VOLUME I

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION

GENERAL INVESTIGATIONS STUDY
FINAL REPORT

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DECEMBER 2012

US Army Corps
of Engineers®
Mobile District

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION

GENERAL INVESTIGATIONS STUDY

EXECUTIVE SUMMARY

The purpose of this study is to assess the needs for hurricane and storm damage reduction and opportunities for environmental restoration and protection along the Gulf Coast of Walton County, Florida. Walton County is located approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida. The beaches of Walton County encompass approximately 26 miles of shoreline extending eastward from the City of Destin in Okaloosa County, Florida to the Walton/Bay County line.

Since 1990, several coastal storms have eroded the coastline of Walton County resulting in recession of the protective beach and dune system. The purpose of this report is to document the economic investigations, engineering analyses, and environmental considerations conducted to formulate a shore protection project for Walton County, Florida, which will reduce the damaging effects of hurricanes and severe storms to properties along the coast. The project is constructible, acceptable to the public, environmentally sustainable and justified by an economic evaluation.

This study was authorized both within the United States Senate and the U.S. House of Representatives. In the Senate, the Committee on Environment and Public Works adopted a committee resolution (unnumbered) on July 25, 2002, and in the House, the Committee on Transportation and Infrastructure adopted a resolution, Docket 2690, dated July 24, 2002. The non-Federal sponsor for this study is the Walton County Board of Commissioners. Their central point of contact is the Executive Director, Walton County Tourist Development Council (TDC).

A number of measures were initially considered for alternative development to provide hurricane and storm damage reduction for the Walton County shoreline. Those measures can be classified as either non-structural or structural in nature. Non-structural measures consist of actions that: control or regulate the use of land and buildings such that damages to property are reduced or eliminated; acquire threatened or damageable property; or, consist of retreat which is relocation of threatened property. Structural measures are composed of those actions that block or otherwise retard erosive coastal processes, or restore or nourish beaches to compensate for erosion. Typically, the hardened structural measures consist of seawalls, bulkheads, revetments, breakwaters, or groins. Beach and dune fill is considered a soft structural alternative. Screening of these measures narrowed the alternative development to consist of a non-structural acquisition and structural beach and dune fill alternatives.

The acquisition alternative would remove all damageable structures from the front lots and would eliminate storm damage to approximately 81 percent of the approximately 814 damage elements in the study area. This results in about a $57,819,000 reduction of the total average damages and about a $3,106,000 reduction of the average annual damages. The cost of this alternative is significant with the resulting approximate cost being about $3.42 billion dollars. The annual cost of this acquisition alternative would be about $193,303,000. Because the annual cost exceeds the annual benefits, this alternative is not economically justified.

For the beach and dune fill alternatives, it was recognized that the dunes along the Walton County shoreline provide the principal protection for the damageable structures. Likewise, the dunes are protected by the shoreline berm. It was decided early in the study process that alternative plans would not change the existing natural berm or dune heights. As such, a range of beach and dune fill alternative plans were formulated to evaluate both berm width and dune width alternatives. The evaluation approach adopted a two-phase process with the first phase of the evaluation optimizing the proposed berm width. The second phase would build on the results of the first phase by optimizing the dune width. Thus the resulting beach and dune fill alternative is a combination of the optimized berm width and the optimized dune width evaluations. Four berm width alternatives were evaluated with an additional two added to confirm optimization. After the optimized berm width alternative was determined five dune width alternatives were evaluated.

These evaluations resulted in an economically justified beach fill plan that could be implemented to provide hurricane and storm damage reduction for the Walton County shoreline. This plan is considered the National Economic Development (NED) Plan as it maximizes beneficial contributions to the Nation while satisfying the study objectives. The NED Plan is composed of a 50-foot berm width that includes a 25-foot berm and an additional 25 feet of advanced nourishment along approximately 15.2 miles of the Walton County Shoreline. The project will also include added dune widths of either 10 or 30 feet.

After consultation with the non-Federal sponsor, a locally preferred plan (LPP) was developed to include the work contained in the NED Plan and include additional shoreline length of about 3.6 miles to provide consistent shoreline protection in areas that were not economically justified. The non-Federal sponsor is willing to provide funding for work in this area. The LPP, similar to the NED Plan, will include a 50-foot berm with added dune widths of either 10 or 30 feet throughout the project length. Per ER 1105-2-100, the recommended plan may deviate from the NED Plan if the non-Federal sponsor agrees to pay the cost difference between the NED Plan and the LPP, the LPP has outputs similar in-kind, and the LPP has benefits that are equal or greater to the NED benefits. A waiver, that the LPP be considered for recommendation, was requested and on 7 February 2012, was approved by the Assistant Secretary of the Army for Civil Works (ASA(CW)). As such, the LPP is the selected plan.

Initial construction of the NED Plan will require the placement of 3,273,000 cubic yards (cy) of material while initial construction of the selected plan will require the placement of 3,868,000 cy of material. During the 50-year life of the project it was determined that the project will require periodic renourishment for both the NED Plan and the selected plan. Four renourishments will occur on a 10-year cycle and require about 1,585,000 cy and 1,789,000 cy of material for the NED Plan and the selected plan, respectively. Material for the initial beach fill placement and renourishments will come from a nearby offshore borrow area.

The NED Plan would have a total project economic first cost of about $90,724,000 with the selected plan total project economic first cost totaling about $103,598,000. The NED Plan would have an annual cost of about $4,168,000 with the selected plan annual cost totaling about $4,786,000. The annual benefits of the NED Plan would total about $7,380,000 with the selected plan annual benefits totaling about $7,570,000. The BCR of the NED Plan is about 1.77 while the BCR of the selected plan is about 1.58. The NED Plan would protect about 15.2 miles of the Walton County shoreline while the selected plan would protect about 18.8 miles. Of the plans considered the non-Federal sponsor has expressed their desire to implement the selected plan. Listed in the table below is a comparison of the project features and economics of the NED Plan and selected plan. The expected average annual damages will be reduced by approximately $7,555,000, and the recommended plan reduces the risk of average annual damages due to wave attack and erosion by roughly 92 percent.

Plan Comparison
Project Features and Economics, NED Plan and Selected Plan
(Note – Monetary amounts are shown in FY 2013 Dollars)

Category	NED Plan	Selected Plan
Project Length	15.2 Miles	18.8 Miles
Initial Beach Fill Quantity	3,273,000 cy	3,868,000 cy
Renourishment Cycle	10 years	10-years
Renourishment Quantity	1,585,000 cy	1,789,000 cy
2014 Initial Construction Cost	$51,945,000	$61,397,000
2024 Renourishment Cost	$15,240,459	$16,561,078
2034 Renourishment Cost	$10,546,710	$11,460,605
2044 Renourishment Cost	$7,298,539	$7,930,973
2054 Renourishment Cost	$5,050,738	$5,488,396
Total Economic First Cost	$90,081,000	$102,838,052
Interest During Construction	$643,000	$760,000
Total Project Economic First Cost	$90,724,000	$103,598,000
Average Annual Economic First Cost	$4,044,000	$4,618,000
Annual OMRR&R	$124,500	$168,000
Total Average Annual Economic Cost	$4,168,000	$4,786,000
Average Annual HSDR Benefits	$7,365,000	$7,555,000
Average Annual Recreation Benefits	$15,000	$15,000
Total Average Annual Benefits	$7,380,000	$7,570,000
Benefit-to-Cost Ratio	1.77	1.58
Net Benefits	$3,212,000	$2,784,000

The selected plan recommended for implementation is composed of a 50-foot berm width that includes a 25-foot berm and an additional 25 feet of advanced nourishment in all construction reaches. The project will also feature added dune width in all construction reaches of either 10 or 30 feet. The initial construction cost for the project will total $61,397,000 with additional costs to be incurred during the project life for periodic renourishments. Typical cost share for hurricane and storm damage reduction projects is 65 percent Federal and 35 percent non-Federal. Adjustment can be made to this ratio based on adequacy of public access and parking, whether private shoreline is being protected, and if any economically unjustified reach is being included in the selected plan. A cost share analysis found that the initial construction costs of the NED Plan would be about 33 percent Federal and about 67 percent non-Federal. The renourishment costs were adjusted to comply with amendments made by Section 215 of Water Resources Development Act 1999, Public Law (PL) 106-53, to Section 103(d) of WRDA 1986, PL 99-662, which established 50 percent non-Federal cost sharing for periodic nourishment on any beach erosion control authorized for construction after December 31, 1999 and carried out after January 1, 2003. U.S. Army Corps of Engineers (Corps) policies require adjustments be made to this cost sharing based on public access/parking, ownership and land use conditions similar to the adjustments that are made to cost sharing for initial construction. The resulting cost share for the NED renourishment costs is about 26 percent Federal and about 74 percent non-Federal. The cost share ratio for the initial construction costs of the selected plan would be about 28 percent Federal and about 72 percent non-Federal. The cost share ratio for the selected plan renourishment costs is about 23 percent Federal and about 77 percent non-Federal. The overall cost ratio for both the initial construction costs and the renourishment costs of the NED Plan is about 30 percent Federal and about 70 percent non-Federal. The overall cost ratio for both the initial construction costs and the renourishment costs of the selected plan is about 26 percent Federal and about 74 percent non-Federal.

Agency Technical Review (ATR) of this report was conducted in accordance with the Corps' "Peer Review of Decision Documents" process and has been reviewed by Corps staff outside the South Atlantic Division. This review was coordinated by the National Planning Center of Expertise in Coastal Storm Damage Reduction, North Atlantic Division, U.S. Army Corps of Engineers. Comments and responses will accompany the report to the Assistant Secretary of the Army for Civil Works (ASA(CW)) and the Office of Management and Budget (OMB). Documentation of ATR certification will accompany the final report.

An Independent External Peer Review (IEPR) was conducted on the draft report after approval for public release of the draft report. The IEPR was conducted by a non-Corps national team of experts in the field, and coordinated by the National Planning Center of Expertise in Coastal Storm Damage Reduction, North Atlantic Division, U.S. Army Corps of Engineers. Comments and responses will accompany the report to the ASA(CW) and the Office of Management and Budget (OMB). Documentation of IEPR certification will accompany the final report.

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1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of an investigation that has been conducted to analyze and formulate a hurricane and storm damage reduction project for Walton County, Florida. Since 1990, several coastal storms have eroded the coastline of Walton County resulting in recession of the protective beach and dune system.

1.2 STUDY AUTHORITY

This study was authorized both within the United States Senate and the U.S. House of Representatives. In the Senate, the Committee on Environment and Public Works adopted a committee resolution (unnumbered) on July 25, 2002, which reads as follows:

"Resolved by the Committee on Environment and Public Works of the United States Senate, That in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army is requested to review the feasibility of providing beach nourishment, shore protection and related improvements in Walton County, Florida, in the interest of protecting and restoring the environmental resources on and behind the beach, including the feasibility of providing shoreline and erosion protection and related improvements consistent with the unique characteristics of the existing beach sand, and with consideration of the need to develop a comprehensive body of knowledge, information, and data on coastal area changes and processes as well as impacts from Federally constructed projects in the vicinity of Walton County, Florida.

In the House, the Committee on Transportation and Infrastructure adopted a resolution, Docket 2690, dated July 24, 2002, which reads as follows:

"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army is requested to review the feasibility of providing beach nourishment, shore protection and environmental restoration and protection in the vicinity of Walton County, Florida.

Section 110 of the Rivers and Harbors Act of 1962, Public Law 87-874, authorized a number of navigation surveys in various locations and subjected them to "all applicable provisions of section 110 of the River and Harbor Act of 1950." Section 110 of the Rivers and Harbors Act of 1950, Public Law 81-516, reads:

The Secretary of the Army is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following-named localities, the cost thereof to be paid from appropriations heretofore or hereafter made for such purposes: *Provided*, That no preliminary examination, survey, project, or estimate for new works other than those designated in this title or some prior Act or joint resolution shall be made: *Provided further*, That after the regular or formal reports made as required by law on any examination, survey, project, or work under way or proposed are submitted, no supplemental or additional report or estimate shall be made unless authorized by law: *Provided further*, That the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this title until the project for the proposed work shall have been adopted by law: *Provided further*, That reports of surveys on beach erosion and shore protection shall include an estimate of the public interests involved, and such plan of improvement as is found justified, together with the equitable distribution of costs in each case: *And provided further*, That this section shall not be construed to interfere with the performance of any duties vested in the Federal Power Commission under existing law….

1.3 NON-FEDERAL SPONSOR

The Non-Federal Sponsor is the Walton County Board of Commissioners. Their central point of contact is the Executive Director, Walton County Tourist Development Council (TDC). A Feasibility Cost Sharing Agreement (FCSA) was executed between the U.S. Army Corps of Engineers (Corps) and Walton County in December 2003, that defined the cost share responsibilities for conducting the feasibility study. The agreement provided that the feasibility costs would be shared 50/50 between the Corps and Walton County and that 50 percent of Walton County's share would be provided in cash with the remainder provided as in-kind services.

1.4 PURPOSE AND SCOPE OF STUDY

The purpose of this study is to assess the needs for hurricane and storm damage reduction and opportunities for environmental restoration and protection along the Gulf Coast of Walton County, Florida. The purpose of this report is to document the economic investigations, engineering analyses, and environmental considerations conducted to formulate a shore protection project for Walton County, Florida, which will reduce the damaging effects of hurricanes and severe storms to properties along the coast. The project will be constructible, acceptable to the public, environmentally sustainable and justified by an economic evaluation.

1.5 DESCRIPTION OF STUDY AREA

Walton County is located approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida, Figure 1. The beaches of Walton County encompass approximately 26 miles of shoreline extending from the City of Destin in Okaloosa County, Florida (about six miles to the east of East Pass) to the Walton/Bay County line near Phillips Inlet. The western two-thirds of Walton County are comprised of a coastal peninsula extending from the mainland, and the eastern third is comprised of mainland beaches. Choctawhatchee Bay lies north of the peninsula. Walton County includes 15.7 miles of state-designated critically eroding areas and three State of Florida park areas that cover approximately six miles of the 26-mile shoreline.

The Walton County shoreline is characterized by high dune elevations partly due to the presence of Pleistocene bluffs formed as a result of an exposed submarine berm formed during inundation of the Florida Peninsula during that geologic period. Primary dune elevations in Walton County range from 11.5 to 44.5 feet North American Vertical Datum, 1988 (NAVD88) and average 25.5 feet. Along the mid-section of Walton County, Bluff elevations exceed 60 feet in height, Figure 2A. Bluff erosion and undercutting occur in this area due to the interface of relatively low flat beaches and the bluff toe. An unusual attribute of the Walton County shoreline is the presence of coastal dune lakes. These lakes are rare worldwide and are almost exclusive to the Gulf Coast within the United States. The lakes are about five feet deep and intermittently breach the dune system and discharge directly into the Gulf of Mexico, Figure 2B.

Mild winters and warm hot summers characterize the project area, with an average in excess of 280 days a year of sunshine. The average daily temperature is 67 degrees Fahrenheit and the average water temperature is about 70 degrees Fahrenheit. The months from June through November constitute the hurricane storm season, and this area is subject to tropical storm and strong hurricane conditions. The highest period of rainfall occurs during the storm season, with an average annual rainfall of 64 inches.

1.6 BACKGROUND

Walton County's shoreline is receding and its protective dunes and high bluffs are being adversely impacted by hurricane and coastal storm forces. The impacts of these storms to property and infrastructure are considerable and can possibly be reduced through a beach restoration and stabilization project. Behind the dune system, upland drainage feeds several freshwater lakes that intermittently breach the dune system and discharge directly into the Gulf. Primary dune elevations range from 11.5 to 44.5 feet NAVD88 and average 25.5 feet National Geodetic Vertical Datum (NGVD).

During the late 1990s, the area endured several strong hurricanes resulting in extensive shoreline erosion (Taylor Engineering, 2003). In 2004 the area was affected severely by Hurricane Ivan (Sep 04) and early into the 2005 hurricane season it was impacted by Hurricanes Arlene (June 05), Dennis (July 05), and Katrina (Aug 05). Photographs depicting the Walton County shoreline as well as structures are displayed in Plates 1 through 11 at the end of this report. Visual comparisons are shown for pre-Ivan, post-Ivan and Post Dennis.

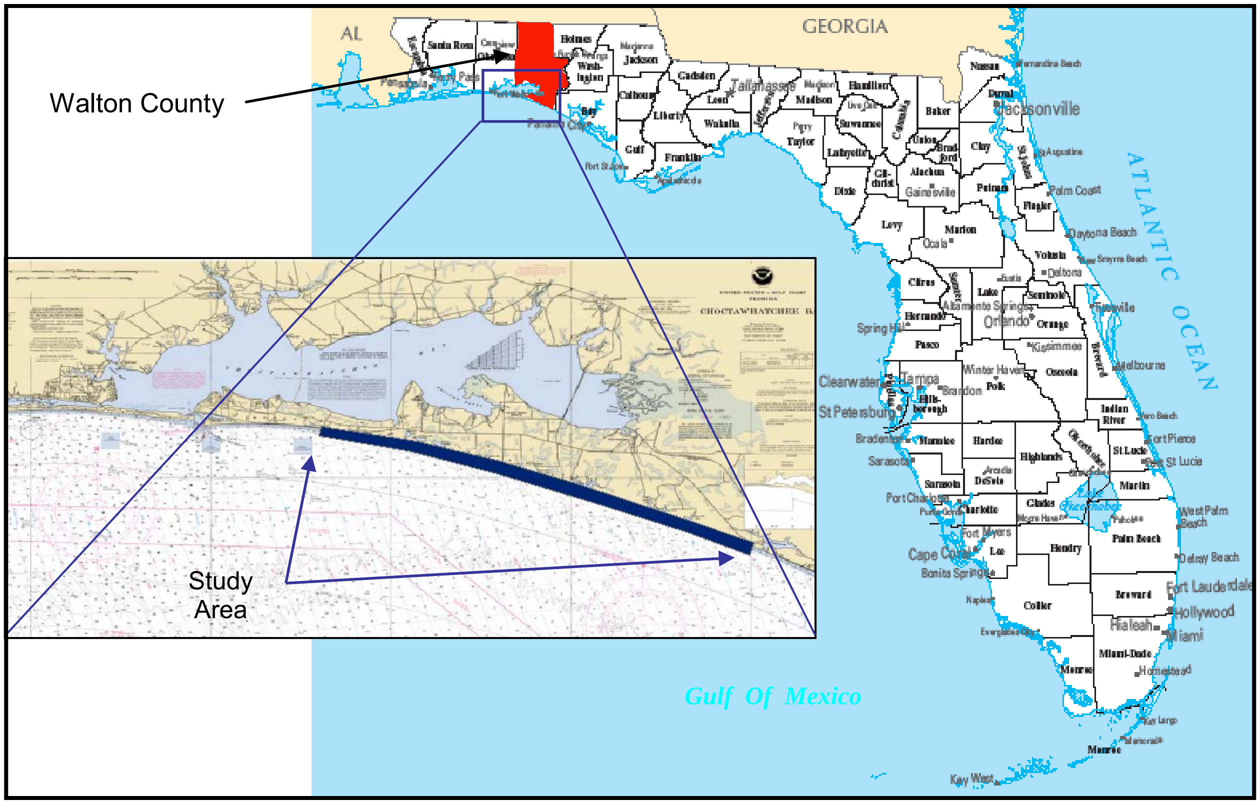


FIGURE 1. WALTON COUNTY LOCATION MAP

FIGURE 2A. HIGH BLUFFS WESTERN WALTON COUNTY

FIGURE 2B. COASTAL DUNE LAKE

1.7 PREVIOUS STUDIES AND REPORTS

Previous investigations and reports have been completed for the area. The most recent studies pertinent to the erosion problems at Walton County are summarized below:

(1) Leadon, M.E., Nguyen, N.T., and Clark, R.R., 1998. *Hurricane Opal: Beach and Dune Erosion and Structural Damage Along the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems Report No. BCS-98-01, 102 p.

(2) Leadon, M.E., Clark, R.R., and Nguyen, N.T., 1999. *Hurricane Earl and Hurricane Georges, Beach and Dune Erosion and Structural Damage Assessment and Post-Storm Recovery Plan for the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems Report No. BCS-99-01, 43 p.

(3) "State of the Beaches" of Walton County, Florida 2001, 2002, 2003, 2004, and 2005 Walton County Tourism Development Council. These reports present data, analysis, and recommendation for managing the Florida coastline. Specific emphasis is placed on determining trends in beach width and explaining the physical and coastal processes that cause the changes.

(4) Beach Management Feasibility Study for Walton County and Destin Florida, Taylor Engineering, Inc., April 2003. The purpose of this study was to determine the most technically feasible and financially acceptable alternatives for protecting 9.2 miles of "critically eroding shoreline." The feasibility study is a six-part study funded by Walton County.

(5) Leadon, M.E. et al, 2004. *Hurricane Ivan: Beach and Dune Erosion and Structural Damage Assessment and Post-storm Recovery Plan for the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 64 p.

(6) Pickle B., 2005. An Evaluation of Storm Impacts, Cumulative Effect and Long-Term Recovery for Walton County, Florida. Coastal Disasters 2005, Proceedings to Solutions to Coastal Disasters 2005. Retson V.A. America Society of Engineers

(7) Clark, R.R., and LaGrone, J., 2006b. *Hurricane Dennis & Hurricane Katrina Final Report on 2005 Hurricane Season Impacts to Northwest Florida*. Publication of the Bureau of Beaches and Coastal Systems, April, 2006, 116 p.

(8) Taylor Engineering, Inc. June 2006. *Post Hurricane Dennis Beach Assessment, Shorefront Development Risk Analysis, and Project Prioritization, Walton County.*

(9) Florida Department of Environmental Protection. *Critically Eroded Beaches in Florida*, Bureau of Beaches and Coastal Systems, June 2007.

(10) Trammell M., and Trudnak, M., 2010. Walton County/Destin Beach Restoration Project, Walton County and Okaloosa County, Florida, 2010. Three-Year Post-Construction Monitoring Report, Taylor Engineering, Inc.

1.8 EXISTING WATER RESOURCES PROJECTS

There are four existing Federal projects in or adjacent to Walton County. In Walton County and its neighboring counties of Okaloosa and Bay, there is the Gulf Intracoastal Waterway. The existing project, authorized by the River and Harbor Acts of 1942, 1943, and 1966, provides for a through waterway with minimum dimensions of 12 by 125 feet from Apalachee Bay, Florida, to the Mexican Border via coastal bays, sounds and lands cuts. The existing project from Carrabelle (east of Walton County) to the Rigolets, Louisiana was completed in 1957. Maintenance on the waterway is sporadic across its length but on an annual basis. In Walton County the waterway transits through Choctawhatchee Bay and a land cut to St. Andrew Bay on the east. In neighboring Bay County there are three other existing projects:

a. Panama City Harbor, Florida. The existing project provides for an entrance channel 38 feet deep and 450 feet wide in the Gulf of Mexico, thence 38 feet deep and 300 feet wide across Lands Ends Peninsula to deep water in St. Andrew Bay, with a branch channel 36 feet deep and 300 feet wide, leading from the inner end of the main entrance channel westward to the Port Authority Terminal at Dyers Point. The entrance channel is protected by east and west jetties extending 2,075 feet and 2,896 feet, respectively. The existing project was completed in 2003. Suitable sands dredged from the entrance channel are bypassed to down drift beaches on a 24 – 36 month cycle. Prior to the recently completed modifications, the project provided for a 32-foot deep project which was begun in 1933 and completed in 1949.

b. Panama City Beaches, Florida. A hurricane and storm damage reduction project for 18.5 miles of the Panama City Beaches was authorized by the Water Resources Development Act of 1986. This project extends from Phillips Inlet near the Walton County line eastward to the Panama City Harbor entrance channel. The authorized plan consisted of a 7-foot elevation berm landward of the erosion control line with a 50-foot top width over approximately 16.8 miles of shoreline. Approximately 6.4 million cubic yards (cy) of sand was dredged from six borrow sites approximately 2000 feet offshore and from the Panama City Harbor entrance channel. Renourishment was estimated to be required at five-year intervals. A slightly modified plan was constructed by the Bay County Tourist Development Council between 1998 and 2000 under the authority of Section 203 of the Water Resources Development Act (WRDA) of 1996. Bay County was approved for reimbursement of the Federal share for the authorized project.

c. East Pass Channel, Florida. The existing East Pass Channel from the Gulf of Mexico into Choctawhatchee Bay, Florida, located east of Walton County, was authorized by the River and Harbor Act Of 1965 and consists of a channel 12 feet deep, 180 feet wide, and 1.5 miles long from the Gulf into the bay via East Pass and a spur channel six feet deep and 100 feet wide from the main channel into Old Pass Lagoon to the harbor at Destin, a distance of about 0.2 miles. The main entrance channel from the Gulf is protected by two converging rock jetties, spaced 1,000 feet apart at the seaward end. This channel was completed in 1969. An extension of the 6 by 100-foot channel into Old Pass Lagoon was authorized by the Energy and Water Development

Appropriation Act of 1981 and completed in 1983. Project maintenance is on an 18-month cycle with most of the dredged sands being passed down drift as part of the regional sediment management plan.

1.9 PLANNING PROCESS

The plan formulation process for this study applied the six step planning process described in the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies (P&G, 1983). This planning process is more fully specified in Corps of Engineers' Engineering Regulation (ER) 1105-2-100 (the Planning Guidance Notebook, 22 April 2000). Steps in the plan formulation process include:

1. The specific problems and opportunities to be addressed in the study are identified, and the causes of the problems are discussed and documented. Planning goals are set, objectives are established, and constraints are identified.
2. Existing and future without-project conditions are identified, analyzed and forecast. The existing condition resources, problems, and opportunities critical to plan formulation, impact assessment, and evaluation are characterized and documented.
3. The study team, including Federal, State, County and local officials and interested individuals, formulates alternative plans that address the planning objectives. A range of alternative plans are identified at the beginning of the planning process and screened and refined in subsequent iterations throughout the planning process.
4. Alternative project plans are evaluated for effectiveness, efficiency, completeness, and acceptability. The impacts of alternative plans will be evaluated using the system of accounts framework (NED, EQ, RED, OSE) specified in the Principles and Guidelines and ER 1105-2-100.
5. Alternative plans will be compared. Contributions to National Economic Development (NED) will be used to prioritize and rank alternatives that are consistent with protecting the nation's environment and are publically acceptable. The public involvement program will be used to obtain public input to the alternative identification and evaluation process.
6. A plan will be selected for recommendation, and a justification for plan selection will be prepared.

2.0 PROBLEMS AND OPPORTUNITIES

2.1 PROBLEMS

Walton County's shoreline is receding and its protective dunes and high bluffs are being adversely impacted by hurricane and coastal storm forces. The impacts of these storms to property and infrastructure have been considerable. Erosion is also having an impact on the environment due to decreased beach area and elevation. Such impact directly affects the availability of suitable nesting habitat required for nesting sea turtles and the areas needed by shorebirds to forage and rest. Damage to the previously established dune system destroyed much of the existing vegetation that provides stabilization. The absence of the dunes and associated vegetation eliminates much of the suitable habitat required to sustain beach mice populations and other wildlife that relies on these types of habitats for their continued survival. These problems can be summarized by the following statements which will be used by the study team in developing the planning objectives:

- Damage to properties and infrastructure due to hurricane and storm induced erosion.
- Damage to beach and dune habitats due to hurricane and storm induced erosion.
- Reduced beach recreational opportunities due to hurricane and storm induced erosion.

2.2 OPPORTUNITIES

Because of the damaging effects of hurricanes and severe storms to properties and infrastructure along the coast, there is an opportunity for a hurricane and storm damage reduction project for Walton County, Florida. Such a project can reduce damage caused by wind-generated and tide-generated waves and currents by stabilizing or restoring the eroded shoreline. Stabilizing or restoring the shoreline provides environmental restoration opportunities within the proposed project area. Restoring a beach-dune system allows greater stability and sustainability of the coastal environment once it has become re-established. Restoring the beach and dune habitats that support a variety of associated flora and fauna can contribute to the success and continual survival of several threatened or endangered species. The restoration effort will also contribute to the well-being of various other flora and fauna that naturally occur in the immediate vicinity. Restoration opportunities include increasing both the beach berm and dune widths to reduce, stabilize and/or restore the shoreline to provide protection to properties and infrastructure, increase sea turtle nesting habitat, and provide numerous benefits to a variety of shore birds, beach mice, and natural vegetation as well as other inhabitants of the coastal environment. These opportunities can be summarized by the following statements which, in addition to the problem statements, will be used by the study team to develop the planning objectives:

- Reduce damages to properties and infrastructure along Walton County's coastline.
- Restore wildlife habitat along Walton County's coastline.
- Provide increased recreational opportunities along Walton County's coastline.

2.3 PLANNING GOALS AND OBJECTIVES

The primary goal of this study is to investigate, analyze and recommend solutions to provide for hurricane and storm damage reduction opportunities along the coastline of Walton County, Florida. Over the years coastal erosion in the project area has seriously reduced the ability of the shoreline to provide adequate protection from routine coastal storms. Planning objectives were identified based on the problems, needs, and opportunities as well as existing physical and environmental conditions present in the project area and consist of:

a. Reduce shoreline erosion along the shoreline of Walton County.
b. Reduce the potential for storm damages caused by hurricanes and storms along the shoreline of Walton County.
c. Restore beach and dune ecosystem habitats along the shoreline of Walton County.
d. Increase the recreational opportunities along the shoreline of Walton County.

In general, the primary Federal objective is to formulate alternatives and make recommendations for Federal participation in construction of a project that will offer the most significant contribution to the National Economic Development (NED) account and that is consistent with protecting the Nation's environment. Furthermore, the development of the alternative plans should be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated.

2.4 Assumptions

The planning assumptions for this study are**:**

- The Fiscal Year (FY) 2013 Federal discount rate of 3.75 percent is used in this evaluation. The period of study is 54 years, beginning in 2010 and ending after 2063. There are four pre-base years from 2010 through 2013. The base year is FY 2014. Benefits begin to accrue to the project in the base year of FY 2014.
- Benefits are stated in constant FY 2013 dollars.
- The analysis will consider expected future beachfront development.
- Critically eroding beach will be protected to some level at one area by a local project to be constructed as a one-time fill funded by state and county jointly.
- Structure values will be based on depreciated replacement costs.
- Land use zoning and construction codes will not change during the period of analysis.
- Damaged or destroyed properties will be repaired to pre-storm conditions.
- Lost land will be valued at nearshore prices.
- Empirical storm frequencies based on historical records for the study area are assumed to be predictive of the probability of future events.
- Beach mice will continue to be a protected species and there will be no changes to existing environmental laws.
- Existing state and county owned public park limits would remain the same in the future.
- Emergency nourishment in the future without project condition, will take place following each serious storm event and will not be a project cost.

2.5 Constraints

Planning constraints are statements of things unique to a specific planning study that alternative plans should avoid. The constraints for this study are:

- This analysis considers applicable Federal and State laws.
- Sufficient parking must be available within a reasonable walking distance on free or reasonable terms. Reasonable public access must be furnished to comply with the planned recreational use of the area; however, public use is construed to be effectively limited to within one-quarter mile from available points of public access to any particular shore.
- There is a requirement for the benefit-to-cost ratio (BCR) to be greater than 1-to-1.
- The project will be formulated to avoid impacts to dune, lake and Gulf connections.
- Private beaches owned by beach clubs and hotels cannot be included in Federal shore protection activities if the beaches are limited to use by members or paying guests.
- Consideration should be given to public health, safety, and social well-being, including possible loss of life.
- Wherever possible, provide an aesthetically balanced and consistent appearance without changing the existing natural berm or dune height.
- Avoid detrimental environmental and social effects, specifically eliminating or minimizing the following where applicable:
    a. Air, noise and water pollution;
    b. Destruction or disruption of manmade and natural resources, aesthetic and cultural values, community cohesion, and the availability of public facilities and services;
    c. Adverse effects upon employment as well as the tax base and property values;
    d. Displacement of people, businesses, and livelihoods; and,
    e. Disruption of normal and anticipated community and regional growth.
- Maintain, preserve, and, where possible and applicable, enhance the following in the study area:
    a. Water quality;
    b. The beach and dune system together with its attendant fauna and flora;
    c. Wetlands and other emergent coastal habitats;
    d. Commercially important aquatic species and their habitats;
    e. Nesting sites for colonial nesting birds;
    f. Habitat for endangered and threatened species.

3.0 INVENTORYING AND FORECASTING RESOURCES

3.1 STUDY METHODOLOGY

3.1.1 Evaluation Framework

Shore protection projects are formulated to provide hurricane and storm damage reduction while recreation benefits are incidental. ER 1165-2-130 provides policies and guidelines for determining the extent of Federal participation in potential Federal projects for protection from shore erosion, hurricanes, and abnormal tidal and lake flooding that result in damages or losses to coastal resources and/or development. Federal participation in shore protection projects must produce economic justification from storm damage reduction benefits or a combination of damage reduction benefits and recreation benefits not to exceed 50 percent of the total benefits required for justification.

The general economic principles and guidelines for assessing NED benefits are documented in the Water Resources Council's Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies, Chapter II - National Economic Development Benefit Evaluation Procedures (March 10, 1983).

The specific methodologies that will be used for the benefit study are based on the P&G and are documented in ER 1105-2-100, 22 April 2000, Planning – Planning Guidance Notebook, Section I – Hurricane and Storm Damage Reduction, Appendix D – Economic and Social Considerations, and Appendix E – Civil Works Missions and Evaluation Procedures.

3.1.2 Beach-*fx* The Hurricane and Storm Damage Simulation Model

Beach-*fx* is a comprehensive new analytical framework for evaluating the physical performance and economic benefits and costs of storm damage reduction projects, particularly beach nourishment along sandy shores. The model has been implemented as an event-based Monte Carlo life-cycle simulation tool that is run on desktop computers. Beach-*fx* relies on user-populated databases that describe the coastal area under study: environmental forcing in the form of a suite of historically-based plausible storm events that can impact the area; an inventory of infrastructure that can be damaged; and estimates of morphology response of the anticipated range of beach profile configurations to each storm in the plausible storm suite together with damage driving parameters for erosion, inundation, and wave impact damages. The model is data driven in that all site-specific information is contained within the input databases, which generalizes the model and makes it easily transportable between study areas. Beach-*fx* integrates the engineering and economic analyses and incorporates uncertainty in both physical parameters and environmental forcing, which enables quantification of risk with respect to project evolution and economic costs and benefits of project implementation. This new model provides for a more realistic treatment of shore protection project evolution through the relaxation of a variety of simplifying assumptions that are made in existing, commonly applied approaches. Beach-*fx* is implemented with a modern graphical user interface, linkages to geographical information system data, extensive reporting and visualization, and database population tools.

The application of Beach-*fx* in this study is to estimate future without project damages and quantify the damages prevented by various storm damage reduction alternatives for Walton County over the 50 year project life.

A suite of historically-based plausible storm events as described in Section 3.1.4 were applied in this study. In total 300 potential future life-cycles were evaluated. The beach morphology evolution concepts implemented in Beach-*fx* including trigger-based emergency protective actions employed to obtain estimates of the expected without-project morphology over the simulated 50-year life cycle and at the beginning of the project life or base year. The estimate of damages prevented during the tropical season was obtained as the difference between the expected damages for with-project condition and the expected damages for the without-project condition.

Beach-*fx* comprises four basic elements:

a. Meteorological data and processes.
b. Coastal morphology change data and processes.
c. Economic data and processes.
d. Management measures data and processes.

Beach-*fx* is a data-driven model, in that the data elements are stored in a relational database, whereas process descriptions (rules for applying the data elements) are embodied in the program. The databases that provide the necessary input to run Beach-*fx* contain a full description of the coastal area under study, a suite of historically-based plausible storms that can impact the area, an inventory of structure elements that can be damaged, and the estimated morphology response of the anticipated range of beach profile configurations to each storm in the plausible storm suite, together with a cross-shore varying profile of damage-driving parameters for estimating inundation, erosion, and wave impact damages.

Project Area Representation. The overall unit of analysis is the project, a shoreline area for which the analysis is to be performed. The project is divided, for purposes of analysis, into reaches, which are characterized as contiguous, morphologically homogeneous areas. The structures within a reach are referred to as Damage Elements (DE), and are located within lots. All locations are geospatially referenced using a cartographic state plane coordinate system. This project definition scheme is shown schematically in Figure 3, in which the shoreline is linear within each reach.

Each reach is associated with a representative beach profile that describes the shape of the cross-shore profile and beach composition. Thus, within a project, multiple reaches can share the same representative beach profile. The profile is the basic unit of beach response. Natural beach profiles are complex; for the modeling, a simplified beach profile, representing key morphological features defined by points, is used as shown in Figure 3B (see Section 3.1.3.1).

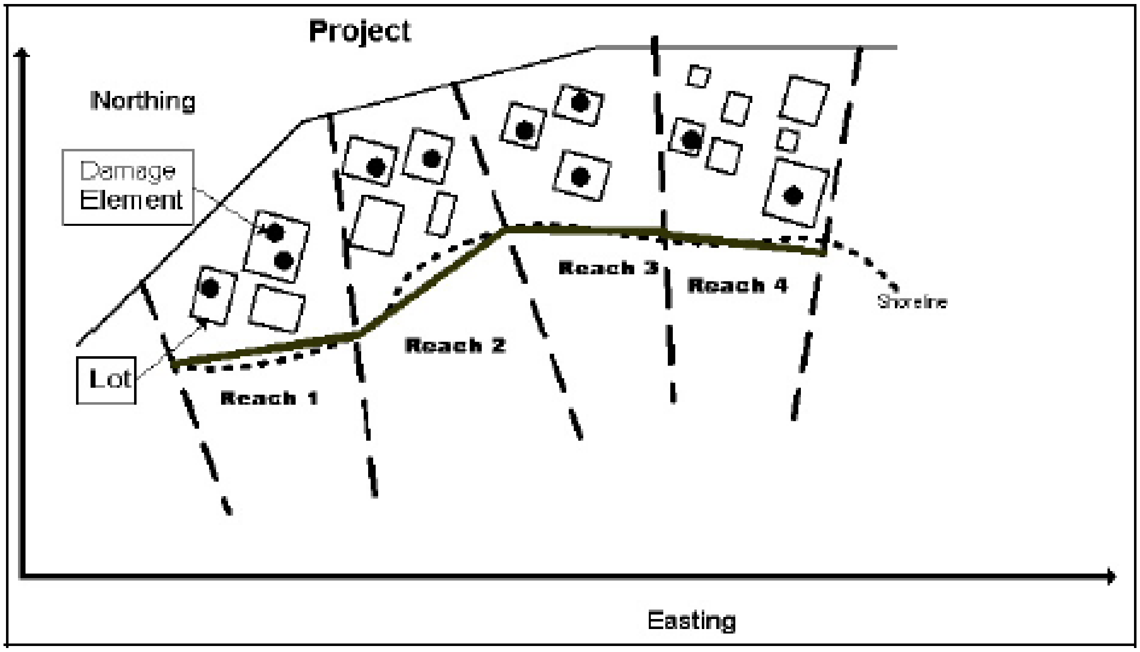


FIGURE 3. BEACH-*fx* SCHEMATIZATION OF STUDY AREA

Each reach is associated with a representative beach profile that describes the shape of the cross-shore profile and beach composition. Thus, within a project, multiple reaches can share the same representative beach profile. The profile is the basic unit of beach response. Natural beach profiles are complex; for the modeling, a simplified beach profile, representing key morphological features defined by points, is used as shown in Figure 3B (see Section 3.1.3.1).

