FINAL
INTEGRATED
FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

COASTAL STORM DAMAGE REDUCTION

BOGUE BANKS, CARTERET COUNTY

NORTH CAROLINA

APPENDIX D

Cost Engineering

US Army Corps of Engineers
Wilmington District

Appendix D: Cost Engineering

BOGUE BANKS BEACHES
Feasibility Report
Carteret County, North Carolina

1. The Cost Engineering Appendix project costs were prepared to describe the Current Working Estimate (CWE) for the National Economic Development (NED) Plan for the Bogue Banks Beaches, North Carolina – Feasibility Report.

The NED Plan is the alternative selected plan which has the greatest net benefits. The NED for Bogue Banks includes the beaches from Bogue Banks Inlet to Beaufort Inlet approximately 22.7 miles from Reaches 1 thru 117. The two essential features of the selected plan are the varying dune heights and a 50 foot design berm based on Alternative 9 as shown in main report Table 5.3 of all alternative comparisons evaluated.

Alternatives were evaluated using SBEACH and Beach-*fx* modeling. Coastal analysis and characterizing the physical characteristics of the shoreline was used for modeling with the Storm-induced Beach Change (SBEACH) model. The SBEACH model output of shoreline responses was then used as an input into the Beach-*fx* model, which uses a Monte Carlo simulation to track beach profile evolution over time and measure average economic damages over multiple project life cycles. Costs plus a contingency from each borrow area were used in the model of alternatives.

The NED, Alternative 9, consists of sand dunes constructed to elevations ranging from 15 to 20 feet above the National Geodetic Vertical Datum (NGVD), fronted by a 50-foot wide beach berm (elevation of 5.5 or 7-ft).

Material for placement on the beach will come from three (3) offshore borrows areas (see Figure 1) located approximately 2.3 to 5.5 miles offshore from the beach (measurement is average distance from pumpout location to center of the borrow area). These borrow areas are labeled Y, U, and Q2. Quantities of borrow areas and depths are shown in Table 1. It was assumed Hopper dredges would be the most economical method (vs. cutterhead suction pipeline which would have very long pumping distances) to excavate material, travel to pump out stations, and pump material onto the beach.

The current borrow use plan involves placing material from Borrow Area Y on reaches 1-36, material from Borrow Area U on reaches 37-79, and material from the Q2 on reaches 80-117. There is sufficient material in the borrow areas to allow periodic nourishments to continue throughout the 50-year project life without each borrow area being depleted of material.

2. The TOTAL CURRENT WORKING ESTIMATE (CWE) for NED Initial Construction of beach nourishment is $29,495,000 October 2013 pricing ($36,574,000 with 24 percent contingency). Initial Construction will take 3.5 months for 2,451,000 cy. Hopper dredging will only be performed during the periods (seasons) December 15 thru March 31 during Initial construction because of environmental windows for turtles. The CWE for Initial Construction fully funded to midpoint of construction FEB 2020 is $33,341,000 ($41,343,000 with 24% contingency).

Future or subsequent Periodic Nourishments each are estimated to be 1,070,000 cy for each cycle at $10,960,000 OCT 2013 pricing ($14,029,000 with 28% contingencies). The periodic nourishment years occur every 3 years after completion of Initial Construction beginning year 2023 for 50 years until 2070. The periodic nourishments assume 1 season using 1-hopper medium class dredge. The CWE for Periodic Construction fully funded to midpoint of construction is $441,346,000 ($564,923,000 with 28% contingency).

All quantities are dredge volumes and not beach template quantities.

The CWE costs, for construction and non-construction items, were established to be the most likely Baseline Cost Estimate at October 2013 price levels.

3. Baseline most likely CWE's are shown in the attached MCACES (Microcomputer Aided Cost Engineering System) summary sheets. The summary sheets are formatted into a Code of Accounts framework for reporting. The costs included under each Code of Accounts are described below.

The 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.

4. CODE OF ACCOUNTS

CODE OF ACCOUNT 01 – LANDS AND DAMAGES: The detail estimated costs were prepared and furnished by the Real Estate Division, Savannah District as discussed in the Real Estate Appendix H. Contingencies were developed during the formal Cost Schedule Risk Analysis and resulted in 24% contingency.

CODE OF ACCOUNT 17 – BEACH REPLENISHMENT: This account includes project costs for mobilization and demobilization, dredging, beach fill shaping, beach tilling, dune vegetation, and dune walkover structures.

Emphasis was placed on accuracy of dredging costs during evaluation of alternative plans to develop the NED Plan. The location and features of borrow areas in relation to the project, as well as historical production of dredges for similar projects, were used in conjunction with the Corps of Engineers Dredge Estimating Program (CEDEP).

CEDEP considers details of borrow area characteristics, depth of borrow, effective production time, distances from borrow sites, costs of dredge plant ownership, operating and repair, fuel consumption/prices, and other economic adjustments for labor and equipment at OCT 2013 price levels.

a. For Initial Construction it was determined two(2) medium class size hopper dredges would be used to place sand on the beach from pump out locations about 3,000 to 3,500 feet from the shoreline. The average travel distance 1-way to the pump out stations from the 3 borrow areas varies from 2.3 miles to 5.5 miles on average. The one way distance depends on which project segment is receiving beach sand.

The initial construction time for placement of sand on project is estimated to be 3.5 months (dependent on medium to large Hoppers) for 2.45 million cubic yards (borrow area quantity) based on using 2 hopper dredges throughout the environmental window. The environmental window for hopper dredges is December 15 through March 31 or about 3.5 months for a season.

Additional time for mob/demob and pipe set up on the beach needs to be added for each seasonal contract. Mobilization is typically estimated at approximately 30 days prior to beginning initial placement and 30 days demobilization of pipe and equipment off the beach, as well as beach tilling, dune vegetation and new wooden walkover structures.

Two hoppers were considered to be typical of past project equipment availability that would be used for construction. Although Pipeline suction cutterhead dredges were considered, pipeline lengths from the borrow areas and beach were not considered as economical as the use of hopper dredges. However, the solicitation for construction will not limit the type of equipment to construct the project.

b. For Periodic Nourishments it was determined that one hopper dredge with pump out would continue to be the most suitable method to place sand on the beach. This was based on the same overall borrow proximity to the beach. Pump out stations located approximately 3,000 to 3,500 feet from shore were assumed.

The Periodic Nourishment construction time for placement of sand on project is estimated to be 3 months for 1.07 million cubic yards (borrow area quantity) based on using 1 hopper dredge throughout the environmental windows. The environmental window for hopper dredges during periodic nourishment is January 1 through March 31 or about 3 months for a season.

Beach fill placement costs are included as part of the hopper dredging unit price. Beach fill consists of shaping the dredged material with dozers to the required cross section while the dredge is pumping material onto the beach.

c. The costs for Beach Tilling were based on historical costs for similar projects. The costs for Dune Vegetation were based on historical pricing and discussions with North Carolina extension services. The price for Dune Walkover Structures was based on

detailed cost estimates used for similar structures and historical costs on similar projects. There will be no Dune vegetation or walkover structures for periodic nourishments.

d. For Initial and Periodic nourishments, a contingency of 24% and 28%, respectively, were included to represent unanticipated conditions and uncertainties not known at the time the estimate was developed. There is a better than average level of confidence in the dredge pricing, because of the detailed geotechnical investigations of borrows areas, similarities of other beach nourishment projects, and the historical costs for similar projects. A contingency of 24% for Initial construction & 28% contingency for Periodic nourishments were developed in a detailed Cost Schedule and Risk Analysis (CSRA) through the Cost Center of Expertise in Walla Walla, Washington.

CODE OF ACCOUNT 30 – PLANNING, ENGINEERING AND DESIGN: The costs included in this account were furnished by those responsible for performing each activity. This account includes plans and specifications, field investigations and surveys, cost estimates, engineering during construction, environmental monitoring, and project management. A 24% Initial & 28% periodic contingency assigned to ACCOUNT 30.

CODE OF ACCOUNT 31 – CONSTRUCTION MANAGEMENT – This account includes supervision and administration of the contracts by construction management, hydrologic surveys during construction, environmental/coastal monitoring after construction, and contracting personnel during construction. A 24% Initial & 28% Periodic contingency was assigned to ACCOUNT 31.

Figure 1. Vicinity map, including potential offshore borrow locations (Y,U, and Q2).

Borrow Area	Depth (ft)			Footprint (acres)	Volume (cy)
	Min	Max	Avg		
Y	2.2	7.6	4.4	1,100	6,400,000
U	1.4	4.0	2.8	3,600	14,400,000
Q2	3.1	8.1	5.3	4,400	35,900,000

Table 1. Depth, area, and volume of material at each of the three borrow sites.

The plan has a main fill length of 119,670 ft, starting 1,000 ft east of Bogue Inlet (Reach 4) and extending to the boundary of Atlantic Beach and Fort Macon State Park (Reach 117). The dimensions of the main fill are shown in Table 2 below. The constructed dune feature dimensions listed are inclusive of the existing dune.

Reaches	Length (ft)	Landward Dune Slope (X:1)	Max Dune Elevation (ft)	Dune Width (ft)	Seaward Dune Slope (X:1)	Berm Height (ft)	Berm Width (ft)	Berm Seaward Slope (X:1)
4-10	4,876	4	16	95	-4	5.5	50	-15
11-15	5,633	4	15	45	-4	7	50	-15
16-21	6,891	4	20	10	-4	7	50	-15
22-92	82,053	4	x	x	-4	7	50	-15
93-110	15,274	4	18	40	-4	5.5	50	-15
111-117	4,943	4	x	x	-4	5.5	50	-15

Table 2. Main beachfill dimensions. A "x" indicates that a federally maintained dune feature is not part of the selected plan in those reaches.

Example plan and cross-section views of the project from selected reaches are shown in Appendix A. The average depth of closure for the constructed profile is -19 ft mean low water (mlw).

Transition sections are needed to improve project stability and reduce end losses. The transition sections for this project include a 1,000 ft tapered berm at each end of the project. At the west end of the project, the taper extends from Bogue Inlet up to reach 4, at the east end of the project the taper starts at the end of reach 117 and extends into Fort Macon State Park.

Table 3 shows the current project schedule following authorization of the project. The schedule assumes expeditious review and approval of the project through all steps, including authorization and funding, and as such is subject to change.

Activity	Date
Project Authorization (WRDA)	Dec 2014
Sign PPA	Dec 2017
Complete Real Estate Acquisition	Sept 2019
Complete Final Plans and Specs	Sept 2019
Award Construction Contract	Nov 2019
Begin Initial Construction	Dec 2019
Complete Initial Construction	Mar 2020
Begin First Renourishment	Dec 2022
Complete First Renourishment	Mar 2023

Table 3. Project schedule following authorization.

Bogue-INITIAL_LS_OCT_1_2013--FEB-2014
BOGUE BEACHES - FEASIBILITY REPORT - CURRENT WORKING ESTIMATE (CWE)

Estimated by	CESAW-TS-EE
Designed by	USACE - WILMINGTON DISTRICT
Prepared by	John C. Caldwell
Preparation Date	2/7/2014
Effective Date of Pricing	10/1/2013
Estimated Construction Time	110 Days

Date	Author	Note
6/22/2012	CESAW-TS-EE	New Project Note - SEE APPNDIX D NARRATIVE FOR OVERALL DESCRIPTION OF PROJECT SPECIFICS.

