US Army Corps of Engineers ®
Wilmington District

DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

GREENVILLE UTILITIES COMMISSION, NC

SECTION 14 EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT

Emergency Streambank and Shoreline Erosion Protection
Section 14 of the Flood Control Act of 1946, as amended

April 2023

FINDING OF NO SIGNIFICANT IMPACT

GREENVILLE UTILITIES COMMISSION, NC

SECTION 14 EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT

The U.S. Army Corps of Engineers, Wilmington District (Corps) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Detailed Project Report and Environmental Assessment (DPR/EA) dated November 2022, for the Greenville Utilities Commission, NC Section 14 Emergency Streambank and Shoreline Erosion Protection Project addresses opportunities to provide reliable protective measures to prevent ongoing streambank erosion on the Tar River from destructively impacting water supply infrastructure at the Greenville Utilities Commission's (GUC) water treatment plant in Pitt County, North Carolina.

The DPR/EA, incorporated herein by reference, evaluated various alternatives that would provide protection to water supply infrastructure from erosion. The Recommended Plan is the National Economic Development (NED) Plan and includes:

- Stabilization with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet of streambank. The riprap will tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built up revetment protecting the toe. The existing streambank and surrounding area will be cleared of vegetation and existing erosion protection measures. The cleared material will be taken offsite to an approved disposal facility. Above the ordinary high water line, backfill material consisting of satisfactory fill (earth) material will be placed on the existing cleared streambank, graded to a 2H:IV slope, and then compacted as required for placement of the streambank slope protection. These new backfill materials used for grading will be in accordance with the Unified Soil Classificaiton System ASTM D2487 and will be free from roots and other organic matter, trash, debris, frozen material, and stones larger than 3 inches in any dimension. Once the foundation material is in place, the streambank will be covered with slope protection measures that consist of a 1' layer of bedding stone (NCDOT #57 stone) and a 25.5" thick layer of NCDOT Class I riprap placed over a layer of geotextile and graded fill slope. Below the ordinary high water line, backfill material consisting of NCDOT #57 stone will be placed over a geotextile layer, and compacted as required to provide a smooth sloped surface for the placement of the stone protection. A toe protection revetment will be built up along the toe of the stream bottom. Riprap placement will cover 0.25 acres of upland area and 0.25 acres of benthic habitat (i.e., submerged bank and river bottom). In total, riprap placement will cover 0.5 acres. The design will accommodate flow vanes which already exist adjacent to the construction area. Materials staging and construction would take place in previously disturbed areas.

Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. To avoid potential impacts to anadromous fish species, an in-water work moratorium will be established between February 1 and September 30. Estimated construction time is 4-6 months.

In addition to a "No Action" alternative, five alternatives were evaluated: relocation, stone riprap protection (Recommended Plan), gabion baskets, steel sheet pile bulkhead, high performance reinforced matting combined with riprap. A list of alternatives and their descriptions are in Section 6 of the DPR/EA.

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the Proposed Action are listed in Table 1:

Table 1: Summary of Potential Effects of the Proposed Action

	Insignificant effects	Insignificant effects as a result of mitigation	Resource unaffected by action
Aesthetics	☒	☐	☐
Air quality	☒	☐	☐
Aquatic resources/wetlands	☒	☐	☐
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☐	☒	☐
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Hazardous, toxic & radioactive waste	☐	☐	☒
Hydrology	☒	☐	☐
Noise levels	☒	☐	☐
Public infrastructure	☒	☐	☐
Socio-economics	☒	☐	☐
Environmental justice	☒	☐	☐
Geology and Sediment	☒	☐	☐
Water quality	☒	☐	☐
Climate change	☒	☐	☐

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the Proposed Action. Best management practices (BMPs) as detailed in the DPR/EA will be implemented to minimize impacts. BMPs include minimizing clearing by using existing access and staging areas, avoiding impacts to wetlands, and using appropriate sedimentation and erosion control measures that equal or exceed the most recent version of the "North Carolina Erosion and Sediment Control Planning and Design Manual". Mitigation measures will include adherence to the U.S. Fish and Wildlife Service's (USFWS) guidelines for avoiding impacts to the West Indian manatee, implementation of an in-water work moratorium will be established between February 1 and September 30 to avoid impacts to anadromous fish species, and potential relocation of bivalve species outside of the project area (pending survey results and coordination with the USFWS and N.C. Wildlife Resources Commission). The Corps will accomplish all future work in accordance with applicable permits.

Public review of the draft DPR/EA was completed on **28 December 2022**. All comments submitted during the public review period were addressed in the final DPR/EA and FONSI.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the Corps determined that the Recommended Plan may affect but is not likely to adversely affect the following Federal / State listed threatened or endangered species or other species of concern: Atlantic Pigtoe, Eastern Lampmussel, Roanoke Slabshell, Neuse River Waterdog, Tar River Spineymussel, Tidewater Mucket. Effects to mollusks and the Neuse River Waterdog may be realized as temporary increases in localized turbidity associated with in-water construction activity, alteration of benthic habitat from sandy bottom to riprap, and burial during construction; however, riprap may provide favorable substrate for mollusks such as freshwater clams and mussels. Prior to construction, the Corps will conduct a freshwater mollusk survey using a qualified and properly credentialled individual to assess relative abundance in the project area. The survey, including its methodology and results, will be coordinated with the USFWS and NCWRC. Should mollusks be found during the survey, formal Section 7 consultation may be required and would be completed prior to construction. All terms and conditions, conservation measures, and reasonable and prudent alternatives and measures resulting from consultation with the U.S. Fish and Wildlife Service would be implemented to minimize take of endangered species and avoid jeopardizing federally listed species.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the Corps determined that the Recommended Plan has no effect on historic properties.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the Recommended Plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix G of the DPR/EA.

Pursuant to Section 401 of the Clean Water Act of 1977 (P.L. 95- 217), as amended, a Water Quality Certification (WQC) is required for this proposed project. A 401 WQC was issued on March 16, 2023 and is included as Appendix I of the DPR/EA.

All applicable laws, executive orders, regulations, and local government plans were considered in the evaluation of alternatives. Coordination with all appropriate agencies and officials required to comply with applicable environmental laws has been completed.

Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the Proposed Action would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

April 5, 2024

Digitally signed by MORGAN.BRAD.ALAN.1107832706
Date: 2024.04.05 12:35:24 -04'00'

Date

Brad A. Morgan, P.E.
Colonel, U.S. Army
District Commander

Table of Contents

DPR/EA Appendices

EXECUTIVE SUMMARY

This Detailed Project Report and Environmental Assessment (DPR/EA) presents the findings of the "Greenville Utilities Commission (GUC), NC Section 14 Emergency Streambank and Shoreline Erosion Protection Study", and has been prepared by the U.S. Army Corps of Engineers – Wilmington District in partnership with the GUC to document the plan formulation process and potential environmental effects associated with the implementation of emergency streambank and shoreline erosion protection alternatives for the project site. The geographic scope of the GUC, NC Section 14 study consists of the implementation site along the northern shoreline of the Tar River in the immediate vicinity of the GUC water treatment plant, located in the City of Greenville, NC. Additionally, positive impacts from the project extend to areas of Pitt and Greene counties which are provided water supply from the plant.

The overall goal of the project is to provide long-term protection and stabilization for the embankment along the Tar River adjacent to the GUC water treatment plant in order to reduce risk to the adjacent water intake infrastructure. Section 14 of the Flood Control Act of 1946, as amended, is a Continuing Authorities Program (CAP) focusing on relatively smaller water resource-related projects not requiring specific Congressional authorization. The Section 14 program is designed for protection of essential, properly maintained public facilities in imminent threat of damage or failure from natural streambank and shoreline erosion processes. The drinking water intake system is a key element of the regions drinking water operations, is an essential public service to over 140,000 citizens (GUC 2022), and is maintained as such. The GUC is the non-Federal sponsor for this feasibility study. The GUC provides electric, water, sewer and natural gas services to the City of Greenville and portions of Pitt and Greene Counties. GUC is owned by the citizens of Greenville but operates under a separate charter issued by the N.C. General Assembly and is an eligible non-Federal sponsor.

Per EP 1105-2-58, paragraph 29(g), evaluation of risk and consequences must be performed for all Section 14 projects to assist with budgetary prioritization. A risk consequence matrix is provided below in Table ES-1. The ranking within the matrix is based on the following: An undesirable event is anything that causes adverse consequences. In this case, the undesirable event is structural failure, either partial or total, of the existing water intake infrastructure of the GUC water treatment plant due to adjacent streambank erosion. The existing river bank revetment is in poor condition with active failure of the previously installed articulating concrete mat erosion protection. The steel cables connecting the individual concrete mats have rusted and broken, with the loss of mats and erosion of the earthen riverbank. Scour holes have developed along the revetment its intersection with water intake pipes. Failure of the existing revetment is pronounced at terminal sections, where continual erosion exacerbates the issue. The terminal sections of the existing revetment have failed with erosion of the riverbank at each end of the revetment. The potential consequence of the erosion threat is embankment collapse onto the water intake structures, damaging the structures or severing associated water transmission infrastructure. This threat places over 140,000 citizens at risk of losing valuable water resources which would jeopardize public health and fire flow protection.

"Risk Level" is an estimate of the time, starting from the present, when an undesirable event is considered likely to occur. The subject embankment has visibly deteriorated on a month to month basis according to GUC observations. Based on professional judgement, failure would be likely to occur within the next 2 years. These considerations elevate the Safety Risk Ranking in the Risk Consequence Matrix to a rank of 1, signifying Risk Level A, as shown in Table ES-1.

Table ES-1. Risk Consequence Ranking

SAFETY MATRIX RANKING		Consequences Category				
		Category A (highest Severity)	Categorty B	Categoy C	Category D	Category E (lowest Severity)
Risk Level (probability of event)	Level A (0 to 2 years)	1	3	5	7	12
	Level B (2 to 4 years)	2	4	6	8	12
	Level C (4 to 6 years)	3	5	7	9	12
	Level D (6 to 8 years)	4	6	8	10	12
	Level E (Over 8 years)	5	7	9	11	12

This DPR/EA develops and discusses potential solutions as a guide to Federal and non-Federal partnership in a protection project. This DPR/EA provides a description and discussion of the existing conditions in the project area, and the array of alternative plans evaluated, including their benefits, costs, and environmental effects. This report also identifies, evaluates, and recommends a solution (the Recommended Plan) that best meets the planning objective of managing the risk of damage to the GUC water intake system posed from adjacent shoreline erosion along the Tar River over a 50-yr period of analysis (2023-2072).

The Recommended Plan (Stone (Riprap) Slope Protection) will provide stabilization with a layer of stone (riprap) placed over a layer of bedding stone and geotextile along approximately 300 linear feet of streambank. The riprap will tie into the top of the existing embankment and will cover the streambank down to the channel bottom with a built up revetment protecting the toe. The existing streambank and surrounding area would be cleared of vegetation as well as the existing failing erosion protection measures. The streambank would be graded to a 2H:IV slope for placement of the streambank slope protection. Below the ordinary high water line, backfill material consisting of NCDOT #57 stone would be placed over a geotextile layer, graded, and compacted as required to provide a smooth sloped surface for the placement of the stone. Above the ordinary high water line, backfill material consisting of satisfactory fill (earth) material would be placed on the existing cleared streambank, graded, and compacted as required to provide a smooth sloped surface for placement of the stone slope protection. Toe protection would be placed along the toe of the stream bottom. The stone toe protection would be placed to a distance of approximately eleven (11) feet to eighteen (18) feet from the toe and to a height of approximately 6 feet above the stream bottom. Materials staging and construction access would take place in previously disturbed areas and is available via an existing access road. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. Estimated construction time is 4-6 months.

The Direct Construction Cost of the Recommended Plan is $1,376,000 (does not include real estate, detailed design and construction management costs). Project First Costs, including detailed design and construction management, are $1,841,000. The figure of $1,841,000 is used as the basis for cost sharing. The project will be designed and constructed through the USACE Continuing Authorities Program. The Federal cost-share for the Recommended Plan is $1,196,000, which is 65% of $1,841,000. The non-Federal cost-share of 35% is $644,000. In addition to the design and construction costs, the feasibility phase costs are $150,000 and cost-shared at $125,000 Federal and $25,000 non-Federal, which brings the Fully Funded Federal Cost to $1,321,000. The non-Federal sponsor fully supports the Recommended Plan .

1.0 STUDY AUTHORITY

The proposed project, protection of a municipal drinking water intake system, is located within and adjacent to the Tar River in the City of Greenville, North Carolina (Figure 1.1) and is being pursued under the authority of Section 14 of the Flood Control Act of 1946 (PL 79-526), as amended, for emergency streambank and shoreline erosion protection for public facilities and services. Applicable paragraph(s) used to determine eligibility in U.S. Army Corps of Engineers (USACE) Engineering Pamphlet (EP) 1105-2-58: paragraph 29(a) states "This program is designed to implement projects to protect public facilities and facilities owned by non-profit organizations that are used to provide public services that are open to all on equal terms. These facilities must have been properly maintained but be in imminent threat of damage or failure by natural erosion processes on stream banks and shorelines, and are essential and important enough to merit Federal participation in their protection." The subject drinking water intake system is a key element of the regions drinking water operations, is an essential public service to over 140,000 citizens (GUC 2022), and is maintained as such. The Greenville Utilities Commission (GUC) water treatment plant is not a Federal facility or a private property. It is under imminent threat of damage or failure from continuing shoreline erosion at the site, and therefore qualifies under the Section 14 program. The non-Federal sponsor for this study, the GUC, strongly supports a partnership with the USACE to protect the system through the Section 14 authority, as stated in a letter from GUC officials (Appendix A).

Section 14 is under the Continuing Authorities Program (CAP), which focuses on water resource-related projects of relatively smaller scope, cost and complexity than USACE projects conducted under the General Investigations program. The Continuing Authorities Program is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization. Additional information on this program can be found in USACE 2019, Engineer Pamphlet (EP) 1105-2-58.

The feasibility study was carried out in a manner consistent with the USACE Environmental Operating Principles (EOPs). The principles are consistent with the National Environmental Policy Act (NEPA); the Army's Environmental Strategy with its four pillars (prevention, compliance, restoration, and conservation); and other environmental statutes that govern USACE activities. Finally, the implementation framework proposed as part of the study will facilitate a collaborative effort by fully engaging individuals, agencies, and local groups in identifying, planning, and implementing shoreline protection efforts. Total study costs were $150,000 and cost-shared by USACE and the GUC as outlined in section 9.0 of this report.

2.0 NON-FEDERAL SPONSOR AND PURPOSE AND NEED FOR ACTION

The GUC is the non-Federal sponsor for this feasibility study. The GUC provides electric, water, sewer and natural gas services to the City of Greenville and 75% of Pitt County. The GUC is owned by the citizens of Greenville but operates under a separate charter issued by the N.C. General Assembly.

Based on a request from the GUC, USACE staff conducted a site visit on July 8, 2020 to the GUC Water Treatment Plant to investigate streambank erosion adjacent to the plant's water intake infrastructure. Resulting from the site investigation was a determination that the Section 14 Authority was an avenue for USACE assistance.

The GUC water treatment plant is located along the Tar River from which it pulls water through intake structures into the treatment plant. The plant has two 30-inch water intake pipes on the Tar River at their water treatment plant serving a population of approximately 140,000 along with industrial demands (GUC 2022). The average water demand is 14.1 MGD with a peak of 18.6 MGD. Streambank erosion has been occurring adjacent to the intake structures. In 2011, the GUC implemented a streambank stabilization project to address this issue. That previously constructed project is currently in poor condition with visible failure of the articulating concrete mat erosion protection. The steel cables connecting the individual concrete mats together have rusted and broken with the loss of mats and erosion of the earthen riverbank. Scour holes have developed along the revetment at the intake pipes. The end sections have failed with erosion of the riverbank at each end of the revetment. This threatens the continued operation of the water intakes and water supply to the GUC service region.

Repair and stabilization of the riverbank at the water intakes on the Tar River is needed to prevent loss of water supply due to potential collapse of the riverbank and damage to the water intake pipes and intake structure. The current condition the riverbank is too unstable to allow safe access to maintenance equipment to clear debris and sediment from the water intakes. Maintenance has to be performed from more expensive barges. Quick emergency repairs are not possible from the riverbank. Should the riverbank fail and damage the water intakes the GUC has only three days of emergency water supply storage. The biggest threat is embankment collapse onto the intake structures, damaging the structures or cutting the lines. This would put over 140,000 citizens at risk of losing valuable water resources which would jeopardize public health and fire flow protection.

The purpose of this study is to provide long-term protection and stabilization for the embankment along the Tar River adjacent to the GUC water treatment plant.

3.0 LOCATION OF STUDY AREA AND ENDANGERED FACILITY

The study area is located near the City of Greenville, North Carolina. Greenville is located in Pitt County in eastern NC and has a population of approximately 90,000. The service area of the endangered facility includes both Pitt and Greene counties. The facility is located along the Tar River, approximately 3 miles upstream from the City of Greenville (Figure 3-1). The water treatment plant's water intake infrastructure is located within the left bank or northern side of the river, as shown in Figure 3-2. Congressional representation for the area includes the following:

Senator Thom Tillis
Senator Ted Budd
Congressional District: NC-03 – Greg Murphy
NC-01 – Donald Davis

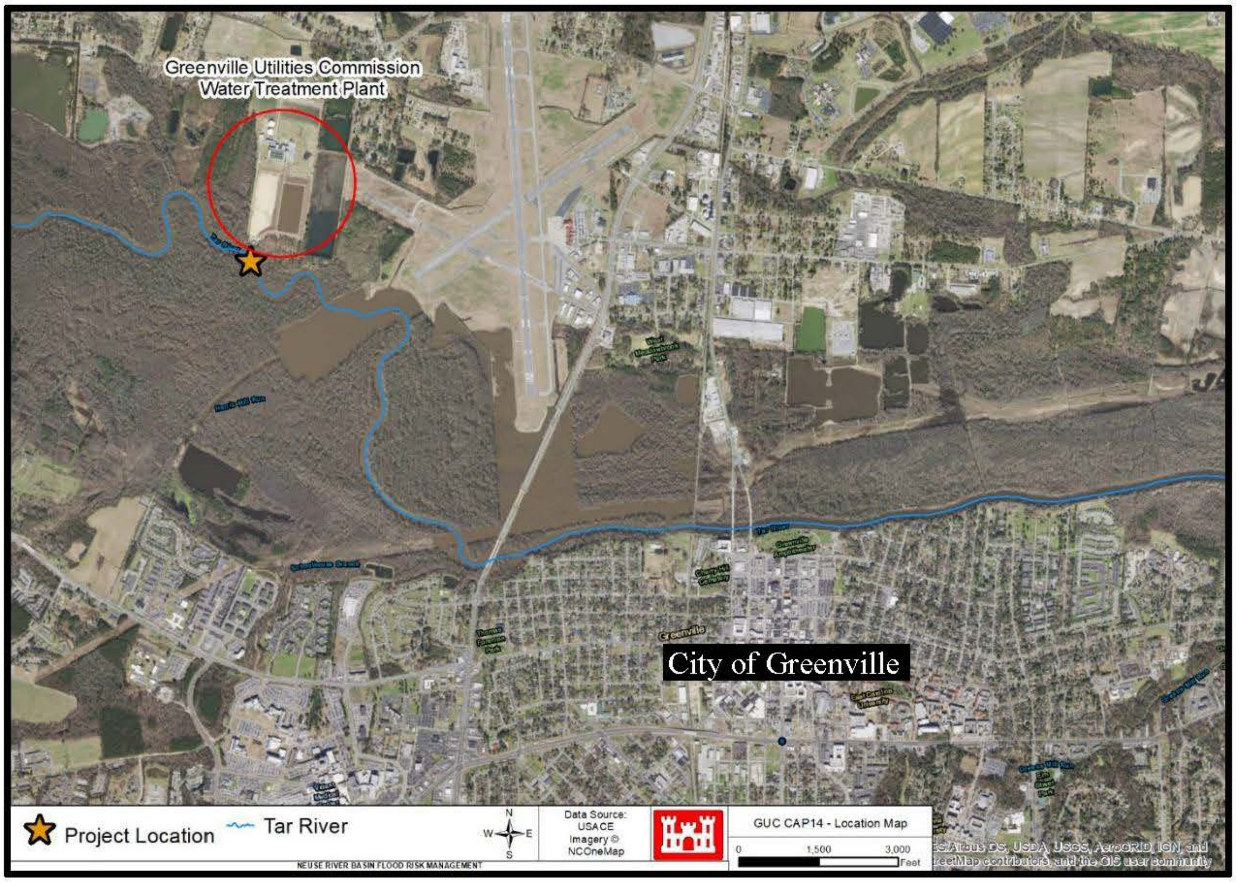


Figure 3-1. Location of Project Site in relation to the City of Greenville, NC

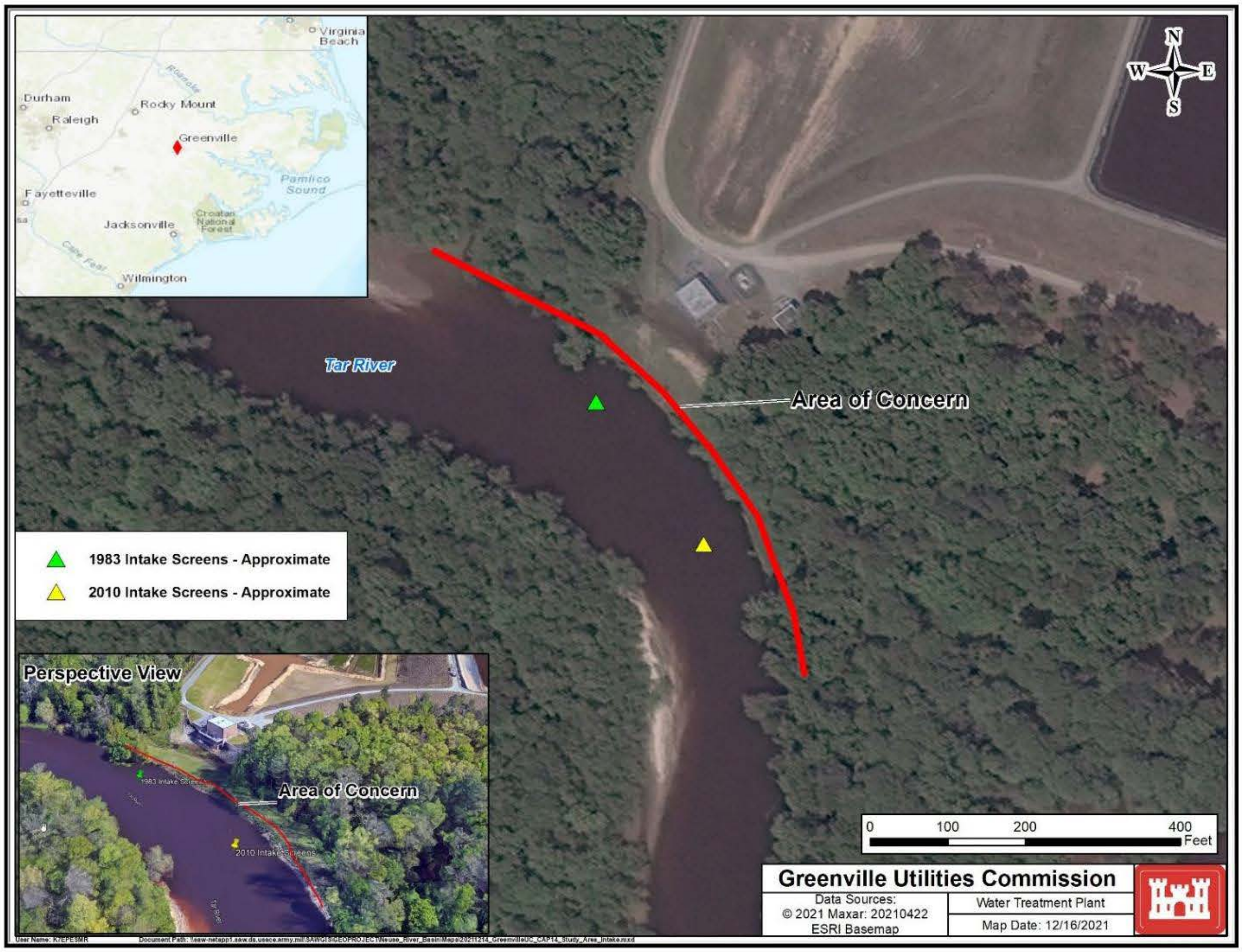


Figure 3-2. Location of Endangered Critical Public Facility

4.0 EROSION ASSESSMENT

There are a number of natural processes causing the continued erosion along the left riverbank of the Tar River in the project area. These natural factors include riverine-based storm events, in addition to wind, wave, and tides associated with coastal-based storm events. Based on input from the GUC, the predominate factors that induce erosion in the project area are associated with how quickly water levels rise and fall against the riverbank. Riverbank erosion has been a persistent issue adjacent to the intake structures (figure 4-1). The problem was significant enough that in 2011, the GUC implemented a riverbank stabilization project to address this issue.

Figure 4-1. Riverbank erosion prior to 2011 project.

Since 2011, erosion has continued in spite of the previous erosion protection project. The GUC staff describe a situation of visually apparent degradation worsening on a month-by-month basis (figure 4-2). The biggest threat is embankment collapse onto the intake structures, damaging the structures or cutting the lines.

Figure 4-2. 2011 project in state of degradation (photo: USACE site visit 2020).

5.0 PLAN FORMULATION AND EVALUATION OF ALTERNATIVES

5.1 Alternatives Considered

USACE Engineer Pamphlet (EP) 1105-2-58 paragraph 29(d) directs that "… given the narrow geographic focus, low cost of these projects, and the imminent threat to the facilities, the formulation and evaluation will focus on the least-cost alternative solution. The least-cost alternative plan is considered to be justified if the total cost of the proposed alternative is less than the costs to relocate the threatened facility."

As follows, the project delivery team (PDT) initially identified the study problem and opportunities in partnership with the non-Federal sponsor, the GUC. A study objective was identified, as well as study constraints:

Problem Statement: Natural streambank erosion is threatening imminent damage to the Greenville, NC regional drinking water intake system.

Opportunities:

- Reduce risk of interrupted water service to the public

Objective:

- Identify an alternative to manage the risk of damage to the GUC water intake system posed from adjacent shoreline erosion along the Tar River over a 50-yr period of analysis (2023-2072).

Constraints:

- Any Federally recommended protection project must cost less than relocating the threatened facility out of harm's way.
- Changes to the streambank and channel must not increase flooding to adjacent properties.

Additional Considerations:

- To avoid impacts to anadromous fishes, no in-water work will occur between February 1 and September 30.

The Project Delivery Team (PDT) considered a range of possible actions, or measures, to meet the study objective while managing constraints. Several of these measures were screened out during preliminary investigation.

The PDT used basic evaluation criteria for each of the measures considered, as follows:

Criteria Type	Description
Completeness	The extent to which the alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.
Effectiveness	The extent to which an alternative plan contributes to achieve the planning objectives.
Efficiency	The extent to which an alternative plan is the most cost-effective means of achieving the objectives
Acceptability	The extent to which an alternative plan is acceptable in terms of applicable laws, regulations and public policies.

5.2 Measures initially considered and screened

The following measures were considered by the PDT early in the plan formulation process, but were screened out prior to any cost analysis as they would not meet the study objective.

Flow Diversion Structure with supplemental riprap:

This alternative included a flow diversion structure that more effectively directed flow through the natural riverbend within the project area. Complex modeling would be required to avoid unintended consequences, as the structure may act differently during varying flow conditions, resulting in potential negative consequences. Some level of supplemental riprap would be required to accompany the flow diversion structure if implemented. Considering the proximity of the raw water intake structures and associated piping, as well as the amount of physical modification required for the natural channel, this alternative did not provide a practical solution. Due to technical concerns, this alternative did not meet the study objective.

Articulating Concrete Block Protection:

This alternative included an articulated concrete block design that would replace the existing, failing armor. Due to the historical failing performance of the existing protection using this same methodology, and concerns of maintenance and resiliency to the combined riverine and coastal-based erosion, this alternative was screened.

Sandbag Protection:

This protection measure was considered due to the potentially significant cost savings. However, because sandbags are not durable and are easily damaged, this alternative would merely serve as a temporary solution. Therefore, this alternative would not meet the study objective to provide long-term protection and stabilization.

High Performance Turf Reinforcement Matting:

This measure included construction of a high-performance turf reinforcement Matting atop the area of eroded riverbank. This design involved a thin, synthetic layer of non-biodegradable material, such as polypropylene, that replaced the existing, failing articulated concrete block armor. Due to concerns of structural durability given the riverine and coastal-based hydraulic loading that the project area was subjected to on a relatively frequent basis, this measure was screened.

5.3 Preliminary Array of Alternatives Carried Forward for Additional Consideration

The following alternatives were carried forward for further consideration, including preliminary costs assessments for comparison purposes. Cost estimates were developed using the same line items for Total Direct Construction Costs (not to include real estate, detailed design and construction management costs). Additionally, a summary of the environmental effects associated with each of the preliminary alternatives is evaluated in Table 5-1.

No Action Alternative:

Under the No Action Alternative, the USACE would not construct streambank protection to address existing erosion near the intake structures of the GUC water treatment plant. Previous attempts by the non-Federal sponsor to address the issue have not been successful. With No Action, erosion is expected to continue with potential collapse of portions of the embankment into the adjacent stream. This increases risk to the integrity of the intake system and operations of the water treatment plant. No federal construction costs are incurred with this alternative. The No Action alternative is carried forward for comparative purposes.

Relocation:

USACE EP 1105-2-58 paragraph 29(d) states that "The least-cost alternative plan is considered to be justified if the total cost of the proposed alternative is less than the costs to relocate the threatened facility." Therefore, relocation of the threatened water intake system was investigated for economic justification purposes. This alternative included relocation of the raw water intake infrastructure away from the eroding riverbank, involving complete decommissioning of existing raw water intake screens within the project area and the associated pipe network that fed into the water treatment plant. This action would eliminate the need for emergency erosion protection. Cost estimates for relocation of the threatened infrastructure were primarily based on actual construction costs incurred in 2013 from the construction of a second intake structure. These costs do not include the cost of obtaining a replacement site or removal costs of the intake system from its current location, and were obtained from a signed financial closeout document provided by the GUC to the North Carolina Division of Water Quality (Appendix C). Construction costs were approximately $4.6 million in 2013. It is assumed that costs from 2013 would be escalated to current costs and include removal costs as well. Based upon this information, it is assumed that costs for relocating the threatened infrastructure would be greater than $4,600,000.

Stone (Riprap) Slope Protection:

This alternative included the construction of a riprap revetment to replace the existing, failing, articulated concrete block armor along the riverbank. The total length of revetment extended beyond the existing armoring to appropriately tie into the natural riverbank. Proposed earthwork modified the natural streambank such that the riprap revetment would be placed at a 2H:1V slope. This alternative also included additional stone placed along the riverbank toe to account for potential toe scour. Riprap slope protection would be sustainable with a minimal level of maintenance, primarily for occasional repairs to maintain revetment integrity. This alternative would be technically feasible in that the structure is a proven and commonly used method of streambank stabilization for locations with similar conditions. Initial rough order of magnitude (ROM) cost estimate for comparative purposes was $980,000.

Gabion Baskets

This alternative included the use of Gabion Baskets to replace the existing, failing, articulated concrete block armor along the riverbank. This alternative involved relatively smaller sized stone encased in a series of stacked wired cages to act as a buffer between the natural streambank soils and erosive flows from the Tar River. A concern over this alternatives ability to provide adequate toe scour protection was a consideration. The initial ROM cost estimate for comparative purposes was $2,170,000.

Steel Sheet Pile Bulkhead

This alternative includes the construction of a steel sheetpile bulkhead within the area of eroded riverbank. The bulkhead would extend beyond the existing articulated concrete block armor to appropriately tie into high ground. The structure's design elevation was set to the approximate top of riverbank. During the assessment of this alternative, a concern was identified of the risk of requiring the depth of the steel sheetpile to extend below the raw water intake pipe network. A more detailed analysis would have been required to confirm this. However, preliminary cost estimates of this alternative resulted in it not being the least-cost, so further analysis was not conducted. Initial ROM cost estimate for comparative purposes was $1,675,000.

High Performance Turf Reinforcement Matting combined with Rip Rap:

This alternative included construction of a High-Performance Turf Reinforcement Matting atop the area of eroded riverbank. This design involved a thin, synthetic layer of non-biodegradable material, such as polypropylene, that replaced the existing, failing articulated concrete block armor. Due to concerns of structural durability given the riverine and coastal-based hydraulic loading that the project area was subjected to on a relatively frequent basis, this alternative would also be supplemented by rock rip rap. Initial ROM cost estimate for comparative purposes was $1,100,000.

Table 5-1. Summary of the Environmental Effects Associated with the Alternative Plans

Project Area Resource	Impacts of No Action Alternative	Impacts of Relocation	Impacts of Stone (Riprap) Slope Protection	Impacts of Gabion Baskets	Impacts of Steel Sheet Pile Bulkhead	Impacts of High Performance Turf Reinforcement Matting combined with Riprap
Sediments	Continued streambank erosion in the project area, resulting in increased turbidity. Potential bank failure under the No Action alternative may damage water intake structures or associated transmission infrastructure.	Temporary impacts from excavation, grading, and material placement associated with in-water and upland removal of water intake structures and associated equipment. Similar impacts associated with re-installation at a new location, plus possible clearing.	Temporary impacts from excavation, grading, and material placement during construction. Expected to result in an overall reduction in erosion at the proposed project area and improve bank stabilization.	Temporary impacts from excavation, grading, and material placement during construction. Long-term toe scour is a concern.	Temporary impacts from excavation, grading, and material placement during construction. Expected to result in an overall reduction in erosion at the proposed project area and improve bank stabilization.	Temporary impacts from excavation, grading, and material placement during construction. Expected to result in an overall reduction in erosion at the proposed project area and improve bank stabilization.
Water Quality	Continued streambank erosion, and associated elevated turbidity in and downstream of the proposed project area. Potential bank failure under the No Action alternative may damage water intake structures or associated transmission infrastructure.	Temporary elevation in turbidity during construction.	Temporary elevation in turbidity during construction. Expected to have favorable long-term effects on water quality in, and downstream of, the project area by decreasing erosion and subsequent turbidity introduced to the Tar River following high water events	Temporary elevation in turbidity during construction. Long-term toe scour is a concern.	Temporary elevation in turbidity during construction. Expected to have favorable long-term effects on water quality in, and downstream of, the project area by decreasing erosion and subsequent turbidity introduced to the Tar River following high water events	Temporary elevation in turbidity during construction. Expected to have favorable long-term effects on water quality in, and downstream of, the project area by decreasing erosion and subsequent turbidity introduced to the Tar River following high water events
Wetlands and Floodplains	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.
Hazardous and Toxic Materials	No impacts	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.
Cultural Resources	Continued streambank erosion, which may endanger any unidentified cultural resources in the proposed project area.	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.
Air Quality	No impacts	Temporary increases in emissions during construction.	Temporary increases in emissions during construction.	Temporary increases in emissions during construction.	Temporary increases in emissions during construction.	Temporary increases in emissions during construction.
Noise	No impacts.	Temporary increases in noise during construction. Construction would comply with the published Noise Control Ordinance of Pitt County, NC.	Temporary increases in noise during construction. Construction would comply with the published Noise Control Ordinance of Pitt County, NC.	Temporary increases in noise during construction. Construction would comply with the published Noise Control Ordinance of Pitt County, NC.	Temporary increases in noise during construction. Construction would comply with the published Noise Control Ordinance of Pitt County, NC.	Temporary increases in noise during construction. Construction would comply with the published Noise Control Ordinance of Pitt County, NC.
Benthic Resources	Continued streambank erosion, potentially altering benthic habitat regularly following extreme weather and flow events.	Permanent habitat alteration from hard structure to sandy bottom at removal location and from from sandy bottom to hard structure at new location. Temporary community composition disruption in proposed project footprint.	Permanent habitat alteration from sandy bottom to hard structure and temporary community composition disruption in proposed project footprint. Long-term sediment stabilization in the proposed project area and introduction of hard structure for utilization by benthic organisms and other aquatic fauna.	Permanent habitat alteration from sandy bottom to hard structure and temporary community composition disruption in proposed project footprint. Long-term sediment stabilization in the proposed project area and introduction of hard structure for utilization by benthic organisms and other aquatic fauna, although toe scour is a concern.	Permanent habitat alteration from sandy bottom to hard structure and permanent habitat fragmentation in proposed project footprint (loss of a sloped land-to-water interface). Long-term sediment stabilization in the proposed project area.	Permanent habitat alteration from sandy bottom to hard structure and temporary community composition disruption in proposed project footprint. Long-term sediment stabilization in the proposed project area and introduction of hard structure for utilization by benthic organisms and other aquatic fauna.
Fisheries Resources	Continued streambank erosion, potentially altering localized turbidity and forage substrate for fishes.	Temporary increased turbidity and temporary species displacement during construction. Alteration of benthic habitat from rock structure to sandy sediment at removal location and from sandy sediment to rock structure at new location.	Temporary increased turbidity and temporary species displacement during construction. Alteration of benthic habitat from sandy sediment to rock structure.	Temporary increased turbidity and temporary species displacement during construction. Alteration of benthic habitat from sandy sediment to rock structure. Long-term toe scour is a concern.	Temporary increased turbidity and temporary species displacement during construction. Alteration of benthic habitat from sandy sediment to rock structure. Permanent habitat fragmentation in proposed project footprint (loss of a sloped land-to-water interface).	Temporary increased turbidity and temporary species displacement during construction. Alteration of benthic habitat from sandy sediment to rock structure.
Terrestrial Resources	Continued streambank erosion and associated vegetation loss.	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction. Disturbed areas would be re-vegetated with grasses or other native plants upon project completion.	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction. Disturbed areas would be re-vegetated with grasses or other native plants upon project completion.	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction. Disturbed areas would be re-vegetated with grasses or other native plants upon project completion.	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction. Disturbed areas would be re-vegetated with grasses or other native plants upon project completion. Permanent habitat fragmentation in proposed project footprint (loss of a sloped land-to-water interface).	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction. Disturbed areas would be re-vegetated with grasses or other native plants upon project completion.
Threatened and Endangered Species, and Species of Concern	Continued streambank erosion may displace aquatic threatened and endangered species and other species of concern by degrading water quality.	Construction activity may affect and is likely to adversely affect Federally-listed mussel species. Construction may affect but is not likely to adversely affect multiple other threatened and endangered species, or other species of concern. Critical habitat will be unaffected.	Construction activity may affect and is likely to adversely affect Federally-listed mussel species. Construction may affect but is not likely to adversely affect multiple other threatened and endangered species, or other species of concern. Critical habitat will be unaffected.	Construction activity may affect and is likely to adversely affect Federally-listed mussel species. Construction may affect but is not likely to adversely affect multiple other threatened and endangered species, or other species of concern. Critical habitat will be unaffected.	Construction activity may affect and is likely to adversely affect Federally-listed mussel species. Construction may affect but is not likely to adversely affect multiple other threatened and endangered species, or other species of concern. Critical habitat will be unaffected.Permanent habitat fragmentation in proposed project footprint (loss of a sloped land-to-water interface).	Construction activity may affect and is likely to adversely affect Federally-listed mussel species. Construction may affect but is not likely to adversely affect multiple other threatened and endangered species, or other species of concern. Critical habitat will be unaffected.
Aesthetic and Recreational Resources	Continued streambank erosion may detract from the aesthetic value.	Impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. Aesthetic and recreational impacts associated with relocation are unknown as a viabile relocation area has not been identified.	Impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. A maintained bank is congruent with other landuse in the project area and would be an aesthetic improvement as compared to current conditions.	Impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. A maintained bank is congruent with other landuse in the project area and would be an aesthetic improvement as compared to current conditions.	Impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. A maintained bank is congruent with other landuse in the project area and would be an aesthetic improvement as compared to current conditions.	Impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. A maintained bank is congruent with other landuse in the project area and would be an aesthetic improvement as compared to current conditions.

5.4 Comprehensive Benefits Analysis of the Four Accounts

The 5 January 2021 memorandum "SUBJECT: POLICY DIRECTIVE – Comprehensive Documentation of Benefits in Decision Document," provides policy direction on the assessment and documentation of benefits for USACE water resources planning.

Per Section 7(e) of the Directive, studies fall under one of three categories (dependent on when the study initiated) which guide the level of implementation expected by the Directive. The following are the three categories as described in the Policy Directive. The GUC, NC CAP 14 study falls into category 7(e)(3), which is delineated in the red outline below.

(3) Future detailed studies will include comprehensive analysis of the total benefits of each plan including equal consideration of all benefit types in the study scope of work. When determining the scope of work, the PDT must collaborate with the non-federal partner and consider the views of the public and stakeholders.

Given the narrow focus and streamlined formulation process of the CAP 14 Authority, the PDT conducted a commensurate comprehensive benefits analysis.

To meet the 5 January 2021 Policy Directive, meaningful factors were identified for each of the 4 accounts to be evaluated on how they would be impacted by each alternative in the final array (Table 6-2). Methods of evaluation are primarily qualitative.

National Economic Development (NED)	Regional Economic Development (RED)
Project Costs	Jobs
Ability to Meet Study Objective	Labor Income
	Value Added
Other Social Effects (OSE)	**Environmental Quality (EQ)**
Health and Safety	Habitat Change
Social Vulnerability and Resiliency	Threatened & Endangered Species Risk
	Cultural Resources Sites

Table 6-2 Factors Evaluated for the Four Benefit Accounts

The following paragraphs summarize the evaluation of the final array of alternatives against the four Accounts. Table 6-3 on the following page presents the evaluation results.

Plan which maximizes NED: Stone (Riprap) Slope Protection – Using preliminary rough-order-of-magnitude cost estimates for comparison purposes, the stone (riprap) slope protection alternative provided the benefits of protection at the least cost of $980,000. This compares with high performance turf reinforcement matting combined with riprap ($1,100,000), steel sheetpile bulkhead ($1,675,000), and gabion baskets ($2,170,000).

Plan which maximizes RED: Gabion Baskets – Using preliminary rough-order-of-magnitude cost estimates for comparison purposes, the gabion baskets alternative would provided the most RED benefits when considering local/regional jobs created and labor income associated with the implementation of this project, as it has the highest implementation costs ($2,170,000) as compared with the other alternatives.

Plan which maximizes OSE: All plans would provide equal benefit. To evaluate the impacts of each of the final alternative against the OSE account, a qualitative ranking system was used of High/Medium/Low, with "High" having the greatest OSE benefits, and "Low" the lowest OSE benefits. All plans would provide equal benefit to the population served, as each of them would equally reduce social vulnerability and increase health and safety, and resiliency by reducing the risk of interruption to public drinking water services. An Environmental Justice assessment is located in section 11.0.

Plan which maximizes EQ: High Performance Turf Reinforcement Matting with Riprap. To evaluate the impacts of each of the final alternatives against the EQ account, a qualitative ranking system was used of High/Medium/Low, with "High" having the greatest EQ benefits, and "Low" the lowest EQ benefits. The high performance turf reinforcement matting with riprap was the only alternative ot received a "High' ranking due to its natural and nature-based features. The steel sheetpile bulkhead alternative received a "Low" ranking due to it's removal of habitat along the streambank. All other alternatives received a "Medium" ranking

Table 6-3. Evaluation of the Four Accounts

	FOUR ACCOUNTS			
ALTERNATIVE	**NED**	**RED**	**OSE**	**EQ**
No Action	N/A	N/A	Low	Low
Relocation	$4,500,00	$4,500,000	Medium	Medium
Stone (riprap)	$980,000	$980,000	Medium	Medium
Gabion Baskets	$2,170,000	$2,170,000	Medium	Medium
Steel Sheetpile Bulkhead	$1,675,000	$1,675,000	Medium	Low
High Performance Turf Matting w/ riprap	$1,100,000	$1,100,000	Medium	High

The 5 January 2021 Policy Directive further states that each study must include, at a minimum, the following plans in the final array of alternatives for evaluation:

1. The "No Action" alternative
2. A plan that maximizes net total benefits across all benefit categories ***(Stone (Riprap) Slope Protection).*** This alternative was selected for this category rather than High Performance Turf Matting with riprap because the NED account was given more weight than the EQ account considering the study Authority.
3. A plan that maximizes net benefits consistent with the study purpose (NED for this study) ***(Stone (Riprap) Slope Protection)***
4. For flood-risk management studies, a nonstructural plan ***(Not applicable)***

* There is no locally preferred plan

5.5 Final Array of Alternatives

USACE Engineer Pamphlet (EP) 1105-2-58 paragraph 29(d) directs in relation to the CAP 14 authority that "... given the narrow geographic focus, low cost of these projects, and the imminent threat to the facilities, the formulation and evaluation will focus on the least-cost alternative solution. The least-cost alternative plan is considered to be justified if the total cost of the proposed alternative is less than the costs to relocate the threatened facility."

As shown in table 6-2, the Stone (Riprap) Slope Protection alternative is the least-cost alternative, while the other action alternatives are not economically efficient. The final array of alternatives is as follows:

1. No Action
2. Stone (Riprap) Slope Protection

5.6 Recommended Plan

Relative to the other alternatives considered, the Stone (Riprap) Slope Protection is the least-cost alternative. Considering all evaluation criteria, the Stone (Riprap) Slope Protection is considered the Recommended Plan . The GUC has expressed acceptance of the Stone (Riprap) Slope Protection as their locally-preferred alternative.

Recommended Plan Description: This plan will provide stabilization with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet of streambank. The riprap will tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built up revetment protecting the toe. The existing streambank and surrounding area would be cleared of vegetation and existing erosion protection measures. The cleared material will be taken offsite to an approved disposal facility. Above the ordinary high water line, backfill material consisting of satisfactory fill (earth) material would be placed on the existing cleared streambank, graded to a 2H:IV slope, and then compacted as required for placement of the streambank slope protection. These new backfill materials used for grading will be in accordance with the Unified Soil Classificaiton System ASTM D2487 and will be free from roots and other organic matter, trash, debris, frozen material, and stones larger than 3 inches in any dimension. Once the foundation material is in place, the streambank will be covered with slope protection measures that consist of a 1' layer of bedding stone (NCDOT #57 stone) and a 25.5" thick layer of NCDOT Class I riprap placed over a layer of geotextile and graded fill slope. Below the ordinary high water line, backfill material consisting of NCDOT #57 stone would be placed over a geotextile layer, and compacted as required to provide a smooth sloped surface for the placement of the stone protection. A toe protection revetment will be built up along the toe of the stream bottom. Riprap placement would cover 0.25 acres of upland area and 0.25 acres of benthic habitat (i.e., submerged bank and river bottom). In total, riprap placement would cover 0.5 acres. The design will accommodate flow vanes which already exist adjacent to the construction area. Materials staging and construction would take place in previously disturbed areas. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. To avoid potential impacts to anadromous fish species, an in-water work moratorium will be established between February 1 and September 30. Estimated construction time is 4-6 months. A typical cross section is shown in Figure 5-1. A plan view of the Recommended Plan is shown in figure 5-2. A conceptual rendering is shown in figure 5-3.

Civil/Site Description: Access to the project site is currently via an access road that runs the length of the project. Materials staging would take place in the open areas at the top of the embankment as directed by the facility. Construction access is available via the existing access road. The project site is located on the embankment of the Tar River downstream of the intake. Currently this site has an articulated block system that has failed due to undermining. Additionally there are flow weirs in the channel along the bank that must be incorporated into the design. A Type 2 DOT Turbidity Curtain will be installed during in-water material placement and a silt fence will be installed on the upland perimeter of the construction activities and along most improved access roads. Post construction landscaping to restore disturbed areas and fill slopes is estimated to be approximately 0.3 acre.

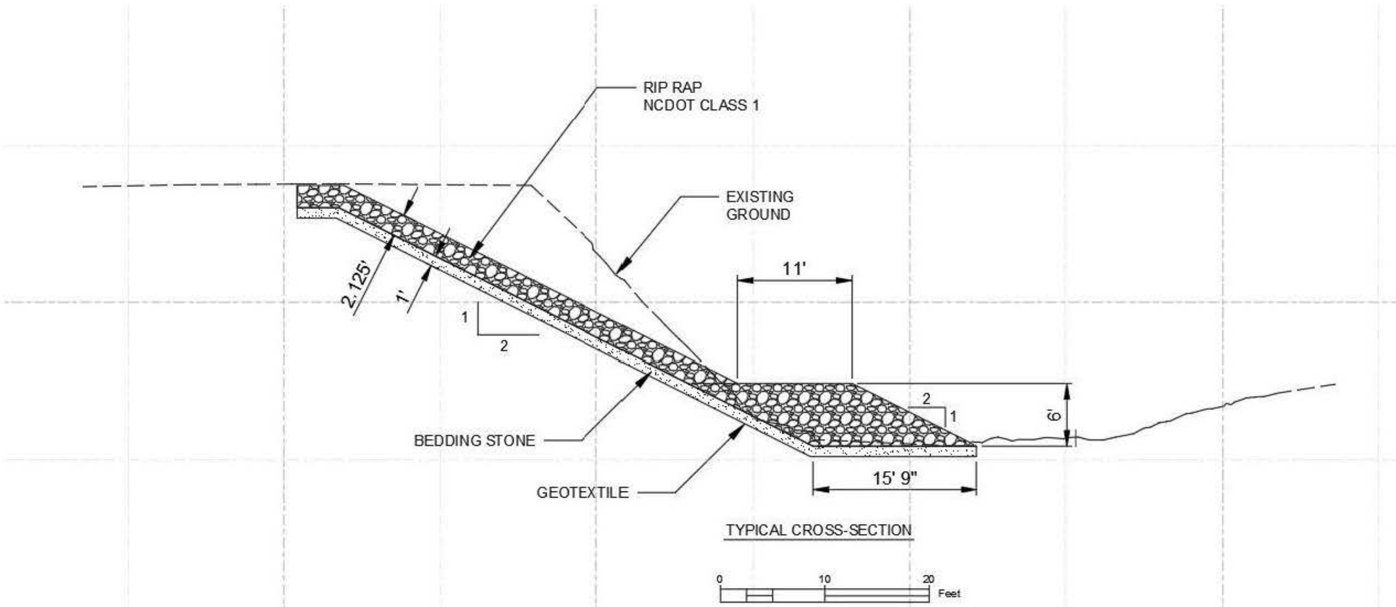


Figure 5-1. Typical cross section of Recommended Plan

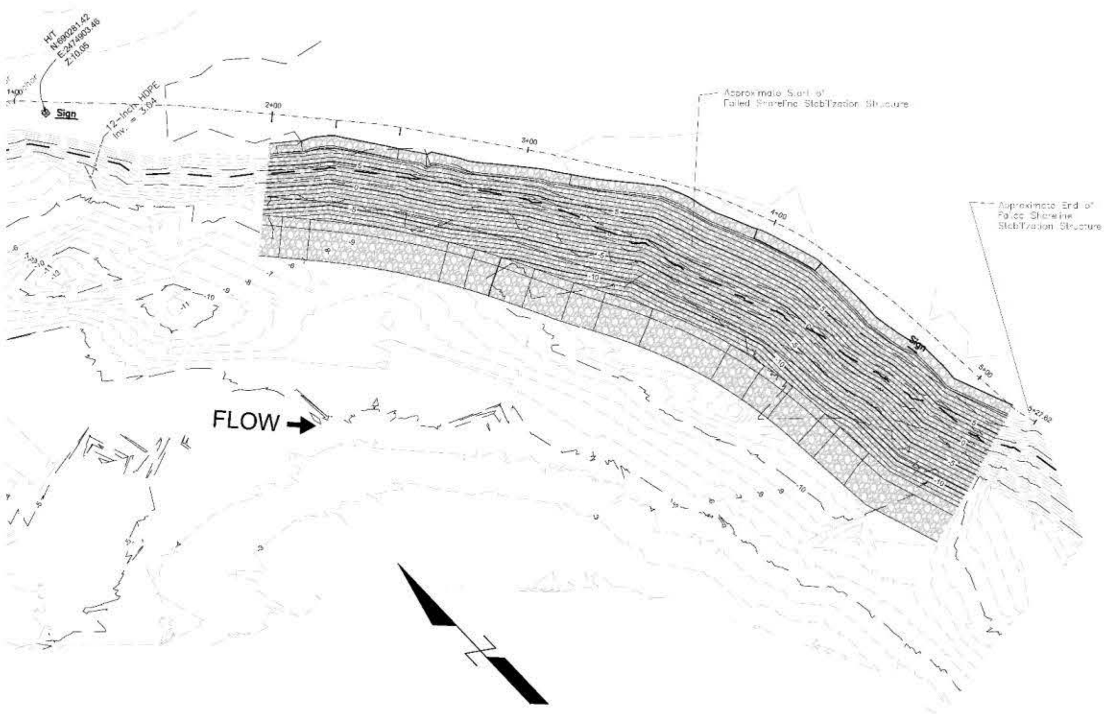


Figure 5-2. Footprint of Recommended Plan

Figure 5-3. Conceptual Rendering of Recommended Plan

6.0 FUTURE-WITHOUT PROJECT CONDITIONS

6.1 Sediments

The future without-project conditions would allow for continued streambank erosion in the project area. Additionally, potential bank failure under future-without project conditions may damage water intake structures or associated transmission infrastructure. This would place over 140,000 citizens at risk of losing critical water resources, jeopardizing public health and fire protection abilities.

6.2 Water Quality and Wetlands

The future without-project conditions would allow for continued streambank erosion in the project area, resulting in increased turbidity as compared to nearby reaches of the Tar River. Additionally, potential bank failure under future-without project conditions may damage water intake structures or associated transmission infrastructure. This would place over 140,000 citizens at risk of losing critical water resources, jeopardizing public health and fire protection abilities.

6.3 Floodplains

No changes to floodplains are expected under future-without project conditions.

6.4 Hazardous, Toxic, and Redioactive Substances

No changes to hazardous, toxic and radioactive materials or waste are expected under future-without project conditions.

6.5 Cultural Resources

The future-without project conditions would allow for continued streambank erosion, which may endanger any unidentified cultural resources in the proposed project area.

6.6 Air Quality

No changes to air quality are expected under future-without project conditions.

6.7 Noise

No changes to noise are expected under future-without project conditions.

6.8 Benthic Resources

The future-without project condition would allow for continued streambank erosion in the project area, potentially altering benthic habitat following extreme weather and flow events.

6.9 Fisheries Resources

The future-without project condition would allow for continued streambank erosion in the project area, potentially increasing localized turbidity and reducing forage substrate for fishes. Generally, fishes in the project area include multiple sunfish species, multiple shiner species, Eastern mosquitofish, pirate perch, redfin pickerel, bluegill, brown bullhead, American eel, hickory shad, alewife, bowfin, inland silverside, multiple dace species, multiple lamprey species, striped bass, largemouth bass, sunfish, and white and yellow perch (NCDEQ 2022; NCWRC 2022; Tracy et al. 2020).

6.9.1 Essential Fish Habitat

No changes to essential fish habitat are expected under future-without project conditions. No EFH exists at or in areas surrounding the proposed project area (NOAA 2022).

6.10 Terrestrial Resources

The future-without project condition would allow for continued streambank erosion and associated vegetation loss (e.g., mowed grasses, vines and hardwood trees) would persist.

6.11 Threatened and Endangered Species, and Species of Concern

The future without-project condition will not result in any direct impacts to threatened and endangered species and species of concern; however, continued streambank erosion and associated vegetation loss would persist. Erosion, specifically, may increase localized turbidity in the Tar River at and downstream of the project area. Turbidity may contrubite to unvavorable conditions for several aquatic threatened and endangered species including the Neuse River waterdog and freshwater bivalves.

According to the United States Fish and Wildlife Service' Information for Planning and Consultation Service (IPaC) (USFWS 2022), six species known to exist in Pitt County, NC are given special consideration under the ESA (Appendix D). The Atlantic Sturgeon is also listed under the ESA but is under the purview of the National Marine Fisheries Service. Additionally, the Tar River contains critical habitat for the Atlantic sturgeon and Neuse River waterdog. The North Carolina Department of Environment and Natural Resources' Natural Heritage Program identifies 102 species, animal assemblages, and natural communities meriting special consideration in Pitt County, NC (NCDNCR 2022a). Please refer to section 7.11 for additional information regarding threatened and endangered species and species of concern.

6.12 Aesthetic and Recreational Resources

No changes to aesthetic and recreational resources are expected under future-without project conditions.

6.13 Socioeconomic Resources

No changes to socioeconomic resources are expected under future-without project conditions.

For information regarding socioeconomic resources in the vicinity of proposed project area, to include environmental justice, please see Section 12.0 Environmental Justice Assessment.

7.0 AFFECTED ENVIRONMENT AND EFFECTS OF THE RECOMMENDED PLAN AND NO ACTION

7.1 Sediments

Pitt County is in the Coastal Plain physiographic province, in the eastern part of North Carolina. Soil topography in Pitt County is considered nearly level to sloping. The nearly level soils are found in the eastern and southeastern parts of the County. The more sloping soils are found in the County's western portions and generally south of Tar River and its tributaries. All soils are naturally acidic, and base saturation is less than 35%. Natural fertility of soils is mostly low or very low. Suitable amounts of lime and fertilizer are generally required to increase the content of calcium, magnesium, phosphorus, and potassium in soils to allow for agricultural use. The content of organic matter in soils is also considered generally low or very low, except where soils are very wet and water has retarded oxidation. The City of Greenville is the approximate geographical center of the county (USDA 1974).

Soils at the proposed project area are mapped as Alaga loamy sand, banded substratum (AgB) and Bibb complex (Bb) (see Figure 7-1). AgB is a somewhat excessively drained, sandy soil on broad, high divides of uplands and stream terraces. Infiltration in this soil type is rapid, and runoff is slow. Bb soils are poorly drained, nearly level soils on flood plains and in upland draws and depressions. Bb soils have a surface layer of fine sandy loam which is underlain by very friable fine sandy loam. Infiltration in Bb soils is moderate, and runoff is slow. Both mapped soil types typically terminate 6 feet deep (USDA 2022).

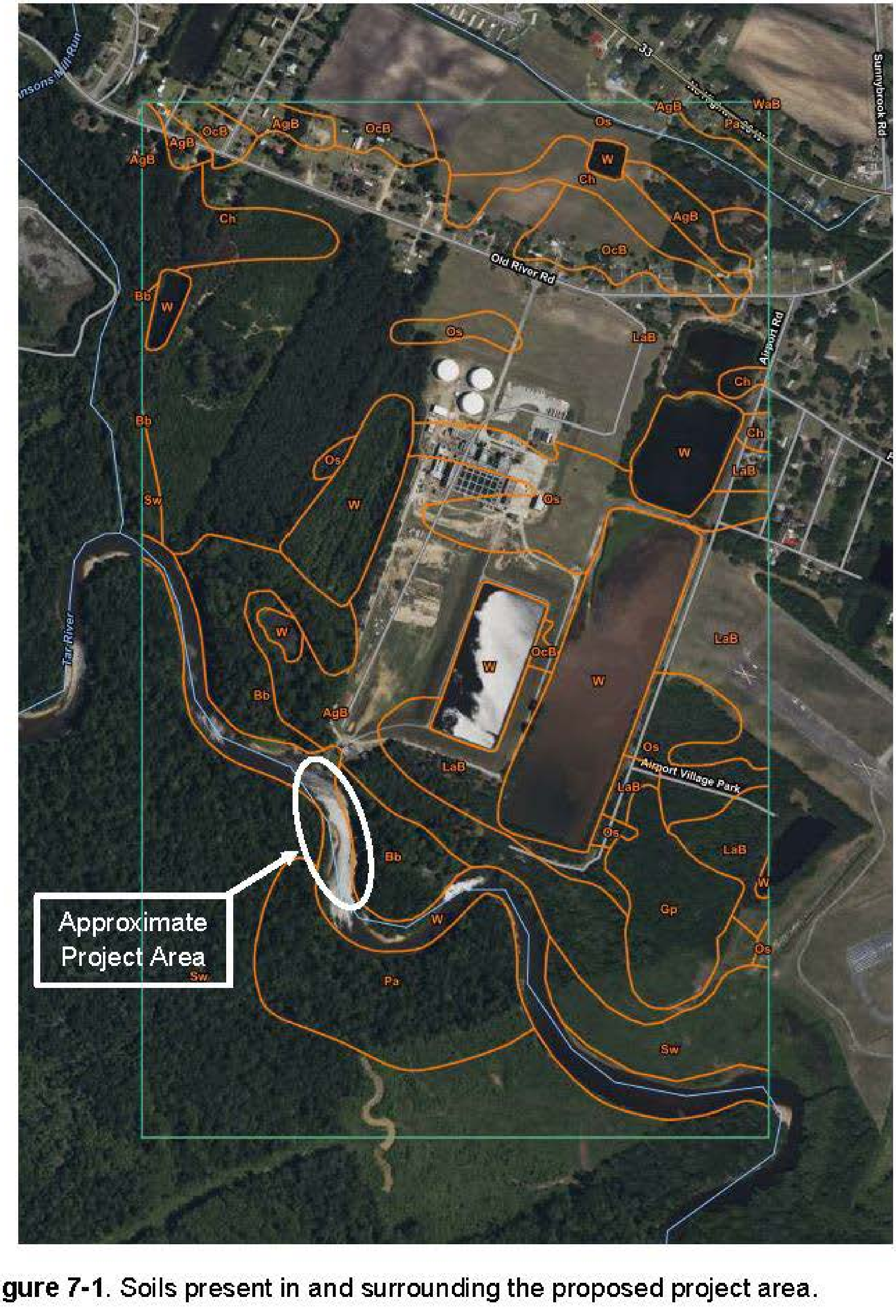


Figure 7-1. Soils present in and surrounding the proposed project area.

A subsurface investigation was conducted by Schnabel Engineering South, P.C. in 2008 as part of water intake upgrades in the project area. The boring logs from the associated report found that the topsoil layer was less than 1 foot deep, followed by alluvium consisting of mostly silt (ML) with sand down to 12 feet below the surface. Laboratory tests of the silt showed up to 81% passing a #200 sieve. From 12 to 39 feet below the surface was sand (SP) with 26% passing a #200 sieve. From 39 to 70 feet below the surface was clay (CL) with 76% passing a #200 sieve. There were no laboratory data defining particle sizes greater than the #200 sieve, though the logs describe some sand as being medium (not passing a #40 sieve) and coarse (not passing a #10 sieve). The United Soil Classification System (USCS) describes sand particle sizes to be between 0.075 and 4.75 mm. Not passing the #200 sieve indicates particles lager than 0.075 mm.

Construction impacts of the Recommended Plan to sediments would result from the minimal excavation and grading of the streambank in the project area, allowing for proper riprap placement. These impacts are considered to be temporary and minimal, and further reduced by implementing appropriate erosion control measures during construction. It is expected that implementation of the Recommended Plan would result in an overall reduction in erosion at the proposed project area, and improve stabilization of the Tar River oxbow bend nearest Greenville Water Treatment Plant water intake infrastructure.

The No Action alternative would allow the riverbank near the intake structures to remain vulnerable to additional erosion and threaten plant's infrastructure. The current riverbank revetment is in poor condition and the articulating concrete mat is failing and the erosion that is occurring behind the mat would continue.

7.2 Water Quality and Wetlands

Waters in and near the proposed project area are classified as WS-IV with a supplemental classification of NSW (NCDEQ 1992). Water Supply IV (WS-IV) waters serve drinking, culinary, or food processing purposes. In the project area, specifically, Tar River waters are also considered in a Critical Area (CA) meaning risk of pollution is greater due their <1/2 mile proximity to water supply intakes. Nutrient Sensitive Waters (NSW) are a supplemental classification intended for waters needing additional nutrient management due to being subject to excessive growths of microscopic or macroscopic vegetation (NCDEQ 2022).

Wetlands are absent from the proposed project area, which consists of a steep-sloping, eroded streambank largely devoid of vegetation as observed during multiple site visits in 2022. High water events have further deteriorated the bank such that the oxbow bend of the Tar River continues to migrate northward.

The Recommended Plan is expected to have favorable long-term effects on water quality in, and downstream of, the project area by decreasing erosion and subsequent turbidity introduced to the Tar River following high water events. There are no wetlands present in the project footprint. For this reason, the Recommneded Plan will have no effect on wetlands. The Recommended Plan will prevent bank sloughing / failure and preclude damage to critical water supply infrastructure. Appropriate sedimentation and erosion control measures that equal or exceed the most recent version of the "North Carolina Erosion and Sediment Control Planning and Design Manual" (NCDEQ 2013) will be designed, installed, and maintained properly to assure compliance with the appropriate turbidity standards, although temporary increases in turbidity may occur during construction. These measures include a Type 2 DOT Turbidity Curtain to be used during in-water material placement, and silt fence use on the upland perimeter of construction activity and along most improved access roads (Appendix C). Note that because clearing of grasses, vines, and trees will not to exceed one acre, an erosion and sedimentation control plan may not be required for this project. A National Pollutant Discharge Elimination System (NPDES) construction stormwater permit (NCG010000), however, may be necessary and would be obtained, if required, prior to construction. Similarly, compliance with 15A NCAC 2H 1000 (i.e., State Stormwater Permitting Programs) would be satisfied prior to construction, if applicable.

The project design requires a broader footprint that described in Nationwide Permit (NWP) 13 criterion (c), in that the Recommended Plan exceeds average placement of one cubic yard of fill material per running foot. Typically, exceeding this criterion may be waived by the District Engineer by making a written conclusion that the discharge of dredged or fill material will result in no more than minimal adverse environmental effects. The Corps does not permit its own actions, though, and a waiver addressing this matter will not be provided; however, the analyses contained within this DPR/EA describes anticipated environmental effects and confirms minimal adverse environmental effects associated with the Recommended Plan. Therefore, all proposed work, construction activity, and contractor actions would be in accordance with the conditions of NWP 13 and all regional conditions for Nationwide Permits in the Wilmington District.

The Recommended Plan would comply with Executive Order 11990, which directs federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. A Clean Water Act Section 401 water quality certification (WQC) is required for construction of the proposed project. A 401 application was submitted to the North Carolina Division of Water Resources (NCDWR) on January 23, 2023. This application was approved and an individual Section 401 WQC was obtained on March 16, 2023.

The approved Section 401 WQC is included as Appendix I. All proposed work will be in compliance with the conditions of the individual WQC.

Additionally, the NCDWR has established riparian buffer rules protecting vegetated areas adjacent to intermittent and perennial streams, lakes, reservoirs, ponds, estuaries, and modified natural streams. The project area is subject to the Tar-Pamlico Buffer rules designed to protect riparian zones. Buffer rules were assessed as part of Section 401 coordination.

Pursuant to 33 C.F.R. § 335.7, and meeting the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process, a 404(b)(1) guidelines analysis has been included as Appendix G.

The No Action alternative would allow for continued streambank erosion in the project area, resulting in increased turbidity as compared to nearby reaches of the Tar River. Additionally, potential bank failure under the No Action alternative may damage water intake structures or associated transmission infrastructure. This would place over 140,000 citizens at risk of losing critical water resources, jeopardizing public health and fire protection abilities.

7.3 Floodplains

In the vicinity of Greenville, NC, the Tar River is characterized by a wide floodplain, primarily on the south side of the river. The proposed project area in its entirety is located within the AE flood zone as defined by the Federal Emergency Management Agency (FEMA) (Figure 7-2) (NCDPS 2022).

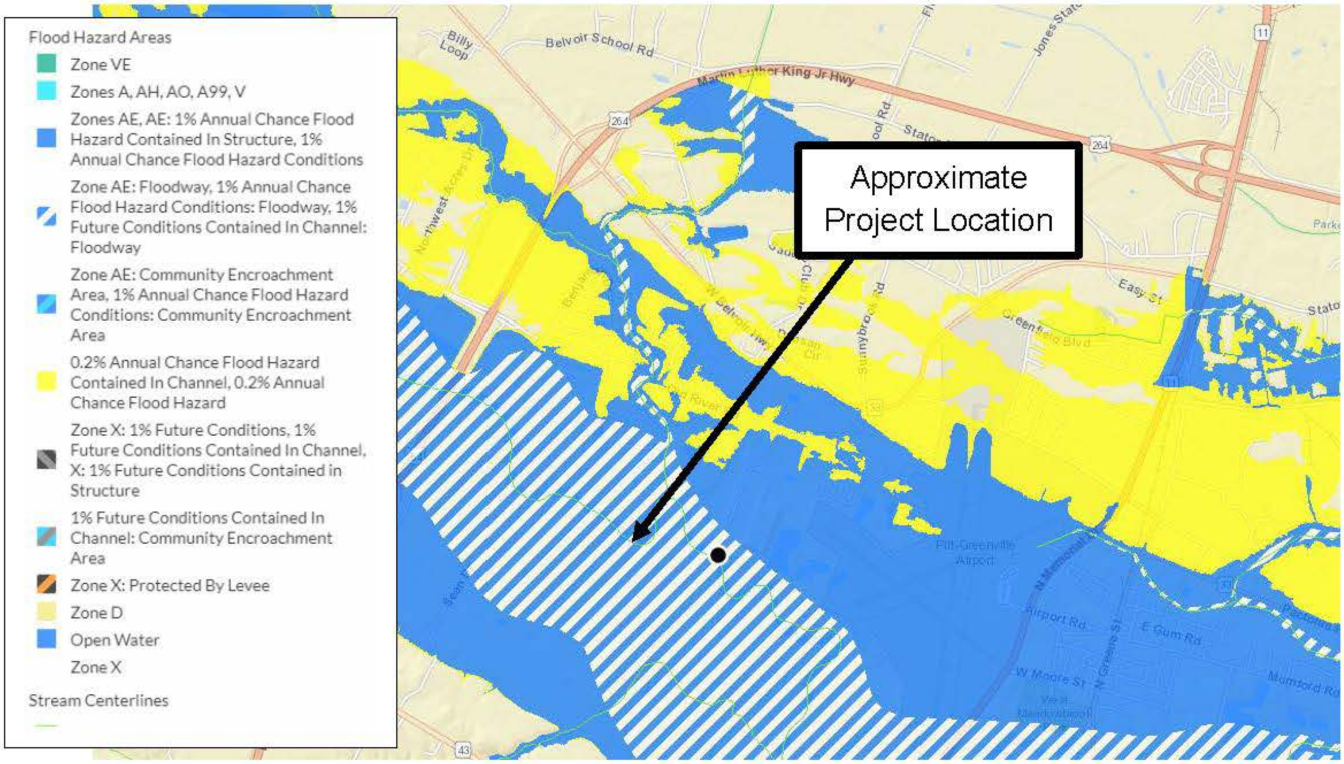


Figure 7-2. Floodplain map at and surrounding project area.

The Recommended Plan would not impact floodplains at or adjacent to the proposed project area. Executive Order 11988 requires Federal agencies to avoid long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development whenever practical. In accomplishing this objective, "[e]ach agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities..." The Recommended Plan is in compliance with Executive Order 11988. No practical alternative exists to the proposed stabilization of the north bank of Tar River near water supply infrastructure. Every effort will be taken to minimize potential harm to or within the floodplain by reducing the amount of material placed in the floodplain to only that which is required to protect the bank. Due to the limited size and scope of the Recommended Plan, implementation will not result in adverse impacts to the adjacent floodplain. Any proposed action within the established floodway/floodplain will comply with state/local floodplain protection standards. Effects of the Recommended Plan associated with Tar-Pamlico Buffer rules were coordinated with the NC Division of Water Resources through the Section 401 water quality permitting process (Appendix I). Additionally, because the Recommended Plan will encroach into a special flood hazard area, a Floodplain Development Permit (or "No-Rise" certification) issued by the City of

Greenville, NC will be acquired prior to construction. The eight steps discussed in Executive Order 11988 were addressed as follows:

1. Floodplain and/or wetland deternination.
   - The Recommended Plan would not adversely impact any floodplains or wetlands, upstream, within, or downstream of the project.
2. Public notification.
   - Public involvement began with scoping and continued throughout the NEPA process. The draft DPR/EA was provided to the public for comment. All comments and information received were considered during development of the FONSI.
3. Identify and evaluate practicable alternatives to locating in the base floodplain.
   - The DPR/EA discusses all practicable alternatives to locating in the base floodplain. No practical alternative exists to the proposed stabilization of the north bank of Tar River near water supply infrastructure.
4. Identify the impacts of the Recommended Plan.
   - Impacts of the Recommended Plan were fully discussed in the report and were compared in Table 5-1 Summary of the Environmental Effects Associated with the Alternative Plans.
5. Evaluate measures to reduce potential adverse impacts of the proposed action.
   - The DPR/EA has evaluated potential measures to reduce adverse impacts. Table 5-1 Summary of the Environmental Effects Associated with the Alternative Plans contains a thorough analysis of all positive and negative impacts.
6. Reievaluate the alternatives.
   - All alternatives were thoroughly evaluated according to the USACE planning process and were presented in Section 6.0 Plan Formulation and Evaluation of Alternatives.
7. Make the final determination and present the decision.
   - The final determination and presentation of the Recommended Plan is that the project would not impact floodplains at or adjacent to the proposed project area.
8. Implement the action.
   - Implementation of the Recommended Plan would result in no significant impacts to floodplains or wetlands. The existing hydrology of the floodplain would not be changed. The Recommended Plan complied with Executive Order 11988.

