



US Army Corps
of Engineers®
Wilmington District

**DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT
HOOKERTON, 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

July 2015

Detailed Project Report and Environmental Assessment

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List of Acronyms

ARA	Abbreviated Risk Analysis
BOD	Biological Oxygen Demand
CAP	Continuing Authorities Program
DI	Design and Implementation
DPR	Detailed Project Report
DWR	North Carolina Division of Water Resources
EA	Environmental Assessment
EFH	Essential Fish Habitat
EOPs	Environmental Operating Principles
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended
MCACES	Microcomputer Aided Cost Estimating System
NCDA&CS	North Carolina Department of Agriculture and Consumer Services
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NEPA	National Environmental Policy Act
NWP	Nationwide Permit
PDT	Project Delivery Team
PED	Planning Engineering & Design
PPA	Project Partnership Agreement
S&A	Supervision and Administration
SHPO	North Carolina State Historic Preservation Office
TPCS	Total Project Cost Summary
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WQC	Water Quality Certification
WWTP	Maury Sanitary Land District, Wastewater Treatment Plant

EXECUTIVE SUMMARY

This Detailed Project Report and Environmental Assessment (DPR/EA) presents the findings of the Hookerton, NC Section 14 Emergency Streambank and Shoreline Erosion Protection Study, and has been prepared 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 Hookerton, NC Section 14 project consists of a Town of Hookerton wastewater treatment facility, specifically Lagoon #1, located along the embankment of Contentnea Creek in Hookerton, NC.

The overall goal of the Hookerton, NC Section 14 project is to provide reliable protective measures to prevent the ongoing streambank erosion at the site from destructively impacting Lagoon #1 and the associated wastewater treatment facility. 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 subject wastewater treatment facility qualifies under the Section 14 program, since it is maintained by the Town of Hookerton as a key element of the municipal wastewater system, and is under imminent threat of damage or failure from continuing streambank erosion at the site.

This DPR/EA summarizes baseline existing conditions in the project area. It also 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 likely 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 objectives of protecting the wastewater treatment facility from damaging streambank shoreline erosion.

The Recommended Plan (Stone (Rip Rap) Slope Protection) would consist of a layer of stone (Rip Rap) placed over a layer of bedding stone along approximately 550 linear feet of streambank and extending for a distance of approximately 40-50 feet from the top of the existing streambank in the oxbow bend of Contentnea Creek adjacent to Lagoon #1. The streambank would be cleared and graded to a 1.5H:1V to 2H:1V slope (depending on segment) 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. The streambank slope protection measures would consist of a 1' layer of bedding stone (NCDOT #57 stone) and a 27"

thick layer of NCDOT Class II riprap placed over a layer of geotextile and graded fill slope. Toe protection will be placed along the toe of the stream bottom. The stone toe protection will be placed to distance of approximately eleven (11) feet to eighteen (18) feet from the toe and to a height of approximately 3 feet above the stream bottom. Materials staging would take place in previously disturbed areas. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment.

Several project costs that reflect the changing value of money over time have been calculated for the Recommended Plan. These estimated costs are documented in the cost appendix and reflect the changing value of money over time. For simplicity in the main report, the Direct Construction Cost figure is used. The Direct Construction Cost of the Recommended Plan would be \$941,000 (does not include detailed design and construction management). Total Project Costs including detailed design and construction management are \$1,306,000. The figure of \$1,306,000 is used as the basis for cost sharing. The Fully Funded Federal cost-share for the Recommended Plan is \$849,000, which is 65% of \$1,306,000. In addition to the \$1,306,000, all feasibility phase costs will be Federally funded, as they will not exceed \$100,000. The Fully Funded non-Federal cost-share of 35% is \$457,000. The non-Federal sponsor fully supports the Recommended Plan.

1.0 STUDY AUTHORITY

The proposed project, protection of a municipal wastewater lagoon located adjacent to Contentnea Creek in the Town of Hookerton, North Carolina (Figure 1.1) would be pursued under the authority of Section 14 of the Flood Control Act of 1946, as amended, for emergency streambank and shoreline erosion protection. Section 14 authorizes the US Army Corps of Engineers (USACE) to study, design, and construct emergency streambank and shoreline works to protect public services including (but not limited to) streets, bridges, schools, water and sewer lines, National Register sites, and churches from damage or loss by natural erosion. 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

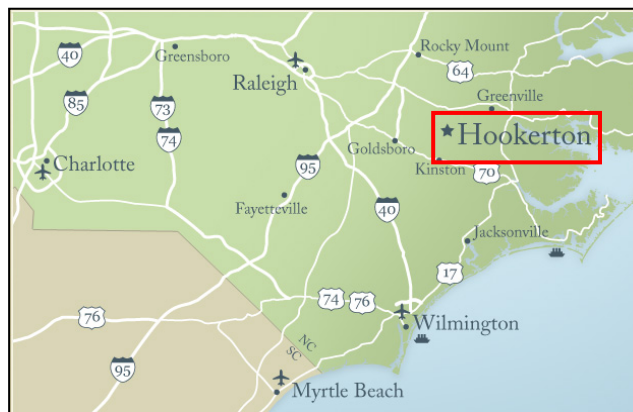


Figure 1.1. Location Map.

authorization. Additional information on this program can be found in USACE 2000, Planning Guidance Notebook, Appendix F.

The Section 14 program is designed for implementing projects to protect public facilities that are used to provide essential public services, are properly maintained, and are in imminent threat of damage or failure related to natural erosion processes on stream banks and shorelines. The subject wastewater lagoon is a key element of the Town's wastewater treatment system, is an essential public service, and is maintained as such. 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 sponsor, the Town of Hookerton, NC, strongly supports a partnership with the USACE to protect the wastewater lagoon through the Section 14 authority, as stated in correspondences with Town officials & and a Town Resolution (Appendix D). The non-Federal sponsor for this study and project is the Town of Hookerton, NC.

The feasibility study was carried out in a manner consistent with the USACE Environmental Operating Principles (EOPs). The principles are consistent with 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, seeks to work collaboratively, fully engaging individuals, agencies, and local groups in identifying, planning, and implementing shoreline protection efforts.

2.0 PURPOSE AND NEED FOR ACTION

The Town of Hookerton, NC currently operates a 0.06 MGD wastewater treatment plant (WWTP) which includes three wastewater settling lagoons located on the north side of Contentnea Creek. The facility treats raw wastewater and discharges treated effluent to the north shore of the Creek. The southernmost of the three lagoon cells (Lagoon #1) is located adjacent to an oxbow bend on the Creek. There is severe erosion near the toe of the Lagoon #1 berm, adjacent to Contentnea Creek. The town is concerned that the berm will fail, releasing large amounts of sewage into the Creek and impacting wastewater service for the Town of Hookerton.

On a 17 December 2014 site visit, the buffer between the Creek and the toe of the berm was observed to be eroded to within approximately three (3) feet of the berm toe at its nearest point. Severe erosion was visible within the red circle as shown on the map in Figure 2.1. Undercutting near the toe was also visible during the site visit (Figures 2.2 & 2.3). In addition, there was vegetation on the stream embankment near the toe that has increased the erosion in several locations. Near the most severe section of erosion a tree recently fell, and with the tree a large quantity of material near the toe was removed.

There is concern that a slope failure of the berm may soon occur at this site. Slope failure appears very likely to occur as a result of a combination of the stream bank erosion and high head between the water in the pond and the creek.



Figure 2.1. Aerial imagery indicating areas of concern (red oval).



Figure 2.2. Erosion and undercutting at toe of berm.



Figure 2.3. Escarpment and creek shoreline at toe of berm.

Continued erosion of the shoreline at the project site is expected to directly impact the wastewater lagoon if reliable protective measures are not provided. The wastewater lagoon is a critical component of the wastewater treatment plant which is a municipal facility critical to the Town's operations. Consequences of berm failure at Lagoon #1 would include the following:

- Loss of wastewater service to approximately 200 homes and businesses
- Pollution of Contentnea Creek (tributary of Neuse River) with between 2.5 – 3.6 million gallons of raw sewage

The purpose of this study is to provide long-term protection and stabilization for Lagoon #1 at the Hookerton wastewater treatment plant. Likewise, the planning objective is to identify a solution to achieve that long-term protection.

3.0 LOCATION OF STUDY AREA AND ENDANGERED FACILITY

The study area is located in Hookerton, North Carolina. Hookerton is located in Greene County in eastern NC and has a population of approximately 410. The endangered facility is located just north of the Town as shown in Figure 3.1 on the following page. Congressional representation for the area includes the following:

Senator Richard Burr (R)

Senator Thom Tillis (R)

Congressional District: NC3 – Walter B. Jones (R)

NC 1 – George “G.K.” Butterfield Jr. (D)



Figure 3.1. Location of Town of Hookerton and the WWTP.

4.0 EROSION ASSESSMENT

Historically, erosion rates have not been dramatic at the oxbow bend of Contentnea creek adjacent to the Hookerton WWTP lagoon #1. Although a comparison of a 1924 Soil Survey Map (Appendix E) for Greene County shows significant meandering between 1924 and the present (approximately 350ft. if the 1924 map is accurate), satellite imagery from recent decades shows an oxbow bend of the Creek in close proximity to Lagoon #1 without significant movement. However, onsite investigation reveals recent and severe shoreline erosion at the site. Recent storm events have caused several trees anchoring the stream bank to become uprooted. This may be a contributing factor in the recent increase in erosion. Additionally, undercutting of the embankment was observed, which raises concerns that unseen erosion may also be occurring below the waterline. The severe erosion observed during onsite inspection is within three (3) ft. of the berm toe of Lagoon #1, which makes berm failure an imminent threat due to natural streambank erosion.

5.0 PLAN FORMULATION AND EVALUATION OF ALTERNATIVES

5.1 Alternatives Considered

The following alternatives had cost estimates developed on the same terms for Total Direct Construction Costs (not to include Real Estate or Detailed Design costs). The Rip Rap alternative was carried forward to MCACES (Micro-Computer Aided Cost Estimating System) analysis as the least cost alternative (see Appendix C). Cost estimates provided in a 2014 Rivers & Associates report were used by Cost Engineering to assist with preliminary cost comparisons with the initial array of alternatives. The Rivers & Associates report summarized a preliminary investigation into protective solutions at Lagoon #1. Relocation of Lagoon #1 was investigated for economic justification purposes.

No Action Alternative:

Under the No Action Alternative, the USACE would not construct stream bank protection to address existing erosion near the toe of the Lagoon #1 berm. As of the writing of this report, the State of North Carolina plans to place rock along the most severely eroded 50-foot section of stream bank. This is intended to act as a temporary stop-gap measure to prevent berm failure until a permanent solution is constructed. Sufficient funds for full long-term protection do not appear to be available in the the No Action alternative. With No Action, flanking of the temporary fill leading to berm failure is expected to occur within 2 years. Therefore, the No Action alternative would not provide long-term stabilization of lagoon #1. No federal construction costs are incurred with this alternative.

Preferred Alternative: Stone (Riprap) Slope Protection:

Under this alternative, a layer of stone (Rip Rap) would be placed over a layer of bedding stone along approximately 550 linear feet of streambank and extending for a distance of

approximately 40-50 feet from the top of the existing streambank in the oxbow bend of Contentnea Creek adjacent to Lagoon #1. The streambank would be cleared and graded to a 1.5H:1V to 2H:1V slope (depending on segment) 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. The streambank slope protection measures would consist of a 1' layer of bedding stone (NCDOT #57 stone) and a 27" thick layer of NCDOT Class II riprap placed over a layer of geotextile and graded fill slope. Toe protection will be placed along the toe of the stream bottom. The stone toe protection will be placed to distance of approximately eleven (11) feet to eighteen (18) feet from the toe and to a height of approximately 3 feet above the stream bottom. Materials staging would take place in previously disturbed areas. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. A typical cross section is shown in section 5.3. The estimated Direct Construction Cost for this alternative is estimated to be \$941,000 (does not include detailed design and construction management).

Articulating Concrete Block Protection:

Under this alternative, the existing streambank in the vicinity of Lagoon #1 would be protected and stabilized with a precast articulating block revetment for approximately 550 linear feet of streambank. The stream bank would be graded to a 1.5H:1.0V slope with offsite select backfill material provided to fill holes and provide for a smooth slope. A toe trench would be required in the channel bottom to allow articulating concrete blocks to extend below the channel bottom to prevent undermining of the slope. Rip rap toe stabilization stone would be used to secure the block mats within the toe trench. A combination of filter stone and filter cloth would extend from the channel bottom to the top of bank to serve as an under liner for the articulating block mat. The mat would consist of a matrix of 4.75" thick open cell precast concrete blocks that are held together with longitudinal steel cables. The top of the mat would be secured in a trench backfilled with concrete and topped with soil. All exposed edges and open cells would be backfilled with suitable material to allow seeding and mulching to establish permanent vegetation along the stabilized bank. The Direct Construction Cost for this alternative is estimated to be \$1,373,000 (does not include detailed design and construction management).

OTHER ALTERNATIVES CONSIDERED BUT INITIALLY SCREENED OUT:

Make Cut-through Channel:

This alternative would consist of making a cut-through channel approximately 500 feet west of the Oxbow bend at Lagoon #1. This measure should redirect much of the water flow and

reduce the velocity flowing along the stream embankment next to the lagoon berm, thereby reducing erosion. However, considering the existing severe erosion in close proximity to the toe of the lagoon berm, some stream embankment stabilization would still be needed. Additionally, acquiring needed regulatory permits for creating a new channel through existing lowlands would be difficult, as the measure does not seek to avoid or minimize environmental impacts. Accordingly, this measure was screened out as a practicable alternative.

Steel Sheet Pile Bulkhead

This alternative would consist of a long bulkhead constructed of steel sheetpiles. Although this alternative should provide adequate protection, it was screened out during a preliminary cost analysis which showed significantly higher costs than the stone (rip rap) slope protection.

Steel Sheet Pile Cutoff Wall

This alternative is similar to the bulkhead in design, but it would be placed beyond the top of the stream bank near the toe of the lagoon berm. This option would be designed to protect the lagoon from the eroding stream bank, rather than stabilize the streambank itself. This alternative was screened out during a preliminary cost analysis which showed significantly higher costs than the stone (rip rap) slope protection.

Sand Bag Protection:

This protection measure was considered due to the potentially significant cost savings. However, because sand bags are not durable, and are easily damaged this alternative would merely serve as a temporary solution. Therefore, this alternative would not meet the study purpose to provide long term protection and stabilization. Sand bag protection was eliminated by the Project Delivery Team (PDT) from further consideration.

Cast-In-Place Concrete Filled Fabric (Fabriform) Revetment:

This alternative would consist of constructing a revetment using Fabriform technology, similar in footprint to the stone rip-rap design. Fabriform consists of a double-layer nylon fabric form combined with a concrete grout to provide armor for erosion control. The Creek alignment (180 degree bend) is such that debris (trees, etc.) floating down the creek during flood events could directly strike any erosion control measure put in place. Concerns were raised among the PDT of Fabriform durability from potential damage caused by debris directly striking and penetrating the fabric and thin revetment layer. Repair of damaged Fabriform is not simple and requires mobilization of specialized equipment. For these reasons, this alternative was screened out, and therefore not evaluated for cost.

5.2 Screening of Final Alternatives

The final array of alternatives considered for implementation were evaluated for their success in meeting the Planning Objective, including Purpose and Need; and the Planning Constraints, including technical feasibility, environmental acceptability, and economic feasibility. The evaluation criteria were then considered in screening the alternatives according to their overall acceptability. As stipulated under the Section 14 Authority, formulation and evaluation should focus on the least cost alternative solution. A discussion of the evaluations follows, with a summary of findings and screening results shown in Table 5.2.

No Action Alternative:

The No Action alternative would not meet the Purpose and Need for action, since no measures would be implemented for protection of the threatened public work (Lagoon #1) other than the temporary 50-foot fill the state is providing as a stop-gap measure. The berm of Lagoon #1 would likely be undermined within the next 2 years, resulting in berm failure and release of potentially 2.5 -3.6 million gallons of raw sewage into Contentnea Creek, which feeds the Neuse River. Essential Wastewater services to the Town of Hookerton would be disrupted. Since “No Action” does not meet the Purpose and Need requirement, it is not considered an acceptable alternative.

Articulating Concrete Block Protection:

The Articulating Concrete Block Protection alternative would meet the stated purpose and need for action. This alternative is technically feasible, involving a proven structure type for sites with similar conditions. This alternative would be considered economically feasible, but at a 38% higher cost than the Stone (Rip Rap) Slope Protection. Therefore it is not the least cost alternative.

Stone (Rip Rap) Slope Protection:

The Stone (Rip Rap) Slope Protection alternative would meet the Purpose and Need by providing long-term effective streambank stabilization to protect Lagoon #1 from threat of erosion. This alternative would be sustainable with a minimal level of maintenance, primarily 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. Relative to the other alternatives considered, this is the least-cost alternative. Considering all evaluation criteria, the Stone (Rip-Rap) Slope Protection is considered the recommended plan.

Relocation of Lagoon #1:

For the Section 14 authority, protection of the threatened facility must be less costly than relocation of the facility. Relocation of lagoon #1 to a site less vulnerable to erosion was investigated for economic justification of the project. This would require the acquisition of real estate not currently within the boundaries of the WWTP. In addition, significant infrastructure modifications and upgrades would be required, along with permitting and cleanup of the existing lagoon. Because of the time required to obtain the necessary real estate and construct the new lagoon, the current Lagoon #1 would likely require additional secondary measures for protection of the existing lagoon pending completion of the relocation work. These costs are estimated to be approximately \$1,650,000 and do not include any required mitigation or the secondary protection measures along Contentnea Creek. For these reasons, relocation of Lagoon #1 is not practicable at this time.

Relocation via re-direction of Wastewater Treatment Services to Kinston, NC:

This option has been preliminarily evaluated by the State of North Carolina's Hazard Mitigation Branch. Under this alternative, all Town of Hookerton wastewater would be pumped to the City of Kinston, NC which is approximately 11 miles to the south. Preliminary cost estimates from the State of North Carolina for this alternative exceeded \$2.2 million dollars and do not include decommissioning costs. Currently this is not a practicable alternative due to high costs.

SCREENING OF ALTERNATIVES						
Possible Alternatives	Planning Objectives		Planning Constraints			Screening Result
	Meets Purpose and Need	Sustainable	Technically Feasible	Environmentally Acceptable	Economically Feasible	
No Action	No	N/A	N/A	N/A	N/A	Not acceptable, doesn't meet Purpose & Need
Stone (Rip-Rap) Slope Protection	Yes	Yes, with minimal-to-moderate maintenance	Yes	Yes; minimizes impacts while meeting purpose and need.	Yes, \$941k	Acceptable, preferred overall
Articulating Concrete Block Protection	Yes	Yes, with minimal-to-moderate maintenance	Yes	Yes; minimizes impacts while meeting purpose and need.	Yes, \$1,373,000k	Acceptable, not most economical
Cut-through Channel	Yes	Long-term effectiveness uncertain	Yes	No. Does not minimize environmental impacts	N/A	Not environment acceptable
Cast-In-Place Fabriform Revetment	Yes	No, damage concerns from debris & maintenance concerns	Yes	Yes, but short-term benefit due to likely failure	N/A	Not acceptable, maintenance concerns
Sandbags	No; does not meet long-term need	No, lack of durability will only provide temporary protection	Yes	Yes; minimizes impacts	N/A	Not acceptable, short term

Table 5.2. Screening of Alternatives.

5.3 Recommended plan

The evaluation and screening of alternatives resulted in the following:

- Four alternatives, the No Action, Cut-through Channel, Cast-In-Place Fabriform Revetment and Sand bags were determined to be unacceptable.
- Two alternatives, the Stone (Rip Rap) Slope Protection, and Articulating Concrete Block Protection were considered acceptable.
- The Stone (Rip Rap) Slope Protection was considered the Recommended Plan, given its cost relative to the other acceptable alternative.

The Town of Hookerton has expressed acceptance of the Stone (Rip-Rap) Slope Protection as their locally-preferred alternative. As a result of evaluation, screening, and local acceptance, the Recommended Plan is the Stone (Rip Rap) Slope Protection.

Recommended Plan Description: This plan will provide stabilization with a layer of stone (Rip Rap) placed over a layer of bedding stone along approximately 550 linear feet of streambank and extending for a distance of approximately 40-50 feet from the top of the existing streambank in the oxbow bend of Contentnea Creek adjacent to Lagoon #1. The existing stream bank and surrounding area would be cleared along the top of bank. The streambank would be graded to a 1.5H:1V to 2H:1V slope (depending on segment) 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 27" thick layer of NCDOT Class II riprap placed over a layer of geotextile and graded fill slope. Toe protection will be placed along the toe of the stream bottom. The stone toe protection will be placed to distance of approximately eleven (11) feet to eighteen (18) feet from the toe and to a height of approximately 3 feet above the stream bottom. Materials staging would take place in previously disturbed areas. Vegetative clearing not to exceed one acre may be required to accommodate necessary equipment. A typical cross section is shown in figure 5.3.1. A plan view of the alternative footprint of the recommended plan is shown in figure 5.3.2. See appendix F for detailed geotechnical analysis of project site. Estimated construction time is 4-6 months.