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**29,495,000**	**0**	**29,495,000**
01 --LANDS and DAMAGES - REAL ESTATE	**1**	**LS**	**3,517,000**	**0**	**3,517,000**
17 --BEACH REPLENISHMENT	**1**	**LS**	**24,068,000**	**0**	**24,068,000**
30 --PLANNING, ENGINEERING & DESIGN	**1**	**LS**	**1,600,000**	**0**	**1,600,000**
31 --S&A-CONST MGT & MONITORING	**1**	**LS**	**310,000**	**0**	**310,000**

Labor ID: NC-GA 2013 EQ ID: EP11R03 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Contract Cost Summary Report			**29,495,000**	**0**	**29,495,000**
01 --LANDS and DAMAGES - REAL ESTATE -	**1.00**	**LS**	**3,517,000**	**0**	**3,517,000**
01_01 --Real Estate Analysis Documents	**1.00**	**LS**	**3,517,000**	**0**	**3,517,000**
1 Real Estate Analysis Documents	**1.00**	**LS**	**3,517,000**	**0**	**3,517,000**
1a Real Estate Analy/Docs	**1.00**	**LS**	**3,517,000**	**0**	**3,517,000**
17 --BEACH REPLENISHMENT -	**1.00**	**LS**	**24,068,000**	**0**	**24,068,000**
17_02 --BEACH NOURISHMENT - PLANTINGS - WALKOVERS	**1.00**	**LS**	**24,068,000**	**0**	**24,068,000**
1 BOGUE BANKS	**1.00**	**LS**	**24,068,000**	**0**	**24,068,000**
A MOB & DEMOB	**1.00**	**LS**	**1,600,000**	**0**	**1,600,000**
B DREDGING - HOPPER	**1.00**	**LS**	**18,384,000**	**0**	**18,384,000**
C DUNE PLANTINGS	**1.00**	**LS**	**3,825,000**	**0**	**3,825,000**
D TILLING	**1.00**	**LS**	**84,000**	**0**	**84,000**
E WALKOVERS	**1.00**	**LS**	**175,000**	**0**	**175,000**
30 --PLANNING, ENGINEERING & DESIGN -	**1.00**	**LS**	**1,600,000**	**0**	**1,600,000**
30_23 --Construction Contracts Documnts	**1.00**	**LS**	**1,600,000**	**0**	**1,600,000**
1 Plans and Specifications (P&S)	**1.00**	**LS**	**1,150,000**	**0**	**1,150,000**
1a P & S Documents	**1.00**	**LS**	**1,150,000**	**0**	**1,150,000**
2 Beach Surveys	**1.00**	**LS**	**450,000**	**0**	**450,000**
2a Beach Surveys	**1.00**	**LS**	**450,000**	**0**	**450,000**
31 --S&A-CONST MGT & MONITORING -	**1.00**	**LS**	**310,000**	**0**	**310,000**
31_12 --Construction Contracts	**1.00**	**LS**	**220,000**	**0**	**220,000**
1 Supervision and Administration	**1.00**	**LS**	**220,000**	**0**	**220,000**
1a Supervn and Adminstn	**1.00**	**LS**	**220,000**	**0**	**220,000**
31_27 --Monitoring - pipeline route, Dredge, Nest Monitoring, Compaction Assessment	**1.00**	**LS**	**90,000**	**0**	**90,000**
2 Construction Monitoring	**1.00**	**LS**	**90,000**	**0**	**90,000**
2a Construction Monitoring	**1.00**	**LS**	**90,000**	**0**	**90,000**

Labor ID: NC-GA 2013 EQ ID: EP11R03 Currency in US dollars TRACES MII Version 4.2

Bogue-PERIODIC LS_OCT_1_2013 Price Level --FEB_2014
BOGUE BEACHES - FEASIBILITY REPORT - CURRENT WORKING ESTIMATE (CWE)

Estimated by	CESAW-TS-DE
Designed by	USACE - WILMINGTON DISTRICT
Prepared by	John C. Caldwell
Preparation Date	2/7/2014
Effective Date of Pricing	10/1/2013
Estimated Construction Time	90 Days

Description **Page**

Date	Author	Note
6/22/2012	CESAW-TS-EE	New Project Note - SEE APPENDIX D NARRATIVE -FEBRUARY 2014 FOR OVERALL DESCRIPTION OF PROJECT SPECIFICS.

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**10,959,861**	**0**	**10,959,861**
17 --BEACH REPLENISHMENT - Periodic Nourishment - - - - - - - - - - - - - - - - - - -	**1**	**LS**	**9,209,861**	**0**	**9,209,861**
30 --PLANNING, ENGINEERING & DESIGN -	**1**	**LS**	**1,000,000**	**0**	**1,000,000**
31 --S&A-CONST MGT & MONITORING -	**1**	**LS**	**750,000**	**0**	**750,000**

Labor ID: NC-GA 2012 EQ ID: EP11R03 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Contract Cost Summary Report			**10,959,861**	**0**	**10,959,861**
17 --BEACH REPLENISHMENT - Periodic Nourishment - - - - - - - - - - - - - - - - - - -	**1.00**	**LS**	**9,209,861**	**0**	**9,209,861**
17_02 --BEACH NOURISHMENT	**1.00**	**LS**	**9,209,861**	**0**	**9,209,861**
1 BOGUE BANKS	**1.00**	**LS**	**9,209,861**	**0**	**9,209,861**
MOB & DEMOB	**1.00**	**LS**	**950,000**	**0**	**950,000**
DREDGING - HOPPER	**1.00**	**LS**	**8,175,861**	**0**	**8,175,861**
TILLING	**1.00**	**LS**	**84,000**	**0**	**84,000**
30 --PLANNING, ENGINEERING & DESIGN - - - - - - - - - - - - - - - - - - -	**1.00**	**LS**	**1,000,000**	**0**	**1,000,000**
30_23 --Construction Contracts Documnts	**1.00**	**LS**	**1,000,000**	**0**	**1,000,000**
1 Plans and Specifications (P&S)	**1.00**	**LS**	**1,000,000**	**0**	**1,000,000**
1a P & S Documents	**1.00**	**LS**	**1,000,000**	**0**	**1,000,000**
31 --S&A-CONST MGT & MONITORING -	**1.00**	**LS**	**750,000**	**0**	**750,000**
31_12 --Construction Contracts	**1.00**	**LS**	**220,000**	**0**	**220,000**
1 Supervision and Administration	**1.00**	**LS**	**220,000**	**0**	**220,000**
1a Supervn and Adminstn	**1.00**	**LS**	**220,000**	**0**	**220,000**
31_27 --Monitoring - pipeline route, Dredge, Nest Monitoring, Compaction Assessment	**1.00**	**LS**	**80,000**	**0**	**80,000**
2 Construction Monitoring	**1.00**	**LS**	**80,000**	**0**	**80,000**
2a Construction Monitoring	**1.00**	**LS**	**80,000**	**0**	**80,000**
31_27 --Beach Survey Monitoring by Coastal Eng	**1.00**	**LS**	**450,000**	**0**	**450,000**
2 Beach Survey Monitoring by Coastal Eng	**1.00**	**LS**	**450,000**	**0**	**450,000**
2a Beach Survey Monitoring by Coastal Eng	**1.00**	**LS**	**450,000**	**0**	**450,000**

Currency in US dollars

Bogue-PERIODIC-TOTALS LS_OCT_1_2013--FEB_2014
BOGUE BEACHES - FEASIBILITY REPORT - CURRENT WORKING ESTIMATE (CWE)

Estimated by	CESAW-TS-DE
Designed by	USACE - WILMINGTON DISTRICT
Prepared by	John C. Caldwell
Preparation Date	2/13/2014
Effective Date of Pricing	10/1/2013
Estimated Construction Time	90 Days

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Date	Author	Note
6/22/2012	CESAW-TS-EE	New Project Note - SEE APPENDIX D NARRATIVE -FEBRUARY 2014 FOR OVERALL DESCRIPTION OF PROJECT SPECIFICS.

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**175,357,776**	**0**	**175,357,776**
Periodic Nourishment 2023	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2026	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2029	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2032	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2035	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2038	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2041	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2044	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2047	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2050	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2053	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2056	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2059	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2062	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2065	**1**	**LS**	**10,959,861**	**0**	**10,959,861**
Periodic Nourishment 2068	**1**	**LS**	**10,959,861**	**0**	**10,959,861**

Labor ID: NC-GA 2012 EQ ID: EP11R03 Currency in US dollars TRACES MII Version 4.2

US Army Corps of Engineers®

BOGUE BANKS, CARTERET COUNTY, NORTH CAROLINA COASTAL STORM DAMAGE REDUCTION FEASABILITY REPORT RISK ANALYSIS

Prepared by:
U.S. Army Corps of Engineers,
Wilmington District

Supported by:
U.S. Army Corps of Engineer
Walla Walla Cost MCX

Date: June 21, 2013

Updated: February 5, 2014

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APPENDIX

Report Purpose

February 5, 2014 UPDATE: The June 2013 cost estimate was updated to OCT 2013 costs and the revisions were negligible mostly due to a reduction in fuel price from $3.50/gallon to $3.35/gallon off-road diesel fuel. Therefore the CSRA was virtually unchanged except for revisions to first cost of OCT 2014 (FY-15) and fully funded costs.

The US Army Corps of Engineers (USACE), Wilmington District, presents this cost and schedule risk analysis (CSRA) report for the Bogue Banks Coastal Storm Damage Reduction Feasibility Report. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on the first cost as well as the periodic renourishment costs of the project. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion.

Project Scope

The project area includes approximately a 25 mile long barrier island on North Carolina's central coasts in Carteret County. The plan calls for an initial placement of then a periodic renourishment every three years for (16 total). Material for the project comes from several offshore borrows locations.

Risk Analysis Results

A Cost and Schedule Risk Analysis (CSRA) update was performed on June 21 2013 on this project to identify the 80% confidence level contingencies for the initial construction and renourishments. The study was performed on the Federal NED plan. The contingencies considered both cost and schedule with the schedule risk being converted to an additional cost risk. The risks for the initial construction were reexamined and adjusted based on the reduced quantities for a renourishment. The midpoint of the 50 year renourishment period was utilized to analysis time sensitive risks. The results are that the examination of the of the risks for the first cost result in a 24% contingency at the 80% confidence level and the renourishments risk result in a slightly higher 28% contingency at the 80% level. These contingencies are applied to the remaining project activities such as Lands and Damages, Design and Construction Management as applicable. The following results were observed based on the MCACES Cost Estimate:

Construction Results	Contingency Amount ($k)	Contingency %
Initial Construction	$6,918	24%
Periodic Renourishments	$49,101	28%

High Risk Items

The following were high risk items affecting cost. The complete risk register and analysis can be viewed in Appendix A.