The simplified profile represents a single trapezoidal dune, with a horizontal berm and a horizontal upland landward of the dune feature. The submerged profile is represented as a detailed series of points or an approximate functional representation known as the equilibrium profile (Dean 1977). Details of the representative profiles utilized for this study are discussed further in Section 3.1.3.1.

Meteorological Data and Processes. Beach-*fx* internally generates a synthetic sequence of storms for each life-cycle simulated. This set of storms is the primary driving force for coastal morphology change and associated damages. The gulf coast of the United States is subject to tropical storms (hurricanes). These types of storms are seasonal. The storm climatology in a given area is site-specific. Beach-*fx* makes use of a set of plausible storms that are derived from the historical record in the study area as described in further detail in Section 3.1.4. The synthetic sequence of storms that make up the simulated life-cycle is obtained by performing a bootstrap sampling with replacement on the plausible storm suite.

The hurricane storm season for the study area is defined as June through November, and each plausible storm is assumed to take place within the season in which the original historical storm occurred. The probability of the tropical storms for Walton County is defined below:

Season Descriptor	Probability of Tropical Storms
No Storms (Dec thru May)	0
June	0.0252
July	0.042
August	0.0672
September	0.1849
October	0.0588
November	0.0084

The cumulative probability is 0.3865. Based on a period of analysis including pre-project base years on average there should be 21.6 storms over the life-cycle of the project. Figure 3A shows the number of storms per Beach-*fx* simulated life-cycle and the moving average of 21.5 storms.

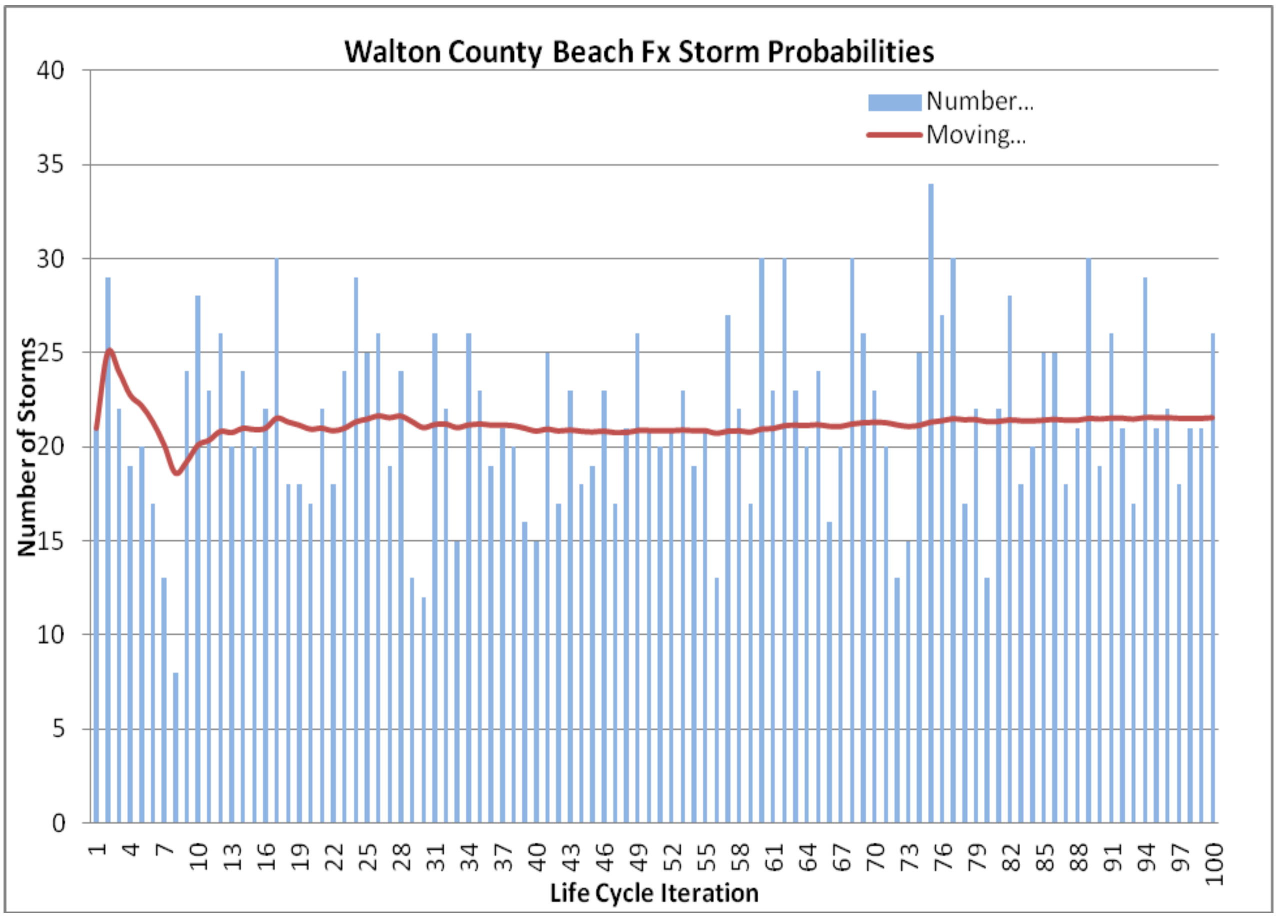


FIGURE 3A. BEACH-*fx* WALTON COUNTY AVERAGE NUMBER OF STORMS

The expected number of storms during a simulated life-cycle in each of the specified seasons based on the input table above are as follows:

Season Descriptor	Expected Average Number of Storms	Average Number of Storms Simulated
No Storms (Dec thru May)	0	0
June	1.41	1.11
July	2.35	2.26
August	3.76	3.76
September	10.35	10.16
October	3.29	2.97
November	0.31	0.31

Based on this assigned probability, a Poisson distribution is used to determine the number of storms of each type that will occur in the season. The Poisson distribution is used because it expresses the probability of a number of events occurring in a fixed period of time, assuming that the events occur with a known average rate, and are independent of the time since the last event.

Once the number of storms is known, the second step of the bootstrap process randomly selects that many storms from the sub-set of plausible storms of that type that occur in the season being processed. For each storm selected, a random time within the season is chosen and assigned as the storm date. To maintain separation between storms, after the first storm date is chosen the date assignment routine preserves a 7-day minimum storm inter-arrival time for the subsequent storm.

Coastal Morphology Change Data and Processes. Beach-*fx* is based on simplified beach profile morphology and plausible storms developed as time series of wave height, wave period, and total water elevation. The beach profile response due to a storm is determined by applying a coastal process response model to the simplified profile. Although alternative coastal process response models could be used, SBEACH has typically been employed and was the model chosen for this study. As described in further detail in Section 3.1.4.1. SBEACH takes as input the storm time series and the initial profile definition, as well as other descriptors of the beach (e.g., grain size) and model parameters, and produces as output the estimated beach profile at the end of the storm as well as cross-shore profiles of erosion, maximum wave height, and total water elevation including wave setup. This information is extracted from the SBEACH output by post-processing routines and stored in the Shore Response Database (SRD), a relational database as described in Section3.1.6, which is used to pre-store results of SBEACH simulations of all storms affecting a pre-defined range of anticipated beach profile configurations.

The SRD provides the mechanism by which Beach-*fx* obtains morphology response and damage-driving parameters for all possible combinations of the storm suite and beach profile configurations encountered throughout any given life-cycle simulation. Beach-*fx* includes a representation of scarping of the seaward dune face as well as post-storm berm width recovery, which is set to 90 percent. Long-term shoreline change is included in Beach-*fx* by way of an applied shoreline change rate. The user-specified applied shoreline change rate is a reach level calibration parameter. The applied shoreline change rate is set so that the combination of the applied shoreline change rate and storm-induced change returns the historical shoreline change rate for the reach. The target historical shoreline change rate is determined based on a separate analysis of the available historical beach profile and/or shoreline position data as described in detail in Appendix A, Engineering Design. The calibration procedure causes Beach-*fx* to return, on average, the historical shoreline change rate over hundreds of iterations of the 50-year life-cycle. Beach-*fx* also includes provisions for specification of project-induced shoreline change rates. The project-induced shoreline change rate accounts for the alongshore dispersion of beach nourishment material. Estimates of the project-induced shoreline change rate are obtained through application the one-line shoreline change model GENESIS as described further in section 3.1.5 (Hanson and Kraus 1989) and are stored in the Beach-*fx* input database.

Economic Data and Processes. The economic analysis incorporated in Beach-*fx* takes into account the probabilistic nature of storm-associated damages to structures. The calculated damages are a function of structure location and character, storm intensity, storm timing, and the degree of protection that is provided by the beach berm and dune system. Structure damage is caused by: (1) erosion, which can result in structural failure due to loss of foundation support; (2) flooding by elevated still water level; (3) wave impact (kinetic forces); and (4) wind associated damage. Beach-*fx* presently represents the first three types of damages; wind damage is not included because shore protection projects do not mitigate wind damage.

Following each storm, damages are calculated for each reach, lot, and damage element (a generalization of the term “structures”). Each DE is geographically referenced and characterized as to usage, construction type, foundation type, value of contents, value of structure and ground, and first floor elevation. The storm determines the water level, maximum wave height, and erosion profiles, which are obtained from look-ups in the SRD. These response profiles exist at the representative profile (and thus, the reach) level and are defined in the cross-shore such that erosion, flooding, and wave damage can vary depending upon the location of the DE within the reach. These values are then used to calculate damage-driving parameters for each DE, which are described in more detail in Section 3.3.3.

Damage functions are user-specified and can vary based on the type of construction, foundation type, etc. Functions are defined separately for structure and contents. Each such function gives a percent damage as a function of the damage driving parameter. To represent uncertainty, three damage curves are specified for each situation as a lower, most likely, and upper curve. This allows for the creation of a triangular distribution based on interpolation across the three curves and then the triangular distribution can be sampled to return a value of percent damage. Consequently, three values are available in the form of percent damage caused by inundation, erosion, and wave attack. Damages due to inundation, erosion, and wave attack are then used to calculate a combined impact, to avoid double-counting of damages. The combined damage impact reduces the current value of the DE. The total of all damages (reductions in value) is the economic loss that can be mitigated by the shore protection project. DE can be rebuilt or, if the shoreline has encroached too far into the lot, the lot can be declared condemned (or unbuildable), such that no rebuilding can take place.

Management Measures Data and Processes. Management measures accommodated within Beach-*fx* are emergency nourishment and planned nourishment. Emergency nourishment occurs when local government takes post-storm action to perform limited beach nourishment by adding volume to the existing profile. Planned nourishment is a proactive measure, in which a designed beach nourishment program is implemented at a regular interval, to build the reach profile to a defined design template.

Within Beach-*fx*, different emergency nourishment and planned nourishment can be set and a simulation run with selected alternatives. For emergency nourishment, an alternative is based on reach-level triggers that will result in emergency nourishment of the reach based on minimum thresholds of dune width, or berm width, which if met will result in an emergency nourishment of the reach. The emergency action is specified as a replacement volume of cubic yards per foot, placed as a dune feature.

Planned nourishment is similarly user-specified based on design templates, triggers, and nourishment cycles. Nourishment cycles are defined as periodic (e.g., every three years). An order of reach nourishment is defined in the database, as are reach-level design templates (dune width, dune height, and berm width), placement rates, unit costs, and borrow to placement ratio, which for this study was conservatively set to 1.17.

At the specified nourishment interval, all reaches to be nourished are examined to determine if mobilization is warranted. The existing reach profile is compared to the design template and if the needed nourishment volume (on the basis of the entire project) exceeds a user-specified threshold volume at which the mobilization cost (a fixed value) is deemed justified, mobilization and nourishment take place. Thus, on a reach-by-reach basis if nourishment is needed, the nourishment time is determined based on placement rates. A start nourishment and end nourishment event for the first reach are created. At the end of the nourishment the reach profile is set to the design template and the next reach in processing order is examined to see if nourishment is required. The process continues until all reaches have been covered. The total cost of the nourishment action, including mobilization and placement costs, is calculated.

3.1.3 Engineering

3.1.3.1 Representative Profiles

Coastal process models need to use a detailed distance vs. elevation (x, z) representation of the shoreline. The amount of data required for such a representation is not needed in an economic-engineering type model such as Beach-*fx* and so a simplified representation for the profile has been adopted. This simplified representation for the profile uses five key features, which are dune width, dune height, dune slope, berm width, and berm height. For Beach-*fx* the 11 representative beach profiles based on averages across multiple profiles surveyed within Walton County project area that were used in SBEACH were simplified using these five variables. The resulting configurations of the simplified beach profiles are provided in Appendix A, Engineering Design, Table A-1-21. Comparisons of the representative and simplified beach profiles for Reaches 1 through 5 are plotted in Appendix A, Engineering Design, Figures A-1-49 through A-1-53.

Figure 3B is a depiction of the simplified Beach-*fx* profile. This representation is founded on three assumptions: 1) a single dune, 2) a single berm (no separate construction berm), and 3) an equilibrium submerged profile.

The beach variables that change with storms are dune width, dune height, berm width, and upland width. Beach variables that are unchanged and remain constant throughout the analysis are upland width, dune slope, berm height, foreslope, and shape of the submerged profile. Thus, in response to a given storm, the berm can be eroded or accreted (change in berm width), the dune can change height and/or width, and can translate landward or seaward (change in upland width).

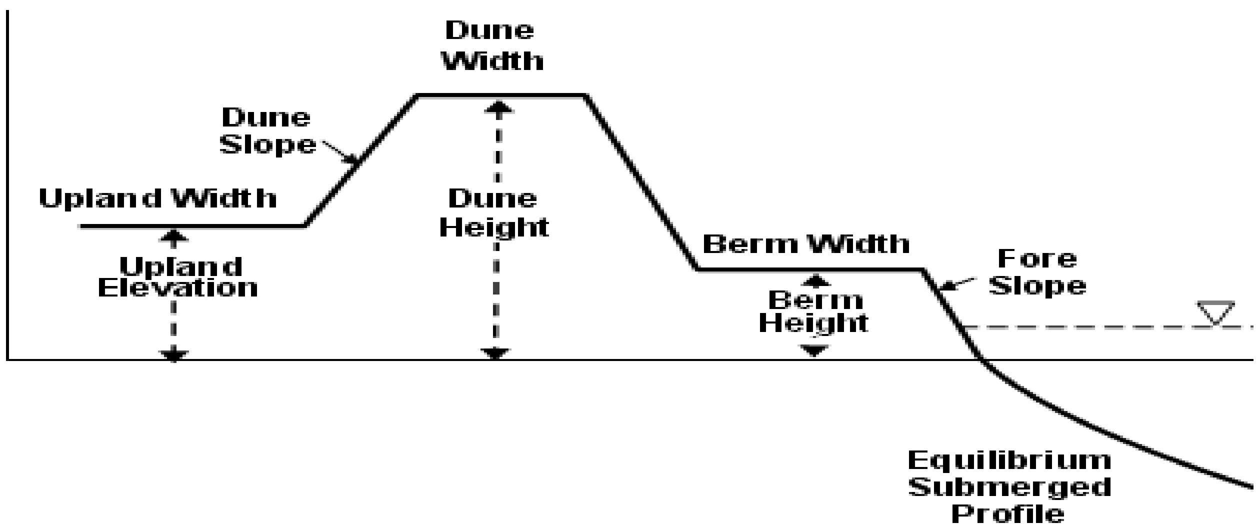


FIGURE 3B. BEACH-*fx* SIMPLIFIED BEACH PROFILE

Figure 4 is a depiction of the simplified Beach-*fx* profile with damage elements viewed in Beach-*fx* model.

In this study, the Beach Morphology Analysis Package (BMAP) was used to develop the representative and simplified beach profiles. BMAP is an integrated set of computer analysis routines developed to support computer simulation of studies of storm-induced beach erosion and to aid in beach-fill design. The software operates on common desktop computers and provides an integrated set of calculation, plotting, and input/output procedures for analyzing beach profile morphology and associated changes.

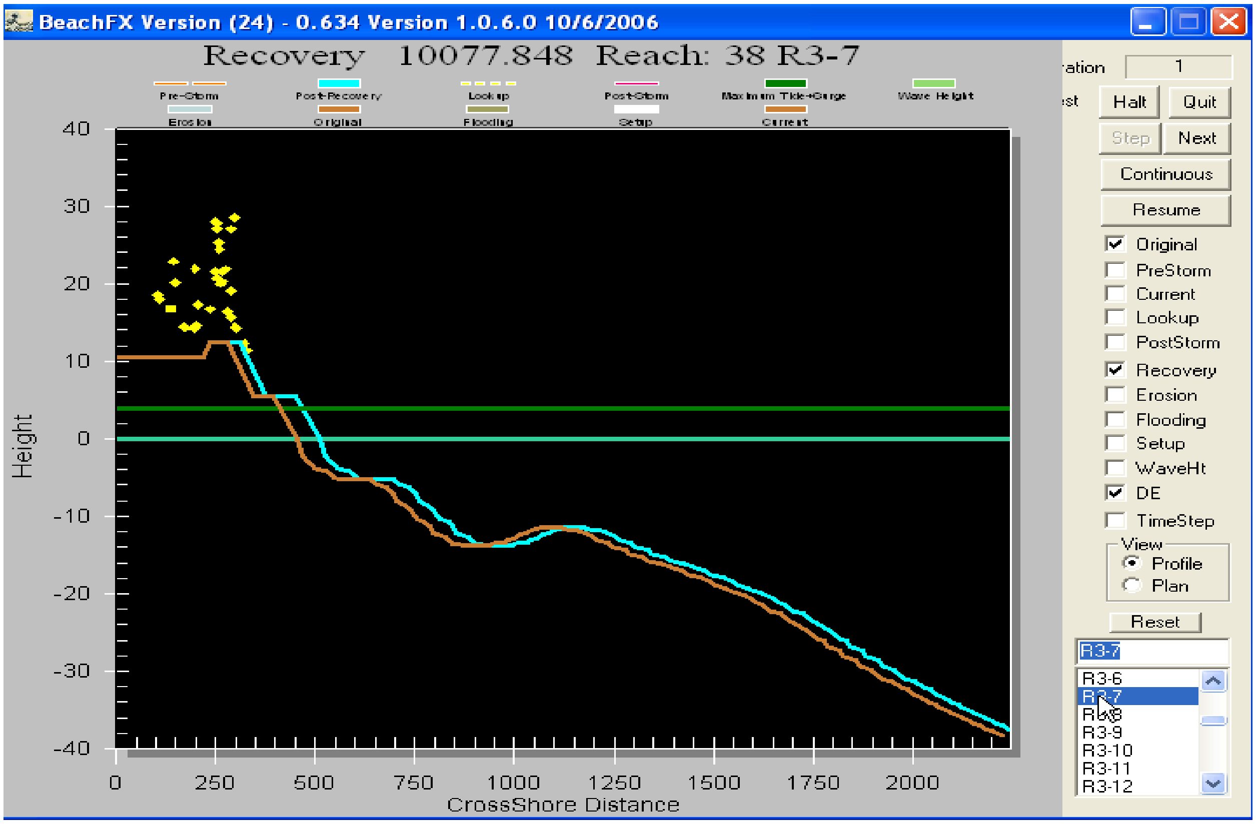


FIGURE 4. CHARACTERIZATION OF A REPRESENTATIVE PROFILE WITH DAMAGE ELEMENTS IN BEACH-*fx*

3.1.4 Storm Set

A set of 46 plausible storms derived from 119 years of available storm record (1886 through 2005), which are specified as storms that generated at least one-foot of storm surge for the study were derived. With the exception of Hurricane Ivan which utilized measurements from local gauges storm surge hydrographs were obtained from numerical estimations from the Dredging Research Program, Tropical Strom Surge Database for the Atlantic and Gulf of Mexico (Scheffner et al., 1994). The historical storm record was extended to the plausible storm suite by assuming that the historical storm could have occurred at various combinations of tidal phase and tidal range, other than the one at which it actually took place, such that for each historical event, 12 plausible storms are generated. This was achieved by combining the historical storm surge hydrograph with 12 possible variations of the astronomical tide. The peak of the storm surge hydrograph was combined with the astronomical tide at high tide, mean tide falling, low tide, and mean tide rising for each of three tidal ranges, corresponding to the lower quartile, mean, and upper quartile tidal ranges. The distribution and sequencing of storms in Beach-*fx* is based on the probabilities determined by the historic record with an applied Poisson distribution to determine the number of storms of each type that will occur in a given hurricane season.

The Monte Carlo simulation uses the same set of storms that were used to create the SRD. As a given storm event from the simulated sequence takes place, the current profile based on updated profiles accounting for Beach-*fx* applied and project-induced shoreline change rate is used to look up the results that are associated with that storm in the SRD for the profile that is 'closest' to the pre-storm profile as tracked in the simulation. These results are then used to define the post-storm profile, to track volume changes, and to determine within-storm erosion, wave heights and water elevations due to the storm along the cross-shore profile.

3.1.4.1 Storm-Induced Beach Change Model (SBEACH)

A pre-computed database of beach profile responses to storms for a range of storms and profiles was generated utilizing the Storm-Induced BEAch CHange Model (SBEACH), (Larson and Kraus 1989).

SBEACH provided estimates of the short-term cross-shore response to a suite of plausible tropical storm events derived from the historical record of tropical storms impacting the Walton County area.

The 11 representative beach profiles generated for the existing condition were modified for various berm and dune configurations as listed in Appendix A, Engineering Design, Table A-1-22. Approximately 436 dune and berm configurations were generated to represent existing conditions. Maximum dune and berm widths were determined based on volumes provided by the Federal Emergency Management Agency (FEMA) post-Hurricane Ivan emergency beach nourishment. FEMA funded the placement of an average of 6 to 8 cy per linear foot of shoreline at specific locations. This study assumes the FEMA emergency nourishment volumes are placed over the entire domain, and emergency placement will be implemented once the existing post-Hurricane Ivan shoreline conditions are reached. Dune widths were modeled in 5 to 10-foot increments from the maximum emergency nourishment width to the existing width. For each dune width, associated berm widths were modeled in 10-foot increments from the maximum emergency nourishment width to a zero berm width (Appendix A, Engineering Design, Figure A-1-54). The SBEACH simulations were conducted to predict the response of each dune and berm configuration to the 552 storms developed for the study. Approximately 240,000 SBEACH simulations were conducted to develop the shoreline responses for the Beach-*fx* shoreline response database described in Section 3.1.4.3.

The dune and berm widths for the with project simulations were determined based on the results of the without project simulations. One profile required a minimum design berm width of 25 feet and the remaining profiles would require a minimum berm width of 50 feet. Dune widening was necessary for two of the representative profiles; however, the existing dune widths were used for the remaining representative profiles. The with-project berm and dune widths were further refined to determine the NED and LP Plans through the Beach-*fx* modeling as described in detail in Appendix B, Economic Investigations.

For the with-project SBEACH simulations, the additional berm and dune configurations were generated to evaluate the increased dune and berm widths for the with project alternative conditions. Similar to the without project conditions, dune widths were modeled in 5 to 10-foot increments, and for each dune width, associated berm widths were modeled in 10-foot increments. Approximately 645 dune and berm configurations were generated, and approximately 356,000 SBEACH simulations were conducted to predict the response of the with project conditions to the 552 storms. The initial and predicted responses of each dune and berm configuration were incorporated into the shoreline response database for subsequent Beach-*fx* model simulations. It should be noted that the sediment characteristics of the identified borrow source is coarser then the natural beach, which would tend to present a slightly steeper offshore profile that would be slightly less resistant to erosion. As a conservative approach in SBEACH all design and simulated profile adjustments were made assuming the same grain size as the native beach as detailed in the Taylor, 2003 report.

3.1.5 Generalized Model for Simulating Shoreline Change (GENESIS)

The Generalized Model for Simulating Shoreline Change (GENESIS) (Hanson and Kraus 1989) provided estimates of long-term shoreline response to existing and without project conditions. GENESIS results were used in Beach-*fx* to provide an estimate of long-shore dispersion (i.e. spreading out of the fill material) or project induced shoreline change. These estimates are determined through comparison of predicted with- and without- project shoreline change rates. The difference between these shoreline change rates are entered into the model, on a renourishment cycle basis to account for end losses from the nourishment area. Details on GENSIS and Beach-*fx* calibration can be found in Appendix A, Engineering Design.

3.1.6 Shoreline Response Database (SRD)

The SRD is a relational database used to pre-store results of SBEACH runs for all plausible storms, and a range of pre-defined profiles, as expressed by ranges of berm width, dune width, and dune height. Two kinds of results from SBEACH are stored: changes in berm width, dune width, dune height, and upland width, and cross-shore profiles of erosion, wave height, and water depth. The SRD is site and study specific, that is, it is created for each shore protection study. The SRD, once generated, is used as a 'lookup table' by the Monte Carlo simulation. Within the Monte Carlo simulation, the shoreline modifications are tracked continuously by the simplified profile representation (primarily dune width and height and berm width). The driving force for profile change is the list of plausible storms. These plausible storms are then used to create SBEACH input, which is run against a range of profiles that is expected to cover the range of natural and managed profiles as described in further detail in Section 3.2.4.1 and Appendix A, Engineering Design. For each such pair (storm and profile), both simplified and detailed SBEACH results are stored in the SRD. The output of SBEACH for a given run is an ASCII file that describes the initial, final, maximum, and minimum cross-shore profiles, and the water and wave heights along the cross-shore. This file must be post-processed by software that extracts the values of changes in berm width, dune width, and dune height, and stores the information in the SRD.

3.2 EXISTING CONDITIONS

3.2.1 Demographics

Walton County is located in the State of Florida. The county is comprised of about 1,058 square miles of area. The 2010 estimated population is 55,043 persons which is a 36 percent increase over the base population estimate of 40,601 in 2000 making it one of the fastest growing counties in Florida. The population density is about 53 persons per square mile and the estimated number of housing units in 2010 was 45,132 1,859. The median household income was $47,273 with 14.6 percent of population estimated to be living below the poverty level. The median value of owner-occupied housing was $199,800. The racial makeup of the county in 2010 was estimated at 89.5 percent white, 6.2 percent African American, 5.5 percent of Hispanic or Latino origin, 0.9 percent American Indian and Alaska Native, and 1.0 percent Asian, with 2.2 percent of the population comprised of two or more races. The Gulf of Mexico borders Walton County to the south and, along with its four neighboring counties, its shoreline comprises part of 200 miles of Gulf beaches in the Florida Panhandle. In Figure 5, from west to east, the Florida Panhandle counties are as follows: Santa Rosa, Okaloosa, Walton, Bay, and Gulf.

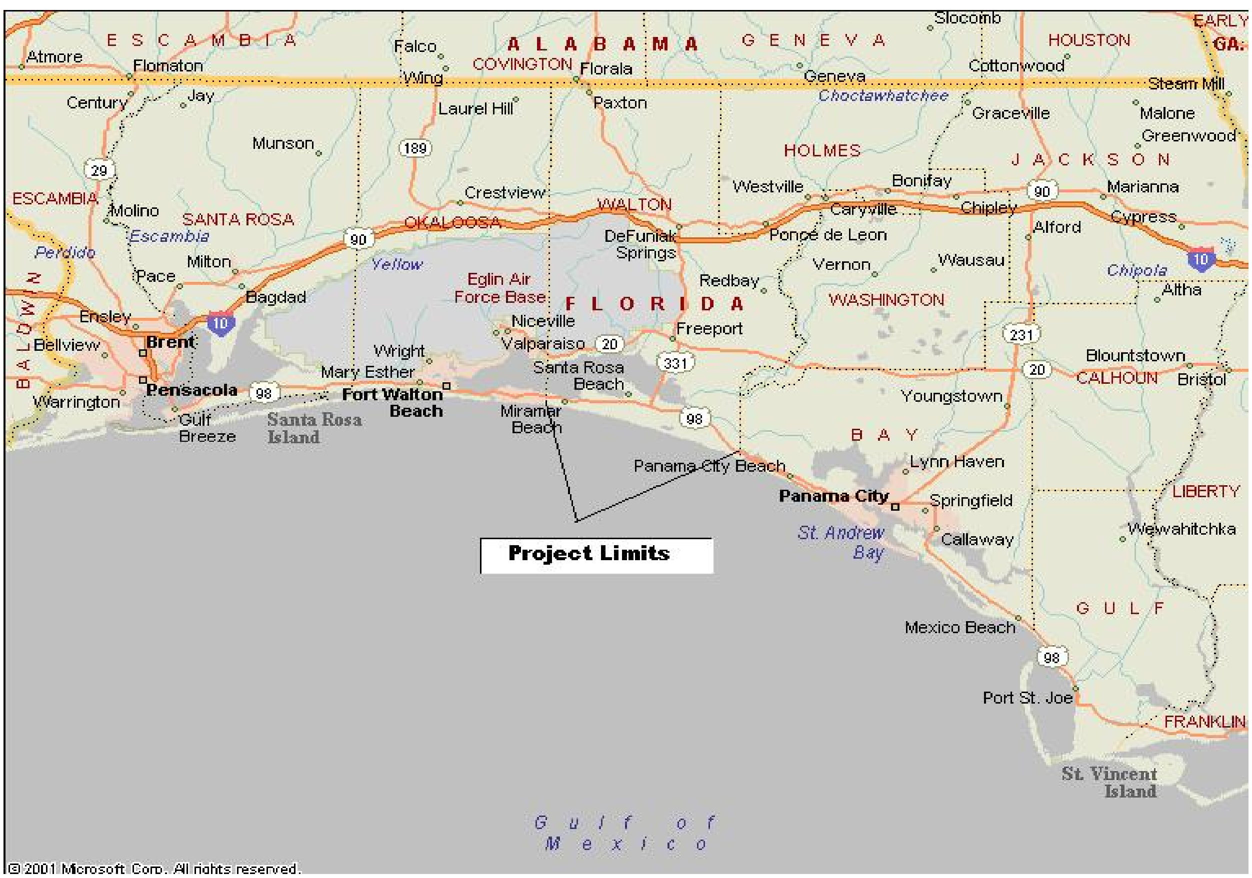


FIGURE 5. COUNTIES OF INTEREST

3.2.2 Population

All five counties experienced population growth from 1990 to 2010. Combined, the counties grew by about 46 percent, roughly equaling the growth rate of Florida for that same time frame. Out of the five counties, Okaloosa County has the highest population, 180,882, and Gulf County the lowest, 15,863. Most the growth took place in Santa Rosa and Walton Counties. Walton County led in growth from 1990 to 2010 by increasing over 98 percent followed by Santa Rosa County with a growth of 85 percent.

3.2.3 Employment

From 1990 to 2010 the number of persons in Florida's labor force increased by 49.3 percent. Four of the five counties in the study area exceeded the state's increase except for Gulf County which had only a 31.2 percent increase. The highest percentage labor force increase occurred in Walton County, a 151.4 percent increase, Santa Rosa County was the second highest gaining county with a 91 percent increase. The state's unemployment rate for 2010 was a high 11.3 percent but all five counties in the study area had lower rates. Bay County had the highest unemployment rate with 10.3 percent and the lowest was 8.1 percent in Okaloosa County.

3.2.4 Households

All five counties experienced a significant increase in the number of households from 1990 to 2010. Santa Rosa and Walton Counties had the greatest growth in the number of households. Of the five counties, Okaloosa led with 72,400 households in 2010. The median household income also increased from 1989 to 2010 for the five counties. Of the five counties, Okaloosa County had the highest median household income in 2010, but Walton County had the greatest percentage increase from 1989 to 2010, 122 percent. The median household income for Santa Rosa, Bay and Okaloosa Counties were higher than that of the State of Florida in 2010.

3.2.5 Study Reaches

Walton County's 26 miles of coastline initially was subdivided into study reaches that very nearly coincided with the neighborhood divisions that already existed in the county's coastal community. That division resulted in 10 major study reaches initially formulated for project delineation identical to those in Taylor Engineering (2003) (see Table 1). The 2003 Beach Management Feasibility Study for Walton County (Taylor Engineering, 2003) defined 10 reaches based on profile geomorphology (dune or bluff profiles), shoreline orientation, nature of upland development (existence of structures encroaching on the active beach profile region), and state-designated critical erosion areas.

Damages to the Walton County coastal area wrought by Hurricane Ivan in 2004 prompted call for expediting the study process and getting the feasibility report complete ahead of the planned schedule outlined in the Project Management Plan (PMP). The Project Delivery Team (PDT) proposed a plan for expediting the study process. That plan included reducing the number of study reaches to five. This was made possible

TABLE 1
INITIAL MAJOR STUDY REACHES

Reach	Reach Name
1	Miramar Beach to Sandestin
2	Sandestin and 4 Mile Village
3	Topsail Hill Preserve State Park
4	Beach Highlands and Dune Allen
5	Santa Rosa Beach
6	Blue Mountain Beach
7	Gulf Trace, Grayton Beach, Grayton Beach State Park and Watercolor
8	Seaside and Seagrove
9	Deer Lake State Park, Watersound and Seacrest West
10	Seacrest West, Rosemary beach and Inlet Beach

because significant upper bluff erosion occurred due to Hurricane Ivan in September of 2004. Hurricane Ivan removed a significant portion of physiographic differences in the shoreline, thus reducing the number of representative profiles needed to account for variation between and among reaches.

Due to the effects of Hurricane Ivan on the beach the PDT decided that the project existing conditions had changed significantly. As a result new surveys of the beach were ordered and obtained. A new existing condition was established and named post-Ivan. That existing condition then became the initial point of beach condition (base condition) for the period of analysis.

Five major study reaches listed in Table 2 were delineated for easy reference and visualization of the approximately 26-mile study area by grouping similar morphologic features, neighborhoods and subdivisions post Hurricane Ivan. These study reaches were numbered from Reach 1 to Reach 5 running west to east in the study area.

The PDT sought out, briefed and obtained from all the affected stakeholders approval of the expedited study plan which resulted in a revised PMP.

TABLE 2
REVISED MAJOR STUDY REACHES

Reach	Reach Name
1	Miramar Beach, Sandestin and Four Mile Village
2	Topsail Hill Preserve State Park
3	Beach Highlands, Dune Allen, Santa Rosa Beach, Blue Mountain and Gulf Trace
4	Grayton Beach State Park, Grayton Beach
5	Watercolor, Seaside, Seagrove, Watersound Seacrest Rosemary and Inlet Beach

3.2.6 Study Reaches Hierarchy and Naming

The study reach hierarchy begins with the five study reaches shown in Figure 6. Within these reaches there are 117 sub-reaches or Beach-*fx* model reaches, which are the same except for their naming convention.

Early on in the study the PDT delineated the 26-mile study area into smaller increments named 'sub-reaches' which were about 1,000 feet in length, some longer, a few shorter but the majority averaged 1,000 feet. This was a very convenient way of defining the smallest reach unit since profiles were taken about every 1,000 feet and the Florida Department of Environmental Protection (FDEP) had set monuments about the same 1,000-foot spacing. This portioning created 117 sub-reaches which were numbered running from west to east, beginning with one and ending at 117.

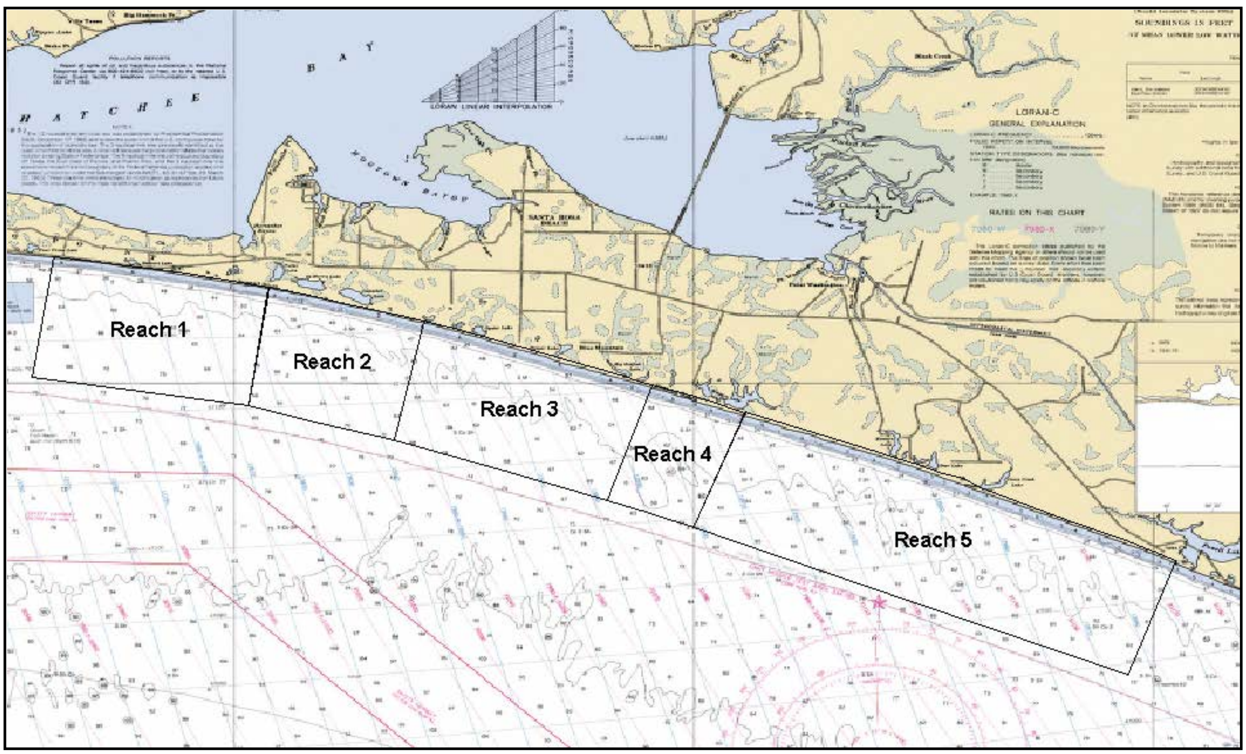


FIGURE 6. REVISED STUDY REACHES

The naming scheme for the 117 Beach-*fx* model reaches was symbolized by 'RX-Y; the R is Reach, the X is the study reach designator and the Y or YY is the numeric reach designator, whose value ranges from 1 to a maximum of 51, to represent the number of approximate 1,000-foot sub-reaches in one of the five study reaches. Also, the Y or YY value was reset to begin at one within each of the five study reaches again with the numbering increasing from the west to the east.

