

Appendix E

Cost Engineering

Emergency Streambank and Shoreline Erosion Protection Study (Section 14)

Detailed Project Report For Southport, NC

This Cost Engineering narrative was prepared to describe the Current Working Estimate (CWE) of alternative plan evaluations for the **Emergency Shoreline Erosion Protection** – Section 14 Study, Southport, NC. This narrative also provides details for the Tentative Selected Plan. The costs are summarized and listed below in the Code of Accounts format and are based upon April 2012 price levels.

The Tentative Selected Plan (TPS) for the Southport 14 – Rock Revetment feasibility study identified armor rock revetment stone along the existing shoreline was the most economical method to prevent shoreline erosion. Other alternatives considered were rock sill offshore with aquatic plantings onshore and sheetpile retaining wall with backfill. The rock revetment along the shoreline will protect an existing wastewater pump station

A screening process of the 3 alternatives for cost and effectiveness were evaluated as described in the main Project Design Report. Shoreline erosion rates are identified in the main report and indicate an emergency need to construct the project. The rock revetment will protect a wastewater pumping station from having to be relocated.

There will be no significant operational or maintenance costs associated with the rock revetment.

– The CWE cost comparison of (a) rock revetment along the shoreline and (b) are summarized below (Oct 2011 Pricing).

(a) Rock Revetment Construction – Initial Costs \$578,000 (with contingency)
Estimated construction time: 4 to 5 months

(b) Offshore rock sill with shoreline plantings - Initial Costs \$914,000 (with contingency)
Estimated construction time: 7 to 9 months

ROCK REVETMENT CONSTRUCTION - The construction of the rock revetment paralleling the existing shoreline will be constructed with conventional land equipment and loader to handle 655 tons of armor stone (avg weight 800 pounds) and 520 tons of bedding stone (NCDOT CLASS B). Geotextile fabric will be placed under the bedding stone and approximately 625 tons of existing concrete rubble debris, along the shoreline, will be removed from the existing shoreline. Very little, if any, grading will be necessary and the revetment will follow the existing shoreline for approximately 350 LF. The shoreline is subject to tidal fluctuations of approximately zero to 3 feet in the construction area. A typical detail of rock stone configuration is shown in Figure 4.07. The existing shoreline and historic shoreline erosion rates are shown in Figure 4.05.

ROCK SILL OFFSHORE CONSTRUCTION - The construction of the rock sill in shallow water offshore paralleling the existing shoreline would have to be constructed with barges and tugs. The estimated quantities would be 1,170 tons of armor stone (avg weight 800 pounds) and 720 tons of bedding stone (NCDOT CLASS B). Geotextile fabric will be placed under the bedding stone. Approximately 650 aquatic plants would be installed along the shoreline between the high and low tide elevations. The existing concrete rubble debris would not be removed from the existing shoreline. The existing shoreline and historic shoreline erosion rates are shown in figure 4.05.

Several stone suppliers and trucking companies were contacted to determine the cost of stone materials. Installation of stone revetment and offshore rock sill would both be similar to previous project constructed within the District.

The rock revetment construction was chosen as the TSP to be the most economical method to protect shoreline erosion.

The CWE and Code of Account features for Rock Revetment construction are further broken down into more detail in the Microcomputer Aided Cost Estimating System (MCACES) MII estimate discussed below and shown in Attachment 1 of this Appendix. The MCACES MII of the Rock Sill Offshore Alternative can be found in Attachment 3 of this Appendix.

A **Total Project Cost Summary (TPCS)**, Attachment 2 of this Appendix, identifies the CWE for the Rock Revetment Construction for Oct 2011 price levels as \$ 462,000 (\$ 578,000 with 25% contingency) and fully funded to midpoint of construction as \$ 596,000 with contingency. The TPCS estimate has been reviewed by Cost Center DX for certification Oct 3, 2012. The final TPCS and COST CENTER DX certification is included with Attachment 2 of this Appendix.

Construction midpoint is estimated to be JULY 2013. Construction completion is estimated to be OCTOBER 2013. Minimal post construction monitoring will be needed. There will be no adaptive management to follow construction completion.

Cost Estimates were prepared under guidance given in the Corps of Engineers Regulation ER 1110-2-1302, *Civil Works Cost Engineering, ER 1110-1-300, Cost Engineering Policy and General Requirements*, and ETL 1110-2-573 Construction Cost Estimating Guide for Civil Works.

An abbreviated **Cost Risk and Schedule Analysis (CRSA)** was conducted with the Project Delivery Team to support a 25% contingency for risk and uncertainty. A final copy of the Cost Risk Report, Risk Register, Cost models, and sensitivity analysis is included in this Appendix as Attachment 3.

A CODE OF ACCOUNTS format is established to provide a consistent organization of major costs by task and type. \$ thousands

<u>Lands and Damages (01)</u> – Real Estate	\$ 50
<u>Bank Stabilization (16)</u> –Rock Revetment	\$ 260
<u>Planning, Engineering and Design (30)</u> – Investigations, Plans and Specifications	\$ 123
<u>Construction Management (31)</u> – Contract Admin, Construction Inspection,	\$ 29
TOTAL thousands	\$ 462
<u>Project Cost and Schedule Risk Analysis: Contingency Summary</u> 25%	\$ 116
<u>Oct 2011 Price Levels</u>	<u>TOTAL PROJECT COSTS with Contingency</u> \$ 578

5.1 Preconstruction Engineering and Design Phase

The PED phase would follow the feasibility study. The purpose of the phase would be to complete all the details and design needed to advertise and initiate construction. The phase would be complete with the finalization of detailed construction drawings and specifications.

PED costs prepared during the PED phase would include the following:

- Updated Real Estate Plan
- PED agreement with the non-Federal sponsor
- First detailed construction drawings and specifications
- Updated Monitoring and Adaptive Management plan
- Draft Project Partnership Agreement

5.2 Construction Phase

After Congress appropriates funds specifically for this project, the PPA would be finalized and signed. The construction work would begin soon after the PPA is approved and executed, the real estate clearances checked, and a construction contract is awarded. The construction phase would include the following:

- Appropriation of construction funds
- PPA approval and execution
- Construction contract advertised
- Construction contract awarded
- Construction completion
- Project acceptance and transfer to sponsor

5.3 Construction Phasing

Project construction of the rock revetment along the shoreline, which is the TSP, is estimated to take 4-5 months.