- Market Conditions

Discussion: Dredging is a highly competitive industry and there are limited windows when dredging can be performed in this area. The PDT has planned (and currently has adequate time in the project schedule) to advertise the project early in order to ensure the largest number of potential bidders. This represents an opportunity to reduce costs on the initial construction but may not be as likely to be recognized on the renourishments.

- Dredge number and size

Discussion: The choice of dredge size can affect efficiency and productivity, causing a difference between the government estimate and the bid price of the contract. The estimate assumed two medium-sized hopper dredges will be utilized, but the actual equipment is not restrictive within the proposed contract. A large hopper dredge could result in greater efficiency as compared to two smaller hoppers, but are less available and may be impacted by speed restrictions and may cause variations in the bid pricing.

Contract Modifications/Claims:

Discussion- Contract modifications are always a risk in dredging. This work has proscriptive work windows and any environmental impacts in the region could potentially stop or delay the work that season resulting in remobilization costs.

- Other risks- Fuel, Quantities, and Borrow assumptions

Discussion- With dredging work the price of fuel is a significant cost and is usually a high risk factor along with the quantities and borrow assumptions. Overall this is a relatively straightforward project and many of the risks are typical of similar projects.

Mitigation Recommendations

A positive outcome of the CSRA was a thorough discussion of the risks and their mitigation measures. PDT members worked through each risk item and how the risks would affect the overall project. Most could not be mitigated such as adverse weather and funding issues

Major recommendations are as follows for high risk items:

- Modifications/Claims during Project Construction Execution – Research into specific risk events which cause modification or claim during previous construction periods. Identify potential risk mitigation efforts from results.

- For the periodic renourishments, the quantities of remaining borrow should be evaluated each year to ensure that the necessary materials are available as the project progresses.

Total Project Cost Summary

The following tables portray the first cost of the initial construction and the 16 periodic renourishments features based on the anticipated contracts. The costs are intended to address the necessary costs at authorization of the project. Costs are in thousands of dollars. The contingency is based on an 80% confidence level, as per USACE Civil Works guidance. The most likely cost of the project INITIAL NOURISHMENT at OCT 2013 price levels is $29,495,000 and $36,574,000 with 24% contingency. Project First Costs are in FY15 dollars are summarized below.

Table 1 - Project First Cost Summary

		FIRST COSTS			FULLY FUNDED COSTS		
ACCT	DESCRIPTION	COST ($k)	CONTG ($k)	TOTALS ($k)	COST ($k)	CONTG ($k)	TOTALS ($k)
1	Lands & Damages	$3,586	$861	$4,446	$3,830	$919	$4,749
17	Beach Replenishment	$24,537	$5,889	$30,426	$27,088	$6,501	$33,589
Construction Costs		**$28,123**	**$6,750**	**$34,872**	**$30,918**	**$7,420**	**$38,338**
30	Planning, Engineering & Design**	$1,659	$398	$2,057	$2,023	$486	$2,509
31	Supervision & Administration**	$321	$77	$398	$400	$96	$496
	Summary 30 & 31 Account	**$1,980**	**$475**	**$2,455**	**$2,423**	**$582**	**$3,005**
	Total	**$30,103**	**$7,225**	**$37,327**	**$33,341**	**$8,002**	**$41,343**

The most likely cost of the project Periodic Nourishments at OCT 2013 price levels is $175,360,000 and $224,461,000 with 28% contingency. Project First Costs are in FY15 dollars are summarized below.

Table2 - Project Renourishment Cost Summary (16 renourishments)

		Renourishment First Cost			RENORISHMENT FULLY FUNDED COST		
ACCT	DESCRIPTION	COST ($k)	CONTG ($k)	TOTALS ($k)	COST ($k)	CONTG ($k)	TOTALS ($k)
17	Beach Replenishment	$150,233	$42,065	$192,299	$277,182	$77,611	$354,794
Construction Costs							
30	Planning, Engineering & Design**	$16,585	$4,644	$21,229	$93,286	$26,120	$119,406
31	Supervision & Administration**	$12,439	$3,483	$15,922	$70,878	$19,846	$90,724
	Total O&M Cost	**$179,258**	**$50,192**	**$229,450**	**$441,346**	**$123,577**	**$564,923**

PURPOSE/BACKGROUND

The US Army Corps of Engineers (USACE), Wilmington District, presents this cost and schedule risk analysis (CSRA) report for the Bogue Banks Coastal Storm Damage Reduction Feasibility Report. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on the costs to implement the selected alternative. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion

REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both the first cost and the renourishments risks for all project features. The project schedule was examined and schedule risks for the initial construction are only considered as the schedule risks for the long term renourishments are primarily limited by the funding received and are beyond the team to influence. The schedule risk for the initial construction is generally minor and is converted to costs and added to the cost risk model. It is assumed that after the initial construction is complete that the project would receive the necessary funding to renourish the beach segments. The study and presentation can include or exclude consideration for operation and maintenance or life cycle costs, depending upon the program or decision document intended for funding.

Project Scope

Major Project Features studied from the civil works work breakdown structure (CWWBS) for this project includes:

01 – Lands & Damages

17 – Beach Replenishment

30 - Planning, Engineering & Design

31 - Construction Management

USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering MCX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted. The risk study utilizes the MCACES cost estimate amount for all features then applies the resultant percentage of risk/contingency to the project first and fully funded costs.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

METHODOLOGY/PROCESS

The initial CSRA meeting was held via teleconference on May 01 2013 for the purposes of identifying and assessing risk factors. Participants include the following PDT members:

Mike Jacobs, NWW – Cost DX

Pamela Castens, SAW – Project Mgt

John Caldwell, SAW – Cost Engineering

Jeffrey Lin, SAW - Planning

Christopher Graham, SAW - Economics

Eric Gasch, SAW - Environmental

Kevin Conner, SAW – Coastal Engineering

Belinda Eastbrook, SAS – Real Estate

Ben Lackey, SAW – Geotechnical Engineering

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project

leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering MCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

The initial formal meeting focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Discussions focused primarily on risk factor assessment and quantification.

Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.

- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

Risk discussions focused on the various project features as presented within the USACE Civil Works Work Breakdown Structure for cost accounting purposes. It was recognized that the various features carry differing degrees of risk as related to cost, schedule, design complexity, and design progress.

The resulting product from the PDT discussions is captured within a risk register as presented in Appendix A, for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering MCX guidance, only critical path and near critical path tasks are considered to be uncertain for the purposes of contingency analysis.

KEY CONSIDERATIONS AND ASSUMPTIONS

Key assumptions include the following:

- Adequate Borrow currently exists for the project in the three well defined borrow areas.
- Life Cycle costs have not been included in this cost estimate.
- Contract acquisition strategy will be full and open.

- The initial contract will be awarded earlier than other competing dredging contracts for the winter work window.

Risk Register

Risk is unforeseen or unknown factors that can affect a project's cost or schedule. Time and money have a direct relationship due to the time value of money. A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. The risk register describes risks in terms of cost and schedule. A summary risk register that includes typical risk events studied (high and moderate levels) is presented in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register is provided in Appendix A. The detailed risk registers of Appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing and communicating identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

A correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. Correlations were not identified in this analysis.

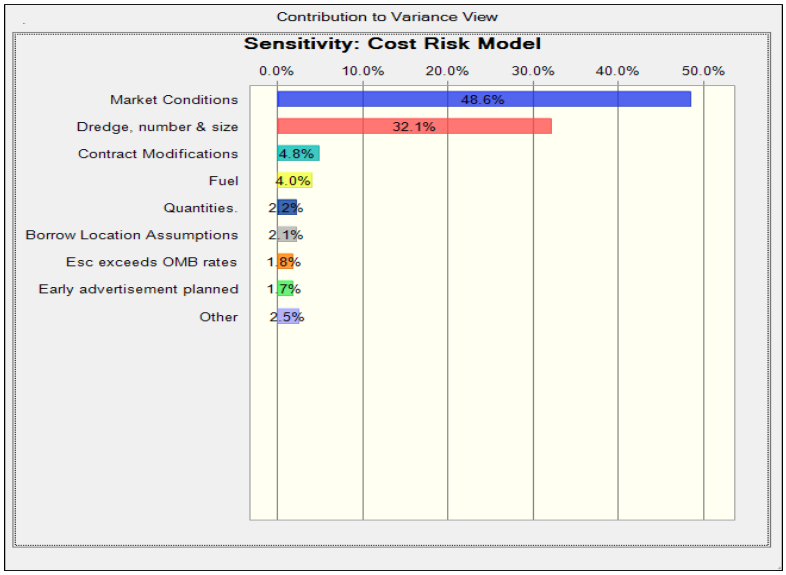
The risk register identifies thirty five different risks. There are twelve are either moderate or high risks. An abridged version of the risk register is presented below.

Table 2 - Risk Register (Short)

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule		
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)									
PROJECT & PROGRAM MGMT									
PPM-2	Congressional Funding - PED	Concern is that the PED Congressional funding is uncertain, post feasibility.	Need a chiefs report by Sept 13 by new program EC. Request for PED funding is not able to be go in until FY16 which could delay start of final design. Design would move to FY16-17. There is approximately a year of float in the schedule.	Likely	Negligible	LOW	Likely	Marginal	MODERATE
PPM-3	Congressional Funding Construction	Concern is that construction funding is incremental or delayed by not getting the initial project.	Relatively small overall dollar project most likely would get construction dollars.	Very Likely	Negligible	LOW	Very Likely	Marginal	MODERATE
PPM-8	Public Access Requirements	Sponsor must complete construction parking and facilities to support use of beach.	Sponsor must construct significant parking and associated facilities prior to construction project to set the conditions that benefits are received from the project. Failure to complete would stop or delay project. This is not part of the total project cost.	Unlikely	Crisis	HIGH	Unlikely	Crisis	HIGH
	RISKS								
CA-2	Early advertisement planned	Plan to award in July to get ahead of other districts.	optimizes timeline to get best dredge bidding competition and minimize.	likely	marginal	MODERATE	Unlikely	Negligible	LOW
	TECHNICAL RISKS								
T-2	Quantities.	change over time due to beach erosion during the PED phase and geotechnical overfill ratios-- additionally funding delays may increase quantities.	Overall quantities are based on average volumes. There could be variation over time over the models .	Likely	marginal	MODERATE	Likely	Marginal	MODERATE
	CONSTRUCTION RISKS								
CON-1	Contract Modifications	There may be modification issues that have not been captured in current risks.	quantities. This is considered elsewhere. Each contract will likely carry the intended quantities per contract, but is restricted by the work window. Competing work, loss of dredger, quantity assumption can cause modifications such as remobilizations and delays. Other modification potentials could	Unlikely	Marginal	LOW	Unlikely	Significant	MODERATE
CON-2	Pipeline Dredge	The estimate assumes a hopper dredge because of longer pipeline distances and depth to borrow.	Pipeline dredge not likely due to ratio of beach length.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
	RISKS								
EST-1	Dredge, number & size	Estimate choice can effect efficiency and productivity, causing a change to the estimate.	dredges but equipment is not restrictive w/in contract. The chosen estimate hopper size and number can affect the cost and productivity. Hopper dredges accommodate poor weather better than pipeline dredges. A large hopper results in greater efficiency as compared to two smaller hoppers, but less available and may be impacted by speed	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
EST-3	Fuel	Fuel fluctuations can impact dredging costs.	driver for equipment. Fuel has fluctuated drastically in the past 18 months. It is now back on the upswing. Study should be for time of funding date estimate.	Likely	Significant	HIGH	Unlikely	Marginal	LOW
EST-4	Two Dredge Productivity	The estimate assumes a certain productivity based on two medium sized dredge. Productivity may vary.	the size and productivity for two medium sized hopper dredges with a 2.3-5.5 mile haul mile haul. Those estimate assumptions establish the schedule. Productivity of two hopper dredges can vary due to various possibilities. And conditions. Productivity	Likely	Marginal	MODERATE	Likely	Negligible	LOW
EST-5	Borrow Location Assumptions	borrow areas will be used to support the beach locations.	Borrow areas well defined and have excess material so low risk.	Likely	Marginal	MODERATE	Likely	Negligible	LOW
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)							
EXT-1	Market Conditions	Market conditions and competing projects may impact bid competition.	when considering the number of dredges available. It is a tough bidding climate based on environmental time-line restrictions.	Likely	Significant	HIGH	Likely	Negligible	LOW
EXT-5	Esc exceeds OMB rates	Over longer periods of time, the actual market may be greater than the OMB rates, impacting contract costs.	Volatile fuel, being a larger risk on dredging projects, may not correlate with the OMB rates and may be higher as time passes.	Likely	Marginal	MODERATE	Unlikely	Negligible	LOW