The post-Ivan survey data was employed to produce revised representative profiles. Based on an assessment historical and current beach profile surveys in the project area contiguous stretched of the shoreline that shares a common morphological makeup were delineated. This assessment reduced the number of representative profiles to 11.

Reaches 1, 2, 3, and 4 could be represented by two profiles each while Reach 5 required three representative profiles (Appendix A, Engineering Design, Figures A-1-11 to A-1-15). These representative profiles characterized the typical without project beach morphology for input into Beach-*fx*.

In the with-project condition these profiles are combined with alternative design templates to characterize that condition for various beach fill alternatives. Table 3 lists the various sub-reaches and associated profiles.

TABLE 3
WALTON COUNTY STUDY AREA – SUB-REACHES, MODEL REACHES, AND REPRESENTATIVE PROFILES

Sub-Reach	FDEP Monument	Beach-*fx* Model Reach	Representative Profile	Study Reach
1	R-1	R1-1	R1P1	**1**
2	R-2	R1-2	R1P1	**1**
3	R-3	R1-3	R1P1	**1**
4	R-3A	R1-4	R1P1	**1**
5	R-4	R1-5	R1P1	**1**
6	R-5	R1-6	R1P1	**1**
7	R-6	R1-7	R1P1	**1**
8	R-6A	R1-8	R1P1	**1**
9	R-7	R1-9	R1P1	**1**
10	R-8	R1-10	R1P1	**1**
11	R-9	R1-11	R1P1	**1**
12	R-10	R1-12	R1P1	**1**
13	R-11	R1-13	R1P1	**1**
14	R-12	R1-14	R1P1	**1**
15	R-13	R1-15	R1P2	**1**
16	R-14	R1-16	R1P2	**1**
17	R-15	R1-17	R1P2	**1**
18	R-16	R1-18	R1P2	**1**
19	R-17	R1-19	R1P2	**1**
20	R-18	R1-20	R1P2	**1**
21	R-19	R1-21	R1P1	**1**
22	R-20	R1-22	R1P1	**1**
23	R-21	R1-23	R1P1	**1**
24	R-22	R1-24	R1P1	**1**
25	R-23	R2-1	R2P1	**2**
26	R-24	R2-2	R2P1	**2**
27	R-25	R2-3	R2P2	**2**
28	R-27	R2-4	R2P1	**2**
29	R-29	R2-5	R2P2	**2**
30	R-30	R2-6	R2P1	**2**
31	R-40	R2-7	R2P1	**2**
32	R-41	R3-1	R3P1	**3**
33	R-42	R3-2	R3P1	**3**
34	R-43	R3-3	R3P1	**3**
35	R-44	R3-4	R3P2	**3**
36	R-45	R3-5	R3P2	**3**
37	R-46	R3-6	R3P2	**3**
38	R-47	R3-7	R3P2	**3**
39	R-48	R3-8	R3P1	**3**
40	R-49	R3-9	R3P1	**3**
41	R-50	R3-10	R3P1	**3**
42	R-51	R3-11	R3P1	**3**
43	R-52	R3-12	R3P1	**3**
44	R-53	R3-13	R3P1	**3**
45	R-54	R3-14	R3P1	**3**

TABLE 3
WALTON COUNTY STUDY AREA – SUB-REACHES, MODEL REACHES, AND REPRESENTATIVE PROFILES

Sub-Reach	FDEP Monument	Beach-*fx* Model Reach	Representative Profile	Study Reach
46	R-55	R3-15	R3P1	**3**
47	R-56	R3-16	R3P1	**3**
48	R-57	R3-17	R3P1	**3**
49	R-58	R3-18	R3P1	**3**
50	R-59	R3-19	R3P1	**3**
51	R-60	R3-20	R3P1	**3**
52	R-61	R3-21	R3P1	**3**
53	R-62	R3-22	R3P1	**3**
54	R-63	R3-23	R3P1	**3**
55	R-64	R3-24	R3P2	**3**
56	R-65	R3-25	R3P2	**3**
57	R-66	R3-26	R4P1	**4**
58	R-67	R4-1	R4P1	**4**
59	R-68	R4-2	R4P1	**4**
60	R-69	R4-3	R4P2	**4**
61	R-70	R4-4	R4P2	**4**
62	R-71	R4-5	R4P1	**4**
63	R-72	R4-6	R4P2	**4**
64	R-73	R4-7	R4P2	**4**
65	R-74	R4-8	R4P1	**4**
66	R-76	R4-9	R4P1	**4**
67	R-78	R5-1	R5P2	**5**
68	R-79	R5-2	R5P2	**5**
69	R-80	R5-3	R5P2	**5**
70	R-81	R5-4	R5P2	**5**
71	R-82	R5-5	R5P2	**5**
72	R-83	R5-6	R5P1	**5**
73	R-84	R5-7	R5P1	**5**
74	R-85	R5-8	R5P1	**5**
75	R-86	R5-9	R5P2	**5**
76	R-87	R5-10	R5P2	**5**
77	R-88	R5-11	R5P2	**5**
78	R-89	R5-12	R5P2	**5**
79	R-90	R5-13	R5P2	**5**
80	R-91	R5-14	R5P2	**5**
81	R-92	R5-15	R5P2	**5**
82	R-93	R5-16	R5P2	**5**
83	R-94	R5-17	R5P3	**5**
84	R-95	R5-18	R5P2	**5**
85	R-96	R5-19	R5P3	**5**
86	R-97	R5-20	R5P2	**5**
87	R-98	R5-21	R5P2	**5**
88	R-99	R5-22	R5P3	**5**
89	R-100	R5-23	R5P3	**5**
90	R-101	R5-24	R5P2	**5**

TABLE 3 WALTON COUNTY STUDY AREA – SUB-REACHES, MODEL REACHES, AND REPRESENTATIVE PROFILES				
Sub-Reach	**FDEP Monument**	**Beach-*fx* Model Reach**	**Representative Profile**	**Study Reach**
91	R-102	R5-25	R5P2	**5**
92	R-103	R5-26	R5P1	**5**
93	R-103A	R5-27	R5P3	**5**
94	R-104	R5-28	R5P3	**5**
95	R-105	R5-29	R5P2	**5**
96	R-106	R5-30	R5P2	**5**
97	R-107	R5-31	R5P2	**5**
98	R-108	R5-32	R5P1	**5**
99	R-109	R5-33	R5P1	**5**
100	R-110	R5-34	R5P1	**5**
101	R-111	R5-35	R5P1	**5**
102	R-112	R5-36	R5P1	**5**
103	R-113	R5-37	R5P1	**5**
104	R-114	R5-38	R5P1	**5**
105	R-115	R5-39	R5P1	**5**
106	R-116	R5-40	R5P2	**5**
107	R-117	R5-41	R5P2	**5**
108	R-118	R5-42	R5P2	**5**
109	R-119	R5-43	R5P2	**5**
110	R-120	R5-44	R5P2	**5**
111	R-121	R5-45	R5P2	**5**
112	R-122	R5-46	R5P2	**5**
113	R-123	R5-47	R5P2	**5**
114	R-124	R5-48	R5P3	**5**
115	R-125	R5-49	R5P3	**5**
116	R-126	R5-50	R5P3	**5**
117	R-127	R5-51	R5P3	**5**

3.2.7 Public Access and Parking

Current shore protection guidance provides for Federal participation in restoring and protecting publicly owned shores available for use by the general public. Typically, beaches must be either public or private with public easements/access to allow Federal involvement in providing shoreline protection measures. Private property can be included, provided that the protection and restoration is incidental to protection of publicly owned shores or if such protection would result in public benefits. Table 4 lists the location of the access points and the parking availability along the shoreline of Walton County. Not all reaches contain access points. Figures 7A, 7B, and 7C are aerial depictions of the access points that are presented for the entire shoreline of Walton County. Each parking space assumes 4.5 persons per vehicle multiplied by 1.5 turnovers per day to yield visits parking will support.

TABLE 4
WALTON COUNTY ACCESS AND PARKING

Construction Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
1	R1-3	Miramar Beach Regional Access West	85	574
1	R1-4	Miramar Beach Regional Access East	85	574
1	R1-10	Scenic Gulf Drive	100	675
1	R1-12	735 Scenic Gulf Drive	0	0
1	R1-14	132 Norwood Drive	0	0
1	R1-15	Open Gulf Street	0	0
1	R1-16	~ 90 Beach Drive	6	41
1	R1-17	253 Sand Trap Road	3	20
1	R1-18	End of Tango De Mer	0	0
1	R1-22	San Destin Day Use Area	110	743
1	R2-1	719 Top Sail Hill Road	0	0
2	R3-4	363 Highland Avenue	5	34
2	R3-4	127 Highland Avenue	0	0
2	R3-5	Dune Allen 5753 W. Co Hwy 30A	75	506
2	R3-9	5605 Co Hwy 30A	0	0
2	R3-9	5173 Co Hwy 30A	15	101
2	R3-9	4991 W. Co Hwy 30A	0	0
2	R3-10	4850 W. Co Hwy 30A	5	34
2	R3-11	Gulf Place West Access Point	13	88
2	R3-12	Gulf Place Middle Access Point	13	88
2	R3-13	Gulf Place East Access Point	14	95
2	R3-11	4447 W Co Hwy 30A	42	284
2	R3-13	92 South Spooky Lane	0	0
2	R3-14	4201 Co. Hwy 30A	0	0
2	R3-14	186 Gulf View Heights Street	30	203
2	R3-21	2365 S. Co Hwy 83	22	149
2	R3-21	446 Blue Mountain Road	5	34
2	R3-21	590 Blue Mountain Road	5	34
2	R3-21	726 Blue Mountain Road	5	34
3	R4-5	125 Sandy Lane	12	81
3	R4-6	288 Garfield St.	41	277
3	R4-6	199 Banfill Street	41	277
3	R4-6	208 Holtz Avenue	0	0
3	R4-7	91 Boat Ramp Road	0	0

TABLE 4 (CONTINUED)
WALTON COUNTY ACCESS AND PARKING

Sub- Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
3	R4-6	913 Main Park Road	0	0
4	R5-2	Van Ness Butler Jr. Beach Access and parking and Watercolor Parking Garage and access	100	675
4	R5-4	Seaside (Access & Parking)	60	405
4	R5-5	2560 Co Hwy 30A	0	0
4	R5-6	2624 Co Hwy 30A	2	14
4	R5-6	2680 Co Hwy 30A	0	0
4	R5-6	~ 2750 Co Hwy 30A	0	0
4	R5-6	2790 Co Hwy 30A	32	203
4	R5-7	2845 Co Hwy 30A	0	0
4	R5-7	2920 Co Hwy 30A	0	0
4	R5-8	3020 Co Hwy 30A	4	27
4	R5-9	118 Montgomery Street	0	0
4	R5-9	52 S Andalusia St	0	0
4	R5-9	South end of Dothan Avenue on Montgomery Street	0	0
4	R5-10	3458 E. Co Hwy 30A - San Juan Neighborhood B A	20	135
4	R5-10	3512 E. Co. Hwy 30A	0	0
4	R5-10	3576 E. Co Hwy 30A - Pelaya Neighborhood B A	0	0
4	R5-12	3694 E. Co Hwy 30 A - Campbell Street Neighborhood	75	506
4	R5-12	3874 E. Co Hwy 30A	20	135
4	R5-13	57 Seagrove Place	9	61
4	R5-18	679 Eastern Lake Road	6	41
4	R5-18	491 Eastern Lake Road #33 - Eastern Lake N B A	0	0
4	R5-18	188 San Roy Road - neighborhood come out to helio	0	0
4	R5-19	11 Beachside Dune - Sugar Dune	16	108
4	R5-20	258 Beachfront Trail - Walton Dune	10	68
4	R5-22	308 Beachfront Trail	10	68
4	R5-22	Beachside Drive	16	108
5	R5-22	Deer Lake State Park	1	7
5	R5-32	8040 E. Co Hwy 30A - Gulf Lakes Neighborhood B A	0	0

TABLE 4 (CONTINUED)
WALTON COUNTY ACCESS AND PARKING

Sub- Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
5	R5-34	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	10	68
5	R5-35	Saint Lucia Lane	100	675
5	R5-35	Rosemary Avenue	0	0
5	R5-35	8520 E. Co Hwy 30A - Seacrest Drive Neighborhood B A	0	0
5	R5-46	East Water Street	50	338
5	R5-46	East Water Street	50	338
5	R5-46	188 Winston Lane Beach Access	5	34
5	R5-47	264 South Wall Street - Wall Street Neighborhood	9	61
5	R5-47	435 West Park Place Ave.	67	452
5	R5-48	139 South Orange Street	67	452
5	R5-49	118 West Park Place Avenue FL #20	67	452
5	R5-50	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101
TOTALS		73 Access Points	1,553	10,478

FIGURE 7A
AERIAL SHOWING PARKING AND ACCESS POINTS

FIGURE 7B
AERIAL SHOWING PARKING AND ACCESS POINTS

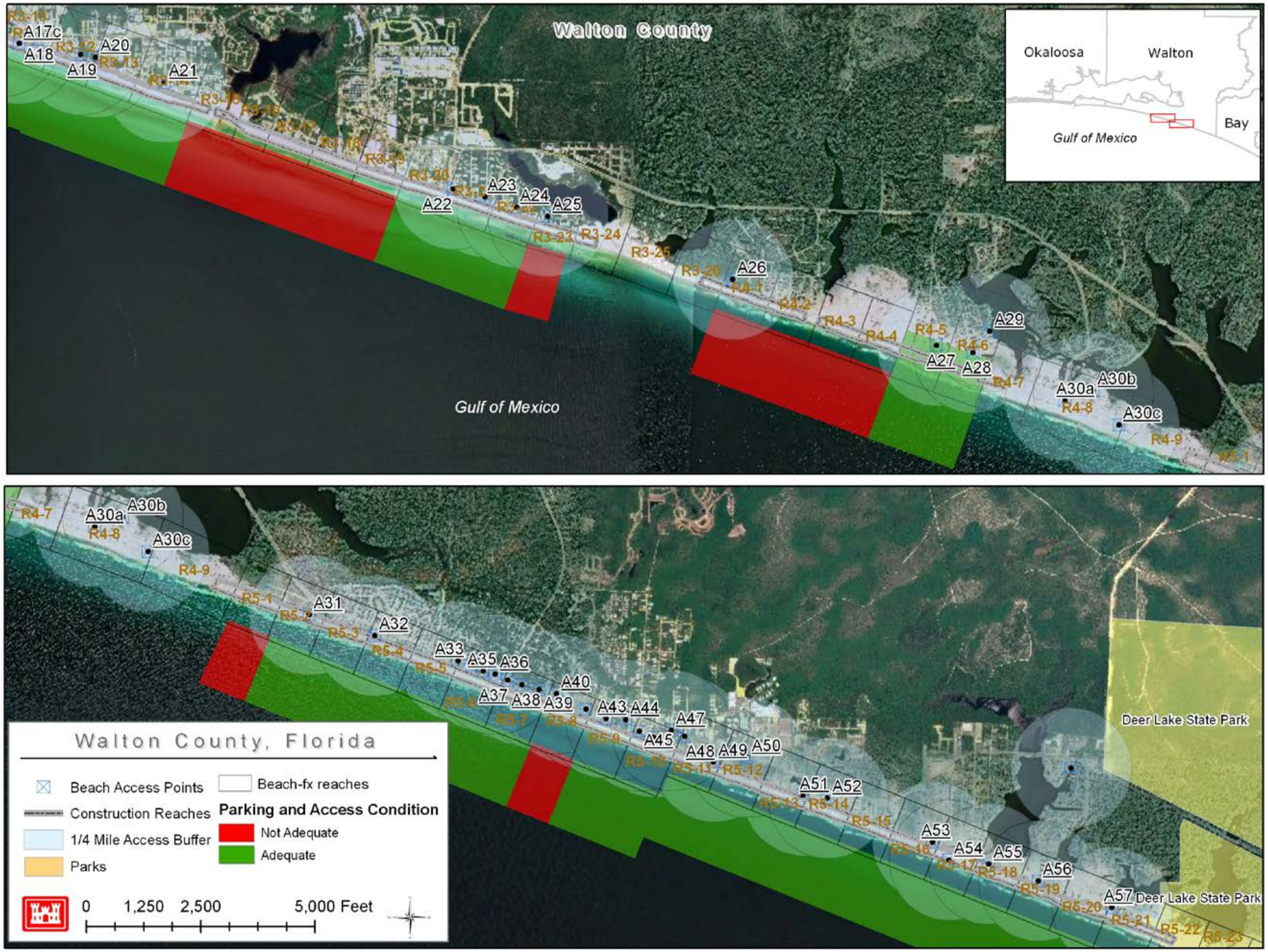
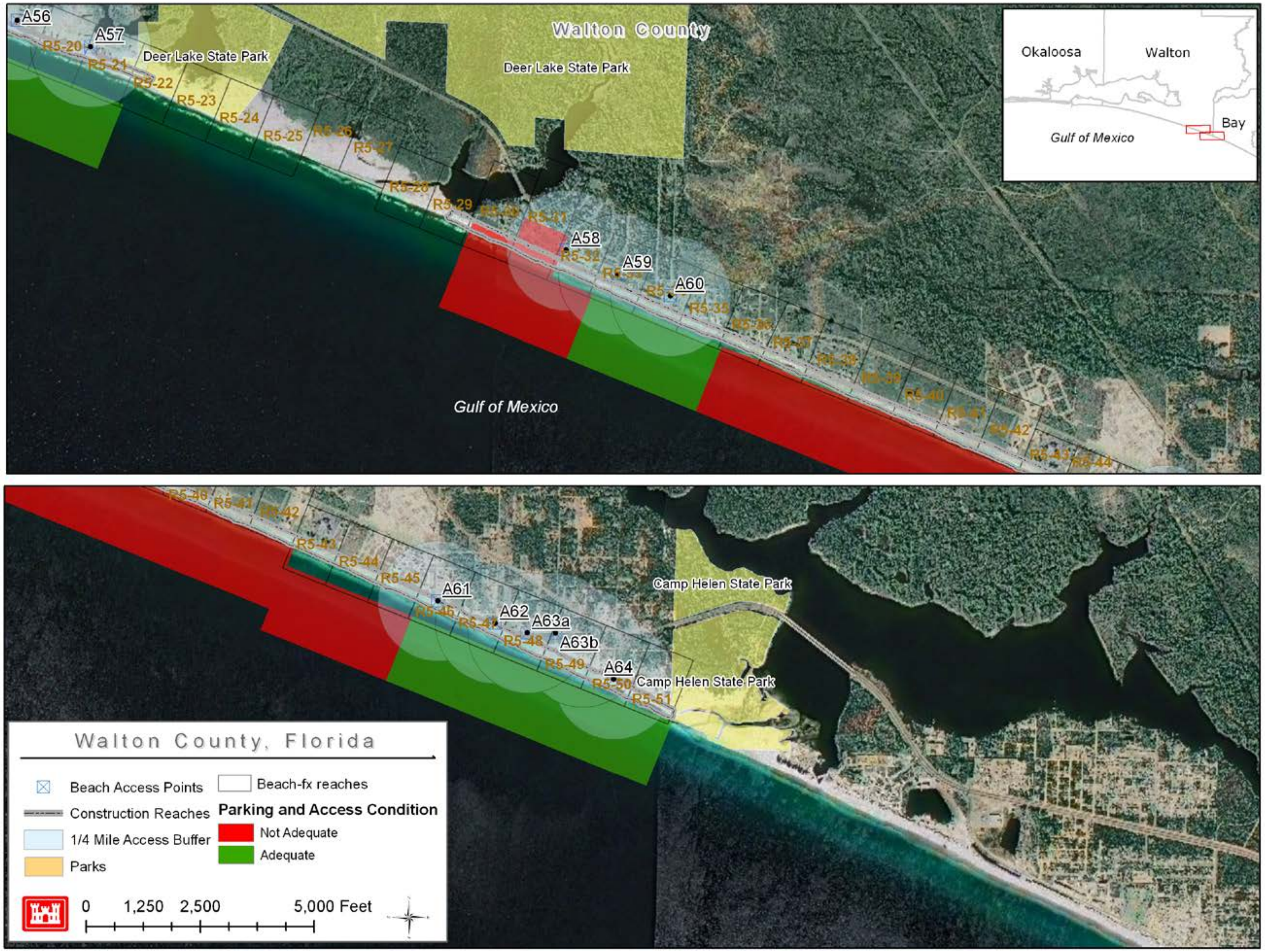


FIGURE 7C
AERIAL SHOWING PARKING AND ACCESS POINTS



3.2.8 Land Use

The coastal beach community layout is somewhat typical of other beach and shoreline development along the Gulf Coast; a checkerboard pattern of single and multi-family residential areas intermixed with a few commercial areas. Walton County's beach shoreside development has less commercial trade on the front row shoreline probably due to the high cost of the land and real estate taxes which affects profitability. Instead, most commercial trade establishments prefer to locate on the north side of the beach road.

The current trend in land use on the shoreline continues to be principally single and multi-family development, with little commercial trade development.

3.2.8.1 State Parks

There are three state parks in the Walton County Study area. They feature great diversity and natural beauty.

Grayton Beach State Park

Grayton Beach State Park is located south of U.S. Hwy 98 approximately halfway between Panama City Beach and Destin. Grayton Beach State Park offers a wide variety of activities for the visitor. Along with the beaches, there are two trails in the 2,228-acre coastal park. There are also 35 campsites with camping and cabin rentals with an additional 22 campsites to be provided in a renovation project that also includes a new ranger station and enhanced Americans with Disabilities Act (ADA) accessibility and boardwalks.

Topsail Hill Preserve State Park

Topsail Hill Preserve State Park features one of the most diverse natural eco-systems in the state, with wet prairies, scrub, pine flatwoods, marshes and cypress domes. The park has more than three miles of beaches and five dune lakes. The lakes total more than 170 acres within the 1,637 acre park. In addition to the beaches, this recreation area provides opportunities for bicycling, camping, fishing, nature trails, picnicking, scuba, and swimming. The park has a 2.5 mile long maritime nature trail which traverses ancient dunes and scrub communities. The park has RV accommodations, with 156 sites and 16 rental cabins. Topsail Hill Preserve State Park is located in Santa Rosa Beach about 10 miles east of Destin, Florida.

Deer Lake State Park

The Deer Lake State Park on County Hwy 30A, just west of Watersound, offers park goers a look at intact ancient sand dunes and vast ecosystems. The park has an area of approximately 2,000 acres, the majority of which lies on the north side of the park across County Hwy 30A. A walking trail approximately one mile long is located in the wooded area in the northern portion of the park. The park has recently completed a remodeling project on the walkway to the beach providing ADA accessibility.

3.2.9 Future Development

Development is both ongoing and continuous at Walton County, as it is likely to continue into the immediate and the near future until the small amount of remaining beachfront, save the state and county properties, is completely developed. The characteristic of the existing beachfront is composed of single and multi-family housing. The multi-family housing includes 29 multi-floored condominiums and resort complexes consisting of four floors or more.

3.2.10 Property Inventory

Recent beachfront development in Walton County has predominately been high-rise condominiums, residential resorts and residential communities. Currently, there is a height restriction of four stories or 50 feet for coastal structures in Walton County; however, there are a number of structures in excess of this height restriction that were either constructed prior to or have been granted waivers subsequent to the height restriction. Most of the coastal area that is not state or county property is highly developed. Construction of new single and multifamily residential structures is ongoing at a brisk pace. The few remaining undeveloped large private holdings are showing signs of infrastructure preparations for development.

In the spring of 2004, a complete property inventory of existing structures that may benefit from a storm damage reduction project was undertaken. In 2010, a windshield survey of the study area was undertaken. That survey revealed no significant changes had occurred since the last inventory was completed. Some structures that were under construction are now fully constructed. They were already entered in the initial property inventory along with their values. The purpose of this inventory is to gather data required for the Beach-*fx* data inputs and to obtain a database that would facilitate the gathering of critical metrics that locate the structure spatially in relation to the shoreline and the beach profile as well as its elevation. Routinely, recreational facilities that are damaged or destroyed by storm events are repaired or rebuilt.

Beach-*fx* considers the inventory of structures (damage elements) as items that are containerized in ‘lots’. Lots form boundaries that contain damage elements. Lots are defined as quadrilaterals that approximate lot parcels as delineated in the tax assessor’s files, databases and Geographic Interface Systems (GIS). An aggregation of lots that are for the most part contiguous composes a reach. All reaches taken in aggregate compose the study area.

Photos of structures along with pertinent statistics of construction and foundation type, number of floors, and accompanying detached structures that may benefit from a project were also collected.

The result of that inventory is displayed in Table 5.

TABLE 5
STRUCTURE INVENTORY COUNT BY REACH BY TYPE

Damage Element	Major Study Reach				
	1	2	3	4	5
Commercial	10		1	7	13
Single-Family	99		268	118	348
Multi-Family	62		37	21	99
Walkovers	151		189	20	263
Pool	36		12	9	84
Gazebo	4		7		7
Jacuzzi	4				
Total	366		514	175	814
Grand Total	1869				

3.2.11 Value Of Coastal Inventory

3.2.11.1 Structure Value

The depreciated replacement cost of structures in the study area is required for the economic analysis to determine NED benefits.

The Mobile District Real Estate Division conducted investigations to determine the depreciated replacement cost for single family residential structures. Depreciated replacement cost is based on a combination of adjusting criterion using a formula that takes into account the category and age of the structure. Replacement cost is the cost of physically replacing the structure. Depreciation accounts for deterioration occurring prior to flooding and variations in remaining useful life of the structure. Depreciated replacement cost was calculated for a representative sample of fifty structures. Tax Assessor assessed values for improvements (net of land value) are compared to the calculated depreciated replacement cost to yield a ratio to estimate that is used to estimate the remaining structures depreciated replacement cost. The point estimate served as the mean or average value random variable in Beach-*fx*. The low and high estimates around the mean were developed by using plus and minus 10 percent of the mean value to represent plus and minus one standard deviation's variance around the likely value. Tax Assessor's records were examined and studied on the current inventory. Variables of interest relating to assessed value, date of construction, type of construction, number of floors, square footage, recent sales and selling prices, along with other information was analyzed. Sampling techniques, professional judgment, professional guidelines, and consultations with the tax assessor's office and field visits composed of methods used to complete the investigations.

Some of the findings from that analysis were that there were two significantly different classes of valuations between the types of development in Walton County: pre-1990 construction and post-1990 construction. The handful of pre-1990 typical construction was generally less than 1,800 square foot, one-story structures. Many were on grade and most were of masonry or brick construction and only a few made of wood. Assessed values for these structures were very low when compared to calculated depreciated replacement costs. The value of the land has outgrown the value of the structure. When these structures are sold they are usually torn down for larger and more expensive ones. On average they were assessed about one-half of their depreciated replacement cost. The Walton inventory for these structures saw their assessed value increased by 200 percent to arrive at their true depreciated replacement cost.

Post-1990 construction was much larger than 1,800 square feet and most are multi-storied structures. The division between masonry, and wood was about equal for the majority of structure while the remaining minority was brick or wood. A representative sample of 51 properties were selected and used by the Mobile District's appraiser to calculate the depreciated replacement cost to determine the ratio to convert the remaining structure to depreciated replacement cost. The agreed upon methodology for determining depreciated replacement cost was to estimate replacement cost as 125 percent of assessed value.

A relationship between assessed values and depreciated replacement cost for multi-family structures was found to be highly variable and not reliable. The methodology that would render the best estimate of depreciated replacement cost for these structures was to begin with current per square foot construction costs and depreciates that value by two percent each year of age. Current construction costs developed from activity in the last five years was estimated to be $160.00 a square foot for construction less than 20,000 square feet and $175.00 per square foot for construction greater than 20,000 square feet.

Telephonic conversations with the Walton County Tax Assessor about trends in the market from 2008 to date reveals that for South Walton County, all lands south of Choctawhatchee Bay, began to show a slight decline of about 5.7 percent. The decline continued into 2009 and 2010 with 22 and 18 percent reductions, respectively. The fall slowed in 2011 showing a 4.5 percent decrease and increased just slightly in 2012 by one-tenth of one percent.

Walkovers were valued at an average $200.00 per linear foot for wood structures and $320.00 per linear foot for structures constructed from a commercially produced composite called 'Trex' that was used for public access provided by the TDC's public accesses. The values were obtained by the TDC from recent invoices for walkovers and their own access construction costs. Pool values were based on an average updated composite value obtained by interviews and sampling for an earlier study in neighboring Bay County. The few jacuzzis and tennis court values were based on typical sized units at current costs.

3.2.11.2 Content Value – Structure-Content Ratio

The National Flood Insurance Agency (NFIA) claims database was searched for paid claim history in Walton and the neighboring counties of Bay, Okaloosa and Fort Walton. These records show the date of the loss and what was paid for building and content loss for each claim. No claims were found for any of these counties. The NFIA is now under Homeland Security. They have been contacted for updated claim data. As of the date of this report no updated data has been provided.

A web search of trade associations of homeowner casualty underwriters revealed that insurers generally use a content to structure ratio between 50 and 75 percent of replacement cost. The Walton County inventory is valued at depreciated replacement cost not full replacement cost. The average insurer's content-to-structure ratio of 62.5 percent was used to estimate the value of contents for Walton County based on depreciated structure replacement cost. The range between 50 and 75 percent is 25 percent, so assuming six standard deviations in the range one standard deviation is about 4.16 percent. The Beach-*fx* triangular distribution used the mean structure to content ratio, 62.5 percent plus and minus 10 percent, to specify the low and high value, plus and minus 6.25 percent, which is a little larger than the one standard deviation of 4.16 percent.

Table 6 presents the structure and content value of damageable property based on depreciated replacement cost. Damageable property value is used here to reflect that only the lower two floors of multi-storied structures were valued in the property inventory as they alone were susceptible to modeling damages.

TABLE 6
VALUE OF WALTON COUNTY
STRUCTURE AND CONTENT VALUE BY REACH
(DOLLARS IN MILLIONS)

	Reach				
	1	2	3	4	5
Damage Elements	366		514	175	814
Structure Value	$317.3		$164.9	$33.7	$276.9
Content Value	$156.1		$78.9	$16.2	$133.5
Total	$473.4		$243.8	$49.9	$410.4
Grand Total	$1,177.5				

3.3 ECONOMIC BENEFIT EVALUATION

3.3.1 Assumptions

The economic benefits are from four categories: storm damage reduction, lost land reduction, elimination of emergency nourishment costs and recreation. The primary benefit category is the storm damage reduction as mandated in ER 1105-2-100, shore protection projects are to be formulated to provide for storm damage reduction.

Benefits are stated in constant FY 2013 dollars. The period of analysis is 50 years from January, 2014 through and including all of the year 2063, there are four pre-project base years, 2010 through 2013, making the period of study 54 years. The base year is FY 2014. The structure inventory is valued at FY 2013 dollars.

3.3.2 Storm Damage Reduction

Beach-*fx* calculates the storm damage reduction from inundation, storm-induced erosion, long-term erosion and wave attack on a damage element-by-damage element basis for each storm event for the study period for a large number of iterations.

3.3.3 Damage Functions

The damage functions used in Beach-*fx* are those developed for the Institute for Water Resources (IWR). A Coastal Storm Damage Workshop (CSDW) was held in Alexandria, Virginia to solicit expert-opinion for economic consequence assessment of coastal storm damage. The workshop is part of longer-term research effort whose objective is to develop a peer-reviewed, step-by-step methodology for estimating coastal storm damages.

The objective of the workshop was to discuss and recommend damage relationships needed to predict structural damage from coastal storms as functions of hazard intensity levels, with associated uncertainties, resulting from erosion, waves, inundation, and their combined effects. Because information on the relationship between residential structural damage and storm parameters is limited, this workshop used expert-opinion as a means of gaining information on these relationships (see Ayyub 2001). A report describing the results of the workshop both in terms of damage relationships and future information needs identified by the experts at the workshop is included in Attachment II of Appendix B, Economic Investigations.

The CSDW developed a set of lookup curves, defined for various damage types and foundation types, to calculate percentage loss associated with structure and contents for each damage type the input to these curves, or the “damage driving parameter”, has been defined by the CSDW. The appropriate damage-driving parameters for each damage type are:

Flooding:

Depth of water over walking surface of lowest walking floor

Waves:

Difference between the top of wave (crest) and the bottom of the lowest horizontal member

Erosion:

Percent of footprint compromised

Damage functions for each damage type (erosion, inundation, and wave) are currently associated with damage element type (single family residential, multi-family residential, walkway, etc.) foundation type (shallow piles, deep piles, slab, etc.) and construction type (wood frame concrete, masonry, etc.) and armor type (no armor, sheet pile, etc.) are used to select the appropriate damage function.

Damages are calculated at the damage element level, following each storm. For each damage type, a damage driving parameter is calculated for each damage element, and used as a lookup into stored damage functions. The participants in the CSDW developed the triangular distributions using a mid, high and low value to describe each increment of the damage function which is sampled by Beach-*fx* during the simulation runs.

3.3.4 Damage Element

Damages are estimated based on the concept of a "damage element". Damage elements are structures, walkways, etc., anything that can incur economic losses. In Beach-*fx's* system hierarchy reaches contain lots, and lots contain damage elements. For each storm, damages are estimated by examining the reach, lots, and damage elements within the lots. Thus, the basic unit on which damages are calculated at present is the damage element. Damage elements have attributes relating to type, geographic location, and value. Each damage element has information relating to structure and content value (treated as a three-parameter distribution for purposes of incorporating uncertainty). For location information, a structure's center point is referenced, as well as its width and length. A single value of ground elevation is specified, which also includes a three-parameter distribution for describing the first floor elevation and uncertainty.

3.3.5 Damage Estimation

Damages are estimated, based on calculation of the value of a "damage-driving parameter" for the damage element, which is then used as the independent variable to use for lookup into the stored damage functions. These damage functions provide the percentage loss for structure and contents. (See Appendix B, Economic Investigations, Attachment II – Coastal Storm Damage Workshop for a description of the methodology and the damage functions used in the Beach-*fx* simulations.

3.3.6 Structure and Content Damages

The determination of structure and content damage was calculated using the IWR damage functions. These damage functions generally give the percent damage as related to a water level for inundation damages, and the percent of structure footprint compromised to calculate storm induced and long-term erosion damages.

3.3.7 Inundation Damages

Inundation damages occur when storm surge elevations obtained from SBEACH simulations exceed the elevation of the dune line, when waves break over the dunes or if a given reach is susceptible to "back-bay" flooding the specified maximum tide plus surge input value associated with each storm is used to determine inundation damages. In the event that tide plus surge plus wave setup exceeds the dune crest elevation then inundation elevation extends to the landward boundary of the SBEACH line. Otherwise, inundation damages are restricted to damage elements that are located seaward of the dune crest and are subjected to the inundation elevations computed within Beach-*fx*. Inundation damages were assumed to begin for existing conditions when the maximum water level exceeded the first floor elevation of structure, since there is not always a continuous dune system. Inundation damages in the Walton County project area are very small. This is due to the high upland beach morphology type that predominates the study area.

3.3.8 Lost Land Reduction

The P&G states that erosion protection benefits include loss of land, structural damage prevention, reduced emergency costs, and reduced maintenance of existing structures and incidental benefits. The loss of land benefit is measured as the value of nearshore upland. Nearshore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore.

3.3.9 Loss of Land Benefit

With a project in place land that would be lost in the without project future condition would be preserved by a project. The design template that represents the project that provides full benefits to protected properties would be in place for the period of analysis preserved through the process of periodic renourishment. This benefit is based upon the value of near shore lands. Normally determinations of the market value for the land losses are based on the value of near shore upland. Near shore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore.

For this project, near shore values were estimated by Mobile District's Real Estate Division. The criterion used was, near shore lands are those parcels that are sufficiently removed from the shore to lose any direct water frontage value. These parcels have; no Gulf frontage, no view of the water, no access point to the Gulf as part of any deeded subdivision rights. The methodology used was to track 2005 and 2006 sales of near shore parcels in Walton County. Since property values varied according to location and sale prices also varied broadly due to the pause in the market caused by the storm activity on the Gulf in 2004 and 2005, a range of values, a low and a high, price per square foot was calculated. Then the average of the high and low was used to estimate the value of land lost. The value used represents a long-term value suitable for the period of evaluation. The value of land lost ranges from a low of $35 per square foot to $112.50 per square foot. In each eroding reach the average yearly erosion rate multiplied by the length of the reach multiplied by the price per square yard gave the average annual value of land lost.

3.3.10 Emergency Nourishment Cost

Emergency nourishment is performed at the reach level. At each time step of the model, the need for emergency nourishment is tested for each reach. The test consists of an examination of the current model-simulated reach, dune and berm width, which are compared to user input "triggers", that is, limits below which emergency nourishment takes place. For example, if the input berm width trigger is 100.0 feet, then if the current berm width is below 100', emergency nourishment takes place. Each trigger acts independently, such that if either the berm width or the dune trigger is activated, emergency nourishment takes place.

Once emergency nourishment is triggered for the reach, the emergency nourishment will start after a user-entered mobilization time. (There is also a user-entered mobilization cost which can be associated with the reach-level mobilization). Thus, if the trigger for emergency nourishment takes place on day 255 of the simulation, and the mobilization time is 30 days, then emergency nourishment will start on day 285.

The volume of emergency nourishment is determined based on the user input emergency template, defined by dune height, dune width, and berm width. This information is used to calculate a needed volume for the reach. Three parameters are then used to determine how long it will take to place the volume and how much it will cost: the production volume (cubic yards (cu/yd) per day), the borrow to placement ratio (cu yds) of borrow per cu yd placed), and the unit cost ($/cu yd). Based on the needed volume, production rate, and borrow to placement ratio, the time for restoration of the emergency template is determined and at that time increment after start of nourishment, the dune template is set to the emergency template, subject to rules that preclude diminishing the existing berm height, dune width, or dune height if they are currently greater than the corresponding template values.

Model output includes the cost of emergency nourishment for the complete future without project condition and for each alternative plan. The cost avoidance benefit of a project feature is defined as the difference between the with and without project emergency costs.

3.3.11 Erosion Damages

Erosion damages are calculated on a storm-by-storm profile response and damage element basis within Beach-*fx*. By entering the damage function with the damage driving parameter percent of footprint compromised based on the post storm profile and structure location a triangular distribution is drawn across the minimum, most likely, and maximum values and then randomly sampled to arrive at a loss value. Each foundation type (slab on grade, shallow pile, deep pile, etc.) has a specific definition of compromised as detailed in Appendix B, Economic Analysis.

3.3.12 Wave Attack Damages

Wave conditions, which drive the model, consist of wave height, period, and direction and can originate from multiple sources. Predictive simulations estimate the performance of any proposed beach fill or structural modifications.