Civil/Site Description: Access to the site is currently via a 12 ft. wide dirt road that will need to be upgraded for construction traffic. A 12" DIP sewer feeder is located above grade and blocks access from the access road directly around the southwest (stream) side of Lagoon #1. The proposed plan is to improve the access road from the highway passing around the opposite side of Lagoon #1 to around the far side of Lagoons #2 and #3 back to the open area between Lagoon #1 and Lagoons #2 & #3 where there is room for a construction staging area. About 180 LF of the access road south of Lagoon #1 between the security gates is subject to intermittent flooding during rain events. This areas will be raised and a 24-inch CMP will be placed under the roadway to drain the trapped high water. Much of the stream bank is wooded so it is estimated up to an acre of clearing and grubbing will be required to gain construction access to the stream bank area to be stabilized. It is assumed that a Type 2 DOT Turbidity Curtain will be required

during in water material placement. Silt fence is assumed on the upland perimeter of the construction activities and along most of both sides of the improved road construction. Portions of an existing security fence will need to be removed and later replaced to facilitate construction access to portions of the stream bank. Post construction landscaping to restore disturbed areas and fill slopes is estimated to be approximately a ½ acre.

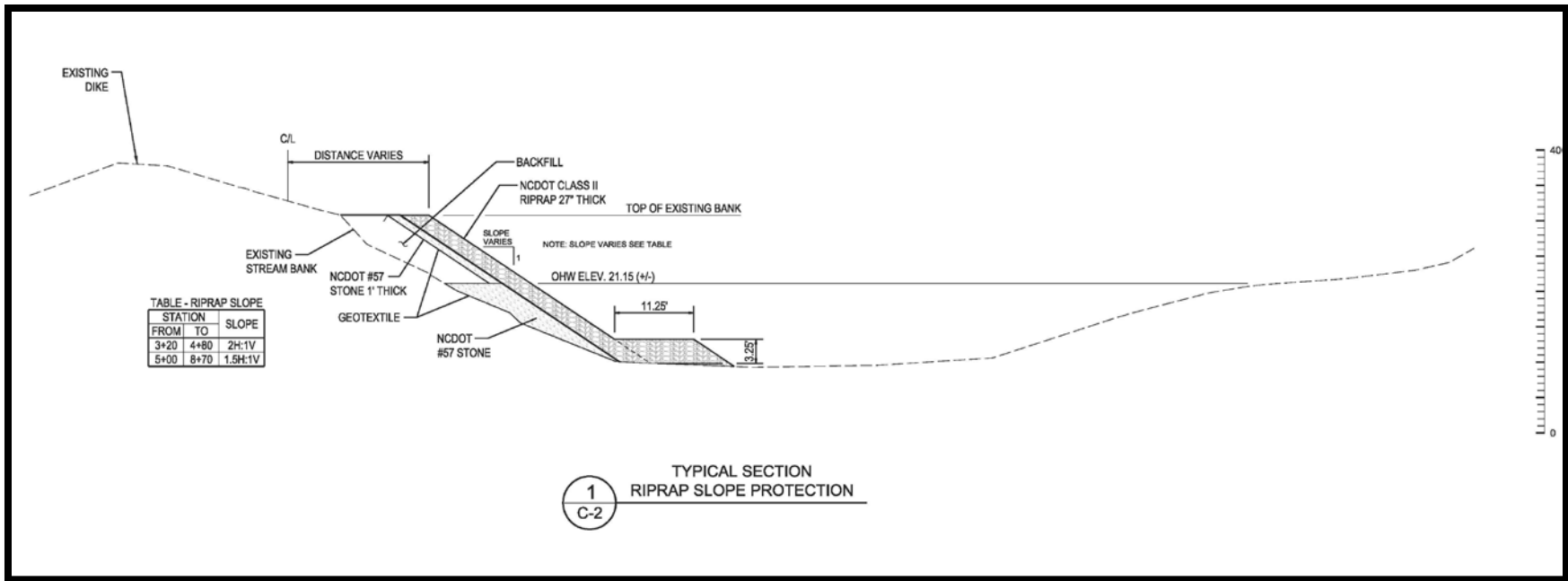


Figure 5.3.1. Typical cross section of Recommended Plan.

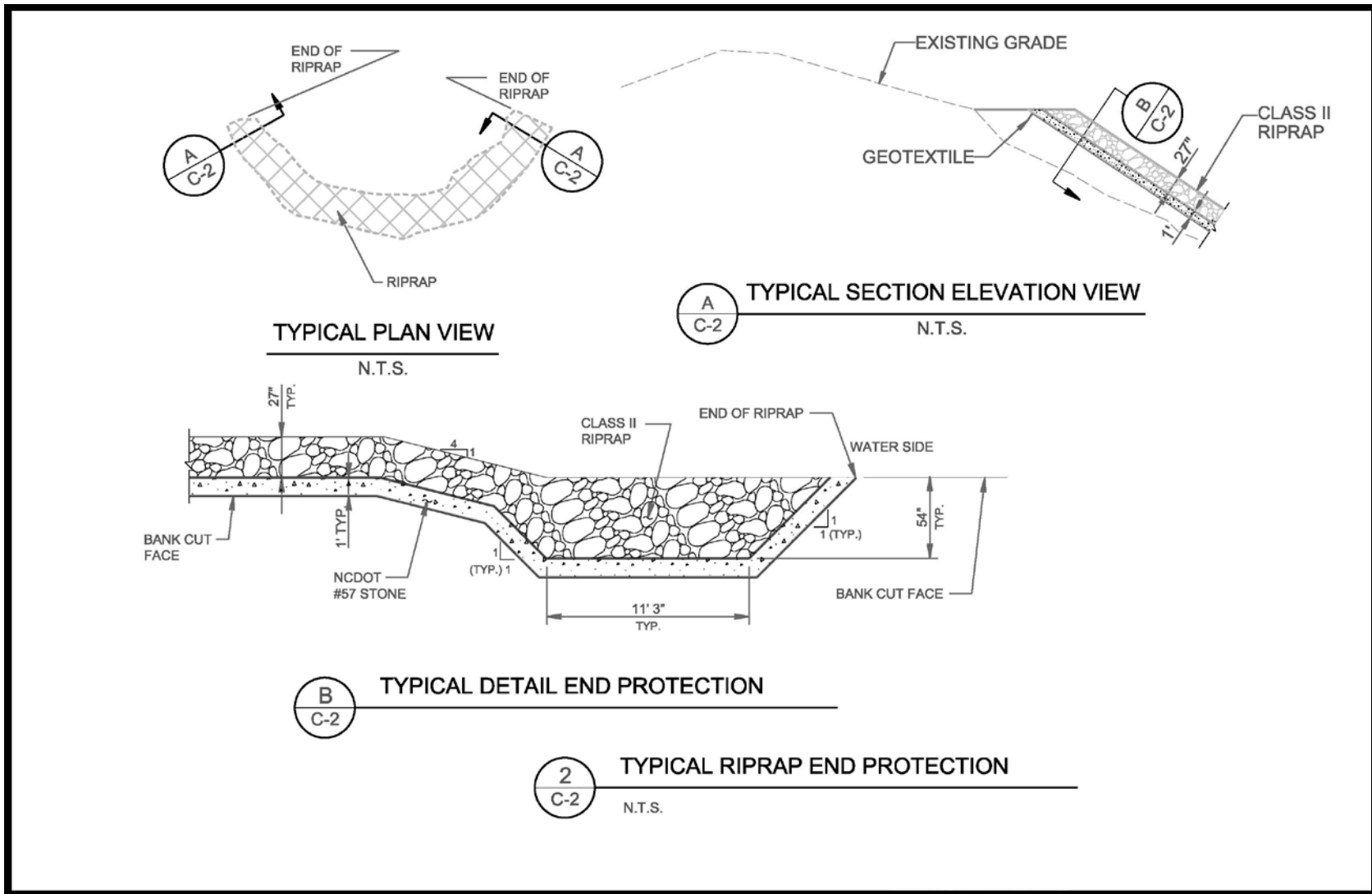


Figure 5.3.2 Typical details of Recommended Plan



Figure 5.3.3. Plan View of Recommended Plan.



Figure 5.3.4. Aerial Map showing project site, access road and proposed staging area.

6.0 EXISTING AND FUTURE-WITHOUT PROJECT CONDITIONS, AND IMPACTS OF THE PROPOSED ACTION AND NO ACTION

6.1 Sediments

Greene County contains two divisions of North Carolina's Coastal Plain physiographic region – the Sunderland and Wicomico Terraces. The Wicomico Terrace exists toward the eastern side of the county, and includes the town of Hookerton and the project area. The Scurry Scarp, nearly continuous throughout the county, separates the two terrace divisions. In general, the county gently slopes toward the southeast with common elevations between 75 and 110 feet above mean sea level. Contentnea Creek ranges in elevation from 120 feet above mean sea level in western portions of the county to 20 feet in eastern extents (U.S. Department of Agriculture et al. 2015).

Soils at and within approximately 500 feet of the proposed project area are Alpine fine sand (AnB), Cowarts sandy loam (CoC2), Lumbee sandy loam (Lu), Pactolus fine sand (Pa), Paxville loam (Pm) and Pits (Pt) (Figure 6.1.1). Pa soils, in the immediate project area, are characterized as being moderately well-drained and as having low available water storage (U.S. Department of Agriculture 2015).

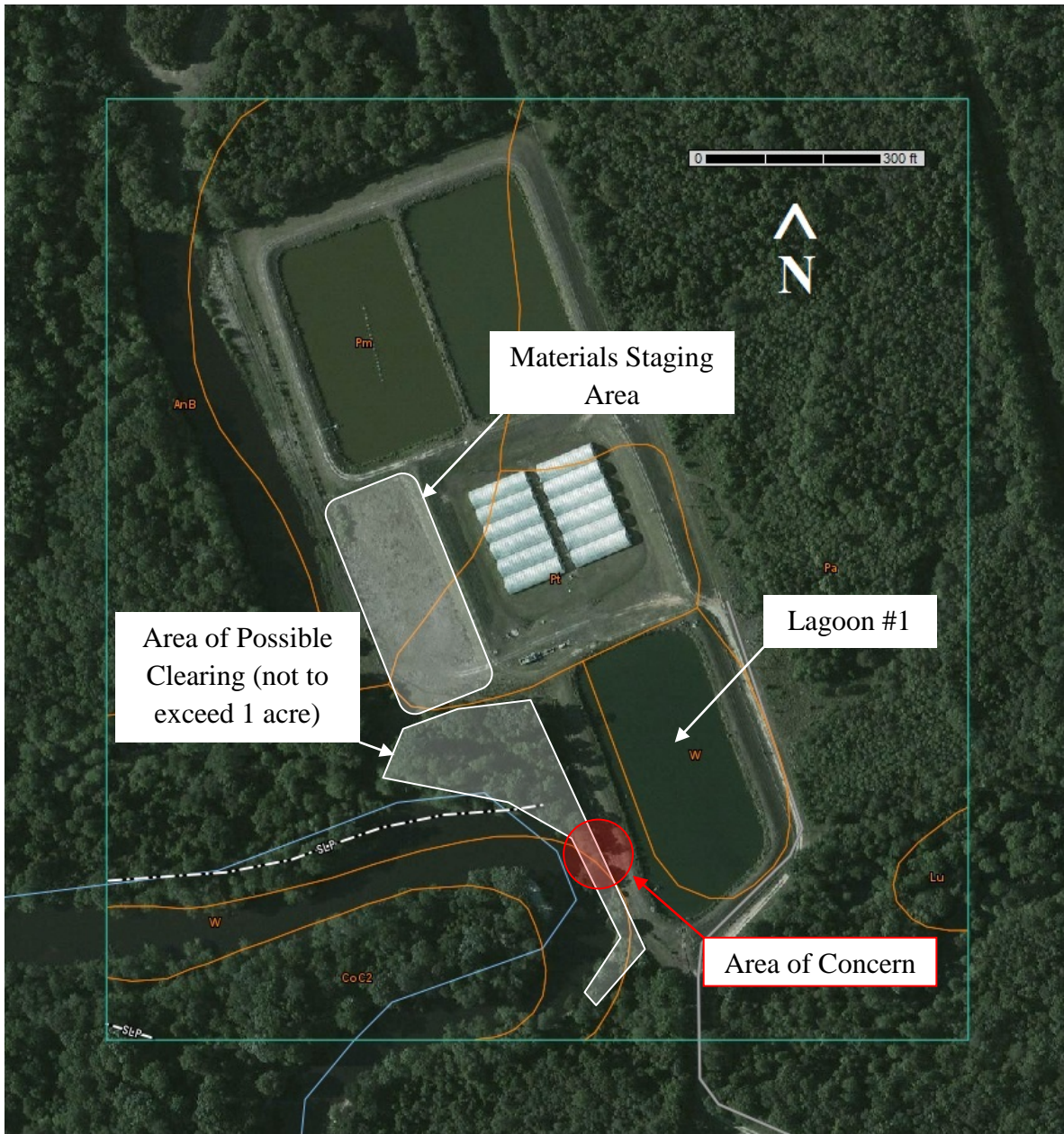


Figure 6.1.1. Soils present at and surrounding project area, and project area overview.

Construction impacts of the recommended plan to sediments would result from the removal of existing emergency streambank stabilization measures (crushed concrete) and minimal excavation and grading of the streambank, allowing for proper rip rap 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 Contentnea Creek oxbow bend nearest Lagoon #1 of the WWTP.

The no action alternative would allow the shoreline at the oxbow bend of Contentnea Creek nearest Lagoon #1 to remain vulnerable to additional erosion during high water events and threaten WWTP infrastructure. Rock placement along the most severely eroded 50-foot section of stream bank is currently being installed as of May 2015. This is intended to act as a temporary stop-gap measure, and will not offer the level of protection provided by the proposed action. Should the berm surrounding Lagoon #1 fail, a high sediment loading event may occur in and downstream of the proposed project area negatively affecting flora and fauna. Photographs of the site are included as Figures 2.2 and 2.3.

6.2 Water Quality

Waters in and near the proposed project area are classified as Class C, with supplemental classifications of SW and NSW. Class C waters are protected for uses including fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, agriculture, and secondary recreation, where secondary recreation includes wading, boating, and other uses involving infrequent human body contact with water. Swamp waters (SW) are defined as having low velocities and other natural characteristics which are different from adjacent streams. Nutrient sensitive waters (NSW) are defined as needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation (NC Department of Environment and Natural Resources 2013a).

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 Contentnea Creek following high water events. Additionally, the recommended plan will prevent berm failure at Lagoon #1 and preclude the discharge of 2.5-3.6 million gallons of raw sewage directly into Contentnea Creek. 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” (NC Department of Environment and Natural Resources 2013b) 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).

A Section 401 (Public Law 92-500 and Public Law 95-217) water quality certification (WQC) (#3885) will be acquired prior to implementation of the proposed action. The USACE will request written approval from the North Carolina Division of Water Resources (DWR) confirming that the WQC is applicable. No work will begin until DWR has either formally approved use of WQC #3885 or issued a water quality certificate that covers this project. All proposed work would be in compliance with the conditions of the appropriate water quality

certificate. Additionally, all proposed work, construction activity, and contractor actions would be in compliance with the conditions of Nationwide Permit (NWP) 13 and all regional conditions for Nationwide Permits in the Wilmington District.

The no action alternative would allow for continued streambank erosion in the proposed project area, resulting in increased turbidity as compared to nearby reaches of Contentnea Creek. Rock placement along the most severely eroded 50-foot section of stream bank will be installed by Summer of 2015 by the State. This is intended to act as a temporary stop-gap measure, and will not offer the long-term level of protection provided by the proposed action. Should the berm surrounding Lagoon #1 fail, it could lead to the direct discharge of 2.5-3.6 million gallons of raw sewage into Contentnea Creek in and downstream of the proposed project area.

6.3 Wetlands and Floodplains

Marshlands or 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, most recently on March 18, 2015. High water events have further deteriorated the bank and undercut remaining vegetation such that the oxbow bend of Contentnea Creek continues to migrate eastward.

In the vicinity of Hookerton, NC, Contentnea Creek is characterized by a wide floodplain, primarily on the north side of the creek, which includes the proposed project area. The WWTP in its entirety is located within the 100-year floodplain of Contentnea Creek (Figure 6.3.1) (NC Floodplain Mapping Program 2015).

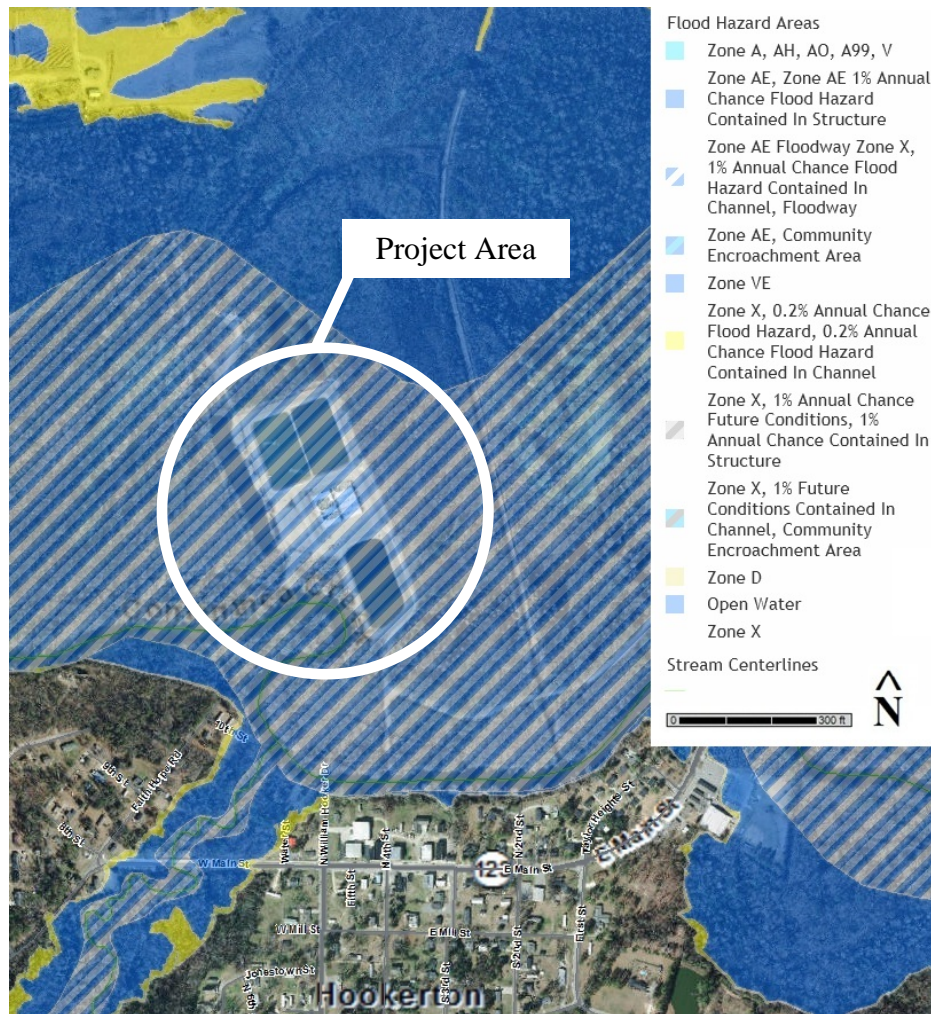


Figure 6.3.1. Flood plain map at and surrounding proposed project area.

The recommended plan would not impact wetlands at or adjacent to the proposed project area. In compliance with Executive Order 11988, which directs 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, no practical alternative exists to the proposed stabilization of the Contentnea Creek streambank nearest Lagoon #1 of the Hookerton, NC WWTP. Every effort will be taken to minimize potential harm to or within the flood plain by reducing the amount of material placed in the floodplain to only that which is required to protect the streambank. Due to the limited size and scope of the recommend plan, implementation is unlikely to result in adverse impacts to the adjacent floodplain. Any proposed action within the established floodway/floodplain will comply with state/local floodplain protection standards. Additionally, the North Carolina Department of Environment and Natural Resources was notified of the proposed project and provided a fact sheet on May 8, 2015.

The No Action alternative, including State-installed emergency rip rap, would not result in any impacts to wetlands or floodplains in the proposed project area.

6.4 Hazardous and Toxic Materials

The United States Environmental Protection Agency's (EPA) Envirofacts website was queried to identify the presence of EPA-regulated facilities within three miles 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. One site was reported within a three mile radius, and was identified as the WWTP immediately adjacent to the proposed project area (U.S. Environmental Protection Agency 2015).

Multiple on-site inspections of the project area and surroundings have been performed by USACE, Wilmington District staff. Based on the site visit on March 18, 2015, 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 would not adversely impact hazardous and toxic materials in the proposed project area, nor would it produce hazardous and toxic materials. On the contrary, the proposed action is expected to help minimize streambank erosion in the proposed project area and offer protection to Lagoon #1 of the WWTP, greatly reducing the risk of infrastructure failure and the resulting discharge of hazardous and toxic materials directly into Contentnea Creek.

The No Action alternative may not directly result in any impacts to hazardous and toxic materials. Rock placement along the most severely eroded 50-foot section of stream bank will be installed by Summer of 2015 by the State. This is intended to act as a temporary stop-gap measure, and will not offer the level of protection provided by the proposed action. Should the berm surrounding Lagoon #1 fail due to continued streambank erosion, direct discharge of Lagoon #1 contents (raw sewage) into Contentnea Creek would introduce hazardous and toxic materials to the Contentnea Creek watershed to the detriment of flora, fauna, and human health.