Cost Risk Analysis - Cost Contingency Results

The project Cost Contingency at the 80% confidence level is 24%. This level was established by analyzing the different cost risk factors that affect the project. Cost contingencies can be either positive or negative. The cost sensitivity chart demonstrates relative cost contingency of individual risks for the initial construction. The chart for the renourishments is similar with long term variables such as escalation, fuel, and the borrow sources having slightly higher rankings. The sensitivity chart for the first cost is depicted below.



- Market Conditions

Discussion: Dredging is a highly competitive industry and there are limited windows when dredging can be performed in this area. The PDT has planned (and currently has adequate time in the project schedule) to advertise the project early in order to ensure the largest number of potential bidders. This represents an opportunity to reduce costs on the initial construction but may not be as likely to be recognized on the renourishments.

- Dredge number and size

Discussion: The choice of dredge size can affect efficiency and productivity, causing a difference between the government estimate and the bid price of the contract. The estimate assumed two medium-sized hopper dredges will be utilized, but the actual equipment is not restrictive within the proposed contract. A large hopper dredge could result in greater efficiency as compared to two smaller hoppers, but are less available and may be impacted by speed restrictions and may cause variations in the bid pricing.

- Contract Modifications/Claims:

Discussion- Contract modifications are always a risk in dredging the largest risk being the quantity assumptions and or borrow source competition/depletion over a long period of time.

Schedule Risk Analysis - Schedule Contingency Results

No specific schedule risk was derived from team's analysis. Schedule risks for the construction window were assessed for their impacts to cost and added to the cost contingency for both the first and the nourishment costs. The cost contingency analysis results are in the table below.

Table 3 - Contingency Analysis Results

Estimate of First Costs	$29,495,000		
Confidence Level	Value	Contingency	%
0%	$28,571,673	$ (1,179,800)	-4%
5%	$30,446,256	$ 1,179,800	4%
10%	$31,271,327	$ 2,064,650	7%
15%	$31,798,503	$ 2,359,600	8%
20%	$32,313,720	$ 2,949,500	10%
25%	$32,752,657	$ 3,539,400	12%
30%	$33,116,801	$ 3,834,350	13%
35%	$33,395,832	$ 4,129,300	14%
40%	$33,691,159	$ 4,424,250	15%
45%	$34,033,013	$ 4,719,200	16%
50%	$34,331,307	$ 5,014,150	17%
55%	$34,626,209	$ 5,309,100	18%
60%	$34,913,961	$ 5,604,050	19%
65%	$35,216,561	$ 5,899,000	20%
70%	$35,600,623	$ 6,193,950	21%
75%	$36,023,845	$ 6,783,850	23%
80%	$36,412,519	$ 7,078,800	24%
85%	$36,835,665	$ 7,373,750	25%
90%	$37,718,512	$ 8,258,600	28%
95%	$38,574,091	$ 9,143,450	31%
100%	$41,927,605	$ 12,682,850	43%

Estimate of Renourishment First Costs	$175,360,000		
Confidence Level	Value	Contingency	%
0%	$159,577,600	$ (15,782,400)	-9%
5%	$184,128,000	$ 8,768,000	5%
10%	$189,388,800	$ 14,028,800	8%
15%	$192,896,000	$ 17,536,000	10%
20%	$196,403,200	$ 21,043,200	12%
25%	$199,910,400	$ 24,550,400	14%
30%	$201,664,000	$ 26,304,000	15%
35%	$203,417,600	$ 28,057,600	16%
40%	$206,924,800	$ 31,564,800	18%
45%	$208,678,400	$ 33,318,400	19%
50%	$210,432,000	$ 35,072,000	20%
55%	$212,185,600	$ 36,825,600	21%
60%	$213,939,200	$ 38,579,200	22%
65%	$217,446,400	$ 42,086,400	24%
70%	$219,200,000	$ 43,840,000	25%
75%	$220,953,600	$ 45,593,600	26%
80%	$224,460,800	$ 49,100,800	28%
85%	$227,968,000	$ 52,608,000	30%
90%	$231,475,200	$ 56,115,200	32%
95%	$238,489,600	$ 63,129,600	36%
100%	$261,286,400	$ 85,926,400	49%

APPENDIX A
DETAILED RISK ANALYSIS RESULTS AND MODEL

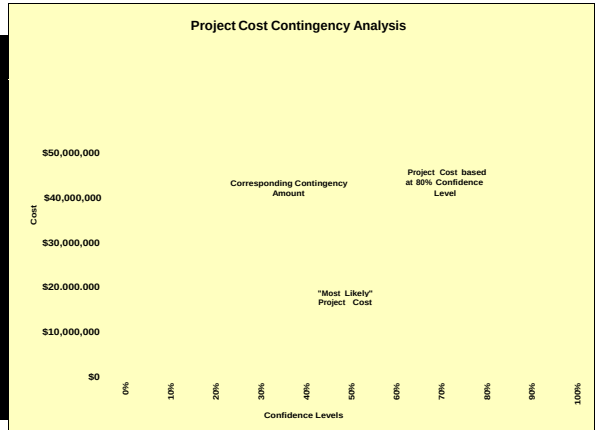
Contingency on Base Estimate	80% Confidence Project Cost
MCACES Estimate First Cost (Most Likely) ->	**$29,495,000**
Baseline Estimate Cost Contingency Amount ->	$7,078,800
Baseline Estimate First Costs (80% Confidence) ->	**$36,573,800**

Contingency on Renourishments	80% Confidence Project Cost
MCACES Renourishment Estimate First Cost (Most Likely) ->	**$175,360,000**
Renourishment Estimate Cost Contingency Amount ->	$49,100,800
Renourishment Estimate First Costs (80% Confidence) ->	**$224,460,800**

- PROJECT CONTINGENCY DEVELOPMENT -

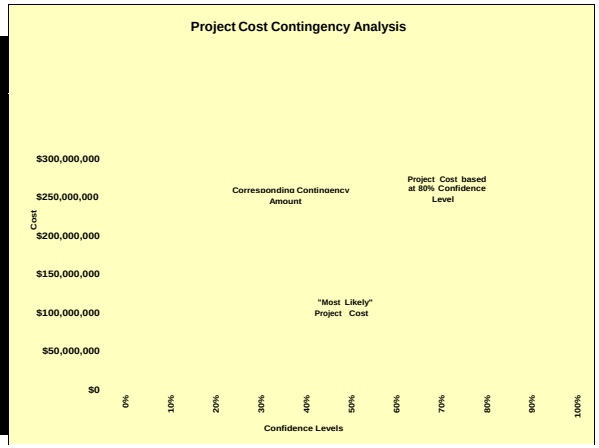
Contingency Analysis

MCACEs Estimate of First Costs	$29,495,000		
Confidence Level	Value	Contingency	%
0%	$28,571,673	$ (1,179,800)	-4%
5%	$30,446,256	$ 1,179,800	4%
10%	$31,271,327	$ 2,064,650	7%
15%	$31,798,503	$ 2,359,600	8%
20%	$32,313,720	$ 2,949,500	10%
25%	$32,752,657	$ 3,539,400	12%
30%	$33,116,801	$ 3,834,350	13%
35%	$33,395,832	$ 4,129,300	14%
40%	$33,691,159	$ 4,424,250	15%
45%	$34,033,013	$ 4,719,200	16%
50%	$34,331,307	$ 5,014,150	17%
55%	$34,626,209	$ 5,309,100	18%
60%	$34,913,961	$ 5,604,050	19%
65%	$35,216,561	$ 5,899,000	20%
70%	$35,600,623	$ 6,193,950	21%
75%	$36,023,845	$ 6,783,850	23%
80%	**$36,412,519**	**$ 7,078,800**	**24%**
85%	$36,835,665	$ 7,373,750	25%
90%	$37,718,512	$ 8,258,600	28%
95%	$38,574,091	$ 9,143,450	31%
100%	$41,927,605	$ 12,682,850	43%

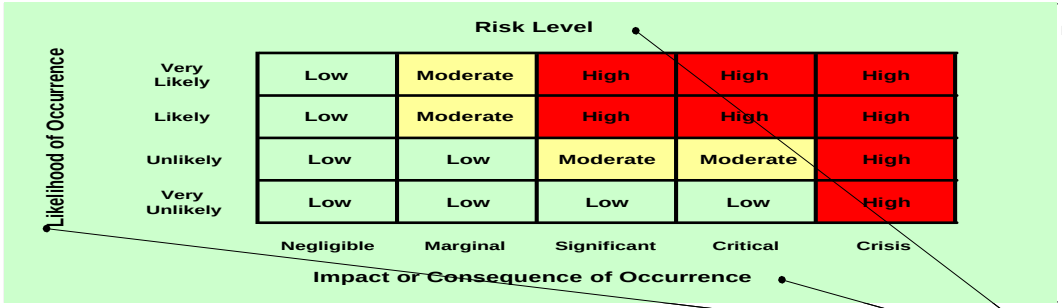


Contingency Analysis

MCACES Estimate of Renourishment First Costs	$175,360,000		
Confidence Level	Value	Contingency	%
0%	$159,577,600	$ (15,782,400)	-9%
5%	$184,128,000	$ 8,768,000	5%
10%	$189,388,800	$ 14,028,800	8%
15%	$192,896,000	$ 17,536,000	10%
20%	$196,403,200	$ 21,043,200	12%
25%	$199,910,400	$ 24,550,400	14%
30%	$201,664,000	$ 26,304,000	15%
35%	$203,417,600	$ 28,057,600	16%
40%	$206,924,800	$ 31,564,800	18%
45%	$208,678,400	$ 33,318,400	19%
50%	$210,432,000	$ 35,072,000	20%
55%	$212,185,600	$ 36,825,600	21%
60%	$213,939,200	$ 38,579,200	22%
65%	$217,446,400	$ 42,086,400	24%
70%	$219,200,000	$ 43,840,000	25%
75%	$220,953,600	$ 45,593,600	26%
80%	**$224,460,800**	**$ 49,100,800**	**28%**
85%	$227,968,000	$ 52,608,000	30%
90%	$231,475,200	$ 56,115,200	32%
95%	$238,489,600	$ 63,129,600	36%
100%	$261,286,400	$ 85,926,400	49%