Damage elements along the shoreline can be damaged from wave run-up or from waves breaking directly on the damage element when storm surge elevations are high. These damages are determined using the IWR expert elicitation damage functions.

3.3.13 Emergency Nourishment

In the without-project condition it is assumed that emergency nourishment will be performed as needed, over the 54-year period of study. The non-Federal sponsor indicated that, in the absence of a Federal project, they will, acquire funding to pursue a renourishing action after each significant storm. When a disaster is declared for a particular county, the Federal Emergency Management Agency (FEMA) will provide up to six cy per linear foot to mitigate for loss. There is a cost sharing provision requirement by FEMA that can be as low as zero percent.

The non-Federal sponsor completed a dune restoration project to partially replace the erosion losses due to Hurricane Ivan to provide storm protection for existing infrastructure, mainly Scenic Highway 98 and Gulf-front development. The current most threatened areas are the beneficiaries of this effort; Miramar Beach, Dune Allen and the Inlet Beach areas. The funding was provided by FEMA.

Temporarily, the non-Federal sponsor has deferred emergency work in anticipation of a Federal project. This deferral should be viewed as an anomaly and such work will be performed if project implementation is delayed for some reason.

Beach-*fx* executes a nourishing action after each hurricane event, which averages about 125,000 cy of material on the beach. This material is trucked in for placement on the beach and has a cost of about $30 per cy. Reach 2, which is all State Recreation Area Lands and Reach 4 which is primarily State Recreation Area Lands do not receive emergency nourishment.

3.3.14 Rebuilding

The model allows the user to define a distribution (triangular, you provide minimum, most likely, and maximum) of the number of days required for rebuilding, at the DE level, that is, the distribution can be changed for each damage element. Thus, the user might enter 350, 365, or 380 to get a distribution around one year. At the start of each iteration, a value is drawn for the sample, setting the rebuilding time for the DE for that iteration. The Walton County existing condition rebuilding parameters for single and multi-family construction was 365, 730 and 1,825 days. Walkovers, pools, jacuzzis, were assigned 365, 548 and 730 days. The number of times rebuilding could occur was unlimited if sufficient room on the lot permitted rebuilding.

If a DE is damaged to any degree, and has not been "rebuilt" more times than the maximum allowable, then a "rebuilding event" is set at a time in the future corresponding to the random rebuilding time. When the simulation reaches that time, the lot on which the DE exists is checked to see if it is buildable. The model makes a simple check based on whether or not the landward toe of the dune has retreated past the center point of the lot. If so, the lot is not buildable, and rebuilding does not take place.

If the lot is rebuildable at the time of rebuilding, then structure and contents values are restored to their initial values at the start of the simulation, such that they are able to be taken as damages again at the next storm event, and the number of times the damage element is rebuilt is incremented by one.

3.3.15 Combining Damages – Composite Damage Function

Total DE damages are calculated using a composite damage function that takes into account damages for all damage mechanisms present while avoiding double counting. Because a structure may be damaged by more than one storm damage hazard a methodology was needed to be developed for combining the damages. This methodology was defined during the IWR workshop and is included in Appendix B, Economic Investigations, Attachment II.

3.3.16 Recreation Benefits

In order to determine the recreation benefits for a selected plan an economic value must be placed on the recreation experience at the Walton County Beaches. This value can then be applied to the visitation which results from the project to determine the NED recreation benefits. For this report, unit day values (UDV) are used to determine the economic value of recreation at Walton County Beaches. UDV's are administratively determined values which represent the NED recreation values for typical types of recreation. Guidance for their use is provided by ER 1105-2-100.

The UDV are determined using a point system that takes into account the following factors: recreation experience, availability of opportunity, carrying capacity, accessibility, and environmental (esthetics) quality. A good deal of judgment is required in the assessment of point values. A group of planning professionals with knowledge of the study area made independent judgments of the UDV values which were averaged. The UDV point totals convert to a recreation value of $5.07 for the without project condition and $5.16 for the with project condition. These values were applied to the visitation over the study period. The difference between the without and with project value of recreation determines the recreation benefits. The complete recreation analysis can be found in Appendix B, Economic Investigations, Attachment I. The source of the value of recreation is obtained from Economic Guidance Memorandum, 10-03, Unit Day Values for Recreation, Fiscal Year (FY) 2010.

3.4 ENVIRONMENTAL

3.4.1 Environmental Considerations

The study area is located in Walton County, Florida as illustrated in Figure 1. During the late 1990s, this region endured several strong hurricanes, most notably Hurricane Opal in 1995 and Hurricane Georges in 1998. More recently, the entire coast of Walton County sustained major beach and dune erosion from Hurricane Ivan in 2004 and Hurricane Dennis in 2005. Erosion occurred both in terms of beach profile lowering and dune erosion. Major dune recession occurred throughout the county, including a number of locations where high dune-bluff escarpments replace the once established dune systems. These areas have become particularly vulnerable to further storm erosion.

Environmental impacts associated with Hurricane Ivan have resulted in decreased beach area and elevation. Such impacts directly affect availability for suitable nesting habitat required for nesting sea turtles. If nesting does occur, the lower elevations allow the nests to be more vulnerable to water inundation from lesser magnitude storms. Narrower beaches decrease the areas for shorebirds to forage and rest. Damage to the previously established dunes system destroyed much of the existing vegetation that provides stabilization. The absence of the dunes and associated vegetation eliminates much of the suitable habitat required to sustain beach mice populations and other wildlife that relies on these types of habitats for their continued survival.

These impacts provide environmental restoration opportunities within the proposed project area. Restoring a beach-dune system allows greater stability and sustainability of the coastal environment once it has become re-established. Restoring the beach and dune habitats that support a variety of associated flora and fauna contribute to the success and continual survival of several threatened or endangered species. The restoration effort will also contribute to the well-being of various other flora and fauna that naturally occur in the immediate vicinity. Restoration opportunities include increasing both the beach berm and dune widths to increase sea turtle nesting habitat and provide numerous benefits to a variety of shore birds, beach mice, and natural vegetation as well as other inhabitants of the coastal environment. The dune vegetation will be restored with naturally occurring dune vegetation designed to create a dune that matches the surrounding natural dune patterns in the area.

The general environmental criteria for projects of this nature are identified in Federal environmental statutes, executive orders, planning guidelines, and the Corps Environmental Operating Principles (EOP) originally established in 2002. It is the national policy that ecosystem restoration, particularly that which results in the conservation of fish and wildlife resources be given equal consideration with other study purposes in the formulation and evaluation of alternative plans. The basic guidance during planning studies is to assure that care is taken to preserve and protect significant ecological and cultural resources, and to conserve natural resources. These efforts also should provide the means to maintain and restore, as applicable, the desirable qualities of the human and natural environment. Formulation of alternative plans should avoid damaging the environment to the extent practicable and contain measures to minimize or mitigate unavoidable environmental damages. Consistent with laws and policy, alternative plans formulated should avoid damaging the environment to the extent practicable and contain measures to minimize or mitigate unavoidable environmental impacts.

The initial concepts embedded in the Principles are vital to the success of the Corps and its missions. However, in August 2012 the Corps re-energized the EOP providing more emphasis on proactively implementing these principles and guides all Corps management initiatives and business processes and encompasses the full spectrum on Corps activities. Re-committing to these principles and environmental stewardship will lead to more efficient and effective solutions, and will enable the Corps to further leverage resources through collaboration. This is essential for successful integrated resources management, restoration of the environment and sustainable and energy efficient approaches to all Corps mission areas. It is also an essential component of the Corps of Engineers' risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure. The re-energized EOP include:

- Foster sustainability as a way of life throughout the organization
- Proactively consider environmental consequences of all Corps activities and act accordingly
- Create mutually supporting economic and environmentally sustainable solutions
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities

The following criteria were used to address environmental impacts during the evaluation of alternatives.

- Protection, preservation, and improvement of the existing fish and wildlife resources along with the protection and preservation of coastal and offshore habitat and water quality;
- Consideration in the project design of the least disruptive construction techniques and methods;
- Protection and preservation of endangered and/or threatened species, Critical Habitat, and Essential Fish Habitat (EFH); and

- Preservation of significant historical and archeological resources through avoidance, if possible, or data recordation if destruction of the resources is necessary.

Of primary concern is compliance with the Clean Water Act (CWA). The CWA states that it is unlawful to discharge any pollutant from a point source into navigable waters, unless appropriate permits have been obtained through the Section 401 water quality certification process. Dredging material from an offshore borrow site and placement of the material on the shoreline requires that a Section 401 permit be obtained. Potential water quality impacts associated with the borrowing and placement of fill material associated with beach nourishment operations must be considered. Such activities will include evaluation of sediment from identified borrow sources for placement within the littoral zone throughout the study area. Sediment characteristics of concern are sediment grain size and color. Borrow sediments identified as suitable must match, as closely as possible, the sediment characteristics at the nourishment site. This information has been utilized in the preparation of the Section 404(b)(1) evaluation and also in developing the management requirements to minimize impacts to threatened and/or endangered species under Section 7 of the Endangered Species Act.

Additional issues that have been addressed include coordination with the U.S. Fish and Wildlife Service (USFWS) on six Coastal Barrier Resource System Units. The Coastal Barrier Resources Act (CBRA) limits the expenditure of Federal funds in designated system units so that expenditure would not enhance future/further development of the area. It was initially determined by the Corps that the activities would protect or enhance fish and wildlife resources and habitats within these units which are exempt under CBRA. The CBRA Units that are within the project limits are illustrated in Figure EA-8 of the Environmental Assessment (EA). Coordination with the USFWS concerning the consistency of proposed actions with the requirements of CBRA has been conducted for the selected plan and the USFWS does not agree with the Corps' determination for the CBRA exemptions. By letter dated February 22, 2010, the USFWS issued their determination that this project is not consistent with the purpose of CBRA. It should be recognized that CBRA units P31A, FL-96, and FL-94 are the only units that have been determined to fall within the Federal cost-shared project reaches as discussed in Section 4.9. These reaches are for the most part at the tapered ends of those reaches. The decision has been made that funding of these reaches will be 100 percent locally funded.

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) identified habitats within the marine and estuarine areas of the United States that were essential to the management of certain specific fin and shellfish. Areas identified by the Gulf of Mexico Fishery Management Council as EFH include all the marine and estuarine areas of Walton County. Consultation with the National Marine Fisheries Service (NMFS), Habitat Conservation Division has been completed and focuses on minimizing impacts to EFH. Of particular concern is avoidance or minimization of impacts or the enhancement of EFH.

Coordination with the NMFS concerning potential impacts to listed species and critical habitats has been conducted for the selected Federal plan. The consultation and coordination includes efforts to minimize impacts and benefit the recovery of listed species. Coordination with the USFWS has been conducted through the recent finalization of the Statewide Programmatic Biological Opinion (PBO) for Shore Protection Activities along the Coast of Florida dated August 2011. Due to issues regarding piping plover and beach mice that could not be resolved, the PBO does not address these two species. Coordination for the piping plover and the Choctawhatchee beach mouse will be conducted prior to the final report.

All Federal activities that will affect any land, water use, or natural resource of the coastal zone shall be carried out in a manner which is consistent, to the maximum extent practicable with the enforceable policies of the Florida Coastal Management Program. In addition, water quality certification from the State of Florida is required for all actions to be implemented. The feasibility study of the critically eroded shoreline has been conducted and determined to be consistent with State of Florida's beach management plan.

3.4.1.1 Coastal and Marine Resources

Coastal Walton County consists of approximately 26 miles of both developed and undeveloped beach and dune systems including six miles of state recreation areas and nine miles of state-designated critical eroding areas. The county's coastline also supports a number of coastal dune lakes considered rare worldwide and unique to the northern Gulf of Mexico and the United States. The existing coastal resources within the study area range from natural pristine systems found within state recreation areas to severely disturbed systems found within the more developed areas. The dune systems fronting developed areas range from little or no dune to larger relatively healthy dune systems. North of the county's coastal areas lies Choctawhatchee Bay. The ecosystem associated with Choctawhatchee Bay is typical of northern gulf coast estuaries including wetlands consistent with adjacent estuaries and submerged aquatic vegetation. It is not expected that the Bay will be affected by the proposed beach restoration and will not be considered in this study.

The area has been further characterized by a previous study conducted by Taylor Engineering, Inc. as a coastal peninsula extending west from the mainland defining the western two-thirds of the coastline and mainland beaches characterizing the eastern third. A copy of the 2003 Taylor Engineering Report is included in the geotechnical section of Appendix A, Engineering Design. Behind the county dune system, upland drainage feeds the coastal dune lakes that intermittently breach the dune system and discharge directly into the Gulf of Mexico. The area supports a variety of coastal wildlife with natural communities consistent with the northern Gulf of Mexico. The proposed beach restoration effort may potentially affect three beach zones which define the natural communities within the placement and borrow areas. These zones, addressed in this evaluation, are classified as coastal beach and dune, intertidal swash, and nearshore. These zones are discussed in greater detail in the EA.

An unusual attribute of the Walton County's coastal beach and dune community is the presence of coastal dune lakes. There are a number of dune lakes throughout the Walton County coast as shown in Figure 8. Coastal dune lakes are relatively small bodies of water that occur in coastal communities along the northern Gulf of Mexico. The lakes are typically separated from the Gulf by a barrier beach and dune system which may be intermittent with or without a meandering tidal outlet. The lakes contain and support valuable wetlands and a variety of coastal wildlife with natural communities unique to this region that may be impacted if the periodic breaching process is impacted by this project. Some of the coastal dune lakes have dune systems 500 feet wide and ridges extending 10-30 feet high and are important breeding areas for insects and crustaceans. Many birds and mammals also utilize coastal dune lakes for food and habitat. The intermittent connection to the Gulf is what distinguishes these lakes as rare. Prior to Ivan, most of the coastal dune lakes were not openly flowing into the Gulf of Mexico. Following Ivan, most all of them were flowing freely into the Gulf. The Florida Natural Areas Inventory designates the coastal dune lakes as "critically impaired in Florida because of extreme rarity." A more detailed discussion of the coastal dunes lakes can be found in the EA.

The study conducted by Taylor Engineering also evaluated the native beach characteristics of Walton County and found that the sand in the beach system was fairly uniform throughout the study area. They collected 314 samples from the dune vegetation, dune toe, mid-berm, mean high water (MHW), and mean low water (MLW) at approximately one-mile intervals throughout Walton County. Testing of the beach material samples in the laboratory determined the grain size distribution for each sample. The native beach material consists of well- to moderately well-sorted medium sand. The largest and smallest mean grain size is 0.485 millimeter (mm) and 0.235 mm, respectively. Based on all the data, the subaerial beach in Walton County has a mean grain size of 0.28 mm and the intertidal zone has a mean grain size of 0.34 mm. Overall the native beach sand of Walton County has a mean grain size of 0.30 mm.

FIGURE 8. APPROXIMATE LOCATIONS OF COASTAL DUNE LAKES THROUGHOUT WALTON COUNTY

3.4.1.2 Threatened and Endangered Species

There are several listed species known to exist within the Walton County project area and will require coordination with the appropriate agencies as specified by Section 7 of the Endangered Species Act. Table 6A contains a comprehensive list of State and Federal Protected Species in the Walton County area. Florida's Panhandle beaches provide nesting grounds for federally listed (threatened and endangered) sea turtles. Sea turtle nesting season in this area spans from May 1 through October 31. The threatened Atlantic loggerhead turtle (*Caretta caretta*) and the endangered green turtle (*Chelonia mydas mydas*) frequently nest on the beaches of Walton County and Destin. The endangered leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempi*), and hawksbill (*Eretmochelys imbricata*) sea turtles may also occasionally nest on northwest Florida's beaches.

The swash and nearshore zone is host to the endangered Gulf sturgeon *(Acipenser oxyrinchus*) during certain times of the year and has been determined as sturgeon wintering feeding ground from the Yellow River, Choctawhatchee River, and Apalachicola River subpopulations. The project areas from the Mean High Water (MHW) line of the mainland shoreline extending seaward one nautical mile is designated as Gulf sturgeon critical habitat. The Choctawhatchee beach mouse (CBM), a federally listed endangered species, inhabits the coastal dune communities along portions of the northern Gulf Coast. This endemic subspecies once had a historic range from East Pass in Okaloosa County to Shell Island in Bay County. Today, only three main populations exist in Topsail Hill Preserve State Park, Grayton Beach State Park in Walton County, and Shell Island in Bay County. The USFWS designated all three areas as critical habitat for the CBM. In Walton County, Topsail Hill Preserve State Park comprises about 200 acres of critical habitat along 2.7 miles of coastline. Critical habitat within Grayton Beach State Park consists of 67 acres along 1.7 miles of coastline. The FDEP manages these areas. The population at Grayton Beach State Park exists only as a result of a translocation program in cooperation with the Florida Fish and Wildlife Conservation Commission (FWCC) and the FDEP.

Several protected bird species use beach habitat for foraging, resting, or nesting. The black skimmer, least tern (*Sterna antillarum*), and southeastern snowy plover (*Charadrius alexandrinustenuirostris*) have all used portions of the beach within Walton County. In Florida, migratory bird nesting season spans from April 1 through August 31.

The piping plover (*Charadrius melodus*) nests well to the north, but winters in different areas of Florida including the gulf coast. The State of Florida designates the black skimmer as a species of special concern, and the southeastern snowy plover and least tern as threatened species. Both Federal and state entities consider the piping plover a threatened species.

The endangered Gulf coast lupine *(Lupinus westianus)* is a plant that inhabits the coastal dunes of Walton County. This species is specific to the coastal areas of the eastern and northern Gulf of Mexico. Coastal development and storm induced dune erosion has a direct impact towards sustaining suitable habitat for this species.

3.4.1.3 Critical Habitats

The proposed beach restoration area falls within the designated Gulf sturgeon Florida Nearshore Gulf of Mexico critical habitat (Unit 11). This area falls under the jurisdiction of the NMFS. Consultation with NMFS regarding the effects of the proposed action on Gulf sturgeon and subsequent potential modification to Gulf sturgeon critical habitat has been conducted. Direct placement of beach material will increase shoreline width and extend into the critical habitat area. The increased width is intended to restore the shoreline position to pre-hurricane positions and believed not to have an effect on Gulf sturgeon critical habitat areas.

The direct berm and beach placement is adjacent to designated critical habitat for the Choctawhatchee beach mouse (CBM). The placement of sediment directly on the beach and seaward of the toe of the existing primary dune line would not generally impact existing habitat. Pipeline routes for beach construction will typically avoid identified primary constituent elements for critical habitat. Considering that much of the mature coastal barrier sand dunes and scrub dune habitat on the Gulf and Atlantic Coasts of Florida have been lost and populations of beach mice have declined as a result, the development of new habitat or enhancement of existing habitat is beneficial to the recovery goals of beach mice. Dune restoration activities allows for the availability of materials for the natural formation and growth of primary and secondary dunes. Such processes would help in the development of new beach mouse habitat and may aid in the enhancement and expansion of existing populations by stabilizing and enhancing existing dune communities with available sand and associated aeolian transport processes. This in turn promotes natural recruitment of native dune vegetation that contributes to the primary constituent elements for critical habitat by providing food resources for beach mice. Consultation with USFWS regarding the potential effects of the project on Choctawhatchee beach mouse critical habitat has been completed. The terms and conditions resulting from formal consultation for the project will be observed.

Table 6A

List of Protected Species in the Walton County Area

Common Name	***Scientific Name***	***State***	***Federal***
Fish			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	SSC	T
Reptiles			
American alligator	*Alligator mississippiensis*	SSC	T (s/a)
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Atlantic loggerhead turtle	*Caretta caretta*	T	T
leatherback turtle	*Dermochelys coriacea*	E	E
Kemp's ridley	*Lepidochelys kempi*	E	E
Green sea turtle	*Chelonia mydas mydas*	E	E
Hawksbill turtle	*Eretmochelys imbricata imbricata*	E	E
Birds			
Arctic peregrine falcon	*Falco peregrinus tundrius*	CE	CE
Wakulla seaside sparrow	*Ammodramus maritimus juncicolus*	SSC	n/a
bald eagle	*Haliaeetus leucocephalus*	**	**
brown pelican	*Pelecanus occidentalis*	SSC	n/a
least tern	*Sterna antillarum*	T	n/a
Southeastern American kestrel	*Falco sparverius paulus*	T	n/a
black skimmer	*Rynchops niger*	SSC	n/a
Southeastern snowy plover	*Charadrius alexandrinus tenuirostris*	T	n/a
snowy egret	*Egretta thula*	SSC	n/a
reddish egret	*Egretta rufescens*	SSC	SSC
tricolored heron	*Egretta tricolor*	SSC	n/a
little blue heron	*Egretta caerulea*	SSC	n/a
piping plover	*Charadrius melodus*	T	T
American oystercatcher	*Haematopus palliatus*	SSC	n/a
white ibis	*Eudocimus albus*	SSC	n/a
seaside sparrow	*Ammodramus maritimus*	SSC	n/a
grasshopper sparrow	*Ammodramous savannarum*	E	E
Florida sandhill crane	*Grus canadensis pratensis*	T	n/a
marsh wren	*Cistothorus palustris*	SSC	n/a
Mammals			
West Indian manatee	*Trichechus manatus floridanus*	E	E
Choctawhatchee beach mouse	*Peromyscus polionotus allophrys*	E	E
Plants			
Gulf coast lupine	*Lupinus westianus*	T	n/a

E = Endangered. T = Threatened. T (s/a) = Threatened due to similarity in appearance. SSC= Species of Special Concern. UR = Under review. CE = Consideration Encouraged, n/a = information not available or no designation listed.
** Protected under the Bald and Golden Eagle Protection Act.

3.4.1.4 Essential Fish Habitat (EFH)

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCA) require that Federal agencies assess potential impacts to EFH for NMFS managed commercial fisheries. In accordance with the MSFCA, any Federal action that has the potential to adversely affect EFH requires consultation with the NMFS. EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity and include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate. The near and offshore areas of the Walton County project reaches supports a variety of fish species, primarily small species and juveniles of larger fish species. EFH for many of these species occur within the project area and include such species managed under the purview of the NMFS, Habitat Conservation Division as identified in the EA.

The intertidal swash zone and nearshore areas along the northern Gulf of Mexico is defined by the Florida Natural Area Inventory (1990) as consisting of expansive unconsolidated substrate which lack dense populations characterized by sea grasses, oyster reefs, coral reefs, or other hard-bottom structures. This area of the beach provides habitat for benthic and infaunal communities characterized by low species diversity.

Material will be removed from potential borrow area and pumped onto the beach to create the desired template. This method is preferable in terms of turbidity reduction and minimizing the potential impact to fish and wildlife. Most of the motile benthic and pelagic fauna, such as crab, shrimp, and fish should able to avoid the disturbed area and should recover shortly after the activity is completed. The potential borrow area is characterized as sandy bottom and does not contain any hard-bottoms, coral reefs, oyster beds, or seagrass. No hard-bottom structures were identified in and around the potential borrow area. No long-term direct impacts to managed species are anticipated; however, it is reasonable to anticipate some non-motile and motile invertebrate species will be physically affected through the dredging and placement operations.

3.4.1.5 Cultural Resources

The Walton County shoreline has been the site of numerous cultural resources investigations since the 1940s. Over forty archaeological and historical sites are known to exist within one mile inland of the current beachfront with at least two of those sites considered potentially eligible or eligible for the National Register of Historic Places. Known archaeological sites suggest that humans have occupied the area as far back as 8500 BC, beginning with the Archaic period. The Walton County coast has been continually although sparsely inhabited up to the present.

In accordance with Section 106 of the National Historic Preservation Act and other relevant cultural resource laws, recommendations and actions have been coordinated with the Florida State Historic Preservation Officer (FLSHPO). Coordination with the appropriate Federally recognized American Indian tribes have been conducted as part of the required public notice.

A cultural resource survey was conducted by Sonographics, Inc. under contract with Taylor Engineering. Remote sensing surveys were performed for the proposed project and potential borrow areas. The remote sensing survey consisted of a magnetometer survey, side-scan sonar survey, and a sub-bottom profile survey. No concentrated pattern or scatter pattern of magnetic anomalies and side scan sonar targets were recorded that suggested the presence of shipwreck resources in the potential borrow area, nor did the sub-bottom profiler data indicate the presence of areas that would indicate prehistoric midden sites or other inundated habitation sites. Based on the analysis of the remote sensing data it was the conclusion of the principal investigator that there are no sunken shipwreck resources, or other sunken cultural sites within the potential borrow area.

Based on the remote sensing analysis, Walton County initiated coordination with the Florida Historic Preservation Officer (SHPO) presenting this determination. In a letter dated December 11, 2008, concurrence was issued by the Florida Division of Historic Resources for the local project. It should be understood that this determination was issued for the local plan that covers the same areas as the proposed Federal project. Based on the previous coordination for the local plan, the SHPO concurred that the proposed Federal project will have no effect on any cultural resources. The letter of concurrence from the SHPO and the cultural resources survey report is included in Appendix B of the EA.

3.4.1.6 Water Quality

Some silty material will be associated with the dredging and placement operations and its suspension may result in a slight localized increase in turbidity at the dredging and disposal sites. The direct placement of material on the beach will consist of beach quality sandy material and no significant long-term elevation of turbidity is expected. The State of Florida's water quality standards would not be significantly affected and water clarity would return to ambient conditions shortly after sediment placement at the dredge and disposal sites. As required by the CWA, a Section 404 (b)(1) evaluation report for the borrow and placement of sediment at the proposed beach placement areas has been prepared and can be found in Appendix A of the EA.

The sandy dredged material designated for beach and nearshore placement consists of medium-grained marine sand. Section 404 of the Clean Water Act (CWA) [230.60(b)] states that no testing is required by virtue of the fact that the dredged material is sufficiently removed from pollution sources. Furthermore, the CWA states that material primarily composed of sand, gravel, or other inert material found in areas of high current and wave energy conditions are most likely free of contaminants CWA. The sandy material being dredged and placed on the designated beach areas is littoral sand from the same source as the sand found within these proposed disposal sites. Previous operations and water quality certifications has found that the material dredged from the site is free of contaminants.

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore of Louisiana, the floating semi-submersible mobile offshore drilling unit Deepwater Horizon experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. The total amount of oil and natural gas that has escaped into the Gulf of Mexico is unknown, but is currently believed to be between 35,000 and 65,000 barrels per day for an approximate total of 4.9 million barrels. On September 19, the relief well process was successfully completed and the federal government declared the well permanently capped. The spill has caused extensive damage to marine and wildlife habitats as well as the Gulf's fishing and tourism industries.

This spill has created uncertainty on whether future dredging operations will meet environmental compliance criteria and requirements for ocean disposal. The long-term impacts of the oil spill on coastal Florida are uncertain at this time. This spill could potentially adversely impact Corps water resources projects and studies within the coastal area. Potential impacts could include factors such as changes to existing or baseline conditions, as well as changes to future-without and future with project conditions. The Corps will continue to monitor and closely coordinate with other Federal and state resource agencies and non-Federal sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact Corps water resources development projects/studies. This could include revisions to proposed actions as well as the generation of supplemental environmental analysis and documentation for specific projects/studies as warranted by changing conditions.

Because of the oil spill, testing of the sediment at the potential borrow area has been conducted with no contamination detected. If, during project construction, evidence of oil is detected, dredging and placement activities will be suspended and steps taken to initiate clean-up efforts.

3.4.1.7 Hazardous Materials

The material contained in the selected nearshore borrow areas consists of medium-grained marine. These areas are far removed from any historically known sources of contaminants. Also, the material is primarily composed of unconsolidated quartz sand which is considered inert and in areas of high current and wave energy conditions, in which such material is considered to likely be free of contaminants. Typically, considering these conditions, based on 40 CFR 230.60, no testing for contaminants should be necessary. Because of recent events in the Gulf of Mexico, there is concern that there may offshore oil contamination. No known hazardous, toxic or radioactive waste concerns are known to exist within the confines of the project area. Nor would any be added as a result of the proposed activities. The material to be excavated are naturally occurring marine sands in areas of high current activity and far removed from sources of pollution, thus providing reasonable assurance that the material is not contaminated. The material to be utilized during restoration of the beach meets the criteria set forth in 20 CFR 230.60(b) as clean sand which is sufficiently removed from sources of pollution and is located in areas of high current velocities to provide reasonable assurance that the material would not be contaminated by such pollution. Hence, no further physical, biological, or chemical testing is required pursuant to the 404(b)(1) Guidelines.

3.4.1.8 Sediment Compatibility

The non-Federal sponsor has conducted offshore studies to include geological and geophysical interpretation of seismic records and vibracores, performed by Taylor Engineering, Inc. Their investigations looked at the entire coastline to confirm locations with sufficient quantities for the initial beach placement and future renourishments.

The State of Florida requires shoreline storm protection and restoration activities that artificially place sand on the beach from remote sources must use sand similar to the native beach sand in order preserve the beach's natural characteristics to the maximum extent practicable. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system. The borrow area investigations conducted by Taylor Engineering indicates that the mean grain sizes (0.25mm − 0.26mm) of the potential borrow area layouts are slightly finer than or equal to the native beach sand and that the borrow material is more sorted (has less variation in grain size) than the native beach sand. Given these slight differences, an overfill volume must be applied to the design volumes in order to achieve the desired amount of stable fill.

A Sediment Quality Assurance Plan has been prepared that outlines the steps that must be taken to observe, sample, and test the placed sediments to assure compliance with the standards set by the State of Florida. The technical requirements addressed in this plan include the location of dredging, sediment quality monitoring on the beach, and remedial actions if necessary.

3.4.1.9 Environmental Mitigation

It is believed that the beach restoration efforts will provide numerous benefits towards improving the size and quality of habitats for shoreline wildlife that result from wider beaches and healthier dunes. Biological opinions have been issued by USFWS and NMFS to incorporate methods and measures to avoid and/or minimize environmental impacts to existing habitats and threatened or endangered species and associated critical habitats. These methods and conditions will be incorporated into the proposed action. Based on the identified borrow area and the various coordination conducted with the support agencies, no mitigation requirements have been identified.

3.4.1.10 Borrow Area Environmental Impacts

It is expected that the dredging action would have some impacts on the infaunal assemblages within the borrow area. Monitoring the effects of dredging of borrow areas along coastal New Jersey indicated obvious impacts on the infaunal assemblage including decreases in abundance, biomass, taxa richness and the average size of the dominant biomass species. There were also changes in both species and biomass composition. However, abundance, biomass, and taxa richness recovered quickly after dredging operations with no detectable difference between dredged and undisturbed areas by the following spring. Taxonomic composition of the finfish assemblage present at the borrow areas was similar for inshore areas in the general region around the borrow areas. There was no substantive difference in species composition or catch-per-unit-effort among areas within any given collection period.

Another consideration in benthic recovery is the topographic features created by the offshore dredging process. Reworking of exposed sediments is an important process in benthic recovery after dredging because it promotes diffusion of dissolved oxygen into soft substrata exposed during dredging. Related studies have shown offshore sediments along coastal Alabama are continually being reworked to depths up to 60 meters, which is attributed to storms and sediment influxes of material associated with river discharges.

Offshore equipment employed for borrow area excavation typically consists of a hopper dredge and possibly pipelines, equipment barges, marker buoys, and small tugs. Dredging would temporarily affect water quality by increasing local turbidity levels around the dredging sites. Increased water column turbidity during sand excavation would be temporary and localized. The spatial extent of elevated turbidity is expected to be within 1,000 meters of the operation, with turbidity levels returning to ambient conditions within a few hours after completion of the dredging activities. Therefore, no significant long-term impacts to water quality are expected to occur. Elevated turbidity levels resulting from construction should not have a significant negative effect on organisms inhabiting the area.

Given the naturally dynamic waters and unconsolidated sandy nature of the local Gulf of Mexico coast, organisms inhabiting the offshore areas adapt well to reasonable environmental changes such as moderate increases in turbidity. Fish and other mobile species may temporarily leave the dredging site if turbidity becomes too great. Dredging activities would result in significant mortality of non-motile benthic organisms. Impacts to the benthic community are expected from physical removal of sediments and infauna, however, assuming that dredging does not produce deep depressions causing very fine sediment deposition or hypoxic or anoxic conditions, levels of infaunal abundance and diversity may recover within one to three years.

The proposed borrow sources for Walton County, BA-4 and potential BA-7, are located approximately 4 and 2 miles offshore in water depths in excess of 70 and 50 feet respectively. Given the offshore distance and ambient water depths it is unlikely that the potential borrow areas for Walton County would have discernible impacts from wave refraction or focusing on increased erosion rates along Walton County. The potential borrow area does not contain any known hard bottom or associated communities. Therefore, dredging activities within the borrow area will have no impacts to hard bottom environments.

3.4.1.11 Effects of Sea Level Rise (SLR) on Environmental Conditions

Florida is one of the most vulnerable areas in the world to the consequences of climate change. One of the most serious threats to Florida’s coasts comes from the combination of elevated sea levels and intense hurricanes. Florida has over 1,350 miles of coastline, low-lying topography, and proximity to the hurricane-prone subtropical mid-Atlantic Ocean and Gulf of Mexico. As a result, barrier islands and low lying areas of Florida will be more susceptible to the effects of storm surge. Rising sea levels will result in pushing the high-water mark landward, causing beaches to migrate slowly inland. The primary result especially where development exists is increased erosion rates. This could particularly impact areas with low-lying beaches where sand depth is a limiting factor. These losses could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion which could translate into continued loss of valuable beach habitat along Walton County, including sea turtle nesting habitat, shorebird foraging and roosting areas, dune habitat supporting various flora and fauna, and general beach ecosystem functions. Florida experiences more landings of tropical storms and hurricanes than any other state in the United States. Storm surges due to hurricanes will be on top of elevated sea levels, tides, and wave action. An important element of adaptation strategy is how to protect beaches, buildings and infrastructure against the effects of rising seas and wind, wave action and storm surge due to hurricanes.

For Walton County, the increase in shoreline recession would directly impact the beach and dune habitat available to the terrestrial wildlife (i.e. shorebirds, beach mice, sea turtles, etc.) that utilizes the coastline of Walton County. The pressure to protect properties and the fronting dune/bluff would likely result in a reduction of the available habitat. Under the projected SLR scenarios and associated recession rates of 0.4 to 2.4 feet per year as much approximately 270 acres of habitat under the future without project could be impacted by SLR.

3.4.1.12 Environmental Compliance, Coordination, and Agency Views

On 29 June 2004, an interagency meeting was held at the Walton County, Tourist Development Council facility in Santa Rosa Beach, Florida. The purpose of the meeting was to initiate environmental coordination with the interagency team involved in the permitting and environmental compliance processes for the Walton County Shore Protection Feasibility Study. The meeting's primary objects were to identify and discuss environmental issues and opportunities, permitting issues, and environmental compliance requirements associated with the proposed Walton County project. In attendance were representatives from the Corps, Walton County, USFWS, FDEP, and FWCC. It should be noted that representatives from the NMFS were invited to participate. Communications with the Habitat Conservation Division expressed that the project did not raise issues that would require their representation. A Memorandum for Record (MFR) summarizing the meeting was prepared and distributed. A copy of the MFR is included in the EA.

An important topic of discussion at the interagency meeting dealt with the National Environmental Policy Act (NEPA) process that should be conducted for the Walton County project, specifically whether the project would require an EA or Environmental Impact Statement (EIS). The USFWS expressed that their agency is not viewing this project as one that would require an EIS. Although the project area encompasses some 26 miles of shoreline, the activities will be comprised of segmented beach nourishment and/or dune restoration. The group in attendance felt that given the project characteristics, low level of controversy, absence of contamination, and precedent set by other local beach projects that an EA would be the appropriate level of environmental documentation for the Walton County project. An EA must adequately address the cumulative impacts of the entire project and may be subject to future change into an EIS should any major issues and controversy arise. If the EA results in a finding that no significant resources would be impacted by the proposed actions, a Finding of No Significant Impact (FONSI) would be prepared.

The Corps, Mobile District has reopened communications with the interagency team to reaffirm this determination. Reaffirmation has been received from the team that their position is that an EA would be the appropriate level of NEPA documentation. The USFWS, in an email dated December 9, 2009, concurs that with the information available an EA is the appropriate level of NEPA documentation. Also in an email dated December 9, 2009, FDEP has indicated that they feel the determination as to the appropriate level of NEPA documentation is the Corps' decision as long as it adequately addresses the information outlined in the Joint Coastal Permit (JCP) application package. A conference call was held on December 16, 2009 between Corps representatives and Ntale Kajumba and Paul Gagliano from EPA Region IV. After describing the project and answering several questions the EPA representatives felt that the Corps was justified in the determination to generate an EA. They also affirmed that this decision is the responsibility of the Corps; however, the information contained in the EA must support the FONSI. If the EA reveals significant impacts, then an EIS must be initiated.

The Mobile District maintains the position that based on project characteristics, low level of controversy, absence of chemical contamination, lack of any mitigation requirements, and precedent set by other local beach projects that an EA would be the appropriate level of environmental documentation for the Walton County project.

3.4.1.13 Public Stakeholder Coordinations

Public support for this project is especially important considering the cost sharing requirements. The non-Federal sponsor has been very proactive in insuring that the public has been informed of the process as well as status of the feasibility study. The non-Federal sponsor's designated point of contact is a consultant with the TDC, with whom the Mobile District provides monthly study updates. Information briefed to the TDC and the non-Federal sponsor leadership is a matter of public record. Public Notice was placed on the District website and an e-mail was sent to all coordinating agencies, including congressional offices, notifying them of the availability of the Peer Review Plan. Public Notice of the Federal Feasibility Study was also placed in the DeFuniak Herald (Walton County Newspaper of record). A public workshop was held at Sandestin Resort in Walton County in April 2012, where approximately 20 people attended. A public workshop was also held at the Walton County Board of County Commissioners meeting in June 2012, where approximately 50 people attended. Updates have been presented to Walton County Tourist Development Council since 2007 and are part of the public record. No formal public or agency comments were received from these engagements; however, based on informal discussion at the meetings, it was apparent that public response to the project has been overwhelmingly positive. For the purpose of funding a HSDR project, the non-Federal sponsor enacted a bed tax for the area several years ago with that tax continuing in place to fund the local share for this project.

In addition to the public engagement described above, environmental coordination included numerous stakeholder and support agencies as required by NEPA and other Federal laws and regulations. Such engagement included meetings with state and local agencies to determine the appropriate level of NEPA documentation for this project.