6.5 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 (NC State Historic Preservation Office 2015). 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 6.5.1) (NC State Historic Preservation Office 2015).

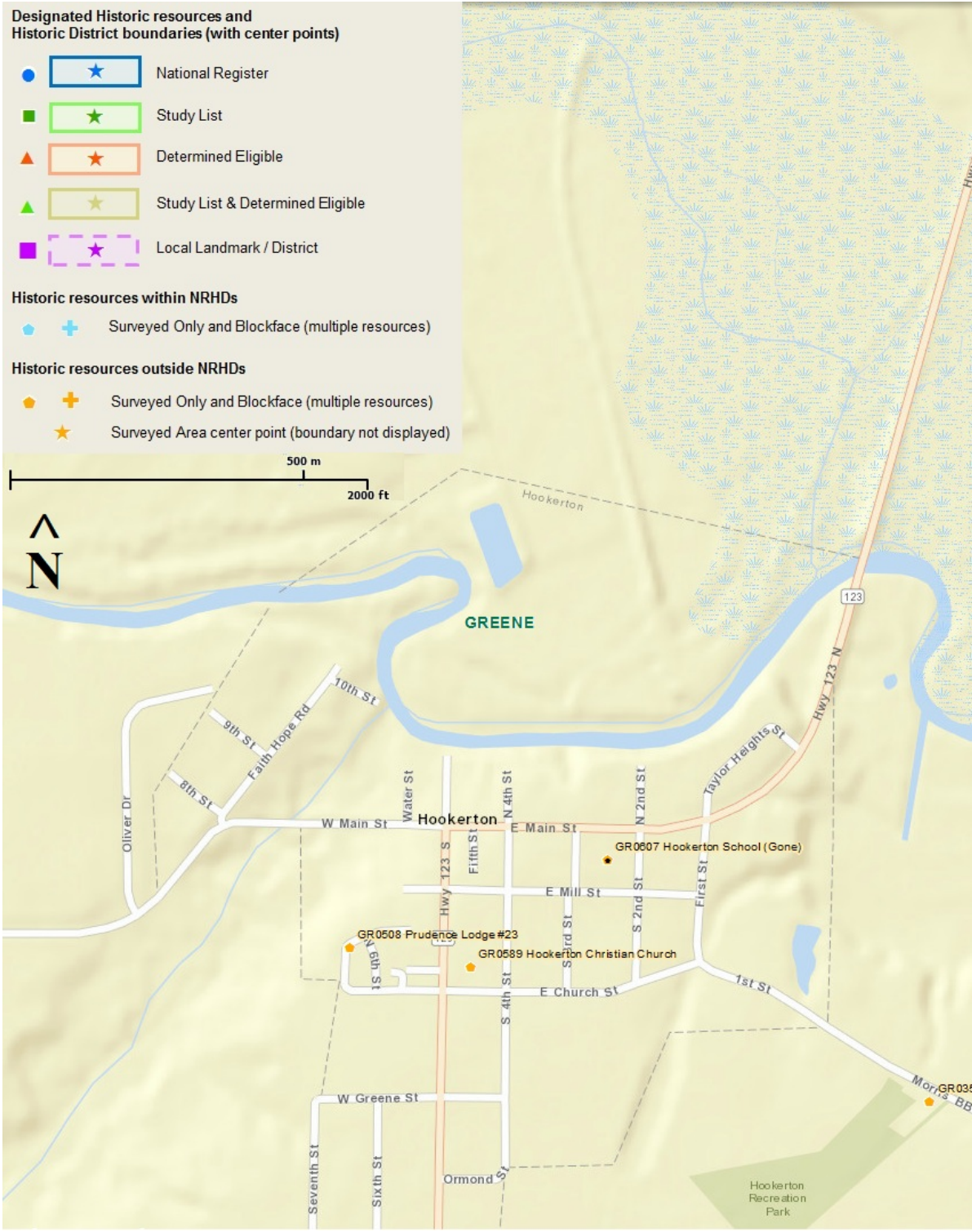


Figure 6.5.1. Cultural resources near proposed project area.

The proposed project area is immediately adjacent to a previously disturbed area, the WWTP, which is not known to be associated with, or itself be, a culturally-significant resource.

Furthermore, considering severe streambank scouring in the proposed project area, minimal excavation and clearing involved during construction, and the relatively small proposed project area itself, 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 (Figure 6.1.1). The recommended plan is not expected to impact cultural resources in the proposed project area, and would provide protection to the streambank from future erosive events. By email dated March 30, 2015 (Appendix B), the State Historic Preservation Office (SHPO) has assessed proposed project impacts and concurred with the USACE finding of no effect to cultural resources. Should any cultural resources be discovered during implementation of the recommended plan, the SHPO would be contacted and construction would be temporarily suspended.

The no action alternative would allow for continued streambank erosion even with State-installed emergency rip rap in place, which may endanger any unidentified cultural resources in the proposed project area.

6.6 Air Quality

The proposed project area, located in Greene County, NC, is in attainment with both State and Federal National Ambient Air Quality Standards parameters (Figures 6.6.1 and 6.6.2) (NC Department of Environment and Natural Resources 2014, U.S. Environmental Protection Agency 2013). The recommended plan would not affect the attainment status of the project area or region.

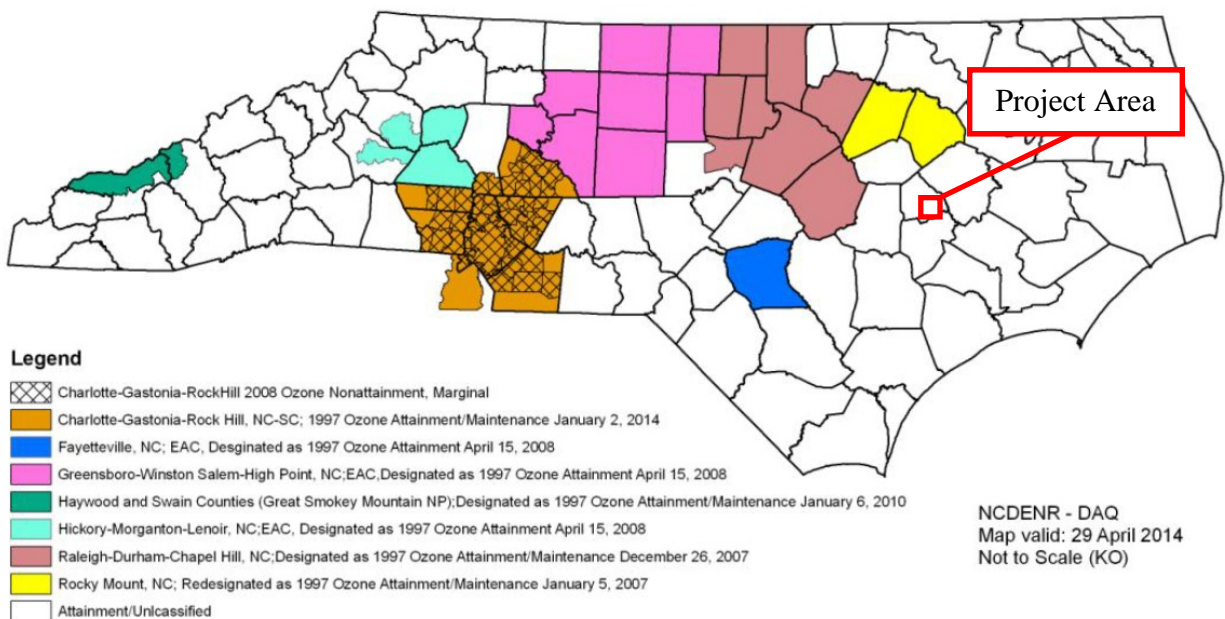


Figure 6.6.1. North Carolina’s current ozone designation status.

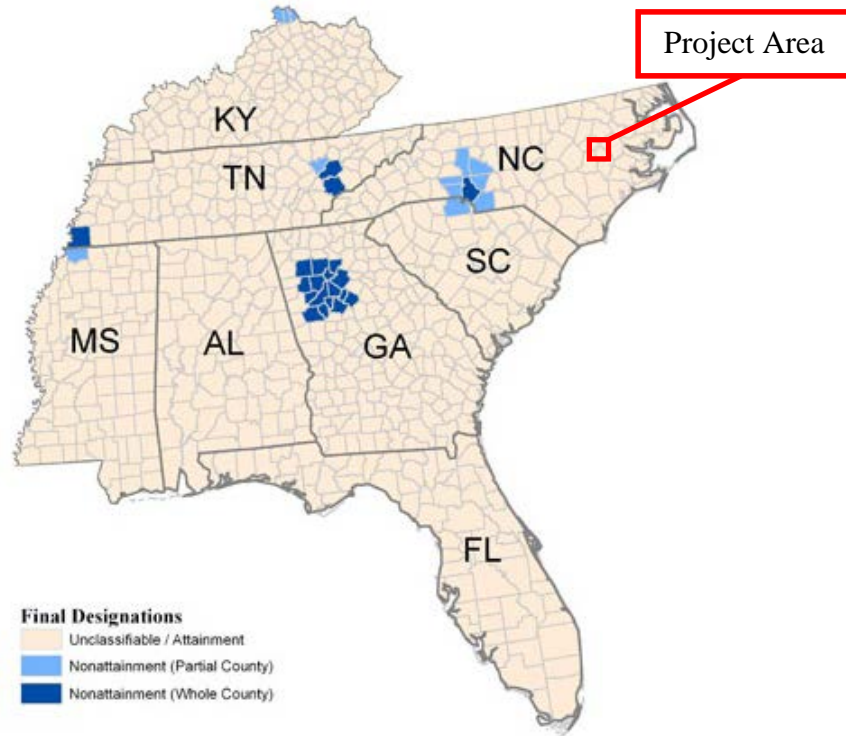


Figure 6.6.2. EPA 2008 ground-level ozone standards.

Air quality would be temporarily and insignificantly affected by the recommended plan. 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 occur while construction is active, and not impact overall air quality. Any proposed project-related emissions are not expected to contribute significantly to direct or indirect emissions and would not impact air quality within 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, although construction activity associated with State-installed emergency rip rap may affect air quality in a manner similar to that of the proposed action.

6.7 Noise

Noise levels vary in Greene County, NC. In the proposed project area vicinity, noise levels are typically dependent on periodic commercial/residential construction and seasonal agricultural activities. Noise levels may be temporarily elevated during construction activities, with expected duration of 4-6 months. In accordance with Chapter 91 of the Greene County, NC code of ordinances (American Legal Publishing Corporation 2015), construction activity

associated with the recommended plan is expected to comply with all published noise ordinances.

The no action alternative, including construction associated with State-installed emergency rip rap would comply with Chapter 91 of the Greene County, NC code of ordinances, as well.

6.8 Benthic Resources

The benthic community in the proposed project area has been rated 'fair' by the North Carolina Department of Natural Resources' Division of Water Quality, Biological Assessment Branch (2015a) after sampling wadable and non-wadable lotic water of the Neuse River Basin, which encompasses Contentnea Creek. Standard operating procedures for these surveys can be found at http://portal.ncdenr.org/c/document_library/get_file?uuid=f3cfa483-16de-4c18-95b7-93684c1b64aa&groupId=38364.

The recommended plan would have negligible impacts on benthic resources in the proposed project area as the majority of work 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 (Figures 5.3.1 and 5.3.2). The proposed project area lies on the eastward (outer) bank of a sharp oxbow bend of Contentnea Creek, which experiences higher water velocities and increased erosive forces as compared to the creek's opposite bank. Due to these relatively higher water velocities, severe bank erosion, and NCDENR, DWR's Biological Assessment Branch survey results, it is not expected that there exists a thriving benthic community in the proposed project area. However, construction of the recommended plan would permanently alter the predominant habitat from a highly eroded sandy habitat to a rocky habitat (rip rap) in the immediate project area and bury existing benthic fauna. 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 North Carolina DWR was notified of the proposed project and provided a fact sheet on May 8, 2015 for preliminary review.

The no action plan would allow for continued streambank erosion. Rock placement along the most severely eroded 50-foot section of stream bank will be installed by Summer of 2015 by the State. This is intended to act as a temporary stop-gap measure, and will not offer the level of protection provided by the proposed action. Should the berm surrounding Lagoon #1 fail, direct discharge of Lagoon #1 contents into Contentnea Creek may alter the benthos by burial and disruption of current community composition at and downstream of the proposed project area. Additionally, dike failure would elevate biological oxygen demand (BOD) and fecal coliform bacteria levels in the project area. While harmful fecal coliform may persist for prolonged

periods of time in benthic sediment, elevated BOD may lead to hypoxic or anoxic benthic conditions, directly contributing to benthic mortality events.

6.9 Fisheries Resources

Fisheries resources in waters near the proposed project area have been surveyed by North Carolina Department of Natural Resources' Division of Water Quality, Biological Assessment Branch (2015c). Standard operating procedures for these surveys can be found at http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=125626&name=DLFE-78577.pdf.

For all six sample stations applicable to Contentnea Creek, 6,728 fish belonging to over 30 different species were identified during the most recent, April 22, 2005, sampling event. At station JF50 (on Rainbow Creek which a tributary of Contentnea Creek), which is the nearest station to the proposed project area, 17 fish species were identified. These species were primarily dusky shiner (*Notropis cummingsae*), American eel (*Anguilla rostrata*), and redbreast sunfish (*Lepomis auritus*).

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 bottom habitat from sandy sediment to rock structure (rip rap). 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. Additionally, the North Carolina DWR was notified of the proposed project and provided a fact sheet on May 8, 2015.

The no action plan would allow for continued streambank erosion. Rock placement along the most severely eroded 50-foot section of stream bank will be installed during the Spring of 2015 by the State. This is intended to act as a temporary stop-gap measure, and will not offer the level of protection provided by the proposed action. Should the berm surrounding Lagoon #1 fail, direct discharge of Lagoon #1 contents into Contentnea Creek may contribute to hypoxic/anoxic conditions and fish kills at and downstream of the proposed project area.

6.9.1 Essential Fish Habitat

The Magnuson-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. The recommended plan and no action alternative will not result in any impacts to essential fish habitat (National Oceanic and Atmospheric Administration 2015).

The National Marine Fisheries Service NMFS was notified of the proposed project and provided a fact sheet on May 8, 2015. NMFS provided an unofficial response in a May 11, 2015 email (Appendix G) supporting project goals.

6.10 Terrestrial Resources

Erosion at the proposed project site has 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 American Holly (*Ilex opaca*). As streambank erosion continues in the proposed 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 between 1.5H:1V and 2H:1V. Clearing of grasses, vines, and trees, not to exceed one acre (Figure 6.1.1), will be required to allow for equipment operation. This clearing will be minimized as to retain as much existing riparian vegetation as practicable. No other impacts to terrestrial resources are expected, and all disturbed 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. State-installed emergency rip rap measures may require vegetative clearing similar to the recommended plan. Should the berm surrounding Lagoon #1 fail, riparian vegetation loss would be further amplified.

6.11 Threatened and Endangered Species, and Species of Concern

The recommended plan has been reviewed for compliance with the Endangered Species Act of 1973, as amended (ESA). According to the United States Fish and Wildlife Service (USFWS) (2010), three species known to exist in Greene County, NC are listed as federal species of concern, and one is listed as endangered.

The North Carolina Department of Environment and Natural Resources’ Natural Heritage Program identifies 17 species as meriting special consideration in Greene County, NC. (NC Department of Environment and Natural Resources 2015b).

The species featured in Table 6.11.1 were considered in the development and documentation of the proposed action.

Table 6.11.1. Endangered, threatened, and other species of concern known to exist in areas surrounding the proposed project area.

Federally Listed Species		
Common Name	Scientific Name	Status
American eel	<i>Anguilla rostrata</i>	FSC
Carolina madtom	<i>Noturus furiosus</i>	FSC
Pinewoods shiner	<i>Lythrurus matutinus</i>	FSC
Northern long-eared bat	<i>Myotis septentrionalis</i>	T
Red-cockaded woodpecker	<i>Picoides borealis</i>	E
State Listed Species		

Common Name	Scientific Name	Status
A moss	<i>Brachelyma subulatum</i>	W7
Box Spike	<i>Elliptio cistellaeformis</i>	W3, W5
Robust baskettail	<i>Epitheca spinosa</i>	W3, W5
Glassy darter	<i>Etheostoma vitreum</i>	W5
Banner clubtail	<i>Gomphus apomyius</i>	W3, W5
Large whorled pogonia	<i>Isotria verticillata</i>	W1
Dollar sunfish	<i>Lepomis marginatus</i>	W2
Pinewoods shiner	<i>Lythrurus matutinus</i>	W2
Neuse River waterdog	<i>Necturus lewisi</i>	SC
Ironcolor shiner	<i>Notropis chalybaeus</i>	W1
Mimic shiner	<i>Notropis volucellus</i>	SR
Carolina madtom	<i>Noturus furiosus</i>	T
North Carolina spiny crayfish	<i>Orconectes carolenensis</i>	SC
Red-cockaded woodpecker	<i>Picoides borealis</i>	E
Coppery emerald	<i>Somatochlora georgiana</i>	SR
Carolina dropseed	<i>Sporobolus pinetorum</i>	W1
Riverine clubtail	<i>Stylus amnicola</i>	W3

E - Endangered

FSC - Federal Species of Concern

SC - Special Concern

SR - Significantly Rare

T - Threatened

W1 - Watch Category 1; rare plants having relatively secure populations

W2 - Watch Category 2; rare plants having questionable taxonomy

W3 - Watch Category 3; rare plants reported without adequate documentation

W5 - Watch Category 5; plants experiencing sharp population declines, but do not yet warrant site-specific monitoring

W7 - Watch Category 7; plants with inadequate information concerning rarity and distribution.

No Federally listed threatened or endangered species known to inhabit Greene County, NC are expected to be encountered during proposed project construction. The American eel, Carolina madtom, and pinewoods shiner are federally listed as species of concern and may be present in the project area. These species are highly mobile and are not likely to be adversely affected by the proposed action. Likewise, the federal and State listed, endangered red-cockaded woodpecker is a highly mobile species and is not currently known to roost or forage in the proposed project area vicinity. Regarding the Northern Long-Eared Bat (NLEB), the USFWS published a final interim rule under section 4(d) of the ESA listing the northern long-eared bat as threatened in the *Federal Register* on April 2, 2015. This rule only recently became effective (May 4, 2015). Information concerning the northern long-eared bat and its known range (subject to change as new data area collected) can be found in Appendix A of this EA. Incidental take resulting from clearing of grasses, vines, and trees will not be prohibited if the activity is conducted in a manner that avoids cutting or destroying known, occupied maternity roost trees during the pup season (June 1-July 31). During the summer, northern long-eared bats typically roost singly or in colonies in a wide-variety of forested habitats, underneath bark or in cavities/crevices of both live trees and snags. Northern long-eared bats have also been documented as roosting in man-made structures (i.e., buildings, barns, etc.) during the summer. Northern long-eared bats predominately winter in hibernacula that include caves and abandoned mine portals, and potentially large boulder areas. It should be noted that the general habitat types described above

may not be all-inclusive, and additional habitat types may be identified as new information is obtained. Currently, there are no known hibernacula or roost trees in Greene County, NC; however, there have been very few NELB surveys conducted in eastern North Carolina. The USACE is aware of the potential presence of the Northern Long-Eared Bat in the proposed project area and, if warranted by future data and circumstances, will reinstate consultation.

The State of North Carolina considers the Carolina madtom to be a threatened species. The Carolina madtom was not identified in or near the proposed project area during most recent North Carolina Department of Natural Resources' Division of Water Quality, Biological Assessment Branch fisheries surveys of Greene County, NC waters (2015c). However, it is a highly mobile species and not likely to be adversely affected by the proposed action. The Neuse River waterdog and North Carolina spiny crayfish, both State listed as special concern species, are known to exist in Greene County. These species are also mobile and unlikely to be adversely affected during construction of the recommended plan. The A moss, box spike, robust baskettail, glassy darter, banner clubtail, large whorled pogonia, dollar sunfish, pinewoods shiner, ironclad shiner, mimic shiner, coppery emerald, Carolina dropseed, and riverine clubtail are State listed as either significantly rare or as belonging to a watch category (Table 6.11.1). It is possible that these species may be encountered during construction of the recommended plan; however, due to relatively short construction duration and minimizing necessary clearing, it is unlikely that these species will be adversely affected by the proposed plan. Additionally, both the USFWS and NCDENR were notified of the proposed project and provided a fact sheet on May 8, 2015 so that they could preliminarily assess its effects on threatened and endangered species (Appendices H, I).

With the exception of the NLEB, which will not be affected by the proposed action, the recommended plan may affect but is not likely to adversely affect federal or State listed threatened or endangered species, or other species of concern.

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. Also, impacts to threatened and endangered species, and other species of concern, of State-installed emergency rip rap measures, to be constructed at the site of most severe streambank erosion and spanning 50 feet, are expected to be similar to but lesser in scale than the recommended plan. Should the berm surrounding Lagoon #1 berm fail, direct discharge of Lagoon #1 contents into Contentnea Creek would potentially harm or displace threatened and endangered species, and other species of concern, at and downstream of the proposed project area.