The No Action alternative would not result in any impacts to floodplains.

7.4 Hazardous, Toxic and Radioactive Materials

The United States Environmental Protection Agency's (USEPA) Envirofacts website was queried to identify the presence of EPA-regulated facilities within one mile of the proposed project area. The Envirofacts website contains information collected from regulatory programs and other data relating to environmental activities with the potential to affect air, water, and land resources in surrounding areas. Forty-eight sites were reported within a one mile radius however, there was only one site in the immediate vicinity of the proposed project area. This site was identified as the Greenville Water Treatment Plant immediately north of the proposed project area (USEPA 2022).

Multiple on-site inspections of the project area and surroundings have been performed by USACE, Wilmington District staff in 2022. Based on these site visits and an investigation of historic aerial photographs, no evidence of improperly managed hazardous and/or toxic materials, or indicators of those materials were present in the proposed project area.

The Recommended Plan and the No Action alternative would have no effects to hazardous, toxic and radioactive materials or waste. Similarly, the Recommended Plan and the No Action alternative would not produce hazardous, toxic and radioactive materials or waste.

7.5 Cultural Resources

The North Carolina State Historic Preservation Office's (SHPO) HPOWEB Map Service was queried to identify known cultural resources in and near the project area. This service provides information such as cultural resources sites listed on the National Register, sites designated as Local Landmarks, and other data useful in considering potential impacts to cultural resources. No cultural resources are known to exist in the proposed project area, or along roadways to be used during construction (Figure 7-3) (NCDNCR 2022b).

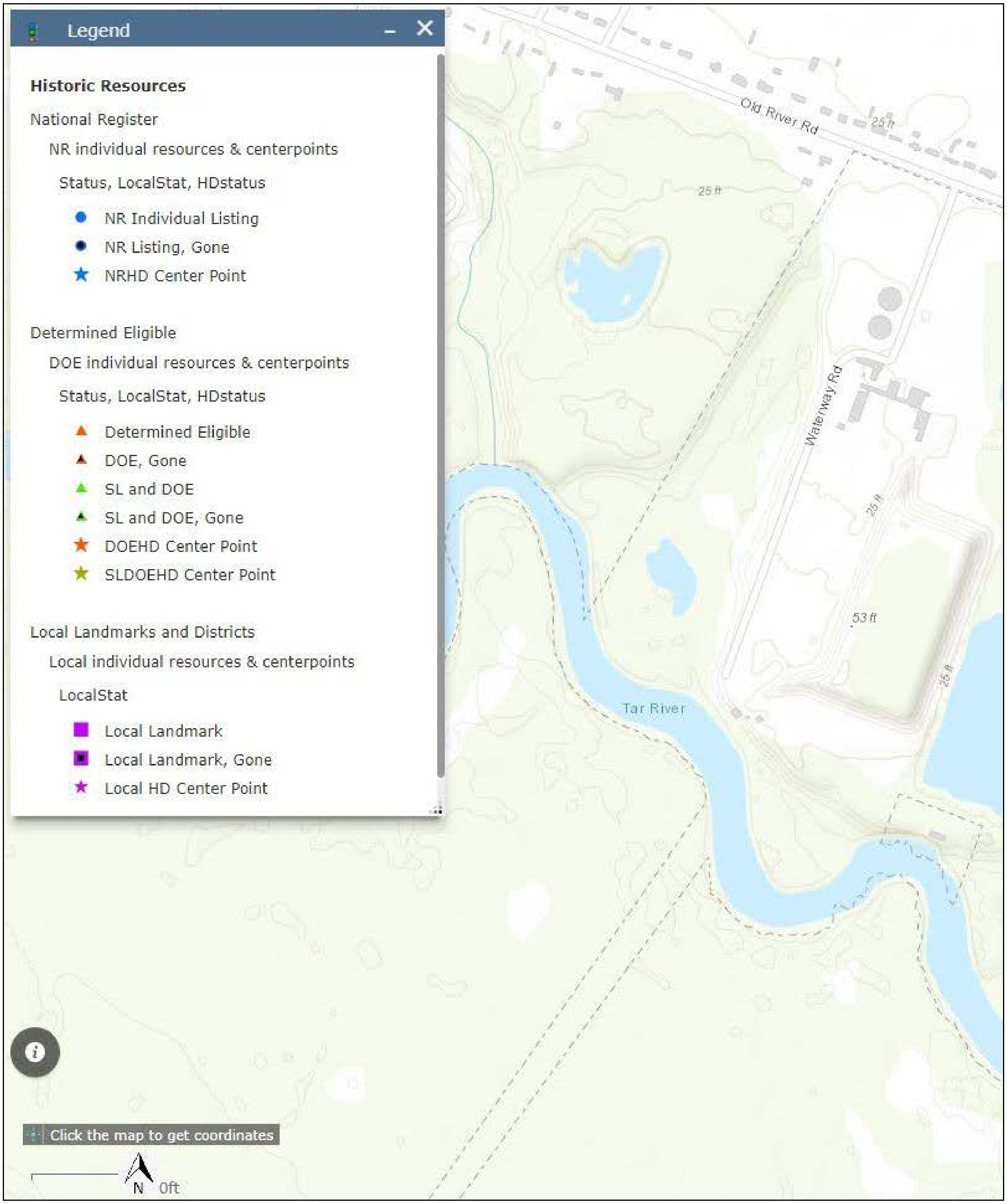


Figure 7-3. Known cultural resources located at and surrounding proposed project area.

The proposed project area is immediately adjacent to a previously disturbed area, the Greenville Water Treatment Plant, which is not known to be associated with, or itself be, a culturally-significant resource. Furthermore, considering severe streambank erosion in the proposed project area, the minimal excavation and clearing involved during construction, and the relatively small, proposed project area, it is unlikely that any cultural resources will be affected by the Recommended Plan . Materials staging areas and construction traffic will be in previously disturbed areas as well. The proposed action will have no effect on historic properties or cultural resources and would provide protection to the streambank from future erosive events. By letter dated January 9, 2023, referencing project number ER 22-0162, the SHPO concurred with the USACE's effects determination. Should any cultural resources be discovered during implementation of the Recommended Plan , construction would be temporarily suspended, and the SHPO would be contacted.

The Recommended Plan would not affect cultural resource in the proposed project area. On the contrary, the proposed action is expected to help minimize streambank erosion in the proposed project area and offer protection to water intake infrastructure. Reducing bank erosion may serve to protect any unidentified cultural resources adjacent to the banks of the Tar River.

The No Action alternative would allow for continued streambank erosion, which may endanger any unidentified cultural resources in the proposed project area.

7.6 Air Quality

The proposed project area, located in Pitt County, NC, is in attainment with both State and Federal National Ambient Air Quality Standards parameters (Figures 7-4 and 7-5) (NCDEQ 2011, USEPA 2012).

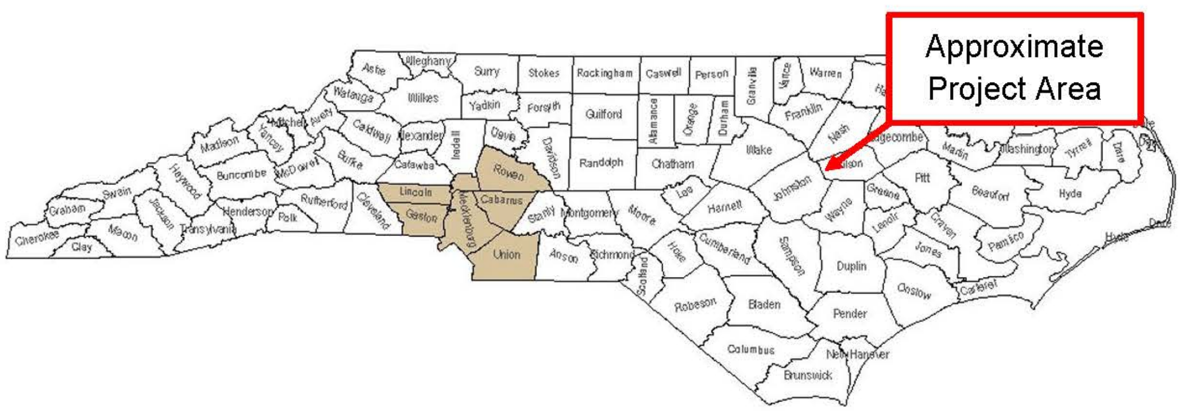


Figure 7-4. North Carolina 8-hour Ozone nonattainment area boundaries

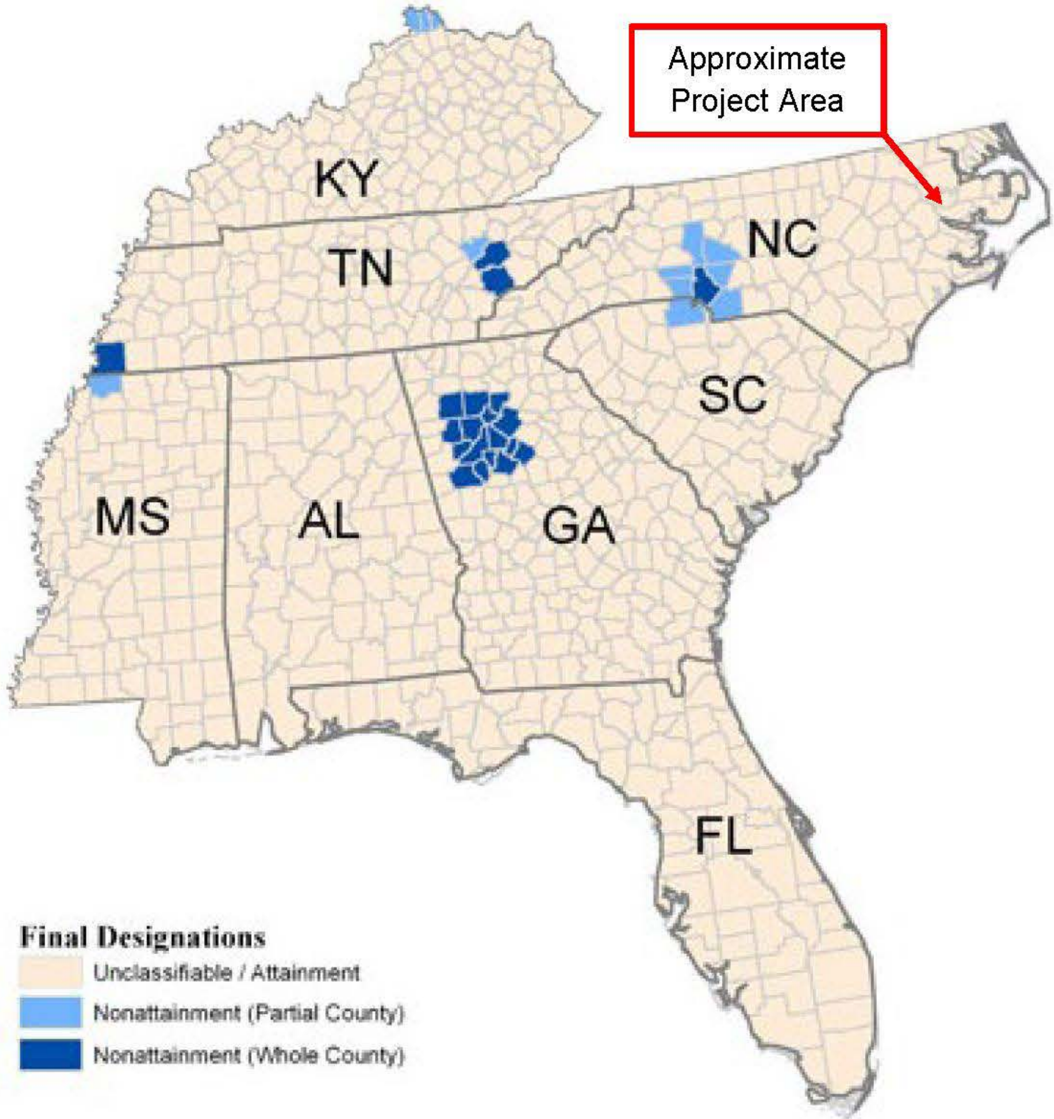


Figure 7-5. EPA ground-level ozone standards.

Air quality, including greenhouse gas (GHG) emissions, would temporarily and insignificantly increase with implementation of the Recommended Plan due to necessary use of heavy machinery and construction-related equipment. Regarding a comparision to baseline GHG emissions conditions, gasoline- and diesel-powered vehicles and machinery are commonly used in the project vicinity for construction, operations and maintenance, and general transportation purposes. Emissions are expected from equipment used during construction, and any other support equipment which may be on or adjacent to the proposed project area. Increases in dust emissions would occur during construction, but these impacts would be short-term, only occuring while construction is active, and would not impact overall air quality. Any proposed project-related emissions are not expected to contribute significantly to climate change and would not impact air quality in the project area. A State Implementation Plan conformity determination is not required since the proposed project area is in attainment for all criteria pollutants.

The No Action alternative would not contribute to emissions and would not impact air quality.

7.7 Noise

Noise levels vary in Pitt County, NC. In the proposed project area vicinity, noise levels are typically associated with industrial operations, air travel, and local agricultural activity. Noise levels may be temporarily elevated during construction in the proposed project area, with expected duration of 4-6 months during daylight hours.

Noise would temporarily and insignificantly increase with implementation of the Recommended Plan due to necessary use of heavy machinery and construction-related equipment. In accordance with the published Noise Control Ordinance of Pitt County, NC (Pitt County 2022), construction activity associated with the Recommended Plan is expected to comply with all published noise ordinances.

The No Action alternative would have no impacts on noise.

7.8 Benthic Resources

The benthic community in the vicinity of the proposed project area has been rated “excellent” by the North Carolina Department of Environmental Quality’s Division of Water Resources’ Biological Assessment Branch (NCDEQ 2007b). Specifically, benthic sampling occurred at Station OB163 which is located in the Tar River approximately one mile northwest of the proposed project area.

The Recommended Plan would have negligible impacts on benthic resources in the proposed project area as the majority of construction-related disturbance would occur in the upland portion of the project area. Additionally, material excavation would be minimal, if any. NCDOT #57 stone would be placed on the eroding streambank from the waterline to the stream bed at which point, NCDOT Class II rip rap would be placed on the streambed and extend westward for approximately 12 feet. The proposed project area lies on the northward (outer) bank of an oxbow bend of the Tar River, which experiences higher water velocities and increased erosive forces as compared to the river’s opposite bank. Due to these relatively higher water velocities, severe bank erosion, and benthic survey results (NCDEQ 2007), it is not expected that there exists a thriving benthic community in the immediate project area. However, construction of the Recommended Plan would permanently alter the predominant benthic habitat from a highly eroded sandy habitat to a rocky habitat (riprap) in the immediate project area and bury existing benthic fauna, temporarily disrupting benthic community composition. In total, 0.25 acres of sandy habitat would be permanently covered by riprap. Construction of the Recommended Plan would stabilize sediments in the most eroded portions of the proposed project area and provide hard structure for utilization by benthic organisms and other aquatic fauna. Impacts to benthic community composition in areas surrounding construction activities would be short-lived.

The No Action plan would allow for continued streambank erosion in the project area, potentially altering benthic habitat regularly following extreme weather and flow events.

7.9 Fisheries Resources

Fisheries resources in the Tar River basin are rich. Waters upstream the proposed project area have been surveyed by North Carolina Department of Environmental Quality's Division of Water Resources' Biological Assessment Branch (NCDEQ 2022). Fish community collection sites are typically located at bridge crossings or other public access points on second, third, and fourth order streams where backpack electrofishing methods can be safely and efficiently applied. The nearest site upstream of the project area is station OF57, located approximately 7 miles northwest of the project area in Tyson Creek at the SR 1255 road crossing. The nearest site downstream of the project area is station OF31, located approximately 2.5 miles east of the project area in Parker Creek at the NC 33 road crossing. At each collection site fish communities include, but are not limited to, multiple sunfish species, multiple shiner species, Eastern mosquitofish, pirate perch, redfin pickerel, bluegill, brown bullhead, and American eel. Additionally, Tracy et al. (2020) describe hickory shad, alewife, bowfin, inland silverside, multiple dace species, multiple lamprey species, and multiple chub species as species occupying the Tar River basin. Generally, according to the North Carolina Wildlife Resources Commission (NCWRC), in the Tar River and Upper Pamlico River common game fishes include striped bass, largemouth bass, sunfish, and white and yellow perch (NCWRC 2022).

The Recommended Plan will involve in-water placement of material, which will have minimal and short-lived impacts on fisheries resources, primarily by temporarily increasing turbidity during construction and by alteration of benthic habitat from sandy sediment to rock structure (riprap). Short-lived turbidity increases and construction activity in the proposed project area may temporarily displace fish species; however, these mobile species are capable of foraging in similar, nearby waters for the duration of the project and are not expected to be negatively impacted by the proposed action. To further avoid potential impacts to anadromous fish species, an in-water work moratorium will be established between February 1 and September 30.

The No Action plan would allow for continued streambank erosion in the project area, potentially altering localized turbidity and forage substrate for fishes.

7.9.1 Essential Fish Habitat

The Magnusson-Stevens Fishery Conservation Act of 1976 governs marine fisheries resources and provides for protection of essential fisheries habitat (EFH). No EFH exists at or in areas surrounding the proposed project area (NOAA 2022).

The Recommended Plan and No Action alternative will not result in any impacts to essential fish habitat.

7.10 Terrestrial Resources

Erosion and failed erosion control measures at the proposed project site have eliminated much of the streambank vegetation, leaving an eroded steep slope with minimal to no vegetation remaining. Vegetation above the eroded zone is comprised of predominately regularly mowed grasses, vines, and hardwood trees such as bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), river birch (*Betula nigra*), sweet gum (*Liquidambar styraciflua*) and various pine species (*Pinus spp.*). As streambank erosion continues in the project area, especially following storm events, riparian vegetation continues to become increasingly scarce.

The Recommended Plan would require grading of the streambank, principally by material placement, to a contour of 2H:1V. Clearing of grasses, vines, and trees, not to exceed one acre, will be required to allow for equipment operation. This clearing will be minimized as to retain as much existing riparian vegetation as practicable. Additionally, 0.25 acres of previously disturbed terrestrial habitat will be permanently covered with riprap. No other impacts to terrestrial resources are expected, and all disturbed bare ground areas would be re-vegetated with grasses or other native plants upon project completion.

Under the No Action, continued streambank erosion and associated vegetation loss would persist.

7.11 Threatened and Endangered Species, and Species of Concern

According to the United States Fish and Wildlife Service' Information for Planning and Consultation Service (IPaC) (USFWS 2022), six species known to exist in Pitt County, NC are given special consideration under the ESA (Appendix D). The Atlantic Sturgeon is also listed under the ESA but is under the purview of the National Marine Fisheries Service. Additionally, the proposed project area overlaps with designated critical habitat for the Atlantic sturgeon and Neuse River waterdog.

The North Carolina Department of Environment and Natural Resources' Natural Heritage Program identifies 102 species, animal assemblages, and natural communities meriting special consideration in Pitt County, NC (NCDNCR 2022a).

Several birds of conservation concern and migratory birds may be present in the project area and vicinity. Following coordination with the USFWS, a bald eagle survey was conducted in Aprill 2022 encompassing all areas within a 660 ft radius of the area of concern (i.e., proposed project footprint), as depicted in Figure 7-6. A 660 ft radius buffer accounts for adequate project distance from an active eagle nest, should an eagle nest be present in the vicinity. The survey was conducted by boat and on foot, on both banks of the Tar River. No bald eagles or bald eagles were observed. Additionally, Greenville Water Treatment Plant staff had not reported any sightings of bald eagles in the area in several years.

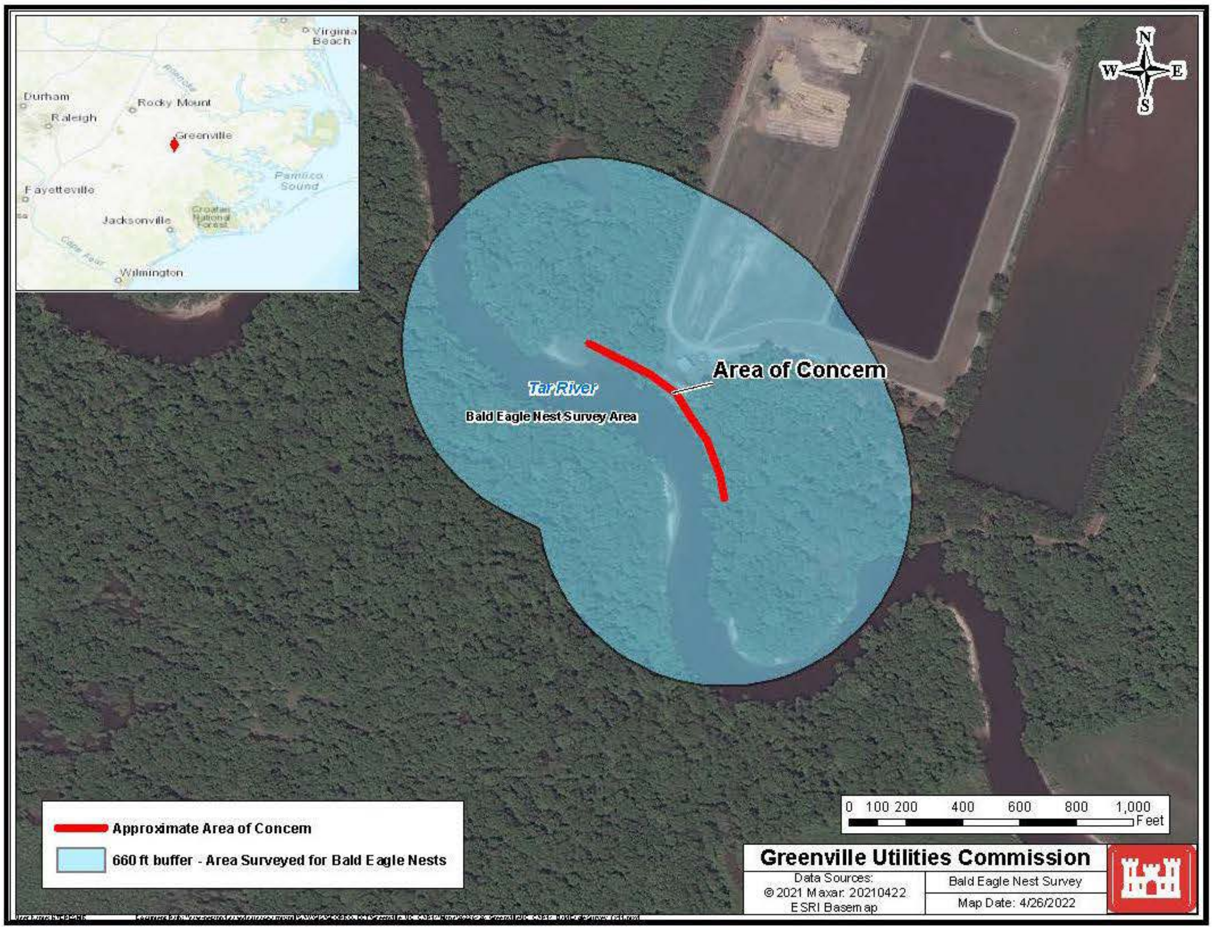


Figure 6-6. Bald eagle survey area.

The Recommended Plan will have no effect on the Federally listed American alligator, Atlantic Sturgeon, Bald Eagle, Monarch butterfly, or West Indian manatee. Although the American Alligator may be present in the project area, it is mobile and will not be affected by construction activity. Based upon known spawning run patterns, it is unlikely that Atlantic Sturgeon would be encountered during in-water construction. To avoid potential impacts to Atlantic Sturgeon, an in-water work moratorium will be established between February 1 and September 30; therefore, the Recommended Plan will have no effect on Atlantic Sturgeon. Additionally, primary constituent elements for Atlantic sturgeon critical habitat including, but not limited to, suitable spawning sites, aggregation areas, and preferred flow regime are absent from the project area (USFWS 2016). Bald eagles are currently absent from the project area. The Monarch butterfly may be seen in western portions of North Carolina during its annual migration, but is unlikely to be encountered in the project area. The West Indian Manatee is also unlikely to be encountered in the project area due to the project area's inland distance from the Atlantic ocean and its relatively northern latitude; however, the Recommended Plan will adhere to the USFWS' guidelines for avoiding impacts to the West Indian manatee (Appendix E).

The Recommended Plan may affect but is not likely to adversely affect the following Federal / State listed threatened or endangered species or other species of concern: Atlantic Pigtoe, Eastern Lampmussel, Roanoke Slabshell, Neuse River Waterdog, Tar River Spinymussel, Tidewater Mucket. Effects to mollusks and the Neuse River Waterdog may be realized as temporary increases in localized turbidity associated with in-water construction activity, alteration of benthic habitat from sandy bottom to riprap, and burial during construction; however, riprap may provide favorable substrate for mollusks such as freshwater clams and mussels. Prior to construction, the USACE will conduct a freshwater mollusk survey using a qualified and properly credentialled individual to assess presence and, if applicable, relative abundance in the project area. The survey will be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when mollusks are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and NCWRC. If listed species (e.g., Atlantic Pigtoe and Tar River Spinymussel) are found during surveys, a Biological Opinion may be required and a shift from informal to formal consultation between the USACE and USFWS to satisfy Section 7 of the ESA (Appendix J). The Neuse River Waterdog typically prefers leaf beds and quiet waters, which are absent from the immediate project area. Additionally, implementation of the Recommended Plan will reduce long-term turbidity and erosion in the project area.

The effects determination for the Atlantic Pigtoe and Tar River Spinymussel reflects a current knowledge gap regarding presence and abundance. The survey described above may revise this effects determination. The USFWS and the Corps will continue to work together to resolve issues such that Greenville Utilities Commission infrastructure and these species are protected. Should the USFWS deem it necessary following interpretation of survey results, mollusks would be relocated outside of the project area prior to construction activities. These relocations will occur not more than a month before construction begins. Relocation of mussels, stringent erosion and sediment controls on land, and use of silt curtains during in-water construction are expected to minimize potential negative effects to listed species in the project area and downstream. Monitoring and maintenance of erosion and sediment / silt and erosion controls will occur more often than in their typical use, especially before or after any rainfall events or expected rises in the Tar River.

Species featured in Table 7-1 summarizes listed species that may be present in the project area. Clams and mussels are largely sessile and those in the immediate project footprint may be buried during construction; however, other animal species in the project vicinity are mobile and could likely avoid impacts associated with construction activity, should they be present. Similarly, it is unlikely that any plants given special consideration by the Natural Heritage Program would be affected by proposed construction. Affected upland areas are heavily disturbed and/or maintained.

Table 7-1. ESA and State-listed species potentially present in project area.

Federally / State Listed Species				
Common Name	**Scientific Name**	**Responsible Agency**	**Status**	**Effects Determination**
American Alligator	*Alligator mississippiensis*	USFWS	FSAT	NE
Atlantic Pigtoe	*Fusconaia masoni*	USFWS	FT	MANLAA
Atlantic Sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	NFMS	FE	NE
Bald Eagle	*Haliaeetus leucocephalus*	USFWS	BGEPA	NE
Eastern Lampmussel	*Lamsilis radiata*	NCWRC	ST	MANLAA
Monarch Butterfly	*Danaus plexippus*	USFWS	FC	NE
Roanoke Slabshell	*Elliptio roanokensis*	NCWRC	SSC	MANLAA
Neuse River waterdog	*Necturus lewisi*	USFWS	FT	MANLAA
Tar River Spinymussel	*Parvaspina steinstansana*	USFWS	FE	MANLAA
Tidewater Mucket	*Leptodea ochracea*	NCWRC	ST	MANLAA
West Indian Manatee	*Trichechus manatus*	USFWS	FT	NE

FC - Federal Candidate
FE - Federal Endangered
FSAT - Federal Similarity of Appearance (Threatened)
FT - Federal Threatened
SSC - State Special Concern
ST - State Threatened
BGEPA - Bald and Golden Eagle Protection Act

NE - No Effect
MANLAA - May Affect, Not Likely to Adversely Affect
MALAA - May Affect, Likely to Adversely Effect

The Recommended Plan will not include destruction or adverse affects to designated critical habitat for the Atlantic Sturgeon or Neuse River Waterdog. The specific 0.25 acres of river bottom to be covered with riprap is in an area currently subject to erosion and elevated turbidity during storm events and other high water events, reducing its value as high quality critical habitat. The USFWS provided tentative concurrence with the effects determinations and survey commitments presented in this document via email dated April 7, 2023 (Appendix J), in accordance with Section 7 of the Endangered Species Act.

The No Action alternative would allow for continued streambank erosion, which may displace aquatic threatened and endangered species, and other species of concern, by degrading water quality.

7.12 Aesthetic and Recreational Resources

The Tar River empties into Pamlico Sound. The relatively flat topography of Pitt County affords the Tar River a moderate degree of sinuosity and a relatively unconstrained floodplain. With few exceptions, including the Greenville Water Treatment Plant, the River's banks are bordered by woodlands and natural areas with pleasing aesthetic qualities. Primary recreational opportunities present in the proposed project vicinity are recreational shoreline and small craft fishing, hunting, and hiking.

The Recommended Plan is not expected to significantly impact aesthetic or recreational resources. Construction would be restricted to the immediate proposed project area and would provide stabilization to the eroding streambank. Any impacts related to construction, including noise, presence of construction equipment, and potential effects to roadway traffic circulation associated with equipment or material transport would be temporary and short-lived. Although the proposed project area would be covered with riprap, a maintained bank is congruent with other landuse in the project area and would be an aesthetic improvement as compared to current conditions (bank erosion and failing existing protection measures). The Recommended Plan would not adversely impact any scenic views or adversely impact recreation in the proposed project area.

The No Action alternative would not directly impact aesthetic and recreational resources in the proposed project area; continued bank erosion may detract from recreational opportunities and the aesthetic value of lands at and downstream of the proposed project area.

7.13 Socioeconomic Resources

For information regarding socioeconomic resources in the vicinity of proposed project area, to include environmental justice, please see Section 12.0 Environmental Justice Assessment.

7.14 Cumulative Impacts

The Recommended Plan would armor approximately 305 linear feet of the Tar River bank with riprap to prevent continued erosion and bank sloughing, endangering critical water supply infrastructure. Streambanks abutting the proposed project area are, and would remain, unarmored. The proposed action is expected to have minimal impact on overall functionality and quantity of riparian vegetation and available wildlife habitat in the proposed project area.

The Recommended Plan would have no appreciable adverse impact on environmental resources in the proposed project area or the Tar River watershed, and may provide environmental benefits by stabilizing the streambank.

Following construction of the proposed action, water supply infrastructure associated with the Greenville Water Treatment Plant is expected to remain protected from erosion caused by scouring of the northern Tar River bank following storm and other high water events for a period of 50 years and is not expected to alter any ecological function or community structure in the project vicinity (i.e., within a five mile radius of the project area). Additionally, no known future actions are expected to be constructed by other agencies / organizations in the project vicinity during the expected 50-year life of the proposed action.

7.15 Conclusion

Based on findings described in this report, it is in the federal interest to implement the Recommended Plan for emergency streambank erosion control at the Greenville Water Treatment Plant. The proposed action will meet the objective of protecting vulnerable water supply infrastructure. Table 5-1 details significant environmental factors and impacts taken into consideration. Project construction will result in long-term impacts to benthic habitat and terrestrial vegetation (not to exceed one acre) and short-term impacts to benthic community composition, fish species habitat, water quality, air quality, and noise levels in the project area. Overall benefits of the Recommended Plan, however, include a long-term reduction in streambank erosion and turbidity in the project area and protection of critical water supply infrastructure.

8.0 CLIMATE CHANGE CONSIDERATIONS

ER 1100-2-8162, Incorporating Sea Level Change (SLC) in Civil Works Programs, provides regulations and guidance for incorporating direct and indirect physical effects of projected future sea level change to USACE Civil Works projects. Consideration of potential relative sea level change is required in every USACE coastal activity as far inland as the estimated tidal influence, including studies that calculate backwater profiling with the ocean as the downstream boundary condition.

NOAA's "Sea Level Rise Viewer" (https://coast.noaa.gov/) was used to determine the impacts of SLC. Present day MHHW extends up the mouth of the Tar River to near the Edgecombe and Pitt County border. Four MHHW scenarios that included sea level rise were assessed within the tool, 1-ft sea level rise, 2-ft sea level rise, 6-ft sea level rise, and 8-ft sea level rise. Based on a comparison of the encroaching water depth footprint between the different sea level rise scenarios, no GUC WTP infrastructure would be impacted by the increased MHHW. For reference, the USACE Sea-level Change Curve Calculator for the Beaufort, NC gauge #8656483 resulted in the following projections for year 2073: Low Curve is 0.66-ft, Intermediate Curve is 1.27-ft, and High Curve is 3.12-ft. The specified range of RSLR based on the Beaufort, NC gauge (0.66-ft to 3.12-ft) falls within the NOAA's Sea Level Rise Viewer range (1-ft to 8-ft); therefore, RSLR is unlikely to adversely affect the performance of the Recommended Plan .

The USACE Sea Level Tracker (https://climate.sec.usace.army.mil/slr_app/) was used to visualize the variability of coastal water levels at the Beaufort, NC Gage, and compare the different USACE sea level change scenarios. Results of the tracker tool include historical gauge records through year 2021. Notably, there has been an apparent upward trend of both 5- and 19-year MSL moving averages since the mid-2000's. This pitch upward may suggest convergence with the High SLC curve in the near future.

A qualitative climate change analysis was performed as required by U.S. Army Corps of Engineers (USACE) Engineering and Construction Bulletin (ECB) 2018-14, "Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects." This analysis captured current and projected future climate change trends that are applicable to the GUC study area. Findings of these assessments revealed increasing temperatures though was unable to definitively show an increasing or decreasing trend in precipitation, based on observed data. Assessment of future projections also showed an increasing temperature trend as well as also suggesting an increasing trend in precipitation. Overall, there were no significant trends evident in observed streamflow throughout the study basin while more uncertainty was associated with projected future streamflow trends, particularly with higher streamflow projections. Refer to Appendix B Hydrology and Hydraulics, Section 7 for more details of the climate change analysis performed as part of this report.

9.0 HYDRAULIC ANALYSIS

Appendix B documents the hydrologic and hydraulic analysis and includes a summary of the design considerations on the Recommended Plan.

Erosion mechanisms that are occurring within the project area and potential solutions were assessed using Hydrologic Engineering Center's (CEIWR-HEC) River Analysis System (HEC-RAS) software, version 6.2. In accordance of Engineering Manual 1110-2-1601, Hydraulic Design of Flood Control Channels, HEC-RAS was utilized to riprap protection associated with the Recommended Plan . The HEC-RAS Hydraulic Design Functions, Riprap Calculator contains the methodologies prescribed in EM 1110-2-1601, Chapter 3, and used 1-dimension, steady-state hydraulic results. A sensitivity analysis was also conducted that includes the use of field-measured streamflow velocity values as provided by the Greenville Utilities Commission.

9.1 HEC-RAS

The project HEC-RAS model was based on the current 2022 Effective FEMA model for Tar River in Pitt County. A series of refinements and improvements were made to the FEMA model which included georeferencing of existing cross sections as well as insertion of new cross sections based on recent bathymetric surveying by USACE and Greenville Utilities Commission. Simplified calibration of flows and water surface elevation within the HEC-RAS was achieved by using the nearby, downstream USGS streamflow gage at Greenville, NC.

9.1.1 RIPRAP CALCULATOR

Riprap was sized following procedures in EM 1110-2-1601, which is based on critical flow velocity within the Tar River channel. Two methods of determining average channel velocity were used due to the presence of field measurements within the project area. The first method was based on the aforementioned HEC-RAS hydraulic model to calculate velocity and is the preferred method within EM 1110-2-1601. The second method determined velocity from field measurements within the channel (Schnabel, 2008). Safety factors assumed for the first and second methods were 1.4 and 1.2, respectively. It was determined that conditions that produce the critical flow velocity would occur at near channel capacity or bankfull condition. Modeling showed that interaction with the surrounding inundated floodplain of the Tar River resulted in lower velocities for the project area.

The HEC-RAS method resulted in a critical flow velocity of approximately 5 feet per second within the project area and recommended a riprap gradation equivalent to

EM 1110-2-1601 gradation #1. The second method, based on field-measured flow velocities resulted in a critical flow velocity of approximately 7 feet per second within the project area and recommended a riprap gradation equivalent of EM 1110-2-1601 gradation #3. EM 1110-2-1601 gradation #3 is as follows:

D15(min) = 5.98 in. / W15(min) = 10.67 lbs.

D15(max) = 7.88 in. / W15(max) = 24.50 lbs.

D30 = 7.32 in. / W30 = 19.61 lbs.

D50(min) = 8.80 in. / W50(min) = 34.02 lbs.

D50(max) = 10.01 in. / W50(max) = 50.12 lbs.

D90 = 10.56 in. / W90 = 58.87 lbs.

D100(min) = 11.03 in. / W100(min) = 67.05 lbs.

D100(max) = 15.00 in. / W100(max) = 168.74 lbs.

The resulting velocities from the two methods described above produced different recommendations of riprap sizes for the project site. Method #1 calculated relatively low averaged channel velocities and consequently resulted in choosing the smallest EM 1110-2-1601 gradation #1 curve. Method #1 corresponding stone size readily available at a local quarry was NCDOT Class B. Method #2, based on higher average velocities measured within the channel, resulted in choosing EM 1110-2-1601 gradation #3 curve. Method #2 corresponding stone size readily available a local quarry was NCDOT Class 1. Generally, it is uncommon to recommend riprap sizing be determined based solely on field observations as it carries uncertainty related to limited observation points. However, due to the emergency streambank stabilization nature of this study authority and method #2 producing relatively larger stone size, it is recommended that NCDOT Class 1, or an equivalent readily available stone be placed along the Tar River left bank at the project site.

9.2 FINAL RIPRAP SIZE RECOMMENDATIONS

The Recommended Plan (Stone (Riprap) Slope Protection) would consist of a layer of stone (Riprap) placed over a layer of bedding stone along approximately 305 linear feet of streambank and extending from the top of the existing streambank in the oxbow bend of Tar River to the embankment toe. The streambank would be cleared and graded to a 2H:IV slope for placement of the streambank slope protection. Below the ordinary high water line, backfill material consisting of NCDOT #57 stone would be placed over a geotextile layer, graded, and compacted as required to provide a smooth sloped surface for the placement of the stone. Above the ordinary high water line, backfill material consisting of satisfactory fill (earth) material would be placed on the existing cleared streambank, graded, and compacted as required to provide a smooth sloped surface for placement of the stone slope protection. (Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, and CL-ML. Satisfactory materials for grading shall be free from roots and other organic matter, trash, debris, frozen material, and stones larger than 3 inches in any dimension.) The streambank slope protection measures would consist of a 1' layer of bedding stone (NCDOT #57 stone) and a 25.5" thick layer of NCDOT Class I riprap placed over a layer of geotextile and graded fill slope. Toe protection will be placed along the toe of the stream bottom. The cut/fill volume associated with the design 2H:1V graded streambank and placement of toe protection will have a negiligible effect to existing water levels based on the hydraulic modeling.

10.0 DETAILED COST ESTIMATE FOR RECOMMENDED PLAN

RECOMMENDED PLAN, "STONE (RIPRAP) SLOPE PROTECTION"
GREENVILLE, NC SECTION 14 EMERGENCY STREAMBANK
AND SHORELINE EROSION PROTECTION PROJECT

ESTIMATED PROJECT FIRST COSTS (FULLY FUNDED)
(all costs include contingency in accordance with Appendix C)

	2024 Q3 Price Level Prices
Direct Construction Costs	$1,376,000
Real Estate Costs	$3,000
Detailed Design (from DI phase)	$279,000
Supervision and Administration	$183,000
PROJECT FIRST COST	$1,841,000

ESTIMATED FEDERAL COST:	$1,196,650 (65%)
ESTIMATED NON-FEDERAL COST:	$644,350 (35%)
Subtotal:	$1,841,000
FEASIBILITY STUDY COST:	$150,000 ($125k Fed / $25k non-Fed)
PROJECT FIRST COST WITH STUDY:	$1,991,000

11.0 ECONOMIC JUSTIFICATION FOR RECOMMENDED PLAN

ER 1105-2-100 Appendix C, Section III, F-23 states that the least cost alternative plan is considered to be justified if the total costs of the proposed alternative are less than the costs to relocate the threatened facility. With the estimated costs of relocation at greater than $4,600,000 and the protection cost of the Recommended Plan at approximately $1,841,000, it is determined that the Recommended Plan of Stone (Riprap) Slope Protection is economically justified.

12.0 ENVIRONMENTAL JUSTICE ASSESSMENT

Background and Definitions

Executive Order 12898, dated February 11, 1994, mandates that “each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

The Council on Environmental Quality (CEQ) has oversight of the federal government’s compliance with EO 12898 and NEPA. CEQ, in consultation with the US Environmental Protection Agency (EPA) and other affected agencies, developed NEPA guidance for addressing requirements of the EO (CEQ, 1997). This guidance was developed to further assist federal agencies with their NEPA procedures so that environmental justice (EJ) concerns are effectively identified and addressed.

The CEQ has also identified six general principles for consideration in identifying and addressing EJ in the NEPA process which include: (1) area composition (demographics); (2) data (concerning cumulative exposure to human health or environmental hazards); (3) interrelated factors (recognize the interrelated cultural, social, occupational, or economic factors); (4) public participation; (5) community representation; and (6) tribal representation.

The following definitions are used by the CEQ in guidance on key terms of the EO:

- Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census’ Current Population Reports, Series P-60 on Income and Poverty. In identifying low income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

- Minority: Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

- Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as not to artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.

- Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

    - Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
    - Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
    - Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

- Disproportionally high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

    - Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment.

- Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group.
- Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

Analysis and Conclusions

USACE conducted an EJ analysis by determining whether EJ populations are present and whether the proposed action would result in a disproportionately high and/or adverse effect on these populations.

For purposes of the EJ analysis, the area of effect is the area which is served by the public utility which is being protected (Figure 12-1). Using the Center for Disease Control (CDC) Social Vulnerability Index (SVI) by census tract, the Recommended Plan would have positive impacts on the following populations:

***Minority Population*:** Varies from low to high, but most proposed areas of impact received a CDC CVI ranking exceeding 0.5 for the minority status and language category, signifying that 50% of the tracts in North Carolina are less vulnerable than these identified tracts based on minority & English-speaking status.

***Per Capita Income*:** The majority of the population that is affected is in the "Highest Vulnerability" category.

***SVI Overall Percentile ranking*:** The majority of the population that is affected is in the "Highest Vulnerability" category.

Impacts to the above populations due to the Recommended Plan are anticipated to be positive as a result of protecting operations which provide their drinking water. There are no expected significant adverse impacts to EJ populations due to the implementation of this project.

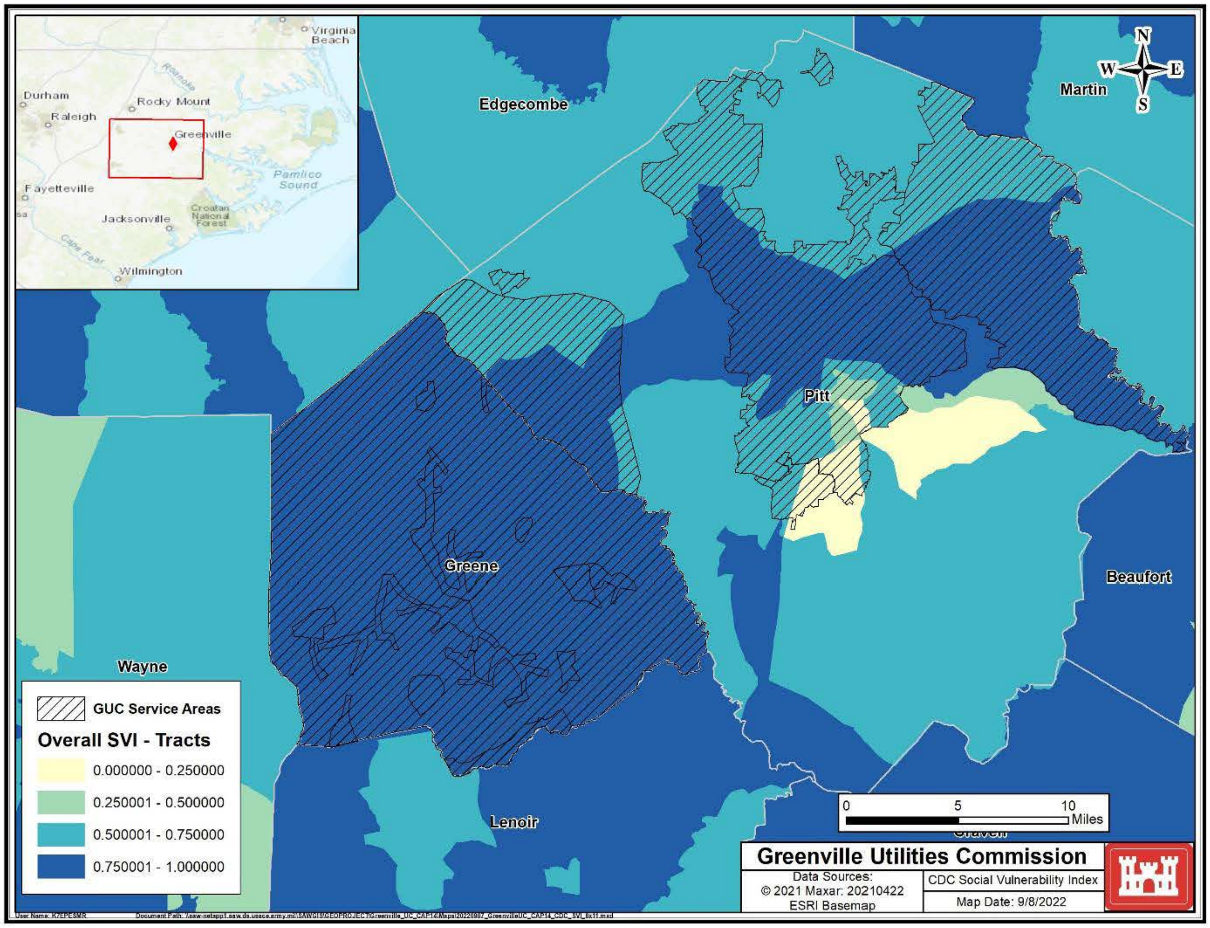


Figure 12-1. Map CDC SVI Index overlayed with the GUC service area. The dark blue represents the overall "highest vulnerability" where the populations are more vulnerable than at least 75% of other populations in North Carolina.

13.0 REAL ESTATE REQUIREMENTS

The lands required for the Greenville Utilities Commission Section 14 Project are owned in fee by the Greenville Utilities Commission (GUC). In 2011, the GUC implemented a streambank stabilization project. However, continued riverbank erosion of the Tar River has created a direct threat to the continued operation of the water intakes and water supply to the GUC service region.

Based on the current design, no additional real estate will be required for the construction of this project. All proposed access and staging areas will be located on lands owned in fee by the GUC. However, should additional requirements become necessary, the appropriate standard estate will be determined based on the need and the GUC will be responsible for obtaining the estate identified at that time over such lands. The estimated Federal and Non-Federal Real Estate administrative costs are as follows:

Federal $500

Non-Federal $1,500

Prior to advertisement for construction, the GUC will provide Real Estate Division an executed Authorization for Entry for Construction and Attorneys Certificate of Authority shown in section 11.1. Once received by Real Estate Division, a Real Estate Certification Letter will be provided to the Wilmington Districts Project Management and Contracting Divisions.

14.0 SUMMARY COORDINATION, PUBLIC VIEWS, AND COMMENTS

In response to an email inquiry, a site visit was conducted on July 8, 2020 to investigate the erosion concern at the GUC water treatment plant. As a result of the site visit, a letter was sent to the USACE Wilmington District dated August 21, 2020 requesting assistance under the CAP 14 authority. The study initiated when Federal funds were received in November of 2021.

Since initiation of the Section 14 study, coordination with the Sponsor and Agencies has occurred via teleconference, emails, letter exchange, and on-site meetings. Coordination to date has included Pitt County, the City of Greenville, the Greenville Utilities Commission, the US Environmental Protection Agency, the NC State Historic Preservation Office, the NC Division of Water Quality, the NC Division of Marine Fisheries, the NC Wildlife Resources Commission, the National Marine Fisheries Service, the US Fish and Wildlife Service, the Friends of Greenville Greenways, the North Carolina Black Alliance, and Sound Rivers.

Specifically, regarding feedback opportunities, a project scoping letter was distributed to all identified stakeholders on February 23, 2022 requesting preliminary project review and comment. Comments were received from the the NC State Historic Preservation Office, the NC Wildlife Resources Commission, the US Environmental Protection Agency, and the US Fish and Wildlife Service. In general comments concerned potential impacts to air quality, water quality and hydrodynamics, terrestrial and aquatic resources, threatened and endangered species, and environmental justice. The proposed action and the environmental impacts of the proposed action are thoroughly addressed in this EA. On November 28, 2022, a draft of the DPR/EA was made available to Tribes, local, State, and Federal regulatory agencies, and members of the public for a 30-day review and comment period. All comments received, and associated responses, are included in Appendix H of this document. All identified concerns were considered and addressed during the development of this document. Pursuant to NEPA, a new DPR/EA will be prepared if there are significant changes proposed to the project or new circumstances or information relevant to the environmental impacts of the proposed action.

15.0 PLAN IMPLEMENTATION

15.1 Non-Federal Responsibilities

The GUC, as stated in a letter and resolution dated 21 August 2020 (Appendix A), has expressed support for the project and has agreed to accept the role of non-Federal sponsor in the event of approval of a final Detailed Project Report. The GUC has statutory authority under the Federal Water Resources Development Law of 1969 (G.S. 143-215.38 et.seq.) to make binding commitments to carry out the non-Federal responsibilities related to USACE projects, including making cash contributions to projects. Recommendations for provision of Federal participation in the Recommended Plan described in this report would require the Project Sponsor to enter into a written Project Partnership Agreement, as required by Section 221 of the Flood Control Act of 1970 Public Law 91-611, as amended, to provide local partnership satisfactory to the Secretary of the Army. Such local cooperation shall provide the following non-Federal responsibilities:

a. Provide at least 35 percent, but not to exceed 50 percent, of total Project costs, plus 100 percent of Project costs that exceed the U.S. Army Corps of Engineers (USACE) maximum Federal expenditure limit as further specified below:

(1) Enter into an agreement which provides, at least 35 percent, but not to exceed 50 percent, of total Project costs during the design and implementation phase, plus 100 percent of the Project costs that exceed the USACE maximum Federal expenditure limit of $10,000,000 as defined in Section 14, and the Non-Federal Sponsor shall provide a minimum contribution of funds equal to 5 percent of total Project costs;

(2) Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

(3) Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material, perform or ensure the performance of any relocations, and construct improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material that the Federal Government to be required or to be necessary for the initial construction, operation, and maintenance of the Project;

b. For so long as the Project remains authorized, the non-Federal Sponsor will operate, maintain, and repair the completed Project, or functional portion of the Project, at no cost to the Federal Government, in a manner compatible with the

Project's purposes and in accordance with Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor, now or hereafter, owns or controls for access to the Project for the purpose of inspection, operating, maintaining, repairing, replacing, rehabilitating, or completing the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the non-Federal sponsor of responsibility to meet the non-Federal Sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, mitigation, operation, maintenance, repair, replacement, and rehabilitation of the Project and any Project related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Partnership Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20, as amended or re-codified;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, operation, and maintenance of the Project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

g. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, operation, or maintenance of the Project;

h. Agree that the non-Federal Sponsor shall be considered the operator of the Project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the Project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with the said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying, and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

k. Provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation that are in excess of 1% of the total amount authorized to be appropriated for the Project in accordance with the cost sharing provisions of the agreement;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Do not use Federal funds to meet the non-Federal Sponsor's share of total Project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized;

n. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project;

o. Recognize and support the requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources Project or separable element thereof, until the non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the Project or separable element;

p. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires the non-federal sponsor to participate in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing the Project Partnership Agreement (PPA), and implement the plan no later than one year after project construction is complete.

15.2 Federal Responsibilities

In order to implement the Recommended Plan, the USACE would provide the Federal share of project cost, to equal project first cost less the total non-Federal share, not including Annual Operation and Maintenance expenses. The Federal share of project cost is currently estimated to be $1,196,000 which is 65% of Total Project Costs (not including Feasibility Phase costs). Federal expenditures shall not exceed $10 million for flood control (Section 14) purposes at any single locality for any one fiscal year. The USACE would also provide the following:

1. Review and certification of Real Estate provisions.
2. Design and Implementation of the project.
3. Contracting for project construction.
4. Supervision and Administration of project construction.

15.3 In-kind Contributions

In-kind contributions are work performed by and/or materials provided by the non-Federal sponsor pursuant to an executed agreement for which the sponsor receives a credit toward its share of total project costs (excluding the required 5 percent cash contribution for this project) if the work (and materials) is determined to be integral to the project. At this time, the non-Federal sponsor does not intend to provide any in-kind contributions for this project.

15.4 Project Partnership Agreement (PPA)

After approval of a final Detailed Project Report for this Greenville Utilities Commission, NC Section 14 project, a Project Partnership Agreement (PPA) would be executed. A PPA is a legally binding agreement between the USACE and a non-Federal sponsor (in this case, the GUC) for construction of a water resources project, in this case, the GUC Emergency Streambank and Shoreline Erosion Protection Project. The PPA would describe the project and the responsibilities of the USACE and the GUC in the cost sharing and execution of project work.

15.5 Sponsor Views

The GUC has expressed support for this project and has agreed, by letter dated August 21, 2020, to accept the role of non-Federal sponsor in event of approval of a final feasibility report. The GUC's preference among the alternatives (i.e., the "Locally-Preferred Plan") is the Recommended Plan consisting of Stone (Riprap) Slope Protection.

16.0 RECOMMENDATIONS

Based on the evaluation and screening process, the Stone (Riprap) Slope Protection emerged as the single alternative that best meets the planning objective of managing the risk of damage from erosion to the GUC water intake system over a 50-yr period of analysis (2023-2072) while meeting the planning evaluation criteria of completeness, effectiveness, efficiency and acceptability. This alternative is economically justified as the least-cost alternative and would be more economical than relocating the infrastructure. Therefore, the Stone (Riprap) Slope Protection was selected as the Federally-Preferred Alternative. The GUC has expressed its support for the project, and is willing and capable of accepting the role of non-Federal Sponsor, as stated in their letter dated August 21, 2020. In addition, the GUC has expressed acceptance that the Federally-Preferred Alternative is their Locally-Preferred Alternative.

The Stone (Riprap) Slope Protection, as both Federally-Preferred and Locally-Preferred Alternative, is therefore selected as the Recommended Plan . It is further recommended that implementation of the project proceed, with plans and specifications, execution of a PPA and construction contract, and construction of the Stone (Riprap) Slope Protection.

Any comments or questions regarding this Integrated Feasibility Report and Environmental Assessment should be addressed to the U.S. Army Corps of Engineers, Wilmington District, 69 Darlington Avenue, Wilmington, NC 28403, ATTN: Jason Glazener, Lead Planner.

17.0 REFERENCES

Greenville Utilities Commission – Local Water Supply Plan 2020/2021, February 2022.

National Oceanic and Atmospheric Administration. "Essential Fish Habitat Mapper." *National Marine Fisheries Service*, 6 Sept. 2022, https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper. Accessed 6 Sept. 2022.

North Carolina Department of Environmental Quality. "NC Surface Water Classifications." *North Carolina Division of Water Resources*, 2 Aug. 1992, https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/classifications#DWRPrimaryClassification. Accessed 6 Sept. 2022.

North Carolina Department of Environmental Quality. "Benthos Site Details." North Carolina Division of Water Resources, Biological Assessment Branch, 25 June 2007, https://www.ncwater.org/?page=672&SiteID=OB163. Accessed 6 Sept. 2022.

North Carolina Department of Environmental Quality. "Fish Community Assessment Data." North Carolina Division of Water Resources, Biological Assessment Branch, 13 Mar. 2022, https://deq.nc.gov/about/divisions/water-resources/water-sciences/biological-assessment-branch/fish-community-assessment-data. Accessed 3 Feb. 2023.

North Carolina Department of Environmental Quality. "Recommended Nonattainment Area Boundaries Map." North Carolina Division of Air Quality, 28 Oct. 2011, https://deq.nc.gov/about/divisions/air-quality/air-quality-planning/attainment/designation-history-pollutant/8-hour-ozone-nonattainment-boundary-recommendations. Accessed 6 Sept. 2022.

North Carolina Department of Environmental Quality. "Erosion and Sediment Control Planning and Design Manual." *North Carolina Division of Energy, Mineral, and Land Resources*, 1 May 2013, https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/erosion-and-sediment-control/erosion-and-sediment-control-planning-and-design-manual. Accessed 6 Sept. 2022.

North Carolina Department of Environmental Quality. "Classifications." *North Carolina Division of Water Resources*, 6 Sept. 2022, https://deq.nc.gov/about/divisions/water-resources/water-planning/classification-standards/classifications#DWRPrimaryClassification. Accessed 6 Sept. 2022.

North Carolina Department of Public Safety. “North Carolina Floodplain Mapping Program.” *Flood Risk Profile*, 6 Sept. 2022, https://flood.nc.gov/ncflood/. Accessed 6 Sept. 2022.

North Carolina Department of Natural and Cultural Resources. “Species/Community Search.” *Natural Heritage Program*, 5 Aug. 2022, https://www.ncnhp.org/data/speciescommunity-search. Accessed 6 Sept. 2022

North Carolina Department of Natural and Cultural Resources. “GIS Maps and Data.” *North Carolina State Historic Preservation Office*, 6 Sept. 2022, https://www.ncdcr.gov/about/history/division-historical-resources/state-historic-preservation-office/gis-maps-and-data. Accessed 6 Sept. 2022.

North Carolina Wildlife Resources Commission. “Fishing Opportunities in the Coastal Region of NC”. 21 Sept. 2022, https://www.ncwildlife.org/Fishing/Where-To-Fish/Fishing_Opps_in_the_Coastal_Region_of_NC. Accessed 21 Sept. 2022.

Pitt County, North Carolina. “Code of Ordinances.” 6 Sept. 2022, https://www.pittcountync.gov/300/Code-of-Ordinances. Accessed 6 Sept. 2022.

Tracy, Bryn H.; Rohde, Fred C.; and Hogue, Gabriela M. "An Annotated Atlas of the Freshwater Fishes of North Carolina”. 2020, *Southeastern Fishes Council Proceedings: No. 60*. https://trace.tennessee.edu/sfcproceedings/vol1/iss60/1. Accessed 3 Feb. 2023.

United States Department of Agriculture. “Soil Survey, Pitt County, North Carolina.” *Natural Resource Conservation Service*, 1 Nov. 1974, https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/north_carolina/pittNC1974/pittNC1974.pdf. Accessed 6 Sept. 2022.

United States Department of Agriculture. “Web Soil Survey.” *Natural Resource Conservation Service*, 6 Sept. 2022, https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed 6 Sept. 2022.

United States Environmental Protection Agency. “2008 Ground-Level Ozone Standards - Region 4 Final Designations, April 2012.” 1 Apr. 2012, https://archive.epa.gov/ozonedesignations/web/html/region4f.html. Accessed 6 Sept. 2022.

United States Environmental Protection Agency. “Enveloper for Envirofacts.” 6 Sept. 2022, https://enviro.epa.gov/enviro/em4ef.home. Accessed 6 Sept. 2022.

United States Fish and Wildlife Service. “2015-2016 Implementation Strategy for the Louisiana Department of Environmental Quality and the U.S. Fish and Wildlife Service Memorandum of Understanding.” 18 May 2016, https://deq.louisiana.gov/assets/docs/Water/FishWildlifeMOAletter051816.pdf . Accessed 24 Jan. 20232.

United States Fish and Wildlife Service. “Information for Planning and Consultation.” 6 Sept. 2022, https://ipac.ecosphere.fws.gov/. Accessed 6 Sept. 2022.

Appendix A

Sponsor Request Letter

Greenville Utilities

August 21, 2020

U.S. Army Corps of Engineers
Wilmington District
69 Darlington Avenue
Wilmington, NC 28403

Dear Colonel Bennett:

The Greenville Utilities Commission (GUC) Water Treatment Plant was commissioned in 1983 at a capacity of 12 Million Gallons a Day (MGD) to provide safe drinking water to our customers. Today, GUC treats an average of 14 MGD with peak demands of 18.5 MGD serving over 140,000 customers in our service area. The water treatment plant current capacity is 22.5 MGD. In addition, GUC has been providing surface water to five wholesale communities since 2011 due to restrictions imposed by the Central Coastal Plain Capacity Use Area Rule. To increase the reliability of water supply to the water plant, a redundant set of intake screens, piping, and manifold were installed in 2010 to ensure sufficient water could be withdrawn from the Tar River and treated to provide safe water that is essential for public health. The redundant intakes allow water to be withdrawn from the river and pulled into the raw water pump station through two thirty-inch pipes that were installed through the riverbank.

A project was completed in 2011 to stabilize the riverbank using the ArmorFlex revetment system and Iowa training vanes. The riverbank has seen significant erosion behind the ArmorFlex system increasing the potential of damage to the raw water intake lines coming from the intake screens. If the riverbank collapsed and severed the lines, then over 140,000 customers would be at risk of losing a valuable resource which would jeopardize public health and fire flow protection. In addition, the screens have also been covered by river sediment due to many high river events since 2011. Dredging contractors have removed an average of 4,000 cubic yards of material since 2016 to keep sediments from covering screens.

The riverbank needs to be stabilized to ensure an adequate amount of water is available for public health protection. Greenville Utilities Commission is willing and able to partner with the U.S. Army Corps of Engineers under the Section 14 Authority to address the problem.

Respectfully Submitted,

Randall D. Emory

Randall D. Emory, PE
Director of Water Resources

cc: Anthony C. Cannon, General Manager/CEO
David W. Springer, PE, Assistant Director of Water Resources
D. Anthony Whitehead, Water Quality Manager
Julius E. Patrick, Water Treatment Plant Superintendent

PO Box 1847
Greenville, NC
27835
www.guc.com

Appendix B

Hydrology and Hydraulics

October 2022

Page Intentionally Left Blank

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Page Left Intentionally Blank

1 Introduction

This hydrology and hydraulics appendix serves as documentation of the engineering evaluation process for the Greenville Utilities Commission (GUC) Section 14 Emergency Streambank and Shoreline Erosion Protection Final Integrated Feasibility Report. The Continuing Authorities Program (CAP) project is authorized by the Flood Control Act of 1946, Section 14 of the Emergency Streambank and Shoreline Protection, as amended. This report is in response to a request from the Greenville Utilities Commission that the U.S. Army Corps of Engineers provide assistance in addressing riverbank erosion problems at their Water Treatment Plant. Riverine and coastal storm damages that originate from the Tar River, including erosion causing riverbank instability and failure, threatens GUC infrastructure that is critical to ensuring safe, useable water is available for public use. This appendix describes the development of existing conditions (EC) and future without project (FWOP) conditions in addition to the formulation, refinement, and design of structural study measures and alternative plans. This appendix is in accordance with ER 1110-2-115 (USACE, 1999), provides assumptions of underlying hydrology and hydraulic uncertainty in accordance with ER 1105-2-101 (USACE 2019b), and includes an assessment of climate change of the study area and potential effects of such change by ECB 2018-14 (USACE, 2018).

1.1 Vertical Datum

All elevations in this repot are referenced to the North American Vertical Datum of 1988 (NAVD88) unless otherwise noted.

2 Background

2.1 Location

The GUC Water Treatment Plant (WTP) is located along the Tar River, approximately 3 miles upstream from the City of Greenville, NC, in Pitt County (Figure 1). The plant's infrastructure is situated within the left overbank or northern side of the Tar River and is inside the extents of the Federal Emergency Management Agency (FEMA) effective flood zone designated "AE" (Figure 2). Based on FEMA Map Number 3720467900J, panel effective date 1/2/2004, portions of the facility are also within the FEMA Regulatory Floodway (Figure 3). This reach of the Tar River is characterized by shallow channel bottom gradients and tends to be sluggish in flow with predominant swamp and marshes.

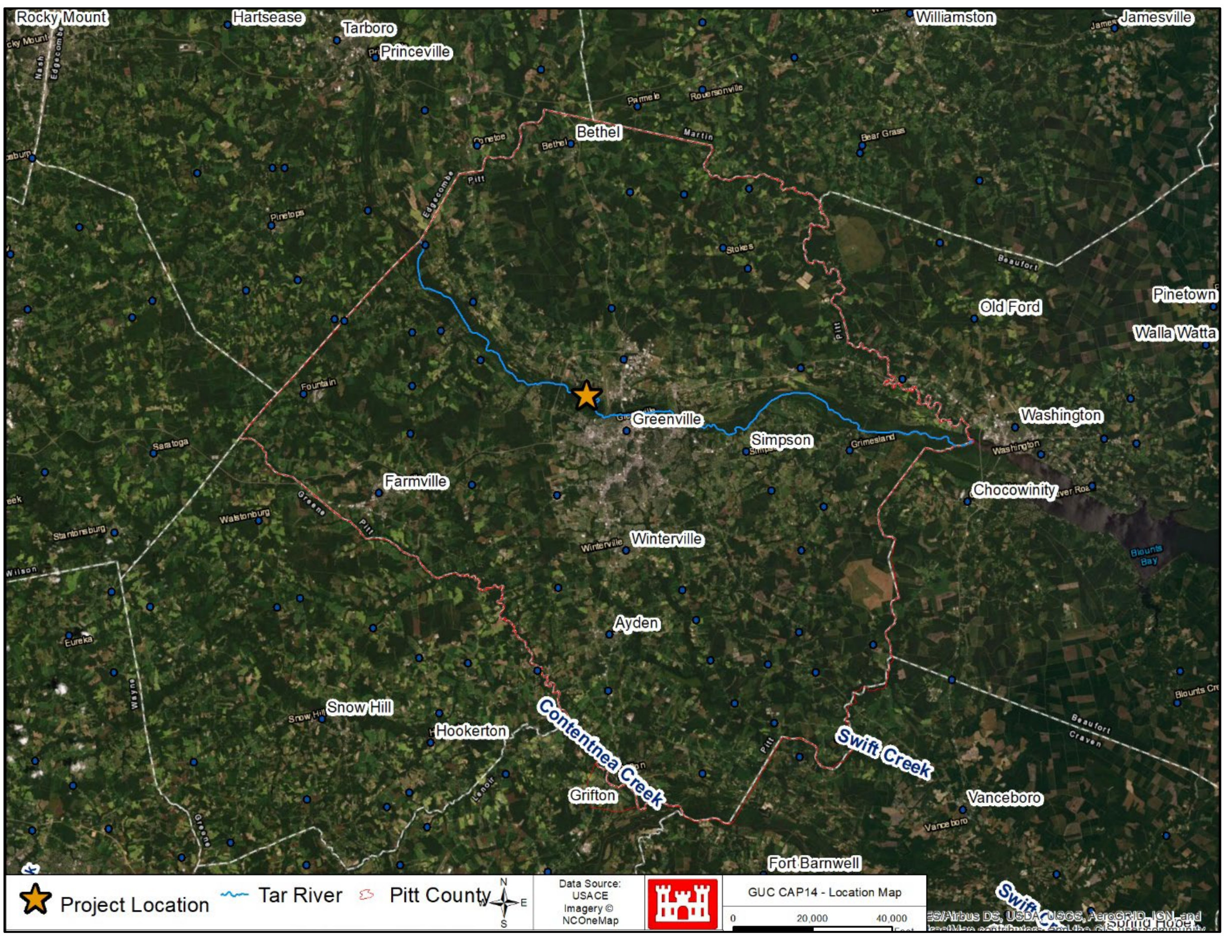


Figure 1. Location Map 1

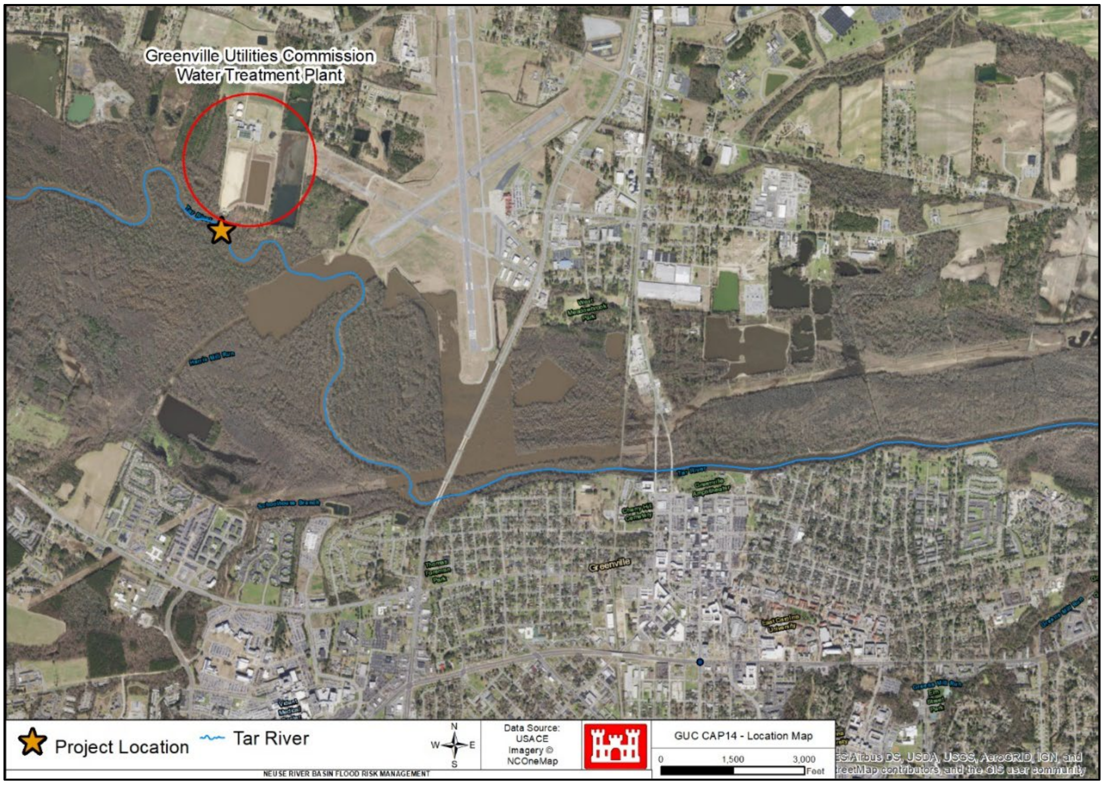


Figure 2. Location Map 2

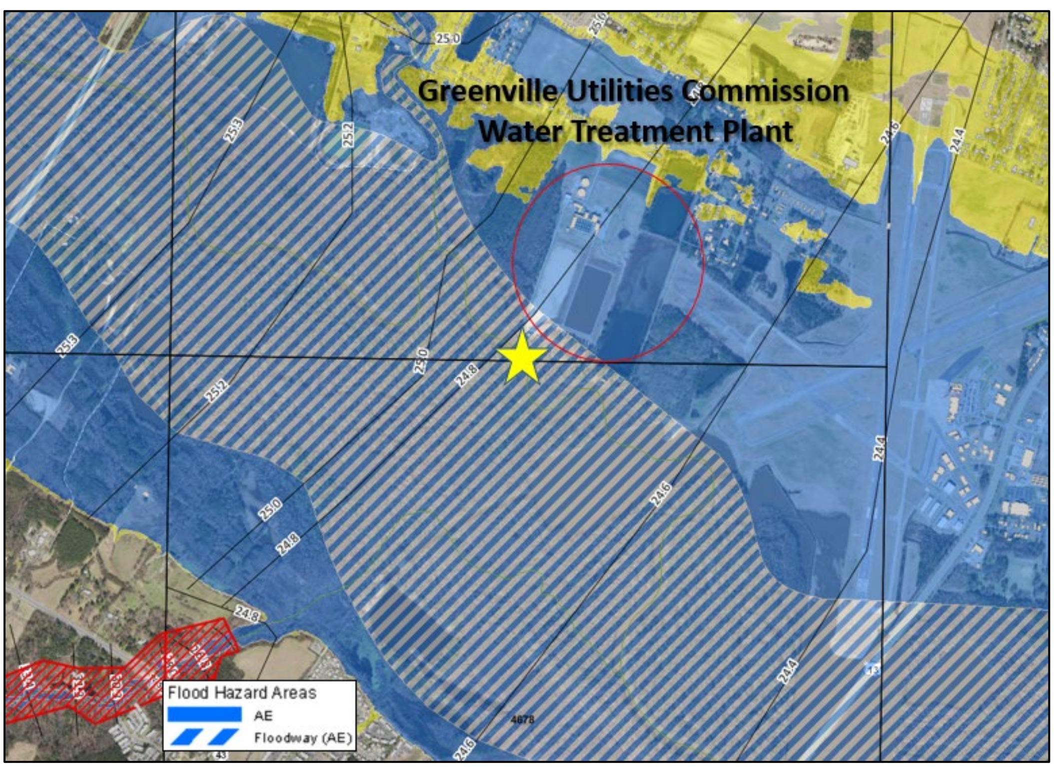


Figure 3. NCFRIS Screenshot – Project Area

2.2 Infrastructure at Risk

The GUC WTP utilizes two sets of raw water intake structures that pull water from the Tar River into their facility for treatment. The structures are placed near the thalweg of the Tar River in proximity to the left riverbank (Figure 4). Each set is comprised of two individual intake screens that takes advantage of the river's natural flow velocity to allow water to be pulled into a pipe network that converges to a pump station, located further away from the left bank. The total pipe length from intakes to pump station is roughly 500 linear feet.