- Formal endangered species consultation with USFWS and NOAA National Marine Fisheries Service (NMFS) as required by the Endangered Species Act.
- Formal consultation with NMFS regarding Essential Fish Habitat as required the Magnuson–Stevens Fishery Conservation and Management.
- Formal consultation with the USFWS regarding the consistency of proposed actions with the requirements of Coastal Barrier Resources Act required to ensure that the expenditure of Federal funds do not enhance the potential for development within these units.
- Formal cultural resources consultation with the Florida State Historic Preservation Officer regarding potential impacts to historic resources as required by the National Historic Preservation Act

3.4.2 Status of Environmental Compliance Actions, Coordination, and Documentation

It should be recognized that the non-Federal sponsor proceeded with pursuing a beach restoration plan of their own. Their local project area lays the length of Walton County. The proposed local plan includes a berm design that exhibits a construction profile that has a 207-foot wide berm measured from the existing 9.5 feet NAVD contour with a10-foot wide dune crest. The proposed plan view and profiles totally encompasses the selected plan and uses the same borrow site. Subsequently, the county has already completed the process of applying for the state Water Quality Certification/Coastal Zone Consistency (WQC/CZC). They have also completed coordination for threatened and endangered species as required by the ESA, initiated coordination on essential fish habitat (EFH), completed cultural resources coordination, and prepared a draft EA for their local plan. Although their efforts are for a larger area, these same coordinations are required to be conducted for the selected plan, but have provided a level confidence that the same outcome will be achieved. Much of the information already generated by the non-Federal sponsor for the local plan has been used in the various coordinations and consultations for the selected plan.

Although the non-Federal sponsor has conducted the coordination required by the ESA, the Fish and Wildlife Coordination Act (FWCA) requires that Federal agencies consult with the USFWS regarding fish and wildlife resources in the project area. This consultation has been conducted for the selected plan.

The Coastal Barrier Resources Act (CBRA) of 1982 must also be considered for the selected plan. The CBRA restricts Federal expenditures and financial assistance within designated CBRA zones in the Gulf and Atlantic Coasts. Several CBRA units are located within the project area. Coordination with the USFWS concerning the consistency of the selected plan in accordance with the requirements of CBRA for the six system units has been completed in efforts to ensure that the expenditure of Federal funds does not enhance the potential for development within these units.

Table 6B at the end of this section summarizes the coordination and consultations required for environmental compliance for the selected plan.

3.4.2.1 Water Quality Certification (WQC) Coordination

A Water Quality Certification/Coastal Zone Consistency application with the FDEP, Bureau of Beaches and Coastal Systems dated June 27, 2007 has been prepared by the non-Federal sponsor for their local plan. Their application has been deemed complete but the final permit has not yet been issued. The state has indicated that since the application for the local plan totally encompasses the selected Federal plan that much of the information submitted in the local application will be accepted for the Federal plan. Most of the required information is already contained in the permit application and the only thing that would be necessary is to replace the project description with the selected Federal plan. The Corps is currently coordinating this effort with FDEP and the non-Federal sponsor to prepare a WQC/CZC application.

3.4.2.2 Endangered and Threatened Species

An existing Regional Biological Opinion (RBO) issued by NMFS pertaining to hopper dredging in navigation channels and sand mining areas in the Gulf of Mexico concerning sea turtles and Gulf sturgeon will be useful during the coordination process. The RBO that was issued in November 2003 directly pertains to dredging operations at the borrow area. A second RBO that will be useful during the coordination of this project is currently being developed by the USFWS with cooperation from the Corps for beach fill projects in the State of Florida. If available during the final coordination stages of this project it will be useful for the coordination of the threatened and endangered species under Section 7 of the Endangered Species Act, but does not address Gulf sturgeon critical habitat. A biological assessment was submitted to initiate formal consultation with NMFS regarding Gulf sturgeon critical habitat.

Although coordination efforts were conducted by the non-Federal sponsor for the local plan, the Corps has, in addition, conducted formal Section 7 consultation with the USFWS and NMFS for the selected plan. Biological Assessments (BA) were prepared and submitted initiating consultation with both agencies, which addressed the potential impacts to the listed species and/or critical habitats. Copies of these BA are included in the EA. Based on the evaluation for species and critical habitats under the purview of the USFWS, it is the Corps' assessment that the actions may have an adverse affect on sea turtles, piping plovers, and CBM. Upon further consideration of the previous biological opinion issued for the local Walton County project, it is the USFWS opinion that the effects of the proposed activities are not likely to jeopardize the continued existence of these species and not likely to destroy or adversely modify designated critical habitat for the CBM. Subsequently, based on the evaluation for species and critical habitats under the purview of the NMFS, it is the Corps' assessment that the actions may have an adverse affect on Gulf sturgeon but not likely to jeopardize their continued existence and not likely to adversely modify Gulf sturgeon critical habitat.

By email dated March 1, 2010, the NMFS indicated that the Walton County Federal project would not result in additional impacts already coordinated for the non-Federal sponsor (EA-Appendix B). In August, 2011, the USFWS finalized the Statewide Programmatic Biological Opinion (PBO) for Shore Protection Activities along the Coast of Florida. The PBO indicates that for sand placement actions such as this in the State of Florida, the USFWS has determined that the proposed action would not jeopardize the continued existence of nesting sea turtles. However, there is still a potential for incidental takes in the form of long-term and short-term impacts on sea turtles. The USFWS has therefore imposed terms and conditions to be implemented that would minimize the potential for incidental takes. The USFWS also agrees with the Corps' determination that the proposed action may adversely affect non-breeding piping plover. Due to issues regarding piping plover that could not be resolved, the PBO does not address this species. Coordination for the piping plover has completed in October 2012. A copy of the PBO is included in the EA-Appendix B. Based on the formal consultations regarding threatened and endangered species and associated designated critical habitats, no mitigation requirements have been identified.

3.4.2.3 Fish and Wildlife Coordination Act (FWCA)

Although the non-Federal sponsor has conducted the coordination required by the ESA and formal consultation has been initiated for the selected plan, the Fish and Wildlife Coordination Act (FWCA) requires that federal agencies consult with the USFWS with regarding fish and wildlife resources in the project area. Such coordination will result in a FWCA Report. This coordination has been conducted with the USFWS for the selected plan in accordance with the FWCA of 1958 regarding impacts to significant fish and wildlife resources and impacts to federally listed or proposed species or their designated or proposed critical habitat, which is in accordance with Section 7 of the Endangered Species Act of 1973. A copy of the coordination letter is included in the EA. A scope of work and transfer of funds to the USFWS has been completed for the preparation of this report. The USFWS has completed and submitted the FWCA report to the Mobile District staff dated October 2012. A copy of the FWCA report is included in the EA-Appendix B.

3.4.2.4 Essential Fish Habitat (EFH)

Coordination with the NMFS, Habitat Conservation Division in accordance with the MSFCMA has been completed involving the dredging and placement activities for selected plan. Activities have been undertaken to assure that plans identified for this study are not in conflict with existing Federal fishery management plans or do not result in unacceptable impacts to the habitats of managed species.

The Corps will be adhering to water quality requirements under the conditions specified by the FDEP to further reduce impacts to EFH. Consultation with the NMFS, Habitat Conservation Division concerning EFH has been completed for the selected plan pursuant to the MSFCMA (PL 94-265). A copy of the coordination documentation is included in the EA. The Corps' assessed the project in relation to impacts to fisheries resources and determined that the overall impact to identified species is considered negligible given the relatively small area and will not result in significant impacts to EFH.

By letter dated October 6, 2010, NOAA's NMFS, Habitat Conservation Division has stated that they have reviewed the Corps' EFH assessment and subsequent information for the proposed selected plan and determined that the NMFS does not have any EFH consultation recommendations to offer. A copy of this letter of determination in included in the EA-Appendix B. Based on the formal consultations regarding EFH, no mitigation requirements have been identified.

3.4.2.5 Coastal Barrier Resources Act (CBRA)

The CBRA Units that are within the project limits include FL-94, FL-96, FL-95P, FL-93P, P32, and P31A as illustrated in Figure EA-8 of the EA. Coordination with the USFWS concerning the consistency of the selected plan in accordance with the requirements of CBRA for the six system units has been initiated to ensure that the expenditure of Federal funds does not enhance the potential for development within these units. A copy of the coordination document in included in the EA.

CBRA units 95P and FL-93P are considered as otherwise protected areas and only applies to Federal flood insurance which does not apply to this project. CBRA unit P32 falls within a segment of the project that cannot be justified for Federal funding and will be 100 percent locally funded, which is exempt from CBRA requirements. The Corps initially determined that the selected plan qualifies for an exemption under Section 6 Exemptions for CBRA units P31A, FL-96, and FL-94. 16 U.S.C. § 3505 (a)(6)(A) identifies projects relating to the study, management, protection, and enhancement of fish and wildlife resources and habitats, including acquisition of fish and wildlife habitats and related lands, stabilization projects for fish and wildlife habitats, and recreational projects. 16 U.S.C. § 3505 (a)(6)(G) also exempts nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore natural stabilization systems.

Upon completion of the CBRA consultation, the USFWS does not agree with the Corps' determination for the CBRA exemptions. In their response letter dated February 22, 2010, the USFWS issued their determination that this project is not consistent with the purpose of CBRA. It should be recognized that CBRA units P31A, FL-96, and FL-94 are the only units that have been determined to fall within the Federal cost-shared project reaches as discussed in Section 4.9 of the EA. These reaches are, for the most part, at the tapered ends of those reaches. The non-Federal sponsor is aware of this situation and has agreed to locally fund these segments. Therefore, no Federal funds will be used towards the development of these segments will be 100 percent non-federally funded. Since no Federal funding will be used in the construction of these segments of the project, the CBRA will no longer be applicable.

3.4.2.6 Cultural Resources

Archival research and field work has been initiated by the non-Federal sponsor. Sonographics, Inc conducted a cultural resource survey and detail phase sub-bottom seismic survey in June 2007. Potential identified cultural resources were investigated using qualitative visual observations. It was determined that none of the anomalies detected appeared to represent any type of cultural resources and a determination was made that the activities associated with this project are unlikely to affect any historic or cultural resources. The county subsequently initiated coordination with the Florida Division of Historic Resources presenting this determination. In a letter dated December 11, 2008, concurrence was issued by the Florida Division of Historic Resources for the project. This determination covers the same areas as the selected plan. Section 106 consultation has been initiated for the Federal plan using this existing information.

In accordance with Section 106 of the National Historic Preservation Act and other relevant cultural resource laws, recommendations and actions have been coordinated with the FLSHPO. The Mobile District's cultural resources staff has composed a letter indicating that the Mobile District has reviewed the aforementioned cultural resources survey and review by the FLSHPO. Based on this information, and the nature of the project, the Mobile District, as lead Federal agency, has determined that the selected plan will have no effect on historic properties as per 36 CFR 800.4(d)(1). A copy of this coordination is included in the EA. By letter dated March 11, 2010, the FLSHPO provided their concurrence that the Federal action will have no effect on historic properties. A copy of this coordination is included in the EA-Appendix B. Based on the consultation regarding cultural resources, no mitigation requirements have been identified.

3.4.2.7 National Environmental Policy Act (NEPA) Documentation

During an interagency meeting held in June 2004, it was determined that given the project characteristics, low level of controversy, absence of chemical contamination, and precedent set by other local beach projects that an EA would be the appropriate level of environmental documentation for the Walton County project. The EA must adequately address the cumulative impacts of the entire project. It is recognized that if the findings of the EA is that the major Federal undertaking will not significantly affect the environment then a FONSI will be prepared.

An EA, based on the selected plan, has been prepared and included with this report. Also, a 404(b)(1) Evaluation Report has also been prepared based on the final geotechnical assessments conducted on both the borrow and native beach characteristics. The 404(b)(1) confirms that the borrow material closely matches that of the native beach. Any adverse impacts would come from increased turbidity, which is expected to be short term in nature. No mitigation requirements have been identified associated increased turbidity levels resulting from placement of the borrow material on the beaches. This report is included as part of the EA.

As required by NEPA, a public notice for this project has been issued on April 27, 2010, in accordance with rules and regulations published in the Federal Register on April 26, 1988. These laws are applied whenever dredged or fill materials may enter waters of the United States, or for the transportation of dredged material for the purpose of placement into ocean waters. The only comment received in response to the public notice was from the Seminole Tribe of Florida. By letter dated May 27, 2010, they indicated that they have no objection to the project. A copy of their letter is included in the EA.

It should also be considered that all of the required formal consultations have been completed and no mitigation requirements have been identified for the proposed selected project.

TABLE 6B
STATUS OF AGENCY COORDINATIONS AND CONSULTATIONS

APPLICABLE LAW/REGUALTION	AGENCY	COORDINATION/CONSULTATION	
		INITIATED	STATUS
National Environmental Policy Act (NEPA)		Public Notice Issued April 27,2010	No objection comments received.
Endangered Species Act (ESA)	U.S. Fish and Wildlife Service	Consulted initiated January 15, 2010	In August, 2011, the USFWS finalized the Statewide Programmatic Biological Opinion (PBO) for Shore Protection Activities along the coast of Florida. The PBO indicates that for actions such as this in Florida, the USFWS has determined that the proposed action would not jeopardize the continued existence of nesting sea turtles. The final coordination for the piping plover was completed in October 2012.
	NOAA-National Marine Fisheries Service, Office of Protected Resources	Consultation initiated January 15, 2010	Email dated March1, 2010, concurring that project would not result in additional impacts already coordinated for the non-Federal sponsor
Fish and Wildlife Coordination Act (FWCA)	U.S. Fish and Wildlife Service	Request for Fish and Wildlife Coordination Act Report (FWCAR) initiated January 8, 2010.	Final report received October 2012..
Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) – Essential Fish Habitat (EFH)	NOAA-National Marine Fisheries Service, Habitat Conservation Division	EFH consultation initiated January 8, 2010	Letter received October 6, 2010, NMFS, Habitat Conservation Division determined that they do not have any EFH additional consultation recommendations to offer.
Coastal Barrier Resources Act (CBRA)	U.S. Fish and Wildlife Service	CBRA consultation initiated January 13, 2010	Letter received February 22, 20210 indicating USFWS's determination that project is not consistent with the purpose of CBRA. Areas within CBRA will be constructed using non-Federal funds
National Historic Preservation Act (NHPA)	Florida Division of Historic Resources	Cultural resources consultation initiated January 8, 2010	Letter received March 11, 2010 that FLSHPO concurred the action will have no effect on historic properties.
Clean Water Act (CWA)	Florida Department and Environmental Protection (FDEP)	The water quality certification application is being prepared for submittal to FDEP	Draft 404(b)(1) Evaluation Report prepared. Currently coordinating with the FDEP and non-Federal sponsor for final preparation.
Coastal Zone Management Act (CZMA)	Florida Department and Environmental Protection (FDEP)	The water quality certification application is being prepared which also includes the Coastal Zone Consistency (CZC) determination	Currently coordinating with the FDEP and non-Federal sponsor for final preparation.

3.5 FUTURE WITHOUT PROJECT CONDITION

3.5.1 General

Most of the existing shoreline is developed with the exception of state and county lands. Those properties not currently developed will likely be developed in the future. The development will likely be single and multi-family with little commercial trade development. The undeveloped areas are zoned by the county to insure that future development is compatible to neighboring property. Commercial development that may occur will be located on the north side of the beach inland from the shoreline. This development will be limited if the beach system continues to degrade and current development will ultimately be impacted, perhaps irreparably, as additional beach and dune area is lost.

Without restoration, there will be continued degradation of a valuable beach ecosystem and loss of associated habitats and benefits. The habitats will remain particularly vulnerable to wave and storm activity that continually threaten and will prevent the re-establishment of valuable natural resources. Degradation of valuable dune and beach habitat including sea turtle nesting habitat, shorebird foraging and roosting areas, dune habitat that supports various flora and fauna, and general beach ecosystem functions will persist as the area continues to be vulnerable to even minor storm activity.

Continued degradation of the beach system will have a negative effect on the value of the properties located along the beach because of cost to the property owners of increased insurance costs. As the properties experience damage there will be the loss of ability to utilize ones property as well as the loss of rental income from rental property. These losses will have a negative effect on not just the immediate area of the beach but on the general economy of the southern portion of Walton County as tourism in this area will diminish along with the value that it adds to the local economy.

3.5.2 Damages

The Beach-*fx* hurricane and storm damage model was executed to simulate the future without project condition over the study period of analysis for 100 iterations (realizations). The model process is event driven, that is, it processes storm events as they happen. In the first year if there are three storm events, then the model calculates the change in beach morphology from the start year to the time for the first storm. Simulated change prior and in between storms is based on Beach-*fx* calibrated applied erosion rates. Long-term shoreline change is incorporated into the Beach-*fx* calculations through the calibration procedure in which a model parameter known as the “applied erosion rate” is adjusted such that the model returns, on average over multiple lifecycle simulations, the historical rate of shoreline change which is developed based on available historical shoreline position information. Beach losses as a result of the storm are determined based on the simulated profile condition prior to the storm and the storm characteristics determined from the SRD. Reach processing involves determination of the post-storm and post-recovery berm width, dune width, and dune height, through lookup into the SRD, choosing the information that best fits the pre-storm reach configuration. Post-storm berm width recovery of 90 percent is applied.

For each lot within the reach, and for each damage element within the lot, wave, flooding, and erosion damages are calculated. Any damages are then calculated and triggers are checked to ascertain if any action may be warranted, for example, an emergency nourishment action. If not then the revised beach morphology is adapted for each reach as it responds to the passage of time. It then moves to the next event, a storm, and the process repeats itself until the end of the iteration and the model is reset and another possible future storm event is run. When 100 iterations are complete, summary variables are computed and read into output files to protect them. Table 7 displays the future without project condition by study reach. Table 7A shows average annual damages by type for the future without project condition to illustrate what is being damaged comparatively.

TABLE 7
WITHOUT PROJECT DAMAGES
AVERAGE VALUES – PER 54-YEAR ITERATION (EXCEPT AVERAGE ANNUAL VALUES)

Study Reach	Model Reach	Average Structure Damage	Average Content Damage	Average Total Damage	Average Annual Damages	Average Emergency Nourishment	Average Annual Emergency Nourishment
1	R1-1 to R1-24	$14,138,949	$6,011,169	$20,150,119	$1,082,511	$5,033,773	$270,425
2	R2-1 to R2-6	$9,908	$0	$9,908	$532	$181,819	$9,768
3	R3-1 to R3-26	$19,554,284	$5,266,372	$24,820,659	$1,333,421	$16,633,442	$893,586
4	R4-1 to R4-9	$3,863,133	$1,554,697	$5,417,829	$291,058	$2,942,889	$158,099
5	R5-1 to R5-51	$16,501,429	$4,481,685	$20,983,115	$1,127,259	$18,206,371	$978,091
	All Reaches	$54,067,703	$17,313,923	$71,381,630	$3,834,781	$42,998,294	$2,309,969

TABLE 7A
AVERAGE ANNUAL WITHOUT PROJECT STRUCTURE AND CONTENT DAMAGES BY TYPE

Type	Average Annual Structure Damage	Average Annual Content Damage
Private Access	$7,835	$0
Public Access	$21,111	$0
Commercial	$14,782	$6,954
Gazebo	$54,185	$4,705
Jacuzzi	$766	$0
Small Multi-Family	$55,580	$22,056
Medium Multi-Family	$370,640	$182,143
Large Multi-Family	$343	$16,689
Pool	$83,474	$2,914
Single Family Residential	$1,508,554	$707,273
Walkovers	$774,781	$0
Average Annual Damages	$2,892,051	$942,730

4.0 FORMULATING ALTERNATIVE PLANS

4.1 DEVELOPING MEASURES

Projects are formulated in accordance with policies, principles and procedures contained in ER 1105-2-100 and related regulations (e.g., ER 200-2-2) describing the planning process developed to implement the Water Resources Council's Principles and Guidelines, and the NEPA. Consideration should be given to structural and nonstructural solutions. Plan formulation should be accomplished systematically to arrive at the best solution, considering all factors, including engineering, economic, environmental, and social. ER 1105-2-100 requires that the effects of alternatives are to be determined and evaluated in terms of four accounts: national economic development (NED); environmental quality (EQ); regional economic development (RED) and other social effects (OSE).

The initial list of measures developed by the study team to address the planning objectives included the following:

- No Action
- Seawalls
- Bulkheads
- Revetments
- Breakwaters
- Groins
- Beach and dune fill
- Land use regulations
- Acquisition (buyouts)
- Relocation

4.2 EVALUATING MEASURES

Coastal protection alternatives can be classified into two groups: Non-structural and structural. Non-structural alternatives can consist of those measures that: control or regulate the use of land and buildings such that damages to property are reduced or eliminated; acquire threatened or damageable property; or, retreat which is relocation of threatened property.

Structural alternatives are composed of those measures that block or otherwise retard erosive coastal processes, or restore or nourish beaches to compensate for erosion. Typically, the hardened structural alternatives consist of seawalls, bulkheads, revetments, breakwaters, or groins. Beach and dune fill is considered a soft structural alternative. In general, seawalls, bulkheads and revetments are shore parallel structures used to retain fill and/or reduce direct wave attack on the backshore. Typical construction materials are timber and steel sheet piles, rock and/or concrete. Breakwaters are also shore parallel structures, typically constructed of rock or concrete, and placed offshore to reduce incoming wave energy. Groins, on the other hand, are typically shore perpendicular structures used to interrupt the long shore sediment transport to build a protective beach, retard erosion of an existing beach or prevent alongshore transport of sand to some downdrift point. Groins can be constructed of a wide variety of materials. The placement of sand on the beach to provide a larger berm and/or dune and to offset erosion is known as beach or dune fills. Of the structural alternatives, seawalls, bulkheads, revetments, breakwaters and groins are typically expensive to construct. The beach/dune fill option; however, is usually less expensive and more environmentally favorable since it responds to the natural beach environment.

4.3 SCREENING MEASURES

4.3.1 Initial Screening

A matrix was developed by the PDT to compare and screen the various measures against the initial screening criteria to determine which measures could be carried forward and formulated as alternative solutions to the study needs. The measures were initially qualitatively screened for:

- Engineering Feasibility
- Economic Feasibility
- Environmental Feasibility

Table 8 displays this matrix and shows what measures demonstrate promise for continued consideration.

Also of concern is assuring that the proposed measures fulfill the stated objectives for the study. A matrix was also developed to compare the success of the various measures against the objectives:

- Reduce shoreline erosion
- Reduce potential for storm damages
- Protect fish and wildlife resources
- Restore beach and dune ecosystem habitats
- Increase recreational opportunities

Table 8A displays the results of the comparison of the measures against the objections.

4.3.2 Measures Screened

4.3.2.1 Non-Structural Measures

While non-structural alternatives serve to reduce damages to the development or structures that have developed along the beach, they do not reduce land loss or damage to the shoreline and dunes. Regulation of land use may establish oceanfront setback limits or restrict building below a certain elevation; however, the study area is nearly fully developed and implementation of additional land use regulations will not serve to reduce the threat of damage to the existing structures. Additionally, there are already regulations in place for building and development along the shoreline of Walton County to minimize the threat of damage to shoreline structures. The county, along with the state, has established evacuation zones and evacuation routes and has in place procedures to alert affected residents and visitors regarding potential storm threats that could impact the coastal shoreline.

TABLE 8
INITIAL SCREENING MATRIX

		Non-Structural Measures			Structural Measures					
Screening Criteria	No Action	Regulations	Acquisition	Retreat	Seawall	Bulkhead	Revetment	Breakwater	Groin	Beach Fill
Engineering Feasibility	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Feasibility	No	No	No	No	No	No	No	No	No	Yes
Environmental Feasibility	No	No	Short Term	Short Term	No	No	No	No	No	Yes

TABLE 8A
OBJECTIVES-MEASURES SUCCESS ASSESSMENT MATRIX

		Non-Structural Measures			Structural Measures					
Objectives	No Action	Regulations	Acquisition	Retreat	Seawall	Bulkhead	Revetment	Breakwater	Groin	Beach Fill
Reduce shoreline erosion	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Reduce potential for storm damages	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Protect fish and wildlife resources	No	Yes	Short Term	Yes	No	No	No	No	No	Yes
Restore beach and dune ecosystem habitats	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Increase recreational opportunities	No	Yes	Yes	Yes	No	No	No	No	No	Yes

Retreat of the affected structure on the existing property is not practicable. Because of the small size of the existing lots, the structures could not be relocated further from the shoreline nor is there available property to relocate the structures upon. Retreat was therefore not considered a viable option and dropped from further consideration.

Property acquisition was also considered as a storm damage reduction measure. Property acquisition would involve the purchase of the damageable property that is threatened by extra-tropical and tropical storms, and relocating the residents. While the implementation of this non-structural measure will likely exceed the cost of any structural measure it will be analyzed further to determine its relative cost.

4.3.2.2 Structural Measures

Structural alternatives serve to reduce land loss or damage to the shoreline and dunes and as a consequence also reduce damages to the development or structures along the beach. These alternatives include the construction of hard structures and/or beach fill.

In the initial consideration of using hard structures it was determined that there were both engineering and environmental factors that would preclude their use. As there were no concentrated locations of erosion the usage of groins was not appropriate. Other hard structures would also disrupt the normal natural dispersal of material down drift. Additionally, Chapter 62B-33 of the State of Florida's Bureau of Beaches and Coastal Systems - Rules and Procedures for Coastal Construction and Excavation, provides guidance on criteria that must be met for use of coastal structures within the state. Specifically, 62b-33.0051 details coastal armoring and related structures and what constitutes an eligible permitable structure and under what condition structures could be authorized. The use of coastal structures in this case would not be consistent with state policy for a shore-wide solution for Walton County.

Additionally, it is believed that the use of hard structures would have a negative impact on listed species inhabiting the area. It has been demonstrated that a loss of nesting habitat related to placement of coastal structures has had an impact on nesting sea turtles in Florida. Structures not only cause the loss of suitable nesting habitat, but can result in the disruption of coastal processes accelerating erosion and interrupting the natural shoreline migration. Because of the effects on sea turtle nesting habitat believed to be caused by coastal structures, the continued vulnerability of remaining nesting habitat to frequent or successive severe weather events, may impact ability of sea turtle populations to survive and recover. In response to periodic storms, the beach itself moves landward, construction or persistence of structures at their pre-storm locations can result in a major loss of nesting habitat. In addition, the presence of hard coastal structures may interfere with nesting turtle access to the beach, result in a change in beach profile and width (downdrift erosion, loss of sandy berms, and escarpment formation), trap hatchlings, and concentrate predatory fishes, resulting in higher probabilities of hatchling predation. The combination of habitat loss and nesting opportunities resulting from beachfront development and subsequent use of coastal structures such as seawalls, bulkheads, and groins is believed to be a threat to sea turtle survival and recovery and should be avoided were possible.

Coastal structures are known to have a similar affect on beach mouse habitat and various shorebirds known to exist along the project area. The use of seawalls, bulkheads, and groins disrupt the natural dune and beach building processes that are critical to the survival of endangered beach mouse populations and shorebirds. Because of the limited remaining habitat such structures could compromise the ability of certain populations to survive and recover. As with sea turtles, the combination of habitat loss to beachfront development and subsequent use of persistent coastal structures to stabilize the shorelines at their pre-storm locations has resulted in an increased threat to species survival and recovery. In order to preserve the survival and recovery of these species, the use of such coastal structures be avoided.

Based on these considerations, beach fill is the only structural measure that can be implemented and also satisfy the study objectives.

4.4 DEVELOPING ALTERNATIVE PLANS

Of the measures that were screened, those remaining that could be considered for implementation can be used to develop alternatives. After these alternatives are developed, they will be evaluated as to how well they satisfy the planning objectives and avoid the planning constraints, and then compared against each other to determine which provides the greatest benefit for the least cost. The measures remaining after the initial screening are acquisition and beach fill.

4.4.1 Acquisition Alternative

The acquisition alternative would remove damageable property off of the beach and dune area. This would consist of acquiring those damage elements and the front lots in the study area. This alternative would remove all damageable structures from the front lots and would eliminate storm damage to approximately 81 percent of the approximately 814 damage elements in the study area. This results in about a \$57,819,000 reduction of the total average damages and about a \$3,106,000 reduction of the average annual damages. The cost of this alternative is significant. For this study area, the typical 50-foot front row lot averages one million dollars each, appraised value. There are approximately 20 lots per sub-reach, multiplied by 117 sub-reaches equals about 2,340 lots. At one million dollars each lot, multiplied by 2,340 lots yields about \$2.34 billion dollars in land value. When this land value is added to \$1.18 billion in damageable structure value (Note: only the value of the first two floors for multi-storied structures was counted in the damageable structure inventory) the resulting approximate cost is about \$3.42 billion dollars. The annual cost of this acquisition alternative would be about \$193,303,000.

4.4.2 Beach Fill Alternatives

The PDT recognized that the dunes along the Walton County shoreline provide the principal protection for the damageable structures. Likewise, the dunes are protected by the shoreline berm. Berm alternatives were formulated for each reach that would likely provide a robust berm feature in front of the dune. After the optimized berm alternative was developed for each reach, several dune alternatives were analyzed to optimize the dune width needed to provide significant reduction to hurricane and storm damages. Thus the resulting beach fill alternative is a combination of the optimized berm width and the optimized dune width.

The evaluation of erosion control and storm damage reduction alternatives took into account some heuristics and prior experience from similar constructed projects. The PDT decided to follow the process that was successfully implemented in the neighboring and adjacent Bay County, Florida, the Panama City Beaches storm damage and beach erosion protection project. Any alternative plans would not change the existing natural berm or dune height. The berm elevation is driven by local coastal processes specifically tidal range and typical wave height. In accordance with the Coastal Engineering Manual (EM) 1110-2-1100 the berm elevation was set to the natural elevation and was not considered a design parameter. In addition, because Walton County is a high upland beach morphology type (essentially a bluff-backed beach) dune elevations were not considered a design parameter.

A range of beach fill alternative plans were formulated by the PDT to evaluate both berm width and dune width alternatives. The evaluation approach adopted was a two-phase process with the first phase of the evaluation optimizing the proposed berm width. The second phase would build on the results of the first phase by optimizing the dune width.

4.4.2.1 Berm Width Optimization Alternatives

Four berm width optimization alternatives were formulated for evaluation. These berm width alternatives were specified as minimum, small, medium and maximum beach fill alternatives. These four alternatives berm widths of 50, 75, 100 and 125 feet were held for all profiles except in reach one profile one (R1P1) whose alternative berm width was 25 feet smaller. For reference purposes, the shoreline template depicting the location of the varying width is shown on Figure 9. The specifications of the four alternatives are shown in Table 9.

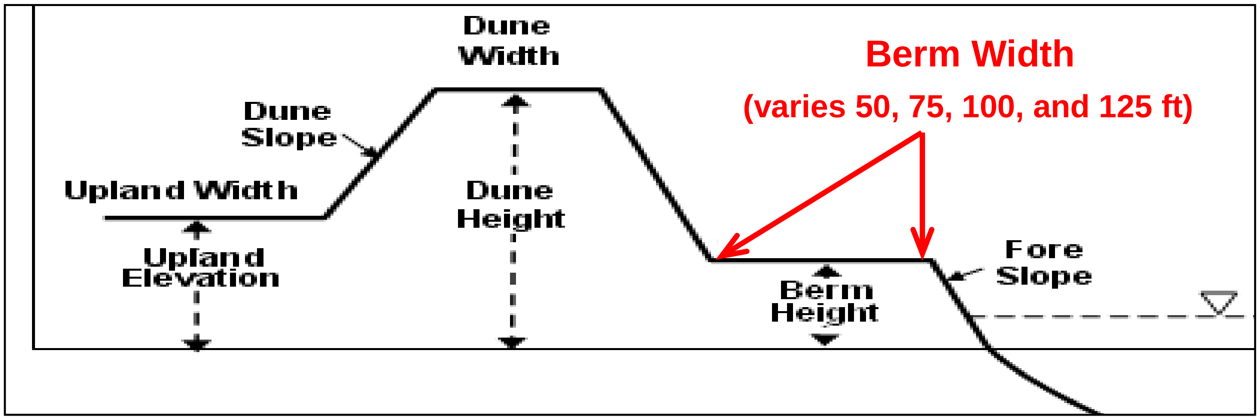


FIGURE 9. BEACH PROFILE SHOWING VARYING WIDTH OF BERM

TABLE 9
BERM WIDTH OPTIMIZATION
ALTERNATIVES AND SPECIFICATIONS

Reach	Representative Profile	Existing Dune Height (Feet)	Existing Dune Width (Feet)	Alternative Dune Width (Feet)	Alternative Berm Width (Feet)			
					Minimum	Small	Medium	Maximum
1	R1P1	22.2	55	75	25	50	75	100
	R1P2	13.6	100	120	50	75	100	125
3	R3P1	23	75	95	50	75	100	125
	R3P2	12.5	45	65	50	75	100	125
4	R4P1	23	50	70	50	75	100	125
	R4P2	10	82	10	50	75	100	125
5	R5P1	32	185	205	50	75	100	125
	R5P2	24	65	85	50	75	100	125
	R5P3	15.5	50	70	50	75	100	125

4.4.3 Reformulating Beach Fill Alternatives

4.4.3.1 Refining Berm Width Optimization

The berm width optimization runs, that kept the existing dune width constant for the four berm width optimization alternatives, resulted in justified economic reaches that were not very combinable to yield robust beach-fill features. As a result, the PDT reformulated the six alternatives to include additional dune width to test the assumption that protecting the toe of the dune would be of great benefit. These four alternatives were re-run in Beach-*fx* with 20 feet of additional dune width. The results of these runs indicated that the minimum berm template was the alternative with the greatest net benefits. Another determination from the Beach-*fx* runs of the berm width optimizations was that not all sub-reaches were going to be cost justified or they may not be robust enough for coastal hydrodynamic forces. These short sections cannot be effectively protected or left out when sandwiched between larger justified reaches. When the cost of construction per unit of benefited shore length is not reasonably uniform for the entire project area, the project should be subdivided into elements (construction reaches) within which this condition is met.

4.4.3.2 Formulation of Construction Reaches

Five possible construction reaches were formed as candidates for economic justification. Those five construction reaches were identified, numbered one through five from the west to east formed the basis for subsequent alternative analyses. Table 10 depicts the study model reaches contained within the construction reaches.

TABLE 10
WALTON COUNTY CONSTRUCTION REACHES

Construction Reach	Beginning Model Reach	Ending Model Reach	Model Reach Length (ft)	Model Reach Length (miles)
1	R1-11	R1-16	6,191	1.2
2	R3-2	R3-23	22,980	4.4
3	R4-1	R4-6	6,101	1.2
4	R5-1	R5-21	21,688	4.1
5	R5-30	R5-51	22,319	4.2

4.4.3.3 Berm Width Optimization by Construction Reach

The PDT noted that the Minimum Berm width alternative maximized net benefits but there was not an identified alternative plan that was smaller and, as a consequence, the minimum may not be the optimized berm width. The PDT formulated a smaller berm width plan called the MiniMin alternative to try and bracket an optimized berm width. In addition the alternative of zero added berm width needed to be analyzed. The MiniMin Alternative features a 10-foot berm width in Profile R1-P1 and a 25-foot berm width in the remaining profiles with a +20 foot dune width. Tables 11, 12 and 13 show the design and results of the Zero, MiniMin and the Minimum alternatives and net benefits by construction reach.

TABLE 11
ZERO, MINIMIN AND MINIMUM DESIGN ALTERNATIVES

Representative Profile	Zero Berm Width	MiniMin Berm Width	Minimum Berm Width
R1P1	0	10	25
R1P2	0	25	50
R2P1	0	25	50
R2P2	0	25	50
R3P1	0	25	50
R3P2	0	25	50
R4P1	0	25	50
R4P2	0	25	50
R5P1	0	25	50
R5P2	0	25	50
R5P3	0	25	50

4.4.3.4 The Optimized Berm Width Alternative

A comparison of the net benefits, Table 12, between the MiniMin and the Minimum Alternative reveals that in construction reach 1 the Minimum alternative maximizes net benefits and the MiniMin alternative maximizes net benefits in Construction reaches 2, 3, 4 and 5. Construction reach 1 is composed of profiles R1P1 and R1P2. R1P1 in the Minimum alternative has a berm width of 25 feet whereas profile R1P1 in the MiniMin alternative has a berm width of 10 feet.

TABLE 12
WALTON COUNTY CONSTRUCTION REACHES BERM WIDTH OPTIMIZATION

Construction Reach	Beginning Model Reach	Ending Model Reach	Net Benefits Zero Berm	Net Benefits MiniMin Berm	Net Benefits Minimum Berm	Net Benefits Small Berm	Net Benefits Medium Berm	Net Benefits Maximum Berm
1	R1-11	R1-16	$435,924	$414,516	$440,993	$311,341	$159,172	$13,458
2	R3-2	R3-23	$904,813	$1,742,843	$1,676,708	$1,287,383	$815,509	$26
3	R4-1	R4-6	$97,911	$166,356	$103,342	$22,924	-$117,384	-$76,562
4	R5-1	R5-21	$710,743	$868,767	$600,593	$176,833	-$208,993	-$611,285
5	R5-30	R5-51	$636,087	$932,571	$645,701	$177,435	-$313,043	-$788,554
Total NED			**$2,785,478**	**$4,125,053**	**$3,467,337**	**$1,975,916**	**$335,261**	**-$1,462,917**

Table 12 shows the Optimized Berm Width Alternative is the Minimum beach fill in construction reach one and the MiniMin beach fill in construction reaches 2 through 5. The optimized berm width alternative, then, is the one with berm widths of 25 feet in all profiles and construction reaches as illustrated in Table 13. The resulting widths and the reaches in which the work can be justified are used in the next phase of analysis.

TABLE 13
MINIMIN AND MINIMUM AND OPTIMIZED BERM WIDTH ALTERNATIVES

Representative Profile	MiniMin Berm Width	Minimum Berm Width	Optimized Berm Width
R1P1	10	25	25
R1P2	25	50	25
R2P1	25	50	25
R2P2	25	50	25
R3P1	25	50	25
R3P2	25	50	25
R4P1	25	50	25
R4P2	25	50	25
R5P1	25	50	25
R5P2	25	50	25
R5P3	25	50	25

Denotes optimized berm width

4.4.4 Evaluating Beach Fill Alternative Plans

4.4.4.1 Optimized Dune Width Alternatives

Having determined the optimal berm width for construction, the next phase of analysis optimizes on added dune width. In optimizing berm width it was realized that benefits were sensitive to dune width along Walton county; therefore smaller 10-foot incremental added dune width alternatives of 0, 10, 20, 30 and 40 feet were run in Beach-*fx* with the optimized berm width alternative of 25 feet (Optimized berm template of 50 feet, 25 design berm width plus 25 feet of advanced nourishment). Table 14 lays out the results of the five dune width optimization alternatives. The maximized net benefit by model reach column identifies the added dune width alternative optimized by Beach-*fx* for each model reach (the constructible dune width column on this table will be discussed in the following section).