6.12 Aesthetic and Recreational Resources

Contentnea Creek is a tributary of Neuse River and ultimately empties into Pamlico Sound. The relatively flat topography of Greene County affords Contentnea Creek a high degree of sinuosity and relatively unconstrained floodplain. With few exceptions, including the WWTP,

the Creek's banks are bordered by woodlands with pleasing aesthetic qualities. Primary recreational opportunities present in the proposed project vicinity are recreational shoreline and small craft fishing, hiking, wading, and sunbathing on sandy accretionary portions of shoreline.

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 (see Section 6.7), presence of construction equipment, and effects on traffic circulation would be temporary and short-lived. 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; however, should the berm surrounding Lagoon #1 berm fail, direct discharge of Lagoon #1 contents into Contentnea Creek would potentially detract from recreational opportunities and the aesthetic value of lands at and downstream of the proposed project area.

6.13 Cumulative Impacts

The Federal Executive Branch's Council on Environmental Quality defines cumulative impact as "the impact on the environment [that] results from the incremental impact of an action when added to other past, present, and reasonably foreseeably future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7, National Environmental Policy Act of 1969, as amended).

Over multiple years, storms and other high water events in the Contentnea Creek watershed have resulted in successive severe erosion events on the eastward (outer) bank of an oxbow bend of Contentnea Creek nearest Lagoon #1 of the Hookerton, NC WWTP. Continued erosion in the proposed project area may ultimately result in berm failure at Lagoon #1, and subsequent discharge of the Lagoon's contents directly into Contentnea Creek. This would have a profoundly negative effect on water quality in and downstream of the proposed project area, and be detrimental to human and environmental health at and in areas downstream of the proposed project area.

The recommended plan provides approximately 550 ft linear of the Contentnea Creek streambank to be armored with rip rap to prevent failure of the berm at Lagoon #1 and discharge of 2.5-3.6 gallons of raw sewage into Contentnea Creek. 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.

Shoreline protection efforts, similar to the proposed action, are not known to exist in other reaches of Contentnea Creek near the proposed project area. Within the past three years (since 2012), there have no reported similar instances of imminent danger to existing

infrastructure due to streambank erosion or other examples of severe shoreline erosion requiring emergency protection in Greene County (Personal Communication; Mr. Trey Cash, Greene County Emergency Services, April 2, 2015).

The selected alternative would have no appreciable adverse impact on environmental resources in the proposed project area or the Contentnea Creek watershed, and may provide environmental benefits by stabilizing the streambank.

Following construction of the proposed action, Lagoon #1 of the Hookerton, NC WWTP is expected to remain protected from erosion caused by scouring of the Contentnea Creek streambank 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.

6.14 Public Laws and Executive Orders

Table 6.14.1 lists the compliance status of all executive orders considered for the proposed Hookerton, NC Section 14 emergency streambank and shoreline protection project. Further descriptions of proposed project compliance with executive orders is are below.

Table 6.14.1. Compliance of the proposed action with executive orders.

Executive Orders	US CODE	Compliance Status
Protection and Enhancement of Environmental Quality	11514	Partial*
Protection and Enhancement of the Cultural Environment	11593	Partial*
Floodplain Management	11988	Partial*
Protection of Wetlands	11990	Partial*
Federal Compliance with Pollution Control Standards	12088	Partial*
Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	12898	Partial*
Protection Of Children from Environmental Health Risks and Safety Risks	13045	Partial*
Invasive Species	13112	Partial*

* - Compliance Status shall be considered 'Full Compliance' following completion of the NEPA process.

6.14.1 Protection and Enhancement of Environmental Quality

The Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals.

The recommended plan will not violate any provisions relating to protection and enhancement of environmental quality and will be in full compliance with Executive Order 11514 following completion of the NEPA process.

6.14.2 Protection and Enhancement of the Cultural Environment

The Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people, and, in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

The recommended plan will not adversely affect cultural resources and will be in full compliance with Executive Order 11593 following completion of the NEPA process.

6.14.3 Floodplain Management

In order to avoid, to the extent possible, the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, federal agencies shall take action to reduce the risk of flood loss, and minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

The recommended plan nor the no action alternative would adversely affect floodplains or alter their function and will be in full compliance with Executive Order 11988 following completion of the NEPA process.

6.14.4 Protection of Wetlands

In order to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative, federal agencies shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities.

The recommended plan will not adversely affect wetlands or alter their function and will be in full compliance with Executive Order 11990 following completion of the NEPA process.

6.14.5 Pollution Control Standards

Federal agencies are responsible for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution with respect to Federal facilities and activities under the control of the agency.

The recommended plan will not violate applicable pollution control standards and will be in full compliance with Executive Order 12088 following completion of the NEPA process.

6.14.6 Environmental Justice in Minority Populations and Low-Income Populations

Environmental justice is defined as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA further defines fair treatment to mean that no group of people should bear a disproportionate share of the negative environmental consequences of industrial, governmental, or commercial operations or policies.

The recommended plan provides benefits by preventing the potential discharge of 2.5-3.6 million gallons of raw sewage into Contentnea Creek in the event of berm failure at Lagoon #1, which would disrupt waste water treatment services for the Town of Hookerton, NC and create health hazards for its residents by means of contaminated water exposure. The recommended plan will not have the potential for disproportionate health or environmental effects on minorities or low-income populations or communities and will be in full compliance with Executive Order 12898 following completion of the NEPA process.

6.14.7 Protection of Children from Environmental Health Risks and Safety Risks

Federal agencies identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of federal policies, programs, activities, and standards.

The recommended plan provides benefits by preventing the potential discharge of 2.5-3.6 million gallons of raw sewage into Contentnea Creek in the event of berm failure at Lagoon #1, which would disrupt waste water treatment services for the Town of Hookerton, NC and create health hazards for its residents by means of contaminated water exposure. The recommended plan will not have the potential to disproportionately affect the safety or health of children and will be in full compliance with Executive Order 13045 following completion of the NEPA process.

6.14.8 Invasive Species

Introduction of invasive species has the potential to affect the economic, ecological, and human health of areas in which these species become established. The federal government, by presidential authority and the authority of other pertinent statutes, is charged with controlling and preventing introduction of harmful invasive species.

Any planting to occur following construction of the proposed action will utilize native species. The recommended will not have the potential to introduce or otherwise promote invasive species and will be in full compliance with Executive Order 13112 following completion of the NEPA process.

6.15 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 Hookerton, NC WWTP. The proposed action will meet the objective of protecting Lagoon #1 at the WWTP. Table 6.15.1 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 long-term reduction in streambank erosion and turbidity in the proposed project area, thereby improving terrestrial and aquatic habitat while providing protection to Lagoon #1 of the Hookerton, NC WWTP.

Table 6.15.1. Comparison of environmental impacts associated with proposed action and No Action alternative.

Project Area Resource	Impacts of Proposed Action	Impacts of No Action Alternative
Sediments	Temporary impacts from excavation, grading, and material placement during construction	Continued streambank erosion; Should Lagoon #1 berm fail due to continued streambank erosion, a high sediment loading event may occur in and downstream of the proposed project area affecting flora and fauna Temporary impacts from excavation, grading, and material placement during construction of emergency rip rap installation by the State of NC
Water Quality	Temporary elevation in turbidity during construction	Continued streambank erosion, and associated elevated turbidity in and downstream of the proposed project area; Should Lagoon #1 berm fail due to continued streambank erosion, direct discharge of Lagoon #1 contents into Contentnea Creek may introduce physical, chemical, and biological (sediment and raw sewage) water quality challenges in and downstream of the proposed project area Temporary elevation in turbidity during construction of emergency rip rap installation by the State of NC
Wetlands and Floodplains	No impacts	No impacts
Hazardous and Toxic Materials	No impacts	Should Lagoon #1 berm fail due to continued streambank erosion, direct discharge of Lagoon #1 contents (sediment and raw sewage) into Contentnea Creek would introduce hazardous and toxic materials to the Contentnea Creek watershed to the detriment of flora, fauna, and human health
Cultural Resources	No impacts	Continued streambank erosion, which may endanger any unidentified cultural resources in the proposed project area
Air Quality	Temporary increases in emissions during construction	Temporary increases in emissions during construction of emergency rip rap installation by the State of NC
Noise	Temporary increases in noise during construction	Temporary increases in noise during construction of emergency rip rap installation by the State of NC
Benthic Resources	Permanent habitat alteration from sandy bottom to hard structure and temporary community composition disruption in proposed project footprint	Should Lagoon #1 berm fail due to continued streambank erosion, direct discharge of Lagoon #1 contents (sediment and raw sewage) into Contentnea Creek may alter the benthos by burial and disruption of current community composition at and downstream of the proposed project area Temporary habitat alteration from sandy bottom to hard structure and community composition disruption in proposed project footprint during construction of emergency rip rap installation by the State of NC
Fisheries Resources	Temporary species displacement during construction	Should Lagoon #1 berm fail due to continued streambank erosion, direct discharge of Lagoon #1 contents (sediment and raw sewage) into Contentnea Creek may contribute to hypoxic/anoxic conditions and fish kills at and downstream of the proposed project area Temporary species displacement during construction of emergency rip rap installation by the State of NC
Terrestrial Resources	Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction	Continued streambank erosion, and vegetation loss; Should Lagoon #1 berm fail due to continued streambank erosion, riparian vegetation loss would be further amplified Vegetation clearing (grasses, vines, and trees) and grading to accommodate required equipment during construction of emergency rip rap installation by the State of NC
Threatened and Endangered Species, and Species of Concern	Construction activity may affect but is not likely to adversely affect threatened and endangered species, or other species of concern	Continued streambank erosion may displace aquatic threatened and endangered species and other species of concern by degrading water quality; Should Lagoon #1 berm fail due to continued streambank erosion, direct discharge of Lagoon #1 contents (sediment and raw sewage) into Contentnea Creek would potentially harm or displace threatened and endangered species, and other species of concern, at and downstream of the proposed project area Construction activity associated with State of NC-installed emergency

		rip rap may affect but is not likely to adversely affect threatened and endangered species, or other species of concern
Aesthetic and Recreational Resources	Temporary presence of heavy equipment and traffic increases during construction	Should the berm surrounding Lagoon #1 berm fail, direct discharge of Lagoon #1 contents (sediment and raw sewage) into Contentnea Creek would detract from recreational opportunities and the aesthetic value at and downstream of the proposed project area Temporary presence of heavy equipment and traffic increases during construction during construction of emergency rip rap installation by the State of NC

7.0 SEA LEVEL RISE CONSIDERATIONS

In accordance with ER 1100-2-8162 dated 31 December 2013, potential relative sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. The Hookerton 14 study area along Contentnea Creek in Greene County, NC is at an elevation more than 20 feet above sea level and water levels are not influenced by tidal fluctuations. Therefore, a sea level rise analysis is not required.

8.0 HYDRAULIC ANALYSIS

Technical analysis was performed using CHANLPRO software to support design decisions for the considered protection alternatives. The following sub-sections describe the analysis and recommendations.

8.1 Overview of Technical Analysis

In accordance of EM 1110-2-1601 The Manning's Equation and Continuity Equation were utilized to determine average maximum velocity at the location of the creek bend. CHANLPRO software was then used to determine riprap stone size and gradation based on depth-averaged local maximum velocity at the location of creek bend.

8.2 Hand Calculations

The Manning's equation was first used to determine peak discharge. Manning's equation variables were derived from channel survey and geospatial analysis. (9) Cross sectional surveys were taken of the creek bend. An example of one of these surveys is shown in Figure 8.2.1.

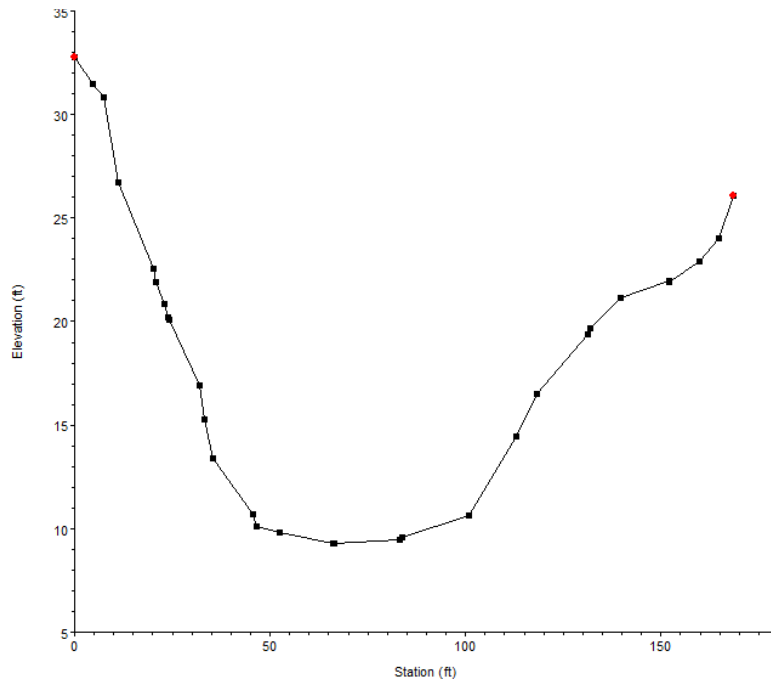


Figure 8.2.1. Typical survey channel cross section.

Geometric calculations were used to develop cross sectional area and wetted perimeter. An approximate water surface elevation of 28.0 ft NAVD88 was assumed to depict maximum design flow at the proposed riprap location. This critical water elevation was based on the top of the natural river embankment. Up until the WSEL of 28.0 ft NAVD88 flow is confined with the outside stream bank. Water any higher than this elevation would have flow spill into the flatter outer floodplain and as a consequence velocities would decrease. A 0.0006 value for the slope of the hydraulic grade line was primarily based on an existing FEMA HEC-RAS model. A Manning's n-value of the channel was assumed to be 0.035. Geometric variables are shown in Table 8.2.1.

Channel Cross Section	Flow Area (ft ²)	W. Perimeter (ft)	Hydraulic Radius (ft)
1	1480	142	10.4
2	2210	179	12.4
3	2272	184	12.3
4	2139	166	12.9
5	1963	168	11.7
6	1950	149	13.1
7	1689	142	11.9
8	1539	131	11.8
9	1820	140	13.0

Table 8.2.1. Geometric variables.

Discharge for each cross section was then solved for using the Manning's equation. The Continuity Equation, $Q=VA$, was then used to solve for the velocity term. Discharge and velocity for each cross section are shown in Table 8.2.2.

Channel Cross Section	Discharge (cfs)	Velocity (fps)
1	7349	5.0
2	12333	5.6
3	12633	5.6
4	12282	5.7
5	10559	5.4
6	11307	5.8
7	9155	5.4
8	8305	5.4
9	10483	5.8

Table 8.2.2. XS discharge and velocity.

An average channel velocity of 6.0 fps was selected to represent the local maximum velocity at the location of the creek bend.

8.3 CHANLPRO

The CHANLPRO software was originally developed by the Waterways Experiment Station (now known as the Engineer Research and Development Center (ERDC)). The software computes a local depth averaged velocity and corresponding appropriate riprap gradations in accordance with EM 1110-2-1601. The average channel velocity determined in section 8.2 was used as input in the CHANLPRO software. The following values and assumptions were used as inputs for the CHANLPRO software; spatial parameters were obtained through ArcGIS aerial photography:

- Natural channel side slope riprap
- Bendway
- Minimum center line bend radius: 200 ft
- Water surface width: 165 ft
- Specific Weight of Stone = 165 pcf
- Channel side slope = 1 vertical : 1.5 horizontal
- Local flow depth = 8 ft
- Average maximum channel velocity = 6.0 fps

Output:

- Computed local depth averaged velocity = 8.71 fps
- Local velocity / average channel velocity = 1.58
- Side slope correction factor $k_1 = 0.71$
- Correction for velocity profile in bend = 1.22
- Riprap design safety factor = 1.5

<u>Computed D30 (ft)</u>	<u>D30 (Min) (ft)</u>	<u>D100 (Max) (in)</u>	<u>D85/D15</u>	<u>N=Thickness/D100 (Max)</u>	<u>CT</u>	<u>Thickness (in)</u>
n/a	0.73	18	1.7	NOT STABLE	n/a	n/a
0.85	0.85	21	1.7	1.65	0.87	34.6
0.97	0.97	24	1.7	1.02	0.99	24.6
0.98	1.1	27	1.7	1	1	27

<u>D100 (Max) (in)</u>	<u>Limits of Stone Weight (lb) for Percent Lighter by Weight</u>			<u>D30 (Min) (ft)</u>	<u>D90 (Min) (ft)</u>
	<u>100</u>	<u>50</u>	<u>15</u>		
21	463-185	137-93	69-29	0.85	1.23
24	691-276	205-138	102-43	0.97	1.4
27	984-394	291-197	146-62	1.1	1.59

<u>Equivalent Spherical Diameter in Inches</u>					
<u>D100 (Max)</u>	<u>D100 (Min)</u>	<u>D50 (Max)</u>	<u>D50 (Min)</u>	<u>D15 (Max)</u>	<u>D15 (Min)</u>
21	15.5	14	12.3	11.1	8.3
24	17.7	16	14	12.7	9.5
27	19.9	18	15.8	14.3	10.7

Table 8.3.1. Selected table gradations, ERL gradation.

8.4 Recommendations

The Recommended Plan (Stone (Rip Rap) Slope Protection) would consist of a layer of stone (Rip Rap) placed over a layer of bedding stone along approximately 550 linear feet of streambank and extending for a distance of approximately 40-50 feet from the top of the existing streambank in the oxbow bend of Contentnea Creek adjacent to Lagoon #1. The streambank would be cleared and graded to a 1.5H:1V or 2H:1V 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 27" thick layer of NCDOT Class II riprap placed over a layer of geotextile and graded fill slope. Toe protection will be placed along the toe of the stream bottom. See appendix F for detailed geotechnical analysis of project site.

9.0 DETAILED COST ESTIMATE FOR RECOMMENDED PLAN

RECOMMENDED PLAN, “STONE (RIP-RAP) SLOPE PROTECTION” HOOKERTON, NC SECTION 14 EMERGENCY STREAMBANK AND SHORELINE EROSION PROTECTION PROJECT

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

	2015 Q1 Price Level
	<u>Prices</u>
Direct Construction Costs	\$941,000
Real Estate Costs	\$6,000 (all costs)
Detailed Design (from DI phase)	\$247,000
Supervision and Administration (9% cost to construct)	<u>\$112,000</u>
TOTAL PROJECT COST	\$1,306,000
ESTIMATED FEDERAL COST:	\$849,000 (65%)
ESTIMATED NON-FEDERAL COST:	<u>\$457,000 (35%)</u>
Subtotal:	\$1,306,000
FEASIBILITY STUDY COST:	<u>\$100,000 (100% Federal)</u>
TOTAL COST WITH STUDY:	\$1,406,000

10.0 ECONOMIC JUSTIFICATION FOR RECOMMENDED PLAN

ER 1105-2-100 Appendix F, 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 \$1,650,000 and the protection cost of the Recommended Plan at approximately \$1,300,000, it is determined that the Recommended Plan of Stone (Rip Rap) Slope Protection is economically justified.

11.0 REAL ESTATE REQUIREMENTS

The Town of Hookerton is the fee owner of all lands where construction is proposed. Access to this site is along an existing dirt road crossing four private land owners as shown on Figure 12.1. As of the date of this report, the Town of Hookerton has been unable to locate recorded access easements. Should it be determined after the approval of the TSP that easements do not exist, a recommendation will be made in the real estate appendix that perpetual road easements be acquired using standard estate # 11, Road Easement. For cost estimating purposes, the estimated land value of the four easements is \$2,400.00. Real Estate costs of \$6,000 in section 9.0 include USACE labor costs of \$3,600.



Figure 11.1. Town of Hookerton ownership and access.

Note: Red line represents property boundary. White line represents construction access.

12.0 SUMMARY COORDINATION, PUBLIC VIEWS, AND COMMENTS

USACE coordination for the long-term protection of the Hookerton WWTP Lagoon #1 began prior to initiation of the Section 14 study with an interagency coordination meeting on January 24, 2014 in Washington, NC at the NCDENR office. At the meeting, an engineering firm (Rivers & Associates) briefed all agencies in attendance on conceptual plans for protecting the WWTP which are similar to alternatives discussed in this report.

Since initiation of the Section 14 study, coordination with the Sponsor and Agencies has occurred via teleconference, emails, and on-site meetings at Hookerton WWTP. These agencies include North Carolina Department of Environment and Natural Resources, US Fish and Wildlife Service, and National Marine Fisheries Service. All involved Agencies have expressed support for the Section 14 project.

This report will be circulated for 30 days for public and agency review. All comments will be considered prior to completion of the study.

13.0 PLAN IMPLEMENTATION

13.1 Non-Federal Responsibilities

The Town of Hookerton, as stated in a letter and resolution dated 23 September 2013 (Appendix D), 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 Town of Hookerton 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. In order to implement the Recommended Plan, the Town of Hookerton, as the non-Federal sponsor, would be responsible for the following:

1. Without cost to the U.S. Government, provision of legally sufficient title to real estate for all necessary land, easements, rights-of-way, and access routes necessary for project construction and subsequent operation and maintenance. Land provisions would include:
 - a. construction site to accommodate all emergency streambank and shoreline erosion protection features to be constructed, and
 - b. temporary staging area of acceptable location and acreage for contractor's use during construction period. Staging area will be a previously disturbed site.
2. Cash contribution, provided during the period of implementation, toward cost of the project totaling 35% of Total Project Cost (not including Feasibility Study costs which are 100% Federally funded), less value of the non-Federal sponsor's real estate contribution and in-kind services (project coordination team activities), as well as Feasibility Phase costs. The amount of cash contribution is currently estimated to be \$457,000 of the total \$1,306,000. This cash amount will vary depending on the actual real estate costs and in-kind services. The Town of Hookerton has stated their intent by letter dated September 23, 2013 (Appendix D), to accept the non-Federal sponsor's responsibilities as defined in a Project Partnership Agreement, should the project report be approved.
3. Funding of 100% of the cost of Annual Operation and Maintenance required to keep the project in viable condition to satisfy its design function. This funding would not be provided for during the initial implementation of the project, but would become a yearly responsibility of the non-Federal sponsor upon completion of the construction phase.
4. Satisfy all provisions of the Project Partnership Agreement (PPA) regarding non-Federal sponsor responsibilities in implementing the project.