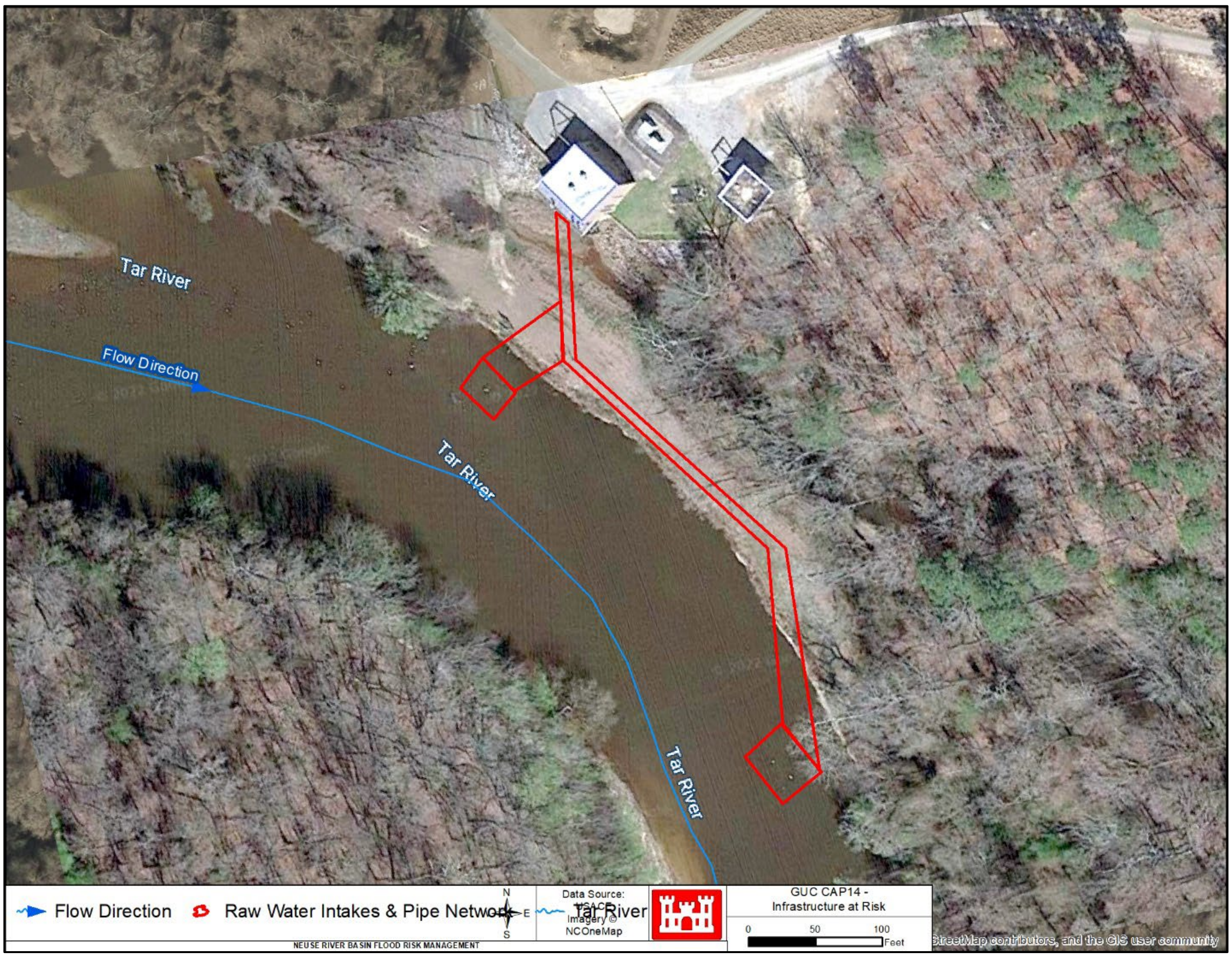


Figure 4. Infrastructure at Risk

2.3 Existing Conditions

The natural riverbank nearest the intake structures has historically been subjected to frequent overtopping flow from the Tar River. This has resulted in erosion of approximately 300 linear feet of riverbank in the area of the intakes (Figure 5, Figure 6). In 2013, a length of articulated concrete block armor was placed atop the eroded streambank (Figure 7). The design allowed for topsoil to be placed within the mat's open cells to promote natural vegetated cover (Figure 8). The mat footprint was to extend from the top of bank to cover about 40 horizontal feet of the riverbank at a 2H:1V slope. The mat's toe would tie into a series of intermittent flow vanes. These vanes were designed to deflect erosive wave action away from the riverbank and encourage the main flow path of the river to remain near the intake locations. Lastly, the design called for aggregate to be placed at the toe tie-in section.

Figure 5. Riverbank erosion, 2011 – Pre-Remediation

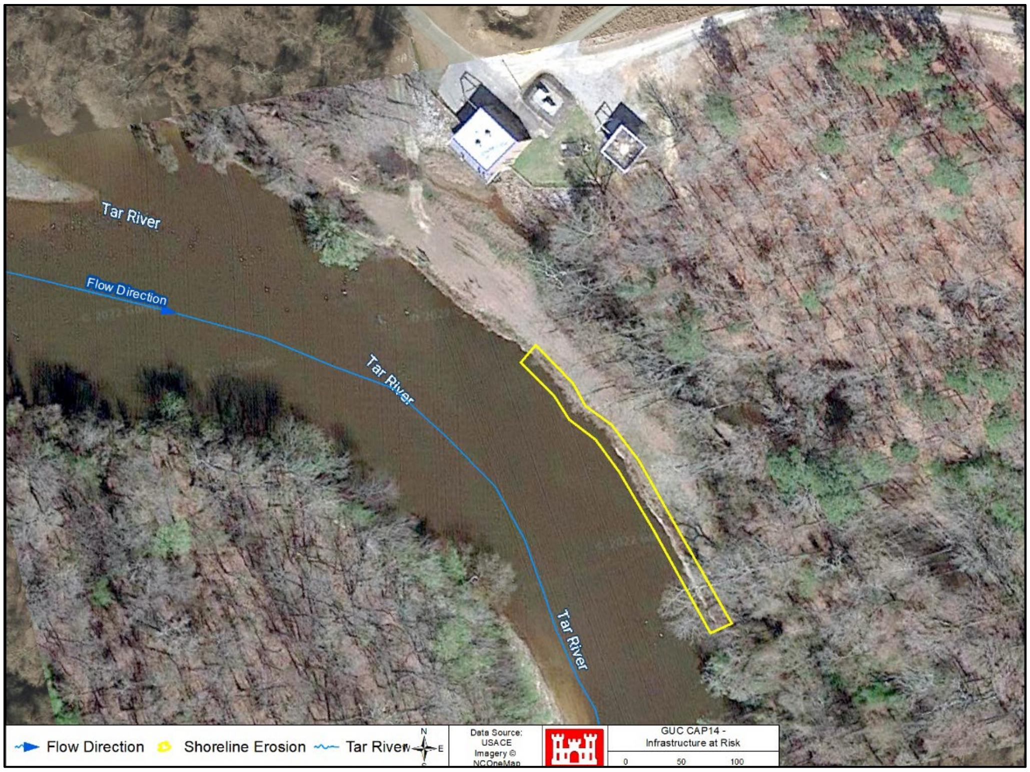


Figure 6. Shoreline Erosion

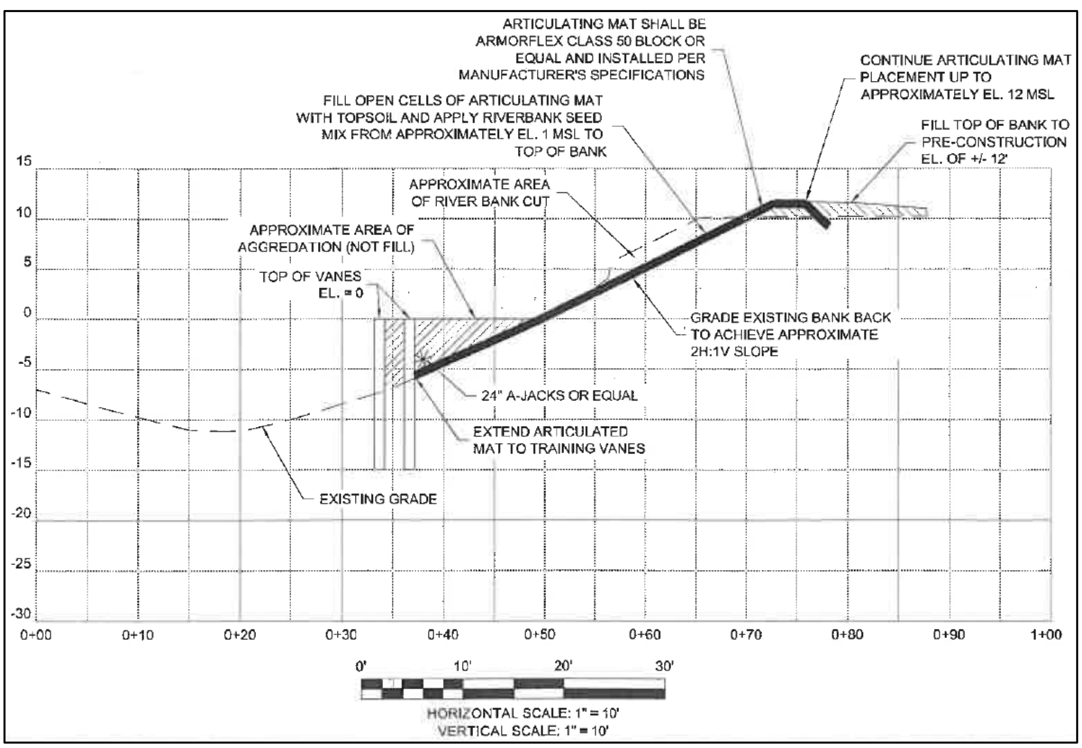


Figure 7. Existing Articulated Concrete Block Design

Figure 8. Newly Completed Construction of Articulated Concrete Block Armor

Between completion of the articulated concrete block armor and current year, 2022, significant portions of the design have failed. Segments of the mat cell have separated, breaking apart the steel wire mesh that had originally kept it together (Figure 9). With dislodged concrete cells collapsing into the channel, the riverbank's natural soils were once again exposed to erosion from the Tar River. This has ultimately resulted in conditions similar to pre-remediation. Furthermore, the nature in which the armor failed, large segments of connected concrete and steel wire, pose a threat to damage the intake structures, should they completely disconnect and fall on top of the intake screens (Figure 10). A sole contributor to failure of the protection structure was not apparent based on field and data investigation uncertainties and may have been a combination of design failure and protection level exceedance. One plausible failure scenario may have involved bank saturation and resulting rotational and/or sliding bank material from frequent overtopping combined with erosive flow velocities along the embankment toe.

Figure 9. USACE Site Visit 2020

Figure 10. USACE Site Visit 2022

2.3.1 Erosion Mechanism

There are a number of natural processes causing the continued erosion along the left riverbank of the Tar River. These natural factors include riverine-based storm events, in addition to wind, wave, and tides associated with coastal-based storm events. Based on input from GUC, the predominate factors that induce erosion in the project area are associated with how quickly water levels rise and fall against the riverbank. This input suggested that riverine-based flooding mechanism may play the larger role in causing erosion.

2.4 Problem Statement

Natural streambank erosion is threatening imminent damage to the Greenville, NC regional drinking water intake system.

Riverbank erosion has been a persistent issue adjacent to the intake structures. In 2011, GUC implemented a riverbank stabilization project to address this issue. However, the existing riverbank erosion protection on the Tar River where the water intakes are located is failing. This is a direct threat to the continued operation of the water intakes and water supply to the GUC service region. The existing riverbank revetment is in poor condition and the articulated concrete mat is failing with erosion occurring behind the mat. The steel cables that once connected the individual concrete mats together have rusted and broken, rendering the disconnected mats ineffective as erosion protection for the earthen riverbank due to the steepened banks. Scour holes have developed along the revetment at the intake pipes. The end sections have failed, with erosion of the riverbank at each end of the revetment.

GUC staff describe a situation of visually apparent degradation worsening on a month-by-month basis. The biggest threat is embankment collapse onto the intake structures, damaging the structures or cutting the lines. This would put over 140,000 citizens at risk of losing valuable water resources and would jeopardize public health and fire flow protection.

2.5 Objective

The study objective is to provide emergency riverbank erosion protection to ensure uninterrupted water services to the public.

3 Alternatives

This section details the formulation and assessment of measures to provide emergency riverbank protection within the project area. A method of analysis and means of screening was based on assessment iterations due to the need to narrow down the number of proposed measures. Early assessment iterations focused on leveraging available existing reporting, data, and modeling to determine measure viability. Later iterations involved a more detailed assessment approach that included quantitative modeling to determine measure viability. This assessment resulted in the selection of Alternative 3, riprap revetment, being carried forward. The design was optimized to ensure it will meet the erosion projection objective to the extent that the cost constraints of CAP would allow.

3.1 Alternative 1 Relocation

Alternative 1 included relocation of raw water intake infrastructure away from the eroding riverbank. This alternative involved complete decommissioning of existing raw water intake screens within the project area and associated pipe network that fed into the water treatment plant. This action would eliminate the need for emergency erosion protection. However, due to relocation cost data provided by GUC, this alternative was not a practical solution that would meet the planning objective.

3.2 Alternative 2 Gabion Baskets

Alternative 2 included the use of Gabion Baskets to replace the existing, failing, articulated concrete block armor along the riverbank. This alternative involved relatively smaller sized stone encased in a series of stacked wired cages to act as a buffer between the natural streambank soils and erosive flows from the Tar River. Due to cost data and concerns of providing adequate toe scour protection, this alternative was not a practical solution that would meet the planning objective.

3.3 Alternative 3 Stone (Riprap) Slope Protection

Alternative 3 included the construction of a Riprap revetment to replace the existing, failing, articulated concrete block armor along the riverbank. The total length of revetment extended beyond the existing armoring to appropriately tie into the natural riverbank. Proposed earthwork modified the natural streambank such that the riprap revetment would be placed at a 2H:1V slope. This alternative also included additional stone placed along the riverbank toe to account for potential toe scour. This is the only solution that is both practical and sustainable and would meet the planning objective.

3.4 Alternative 4 Flow Diversion Structure

Alternative 4 included a flow diversion structure that more efficiency directed flow through the nature riverbend within the project area. Due to the proximity of the raw water intake structures and associated piping as well as amount of physical modification required for the natural channel, this alternative did not provide a practical solution that would meet the planning objective.

3.5 Alternative 5 Articulating Concrete Block Protection

Alternative 5 included an articulated concrete block design that would replace the existing, failing armor. Due to the historical performance of the existing protection and concerns of maintenance and resiliency to the riverine erosion, this alternative did not provide a practical solution that would meet the planning objective.

3.6 Alternative 6 Steel Sheetpile Bulkhead

Alternative 6 included construction of a steel sheetpile bulkhead within the area of eroded riverbank. The bulkhead would extend beyond the existing articulated concrete block armor to appropriately tie into high ground. The structure’s design elevation was set to the approximate top of riverbank. Due to cost data and concern of the required penetration depth of the steel sheetpile extending below the raw water intake pipe network, this alternative did not provide a practical solution that would meet the planning objective.

3.7 Alternative 7 High Performance Turf Reinforcement Matting

Alternative 7 included construction of a High-Performance Turf Reinforcement Matting atop the area of eroded riverbank. This design involved a thin, synthetic layer that replaced the existing, failing articulated concrete block armor. Due to concerns of structural durability given the riverine hydraulic loading that the project area was subjected to on a relatively frequent basis, this alternative did not provide a practical solution that would meet the planning objective.

3.8 Alternative 8 Sandbags

Alternative 8 included installation of sandbags within the area of eroded riverbank. Due to the inability for a sandbag design to provide a long-term solution and overall concerns of durability and maintenance, this alternative did not provide a practical solution that would meet the planning objective.

3.9 Selected Alternative

Optimization of Alternative 3 resulted in a plan that includes a stone (riprap) slope protection revetment keyed into the top-of-bank and additional toe scour protection, while also accommodating the existing flow vanes.

This alternative involves placing a continuous riprap revetment along approximately 300 feet of riverbank, adjacent to the raw water intake infrastructure. The elevation of the revetment crest would match the existing ground elevation, a range from roughly 10.0-ft to 10.5-ft, NAVD88. The design details are discussed in Section 5.

4 Pertinent Data

4.1 Imagery

Historical imagery was made readily available from Google Earth and NC OneMap. This dataset included aerial imagery for dates that captured conditions seen over the past 22 years, from 1998 to 2020. A qualitative assessment of visual change in overbank conditions affirmed the high frequency in which the project area is exposed to overtopping flow from the Tar River.

Figure 11. Google Earth Historical Imagery

4.2 Land Cover

The most current (2019) National Land Cover Database (NLCD) was used to characterize Land Use in the project area (Figure 12). NLCD 2019 provided a raster of descriptive land cover types at a 30-meter resolution and enables hydrologic characterization at a subbasin-level.

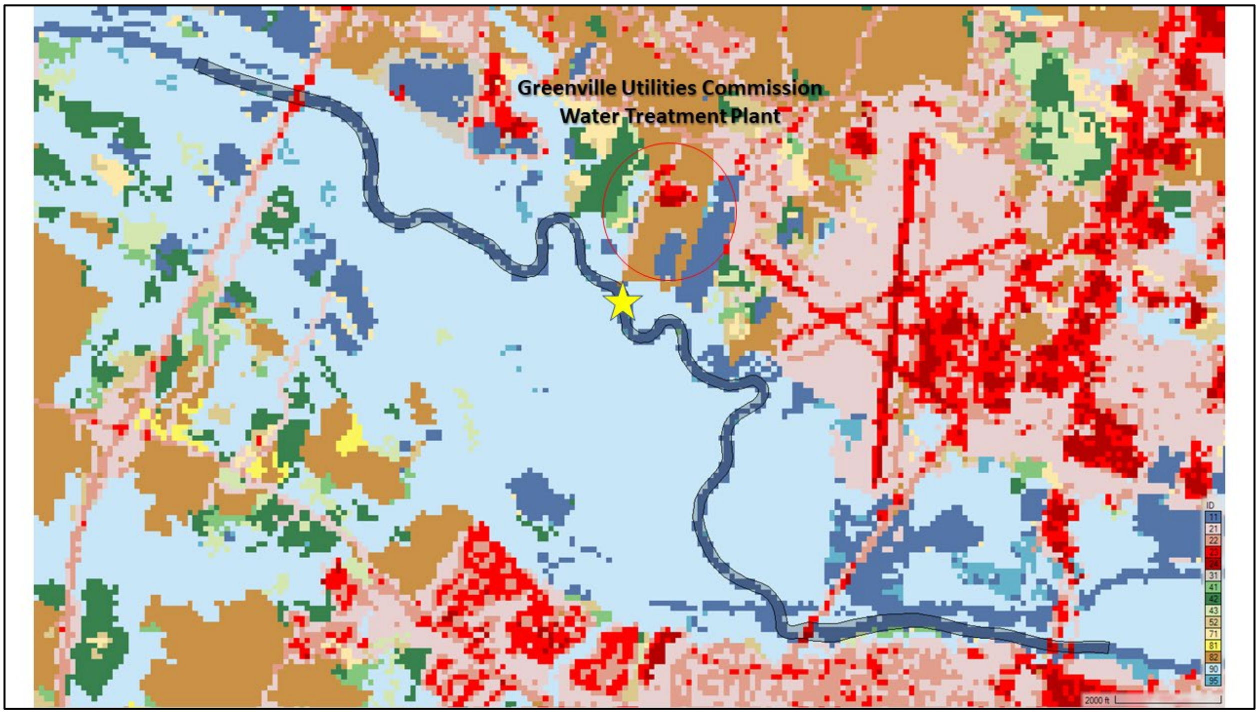


Figure 12. Project Area Land Cover – NLCD 2019

Table 1. NLCD 2019 Land Cover Classification

Open Water
Developed - Open Space
Developed - Low Intensity
Developed - Medium Intensity
Developed - High Intensity
Barren Land (Rock/Sand/Clay)
Deciduous Forest
Evergreen Forest
Mixed Forest
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands

4.3 Topography

Several sources for topography were used based on the need to capture overbank conditions (overland) as well as in-channel conditions (underwater). This information combined with aerial imagery was utilized to layout, analyze, and compute quantities for the riprap revetment design.

Two primary sources of overland terrain data were the State of North Carolina's Light Detection and Ranging (LiDAR) dataset and a recent ground-based survey conducted by USACE as part of this CAP study. The North Carolina LiDAR collection includes Quality Level 2 (QL2) LiDAR as defined by USGS (Table 2). This dataset is approximately 8 years old and was considered appropriate to represent existing conditions (Figure 13). The USACE survey was specific to the project area with the intent to capture as accurate as possible top of riverbank elevations and nearest adjacent high ground.

Table 2. LiDAR Quality Level Requirements

QUALITY LEVEL	DATA SOURCE	VERTICAL ACCURACY RMSEz (cm)	NOMINAL PULSE SPACING (NPS) meters	NOMINAL PULSE SPACING (NPD) points per square meter	DIGITAL ELEVATION MODEL (DEM) cell size (meters)
QL0	**Lidar**	**5 cm**	**<= 0.35 m**	**>= 8 pts/square meter**	**0.5 m**
QL1	**Lidar**	**10 cm**	**<= 0.35 m**	**>= 8 pts/square meter**	**0.5 m**
QL2	**Lidar**	**10 cm**	**<= 0.71 m**	**>= 2 pts/square meter**	**1 m**
QL3	Lidar	20 cm	<= 0.35 m	>= 0.5 pts/square meter	2m
QL4	Imagery	139 cm	N/A	N/A	5 m
QL5	IfSAR	185 cm	N/A	N/A	5 m

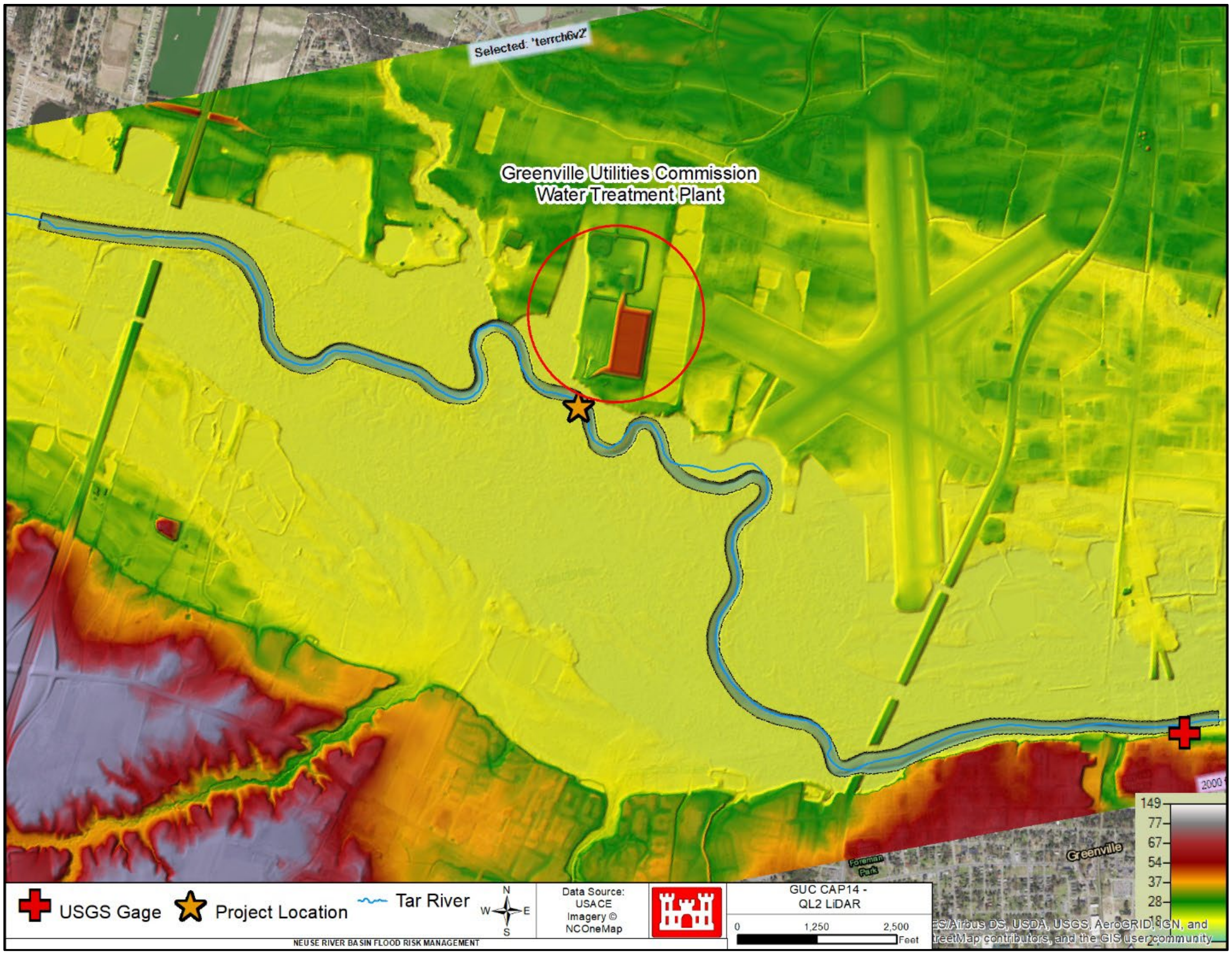


Figure 13. Project Area QL2 LiDAR

For underwater, or bathymetric, data needs, several sources were leveraged. The underlying, largest extent of the project area was included in the hydraulic modeling as part of FEMA's National Flood Insurance Program (NFIP). FEMA effective mapping in this region of the Tar River is based on a HEC-RAS model, version 3.1, originally developed in the early 2000's. As such, the model was not georeferenced. Approximate locations of hydraulic cross sections that include channel bathymetry of the Tar River were provided by the North Carolina Floodplain Mapping Program (Figure 14).

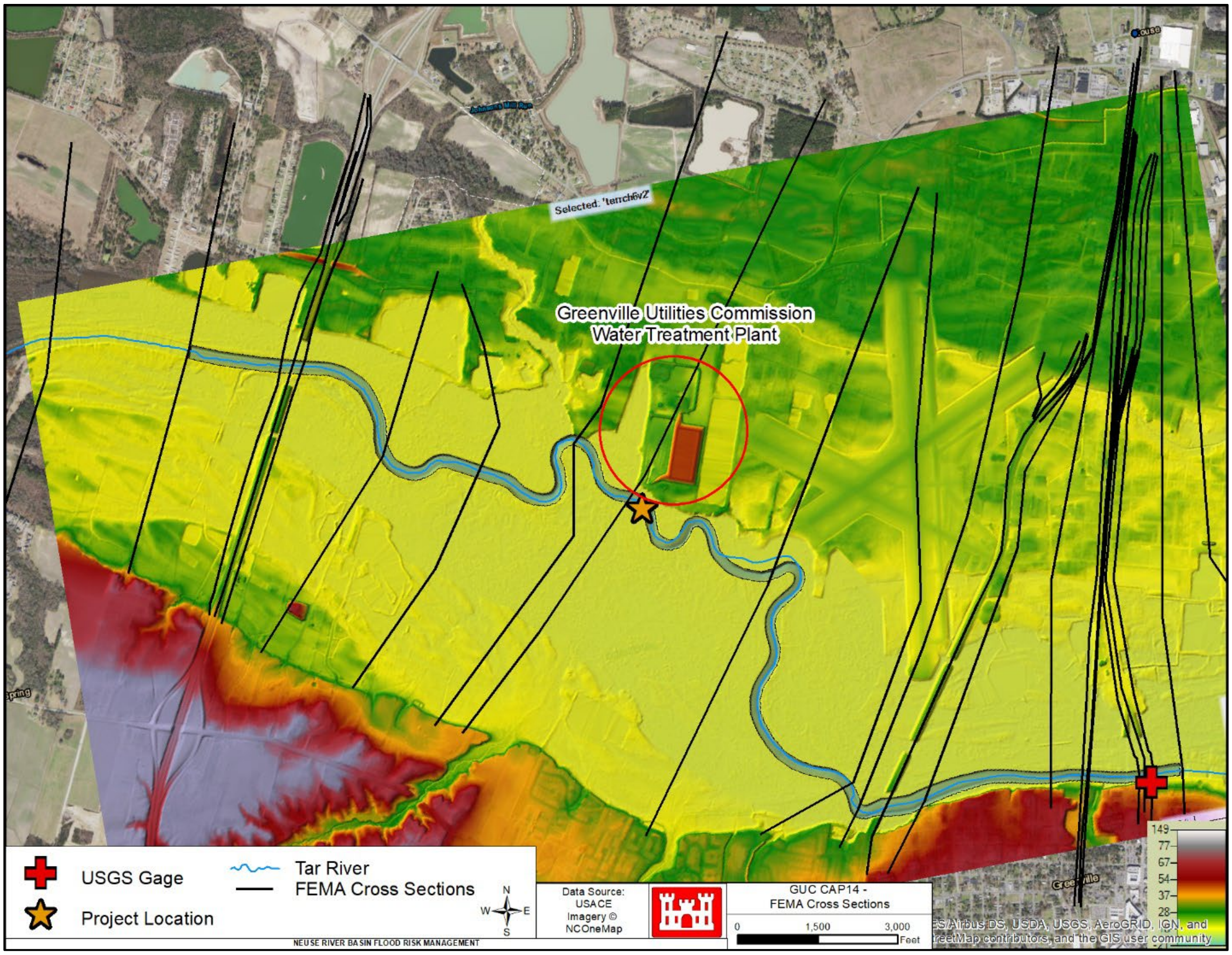


Figure 14. FEMA Cross Sections

Another source of bathymetry was provided by GUC, in the form of a 2008 sedimentation survey. This survey was part of an investigation of water velocities at the raw water intake structures. It included bathymetric surveys, water velocity measurements, and sediment sampling. Nine bathymetric channel profiles were taken that extended upstream and downstream of the project area. Two of the nine profiles fall within the immediate project area (Figure 15).

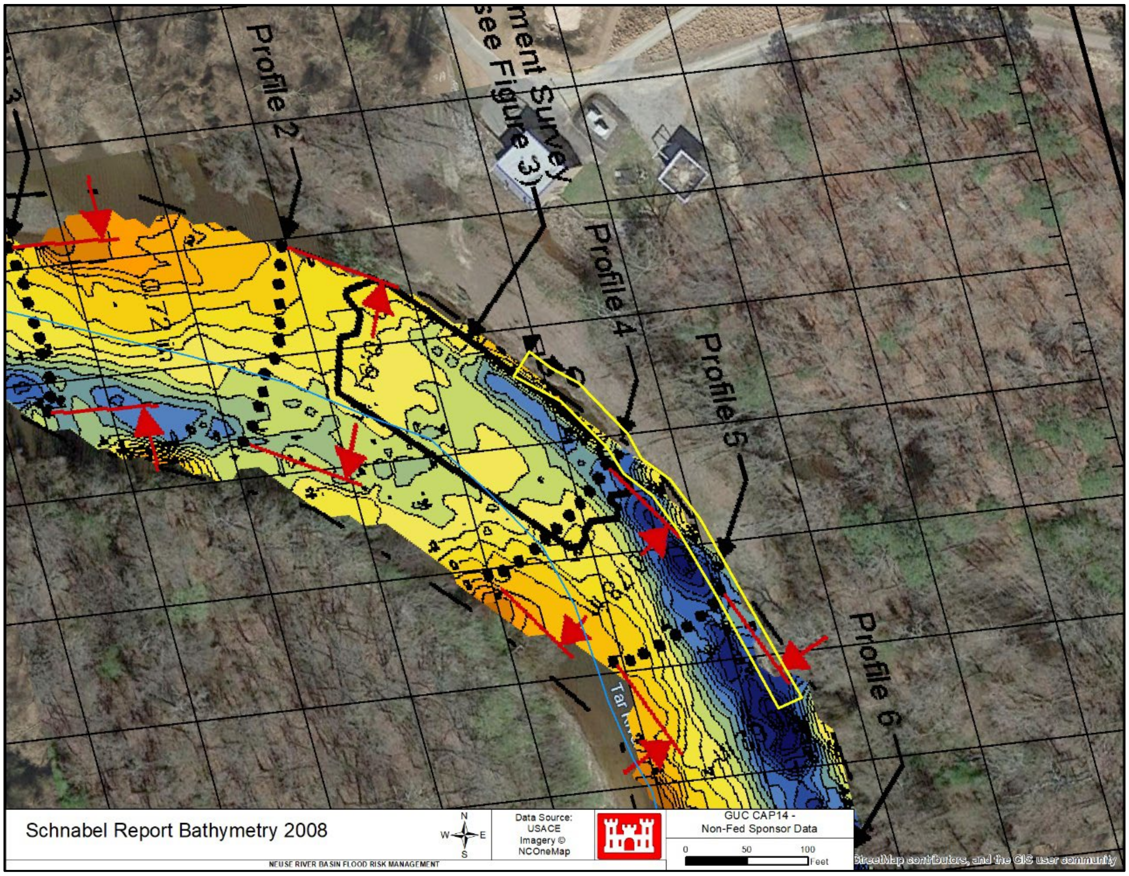


Figure 15. Survey Data Provided by Sponsor, Dated 2008

The last source of bathymetric data was based on a USACE survey conducted as part of this CAP study. This effort included the overland survey mentioned earlier in this section. The survey included multiple cross-sectional profiles as well as several parallel to the river's flow path (Figure 16).

Figure 16. Survey Data Provided by USACE, Dated 2022

4.4 Streamflow

Streamflow records of the Tar River were used to analyze the project conditions and formulate engineering solutions. The USGS Tar River at Greenville, NC (ID 02084000) streamflow station was exclusively used to represent flow conditions within the project area due to its proximity to the GUC WTP (Figure 17). The streamflow station location is approximately 3 river miles downstream of the raw water intake structures and eroded riverbank. The station captures unregulated discharge (cfs) and stage (ft) with a drainage area of 2,660 square miles. Its datum is about 3.5 feet below NAVD88 datum. USGS notes that the station is affected by both astronomical and wind tides that originate from the Pamlico Sound. Although the exact station location has shifted 200 to 800 feet upstream of its current location throughout its period of record, surface-water records date back to 1905. The station's POR extreme was Hurricane Floyd in September 1999 with a maximum discharge of 73,000 cfs and a maximum gage height of 29.72 feet. A Hydrologic Engineering Center Statistical Software Package (HEC-SSP) Bulletin 17C flood frequency analysis was conducted using the USGS streamflow gage (Figure 18, Table 3).

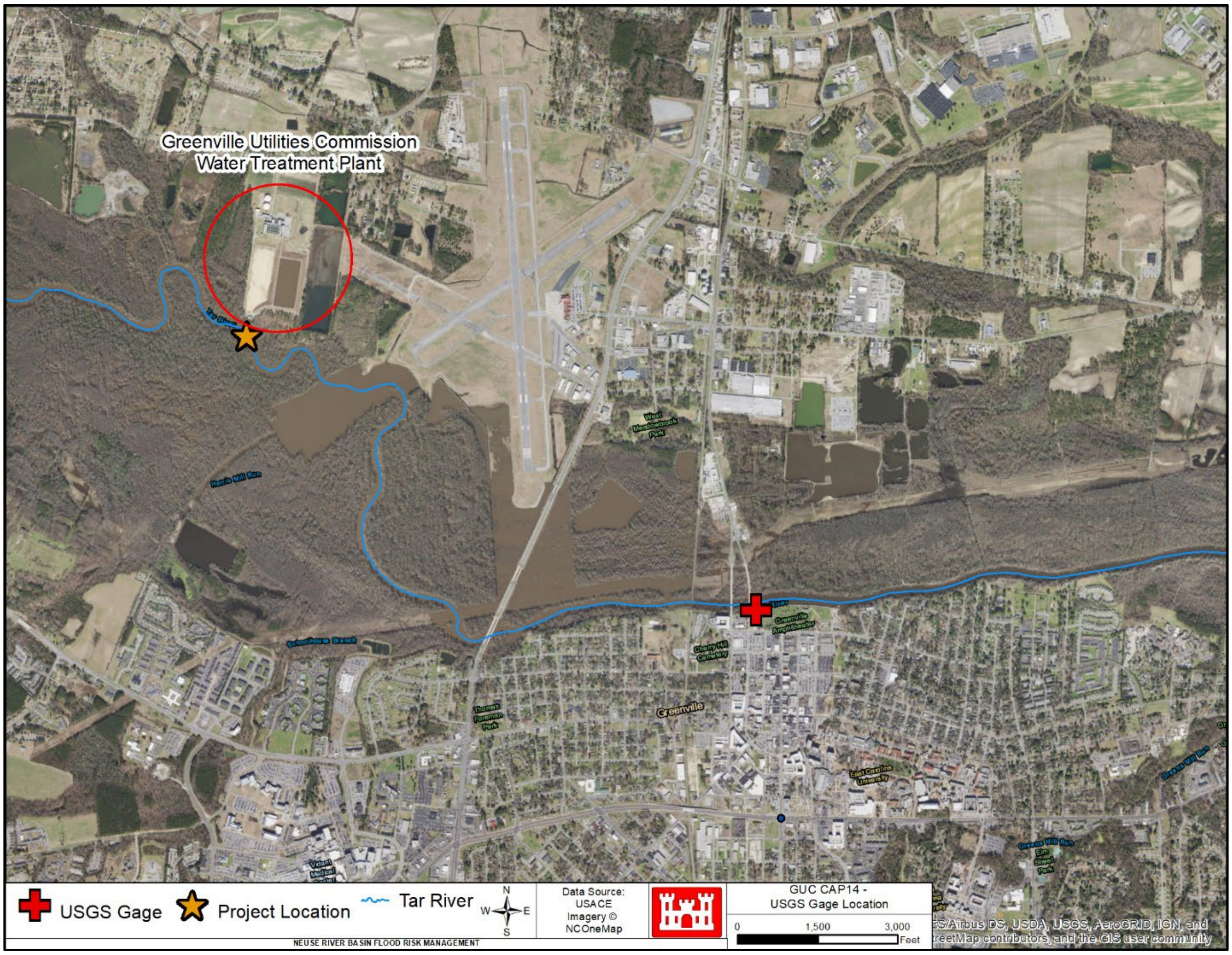


Figure 17. USGS 02084000 Tar River at Greenville Gage

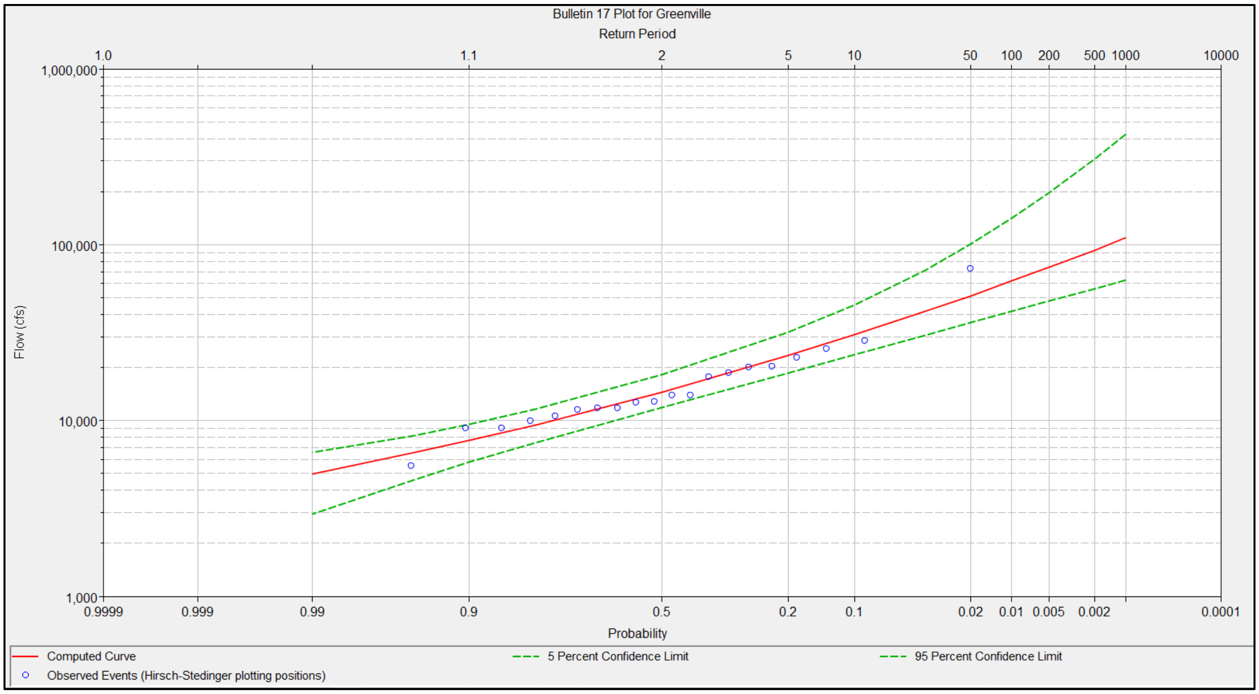


Figure 18. HEC-SSP Bulletin 17C Flood Frequency Analysis Curve at USGS 02084000 Tar River at Greenville, NC Streamflow Gage

Table 3. HEC-SSP Bulletin 17C Flood Frequency Analysis Table at USGS 02084000 Tar River at Greenville, NC Streamflow Gage

Percent Change Exceedance (%)	Computed Curve Flow (cfs)	Confidence Limits Flow (cfs)	
		0.05	0.95
0.1	109,400	426,800	62,600
0.2	93,100	306,300	56,000
0.5	74,300	197,000	47,700
1	62,100	140,900	41,700
2	51,200	100,600	36,000
4	41,700	71,700	30,500
10	30,700	45,500	23,600
20	23,400	31,800	18,600
50	14,500	18,200	11,800
80	9,500	11,600	7,500
90	7,700	9,500	5,800
95	6,600	8,200	4,600
99	5,000	6,600	2,900

5 Riprap Revetment Analysis and Design

5.1 Critical Flow Velocities

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) model was utilized to determine critical flow velocities that result in riverbank erosion along the project reach and are used as riprap design criteria. Input data required to develop the HEC-RAS model included initial upstream flow data, overland and bathymetric topographic data, and downstream boundary condition stage-discharge data. The following methodology was followed to calculate the input data, and ultimately the final velocity values.

1. Develop stage-discharge relationship at the project based on streamflow station records and measurements taken simultaneously at both locations during USACE survey. During separate trips and under normal flows (contained within channel well below bankfull) between February and April of 2022, survey instrumentation had been set up at the riverbank of the project site as well as at a water access point near the USGS streamflow gage location in downtown Greenville, NC. Coordinated water level readings were then taken to determine the general slope in water level between both locations. This established relationship was considered appropriate given the emergency nature of this CAP, Section 14 project.
2. HEC-RAS model geometry was based on existing FEMA cross sections, GUC sedimentation survey data, and new placement of cross sections near the eroded riverbank based on USACE bathymetric survey (Figure 19). Hydraulic structure data was based on the FEMA effective model.

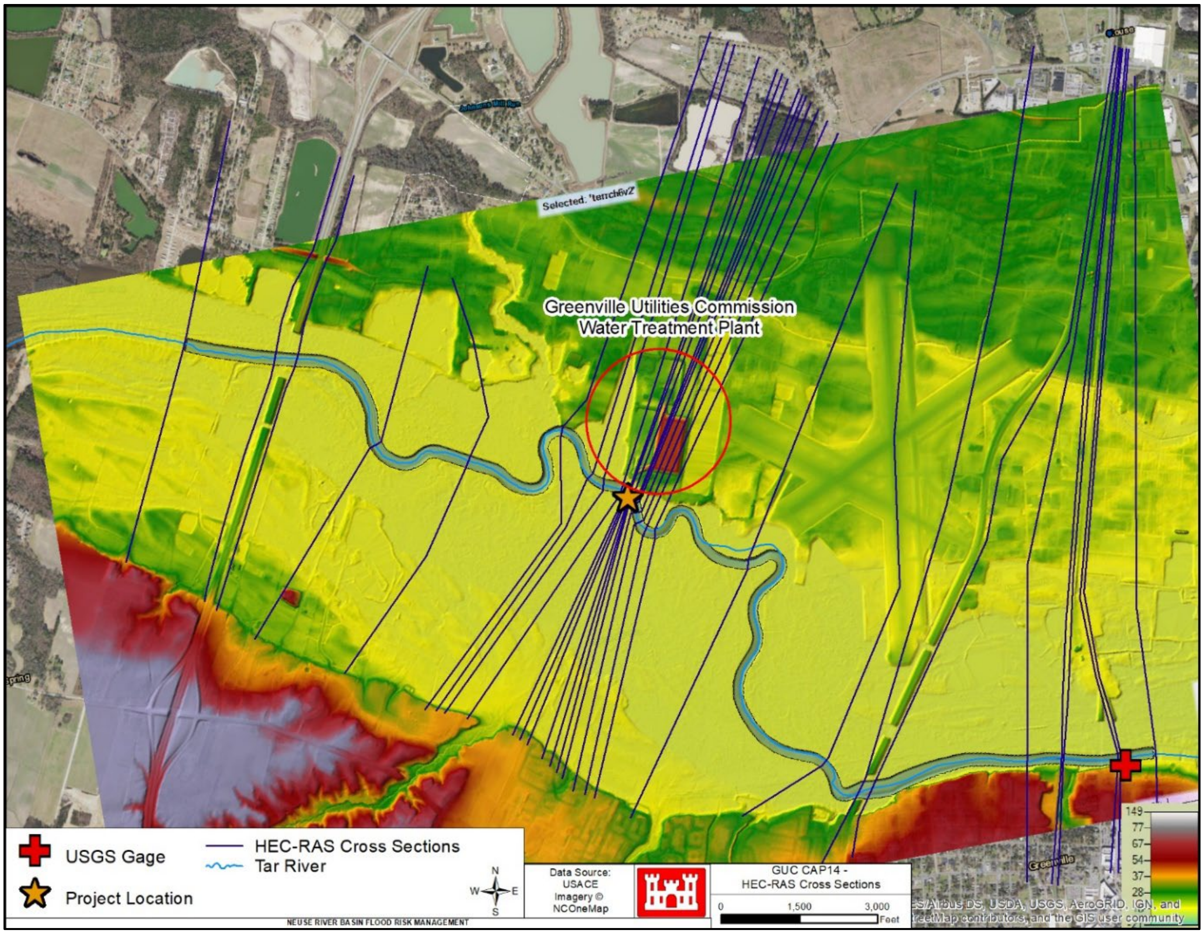


Figure 19. Project HEC-RAS Cross Sections

3. Initial Manning's n-values were based on the FEMA effective HEC-RAS model. Insertion and adjustments were then made based on review of aerial imagery given the age of the original model and changes in land use over time. Finally, values were adjusted during model calibration to the USGS streamflow station, given the in-situ stage-discharge relationship established in step 1 and the USGS-derived stage discharge rating curve used as the downstream boundary condition (Table 4).

Table 4. HEC-RAS Final Manning's N Values

Cross Section ID	Cross Section Region # (**Bold** number denotes channel value)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
79708	.08	.06	1.01	.15	**.04**	.15													
77934	.08	1.01	.15	**.04**	.04	.15													
77514	.08	.15	**.04**	.15															
74977	.08	1.01	.15	**.04**	.15	1.01	.15												
72925	.08	1.01	.15	**.04**	.15														
69996	.08	.15	.12	.08	.15	**.04**	.15												
68951	.08	1.01	.08	.09	.06	.15	**.04**	.15											
68648	.08	1.01	.06	.08	.06	.15	**.04**	.15											
68284	.08	.06	.08	.06	.15	**.04**	.15												
68159	.08	.06	.10	.06	**.04**	.15													
68132	.08	.15	.06	.10	.06	.15	**.04**	.15											
68067	.08	.15	.06	.10	.06	.15	**.04**	.15											
67982	.08	.15	.06	.10	.06	1.01	.06	.15	**.04**	.15	1.01	.15							
67957	.08	.15	.06	.10	.06	1.01	.06	.15	**.04**	.15	1.01	.15							
67908	.08	.15	.06	.10	1.01	.10	.06	1.01	.06	.15	**.04**	.15	1.01	.15					
67727	.15	.06	.10	1.01	.06	1.01	.06	.15	**.04**	.15	1.01	.15							
67529	.08	.15	.06	.10	1.01	.06	1.01	.06	.15	**.04**	.15	1.01	.15						
67309	.06	.15	.06	.10	1.01	.06	1.01	.06	.15	**.04**	.15	1.01	.15						
67111	.06	.10	1.01	.15	**.04**	.15	1.01	.15											
64535	.06	.10	.06	**.04**	.15														
58701	.06	.15	**.04**	.15															
57629	.10	.91	.06	.10	.15	.10	.06	.09	.06	.09	.06	.15	**.04**	.15					
57359	.09	.06	.08	.06	.09	.10	.15	**.04**	.15										
54258	.15	.09	.10	.09	.06	.09	.08	.15	**.04**	.08									
53587	.15	.08	.10	.06	.09	.06	.08	.15	**.04**	.08									
53550	.06	.09	.06	.09	.06	.09	.15	**.04**	.08										
52491	.09	.06	.09	.06	.09	.06	.15	**.04**	.08										
52441	.09	.06	.09	.15	**.04**	.08													
51753	.10	.09	.06	.09	.06	.09	.06	.09	.06	.15	.09	.06	.08	.15	.08	.09	.15	**.04**	.08

4. Upstream model boundary was set sufficiently far enough upstream of the eroded riverbank reach as to not inadvertently influence modeled velocities. Downstream model boundary location was set to the approximate USGS streamflow station, roughly 3 river miles below the project area. The downstream boundary condition method was set to the USGS streamflow station rating curve (Figure 20, Table 5). Choice of this method was consistent with step 1.

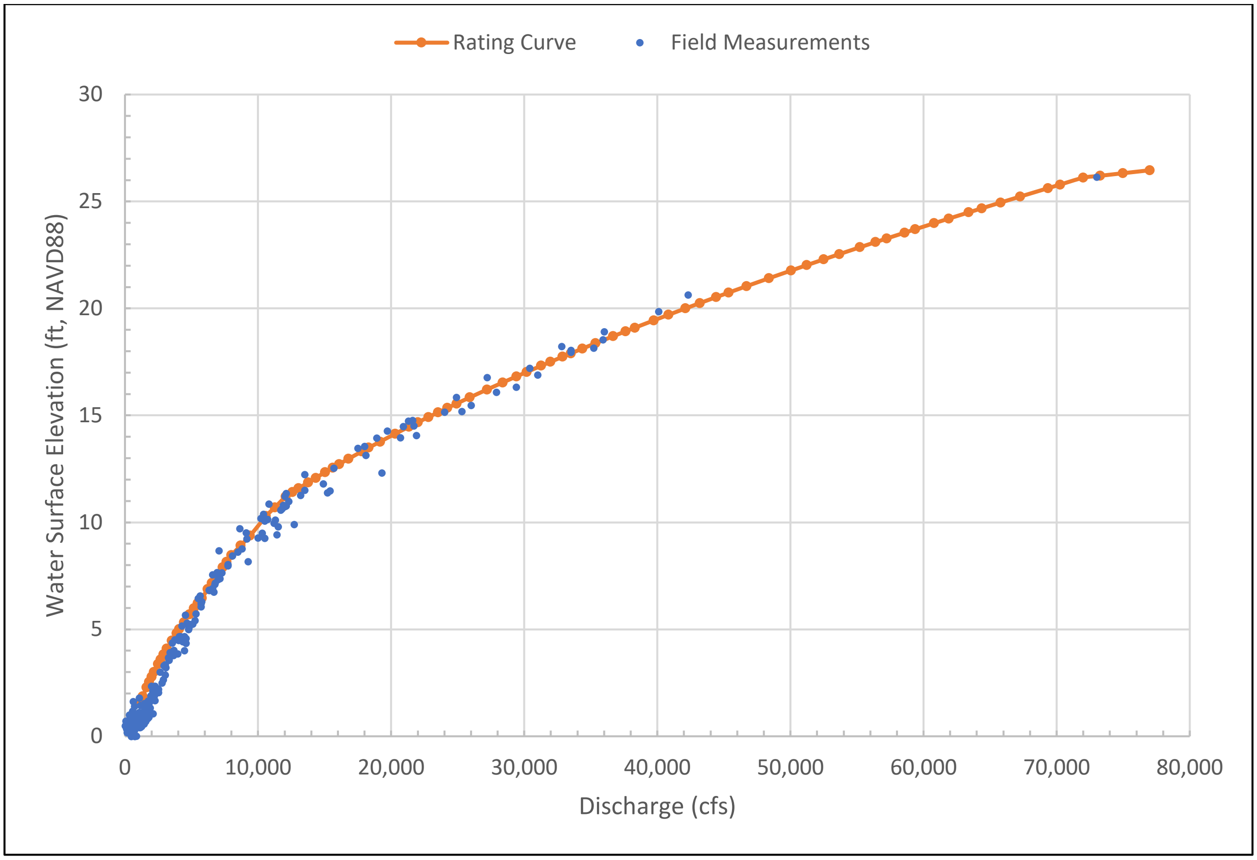


Figure 20. USGS 02084000 Tar River at Greenville, NC Stage-Discharge Rating Curve

Table 5. USGS 02084000 Tar River at Greenville, NC Stage-Discharge Rating Table

Water Surface Elevation (ft, NAVD88)	Discharge (cfs)
2	1,400
4	3,100
6	5,200
8	7,500
10	10,200
12	14,100

14	19,900
16	26,500
18	33,900
20	42,100
22	51,100
24	60,900
26	71,400
26.5	77,000

5. A suite of flows was input at the upstream beginning of the HEC-RAS model (Table 6). All discharge values were directly sourced from the USGS streamflow gage at Greenville, NC (02084000) due to its proximity to the project site. Return frequencies for discharge less than 5,000 cfs were based on a flow duration analysis using HEC-SSP. For larger flows, return frequencies were based on a Bulletin 17C analysis using HEC-SSP. This suite was modeled to capture velocity characteristics of the Tar River within the project area during low, typical, channel-capacity, and significant overbank flooding. Comparison of modeled output would provide insight on what flow scenario produced the highest, critical velocity. The stage-discharge rating table at the project site (HEC-RAS XS 68284) is shown in Table 7.Tabulated HEC-RAS output for all modeled flow scenarios has been included in Attachment 1 of this appendix.

Table 6. HEC-RAS Inflows for Upstream Boundary Condition

Discharge	Return Frequency	Description
2,000	41	Duration
3,000	27	Duration
4,000	18	Duration
5,000	99	B17C
6,000	96	B17C
7,000	93	B17C
7,300	92	Approximate discharge during Schnabel survey
8,000	88	B17C
10,000	77	B17C
20,000	32	B17C
28,300	13	Approximate FEMA 10% discharge
40,000	4.9	B17C
53,100	1.8	Approximate FEMA 1% discharge
73,000	0.6	Approximate Hurricane Floyd discharge
74,900	0.5	Approximate FEMA 0.2% discharge

Table 7. Stage-Discharge Rating at Project Location (HEC-RAS XS68284)

Water Surface Elevation (ft, NAVD88)	Discharge (cfs)
2	1,600
4	2,000
6	3,200
8	4,700
10	6,500
12	8,900
14	13,900
16	19,200
18	25,900
20	33,300
22	41,500
24	52,200
26	64,400
27.5	77,000

5.2 Riprap Revetment Design

Riprap was sized following procedures in EM 1110-2-1601, which is based on critical flow velocity within the Tar River channel. Two methods of determining average channel velocity were used due to the presence of field measurements within the project area. The first method described below was based on development of a HEC-RAS hydraulic model to calculate velocity and is the preferred method within EM 1110-2-1601. The second method determined velocity from field measurements within the channel (Schnabel, 2008). Consideration of results from these two methods are presented below, and a final recommendation of riprap size is presented.

5.2.1 Method #1: Hydraulic Model-Derived Velocity

HEC-RAS, version 6.2 was used to determine the appropriate riprap size classification. The program follows the procedure in EM 1110-2-1601 (USACE, 1924) for cases where velocity and depth are given. Riprap was sized by the following equation:

$$D_{30} = S_f C_s C_V C_T d \left[\left(\frac{\gamma_W}{\gamma_S - \gamma_W} \right)^{1/2} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5} \qquad \text{eq. 1}$$

where

D_{30}= riprap of size which 30 percent is finer by weight
S_f= safety factor
C_s= stability coefficient for incipient failure, 0.3 for angular rock
C_v= vertical velocity distribution coefficient, 1.0 for straight channels
C_T= thickness coefficient, 1.0
d= local depth of flow
γ_W= unit weight of water
γ_S=unit weight of stone
V= V_{ss}, local depth averaged side slope velocity
K_1= side slope correction factor
g= gravitational constant

Values for the equation variables above were based on a cross section (XS 68951) located upstream of the river bend and was approximately 1,000 feet upstream of the design section (XS 67957). Hydraulic model results showed that velocities were maximized during near bankfull conditions (8,000 cfs) and that for higher flows overbank actually decreased channel velocities. As shown in Table 6, a near bankfull condition of 8,000 cfs was expected to occur at an annual frequency of 88.0% or between a 1.0-year and 2.0-year event. For reference, research has shown the average return frequency for bankfull flows to be between 99.0% and 40% (1-year to 2.5-year) for most stable channels (USACE, 2000). Local depth averaged side slope velocity (Vss) was 5.2 fps with a local depth of flow (d) of 11.0 ft. Unit weight of stone (γ_S) was 165 lb/cf. Side slope correction factor was set to 1.0 due to a design side slope angle of 26.6 deg (2H:1V). A 1.4 safety factor was used (EM recommends a minimum value of 1.1) to account for potential irregularities in velocity within the river.

A D30 size of 1.8 inches was calculated. EM 1110-2-1601 recommends a minimum riprap gradation D30 of 4.44 inches (EM1601 #1). EM 1110-2-1601 gradation #1 consists of the following stone size and percent finer by weight:

D15(min) = 3.49 in. / W15(min) = 2.13 lbs.

D15(max) = 4.74 in. / W15(max) = 5.32 lbs.

D30 = 4.44 in. / W30 = 4.38 lbs.

D50(min) = 5.30 in. / W50(min) = 7.46 lbs.

D50(max) = 5.98 in. / W50(max) = 10.67 lbs.

D90 = 6.36 in. / W90 = 12.86 lbs.

D100(min) = 6.68 in. / W100(min) = 14.93 lbs.

D100(max) = 9.00 in. / W100(max) = 36.45 lbs.

In general, EM 1110-2-1601 gradations call for more restrictive gradation bands than what is typically available at local quarries. For convenience, the standard NCDOT riprap classifications for stone readily available near the project area are given in the table below:

Table 8. NCDOT Standard Riprap Classifications

TABLE 1042-1
ACCEPTANCE CRITERIA FOR RIP RAP AND STONE FOR EROSION CONTROL

Class	Required Stone Sizes, inches		
	Minimum	Midrange	Maximum
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

No more than 5.0% of the material furnished can be less than the minimum size specified nor no more than 10.0% of the material can exceed the maximum size specified.

Notably, NCDOT gradations are given by simplified dimension and not by weight. Therefore, care was taken in choosing a NCDOT riprap classification that would produce gradation bands similar to those in EM 1110-2-1601. As shown in the table above, NCDOT riprap Class B appeared to meet D50 and D100 requirements of EM 1110-2-1601 gradation #1.

5.2.2 Method #2: Field Measurement-Derived Velocity

The HEC-RAS average channel velocity used in determining Vss in method #1 was approximately 3.6 fps for bankfull conditions (8,000 cfs). This value did not seem to be representative of the field measurements taken as part of the Schnabel Bathymetry and Water Velocity Studies (April 2008). Review of the effective FEMA hydraulic model also appeared not to be representative (Vavg <3 fps). The Schnabel study measured velocities about 3 feet below the water surface during a flow event near bankfull conditions (7,300 cfs) based on USGS station 02084000 Tar River at Greenville. Twenty-one field measurements of velocities near the upstream cross section (XS 68951) resulted in an average velocity of about 7 fps with a range of 1-11 fps. Attempts in HEC-RAS calibration to the field measurements resulted in unreasonable manning's n values and energy gradient slopes. Therefore, method #2 is based solely on field-measured data. Based on a Vavg of 7 fps at 8,000 cfs, and a slight safety factor reduction to 1.2 that reflected more confidence in velocity measurements, a D30 size of 7.5 inches was calculated. A D30 of 7.5 inches falls within EM 1110-2-1601 gradation #3, which is as follows:

D15(min) = 5.98 in.	/	W15(min) = 10.67 lbs.
D15(max) = 7.88 in.	/	W15(max) = 24.50 lbs.
D30 = 7.32 in.	/	W30 = 19.61 lbs.
D50(min) = 8.80 in.	/	W50(min) = 34.02 lbs.
D50(max) = 10.01 in.	/	W50(max) = 50.12 lbs.
D90 = 10.56 in.	/	W90 = 58.87 lbs.
D100(min) = 11.03 in.	/	W100(min) = 67.05 lbs.
D100(max) = 15.00 in.	/	W100(max) = 168.74 lbs.

Based on average velocity measurements from the Schnabel study and from the NCDOT riprap classification table above, NCDOT riprap Class 1 appeared to meet D50 requirements but slightly overestimated D100 requirements.

5.2.3 Final Riprap Size Recommendation

The resulting velocities from the two methods described above produced different recommendations of riprap sizes for the project site. Method #1 calculated relatively low averaged channel velocities and consequently resulted in choosing the smallest EM 1110-2-1601 gradation #1 curve. Method #1 corresponding stone size readily available at a local quarry was NCDOT Class B. Method #2, based on higher average velocities measured within the channel, resulted in choosing EM 1110-2-1601 gradation #3 curve. Method #2 corresponding stone size readily available a local quarry was NCDOT Class

1. Generally, it is uncommon to recommend riprap sizing be determined based solely on field observations as it carries uncertainty related to limited observation points. However, due to the emergency streambank stabilization nature of this study authority and method #2 producing relatively larger stone size which will further reduce the risk of project failure, it is recommended that NCDOT Class 1 stone be placed along the Tar River left bank at the project site.

5.2.4 Layer Thickness

EM 1110-2-1601 calls for stone to be contained with a riprap layer, a thickness no less than 1.5 x the spherical diameter of the upper limit W50 stone or 1.0 x the spherical diameter of the upper limit W100 stone. Therefore, a layer thickness of 17 inches is recommend based on NCDOT Class 1 stone.

*The thickness determined above should be increased by 50-percent when the riprap is placed underwater to provide for uncertainties associated with this type of placement. Therefore, a layer thickness of 25.5 inches is recommended for underwater placement.

5.2.5 Revetment Top Protection

Placement of riprap is recommended to extend to top of bank. A level surface equal to the layer thickness is recommended past the top of bank and is to be keyed into natural ground.

5.2.6 Revetment End Protection

The upstream and downstream ends of riprap revetment are to be extended to areas of noneroding velocities and relatively stable banks. As design velocities were calculated to be relatively low, primary identification of revetment end protection should be based on location of stable bank. This is anticipated to extend at a minimum beyond the existing articulating block footprint.

5.2.7 Revetment Toe Scour Estimation

Local scour was estimated following procedures in EM 1110-2-1601 and using HEC-RAS, version 6.2. The Hydraulic Design (HD) Riprap and Scour Calculator within HEC-RAS was used to determine the range of estimated scour depths. Manual hydraulic data inputs required by the scour calculator include the following:

Radius of Curvature = 575 feet

D50 of Bed Material = 0.16 millimeters (Schnabel, 2008)

Bend Severity = Severe

The scour calculator included a suite of empirical simple scour calculators that take an ensemble approach to scour calculations. Engineering judgment was then used to determine the maximum likely scour depth. Scour calculator results for four different Bend Scour methods are as follows:

Maynord = 10.8 feet

Zeller = 2.9 feet

Thorne = 14.2 feet

USACE Curve = 12.9 feet

Maximum bend scour depths ranged from 2.9 feet to 14.2 feet, with mean and median values of 10.2 feet and 11.9 feet, respectively. With a maximum estimated bend scour depth of 2.9 feet, Zeller appeared as an outlier. However, it is anticipated that some methods are more likely to generate similar results because they have similar structure. Therefore, the mean value of 10.2 feet across the four methods would be used to assist in final recommended bend scour depth. As this average was closest to the Maynord value, it was chosen to represent the maximum bend scour depth, at 10.8 feet. A safety factor 1.1 was applied to the recommended bend scour depth, resulting in a final value of 11.9 feet.

5.2.8 Revetment Toe Protection

Toe protection would be provided by placing launchable stone at the toe of the bank (Figure 21).

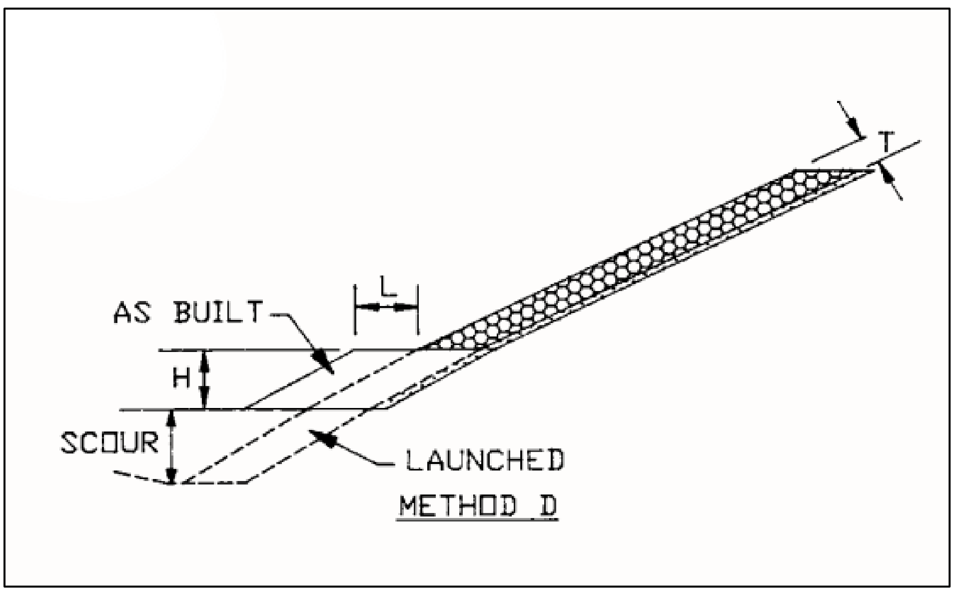


Figure 21. Revetment Toe Protection – Launchable Stone

The portion of Tar River within the project area was characterized by incurring gradual scour in regular bendways, thus, the height of the stone section before launching would be 2.5 to 4.0 times the bank protection thickness, or 5.3 feet to 8.5 feet. Per EM 1110-2-1601, Table 3-2, with a vertical launch distance of 11.9 feet and assumed underwater placement, stone volume for the riprap launching section was increased by 50-percent. The following equation was used to calculate volume of launchable stone required per linear foot of protection:

Volume = (Table 3-2 factor) * (thickness of the bank revetment) * (scour depth) * (5^1/2)

where

Table 3-2 factor = 1.5

Thickness of bank revetment = 25.5 inches (2.125 feet)

Scour depth = 11.9

The volume per linear foot of protection was calculated to be 84.8 cubic feet/ft. A safety factor of 1.1 was then applied. The final value was 93.3 cubic feet/ft.

5.2.9 Typical Riprap Revetment Detail

Design elements of the selected plan as described in the preceding subsections is shown in Figure 22. A full description of the selected plan is included in Section 8 of the Feasibility Integrated EA Report document.

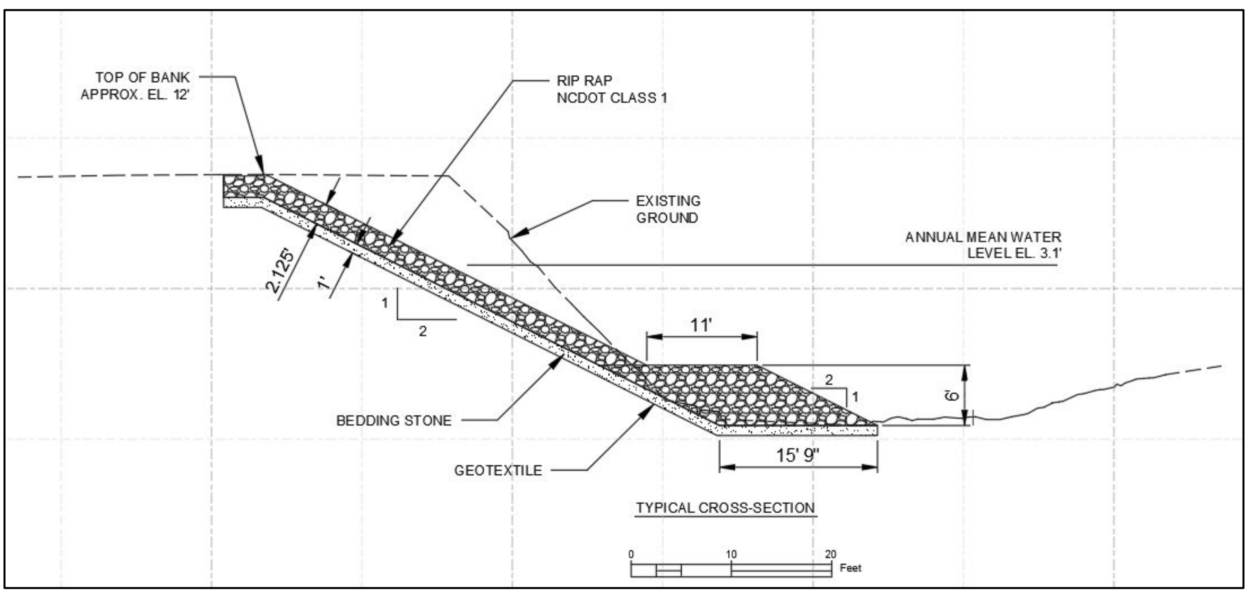


Figure 22. Typical Section of the Selected Plan

6 Sea Level Change

ER 1100-2-8162, Incorporating Sea Level Change (SLC) in Civil Works Programs, provides regulations and guidance for incorporating direct and indirect physical effects of projected future sea level change to USACE Civil Works projects. Consideration of potential relative sea level change is required in every USACE coastal activity as far inland as the estimated tidal influence, including studies that calculate backwater profiling with the ocean as the downstream boundary condition.

Using the USACE Sea-Level Change Curve Calculator (Version 2019.21), historical rates and future rates are calculated for the Beaufort, NC Gage 8656483 (Figure 23, Figure 24). This site has 54 years of record based on the current 2017 accepted datum status (listed POR from 1953 to 2007). The current accepted NOAA relative sea level trend rate along with its 95% confidence intervals for the Beaufort, NC Gauge 8656483 is 3.36 +/- 0.34 mm/yr (Figure 25). For reference, the absolute global sea level rise is believed to be 1.7-1.8 millimeters/year, or roughly half of the relative rise predicted at the Beaufort, NC gauge. Interannual variation at this site is shown in Figure 26. According to ER 1100-2-8162, these historical and future rates are then used by the calculator to produce three curves which are the *USACE Low Curve*, *USACE Intermediate Curve*, and the *USACE High Curve*. The *USACE Low Curve* is calculated using the historic rate of sea-level change for each given location. The *USACE Intermediate Curve* is computed from the modified National Research Council (NRC) Curve I considering both the most recent Intergovernmental Panel on Climate Change (IPCC) projections and modified NRC projections with the local rate of vertical movement added. The *USACE High Curve* is computed from the modified NRC Curve III considering both the most recent IPCC projections and modified NRC projections with the local rate of vertical land movement added. The results for Beaufort, NC gage can be found in Figure 27 and Table 9 in both graphical and tabular form for each curve. The project base year was specified as 2023, and the analysis projected out 100 years. The results of the calculator for the year 2073 are as follows: Low Curve is 0.66-ft, Intermediate Curve is 1.27-ft, and High Curve is 3.12-ft. Results for year 2123 are as follows: Low Curve is 1.10-ft. Intermediate Curve is 2.63-ft, and High Curve is 7.47-ft.