TABLE 14
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune Width by Model Reach	Constructible Added Dune Width
R1-1	-$21,973	-$24,268	-$29,633	-$32,663	-$70,656	+00	
R1-2	-$20,560	-$23,275	-$28,261	-$31,277	-$64,626	+00	
R1-3	-$19,452	-$22,450	-$26,062	-$28,842	-$59,847	+00	
R1-4	-$20,515	-$21,875	-$26,597	-$29,331	-$59,152	+00	
R1-5	-$22,644	-$24,528	-$27,754	-$30,620	-$62,686	+00	
R1-6	-$26,738	-$25,173	-$31,575	-$34,387	-$66,491	+10	
R1-7	-$25,776	-$24,932	-$30,447	-$33,119	-$64,351	+10	
R1-8	-$27,070	-$26,652	-$31,812	-$34,591	-$67,592	+10	
R1-9	-$23,183	-$23,071	-$27,636	-$30,195	-$60,899	+10	
R1-10	-$19,414	-$20,251	-$22,745	-$25,250	-$53,615	+00	
R1-11	$30,826	$56,895	$68,085	$66,491	$34,057	+20	+10
R1-12	-$24,859	-$21,595	-$29,833	-$32,618	-$64,658	+10	+10
R1-13	$163,848	$164,890	$159,465	$156,755	$120,973	+10	+10
R1-14	$74,404	$76,523	$72,382	$69,860	$34,592	+10	+10
R1-15	$108,037	$131,552	$189,573	$212,157	$204,933	+30	+30
R1-16	$108,817	$119,998	$151,449	$162,735	$137,214	+30	+30
R1-17	-$10,947	-$8,672	-$12,337	-$13,249	-$44,213	+10	
R1-18	-$6,686	-$4,787	-$8,185	-$10,136	$12,779	+10	
R1-19	-$16,464	-$11,762	-$16,353	-$16,455	-$44,967	+10	
R1-20	-$18,102	-$14,543	-$17,092	-$16,619	-$41,608	+10	
R1-21	-$23,864	-$24,628	-$28,267	-$30,742	-$60,704	+00	
R1-22	-$22,459	-$22,298	-$26,891	-$29,509	-$59,756	+10	
R1-23	-$22,482	-$24,929	-$28,360	-$31,250	-$65,072	+00	
R1-24	-$18,535	-$19,329	-$25,302	-$28,140	-$58,971	+00	
R3-1	-$6,480	-$1,676	-$523	-$1,133	-$48,529	+20	
R3-2	$60,918	$88,440	$99,635	$105,914	$67,319	+30	+10
R3-3	-$3,637	$2,903	$495	-$467	-$39,895	+10	+10
R3-4	-$8,604	-$8,046	-$11,455	-$12,306	-$36,443	+10	+10
R3-5	-$10,952	-$7,497	-$13,443	-$14,081	-$40,631	+10	+10
R3-6	-$13,879	-$9,546	-$16,724	-$17,106	-$44,795	+10	+10
R3-7	-$12,437	-$9,368	-$15,972	-$16,624	-$44,681	+10	+10
R3-8	$6,269	$10,978	$10,427	$10,154	-$33,177	+10	+10
R3-9	$21,777	$33,172	$32,887	$33,918	-$7,904	+30	+30
R3-10	$54,721	$115,738	$157,575	$194,603	$178,292	+30	+30
R3-11	$29,313	$44,573	$49,252	$53,628	$13,442	+30	+30
R3-12	$46,295	$80,649	$104,132	$127,568	$103,900	+30	+30

TABLE 14 (CONTINUED)
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune Width by Model-Reach	Constructible Added Dune Width
R3-13	$37,990	$42,943	$42,354	$41,955	$656	+10	+30
R3-14	$107,187	$125,032	$125,659	$128,119	$74,087	+30	+30
R3-15	$53,578	$57,577	$56,864	$56,257	$11,006	+10	+30
R3-16	$42,516	$44,866	$45,067	$44,743	$13,220	+20	+30
R3-17	$70,535	$75,378	$76,840	$77,139	$32,760	+30	+30
R3-18	$76,242	$84,878	$86,728	$88,165	$42,842	+30	+30
R3-19	$77,587	$81,617	$83,045	$82,970	$38,210	+20	+30
R3-20	$239,534	$274,140	$287,533	$294,440	$252,339	+30	+30
R3-21	$90,529	$112,124	$118,304	$123,926	$80,356	+30	+30
R3-22	$60,602	$71,894	$70,982	$72,274	$30,460	+30	+30
R3-23	$45,841	$55,004	$53,541	$54,111	$17,947	+10	+30
R4-1	$57,579	$60,774	$59,376	$59,220	-$1,796	+10	+10
R4-2	$56,114	$69,534	$65,479	$66,614	-$9,366	+10	+10
R4-3	-$5,402	-$1,372	-$6,935	-$7,651	$1,532	+40	+10
R4-4	-$1,736	-$1,313	-$3,208	-$3,895	$1,471	+40	+10
R4-5	$22,248	$25,615	$23,096	$22,401	-$848	+10	+10
R4-6	-$405	$3,772	$3,267	$2,791	-$3,672	+10	+10
R5-1	$101,205	$98,415	$95,873	$95,109	$5,332	+00	+10
R5-2	$70,355	$68,018	$64,932	$63,312	$5,423	+00	+10
R5-3	$37,513	$37,398	$33,074	$31,024	$4,439	+00	+10
R5-4	$11,335	$10,860	$6,833	$3,971	$4,502	+00	+10
R5-5	$1	$3,602	-$1,157	-$3,562	$1,157	+10	+10
R5-6	$140,226	$157,419	$154,409	$151,764	-$14,183	+10	+10
R5-7	$200,024	$214,153	$209,752	$206,797	-$9,729	+10	+10
R5-8	$86,384	$100,229	$95,839	$93,221	-$9,455	+10	+10
R5-9	$12,641	$15,448	$8,646	$6,694	$3,995	+10	+10
R5-10	$16,735	$17,865	$12,965	$11,068	$3,770	+10	+10
R5-11	$22,492	$25,100	$18,724	$16,681	$3,768	+10	+10
R5-12	$19,276	$19,473	$16,094	$14,321	$3,182	+10	+10
R5-13	$17,898	$23,227	$15,965	$13,943	$1,934	+10	+10
R5-14	$15,842	$18,371	$12,358	$10,452	$3,484	+10	+10
R5-15	$22,419	$23,919	$18,097	$15,770	$4,322	+10	+10
R5-16	$25,421	$31,720	$27,972	$26,043	-$2,551	+10	+10
R5-17	$6,949	$10,436	$4,477	$3,815	$2,472	+10	+10
R5-18	$24,250	$25,944	$22,209	$20,851	$2,041	+10	+10
R5-19	$462	$4,253	$70	$647	$392	+10	+10

TABLE 14 (CONTINUED)
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune Width by Model-Reach	Constructible Added Dune Width
R5-20	-$563	$825	-$3,538	-$5,666	$2,975	+40	+10
R5-21	$135	$985	-$3,266	-$5,468	$3,401	+40	+10
R5-30	$31,359	$32,542	$27,446	$25,763	-$4,716	+10	+10
R5-31	$39,204	$40,628	$34,506	$32,596	$2,163	+10	+10
R5-32	$93,797	$116,901	$120,434	$119,260	$77,242	+20	+10
R5-33	$70,338	$76,230	$72,162	$69,274	$25,221	+10	+10
R5-34	$47,939	$51,558	$46,369	$43,212	-$235	+10	+10
R5-35	$52,939	$56,658	$52,726	$49,924	$8,037	+10	+10
R5-36	$97,937	$124,305	$126,632	$126,125	$83,916	+20	+10
R5-37	$76,094	$79,651	$74,974	$71,484	$28,353	+10	+10
R5-38	$97,013	$107,768	$99,436	$95,873	$48,203	+10	+10
R5-39	$90,626	$91,422	$88,855	$86,031	$41,575	+10	+10
R5-40	$49,424	$47,040	$44,289	$42,296	$11,247	+00	+10
R5-41	$44,150	$42,989	$39,376	$37,311	$6,701	+00	+10
R5-42	$28,280	$28,539	$23,859	$21,635	-$8,858	+10	+10
R5-43	$17,851	$17,377	$13,587	$11,494	-$17,881	+00	+10
R5-44	$3,985	$4,253	-$3	-$2,204	-$26,622	+10	+10
R5-45	-$1,618	-$1,157	-$5,345	-$7,562	-$15,038	+10	+10
R5-46	$621	$6,642	$2,709	$408	-$27,913	+10	+10
R5-47	$2,923	$17,635	$15,037	$13,057	-$1,926	+10	+10
R5-48	-$4,635	-$3,737	-$7,661	-$8,418	-$31,424	+10	+10
R5-49	$5,033	$4,860	$3,240	$2,480	-$20,329	+00	+10
R5-50	$9,987	$9,714	$7,843	$7,514	-$20,651	+00	+10
R5-51	$21,836	$23,141	$19,461	$18,844	-$6,300	+10	+10

LEGEND

CONSTRUCTION TEMPLATE 10 FEET OF ADDED DUNE WIDTH	+10
CONSTRUCTION TEMPLATE 30 FEET OF ADDED DUNE WIDTH	+30
ECONOMICALLY JUSTIFIED MODEL REACHES	

4.4.4.2 Constructible Dune Width Alternative

The best beach fill alternative plan based solely on an economic criterion is based on net excess benefits. The optimization by sub-reach shown in Table 14 describes an alternative with jagged added dune widths within those reaches that have positive net benefits and is shown in the Maximized Added Dune Width by Sub-Reach column; however, a project must also be constructible and coastal engineering and constructability issues would point to a uniform smoothed and connected robust beach fill.

One question that arose while evaluating the results of the dune width optimization results was what would be the smallest segment of beach fill that could be constructed and yet perform adequately. Coastal engineering experience suggests that a beach fill as small as 2,000 feet would perform very poorly due to its small size.

If material is placed irregularly alongshore, i.e. gaps along the placement, then the nearshore contours will be altered by the presence of the fill. Wave refraction over irregular contours will tend to cause a systematic pattern of convergence and divergence of breaking waves. Different wave heights and directions along the beach will produce areas of varying erosion and accretion. If the material is not placed over a sufficient length of beach, the material will diffuse or spread laterally to the adjacent areas and the project will perform poorly. The longer the original fill distance, the longer the material will remain in the original fill area.

Using both engineering and sound coastal engineering principles and previous experience a constructible beach fill plan was formulated. That plan utilized the data in Table 14 to include the following attributes.

In Construction Reach 1, (R1-11 to R1-16), unjustified reach R1-12 was added for constructability reasons. Filling this reach ties R1-11 into the larger neighboring reach which would present a robust beach fill of about 6,000 feet. Dune widths were standardized, 10 feet of added dune width in reaches R1-11 to R1-14 and 30 feet of added dune width for reaches R1-15 and R1-16. This reach, R1-11 to R1-16, with transitions is about 7,191 feet or 1.4 miles.

In Construction Reach 2, (R3-2 to R3-23), the 2000-foot justified segment R3-2 and R3-3 is too small of a beach fill segment and would perform too poorly to provide hurricane and storm damage reduction adequately. Filling the unjustified reaches R3-4 to R3-7 would tie this smaller segment in with the larger segment Reach R3-9 through R3-23. A robust beach fill segment from R3-2 to R3-23 would be constructed. Two uniform dune widths would be constructed, 10 feet of added dune with in reaches R3-2 to R3-8 and 30 feet of added dune width in reaches R3-9 to R3-23. This reach, R3-2 to R3-23, with transitions is about 23,980 feet or 4.5 miles.

In Construction Reach 3, (R4-1 to R4-6), the unjustified reaches R4-3 and R4-4 would be filled to provide a uniform and high performing beach fill. This would also eliminate the need for transitions that would have been required in the unjustified reaches. The predominate 10 feet of added dune width is recommended for this construction reach. This reach R4-1 to R4-6, with transitions is about 7,100 feet or 1.3 miles.

In Construction Reach 4, (R5-1 to R5-21) reaches R5-1 to R5-4 would receive 10 feet of added dune width based on constructability and engineering performance reasons to match the 10 feet of added dune width optimized for the remainder of this construction segment. This reach, R5-1 to R5-21, with transitions is about 22,690 feet or 4.3 miles.

In Construction Reach 5, (R5-30 to R5-51), unjustified reaches R5-45 and R5-48 would receive full beach fill based on engineering and constructability reasons. In addition R5-1 to R5-4 would be constructed with an added dune width of 10 feet to tie into the higher dune elevation along the adjacent State Recreation Area (see construction drawing F-110 of Appendix A, Engineering Design, Section 2, Attachment I). This reach, R5-30 to R5-51, is about 22,320 feet or 4.4 miles.

4.4.5 Borrow Source Alternatives

Ten potential offshore borrow areas, BA-1 to BA-10, were identified for detailed investigation after evaluation of reconnaissance phase information. More detailed investigations were made at five of these areas. Two areas, BA-4 and BA-7, were found to contain sufficient quantities of contiguously located beach compatible sand to be used for borrow areas. BA-4 has a mean grain size of 0.31 mm and average fines content of 0.21 percent. The sand at BA-7 is slightly coarser than at BA-4, having a mean grain size of 0.36 mm and average fines content of 0.13 percent. The sand at both BA-4 and BA-7 is slightly coarser than the native beach, which has a mean grain size of 0.30 mm and fines content that varies from 0.0 percent to 0.3 percent. More detailed information can be found in Appendix A, Engineering Design, Section 2.

Other potential borrow sources were considered but they are located further away from the project in areas with competing interest with neighboring counties, such as the East Pass Inlet and/or upland sources which were not deemed adequate given the large fill volume requirements, distances and typical costs of these sources. Therefore detailed analysis of these sources were not conducted.

5.0 COMPARING ALTERNATIVE PLANS

From the alternatives analyzed, three plans were developed to satisfy the study objectives. Those plans are the No Action, Acquisition Alternative, and Beach Fill. The plan that maximizes beneficial contributions to the Nation while satisfying the study objectives is designated as the NED Plan. Based on the foregoing analysis, that plan is the beach fill alternative.

5.1 NO ACTION PLAN

The no action plan is essentially a status quo plan. It assumes that no additional actions other than that which occurs currently will be undertaken to provide hurricane storm damage and erosion protection to damageable properties in Walton County. The No Action Alternative uses emergency nourishment as the plan to provide hurricane storm damage and erosion protection to damageable properties in Walton County. There are no costs or benefits associated with this plan.

5.2 NON-STRUCTURAL ACQUISITION PLAN

The acquisition alternative would remove damageable property off of the beach and dune area. This would consist of acquiring those damage elements and the front lots in the study area. This alternative would remove all damageable structures from the front lots and would eliminate storm damage to approximately 81 percent of the approximately 814 damage elements in the study area. This results in about a $3,106,000 reduction of the average annual damages. The approximate cost is about $3.42 billion dollars. The annual cost of this acquisition alternative would be about $193,303,000. The resulting BCR is about 0.02.

5.3 NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN

5.3.1 General

In Table 14 the constructible added dune width column identifies the NED Plan. This plan is a robust design is based on economics, engineering performance characteristics, constructability and beach fill uniformity. The reach length of the NED Plan is 80,280 feet, about 15.2 miles without transitions, with transitions it is 85,280 feet about 16.2 miles.

Table 15 summarizes the optimum added dune width within the five construction reaches by representative profile.

TABLE 15
OPTIMUM ADDED DUNE WIDTH – REPRESENTATIVE PROFILE

Construction Reach	Representative Profile	Existing Dune Width	Optimum Added Dune Width	Construction Reach Length w/o transitions (feet)	Construction Reach Length w/o transitions (miles)
CR1	R1P1	55	+10		
	R1P2	100	+30		
				6,391	1.2
CR2	R3P1	76	+10 & +30		
	R3P2	45	+10		
				23,180	4.4
CR3	R4P1	50	+10		
	R4P2	85	+10		
				6,301	1.2
CR4	R5P1	185	+10		
	R5P2	65	+10		
	R5P3	50	+10		
				21,888	4.1
CR5	R5P1	185	+10		
	R5P2	65	+10		
	R5P3	50	+10		
				22,519	4.3

5.3.2 Periodic Nourishment – NED Plan

Periodic nourishment is placement of suitable material on a beach at appropriate intervals of time to maintain the design template. Periodic nourishment plans for Walton County do not include any form of retaining structures that would reduce littoral drift from reaching down-drift beaches.

Beach-*fx* examines all reaches to be nourished to determine if mobilization is warranted. The existing reach profile is compared to the design template, and a nourishment volume is determined. If the total nourishment volume for all reaches exceeds a user-defined threshold, then mobilization and nourishment take place. If nourishment is required, then nourishment time is determined based on placement rates. A start nourishment and end nourishment event for the first reach are created. At the end nourishment event, the reach profile is set to the design template, and the next reach in processing order is examined, to see if nourishment is required. The process continues until all reaches have been handled. The cost of nourishment, including mobilization and placement costs, is calculated based on nourishment volumes and user-defined cost-related parameters.

Once the optimized beach fill template was determined then GENESIS runs were undertaken to determine the effect of longshore transport on the constructed project. These results were incorporated into the Beach-*fx* model and rerun then re-examined to determine renourishment quantities and cycles.

The results of the Beach-*fx* runs with GENESIS information for the NED Plan alternative revealed that there would be four renourishments. The initial fill and four renourishments make for five nourishments in 50 years, therefore a 10-year nourishment cycle.

From the 100 different realizations of alternative futures came the total period of analysis volume of 9,613,000 cy and on average five nourishment cycles, the initial and four renourishments. The initial fill is estimated to require on average 3,273,000 cy and each of the four renourishments averaging 1,585,000 cy each. Renourishment summary statistics are presented in Tables 16 and 17. A frequency distribution of renourishment cycles obtained from 100 possible realizations is produced in Table 18.

5.3.2.1 Comparison With Other Renourishment Projects

With the determination that the renourishment cycle for this project will be a 10-year cycle, it would be prudent to compare this with any adjacent renourishment projects to insure that they will perform in concert with this project. The only adjacent Federal project is Panama City Beach, which is immediately updrift in Bay County. The average renourishment interval of 5 years was found to produce the lowest total average equivalent cost in the 1996 Panama City Beaches, Florida General Reevaluation Report (GRR). However, the Panama City Beaches, Florida Beach Erosion Control and Storm Damage Reduction Project 5-year Monitoring Report showed that the 1998/1999 constructed beach project (R-l to R-91.5) performed above expectations. The 5-year monitoring data showed that the project had retained 85 percent of the as-built fill within the Federal project limits and suggested that the design standard had been violated only at R-84, R-85 and R-86. The post-construction monitoring supports the notion that the average beach nourishment cycle for the project is much greater than five years. In addition, the 2009 limited reevaluation study for Carillon Beach and Pinnacle Port updated the economics to determine whether the currently authorized yet federally un-constructed Carillon Beach and Pinnacle Port portion of the Panama City Beaches, Florida Beach Erosion Control and Storm Damage Reduction project was still economically justified. To calculate erosion, wave attack and inundation benefits the engineering-economic Monte Carlo simulation model, Beach-*fx*, which relates beach profile change to storms, coastal processes and nourishment programs was used. The average periodic nourishment for this reach was determined to be on average every 10 years based on 100 iterations in Beach-*fx*.· Initially, 300 iterations were simulated. Convergence appeared acceptable at about 100 iterations. Typically, early estimates are close to the starting value. Discarding the first 25 iterations found the recalculated average differed by two percent.

TABLE 16
NED PLAN PERIODIC NOURISHMENT SUMMARY STATISTICS
(VOLUMES IN CUBIC YARDS)

	Average	Standard Deviation
Average Total Nourishment Volume	9,613,000	3,828,971
Average Initial Construction Volume	3,273,000	1,418,378
Average Total Renourishment Volume	6,340,000	3,525,053
Average Number of Renourishment	4	
Average Renourishment Volume	1,585,000	

TABLE 17
NED PLAN PERIODIC NOURISHMENT CONFIDENCE INTERVALS
(VOLUMES IN CUBIC YARDS)

Average Initial Construction Volume	2,639,000	
Standard Deviation	1,418,378	
95% Confidence Interval	1,534,626	2,090,620
90% Confidence Interval	1,579,321	2,045,926
Average Total Renourishment Volume	6,341,000	
Standard Deviation	3,525,053	
95% Confidence Interval	5,182,321	6,564,117
90% Confidence Interval	5,293,399	6,453,038

TABLE 18
NOURISHMENT FREQUENCY DISTRIBUTION
100 POSSIBLE FUTURE REALIZATIONS

Number of nourishment	Number of Occurrences
0	0
1	0
2	1
3	11
4	32
5	30
6	19
7	7
8	0
9	0
10	0

5.3.3 Borrow Source – NED Plan

The proposed source of material is from an offshore sand source known as BA-4. The required quantity of fill and borrow over the project life is uncertain. Fill volume requirements in Beach-*fx* were conservatively estimated considering an overfill ratio of 1.17. For initial fill volume estimates based on 2010 surveys was assumed with a 1.0 overfill. Limit volumes of BA-4 is approximately 18.6. Estimated effective borrow volumes after accounting for dredging inefficiency are approximately 15.6 MCY.

5.3.4 Benefit Analysis – NED Plan

Table 19 presents the Hurricane and Storm Damage Reduction (HSDR) benefits by reach, profile and added dune width for the NED Plan. Total HSDR benefits are about $7,365,000.

TABLE 19
WALTON COUNTY – NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R1-1	R1P1		
R1-2	R1P1		
R1-3	R1P1		
R1-4	R1P1		
R1-5	R1P1		
R1-6	R1P1		
R1-7	R1P1		
R1-8	R1P1		
R1-9	R1P1		
R1-10	R1P1		
R1-11	R1P1	+10	$98,294
R1-12	R1P1	+10	$9,794
R1-13	R1P1	+10	$296,297
R1-14	R1P1	+10	$215,054
R1-15	R1P2	+30	$317,002
R1-16	R1P2	+30	$281,671
R1-17	R1P2		
R1-18	R1P2		
R1-19	R1P2		
R1-20	R1P2		
R1-21	R1P1		
R1-22	R1P1		
R1-23	R1P1		
R1-24	R1P1		
SUBTOTALS	**CONSTRUCTION REACH 1**		**$1,218,113**
R2-1	R2P1		
R2-2	R2P1		
R2-3	R2P2		
R2-4	R2P1		
R2-5	R2P2		
R2-6	R2P1		
R2-7	R2P1		

TABLE 19 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R3-1	R3P1		
R3-2	R3P1	+10	$169,461
R3-3	R3P1	+10	$37,805
R3-4	R3P2	+10	$7,948
R3-5	R3P2	+10	$10,704
R3-6	R3P2	+10	$10,761
R3-7	R3P2	+10	$15,941
R3-8	R3P1	+10	$59,368
R3-9	R3P1	+30	$89,601
R3-10	R3P1	+30	$289,553
R3-11	R3P1	+30	$122,795
R3-12	R3P1	+30	$224,146
R3-13	R3P1	+30	$115,949
R3-14	R3P1	+30	$264,479
R3-15	R3P1	+30	$138,857
R3-16	R3P1	+30	$105,845
R3-17	R3P1	+30	$170,314
R3-18	R3P1	+30	$189,434
R3-19	R3P1	+30	$182,301
R3-20	R3P1	+30	$456,390
R3-21	R3P1	+30	$222,335
R3-22	R3P1	+30	$158,430
R3-23	R3P1	+30	$126,316
R3-24	R3P2		
R3-25	R3P2		
R3-26	R4P1		
SUBTOTALS	**CONSTRUCTION REACH 2**		**$3,168,734**

TABLE 19 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R4-1	R4P1	+10	$76,345
R4-2	R4P1	+10	$58,509
R4-3	R4P2	+10	$0
R4-4	R4P2	+10	$0
R4-5	R4P1	+10	$38,623
R4-6	R4P2	+10	$6,393
R4-7	R4P2		
R4-8	R4P1		
R4-9	R4P1		
SUBTOTALS	**CONSTRUCTION REACH 3**		**$179,869**
R5-1	R5P2	+10	$117,676
R5-2	R5P2	+10	$82,862
R5-3	R5P2	+10	$50,371
R5-4	R5P2	+10	$22,137
R5-5	R5P2	+10	$16,725
R5-6	R5P1	+10	$233,802
R5-7	R5P1	+10	$331,560
R5-8	R5P1	+10	$151,955
R5-9	R5P2	+10	$27,704
R5-10	R5P2	+10	$30,968
R5-11	R5P2	+10	$42,879
R5-12	R5P2	+10	$32,155
R5-13	R5P2	+10	$39,259
R5-14	R5P2	+10	$31,682
R5-15	R5P2	+10	$37,354
R5-16	R5P2	+10	$47,849
R5-17	R5P3	+10	$24,884
R5-18	R5P2	+10	$39,545
R5-19	R5P3	+10	$14,251
R5-20	R5P2	+10	$12,748

TABLE 19 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-21	R5P2	+10	$13,455
R5-22	R5P3		
R5-23	R5P3		
R5-24	R5P2		
R5-25	R5P2		
R5-26	R5P1		
R5-27	R5P3		
R5-28	R5P3		
R5-29	R5P2		
SUBTOTALS	**CONSTRUCTION REACH 4**		**$1,401,821**
R5-30	R5P2	+10	$44,418
R5-31	R5P2	+10	$65,465
R5-32	R5P1	+10	$155,933
R5-33	R5P1	+10	$100,098
R5-34	R5P1	+10	$71,709
R5-35	R5P1	+10	$77,531
R5-36	R5P1	+10	$167,208
R5-37	R5P1	+10	$104,887
R5-38	R5P1	+10	$134,131
R5-39	R5P1	+10	$112,222
R5-40	R5P2	+10	$60,081
R5-41	R5P2	+10	$57,009
R5-42	R5P2	+10	$40,735
R5-43	R5P2	+10	$28,111
R5-44	R5P2	+10	$12,618
R5-45	R5P2	+10	$9,751
R5-46	R5P2	+10	$18,854
R5-47	R5P2	+10	$32,467
R5-48	R5P3	+10	$7,395
R5-49	R5P3	+10	$23,488
R5-50	R5P3	+10	$29,643
R5-51	R5P3	+10	$42,392
SUBTOTALS	**CONSTRUCTION REACH 5**		**$1,396,145**
TOTALS	**ALL CONSTRUCTION REACHES**		**$7,364,682**

5.3.5 NED Plan Costs and Benefits

Modeling with Beach-*fx* began in January 2005 using the post Hurricane Ivan surveys. Post Ivan, the very active 2005 hurricane season sent five named storms to the State of Florida. In the Gulf of Mexico, Hurricane Katrina, which made landfall in Mississippi and several other storms since then, Hurricane Dennis for example, have devastated the beaches of Northwest Florida of which Walton County is no exception. These conditions have changed the morphology of the study area in significant ways since the post Ivan surveys used in the Beach-*fx* modeling.

The Beach-*fx* modeling efforts predicted an initial fill requirement of 2,639,000 cy for the NED Plan. Recent surveys have shown that the erosion activity that has occurred since the post Hurricane Ivan surveys would require an equivalent initial NED placement of about 3,273,000 cy to fill the initial construction template. Renourishments will still be on a 10-year cycle with the renourishment volume of 1,585,000 for the NED Plan.

The FY 2013 initial construction costs are $51,945,000 and a single renourishment FY 2013 cost is $22,849,000. Renourishment costs for each fill are lower than the FY 2013 cost due to present worthing. Total project economic first cost including Interest during construction for this plan is $90,724,000. The annualized economic cost including Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) is $4,168,000. The annualized benefits, $7,380,000, include both HSDR benefits of about $7,365,000 and recreation benefits of about $15,000. The BCR is 1.77 to 1 which yields net benefits of about $3,212,000.

Table 20 summarizes the costs, benefits and other pertinent information on project justification for the NED Plan.

TABLE 20
SUMMARY BENEFITS NED PLAN
WALTON COUNTY, FLORIDA - FEASIBILITY

	FY 2013 Dollars	Category
	$51,945,000	2014 Initial Construction
	$15,240,459	2024 Renourishment
	$10,546,710	2034 Renourishment
	$7,298,539	2044 Renourishment
	$5,050,738	2054 Renourishment
Total Economic First Cost	$90,081,000	
Interest During Construction	$643,000	
Total Project Economic First Cost	$90,724,000	
Average Annual Economic First Cost	$4,044,000	
Annual OMRR&R	$124,500	
Total Average Annual Economic Cost	$4,168,000	
Average Annual HSDR Benefits	$7,365,000	
Average Annual Recreation Benefits	$15,000	
Total Average Annual Benefits	$7,380,000	
Benefit-to-Cost Ratio	1.77	
Net Benefits	$3,212,000	

5.4 LOCALLY PREFERRED PLAN (LPP)

5.4.1 General

The PDT met with the non-Federal sponsor and presented the NED Plan. The non-Federal sponsor approved of the plan and committed to supporting that conclusion. When asked if that plan was also the preferred plan, the non-Federal sponsor indicated that they would like to have added to the project the unjustified reaches R1-1 to R1-10. The non-Federal sponsor has just recently constructed a similar project in those reaches. Also they would like to have reaches R1-17 to R1-24 added to the project. The beach fill in the added reaches will match the adjacent beach fill of the NED Plan, a 50-foot berm width and 30 feet of added dune in profile R1P2 and 10 feet of added dune width in profile R1P1. The LPP adds 18,811 feet to construction reach one which gives a total length of 25,202 feet, about 4.8 miles. Total reach length of the LPP without transitions is 99,091 feet, about 18.8 miles. With transitions the LPP is 104,091 feet, about 19.7 miles. Table 21 details the features of the LPP.

5.4.2 Periodic Nourishment – Locally Preferred Plan

The results of the Beach-*fx* runs with GENESIS information for the LPP alternative revealed that there would be four renourishments. The initial fill and four renourishments make for five nourishments in 50 years, therefore a 10-year nourishment cycle.

From the 100 different realizations of alternative futures came the total period of analysis nourishment volume of 11,024,000 cy and five nourishment cycles, the initial and four renourishments. The initial fill is estimated to require on average 3,868,000 cy, and a total 7,157,000 cy for the four renourishments which average 1,789,000 cy each. Renourishment summary statistics are presented in Tables 22 and 23. A frequency distribution of renourishment cycles obtained from 100 possible realizations is produced in Table 24.

5.4.3 Borrow Source – Locally Preferred Plan

The same borrow source as detailed in Section 5.3.3 is recommended for LPP.

5.4.4 Summary Benefit Analysis – Locally Preferred Plan

Table 25 represents the LPP benefits.

TABLE 21
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R1-1	-$21,973	-$24,268	-$29,633	-$32,663	-$70,656	+00	R1P1	+10
R1-2	-$20,560	-$23,275	-$28,261	-$31,277	-$64,626	+00	R1P1	+10
R1-3	-$19,452	-$22,450	-$26,062	-$28,842	-$59,847	+00	R1P1	+10
R1-4	-$20,515	-$21,875	-$26,597	-$29,331	-$59,152	+00	R1P1	+10
R1-5	-$22,644	-$24,528	-$27,754	-$30,620	-$62,686	+00	R1P1	+10
R1-6	-$26,738	-$25,173	-$31,575	-$34,387	-$66,491	+10	R1P1	+10
R1-7	-$25,776	-$24,932	-$30,447	-$33,119	-$64,351	+10	R1P1	+10
R1-8	-$27,070	-$26,652	-$31,812	-$34,591	-$67,592	+10	R1P1	+10
R1-9	-$23,183	-$23,071	-$27,636	-$30,195	-$60,899	+10	R1P1	+10
R1-10	-$19,414	-$20,251	-$22,745	-$25,250	-$53,615	+00	R1P1	+10
R1-11	$30,826	$56,895	$68,085	$66,491	$34,057	+20	R1P1	+10
R1-12	-$24,859	-$21,595	-$29,833	-$32,618	-$64,658	+10	R1P1	+10
R1-13	$163,848	$164,890	$159,465	$156,755	$120,973	+10	R1P1	+10
R1-14	$74,404	$76,523	$72,382	$69,860	$34,592	+10	R1P1	+10
R1-15	$108,037	$131,552	$189,573	$212,157	$204,933	+30	R1P2	+30
R1-16	$108,817	$119,998	$151,449	$162,735	$137,214	+30	R1P2	+30
R1-17	-$10,947	-$8,672	-$12,337	-$13,249	-$44,213	+10	R1P2	+30
R1-18	-$6,686	-$4,787	-$8,185	-$10,136	$12,779	+10	R1P2	+30
R1-19	-$16,464	-$11,762	-$16,353	-$16,455	-$44,967	+10	R1P2	+30
R1-20	-$18,102	-$14,543	-$17,092	-$16,619	-$41,608	+10	R1P2	+30
R1-21	-$23,864	-$24,628	-$28,267	-$30,742	-$60,704	+00	R1P1	+10
R1-22	-$22,459	-$22,298	-$26,891	-$29,509	-$59,756	+10	R1P1	+10
R1-23	-$22,482	-$24,929	-$28,360	-$31,250	-$65,072	+00	R1P1	+10
R1-24	-$18,535	-$19,329	-$25,302	-$28,140	-$58,971	+00	R1P1	+10

TABLE 21 (CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R3-1	-$6,480	-$1,676	-$523	-$1,133	-$48,529	+20	R3P1	
R3-2	$60,918	$88,440	$99,635	$105,914	$67,319	+30	R3P1	+10
R3-3	-$3,637	$2,903	$495	-$467	-$39,895	+10	R3P1	+10
R3-4	-$8,604	-$8,046	-$11,455	-$12,306	-$36,443	+10	R3P2	+10
R3-5	-$10,952	-$7,497	-$13,443	-$14,081	-$40,631	+10	R3P2	+10
R3-6	-$13,879	-$9,546	-$16,724	-$17,106	-$44,795	+10	R3P2	+10
R3-7	-$12,437	-$9,368	-$15,972	-$16,624	-$44,681	+10	R3P2	+10
R3-8	$6,269	$10,978	$10,427	$10,154	-$33,177	+10	R3P1	+10
R3-9	$21,777	$33,172	$32,887	$33,918	-$7,904	+30	R3P1	+30
R3-10	$54,721	$115,738	$157,575	$194,603	$178,292	+30	R3P1	+30
R3-11	$29,313	$44,573	$49,252	$53,628	$13,442	+30	R3P1	+30
R3-12	$46,295	$80,649	$104,132	$127,568	$103,900	+30	R3P1	+30
R3-13	$37,990	$42,943	$42,354	$41,955	$656	+10	R3P1	+30
R3-14	$107,187	$125,032	$125,659	$128,119	$74,087	+30	R3P1	+30
R3-15	$53,578	$57,577	$56,864	$56,257	$11,006	+10	R3P1	+30
R3-16	$42,516	$44,866	$45,067	$44,743	$13,220	+20	R3P1	+30
R3-17	$70,535	$75,378	$76,840	$77,139	$32,760	+30	R3P1	+30
R3-18	$76,242	$84,878	$86,728	$88,165	$42,842	+30	R3P1	+30
R3-19	$77,587	$81,617	$83,045	$82,970	$38,210	+20	R3P1	+30
R3-20	$239,534	$274,140	$287,533	$294,440	$252,339	+30	R3P1	+30
R3-21	$90,529	$112,124	$118,304	$123,926	$80,356	+30	R3P1	+30
R3-22	$60,602	$71,894	$70,982	$72,274	$30,460	+30	R3P1	+30
R3-23	$45,841	$55,004	$53,541	$54,111	$17,947	+10	R3P1	+30
R4-1	$57,579	$60,774	$59,376	$59,220	-$1,796	+10	R4P1	+10
R4-2	$56,114	$69,534	$65,479	$66,614	-$9,366	+10	R4P1	+10
R4-3	-$5,402	-$1,372	-$6,935	-$7,651	$1,532	+10	R4P2	+10
R4-4	-$1,736	-$1,313	-$3,208	-$3,895	$1,471	+10	R4P2	+10
R4-5	$22,248	$25,615	$23,096	$22,401	-$848	+10	R4P1	+10
R4-6	-$405	$3,772	$3,267	$2,791	-$3,672	+10	R4P2	+10

TABLE 21 (CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R5-1	$101,205	$98,415	$95,873	$95,109	$5,332	+00	R5P2	+10
R5-2	$70,355	$68,018	$64,932	$63,312	$5,423	+00	R5P2	+10
R5-3	$37,513	$37,398	$33,074	$31,024	$4,439	+00	R5P2	+10
R5-4	$11,335	$10,860	$6,833	$3,971	$4,502	+00	R5P2	+10
R5-5	$1	$3,602	-$1,157	-$3,562	$1,157	+10	R5P2	+10
R5-6	$140,226	$157,419	$154,409	$151,764	-$14,183	+10	R5P1	+10
R5-7	$200,024	$214,153	$209,752	$206,797	-$9,729	+10	R5P1	+10
R5-8	$86,384	$100,229	$95,839	$93,221	-$9,455	+10	R5P1	+10
R5-9	$12,641	$15,448	$8,646	$6,694	$3,995	+10	R5P2	+10
R5-10	$16,735	$17,865	$12,965	$11,068	$3,770	+10	R5P2	+10
R5-11	$22,492	$25,100	$18,724	$16,681	$3,768	+10	R5P2	+10
R5-12	$19,276	$19,473	$16,094	$14,321	$3,182	+10	R5P2	+10
R5-13	$17,898	$23,227	$15,965	$13,943	$1,934	+10	R5P2	+10
R5-14	$15,842	$18,371	$12,358	$10,452	$3,484	+10	R5P2	+10
R5-15	$22,419	$23,919	$18,097	$15,770	$4,322	+10	R5P2	+10
R5-16	$25,421	$31,720	$27,972	$26,043	-$2,551	+10	R5P2	+10
R5-17	$6,949	$10,436	$4,477	$3,815	$2,472	+10	R5P3	+10
R5-18	$24,250	$25,944	$22,209	$20,851	$2,041	+10	R5P2	+10
R5-19	$462	$4,253	$70	$647	$392	+10	R5P3	+10
R5-20	-$563	$825	-$3,538	-$5,666	$2,975	+10	R5P2	+10
R5-21	$135	$985	-$3,266	-$5,468	$3,401	+10	R5P2	+10
R5-30	$31,359	$32,542	$27,446	$25,763	-$4,71	+10	R5P2	+10
R5-31	$39,204	$40,628	$34,506	$32,596	$2,163	+10	R5P2	+10
R5-32	$93,797	$116,901	$120,434	$119,260	$77,242	+20	R5P1	+10
R5-33	$70,338	$76,230	$72,162	$69,274	$25,221	+10	R5P1	+10
R5-34	$47,939	$51,558	$46,369	$43,212	-$235	+10	R5P1	+10
R5-35	$52,939	$56,658	$52,726	$49,924	$8,037	+10	R5P1	+10
R5-36	$97,937	$124,305	$126,632	$126,125	$83,916	+20	R5P1	+10
R5-37	$76,094	$79,651	$74,974	$71,484	$28,353	+10	R5P1	+10
R5-38	$97,013	$107,768	$99,436	$95,873	$48,203	+10	R5P1	+10
R5-39	$90,626	$91,422	$88,855	$86,031	$41,575	+10	R5P1	+10
R5-40	$49,424	$47,040	$44,289	$42,296	$11,247	+00	R5P2	+10