13.2 Federal Responsibilities

In order to implement the Selected Alternative, 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 \$849,000 which is 65% of Total Project Costs (not including Feasibility Phase costs). Cost-shared Federal expenditures on any one project under Section 14 authority may not exceed a total of \$5 million. 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.

13.3 Work-in-Kind

Work-in-Kind is defined as work contributed by the non-Federal sponsor toward implementation of a project, in lieu of payment of a portion of the sponsor's cash contributions toward implementation of the project. In some cases, completed Work-in-Kind may be credited by the USACE to the non-Federal sponsor, resulting in a reduction of their cash contribution on behalf of the project. At this time there is no identified Work-in-Kind for this project.

13.4 Project Partnership Agreement (PPA)

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

13.5 Sponsor Views

The Town of Hookerton has expressed support for this project and has agreed, by letter dated September 23, 2013, to accept the role of non-Federal sponsor in event of approval of a final feasibility report. The Town of Hookerton's preference among the alternative plans (i.e. the "Locally-Preferred Plan") is the Stone (Rip Rap) Slope Protection. Since this alternative is also the Federally-Recommended Alternative, it is considered the Recommended Plan.

14.0 RECOMMENDATIONS

Based on the evaluation and screening process, the Stone (Rip Rap) Slope Protection emerged as the single alternative that best meets the combined Planning Objectives of purpose and need and sustainability, and Planning Constraints of technical feasibility, environmental acceptability, and economic feasibility. Therefore, the Stone (Rip Rap) Slope Protection was selected as the Federally-Preferred Alternative. The Town of Hookerton 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 and resolution dated September 23, 2013. In addition, the Town has expressed acceptance that the Federally-Preferred Alternative is their Locally-Preferred Alternative.

The Stone (Rip Rap) 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 (Rip Rap) Slope Protection.

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APPENDICES

APPENDIX A
USFWS Northern Long-Eared Bat 4(d) Rule and Range Map



Northern Long-eared Bat - Interim Final 4(d) Rule *Questions and Answers*

1. What action is the Service taking?

On January 15, 2015, the Service published a proposed rule under section 4(d) of the Endangered Species Act (ESA) for the northern long-eared bat and opened a public comment period on the proposal. Rather than publishing a final 4(d) rule at this time, we are publishing an interim 4(d) rule in conjunction with the final rule to list the northern long-eared bat as threatened. We are also opening a 90-day public comment period on the interim rule to gather additional information as we work to refine and finalize the 4(d) rule.

2. Is the 4(d) rule in effect now?

The final listing and interim rule published in the *Federal Register* on April 2, 2015, and the rule goes into effect on May 4, 2015.

3. What provisions are included in the interim 4(d) rule for the northern long-eared bat?

For all areas within the range of the northern long-eared bat, all purposeful take is prohibited except:

- removal of northern long-eared bats from human structures, and
- actions relating to capture, handling, and related activities for northern long-eared bat by individuals permitted to conduct these same activities for species of bats (for a period of one year).

For areas of the country not affected by white-nose syndrome (i.e., areas outside the white-nose syndrome buffer zone), the interim 4(d) rule exempts incidental take from all activities.

For areas of the country impacted by white-nose syndrome, the measures provided in the interim 4(d) rule exempt take from the following activities:

- forest management practices,
- maintenance and limited expansion of transportation and utility rights-of-way,
- prairie habitat management,
- limited tree removal projects, provided these activities protect known maternity roosts and hibernacula,
- removal of hazardous trees,

as long as these activities include these measures:

- (i) Activity occurs more than 0.25 mile (0.4 km) from a known, occupied hibernacula.
- (ii) Activity avoids cutting or destroying known, occupied roost trees during the pup season (June 1–July 31).
- (iii) Activity avoids clearcuts (and similar harvest methods, e.g. seed tree, shelterwood and coppice) within 0.25mile (0.4 km) of known, occupied roost trees during the pup season (June 1–July 31).

4. What is a 4(d) rule?

A 4(d) rule is one of many tools provided by the ESA to allow for flexibility in the ESA's implementation and to tailor prohibitions to those that make the most sense for protecting and managing at-risk species. This rule, which may be applied only to species listed as threatened, directs the Service to issue regulations deemed "necessary and advisable to provide for the conservation of threatened species."

The 4(d) rule ensures private landowners and citizens are not unduly burdened by regulations that do not further the conservation of the species and are exempted from "take" prohibitions (defined in the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, etc.), when conducting certain activities. The rule is often used to clarify or simplify what forms of take of a threatened species are and are not prohibited. Without a 4(d) rule, threatened wildlife species automatically get the same protections as endangered species under section 9 of the ESA and FWS regulations.

5. Why is the Service publishing an "interim" 4(d) rule?

The intent of the proposed 4(d) rule is to lessen ESA restrictions that do not provide conservation benefit for the bat. In the proposed 4(d) rule, we specifically asked for comments on "Whether it may be appropriate to except incidental take as a result of other categories of activities beyond those covered in this proposed rule and, if so, under what conditions and with what conservation measures." Due to the complexity of this issue, the volume of comments and the limited time between proposing the 4(d) rule and the date that the final listing rule had to be published, we decided to publish an interim 4(d) rule. An interim 4(d) rule allows incidental take exemptions to be in place when the listing of the northern long-eared bat becomes final, but also allows us additional time to open another public comment period and engage with stakeholders to explore whether additional exemptions should be included in a final 4(d) rule.

6. Why did the Service implement a 4(d) rule for the northern long-eared bat?

The primary threat to the northern long-eared bat is white-nose syndrome. This disease, first discovered in the winter of 2006-2007, has decimated many cave-hibernating bat populations in the Northeast. Since that time the disease or the fungus that causes it has spread to 28 of the 37 states (plus the District of Columbia) within the range of the northern long-eared bat. However, there are other activities considered secondary threats that may harm or kill northern long-eared bats. These activities include: cave/mine modifications, human disturbance in roosts and hibernation areas, forest habitat modification, and wind power development.

Now that the northern long-eared bat is listed under the ESA, incidental take of a bat while conducting any of these otherwise lawful activities would be prohibited without a permit or authorization. However, a 4(d) rule allows the Service to avoid regulating activities that may benefit the species or cause only limited amounts of take. This would then allow the Service and our partners to focus on actions that are most important to conserving northern long-eared bats.

7. Why does the Service believe the exempted activities identified in the interim 4(d) rule do not need to be prohibited to protect and conserve the northern long-eared bat?

The primary factor threatening the northern long-eared bat is white-nose syndrome. Other human activities, including forest management, habitat modification, destruction and disturbance may

cause limited mortality, but did not cause significant population declines prior to the onset of white-nose syndrome. The cumulative mortality from these activities is expected to be minimal and not enough to impact the species' conservation. Additionally, the prohibitions may also have caused some activities beneficial to the bat to be stopped, and place an undue regulatory burden on individuals not negatively impacting northern long-eared bat populations.

In particular, in areas of the northern long-eared bat's range that have not yet been affected by white-nose syndrome, as defined in the interim rule, incidental take by any means is not prohibited. In areas of the bat's range that may be affected by white-nose syndrome, we believe incidental take caused by some tree removal and tree-clearing activities, when combined with conservation measures that protect the bat's most vulnerable life stages, does not need to be prohibited to conserve the northern long-eared bat. In addition, we believe removing bats from human dwellings does not need to be regulated.

8. How do I know if my activity is in an area of the country within the white-nose syndrome buffer zone?

The Service has identified such areas as those counties within 150 miles of the boundaries of U.S. counties or Canadian districts where the fungus *Pseudogymnoascus destructans* or white-nose syndrome has been detected. We have chosen to use county boundaries to delineate the boundary because they are clearly recognizable and will minimize confusion. If any portion of a county falls within 150 miles of a county or district where WNS has been detected, the entire county will be considered affected.

For illustrative purposes, you may view the most recent map of such areas at the following website: <http://www.fws.gov/midwest/nleb/>. Contact your local U.S. Fish and Wildlife Service Ecological Services Field Office for assistance in determining if your activity falls within an area where there are northern long-eared bat WNS infections. Visit <http://www.fws.gov/offices/index.html> to find your local office.

9. What does the Service mean by “forest management practices?” Does that include timber harvest?

The Service considers forest management practices to include a suite of activities used to maintain and manage forest ecosystems, including, but not limited to, timber harvest and other silvicultural treatments, prescribed burning, invasive species control, wildlife openings and temporary roads. These activities must be carried out using the applicable conservation measures outlined in Question 3 and the interim 4(d) rule, along with applicable state water quality best management practices.

The conversion of mature hardwood, or mixed forest into intensively managed monoculture pine plantation stands is not exempted under this interim rule, as typically these types of monoculture pine plantations provide very poor-quality bat habitat.

10. What is meant by “minimal tree removal?”

The Service considers minimal tree removal to be cutting or removal of individual or a limited number of trees as long as the activity does not significantly change the overall nature and function of the local forest habitat and is carried out under the rule's conservation measures. By “minimal,” we mean to limit the effect to an impact of one acre or less. This could be one acre

of contiguous habitat, or a total of one acre within a larger tract that is entirely forested, or a mixture of forested and non-forested cover types. Activities that remove an acre or less of forested habitat are expected to have little or no impact on the ecological value and function and, therefore, would be considered to be “minimal” as defined by this rule. Examples of activities that might fall within this category are: firewood cutting, shelterbelt renovation, removal of diseased trees, culvert replacement, habitat restoration for fish and wildlife conservation, and backyard landscaping

11. Does the interim 4(d) rule allow me to remove a northern long-eared bat from my home?

Yes. Northern long-eared bats have been documented roosting in human-made structures including buildings, barns, pavilions, sheds, cabins, under building eaves, behind shutters and in bat houses. The Service considers that the overall impact of removing northern long-eared bats from these structures is not expected to adversely affect the species’ conservation or recovery. Removal activities must comply with any applicable state laws. The Service recommends minimizing the use of pesticides and avoiding the use of sticky traps around bat roosts. If bats are to be excluded from where they are roosting, the Service recommends those exclusions be done in the spring or fall if possible. The Service also recommends you contact a nuisance wildlife specialist for humane exclusion techniques.

12. How do human activities impact northern long-eared bats, especially those populations already affected by white-nose syndrome?

Several sources of mortality may be important factors affecting the northern long-eared bat’s ability to persist while experiencing dramatic declines caused by white-nose syndrome.

Impacts to hibernacula: Cave-dwelling bats are vulnerable to human disturbance while hibernating. Bats use up their energy stores when roused and may not survive the winter, or females may not successfully give birth or rear young. Improperly designed or installed gates or other structures to exclude people from caves and mines may restrict bat flight and movement and change airflow and internal cave and mine microclimates. A few degrees change can make a cave unsuitable for hibernating bats. Many agencies and organizations are working to protect caves and mines that are important hibernacula for cave-dwelling bats.

Loss or degradation of summer habitat: Many activities such as commercial and residential development, transportation and energy rights-of-way development, surface mining and wind facility construction permanently remove habitat and are prevalent in many areas of this bat’s range. Timber harvest and forest management can remove or degrade summer roosting and foraging habitat. When done during the active season, these activities can also directly kill or injure bats by cutting down their roosts.

Wind farm operation: Wind turbines kill bats, including northern long-eared bats, although only a relatively small number have been documented to date. However, there are many wind projects within a large portion of the bat’s range, and many more are planned. The Service and others are working to minimize bat mortality from wind turbines on several fronts. We fund and conduct research to determine why bats are susceptible to turbines, how to operate turbines to minimize mortality, and where important bat migration routes are located. The Service, state

natural resource agencies, and wind energy industry are developing a Midwest Wind Energy Multi-Species Habitat Conservation Plan, which will provide wind farms a mechanism to continue operating legally while minimizing and mitigating listed bat mortality. In other Service regions, individual HCPs that include the northern long-eared bat are in development.

13. How are private landowners affected by the interim 4(d) rule?

Many factors dictate whether a wooded area provides northern long-eared bat habitat or whether the bats use the area. For private actions on private property, we do not presume that northern long-eared bats are present in all wooded areas throughout its range, and we do not require private landowners to conduct surveys. However, with the 4(d) rule in place, landowners have the added certainty that any incidental take resulting from the exempted activities are not prohibited.

14. How are states and tribes affected by the 4(d) rule?

Similar to private actions on private lands, we do not require states and tribes to survey for listed species before conducting actions that do not have a federal nexus. But, if listed species are known to occur in an area and a proposed action is likely to cause incidental take, then development of a Habitat Conservation Plan, in conjunction with an application for an Incidental Take Permit, would be necessary. With the interim 4(d) rule in place, incidental take permits will not be required for activities exempted in the 4(d) rule.

15. How are federal agencies affected by the 4(d) rule?

The ESA holds federal agencies to higher standards than private landowners, states and tribes. Under section 7 of the ESA, federal agencies must consult with the Service to ensure that any action they authorize, fund, permit or carry out does not jeopardize the existence of a listed species. This requirement does not change when a 4(d) rule is implemented. Federal agencies are still required to consult with the Service on actions that may affect the northern long-eared bat. However, with a 4(d) rule in place, any actions taken by an agency that are exempted in the 4(d) rule will not require an incidental take statement in a biological opinion.

16. How will the interim 4d rule help federal agencies comply with their section 7 consultation requirements for activities taking place in forested areas during the breeding season?

We believe that with the interim 4(d) rule in place on the effective date of the final listing rule, and the advance work that we and other federal agencies have done during the proposal period, most federal agencies will be able to comply with their section 7 consultation requirements and the listing should not prevent or delay their activities. For example, the Service's Northern Long-eared Bat Interim Conference and Planning Guidance has assisted many federal agencies with assessing the impact their activities may have on the bat. We will continue to work with all federal agencies to help them understand where and to what extent their activities may have an effect on the bat.

17. Are there similarities between the northern long-eared bat and the endangered Indiana bat, whose range overlaps that of the northern?

The Indiana bat was recognized as an endangered species in 1967 when populations were declining primarily due to human disturbance at hibernation sites. Indiana bats are found in 20

states across much of the eastern half of the country. Like northern long-eared bats, Indiana bats hibernate in caves and use forested habitat in the summer to roost and raise their young. We expect that any best management practices recommended for the northern long-eared bat would be very similar to recommendations for the Indiana bat.

Since the Indiana bat was listed, we have worked with a variety of federal, state and private partners to conserve the Indiana bat. For example, we have funded research, gated and protected hibernacula, protected summer habitat, and worked with various entities to minimize impacts from projects on the species. Since white-nose syndrome has affected Indiana bats, we have focused on also addressing this new threat to the species.

18. How has the Indiana bat's endangered status affected development within its range, and do you expect the impacts to be similar for northern long-eared bat for activities not exempted under the interim 4(d) rule?

Our approach to conservation of the Indiana bat is to work with states and federal partners at the planning stage to avoid and minimize impacts on the species and to mitigate remaining impacts. In this way, projects are not delayed, but carried out to be the least environmentally detrimental, with mitigation to offset unavoidable losses. If listed, we expect to work in a similar way to conserve the northern long-eared bat.

19. Are entities with HCPs, completed consultations or other conservation agreements for Indiana bats covered for the northern long-eared bat?

No, any existing vehicle (i.e., HCPs and section 7 consultations) that provides an exemption from ESA take prohibitions will need to be updated to include northern long-eared bats. If the 4(d) rule is adopted, actions exempted by the rule would not require a permit and thus would not need to be included in an HCP. For section 7 consultations, take from those actions would not be included in an incidental take statement.

20. What are examples of a 4(d) rule aiding in the conservation of a threatened species?

In 2014, the Service listed the Dakota skipper, a prairie butterfly, as threatened and implemented a 4(d) rule. The listing prohibits actions that threaten the Dakota skipper, but the 4(d) rule also provides flexibility to non-federal landowners for specific activities that do not negatively affect the species' conservation. The rule exempts from take prohibitions some actions associated with ranching, such as grazing, fencing, watering livestock and haying after July 15. Although some of these activities may impact some individual Dakota skippers, many can result in benefits to the species. For more information, go to

<http://www.fws.gov/midwest/endangered/insects/dask/DASKfinal4dRuleFAQs22Oct2014.html>

In March 2014, the Service finalized a special 4(d) rule for the lesser prairie-chicken concurrently with the listing of the species as threatened. The Service developed the 4(d) rule in recognition of significant and ongoing efforts of states and landowners to conserve this ground-dwelling bird. The 4(d) rule allows the five range states to continue to manage conservation efforts for the species and avoid further regulation of activities such as oil and gas development and utility line maintenance that are covered under the Western Association of Fish and Wildlife Agencies' range-wide conservation plan for the lesser prairie-chicken. The special rule also establishes that conservation practices carried out through the USDA Natural Resources Conservation Service's Lesser Prairie-Chicken Initiative and through ongoing normal

agricultural practices on existing cultivated land are all in compliance with the ESA and not subject to further regulation.

21. How can the public have input into the 4(d) rule development process?

You may submit comments on the interim 4(d) rule by one of the following methods:

(1) Electronically: Go to the Federal eRulemaking Portal: <http://www.regulations.gov>. In the Search box, enter FWS-R5-ES-2011-0024, which is the docket number for this rulemaking. You may submit a comment by clicking on “Comment Now!”

(2) By hard copy: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS-R5-ES-2011-0024; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042-PDM; Arlington, VA 22203.

We request that you send comments only by one of the methods described above. We will post all comments on <http://www.regulations.gov>. This generally means that we will post any personal information you provide us. Deadline for comments is July 1, 2015.

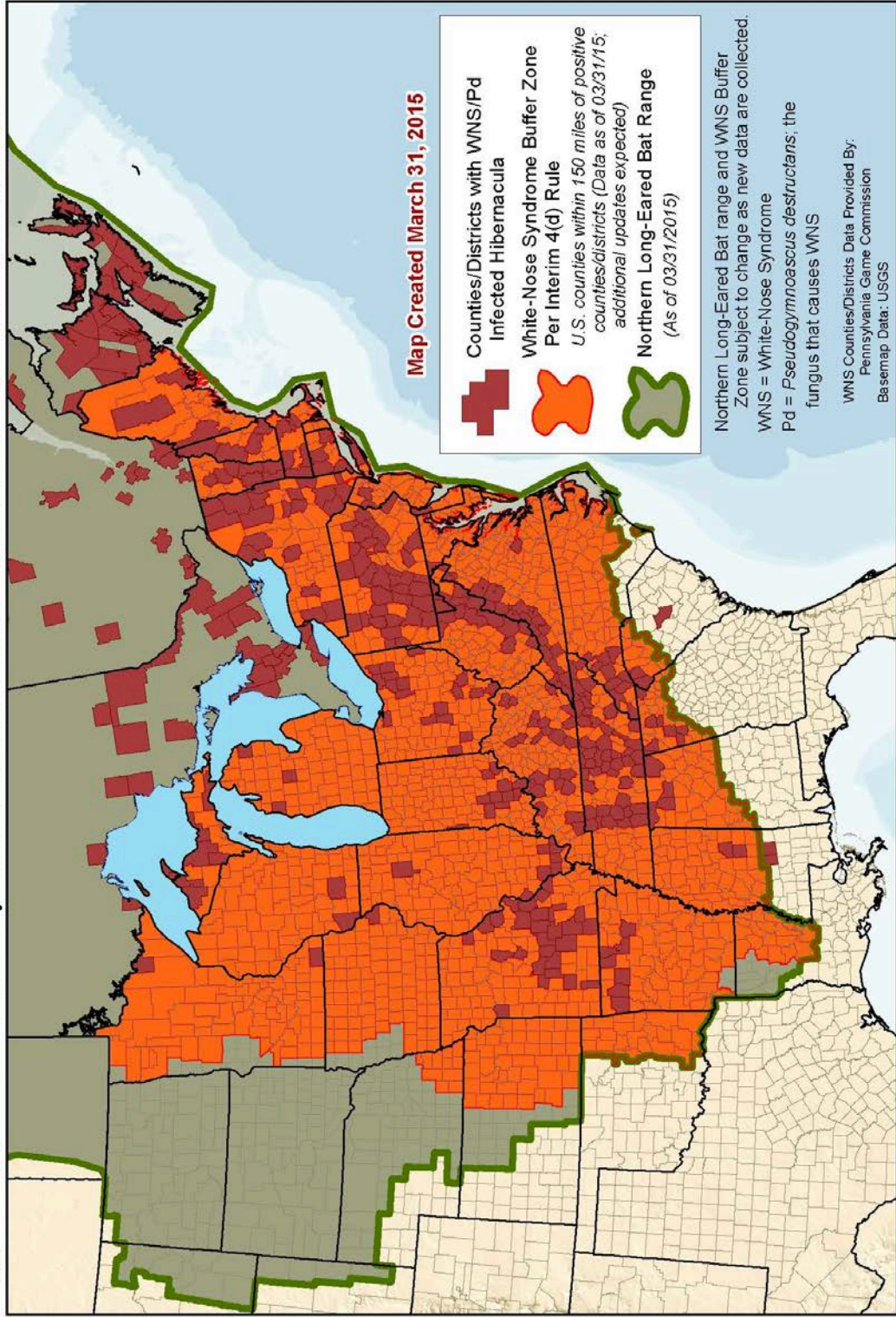
22. Where can I find more information?