Bogue Banks Feasability Study 2013 CSRA



Project Scope Narrative:

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule			Responsibility/PDC	Affected Project Component
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*		
	Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)										
PROJECT & PROGRAM MGMT											
PPM-1	Congressional Funding - Feasibility	Adequate Congressional funding to complete the feasibility study.	Funding is in place to complete feasibility study.	Very Unlikely	Marginal	LOW	Very Unlikely	Marginal	LOW		Project Cost & Schedule
PPM-2	Congressional Funding - PED	Concern is that the PED Congressional funding is uncertain, post feasibility.	PED funding is not able to be go in until FY16 which could delay start of final design. Design would move to FY16-17. There is approximately a year of float in the schedule.	Likely	Negligible	LOW	Likely	Marginal	MODERATE		Project Cost & Schedule
PPM-3	Congressional Funding Construction	Concern is that construction funding is incremental or delayed by not getting the initial project.	Relatively small overall dollar project most likely would get construction dollars.	Very Likely	Negligible	LOW	Very Likely	Marginal	MODERATE		Project Cost & Schedule
PPM-4	Stakeholder funding capability	Sponsor has large tax base and is likely to be able to meet requirements.	Sponsors must fund portion of 50% feasibility, 25% PED and 35% initial construction plus 100% real estate acquisition. Sponsors feel confident that their budget shares are not a critical constraint and that the Federal shares and funding are a greater concern.	Very Unlikely	Negligible	LOW	Very Unlikely	Marginal	LOW		Project Cost & Schedule
PPM-5	Adequate PDT Resources	Stable long term PDT.	The District feels that there is adequate District support and team development for future efforts.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
PPM-6	Sponsor Support	Sponsor support and agreement with the project plan.	Sponsor coordination and support is healthy, alleviated with monthly meetings that include PDT and sponsors. c. The PED is confident of the schedule for PED and construction	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
PPM-7	Schedule quality	Concern whether current schedule is realistic, optimistic.	durations. The construction durations reflect a conservative estimate approach and establish the construction schedule. Extra 30 days in initially	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
PPM-8	Public Access Requirements	Sponsor must complete construction parking and facilities to support use of beach.	Sponsor must construct significant parking and associated facilities prior to construction project to set the conditions that benefits are received from the project. Failure to complete would stop or delay project. This is not part of the total project cost.	Unlikely	Crisis	HIGH	Unlikely	Crisis	HIGH		Project Cost & Schedule
	CONTRACT ACQUISITION RISKS										
CA-1	Contract Acquisition Strategy	The acquisition strategy could impact the construction cost and schedule.	Work type is not complicated. It is likely that it will be a FFP large business, based on historical and small business does not have capability. The contract packages will consider the estimate schedule projections related to productivity.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
CA-2	Early advertisement planned	Plan to award in July to get ahead of other districts.	Plan is to award in July for Dec start which optimizes timeline to get best dredge bidding competition and minimize.	likely	marginal	MODERATE	Unlikely	Negligible	LOW		Project Cost & Schedule
	TECHNICAL RISKS										
T-1	Soil Quality	Limited borings done on borrow sources. However there is a pretty good data set from previous projects.	There may be pockets of material that are not suitable but overall we have enough material to complete the project. More data will be obtained in PED phase but generally thought to be a low risk.	Unlikely	Marginal	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
T-2	Quantities.	Scope definition is excellent, but quantities can change over time due to beach erosion during the PED phase and geotechnical overfill ratios--additionally funding delays may increase quantities.	Overall quantities are based on average volumes. There could be variation over time over the models	Likely	marginal	MODERATE	Likely	Marginal	MODERATE		Project Cost & Schedule
T-4	Hard Bottom Encounter	Hard bottoms may be uncovered later in out years .	Sand bottom may be covering hard bottoms, leaving a risk in the borrow quantity available at each site. It could damage the hopper dredge. Risk is increased in the out years, because in the near term the dredge can simply relocate. Better clarification should occur during PED phase with better surveys.	Very Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
T-5	Work window	Work window is in winter when storms can occur.	Seasonal weather patterns utilized for window. South facing beaches are generally less impacted by weather. Average productivities from historical data are used.	Likely	Negligible	LOW	Likely	Negligible	LOW		Project Cost & Schedule
	LANDS AND DAMAGES RISKS										
RE-1	Acquire real estate	Concern that RE cannot acquire real estate timely to support the construction contracts.	Historically, a good track record and relocations are minor.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
RE-2	Real Estate Estimate	Real Estate estimate may cause cost impact.	Historical information is good. The estimate currently includes a 25% contingency. This should be re-evaluated within the risk analysis outcome.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
	RISKS										
ENV-1	UXO	Area is near Camp Lejune ranges west of project.	Area surveyed. Mitigation will be required if encountered.	Very Unlikely	Negligible	LOW	Unlikely	Negligible	LOW		Project Cost & Schedule
ENV-2	Critical Habitat Designation Sea Turtle Site Take	Designation of area as critical habitat could change work window.	Area could be designated as a "critical habitat" and have more restrictions on work window, sand quality, etc.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule

ENV-3	SAD Turtle Incidental Take	Other projects encountering sea turtles	Other SAD impacts or "takes" can impact this project. Time frame shut down could occur (standby time based in days). Takes in this area could shut down project. About a 1 in 15 year experience.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
ENV-4	Bird Nesting	Bird nesting impacts construction.	Winter work window is also based on bird nesting concerns. Risk is minimized, but such an encounter may shut down work activity for a period of time.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
ENV-5	Wright Whale Restrictions	Encounter potential impacts dredge fleet speed.	10 knot speed restriction if you encounter whales. Larger hopper dredges have a higher speed that could be impacted. Feds may not require this restriction on a federal project and the current estimate assumes smaller dredges with slower speed capability. Feds also monitor whale movement. Estimate must accommodate speed restrictions, affecting the productivity. The estimate is developed to accommodate the speed restrictions.	Likely	Negligible	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
ENV-6	Environmental Monitoring	Environmental monitoring required during dredging.	impacts are found. Environmental group will have a separate monitoring contract. The monitoring costs have been considered within PED.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
ENV-7	Dune Revalidation	Dune Revegetation required	Estimate includes first vegetation. Dune Revegetation may be required on renourishments but is not included..	Likely	Negligible	LOW	Likely	Negligible	LOW		Project Cost & Schedule
ENV-8	Archeological	Concern that there may be uncovered archeological finds during the underwater excavations.	Borrow areas have been well established with adequate investigation to determine this is not a concern. If anything was discovered, another available nearby borrow source, already identified and studied, would be the next source.	Very Unlikely	Marginal	LOW	Very Unlikely	Marginal	LOW		Project Cost & Schedule
	CONSTRUCTION RISKS										
CON-1	Contract Modifications	There may be modification issues that have not been captured in current risks.	considered elsewhere. Each contract will likely carry the intended quantities per contract, but is restricted by the work window. Competing work, loss of dredger, quantity assumption can cause modifications such as remobilizations and delays. Other modification potentials could include borrow source remobilization resulting from environmental impacts.	Unlikely	Marginal	LOW	Unlikely	Significant	MODERATE		Project Cost & Schedule
CON-2	Pipeline Dredge	The estimate assumes a hopper dredge because of longer pipeline distances and depth to borrow.	Pipeline dredge not likely due to ratio of beach length.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Dredge, number & size	Estimate choice can effect efficiency and productivity, causing a change to the estimate.	Estimate assumed two medium-sized hopper dredges but equipment is not restrictive w/in contract. The chosen estimate hopper size and number can affect the cost and productivity. Hopper dredges accommodate poor weather better than pipeline dredges. A large hopper results in greater efficiency as compared to two smaller hoppers, but less available and may be impacted by speed restrictions. productivity is generally conservative at 77%.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE		Project Cost & Schedule
EST-3	Fuel	Fuel fluctuations can impact dredging costs.	Fuel has fluctuated drastically in the past 18 months. It is now back on the upswing. Study should be for time of funding date estimate.	Likely	Significant	HIGH	Unlikely	Marginal	LOW		Project Cost & Schedule
EST-4	Two Dredge Productivity	The estimate assumes a certain productivity based on two medium sized dredge. Productivity may vary.	The current estimate makes assumptions in the size and productivity for two medium sized hopper dredges with a 2.3-5.5 mile haul mile haul. Those estimate assumptions establish the schedule. Productivity of two hopper dredges can vary due to various possibilities. And conditions. Productivity could be 70-85%.	Likely	Marginal	MODERATE	Likely	Negligible	LOW		Project Cost & Schedule
EST-5	Borrow Location Assumptions	The estimate makes assumptions as to which borrow areas will be used to support the beach locations.	Borrow areas well defined and have excess material so low risk.	Likely	Marginal	MODERATE	Likely	Negligible	LOW		Project Cost & Schedule
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)									
EXT-1	Market Conditions	Market conditions and competing projects may impact bid competition.	Currently, there are a lot of projects planned when considering the number of dredges available. It is a tough bidding climate based on environmental time-line restrictions.	Likely	Significant	HIGH	Likely	Negligible	LOW		Project Cost & Schedule
EXT-2	External Opposition	External opposition may cause scope or schedule change.	Feds adhering to the environmental requirements. Sponsors in favor of project. No serious historical intervention because it is a beach renourishment project.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
EXT-3	Acts of God	Severe weather may impact cost or schedule.	Nor easter storms or hurricanes could impact construction as well as beach profile. Construction occurs in low period of weather risks; however, storms are still a potential. As long as the estimate and schedules assume some inefficiency, it should not be a serious issue. For wind construction this is unlikely. Long term competition is	Likely	Negligible	LOW	Likely	Negligible	LOW		Project Cost & Schedule
EXT-4	Borrow Competition	External entities may compete for the borrow sources.	unknown. The long term competition does not impact initial appropriation needs and feasibility funding request. Future projects must consider this potential as it occurs in future contracts.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW		Project Cost & Schedule
EXT-5	Esc exceeds OMB rates	Over longer periods of time, the actual market may be greater than the OMB rates, impacting contract costs.	Volatile fuel, being a larger risk on dredging projects, may not correlate with the OMB rates and may be higher as time passes.	Likely	Marginal	MODERATE	Unlikely	Negligible	LOW		Project Cost & Schedule

*Likelihood, Impact, and Risk Level to be verified through market research and analysis (conducted by cost engineer).