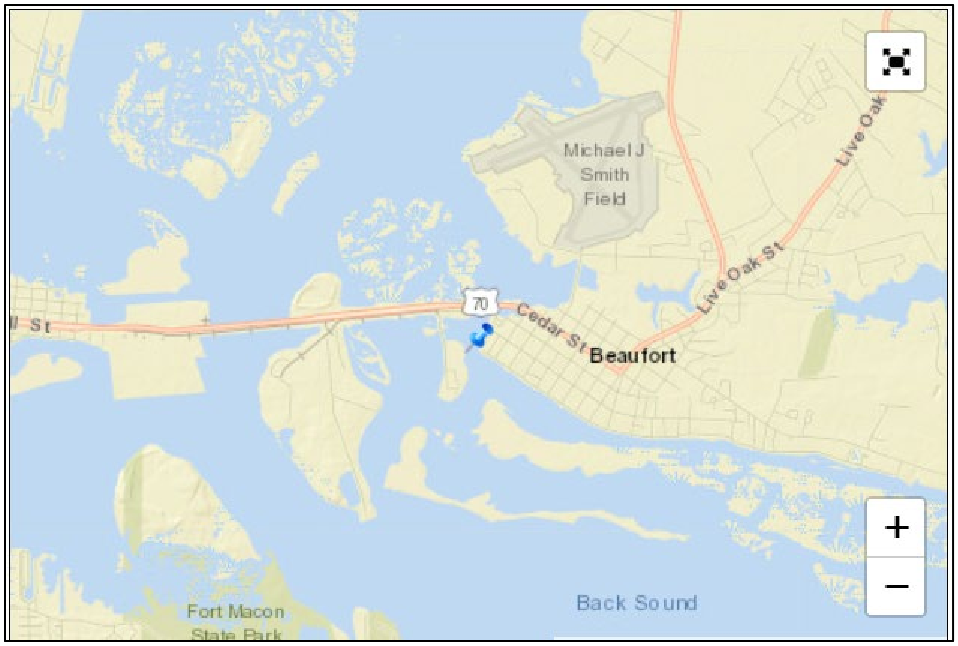


Figure 23. Location of Beaufort, NC Gage 8656483

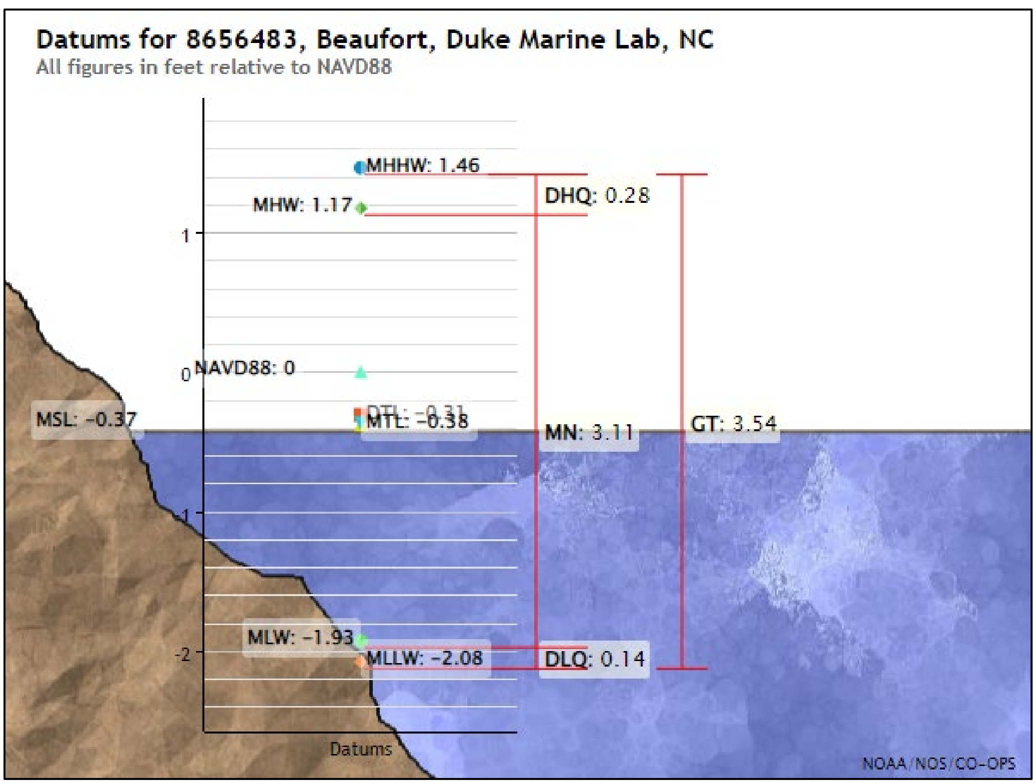


Figure 24. Beaufort, NC Gauge 8656483 Datum Information

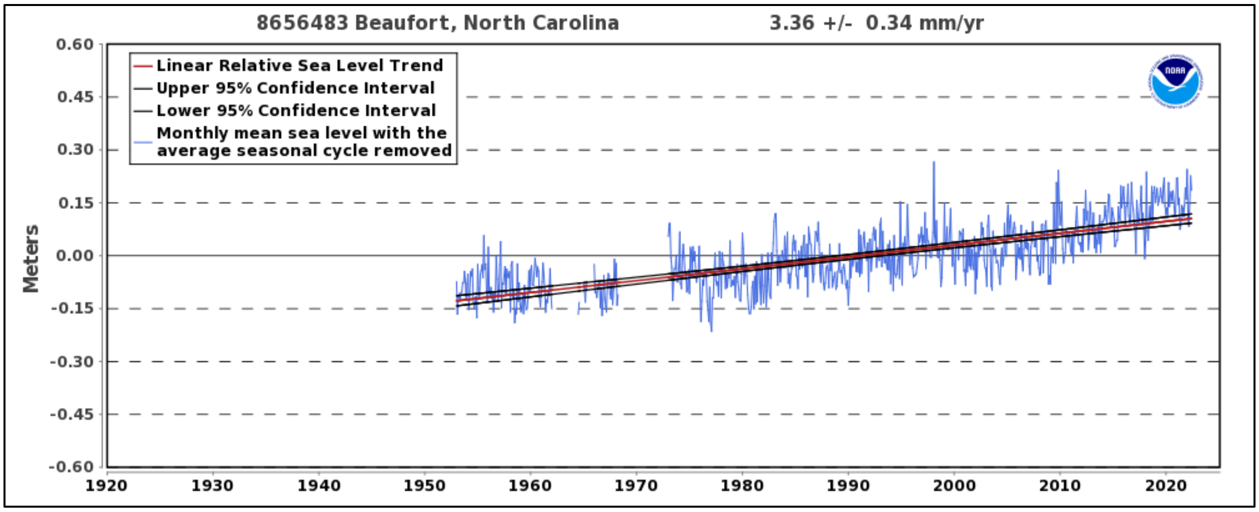


Figure 25. Beaufort, NC Gauge 8656483 Relative Sea Level Trend

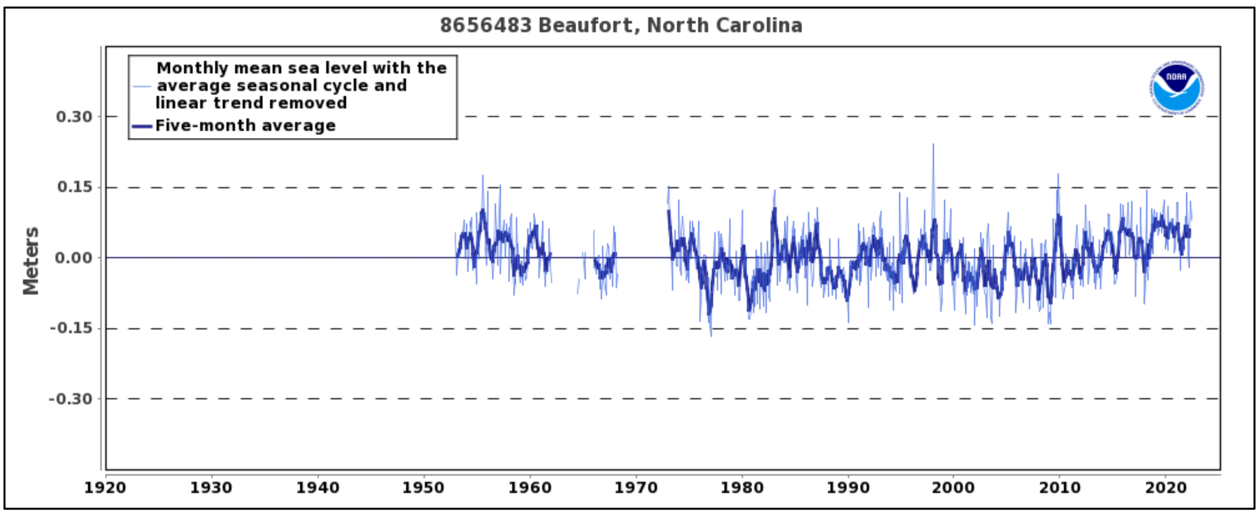


Figure 26. Beaufort, NC Gauge 8656483 Interannual Variation

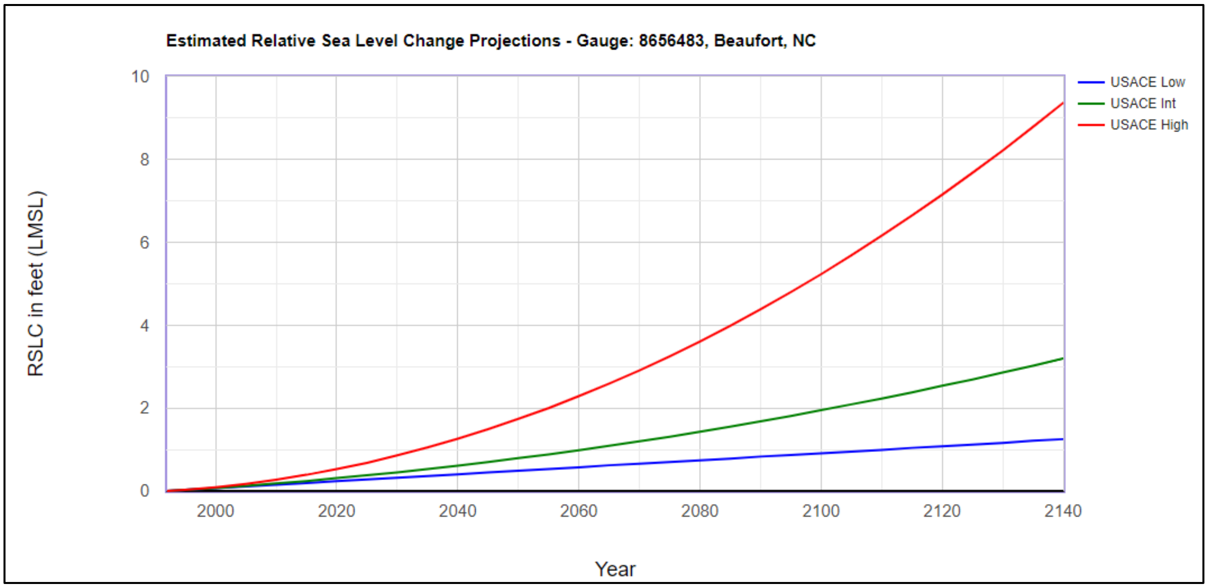


Figure 27. Estimated Relative Sea Level Change Projection Curves Beaufort, NC Gage 8656483

Table 9. Estimated Relative Sea Level Change Projection Tabular Data Beaufort, NC Gage 8656483

8656483, Beaufort, NC
NOAA's 2006 Published Rate: 0.00843 feet/yr
All values are expressed in feet relative to LMSL
Gauge Status: Compliant

Year	USACE Low	USACE Int	USACE High
1992	0.00	0.00	0.00
1995	0.03	0.03	0.03
2000	0.07	0.07	0.09
2005	0.11	0.12	0.17
2010	0.15	0.18	0.27
2015	0.19	0.24	0.39
2020	0.24	0.31	0.53
2025	0.28	0.38	0.68
2030	0.32	0.45	0.86
2035	0.36	0.53	1.05
2040	0.40	0.61	1.26
2045	0.45	0.70	1.49
2050	0.49	0.79	1.74
2055	0.53	0.88	2.00
2060	0.57	0.98	2.29
2065	0.62	1.09	2.59
2070	0.66	1.20	2.91
2075	0.70	1.31	3.25
2080	0.74	1.43	3.61
2085	0.78	1.55	3.99
2090	0.83	1.68	4.39
2095	0.87	1.81	4.80
2100	0.91	1.95	5.23
2105	0.95	2.09	5.69
2110	0.99	2.23	6.16
2115	1.04	2.38	6.65
2120	1.08	2.54	7.15
2125	1.12	2.69	7.68
2130	1.16	2.86	8.22
2135	1.21	3.02	8.79
2140	1.25	3.20	9.37

The USACE Sea Level Tracker (https://climate.sec.usace.army.mil/slr_app/) was used to visualize the variability of coastal water levels at the Beaufort, NC Gage, and compare the different USACE sea level change scenarios. Results of the tracker tool include historical gauge records through year 2021 (Figure 28). Notably, there has been an apparent upward trend of both 5- and 19-year MSL moving averages since the mid-2000's. This pitch upward may suggest convergence with the High SLC curve in the near future.

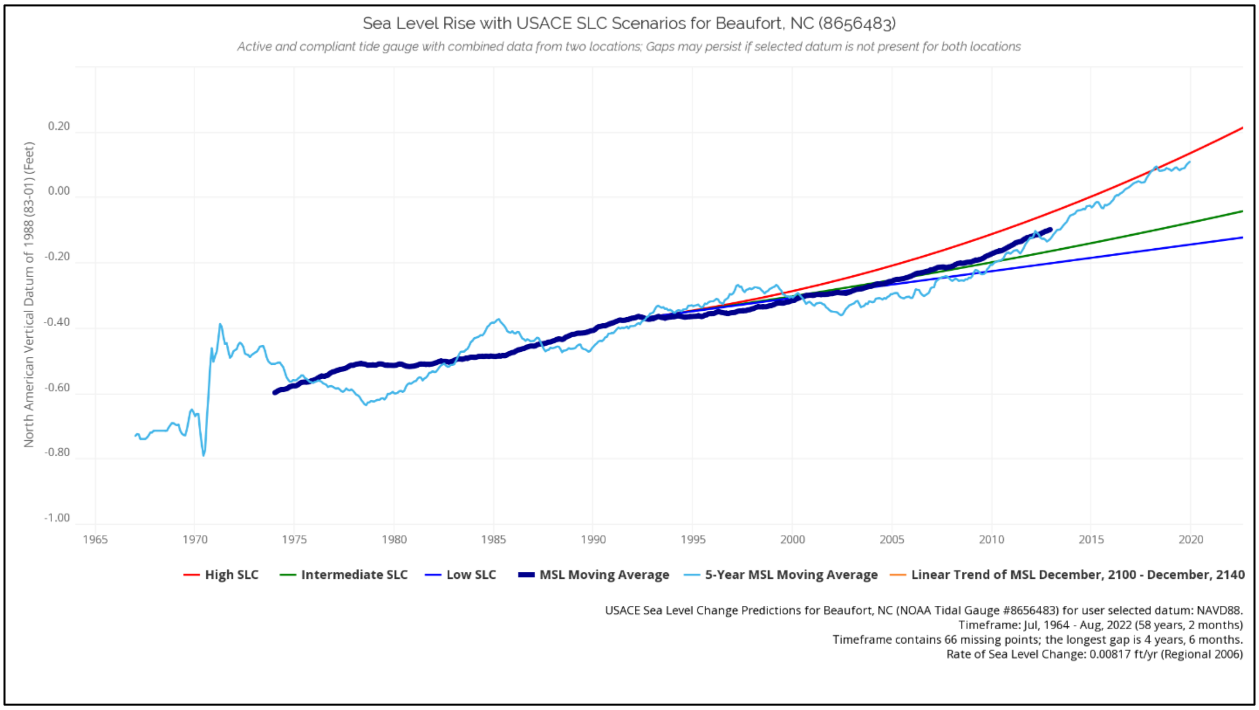


Figure 28. USACE Sea Level Tracker for Beaufort, NC (8656483) through Year 2021

NOAA's "Sea Level Rise Viewer" (https://coast.noaa.gov/) was used to determine the impacts of SLC. Present day MHHW extends up the mouth of the Tar River to near the Edgecombe and Pitt county border (Figure 29). Four MHHW scenarios that included sea level rise were assessed within the tool, 1-ft sea level rise (Figure 30), 2-ft sea level rise (Figure 31), 6-ft sea level rise (Figure 32), and 8-ft sea level rise (Figure 33). Based on a comparison of the encroaching water depth footprint between the different sea level rise scenarios, no GUC WTP infrastructure would be impacted by the increased MHHW.

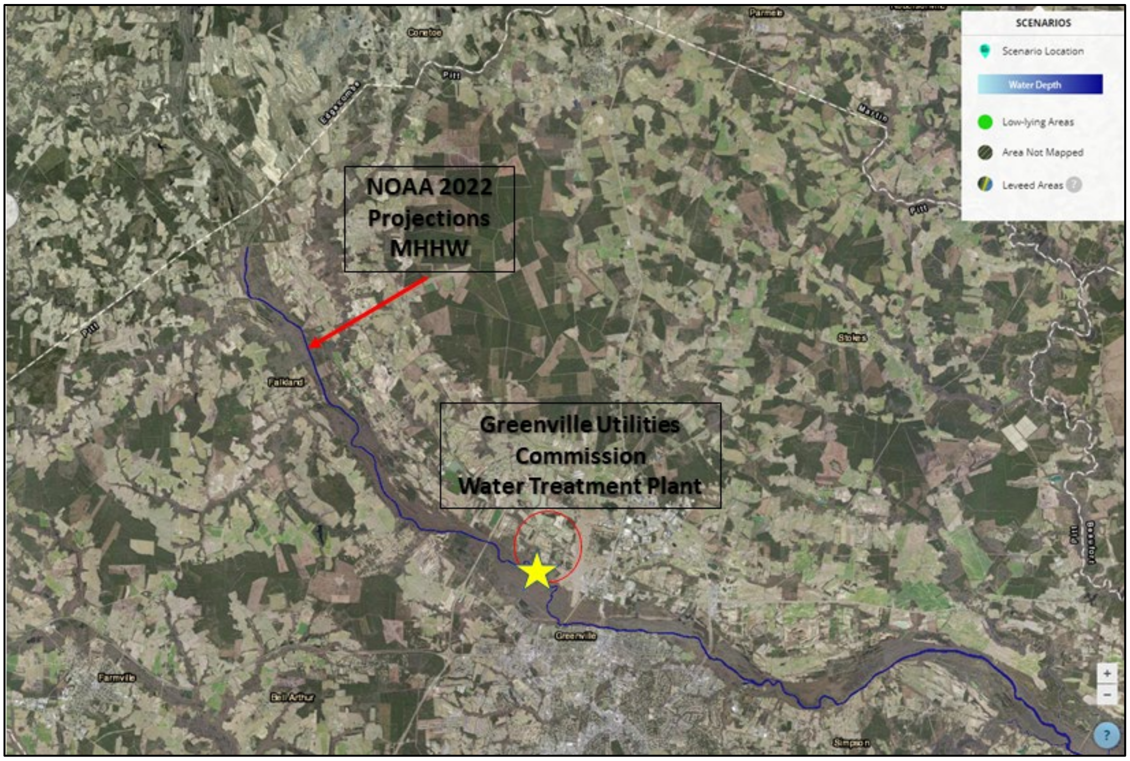


Figure 29. NOAA Sea Level Rise Viewer – 2022 MHHW Projections

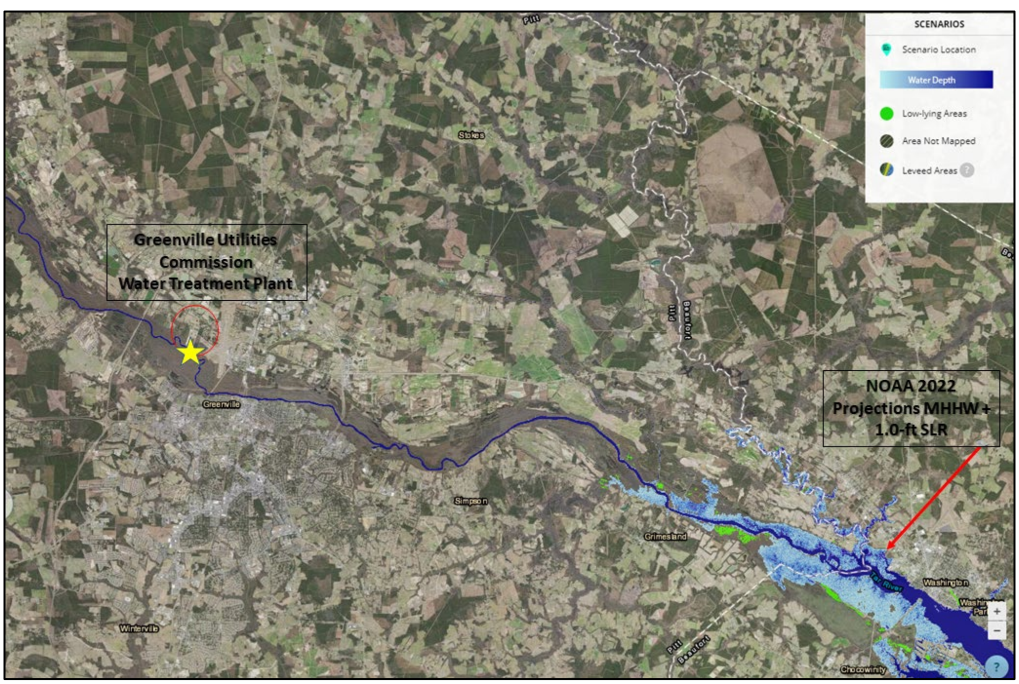


Figure 30. NOAA Sea Level Rise Viewer – 2022 MHHW Projections + 1.0-ft Sea Level Rise

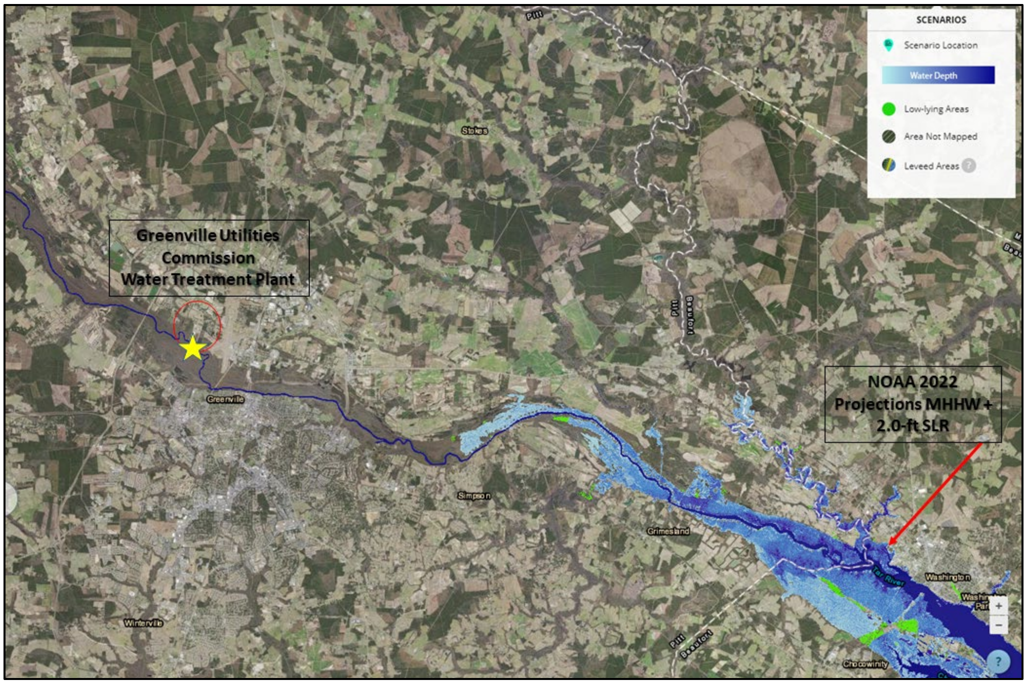


Figure 31. NOAA Sea Level Rise Viewer – 2022 MHHW Projections + 2.0-ft Sea Level Rise

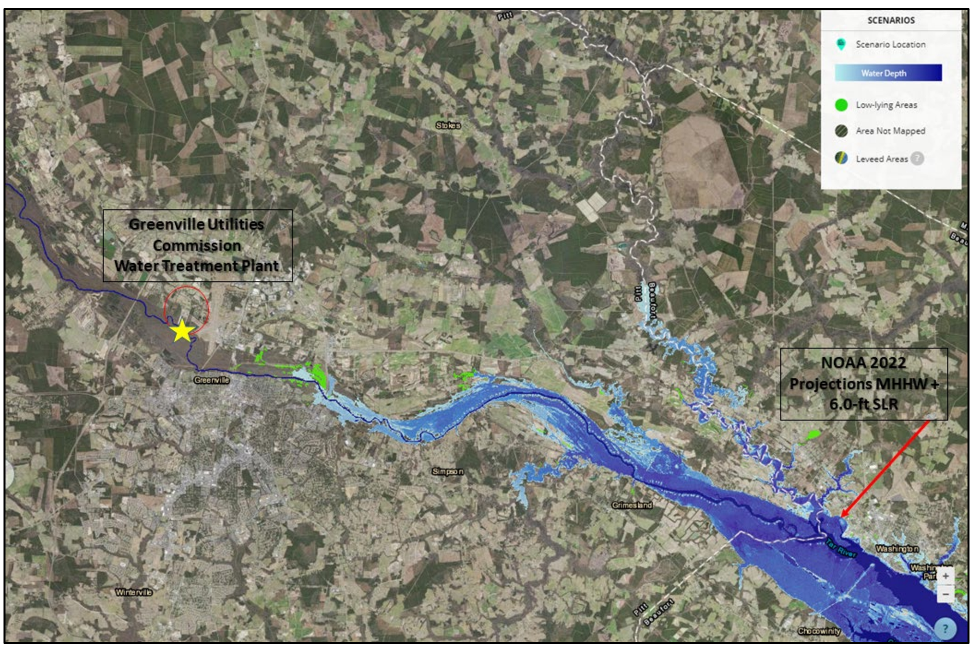


Figure 32. NOAA Sea Level Rise Viewer – 2022 MHHW Projections + 6.0-ft Sea Level Rise

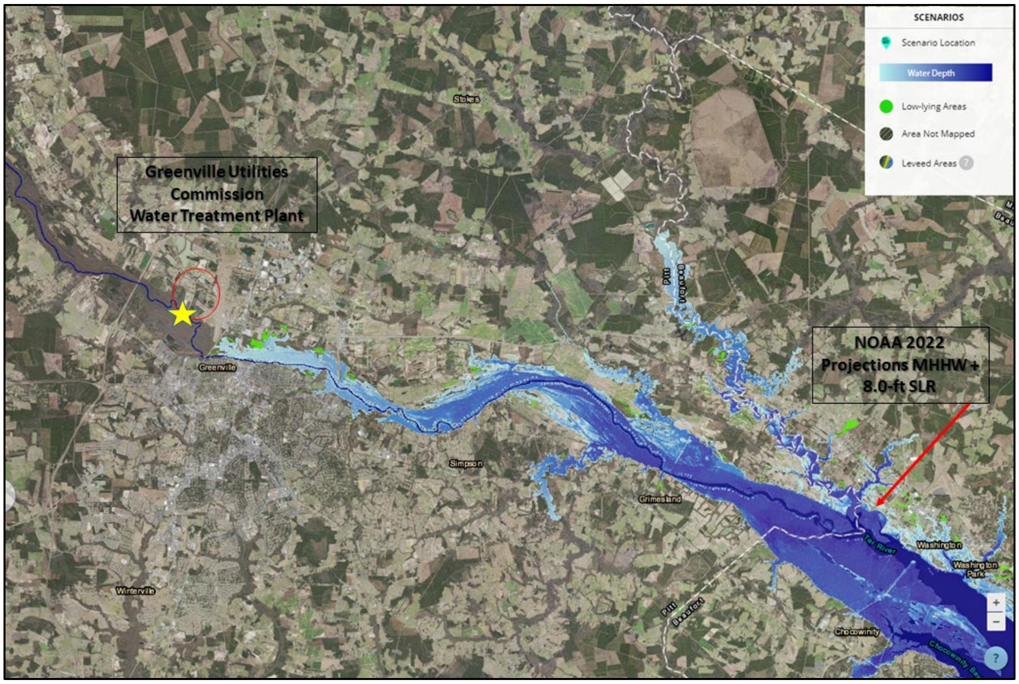


Figure 33. NOAA Sea Level Rise Viewer – 2022 MHHW Projections + 8.0-ft Sea Level Rise

6.1 SLC Impacts to Infrastructure and Project Adaptability

Engineer Technical Letter (ETL) 1100-2-1, Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation, provides guidance for a qualitative analysis to determine the risk of potential SLC. A qualitative matrix was developed to evaluate SLC impacts to infrastructure and critical resources in the project area (Table 10). This matrix shows the resources on which the study area depends, and the vulnerability of each resource from potential SLC. The common driving factor for SLR vulnerability was inundation within the project area caused by higher tailwater conditions. While results from the NOAA Sea Level Rise Viewer showed the project area to be outside of the area influenced by SLR, there may be risk related to model and natural uncertainty that has been incorporated into the tool.

Table 10. Qualitative Sea Level Rise Matrix

Critical Resources in Project Area	Density of Resource*	Resource and Risk Description	Risk from SLR*
Federal and local levees and floodwalls	0	No levees or floodwalls located within the project area.	0
Federal and local pump stations, flood gates, drainage network, etc.	1	1 GUC WTP pump station building. Intake pipes will be inundated more often due to higher tailwater.	1
River, channel, lake exposure	1	Tar River. Near channel capacity and overbank flows will occur more often due to higher tailwater	1
Potential area of impact	0	Project area falls outside of the potential impact area.	0
Commercial and industrial infrastructure	1	GUC WTP raw water intake structures and pump station	1
Transportation infrastructure	0	There are no bridges within the project area.	0
Utilities, sewage, communication networks	0	There are no utilities, sewage, or communication networks within the project area.	0
Private infrastructure	0	There is no private infrastructure within the project area.	0
Evacuation routes	0	There are no evacuation routes within the project area.	0
Environmental and habitat areas	1	There are overbank marshes and wetlands within the project area. Will be inundated more often due to higher tailwater.	1
Potential for impacts at adjacent navigation, coastal storm damage, or ecosystem projects	1	Pamlico and Tar Rivers Navigation project. Will be inundated more often due to higher tailwater.	1

*3 = high, 2 = medium, 1 = low, 0 = none

6.2 Sea Level Change Conclusion

Sea level change is a growing concern in estuary and coastal regions of North Carolina. In order to ensure projects are adaptable to changing conditions related to SLC, structural components of the project should ideally be flexible to modifications and be able to accommodate re-assessments of SLC at later dates within the assumed project life span. Based on incremental SLR projections from NOAA (Figure 30 - Figure 33) at this time, additional resiliency and robustness actions in the future do not appear warranted. Furthermore, immediate impacts from SLR, should they extend into the project location, would predominately serve to worsen backwater effects from the downstream Pamlico Sound estuary. Backwater effects would reduce efficiency of the Tar River to drain and would result in lower flow velocities. However, should future coastal mechanisms related to SLR contribute to additional erosion to the project site, additional and larger stone may be implemented to maintain riverbank erosion protection level of this project’s components.

7 Climate Change Analysis

This qualitative assessment of climate change impacts is required by U.S. Army Corps of Engineers (USACE, “the Corps”) Engineering and Construction Bulletin (ECB) 2018-14, “Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects.” This assessment documents the qualitative effects of climate change on the hydrology in the region. The ECB 2018-14 analysis is targeted at identifying potential impacts and risks to the GUC CAP, Section 14 Feasibility Study due to climate change.

USACE projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows that in some places and for some impacts relevant to USACE operations, climate change is shifting the baseline about which that natural climate variability occurs and may be changing the range of that variability as well. This is relevant to USACE because the assumptions of stationary climate conditions and a fixed range of natural variability, as captured in the historic hydrologic record may no longer apply. Consequently, historic hydrologic records may no longer be appropriately applied to carry out hydrologic assessments for flood risk management in watersheds such as the Tar-Pamlico Basin.

7.1 Tar-Pamlico Basin Description

The Tar-Pamlico River basin is the fourth largest river basin in North Carolina and is one of only four river basins whose boundaries are located entirely within the state. The Tar River originates in north central North Carolina in Person, Granville and Vance counties and flows southeasterly until it reaches tidal waters near Washington and becomes the Pamlico River. The Pamlico River is a tidal estuary that flows into the Pamlico Sound. Major tributaries of the Tar River include Fishing Creek, Swift Creek, Little Fishing Creek, Town Creek, Conetoe Creek, Chicod Creek, Tranters Creek and the Pungo River. Based on the 2011 National Land Cover Data, the Tar-Pamlico River Basin's estimated developed area is ~7%, agriculture ~29%, wetlands ~23% grassland/scrub ~12% and forest ~27%. Development and population growth centers around Greenville, Rocky Mount, Washington and in rural areas within commuting distance to Raleigh.

The Tar River Basin begins in the Piedmont of North Carolina and extends 215 miles southeast through the Coastal Plain and flows to the Pamlico Sound estuary. The basin covers about 6,100 square miles. The basin encompasses all or part of 18 counties. Major population centers in the study area include the cities of Louisburg, Rocky Mount, Greenville, Tarboro, and Princeville, NC.

7.2 Tar-Pamlico Basin Gage Data

The Tar-Pamlico Basin has 13 stream gage sites, of which 8 are located along the Tar River mainstem (Table 11).

Table 11. Summary of Available USGS gages located in the Tar-Pamlico Basin

USGS NO.	Gage Name and Location	DA, mi^2	Latitude	Longitude	Water Quality Data	Start of Record	Latest Record
02081500	Tar River near Tar River, NC	165	36.1942	-78.5831	Yes	1939	2020
02081747	Tar R at Us 401 At Louisburg, NC	435	36.0931	-78.2961	Yes	1934	2020
02082000	Tar River near Nashville, NC	708	35.8493	-77.9305	Yes	1929	1970
02082506	Tar R Bl Tar R Reservoir near Rocky Mount, NC	784	35.9006	-77.8656	Yes	1971	2012
02082585	Tar River at Nc 97 At Rocky Mount, NC	933	35.9547	-77.7872	No	1977	2020
02082770	Swift Creek at Hilliardston, NC	173	36.1122	-77.9200	Yes	1924	2020
02082950	Little Fishing Creek near White Oak, NC	178	36.1833	-77.8761	Yes	1960	2020
02083000	Fishing Creek near Enfield, NC	530	36.1506	-77.6931	Yes	1910	2020
02083500	Tar River at Tarboro, NC	2,222	35.8944	-77.5331	Yes	1897	2020
02083800	Conetoe Creek near Bethel, NC	72	35.7760	-77.4622	Yes	1955	2002
02084000	Tar River at Greenville, NC	2,697	35.6167	-77.3728	Yes	1887	2020
02084160	Chicod Cr at SR1760 Near Simpson, NC	42	35.5617	-77.2308	Yes	1976	2020
02084472	Pamlico River at Washington, NC	3,200	N/A	N/A	Yes	1999	2020

7.3 Literature Review

7.3.1 Observed Trends

7.3.1.1 Literature Review of Observed Climate Changes

The Tar-Pamlico River Basin is located in Water Resource Region (i.e., HUC-2 watershed) number 03, the South Atlantic-Gulf Region.

7.3.1.2 Temperature

A number of studies focusing on observed trends in historical temperatures were reviewed for this report. These include both national scale studies inclusive of results relevant to Water Resources Region 03 and regional studies focusing more specifically and exclusively on the area. Results from both types of studies are discussed below.

A 2009 study by Wang et al. examined historical climate trends across the continental United States. Gridded (0.5 degrees x 0.5 degrees) mean monthly climate data for the period 1950 – 2000 were used. The focus of this work was on the link between observed seasonality and regionality of trends and sea surface temperature variability. The authors identified positive statistically significant trends in recent observed mean air temperature for most of the U.S. (Figure 34). For the South Atlantic-Gulf Region, mixed results are presented. A positive, but small, warming trend is identified for most of the area in the spring and summer. For the fall months, the southern portion of the area is shown to be warming while some cooling is shown in the northern portion of the area. For the winter months, the divide appears to be more east-west, with warming in the east and cooling in the western portion of the area. A later study by Westby et al. (2013), using data from the period 1949 – 2011, moderately contradicted these findings, presenting a general winter cooling trend for the entire region for this time period. The third NCA report (Carter et al., 2014) presents historical annual average temperatures for the southeast region. Their southeast study region is larger than, but inclusive of the South Atlantic-Gulf Region. For this area, historical data generally shows warming of average annual temperatures in the early part of the 20th century, followed by a few decades of cooling, and is now showing indications of warming. However, though a seasonal breakdown is not presented, the NCA report cites an overall lack of trend in mean annual temperature in the region for the past century. Details on statistical significance are not provided.

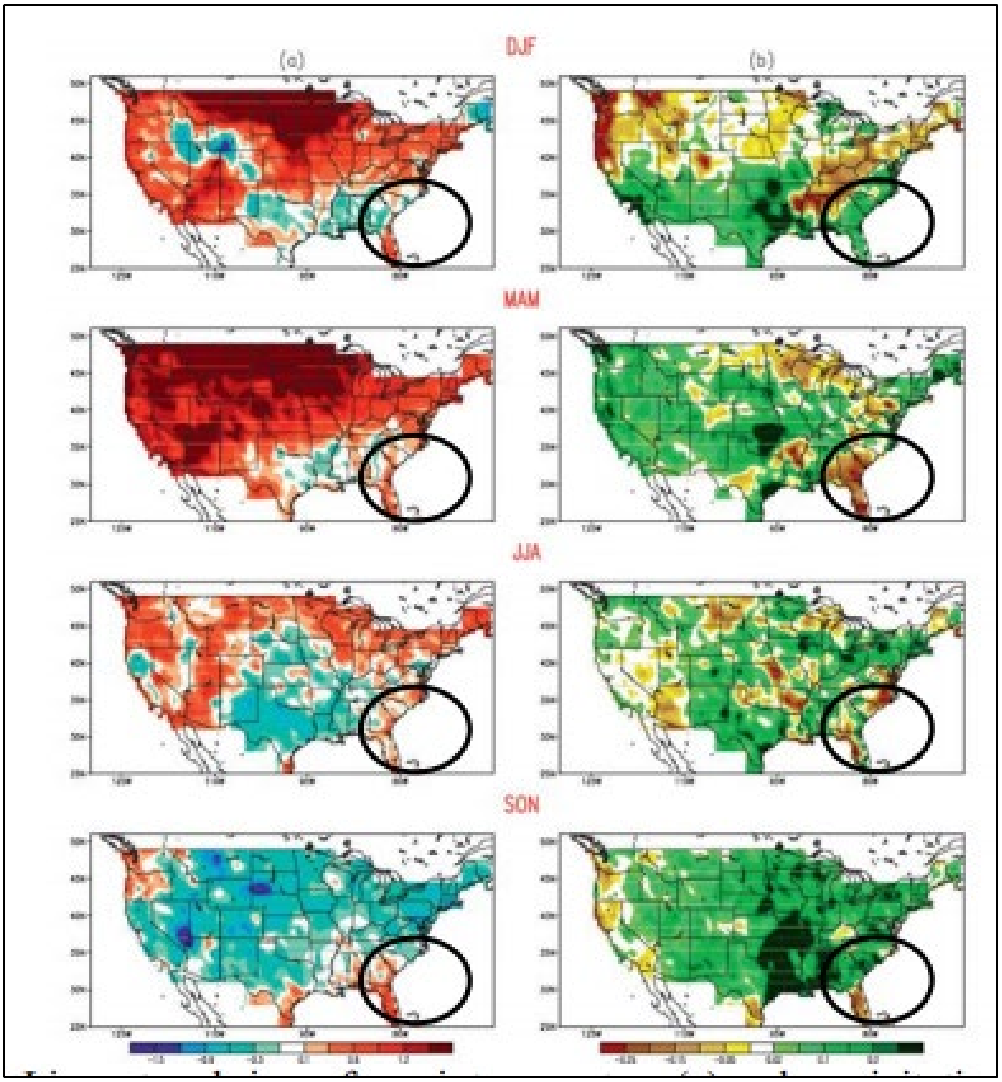


Figure 34. Linear trends in surface air temperature (a) and precipitation (b) over the United States, 1950 – 2000. The South Atlantic-Gulf Region is within the black oval (Wang et al., 2009)

A 2012 study by Patterson et al. focused exclusively on historical climate and streamflow trends in the South Atlantic region. Monthly and annual trends were analyzed for a number of stations distributed throughout the South Atlantic-Gulf Region for the period 1934 – 2005. Results (Figure 35) identified a largely cooling trend for the first half of the historical period and the period as a whole. However, the second half of the study period (1970 – 2005) exhibits a clear warming trend with nearly half of the stations showing statistically significant warming over the period (average increase of 0.7 ºC). The circa 1970 "transition" point for climate and streamflow in the U.S. has been noted elsewhere, including Carter et al. (2014). Trends in overnight minimum temperatures (Tmin) and daily maximum (Tmax) temperatures for the southeast U.S. were the subject of a study by Misra et al. (2012). Their study region encompasses nearly the full extent of the South Atlantic-Gulf Region and used data from 1948 to

2010. Results of this study show increasing trends in both Tmin and Tmax throughout most of the study region. The authors attribute at least a portion of these changes to the impacts of urbanization and irrigation.

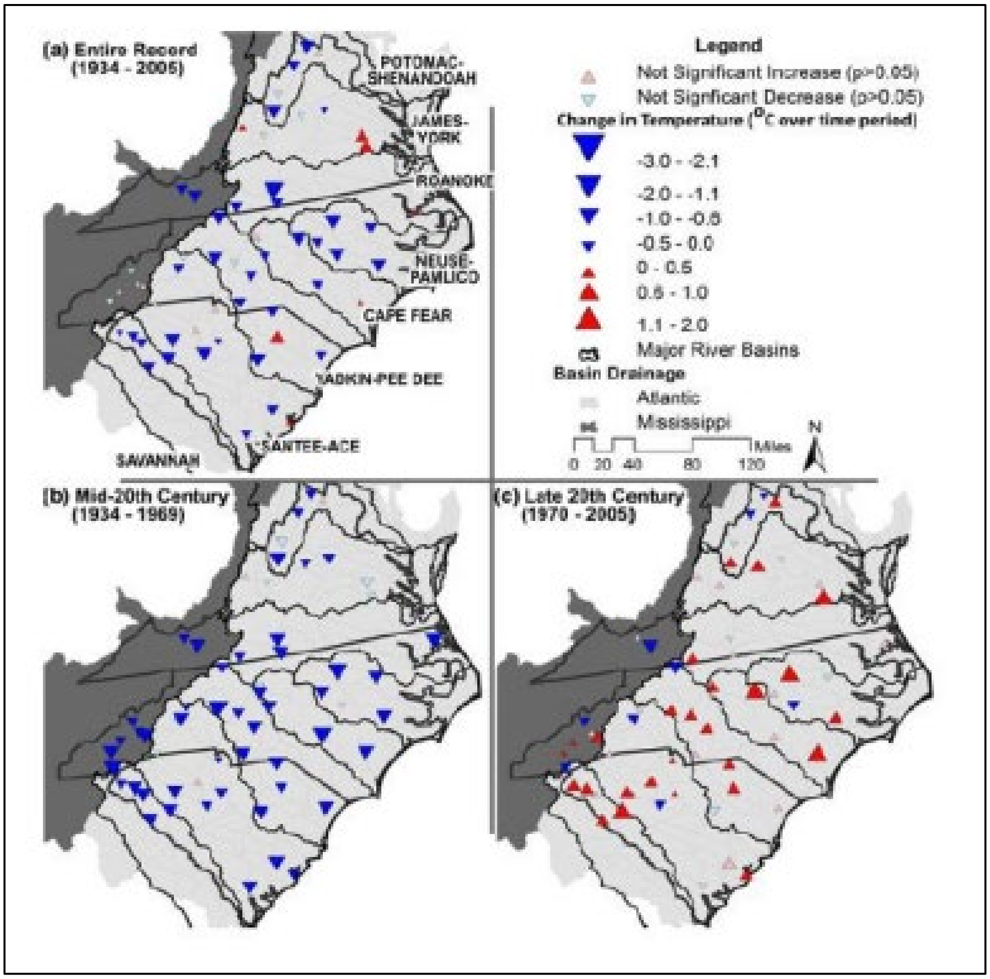


Figure 35. Historical annual temperature trends for the South Atlantic Region, 1934 – 2005. Triangles point in the direction of the trend, size reflects the magnitude of the change. Blue indicates a decreasing temperature trend. Red indicates an increasing temperature trend (Patterson et al., 2012)

In North Carolina specifically the temperatures have risen more than 1°C since the beginning of the 20th century (NCEI, 2022). Winter average temperatures have been increasing with the 2015-2020 period exceeding the levels of the 1930's and 1950's. Summer average temperatures in the 2005-2020 period have been the warmest on record.

7.3.1.3 Precipitation

Palecki et al. (2005) examined historical precipitation data from across the continental United States. They quantified trends in precipitation for the period 1972 – 2002 using NCDC 15- minute rainfall data. For the South Atlantic-Gulf Region, statistically significant increases in winter storm intensity (mm per hour) and fall storm totals were identified for the southernmost portion of South Atlantic-Gulf Region. Additionally, a statistically significant decrease in summer storm intensity was identified for the northern portion of the area.

A 2011 study by McRoberts and Nielsen-Gammon used a new continuous and homogenous data set to perform precipitation trend analyses for sub-basins across the United States. The extended data period used for the analysis was 1895 – 2009. Linear positive trends in annual precipitation were identified for most of the U.S (Figure 36). For the South Atlantic-Gulf Region, results were mixed with some areas showing mild decreases in precipitation and others showing mild increases. No clear trend for the area is evident from these results.

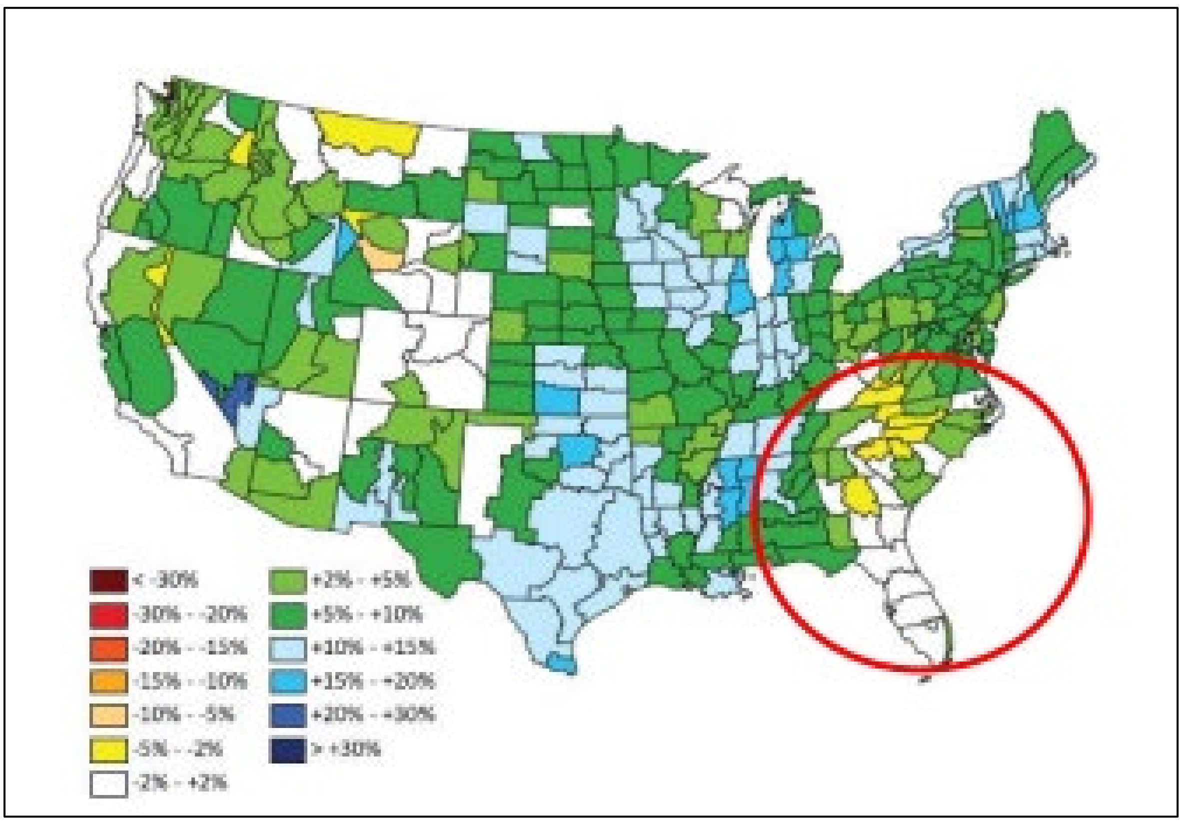


Figure 36. Linear trends in annual precipitation, 1895 – 2009, percent change per century. The South Atlantic-Gulf Region is within the red oval (McRoberts and Nielsen-Gammon, 2011).

Changes in extreme precipitation events observed in recent historical data have been the focus of a number of studies. Studies of extreme events have focused on intensity, frequency, and/or duration of such events. Wang and Zhang (2008) used recent historical data and downscaled Global Climate Models (GCMs) to investigate changes in extreme precipitation across North America. They focused specifically on the changes in the frequency of the 20-year maximum daily precipitation event. The authors looked at both historical trends in observed data and trends in future projections. Statistically significant increases in the frequency of the 20-year storm event were quantified across the southern and central U.S., in both the recent historical data and the long-term future projections (described below). For the South Atlantic-Gulf Region, significant changes in the recurrence of this storm were identified for the period 1977 – 1999 compared to the period 1949 – 1976. An increase in frequency of approximately 25 to 50% was quantified.

In North Carolina (at the Coweeta Laboratory), changes in precipitation variability have been observed (Laseter et al., 2012) (Figure 37). These changes include wetter wet years and dryer dry years compared to the middle of the 20th century. As an example, the wettest year on record occurred in 2009 at Coweeta, and only two years earlier (2007) the driest year on record was observed. This pattern of change is supported by the NCA report (Carter et al., 2014), which states that, “summers have been either increasingly dry or extremely wet” in the southeast region. This assessment is based on analysis of data dating back to the turn of the 20th century.

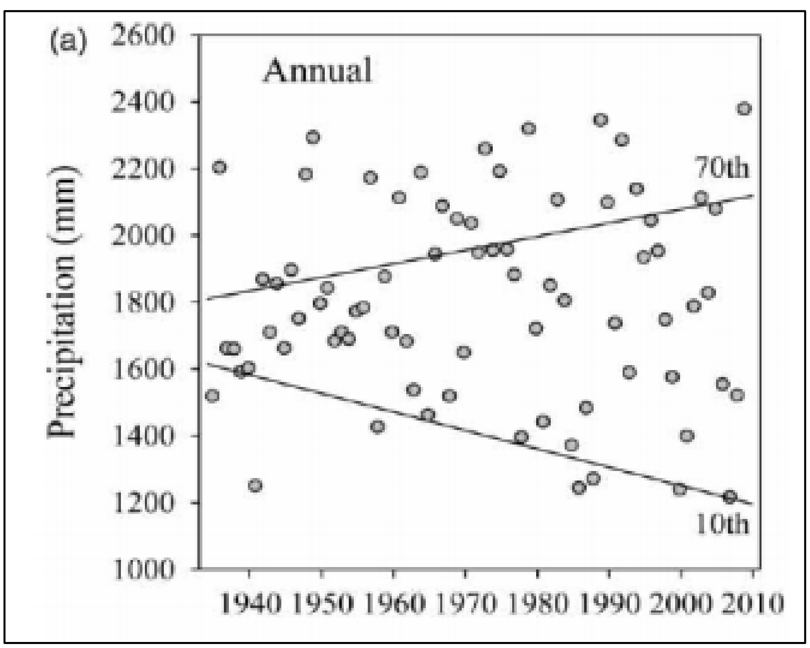


Figure 37. Total annual precipitation at Coweeta Laboratory (North Carolina). Lines show modeled 10th and 90th quantiles as a function of time, 1940 – 2010. (Laseter et al., 2012).

A 2012 study by Patterson et al. focused exclusively on the South Atlantic Region, investigating historical climate and streamflow trends. Monthly and annual trends were analyzed for a number of stations distributed throughout the South Atlantic-Gulf Region for the period 1934 – 2005. Results identified little, if any, patterns of precipitation change in the area over this period. Some sites showed increasing trends, others showed decreasing trends. Overall, and for the full period of record, more sites exhibited mild increases in precipitation than decreases.

In North Carolina there is no overall trend in annual precipitation, but precipitation is generally higher in the summer months (NCEI, 2022).

7.3.1.4 Hydrology

Kalra et al. (2008) found statistically negative trends in annual and seasonal streamflow for a large number of stream gages in the South Atlantic-Gulf Region, analyzed in aggregate, for the historical period 1952 – 2001. This study also identified a statistically significant stepwise change occurring in the mid-1970s, concurrent with the warming climate “transition” period previously noted in Section 2.1, Temperature. These findings are supported by a regional study by Small et al. (2006). This study, using HCDN data for the period 1948 – 1997, identified statistically significant negative trends in annual low flow for multiple stations distributed throughout the South Atlantic-Gulf Region (but even more stations exhibited no significant trend at all).

The Patterson et al. (2012) study also observed a “transition” period occurring around 1970, as well as identified significant decreasing trends in streamflow in the South Atlantic-Gulf Region for the period 1970 – 2005 (Figure 38). Results were mixed for an earlier time period (1934 – 1969), with some decreasing and some increasing trends. These results again highlight the noted transition period of the 1970s.

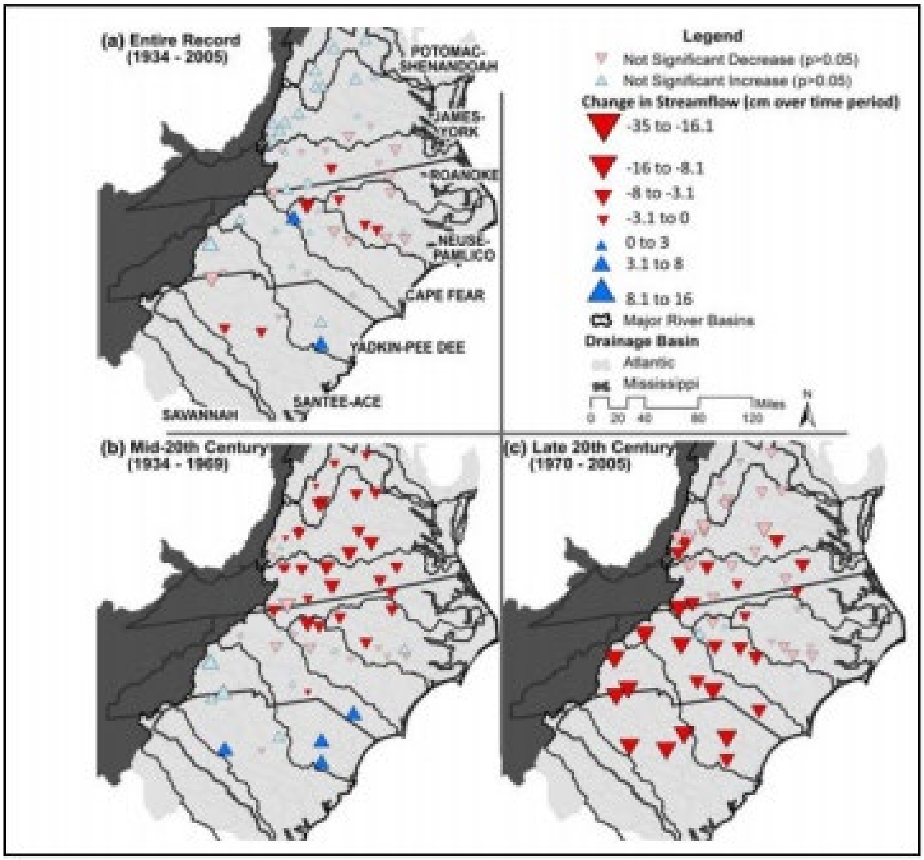


Figure 38. Observed changes in annual streamflow, South Atlantic Region, 1934 – 2005. Triangles point in the direction of the trend, size reflects the magnitude of the change. Blue indicates a decreasing streamflow trend. Red indicates and increasing streamflow trend. (Patterson et al., 2012).

7.3.2 Future Trends

7.3.2.1 Literature Review of Project Climate Changes

While historical data is essential to understanding current and future climate, non-stationarity in the data (i.e., a changing climate) dictates the use of supplemental information in long-term planning studies. In other words, the past may no longer be a good predictor of the future (Milly et al., 2008). Consequently, the scientific and engineering communities are actively using computer models of the Earth's atmosphere and associated thermodynamics to project future climate trends for use in water resources planning efforts. Although significant uncertainties are inherent in these model projections, the models, termed global climate models (GCMs), are widely accepted as representing the best available science on the subject, and have proven highly useful in planning as a supplement to historical data. A wealth of literature now exists on the use of GCMs across the globe.

7.3.2.2 Temperature

Elguindi and Grundstein (2013) present results of regional climate modeling of the U.S. focused on the Thornthwaite climate type – a measure of the combination of relative temperature and precipitation projections. For the South Atlantic-Gulf Region, results show a shift from primarily warm wet or warm moist climate type in the latter decades of the 20th century to a much larger proportion of hot moist or hot dry climate type areas by the period 2041 – 2070 (Figure 39).

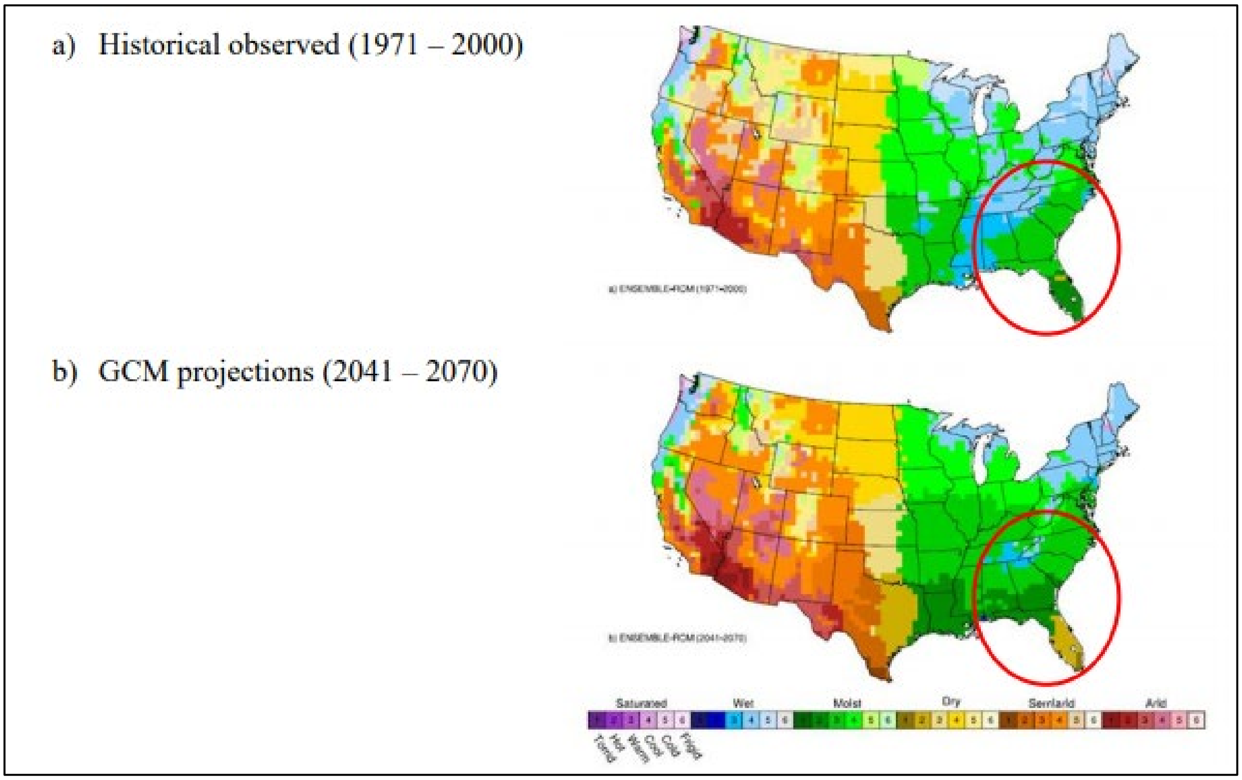


Figure 39. Revised Thornthwaite climate types projected by regional climate models. The South Atlantic-Gulf Region is within the red oval (Elguindi and Grundstein, 2013)

Projections of changes in temperature extremes have been the subject of many recent studies performed at a national scale. A 2006 study by Tebaldi et al. applied nine GCMs at a global scale focused on extreme precipitation and temperature projections. Model projections of climate at the end of the century (2080 – 2099) were compared to historical data for the period 1980 – 1999. For the general southeastern U.S., inclusive of the South Atlantic-Gulf Region, the authors identified small increases in the projected extreme temperature range (annual high minus annual low temperature), a moderate increase in a heat wave duration index (increase of 3 to 4 days per year that temperatures continuously exceeds the historical norm by at least 5 ºC), and a moderate increase in the number of warm nights (6 to 7% increase in the percentage of times in the year when minimum temperature is above the 90th percentile of the climatological distribution for the given calendar year), compared to the baseline period. NCEI, 2022 predicts temperatures in North Carolina will continue to rise (Figure 40).

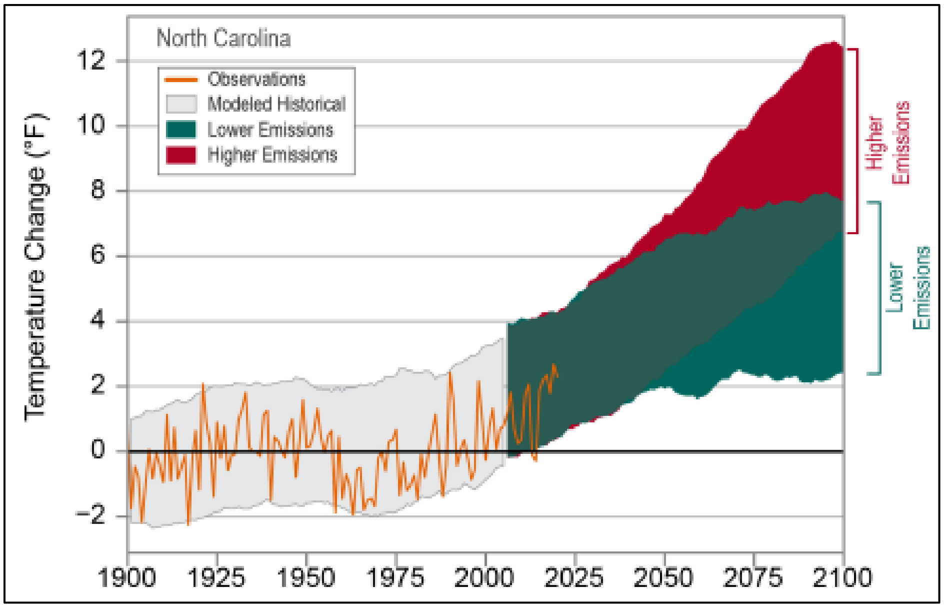


Figure 40. Projected annual average air temperature, North Carolina, 1995–2100. (NCEI, 2022)

7.3.2.3 Precipitation

Future projections of extreme events, including storm events and droughts, are the subject of studies by Tebaldi et al. (2006), Wang and Zhang (2008), Gao et al. (2012), and Wang et al. (2013a). The first authors, as part of a global study, compared an ensemble of GCM projections for the southeast U.S. and a 2090 planning horizon with historical baseline data (1980 – 1999). They report small increases in the number of high (> 10 mm) precipitation days for the region, the number of storm events greater than the 95th percentile of the historical record, and the daily precipitation intensity index (annual total precipitation divided by number of wet days). In other words, the projections forecast small increases in the occurrence and intensity of storm events by the end of the 21st century for the general study region. In addition to the historical data trend analyses by Wang and Zhang (2008) described above, these authors also used downscaled GCMs to look at potential future changes in precipitation events across North America. They used an ensemble of GCMs and a single high emissions scenario (A2) to quantify a significant increase (c. 30 to 50%) in the recurrence of the current 20-year 24-hour storm event for their future planning horizon (2075) and the general South Atlantic-Gulf Region (Figure 41). The projected increases in storm frequency presented by Wang and Zhang appear to be more significant than those projected by Tebaldi et al. (2006), but there is agreement on the general trend.

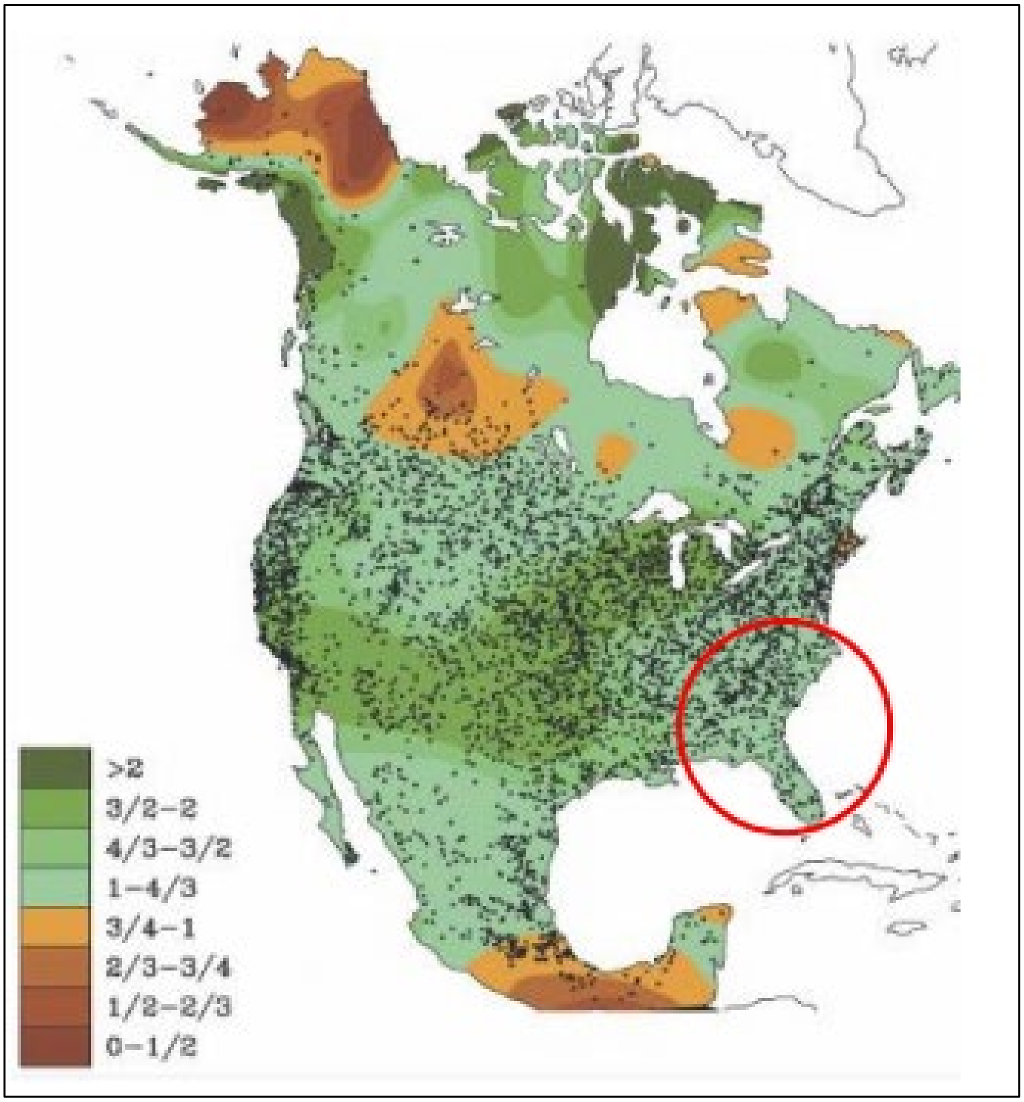


Figure 41. Projected risk of current 20-year 24-hour precipitation event occurring in 2070 compared to historical (1974). A value of 2 indicates this storm will be twice as likely in the future compared to the past. Black dots show the locations of stations. The South Atlantic Gulf Region is within the red oval (Wang and Zhang, 2008).

NCEI 2022 projects an increase in precipitation in North Carolina, primarily in the winter and spring, as well as an increase in hurricane-associate storm intensity and rainfall rates.

7.3.2.4 Hydrology

Study projections from Hagemann et al. (2013) for the general South Atlantic-Gulf Region show an overall decrease in runoff by approximately 200 mm per year for their future planning horizon (2071 – 2100) compared to the recent historical baseline (1971 – 2000) (Figure 42), assuming an A2 emissions scenario.

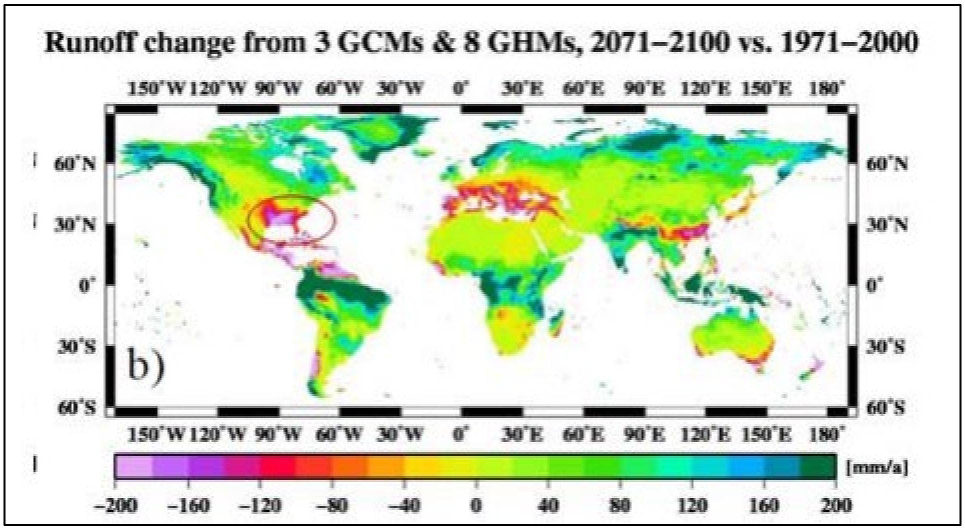


Figure 42. Ensemble mean runoff projections (mm/year) for A2 greenhouse gas emissions scenario, changes in annual runoff, 2085 vs. 1985. The South Atlantic-Gulf Region is within the red oval (Hagemann et al., 2013).

Wu et al. (2014), used the full suite of CMIP3 GCM projections in combination with a lumped rainfall-runoff model to project future streamflow changes for Coweeta Laboratory, a watershed in North Carolina. The results suggest a likely increase in winter streamflow, however it shows mixed results for other seasons.

No clear consensus was found in projected streamflow changes in the South Atlantic-Gulf Region. Some studies point toward small increases in flow, others point toward small decreases in flow.

7.3.3 Summary of Literature Review

A January 2015 report conducted by the USACE Institute for Water Resources (USACE 2015b) summarizes the available climate change literature for this region, covering both observed and projected changes (Figure 43).

The results presented in this review indicate a small upward trend in temperature and a small downward trend in streamflow in the South Atlantic-Gulf Region, particularly since the 1970s. Both temperature and streamflow show majority consensus within the literature. Studies on precipitation show mixed results but with more findings showing an upward, rather than downward, pattern over the past 50 to 100 years. There is a high consensus that future average and maximum temperatures are forecasted to have a large increase. There is no consensus on precipitation averages and streamflow trends in the future, with contradicting predictions. Precipitation extremes however are predicted to have a small increase in the future based on a majority consensus.