TABLE 21 (CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R5-41	$44,150	$42,989	$39,376	$37,311	$6,701	+00	R5P2	+10
R5-42	$28,280	$28,539	$23,859	$21,635	-$8,858	+10	R5P2	+10
R5-43	$17,851	$17,377	$13,587	$11,494	-$17,881	+00	R5P2	+10
R5-44	$3,985	$4,253	-$3	-$2,204	-$26,622	+10	R5P2	+10
R5-45	-$1,618	-$1,157	-$5,345	-$7,562	-$15,038	+10	R5P2	+10
R5-46	$621	$6,642	$2,709	$408	-$27,913	+10	R5P2	+10
R5-47	$2,923	$17,635	$15,037	$13,057	-$1,926	+10	R5P2	+10
R5-48	-$4,635	-$3,737	-$7,661	-$8,418	-$31,424	+10	R5P3	+10
R5-49	$5,033	$4,860	$3,240	$2,480	-$20,329	+00	R5P3	+10
R5-50	$9,987	$9,714	$7,843	$7,514	-$20,651	+00	R5P3	+10
R5-51	$21,836	$23,141	$19,461	$18,844	-$6,300	+10	R5P3	+10

LEGEND

CONSTRUCTION TEMPLATE 10 FEET OF ADDED DUNE WIDTH	+10
CONSTRUCTION TEMPLATE 30 FEET OF ADDED DUNE WIDTH	+30
ECONOMICALLY JUSTIFIED MODEL REACHES	

TABLE 22
LOCALLY PREFERRED PLAN PERIODIC NOURISHMENT SUMMARY STATISTICS
(VOLUMES IN CUBIC YARDS)

	Average
Average Total Nourishment Volume	11,024,000
Average Initial Construction Volume	3,868,000
Average Total Renourishment Volume	7,157,000
Average Number of Renourishments	4
Average Renourishment Volume	1,789,000

TABLE 23
LOCALLY PREFERRED PLAN PERIODIC NOURISHMENT CONFIDENCE INTERVALS
(VOLUMES IN CUBIC YARDS)

Average Initial Construction Volume	3,152,000	
Standard Deviation	1,599,545	
95% Confidence Interval	1,913,051	2,237,091
90% Confidence Interval	1,862,647	2,287,494
Average Total Renourishment Volume	7,157,000	
Standard Deviation	4,088,020	
95% Confidence Interval	5,388,314	6,990,788
90% Confidence Interval	5,517,131	6,861,970

TABLE 24
NOURISHMENT FREQUENCY DISTRIBUTION
100 POSSIBLE FUTURE REALIZATIONS

Number of Nourishments	Number of Occurrences
0	0
1	0
2	0
3	14
4	34
5	29
6	19
7	4
8	0
9	0
10	0

TABLE 25
WALTON COUNTY – LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R1-1	R1P1	+10	$2,968
R1-2	R1P1	+10	$1,996
R1-3	R1P1	+10	$2,193
R1-4	R1P1	+10	$2,328
R1-5	R1P1	+10	$2,021
R1-6	R1P1	+10	$2,809
R1-7	R1P1	+10	$3,555
R1-8	R1P1	+10	$3,116
R1-9	R1P1	+10	$3,833
R1-10	R1P1	+10	$2,655
R1-11	R1P1	+10	$120,608
R1-12	R1P1	+10	$9,880
R1-13	R1P1	+10	$299,683
R1-14	R1P1	+10	$217,062
R1-15	R1P2	+30	$341,492
R1-16	R1P2	+30	$280,917
R1-17	R1P2	+30	$32,987
R1-18	R1P2	+30	$38,156
R1-19	R1P2	+30	$26,922
R1-20	R1P2	+30	$9,227
R1-21	R1P1	+10	$1,880
R1-22	R1P1	+10	$2,732
R1-23	R1P1	+10	$2,028
R1-24	R1P1	+10	$10,942
R2-1	R2P1		
R2-2	R2P1		
R2-3	R2P2		
R2-4	R2P1		
R2-5	R2P2		
R2-6	R2P1		
R2-7	R2P1		

TABLE 25 (CONTINUED)
WALTON COUNTY – LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R3-1	R3P1		
R3-2	R3P1	+10	$151,815
R3-3	R3P1	+10	$36,755
R3-4	R3P2	+10	$7,900
R3-5	R3P2	+10	$10,419
R3-6	R3P2	+10	$10,386
R3-7	R3P2	+10	$15,819
R3-8	R3P1	+10	$60,253
R3-9	R3P1	+30	$90,386
R3-10	R3P1	+30	$294,486
R3-11	R3P1	+30	$122,825
R3-12	R3P1	+30	$223,182
R3-13	R3P1	+30	$115,932
R3-14	R3P1	+30	$264,362
R3-15	R3P1	+30	$138,857
R3-16	R3P1	+30	$105,845
R3-17	R3P1	+30	$170,269
R3-18	R3P1	+30	$189,346
R3-19	R3P1	+30	$182,292
R3-20	R3P1	+30	$456,983
R3-21	R3P1	+30	$222,634
R3-22	R3P1	+30	$158,622
R3-23	R3P1	+30	$126,427
R3-24	R3P2		
R3-25	R3P2		
R3-26	R4P1		
R4-1	R4P1	+10	$74,910
R4-2	R4P1	+10	$54,127
R4-3	R4P2	+10	$0
R4-4	R4P2	+10	$0
R4-5	R4P1	+10	$36,920
R4-6	R4P2	+10	$6,393
R4-7	R4P2		
R4-8	R4P1		
R4-9	R4P1		

TABLE 25 (CONTINUED)
WALTON COUNTY – LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-1	R5P2	+10	$117,769
R5-2	R5P2	+10	$82,853
R5-3	R5P2	+10	$50,375
R5-4	R5P2	+10	$22,139
R5-5	R5P2	+10	$16,720
R5-6	R5P1	+10	$233,335
R5-7	R5P1	+10	$331,279
R5-8	R5P1	+10	$151,886
R5-9	R5P2	+10	$27,686
R5-10	R5P2	+10	$30,961
R5-11	R5P2	+10	$42,883
R5-12	R5P2	+10	$32,159
R5-13	R5P2	+10	$39,251
R5-14	R5P2	+10	$31,676
R5-15	R5P2	+10	$37,350
R5-16	R5P2	+10	$47,828
R5-17	R5P3	+10	$24,882
R5-18	R5P2	+10	$39,531
R5-19	R5P3	+10	$14,183
R5-20	R5P2	+10	$12,654
R5-21	R5P2	+10	$13,454
R5-22	R5P3		
R5-23	R5P3		
R5-24	R5P2		
R5-25	R5P2		
R5-26	R5P1		
R5-27	R5P3		
R5-28	R5P3		
R5-29	R5P2		
R5-30	R5P2	+10	$44,315
R5-31	R5P2	+10	$65,452
R5-32	R5P1	+10	$155,318
R5-33	R5P1	+10	$100,014
R5-34	R5P1	+10	$71,684
R5-35	R5P1	+10	$77,470

TABLE 25 (CONTINUED)
WALTON COUNTY – LOCALLY PREFERRED PLAN BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-36	R5P1	+10	$166,641
R5-37	R5P1	+10	$104,860
R5-38	R5P1	+10	$134,036
R5-39	R5P1	+10	$112,205
R5-40	R5P2	+10	$60,081
R5-41	R5P2	+10	$57,009
R5-42	R5P2	+10	$40,735
R5-43	R5P2	+10	$28,107
R5-44	R5P2	+10	$12,618
R5-45	R5P2	+10	$9,751
R5-46	R5P2	+10	$18,678
R5-47	R5P2	+10	$32,068
R5-48	R5P3	+10	$7,394
R5-49	R5P3	+10	$23,588
R5-50	R5P3	+10	$29,640
R5-51	R5P3	+10	$42,370
Average Annual Benefits LPP			**$7,554,927**

5.4.5 Locally Preferred Plan Costs and Benefits

Modeling with Beach-*fx* began in January 2005 using the post Hurricane Ivan surveys. During the very active 2005 hurricane season, five named storms affected the State of Florida. In the Gulf of Mexico, Hurricane Katrina, which made landfall in Mississippi and several other storms since then, Hurricane Dennis, for example, have devastated the beaches of Northwest Florida of which Walton is no exception. These conditions have changed the morphology of the study area in significant ways since the post Hurricane Ivan surveys used in Beach-*fx* modeling efforts predicted initial fill requirements of 3,152,000 cy. The NED Plan and the LPP maintain the same placement template (see Appendix B, Economic Investigations, Figure B-6) but the LPP extends the coverage area to the westernmost limits of the county where the NED Plan could not justify the coverage. Recent surveys have shown that the erosion activity that has occurred since the post Hurricane Ivan surveys would require an equivalent LPP placement of 2,980,000 cy. If the historical long-term erosion rate is applied to the predicted construction timeframe of FY14, then the necessary LPP beach fill initial construction requirements will be 3,868,000 cy. Renourishments will still be on a 10-year cycle and the renourishment volume is 1,789,000 cy for the LPP. The economic benefit period for this project begins with the base year of 2014, and ends at the conclusion of 2063. The project will be fully constructed in 2014, and will be renourished in 2024, 2034, 2044, and 2054. The final renourishment in 2054 will function through 2063, the last year of the economic benefit evaluation period.

The FY 2013 initial construction costs are $61,397,000 and a single renourishment FY 2013 cost is $25,760,000. Renourishment costs for each fill are lower than the FY 2013 cost due to present worthing. Total project economic cost including interest during construction for this plan is $103,598,000. The average annual economic construction cost is about $4,618,000 and annual OMRR&R is $168,000 making total average annual economic cost $4,786,000. The annualized benefits, $7,570,000, include both HSDR benefits of about $7,555,000 and recreation benefits of about $15,000. The BCR is 1.58 to 1 which yields net benefits of about $2,784,000. Table 26 summarized the costs, benefits and other pertinent information on project justification for the LPP.

TABLE 26
SUMMARY BENEFITS LPP
WALTON COUNTY, FLORIDA – FEASIBILITY

	FY 2013 Dollars	Category
	$61,397,000	2014 Initial Construction
	$16,561,078	2024 Renourishment
	$11,460,605	2034 Renourishment
	$7,930,973	2044 Renourishment
	$5,488,396	2054 Renourishment
Total Economic First Cost	$102,838,052	
Interest During Construction	$760,000	
Total Project Economic First Cost	$103,598,000	
Average Annual Economic First Cost	$4,618,000	
Annual OMRR&R	$168,000	
Total Average Annual Economic Cost	$4,786,000	
Average Annual HSDR Benefits	$7,555,000	
Average Annual Recreation Benefits	$15,000	
Total Average Annual Benefits	$7,570,000	
Benefit-to-Cost Ratio	1.58	
Net Benefits	$2,784,000	

5.5 SYSTEM OF ACCOUNTS

Principles and Guidelines prescribe for an evaluation of project benefits for the final array of alternatives and the selected plan according to the four accounts: National Economic Development (NED), Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ).

The NED benefits were fully and illustratively presented throughout the economic analysis. Regional Economic Development Benefits are calculated using the Economic Impact Forecasting System (EIFS). EIFS is an regional economic impact assessment model that uses economic multipliers and a database of economic and financial statistics by county to measure the economic and financial impact to a community through various increases and/or decreases in economic activity in that community.

The Other Social Effects (OSE) account, would report that there are either no negative impacts on community cohesion or community growth. There will be minor to no appreciable impacts on tax or property values. There will be a small positive impact to front row residents who are likely to incur less impacts from erosion and wave action due to the project.

The evaluation of the System of Accounts is displayed in Table 27.

TABLE 27
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
A. PLAN DESCRIPTION	No Federal Action	Buyout all row one damageable elements and land	Construct a 50-foot beach fill project in five reaches	Construct a 50-foot beach fill project in five reaches
B. IMPACT ASSESSMENT				
1. National Economic Development				
a. Beneficial Impacts				
(1) Damages Prevented	$0	$3,106,000	$7,365,000	$7,555,000
(2) Emergency Costs Avoided	$0	$0	$0	$0
(3) Recreation	$0	$0	$15,000	$15,000
(4) Total Beneficial Impacts	None.	$3,106,000	$7,380,000	$7,570,000
b. Adverse Impacts				
(1) Project Cost	$0	$3,420,000,000	$90,081,000	$102,838,000
(2) Interest During Construction	$0	$32,665,600	$643,000	$760,000
(3) Average Annual First Cost	N/A	$193,303,000	$4,044,000	$4,618,000
4) Annual OMRR&R	$0		$124,500	$168,000
(5) Total Avg. Annual Costs	$0	$193,303,000	$4,168,000	$4,786,000
2. Environmental Quality (EQ)				
(1) Ecosystem Restoration	No ecosystem restoration benefits.	Significantly Increased dune habitat from added dune width	Increased habitat from added dune and berm width	Increased habitat from added dune and berm width
(2) Water Circulation	No anticipated effect on water circulation.	No anticipated effect on water circulation.	No anticipated effect on water circulation.	No anticipated effect on water circulation.
(3) Noise Level Changes	No change in noise levels	No change in noise levels	Temporary increase in noise levels during construction	Temporary increase in noise levels during construction

TABLE 27 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
(4) Public Facilities	N/A	N/A	N/A	N/A
(5) Aesthetic Values	No significant change in aesthetic values	Significant increase to aesthetic improvement	Significant increase to aesthetic improvement	Significant increase to aesthetic improvement
(6) Natural Resources	No impact.	Alternative would result in restoration of coastal marsh resources.	Alternative would result in restoration of coastal marsh resources.	Alternative would result in restoration of coastal marsh resources.
(7) Biological Resources	No impact.	Biological resources would be improved versus the no-action alternative.	Biological resources would be improved versus the no-action alternative.	Biological resources would be improved versus the no-action alternative.
(8) Air Quality	Alternative would have no anticipated effect on air quality	Air emission would be *de minimus*	Air emission would be *de minimus*	Air emission would be *de minimus*
(9) Water Quality	No impact.	No impact.	Temporary negative impacts to water quality due to construction.	Temporary negative impacts to water quality due to construction.
(10) Public Services	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events
(11) Cultural and Historical Preservation	No impact.	No impact.	No impact.	No impact.
(12) Total Quality of the Environment	No impact.	Environmental quality would be improved.	Environmental quality would be improved.	Environmental quality would be improved.
3. Regional Economic Development (RED)				
(1) Impact on Sales Volume	No impact.	Decrease of **$47,819,840** in sales volume.	Increase of **$167,576,000** in additional sales volume.	Increase of **$192,354,000** in additional sales volume.
(2) Impact on Income	No impact.	Decrease of **$35,723,610** in local income.	Increase of **$30,595,000** in additional local income.	Increase of **$35,119,000** in additional local income.
(3) Impact on Employment	No impact.	Decrease of **1141** jobs.	Increase of **1055** new jobs.	Increase of **1210** new jobs.
(4) Tax Changes	No impact.	Would result in loss of some local tax revenue due to acquisition of properties.	No Change	No Change

TABLE 27 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
4. Other Social Effects (OSE)				
a. Beneficial Impacts				
(1) Security of Life, Health, and Safety	Continued risks to life, health and safety	Major reduction in potential loss of life of persons and property.	No appreciable difference	No appreciable difference
(2) Community Cohesion	No negative impact on community cohesion.	Community would be dispersed and/or relocated	No negative impact on community cohesion.	No negative impact on community cohesion.
(3) Tax Values	No Impact.	Ownership and land use changes would impact tax value	Increase due to enhanced property values	Increase due to enhanced property values
(4) Community Growth	No Impact.	No Impact.	No Impact.	No Impact.
(5) Property Values	No Impact.	Minor temporary negative impact to adjacent properties during acquisition phase.	Minor Positive impact to protected properties.	Minor Positive impact to protected properties.
(6) Displacement of Businesses	N/A	N/A	N/A	N/A
(7) Public Facilities	N/A	Enhances opportunities for additional public facilities for recreation	Minor improvement to recreational activities from increased beach	Minor improvement to recreational activities from increased beach
(8) Injurious Displacement of Farms	N/A	N/A	N/A	N/A
b. Preservation of loss of life	No Impact.	Some reduction in potential loss of life.	No Change	No Change
C. PLAN EVALUATION				
1. Contributions to Planning Objectives				
a. Flood, Hurricane and/or Storm Damage Reduction	No Improvement.	Total reduction in damages at project site and less stress on dune system.	Significant reduction of storm damages and loss of land	Significant reduction of storm damages and loss of land
b. Recovery of lost environmental resources	Continued loss of environmental resources.	Significant opportunity to recover environmental resources negatively impacted in past	Some Recovery of environmental resources through additional dune area for nesting birds, beach mice and turtles	Some Recovery of environmental resources through additional dune area for nesting birds, beach mice and turtles
2. Response to Planning Constraints				
a. Avoid environmental impacts and minimize induced damages	Continued loss of environmental resources.	Positive effect on environmental resources.	Positive effect on environmental resources.	Positive effect on environmental resources.

TABLE 27 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
b. Institutional Acceptability	Not supported by state or local government	Not supported by state or local government	Is supported by local and state governments	Is supported by local and state governments
3. Response to Evaluation Criteria				
a. Acceptability	NO	NO	YES	YES
b. Completeness	NO	YES	YES	YES
c. Effectiveness	NO	YES	YES	YES
d. Efficiency (Cost-Effectiveness; i.e., most efficient use of Federal and Non-Federal Funds)	NO	NO	YES	YES
e. Integration	N/A	N/A	N/A	N/A
f. Reversibility	N/A	NO - land could not be resold for development	YES - project nourishment can be abandoned	YES - project nourishment can be abandoned
4. Stakeholder Preference Score (From MCDA weightings analysis)				
a. Summary Score	N/A	N/A	N/A	N/A
Cluster Group A	N/A	N/A	N/A	N/A
Cluster Group B	N/A	N/A	N/A	N/A
Cluster Group C	N/A	N/A	N/A	N/A
Cluster Group D	N/A	N/A	N/A	N/A
b. Stakeholder Preference	NO	NO	Stakeholder would approve.	Stakeholder Preference
D. Implementation Responsibility	No implementation responsibilities	Joint Federal/Non-Federal implementation responsibility.	Joint Federal/Non-Federal implementation responsibility.	Joint Federal/Non-Federal implementation responsibility.
E. State and other Non-Federal Coordination	No State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities
F. Risk Evaluation				
1. Risk and Vulnerabilities				
a. Risk of Failure	N/A	Very low risk of failure	Moderate risk of failure.	Moderate risk of failure.
b. Residual Risk	Residual risk of all actions will remain substantial due to storm surge.	Residual risk of all properties purchased virtually eliminated	Residual risk of all actions will remain substantial due to storm surge.	Residual risk of all actions will remain substantial due to storm surge.
c. Reliability	N/A	This plan would provide a significant degree of reliability to properties purchased. Residents are moved out of harm's way.	This plan would provide a significant degree of reliability, would receive damage from storm events, and would require maintenance.	This plan would provide a significant degree of reliability, would receive damage from storm events, and would require maintenance.

TABLE 27 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
d. Relative Sea Level Rise	Problems will be substantially exacerbated by an increasing relative rise of sea level	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis
e. Risk of Ecosystem Damage	Ecosystem damage will continue to accrue at a rate at least that of recent history with substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at least that of recent history with substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at less than that of recent history with less substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at less than that of recent history with less substantial negative outcomes.
f. Risk to Life and Safety	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents will be substantial.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures would be eliminated.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents substantially reduced.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents substantially reduced.
g. Risk to Mental and Physical Health	N/A	N/A	N/A	N/A
2. Recommendations and Preferences				
a. Federal Recommendation			The NED Plan is the plan that maximizes net benefits	
b. Stakeholder Preference	No clear stakeholder preference indicated, but all action plans preferred to no action plan.			The Locally Preferred Plan provides a higher extent of protection over the NED Plan but is more costly. The sponsor is willing to pay 100 percent of the additional cost for this added extent of protection

6.0 SELECTING A PLAN

Based on plan comparison, as shown in Table 27, it is apparent that implementation of a beach fill plan will satisfy the study objectives and provide hurricane and storm damage reduction and environmental restoration along the coastline of Walton County, Florida. Further, both the NED and LPP beach fill plans were found superior to the Acquisition and No Action plans in each of the System of Accounts. The Acquisition Plan would cost nearly 40 times more than the NED and LPP beach fill plans while providing less economic benefit and the no action plan would provide no economic benefit. The NED Plan would have an annual cost of about $4,429,000 with the LPP annual cost totaling about $5,159,000. The annual benefits of the NED Plan would total about $7,353,000 with the LPP annual benefits totaling about $7,533,000. The BCR of the NED Plan is about 1.66 while the BCR of the LPP is about 1.46. The NED Plan would protect about 15.2 miles of the Walton County shoreline while the LPP would protect about 18.8 miles.

The non-Federal sponsor has expressed their desire to implement the LPP. Per ER 1105-2-100, the recommended plan may deviate from the NED Plan if the non-Federal sponsor agrees to pay the cost difference between the NED Plan and the LPP, the LPP has outputs similar in-kind, and the LPP has benefits that are equal or greater to the NED benefits. A waiver, that the LPP be considered for recommendation, was requested and on 7 February 2012, was approved by the ASA (CW). As such, the LPP is the selected plan.

6.1 PLAN DETAILS

6.1.1 NED Plan and Selected Plan for Construction with Renourishments

The modeling efforts have predicted initial fill requirements of 2,639,000 cy for the NED Plan and a selected plan requirement of 3,152,000 cy. The two plans maintain the same placement template (see Figure 10) but the selected plan extends the coverage area to the westernmost limits of the county where the NED Plan could not justify the coverage. If this condition accounts for depletion rates to the predicted construction timeframe of FY 14, then the necessary beach fill requirements will be 3,273,000 cy and 3,868,000 cy for the NED and selected plan, respectively. Renourishments will still be on a 10-year cycle with renourishment volumes of 1,585,000 and 1,789,000 for the NED and selected plan, respectively. Approved borrow sources lie offshore within the State of Florida waters.

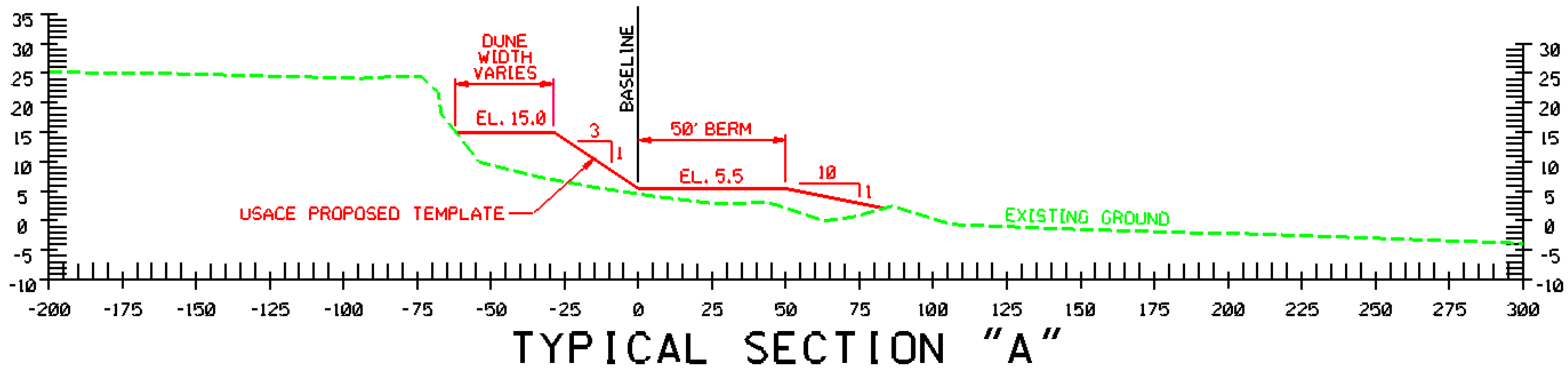
6.2 COST SHARE

Typical cost share for HSDR projects is 65 percent Federal and 35 percent non-Federal. Adjustment can be made to this ratio based on adequacy of public access and parking, whether private shoreline is being protected, and if any economically unjustified reach is being included in the selected plan. A cost share analysis presented in Table 28 shows that the cost share ratio for the initial construction costs of the NED Plan would be about

33 percent Federal and about 67 percent non-Federal. The renourishment costs were adjusted to comply with amendments made by Section 215 of WRDA 1999, Public Law 106-53, to Section 103(d) of WRDA 1986, PL 99-662, which established 50 percent non-Federal cost sharing for periodic nourishment on any beach erosion control authorized for construction after December 31, 1999 and carried out after January 1, 2003. Corps policies require adjustments be made to this cost sharing based on public access/parking, ownership and land use conditions similar to the adjustments that are made to cost sharing for initial construction. The resulting cost share for the NED renourishment costs is about 26 percent Federal and about 74 percent non-Federal. Similarly, the cost share analysis presented in Table 29 shows that the cost share ratio for the initial construction costs of the LPP would be about 28 percent Federal and about 72 percent non-Federal. The cost share ratio for the LPP renourishment costs is about 23 percent Federal and about 77 percent non-Federal. The overall cost ratio for both the initial construction costs and the renourishment costs of the NED Plan is about 30 percent Federal and about 70 percent non-Federal. The overall cost ratio for both the initial construction costs and the renourishment costs of the LPP is about 26 percent Federal and about 74 percent non-Federal. See Appendix D, non-Federal Coordination for sponsor views and statement of financial capability. Tables 30 and 30A shown below, exhibit the differences between the NED Plan and the LPP. Note that while some sub-reaches qualify for Federal participation based on parking and access, sub-reaches that contain an asterisk in the last column designate that all or a portion of the reach is in a CBRA zone. Only work outside the CBRA zone can be cost shared. Any work within the CBRA would have to be 100 percent non-Federal funded.

Table 31 demonstrates if a particular reach qualifies for cost share based on adequacy of public access and parking. The location of beach access points is publicly available on the World Wide Web. The analysis of adequate parking along the beaches requires either a beach capacity or peak user day point of view. Since the beach capacity is greater than the peak day visitation, the peak user day analysis is used. The most recent peak day visitation at Walton County beaches, which occurred during the July 4, 2009 holiday, was estimated at 13,537 visits. Assumptions of the analysis are (1) the demand for public parking originates from both resident and non-residents population; (2) beach rentals on the beach that have access to the beach contribute to the supply of parking in absolute parking space terms without turnover; (3) The large county beach access and parking available at Miramar Beach and other such large day use areas, are very popular and highly attended areas. These areas will, on peak day, operate at full parking capacity where the average daily turnover rate on purely public parking is 1.5 times. Assuming 4.5 persons per vehicle, each parking space will accommodate 6.75 visits per day. Surplus and deficits in parking areas in any reach are available to be used within a quarter mile radius of the loci of the parking supply except near the large day use areas whose supply is completely used.

Parking and access reflected in this report is what is anticipated at the time of project implementation and the non-Federal sponsor has accepted the requirement to fund those reaches that do not provide adequate parking. The non-Federal sponsor has indicated that over the project life it is possible that additional parking and access may be provided which would change cost sharing in the future.



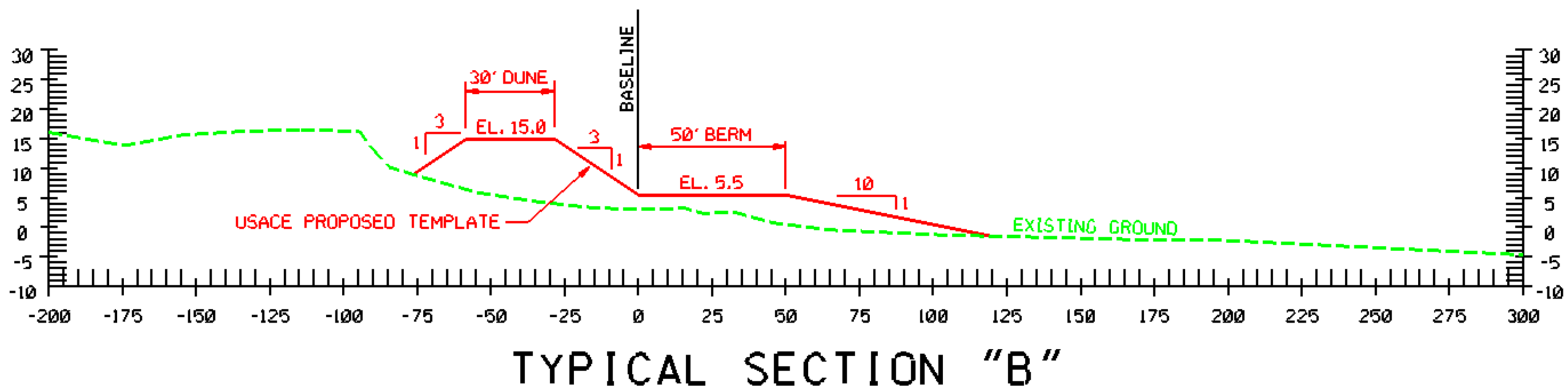


FIGURE 10. TYPICAL PROJECT SECTIONS TO BE CONSTRUCTED

TABLE 28
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
			65%	0%	50%	65%	65%	0%	50%	65%					
			35%	100%	50%	35%	35%	100%	50%	35%					
1	R1-1	1150	1,150	0	0	0	0	0%	0%	0%		0.0%	0.0000		
2	R1-2	1102	560	0	0	0	0	0%	0%	0%		0.0%	0.0000		
3	R1-3	1044	0	0	0	0	0	0%	0%	0%		0.0%	0.0000		
4	R1-4	1002	102	0	0	0	0	0%	0%	0%		0.0%	0.0000		
5	R1-5	1062	1,062	0	0	0	0	0%	0%	0%		0.0%	0.0000		
6	R1-6	1045	998	0	0	0	0	0%	0%	0%		0.0%	0.0000		
7	R1-7	1003	1,003	0	0	0	0	0%	0%	0%		0.0%	0.0000		
8	R1-8	1061	984	0	0	0	0	0%	0%	0%		0.0%	0.0000		
9	R1-9	1014	984	0	0	0	0	0%	0%	0%		0.0%	0.0000		
10	R1-10	959	100	0	0	0	0	0%	0%	0%	0.0012	0.0%	0.0000	100.00%	
11	R1-11	1021	955	66	0	0	94%	6%	0%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach One
12	R1-12	1057	1057	0	0	0	100%	0%	0%	0%	0.0132	65.0%	0.0086	35.00%	
13	R1-13	1040	1,040	0	0	0	100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
14	R1-14	1051	1,051	0	0	0	100%	0%	0%	0%	0.0131	65.0%	0.0085	35.00%	
15	R1-15	998	923	75	0	0	92%	8%	0%	0%	0.0124	60.1%	0.0075	39.89%	
16	R1-16	1025	883	142	0	0	86%	14%	0%	0%	0.0128	56.0%	0.0071	43.99%	
17	R1-17	1114	100	0	0	0	0	0%	0%	0%	0.0012	62.3%	0.0080	37.66%	
18	R1-18	1133	1,033	100	0	0	0	9%	0%	0%		0.0%	0.0000		
19	R1-19	1058	1,058	0	0	0	0	0%	0%	0%		0.0%	0.0000		
20	R1-20	961	961	0	0	0	0	0%	0%	0%		0.0%	0.0000		
21	R1-21	952	952	0	0	0	0	0%	0%	0%		0.0%	0.0000		
22	R1-22	1028	1,028	0	0	0	0	0%	0%	0%		0.0%	0.0000		
23	R1-23	1086	956	130	0	0	0	12%	0%	0%		0.0%	0.0000		
24	R1-24	1139	1139	0	0	0	0	0%	0%	0%		0.0%	0.0000		
Construction Reach One Sub Totals													0.0482		6391.2

TABLE 28 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
25	R2-1	495	0	0	0	0	0%	0%	0%	0%					
26	R2-2	936	0	0	0	0	0%	0%	0%	0%					
27	R2-3	2160	0	0	0	0	0%	0%	0%	0%					
28	R2-4	2066	0	0	0	0	0%	0%	0%	0%					
29	R2-5	1001	0	0	0	0	0%	0%	0%	0%					
30	R2-6	10078	0	0	0	0	0%	0%	0%	0%					
31	R2-7	1040	0	0	0	0	0%	0%	0%	0%					
32	R3-1	1147	0	0	100	0	0%	0%	9%	0%	0.0012	0.0%	0.0000	100.00%	*
33	R3-2	1037	838	199	0	0	81%	19%	0%	0%	0.0129	0.0%	0.0000	100.00%	Construction Reach Two
34	R3-3	1052	904	148	0	0	86%	14%	0%	0%	0.0131	0.0%	0.0000	100.00%	
35	R3-4	1026	914	112	0	0	89%	11%	0%	0%	0.0128	57.9%	0.0074	42.10%	
36	R3-5	1121	1,121	0	0	0	100%	0%	0%	0%	0.0140	65.0%	0.0091	35.00%	
37	R3-6	1185	1,115	70	0	0	94%	6%	0%	0%	0.0148	0.0%	0.0000	100.00%	
38	R3-7	1156	1,120	36	0	0	97%	3%	0%	0%	0.0144	0.0%	0.0000	100.00%	
39	R3-8	1103	909	194	0	0	82%	18%	0%	0%	0.0137	53.6%	0.0074	46.43%	
40	R3-9	1058	875	183	0	0	83%	17%	0%	0%	0.0132	53.8%	0.0071	46.25%	
41	R3-10	1068	1,068	0	0	0	100%	0%	0%	0%	0.0133	65.0%	0.0086	35.00%	
42	R3-11	1045	794	55	196	0	76%	5%	19%	0%	0.0130	58.8%	0.0076	41.24%	
43	R3-12	1007	824	100	83	0	82%	10%	8%	0%	0.0125	57.3%	0.0072	42.69%	
44	R3-13	1004	716	288	0	0	71%	29%	0%	0%	0.0125	46.4%	0.0058	53.65%	
45	R3-14	1345	960	385	0	0	71%	29%	0%	0%	0.0168	46.4%	0.0078	53.61%	
46	R3-15	1062	997	65	0	0	94%	6%	0%	0%	0.0132	0.0%	0.0000	100.00%	*
47	R3-16	732	732	0	0	0	100%	0%	0%	0%	0.0091	0.0%	0.0000	100.00%	*
48	R3-17	1017	758	259	0	0	75%	25%	0%	0%	0.0127	0.0%	0.0000	100.00%	
49	R3-18	1039	667	372	0	0	64%	36%	0%	0%	0.0129	0.0%	0.0000	100.00%	
50	R3-19	1036	1,036	0	0	0	100%	0%	0%	0%	0.0129	0.0%	0.0000	100.00%	
51	R3-20	1027	922	0	105	0	90%	0%	10%	0%	0.0128	63.5%	0.0081	36.53%	
52	R3-21	1029	903	126	0	0	88%	12%	0%	0%	0.0128	57.0%	0.0073	42.96%	

TABLE 28 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
53	R3-22	978	978	0	0	0	100%	0%	0%	0%	0.0122	65.0%	0.0079	35.00%	
54	R3-23	855	775	80	100	0	91%	9%	12%	0%	0.0107	0.0%	0.0000	100.00%	
55	R3-24	1115	0	200	100	0	0%	18%	9%	0%	0.0139	4.5%	0.0006	95.52%	
Construction Reach Two Sub Totals													0.0913		23,180.4
56	R3-25	1274	0	200	0	0	0%	16%	0%	0%	0.0159	0.0%	0.0000	100.00%	
57	R3-26	1082	0	100	0	0	0%	9%	0%	0%	0.0135	0.0%	0.0000	100.00%	
58	R4-1	1082	922	160	100	0	85%	15%	9%	0%	0.0135	0.0%	0.0000	100.00%	Construction Reach Three
59	R4-2	1126	970	156	0	0	86%	14%	0%	0%	0.0140	0.0%	0.0000	100.00%	
60	R4-3	982	0	0	982	0	0%	0%	100%	0%	0.0122	0.0%	0.0000	100.00%	
61	R4-4	942	0	0	942	0	0%	0%	100%	0%	0.0117	0.0%	0.0000	100.00%	
62	R4-5	998	786	70	142	0	79%	7%	14%	0%	0.0124	58.3%	0.0072	41.70%	
63	R4-6	971	0	0	971	0	0%	0%	100%	0%	0.0121	50.0%	0.0061	50.00%	
64	R4-7	1061	0	0		100	0%	0%	0%	9%	0.0000	0.0%	0.0000	100.00%	
Construction Reach Three Sub Totals													0.0139		6,300.8
65	R4-8	2119	0				0%	0%	0%	0%					
66	R4-9	2075	0			100	0%	0%	0%	5%	0.0000	0.0%	0.0000	100.00%	*
67	R5-1	993	993	0	100	0	100%	0%	10%	0%	0.0124	0.0%	0.0000	100.00%	Construction Reach Four
68	R5-2	1003	805	198	0	0	80%	20%	0%	0%	0.0125	52.2%	0.0065	47.83%	
69	R5-3	1039	809	230	0	0	78%	22%	0%	0%	0.0129	50.6%	0.0066	49.38%	
70	R5-4	1304	1,224	80	0	0	94%	6%	0%	0%	0.0162	61.0%	0.0099	38.99%	
71	R5-5	1009	773	236	0	0	77%	23%	0%	0%	0.0126	49.8%	0.0063	50.20%	
72	R5-6	1062	858	204	0	0	81%	19%	0%	0%	0.0132	52.5%	0.0069	47.49%	
73	R5-7	1038	1,038	0	0	0	100%	0%	0%	0%	0.0129	65.0%	0.0084	35.00%	
74	R5-8	992	992	0	0	0	100%	0%	0%	0%	0.0124	0.0%	0.0000	100.00%	
75	R5-9	1027	881	146	0	0	86%	14%	0%	0%	0.0128	55.8%	0.0071	44.25%	
76	R5-10	1011	744	129	138	0	74%	13%	14%	0%	0.0126	54.7%	0.0069	45.34%	