For more information about the northern long-eared bat, the final listing as threatened, the 4(d) rule and related information, visit the Service’s web site at www.fws.gov/midwest/endangered/mammals/nleb



Northern Long-Eared Bat Interim 4(d) Rule

White-Nose Syndrome Buffer Zone Around WNS/Pd Positive Counties/Districts



APPENDIX B
NC State Historic Preservation Office Preliminary Coordination

From: [Bashaw, Justin P SAW](mailto:Justin.P.SAW)
To: [Hall, Dolores](mailto:Dolores.Hall)
Subject: RE: USACE, Section 14 Project - Hookerton, NC WWTP - Cultural Resources in Project Area (UNCLASSIFIED)
Date: Monday, March 30, 2015 3:03:00 PM

Classification: UNCLASSIFIED
Caveats: NONE

Thank you very much for your time and effort, Dolores.

Justin Bashaw

Biologist, Cultural Resources Manager
Environmental Resources Section
US Army Corps of Engineers, Wilmington District

- 69 Darlington Avenue
Wilmington, NC 28403-1343
- 910.251.4581 (telephone)
- 910.251.4744 (facsimile)
- justin.p.bashaw@usace.army.mil

-----Original Message-----

From: Hall, Dolores [<mailto:dolores.hall@ncdcr.gov>]
Sent: Monday, March 30, 2015 2:31 PM
To: Bashaw, Justin P SAW
Cc: Glazener, Jason S SAW; Owens, Jennifer L SAW; Creech, Larry T SAW; Griffith, Gregory M SAW
Subject: [EXTERNAL] RE: USACE, Section 14 Project - Hookerton, NC WWTP - Cultural Resources in Project Area (UNCLASSIFIED)

Justin:

I took a look at our maps and we have nothing recorded that should be affected by the proposed project, so I think there will be no effect to archaeological resources. Let me know if you need anything else.

Dolores A. Hall
Deputy State Archaeologist - Land

Office of State Archaeology
4619 Mail Service Center
Raleigh, NC 27699-4619
(919) 807-6553
(919) 715-2671 (Fax)

As of October 22, 2008, my new email address is dolores.hall@ncdcr.gov

E-Mail to and from me, in connection with the transaction of public business, is subject to the North Carolina Public Records Law and may be disclosed to third parties.

-----Original Message-----

From: Bashaw, Justin P SAW [<mailto:Justin.P.Bashaw@usace.army.mil>]
Sent: Monday, March 30, 2015 11:28 AM
To: Hall, Dolores
Cc: Glazener, Jason S SAW; Owens, Jennifer L SAW; Creech, Larry T SAW; Griffith, Gregory M SAW

Subject: USACE, Section 14 Project - Hookerton, NC WWTP - Cultural Resources in Project Area (UNCLASSIFIED)

Classification: UNCLASSIFIED

Caveats: NONE

Good morning Dolores,

Thank you for returning my call earlier today, and for your willingness to assist me in assessing potential impacts to cultural resources associated with the below-described project.

USACE proposes a Section 14 (streambank erosion control) project at a waste water treatment plant (WWTP) in Hookerton, NC, to protect infrastructure, and I'd like your help please in properly accounting for any potential impacts cultural resources in the proposed area project area (shown in attachment 1). The project itself will consist of fill and rip rap placement along ~550ft of eroding shoreline on Contentnea Creek (red in attachment 1) nearest to Lagoon #1 of the WWTP. Existing gravel/dirt roadways will be improved, within their existing footprints, to accommodate construction traffic and equipment (yellow in attachment 1). The proposed materials/equipment staging area is in a previously disturbed area (orange in attachment 1). For work to take place, vegetation clearing will likely be necessary (green in attachment 1); however, the extent of necessary clearing is unknown at this time and will depend on available construction equipment and its operation needs.

Attached are three documents:

- 1) Google earth image of the project area with access roads, staging area, potential areas to be cleared, and rip rap placement areas highlighted in different colors.
- 2) An image referencing NCDHR's HPOWEB Map Service and known historic resources in the area.
- 3) Specs of proposed rip rap placement on Contentnea Creek's shoreline.

If you would please, review this information and offer any information you may have which would allow for best-assessment of potential impacts to cultural resources associated with subject project.

Thank you, Dolores, and please contact me with any questions.

Justin Bashaw

Biologist, Cultural Resources Manager
Environmental Resources Section
US Army Corps of Engineers, Wilmington District






- 69 Darlington Avenue
Wilmington, NC 28403-1343
- 910.251.4581 (telephone)
- 910.251.4744 (facsimile)
- justin.p.bashaw@usace.army.mil

Classification: UNCLASSIFIED


Caveats: NONE





**Designated Historic resources and
Historic District boundaries (with center points)**

-  National Register
-  Study List
-  Determined Eligible
-  Study List & Determined Eligible
-  Local Landmark / District

Historic resources within NRHDs

-  Surveyed Only and Blockface (multiple resources)

Historic resources outside NRHDs

-  Surveyed Only and Blockface (multiple resources)
-  Surveyed Area center point (boundary not displayed)





APPENDIX C
Cost Estimation Supporting Documentation

Cost Engineering - General Discussion

1. Cost Estimates were prepared under guidance given in the Corps of Engineers Regulation ER 1110-2-1302, CIVIL WORKS COST ENGINEERING and EP 1110-1-8 Vol 3, CONSTRUCTION EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE Cost Book Dated 2014.

2. Cost Estimates were produced using MCACES with the 2012 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 from Oct 11 to Jan 15 using Engineer News Record Indices which resulted in a 7.33% increase in the material costs from the Cost Book. The assumed construction start is March 2016 with a 1 year maximum construction period. Midpoint of construction is assumed fourth quarter FY 2016. Construction estimate is escalated to the midpoint of construction using Total Project Cost Summary escalation percentages.

3. Background. The project purpose is to stop streambank erosion of the Contentnea Creek from eroding the toe foundation of the dike for sewage treatment lagoon #1 of the Hookerton Waste Water Treatment Plant (WWTP). Dike failure would result in raw sewage spill into the adjacent creek. A Study prepared by Rivers & Associates for the Town of Hookerton in March of 2014 outlined several potential erosion control measures to stabilize the streambank in the vicinity of the WWTP. These included:

- a. Rip Rap Revetment
- b. Cast-in-place Concrete Filled Fabric (Fabriform) Revetment
- c. Precast Concrete Articulating Blocks Revetment
- d. Steel Sheet Pile Bulkhead
- e. Steel Sheet Pile Cutoff Wall

The Section 14 Authority guidance (ER 1105-2-100, Appendix F) states that due to limited scope and the emergency nature of these projects, plan formulation should focus on the least cost alternative. PDT discussions eliminated the Fabriform Revetment due to difficulty of construction at the fairly remote site and moreover durability from potential damage caused by debris directly striking and penetrating the fabric and thin revetment layer. The river alignment is such that debris (trees, etc.) floating down the creek during flood event can directly strike any erosion control measures put in place. Repair of damaged Fabriform is not simple and requires mobilization of specialized equipment. The Precast Concrete Articulating Blocks Revetment was investigated by the PDT but screened due to cost. The Steel Sheet Pile Bulkhead and Steel Sheet Pile Cutoff Wall were eliminated due to significantly higher in

place cost comparisons to the Rip Rap Revetment in the Rivers & Associates study. Several other alternatives were initially considered but screened out for reasons other than cost (see Section 5 of main report).

An updated cost estimate was prepared in MCACES for the Articulated Concrete Block based on rough order of magnitude material costs provided by CONTECT during a recent seminar on erosion control (The CONTECT price was about 50% of the cost used in the Rivers & Associates report.) and using the Rivers & Associates articulating block in place cost. The updated construction first cost with the Rivers & Associates block price is \$1,080,692 and with the CONTECT block ROM block price is \$861,641. Either estimate is significantly above the \$744,851 construction estimate for rip rap.

The PDT also considered relocating lagoon #1 away from the streambank. This would require real estate not currently available within the boundaries of the WWTP. In addition, significant infrastructure would be required. The time lag to obtain the real estate and construct the new lagoon was considered to be long enough that the current Lagoon #1 may be eroded into thus requiring secondary erosion measures in addition to the lagoon relocation. The town of Hookerton does not have the financial resources to pay for the real estate or pay for the lagoon relocation cost; therefore the State of North Carolina (designated local sponsor for this project) would be required to pay for the real estate and the other relocation costs. Rough order of magnitude estimate to relocate Lagoon #1 is between \$1,650,000 and \$2,600,000 depending on if and how much environmental mitigation may be required for the new location. The PDT concluded the relocation alternative was not viable at this point in time; therefore, the Section 14 Recommended Plan is the Stone (Rip Rap) Slope Protection. A detailed MCACES estimate was prepared on the Rip Rap Option based on preliminary SAW design and is contained as Encl 1.

4. Cost Estimate Issues and Assumptions. Site access is currently via a 12' wide dirt road that will need to be upgraded for construction traffic. A 12" DIP sewer feeder is located above grade and blocks access from the access road directly around the southwest (stream) side of Lagoon #1. The proposed plan is to improve the access road from the highway passing around the opposite side of Lagoon #1 to around the far side of Lagoons #2 and #3 back to the open area between Lagoon #1 and Lagoons #2 & #3 where there is room for a construction staging area. About 180 LF of the access road south of Lagoon #1 between the security gates is subject to intermittent flooding during rain events. The cost estimate includes raising this area and placing a 24-inch CMP under the roadway to drain the trapped high water. Much of the streambank is wooded so it is estimated up to an acre of clearing and grubbing will be required to gain construction access to the streambank area to be stabilized. It is assumed that a Type 2

DOT Turbidity Curtain will be required during in water material placement. Silt fence is assumed on the upland perimeter of the construction activities and along most of both sides of the improved road construction. Portions of an existing security fence will need to be removed and later replaced to facilitate construction access to portions of the streambank. Post construction landscaping to restore disturbed areas and fill slopes is calculated at about ½ acre but is rounded up to one acre for the study estimate. Excavation, embankment, rip rap, bedding stone and geotextile quantities were provided by SAW Engineering Branch based on current site data and preliminary design.

5. Project Construction Schedule. It is assumed funds will be available in FY16. Construction is assumed to start March 2016 with a one year contract period. Environmental restrictions limit in stream operations between February 15 thru June 30. It is assumed this time will be used by the contractor to improve the road, obtain materials and prepare the upland site as required. Midpoint of construction is estimated at 4th quarter FY16.

6. Project First Costs. Estimated Real Estate costs for right-of-entries, etc. are \$5,000 in January 2015 dollars. Estimated construction costs are \$744,851 in January 2015 dollars. Section 14 feasibility study cost is estimated at \$100K and Design & Implementation costs are estimated at \$213,000. Supervision and Administration costs are estimated at \$93,000 in Jan 2015 dollars.

7. Risk Analysis. Abbreviated Risk Analysis was performed to determine the contingencies in accordance with ER 1110-2-1302. See attached Risk Register and Input & Results forms for details (Encl 2). Real Estate Contingency is taken as 25% or \$1,250. Construction cost contingency was determined to be 22.98% or \$174K before escalation. Design & Implementation (i.e. PED) contingency was determined to be 12.67% or \$27K before escalation. S&A contingency was determined at 14.48% or \$13.5K before escalation.

8. Fully Funded Project Cost Estimate - Total Project Cost Summary. Fully funded project costs are from the Total Project cost summary Sheet for CAP projects that is attached. Estimated RE contingency of \$1,250 makes the fully funded Project Cost Estimate for Real Estate \$6,000. Minimal escalation is applied to the Real Estate Costs because they are assumed to take place prior to construction. Construction costs are escalated to midpoint of construction (2.8%) at \$20K for escalation plus 22.98% contingency on both the first cost and escalation for total contingency of \$176K and a fully funded construction estimate of \$941,000. The fully funded PED estimate is \$247,000 (excluding the \$100k for Section 14 Study) and the fully funded S&A estimate

is \$112,000. Fully Funded Total Project Cost Estimate is \$1,306,000 excluding \$100,000 for the Section 14 Study.

9. Cost Sharing. The Project costs are generally cost shared at 35% local (State) and 65% Federal except the Section 14 study cost are 100% Federal for the first \$100K. Total Project sponsor cost is estimated at \$457,000 and Total Project federal cost is estimated at \$849,000 plus \$100,000 for the Section 14 Study. See Encl 3 Total Project Cost Summary.

Encl

1. Cost Certification
2. Total Project Cost Summary
3. Abbreviated Risk Analysis

**WALLA WALLA COST ENGINEERING
MANDATORY CENTER OF EXPERTISE**

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 404957

**SAW – Hookerton Section 14
Stream Bank Stabilization**

The Hookerton Stream Bank Stabilization project – Section 14 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 July 15, 2015, the Cost MCX certifies the estimated total project cost:

FY 2016 Project First Cost: \$1,290,000
Total Project Cost: \$1,306,000
Estimated Federal Cost: \$ 949,000

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 throughout the life of the project.



CALLAN.KIM.

C.1231558221

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DN: c=US, o=U.S. Government, ou=DoD,
ou=PKI, ou=US A,
cn=CALLAN.KIM.C.1231558221
Date: 2015.07.15 07:44:33 -0700

**Kim C. Callan, PE, CCE, PM
Chief, Cost Engineering MCX
Walla Walla District**

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

Printed: 7/14/2015
Page 1 of 2

PROJECT: Hookerton Section 14 Stream Bank Protection - CAP Study
PROJECT NO: 404957
LOCATION: Hookerton, NC

DISTRICT: SAW Wilmington PREPARED: 7/8/2015

POC: CHIEF, COST ENGINEERING, Stephen Roman

This Estimate reflects the scope and schedule in report: CAP Feasibility STUDY - Hookerton Wastewater Treatment Plant Emergency Stream Bank Protection

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)	Program Year (Budget EC): Effective Price Level Date:				Spent Thru: 10/1/2014 (\$K)	TOTAL FIRST COST (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
						ESC (%)	COST (\$K)	CNTG (\$K)	REMAINING COST (\$K)						
16	BANK STABILIZATION #VA	\$745	\$171	23%	\$916	1.5%	\$756	\$174	\$929		\$929	1.3%	\$765	\$176	\$941
CONSTRUCTION ESTIMATE TOTALS:		\$745	\$171		\$916	1.5%	\$756	\$174	\$929		\$929	1.3%	\$765	\$176	\$941
01	LANDS AND DAMAGES	\$5	\$1	25%	\$6	1.5%	\$5	\$1	\$6		\$6		\$5	\$1	\$6
30	PLANNING, ENGINEERING & DESIGN	\$213	\$27	13%	\$240	2.3%	\$218	\$28	\$246		\$246	0.5%	\$219	\$28	\$247
31	CONSTRUCTION MANAGEMENT	\$93	\$13	14%	\$106	2.3%	\$95	\$14	\$109		\$109	2.6%	\$98	\$14	\$112
PROJECT COST TOTALS:		\$1,056	\$213	20%	\$1,269		\$1,074	\$216	\$1,290		\$1,290	1.2%	\$1,087	\$219	\$1,306

- _____ CHIEF, COST ENGINEERING, Stephen Roman
- _____ PROJECT MANAGER, Chris Moore
- _____ CHIEF, REAL ESTATE, Ralph Werthmann SAS
- _____ CHIEF, PLANNING, Eldon Gatwood
- _____ CHIEF, ENGINEERING, Greg Williams
- _____ CHIEF, OPERATIONS, Daniel Brown
- _____ CHIEF, CONSTRUCTION, Denis Lynch
- _____ CHIEF, CONTRACTING, John Mayo
- _____ CHIEF, PM-PB, James Medlock
- _____ CHIEF, DPM, Christine Brayman

ESTIMATED TOTAL PROJECT COST: \$1,306
 ESTIMATED FEDERAL COST: 65% \$849
 ESTIMATED NON-FEDERAL COST: 35% \$457

22 - FEASIBILITY STUDY (CAP studies): \$100
 ESTIMATED FEDERAL COST: \$100
 ESTIMATED NON-FEDERAL COST:

ESTIMATED FEDERAL COST OF PROJECT \$949

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

Printed:7/14/2015
Page 2 of 2

**** CONTRACT COST SUMMARY ****

PROJECT: HookertonSection 14 Stream Bank Protection - CAP Study
LOCATION: Hookerton, NC
This Estimate reflects the scope and schedule in report:

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

PREPARED: 7/8/2015

CAP Feasibility STUDY - Hookerton Wastewater Treatment Plant Emergency Stream Bank Protection

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 3/15/2014 Estimate Price Level: 41913				Program Year (Budget EC): 2016 Effective Price Level Date: 1-Oct-15								
		RISK BASED												
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	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
16	PHASE 1 or CONTRACT 1 BANK STABILIZATION #VA	\$745	\$171	23.0%	\$916	1.5%	\$756	\$174	\$929	2016Q4	1.3%	\$765	\$176	\$941
CONSTRUCTION ESTIMATE TOTALS:		\$745	\$171	23.0%	\$916		\$756	\$174	\$929			\$765	\$176	\$941
01	LANDS AND DAMAGES	\$5	\$1	25.0%	\$6	1.5%	\$5	\$1	\$6	2016Q1		\$5	\$1	\$6
30	PLANNING, ENGINEERING & DESIGN													
0.025	Project Management	\$19	\$2	12.7%	\$21	2.3%	\$19	\$2	\$22	2016Q1		\$19	\$2	\$22
0.02	Planning & Environmental Compliance	\$15	\$2	12.7%	\$17	2.3%	\$15	\$2	\$17	2016Q1		\$15	\$2	\$17
0.15	Engineering & Design	\$112	\$14	12.7%	\$126	2.3%	\$115	\$15	\$129	2016Q1		\$115	\$15	\$129
0.02	Engineering Tech Review ITR & VE	\$15	\$2	12.7%	\$17	2.3%	\$15	\$2	\$17	2016Q1		\$15	\$2	\$17
0.02	Contracting & Reprographics	\$15	\$2	12.7%	\$17	2.3%	\$15	\$2	\$17	2016Q1		\$15	\$2	\$17
0.03	Engineering During Construction	\$22	\$3	12.7%	\$25	2.3%	\$23	\$3	\$25	2016Q4	2.6%	\$23	\$3	\$26
0.02	Planning During Construction	\$15	\$2	12.7%	\$17	2.3%	\$15	\$2	\$17	2016Q4	2.6%	\$16	\$2	\$18
	Project Operations			12.7%										
31	CONSTRUCTION MANAGEMENT													
0.1	Construction Management	\$74	\$11	14.5%	\$85	2.3%	\$76	\$11	\$87	2016Q4	2.6%	\$78	\$11	\$89
	Project Operation:			14.5%										
0.025	Project Management	\$19	\$3	14.5%	\$22	2.3%	\$19	\$3	\$22	2016Q4	2.6%	\$20	\$3	\$23
CONTRACT COST TOTALS:		\$1,056	\$213		\$1,269		\$1,074	\$216	\$1,290			\$1,087	\$219	\$1,306

Abbreviated Risk Analysis

Project Name & Location: **Hookerton Section 14 Stream Bank Stabilization, Hookerton,**
 Project Development Stage/Alternative: **Feasibility (Recommended Plan)**
 Risk Category: **Moderate Risk: Typical Project Construction Type**

District: **SAW**
 Alternative: **Rip Rap Erosion Control**
 Meeting Date: **1/15/2015**

Total Estimated Construction Contract Cost = \$ **744,851**

<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
01 LANDS AND DAMAGES	Real Estate	\$ 5,000	25.00%	\$ 1,250	\$ 6,250
1 16 BANK STABILIZATION	Stream Bank Erosion Control	\$ 744,851	22.98%	\$ 171,177	\$ 916,028
2		\$ -	0.00%	\$ -	\$ -
3		\$ -	0.00%	\$ -	\$ -
4		\$ -	0.00%	\$ -	\$ -
5		\$ -	0.00%	\$ -	\$ -
6		\$ -	0.00%	\$ -	\$ -
7		\$ -	0.00%	\$ -	\$ -
8		\$ -	0.00%	\$ -	\$ -
9		\$ -	0.00%	\$ -	\$ -
10		\$ -	0.00%	\$ -	\$ -
11		\$ -	0.00%	\$ -	\$ -
12 All Other (less than 10% of construction costs)	Remaining Construction Items	\$ -	0.0%	\$ -	\$ -
13 30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 212,283	12.67%	\$ 26,904	\$ 239,187
14 31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 93,106	14.48%	\$ 13,482	\$ 106,589
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)			\$ -	

Totals					
	Real Estate	\$ 5,000	25.00%	\$ 1,250	\$ 6,250.00
	Total Construction Estimate	\$ 744,851	22.98%	\$ 171,177	\$ 916,028
	Total Planning, Engineering & Design	\$ 212,283	12.67%	\$ 26,904	\$ 239,187
	Total Construction Management	\$ 93,106	14.48%	\$ 13,482	\$ 106,589
	Total	\$ 1,055,240	20%	\$ 212,813	\$ 1,268,053

	Base	50%	80%
Range Estimate (\$000's)	\$1,055k	\$1,183k	\$1,268k

* 50% based on base is at 50% CL

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.)