1. Risk/Opportunity identified with reference to the Risk Identification Checklist and through deliberation and study of the PDT.
2. Discussions and Concerns elaborates on Risk/Opportunity Events and includes any assumptions or findings (should contain information pertinent to eventual study and analysis of event's impact to project).
3. Likelihood is a measure of the probability of the event occurring -- **Very Unlikely**, **Unlikely**, **Moderately Likely**, **Likely**, **Very Likely.** The likelihood of the event will be the same for both Cost and Schedule, regardless of impact.
4. Impact is a measure of the event's effect on project objectives with relation to scope, cost, and/or schedule -- **Negligible**, **Marginal**, **Significant**, **Critical**, or **Crisis.** Impacts on Project Cost may vary in severity from impacts on Project Schedule.
5. Risk Level is the resultant of Likelihood and Impact **Low**, **Moderate**, or **High**. Refer to the matrix located at top of page.
6. Variance Distribution refers to the behavior of the individual risk item with respect to its potential effects on Project Cost and Schedule. For example, an item with clearly defined parameters and a solid most likely scenario would probably follow a triangular or normal distribution. A risk item for which the PDT has little data or probability of modeling with respect to effects on cost or schedule (i.e. "anyone's guess") would probably follow a uniform or discrete uniform distribution.
7. The responsibility or POC is the entity responsible as the Subject Matter Expert (SME) for action, monitoring, or information on the PDT for the identified risk or opportunity.
8. Correlation recognizes those risk events that may be related to one another. Care should be given to ensure the risks are handled correctly without a "double counting."
9. Affected Project Component identifies the specific item of the project to which the risk directly or strongly correlates.
10. Project Implications identifies whether or not the risk item affects project cost, project schedule, or both. The PDT is responsible for conducting studies for both Project Cost and for Project Schedule.
11. Results of the risk identification process are studied and further developed by the Cost Engineer, then analyzed through the Monte Carlo Analysis Method for Cost (Contingency) and Schedule (Escalation) Growth.

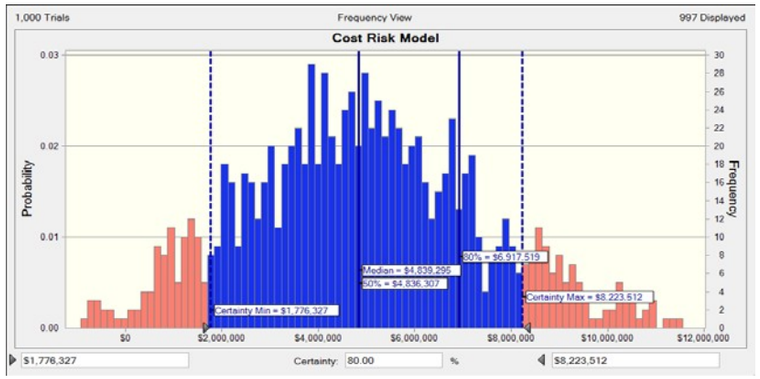
Bogue Banks 2013 CSRA First Cost of Construction

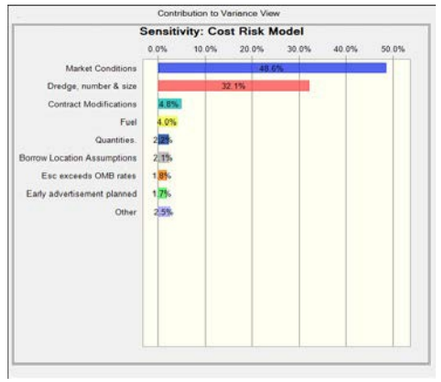
Risk No.	Risk/Opportunity Event	Project Cost: Likelihood*	Project Cost: Impact*	Project Cost: Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Crystal Ball Simulation: Expected Values ($$$): Low	Most Likely	High	Contingency Model	Notes
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)												
	PROJECT & PROGRAM MGMT											
PPM-2	Congressional Funding - PED	Likely	Negligible	LOW	Custom			$ -	$ -	$88,695	0	
PPM-3	Congressional Funding Construction	Very Likely	Negligible	LOW	Custom			$ -	$ -	$295,100	0	
	CONTRACT ACQUISITION RISKS											
CA-2	Early advertisement planned	likely	marginal	MODERATE	Triangular			$ (1,203,400)	$ -	$0	0	
	TECHNICAL RISKS											
T-2	Quantities.	Likely	marginal	MODERATE	Uniform			$ (1,203,400)	$ -	$3,610,200	0	
	LANDS AND DAMAGES RISKS											
	REGULATORY AND ENVIRONMENTAL RISKS											
	CONSTRUCTION RISKS											
CON-1	Contract Modifications	Unlikely	Marginal	LOW	Triangular			$ -	$ -	$1,684,760	0	
	ESTIMATE AND SCHEDULE RISKS											
EST-1	Dredge, number & size	Likely	Marginal	MODERATE	BetaP			($1,112,746)	$ -	$3,338,237	0	
EST-3	Fuel	Likely	Significant	HIGH	BetaP			$0	$ -	$2,000,000	0	
EST-5	Borrow Location Assumptions	Likely	Marginal	MODERATE	Triangular			$0	$ -	$1,390,932	0	
	ECONOMICS RISKS											
	Programmatic Risks											
EXT-1	Market Conditions	Likely	Significant	HIGH	Triangular			($1,390,932)	$ -	$4,172,796	0	
EXT-5	Esc exceeds OMB rates	Likely	Marginal	MODERATE	Uniform			$ -	$ -	$1,179,800	0	
											$ -	

Sum Values to Here

USE ROUNDED DATA FOR REPORT

PROJECT CONTINGENCY	Percentile	MCACES First Costs	Contingency	Baseline w/ Contingency	Contingency %	Rounded %	Rounded $
	0%	$29,495,000	($923,327)	$28,571,673	-3.13%	-4%	$ (1,179,800)
	5%	$29,495,000	$951,256	$30,446,256	3.23%	4%	$ 1,179,800
	10%	$29,495,000	$1,776,327	$31,271,327	6.02%	7%	$ 2,064,650
	15%	$29,495,000	$2,303,503	$31,798,503	7.81%	8%	$ 2,359,600
	20%	$29,495,000	$2,818,720	$32,313,720	9.56%	10%	$ 2,949,500
	25%	$29,495,000	$3,257,657	$32,752,657	11.04%	12%	$ 3,539,400
	30%	$29,495,000	$3,621,801	$33,116,801	12.28%	13%	$ 3,834,350
	35%	$29,495,000	$3,900,832	$33,395,832	13.23%	14%	$ 4,129,300
	40%	$29,495,000	$4,196,159	$33,691,159	14.23%	15%	$ 4,424,250
	45%	$29,495,000	$4,538,013	$34,033,013	15.39%	16%	$ 4,719,200
	50%	$29,495,000	$4,836,307	$34,331,307	16.40%	17%	$ 5,014,150
	55%	$29,495,000	$5,131,209	$34,626,209	17.40%	18%	$ 5,309,100
	60%	$29,495,000	$5,418,961	$34,913,961	18.37%	19%	$ 5,604,050
	65%	$29,495,000	$5,721,361	$35,216,361	19.40%	20%	$ 5,899,000
	70%	$29,495,000	$6,105,623	$35,600,623	20.70%	21%	$ 6,193,950
	75%	$29,495,000	$6,528,845	$36,023,845	22.14%	23%	$ 6,783,850
	80%	$29,495,000	$6,917,519	$36,412,519	23.45%	24%	$ 7,078,800
	85%	$29,495,000	$7,340,665	$36,835,665	24.89%	25%	$ 7,373,750
	90%	$29,495,000	$8,223,512	$37,718,512	27.88%	28%	$ 8,258,600
	95%	$29,495,000	$9,079,091	$38,574,091	30.78%	31%	$ 9,143,450
	100%	$29,495,000	$12,432,605	$41,927,605	42.15%	43%	$ 12,682,850





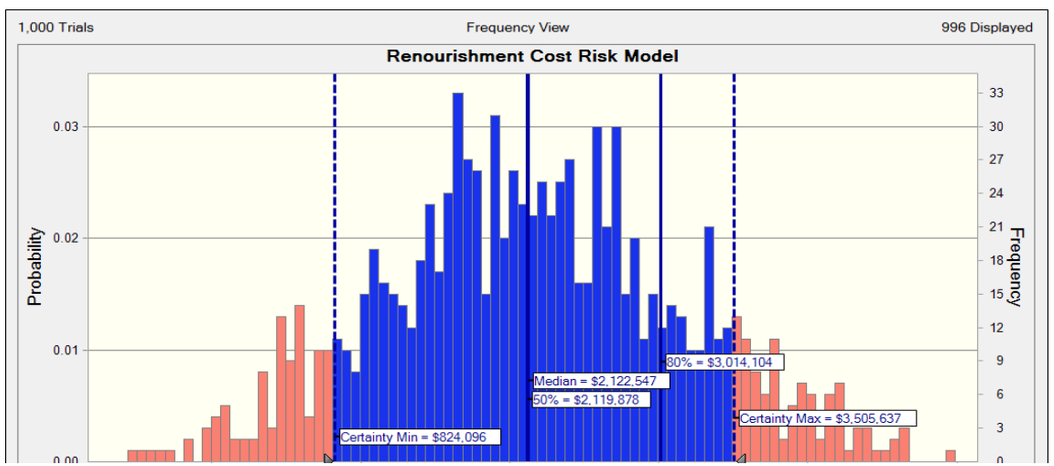
Bogue Banks CSRA - Renourishments

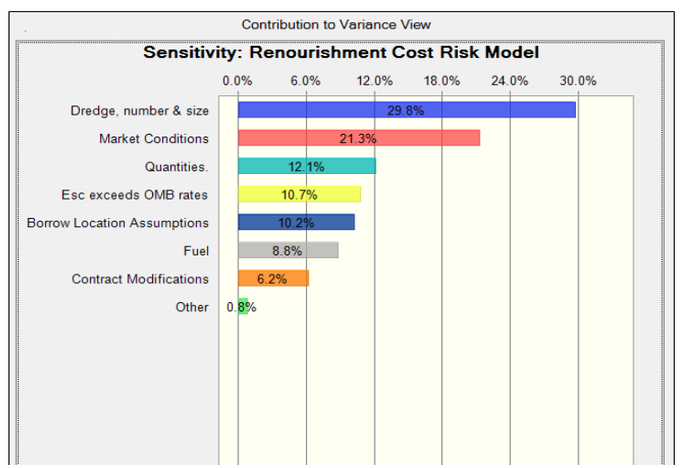
Risk No.	Risk/Opportunity Event	Project Cost: Likelihood*	Project Cost: Impact*	Project Cost: Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Crystal Ball Simulation: Expected Values ($$$): Low	Expected Values ($$$): Most Likely	Expected Values ($$$): High	Contingency Model	Notes
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)												
	PROJECT & PROGRAM MGMT											
	CONTRACT ACQUISITION RISKS											
	TECHNICAL RISKS											
T-2	Quantities.	Likely	marginal	MODERATE	Uniform			$ (524,691)	$ -	$1,574,072	0	
	LANDS AND DAMAGES RISKS											
	REGULATORY AND ENVIRONMENTAL RISKS											
	CONSTRUCTION RISKS											
CON-1	Contract Modifications	Unlikely	Marginal	LOW	Triangular			$ -	$ -	$734,567	0	
	ESTIMATE AND SCHEDULE RISKS											
EST-1	Dredge, number & size	Likely	Marginal	MODERATE	Uniform			($485,165)	$ -	$1,455,494	0	
EST-3	Fuel	Likely	Significant	HIGH	Beta			$0	$ -	$872,014	0	
EST-5	Borrow Location Assumptions	Likely	Marginal	MODERATE	Beta			$0	$ -	$1,212,912	0	
	ECONOMICS RISKS											
	Programmatic Risks											
EXT-1	Market Conditions	Likely	Significant	HIGH	Triangular			($606,456)	$ -	$1,819,368	0	
EXT-5	Esc exceeds OMB rates	Likely	Marginal	MODERATE	Uniform			$ -	$ -	$1,028,802	0	
											$ -	