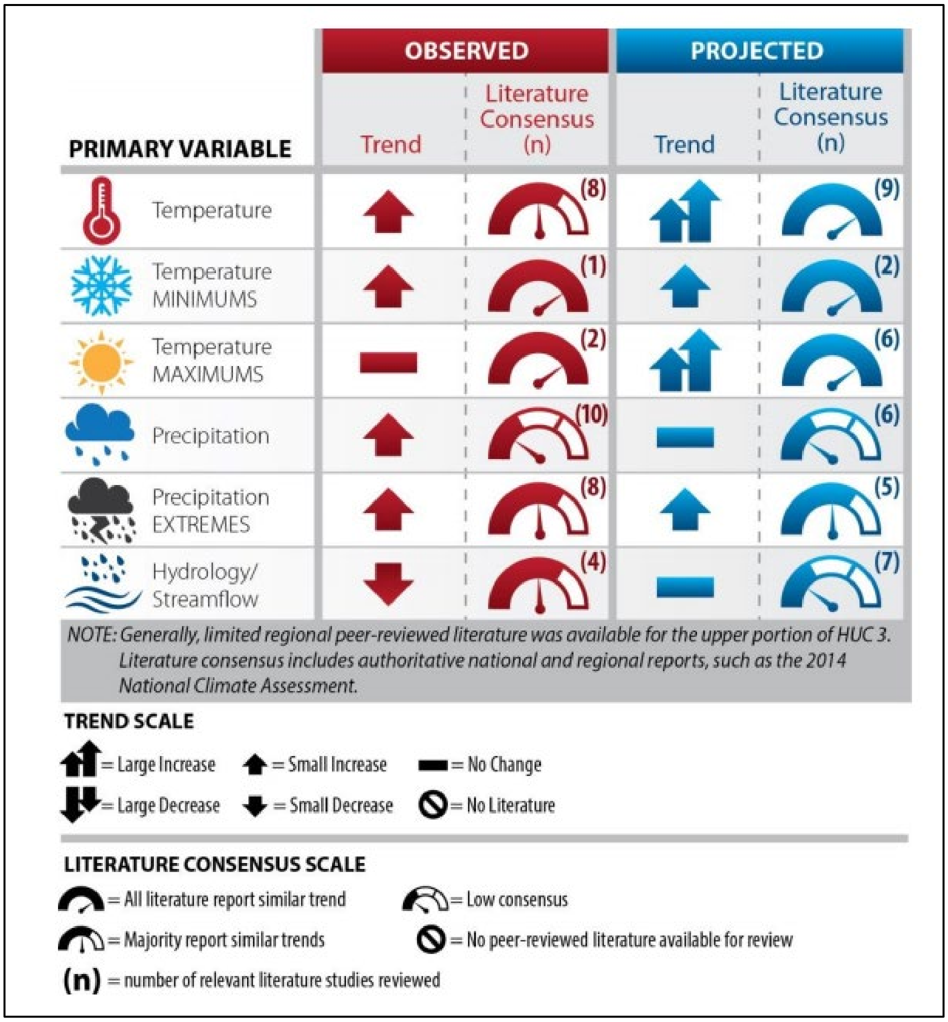


Figure 43. Summary Matrix of Observed and Project Climate Trends

The general consensus in the recent literature points toward small increases in annual temperature in the South Atlantic-Gulf Region over the past century, particularly over the past 40 years. While much of the area is located within the so-called “warming hole” identified by various researchers (including Carter et al., 2014), recent studies have demonstrated significant warming for other parts of the area (particularly northern portions) since the 1970s. Annual precipitation totals have become more variable in recent years compared to earlier in the 20th century. Evidence has also been presented, but with limited consensus, of small increasing trends in the magnitude of annual and seasonal precipitation for parts of the study area. These results are seemingly contradicted by a number of studies that have shown decreasing trends in streamflow throughout the area, particularly since the 1970s. This paradox is discussed by Small et al. (2006), who attribute it largely to seasonal differences in the timing of the changes in precipitation vs. streamflow. The study authors evaluated watersheds that experienced minimal water withdrawals and/or transfers. Results presented here also suggest that increasing temperatures may also play a role in decreasing streamflow, despite the lack of corresponding precipitation decline.

There is strong consensus in the literature that air temperatures will increase in the study area, and throughout the country, over the next century. The studies reviewed here generally agree on an increase in mean annual air temperature of approximately 2 to 4 ºC by the latter half of the 21st century for the South Atlantic-Gulf Region. The largest increases are projected for the summer months. Reasonable consensus is also seen in the literature with respect to projected increases in extreme temperature events, including more frequent, longer, and more intense summer heat waves in the long-term future compared to the recent past. Projections of precipitation in the study area are less certain than those associated with air temperature. Results of the studies reviewed here are roughly evenly split with respect to projected increases vs. decreases in future annual precipitation. This is not unexpected as, according to the recently released NCA (Carter et al., 2014); the southeast region of the country (inclusive of the South Atlantic-Gulf Region) appears to be located in a “transition zone” between the projected wetter conditions to the north and dryer conditions to the west. There is, however, moderate consensus among the reviewed studies that future storm events in the region will be more intense and more frequent compared to the recent past. Similarly, clear consensus is lacking in the hydrologic projection literature. Projections generated by coupling GCMs with macro-scale hydrologic models in some cases indicate a reduction in future streamflow but in other cases indicate a potential increase in streamflow in the study region. Of the limited number of studies reviewed here, results are approximately evenly split between the two.

7.4 Observed Trends in Current Climate and Climate Change

7.4.1 Climate Hydrology Assessment Tool

The USACE Climate Hydrology Assessment Tool (CHAT) was utilized to examine trends in observed annual peak streamflow for various gage locations (Table 11). The CHAT tool is used to fit a linear regression to the peak streamflow data in addition to providing a p-value indicating the statistical significance of a given trend.

A summary of the regression trends and their statistical significance is shown in Table 12 below. Individual graphical output for all gages and period of record data analyzed is shown in Figure 44 through Figure 51. Every gage that was analyzed via CHAT did not have a statistically significant linear trend. A few of the gages were not within the CHAT, and the Tar River at Greenville, NC gage did not have the 30-year period of record needed to perform the analysis. There were no statistically significant trends detected in either gage that would indicate significant changes in observed streamflow due to climate change, long-term natural climate trends, or land use/land cover changes.

These results are further analyzed and checked with the nonstationarity detection tool in the next section.

Table 12. Summary of Observed Streamflow Trends in Annual Peak Streamflow using CHAT

Gage Number	Gage Name and Location	POR for CHAT	POR for NSD	POR Note	Regression Slope	P-Value	Trend Direction	Significance
02081500	Tar River near Tar River, NC	1940-2014	1940-2014	Complete	8.477	0.645	Upward	Insignificant
02081747	Tar R at US 401 at Louisburg, NC	1964-2014	1964-2014	Complete	42.442	0.314	Upward	Insignificant
02082000	Tar River near Nashville, NC	N/A	N/A	Not in CHAT or NSD	N/A	N/A	N/A	N/A
02082506	Tar River below Tar R Reservoir near Rocky Mount, NC	N/A	N/A	Not in CHAT or NSD	N/A	N/A	N/A	N/A
02082585	Tar River at NC 97 at Rocky Mount, NC	1977-2014	1977-2014	Complete	-5.974	0.939	Downward	Insignificant
02082770	Swift Creek at Hilliardston, NC	1964-2014	1964-2014	Complete	25.847	0.409	Upward	Insignificant
02082950	Little Fishing Creek near White Oak, NC	1960-2014	1960-2014	Complete	9.582	0.807	Upward	Insignificant
02083000	Fishing Creek near Enfield, NC	1915-2014	1915-2014	Complete	-8.263	0.556	Downward	Insignificant
02083500	Tar River at Tarboro, NC	1895-2014	1906-2014	Complete	-15.017	0.564	Downward	Insignificant
02083800	Conetoe Creek near Bethel, NC	N/A	N/A	Not in CHAT or NSD	N/A	N/A	N/A	N/A
02084000	Tar River at Greenville, NC	1997-2014	1997-2014	Length not sufficient	N/A	N/A	N/A	N/A
02084160	Chicod Creek at SR1760 near Simpson, NC	1976-2014	1976-2014	Complete, minus gap (1988-91)	39.246	0.07	Upward	Insignificant
02084472	Pamlico River at Washington, NC	N/A	N/A	Not in CHAT or NSD	N/A	N/A	N/A	N/A

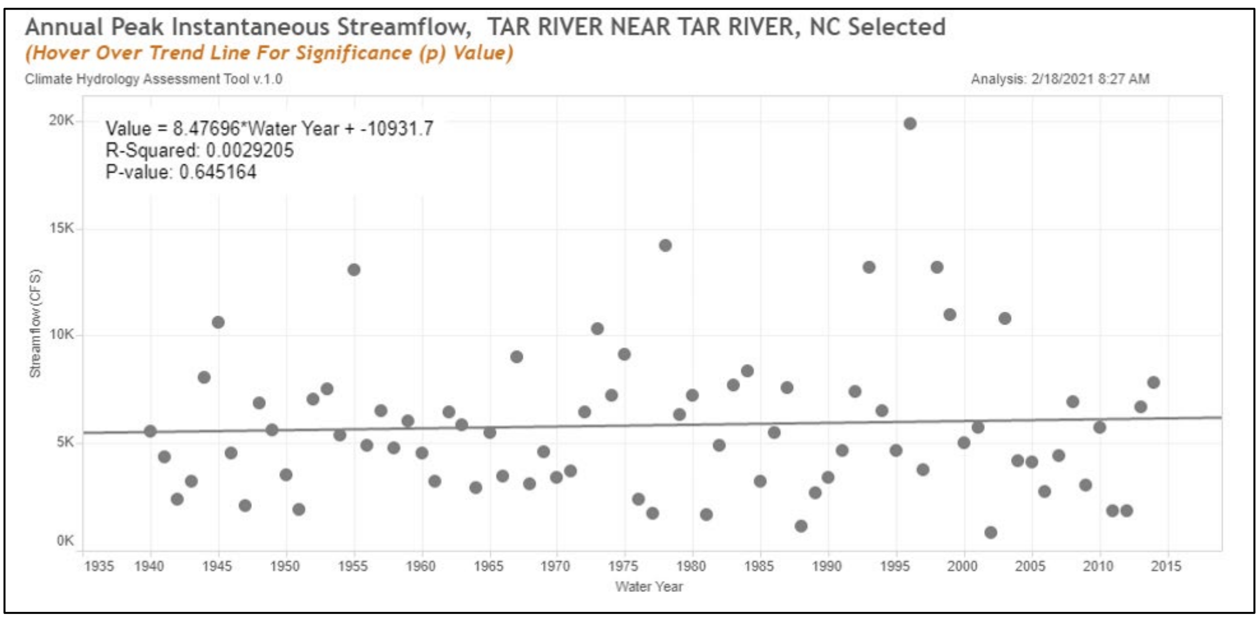


Figure 44. CHAT Results for Gage 02081500 Tar River near Tar River, NC

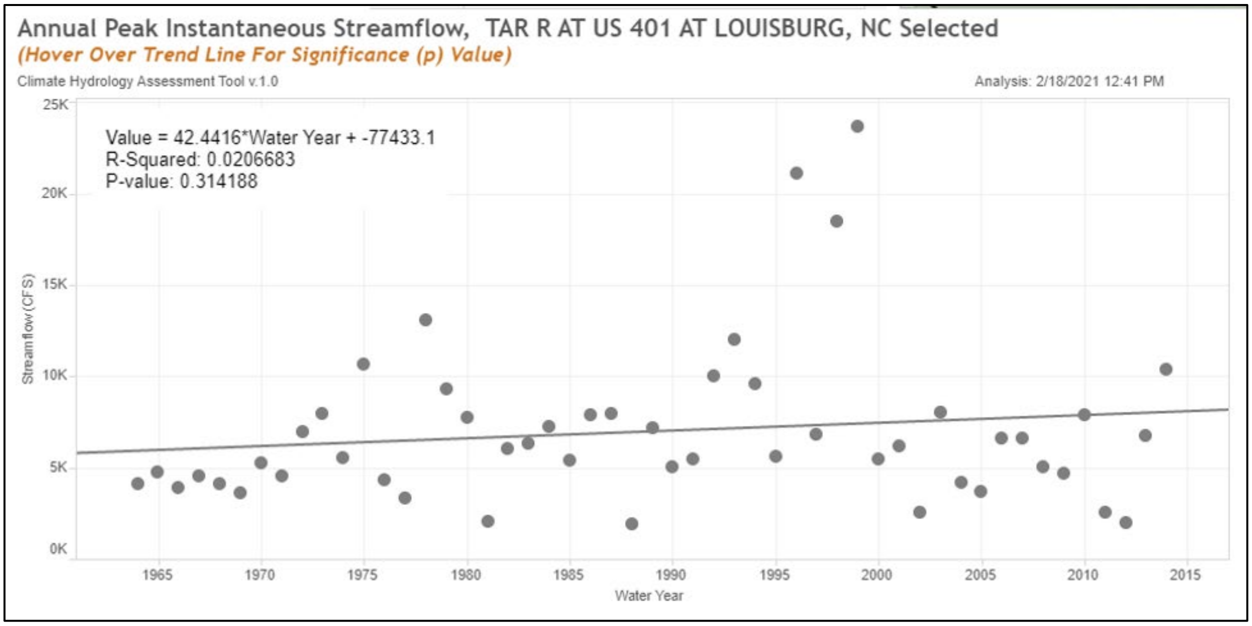


Figure 45. CHAT Results for Gage 02081747 Tar River at US 401 at Louisburg, NC

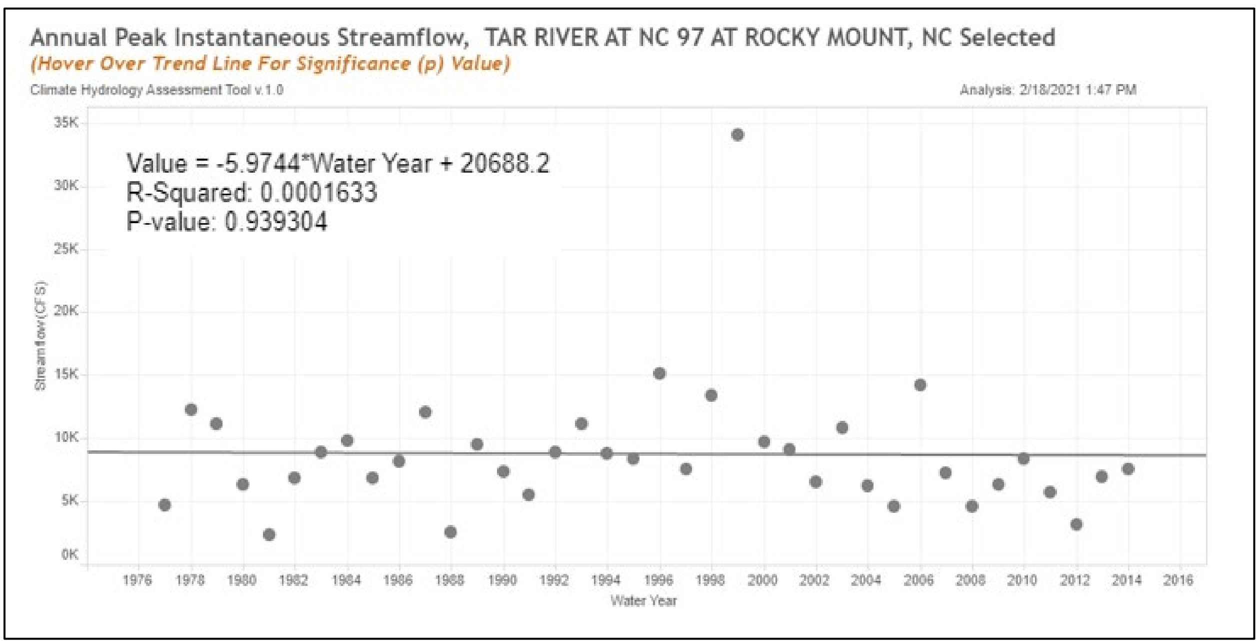


Figure 46. CHAT Results for Gage 02082585 Tar River at NC 97 at Rocky Mount, NC

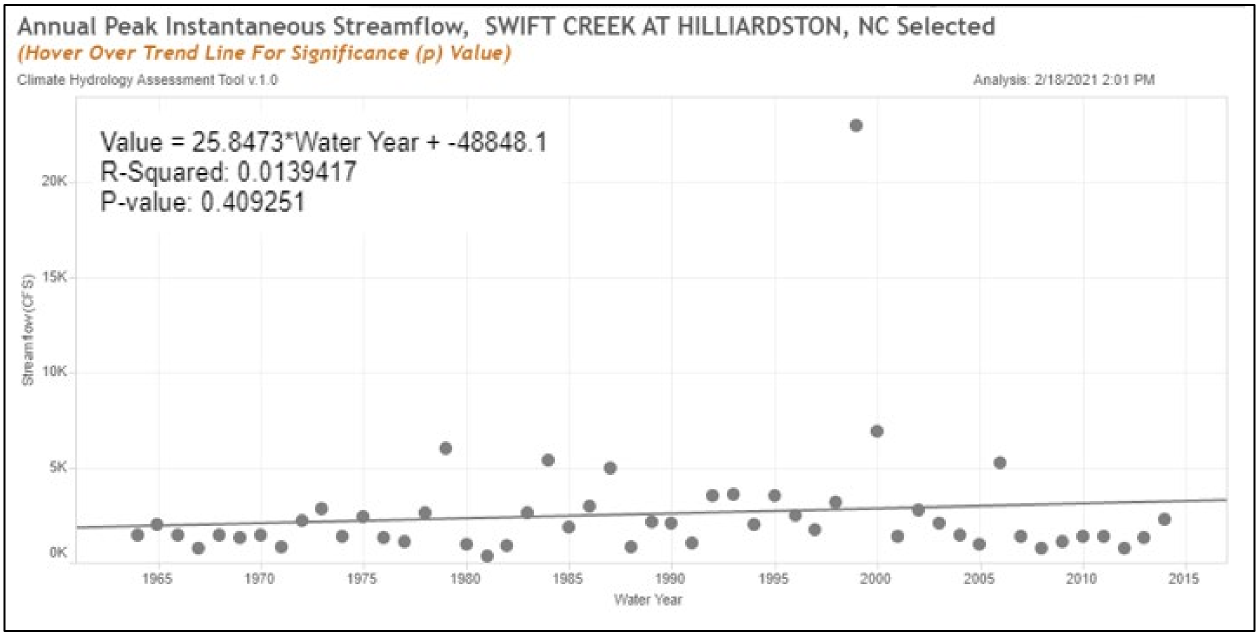


Figure 47. CHAT Results for Gage 02082770 Swift Creek at Hilliardston, NC

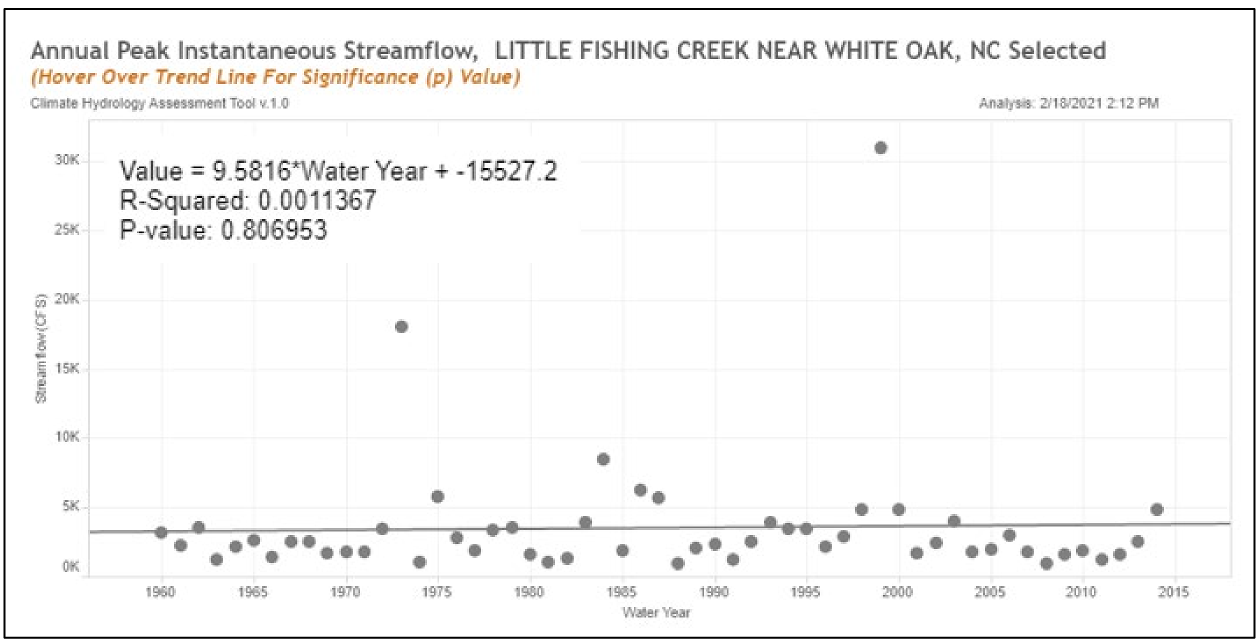


Figure 48. CHAT Results for Gage 02082950 Little Fishing Creek near White Oak, NC

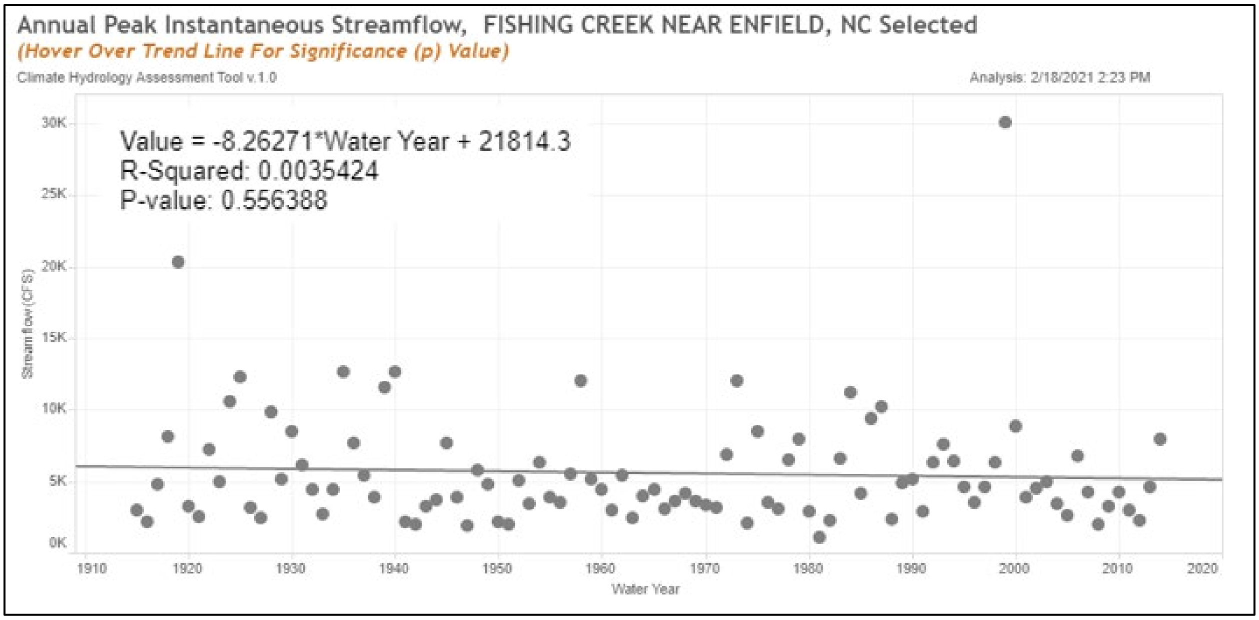


Figure 49. CHAT Results for Gage 02083000 Fishing Creek near Enfield, NC

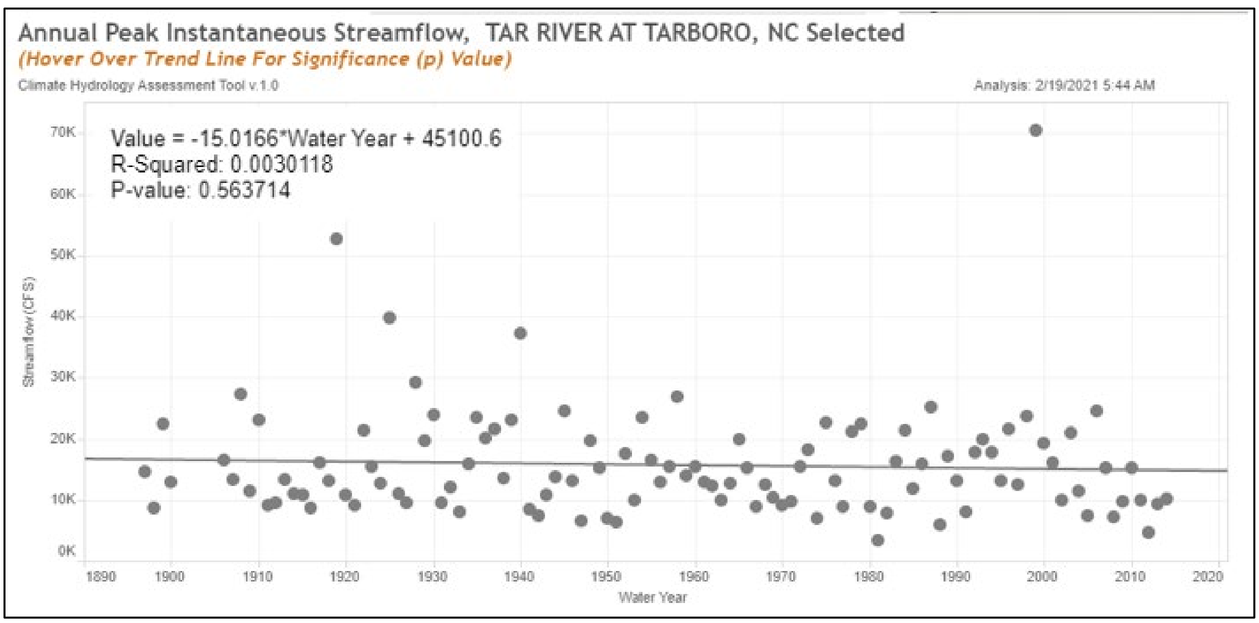


Figure 50. CHAT Results for Gage 02083500 Tar River at Tarboro, NC

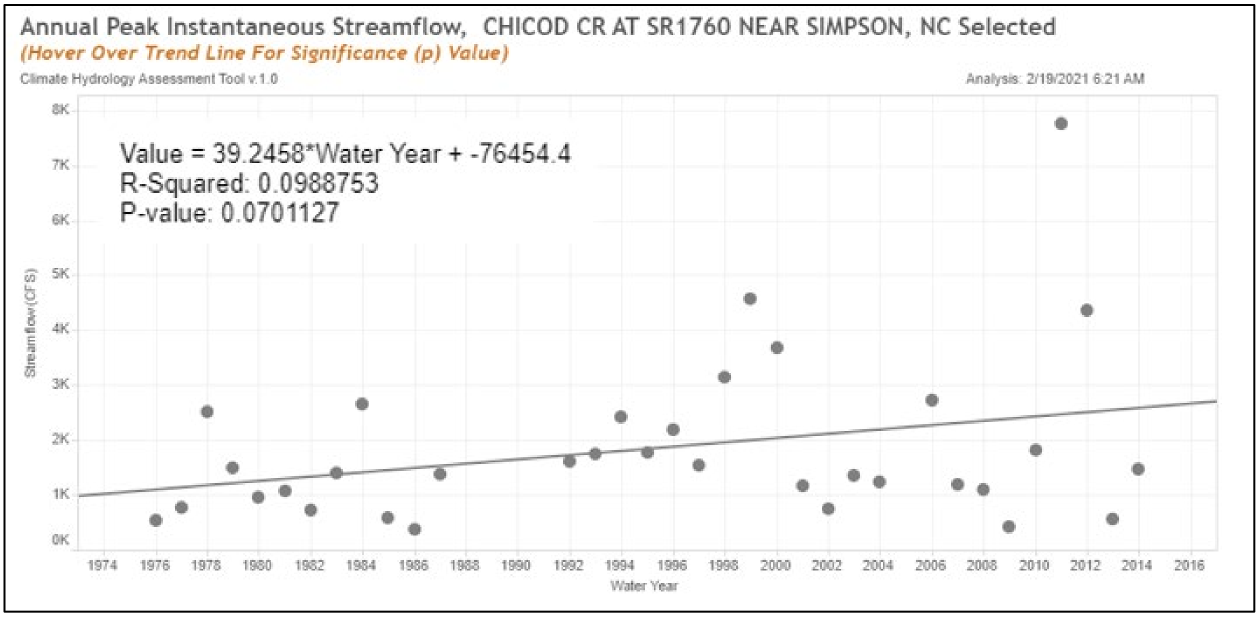


Figure 51. CHAT Results for Gage 02084160 Chicod Creek at SR1760 near Simpson, NC

7.4.2 Nonstationarity Detection Tool

The USACE Nonstationarity Detection (NSD) Tool was used to assess whether the assumption of stationarity, which is the assumption that the statistical characteristics of a time-series dataset are constant over the period of record, is valid for a given hydrologic time-series dataset. Nonstationarities are detected through the use of 12 different statistical tests which examine how the statistical characteristics of the dataset change with time (Engineering Technical Letter (ETL) 1100-2-3, Guidance for Detection of Nonstationarities in Annual Maximum Discharges; Nonstationarity Detection Tool User Manual, version 1.2). Abbreviations of the 12 statistical tests are shown in Table 13.

Table 13. NSD Statistical Test Abbreviations

Nonstationarity Detection Method Abbreviation	Statistical Test Name
CVM	Cramer-Von-Mises (CPM)
KS	Kolmogorov-Smirnov (CPM)
LP	LePage (CPM)
END	Energy Divisive Method
LW	Lombard Wilcoxon
PT	Pettitt
MW	Mann-Whitney (CPM)
BAY	Bayesian
LM	Lombard Mood
MD	Mood (CPM)
SLW	Smooth Lombard Wilcoxon
SLM	Smooth Lombard Mood

A nonstationarity can be considered “strong” when it exhibits consensus among multiple nonstationarity detection methods, robustness in detection of changes in statistical properties, and a relatively large change in the magnitude of a dataset’s statistical properties. Many of the statistical tests used to detect nonstationarities rely on statistical change points, these are points within the time series data where there is a break in the statistical properties of the data, such that data before and after the change point cannot be described by the same statistical characteristics. Similar to nonstationarities, change points must also exhibit consensus, robustness, and significant magnitude of change.

A summary of the NSD results are shown in Table 14. Four stream gages produced a nonstationarity, 020817747 Tar R at US 401 at Louisburg, NC (consensus: CVM & KS in 1971), 02081500 Tar R nr Tar R, NC (consensus: EMD & LM in 1970/71), 02083000 Fishing Ck nr Enfield, NC (consensus: EMD & LM in 1945/50/78, and 02084160 Chicod Ck at SR1760 nr Simpson, NC (consensus: KS in 2004) gages. Overall, the NSD-calculated consensus of distribution presented no robustness for the four gages. All other gages either did not have enough data to perform an analysis or the data that was found on USGS was not recent enough to be feasible for the analysis.

Table 14. Summary of Observed Streamflow Trends in Annual Peak Streamflow using NSD

Gage Number	Gage Name and Location	POR for CHAT	POR for NSD	POR Note	Consensus	Robustness	Conclusion
02081500	Tar River near Tar River, NC	1940-2014	1940-2014	Complete	Yes	No	EDM & LM in 1970/1971
02081747	Tar R at US 401 at Louisburg, NC	1964-2014	1964-2014	Complete	Yes	No	CVM & KS in 1971
02082000	Tar River near Nashville, NC	N/A	N/A	Not in CHAT or NSD (ended in 1970)	N/A	N/A	N/A
02082506	Tar River below Tar R Reservoir near Rocky Mount, NC	N/A	N/A	Not in CHAT or NSD (ended in 2010)	N/A	N/A	N/A
02082585	Tar River at NC 97 at Rocky Mount, NC	1977-2014	1977-2014	Complete	No	No	None
02082770	Swift Creek at Hilliardston, NC	1964-2014	1964-2014	Complete	No	No	None
02082950	Little Fishing Creek near White Oak, NC	1960-2014	1960-2014	Complete	No	No	None
02083000	Fishing Creek near Enfield, NC	1915-2014	1915-2014	Complete	Yes	No	EDM & LM in 1945/50/78
02083500	Tar River at Tarboro, NC	1895-2014	1906-2014	Complete	No	No	None
02083800	Conetoe Creek near Bethel, NC	N/A	N/A	Not in CHAT or NSD (ended in 2001)	N/A	N/A	N/A
02084000	Tar River at Greenville, NC	1997-2014	1997-2014	Length not sufficient	N/A	N/A	N/A
02084160	Chicod Creek at SR1760 near Simpson, NC	1976-2014	1976-2014	Complete, minus gap (1988-91)	Yes	No	KS in 2004
02084472	Pamlico River at Washington, NC	N/A	N/A	Not in CHAT or NSD (length not sufficient)	N/A	N/A	N/A

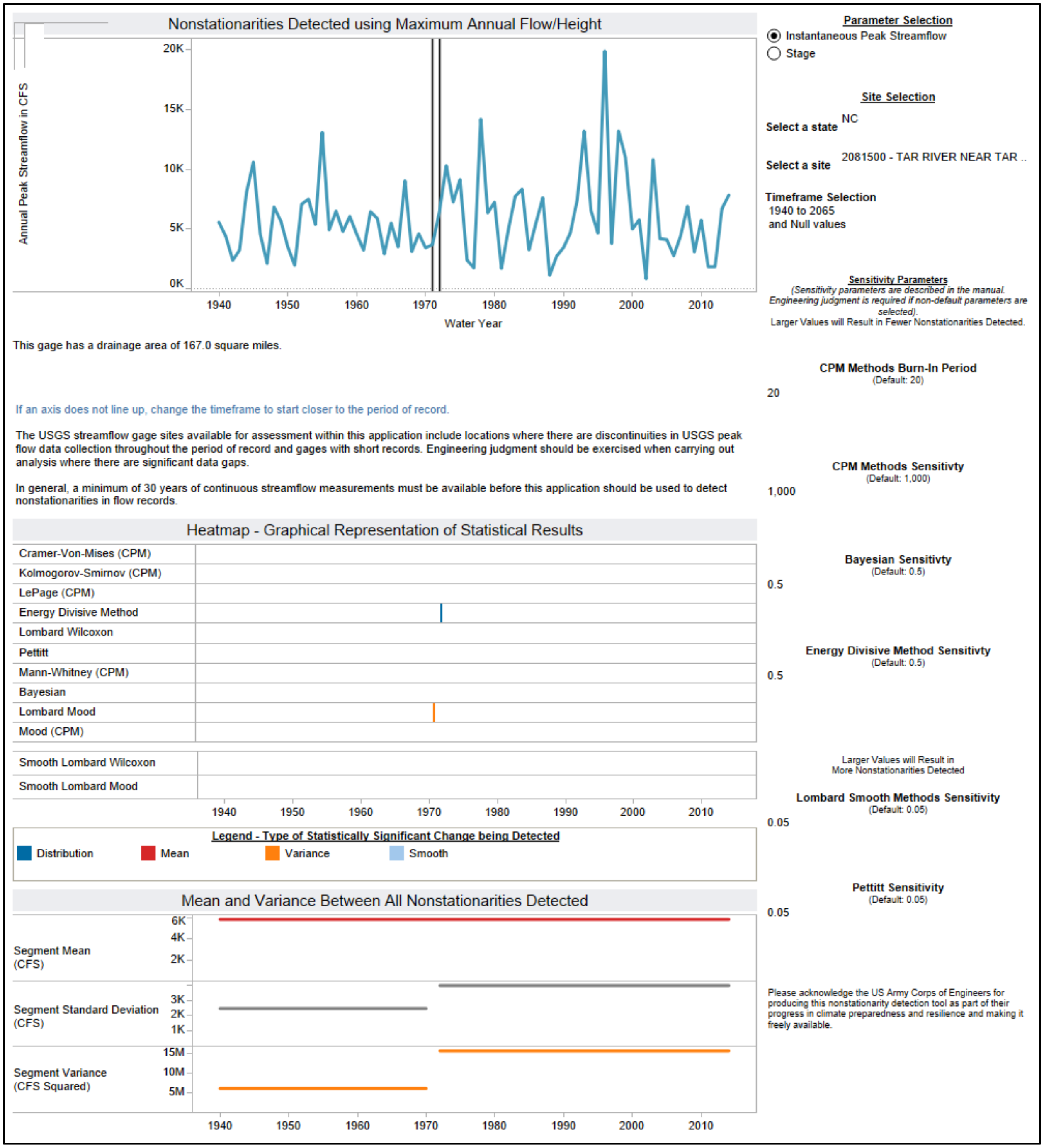


Figure 52. Nonstationarity Detection Results for Gage 02081500 Tar River near Tar River, NC

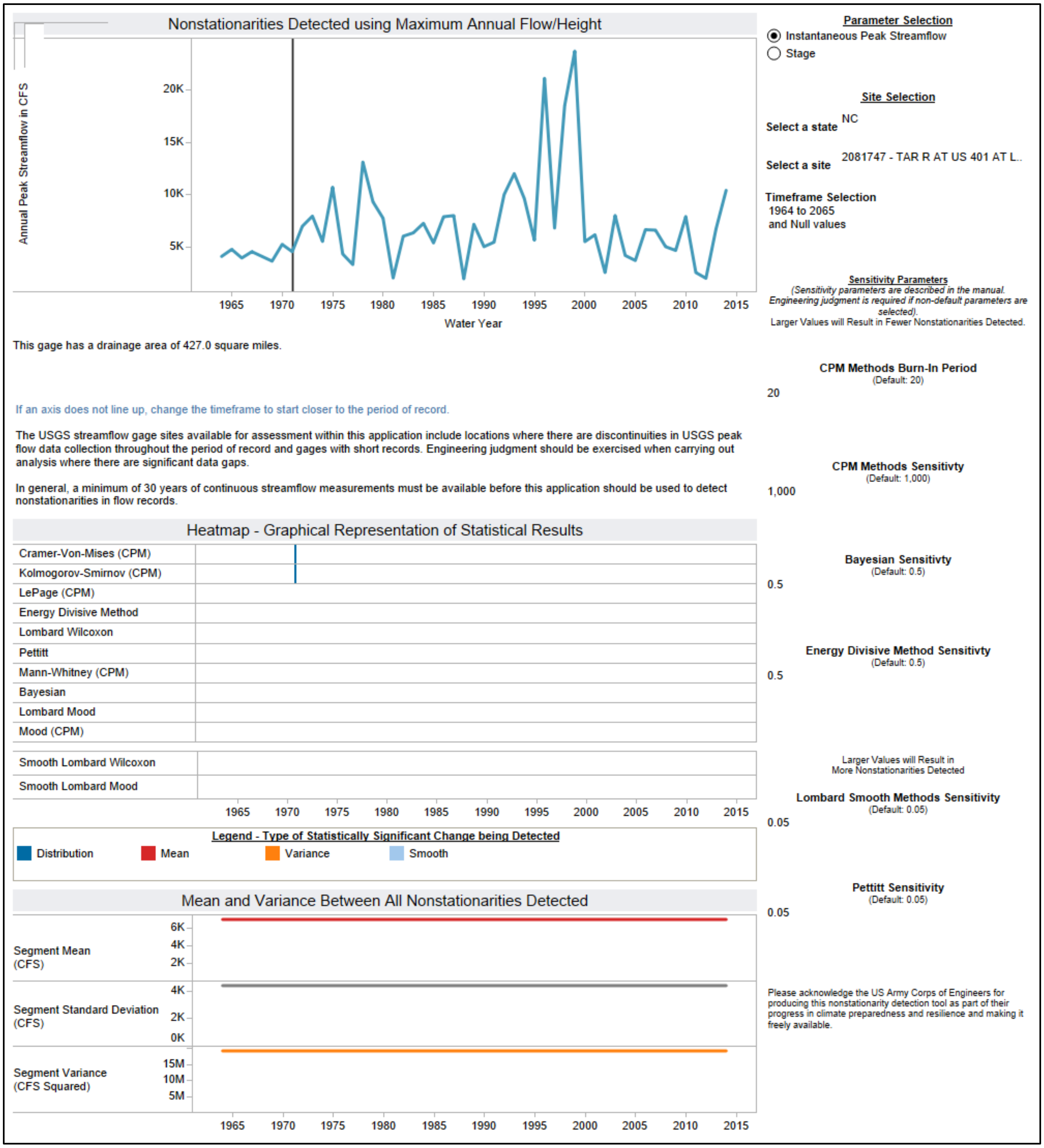


Figure 53. Nonstationarity Detection Results for Gage 02081747 Tar River at US 401 at Louisburg, NC

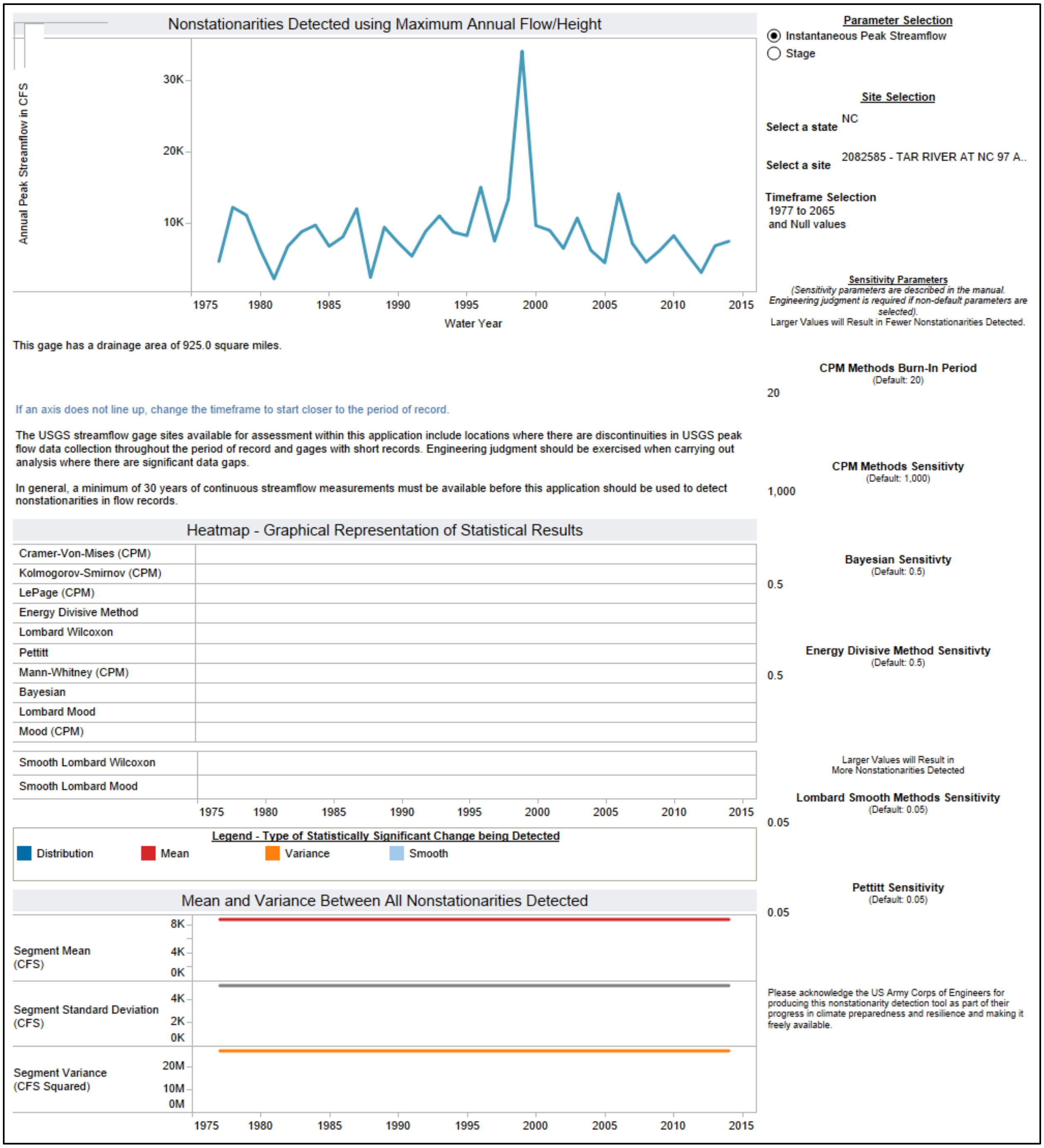


Figure 54. Nonstationarity Detection Results for Gage 02082585 Tar River at NC 97 at Rocky Mount, NC

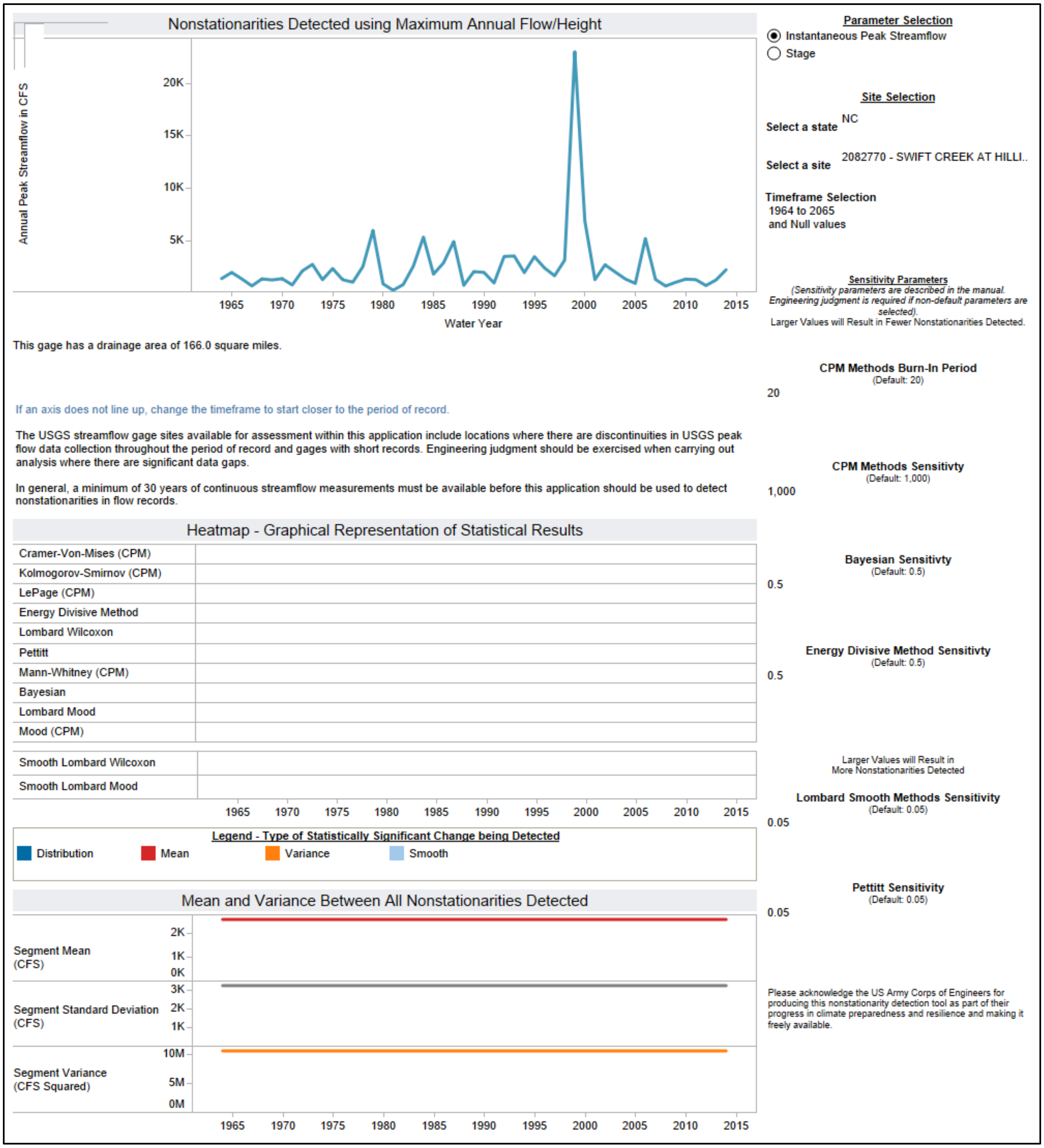


Figure 55. Nonstationarity Detection Results for Gage 02082770 Swift Creek at Hilliardston, NC

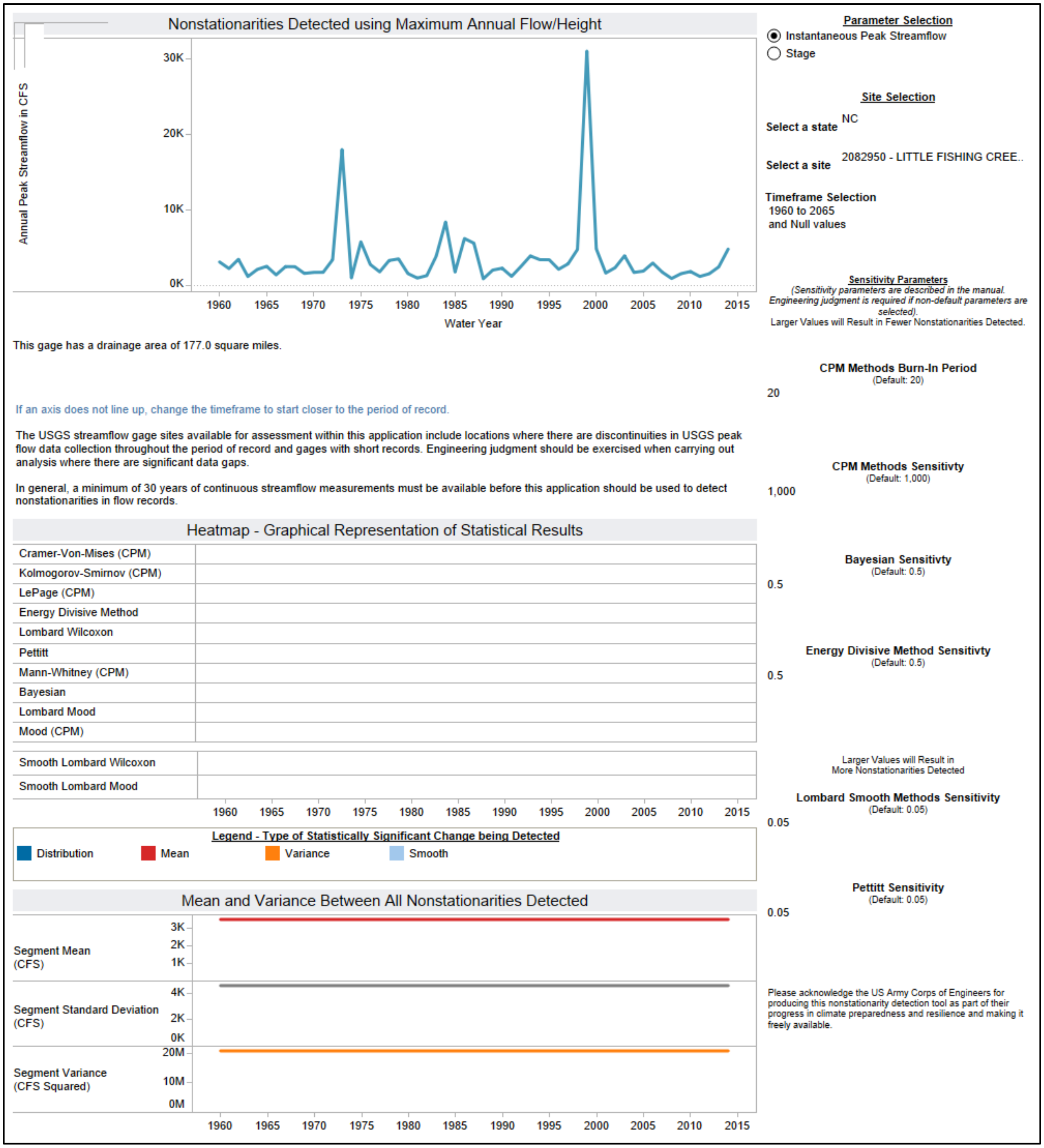


Figure 56. Nonstationarity Detection Results for Gage 02082950 Little Fishing Creek near White Oak, NC

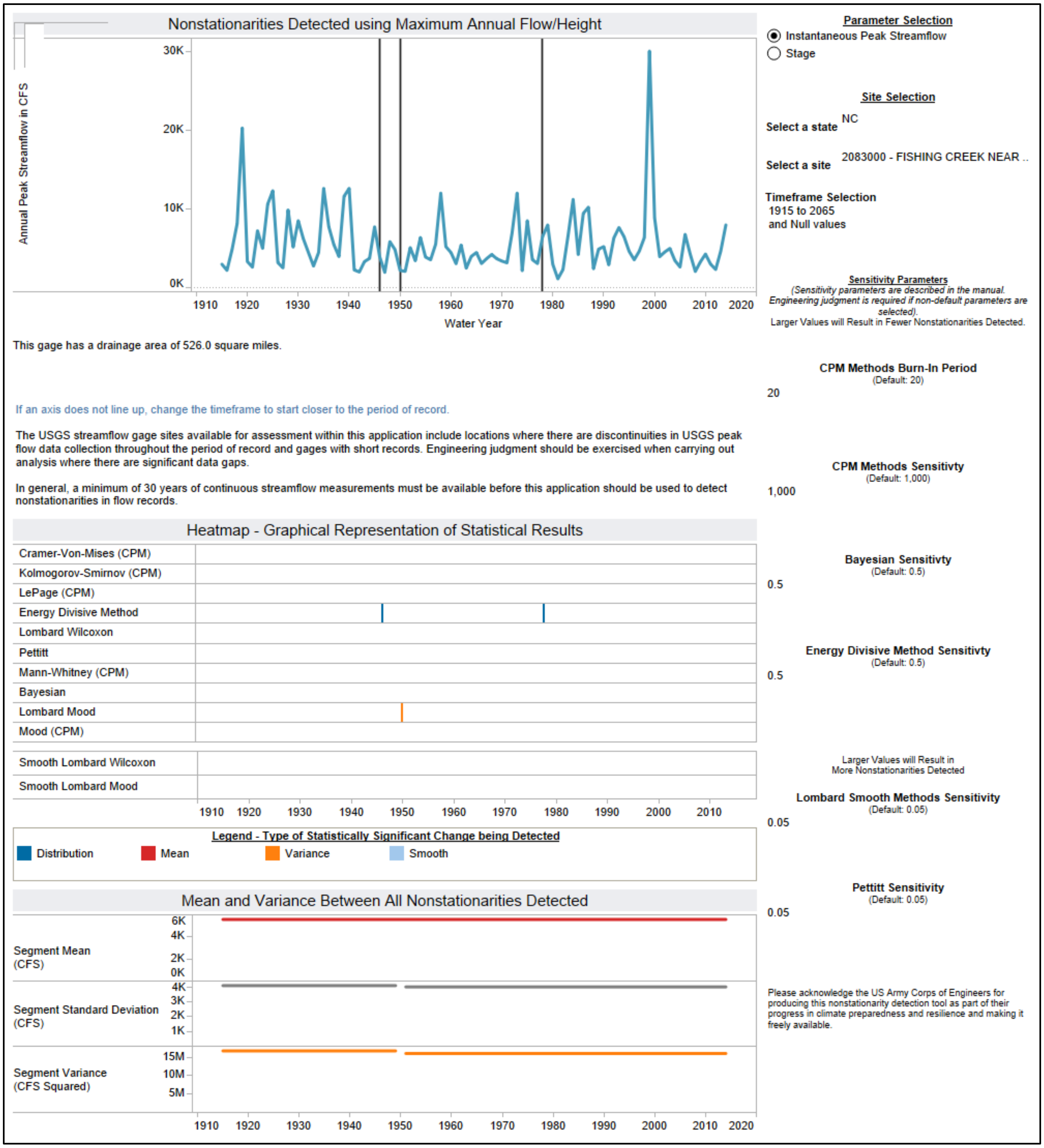


Figure 57. Nonstationarity Detection Results for Gage 02083000 Fishing Creek near Enfield, NC

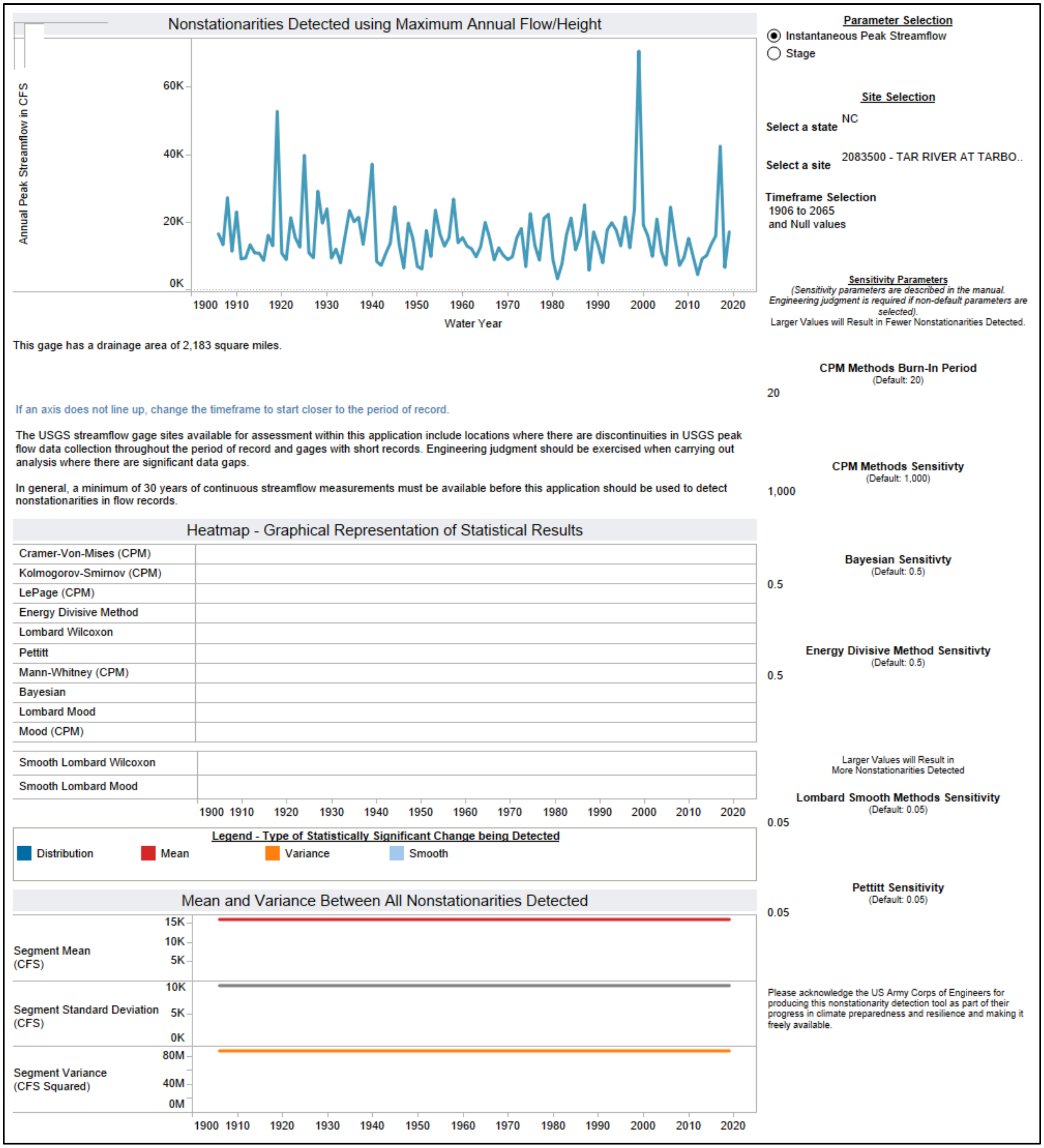


Figure 58. Nonstationarity Detection Results for Gage 02083500 Tar River at Tarboro, NC

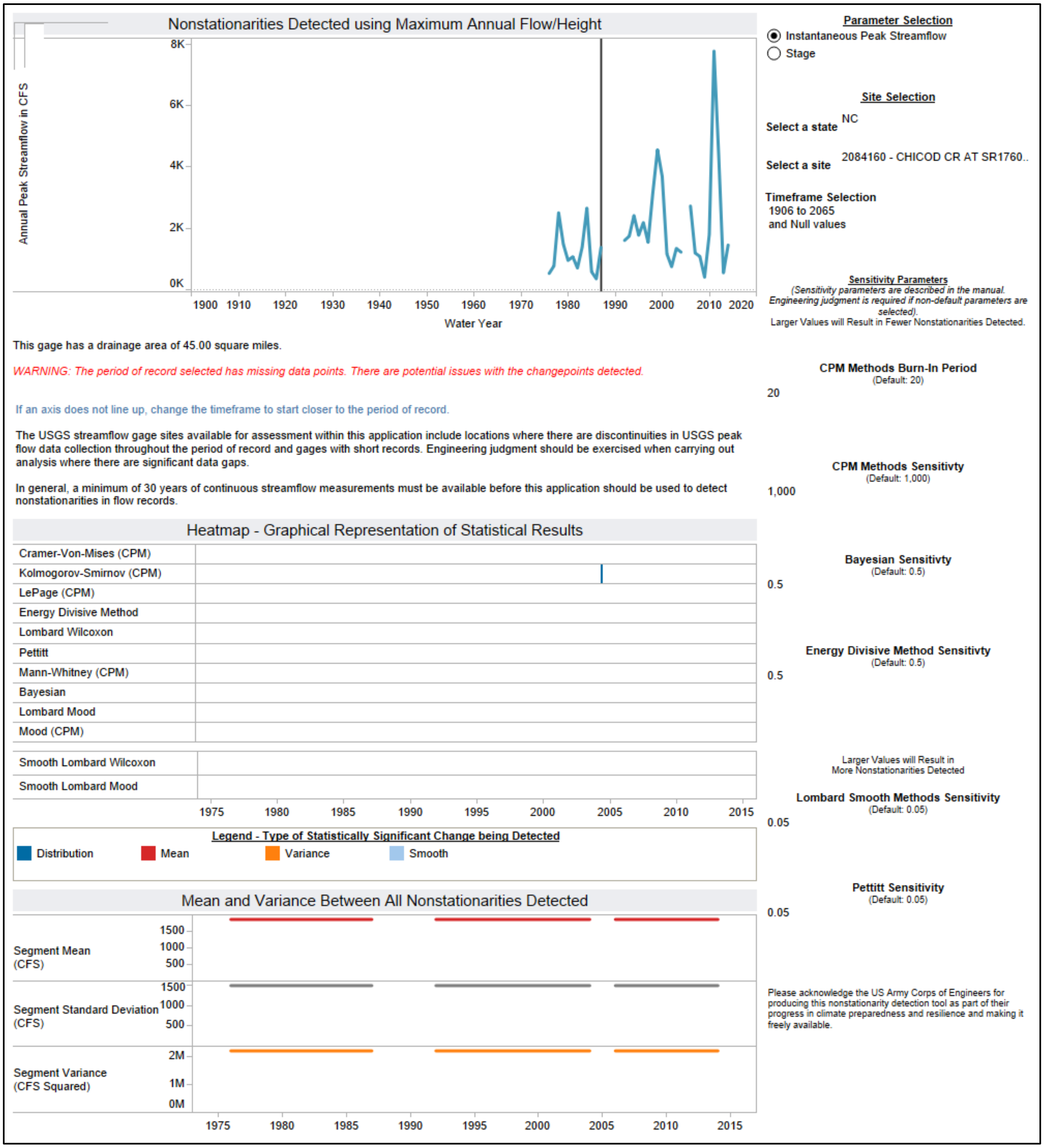


Figure 59. Nonstationarity Detection Results for Gage 02084160 Chicod Creek at SR 1760 near Simpson, NC

7.5 Projected Trends in Future Climate and Climate Change

7.5.1 Neuse-Pamlico Watershed - Climate Hydrology Assessment Tool

The USACE Climate Hydrology Assessment Tool (CHAT) was used to assess projected, future trends within the Neuse-Pamlico watershed, HUC-0302. The tool displays the range of projected annual maximum monthly streamflows from 1950 - 2099, with the projections from 1950 – 1999 representing hindcast projections and 2000 – 2099 representing forecasted projections.

Figure 60 displays the range of projections for 93 combinations of CMIP5 GCMs and RCPs produced using BCSD statistical downscaling. These flows are simulated using an unregulated VIC hydrologic model at the outlet of HUC 0302 Neuse-Pamlico. It should be noted that the hindcast projections do not replicate historically observed precipitation or streamflow and should therefore not be compared directly with historical observations. This is in part because observed streamflows are impacted by regulation, while the VIC model used to produce the results displayed in Figure 60 is representative of the unregulated condition.

Upon examination of the range of model results, there is a clear increasing trend in the higher projections, whereas the lower projections appear to be relatively stable and unchanging through time. The spread of the model results also increases with time, which is to be expected as uncertainty in future projection increases as time moves away from the model initiation point. Sources of variation and the significant uncertainty associated with these models include the boundary conditions applied to the GCMs, as well as variation between GCMs and selection of RCPs applied. Each GCM and RCP independently incorporate significant assumptions regarding future conditions, thus introducing more uncertainty into the climate changed projected hydrology. Climate model downscaling and a limited temporal resolution further contribute to the uncertainty associated with CHAT results. There is also uncertainty associated with the hydrologic models. The large spread of results shown in Figure 60 highlights current climatic and hydrologic modeling limitations and associated uncertainty.

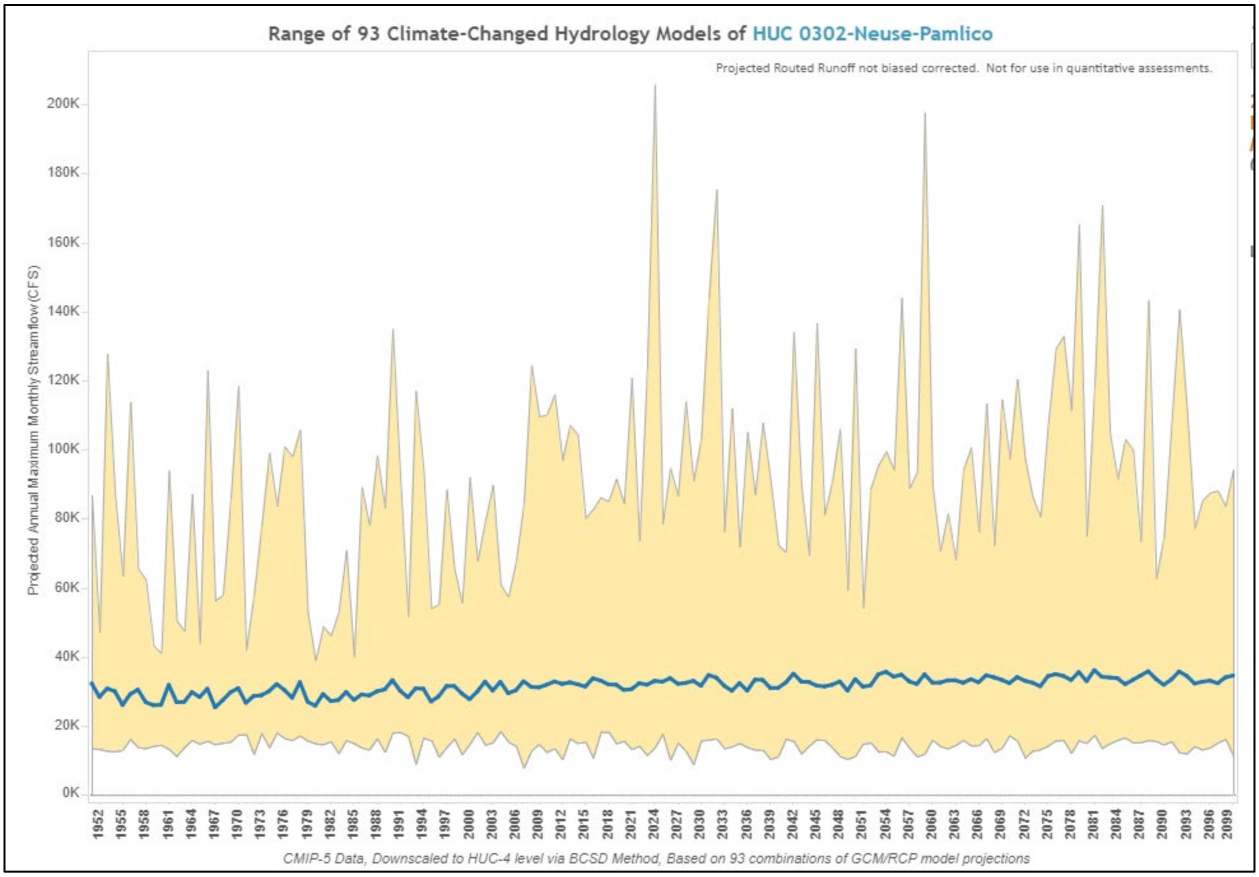


Figure 60. Range of GCM/RCP Projections for the HUC-0302 Neuse-Pamlico

Figure 61 displays only the mean result of the range of the 93 projections of future, climate changed hydrology which are shown in Figure 60. A linear regression line was fit to this mean and displays an increasing trend with a slope of approximately 28.5 cfs/yr. It should be noted that the p-value associated with this trend is less than 0.0001, indicating that the trend should be considered as statistically significant.

These outputs from the CHAT qualitatively suggest that annual maximum monthly flows, and therefore annual peak flows, are expected to increase in the future relative to the current time.

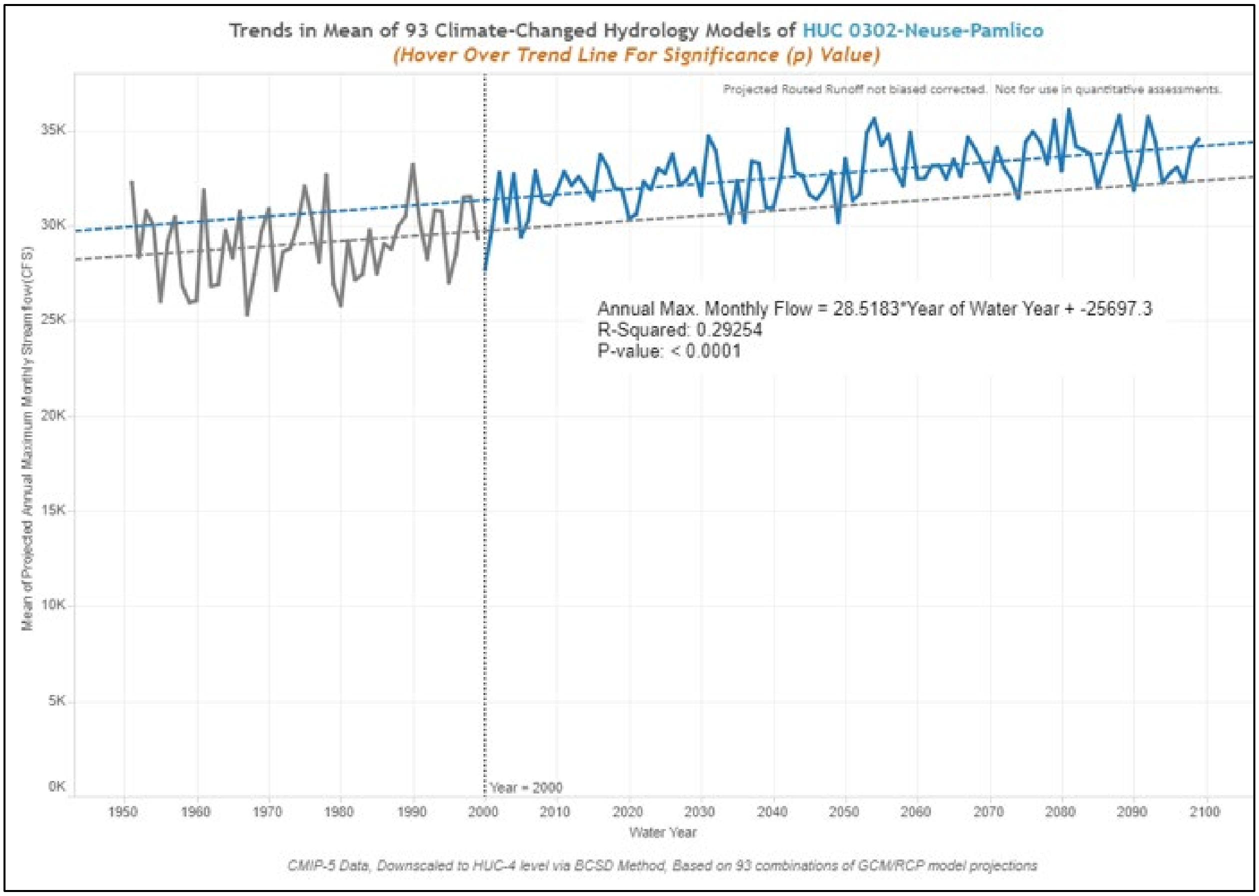


Figure 61. Mean of GCM/RCP Projections for the HUC-0302 Neuse-Pamlico

7.5.2 Vulnerability Assessment

The USACE Watershed Climate Vulnerability Assessment Tool (VA Tool) facilitates a screening level, comparative assessment of how vulnerable a given HUC-4 watershed is to the impacts of climate change relative to the other 201 HUC-4 watersheds within the continental United States (CONUS) using the same 93 projections in the CHAT. The tool can be used to assess the vulnerability of a specific USACE business line such as “Flood Risk Reduction” or “Navigation” to projected climate change impacts. Assessments using this tool help to identify and characterize specific climate threats and particular sensitivities or vulnerabilities, at least in a relative sense, across regions and business lines. The tool uses the Weighted Ordered Weighted Average (WOWA) method to represent a composite index of how vulnerable a given HUC-4 watershed (Vulnerability Score) is to climate change specific to a given business line. The HUC-4 watersheds with the top 20% of WOWA scores are flagged as being vulnerable.