APPENDIX D
Sponsor Request Letter and Resolution

Robert E. Taylor
Mayor

Danny Taylor Mayor Pro-Tem

Loris Jones

Kelley Lasky

Ryan Stocks

Commissioners



Town of Hookerton

April Baker
Town Clerk/Finance Officer/Notary

Beth Slio
Utility Billing/Tax Collector/Notary

Angie Tooley
Economic Developer / Planner

Shaun Jackson
Utilities Superintendent

September 24, 2013

U.S. Army Corps of Engineers
Attn: Jason Glazener
69 Darlington Avenue
Wilmington, NC 28403-1343

Dear Mr. Glazener:

The Town of Hookerton currently has a lagoon berm that is endangered by Contentnea Creek. The creek is undercutting the berm and without solution the town feels this berm will eventually collapse which would be a danger to the wildlife, creek and citizens of Hookerton. At this time, the Town of Hookerton wishes to partner with the U.S. Army Corps of Engineers under the Section 14 Authority to address the problem.

Enclosed are three (3) copies of a resolution that is needed as well. Please call me at 252-747-3816 if you have any questions. The Town of Hookerton is looking forward to working with you.

Sincerely,

April H. Baker

April H. Baker
Town Clerk

P.O. Box 296 • Hookerton, NC 28538
(252) 747-3816 • FAX (252) 747-8131 • ahbaker@embarqmail.com
www.hookertonnc.com

**RESOLUTION APPROVING ASSISTANCE FOR INVESTIGATION AND STUDIES TO
DEVELOP AN EMERGENCY STREAMBANK EROSION PROTECTION
FROM
U.S. ARMY CORPS OF ENGINEERS**

WHEREAS, Town of Hookerton intends for the U.S. Army Corps of Engineers to conduct a study for the stream bank erosion that is endangering the first lagoon cell at the Waste Water Treatment Plant.

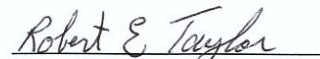
WHEREAS, The Town of Hookerton will contract with the U.S. Army Corps of Engineers to perform the study

NOW THEREFORE, BE IT RESOLVED BY THE TOWN BOARD OF HOOKERTON OF SAID STREAMBANK EROSION requests the U.S. Army Corps of Engineers to conduct investigations and studies to determine the feasibility of developing an emergency stream bank or shoreline erosion protection project at the Waste Water Treatment Plant and Contentnea Creek under the authority provided by Section 14 of the 1946 Flood Control Act, as amended.

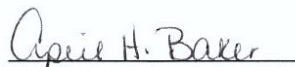
It is understood that, if it is found feasible and advisable to develop an emergency stream bank or shoreline erosion protection project at the Waste Water Treatment Plant and Contentnea Creek, the Town of Hookerton would be required before construction commences to enter into a contractual agreement that it will provide such local cooperation as may be prescribed by the Secretary of the Army.

The Town Clerk of the Town of Hookerton shall be, and is hereby, directed to transmit three copies of this resolution to the District Engineer at U.S. Army Corps of Engineers, Wilmington District, 69 Darlington Avenue Wilmington, NC 28403

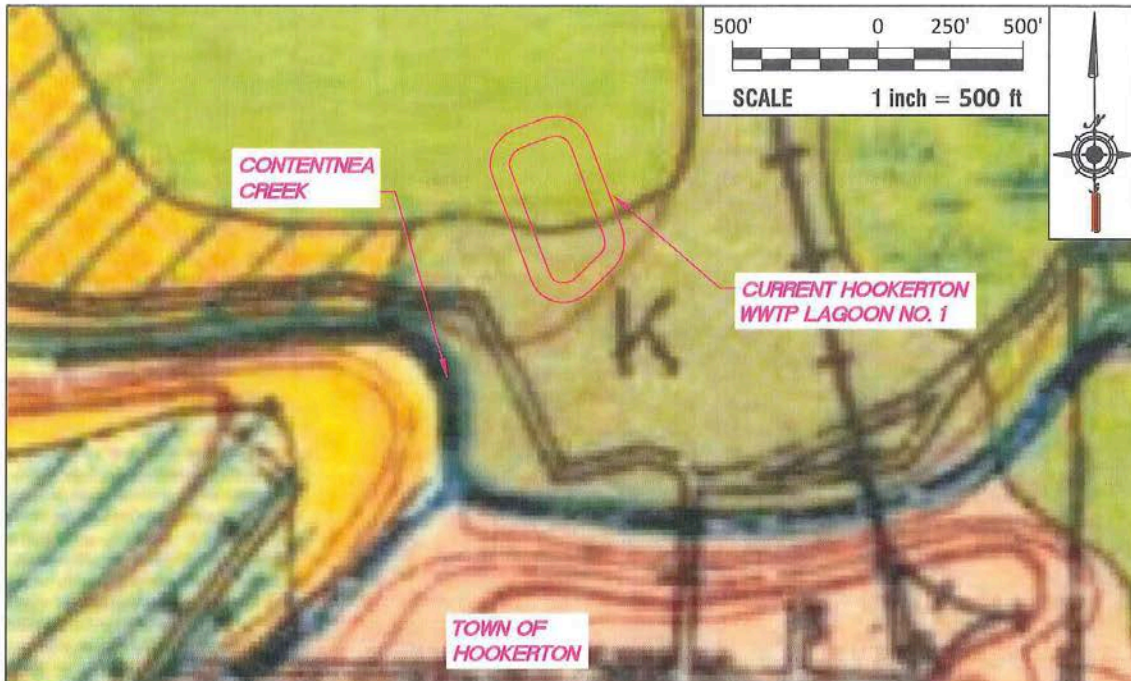
ADOPTED this 23rd day of September 2013.


Robert E. Taylor, Mayor

ATTEST:


April Baker, Town Clerk

APPENDIX E
1924 Soil Survey Map and Current Aerial Photograph



1924 USDA SOIL MAP – GREENE COUNTY, NORTH CAROLINA



CURRENT AERIAL PHOTOGRAPH – HOOKERTON, GREENE COUNTY, NC

APPENDIX F
Geotechnical Analysis

A total of five Cone Penetration Test (CPT) borings were performed at the proposed Hookerton, NC project site. These included two borings on the crest of the holding pond dike (elevation 38.4 feet NAVD88), one on the riverside dike embankment (elevation 35.3 feet NAVD88), and two at the riverside toe of the dike (elevation 30.5 feet NAVD88). This fieldwork was conducted April 7-8, 2015 and in accordance with ASTM D 5770-07, Standard Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils. The CPT borings were originally scoped to extend 50 feet below the surface, but due to a high cone resistance of 4 tons, all CPT borings were terminated before reaching predetermined depth. The refusal elevations were between -5.2 feet and -1.8 feet NAVD88.

The non-normalized, Robertson & Campanella (1986) method was used for predicting soil behavior types. This is standard practice for pushing cones near an embankment. The method categorizes the soil into 12 different behavior types. The complete results of the CPT borings and different soil behavior types are outlined in the legend along the bottom of the CPT logs, found below. In each set of logs, the predicted undrained shear strength of the soil (S_u), friction ratio (R_f), pore pressure (u_2), sleeve friction (f_s), and tip resistance (q_t) for each sounding, are shown. [Table 1](#) lists the observed elevation that a pore pressure was first encountered. This elevation of the pore pressure is assumed to be the water table elevation at the time of the boring.

Table 1. Pore pressure elevations obtained at the time of the boring.

Boring Number	Top of Boring (feet NAVD88) (Location)	Pore Pressure Beginning at Elev (feet NAVD88)
CPT-1	38.4(Crest)	7.4
CPT-2	30.5 (Toe)	10.5
CPT-3	38.4 (Crest)	8.4
CPT-4	35.3 (Side Slope)	13.3
CPT-5	30.5 (Toe)	11.5

The soils at the project site consist mainly of sand, to include silty sand, sandy silt, and clayey sand. At elevations deeper than 10 feet NAVD88, the soils were observed to be sandy silt to clayey silt, until refusal. The CPT refusal could be caused by a rock layer or a dense sand to clayey sand layer. With the soils observed composed mostly of a sand, a geotextile to provide separation between the bedding stone and the bank is recommended. In the Design phase, it is recommended that a grain size analysis be performed for the selection of the geotextile, and a slope stability analysis of the bank be completed. The following tables (Tables 2 through 6) show the soil behavior types obtained during the CPT borings for each location.

Table 2. Soil behavior for CPT-1.

CPT-1			
Elev.	to	Elev.	Soil Behavior Type
38.4	to	37	Silty sand to Sandy Silt
37	to	28	Sand
28	to	26	Silty sand to Sandy Silt
26	to	18	Sand
18	to	13	Sand to Silty Sand
13	to	8	Sand
8	to	-4	Silty sand to Sandy Silt
-4	to	-5	Sand to Clayey Sand

Table 3. Soil behavior for CPT-2.

CPT-2			
Elev.	to	Elev.	Soil Behavior Type
30.5	to	23	Sandy silt to clayey silt
23	to	11.5	Sand to silty sand
11.5	to	-4	Sandy silt to clayey silt
-4	to	-5	Very stiff fine grained sand

Table 4. Soil behavior for CPT-3.

CPT-3			
Elev.	to	Elev.	Soil Behavior Type
38.4	to	36.5	Silty sand to Sandy Silt
36.5	to	20	Sand to Clayey Sand
20	to	-4	Sandy silt to clayey silt
-4	to	-5	Sand to Clayey Sand

Table 5. Soil behavior for CPT-4.

CPT-4			
Elev.	to	Elev.	Soil Behavior Type
35.3	to	26	Silty sand to Sandy Silt
26	to	15	Sand
15	to	0	Sandy silt to clayey silt
0	to	-1.8	Sand to Clayey Sand

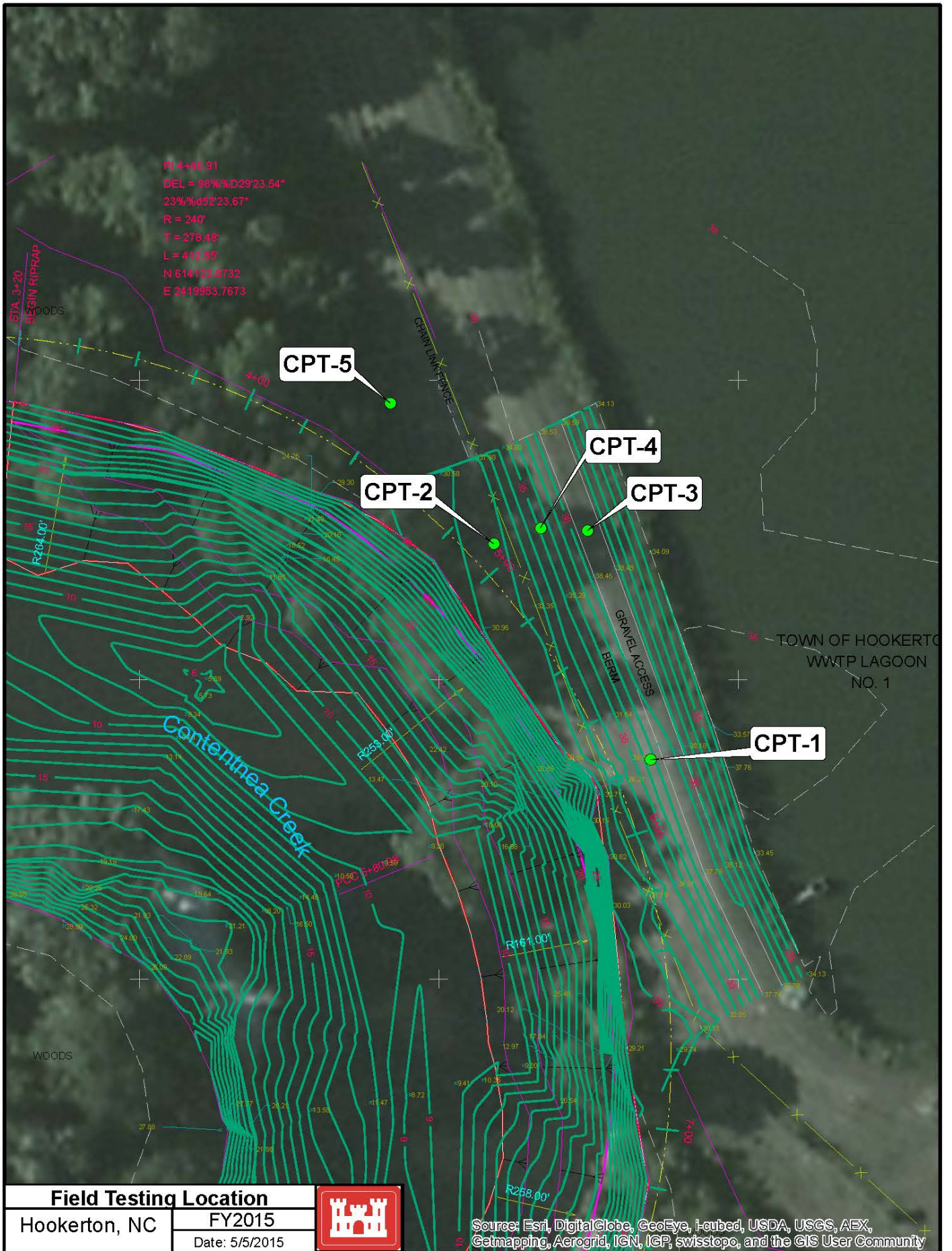
Table 6. Soil behavior for CPT-5.

CPT-5			
Elev.	to	Elev.	Soil Behavior Type
30.5	to	26.5	Silty sand to Sandy Silt
26.5	to	11.5	Sand
11.5	to	-4	Sandy silt to clayey silt
-4	to	-5	Sand to Clayey Sand

The photo below shows the equipment used to advance the CPT borings at the project site. The track mounted rig was manufactured by ARA Verтек of Randolph, Vermont. The rig meets or exceeds the requirements of ASTM D 5778-07 for the performance of CPT and relies solely on its static weight for reaction force. Ms. Kaylin Dunbar, geologist, and Mr. Matt Cook, driller operator, performed the borings, and Mr. Graham Johnston, geologist, processed the data, all from the USACE Savannah District. The locations of the CPT borings are depicted on the Field Testing Location map.



Photo 1. Track mounted CPT rig.



Field Testing Location	
Hookerton, NC	FY2015
	Date: 5/5/2015



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Hookerton
Hookerton, NC

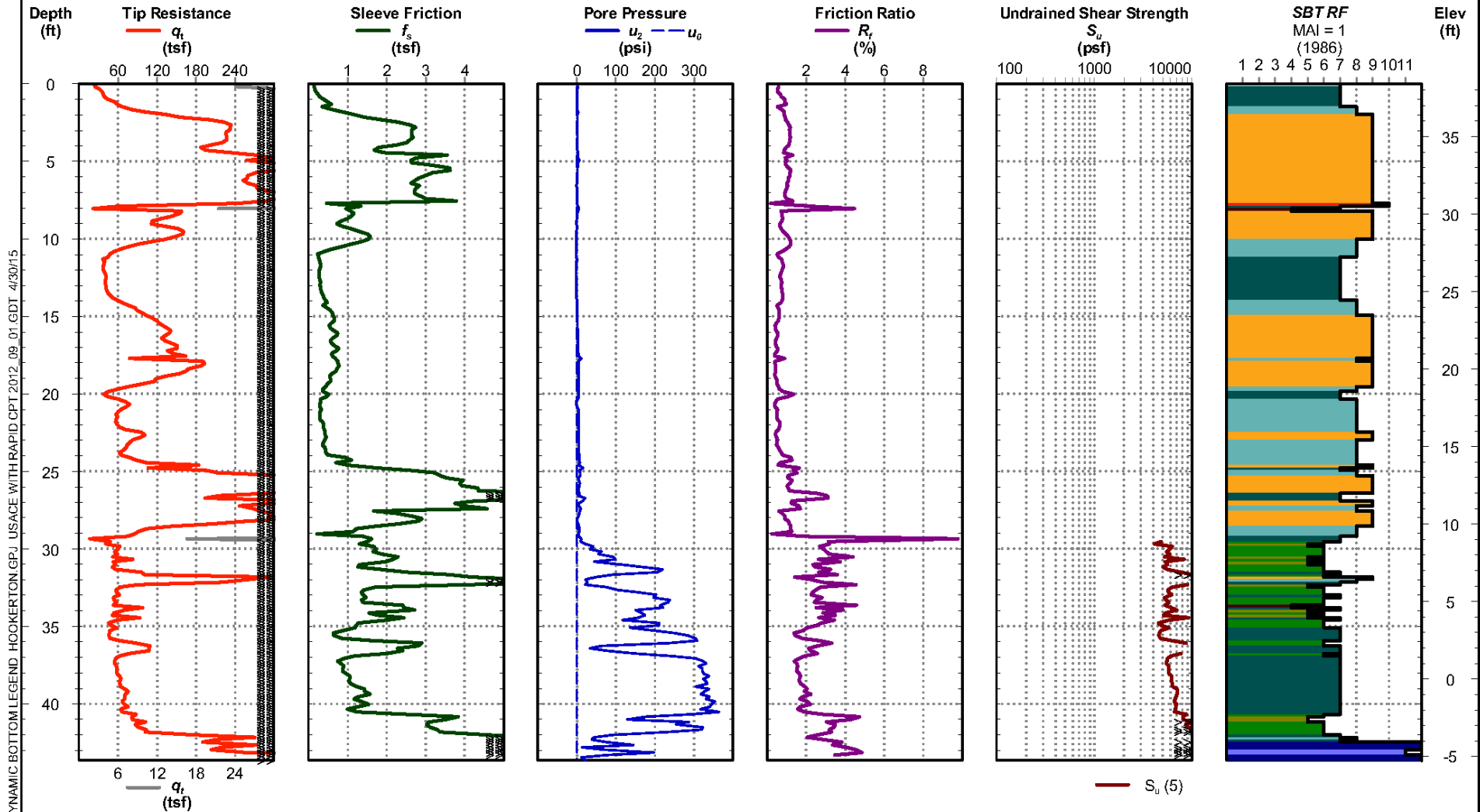
Cone Penetration Test

CPT-1

Date: Apr. 7, 2015
Operator: Dunbar
Drilling Agency: USACE, Savannah District

Northing: 613873.2307
Easting: 2420070.662
Probe ID/Net Area Ratio: DSG1070 / 0.8

Elevation: 38.4
Water Depth:
Total Depth: 43.6 ft



- | | | | |
|----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand |
| 2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*) |
| 3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*) |

Electronic Filename:
HOOK-15-CPT-1.cpt



Hookerton
Hookerton, NC

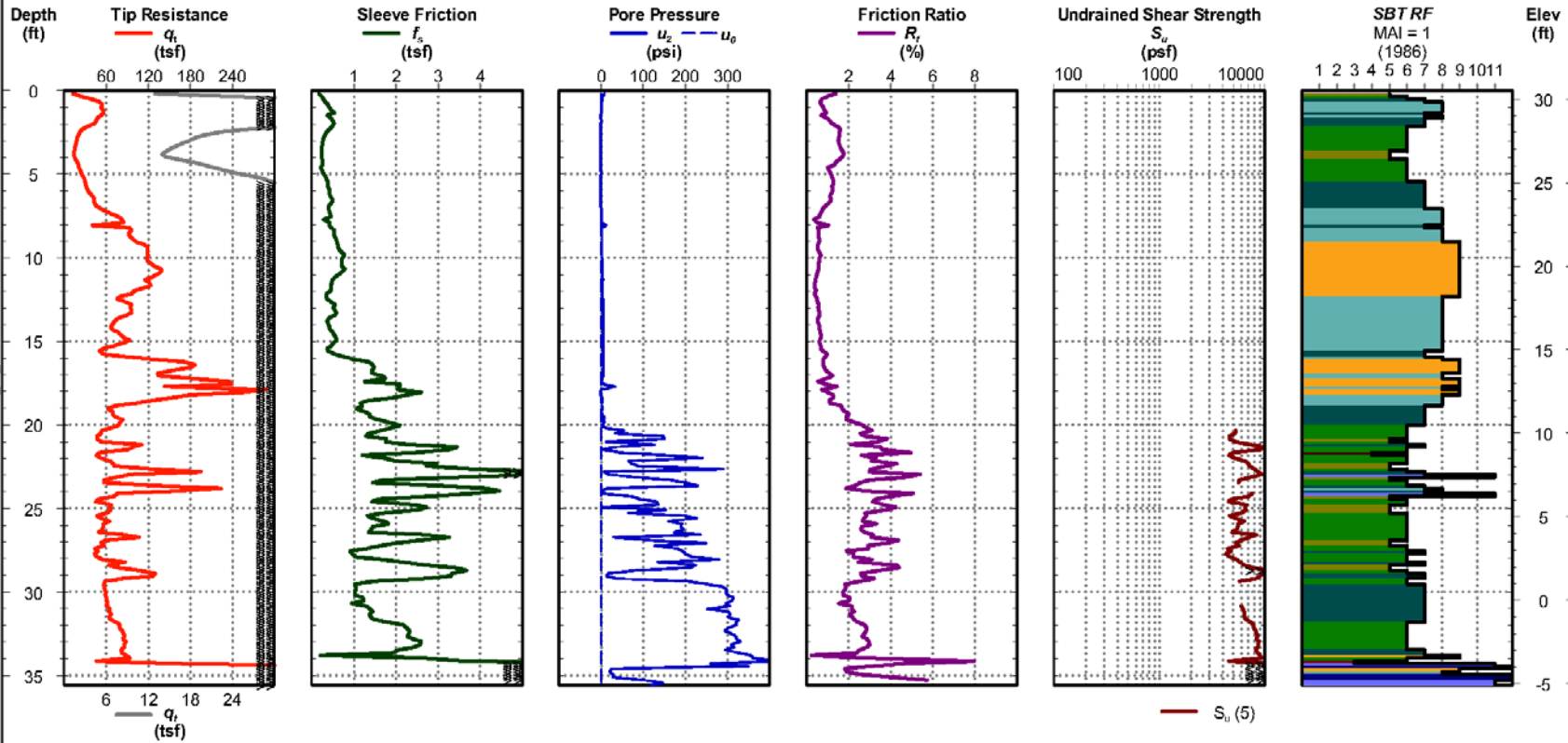
Cone Penetration Test

CPT-2

Date: Apr. 8, 2015
Operator: Dunbar
Drilling Agency: USACE, Savannah District

Northing: 613945.2864
Easting: 2420018.33
Probe ID/Net Area Ratio: DSG1070 / 0.8

Elevation: 30.5
Water Depth:
Total Depth: 35.6 ft



- | | | | |
|----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand |
| 2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*) |
| 3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*) |