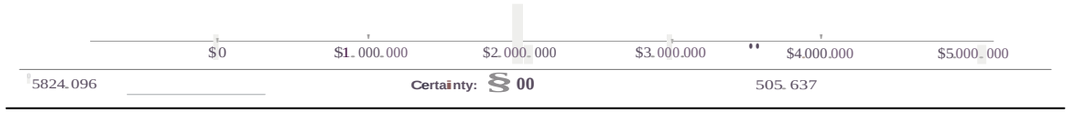
Sum Values to Here

USE ROUNDED DATA FOR REPORT

PROJECT CONTINGENCY	Percentile	MCACES ESTIMATE of One nourishment cost	Contingency	Baseline w/ Contingency	Contingency %	Rounded %	Rounded $
	0%	$10,960,000	($938,487)	$10,021,513	-8.56%	-9%	$ (986,400)
	5%	$10,960,000	$498,076	$11,458,076	4.54%	5%	$ 548,000
	10%	$10,960,000	$824,096	$11,784,096	7.52%	8%	$ 876,800
	15%	$10,960,000	$1,084,728	$12,044,728	9.90%	10%	$ 1,096,000
	20%	$10,960,000	$1,275,532	$12,235,532	11.64%	12%	$ 1,315,200
	25%	$10,960,000	$1,470,333	$12,430,333	13.42%	14%	$ 1,534,400
	30%	$10,960,000	$1,624,645	$12,584,645	14.82%	15%	$ 1,644,000
	35%	$10,960,000	$1,723,431	$12,683,431	15.72%	16%	$ 1,753,600
	40%	$10,960,000	$1,869,987	$12,829,987	17.06%	18%	$ 1,972,800
	45%	$10,960,000	$1,993,128	$12,953,128	18.19%	19%	$ 2,082,400
	50%	$10,960,000	$2,119,878	$13,079,878	19.34%	20%	$ 2,192,000
	55%	$10,960,000	$2,250,800	$13,210,800	20.54%	21%	$ 2,301,600
	60%	$10,960,000	$2,385,306	$13,345,306	21.76%	22%	$ 2,411,200
	65%	$10,960,000	$2,543,521	$13,503,521	23.21%	24%	$ 2,630,400
	70%	$10,960,000	$2,661,520	$13,621,520	24.28%	25%	$ 2,740,000
	75%	$10,960,000	$2,807,572	$13,767,572	25.62%	26%	$ 2,849,600
	80%	$10,960,000	$3,014,104	$13,974,104	27.50%	28%	$ 3,068,800
	85%	$10,960,000	$3,279,229	$14,239,229	29.92%	30%	$ 3,288,000
	90%	$10,960,000	$3,505,637	$14,465,637	31.99%	32%	$ 3,507,200
	95%	$10,960,000	$3,901,877	$14,861,877	35.60%	36%	$ 3,945,600
	100%	$10,960,000	$5,262,897	$16,222,897	48.02%	49%	$ 5,370,400



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Bogue Banks Feasability Study 2013 CSRA

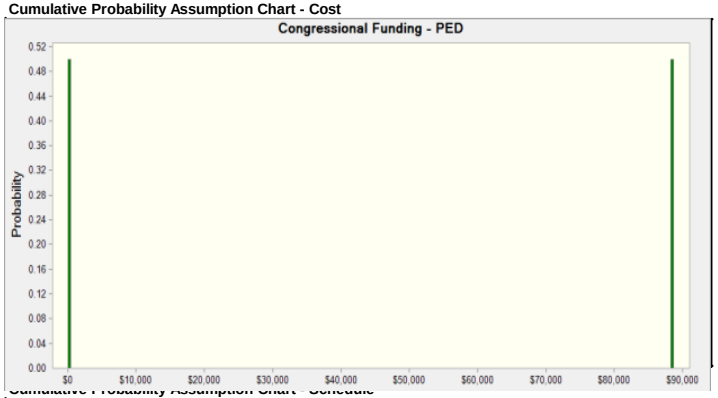
Co:	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
	PPM-2	Congressional Funding - PED	Likely	Negligible	LOW	Custom			$0	$0	$88,695	

Sche:	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
	PPM-2	Congressional Funding - PED	Likely	Marginal	MODERATE	#N/A	#N/A	#N/A	0.0 Months	0.0 Months	0.0 Months	

Description	Concern is that the PED Congressional funding is uncertain, post feasibility. Need a chiefs report by Sept 13 by new program EC. Request for PED funding is not able to be go in until FY16 which could delay start of final design. Design would move to FY16-17. There is approximately a year of float in the schedule.
Development of Low Values	The best case scenario is that the project proceeds on schedule and there is no change to the construction schedule.
Development of High Values	The worst case scenario is that the PED Phase costs would increase approximately 5% or 90k. There is 1 year of float in the PED phase schedule so this would not effect the construction schedule but would change when the PED funds are expended. Not applicable to O&M portion.

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	$0	#N/A
10%	$0	#N/A
20%	$0	#N/A
30%	$0	#N/A
40%	$0	#N/A
50%	$0	#N/A
60%	$88,695	#N/A
70%	$88,695	#N/A
80%	$88,695	#N/A
90%	$88,695	#N/A
100%	$88,695	#N/A

Cumulative Probability Assumption Chart - Cost



Cumulative Probability Assumption Chart - Schedule

Bogue Banks Feasability Study 2013 CSRA

Co

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
PPM-8	Public Access Requirements	Unlikely	Crisis	HIGH	#N/A	#N/A	#N/A		$0		

Sche

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
PPM-8	Public Access Requirements	Unlikely	Crisis	HIGH	#N/A	#N/A	#N/A		0.0 Months		

Description	Sponsor must complete construction parking and facilities to support use of beach. Sponsor must construct significant parking and associated facilities prior to construction project to set the conditions that benefits are received from the project. Failure to complete would stop or delay project. This is not part of the total project cost.
Development of Low Values	This is not modeled as it would stop the project. It is on the risk register as a watch list item only
Development of High Values	

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	#N/A	#N/A
10%	#N/A	#N/A
20%	#N/A	#N/A
30%	#N/A	#N/A
40%	#N/A	#N/A
50%	#N/A	#N/A
60%	#N/A	#N/A
70%	#N/A	#N/A
80%	#N/A	#N/A
90%	#N/A	#N/A
100%	#N/A	#N/A

Cumulative Probability Assumption Chart - Cost

Cumulative Probability Assumption Chart - Schedule

17 ACCT BEACH NOURISHMT																																				
		oct 11	2014	2014	2014	2014	2014	2014	2015	2015	2015	2016	2016	2017	2017	2017	2017	2017	2018	2018	2019	2019	2019	2019	2019	2019	2019	2019	2020	2020	2020	2020	2020	2020	2020	2020
			FEB		APR	OCT		DEC		SEPT	OCT		DEC		FEB		APR		OCT		JUNE		AUG	SEPT	OCT		DEC		FEB		APR		JUNE		AUG	SEPT
			0			15	0				16	0			0			0	19	0	0															
					0	0			0		0			0			0		0				0													
PRINTS BEST USING ANSI E - 33" X 44"																																				
CHIEF'S REPORT		**OCTOBER 2014**				CHIEFS						AUTHORIZATION				OCT 2017 GET CONSTRUCTION FUNDS																						
						REPORT																																
PPA		**DECEMBER 2017**														DEC 2017 SIGN PPA																					
	OCT 13																																			
REAL ESTATE	**$3,516,750**	$4,360,770.00															REAL ESTATE		JAN 2018 REAL ESTATE ACQUISITION (26 mos)																		
		MidPoint APRIL 2018															1		19		26																
	w/24% contingency																HIDDEN MONTHS																				
	$4,360,770																																			
INITIAL CONST	**$1,600,000**	PED																				x														
	OCT 13	MidPoint JULY 2019									**PED INITIAL INVESTIGATIONS**										**FINAL PLANS-SPECS**															
	w/24% contingency																									**Advertise-Bid Open-Award-NTP**										
	$1,984,000																																			
																													2 HOPPERS 1 SEASON							
CONTRACT 1 of 1																																				
BOGUE BANKS	**$24,068,000**	**CONSTRUCTION**																									Contract 1 -									
	OCT 13	**MidPoint FEB 2020**																									MOB and Demob = $1,600,000									
	w/24% contingency																										2,451,200 CY * $ 7.50/CY = $18,384,000									
	$29,844,320																												0							
INITIAL NOURISHMENT																										**mob**	**CONTRACT 1**		**x**		**dmob**				$19,984,000
	$310,000	**S&A**																											TILLING								$84,000
	OCT 13	**MidPoint FEB 2020**																											**DUNE VEGETATIO**		**x**						$3,825,000
	w/24% contingency																																			
	$384,400																												**WALKOVER STRU**		**x**						$175,000
$25,978,000																																				**$24,068,000**
																											CONST MGT AND MONITOR		**x**						**$310,000**

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 113670

SAW – Bogue Banks Feasibility Study

The Bogue Banks Feasibility Study, 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 March 20, 2014, the Cost MCX certifies the estimated total project cost of:

Initial Construction:
FY 2015 Price Level: $37,327,000
Fully Funded Amount: $41,343,000

Periodic Replenishments (2023-2068 16 Total)
FY 2015 Price Level: $229,450,000
Fully Funded Amount: $564,923,000

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.