Flood risk reduction is the most relevant business line for the GUC CAP, Section 14 Feasibility Study and is the primary business line analyzed with the USACE Climate Vulnerability Assessment Tool. Other business lines included in the VA Tool are ecosystem restoration, emergency management, hydropower, navigation, recreation, regulatory, and water supply. While the flood risk reduction is the main business line discussed in detail, all other business lines were analyzed as well.

When assessing future risk projected by climate change, the USACE Climate Vulnerability Assessment Tool makes an assessment for two 30-year epochs of analysis centered at 2050 and 2085. These two periods were selected to be consistent with many of the other national and international analyses. The Vulnerability tool assesses how vulnerable a given HUC-4 watershed is to the impacts of climate change for a given business line using climate hydrology based on a combination of projected climate outputs from the GCMs and representative concentration pathway (RCPs) resulting in 100 traces per watershed per time period. The top 50% of the traces is called “wet” and the bottom 50% of the traces is called “dry.” Meteorological data projected by the GCMs is translated into runoff using the Variable Infiltration Capacity (VIC) macro-scale hydrologic model. For this assessment, the default National Standards Settings are used to carry out the vulnerability assessment.

For the Flood Risk Management business line, the HUC 0302 Neuse-Pamlico Basin is not within the top 20% of vulnerable watersheds within the CONUS for any of the four scenarios, which is not to say that vulnerability to future climate change does not exist within the basin. Table 15 displays the overall vulnerability scores for the business line relevant to this study under both wet and dry scenarios and under both time epochs. The indicators driving the residual vulnerability for the flood risk management business line are shown in Figure 62. Table 15 and Table 16 display the indicators contributing to vulnerability within the Neuse-Pamlico Basin for the flood risk reduction business line; the tables are generally sorted from largest to smallest average indicator contribution to vulnerability. Additionally, the tables display the indicator code, name, and a brief description of the indicator’s meaning.

Regarding the Flood Risk Reduction business line, the primary indicators driving vulnerability within the watershed are the flood magnification factor (indicator 568C), and acres of urban area within the 500-year floodplain (indicator 590). The flood magnification factor represents how the monthly flow exceeded 10% of the time is predicted to change in the future; a value greater than 1 indicates flood flow is predicted to increase, which is true for the Neuse-Pamlico Basin. The acres of urban area withing the 500-year flood plain indicator measures the acres of urban area within the 500-year flood plain, which impacts the land-use/landcover in the area.

Note that some of the indicators contain a suffix of “L” (local) or “C” (cumulative). Indicators with an “L” suffix reflect flow generated within only one HUC-4 watershed, whereas indicators with a “C” suffix reflect flow generated within a HUC-4 watershed and any upstream watersheds.

It is important to note the variability displayed in the VA tool’s results (Table 15, Table 16) highlights some of the uncertainty associated with the projected climate change data used as an input to the VA tool. Because the wet and dry scenarios represent the upper and lower 50% of the GCM outputs, the variability between the wet and dry scenarios underestimates the larger variability between all the underlying projected climate changed hydrology estimates. This variability can also be seen between the 2050 and 2085 epochs, as well as various other analysis within this report, such as output from the CHAT.

Table 15. Overall Vulnerability Score for Epochs and Selected Scenarios

Business Line	**Flood Risk Reduction**	
Epoch	**2050**	**2085**
Dry	45.13	47.59
Wet	48.16	51.99

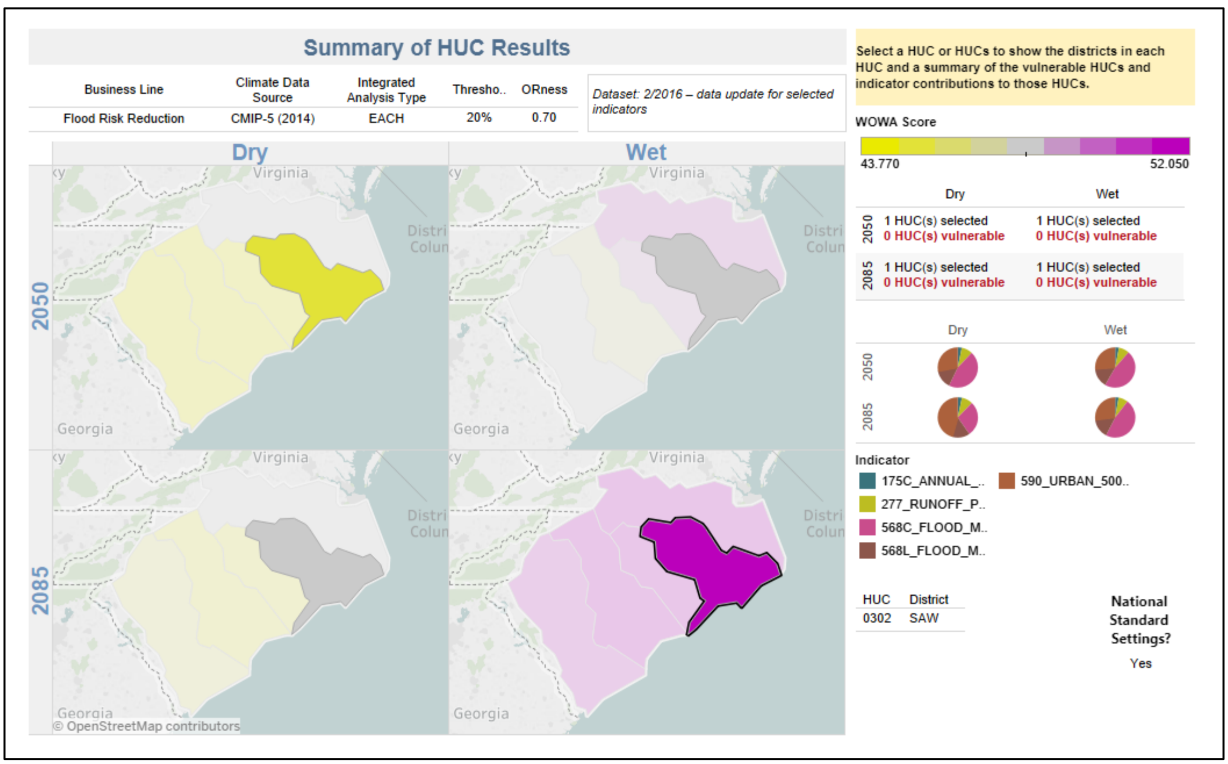


Figure 62. VA Tool Summary of HUC Results for Flood Risk Reduction Business Line

Table 16. Vulnerability Indicators for Flood Risk Reduction Business Line

Indicator Code	Indicator Name	Flood Risk Reduction Description	2050 Dry	2050 Wet	2085 Dry	2085 Wet
568C	Cumulative Flood Magnification Factor	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	45.15%	46.92%	28.07%	47.18%
277	Percent Change in Runoff Divided by the Percent Change in Precipitation	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	8.84%	8.45%	8.94%	7.66%
568L	Local Food Magnification Factor	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	14.82%	15.40%	14.18%	15.49%
175C	Cumulative Annual Covariance of Unregulated Runoff	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).	3.18%	2.97%	3.28%	2.72%
590	Acres of Urban Area Within 500-Year Floodplain	Acres of urban area within the 500-year floodplain.	28.01%	26.25%	45.54%	26.96%

7.6 Summary and Conclusion

7.6.1 Observed Summary and Conclusion

Based on the observed literature review, there is a consistent consensus that points toward mild increases in annual temperature in the South Atlantic-Gulf Region over the past century, particularly over the past 40 years. Annual precipitation totals have become more variable in recent years compared to earlier in the 20th century. Evidence has also been presented, but with limited consensus, of mildly increasing trends in the magnitude of annual and seasonal precipitation for parts of the study area. These results are seemingly contradicted by several studies that have shown decreasing trends in streamflow throughout the area, particularly since the 1970s. The study authors evaluated watersheds that experienced minimal water withdrawals and/or transfers. Results presented here also suggest that increasing temperatures may also play a role in decreasing streamflow, despite the lack of corresponding precipitation decline.

Every gage that was analyzed via Climate Hydrology Assessment Tool did not have a statistically significant linear trend. A few of the gages were not within the CHAT, and the Tar River at Greenville, NC gage did not have the 30-year period of record needed to perform the analysis. There were no statistically significant trends detected in either gage that would indicate significant changes in observed streamflow due to climate change, long-term natural climate trends, or land use/land cover changes.

Using the Nonstationarity Detection Tool only one stream gage produced a nonstationarity, and it is the 020817747 Tar R at US 401 at Louisburg, NC gage. The NSD calculated that a consensus of distribution occurred in 1971 by the CVM and KS methods, but the calculations presented no robustness. All other gages either did not have enough data to perform an analysis or the data that was found on USGS was not recent enough to be feasible for the analysis.

7.6.2 Projected Trends Summary and Conclusion

Based on the projected literature review, there is strong consensus in the literature that air temperatures will increase in the study area, and throughout the country, over the next century. The studies reviewed here generally agree on an increase in mean annual air temperature of approximately 2 to 4 ºC by the latter half of the 21st century for the South Atlantic-Gulf Region. Projections of precipitation in the study area are less certain than those associated with air temperature. Results of the studies reviewed here are roughly evenly split with respect to projected increases vs. decreases in future annual precipitation. Projections generated by coupling GCMs with macro-scale hydrologic models in some cases indicate a reduction in future streamflow but in other cases indicate a potential increase in streamflow in the study region. Of the limited number of studies reviewed here, results are approximately evenly split between the two.

The increased number of consecutive dry days combined with the higher temperatures and uncertainty in severity of large rainfall events has significant implications for the environment, increased soil erosion, and human health related to safe drinking water. The actions that can be taken in the context of this CAP Section 14 study to make the community more resilient to higher future flows, overall higher temperatures, and potentially wetter conditions are similar to those to be taken in the event of sea level change.

Upon examination of the range of model results from the Climate Hydrology Assessment Tool, there is a clear increasing trend in the higher projections, whereas the lower projections appear to be relatively stable and unchanging through time. The spread of the model results also increases with time, which is to be expected as uncertainty in future projection increases as time moves away from the model initiation point. Sources of variation and the significant uncertainty associated with these models include the boundary conditions applied to the GCMs, as well as variation between GCMs and selection of RCPs applied. Climate model downscaling and a limited temporal resolution further contribute to the uncertainty associated with CHAT results. There is also uncertainty associated with the hydrologic models. The large spread of results shown in Figure 60 highlights current climatic and hydrologic modeling limitations and associated uncertainty. Figure 61 displays only the mean result of the range of the 93 projections of future, climate changed hydrology which are shown in Figure 60. A linear regression line was fit to this mean and displays an increasing trend with a slope of approximately 28.5 cfs/yr. It should be noted that the p-value associated with this trend is less than 0.0001, indicating that the trend should be considered as statistically significant.

Results from the USACE Vulnerability Assessment tool were analyzed for the project area and found no outstanding vulnerabilities compared with other HUCs across the continental United States. While the project area is not within the top 20% of vulnerable HUCs nationally, that does not imply that vulnerability to climate change does not exist. The VA tool indicates that the change in flood runoff (cumulative), combined with the acres of urban area within 500-year floodplain, are driving flood risk reduction vulnerability.

8 References

Allen, R. J., Gaetano, A. T. Aeral Reduction Factors for Two Eastern United States Regions with High Rain-Gauge Density. Journal of Hydrologic Engineering. 0.1061/(ASCE)1084-0699(2005)10:4(327). July 2005.

B. F. Pope, Tasker, G. D., Robbins, J. C. 2001. Estimating the Magnitude and Frequency of Floods in Rural Basins of North Carolina. Water-Resources Investigations Report 01-4207. U.S. Geological Survey. Raleigh, NC.

Bastola, S. (2013) Hydrologic impacts of future climate change on Southeast US watersheds. Regional Environmental Change 13, 131-139.

Brommer, D.M., Cerveny, R.S., Balling Jr, R.C. (2007) Characteristics of long-duration precipitation events across the United States. Geophysical Research Letters 34.

Carter, L.M., J W. Jones, L. Berry, V. Burkett, J. F. Murley, J. Obeysekera, P. J. Schramm, and D. Wear, 2014: Ch. 17: Southeast and the Caribbean. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 396-417. doi:10.7930/J0NP22CB.

CDM, (2011) Climate Change Handbook for Regional Water Planning.

CDM Smith, (2012) Incorporating Climate Change into Water Supply Planning and Yield Studies: A Demonstration and Comparison of Practical Methods

Chen G., Tian H., Zhang C., Liu M., Ren W., Zhu W., Chappelka A.H., Prior S.A., Lockaby G.B. (2012) Drought in the Southern United States over the 20th century: Variability and its impacts on terrestrial ecosystem productivity and carbon storage. Climatic Change 114:379-397.

Chow, V.T. 1959. Open Channel Hydraulics, McGraw-Hill, New York, NY

Cook B.I., Smerdon J.E., Seager R., Cook E.R. (2014) Pan-Continental Droughts in North America over the Last Millennium. Journal of Climate 27:383-397.

Dai, Z., Amatya, D.M., Sun, G., Trettin, C.C., Li, C., Li, H. (2011) Climate variability and its impact on forest hydrology on South Carolina coastal plain, USA. Atmosphere 2, 330-357.

Duan Q, Schaake J, Andreassian V, Franks S, Goteti G, Gupta HV, Gusev YM, Habets F, Hall A, Hay L, Hogue T, Huang M, Leavesley G, Liang X, Nasonova ON, Noilhan J, Oudin L, Sorooshian S,Wagener T, Wood EF (2006) Model parameter estimation experiment (MOPEX): an overview of science strategy and major results from the second and third workshops. J Hydrol 320:3–17.

Elguindi N, Grundstein A (2013) An integrated approach to assessing 21st century climate change over the contiguous U.S. using the NARCCAP RCM output. Climatic Change 117:809- 827.

England et al., 2017. Guidelines for Determining Flood Flow Frequency Bulletin 17C.

EPA, 2017. Updates to the Demographic and Spatial Allocation Models to Produce Integrated Climate and Land-Use Scenarios (ICLUS). Version 2. Environmental Protection Agency.

Gao, Y., J. S. Fu, J. B. Drake, Y. Liu and J. F. Lamarque (2012). "Projected changes of extreme weather events in the eastern United States based on a high resolution climate modeling system." Environmental Research Letters 7(4).

Grundstein A (2009) Evaluation of climate change over the continental United States using a moisture index. Climatic Change 93:103-115.

Grundstein A, Dowd J (2011) Trends in extreme apparent temperatures over the United States, 1949-2010. Journal of Applied Meteorology and Climatology 50:1650-1653.

Hagemann, S., C. Chen, D. B. Clark, S. Folwell, S. N. Gosling, I. Haddeland, N. Hanasaki, J. Heinke, F. Ludwig, F. Voss and A. J. Wiltshire (2013). "Climate change impact on available water resources obtained using multiple global climate and hydrology models." Earth System Dynamics 4(1): 129-144.

ICLUS, 2017b. Integrated Climate and Land-Use Scenarios. ICLUS v2.1 Percent ImperviousSurface Projections (A1, A2, B1, and B2). Environmental Protection Agency

Irizarry-Ortiz, M.M., Obeysekera, J., Park, J., Trimble, P., Barnes, J., Park-Said, W., Gadzinski, E. (2013) Historical trends in Florida temperature and precipitation. Hydrological Processes 27, 2225-2246.

Jayakody P, Parajuli PB, Cathcart TP (2013) Impacts of climate variability on water quality with best management practices in sub-tropical climate of USA. Hydrological Processes.

Kalra, A., T. C. Piechota, R. Davies and G. A. Tootle (2008). "Changes in U.S. streamflow and Western U.S. snowpack." Journal of Hydrologic Engineering 13(3): 156-163.

Kunkel KE, Liang X-Z, Zhu J (2010) Regional climate model projections and uncertainties of U.S. summer heat waves. Journal of Climate 23:4447-4458.

Laseter, S.H., Ford, C.R., Vose, J.M., Swift, L.W. (2012) Long-term temperature and precipitation trends at the Coweeta Hydrologic Laboratory, Otto, North Carolina, USA. Hydrology Research 43, 890-901.

Li W, Li L, Fu R, Deng Y, Wang H (2011) Changes to the North Atlantic subtropical high and its role in the intensification of summer rainfall variability in the southeastern United States. Journal of Climate 24:1499-1506.

Liu Y, Goodrick SL, Stanturf JA (2013) Future U.S. wildfire potential trends projected using a dynamically downscaled climate change scenario. Forest Ecology and Management 294:120- 135.

McRoberts DB, Nielsen-Gammon JW (2011) A new homogenized climate division precipitation dataset for analysis of climate variability and climate change. Journal of Applied Meteorology and Climatology 50:1187-1199.

Misra, V., Michael, J.P., Boyles, R., Chassignet, E.P., Griffin, M., O'Brien, J.J. (2012) Reconciling the spatial distribution of the surface temperature trends in the Southeastern United States. Journal of Climate 25, 3610-3618.

Multi-Resolution Land Characteristics Consortium (MRLC). National Landcover Database (2016). Retrieved from https://www.mrlc.gov/.

NACSE, PRISM Climate data. 30-Year Normal Precipitation: Annual dataset. http://prism.oregonstate.edu/normals/. Accessed: 2021.

National Weather Service, Raleigh NC. Hurricane Matthew, October 2016 Event Summary. https://projects.ncsu.edu/atmos_collaboration/nwsfo/storage/cases/20161008/.

NCDOT. Best Available Elevation Data Summary. https://connect.ncdot.gov/resources/Photogrammetry/Photogrammetry%20Documents/Best%20Available%20Elevation%20Data%20Summary_210129.pdf.

NCDOT, Predicted Primary Road Inundation Tool. NCDOT Hurricane Actions, ArcGIS Online. Accessed: January 2021.

NCFMP. North Carolina Flood Risk Information System; North Carolina Floodplain Mapping Program: Raleigh, NC, USA, 2022. https://fris.nc.gov/fris/Home.aspx?ST=NC.

NOAA, 2013. Atlas 14: Precipitation-Frequency Atlas of the United States. Vol. 9 Version 2.0: Southeastern States. National Oceanic and Atmospheric Administration.

North Carolina Emergency Management. QL2/QL1 LiDAR Collection. 2018. https://sdd.nc.gov/SDD/docs/LidarSummary.pdf.

NRCS, 1986. Urban Hydrology for Small Watersheds. Technical Report 55. Natural Resources Conservation Service. June 1986.

Obeysekera, J., Irizarry, M., Park, J., Barnes, J., Dessalegne, T. (2011) Climate change and its implications for water resources management in south Florida. Stochastic Environmental Research and Risk Assessment 25, 495-516.

Palecki MA, Angel JR, Hollinger SE (2005) Storm precipitation in the United States. Part I: Meteorological characteristics. Journal of Applied Meteorology 44:933-946.

Patterson, L.A., Lutz, B., Doyle, M.W. (2012) Streamflow Changes in the South Atlantic, United States During the Mid- and Late 20th Century. Journal of the American Water Resources Association 48, 1126-1138.

Pryor SC, Howe JA, Kunkel KE (2009) How spatially coherent and statistically robust are temporal changes in extreme precipitation in the contiguous USA? International Journal of Climatology 29:31-45.

Qi, S., Sun, G., Wang, Y., McNulty, S.G., Myers, J.A.M. (2009) Streamflow response to climate and landuse changes in a coastal watershed in North Carolina. Transactions of the ASABE 52, 739-749.

SCACIS, Applied Climate Information System. U.S. Climate Resilience Toolkit. http://scacis.rcc-acis.org/. Accessed: 2021.

Schnabel, 2008. Geotechnical Engineering Report, Schnabel Project No. 08390008. Bathymetric and Water Velocity Studies, Greenville WTP Upgrade. Schnabel Engineering South. Accessed February 2022.

Scherer M, Diffenbaugh N (2014) Transient twenty-first century changes in daily-scale temperature extremes in the United States. Climate Dynamics 42:1383-1404.

Schwartz MD, Ault TR, Betancourt JL (2013) Spring onset variations and trends in the continental United States: Past and regional assessment using temperature-based indices. International Journal of Climatology 33:2917-2922.

Small D, Islam S, Vogel RM (2006) Trends in precipitation and streamflow in the eastern U.S.: Paradox or perception? Geophysical Research Letters 33. Tebaldi C (2006) Going To The Extremes: An Intercomparison of Model-Simulated Historical and Future Changes in Extreme Events. Climate Change 79:185-211.

Thomson AM, Brown RA, Rosenberg NJ, Srinivasan R, Izaurralde RC (2005) Climate change impacts for the conterminous USA: An integrated assessment: Part 4: Water resources. Climatic Change 69:67-88.

U.S. Army Corps of Engineers, Engineer Research and Development Center/Coastal and Hydraulics Laboratory. ERDC/CHL CHETN-VIII-5 Channel-Forming Discharge. December 2000.

U.S. Army Corps of Engineers, Engineering and Construction Bulletin 2018-14 (rev1) (Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects). Issued 16 September 2016.

U.S. Army Corps of Engineers, Engineering and Construction Bulletin 2018-14 (Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects). Issued 10 September 2018.

U.S. Army Corps of Engineers, Engineering Manual (EM) 1110-2-1619 (Risk-based analysis for flood damage reduction studies). Issued 1996

U.S. Army Corps of Engineers, Engineering Regulation (ER) 1165-2-21. (Flood Damage Reduction Measures in Urban Areas). Issued 1980.

U.S. Army Corps of Engineers, Engineering Technical Letter (ETL) 1100-2-3. (Guidance for Detection of Nonstationarities in Annual Maximum Discharges.) Issued 28 April 2017.

U.S. Army Corps of Engineers, Final Integrated Feasibility Report and Environmental Assessment Loiza, Puerto Rico Section 14 Study. USACE SAJ. 2018.

U.S. Army Corps of Engineers, Nonstationarity Detection (NSD) Tool and User Guide. Version 1.2. Issued May 2016, updated September 2018.

U.S. Army Corps of Engineers, Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions, South Atlantic-Gulf Region 03. January 2015.

US Army Corps of Engineers (USACE) (2014). Responses to Climate Change. Website. Accessed July 24, 2014: https://corpsclimate.us/.

U.S. Army Corps of Engineers, Vulnerability Assessment (VA) Tool and User Guide. Version 1.1. Issued November 2016.

U.S. Army Corps of Engineers, Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions, Ohio Region 05. January 2015.

U.S. Army Corps of Engineers, Time Series Toolbox, Trend Analysis and Nonstationarity Detection. 2018.

U.S. Army Corps of Engineers, Sea-Level Change Curve Calculator (Version 2019.21).

USGS Scientific Investigations Report (SIR) 2009-5158. Magnitude and Frequency of Rural Floods in the Southeastern United States, Through 2006: Volume 2, North Carolina. Reston, VA 2008. (http://pubs.usgs.gov/sir/2009/5158/pdf/sir2009-5158.pdf)

USGS Advisory Committee on Water Information, “Guidelines for Determining Flood Flow Frequency – Bulletin 17C”, 2018.

USGS, Flood Event Viewer. Hurricane Florence High-Water Marks. https://stn.wim.usgs.gov/FEV/#FlorenceSep2018. Accessed: 2021

USGS, Flood Event Viewer. Hurricane Matthew High-Water Marks. https://stn.wim.usgs.gov/FEV/#MatthewOctober2016. Accessed: 2021

USGS. StreamStats Program. 2019. http://streamstats.usgs.gov (accessed on 10 May 2021).

Villarini G, Smith HA, Vecchi GA (2013). Changing Frequency of Heavy Rainfall over the Central United States. Journal of Climate 26:351-357.

Walsh J, Wuebbles D, Hayhoe K, Kossin J, Kunkel KE, Stephens G, Thorne P, Vose RS, Wehner MF, Willis J, Anderson D, Kharin V, Knutson T, Landerer F, Lenton T, Kennedy J, Somerville R (2014) Appendix 3: Climate Science Supplement. in Melillo JM, Richmond TC, Yohe GW (eds.) Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, pp. 735-789.

Wang, D., Hagen, S.C., Alizad, K. (2013a) Climate change impact and uncertainty analysis of extreme rainfall events in the Apalachicola River basin, Florida. Journal of Hydrology 480, 125- 135.

Wang, R., Kalin, L., Kuang, W., Tian, H. (2013b) Individual and combined effects of land use/cover and climate change on Wolf Bay watershed streamflow in southern Alabama. Hydrological Processes, in press.

Wang H, Killick R, Fu X (2013) Distributional change of monthly precipitation due to climate change: Comprehensive examination of dataset in southeastern United States. Hydrological Processes, in press.

Wang H, Schubert S, Suarez M, Chen J, Hoerling M, Kumar A, Pegion P (2009) Attribution of the seasonality and regionality in climate trends over the United States during 1950-2000. Journal of Climate 22:2571-2590.

Wang J, Zhang X (2008) Downscaling and projection of winter extreme daily precipitation over North America. Journal of Climate 21:923-937.

Weaver, J.C., Feaster, T.D., and Robbins, J.C., 2016, Preliminary peak stage and streamflow data at selected stream-gaging stations in North Carolina and South Carolina for flooding following Hurricane Matthew, October 2016: U.S. Geological

Survey Open-File Report 2016 –1205, 38 p., https://doi.org/10.3133/ofr20161205.

Westby, R.M., Lee, Y.-Y., Black, R.X. (2013) Anomalous temperature regimes during the cool season: Long-term trends, low-frequency mode modulation, and representation in CMIP5 simulations. Journal of Climate 26, 9061-9076.

Wu, W., Clark, J.S., Vose, J.M. (2014) Response of hydrology to climate change in the southern Appalachian Mountains using Bayesian inference. Hydrological Processes 28, 1616-1626.

Xu, X., Liu, W., Rafique, R., Wang, K. (2013) Revisiting Continental U.S. Hydrologic Change in the Latter Half of the 20th Century. Water resources management 27, 4337-4348.

9 Attachment – HEC-RAS Output

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	79708	2k	2000.00	2000.00	5.21	1.49
Tar River	Reach 1	79708	3k	3000.00	3000.00	7.01	1.75
Tar River	Reach 1	79708	4k	4000.00	4000.00	8.54	1.95
Tar River	Reach 1	79708	5k	5000.00	5000.00	9.94	2.12
Tar River	Reach 1	79708	6k	6000.00	6000.00	11.17	2.27
Tar River	Reach 1	79708	7k	7000.00	7000.00	12.33	2.40
Tar River	Reach 1	79708	7.3k	7300.00	7300.00	12.65	2.44
Tar River	Reach 1	79708	8k	8000.00	7998.14	13.35	2.53
Tar River	Reach 1	79708	10k	10000.00	9978.76	14.40	2.92
Tar River	Reach 1	79708	20k	20000.00	14984.65	18.23	3.43
Tar River	Reach 1	79708	28.3k	28300.00	18077.55	20.60	3.64
Tar River	Reach 1	79708	40k	40000.00	21002.83	23.58	3.68
Tar River	Reach 1	79708	53.1k	53100.00	24560.68	26.06	3.88
Tar River	Reach 1	79708	73k	73000.00	29462.10	29.03	4.17
Tar River	Reach 1	79708	74.9k	74900.00	29983.14	29.18	4.22
Tar River	Reach 1	77934	2k	2000.00	1883.54	4.95	1.44
Tar River	Reach 1	77934	3k	3000.00	2791.03	6.74	1.65
Tar River	Reach 1	77934	4k	4000.00	3725.87	8.28	1.85
Tar River	Reach 1	77934	5k	5000.00	4633.28	9.67	1.98
Tar River	Reach 1	77934	6k	6000.00	5468.43	10.90	2.07
Tar River	Reach 1	77934	7k	7000.00	6390.46	12.06	2.17
Tar River	Reach 1	77934	7.3k	7300.00	6618.85	12.39	2.18
Tar River	Reach 1	77934	8k	8000.00	7146.27	13.09	2.23
Tar River	Reach 1	77934	10k	10000.00	8735.24	14.10	2.52
Tar River	Reach 1	77934	20k	20000.00	15874.15	17.80	3.59
Tar River	Reach 1	77934	28.3k	28300.00	21288.13	20.09	4.25
Tar River	Reach 1	77934	40k	40000.00	27999.66	23.01	4.86
Tar River	Reach 1	77934	53.1k	53100.00	35364.48	25.41	5.54
Tar River	Reach 1	77934	73k	73000.00	31638.27	28.69	4.38
Tar River	Reach 1	77934	74.9k	74900.00	32209.12	28.84	4.43
Tar River	Reach 1	77514	2k	2000.00	1884.82	4.66	1.46
Tar River	Reach 1	77514	3k	3000.00	2792.37	6.45	1.67
Tar River	Reach 1	77514	4k	4000.00	3724.20	7.98	1.86
Tar River	Reach 1	77514	5k	5000.00	4639.01	9.37	2.00
Tar River	Reach 1	77514	6k	6000.00	5471.76	10.60	2.08
Tar River	Reach 1	77514	7k	7000.00	6338.36	11.77	2.16
Tar River	Reach 1	77514	7.3k	7300.00	6578.30	12.10	2.18
Tar River	Reach 1	77514	8k	8000.00	7173.29	12.81	2.24
Tar River	Reach 1	77514	10k	10000.00	8766.81	13.80	2.52
Tar River	Reach 1	77514	20k	20000.00	16174.02	17.55	3.59
Tar River	Reach 1	77514	28.3k	28300.00	21846.07	19.87	4.25
Tar River	Reach 1	77514	40k	40000.00	29347.29	22.76	4.95
Tar River	Reach 1	77514	53.1k	53100.00	35864.54	25.14	5.44
Tar River	Reach 1	77514	73k	73000.00	35491.34	28.34	4.75
Tar River	Reach 1	77514	74.9k	74900.00	36129.50	28.50	4.81

Tar River	Reach 1	74977	2k	2000.00	2000.00	4.46	1.04
Tar River	Reach 1	74977	3k	3000.00	3000.00	6.23	1.29
Tar River	Reach 1	74977	4k	4000.00	4000.00	7.74	1.51
Tar River	Reach 1	74977	5k	5000.00	5000.00	9.10	1.69
Tar River	Reach 1	74977	6k	6000.00	6000.00	10.31	1.85
Tar River	Reach 1	74977	7k	7000.00	7000.00	11.47	1.99
Tar River	Reach 1	74977	7.3k	7300.00	7299.97	11.80	2.03
Tar River	Reach 1	74977	8k	8000.00	7999.09	12.50	2.12
Tar River	Reach 1	74977	10k	10000.00	9994.56	13.42	2.51
Tar River	Reach 1	74977	20k	20000.00	15771.23	17.06	3.25
Tar River	Reach 1	74977	28.3k	28300.00	19144.73	19.37	3.54
Tar River	Reach 1	74977	40k	40000.00	23270.75	22.28	3.81
Tar River	Reach 1	74977	53.1k	53100.00	25738.85	24.72	3.84
Tar River	Reach 1	74977	73k	73000.00	30923.09	27.91	4.14
Tar River	Reach 1	74977	74.9k	74900.00	31527.47	28.07	4.20
Tar River	Reach 1	72925	2k	2000.00	2000.00	4.40	0.82
Tar River	Reach 1	72925	3k	3000.00	3000.00	6.15	1.05
Tar River	Reach 1	72925	4k	4000.00	4000.00	7.64	1.25
Tar River	Reach 1	72925	5k	5000.00	5000.00	8.98	1.43
Tar River	Reach 1	72925	6k	6000.00	6000.00	10.18	1.58
Tar River	Reach 1	72925	7k	7000.00	7000.00	11.33	1.72
Tar River	Reach 1	72925	7.3k	7300.00	7300.00	11.66	1.76
Tar River	Reach 1	72925	8k	8000.00	7999.52	12.35	1.85
Tar River	Reach 1	72925	10k	10000.00	9997.04	13.22	2.21
Tar River	Reach 1	72925	20k	20000.00	14079.92	16.85	2.60
Tar River	Reach 1	72925	28.3k	28300.00	16301.61	19.18	2.73
Tar River	Reach 1	72925	40k	40000.00	19046.03	22.10	2.85
Tar River	Reach 1	72925	53.1k	53100.00	22225.71	24.53	3.06
Tar River	Reach 1	72925	73k	73000.00	25998.98	27.73	3.23
Tar River	Reach 1	72925	74.9k	74900.00	26498.76	27.89	3.28
Tar River	Reach 1	69996	2k	2000.00	2000.00	4.30	1.17
Tar River	Reach 1	69996	3k	3000.00	3000.00	5.99	1.52
Tar River	Reach 1	69996	4k	4000.00	4000.00	7.44	1.82
Tar River	Reach 1	69996	5k	5000.00	5000.00	8.74	2.07
Tar River	Reach 1	69996	6k	6000.00	6000.00	9.90	2.29
Tar River	Reach 1	69996	7k	7000.00	6999.92	11.02	2.49
Tar River	Reach 1	69996	7.3k	7300.00	7299.52	11.34	2.54

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	69996	8k	8000.00	7996.66	12.01	2.66
Tar River	Reach 1	69996	10k	10000.00	8596.23	12.87	2.72
Tar River	Reach 1	69996	20k	20000.00	11975.44	16.51	3.11
Tar River	Reach 1	69996	28.3k	28300.00	13248.82	18.88	3.08
Tar River	Reach 1	69996	40k	40000.00	14742.63	21.85	3.03
Tar River	Reach 1	69996	53.1k	53100.00	16869.85	24.29	3.16
Tar River	Reach 1	69996	73k	73000.00	19225.06	27.51	3.23
Tar River	Reach 1	69996	74.9k	74900.00	19557.09	27.66	3.28
Tar River	Reach 1	68951	2k	2000.00	2000.00	4.16	2.00
Tar River	Reach 1	68951	3k	3000.00	3000.00	5.81	2.38

Tar River	Reach 1	68951	4k	4000.00	4000.00	7.21	2.71
Tar River	Reach 1	68951	5k	5000.00	5000.00	8.48	2.98
Tar River	Reach 1	68951	6k	6000.00	6000.00	9.60	3.24
Tar River	Reach 1	68951	7k	7000.00	6998.15	10.70	3.45
Tar River	Reach 1	68951	7.3k	7300.00	7290.37	11.01	3.51
Tar River	Reach 1	68951	8k	8000.00	7931.68	11.67	3.64
Tar River	Reach 1	68951	10k	10000.00	8022.67	12.62	3.44
Tar River	Reach 1	68951	20k	20000.00	8267.32	16.42	2.82
Tar River	Reach 1	68951	28.3k	28300.00	8637.14	18.83	2.61
Tar River	Reach 1	68951	40k	40000.00	9217.96	21.82	2.44
Tar River	Reach 1	68951	53.1k	53100.00	10346.91	24.26	2.48
Tar River	Reach 1	68951	73k	73000.00	11603.23	27.49	2.48
Tar River	Reach 1	68951	74.9k	74900.00	11791.36	27.64	2.51
Tar River	Reach 1	68648	2k	2000.00	2000.00	4.08	1.80
Tar River	Reach 1	68648	3k	3000.00	3000.00	5.73	2.10
Tar River	Reach 1	68648	4k	4000.00	4000.00	7.14	2.34
Tar River	Reach 1	68648	5k	5000.00	5000.00	8.41	2.55
Tar River	Reach 1	68648	6k	6000.00	6000.00	9.54	2.73
Tar River	Reach 1	68648	7k	7000.00	6979.25	10.64	2.88
Tar River	Reach 1	68648	7.3k	7300.00	7250.07	10.95	2.91
Tar River	Reach 1	68648	8k	8000.00	7822.09	11.62	2.97
Tar River	Reach 1	68648	10k	10000.00	7869.52	12.59	2.77
Tar River	Reach 1	68648	20k	20000.00	9693.73	16.38	2.65
Tar River	Reach 1	68648	28.3k	28300.00	10517.95	18.80	2.52
Tar River	Reach 1	68648	40k	40000.00	11724.57	21.79	2.43
Tar River	Reach 1	68648	53.1k	53100.00	13540.01	24.24	2.53
Tar River	Reach 1	68648	73k	73000.00	16191.12	27.46	2.68
Tar River	Reach 1	68648	74.9k	74900.00	16516.96	27.61	2.72
Tar River	Reach 1	68284	2k	2000.00	2000.00	4.06	1.18
Tar River	Reach 1	68284	3k	3000.00	3000.00	5.71	1.48
Tar River	Reach 1	68284	4k	4000.00	4000.00	7.11	1.73
Tar River	Reach 1	68284	5k	5000.00	5000.00	8.38	1.94
Tar River	Reach 1	68284	6k	6000.00	6000.00	9.50	2.13
Tar River	Reach 1	68284	7k	7000.00	6999.88	10.60	2.29
Tar River	Reach 1	68284	7.3k	7300.00	7299.19	10.91	2.33
Tar River	Reach 1	68284	8k	8000.00	7994.23	11.58	2.44
Tar River	Reach 1	68284	10k	10000.00	8597.74	12.53	2.47
Tar River	Reach 1	68284	20k	20000.00	12870.93	16.29	3.00
Tar River	Reach 1	68284	28.3k	28300.00	14859.99	18.71	3.09
Tar River	Reach 1	68284	40k	40000.00	16965.11	21.72	3.11
Tar River	Reach 1	68284	53.1k	53100.00	19635.46	24.17	3.28
Tar River	Reach 1	68284	73k	73000.00	20757.26	27.41	3.10
Tar River	Reach 1	68284	74.9k	74900.00	21026.71	27.56	3.13
Tar River	Reach 1	68159	2k	2000.00	2000.00	4.05	1.24
Tar River	Reach 1	68159	3k	3000.00	3000.00	5.69	1.55
Tar River	Reach 1	68159	4k	4000.00	4000.00	7.10	1.79
Tar River	Reach 1	68159	5k	5000.00	5000.00	8.36	2.00
Tar River	Reach 1	68159	6k	6000.00	6000.00	9.48	2.19
Tar River	Reach 1	68159	7k	7000.00	6999.69	10.58	2.35
Tar River	Reach 1	68159	7.3k	7300.00	7295.41	10.89	2.39

Tar River	Reach 1	68159	8k	8000.00	7959.54	11.56	2.48
Tar River	Reach 1	68159	10k	10000.00	8421.38	12.51	2.46
Tar River	Reach 1	68159	20k	20000.00	12062.54	16.27	2.83
Tar River	Reach 1	68159	28.3k	28300.00	13977.27	18.69	2.90
Tar River	Reach 1	68159	40k	40000.00	16217.42	21.69	2.95
Tar River	Reach 1	68159	53.1k	53100.00	19043.27	24.14	3.15
Tar River	Reach 1	68159	73k	73000.00	23234.44	27.36	3.43
Tar River	Reach 1	68159	74.9k	74900.00	23712.37	27.51	3.49
Tar River	Reach 1	68132	2k	2000.00	2000.00	4.04	1.28
Tar River	Reach 1	68132	3k	3000.00	3000.00	5.69	1.59
Tar River	Reach 1	68132	4k	4000.00	4000.00	7.09	1.85
Tar River	Reach 1	68132	5k	5000.00	5000.00	8.35	2.06
Tar River	Reach 1	68132	6k	6000.00	6000.00	9.47	2.25
Tar River	Reach 1	68132	7k	7000.00	6999.86	10.57	2.41
Tar River	Reach 1	68132	7.3k	7300.00	7296.98	10.88	2.46
Tar River	Reach 1	68132	8k	8000.00	7956.56	11.55	2.55
Tar River	Reach 1	68132	10k	10000.00	8613.80	12.50	2.59
Tar River	Reach 1	68132	20k	20000.00	12468.17	16.25	3.00
Tar River	Reach 1	68132	28.3k	28300.00	14229.61	18.67	3.04
Tar River	Reach 1	68132	40k	40000.00	16449.41	21.68	3.08
Tar River	Reach 1	68132	53.1k	53100.00	19271.26	24.13	3.28
Tar River	Reach 1	68132	73k	73000.00	23301.89	27.35	3.54

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	68132	74.9k	74900.00	23782.98	27.50	3.59
Tar River	Reach 1	68067	2k	2000.00	2000.00	4.04	1.33
Tar River	Reach 1	68067	3k	3000.00	3000.00	5.67	1.66
Tar River	Reach 1	68067	4k	4000.00	4000.00	7.08	1.92
Tar River	Reach 1	68067	5k	5000.00	5000.00	8.34	2.14
Tar River	Reach 1	68067	6k	6000.00	6000.00	9.46	2.34
Tar River	Reach 1	68067	7k	7000.00	6999.67	10.56	2.50
Tar River	Reach 1	68067	7.3k	7300.00	7295.00	10.87	2.54
Tar River	Reach 1	68067	8k	8000.00	7951.37	11.53	2.63
Tar River	Reach 1	68067	10k	10000.00	8374.29	12.49	2.59
Tar River	Reach 1	68067	20k	20000.00	12003.79	16.24	2.96
Tar River	Reach 1	68067	28.3k	28300.00	13932.46	18.67	3.04
Tar River	Reach 1	68067	40k	40000.00	16147.20	21.68	3.08
Tar River	Reach 1	68067	53.1k	53100.00	18970.53	24.12	3.29
Tar River	Reach 1	68067	73k	73000.00	23082.71	27.35	3.56
Tar River	Reach 1	68067	74.9k	74900.00	23560.14	27.49	3.62
Tar River	Reach 1	67982	2k	2000.00	2000.00	4.02	1.48
Tar River	Reach 1	67982	3k	3000.00	3000.00	5.65	1.85
Tar River	Reach 1	67982	4k	4000.00	4000.00	7.05	2.13
Tar River	Reach 1	67982	5k	5000.00	5000.00	8.31	2.36
Tar River	Reach 1	67982	6k	6000.00	6000.00	9.42	2.56
Tar River	Reach 1	67982	7k	7000.00	6999.40	10.52	2.72
Tar River	Reach 1	67982	7.3k	7300.00	7295.78	10.83	2.76
Tar River	Reach 1	67982	8k	8000.00	7942.88	11.49	2.85
Tar River	Reach 1	67982	10k	10000.00	8170.44	12.46	2.73

Tar River	Reach 1	67982	20k	20000.00	11604.47	16.22	3.04
Tar River	Reach 1	67982	28.3k	28300.00	13197.61	18.65	3.03
Tar River	Reach 1	67982	40k	40000.00	15415.43	21.66	3.08
Tar River	Reach 1	67982	53.1k	53100.00	18221.99	24.11	3.29
Tar River	Reach 1	67982	73k	73000.00	22414.69	27.33	3.59
Tar River	Reach 1	67982	74.9k	74900.00	22885.45	27.48	3.64
Tar River	Reach 1	67957	2k	2000.00	2000.00	4.02	1.47
Tar River	Reach 1	67957	3k	3000.00	3000.00	5.65	1.85
Tar River	Reach 1	67957	4k	4000.00	4000.00	7.04	2.15
Tar River	Reach 1	67957	5k	5000.00	5000.00	8.30	2.39
Tar River	Reach 1	67957	6k	6000.00	6000.00	9.41	2.60
Tar River	Reach 1	67957	7k	7000.00	6999.80	10.51	2.77
Tar River	Reach 1	67957	7.3k	7300.00	7296.13	10.82	2.81
Tar River	Reach 1	67957	8k	8000.00	7958.73	11.48	2.91
Tar River	Reach 1	67957	10k	10000.00	9796.97	12.37	3.35
Tar River	Reach 1	67957	20k	20000.00	11417.65	16.22	3.04
Tar River	Reach 1	67957	28.3k	28300.00	13034.00	18.64	3.05
Tar River	Reach 1	67957	40k	40000.00	15298.86	21.65	3.11
Tar River	Reach 1	67957	53.1k	53100.00	18138.50	24.10	3.33
Tar River	Reach 1	67957	73k	73000.00	22395.25	27.32	3.65
Tar River	Reach 1	67957	74.9k	74900.00	22867.51	27.46	3.71
Tar River	Reach 1	67908	2k	2000.00	2000.00	4.01	1.45
Tar River	Reach 1	67908	3k	3000.00	3000.00	5.64	1.85
Tar River	Reach 1	67908	4k	4000.00	4000.00	7.03	2.18
Tar River	Reach 1	67908	5k	5000.00	5000.00	8.28	2.44
Tar River	Reach 1	67908	6k	6000.00	6000.00	9.40	2.67
Tar River	Reach 1	67908	7k	7000.00	6999.83	10.49	2.86
Tar River	Reach 1	67908	7.3k	7300.00	7296.17	10.80	2.92
Tar River	Reach 1	67908	8k	8000.00	7951.31	11.46	3.02
Tar River	Reach 1	67908	10k	10000.00	7976.44	12.41	2.82
Tar River	Reach 1	67908	20k	20000.00	10895.71	16.21	3.03
Tar River	Reach 1	67908	28.3k	28300.00	12465.46	18.64	3.04
Tar River	Reach 1	67908	40k	40000.00	14495.68	21.65	3.08
Tar River	Reach 1	67908	53.1k	53100.00	17102.55	24.09	3.28
Tar River	Reach 1	67908	73k	73000.00	21033.58	27.31	3.59
Tar River	Reach 1	67908	74.9k	74900.00	21472.83	27.46	3.64
Tar River	Reach 1	67727	2k	2000.00	2000.00	4.00	1.29
Tar River	Reach 1	67727	3k	3000.00	3000.00	5.63	1.62
Tar River	Reach 1	67727	4k	4000.00	4000.00	7.02	1.89
Tar River	Reach 1	67727	5k	5000.00	5000.00	8.27	2.12
Tar River	Reach 1	67727	6k	6000.00	6000.00	9.38	2.33
Tar River	Reach 1	67727	7k	7000.00	6998.90	10.47	2.50
Tar River	Reach 1	67727	7.3k	7300.00	7293.65	10.78	2.55
Tar River	Reach 1	67727	8k	8000.00	7953.25	11.44	2.66
Tar River	Reach 1	67727	10k	10000.00	8289.70	12.39	2.60
Tar River	Reach 1	67727	20k	20000.00	11682.13	16.18	2.95
Tar River	Reach 1	67727	28.3k	28300.00	13497.25	18.61	3.03
Tar River	Reach 1	67727	40k	40000.00	15796.17	21.62	3.11
Tar River	Reach 1	67727	53.1k	53100.00	18641.15	24.06	3.34
Tar River	Reach 1	67727	73k	73000.00	22975.59	27.28	3.68

Tar River	Reach 1	67727	74.9k	74900.00	23448.81	27.43	3.74
Tar River	Reach 1	67529	2k	2000.00	2000.00	3.95	1.81
Tar River	Reach 1	67529	3k	3000.00	3000.00	5.56	2.20
Tar River	Reach 1	67529	4k	4000.00	4000.00	6.94	2.51
Tar River	Reach 1	67529	5k	5000.00	5000.00	8.18	2.77
Tar River	Reach 1	67529	6k	6000.00	6000.00	9.28	3.02

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	67529	7k	7000.00	6999.13	10.36	3.22
Tar River	Reach 1	67529	7.3k	7300.00	7296.67	10.67	3.28
Tar River	Reach 1	67529	8k	8000.00	7967.47	11.32	3.40
Tar River	Reach 1	67529	10k	10000.00	7752.31	12.32	3.08
Tar River	Reach 1	67529	20k	20000.00	10108.81	16.14	3.19
Tar River	Reach 1	67529	28.3k	28300.00	11428.77	18.58	3.18
Tar River	Reach 1	67529	40k	40000.00	13150.94	21.60	3.20
Tar River	Reach 1	67529	53.1k	53100.00	15413.92	24.04	3.40
Tar River	Reach 1	67529	73k	73000.00	18880.28	27.26	3.71
Tar River	Reach 1	67529	74.9k	74900.00	19272.52	27.41	3.77
Tar River	Reach 1	67309	2k	2000.00	2000.00	3.88	2.04
Tar River	Reach 1	67309	3k	3000.00	3000.00	5.48	2.35
Tar River	Reach 1	67309	4k	4000.00	4000.00	6.86	2.57
Tar River	Reach 1	67309	5k	5000.00	5000.00	8.11	2.75
Tar River	Reach 1	67309	6k	6000.00	6000.00	9.21	2.91
Tar River	Reach 1	67309	7k	7000.00	7000.00	10.30	3.04
Tar River	Reach 1	67309	7.3k	7300.00	7298.56	10.61	3.08
Tar River	Reach 1	67309	8k	8000.00	7962.35	11.27	3.17
Tar River	Reach 1	67309	10k	10000.00	7737.92	12.28	2.82
Tar River	Reach 1	67309	20k	20000.00	10474.24	16.11	2.91
Tar River	Reach 1	67309	28.3k	28300.00	12006.58	18.55	2.90
Tar River	Reach 1	67309	40k	40000.00	14061.57	21.57	2.92
Tar River	Reach 1	67309	53.1k	53100.00	16878.31	24.01	3.15
Tar River	Reach 1	67309	73k	73000.00	20728.19	27.23	3.41
Tar River	Reach 1	67309	74.9k	74900.00	21162.90	27.38	3.47
Tar River	Reach 1	67111	2k	2000.00	2000.00	3.81	2.17
Tar River	Reach 1	67111	3k	3000.00	3000.00	5.39	2.65
Tar River	Reach 1	67111	4k	4000.00	4000.00	6.74	3.02
Tar River	Reach 1	67111	5k	5000.00	5000.00	7.97	3.27
Tar River	Reach 1	67111	6k	6000.00	6000.00	9.07	3.47
Tar River	Reach 1	67111	7k	7000.00	6998.21	10.15	3.64
Tar River	Reach 1	67111	7.3k	7300.00	7293.23	10.46	3.68
Tar River	Reach 1	67111	8k	8000.00	7952.02	11.11	3.79
Tar River	Reach 1	67111	10k	10000.00	7462.72	12.19	3.25
Tar River	Reach 1	67111	20k	20000.00	9704.20	16.06	3.23
Tar River	Reach 1	67111	28.3k	28300.00	10639.48	18.51	3.08
Tar River	Reach 1	67111	40k	40000.00	12198.46	21.55	3.04
Tar River	Reach 1	67111	53.1k	53100.00	14333.63	23.99	3.21
Tar River	Reach 1	67111	73k	73000.00	16718.21	27.22	3.31
Tar River	Reach 1	67111	74.9k	74900.00	17000.06	27.36	3.34

Tar River	Reach 1	64535	2k	2000.00	2000.00	3.55	1.18
Tar River	Reach 1	64535	3k	3000.00	3000.00	5.04	1.52
Tar River	Reach 1	64535	4k	4000.00	4000.00	6.32	1.80
Tar River	Reach 1	64535	5k	5000.00	5000.00	7.47	2.05
Tar River	Reach 1	64535	6k	6000.00	6000.00	8.53	2.28
Tar River	Reach 1	64535	7k	7000.00	6999.97	9.59	2.46
Tar River	Reach 1	64535	7.3k	7300.00	7297.58	9.89	2.52
Tar River	Reach 1	64535	8k	8000.00	7905.58	10.54	2.61
Tar River	Reach 1	64535	10k	10000.00	7941.60	11.79	2.43
Tar River	Reach 1	64535	20k	20000.00	9672.37	15.81	2.39
Tar River	Reach 1	64535	28.3k	28300.00	10666.35	18.32	2.35
Tar River	Reach 1	64535	40k	40000.00	12012.47	21.39	2.34
Tar River	Reach 1	64535	53.1k	53100.00	14074.16	23.84	2.51
Tar River	Reach 1	64535	73k	73000.00	15124.56	27.10	2.42
Tar River	Reach 1	64535	74.9k	74900.00	15349.48	27.24	2.44
Tar River	Reach 1	58701	2k	2000.00	2000.00	3.10	1.38
Tar River	Reach 1	58701	3k	3000.00	3000.00	4.41	1.78
Tar River	Reach 1	58701	4k	4000.00	4000.00	5.54	2.11
Tar River	Reach 1	58701	5k	5000.00	5000.00	6.55	2.40
Tar River	Reach 1	58701	6k	6000.00	6000.00	7.50	2.65
Tar River	Reach 1	58701	7k	7000.00	7000.00	8.49	2.85
Tar River	Reach 1	58701	7.3k	7300.00	7300.00	8.77	2.91
Tar River	Reach 1	58701	8k	8000.00	7999.73	9.39	3.04
Tar River	Reach 1	58701	10k	10000.00	9107.03	10.84	3.13
Tar River	Reach 1	58701	20k	20000.00	11146.33	15.26	2.95
Tar River	Reach 1	58701	28.3k	28300.00	12458.44	17.90	2.91
Tar River	Reach 1	58701	40k	40000.00	14590.07	21.04	2.98
Tar River	Reach 1	58701	53.1k	53100.00	16768.37	23.50	3.12
Tar River	Reach 1	58701	73k	73000.00	16490.94	26.87	2.73
Tar River	Reach 1	58701	74.9k	74900.00	16742.82	27.01	2.76
Tar River	Reach 1	57629	2k	2000.00	2000.00	3.09	0.59
Tar River	Reach 1	57629	3k	3000.00	2997.82	4.39	0.77
Tar River	Reach 1	57629	4k	4000.00	3980.19	5.52	0.92
Tar River	Reach 1	57629	5k	5000.00	4948.94	6.53	1.06
Tar River	Reach 1	57629	6k	6000.00	5902.12	7.49	1.17
Tar River	Reach 1	57629	7k	7000.00	6841.50	8.48	1.26
Tar River	Reach 1	57629	7.3k	7300.00	7120.07	8.76	1.29
Tar River	Reach 1	57629	8k	8000.00	7765.97	9.38	1.35
Tar River	Reach 1	57629	10k	10000.00	9622.29	10.82	1.52
Tar River	Reach 1	57629	20k	20000.00	18440.10	15.15	2.32
Tar River	Reach 1	57629	28.3k	28300.00	25546.81	17.72	2.86
Tar River	Reach 1	57629	40k	40000.00	35347.56	20.79	3.49

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	57629	53.1k	53100.00	38499.53	23.29	3.48
Tar River	Reach 1	57629	73k	73000.00	30539.09	26.80	2.46
Tar River	Reach 1	57629	74.9k	74900.00	31036.06	26.93	2.49
Tar River	Reach 1	57359	2k	2000.00	2000.00	3.08	0.63
Tar River	Reach 1	57359	3k	3000.00	3000.00	4.38	0.82

Tar River	Reach 1	57359	4k	4000.00	3996.60	5.51	0.98
Tar River	Reach 1	57359	5k	5000.00	4982.47	6.52	1.12
Tar River	Reach 1	57359	6k	6000.00	5953.00	7.47	1.24
Tar River	Reach 1	57359	7k	7000.00	6905.71	8.46	1.33
Tar River	Reach 1	57359	7.3k	7300.00	7186.97	8.74	1.36
Tar River	Reach 1	57359	8k	8000.00	7846.88	9.36	1.42
Tar River	Reach 1	57359	10k	10000.00	9664.09	10.80	1.59
Tar River	Reach 1	57359	20k	20000.00	18495.67	15.10	2.39
Tar River	Reach 1	57359	28.3k	28300.00	25609.22	17.65	2.94
Tar River	Reach 1	57359	40k	40000.00	35412.62	20.72	3.58
Tar River	Reach 1	57359	53.1k	53100.00	32151.23	23.23	2.96
Tar River	Reach 1	57359	73k	73000.00	29988.27	26.64	2.46
Tar River	Reach 1	57359	74.9k	74900.00	30513.08	26.78	2.50
Tar River	Reach 1	54258	2k	2000.00	2000.00	2.95	1.28
Tar River	Reach 1	54258	3k	3000.00	3000.00	4.19	1.65
Tar River	Reach 1	54258	4k	4000.00	4000.00	5.27	1.96
Tar River	Reach 1	54258	5k	5000.00	5000.00	6.23	2.23
Tar River	Reach 1	54258	6k	6000.00	6000.00	7.15	2.46
Tar River	Reach 1	54258	7k	7000.00	6986.43	8.11	2.65
Tar River	Reach 1	54258	7.3k	7300.00	7254.21	8.39	2.69
Tar River	Reach 1	54258	8k	8000.00	7788.00	9.01	2.75
Tar River	Reach 1	54258	10k	10000.00	8939.75	10.45	2.84
Tar River	Reach 1	54258	20k	20000.00	13382.02	14.74	3.29
Tar River	Reach 1	54258	28.3k	28300.00	16127.20	17.31	3.49
Tar River	Reach 1	54258	40k	40000.00	18885.98	20.42	3.57
Tar River	Reach 1	54258	53.1k	53100.00	20356.70	23.02	3.48
Tar River	Reach 1	54258	73k	73000.00	21791.80	26.50	3.31
Tar River	Reach 1	54258	74.9k	74900.00	22140.13	26.64	3.34
Tar River	Reach 1	53587	2k	2000.00	2000.00	2.94	0.80
Tar River	Reach 1	53587	3k	3000.00	3000.00	4.17	1.10
Tar River	Reach 1	53587	4k	4000.00	4000.00	5.24	1.36
Tar River	Reach 1	53587	5k	5000.00	5000.00	6.20	1.59
Tar River	Reach 1	53587	6k	6000.00	5999.91	7.11	1.80
Tar River	Reach 1	53587	7k	7000.00	6994.23	8.07	1.99
Tar River	Reach 1	53587	7.3k	7300.00	7283.87	8.34	2.04
Tar River	Reach 1	53587	8k	8000.00	7933.44	8.95	2.14
Tar River	Reach 1	53587	10k	10000.00	9615.39	10.38	2.41
Tar River	Reach 1	53587	20k	20000.00	16388.88	14.60	3.38
Tar River	Reach 1	53587	28.3k	28300.00	17427.03	17.22	3.23
Tar River	Reach 1	53587	40k	40000.00	20637.46	20.33	3.43
Tar River	Reach 1	53587	53.1k	53100.00	24276.41	22.91	3.71
Tar River	Reach 1	53587	73k	73000.00	26682.21	26.40	3.67
Tar River	Reach 1	53587	74.9k	74900.00	27168.92	26.54	3.73
Tar River	Reach 1	53550	2k	2000.00	2000.00	2.93	0.89
Tar River	Reach 1	53550	3k	3000.00	3000.00	4.16	1.21
Tar River	Reach 1	53550	4k	4000.00	4000.00	5.22	1.49
Tar River	Reach 1	53550	5k	5000.00	5000.00	6.17	1.74
Tar River	Reach 1	53550	6k	6000.00	6000.00	7.07	1.97
Tar River	Reach 1	53550	7k	7000.00	6992.54	8.03	2.16
Tar River	Reach 1	53550	7.3k	7300.00	7282.71	8.30	2.21

River	Reach	River Sta	Profile	Q Total	Q Channel	W.S. Elev	Vel Chnl
				(cfs)	(cfs)	(ft)	(ft/s)
Tar River	Reach 1	53550	8k	8000.00	7928.78	8.91	2.31
Tar River	Reach 1	53550	10k	10000.00	9592.18	10.34	2.58
Tar River	Reach 1	53550	20k	20000.00	16325.20	14.55	3.56
Tar River	Reach 1	53550	28.3k	28300.00	21006.96	17.08	4.11
Tar River	Reach 1	53550	40k	40000.00	26932.36	20.13	4.69
Tar River	Reach 1	53550	53.1k	53100.00	27790.46	22.83	4.41
Tar River	Reach 1	53550	73k	73000.00	27654.31	26.35	3.93
Tar River	Reach 1	53550	74.9k	74900.00	28001.36	26.49	3.97
Tar River	Reach 1	52491	2k	2000.00	2000.00	2.87	1.30
Tar River	Reach 1	52491	3k	3000.00	3000.00	4.07	1.70
Tar River	Reach 1	52491	4k	4000.00	4000.00	5.09	2.04
Tar River	Reach 1	52491	5k	5000.00	5000.00	6.01	2.34
Tar River	Reach 1	52491	6k	6000.00	6000.00	6.88	2.60
Tar River	Reach 1	52491	7k	7000.00	6984.10	7.82	2.81
Tar River	Reach 1	52491	7.3k	7300.00	7265.92	8.09	2.86
Tar River	Reach 1	52491	8k	8000.00	7893.99	8.69	2.97
Tar River	Reach 1	52491	10k	10000.00	9581.34	10.10	3.27
Tar River	Reach 1	52491	20k	20000.00	17446.52	14.17	4.67
Tar River	Reach 1	52491	28.3k	28300.00	23531.75	16.59	5.59
Tar River	Reach 1	52491	40k	40000.00	31679.57	19.52	6.62
Tar River	Reach 1	52491	53.1k	53100.00	26549.38	22.66	4.92
Tar River	Reach 1	52491	73k	73000.00	24797.25	26.29	4.06
Tar River	Reach 1	52491	74.9k	74900.00	25124.43	26.42	4.09
Tar River	Reach 1	52441	2k	2000.00	2000.00	2.87	1.30
Tar River	Reach 1	52441	3k	3000.00	3000.00	4.06	1.70
Tar River	Reach 1	52441	4k	4000.00	4000.00	5.09	2.04
Tar River	Reach 1	52441	5k	5000.00	5000.00	6.00	2.33
Tar River	Reach 1	52441	6k	6000.00	6000.00	6.87	2.59
Tar River	Reach 1	52441	7k	7000.00	6991.98	7.81	2.79
Tar River	Reach 1	52441	7.3k	7300.00	7278.07	8.07	2.84
Tar River	Reach 1	52441	8k	8000.00	7915.41	8.68	2.94
Tar River	Reach 1	52441	10k	10000.00	9622.68	10.08	3.23
Tar River	Reach 1	52441	20k	20000.00	17594.45	14.14	4.62
Tar River	Reach 1	52441	28.3k	28300.00	23782.09	16.54	5.53
Tar River	Reach 1	52441	40k	40000.00	32092.53	19.43	6.56
Tar River	Reach 1	52441	53.1k	53100.00	31936.19	22.44	5.80
Tar River	Reach 1	52441	73k	73000.00	27601.49	26.25	4.39
Tar River	Reach 1	52441	74.9k	74900.00	27960.96	26.38	4.43
Tar River	Reach 1	51753	2k	2000.00	2000.00	2.78	1.53
Tar River	Reach 1	51753	3k	3000.00	3000.00	3.93	1.95
Tar River	Reach 1	51753	4k	4000.00	4000.00	4.93	2.30
Tar River	Reach 1	51753	5k	5000.00	5000.00	5.82	2.60
Tar River	Reach 1	51753	6k	6000.00	6000.00	6.67	2.85
Tar River	Reach 1	51753	7k	7000.00	7000.00	7.59	3.04
Tar River	Reach 1	51753	7.3k	7300.00	7300.00	7.86	3.09
Tar River	Reach 1	51753	8k	8000.00	7999.74	8.46	3.20
Tar River	Reach 1	51753	10k	10000.00	9993.00	9.83	3.56

Tar River	Reach 1	51753	20k	20000.00	13057.65	14.04	3.48
Tar River	Reach 1	51753	28.3k	28300.00	15697.17	16.51	3.65
Tar River	Reach 1	51753	40k	40000.00	18883.07	19.50	3.80
Tar River	Reach 1	51753	53.1k	53100.00	21321.95	22.42	3.79
Tar River	Reach 1	51753	73k	73000.00	21612.13	26.18	3.34
Tar River	Reach 1	51753	74.9k	74900.00	21994.36	26.32	3.38

Appendix C

Cost Estimation Supporting Documentation

Cost Engineering - General Discussion

1. Cost Estimate was prepared for the Greenville Utilities Section 14 project. The project will provide stabilization with a layer of stone (riprap) placed over a layer of bedding stone and geotextile along approximately 300 linear feet of streambank. The cost estimate was prepared with a design comparable to a class 3/4 estimate. Major features of work include excavation, removal of debris along the streambank, and installation of new geotextile and rip rap.

2. Cost Estimates were prepared under guidance given in the Corps of Engineers Regulation ER 1110-2-1302 and EP 1110-1-8 Vol 3, Cost Book Dated 2018.

3. Cost Estimates were produced using MCACES with the 2022 MII Cost Book and quantities provided by Wilmington District Design Section. Labor rates were adjusted to current local North Carolina Davis Bacon rates. Cost Book material rates were adjusted to Q3 2022 RSMeans values or taken from a field quote in the same time period. The assumed construction start is Q2 FY24 with a completion by Q4 FY24. Midpoint of construction is assumed Q3 FY24. Construction estimate is escalated to the midpoint of construction using Total Project Cost Summary escalation percentages.

4. Cost Estimate Issues and Assumptions.

- Site Access will be available through the water treatment plant and their access road to the pump house.
- Disposal of excess spoil can be used on site of the water treatment facility as discussed with the stakeholders
- Acquisition assumed for this estimate was small business or an 8a contract.
- Project will be mostly completed by a subcontractor.

5. Project Construction Schedule. The assumed construction start is Q2 FY24 with a completion by Q4 FY24.

6. Risk Analysis. Abbreviated Risk Analysis was performed to determine the contingencies in accordance with ER 1110-2-1302. Construction cost contingency was determined to be 31%. Design & Implementation (i.e. PED) contingency was determined to be 20%. S&A contingency was determined at 22%.

7. References.

a. EC 11-2-225, Corps of Engineers Civil Works Direct Program: Program Development Guidance Fiscal Year 2024, 31 March 2022.
b. ER 1105-2-100, Planning Guidance Notebook, 22 April 2000.
c. ER 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993.
d. ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999.
e. ER 1110-2-1302, Civil Works Cost Engineering, 30 June 2016.
f. EP 1110-1-8 Volume 2, Construction Equipment Ownership and Operating Expense Schedule – Region III, 12 August 2021.

Total Project Cost Summary

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Greenville Utilities Bank Stabilization**
PROJECT NO: **P2 495966**
LOCATION: **Greenville,NC**

DISTRICT: **Wilmington District** PREPARED: **9/28/2022**
POC: **CHIEF, COST ENGINEERING, Stephen Roman**

This Estimate reflects the scope and schedule in report; Feasibility_EA_Integrated_Rpt_DRAFT_ATR_ 093022

Program Year (Budget EC): 2023
Effective Price Level Date: 1-Oct- 22

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-15 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
16	BANK STABILIZATION	$1,008	$312	31%	$1,320		$1,008	$312	$1,320		$1,320	4.2%	$1,050	$326	$1,376
				-		-						-			
				-		-						-			
				-		-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$1,008	$312		$1,320		$1,008	$312	$1,320		$1,320	4.2%	$1,050	$326	$1,376
01	LANDS AND DAMAGES	$2	$1	25%	$3		$2	$1	$3		$3	4.2%	$2	$1	$3
30	PLANNING, ENGINEERING & DESIGN	$226	$45	20%	$271		$226	$45	$271		$271	2.8%	$232	$46	$279
31	CONSTRUCTION MANAGEMENT	$146	$32	22%	$178		$146	$32	$178		$178	2.8%	$150	$33	$183
	PROJECT COST TOTALS:	$1,382	$390	28%	$1,772		$1,382	$390	$1,772		**$1,772**	3.9%	$1,435	$406	$1,841

CHIEF, COST ENGINEERING, Stephen Roman

PROJECT MANAGER, Jason Glazener

CHIEF, REAL ESTATE, XXX

CHIEF, PLANNING, XXX

CHIEF, ENGINEERING, XXX

CHIEF, OPERATIONS, XXX

CHIEF, CONSTRUCTION, XXX

CHIEF, CONTRACTING, XXX

CHIEF, PM-PB, xxxx

CHIEF, DPM, XXX

ESTIMATED TOTAL PROJECT COST:		**$1,841**
ESTIMATED FEDERAL COST:	**65%**	$1,196
ESTIMATED NON-FEDERAL COST:	**35%**	$644
22 - FEASIBILITY STUDY (CAP studies):		**$150**
ESTIMATED FEDERAL COST:	83%	$125
ESTIMATED NON-FEDERAL COST:	17%	$25
ESTIMATED FEDERAL COST OF PROJECT		**$1,321**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Greenville Utilities Bank Stabilization
LOCATION: Greenville,NC
This Estimate reflects the scope and schedule in report; Feasibility_EA_Integrated_Rpt_DRAFT_ATR_ 093022

DISTRICT: Wilmington District
POC: CHIEF, COST ENGINEERING, Stephen Roman

PREPARED: 9/28/2022

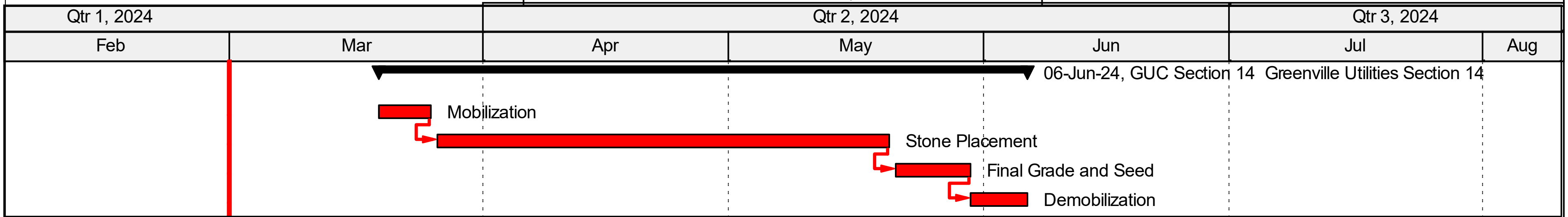
WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 27-Jun-22				Program Year (Budget EC): 2023								
		Estimate Price Level: 1-Oct-22				Effective Price Level Date: 1 -Oct-22								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1 or CONTRACT 1													
16	BANK STABILIZATION	$1,008	$312	31.0%	$1,320		$1,008	$312	$1,320	2024Q3	4.2%	$1,050	$326	$1,376
	CONSTRUCTION ESTIMATE TOTALS:	$1,008	$312	31.0%	$1,320		$1,008	$312	$1,320			$1,050	$326	$1,376
01	LANDS AND DAMAGES	$2	$1	25.0%	$3		$2	$1	$3	2024Q3	4.2%	$2	$1	$3
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$25	$5	20.0%	$30		$25	$5	$30	2024Q1	2.8%	$26	$5	$31
1.0%	Planning & Environmental Compliance	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
10.0%	Engineering & Design	$101	$20	20.0%	$121		$101	$20	$121	2024Q1	2.8%	$104	$21	$125
1.0%	Reviews, ATRs, IEPRs, VE	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
1.0%	Life Cycle Updates (cost, schedule, risks)	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
1.0%	Contracting & Reprographics	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
2.0%	Engineering During Construction	$20	$4	20.0%	$24		$20	$4	$24	2024Q1	2.8%	$21	$4	$25
2.0%	Planning During Construction	$20	$4	20.0%	$24		$20	$4	$24	2024Q1	2.8%	$21	$4	$25
1.0%	Adaptive Management & Monitoring	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
1.0%	Project Operations	$10	$2	20.0%	$12		$10	$2	$12	2024Q1	2.8%	$10	$2	$12
31	CONSTRUCTION MANAGEMENT													
10.0%	Construction Management	$101	$22	22.0%	$123		$101	$22	$123	2024Q1	2.8%	$104	$23	$127
2.0%	Project Operation:	$20	$4	22.0%	$24		$20	$4	$24	2024Q1	2.8%	$21	$5	$25
2.5%	Project Management	$25	$6	22.0%	$31		$25	$6	$31	2024Q1	2.8%	$26	$6	$31
	CONTRACT COST TOTALS:	$1,382	$390		$1,772		$1,382	$390	**$1,772**			$1,435	$406	**$1,841**

Construction Schedule

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish	Total Float	Qtr 1, 2024 Jan
GUC Section 14	Greenville Utilities Section 14	58	58	0%	19-Mar-24	06-Jun-24	0	
A1000	Mobilization	5	5	0%	19-Mar-24*	25-Mar-24	0	
A1010	Stone Placement	40	40	0%	26-Mar-24	20-May-24	0	
A1020	Final Grade and Seed	8	8	0%	21-May-24	30-May-24	0	
A1030	Demobilization	5	5	0%	30-May-24	06-Jun-24	0	

Actual Level of Effort
Remaining Work
Actual Work
Critical Remainin...

TASK filter: All Activities



Actual Level of Effort
Actual Work
Remaining Work
Critical Remainin...

TASK filter: All Activities

Cost Certification

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW CERTIFICATION STATEMENT

For Project No. 495966

SAW – Greenville Utilities Commission Section 14
Emergency Streambank and Shoreline Erosion

The Greenville Utilities Commission Section 14 – Emergency Streambank and Shoreline Erosion as presented by Wilmington District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of October 20, 2022, the Cost MCX certifies the estimated total project cost:

FY23 Project First Cost:	$1,772,000
Fully Funded Total Project Cost:	$1,841,000
Federal Cost of Project:	$1,321,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.