Electronic Filename:
HOOK-15-CPT-2.cpt

CPT REPORT - DYNAMIC BOTTOM LEGEND: HOOKERTON.GPJ USACE WITH RAPID.CPT 2012_09_01.GDT 4/30/15



Hookerton
Hookerton, NC

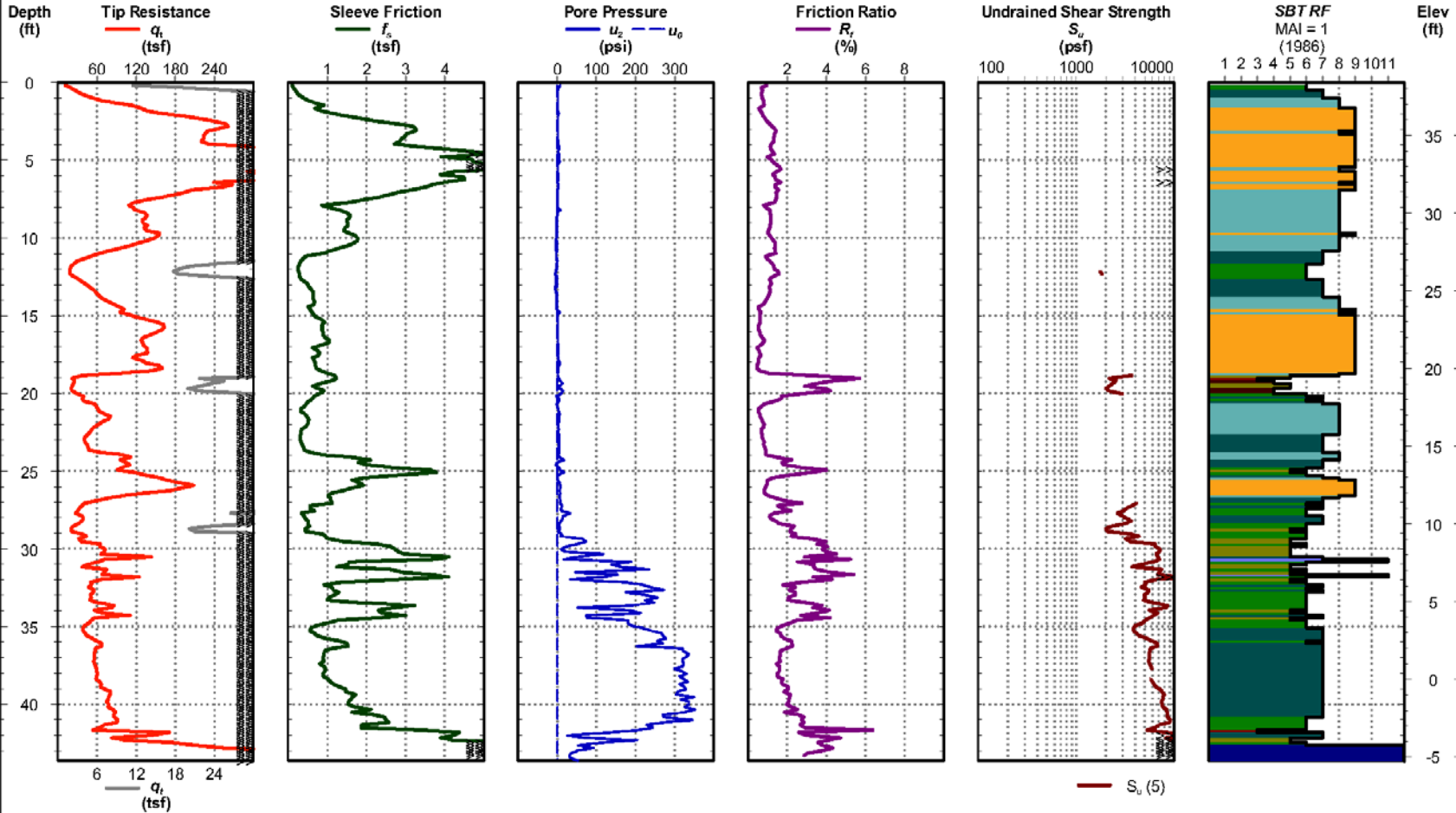
Cone Penetration Test

CPT-3

Date: Apr. 7, 2015
Operator: Dunbar
Drilling Agency: USACE, Savannah District

Northing: 613949.7766
Easting: 2420049.713
Probe ID/Net Area Ratio: DSG1070 / 0.8

Elevation: 38.4
Water Depth: 43.6 ft
Total Depth: 43.6 ft



- | | | | |
|----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand |
| 2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*) |
| 3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*) |

Electronic Filename:
HOOK-15-CPT-3.cpt

CPT REPORT - DYNAMIC BOTTOM LEGEND, HOOKERTON.GPJ, USACE WITH RAPID.CPT, 2012_09_01.GDT, 4/30/15



Hookerton
Hookerton, NC

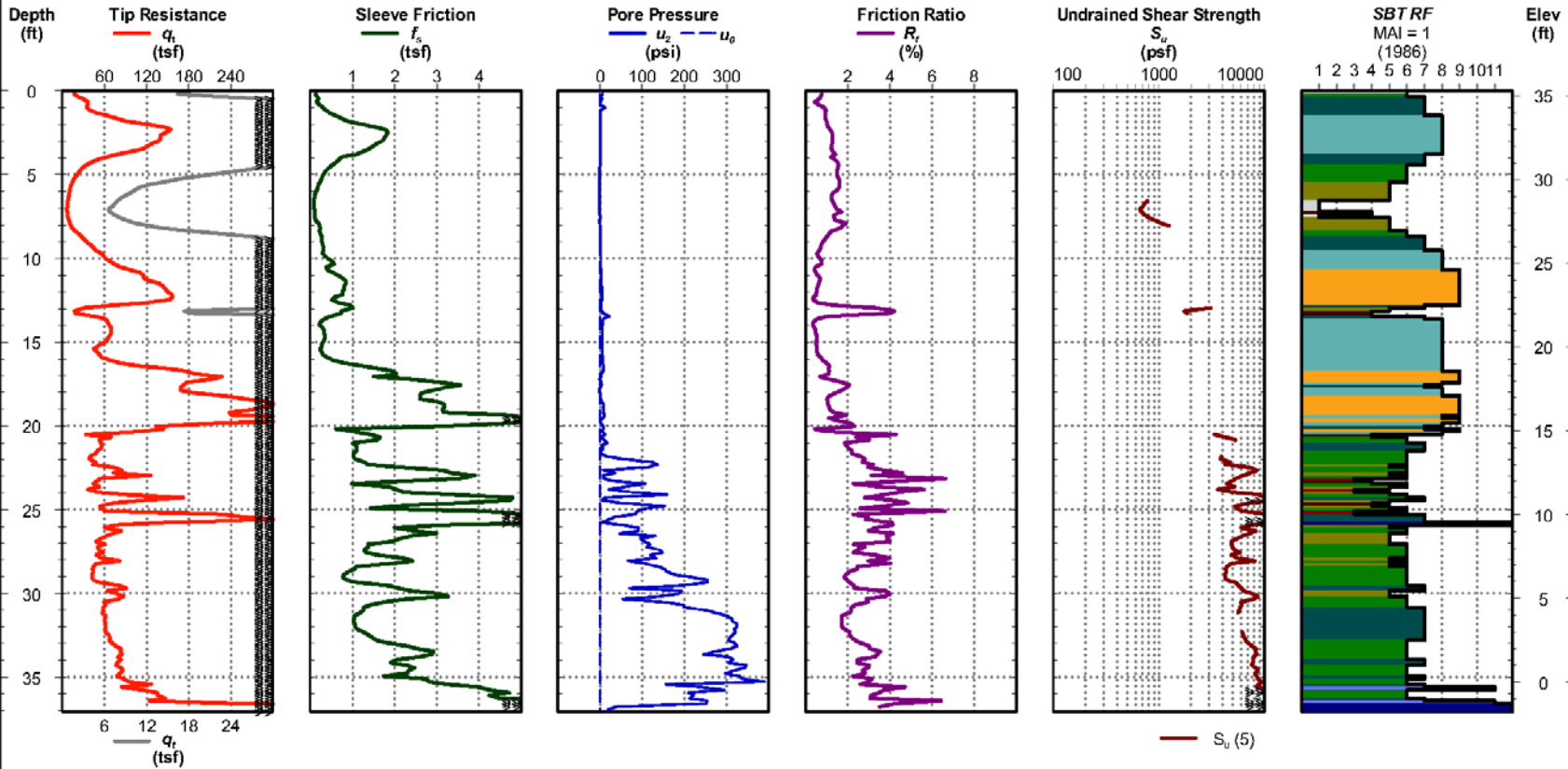
Cone Penetration Test

CPT-4

Date: Apr. 8, 2015
Operator: Dunbar
Drilling Agency: USACE, Savannah District

Northing: 613950.5641
Easting: 2420033.978
Probe ID/Net Area Ratio: DSG1070 / 0.8

Elevation: 35.3
Water Depth:
Total Depth: 37.1 ft



- | | | | |
|----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand |
| 2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*) |
| 3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*) |

Electronic Filename:
HOOK-15-CPT-4.cpt



Hookerton
Hookerton, NC

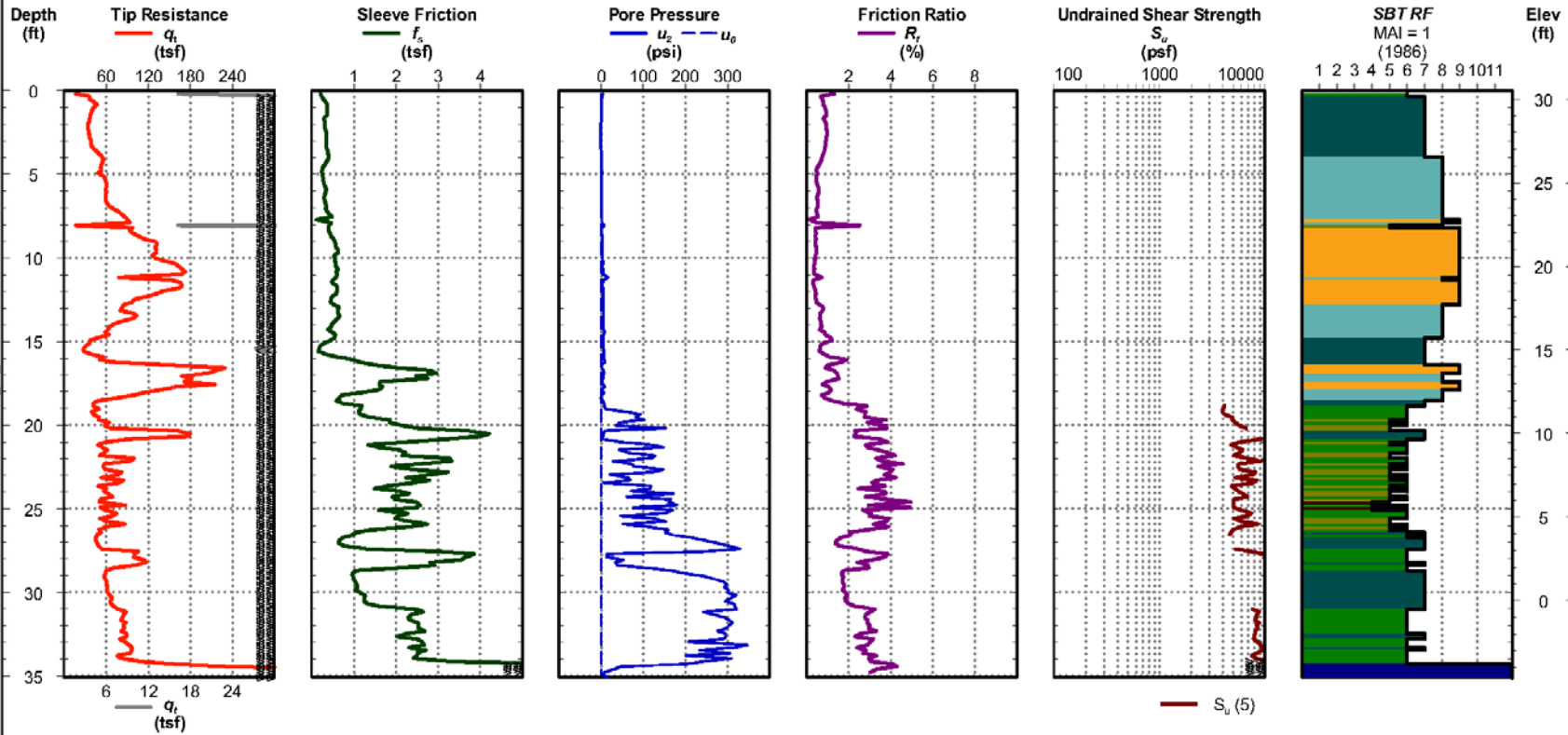
Cone Penetration Test

CPT-5

Date: Apr. 8, 2015
Operator: Dunbar
Drilling Agency: USACE, Savannah District

Northing: 613992.3165
Easting: 2419983.731
Probe ID/Net Area Ratio: DSG1070 / 0.8

Elevation: 30.5
Water Depth:
Total Depth: 35.1 ft



CPT REPORT - DYNAMIC BOTTOM LEGEND: HOOKERTON.GPJ USACE WITH RAPID.CPT 2012_09_01.GDT 4/30/15

- | | | | |
|----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand |
| 2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*) |
| 3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*) |

APPENDIX G
NMFS Preliminary Coordination

From: [Fritz Rohde - NOAA Federal](#)
To: [Bashaw, Justin P.SAW](#)
Subject: [EXTERNAL] Re: USACE, Wilmington District - Proposed USACE Emergency Streambank Protection Project - Continuing Authorities Program, Section 14 (UNCLASSIFIED)
Date: Monday, May 11, 2015 8:39:00 AM

Justin-

NMFS supports this effort and will address the EA quickly once it is received.

Fritz

On Fri, May 8, 2015 at 1:05 PM, Bashaw, Justin P SAW <Justin.P.Bashaw@usace.army.mil> wrote:

Classification: UNCLASSIFIED
Caveats: NONE

Good afternoon Mr. Rohde

The US Army Corps of Engineers, Wilmington District (Corps) plans to construct an emergency streambank protection project (Section 14 of the Corps' Continuing Authorities Program (CAP)) in the Town of Hookerton, NC at their Wastewater Treatment Plant (WWTP). Continued severe streambank erosion in Contentnea Creek threatens critical infrastructure at the WWTP and without immediate action, the dike at the WWTP's lagoon #1 may fail in the near future. Failure of the dike would disrupt WWTP-supplied services to the town, and discharge the contents of Lagoon #1 directly into Contentnea creek (several million gallons of raw wastewater). The Town of Hookerton has recently put in place temporary emergency streambank erosion "stop-gap" protection measures (rip-rap) which are planned to be removed and replaced by the more robust, Corps-constructed project in the near future. An Environmental Assessment (EA) is currently being constructed to describe the potential effects of the proposed Corps project on the human and natural environment in and surrounding the project area. So that you may have an understanding of this project and its impacts prior to receiving a finalized EA, attached for your reference are materials that further describe the Corps' proposed Section 14 project at Hookerton, NC's WWTP.

Please contact me with any questions, and the Corps will be providing you a final EA concerning this proposed streambank erosion project in the near future.

Respectfully,

Justin Bashaw

Biologist, Cultural Resources Manager
Environmental Resources Section
US Army Corps of Engineers, Wilmington District

- 69 Darlington Avenue
Wilmington, NC 28403-1343
- 910.251.4581 (telephone)
- 910.251.4744 (facsimile)
- justin.p.bashaw@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

APPENDIX H
USFWS Preliminary Coordination

From: [Bashaw, Justin P SAW](#)
To: [Pete Benjamin \(pete_benjamin@fws.gov\)](mailto:Pete.Benjamin@fws.gov)
Subject: USACE, Wilmington District - Proposed USACE Emergency Streambank Protection Project - Continuing Authorities Program, Section 14 (UNCLASSIFIED)
Date: Friday, May 08, 2015 1:07:15 PM
Attachments: [USACE - Hookerton, NC - Section 14 Fact Sheet.pdf](#)
[USACE - Hookerton, NC - Section 14 Project Management Plan \(PMP\).pdf](#)

Classification: UNCLASSIFIED
Caveats: NONE

Good afternoon Mr. Benjamin,

The US Army Corps of Engineers, Wilmington District (Corps) plans to construct an emergency streambank protection project (Section 14 of the Corps' Continuing Authorities Program (CAP)) in the Town of Hookerton, NC at their Wastewater Treatment Plant (WWTP). Continued severe streambank erosion in Contentnea Creek threatens critical infrastructure at the WWTP and without immediate action, the dike at the WWTP's lagoon #1 may fail in the near future. Failure of the dike would disrupt WWTP-supplied services to the town, and discharge the contents of Lagoon #1 directly into Contentnea creek (several million gallons of raw wastewater). The Town of Hookerton has recently put in place temporary emergency streambank erosion "stop-gap" protection measures (rip-rap) which are planned to be removed and replaced by the more robust, Corps-constructed project in the near future. An Environmental Assessment (EA) is currently being constructed to describe the potential effects of the proposed Corps project on the human and natural environment in and surrounding the project area. So that you may have an understanding of this project and its impacts prior to receiving a finalized EA, attached for your reference are materials that further describe the Corps' proposed Section 14 project at Hookerton, NC's WWTP.

Please contact me with any questions, and the Corps will be providing you a final EA concerning this proposed streambank erosion project in the near future.

Respectfully,

Justin Bashaw

Biologist, Cultural Resources Manager
Environmental Resources Section
US Army Corps of Engineers, Wilmington District

- 69 Darlington Avenue
Wilmington, NC 28403-1343
- 910.251.4581 (telephone)
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Classification: UNCLASSIFIED
Caveats: NONE

Classification: UNCLASSIFIED
Caveats: NONE

APPENDIX I
NC State Environmental Review Clearinghouse Preliminary Coordination

From: [Bashaw, Justin P SAW](#)
To: crystal.best@doa.nc.gov
Subject: USACE, Wilmington District - Proposed USACE Emergency Streambank Protection Project - Continuing Authorities Program, Section 14 (UNCLASSIFIED)
Date: Friday, May 08, 2015 1:15:47 PM
Attachments: [USACE - Hookerton, NC - Section 14 Fact Sheet.pdf](#)
[USACE - Hookerton, NC - Section 14 Project Management Plan \(PMP\).pdf](#)

Classification: UNCLASSIFIED
Caveats: NONE

Good afternoon Ms. Best,

The US Army Corps of Engineers, Wilmington District (Corps) plans to construct an emergency streambank protection project (Section 14 of the Corps' Continuing Authorities Program (CAP)) in the Town of Hookerton, NC at their Wastewater Treatment Plant (WWTP). Continued severe streambank erosion in Contentnea Creek threatens critical infrastructure at the WWTP and without immediate action, the dike at the WWTP's lagoon #1 may fail in the near future. Failure of the dike would disrupt WWTP-supplied services to the town, and discharge the contents of Lagoon #1 directly into Contentnea creek (several million gallons of raw wastewater). The Town of Hookerton has recently put in place temporary emergency streambank erosion "stop-gap" protection measures (rip-rap) which are planned to be removed and replaced by the more robust, Corps-constructed project in the near future. An Environmental Assessment (EA) is currently being constructed to describe the potential effects of the proposed Corps project on the human and natural environment in and surrounding the project area. So that the State Environmental Review Clearinghouse may have an understanding of this project and its impacts prior to receiving a finalized EA, attached for reference are materials that further describe the Corps' proposed Section 14 project at Hookerton, NC's WWTP.

Please contact me with any questions, and the Corps will be providing the State Environmental Review Clearinghouse a final EA concerning this proposed streambank erosion project in the near future.

Respectfully,

Justin Bashaw

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