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
PROJECT NO: P2 - 113670
LOCATION: CARTERET COUNTY, NORTH CAROLINA

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/6/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: 1-Oct-13 ($K) *K*	*L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
17	BEACH REPLENISHMENT	$24,068	$5,776	24%	$29,844	1.9%	$24,537	$5,889	$30,426	$0		$27,088	$6,501	$33,589
	INITIAL NOURISHMENT													
	CONSTRUCTION ESTIMATE TOTALS:	$24,068	$5,776		$29,844	1.9%	$24,537	$5,889	$30,426	$0		$27,088	$6,501	$33,589
01	LANDS AND DAMAGES	$3,517	$844	24%	$4,361	2.0%	$3,586	$861	$4,446	$0		$3,830	$919	$4,749
30	PLANNING, ENGINEERING & DESIGN	$1,600	$384	24%	$1,984	3.7%	$1,659	$398	$2,057	$0		$2,023	$486	$2,509
31	CONSTRUCTION MANAGEMENT	$310	$74	24%	$384	3.7%	$321	$77	$398	$0		$400	$96	$496
	PROJECT COST TOTALS:	$29,495	$7,079	24%	$36,574		$30,103	$7,225	**$37,327**	$0		$33,341	$8,002	$41,343

_____ CHIEF, COST ENGINEERING, Lee Danley, PE

_____ PROJECT MANAGER, Pam Castens

_____ CHIEF, REAL ESTATE, Ralph Werthmann SAS

_____ CHIEF, PLANNING, Elden Gatwood

_____ CHIEF, ENGINEERING, Greg Williams, PE

_____ CHIEF, OPERATIONS, Bob Sattin, PE

_____ CHIEF, CONSTRUCTION, Dennis Lynch, PE

_____ CHIEF, CONTRACTING, Jon Mayo

_____ CHIEF, PM-PB, Sam Colella

_____ CHIEF, DPM, Christine Brayman

ESTIMATED FEDERAL COST:	**65%**	**$26,873**
ESTIMATED NON-FEDERAL COST:	**35%**	**$14,470**
INITIAL NOURISHMENT ESTIMATED TOTAL PROJECT COST:		**$41,343**
Periodic Nourishments for 50-year project		**$564,923**
ESTIMATED FEDERAL COST - Periodics Nourishments :	**50%**	**$282,462**
ESTIMATED NON-FEDERAL COST - Periodic Nourishments :	**50%**	**$282,462**
ESTIMATED TOTAL PERIODIC PROJECT COST:		**$564,923**

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
LOCATION: CARTERET COUNTY, NORTH CAROLINA
This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/6/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
				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*
	INITIAL NOURISHMENT													
17	BEACH REPLENISHMENT	$24,068	$5,776	24%	$29,844	1.9%	$24,537	$5,889	$30,426	2020Q2	10.4%	$27,088	$6,501	$33,589
	CONSTRUCTION ESTIMATE TOTALS:	$24,068	$5,776	24%	**$29,844**		$24,537	$5,889	$30,426			$27,088	$6,501	$33,589
01	LANDS AND DAMAGES	$3,517	$844	24%	$4,361	2.0%	$3,586	$861	$4,446	2018Q3	6.8%	$3,830	$919	$4,749
30	PLANNING, ENGINEERING & DESIGN PED	$1,600	$384	24%	$1,984	3.7%	$1,659	$398	$2,057	2019Q4	22.0%	$2,023	$486	$2,509
31	CONSTRUCTION MANAGEMENT Construction Management	$310	$74	24%	$384	3.7%	$321	$77	$398	2020Q2	24.6%	$400	$96	$496
	CONTRACT COST TOTALS:	$29,495	$7,079		**$36,574**		$30,103	$7,225	$37,327			$33,341	$8,002	**$41,343**

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
PROJECT NO: P2 - 113670
LOCATION: CARTERET COUNTY, NORTH CAROLINA

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/20/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			5 FEB 14	Program Year (Budget EC):			2015					
		Effective Price Level:			1 OCT 13	Effective Price Level Date:			1 OCT 14					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: 1-Oct-13 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
17	BEACH REPLENISHMENT													
	Periodic Nourishments - 16 years													
	CONSTRUCTION ESTIMATE TOTALS:	$147,360	$41,261		$188,621	1.9%	$150,233	$42,065	$192,299	$0		$277,182	$77,611	$354,794
01	LANDS AND DAMAGES	$0	$0	-	$0	-	$0	$0	$0	$0		$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN	$16,000	$4,480	28%	$20,480	3.7%	$16,585	$4,644	$21,229	$0		$93,286	$26,120	$119,406
31	CONSTRUCTION MANAGEMENT	$12,000	$3,360	28%	$15,360	3.7%	$12,439	$3,483	$15,922	$0		$70,878	$19,846	$90,724
	PROJECT COST TOTALS:	$175,360	$49,101	28%	$224,461		$179,258	$50,192	**$229,450**	$0		$441,346	$123,577	$564,923

	CHIEF, COST ENGINEERING, Lee Danley, PE		
		ESTIMATED FEDERAL COST:	**50% $282,462**
	PROJECT MANAGER, Pam Castens	ESTIMATED NON-FEDERAL COST:	**50% $282,462**
	CHIEF, REAL ESTATE, Ralph Werthmann SAS	**ESTIMATED TOTAL PROJECT COST:**	**$564,923**
	CHIEF, PLANNING, Elden Gatwood		
	CHIEF, ENGINEERING, Greg Williams, PE		
	CHIEF, OPERATIONS, Bob Sattin, PE		
	CHIEF, CONSTRUCTION, Dennis Lynch, PE		
	CHIEF, CONTRACTING, Jon Mayo		
	CHIEF, PM-PB, Sam Colella		
	CHIEF, DPM, Christine Brayman		

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
LOCATION: CARTERET COUNTY, NORTH CAROLINA
This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/20/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
				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*
	PERIODIC Nourishments 2023 to Year 2035													
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2023Q2	16.8%	$10,968	$3,071	$14,039
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2026Q2	23.6%	$11,605	$3,249	$14,854
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2029Q2	30.8%	$12,279	$3,438	$15,717
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2032Q2	38.4%	$12,992	$3,638	$16,630
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2035Q2	46.4%	$13,747	$3,849	$17,596
	Periodic Nourishments every 3 years													
	PERIODIC Nourishments 2023 to Year 2035													
	CONSTRUCTION ESTIMATE TOTALS:	$46,050	$12,894	28%	$58,944		$46,948	$13,145	$60,093			$61,590	$17,245	$78,836
01	LANDS AND DAMAGES	$0	$0	0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	PED, PM, Life Cycle Updates, E&D, Contracts	$5,000	$1,400	28%	$6,400	3.7%	$5,183	$1,451	$6,634	2029Q1	84.9%	$9,583	$2,683	$12,266
31	CONSTRUCTION MANAGEMENT													
	Construction Management, PM, Contracting	$3,750	$1,050	28%	$4,800	3.7%	$3,887	$1,088	$4,976	2029Q2	87.1%	$7,272	$2,036	$9,308
	CONTRACT COST TOTALS:	$54,800	$15,344		**$70,144**		$56,018	$15,685	$71,703			$78,445	$21,965	**$100,409**

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
LOCATION: CARTERET COUNTY, NORTH CAROLINA
This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/20/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
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*
	PERIODIC Nourishments 2038 to Year 2050													
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2038Q2	54.9%	$14,545	$4,073	$18,618
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2041Q2	63.9%	$15,390	$4,309	$19,700
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2044Q2	73.4%	$16,284	$4,560	$20,844
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2047Q2	83.5%	$17,230	$4,824	$22,055
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2050Q2	94.2%	$18,231	$5,105	$23,336
	Periodic Nourishments every 3 years						$0							
	PERIODIC Nourishments 2038 to Year 2050													
	CONSTRUCTION ESTIMATE TOTALS:	$46,050	$12,894	28%	**$58,944**		$46,948	$13,145	$60,093			$81,682	$22,871	$104,553
01	LANDS AND DAMAGES	$0	$0	0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	PED, PM, Life Cycle Updates, E&D, Contracts	$5,000	$1,400	28%	$6,400	3.7%	$5,183	$1,451	$6,634	2044Q1	308.3%	$21,162	$5,925	$27,087
31	CONSTRUCTION MANAGEMENT													
	Construction Management, PM, Contracting	$3,750	$1,050	28%	$4,800	3.7%	$3,887	$1,088	$4,976	2044Q2	313.7%	$16,081	$4,503	$20,584
	CONTRACT COST TOTALS:	$54,800	$15,344		**$70,144**		$56,018	$15,685	$71,703			$118,924	$33,299	**$152,223**

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
LOCATION: CARTERET COUNTY, NORTH CAROLINA
This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/20/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
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*
	PERIODIC Nourishments 2053 to Year 2065													
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2053Q2	105.4%	$19,290	$5,401	$24,692
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2056Q2	117.4%	$20,411	$5,715	$26,126
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2059Q2	130.0%	$21,597	$6,047	$27,644
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2062Q2	143.4%	$22,851	$6,398	$29,249
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2065Q2	157.5%	$24,179	$6,770	$30,948
	Periodic Nourishments every 3 years						$0							
	PERIODIC Nourishments 2053 to Year 2065													
	CONSTRUCTION ESTIMATE TOTALS:	$46,050	$12,894	28%	**$58,944**		$46,948	$13,145	$60,093			$108,327	$30,332	$138,659
01	LANDS AND DAMAGES	$0	$0	0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	PED, PM, Life Cycle Updates, E&D, Contracts	$5,000	$1,400	28%	$6,400	3.7%	$5,183	$1,451	$6,634	2059Q1	811.5%	$47,243	$13,228	$60,471
31	CONSTRUCTION MANAGEMENT													
	Construction Management, PM, Contracting	$3,750	$1,050	28%	$4,800	3.7%	$3,887	$1,088	$4,976	2059Q2	823.6%	$35,900	$10,052	$45,952
	CONTRACT COST TOTALS:	$54,800	$15,344		**$70,144**		$56,018	$15,685	$71,703			$191,471	$53,612	**$245,083**

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

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

PROJECT: BOGUE BANKS FEASIBILITY STUDY REPORT
LOCATION: CARTERET COUNTY, NORTH CAROLINA
This Estimate reflects the scope and schedule in report; BOGUE BANKS FEASIBILITY STUDY - FEBRUARY 2014

DISTRICT: CESAW WILMINGTON DISTRICT PREPARED: 3/20/2014
POC: CHIEF, COST ENGINEERING, Lee Danley, PE

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5 FEB 14 Effective Price Level: 1 OCT 13				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	PERIODIC Nourishment 2068													
17	BEACH REPLENISHMENT	$9,210	$2,579	28%	$11,789	1.9%	$9,390	$2,629	$12,019	2068Q2	172.5%	$25,583	$7,163	$32,746
	Periodic Nourishments every 3 years						$0							
	PERIODIC Nourishment 2068													
	CONSTRUCTION ESTIMATE TOTALS:	$9,210	$2,579	28%	**$11,789**		$9,390	$2,629	$12,019			$25,583	$7,163	$32,746
01	LANDS AND DAMAGES	$0	$0	0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	PED, PM, Life Cycle Updates, E&D, Contracts	$1,000	$280	28%	$1,280	3.7%	$1,037	$290	$1,327	2068Q1	1375.8%	$15,298	$4,284	$19,582
31	CONSTRUCTION MANAGEMENT													
	Construction Management, PM, Contracting	$750	$210	28%	$960	3.7%	$777	$218	$995	2068Q2	1395.3%	$11,625	$3,255	$14,880
	CONTRACT COST TOTALS:	$10,960	$3,069		**$14,029**		$11,204	$3,137	$14,341			$52,506	$14,702	**$67,208**