2022.10.20
15:53:28 -07'00'

Michael P. Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District

®

Appendix D

USFWS IPaC Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To: September 08, 2022
Project Code: 2022-0083530
Project Name: GREENVILLE UTILITIES COMMISSION, EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). If your project area contains suitable habitat for any of the federally-listed species on this species list, the proposed action has the potential to adversely affect those species. If suitable habitat is present, surveys should be conducted to determine the species' presence or absence within the project area. The use of this species list and/or North Carolina Natural Heritage program data should not be substituted for actual field surveys.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- Migratory Birds
- Marine Mammals

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

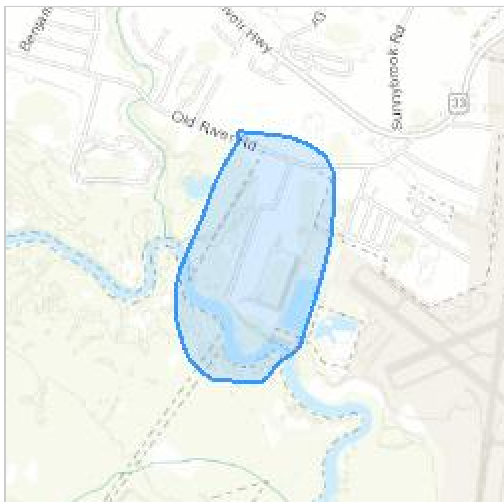
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Project Code:	2022-0083530
Project Name:	GREENVILLE UTILITIES COMMISSION, EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT
Project Type:	Water Supply Pipeline - Maintenance/Modification - Above Ground
Project Description:	Repair and stabilization of the riverbank at the water intakes on the Tar River is needed to prevent potential collapse of the riverbank and damage to the water intake pipes and intake structure and prevent loss of water supply. The current condition the riverbank is too unstable to allow safe access to maintenance equipment to clear debris and sediment from the water intakes.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@35.6388479,-77.39973705631249,14z



Counties: Pitt County, North Carolina

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. The location of the critical habitat is not available. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Reptiles

NAME	STATUS
American Alligator *Alligator mississippiensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/776	Similarity of Appearance (Threatened)

Amphibians

NAME	STATUS
Neuse River Waterdog *Necturus lewisi* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6772	Threatened

Clams

NAME	STATUS
Atlantic Pigtoe *Fusconaia masoni* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5164	Threatened
Tar River Spinymussel *Parvaspina steinstansana* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1392	Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Neuse River Waterdog *Necturus lewisi* https://ecos.fws.gov/ecp/species/6772#crithab	Final

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Kestrel *Falco sparverius paulus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9587	Breeds Apr 1 to Aug 31
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31

NAME	BREEDING SEASON
Brown-headed Nuthatch *Sitta pusilla* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Jul 15
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 26 to Jul 20
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no

data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Marine Mammals

Marine mammals are protected under the Marine Mammal Protection Act. Some are also protected under the Endangered Species Act[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries[3] [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the Marine Mammals page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

---

1. The Endangered Species Act (ESA) of 1973.
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
3. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

West Indian Manatee *Trichechus manatus*
Species profile: https://ecos.fws.gov/ecp/species/4469

IPaC User Contact Information

Agency: Army Corps of Engineers
Name: Justin Bashaw
Address: 69 Darlington Avenue
City: Wilmington
State: NC
Zip: 28403
Email justin.p.bashaw@usace.army.mil
Phone: 9102514581

Appendix E

USFWS Guidelines for Avoiding Impacts to the West Indian Manatee

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

GUIDELINES FOR AVOIDING IMPACTS TO THE WEST INDIAN MANATEE

Precautionary Measures for Construction Activities in North Carolina Waters

The West Indian manatee (*Trichechus manatus*), also known as the Florida manatee, is a Federally-listed endangered aquatic mammal protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) and the Marine Mammal Protection Act of 1972, as amended (16 U.S.C 1461 *et seq.*). The manatee is also listed as endangered under the North Carolina Endangered Species Act of 1987 (Article 25 of Chapter 113 of the General Statutes). The U.S. Fish and Wildlife Service (Service) is the lead Federal agency responsible for the protection and recovery of the West Indian manatee under the provisions of the Endangered Species Act.

Adult manatees average 10 feet long and weigh about 2,200 pounds, although some individuals have been recorded at lengths greater than 13 feet and weighing as much as 3,500 pounds. Manatees are commonly found in fresh, brackish, or marine water habitats, including shallow coastal bays, lagoons, estuaries, and inland rivers of varying salinity extremes. Manatees spend much of their time underwater or partly submerged, making them difficult to detect even in shallow water. While the manatee's principal stronghold in the United States is Florida, the species is considered a seasonal inhabitant of North Carolina with most occurrences reported from June through October.

To protect manatees in North Carolina, the Service's Raleigh Field Office has prepared precautionary measures for general construction activities in waters used by the species. Implementation of these measures will allow in-water projects which do not require blasting to proceed without adverse impacts to manatees. In addition, inclusion of these guidelines as conservation measures in a Biological Assessment or Biological Evaluation, or as part of the determination of impacts on the manatee in an environmental document prepared pursuant to the National Environmental Policy Act, will expedite the Service's review of the document for the fulfillment of requirements under Section 7 of the Endangered Species Act. These measures include:

1 The project manager and/or contractor will inform all personnel associated with the project that manatees may be present in the project area, and the need to avoid any harm to these endangered mammals. The project manager will ensure that all construction personnel know the general appearance of the species and their habit of moving about completely or partially submerged in shallow water. All construction personnel will be informed that they are responsible for observing water-related activities for the presence of manatees.

2. The project manager and/or the contractor will advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act and the Endangered Species Act.

3. If a manatee is seen within 100 yards of the active construction and/or dredging operation or vessel movement, all appropriate precautions will be implemented to ensure protection of the manatee. These precautions will include the immediate shutdown of moving equipment if a manatee comes within 50 feet of the operational area of the equipment. Activities will not resume until the manatee has departed the project area on its own volition (i.e., it may not be herded or harassed from the area).

4. Any collision with and/or injury to a manatee will be reported immediately. The report must be made to the U.S. Fish and Wildlife Service (ph. 919-856-4520), the National Marine Fisheries Service (ph. 252-728-8762), and the North Carolina Wildlife Resources Commission (ph. 252-448-1546).

5. A sign will be posted in all vessels associated with the project where it is clearly visible to the vessel operator. The sign should state:

> CAUTION: The endangered manatee may occur in these waters during the warmer months, primarily from June through October. Idle speed is required if operating this vessel in shallow water during these months. All equipment must be shut down if a manatee comes within 50 feet of the vessel or operating equipment. A collision with and/or injury to the manatee must be reported immediately to the U.S. Fish and Wildlife Service (919-856-4520), the National Marine Fisheries Service (252-728-8762), and the North Carolina Wildlife Resources Commission (252-448-1546).

6. The contractor will maintain a log detailing sightings, collisions, and/or injuries to manatees during project activities. Upon completion of the action, the project manager will prepare a report which summarizes all information on manatees encountered and submit the report to the Service's Raleigh Field Office.

7. All vessels associated with the construction project will operate at "no wake/idle" speeds at all times while in water where the draft of the vessel provides less than a four foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

8. If siltation barriers must be placed in shallow water, these barriers will be: (a) made of material in which manatees cannot become entangled; (b) secured in a manner that they cannot break free and entangle manatees; and, (c) regularly monitored to ensure that manatees have not become entangled. Barriers will be placed in a manner to allow manatees entry to or exit from essential habitat.

Prepared by (rev. 02/2017):
U.S. Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726
919/856-4520

Figure 1. The whole body of the West Indian manatee may be visible in clear water; but in the dark and muddy waters of coastal North Carolina, one normally sees only a small part of the head when the manatee raises its nose to breathe.

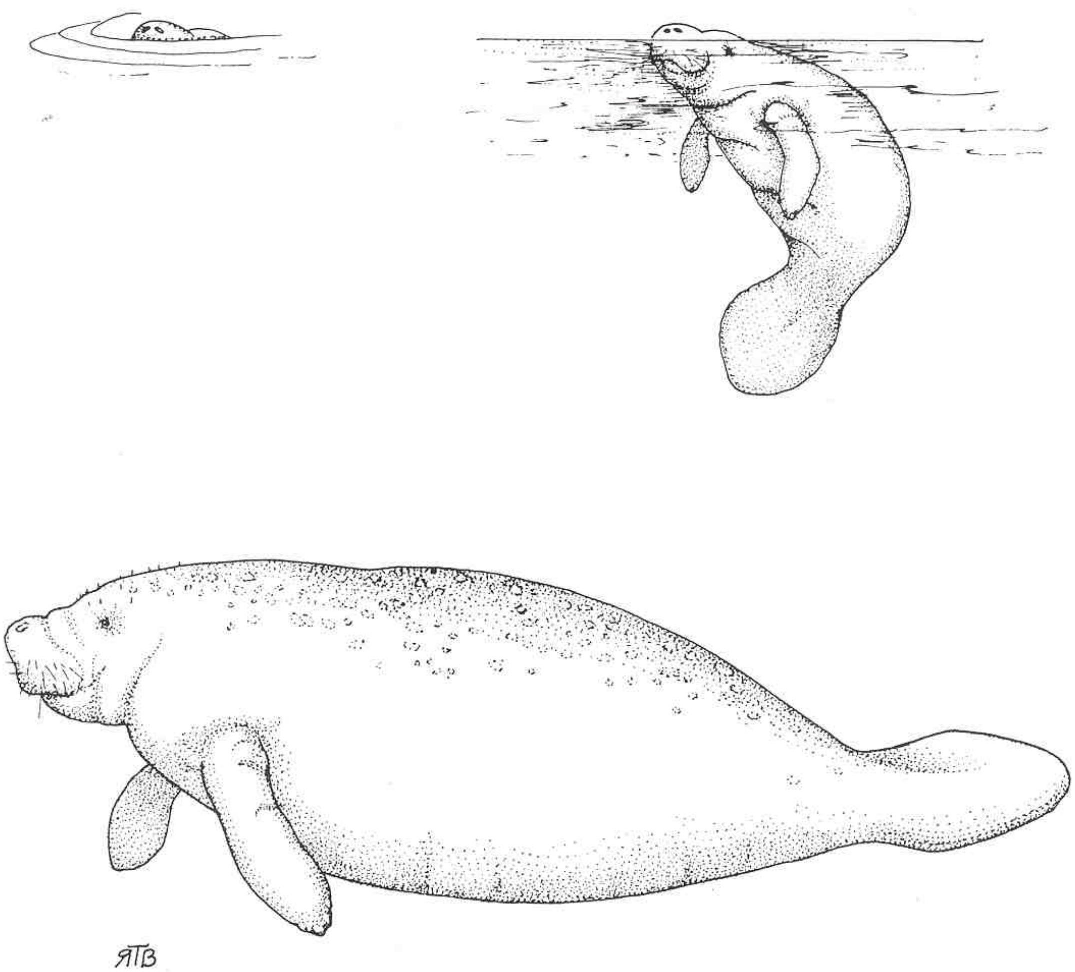


Illustration used with the permission of the North Carolina State Museum of Natural Sciences.

Source: Clark, M. K. 1987. Endangered, Threatened, and Rare Fauna of North Carolina: Part I. A re-evaluation of the mammals. Occasional Papers of the North Carolina Biological Survey 1987-3. North Carolina State Museum of Natural Sciences. Raleigh, NC. pp. 52.

Appendix F

Real Estate

REAL ESTATE SUMMARY

Table of Contents

Figures:

Tables:

SECTION 1. THE REAL ESTATE REPORT

1.1 Statement of Purpose

The Real Estate Appendix is intended to support the Detailed Project Report and Environmental Assessment, Greenville Utility Commission, NC Section 14 Emergency Streambank and Shoreline Protection Project. The author of this report is familiar with the Project area. The Greenville Utility Commission is the non-Federal sponsor (NFS) for the project. This report is tentative in nature, focused on the Tentatively Selected Plan (TSP) and is to be used for planning purposes only. All real estate requirements identified in the report are subject to change pending the completion of the final plans and specifications. As of the release date of the draft report, no coordination with the NFS has taken place with regards to the real estate requirements described in this report. The date of this draft report is 1 March 2023.

1.2 Study Authority

The proposed project, protection of a municipal drinking water intake system, is located within and adjacent to the Tar River in the City of Greenville, North Carolina (Figure 1.1) and is being pursued under the authority of Section 14 of the Flood Control Act of 1946 (PL 79-526), as amended, for emergency streambank and shoreline erosion protection for public facilities and services. Applicable paragraph(s) used to determine eligibility in U.S. Army Corps of Engineers (USACE) Engineering Pamphlet (EP) 1105-2-58: paragraph 29(a) states "This program is designed to implement projects to protect public facilities and facilities owned by non-profit organizations that are used to provide public services that are open to all on equal terms. These facilities must have been properly maintained but be in imminent threat of damage or failure by natural erosion processes on stream banks and shorelines and are essential and important enough to merit Federal participation in their protection." The subject drinking water intake system is a key element of the regions drinking water operations, is an essential public service to over 140,000 citizens (GUC 2022) and is maintained as such. The Greenville Utilities Commission (GUC) water treatment plant is not a federal facility or a private property. It is under imminent threat of damage or failure from continuing shoreline erosion at the site, and therefore qualifies under the Section 14 program.

Section 14 is under the Continuing Authorities Program (CAP), which focuses on water resource-related projects of relatively smaller scope, cost and complexity than USACE projects conducted under the General Investigations program. The Continuing Authorities Program is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization. Additional information on this program can be found in USACE 2019, Engineer Pamphlet (EP) 1105-2-58.

1.3 Project Location

The study area is located near the City of Greenville, North Carolina. Greenville is located in Pitt County in eastern NC and has a population of approximately 90,000. The service area of the endangered facility includes both Pitt and Greene counties. The facility is located along the Tar River, approximately 3 miles upstream from the City of

Greenville (Figure 1.3-1). The water treatment plant's water intake infrastructure is located within the left bank or northern side of the river, as shown in Figure 3-2.

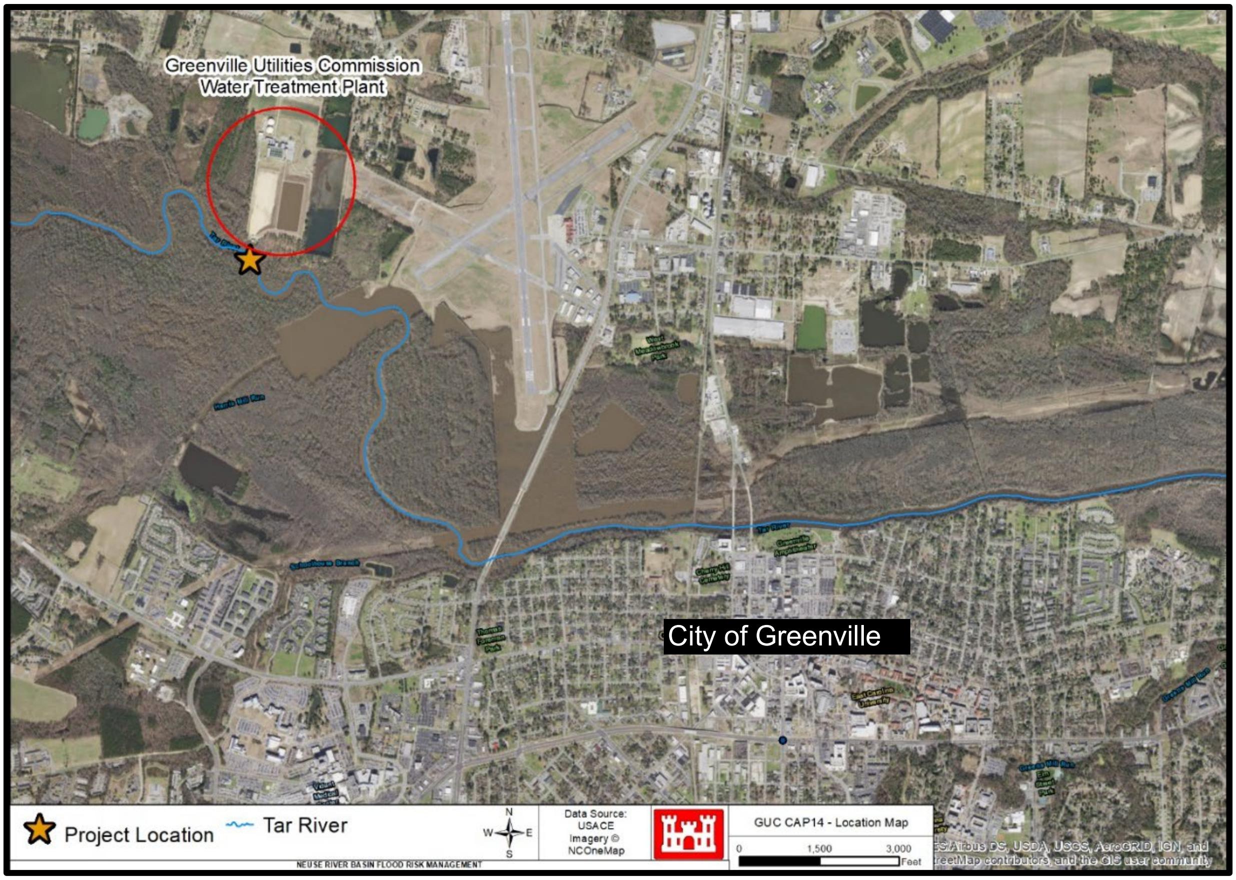


Figure 1.3-1. Location of Project Site in relation to the City of Greenville, NC

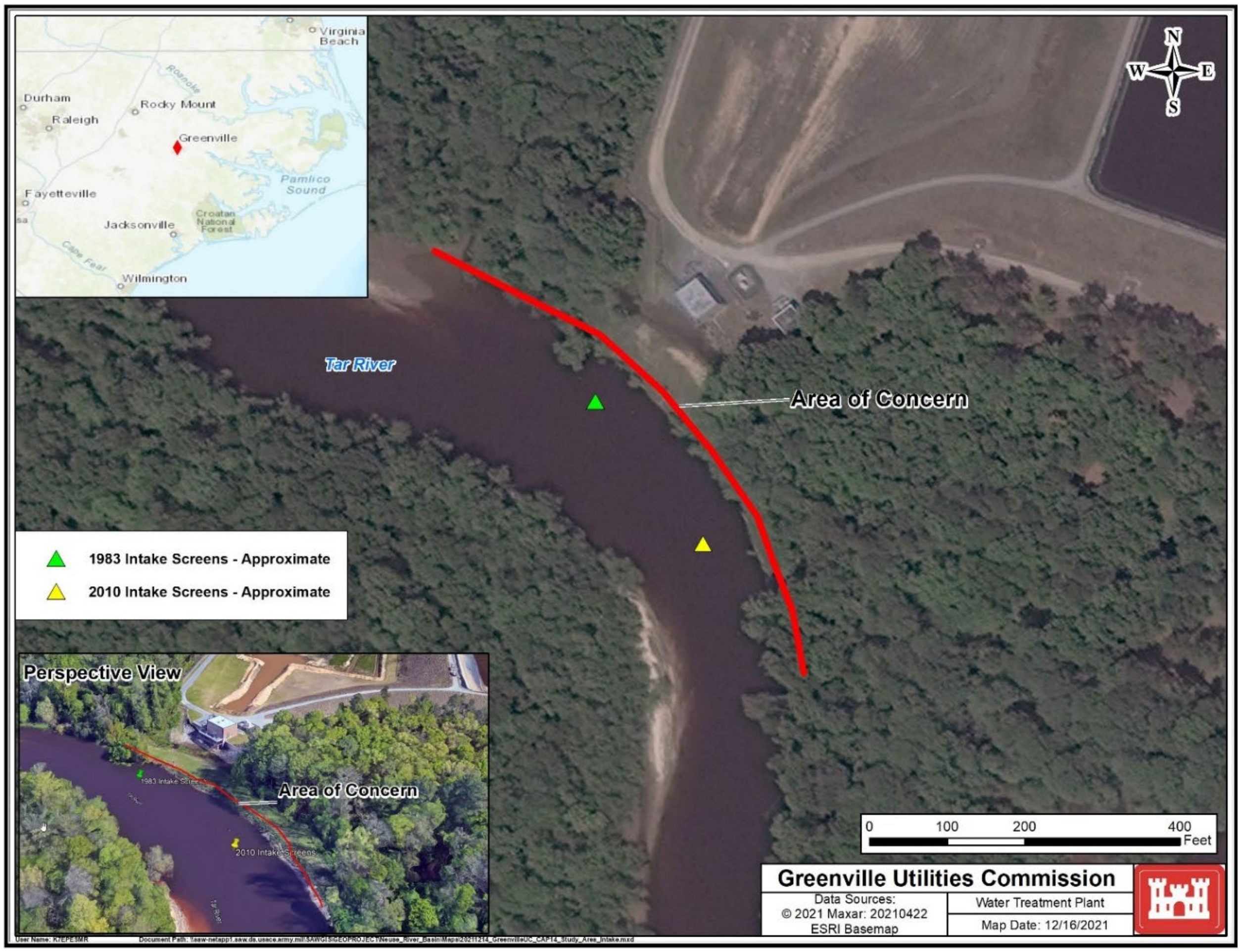


Figure 1.3-2. Location of Endangered Critical Public Facility

1.4 Project Description

The Tentative Selected Plan will provide stabilization with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet of streambank. The riprap will tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built up revetment protecting the toe. The existing streambank and surrounding area would be cleared of vegetation and old erosion protection measures. The cleared material will be taken offsite to an approved disposal facility. Above the ordinary high water line, backfill material consisting of satisfactory fill (earth) material would be placed on the existing cleared streambank, graded to a 2H:lV slope, and then compacted as required for placement of the streambank slope protection. These new backfill materials used for grading will be in accordance with the Unified Soil Classification System ASTM D2487 and will be free from roots and other organic matter, trash, debris, frozen material, and stones larger than 3 inches in any dimension. Once the foundation material is in place, the streambank will be covered with slope protection measures that consist of a 1’ layer of bedding stone (NCDOT #57 stone) and a 25.5" thick layer of NCDOT Class I riprap placed over a layer of geotextile and graded fill slope. Below the ordinary high water line, backfill material consisting of NCDOT #57 stone would be placed over a geotextile layer, and compacted as required to provide a smooth sloped surface for the placement of the stone protection. A toe protection revetment will be built up along the toe of the stream bottom. Riprap placement would cover 0.25 acres of upland area and 0.25 acres of benthic habitat (i.e., submerged bank and river bottom). In total, riprap placement would cover 0.5 acres. The design will accommodate flow vanes which already exist adjacent to the construction area. Materials staging and construction would take place in previously disturbed areas. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. Estimated construction time is 4-6 months. A typical cross section is shown in figure 1.4-1. A plan view of the Tentatively Selected Plan is shown in figure 1.4-2.

Civil/Site Description: Access to the project site is currently via an access road through sponsor owned lands that runs the length of the project. Materials staging would take place in the open areas at the top of the embankment as directed by the facility. Construction access is available via the existing access road. The project site is located on the embankment of the Tar River downstream of the intake. Currently this site has an articulated block system that has failed due to undermining. Additionally there are flow weirs in the channel along the bank that must be incorporated into the design. A Type 2 DOT Turbidity Curtain will be installed during in-water material placement and a silt fence will be installed on the upland perimeter of the construction activities and along most improved access roads. Post construction landscaping to restore disturbed areas and fill slopes is estimated to be approximately 0.3 acre.

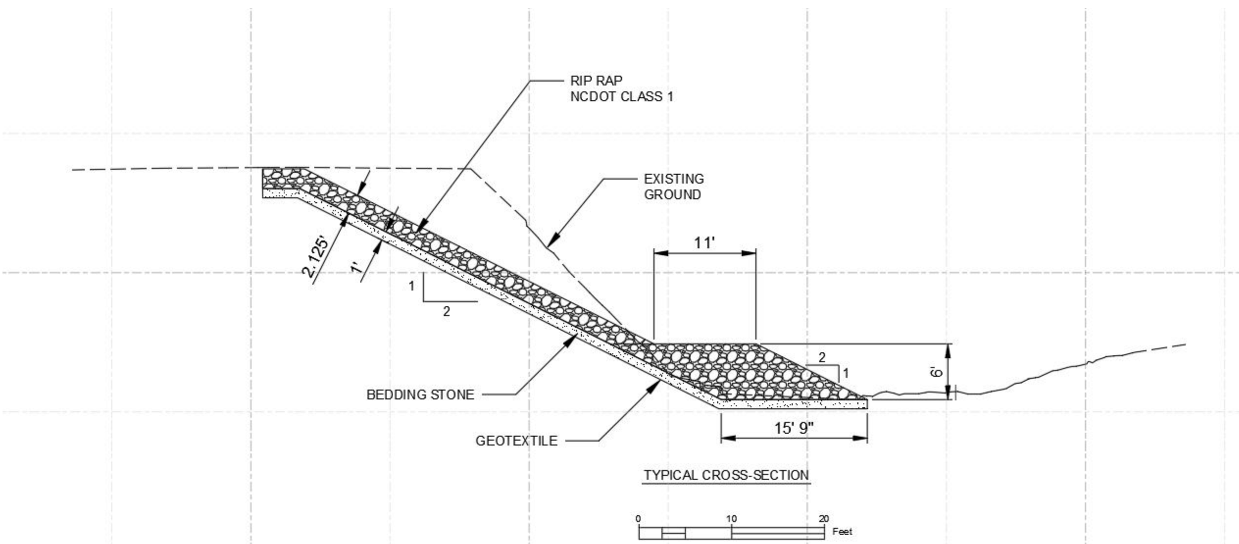


Figure 1.4-1. Typical cross section of Recommended Plan

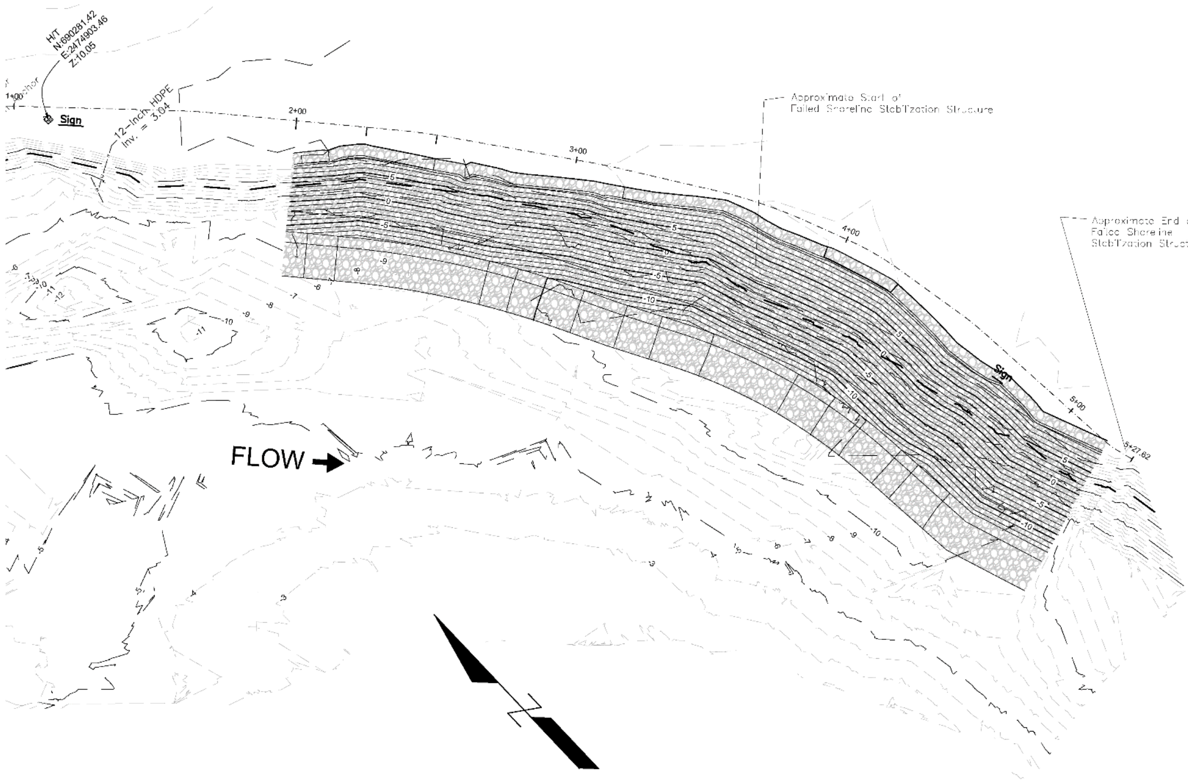


Figure 1.4-2. Footprint of Tentatively Selected Plan

1.6 Utility/Facility Relocation

There are no known utility/facility relocations associated with the project at this time.

1.7 Existing Projects

There are no known existing Federal Projects located within the study area.

1.8 Project Sponsor Responsibilities and Capabilities

All lands required for the project are owned by the NFS. Should it be determined that additional lands are need during the design phase, the appropriate estate will be identified by USACE and acquired by the NFS. The NFS will be required to provide the Authorization for Entry for Construction and the Attorneys Certificate of Authority shown at Exhibit A prior to advertisement of the project.

1.9 Federally Owned Lands

There are no known federally owned lands within the footprint of the project.

1.10 Non-Federal Sponsor Owned Lands

All lands required for the project are owned by the NFS. Therefore, in accordance with ER 405-1-12, 12-38,e and ER 1105-2-100, Appendix F, the NFS will not receive credit for the value of land owned by the NFS that are part of the tract of land on which the facility or structure to be protected is located, if such tract is owned by the NFS or the owner of the facility or structure on the date that the PPA is executed.

1.11 Historical Significance

As of the date of this report, no historically significant properties have been identified. More detailed information on historically significant properties will be addressed in Appendix H to the main report.

1.12 Mineral & Timber Rights

There are no known mineral or timber rights located within the scope of the proposed project. Based on the type of work being proposed, there would be no impact to existing mineral or timber rights should they be identified during the design phase.

1.13 Hazardous, Toxic, and Radioactive Waste (HTRW)

There are no known HTRW contaminants located within the project area as of the date of this report. During the design phase, a Phase I Environmental Site Assessment (ESA) and asbestos investigation will be conducted to confirm the absence of HTRW and damaged or friable asbestos or asbestos-containing materials, and, if warranted, additional HTRW investigations and a Phase II ESA will be conducted at the property. Should the presence of HTRW be discovered, the property owner shall be obligated, at his sole cost and expense, to conduct all necessary response and remedial activities in full compliance with applicable local, state, and federal laws and regulations and provide proof of same before the property can be deemed to have met the eligibility requirements.

1.14 Navigation Servitude

The use of Navigational Servitude does not apply to this project.

1.15 Zoning Ordinances

Zoning ordinances are not of issue with this project. Application or enactment of zoning ordinances is not to be used in lieu of acquisition.

1.16 Induced Flooding

There will be no induced flooding caused by the proposed project.

1.17 Mitigation

Mitigation, monitoring, or adaptive management will not be required for implementation of the proposed action. Should the need for mitigation be revised during the design phase, a Mitigation Plan will be prepared, and all required real estate interest will be addressed at that time.

1.18 Public Law 91-646, Relocation Assistance Benefits

There are no PL 91-646 relocations required for this project.

1.19 Attitude of Property Owners

The lands required for this project are owned in fee by the NFS who is very much in favor of this project.

1.20 Acquisition Schedule

All lands required for this project are currently owned in fee by the NFS. Therefore, no acquisition schedule will be prepared. The Authorization for Entry for Construction and the Attorneys Certificate of Authority will be executed along with the cost share agreement.

1.21 Recommended Estates

All lands required for the project are owned by the NFS therefore there are no recommended estates required for the project.

1.22 Real Estate Cost Estimate

The estimated real estate cost for the project was prepared without consulting with the NFS. Cost shown are the estimated cost of performing all NFS responsibilities described in the implementation plan as well as any tenant relocation assistance required by P.L. 91-646 if any.

Table 1.20-1 Real Estate Cost Estimate

a. Lands				
	Fee			$ -
	Perp Easements	2.9 ac.		$ -
	Temp Easements			$ -
	Permit			$ -
b. Improvements				
	Residential			$ -
	Commercial			$ -
c. Mineral Rights				$ -
d. Damages				$ -
e. P. L. 91-646				$ -
f. Acquisition Cost - Admin				$ 2,000.00
	Federal	$ 500.00		
	Non-Federal		$ 1,500.00	
Sub-Total				$ 2,000.00
	25% contingencies			$ 500.00
TOTAL				$ 2,500.00

1.23 Real Estate Chart of Accounts

The cost estimate for all Federal and non-Federal real estate activities necessary for implementation of the project after completion of the feasibility study for land acquisition, construction, LERRD, and other items are coded as delineated in the Cost Work Breakdown Structure (CWBS). This real estate cost estimate is then incorporated into the Total Current Working Estimate utilizing the Microcomputer Aided Cost Engineering System (MCACES).

Table 1.21-1 Real Estate Chart of Accounts

01A	PROJECT PLANNING	FEDERAL	NON-FEDERAL	TOTALS
	Other			
	Project Cooperation Agreement	$ -	$ -	$ -
01AX	Contingencies (25%)	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -
01B	LANDS AND DAMAGES			
01B40	Acq/Review of PS	$ 500.00	$ -	$ 500.00
01B20	Acquisition by PS	$ -	$ 1,500.00	$ 1,500.00
01BX	Contingencies (25%)	$ 125.00	$ 375.00	$ 500.00
	Subtotal	$ 625.00	$ 1,875.00	$ 2,500.00
01H	AUDIT			
01H10	Real Estate Audit	$ -		$ -
01HX	Contingencies (15%)	$ -		$ -
	Subtotal	$ -		$ -
01R	REAL ESTATE LAND PAYMENTS			
01R1B	Land Payments by PS	**$ -**	$ -	$ -
01R2B	PL91-646 Relocation Pymt by PS	$ -	$ -	$ -
01R2D	Review of PS	$ -	$ -	$ -
01RX	Contingencies (25%)	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -
	TOTALS	**$ 625.00**	**$ 1,875.00**	**$ 2,500.00**

This Real Estate Appendix has been prepared in accordance with policy and guidance set forth in

ER 405-1-12, Chapter 12, Real Estate Planning and Acquisition Responsibilities for Civil Works Projects.

Reviewed by:

Ralph J. Werthmann
Chief, Real Estate Division
Savannah District

Exhibits

Exhibit A –Authorization for Entry for Construction/Attorneys Certificate of Authority

Exhibit A

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I ____________________________, ______________________ for the
(Name of accountable official) (Title)

(Sponsor Name)_______________, do hereby certify that the (Sponsor Name) has acquired the real property interest required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction for (Project Name, Specifically identified project features, etc.). Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon _____(Tract Numbers)_________to construct (Project Name, Specifically identified project features, etc.) as set forth in the plans and specifications held in the U. S. Army Corps of Engineers' (district, city, state)

WITNESS my signature as ____________________________ for the
(Title)

(Sponsor Name)_______________ this __day of ___________, 20___.

BY: ______________________
(Name)
(Title)

ATTORNEY'S CERTIFICATE OF AUTHORITY

I, _____________________ , _____________________ for the
(Name) (Title of legal officer)

(Sponsor Name), certify that ___________________________ has
(Name of accountable official)

authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as ______________________ for the
(Title)

(Sponsor Name), this___________day of________________, 20____.

BY: ______________________
(Name)
(Title)

Appendix G

404(b)(1) Guidelines Analysis

GREENVILLE UTILITIES COMMISSION, NC

SECTION 14 EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT

PITT COUNTY, NORTH CAROLINA

Evaluation of Section 404 (b) (1) Guidelines 40 CFR 230

This evaluation covers the placement of all fill material into waters of the United States required for construction of a riprap revetment to replace the existing, failing, articulated concrete block armor along the Tar River bank abutting Grenville Utilities Commission property in Pitt County, North Carolina. The proposed project will stabilize the bank and protect critical water supply infrastructure. All required Section 401 Water Quality Certificates from the NC Division of Water Resources have been obtained for the project and all conditions/restrictions will be complied with.

Section 404 Public Notice No. CESAW-TS-PE-

	Preliminary 1/	Final 2/
1. Review of Compliance (230.10(a)-(d))		
A review of the NEPA Document indicates that:		
a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and NEPA document);	YES ☒ NO☐	YES ☒ NO☐
b. The activity does not: 1) violate applicable State water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of federally listed endangered or threatened species or their habitat; and 3) violate requirements of any federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);	YES☒ NO☐*	YES☒ NO☐
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2);	YES☒ NO☐	YES☒ NO☐
d Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5).	YES☒ NO☐*	YES☒ NO☐

Proceed to Section 2

2. Technical Evaluation Factors (Subparts C-F)

a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

	N/A	**Not Significant**	**Significant**
(1) Substrate impacts.		X	
(2) Suspended particulates/turbidity impacts		X	
(3) Water column impacts.		X	
(4) Alteration of current patterns and water circulation.		X	
(5) Alteration of normal water fluctuations/hydroperiod.		X	
(6) Alteration of salinity gradients.		X	

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)

	N/A	**Not Significant**	**Significant**
(1) Effect on threatened/endangered species and their habitat.		X	
(2) Effect on the aquatic food web.		X	
(3) Effect on other wildlife (mammals birds, reptiles, and amphibians).		X	

c Special Aquatic Sites (Subpart E)

	N/A	**Not Significant**	**Significant**
(1) Sanctuaries and refuges.	NA		
(2) Wetlands.	NA		
(3) Mud flats.	NA		
(4) Vegetated shallows.	NA		
(5) Coral reefs.	NA		
(6) Riffle and pool complexes.	NA		

d. Human Use Characteristics (Subpart F)

	N/A	**Not Significant**	**Significant**
(1) Effects on municipal and private water supplies.	NA		
(2) Recreational and commercial fisheries impacts		X	
(3) Effects on water-related recreation.		X	
(4) Aesthetic impacts.		X	
(5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.	NA		

Proceed to Section 3

3. Evaluation of Dredged or Fill Material (Subpart G) 3/

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

(1) Physical characteristics ☒

(2) Hydrography in relation to known or anticipated sources of contaminants ☒

(3) Results from previous testing of the material or similar material in the vicinity of the project ☒

(4) Known, significant sources of persistent pesticides from land runoff or percolation ☐

(5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances ☐

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources ☒

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities ☐

(8) Other sources (specify). ☐

List appropriate references.

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to result in degradation of the disposal site.** YES ☒ NO☐*

Proceed to Section 4

4. Disposal Site Determinations (230.11(f)).

a. The following factors as appropriate, have been considered in evaluating the disposal site.

(1) Depth of water at disposal site. ☒

(2) Current velocity, direction, and variability at disposal site ☒

(3) Degree of turbulence. ☒

(4) Water column stratification ☒

(5) Discharge vessel speed and direction ☒

(6) Rate of discharge ☒

(7) Dredged material characteristics (constituents, amount and type of material, settling velocities). ☒

(8) Number of discharges per unit of time. ☒

(9) Other factors affecting rates and patterns of mixing (specify)

List appropriate references.

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable. YES ☒ NO ☐*

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77, to ensure minimal adverse effects of the proposed discharge. See Section 7 of the Environmental Assessment. YES ☒ NO ☐*

Return to section 1 for final stage of compliance review.

6. Factual Determinations (230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:

a. Physical substrate at the disposal site (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

b. Water circulation, fluctuation, and salinity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

d Contaminant availability (review sections 2a, 3, and 4). YES ☒ NO ☐*

e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5). YES ☒ NO ☐*

f. Disposal site (review sections 2, 4, and 5). YES ☒ NO ☐*

g. Cumulative impact on the aquatic ecosystem. YES ☒ NO ☐*

h. Secondary impacts on the aquatic ecosystem. YES ☒ NO ☐*

7. Findings.

a.The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines. . . . . ☒

b.The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions:. . . . . ☐

c.The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reasons(s):

(1) There is a less damaging practicable alternative . . . . ☐

(2) The proposed discharge will result in significant degradation of the aquatic ecosystem . . . . ☐

(3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem. . . . . ☐

___________________________ Date: _____________________

Brad A. Morgan
COL, U.S. Army
District Commander

*A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects may not be evaluated using this "short form procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a-d, before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

Appendix H

Draft EA Public/Agency Comments and Responses

Table of Contents

1. Tribal Government Comments and Responses

Cherokee Nation Email Dated December 29, 2022

Cherokee Nation Comment 1: Many thanks for the review request. Greenville Utilities Commission Section 14 Emergency Streambank and Shoreline Erosion Protection Project. Pitt County, North Carolina is outside the Cherokee Nation's Area of Interest. Thus, this Office respectfully defers to federally recognized Tribes that have an interest in this land base at this time. There is no need to contact our Office for reviews in Pitt County, North Carolina.

USACE Response 1: Noted. The Cherokee Nation will not be contacted regarding reviews of USACE projects located in Pitt County, North Carolina.

From:	Kinsey Shade
To:	Bashaw, Justin P CIV USARMY CESAW (USA)
Subject:	[URL Verdict: Neutral][Non-DoD Source] RE: For Review/Comment - USACE Detailed Project Report and Environmental Assessment, Greenville Utilities Commission, NC Section 14 Emergency Streambank and Shoreline Erosion Protection Project
Date:	Thursday, December 29, 2022 5:33:52 PM

Good Afternoon, Mr. Bashaw:

Many thanks for the review request, *Greenville Utilities Commission Section 14 Emergency Streambank and Shoreline Erosion Protection Project*. Pitt County, North Carolina is outside the Cherokee Nation's Area of Interest. Thus, this Office respectfully defers to federally recognized Tribes that have an interest in this land base at this time. There is no need to contact our Office for reviews in Pitt County, North Carolina.

Thank you for the opportunity to comment upon this proposed undertaking. Please contact me if there are any questions or concerns.

Wado,

Kinsey Shade
Tribal Historic Preservation Office, Technician
Cherokee Nation Tribal Historic Preservation Office
P.O. Box 948
Tahlequah, OK 74465
(918)207-3947

From: Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>
Sent: Monday, November 28, 2022 2:29 PM
To: Elizabeth Toombs <elizabeth-toombs@cherokee.org>
Cc: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>; Owens, Jennifer L CIV USARMY CESAW (USA) <Jennifer.L.Owens@usace.army.mil>
Subject: <EXTERNAL> For Review/Comment - USACE Detailed Project Report and Environmental Assessment, Greenville Utilities Commission, NC Section 14 Emergency Streambank and Shoreline Erosion Protection Project

Good afternoon Ms. Toombs,

Please see the attached letter, which includes the Public Notice, requesting the Cherokee Nation of Oklahoma's review of the U. S. Army Corps of

Engineers, Wilmington District, Detailed Project Report and Environmental Assessment (DPR/EA), Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project, dated November 2022.

The DPR/EA is available on the USACE website at:
http://www.saw.usace.army.mil/Missions/Ecosystem-Restoration-CAP-Studies/

We would appreciate receiving any comments no later than 30 days from the date of this letter or by December 30, 2022. Please submit written comments to Justin Bashaw, at: Justin.P.Bashaw@usace.army.mil.

Best regards,

Jason Glazener
USACE Wilmington District
Planning and Environmental Branch
(910) 251-4910

2. Federal Agencies

National Marine Fisheries Service (NMFS) Protected Resources Division (PRD) Email Dated November 29, 2022

NMFS PRD Comment 1: Because you determined No Effect, Section 7 consultation is not necessary. NMFS does not concur with nor review "No Effect" determinations under Section 7 of the Endangered Species Act. You can find effect determination guidance for Section 7 of the ESA on our website here: Making a "No Effect" Determination. It would be prudent for you to document to your project files your rationale behind your No Effect determination. That way should you ever be questioned about your ESA responsibilities you will be able to share the rationale behind your determinations.

USACE Response 1: Section 7.11 of the final Environmental Assessment document the USACE's reasoning behind its no effect to Atlantic sturgeon determination.

NMFS PRD Comment 2: Consultation requests should be sent following our long-standing procedures for how to submit a consultation on our website: https://www.fisheries.noaa.gov/southeast/endangered-speciesconservation/esa-section-7-interagency-consultation-southeast-united-states. Sending consultation requests following the procedures ensures they will be received and routed in a timely manner and avoids situations where individual staff are unavailable to respond. Please send all consultation requests to this email address: nmfs.ser.esa.consultations@noaa.gov. Also, you will find a library of information about the ESA Section 7 Process on our Section 7 Guidance webpage.

USACE Response 2: Noted. Consultation with NMFS is not required for proposed action.

NMFS PRD Comment 3: Finally, we have been beta-testing a new GIS platform (Section 7 Mapper) to determine which species and critical habitat are in a proposed action area. The mapper has a built-in user guide that is helpful (on the right side of the landing page). Plotting the project location on this mapper shows that the project is located in Atlantic Sturgeon Critical Habitat. I don't recall seeing a determination for critical habitat, so you would need to consider that, before moving forward with your project.

USACE Response 3: The USACE has determined that the proposed action will have no effect on Atlantic Sturgeon critical habitat. This determination is included in Section 7.11 of the final Environmental Assessment.

From:	Karla Reece - NOAA Federal
To:	Bashaw, Justin P CIV USARMY CESAW (USA)
Cc:	Andrew Herndon; Melissa Alvarez - NOAA Federal
Subject:	[URL Verdict: Neutral][Non-DoD Source] Re: For Review/Comment - USACE Detailed Project Report and Environmental Assessment (DPR/EA), Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project
Date:	Tuesday, November 29, 2022 11:40:16 AM

Hello,
Your email was forwarded to me and I wanted to follow up with you on some ESA Section 7 information and guidance.

Because you determined No Effect, Section 7 consultation is not necessary. NMFS does not concur with nor review "No Effect" determinations under Section 7 of the Endangered Species Act. You can find effect determination guidance for Section 7 of the ESA on our website here: Making a "No Effect" Determination. It would be prudent for you to document to your project files your rationale behind your No Effect determination. That way should you ever be questioned about your ESA responsibilities you will be able to share the rationale behind your determinations.

Consultation requests should be sent following our long-standing procedures for how to submit a consultation on our website: https://www.fisheries.noaa.gov/southeast/endangered-species-conservation/esa-section-7-interagency-consultation-southeast-united-states. Sending consultation requests following the procedures ensures they will be received and routed in a timely manner and avoids situations where individual staff are unavailable to respond. Please send all consultation requests to this email address: nmfs.ser.esa.consultations@noaa.gov Also, you will find a library of information about the ESA Section 7 Process on our Section 7 Guidance webpage.

Finally, we have been beta-testing a new GIS platform (Section 7 Mapper) to determine which species and critical habitat are in a proposed action area. The mapper has a built-in user guide that is helpful (on the right side of the landing page). Plotting the project location on this mapper shows that the project is located in Atlantic Sturgeon Critical Habitat. I don't recall seeing a determination for critical habitat, so you would need to consider that, before moving forward with your project.

I have copied Andrew Herndon, our Atlantic Sturgeon Coordinator with this email. If you have sturgeon-specific questions, please reach out to him.

If you have any other questions please let me know.

Thank you,
Karla

><((((º>´¯`·.,,.><((((º>,.·´¯`·.,><((((º>´¯`·.,,..><((((º>

Karla Reece (**she/her**)
Acting Interagency Cooperation Branch Chief
Protected Resources Division
NOAA Southeast Regional Office
National Marine Fisheries Service
263 13th Ave S
St. Petersburg, FL 33701

karla.reece@noaa.gov

-------- Forwarded Message --------

Subject: For Review/Comment - USACE Detailed Project Report and Environmental Assessment (DPR/EA), Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project

Date: Mon, 28 Nov 2022 21:04:11 +0000

From: Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>

To: Bernhart, David <david.bernhart@noaa.gov>

CC: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>, Owens, Jennifer L CIV USARMY CESAW (USA) <Jennifer.L.Owens@usace.army.mil>

Good afternoon Mr. Bernhart,

Please see the attached letter, which includes the Public Notice, requesting NOAA's review of the U. S. Army Corps of Engineers, Wilmington District, Detailed Project Report and Environmental Assessment (DPR/EA), Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project, dated November 2022.

The DPR/EA is available on the USACE website at:
http://www.saw.usace.army.mil/Missions/Ecosystem-Restoration-CAP-Studies/

Included in the EA is our biological assessment and determination that the proposed project will have **no effect** on any federally listed threatened or endangered species in the project area. Of the known species under the purview of the National Marine Fisheries Service (NMFS), only the Atlantic Sturgeon may be present in the project area. To avoid potential impacts to Atlantic Sturgeon, an in-water work moratorium will be established between February 1 and September 30; therefore, the proposed project will have **no effect** on Atlantic Sturgeon.

We would appreciate receiving any comments no later than 30 days from the date of this letter or by December 30, 2022. Please submit written comments to Justin Bashaw, at: Justin.P.Bashaw@usace.army.mil.

Best regards,

Jason Glazener

USACE Wilmington District

Planning and Environmental Branch

(910) 251-4910

National Marine Fisheries Service (NMFS) Habitat Conservation Division (HCD) Letter Dated December 23, 2022

NMFS HCD Comment 1: We confirm the District's determination that the project would not affect essential fish habitat designated under the Magnuson-Stevens Fishery Conservation and Management Act.

USACE Response 1: Noted.

NMFS HCD Comment 2: Section 6.9 of the DRP/EA addresses fisheries resources and would benefit from expansion.

- While the report mentions surveys of fish communities in nearby streams by the NC Department of Environmental Quality, Division of Water Resources, the DRP/EA concludes reports summarizing results are unavailable. Data and reports are available at: https://deq.nc.gov/about/divisions/water-resources/water-sciences/biological-assessment-branch/fish-community-assessment-data.
- Information on fishes in this area of the Tar River can also be found in Tracy, B. H., F.C. Rohde, and G.M. Hogue (2020). An annotated atlas of the freshwater fishes of North Carolina. Southeastern Fishes Council Proceedings No. 60. 198pp. Available at: https://trace.tennessee.edu/sfcproceedings)/vol1/iss60/1

USACE Response 2: The link NMFS provides regarding NC Department of Environmental Quality, Division of Water Resources fish communities (https://deq.nc.gov/about/divisions/water-resources/water-sciences/biological-assessment-branch/fish-community-assessment-data) was consulted during development of the draft Environmental Assessment; however, data specifically informing the draft Environmental Assessment were found through the "NCDWR Wadable Streams Fish Community Assessments" interactive GIS viewer. As stated in the draft Environmental Assessment, Community Assessment data for stations OF57 and OF31 were not readily available; however, additional information found within the two links provided by NMFS has now been added to Sections 6.9 and 7.9 of the final Environmental Assessment to enhance discussion of fisheries resources in the project area.

NMFS HCD Comment 3: To avoid potential impacts to anadromous fishes, the DPR/EA proposes establishing an in-water work moratorium from February 1 through September 30. The NMFS concurs with this moratorium.

USACE Response 3: In consideration of effects to Atlantic Sturgeon potentially utilizing the project area, the USACE acknowledges an in-water work moratorium from February 1 through September 30 in Sections 5.1, 5.6, 7.9, and 7.11 of the final Environmental Assessment.

NMFS HCD Comment 4: Section 6.11 of the DRP/EA (Threatened and Endangered Species) states the tentatively selected plan will have no effect on Atlantic Sturgeon based on the in-water work moratorium. The DRP/EA then cites a source from the U.S. Fish and Wildlife Service to say constituent elements for Atlantic Sturgeon critical habitat are absent from the project area to support a conclusion of no destruction or adverse effects to designated critical habitat for Atlantic Sturgeon. Please note the NMFS has designated all of the Tar River from the mouth to Rocky Mount critical habitat for Atlantic Sturgeon. The tentative plan will cover 0.25 acres of river bottom with riprap. While the area is small and impacts should be minimal to sturgeon critical habitat, the District may want to consider this when making the effects determination in the final report.

USACE Response 4: The USACE maintains that the proposed action will have no effect on Atlantic sturgeon or associated critical habitat. As the NMFS concedes, the area is small and impacts should be minimal. The specific 0.25 acres of river bottom to be covered with riprap is in an area currently subjected to erosion and elevated turbidity during storm events and other high-water events, reducing its value as quality critical habitat.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

December 23, 2022 F/SER47:FR/pw

(Sent via Electronic Mail)

Colonel Benjamin A. Bennett, Commander
U.S. Army Corps of Engineers Wilmington District
69 Darlington Avenue
Wilmington, North Carolina 28403-1398

Attention: Justin P. Bashaw

Dear Colonel Bennett:

NOAA's National Marine Fisheries Service (NMFS) reviewed the District's letter dated November 30, 2022, and the accompanying *Detailed Project Report and Environmental Assessment (DPR/EA), Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project, November 2022* (DPR/EA). The proposed action would stabilize an eroding bank of the Tar River with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet. Existing streambank erosion threatens the city's water supply. The riprap would tie into the top of the existing embankment and cover the streambank down to the channel bottom. We confirm the District's determination that the project would not affect essential fish habitat designated under the Magnuson-Stevens Fishery Conservation and Management Act. As the nation's federal trustee for the conservation and management of marine, estuarine, and diadromous fishery resources, the NMFS provides the following comments pursuant to the authorities of the Fish and Wildlife Coordination Act.

Section 6.9 of the DRP/EA addresses fisheries resources and would benefit from expansion.

- While the report mentions surveys of fish communities in nearby streams by the NC Department of Environmental Quality, Division of Water Resources, the DRP/EA concludes reports summarizing results are unavailable. Data and reports are available at: https://deq.nc.gov/about/divisions/water-resources/water-sciences/biological-assessment-branch/fish-community-assessment-data.
- Information on fishes in this area of the Tar River can also be found in Tracy, B. H., F.C. Rohde, and G.M. Hogue (2020). An annotated atlas of the freshwater fishes of North Carolina. Southeastern Fishes Council Proceedings No. 60. 198pp. Available at: https://trace.tennessee.edu/sfcproceedings)/vol1/iss60/1

To avoid potential impacts to anadromous fishes, the DPR/EA proposes establishing an in-water work moratorium from February 1 through September 30. The NMFS concurs with this moratorium.

Section 6.11 of the DRP/EA (Threatened and Endangered Species) states the tentatively selected plan will have no effect on Atlantic Sturgeon based on the in-water work moratorium. The

DRP/EA then cites a source from the U.S. Fish and Wildlife Service to say constituent elements for Atlantic Sturgeon critical habitat are absent from the project area to support a conclusion of no destruction or adverse effects to designated critical habitat for Atlantic Sturgeon[1]. Please note the NMFS has designated all of the Tar River from the mouth to Rocky Mount critical habitat for Atlantic Sturgeon. The tentative plan will cover 0.25 acres of river bottom with riprap. While the area is small and impacts should be minimal to sturgeon critical habitat, the District may want to consider this when making the effects determination in the final report.

Thank you for the opportunity to provide these comments. Please direct related questions or comments to the attention of Mr. Fritz Rohde at our Beaufort Field Office, 101 Pivers Island Road, Beaufort, North Carolina 28516-9722, or at Fritz.Rohde@noaa.gov.

Sincerely,

/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc: COE, Justin.P.Bashaw@usace.army.mil
NCDMF, Anne.Deaton@ncdenr.gov
NCDCM, Gregg.Bodnar@ncdenr.gov
NCDCM, Daniel.Govoni@ncdenr.gov
EPA, Bowers.Todd@epa.gov
USFWS, Pete_Benjamin@fws.gov, Kathryn_Matthews@fws.gov
F/SER47, Fritz.Rohde@noaa.gov

[1] The cited document appears to be about Gulf Sturgeon in Louisiana, and the listed URL was not accessible on December 21, 2022.

U.S. Fish and Wildlife Service (USFWS) Email Dated December 19, 2022

USFWS Comment 1: The river should be surveyed 100m upstream of the project to 300m downstream of the project [for freshwater mussels by a qualified surveyor].

USACE Response 1: Concur. The survey requirements have been added to the final report. Section 7.11 of the final Environmental Assessment states that prior to construction, the USACE will conduct a freshwater mollusk survey using a qualified and properly credentialled individual to assess relative abundance in the project area. The survey will be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when mollusks are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and North Carolina Wildlife Resources Commission. Should the USFWS deem it necessary following interpretation of survey results, mollusks will be relocated outside of the project area prior to construction activities.

From: Ellis, John
To: Bashaw, Justin P CIV USARMY CESAW (USA); Dunn, Maria T.
Cc: Glazener, Jason S CIV USARMY CESAW (USA)
Subject: [URL Verdict: Neutral][Non-DoD Source] Re: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information
Date: Monday, December 19, 2022 5:04:33 PM

Justin,

The river should be surveyed from 100 m upstream of the project to 300 m downstream of the project. I saw you have contacted Maria about a list of permitted folks to do the surveys. As far as protocols, those folks have lots of experience and know what is required.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Friday, December 16, 2022 8:38 AM
To: Ellis, John <john_ellis@fws.gov>
Cc: Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>
Subject: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Good morning, John.

Thanks for speaking with me last Friday about USACE's bank protection project on the Tar River in Greenville, NC, at the Greenville Utilities Commission's property.

One point we discussed was the need to conduct bivalve surveys in the project area during warmer months between May-October. Survey results would be shared with your office for interpretation and direction (i.e., possible relocations) before any construction occurred. To help planning on my end, can you address the two items?

- The USACE's project will be located on the northeast bank of the Tar River and will extend 305 linear feet. **What footprint should the bivalve survey cover** (i.e., how far into the river channel, how far upstream / downstream of the project extent)?
- Can you provide a **list of qualified and credentialed survey contractors** and, if possible, an **example scope of work** or other information to assist us in describing proper survey methodology and products?

I've also copied the project's manager and planner, Jason Glazener, so he's in the loop.

Thank you,
-Justin

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator | Public Involvement Specialist
U.S. Army Corps of Engineers, South Atlantic Division, Wilmington District

☎ +1 (910) 251-4581
+1 (910) 251-4744
Justin.P.Bashaw@usace.army.mil
🖂 69 Darlington Avenue, Wilmington, NC 28403-1343
https://www.saw.usace.army.mil/

From: Ellis, John <john_ellis@fws.gov>
Sent: Friday, December 9, 2022 11:47 AM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Subject: [Non-DoD Source] Fw: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Justin,

Please give me a call when you have a chance. I left my cell number on your voice mail although you may have it already.

John

From: Ellis, John <john_ellis@fws.gov>
Sent: Tuesday, January 11, 2022 3:03 PM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>; Matthews, Kathryn H <kathryn_matthews@fws.gov>; Mann, Leigh <leigh_mann@fws.gov>
Subject: Re: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Justin,

I'm resending as you had the wrong email for Kathy.. It is Kathryn_matthews@fws.gov.

You can send the info to me and leigh_mann@fws.gov.

I can go ahead and let you know that potential impacts to listed aquatics spp will be of interest. You should also contact NMFS for Alantic sturgeon comments. The Service would recommend the typical moratorium on in-water work to protect diadromous fish. Lastly, there has been a bald eagle nest within 1/2 mile of the water treatment plant in the past so it would be good to do eagle nest surveys to verify if it is still active and if there are others within a distance which would trigger an eagle permit.

It's been a number of years since i last visited the water treatment plant but have some familiarity of where it is located. I believe I was last there when they were working on the permit to install the vanes to split the oncoming bedload around the intakes.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Tuesday, January 11, 2022 10:55 AM
To: Ellis, John <john_ellis@fws.gov>; kathy_matthews@fws.gov <kathy_matthews@fws.gov>
Subject: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Good morning John and Kathy,

Happy new year, and I hope you're both well!

I'll be brief: The USACE is in the scoping phase of a **streambank protection project for the Greenville Utilities Commission's Water Treatment Plant in Pitt County, NC**. I intend to send the USFWS (and others) a scoping letter by the end of the week, but didn't want to over-share and back-up inboxes. **Which one of you would be most appropriate as the USFWS point of contact for this project**?

Thank you!

Respectfully,
-Justin B

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator
U.S. Army Corps of Engineers, Wilmington District, ECP-PE

☎ O: +1 (910) 251-4581
F: +1 (910) 251-4744
E: Justin.P.Bashaw@usace.army.mil
✉ M: 69 Darlington Avenue, Wilmington, NC 28403-1343

3. State Agencies

North Carolina Department of Environmental Quality (NCDEQ) Letter Dated December 23, 2022

NCDEQ Comment 1: Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900

USACE Response 1: No burning is anticipated under the proposed action.

NCDEQ Comment 2: Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 20.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950

USACE Response 2: No demolition or renovations of structures containing asbestos material is anticipated under the proposed action.

NCDEQ Comment 3: The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres are to be disturbed. Plan must be filed with and approved by applicable Regional Office (Land Quality Section) at least 30 days before beginning activity. A NPDES Construction Stormwater permit (NCG010000) is also usually issued should design features meet minimum requirements. A fee of $100 for the first acre or any part of an acre. An express review option is available with additional fees.

USACE Response 3: Because clearing of grasses, vines, and trees will not exceed one acre, an erosion and sedimentation control plan would not be required for this project. A National Pollutant Discharge Elimination System (NPDES) construction stormwater permit (NCG010000), however, may be necessary and would be coordinated prior to construction. Similarly, compliance with 15A NCAC 2H 1000 (i.e., State Stormwater Permitting Programs) would be satisfied prior to construction, if applicable. This information is discussed in Section 7.2 of the final Environmental Assessment.

NCDEQ Comment 4: Compliance with 15A NCAC 2H 1000 -State Stormwater Permitting Programs regulate site development and postconstruction stormwater runoff control. Areas subject to these permit programs include all 20 coastal counties, and various other counties and watersheds throughout the state.

USACE Response 4: Compliance with 15A NCAC 2H 1000 (i.e., State Stormwater Permitting Programs) would be satisfied prior to construction, if applicable. This information is discussed in Section 7.2 of the final Environmental Assessment.

NCDEQ Comment 5: 401 Water Quality Certification - Compliance with the T15A 02H .0500 Certifications are required whenever construction or operation of facilities will result in a discharge into navigable water as described in 33 CFR part 323.

USACE Response 5: An application in pursuit of a 401 Water Quality Certification for the proposed action was submitted to the North Carolina Division of Water Quality on January 23, 2023. This information is discussed in Section 7.2 of the final Environmental Assessment.

NCDEQ Comment 6: Compliance with Catawba, Goose Creek, Jordan Lake, Randleman, Tar Pamlico or Neuse Riparian Buffer Rules is required. Buffer requirements: http://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permits/401-riparianbuffer-protection-program

USACE Response 6: Compliance of the proposed action with Tar River buffer rules was featured in the USACE's 401 Water Quality Certification application submitted to the North Carolina Division of Water Quality on January 23, 2023. Payment associated with permit review was provided to NCDWR on February 8, 2023.

State of North Carolina Department of Environmental Quality
INTERGOVERNMENTAL REVIEW PROJECT COMMENTS

Reviewing Regional Office: Washington
Project Number: 23-0093 Due Date: 12/23/2022
County: Pitt

After review of this project, it has been determined that the DEQ permit(s) and/or approvals indicated may need to be obtained for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of the form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (Statutory time limit)
☐	Permit to construct & operate wastewater treatment facilities, non-standard sewer system extensions & sewer systems that do not discharge into state surface waters.	Application 90 days before begins construction or award of construction contracts. On-site inspection may be required. Post-application technical conference usual.	30 days (90 days)
☐	Permit to construct & operate, sewer extensions involving gravity sewers, pump stations and force mains discharging into a sewer collection system	Fast-Track Permitting program consists of the submittal of an application and an engineer's certification that the project meets all applicable State rules and Division Minimum Design Criteria.	30 days (N/A)
☐	NPDES - permit to discharge into surface water and/or permit to operate and construct wastewater facilities discharging into state surface waters.	Application 180 days before begins activity. On-site inspection. Pre-application conference usual. Additionally, obtain permit to construct wastewater treatment facility granted after NPDES. Reply time, 30 days after receipt of plans or issue of NPDES permit-whichever is later.	90-120 days (N/A)
☐	Water Use Permit	Pre-application technical conference usually necessary.	30 days (N/A)
☐	Well Construction Permit	Complete application must be received, and permit issued prior to the installation of a groundwater monitoring well located on property not owned by the applicant, and for a large capacity (>100,000 gallons per day) water supply well.	7 days (15 days)
☐	Dredge and Fill Permit	Application copy must be served on each adjacent riparian property owner. On-site inspection. Pre-application conference usual. Filling may require Easement to Fill from N.C. Department of Administration and Federal Dredge and Fill Permit.	55 days (90 days)
☐	Permit to construct & operate Air Pollution Abatement facilities and/or Emission Sources as per 15 A NCAC (2Q.O100 thru 2Q.0300)	Application must be submitted, and permit received prior to construction and operation of the source. If a permit is required in an area without local zoning, then there are additional requirements and timelines (2Q.0113).	90 days
☒	Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900	N/A	60 days (90 days)
☒	Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 20.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950	Please Note - The Health Hazards Control Unit (HHCU) of the N.C. Department of Health and Human Services, must be notified of plans to demolish a building, including residences for commercial or industrial expansion, even if no asbestos is present in the building.	60 days (90 days)
☒	The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres are to be disturbed. Plan must be filed with and approved by applicable Regional Office (Land Quality Section) at least 30 days before beginning activity. A NPDES Construction Stormwater permit (NCG010000) is also usually issued should design features meet minimum requirements. A fee of $100 for the first acre or any part of an acre. An express review option is available with additional fees.		20 days (30 days)
☐	Sedimentation and erosion control must be addressed in accordance with NCDOT's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable Stormwater conveyances and outlets.		(30 days)
☐	Sedimentation and erosion control must be addressed in accordance with _____ Local Government's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable Stormwater conveyances and outlets.		Based on Local Program
☐	Compliance with 15A NCAC 04B .0125 – Buffers Zones for Trout Waters shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent (25%) of the buffer zone nearest the land-disturbing activity, whichever is greater.		
☐	Compliance with 15A NCAC 2H .0126 - NPDES Stormwater Program which regulates three types of activities: Industrial, Municipal Separate Storm Sewer System & Construction activities that disturb ≥1 acre.		30-60 days (90 days)
☒	Compliance with 15A NCAC 2H 1000 -State Stormwater Permitting Programs regulate site development and post-construction stormwater runoff control. Areas subject to these permit programs include all 20 coastal counties, and various other counties and watersheds throughout the state.		45 days (90 days)

Reviewing Regional Office: Washington
Project Number: 23-0093 Due Date: 12/23/2022
County: Pitt

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (Statutory time limit)
☐	Mining Permit	On-site inspection usual. Surety bond filed with DEQ Bond amount varies with type mine and number of acres of affected land. Affected area greater than one acre must be permitted. The appropriate bond must be received before the permit can be issued.	30 days (60 days)
☐	Dam Safety Permit	If permit required, application 60 days before begin construction. Applicant must hire N.C. qualified engineer to prepare plans, inspect construction, and certify construction is according to DEQ approved plans. May also require a permit under mosquito control program. And a 404 permit from Corps of Engineers. An inspection of site is necessary to verify Hazard Classification. A minimum fee of $200.00 must accompany the application. An additional processing fee based on a percentage, or the total project cost will be required upon completion.	30 days (60 days)
☐	Oil Refining Facilities	N/A	90-120 days (N/A)
☐	Permit to drill exploratory oil or gas well	File surety bond of $5,000 with DEQ running to State of NC conditional that any well opened by drill operator shall, upon abandonment, be plugged according to DEQ rules and regulations.	10 days N/A
☐	Geophysical Exploration Permit	Application filed with DEQ at least 10 days prior to issue of permit. Application by letter. No standard application forms.	10 days N/A
☐	State Lakes Construction Permit	Application fee based on structure size is charged. Must include descriptions & drawings of structure & proof of ownership of riparian property	15-20 days N/A
☒	401 Water Quality Certification	Compliance with the T15A 02H .0500 Certifications are required whenever construction or operation of facilities will result in a discharge into navigable water as described in 33 CFR part 323.	60 days (130 days)
☒	Compliance with Catawba, Goose Creek, Jordan Lake, Randleman, Tar Pamlico or Neuse Riparian Buffer Rules is required. Buffer requirements: http://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permits/401-riparian-buffer-protection-program		
☐	Nutrient Offset: Loading requirements for nitrogen and phosphorus in the Neuse and Tar-Pamlico River basins, and in the Jordan and Falls Lake watersheds, as part of the nutrient-management strategies in these areas. DWR nutrient offset information: http://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-offset-information		
☐	CAMA Permit for MAJOR development	$250.00 - $475.00 fee must accompany application	75 days (150 days)
☐	CAMA Permit for MINOR development	$100.00 fee must accompany application	22 days (25 days)
☐	Abandonment of any wells, if required must be in accordance with Title 15A. Subchapter 2C.0100.		
☐	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.		
☐	Plans and specifications for the construction, expansion, or alteration of a public water system must be approved by the Division of Water Resources/Public Water Supply Section prior to the award of a contract or the initiation of construction as per 15A NCAC 18C .0300 et. seq., Plans and specifications should be submitted to 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. All public water supply systems must comply with state and federal drinking water monitoring requirements. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days
☐	If existing water lines will be relocated during the construction, plans for the water line relocation must be submitted to the Division of Water Resources/Public Water Supply Section at 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days
☐	Plans and specifications for the construction, expansion, or alteration of the _____ water system must be approved through the _____ delegated plan approval authority. Please contact them at _____ for further information.		

State of North Carolina Department of Environmental Quality
INTERGOVERNMENTAL REVIEW PROJECT COMMENTS

Reviewing Regional Office: Washington
Project Number: 23-0093 Due Date: 12/23/2022
County: Pitt

Other Comments (attach additional pages as necessary, being certain to comment authority)

Division	Initials	No comment	Comments	Date Review
DAQ	FDB	☒	No Comments	12/1/2022
DWR-WQROS (Aquifer & Surface)	DRS &	☒	No Comments & See checked boxes above	12/21/2022
DWR-PWS	CWW	☒	No Comments	12/1/2022
DEMLR (LQ & SW)	SD	☐	E&SC and SW not required	12/6/2022
DWM – UST		☐		/ /
Other Comments		☐		/ /

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

☐ **Asheville Regional Office**
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211
Phone: 828-296-4500
Fax: 828-299-7043

☐ **Fayetteville Regional Office**
225 Green Street, Suite 714,
Fayetteville, NC 28301-5043
Phone: 910-433-3300
Fax: 910-486-0707

☐ **Mooresville Regional Office**
610 East Center Avenue, Suite 301,
Mooresville, NC 28115
Phone: 704-663-1699
Fax: 704-663-6040

☐ **Raleigh Regional Office**
3800 Barrett Drive,
Raleigh, NC 27609
Phone: 919-791-4200
Fax: 919-571-4718

☒ **Washington Regional Office**
943 Washington Square Mall,
Washington, NC 27889
Phone: 252-946-6481
Fax: 252-975-3716

☐ **Wilmington Regional Office**
127 Cardinal Drive Ext.,
Wilmington, NC 28405
Phone: 910-796-7215
Fax: 910-350-2004

☐ **Winston-Salem Regional Office**
450 Hanes Mill Road, Suite 300,
Winston-Salem, NC 27105
Phone: 336-776-9800
Fax: 336-776-9797

North Carolina Department of Public Safety (NCDPS), Division of Emergency Management Letter Dated December 19, 2022

NCDPS Comment 1: The proposed project will encroach into Special Flood Hazard Area (SFHA), therefore a Floodplain Development Permit issued by City of Greenville will be required. Please coordinate with the City's Floodplain Administrator for permitting. Any work within the Floodway of Tar River will require a hydraulic analysis to determine the effects on flood levels from the proposed development. Any increase in flood levels during the base flood discharge will require a Conditional Letter of Map Revision (CLOMR) prior to construction. Otherwise, a "No-Rise" certification will be required.

USACE Response 1: The USACE is in coordination with the City of Greenville regarding a Floodplain Development Permit. A permit, or a “No-Rise” certification, will be acquired prior to construction. This information is included in Section 7.3 of the final Environmental Assessment.

Control No.: 23-E-0000-0093

County.: PITT

Date Received: 11/29/2022

Agency Response: 12/29/2022

Review Closed: 12/29/2022

JINTAO WEN

CLEARINGHOUSE COORDINATOR

DPS - DIV OF EMERGENCY MANAGEMENT

Project Information

Type: National Environmental Policy Act ironmental Assessment

Applicant: Department of the Army

Project Desc.: Proposed project would stabilize an eroding bank of the Tar River with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet. Existing streambank erosion threatens critical water supply infrastructure associated with the Greenville Utilities Commission’s water treatment plant located in Greenville, NC. The riprap would tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built-up revetment protecting the toe.

As a result of this review the following is submitted:

☐ No Comment ☑ Comments Below ☐ Documents Attached

The proposed project will encroach into Special Flood Hazard Area (SFHA), therefore a Floodplain Development Permit issued by City of Greenville will be required. Please coordinate with the City’s Floodplain Administrator for permitting. Any work within the Floodway of Tar River will require a hydraulic analysis to determine the effects on flood levels from the proposed development. Any increase in flood levels during the base flood discharge will require a Conditional Letter of Map Revision (CLOMR) prior to construction. Otherwise, a "No-Rise" certification will be required.

Reviewed By: JINTAO WEN

Date: 12/19/2022

North Carolina Division of Waste Management (NCDWM), Inactive Hazardous Sites Branch Letter Dated December 5, 2022

NCDWM Comment 1: No (0) Superfund Section sites were identified within one mile of the project as shown on the attached report.

USACE Response 1: Noted.

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MICHAEL SCOTT
Director

NORTH CAROLINA
Environmental Quality

Date: December 5, 2022

To: Michael Scott, Director
Division of Waste Management

Through: Janet Macdonald
Inactive Hazardous Sites Branch

From: Katie C Tatum
Inactive Hazardous Sites Branch

Subject: NEPA Project # 23-0093 Department of the Army, Pitt County, North Carolina

The Superfund Section has reviewed the proximity of sites under its jurisdiction to the Department of the Army project. Proposed project would stabilize an eroding bank of the Tar River with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet. Existing streambank erosion threatens critical water supply infrastructure associated with the Greenville Utilities Commission's water treatment plant located in Greenville, NC. The riprap would tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built-up revetment protecting the toe or go to http://www.saw.usace.army.mil/Missions/Ecosystem-Restoration-CAP-Studies.

No (0) Superfund Section sites were identified within one mile of the project as shown on the attached report.

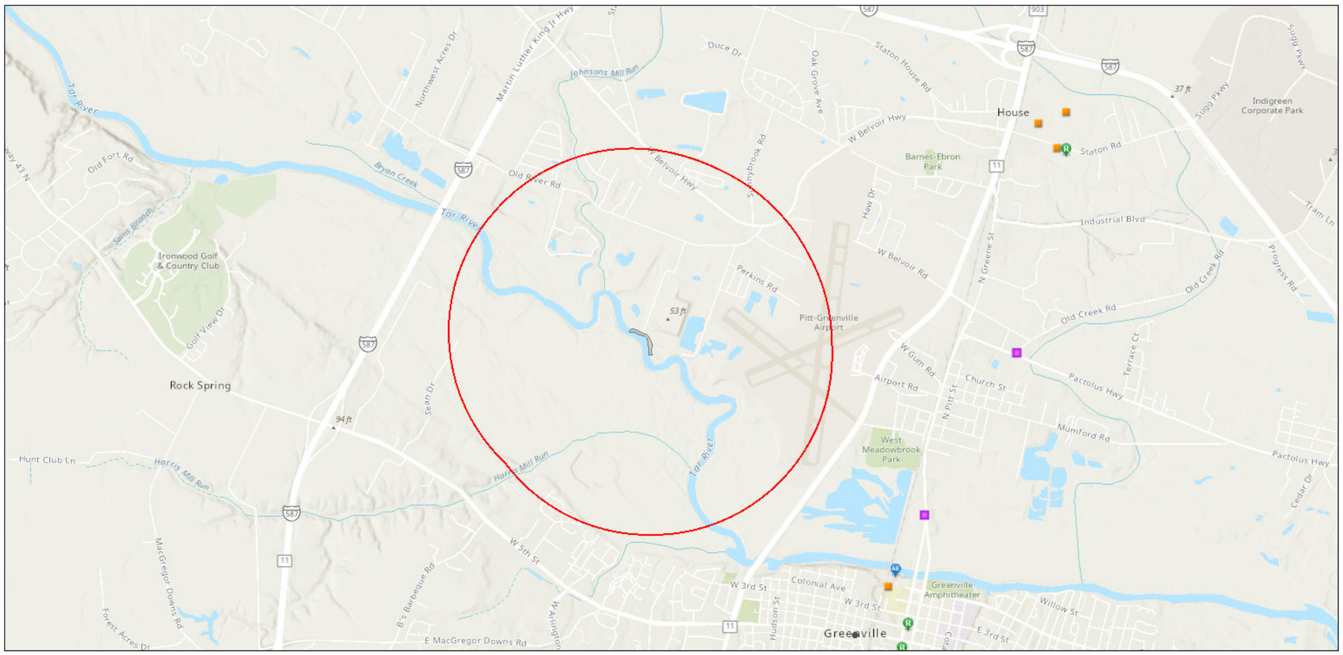
Please contact Janet Macdonald at 919.707.8349 if you have any questions concerning the Superfund Section review portion of this SEPA/NEPA inquiry.

Superfund & Brownfield Sites SEPA/NEPA Review Report

Area of Interest (AOI) Information **Pitt County NEPA project 23-0093**

Area : 2,286.26 acres

Dec 5 2022 12:09:26 Eastern Standard Time



Inactive Hazardous Sites   Active Eligible

NC Brownfields Location_View   Pre Regulatory Landfill Sites

Recorded   Activity Pending

1:36,112

0 0.33 0.65 1.3 mi

0 0.5 1 2 km

Esri, NASA, NGA, USGS, FEMA, State of North Carolina DOT, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Superfund & Brownfields Sites
Pitt County   NEPA project 23-0093

Summary

Name	Count	Area(acres)	Length(mi)
Certified DSCA Sites	0	N/A	N/A
Federal Remediation Branch Sites	0	N/A	N/A
Inactive Hazardous Sites	0	N/A	N/A
Pre-Regulatory Landfill Sites	0	N/A	N/A
Brownfields Program Sites	0	N/A	N/A

Department of Environmental Quality
Project Review Form

Project Number: 23-0093 **County: Pitt** **Date Received: 11-29-2022**

Due Date: 12-23-2022

Project Description: *Environmental Assessment - Proposed project would stabilize an eroding bank of the Tar River with a layer of stone (riprap) placed over a layer of bedding stone along approximately 305 linear feet. Existing streambank erosion threatens critical water supply infrastructure associated with the Greenville Utilities Commission's water treatment plant located in Greenville, NC. The riprap would tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built-up revetment protecting the toe or go to http://www.saw.usace.army.mil/Missions/Ecosystem-Restoration-CAP-Studies/*

This Project is being reviewed as indicated below:

Regional Office	Regional Office Area	In-House Review	
___ Asheville	✓ Air	___ Air Quality	___ Coastal Management
___ Fayetteville	✓ DWR	___ Parks & Recreation	___ Marine Fisheries
___ Mooresville	✓ DWR - Public Water	✓ Waste Mgmt	___ Military Affairs
___ Raleigh	✓ DEMLR (LQ & SW)	___ Water Resources Mgmt (Public Water, Planning & Water Quality Program)	___ DMF-Shellfish Sanitation
✓ Washington	✓ DWM	___ DWR-Transportation Unit	✓ Wildlife Maria
___ Wilmington			___ Wildlife/DOT
___ Winston-Salem			

Manager Sign-Off/Region:	Date:	In-House Reviewer/Agency:
	12/12/22	Melodi Deaver, Hazardous Waste Section

Response (check all applicable)

___ No objection to project as proposed.

X No Comment

___ Insufficient information to complete review

___ Other (specify or attach comments)

If you have any questions, please contact:

Lyn Hardison at lyn.hardison@ncdenr.gov or (252) 948-3842
943 Washington Square Mall Washington NC 27889
Courier No. 16-04-01

North Carolina Division of Waste Management (NCDWM), Solid Waste Section Letter Dated December 8, 2022

NCDWM Comment 1: Based on the information provided in this document, the Section at this time does not see an adverse impact on the surrounding communities and likewise knows of no situations in the communities, which would affect this project.

USACE Response 1: Noted.

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MICHAEL SCOTT
Director

NORTH CAROLINA
Environmental Quality

MEMORANDUM

TO: Michael Scott, Division Director through Sharon Brinkley

FROM: Amanda Thompson, Environmental Senior Specialist - Solid Waste Section

DATE: December 8, 2022

SUBJECT: Review: SW 23-0093 – Pitt County (Environmental Assessment – US Department of Army – Proposed project would stabilize an eroding bank of the Tar River with a layer of stone (riprap) place over a layer of bedding stone along approximately 305 linear feet in Greenville.)

The Division of Waste Management, Solid Waste Section (Section) has reviewed the documents submitted for the subject project in Pitt County, NC. Based on the information provided in this document, the Section at this time does not see an adverse impact on the surrounding communities and likewise knows of no situations in the communities, which would affect this project.

For any planned or proposed projects, it is recommended that during any land clearing, demolition, and construction, the US Department of Army and/or its contractors would make every feasible effort to minimize the generation of waste, to recycle materials for which viable markets exist, and to use recycled products and materials in the development of this project where suitable. **Any waste generated by and of the project that cannot be beneficially reused or recycled as described, may require disposal of at a solid waste management facility permitted by the Division. The Section strongly recommends that the US Department of Army require all contractors to provide proof of proper disposal for all generated waste to permitted facilities.**

Permitted solid waste management facilities are listed on the Division of Waste Management, Solid Waste Section portal site at: https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/solid-waste-management-annual-reports/solid-waste-permitted-facility-list
And the site locator tool at:
https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=7dd59be2750b40bebebfa49fc383f688

Questions regarding solid waste management for this project should be directed to Mr. Ray Williams, Environmental Senior Specialist, Solid Waste Section, at (252) 948-3955.

cc: Ray Williams, Environmental Senior Specialist

North Carolina State Historic Preservation Office (NCSHPO) Letter Dated January 9, 2023

NCSHPO Comment 1: We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

USACE Response 1: Noted.

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.

January 9, 2023

Justin Bashaw
U.S. Army Engineer District-Wilmington
69 Darlington Avenue
Wilmington, NC 28403

justin.p.bashaw@usace.army.mil

Re: Protect water intake structures at the bend of Tar River, Greenville, Pitt County, 23-E-0000-0093, ER 22-0162

Dear Mr. Bashaw:

Thank you for your letter of November 28, 2022, regarding the above-referenced undertaking. We have reviewed the submittal and offer the following comments.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

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@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

cc: Crystal Best, NC State Clearinghouse crystal.best@doa.nc.gov

North Carolina Wildlife Resources Commission (NCWRC) Letter Dated December 21, 2022

NCWRC Comment 1: Due to the numerous listed species that can be found in the vicinity, additional information should be provided to determine the amount of impact the project may have on aquatic species. Therefore, the NCWRC requests a freshwater mussel survey be conducted within the project area as well as 100 meters upstream and 300 meters downstream the site. Staff biologists have been in communication with the USFWS and USACE regarding this request and are looking forward to additional communication as needed and information as it becomes available.

USACE Response 1: Concur. As stated in Section 7.11 of the final Environmental Assessment, prior to construction, the USACE will conduct a freshwater mollusk survey using a qualified and properly credentialled individual to assess relative abundance in the project area. The survey will be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when mollusks are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and North Carolina Wildlife Resources Commission. Should the USFWS deem it necessary following interpretation of survey results, mollusks will be relocated outside of the project area prior to construction activities.

NCWRC Comment 2: In addition to the requested surveys, the applicant should note that a February 1 - September 30 in-water moratorium has been observed for projects in this area due to the PNA designation and presence of several listed species. These are the dates NCWRC has consistently requested in the past.

USACE Response 2: Concur. In consideration of effects to Atlantic Sturgeon potentially utilizing the project area, the USACE acknowledges an in-water work moratorium from February 1 through September 30 in Sections 5.1, 5.6, 7.9, and 7.11 of the final Environmental Assessment.

North Carolina Wildlife Resources Commission

Cameron Ingram, Executive Director

MEMORANDUM

TO: Lyn Hardison, Environmental Assistance Coordinator
NCDEQ Division of Environmental Assistance and Outreach (DEAO)

Maria T. D.

FROM: Maria T. Dunn, Coastal Habitat Coordinator
Habitat Conservation Division

DATE: December 21, 2022

SUBJECT: Greenville Utilities Commission Detailed Project Report and Environmental Assessment Section 14 Emergency Streambank and Shoreline Erosion Protection Project, Pitt County, North Carolina.
OLIA No. 23-0093

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the subject document and we are familiar with the habitat values of the area. Our comments are provided in accordance with provisions of the Coastal Area Management Act (G.S. 113A-100 through 113A-128), as amended, Sections 401 and 404 of the Clean Water Act, as amended, the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Magnuson-Stevens Fishery Conservation and Management Act (FCMA), as amended (16 U.S.C. 1801 et seq.), and the Migratory Bird Treaty Act (16 U.S.C. 703-712 et seq.) and North Carolina Environmental Policy Act (G.S. 113A-1 through 113A-10; 1 NCAC 25).

The applicant proposes to conduct streambank stabilization work to protect public water intake infrastructure for the Greenville Utilities Commission (GUC). The streambank would be stabilized with a layer of stone riprap placed over a layer of bedding stone approximately 305' along the shoreline of the Tar River. The riprap would tie into the top of the existing embankment and cover the streambank down to the channel bottom with a built-up revetment protecting the toe. The streambank would be graded to a 2:1 slope and below the ordinary high water line, backfill material of NCDOT #57 stone would be placed over a geotextile layer, graded, and compacted prior to stone placement. The estimated time of construction is 4-6 months.

The NCWRC has reviewed the documentation and is very familiar with the project area and activities conducted by GUC in the area. Most of these activities have involved improvement or rehabilitation of the water intakes and streambank stabilization. The Tar River at this location is classified WS-IV NSW by the Environmental Management Commission, is subject to the Tar-Pamlico buffer rules, is designated

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

a primary nursery area (PNA) by the NCWRC, is designated critical habitat for Atlantic sturgeon (*Acipenser oxyrhynchus*) by the National Marine Fisheries Service (NMFS) and as critical habitat for the Neuse River waterdog (*Necturus lewisi*) by the US Fish and Wildlife Service (USFWS).

Due to the numerous listed species that can be found in the vicinity, additional information should be provided to determine the amount of impact the project may have on aquatic species. Therefore, the NCWRC requests a freshwater mussel survey be conducted within the project area as well as 100 meters upstream and 300 meters downstream the site. Staff biologists have been in communication with the USFWS and USACE regarding this request and are looking forward to additional communication as needed and information as it becomes available.

In addition to the requested surveys, the applicant should note that a February 1 – September 30 in-water moratorium has been observed for projects in this area due to the PNA designation and presence of several listed species. These are the dates NCWRC has consistently requested in the past.

Thank you for the opportunity to comment on this project. If our agency can be of further assistance, please contact me at (252) 948-3916 or at maria.dunn@ncwildlife.org.

Appendix I

Approval of Individual Section 401 Water Quality Certification

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

NORTH CAROLINA
Environmental Quality

March 16, 2023

DWR # 20230172
Pitt County

Greenville Utilities Commission
Attn: Anthony Whitehead
1721 Old River Road
Greenville, North Carolina 27834

Subject: Approval of Individual 401 Water Quality Certification
Greenville Utilities Commission (GUC), NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Study

Dear Mr. Whitehead:

Attached hereto is a copy of Certification No. 5747 issued to Anthony Whitehead and Greenville Utilities Commission, dated March 16, 2023. This approval is for the purpose and design described in your application. The plans and specifications for this project are incorporated by reference as part of this Water Quality Certification. If you change your project, you must notify the Division and you may be required to submit a new application package with the appropriate fee. If the property is sold, the new owner must be given a copy of this Certification and is responsible for complying with all conditions. [15A NCAC 02H .0507(d)(2)].

This Water Quality Certification does not relieve the permittee of the responsibility to obtain all other required Federal, State, or Local approvals before proceeding with the project, including those required by, but not limited to, Sediment and Erosion Control, Non-Discharge, Water Supply Watershed, and Trout Buffer regulations.

This Water Quality Certification neither grants nor affirms any property right, license, or privilege in any lands or waters, or any right of use in any waters. This Water Quality Certification does not authorize any person to interfere with the riparian rights, littoral rights, or water use rights of any other person and does not create any prescriptive right or any right of priority regarding any usage of water. This Water Quality Certification shall not be interposed as a defense in any action respecting the determination of riparian or littoral rights or other rights to water use. No consumptive user is deemed by virtue of this Water Quality Certification to possess any prescriptive or other right of priority with respect to any other consumptive user.

Upon the presentation of proper credentials, the Division may inspect the property.

This Water Quality Certification shall expire on the same day as the expiration date of the corresponding Section 404 Permit. The conditions shall remain in effect for the life of the project, regardless of the expiration date of this Water Quality Certification.

Non-compliance with or violation of the conditions herein set forth may result in revocation of this Water Quality Certification for the project and may also result in criminal and/or civil penalties.

If you are unable to comply with any of the conditions of this Water Quality Certification you must notify the Washington Regional Office within 24 hours (or the next business day if a weekend or holiday) from the time the permittee becomes aware of the circumstances.

The permittee shall report to the Washington Regional Office any noncompliance with, and/or any violation of, stream or wetland standards [15A NCAC 02B .0200] including but not limited to sediment impacts to streams or wetlands. Information shall be provided orally within 24 hours (or the next business day if a weekend or holiday) from the time the permittee became aware of the non-compliance circumstances.

This approval and its conditions are final and binding unless contested [G.S. 143-215.5]. Please be aware that impacting waters without first applying for and securing the issuance of a 401 Water Quality Certification violates Title 15A of the North Carolina Administrative Code (NCAC) 2H .0500. Title 15A NCAC 2H .0500 requires certifications pursuant to Section 401 of the Clean Water Act whenever construction or operation of facilities will result in a discharge into navigable waters, including wetlands, as described in 33 Code of Federal Regulations (CFR) Part 323. It also states any person desiring issuance of the State certification or coverage under a general certification required by Section 401 of the Federal Water Pollution Control Act shall file with the Director of the North Carolina Division of Water Quality. Pursuant to G.S. 143-215.6A, these violations and any future violations are subject to a civil penalty assessment of up to a maximum of $25,000.00 per day for each violation.

This Certification can be contested as provided in Chapter 150B of the North Carolina General Statutes by filing a Petition for a Contested Case Hearing (Petition) with the North Carolina Office of Administrative Hearings (OAH) **within sixty (60) calendar days**. Requirements for filing a Petition are set forth in Chapter 150B of the North Carolina General Statutes and Title 26 of the North Carolina Administrative Code. Additional information regarding requirements for filing a Petition and Petition forms may be accessed at http://www.ncoah.com/ or by calling the OAH Clerk's Office at (919) 431-3000.

A party filing a Petition must serve a copy of the Petition on:

William F. Lane, General Counsel
Department of Environmental Quality
1601 Mail Service Center
Raleigh, NC 27699-1601

If the party filing the Petition is not the permittee, then the party must also serve the recipient of the Certification in accordance with N.C.G.S 150B-23(a).

This letter completes the Division's review under section 401 of the Clean Water Act and 15A NCAC 02H .0500. Please contact Robert Tankard at 252-948-3921 or robert.tankard@ncdenr.gov if you have any questions or concerns.

Sincerely,

Robert Tankard

Robert Tankard, Assistant Regional Supervisor
Water Quality Regional Operation Section
Division of Water Resources, NCDEQ
Washington Regional Office

Electronic cc: Justin Bashaw, jsutin.p.brashaw@usace.army.mil
Emily Thompson, Emily.b.thompson@usace.army.mil
Laserfiche

NORTH CAROLINA 401 WATER QUALITY CERTIFICATION

CERTIFICATION #5747 is issued in conformity with the requirements of Section 401, Public Laws 92-500 and 95-217 of the United States and subject to North Carolina's Regulations in 15 NCAC 02H .0500 and 15A NCAC 02B .0200, to Anthony Whitehead and Greenville Utilities Commission, who have authorization for the impacts listed below, as described within your application received by the N.C. Division of Water Resources (Division) on January 23, 2023 and subsequent information on February 17, 2023, and by Public Notice issued by the U. S. Army Corps of Engineers on February 3, 2023.

The State of North Carolina certifies that this activity will comply with water quality requirements and the applicable portions of Sections 301, 302, 303, 306, 307 of the Public Laws 92-500 and PL 95-217 if conducted in accordance with the application, the supporting documentation, and conditions hereinafter set forth.

The following impacts are hereby approved. No other impacts are approved, including incidental impacts. [15A NCAC 02H .0506(b)]

Type of Impact	Amount Approved (units) Permanent	Amount Approved (units) Temporary
Stream		
S1	305 (linear feet)	0 (linear feet)
404/401 Wetlands		
W1 -	0 (acres)	0 (acres)
Open Waters		
O1	0 (acres)	0 (acres)

This approval requires you to follow the conditions listed in the certification below.

CONDITIONS OF CERTIFICATION [15A NCAC 02H .0507(c)]:

1. The project area of the Tar River is designated as primary nursery area (PNA) by the NCWRC and is designated as critical habitat for Atlantic sturgeon by NMFS and critical habitat for Carolina madtom and Neuse River waterdog by USFWS. In addition to these critical habitats, several listed freshwater mussel species are in the area. Therefore, prior to disturbance, a mussel survey and relocation effort should be performed with approval by NCWRC and USFWS. Survey and relocation should occur within as well as 100 meters upstream and 300 meters downstream the project area. All in-water work (placement of riprap and shoreline prep) should adhere to a February 1 – September 30 moratorium.

   Citation: 15A NCAC 02H .0506; 15A NCAC 02H .0507(c)
   Justification: Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule (including, at minimum: aquatic life propagation, survival, and maintenance of biological integrity; wildlife; secondary contact recreation; agriculture); and

that activities must not cause water pollution that precludes any best use on a short-term or long-term basis.

2. The permittee shall report to the DWR Washington Regional Office any noncompliance with, and/or any violation of, stream or wetland standards [15A NCAC 02B .0200], including but not limited to sediment impacts to streams or wetlands. Information shall be provided orally within 24 hours (or the next business day if a weekend or holiday) from the time the permittee became aware of the non-compliance circumstances.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c)

   Justification: Timely reporting of non-compliance is important in identifying and minimizing detrimental impacts to water quality and avoiding impacts due to water pollution that precludes any best use on a short-term or long-term basis.

3. No waste, spoil, solids, or fill of any kind shall occur in wetlands or waters beyond the footprint of the approved impacts (including temporary impacts).

   Citation: 15A NCAC 02H .0506; 15A NCAC 02H .0507(c)

   Justification: Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule (including, at minimum: aquatic life propagation, survival, and maintenance of biological integrity; wildlife; secondary contact recreation; agriculture); and that activities must not cause water pollution that precludes any best use on a short-term or long-term basis.

4. All activities shall be in compliance with any applicable State Regulated Riparian Buffer Rules in Chapter 2B of Title 15A in the North Carolina Administrative Code.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c)

   Justification: The referenced Riparian Buffer rules were adopted to address water quality impairments and further protect existing uses.

5. When applicable, all construction activities shall be performed and maintained in full compliance with G.S. Chapter 113A Article 4 (Sediment and Pollution Control Act of 1973). Regardless of applicability of the Sediment and Pollution Control Act, all projects shall incorporate appropriate Best Management Practices for the control of sediment and erosion so that no violations of state water quality standards, statutes, or rules occur.

   Design, installation, operation, and maintenance of all sediment and erosion control measures shall be equal to or exceed the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*, or for linear transportation projects, the *North Caroline Department of Transportation Sediment and Erosion Control Manual*.

   All devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) sites, including contractor-owned or leased borrow pits associated with the project. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

For borrow pit sites, the erosion and sediment control measures shall be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual*. Reclamation measures and implementation shall comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act and the Mining Act of 1971.

If the project occurs in waters or watersheds classified as Primary Nursery Areas (PNAs), SA, WS-I, WS-II, High Quality Waters (HQW), or Outstanding Resource Waters (ORW), then the sedimentation and erosion control designs shall comply with the requirements set forth in 15A NCAC 04B .0124, *Design Standards in Sensitive Watersheds*.

Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC02B .0200; 15A NCAC 02B .0231

Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses; and (21) turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes, or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level shall not be increased. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.

6. Sediment and erosion control measures shall not be installed in wetland or waters except within the footprint of temporary or permanent impacts otherwise authorized by this Certification. If placed within authorized impact areas, then placement of such measures shall not be conducted in a manner that results in dis-equilibrium of any wetlands, streambeds, or streambanks. Any silt fence installed within wetlands shall be removed from wetlands and the natural grade restored within two (2) months of the date that DEMLR or locally delegated program has released the specific area within the project to ensure wetland standards are maintained upon completion of the project.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200; 15A NCAC 02B .0231

   Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12)

Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses; and (21) turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes, or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level shall not be increased. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.

7. Erosion control matting that incorporates plastic mesh and/or plastic twine shall not be used along streambanks or within wetlands.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c)

   Justification: A project that affects waters shall not be permitted unless the existing uses (including aquatic life propagation and biological integrity), and the water quality to protect such uses, are protected. Protections are necessary to ensure any remaining surface waters or wetlands, and any surface waters or wetlands downstream, continue to support existing uses during and after project completion. The Division must evaluate if the activity has avoided and minimized impacts to waters, would cause or contribute to a violation of standards, or would result in secondary or cumulative impacts.

8. If the project is covered by NPDES Construction Stormwater Permit Number NCG010000 or NPDES Construction Stormwater Permit Number NCG250000, full compliance with permit conditions including the erosion & sedimentation control plan, inspections and maintenance, self-monitoring, record keeping and reporting requirements is required.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200; 15A NCAC 02B .0231

   Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses; and (21) turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes, or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level shall not be increased. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.

9. All work in or adjacent to streams shall be conducted so that the flowing stream does not come in contact with the disturbed area. Approved best management practices from the most current version of the NC Sediment and Erosion Control Manual, or the NC Department of Transportation Construction and Maintenance Activities Manual, such as sandbags, rock berms, cofferdams, and other diversion structures shall be used to minimize excavation in flowing water.

   Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200

   Justification: Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule, and that activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses; and (21) turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes, or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level shall not be increased.

10. Application of fertilizer to establish planted/seeded vegetation within disturbed riparian areas and/or wetlands shall be conducted at agronomic rates and shall comply with all other Federal, State and Local regulations. Fertilizer application shall be accomplished in a manner that minimizes the risk of contact between the fertilizer and surface waters.

    Citation: 15A 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200; 15A NCAC 02B .0231

    Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.

11. If concrete is used during construction, then all necessary measures shall be taken to prevent direct contact between uncured or curing concrete and waters of the state. Water that inadvertently contacts uncured concrete shall not be discharged to waters of the state.

    Citation: 15A 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200; 15A NCAC 02B .0231

    Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that *precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.*

12. Any rip-rap used for stream or shoreline stabilization shall be of a size and density to prevent movement by wave, current action, or stream flows, and shall consist of clean rock or masonry material free of debris or toxic pollutants. Rip-rap shall not be installed in the streambed except in specific areas required for velocity control and to ensure structural integrity of bank stabilization measures.

    Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0201

    Justification: Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule, and that activities must not cause water pollution that precludes any best use on a short-term or long-term basis. The Division must evaluate if the activity has avoided and minimized impacts to waters, would cause or contribute to a violation of standards, or would result in secondary or cumulative impacts.

13. All mechanized equipment operated near surface waters shall be inspected and maintained regularly to prevent contamination of surface waters from fuels, lubricants, hydraulic fluids, or other toxic materials. Construction shall be staged in order to minimize the exposure of equipment to surface waters to the maximum extent practicable. Fueling, lubrication, and general equipment maintenance shall be performed in a manner to prevent, to the maximum extent practicable, contamination of surface waters by fuels and oils.

    Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0200; 15A NCAC 02B .0231

    Justification: A project that affects waters shall not be permitted unless the existing uses, and the water quality to protect such uses, are protected. Activities must not cause water pollution that precludes any best use on a short-term or long-term basis. As cited in Stream Standards: (12) Oils, deleterious substances, or colored or other wastes: only such amounts as shall not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. As cited in Wetland Standards: (c)(1) Liquids, fill or other solids, or dissolved gases shall not be present in amounts that may cause adverse impacts on existing wetland uses; and (3) Materials producing color or odor shall not be present in amounts that may cause adverse impacts on existing wetland uses.

14. Heavy equipment working in wetlands shall be placed on mats or other measures shall be taken to minimize soil disturbance and compaction.

Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c); 15A NCAC 02B .0231

Justification: Wetland standards require maintenance or enhancement of existing uses of wetlands such that hydrologic conditions necessary to support natural biological and physical characteristics are protected; populations of wetland flora and fauna are maintained to protect biological integrity of the wetland; and materials or substances are not present in amounts that may cause adverse impact on existing wetland uses.

15. In accordance with 143-215.85(b), the permittee shall report any petroleum spill of 25 gallons or more; any spill regardless of amount that causes a sheen on surface waters; any petroleum spill regardless of amount occurring within 100 feet of surface waters; and any petroleum spill less than 25 gallons that cannot be cleaned up within 24 hours.

    Citation: 15A NCAC 02H .0507(c); N.C.G.S 143-215.85(b)

    Justification: Person(s) owning or having control over oil or other substances upon notice of discharge must immediately notify the Department, or any of its agents or employees, of the nature, location, and time of the discharge and of the measures which are being taken or are proposed to be taken to contain and remove the discharge. This action is required in order to contain or divert the substances to prevent entry into the surface waters. Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule (including, at minimum: aquatic life propagation, survival, and maintenance of biological integrity; wildlife; secondary contact recreation; agriculture); and that activities must not cause water pollution that precludes any best use on a short-term or long-term basis.

16. The permittee and their authorized agents shall conduct all activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act), and any other appropriate requirements of State and Federal Law.

    Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c)

    Justification: Surface water quality standards require that conditions of waters be suitable for all best uses provided for in state rule, and that activities must not cause water pollution that precludes any best use on a short-term or long-term basis. The Division must evaluate if the activity has avoided and minimized impacts to waters, would cause or contribute to a violation of standards, or would result in secondary or cumulative impacts.

17. The permittee shall require its contractors and/or agents to comply with the terms and conditions of this certification in the construction and maintenance of this project, and shall provide each of its contractors and/or agents associated with the construction or maintenance of this project with a copy of this Water Quality Certification. A copy of this Water Quality Certification shall be available at the project site during the construction and maintenance of this project.

    Citation: 15A NCAC 02H .0506(b); 15A NCAC 02H .0507(c)

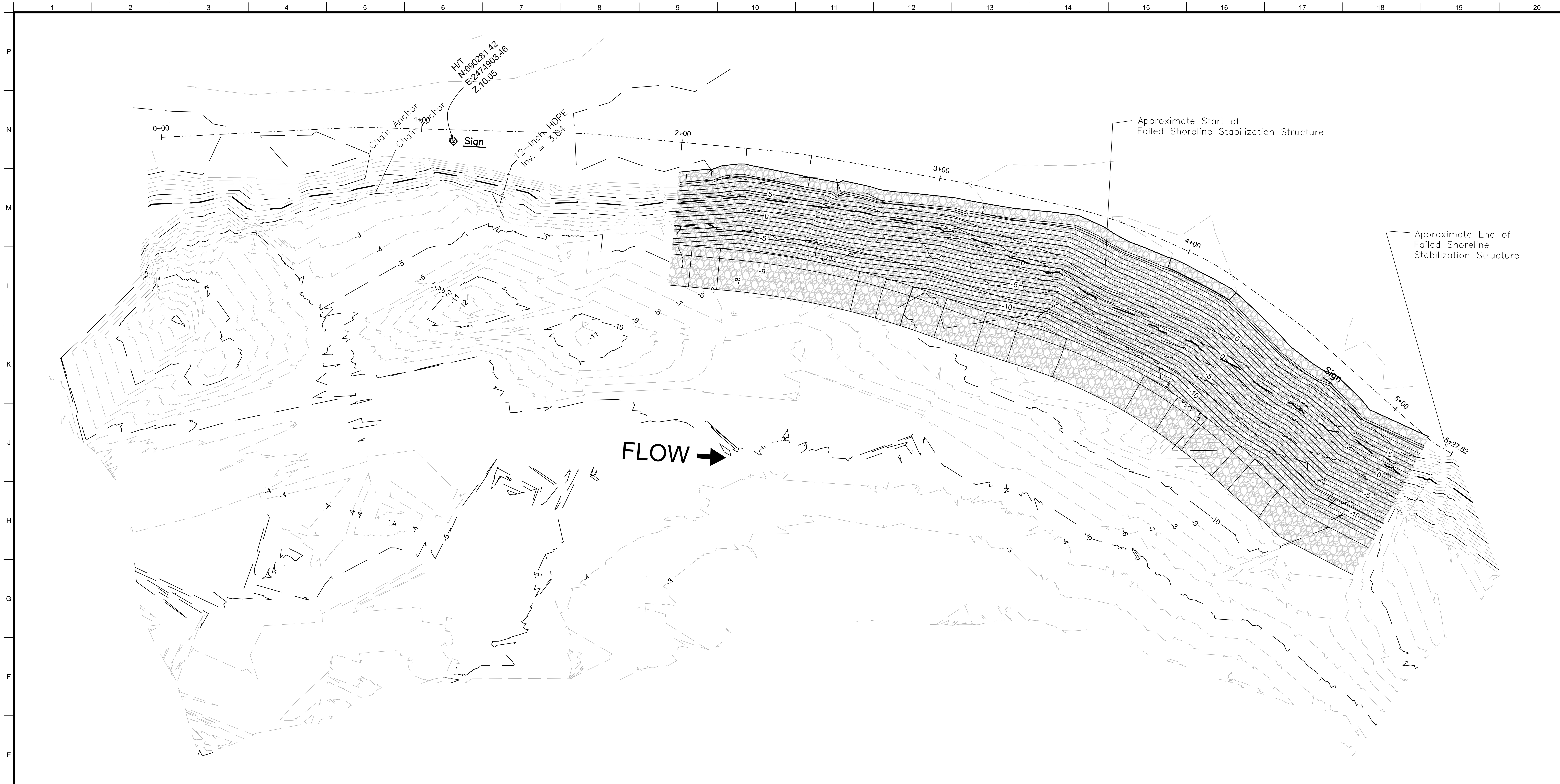
Justification: Those actually performing the work should be aware of the requirements of this 401 Water Quality Certification to minimize water quality impacts.

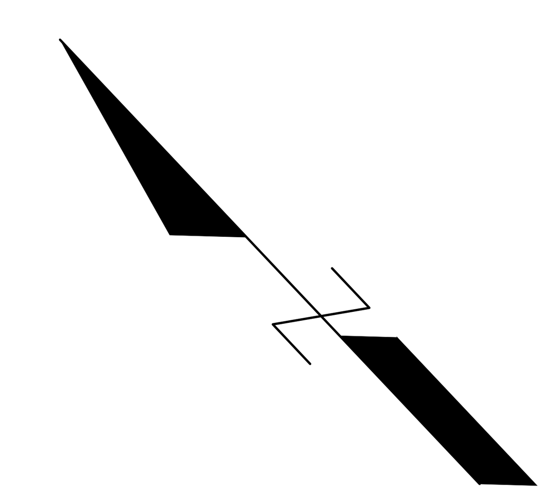
This approval to proceed with your proposed impacts or to conduct impacts to waters as depicted in your application shall expire upon expiration of the 404 Permit. The conditions in effect on the date of issuance shall remain in effect for the life of the project, regardless of the expiration date of this Certification. [15A NCAC 02H .0507(c)]

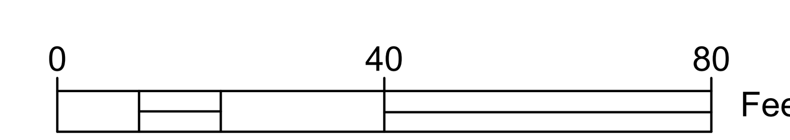
This, the 16th day of March 2023

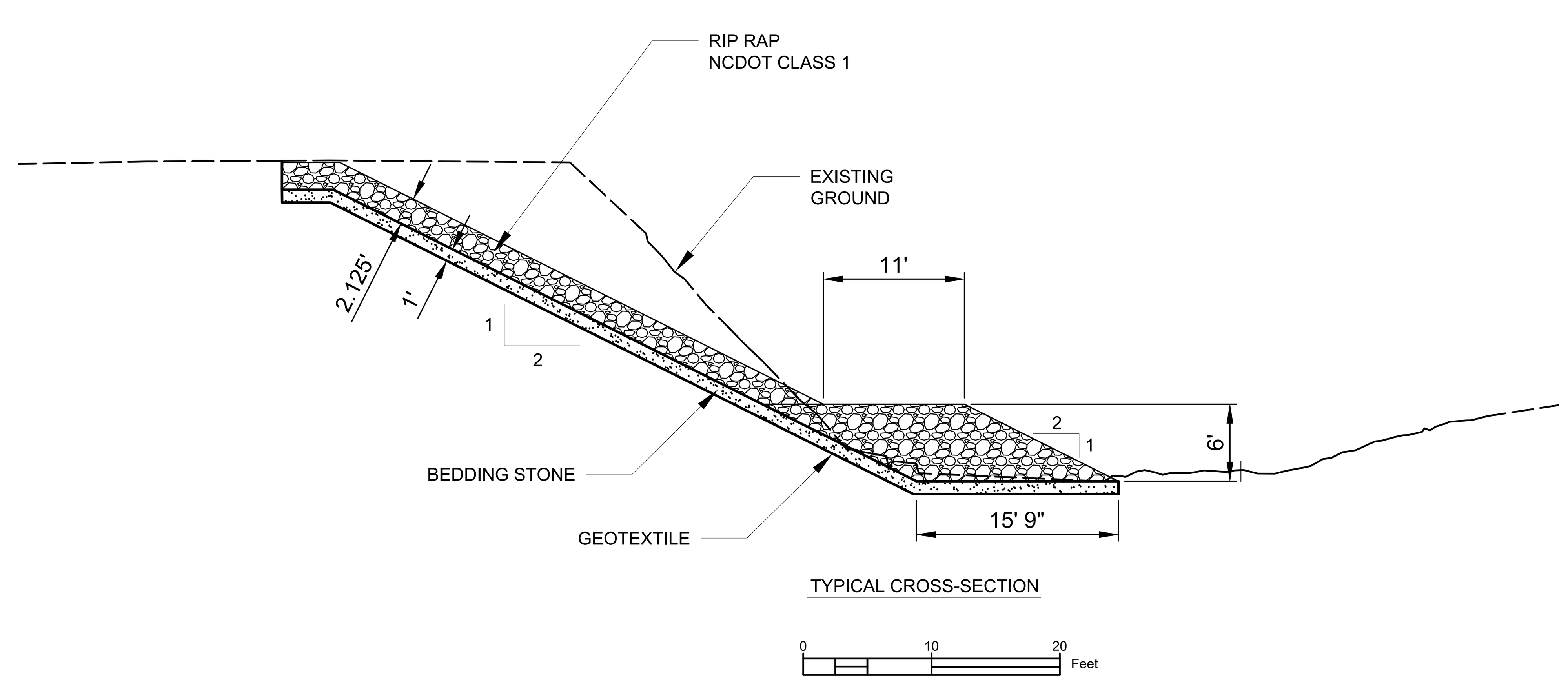
Robert Tankard

Robert Tankard, Assistant Regional Supervisor
Water Quality Regional Operation Section
Division of Water Resources, NCDEQ
Washington Regional Office









TYPICAL CROSS-SECTION

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: S. STELLO
DRAWN BY: S. STELLO
CHECKED BY:
SUBMITTED BY: S. STELLO
SIZE: 22" X 34"

ISSUE DATE: MMMMMMMMM YYYY
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.: XXXXXX-XX-X-XXXX

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
69 DARLINGTON AVENUE
WILMINGTON, NC 28403

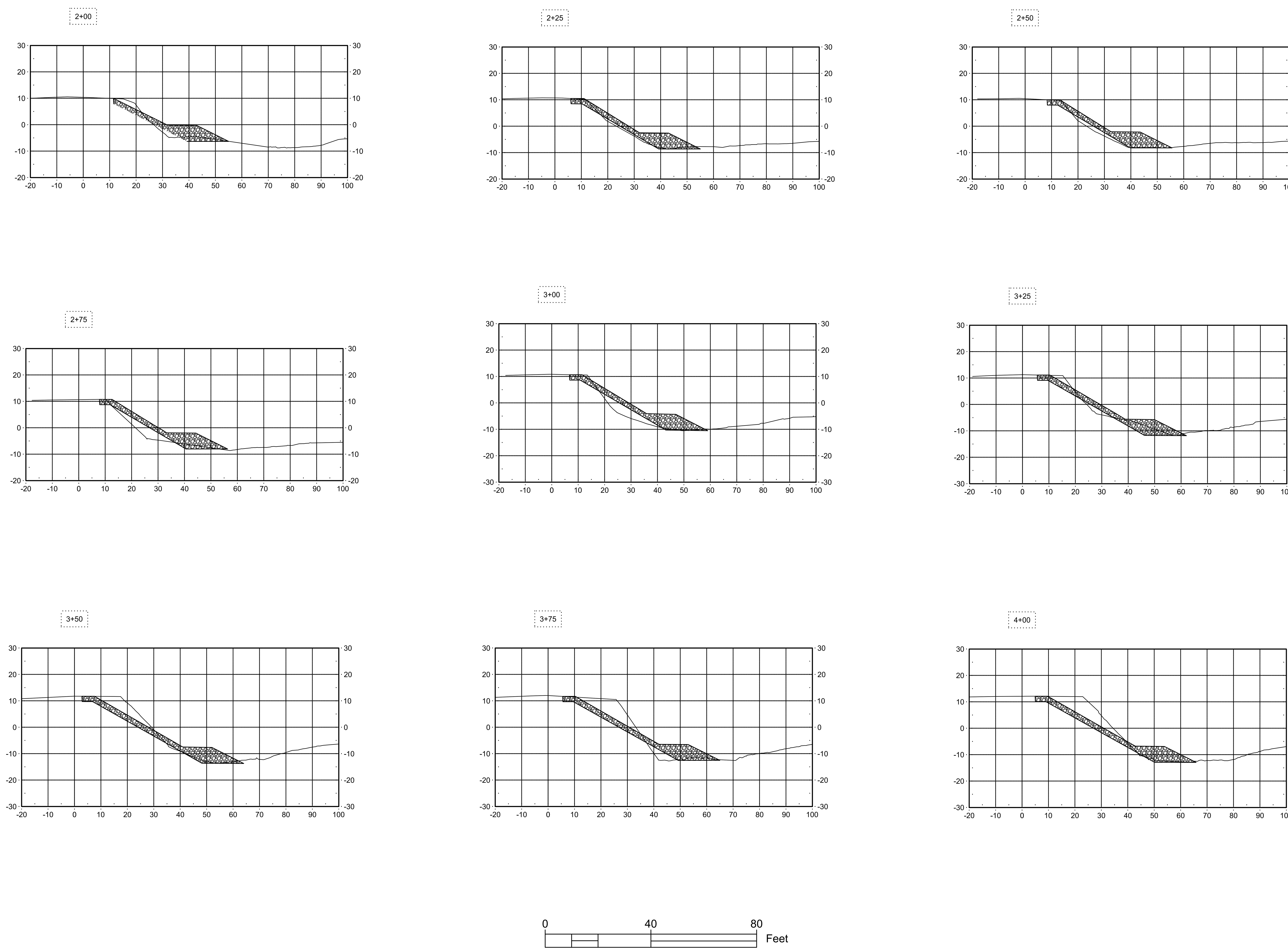
GREENVILLE UTILITY COMMISSION
NC SECTION 14 EMERGENCY STREAMBANK
AND SHORELINE EROSION PROTECTION
GREENVILLE, NC 27858

EROSION PROTECTION PLAN
AND TYPICAL CROSS-SECTION

SHEET ID

CN-100

PRELIMINARY DESIGN



US Army Corps of Engineers

MARK	DESCRIPTION	DATE

ISSUE DATE: MMMMMMMMM YYYY
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.: XXXXXX-XX-X-XXXX

DESIGNED BY: S. STELLO
DRAWN BY: S. STELLO
CHECKED BY: S. STELLO
SUBMITTED BY: S. STELLO
SIZE: 22" X 34"

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
69 DARLINGTON AVENUE
WILMINGTON, NC 28403

GREENVILLE UTILITIES COMMISSION
NC SECTION 14 EMERGENCY STREAMBANK
AND SHORELINE EROSION PROTECTION
GREENVILLE, NC 27858

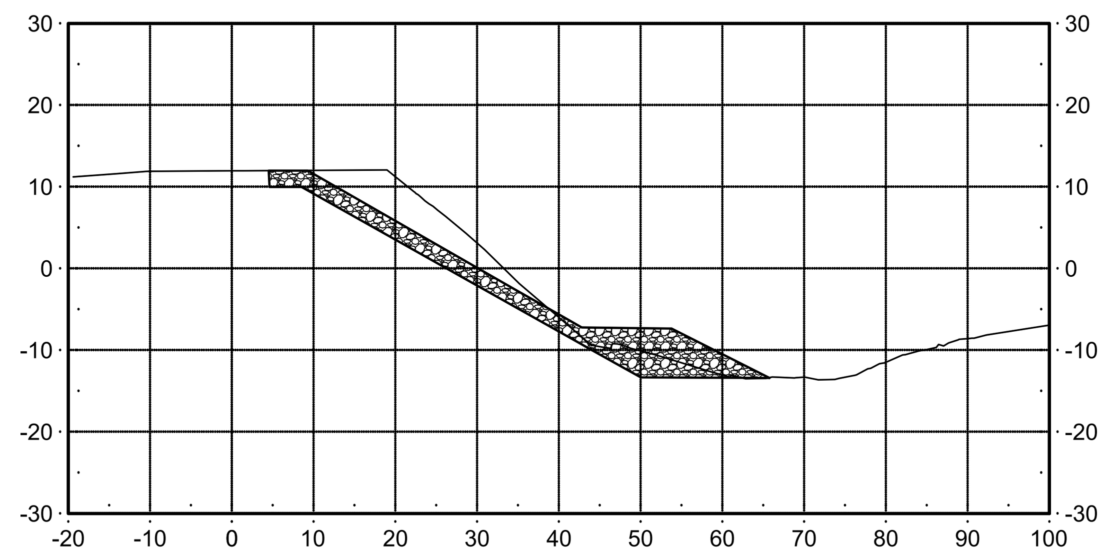
EROSION PROTECTION CROSS SECTIONS
STA. 2+00 TO STA. 4+00

SHEET ID

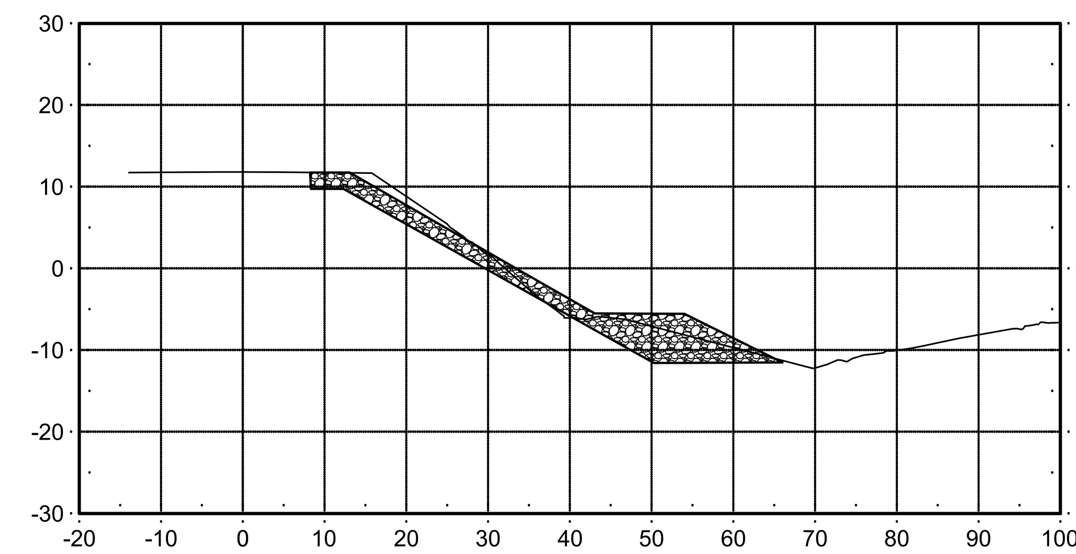
CN-300

PRELIMINARY DESIGN

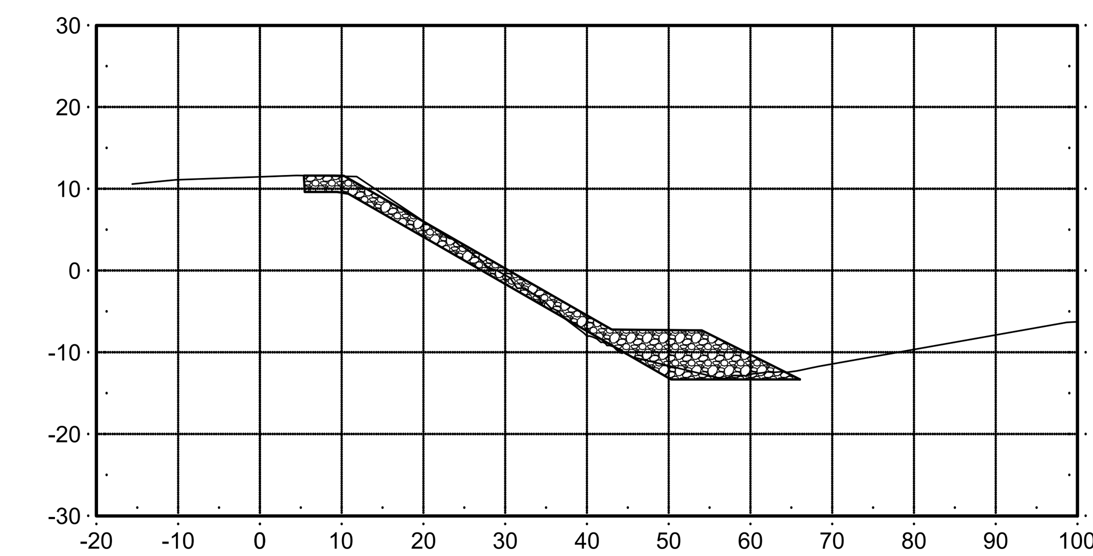
4+25



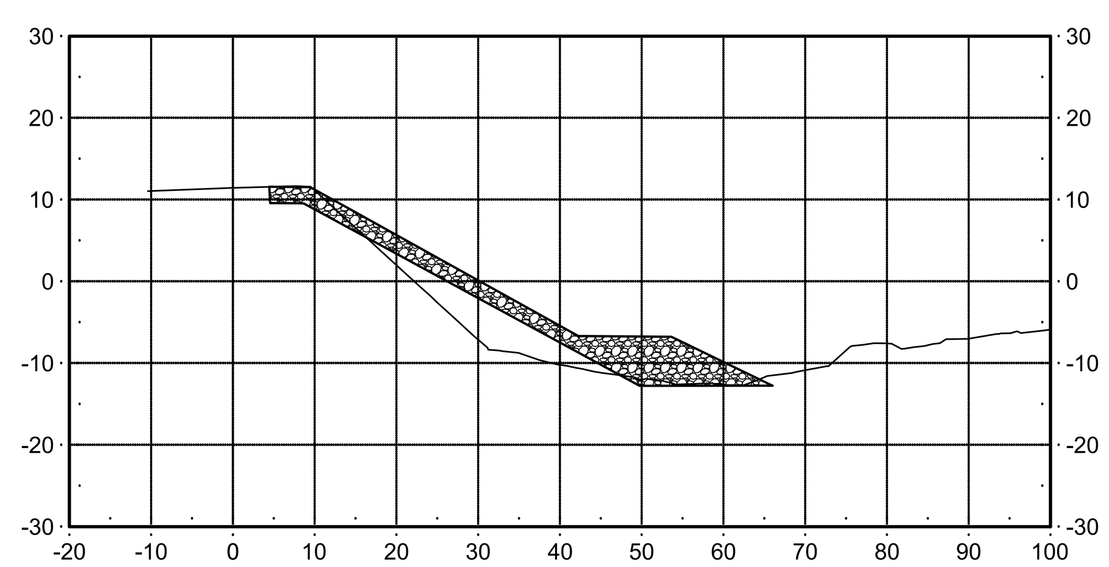
4+50



4+75



5+00



0 40 80
Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: S. STELLO
DRAWN BY: S. STELLO
CHECKED BY: S. STELLO
SUBMITTED BY: S. STELLO
SIZE: 22" X 34"

ISSUE DATE: MMMMMMMMM YYYY
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.: XXXXXX-XX-X-XXXX

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
69 DARLINGTON AVENUE
WILMINGTON, NC 28403

GREENVILLE UTILITIES COMMISSION
NC SECTION 14 EMERGENCY STREAMBANK
AND SHORELINE EROSION PROTECTION
GREENVILLE, NC 27858

EROSION PROTECTION CROSS SECTIONS
STA. 2+00 TO STA. 4+00

SHEET ID
CN-301

PRELIMINARY DESIGN

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

NORTH CAROLINA
Environmental Quality

DWR Project No: ______________________ County: ___________________________

Applicant: ____

Project Name: ____

401 Water Quality Certification Issued Date: ______________________________________

Certificate of Completion

Upon completion of all work approved within the 401 Water Quality Certification or applicable Buffer Rules, and any subsequent modifications, the applicant is required to return this certificate to the DWR Central Office – Wetlands and Buffer Permitting Unit, NC DWR, 1650 Mail Service Center, Raleigh, NC, 27699-1650. This form may be returned to DWR by the applicant, the applicant's authorized agent, **or** the project engineer. It is not necessary to send certificates from all of these.

Applicant's Certification

I, __________________________________, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: ________________________________ Date: ___________________________

Agent's Certification

I, __________________________________, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: ________________________________ Date: ___________________________

If this project was designed by a Certified Professional

I, _________________________________, as a duly registered Professional __________ (i.e., Engineer, Landscape Architect, Surveyor, etc.) in the State of North Carolina, having been authorized to observe (periodically, weekly, full time) the construction of the project, for the Permitee hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: ________________________________ Date: ___________________________

Appendix J

USFWS Tentative Concurrence with Species Effects Determinations

From:	Ellis, John
To:	Bashaw, Justin P CIV USARMY CESAW (USA)
Cc:	Mann, Leigh; Matthews, Kathryn H; Benjamin, Pete; Owens, Jennifer L CIV USARMY CESAW (USA); Glazener, Jason S CIV USARMY CESAW (USA)
Subject:	[URL Verdict: Neutral][Non-DoD Source] Re: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information
Date:	Friday, April 7, 2023 3:34:43 PM

Justin,

The US Fish and Wildlife Service (USFWS) tentatively concurs with the US Army Corps of Engineers' (Corps) effects determinations presented in Table 7-1 of the "Detailed Project Report and Environmental Assessment and Finding of No Significant Impact, Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project" regarding species listed under the Endangered Species Act (ESA) and under the purview of the USFWS (table also featured below); however, the USFWS notes that the presence of the Atlantic Pigtoe (*Fusconaia masoni*) and Tar River Spinymussel (*Parvaspina steinstansana*) is unconfirmed pending a survey to be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when bivalves are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and North Carolina Wildlife Resources Commission. Should the USFWS deem it necessary, following interpretation of survey results, bivalves will be relocated outside of the project area prior to construction activities. These relocations should occur not more than a month before work begins. The Neuse River waterdog is known to occur in large numbers just downstream of the proposed project. Work will occur in areas where armoring efforts have already occurred so the likelihood of encountering a NRWD is very low due to lack of habitat. TheCorps commitment to use stringent erosion and sediment controls on land and silt curtains in the water should minimize negative impacts to listed species in the area and downstream. Monitoring and maintenance of these measures should occur more often than in their typical use esp before or after any rainfall events or expected rises in the Tar River. If listed species are found it may require a Biological Opinion and a shift from informal to formal consultation between the Corps and USFWS to satisfy Section 7 of the ESA.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Tuesday, March 28, 2023 5:21 PM
To: Ellis, John <john_ellis@fws.gov>
Cc: Mann, Leigh <leigh_mann@fws.gov>; Matthews, Kathryn H <kathryn_matthews@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>; Owens, Jennifer L CIV USARMY CESAW (USA) <Jennifer.L.Owens@usace.army.mil>; Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>
Subject: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Good afternoon, John.

Thanks for discussing with your team and for giving this issue some thought. The crux of the matter, from the Corps' perspective, is that we don't have a neat and tidy "official" USFWS response to the effects determinations presented in the EA. This is raising ESA compliance questions during internal Corps reviews. What my team and I are really looking for is documentation of USFWS' recommendations regarding the Corps' effects determinations and acknowledgment that true effects determinations for all species can't be made until surveys are accomplished. An email in lieu of an "official" letter should suffice.

"Official" response aside, it seems that effects to the three species below remain in question:

<u>Atlantic Pigtoe and Tar River Spinymussel</u>

> The Corps is good with changing the effects determination for the Atlantic Pigtoe (*Fusconaia masoni*) and Tar River Spinymussel (*Parvaspina steinstansana*) from "may affect, not likely to adversely affect" to "may affect, likely to adversely to affect" pending survey results. As you suggest, we could include language stating that the determination is due to the lack of survey results at this time and that the USFWS and the Corps will continue to work together to resolve issues such that Greenville Utilities Commission infrastructure and the species are protected. We could also state that measures such as relocation of mussels, increased turbidity/silt containment measures, etc. may be utilized to minimize negative impacts.

<u>Neuse River Waterdog</u>

> For the Corps-led bank protection project, I'd thought we concluded that Neuse River Waterdog (NRWD) concerns would be addressed through robust turbidity/silt containment measures and that favorable leaf pack habitat was absent from the project footprint. I do recall your mention of a healthy NRWD population in the vicinity of the US 64 bridge crossing, but this area is downstream of the project footprint. If NRWD surveys were recommended for the Corps' bank protection project, I'm having trouble finding records of that portion of our conversation. I do appreciate that the Corps' project is similar to, but not directly associated with, the Greenville Utilities Commission's nearby dredging work though. I also appreciate that USFWS needs to be consistent with effects determination and recommendations. So if NRWD surveys are also required for the Corps' project, my team and I would like to account for that need ASAP. Like the mussel surveys, this would affect schedule and budget.

If you'd like to chat further about this project over the phone, I'm happy to do so. Sometimes a phone call can save a few days of email back-and-forth. Bringing it all home, it'd help the Corps to have a neat and tidy written response from USFWS commenting on the EA's effects determinations and providing recommendations.

Thanks for working with us on this project, John and USFWS team!

Best,
-Justin

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator | Public Involvement Specialist
U.S. Army Corps of Engineers, South Atlantic Division, Wilmington District

☎ +1 (910) 251-4581
+1 (910) 251-4744
Justin.P.Bashaw@usace.army.mil
✉ 69 Darlington Avenue, Wilmington, NC 28403-1343
https://www.saw.usace.army.mil/

From: Ellis, John <john_ellis@fws.gov>
Sent: Tuesday, March 28, 2023 10:52 AM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>; Mann, Leigh <leigh_mann@fws.gov>; Matthews, Kathryn H <kathryn_matthews@fws.gov>; Benjamin, Pete <pete_benjamin@fws.gov>
Subject: [URL Verdict: Neutral][Non-DoD Source] Re: [EXTERNAL] Re: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Justin,

I'll need to run this wording by Pete.

My current thinking is a "may affect, likely to adversely affect" determination is more appropriate until surveys are completed. If this is the case, I would recommmend including language stating that the determination is due to the lack of survey results at this time and that the Service and the Corps will continue to work together to resolve issues such that the facility and the species are protected. Measures such as relocation of mussels, increased turbidity/silt containment measures, etc may be utilized to minimize negaive impacts. What are your thoughts on that approach? I'll run them both by others in the meantime.

I'm trying to remember how we had left the NRWD for this project vs the City's project to clean the intake structures. If I recall correctly, with this project involving intensive in-stream and bank work that may increase turbidity, thus I believe we recommended surveys for the Neuse River waterdog too. The City's project was only impacting the streambank in the area where a temporary pipe which would carry sediment slurry from the cleaning pumps to a filter bag and thus NRWD was a MANLAA. Sampling by NCWRC for NRWD in the vicinity of the US 64 bridge over the Tar River indicated a healthy population in the area. NRWD could be present along the banks in areas that are not currently stabilized and turbidity or sediment released during the proposed stabilization has the potential to negatively impact the NRWD.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Monday, March 27, 2023 11:43 AM
To: Ellis, John <john_ellis@fws.gov>
Subject: [EXTERNAL] Re: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Good morning, John.

Following-up on this email thread, I'm hoping to work through an ESA compliance issue with you. Since the phone tag gods are still playing games with us both, below is a summary of the issue and (what I hope can be???) resolution to satisfy the Corps' concerns and USFWS'.

The “Greenville Utilities Commission Water Treatment Plant Streambank Protection” project’s Environmental Assessment is currently with my colleagues at the Corps’ Division in Atlanta for final review. Although you and I discussed the reasons why USFWS hasn’t provided the Corps with an official ESA effects concurrence letter, Corps policy won’t allow us to sign a FONSI (and meet internal set project milestones) without one. So I have a request of you that I believe will satisfy the Corps’ and USFWS’ concerns and still account for the current knowledge / effects gap regarding ESA compliance and endangered bivalves potentially present in the project area.

<u>First, a recap of where we are:</u>
Currently, the Corps is considered in informal consultation with the USFWS pending the results of the bivalve survey to take place in May-October 2023. Although the Corps has made effect determinations for USFWS ESA species but doesn’t have a strong body of evidence to know if bivalves are present in the project area or not, the USFWS’ position is that it isn’t yet able to provide an official ESA concurrence letter. “If” bivalves are found that “may” trigger the need for formal consultation and a BO depending on how the USFWS interprets survey results. Formal consultation, if necessary, would cover any takes during relocations.

<u>Second, my proposed solution to the Corps’ policy compliance conundrum:</u>
In lieu of a formal letter ESA effects concurrence letter from you, Pete Benjamin, or any other USFWS person, would you agree to writing an email to me essentially stating…

- The US Fish and Wildlife Service (USFWS) tentatively concurs with the US Army Corps of Engineers' (Corps) effects determinations presented in Table 7-1 of the "Detailed Project Report and Environmental Assessment and Finding of No Significant Impact, Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project" regarding species listed under the Endangered Species Act (ESA) and under the purview of the USFWS (table also featured below); however, the USFWS notes that the presence of the Atlantic Pigtoe (*Fusconaia masoni*) and Tar River Spinymussel (*Parvaspina steinstansana*) is unconfirmed pending a survey to be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when bivalves are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and North Carolina Wildlife Resources Commission. Should the USFWS deem it necessary, following interpretation of survey results, bivalves will be relocated outside of the project area prior to construction activities. Relocations may require a Biological Opinion and a shift from informal to formal consultation between the Corps and USFWS to satisfy Section 7 of the ESA.

Federally / State Listed Species				
Common Name	**Scientific Name**	**Responsible Agency**	**Status**	**Effects Determination**
American Alligator	*Alligator mississippiensis*	USFWS	FSAT	NE
Atlantic Pigtoe	*Fusconaia masoni*	USFWS	FT	MANLAA
Atlantic Sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	NFMS	FE	NE
Bald Eagle	*Haliaeetus leucocephalus*	USFWS	BGEPA	NE
Eastern Lampmussel	*Lamsilis radiata*	NCWRC	ST	MANLAA
Monarch Butterfly	*Danaus plexippus*	USFWS	FC	NE
Roanoke Slabshell	*Elliptio roanokensis*	NCWRC	SSC	MANLAA
Neuse River waterdog	*Necturus lewisi*	USFWS	FT	MANLAA
Tar River Spinymussel	*Parvaspina steinstansana*	USFWS	FE	MANLAA
Tidewater Mucket	*Leptodea ochracea*	NCWRC	ST	MANLAA
West Indian Manatee	*Trichechus manatus*	USFWS	FT	NE

FC - Federal Candidate
FE - Federal Endangered
FSAT - Federal Similarity of Appearance (Threatened)
FT - Federal Threatened
SSC - State Special Concern
ST - State Threatened
BGEPA - Bald and Golden Eagle Protection Act

NE - No Effect
MANLAA - May Affect, Not Likely to Adversely Affect
MALAA - May Affect, Likely to Adversely Effect

Does this plan of action work from your perspective? Please feel free to call me if you'd like (910-251-4581).

Best,
-Justin

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator | Public Involvement Specialist
U.S. Army Corps of Engineers, South Atlantic Division, Wilmington District

☎ +1 (910) 251-4581

+1 (910) 251-4744
Justin.P.Bashaw@usace.army.mil
🖂 69 Darlington Avenue, Wilmington, NC 28403-1343
https://www.saw.usace.army.mil/

From: Bashaw, Justin P CIV USARMY CESAW (USA)
Sent: Tuesday, March 21, 2023 11:08 AM
To: Ellis, John <john_ellis@fws.gov>
Subject: RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Good morning, John.

I'm sorry we're missing each other's phone calls, but I hope you've been well. I think this morning's freeze in Wilmington just *might* be the last one for a good while. Bring on the spring!

The "Greenville Utilities Commission Water Treatment Plant Streambank Protection" project's Environmental Assessment is currently with my colleagues at the Corps' Division in Atlanta for final review. Although you and I discussed the reasons why USFWS hasn't provided the Corps with an official ESA effects concurrence letter, Corps policy won't allow us to sign a FONSI (and meet internal set project milestones) without one. So I have a request of you that I believe will satisfy the Corps' and USFWS' concerns and still account for the current knowledge / effects gap regarding ESA compliance and endangered bivalves potentially present in the project area.

<u>First, a recap of where we are:</u>
Currently, the Corps is considered in informal consultation with the USFWS pending the results of the bivalve survey to take place in May-October 2023. Although the Corps has made effect determinations for USFWS ESA species but doesn't have a strong body of evidence to know if bivalves are present in the project area or not, the USFWS' position is that it isn't yet able to provide an official ESA concurrence letter. "If" bivalves are found that "may" trigger the need for formal consultation and a BO depending on how the USFWS interprets survey results. Formal consultation, if necessary, would cover any takes during relocations.

<u>Second, my proposed solution to the Corps' policy compliance conundrum:</u>
In lieu of a formal letter ESA effects concurrence letter from you, Pete Benjamin, or any other USFWS person, would you agree to writing an email to me essentially stating…

- The US Fish and Wildlife Service (USFWS) tentatively concurs with the US Army Corps of Engineers' (Corps) effects determinations presented in Table 7-1 of the "Detailed Project Report and Environmental Assessment and Finding of No Significant Impact, Greenville Utilities Commission, NC, Section 14 Emergency Streambank and Shoreline Erosion Protection Project" regarding species listed under the Endangered Species Act (ESA) and under the purview of the USFWS (table also featured below); however, the USFWS notes that the presence of the Atlantic Pigtoe (*Fusconaia masoni*) and

Tar River Spinymussel (*Parvaspina steinstansana*) is unconfirmed pending a Corps-led survey to be conducted within the project area as well as 100 meters upstream and 300 meters downstream. The survey will be conducted between May and October, when bivalves are most conspicuous and less likely to bury themselves in riverine sediments. The survey, including its methodology and results, will be coordinated with the USFWS and North Carolina Wildlife Resources Commission. Should the USFWS deem it necessary, following interpretation of survey results, bivalves will be relocated outside of the project area prior to construction activities. Relocations may require a Biological Opinion and a shift from informal to formal consultation between the Corps and USFWS to satisfy Section 7 of the ESA.

Federally / State Listed Species				
Common Name	**Scientific Name**	**Responsible Agency**	**Status**	**Effects Determination**
American Alligator	*Alligator mississippiensis*	USFWS	FSAT	NE
Atlantic Pigtoe	*Fusconaia masoni*	USFWS	FT	MANLAA
Atlantic Sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	NFMS	FE	NE
Bald Eagle	*Haliaeetus leucocephalus*	USFWS	BGEPA	NE
Eastern Lampmussel	*Lamsilis radiata*	NCWRC	ST	MANLAA
Monarch Butterfly	*Danaus plexippus*	USFWS	FC	NE
Roanoke Slabshell	*Elliptio roanokensis*	NCWRC	SSC	MANLAA
Neuse River waterdog	*Necturus lewisi*	USFWS	FT	MANLAA
Tar River Spinymussel	*Parvaspina steinstansana*	USFWS	FE	MANLAA
Tidewater Mucket	*Leptodea ochracea*	NCWRC	ST	MANLAA
West Indian Manatee	*Trichechus manatus*	USFWS	FT	NE

FC - Federal Candidate
FE - Federal Endangered
FSAT - Federal Similarity of Appearance (Threatened)
FT - Federal Threatened
SSC - State Special Concern
ST - State Threatened
BGEPA - Bald and Golden Eagle Protection Act

NE - No Effect
MANLAA - May Affect, Not Likely to Adversely Affect
MALAA - May Affect, Likely to Adversely Effect

Does this plan of action work from your perspective? Please feel free to call me if you'd like (910-251-4581).

Best,
-Justin

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator | Public Involvement Specialist
U.S. Army Corps of Engineers, South Atlantic Division, Wilmington District

☎ +1 (910) 251-4581
+1 (910) 251-4744
Justin.P.Bashaw@usace.army.mil
✉ 69 Darlington Avenue, Wilmington, NC 28403-1343
https://www.saw.usace.army.mil/

From: Ellis, John <john_ellis@fws.gov>
Sent: Monday, December 19, 2022 5:03 PM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>; Dunn, Maria T. <maria.dunn@ncwildlife.org>
Cc: Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>
Subject: [URL Verdict: Neutral][Non-DoD Source] Re: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Justin,

The river should be surveyed from 100 m upstream of the project to 300 m downstream of the project. I saw you have contacted Maria about a list of permitted folks to do the surveys. As far as protocols, those folks have lots of experience and know what is required.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Friday, December 16, 2022 8:38 AM
To: Ellis, John <john_ellis@fws.gov>
Cc: Glazener, Jason S CIV USARMY CESAW (USA) <Jason.S.Glazener@usace.army.mil>
Subject: [EXTERNAL] RE: USACE Streambank Protection Project - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - Bivalve Survey Information

Good morning, John.

Thanks for speaking with me last Friday about USACE's bank protection project on the Tar River in Greenville, NC, at the Greenville Utilities Commission's property.

One point we discussed was the need to conduct bivalve surveys in the project area during warmer months between May-October. Survey results would be shared with your office for interpretation and direction (i.e., possible relocations) before any construction occurred. To help planning on my end, can you address the two items?

- The USACE's project will be located on the northeast bank of the Tar River and will extend 305 linear feet. **What footprint should the bivalve survey cover** (i.e., how far into the river channel, how far upstream / downstream of the project extent)?
- Can you provide a **list of qualified and credentialed survey contractors** and, if possible, an **example**

scope of work or other information to assist us in describing proper survey methodology and products?

I've also copied the project's manager and planner, Jason Glazener, so he's in the loop.

Thank you,
-Justin

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator | Public Involvement Specialist
U.S. Army Corps of Engineers, South Atlantic Division, Wilmington District

☎ +1 (910) 251-4581
+1 (910) 251-4744
Justin.P.Bashaw@usace.army.mil
✉ 69 Darlington Avenue, Wilmington, NC 28403-1343
https://www.saw.usace.army.mil/

From: Ellis, John <john_ellis@fws.gov>
Sent: Friday, December 9, 2022 11:47 AM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Subject: [Non-DoD Source] Fw: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Justin,

Please give me a call when you have a chance. I left my cell number on your voice mail although you may have it already.

John

From: Ellis, John <john_ellis@fws.gov>
Sent: Tuesday, January 11, 2022 3:03 PM
To: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>; Matthews, Kathryn H <kathryn_matthews@fws.gov>; Mann, Leigh <leigh_mann@fws.gov>
Subject: Re: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Justin,

I'm resending as you had the wrong email for Kathy.. It is Kathryn_matthews@fws.gov.

You can send the info to me and leigh_mann@fws.gov.

I can go ahead and let you know that potential impacts to listed aquatics spp will be of interest. You should also contact NMFS for Alantic sturgeon comments. The Service would recommend the typical moratorium on in-water work to protect diadromous fish. Lastly, there has been a bald eagle nest within 1/2 mile of the water treatment plant in the past so it would be good to do eagle nest surveys to verify if it is still active and if there are others within a distance which would trigger an eagle permit.

It's been a number of years since i last visited the water treatment plant but have some familiarity of where it is located. I believe I was last there when they were working on the permit to install the vanes to split the oncoming bedload around the intakes.

John

From: Bashaw, Justin P CIV USARMY CESAW (USA) <Justin.P.Bashaw@usace.army.mil>
Sent: Tuesday, January 11, 2022 10:55 AM
To: Ellis, John <john_ellis@fws.gov>; kathy_matthews@fws.gov <kathy_matthews@fws.gov>
Subject: [EXTERNAL] USACE Streambank Protection Project (Scoping Phase) - Greenville Utilities Commission Water Treatment Plant, Pitt County, NC - USFWS POC?

Good morning John and Kathy,

Happy new year, and I hope you're both well!

I'll be brief: The USACE is in the scoping phase of a **streambank protection project for the Greenville Utilities Commission's Water Treatment Plant in Pitt County, NC**. I intend to send the USFWS (and others) a scoping letter by the end of the week, but didn't want to over-share and back-up inboxes. **Which one of you would be most appropriate as the USFWS point of contact for this project**?

Thank you!

Respectfully,
-Justin B

Justin Bashaw
Biologist | Cultural Resources Manager | Ocean Disposal Coordinator
U.S. Army Corps of Engineers, Wilmington District, ECP-PE

☎ O: +1 (910) 251-4581

F: +1 (910) 251-4744
E: Justin.P.Bashaw@usace.army.mil
M: 69 Darlington Avenue, Wilmington, NC 28403-1343