TABLE 28 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
77	R5-11	1022	1,022	0	0	0	100%	0%	0%	0%	0.0127	65.0%	0.0083	35.00%	
78	R5-12	1018	578	440	0	0	57%	43%	0%	0%	0.0127	36.9%	0.0047	63.09%	
79	R5-13	1017	965	52	0	0	95%	5%	0%	0%	0.0127	61.7%	0.0078	38.33%	
80	R5-14	1005	876	129	0	0	87%	13%	0%	0%	0.0125	56.7%	0.0071	43.34%	
81	R5-15	1011	744	267	0	0	74%	26%	0%	0%	0.0126	47.8%	0.0060	52.17%	
82	R5-16	1035.2	443	592	0	0	43%	57%	0%	0%	0.0129	27.8%	0.0036	72.17%	
83	R5-17	942.6	824	119	0	0	87%	13%	0%	0%	0.0117	56.8%	0.0067	43.21%	
84	R5-18	999.9	689	311	0	0	69%	31%	0%	0%	0.0125	44.8%	0.0056	55.22%	
85	R5-19	1010.9	719	292	0	0	71%	29%	0%	0%	0.0126	46.2%	0.0058	53.78%	
86	R5-20	1028.6	487	168	374	0	47%	16%	36%	0%	0.0128	0.0%	0.0000	100.00%	*
87	R5-21	1122	684	438	100	0	61%	39%	9%	0%	0.0140	0.0%	0.0000	100.00%	*
88	R5-22	1029.7	0		100		0%	0%	10%	0%	0.0012	0.0%	0.0000	100.00%	
Construction Reach Four Sub Totals													0.1141		21,888.4
89	R5-23	1013	0				0%	0%	0%	0%					
90	R5-24	1022	0				0%	0%	0%	0%					
91	R5-25	1054	0				0%	0%	0%	0%					
92	R5-26	884	0				0%	0%	0%	0%					
93	R5-27	1044	0				0%	0%	0%	0%					
94	R5-28	1059	0				0%	0%	0%	0%					
95	R5-29	987	0	0	100		0%	0%	10%	0%	0.0000	0.0%	0.0000	100.00%	*
96	R5-30	1022	556	466	100		54%	46%	10%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach Five
97	R5-31	1015	737	278	0		73%	27%	0%	0%	0.0126	0.0%	0.0000	100.00%	
98	R5-32	985	985	0	0		100%	0%	0%	0%	0.0123	0.0%	0.0000	100.00%	
99	R5-33	1025	854	171	0		83%	17%	0%	0%	0.0128	54.2%	0.0069	45.84%	
100	R5-34	1038	936	102	0		90%	10%	0%	0%	0.0129	58.6%	0.0076	41.39%	
101	R5-35	1002	945	57	0		94%	6%	0%	0%	0.0125	61.3%	0.0077	38.70%	

TABLE 28 (CONTINUED)

NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
102	R5-36	944	826	118	0		87%	13%	0%	0%	0.0118	0.0%	0.0000	100.00%	
103	R5-37	1020	820	200	0		80%	20%	0%	0%	0.0127	0.0%	0.0000	100.00%	
104	R5-38	1094	945	149	0		86%	14%	0%	0%	0.0136	0.0%	0.0000	100.00%	
105	R5-39	1024	925	99	0		90%	10%	0%	0%	0.0128	0.0%	0.0000	100.00%	
106	R5-40	1010	848	162	0		84%	16%	0%	0%	0.0126	0.0%	0.0000	100.00%	
107	R5-41	1004	274	730	0		27%	73%	0%	0%	0.0125	0.0%	0.0000	100.00%	
108	R5-42	1023	0	1,023	0		0%	100%	0%	0%	0.0127	0.0%	0.0000	100.00%	
109	R5-43	1002	918	84	0		92%	8%	0%	0%	0.0125	0.0%	0.0000	100.00%	
110	R5-44	1001	1,001	0	0		100%	0%	0%	0%	0.0125	0.0%	0.0000	100.00%	
111	R5-45	969	969	0	0		100%	0%	0%	0%	0.0121	0.0%	0.0000	100.00%	
112	R5-46	988	682	306	0		69%	31%	0%	0%	0.0123	44.9%	0.0055	55.14%	
113	R5-47	1031	675	356	0		65%	35%	0%	0%	0.0128	42.5%	0.0055	57.45%	
114	R5-48	1026	1,026	0	0		100%	0%	0%	0%	0.0128	65.0%	0.0083	35.00%	
115	R5-49	1041	1,041	0	0		100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
116	R5-50	1032	862	170	0		84%	16%	0%	0%	0.0129	54.3%	0.0070	45.71%	
117	R5-51	1126	943	83	100		84%	7%	9%	0%	0.0140	58.9%	0.0083	41.12%	
Construction Reach Five Sub Totals													0.0651		22,519.2
	Reach with Transition Zone														
* Designates that all or portion of reach is in a CBRA zone (all work in CBRA zone will be 100% non-Federal funded)															
TOTAL FEDERAL COST SHARE													0.3320		
TOTAL NON FEDERAL COST SHARE													0.6680		
TOTAL CONSTRUCTED PROJECT LENGTH							80,280								80280.0

TABLE 29
SELECTED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
			65%	0%	50%	65%	65%	0%	50%	65%					
			35%	100%	50%	35%	35%	100%	50%	35%					
1	R1-1	1250	1,250	0	0	0	100%	0%	0%	0%	0.0127	0.0%	0.0000	100.00%	*
2	R1-2	1102	560	0	542	0	51%	0%	49%	0%	0.0112	0.0%	0.0000	100.00%	*
3	R1-3	1044	0	0	1,044	0	0%	0%	100%	0%	0.0106	0.0%	0.0000	100.00%	*
4	R1-4	1002	102	0	900	0	10%	0%	90%	0%	0.0102	0.0%	0.0000	100.00%	*
5	R1-5	1062	1,062	0	0	0	100%	0%	0%	0%	0.0108	0.0%	0.0000	100.00%	
6	R1-6	1045	998	47	0	0	96%	4%	0%	0%	0.0106	0.0%	0.0000	100.00%	
7	R1-7	1003	1,003	0	0	0	100%	0%	0%	0%	0.0102	0.0%	0.0000	100.00%	
8	R1-8	1061	984	77	0	0	93%	7%	0%	0%	0.0108	0.0%	0.0000	100.00%	
9	R1-9	1014	984	30	0	0	97%	3%	0%	0%	0.0103	0.0%	0.0000	100.00%	
10	R1-10	959	761	198	0	0	79%	21%	0%	0%	0.0097	0.0%	0.0000	100.00%	
11	R1-11	1021	955	66	0	0	94%	6%	0%	0%	0.0104	0.0%	0.0000	100.00%	
12	R1-12	1057	1,057	0	0	0	100%	0%	0%	0%	0.0107	65.0%	0.0070	35.00%	
13	R1-13	1040	1,040	0	0	0	100%	0%	0%	0%	0.0106	65.0%	0.0069	35.00%	
14	R1-14	1051	1,051	0	0	0	100%	0%	0%	0%	0.0107	65.0%	0.0069	35.00%	Construction Reach One
15	R1-15	998	923	75	0	0	92%	8%	0%	0%	0.0101	60.1%	0.0061	39.89%	
16	R1-16	1025	883	142	0	0	86%	14%	0%	0%	0.0104	56.0%	0.0058	44.01%	
17	R1-17	1114	667	447	0	0	60%	40%	0%	0%	0.0113	0.0%	0.0000	100.00%	
18	R1-18	1133	1,033	100	0	0	91%	9%	0%	0%	0.0115	0.0%	0.0000	100.00%	
19	R1-19	1058	1,058	0	0	0	100%	0%	0%	0%	0.0107	0.0%	0.0000	100.00%	
20	R1-20	961	961	0	0	0	100%	0%	0%	0%	0.0098	0.0%	0.0000	100.00%	
21	R1-21	952	952	0	0	0	100%	0%	0%	0%	0.0097	0.0%	0.0000	100.00%	
22	R1-22	1028	1,028	0	0	0	100%	0%	0%	0%	0.0104	0.0%	0.0000	100.00%	
23	R1-23	1086	956	130	0	0	88%	12%	0%	0%	0.0110	0.0%	0.0000	100.00%	
24	R1-24	1039	1039	0	0	0	100%	0%	0%	0%	0.0105	0.0%	0.0000	100.00%	
25	R2-1	495	100	0	0	0	20%	0%	0%	0%	0.0010	13.1%	0.0001	86.87%	
Construction Reach One Sub Totals															25,202.3

TABLE 29 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
26	R2-2	936	0	0	0	0	0%	0%	0%	0%					
27	R2-3	2160	0	0	0	0	0%	0%	0%	0%					
28	R2-4	2066	0	0	0	0	0%	0%	0%	0%					
29	R2-5	1001	0	0	0	0	0%	0%	0%	0%					
30	R2-6	10078	0	0	0	0	0%	0%	0%	0%					
31	R2-7	1040	0	0	0	0	0%	0%	0%	0%					
32	R3-1	1147	0	0	100	0	0%	0%	9%	0%	0.0012	0.0%	0.0000	100.00%	*
33	R3-2	1037	838	199	0	0	81%	19%	0%	0%	0.0129	0.0%	0.0000	100.00%	Construction Reach Two
34	R3-3	1052	904	148	0	0	86%	14%	0%	0%	0.0131	0.0%	0.0000	100.00%	
35	R3-4	1026	914	112	0	0	89%	11%	0%	0%	0.0128	57.9%	0.0074	42.10%	
36	R3-5	1121	1,121	0	0	0	100%	0%	0%	0%	0.0140	65.0%	0.0091	35.00%	
37	R3-6	1185	1,115	70	0	0	94%	6%	0%	0%	0.0148	0.0%	0.0000	100.00%	
38	R3-7	1156	1,120	36	0	0	97%	3%	0%	0%	0.0144	0.0%	0.0000	100.00%	
39	R3-8	1103	909	194	0	0	82%	18%	0%	0%	0.0137	53.6%	0.0074	46.43%	
40	R3-9	1058	875	183	0	0	83%	17%	0%	0%	0.0132	53.8%	0.0071	46.25%	
41	R3-10	1068	1,068	0	0	0	100%	0%	0%	0%	0.0133	65.0%	0.0086	35.00%	
42	R3-11	1045	794	55	196	0	76%	5%	19%	0%	0.0130	58.8%	0.0076	41.24%	
43	R3-12	1007	824	100	83	0	82%	10%	8%	0%	0.0125	57.3%	0.0072	42.69%	
44	R3-13	1004	716	288	0	0	71%	29%	0%	0%	0.0125	46.4%	0.0058	53.65%	
45	R3-14	1345	960	385	0	0	71%	29%	0%	0%	0.0168	46.4%	0.0078	53.61%	
46	R3-15	1062	997	65	0	0	94%	6%	0%	0%	0.0132	0.0%	0.0000	100.00%	*
47	R3-16	732	732	0	0	0	100%	0%	0%	0%	0.0091	0.0%	0.0000	100.00%	*
48	R3-17	1017	758	259	0	0	75%	25%	0%	0%	0.0127	0.0%	0.0000	100.00%	
49	R3-18	1039	667	372	0	0	64%	36%	0%	0%	0.0129	0.0%	0.0000	100.00%	
50	R3-19	1036	1,036	0	0	0	100%	0%	0%	0%	0.0129	0.0%	0.0000	100.00%	
51	R3-20	1027	922	0	105	0	90%	0%	10%	0%	0.0128	63.5%	0.0081	36.53%	
52	R3-21	1029	903	126	0	0	88%	12%	0%	0%	0.0128	57.0%	0.0073	42.96%	

TABLE 29 (CONTINUED)

SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
53	R3-22	978	978	0	0	0	100%	0%	0%	0%	0.0122	65.0%	0.0079	35.00%	
54	R3-23	855	775	80	100	0	91%	9%	12%	0%	0.0107	0.0%	0.0000	100.00%	
55	R3-24	1115	0	200	100	0	0%	18%	9%	0%	0.0139	4.5%	0.0006	95.52%	
Construction Reach Two Sub Totals															23,180.4
56	R3-25	1274	0	200	0	0	0%	16%	0%	0%	0.0159	0.0%	0.0000	100.00%	
57	R3-26	1082	0	100	0	0	0%	9%	0%	0%	0.0135	0.0%	0.0000	100.00%	
58	R4-1	1082	922	160	100	0	85%	15%	9%	0%	0.0135	0.0%	0.0000	100.00%	Construction Reach Three
59	R4-2	1126	970	156	0	0	86%	14%	0%	0%	0.0140	0.0%	0.0000	100.00%	
60	R4-3	982	0	0	982	0	0%	0%	100%	0%	0.0122	0.0%	0.0000	100.00%	
61	R4-4	942	0	0	942	0	0%	0%	100%	0%	0.0117	0.0%	0.0000	100.00%	
62	R4-5	998	786	70	142	0	79%	7%	14%	0%	0.0124	58.3%	0.0072	41.70%	
63	R4-6	971	0	0	971	0	0%	0%	100%	0%	0.0121	50.0%	0.0061	50.00%	
64	R4-7	1061	0	0		100	0%	0%	0%	9%	0.0000	0.0%	0.0000	100.00%	
Construction Reach Three Sub Totals															6,300.8
65	R4-8	2119	0				0%	0%	0%	0%					
66	R4-9	2075	0			100	0%	0%	0%	5%	0.0000	0.0%	0.0000	100.00%	*
67	R5-1	993	993	0	100	0	100%	0%	10%	0%	0.0124	0.0%	0.0000	100.00%	Construction Reach Four
68	R5-2	1003	805	198	0	0	80%	20%	0%	0%	0.0125	52.2%	0.0065	47.83%	
69	R5-3	1039	809	230	0	0	78%	22%	0%	0%	0.0129	50.6%	0.0066	49.38%	
70	R5-4	1304	1,224	80	0	0	94%	6%	0%	0%	0.0162	61.0%	0.0099	38.99%	
71	R5-5	1009	773	236	0	0	77%	23%	0%	0%	0.0126	49.8%	0.0063	50.20%	
72	R5-6	1062	858	204	0	0	81%	19%	0%	0%	0.0132	52.5%	0.0069	47.49%	
73	R5-7	1038	1,038	0	0	0	100%	0%	0%	0%	0.0129	65.0%	0.0084	35.00%	
74	R5-8	992	992	0	0	0	100%	0%	0%	0%	0.0124	0.0%	0.0000	100.00%	
75	R5-9	1027	881	146	0	0	86%	14%	0%	0%	0.0128	55.8%	0.0071	44.25%	
76	R5-10	1011	744	129	138	0	74%	13%	14%	0%	0.0126	54.7%	0.0069	45.34%	

TABLE 29 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
77	R5-11	1022	1,022	0	0	0	100%	0%	0%	0%	0.0127	65.0%	0.0083	35.00%	
78	R5-12	1018	578	440	0	0	57%	43%	0%	0%	0.0127	36.9%	0.0047	63.09%	
79	R5-13	1017	965	52	0	0	95%	5%	0%	0%	0.0127	61.7%	0.0078	38.33%	
80	R5-14	1005	876	129	0	0	87%	13%	0%	0%	0.0125	56.7%	0.0071	43.34%	
81	R5-15	1011	744	267	0	0	74%	26%	0%	0%	0.0126	47.8%	0.0060	52.17%	
82	R5-16	1035.2	443	592	0	0	43%	57%	0%	0%	0.0129	27.8%	0.0036	72.17%	
83	R5-17	942.6	824	119	0	0	87%	13%	0%	0%	0.0117	56.8%	0.0067	43.21%	
84	R5-18	999.9	689	311	0	0	69%	31%	0%	0%	0.0125	44.8%	0.0056	55.22%	
85	R5-19	1010.9	719	292	0	0	71%	29%	0%	0%	0.0126	46.2%	0.0058	53.78%	
86	R5-20	1028.6	487	168	374	0	47%	16%	36%	0%	0.0128	0.0%	0.0000	100.00%	*
87	R5-21	1122	684	438	100	0	61%	39%	9%	0%	0.0140	0.0%	0.0000	100.00%	*
88	R5-22	1029.7	0		100		0%	0%	10%	0%	0.0012	0.0%	0.0000	100.00%	
Construction Reach Four Sub Totals															21,888.4
89	R5-23	1013	0				0%	0%	0%	0%					
90	R5-24	1022	0				0%	0%	0%	0%					
91	R5-25	1054	0				0%	0%	0%	0%					
92	R5-26	884	0				0%	0%	0%	0%					
93	R5-27	1044	0				0%	0%	0%	0%					
94	R5-28	1059	0				0%	0%	0%	0%					
95	R5-29	987	0	0	100		0%	0%	10%	0%	0.0000	0.0%	0.0000	100.00%	*
96	R5-30	1022	556	466	100		54%	46%	10%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach Five
97	R5-31	1015	737	278	0		73%	27%	0%	0%	0.0126	0.0%	0.0000	100.00%	
98	R5-32	985	985	0	0		100%	0%	0%	0%	0.0123	0.0%	0.0000	100.00%	
99	R5-33	1025	854	171	0		83%	17%	0%	0%	0.0128	54.2%	0.0069	45.84%	
100	R5-34	1038	936	102	0		90%	10%	0%	0%	0.0129	58.6%	0.0076	41.39%	
101	R5-35	1002	945	57	0		94%	6%	0%	0%	0.0125	61.3%	0.0077	38.70%	
102	R5-36	944	826	118	0		87%	13%	0%	0%	0.0118	0.0%	0.0000	100.00%	
103	R5-37	1020	820	200	0		80%	20%	0%	0%	0.0127	0.0%	0.0000	100.00%	

TABLE 29 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
104	R5-38	1094	945	149	0		86%	14%	0%	0%	0.0136	0.0%	0.0000	100.00%	
105	R5-39	1024	925	99	0		90%	10%	0%	0%	0.0128	0.0%	0.0000	100.00%	
106	R5-40	1010	848	162	0		84%	16%	0%	0%	0.0126	0.0%	0.0000	100.00%	
107	R5-41	1004	274	730	0		27%	73%	0%	0%	0.0125	0.0%	0.0000	100.00%	
108	R5-42	1023	0	1,023	0		0%	100%	0%	0%	0.0127	0.0%	0.0000	100.00%	
109	R5-43	1002	918	84	0		92%	8%	0%	0%	0.0125	0.0%	0.0000	100.00%	
110	R5-44	1001	1,001	0	0		100%	0%	0%	0%	0.0125	0.0%	0.0000	100.00%	
111	R5-45	969	969	0	0		100%	0%	0%	0%	0.0121	0.0%	0.0000	100.00%	
112	R5-46	988	682	306	0		69%	31%	0%	0%	0.0123	44.9%	0.0055	55.14%	
113	R5-47	1031	675	356	0		65%	35%	0%	0%	0.0128	42.5%	0.0055	57.45%	
114	R5-48	1026	1,026	0	0		100%	0%	0%	0%	0.0128	65.0%	0.0083	35.00%	
115	R5-49	1041	1,041	0	0		100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
116	R5-50	1032	862	170	0		84%	16%	0%	0%	0.0129	54.3%	0.0070	45.71%	
117	R5-51	1126	943	83	100		84%	7%	9%	0%	0.0140	58.9%	0.0083	41.12%	
Construction Reach Five Sub Totals															22,519.2
	Reach with Transition Zone														
* Designates that all or portion of reach is in a CBRA zone (all work in CBRA zone will be 100% non-Federal funded)															
TOTAL CONSTRUCTED PROJECT LENGTH							99,091								99,091

TABLE 30						
NED AND SELECTED PLAN - COSTS AND COST SHARE						
	NED Plan ($)	Percent	Selected Plan ($)	Percent	Change ($)	Change (%)
Initial Construction Cost	$51,945,000		$61,397,000		$9,452,000	
Federal	$17,298,000	33%	$17,298,000	28%	$0	-5%
Non-Federal	$34,647,000	67%	$44,099,000	72%	$9,452,000	5%
Total Renourishment Cost	$38,136,000		$41,441,000		$3,305,000	0%
Federal	$9,915,000	26%	$9,915,000	23%	$0	-2%
Non-Federal	$28,221,000	74%	$31,526,000	77%	$3,305,000	2%
Total Construction Cost	$90,081,000		$102,838,000		$12,757,000	0%
Federal	$27,072,000	30%	$27,072,000	26%	$0	-4%
Non-Federal	$63,009,000	70%	$75,766,000	74%	$12,757,000	4%

TABLE 30A						
NED AND SELECTED PLAN - AVERAGE ANNUAL EQUIVALENT COSTS AND COST SHARE						
	NED Plan ($)	Percent	Selected Plan ($)	Percent	Change ($)	Change (%)
Initial Construction Cost	$2,418,000		$2,858,000		$440,000	
Federal	$805,000	33%	$805,000	28%	$0	-2.5%
Non-Federal	$1,613,000	67%	$2,053,000	72%	$440,000	2.5%
Total Renourishment Cost	$1,775,000		$1,929,000		$154,000	
Federal	$462,000	26%	$462,000	23%	$0	-2.0%
Non-Federal	$1,314,000	74%	$1,468,000	77%	$154,000	2.0%
Total Construction Cost	$4,193,000		$4,787,000		$594,000	
Federal	$1,260,000	30%	$1,260,000	26%	$0	-2.3%
Non-Federal	$2,933,000	70%	$3,527,000	74%	$594,000	2.3%

Table 31																
Parking - Access - Cost Sharing Qualifying																
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
1	R1-1					0	0	55	0	0	0	Not Adequate		Not Adequate	No ***
2	R1-2					0	0	55	22	99	99	Not Adequate		Adequate	No ***
3	R1-3	A1a	Miramar Beach Regional Access W (Parking/Access)	2375 Scenic Gulf Drive	2375 Scenic Gulf Drive	85	574	574	28	126	700	Adequate		Adequate	No ***
4	R1-4	A1b	Miramar Beach Regional Access E (Parking/Access)	2375 Scenic Gulf Drive		85	574	55	15	68	641	Adequate		Adequate	No ***
5	R1-5					0	0	55	16	72	72	Adequate		Adequate	No ***
6	R1-6					0	0	55	18	81	0	Not Adequate		Not Adequate	No ***
7	R1-7					0	0	55	0	0	0	Not Adequate		Not Adequate	No ***
8	R1-8					0	0	55	10	45	0	Not Adequate		Not Adequate	No ***
9	R1-9					0	0	55	3	14	14	Adequate	R1-10	Adequate	No ***
10	R1-10	A2	Scenic Gulf Drive Access ROW (Parking/Access)	Scenic Gulf Drive		100	675	55	33	149	824	Adequate		Adequate	No ***
11	R1-11					0	0	55	16	72	0	Not Adequate		Not Adequate	No
12	R1-12					0	0	55	31	140	140	Adequate		Adequate	Yes
13	R1-13	A3	Geronimo Street (Access)	735 Scenic Gulf Drive	735 Scenic Gulf Drive	0	0	55	76	342	342	Adequate		Adequate	Yes
14	R1-14					0	0	55	33	149	149	Adequate		Adequate	Yes
15	R1-15	A4	Norwood Drive (Access)	132 Norwood Drive	132 Norwood Drive	0	0	55	77	347	347	Adequate		Adequate	Yes

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
16	R1-16	A5	Open Gulf (Access)	213 Open Gulf St.	Open Gulf Street	6	41	55	103	464	504	Adequate		Adequate	Yes
17	R1-17	A6, A7	Sand Trap & Tango De Mer (Parking & Access)	253 Sand Trap Rd & End of Tango De Mer	253 Sand Trap Road	3	20	55	4	18	38	Adequate	R1-16	Adequate	No ***
18	R1-18		Access at End of Tango De Mer	Access at End of Tango De Mer	End of Tango De Mer	0	0	55	0	0	0	Adequate	R1-19	Adequate	No ***
19	R1-19					0	0	55	55	248	0	Not Adequate		Not Adequate	No ***
20	R1-20					0	0	55	81	365	0	Not Adequate		Not Adequate	No ***
21	R1-21					0	0	55	146	657	657	Adequate		Adequate	No ***
22	R1-22	A8	Sand Destin Day Use Area (Parking & Access)		San Destin Day Use Area	110	743	743	92	414	1,157	Adequate		Adequate	No ***
23	R1-23					0	0	55	155	698	698	Adequate		Not Adequate	No ***
24	R1-24					0	0	55	0	0	0	Adequate	R1-23	Not Adequate	No ***
25	R2-1					0	0	55	0	0	0				
26	R2-2					0	0	55	0	0	0				
27	R2-3					0	0	55	0	0	0				
28	R2-4					0	0	55	0	0	0				
29	R2-5		State Park (Parking & Access)	719 Top Sail Hill Road		0	0	55	0	0	0				
30	R2-6					0	0	55	0	0	0				
31	R2-7					0	0	55	0	0	0				
32	R3-1	A10	Stallworth Preserve North (Access)	140 Stallworth Blvd.		5	34	55	0	0	34				

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
33	R3-2	A11, A12	Beach Highland & Bullard Beach Neighborhood Access (Parking & Access)	127 & 363 Highland Avenue	127 & 363 Highland Avenue	3	20	55	0	0	20	Not Adequate		Adequate	No
34	R3-3					0	0	55	5	23	23	Not Adequate		Adequate	No
35	R3-4					5	34	55	7	32	65	Adequate		Adequate	Yes
36	R3-5	A13	Dune Allen (Parking & Access)	5753 W. Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A	75	506	506	0	0	506	Adequate		Adequate	Yes
37	R3-6	A14	West Allen (Access)	5605 Co. Hwy 30-A		0	0	55	0	0	55	Adequate	R3-5	Adequate	Yes
38	R3-7	A15	Palms Ave W (Parking & Access)	4850 w. Co Hwy 30A		0	0	55	0	0	0	Not Adequate		Adequate	No
39	R3-8	A16a	Palms Ave E (Parking & Access)	4850 w. Co Hwy 30A		0	0	55	12	54	54	Adequate	R3-9	Adequate	Yes
40	R3-9	A16b	Lake Causeway (Access)	5173 Co Hwy 30A	4850 & 4991 & 5605 Co Hwy 30A	15	101	55	0	0	101	Adequate		Adequate	Yes
41	R3-10	A17a, A17b	Gulf Place West and Middle (Access)		4850 w. Co Hwy 30A	5	34	55	0	0	34	Adequate	R3-9	Adequate	Yes
42	R3-11	A17c, A18	Gulf Place East & Ed Walline Regional Beach Access (Parking & Access)	4447 W Co Hwy 30A	4447 W Co Hwy 30A & Gulf Place West Access Point	55	371	55	13	59	430	Adequate		Adequate	Yes
43	R3-12	A19	Spooky lane & Shellseekers (Access and Parking)	92 South Spooky Lane & 4201 W. Co. Rd. Hwy 30-A	92 South Spooky Lane & Gulf Place East Access Point	13	88	55	0	0	88	Adequate		Adequate	Yes

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
44	R3-13	A20				14	95	55	16	72	167	Adequate		Adequate	Yes
45	R3-14	A21	Gulfview Heights (Parking & Access)	186 Gulfview Heights St	4201 Co. Hwy 30A & 186 Gulf View Heights Street	30	203	55	0	0	203	Adequate		Adequate	Yes
46	R3-15					0	0	55	0	0	0	Adequate	R3-14	Not Adequate	No
47	R3-16					0	0	55	0	0	0	Not Adequate		Not Adequate	No
48	R3-17					0	0	55	0	0	0	Not Adequate		Not Adequate	No
49	R3-18					0	0	55	24	108	0	Not Adequate		Not Adequate	No
50	R3-19					0	0	55	111	500	0	Not Adequate		Not Adequate	No
51	R3-20					0	0	55	23	104	104	Adequate		Adequate	Yes
52	R3-21	A22, A23	Blue Mountain and Gulf Point (Parking & Access)	2365 S Co Hwy 83 & 446 Blue Mountain Road	2365 S. Co Hwy 83 & 446, 590 and 726 Blue Mountain Road	37	250	55	0	0	250	Adequate		Adequate	Yes
53	R3-22	A24	Seagrade Road Neighborhood Access (Access)	590 Blue Mountain Road		0	0	55	0	0	0	Adequate	R3-21	Adequate	Yes
54	R3-23	A25	Blue Lake (Access)	726 Blue Mountain Road		0	0	55	0	0	0	Not Adequate		Adequate	No
55	R3-24					0	0	55	0	0	0				
56	R3-25					0	0	55	0	0	0				
57	R3-26					0	0	55	0	0	0				
58	R4-1	A26	Grayton State Park (Access & Parking)			0	0	55	0	0	0	Not Adequate		Adequate	No
59	R4-2					0	0	55	0	0	0	Not Adequate		Not Adequate	No

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
60	R4-3					0	0	55	0	0	0	Not Adequate		Not Adequate	No
61	R4-4					0	0	55	0	0	0	Not Adequate	R4-5	Not Adequate	No
62	R4-5	A27	Ray's Multi-Mountain (Access)	125 Sandy Lane	125 Sandy Lane	12	81	55	0	0	81	Adequate		Adequate	Yes
63	R4-6	A28, A29	Grayton Dunes and Weston (Parking & Access)	288 Garfield St & 208 Holtz Ave	288 Garfield St. & 199 Banfill St.& 208 Holtz Avenue & 913 Main Park Road	82	554	554	0	0	554	Adequate		Adequate	Yes
64	R4-7				91 Boat Ramp Road	0	0	55	0	0	0		R4-6		
65	R4-8	A301, A30B, A30C	Grayton State Park (Access & Parking)			0	0	55	0	0	0				
66	R4-9					0	0	55	0	0	0				
67	R5-1					0	0	55	0	0	0	Not Adequate		Not Adequate	No
68	R5-2	A31	Van Ness Butler (Parking and Access)	1931 E Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A & Water Color Park Garage and Access	100	675	675	11	50	725	Adequate		Adequate	Yes
69	R5-3					0	0	0	0	0	0	Adequate	R5-4	Adequate	Yes
70	R5-4	A32	Seaside (Access and Parking)			60	405	55	0	0	405	Adequate		Adequate	No
71	R5-5	A33	Dogwood/Thyme (Access)	2560 E. Co Hwy 30A	2560 Co Hwy 30A	0	0	55	0	0	0	Adequate	R5-6	Adequate	Yes

Table 31 (Continued)																
Parking - Access - Cost Sharing Qualifying																
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
72	R5-6	A34, A35, A36	Nightcap, Live Oak, Hickory (Access)	30A at End of Nightcap Street, 2680 E. Co Hwy 30A, 2624 E. Co Hwy 30A	2624, 2680, ~2750 and 2790 Co Hwy 30 A	32	216	55	0	0	216	Adequate		Adequate	Yes
73	R5-7	A37, A38, A39	Hollywood, Azalea, Hwy 395 (Access)	2790, 2845, 2920 E. Co. Hwy 30-A	2845 and 2920 Co Hwy 30A	0	0	55	0	0	0	Adequate	R5-6	Adequate	Yes
74	R5-8	A40, A41, A42	Headland, Greenwood, Gardenia (Access)	3020 Co Hwy 30A, 30 & 118 Montgomery	3020 Co Hwy 30A	4	27	55	0	0	27	Not Adequate		Adequate	No
75	R5-9	A43, A44	Dothan and Andalusia (Access)	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	0	0	55	0	0	0	Adequate	R5-9	Adequate	Yes
76	R5-10	A45, A46, A47	Santa Clara, Santa Juan, Pelayo & Montego (Parking & Access)	3458, 3512, 3468, & 3576 E. Co Hwy 30A	3458, 3512 and 3576 E. Co Hwy 30A - San Juan & Pelaya Neighborhood G A	20	135	55	0	0	135	Adequate		Adequate	Yes
77	R5-11	A48, A49	Campbell	3694 E Co Hwy 30A		0	0	55	71	320	320	Adequate		Adequate	Yes
78	R5-12	A50	Beachwood villas (Access)	3874 E. Co Hwy 30A	3694 and 3874 E. Co Hwy 30 A - (Campbell Street)	95	641	641	50	225	866	Adequate		Adequate	Yes
79	R5-13	A51	One Seagrove (Access)		57 Seagrove Place	9	61	55	70	315	376	Adequate		Adequate	Yes
80	R5-14	A52	Sugar Cliffs (Access)			0	0	55	137	617	617	Adequate		Adequate	Yes

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
81	R5-15					0	0	55	0	0	0	Adequate	R5-14	Adequate	Yes
82	R5-16	A53	Ramsgate (Access)	679 Eastern Lake Rd	679 and 491 Eastern Lake Road	0	0	55	2	9	9	Adequate	R5-17	Adequate	Yes
83	R5-17	A54	Eastern Lake (Parking & Access)	28 Lakewood Dr		0	0	55	36	162	162	Adequate		Adequate	Yes
84	R5-18	A55	Port Property (Access)	188 San Roy Rd	188 San Roy Road	6	41	55	0	0	41	Adequate	R5-17, R5-19	Adequate	Yes
85	R5-19	A56	Sugar Dunes (Access)	11 Beachside Drive	11 Beachside Dune - Sugar Dune	16	108	55	0	0	108	Adequate		Adequate	Yes
86	R5-20					10	68	55	51	230	297	Adequate		Adequate	Yes
87	R5-21	A57	Walton Dunes (Access)	258 Beachfront Taril - Walton Dune	258 Beachfront Taril - Walton Dune - Beachside Drive & Deer Lake State Park	0	0	55	9	41	41	Adequate	R5-20, R5-22	Adequate	Yes
88	R5-22					27	182	55	0	0	182				
89	R5-23					0	0	55	0	0	0				
90	R5-24					0	0	55	0	0	0				
91	R5-25					0	0	55	0	0	0				
92	R5-26					0	0	55	0	0	0				
93	R5-27					0	0	55	0	0	0				
94	R5-28					0	0	55	0	0	0				
95	R5-29					0	0	55	0	0	0				
96	R5-30					0	0	55	0	0	0	Not Adequate		Not Adequate	No
97	R5-31					0	0	55	0	0	0	Not Adequate		Adequate	No

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
98	R5-32	A58	Gulf Lake (Access)	8040 E. Co Highway 30A	8040 E Co Hwy 30A - Gulf Lakes Neighborhood	0	0	55	0	0	0	Not Adequate		Adequate	No
99	R5-33	A59	Sea Breeze (Access)	8286 E. Co Hwy 30A	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	0	0	55	13	59	59	Adequate		Adequate	Yes
100	R5-34		Seacrest (Access)	8520 E Co Hwy 30A	Saint Lucia Lane & Rosemary Avenue & 8520 E Co Hwy30A - Seacrest Dr.	10	68	55	4	18	86	Adequate		Adequate	Yes
101	R5-35					100	675	675	6	27	702	Adequate		Adequate	Yes
102	R5-36					0	0	55	0	0	0	Not Adequate		Not Adequate	No
103	R5-37					0	0	55	0	0	0	Not Adequate		Not Adequate	No
104	R5-38					0	0	55	0	0	0	Not Adequate		Not Adequate	No
105	R5-39					0	0	55	0	0	0	Not Adequate		Not Adequate	No
106	R5-40					0	0	55	0	0	0	Not Adequate		Not Adequate	No
107	R5-41					0	0	55	0	0	0	Not Adequate		Not Adequate	No
108	R5-42					0	0	55	13	59	0	Not Adequate		Not Adequate	No
109	R5-43					0	0	55	0	0	0	Not Adequate		Not Adequate	No
110	R5-44					0	0	55	0	0	0	Not Adequate		Not Adequate	No
111	R5-45					0	0	55	0	0	0	Not Adequate		Not Adequate	No

Table 31 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
112	R5-46	A61	Inlet beach Neighborhood (Access)	188 Winston Lane	188 Winston Lane	105	709	709	0	0	709	Adequate		Adequate	Yes
113	R5-47	A62	Wall Street (Access)	264 South Wall Street	435 West Park Place Ave. & 264 South Wall Street	76	513	513	0	0	513	Adequate		Adequate	Yes
114	R5-48	A63A	Inlet Beach Regional Access West (Parking & Access)	438 South Orange Street Center	438 South Orange Street	67	452	452	0	0	452	Adequate		Adequate	Yes
115	R5-49	A63B	Inlet Beach Regional Access Middle & East (Parking and Access)	438 South Orange Street Center	118 West Park Place Avenue FL #20	67	452	452	0	0	452	Adequate		Adequate	Yes
116	R5-50	A64	Philips Inlet (Access)	202 South Walton Lakeshore Drive	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101	55	0	0	101	Adequate		Adequate	Yes
117	R5-51					0	0	55	0	0	0	Adequate	R5-49, R5-50	Adequate	Yes
TOTALS						1,559	10,523	13537**	1,698	7,641	16,743				

* Assuming Large Public Day Use Area Parking is fully utilized and remainder of parking demand is distributed uniformly throughout the study area

** Peak Day Demand (July 4th)

*** LPP Reaches not economically justified, not eligible for cost sharing

Rental Parking disqualified - No Public Access Available

LPP Construction Reaches

6.3 RESIDUAL DAMAGES

With a project in place to reduce hurricane and storm damage not all damages will be prevented only reduced. It is important to provide information on residual damages to demonstrate project performance and communicate that fact that the project will not eliminate all risks. Table 32 shows the average annual remaining damages provided as output from the Beach-*fx* model runs. No alternatives investigated changed the natural berm or dune heights. Therefore, there is no significant reduction in water levels with and without a plan in place. This results in virtually no inundation or wave attack reduction in damages with a plan in place. All measurable damage categories from Beach-*fx* including wave attack, inundation and erosion are accounted for in the residual damages. It should be noted that the values presented in this table are from Beach-*fx* output which is subject to slight variation due to the 100 life cycle iterations.

TABLE 32
AVERAGE ANNUAL RESIDUAL DAMAGES - BY REACH
SELECTED PLAN

R1-1	$1,269	CONSTRUCTION REACH ONE
R1-2	$191	
R1-3	$850	
R1-4	$424	
R1-5	$152	
R1-6	$399	
R1-7	$91	
R1-8	$170	
R1-9	$1,079	
R1-10	$2,078	
R1-11	$33,131	
R1-12	$355	
R1-13	$2,002	
R1-14	$2,454	
R1-15	$67,074	
R1-16	$35,344	
R1-17	$391	
R1-18	$2,813	
R1-19	$3,363	
R1-20	$6,797	
R1-21	$1	
R1-22	$1,591	
R1-23	$105	
R1-24	$161	
R3-1	$0	CONSTRUCTION REACH TWO
R3-2	$56,062	
R3-3	$4,591	
R3-4	$206	
R3-5	$3,390	

TABLE 32
AVERAGE ANNUAL RESIDUAL DAMAGES - BY REACH
SELECTED PLAN

R3-6	$4,858	
R3-7	$1,401	
R3-8	$9,174	
R3-9	$4,088	
R3-10	$74,956	
R3-11	$10,543	
R3-12	$52,398	
R3-13	$890	
R3-14	$5,541	
R3-15	$0	
R3-16	$0	
R3-17	$1,096	
R3-18	$2,634	
R3-19	$609	
R3-20	$11,506	
R3-21	$9,640	
R3-22	$2,553	
R3-23	$1,216	
R4-1	$13,929	CONSTRUCTION REACH THREE
R4-2	$14,809	
R4-3	$0	
R4-4	$0	
R4-5	$12,246	
R4-6	$2,127	
R5-1	$108,531	CONSTRUCTION REACH FOUR
R5-2	$85,810	
R5-3	$60,595	
R5-4	$53,694	
R5-5	$33,177	
R5-6	$81,725	
R5-7	$80,035	
R5-8	$77,521	
R5-9	$36,777	
R5-10	$36,976	
R5-11	$37,804	
R5-12	$37,415	
R5-13	$37,577	
R5-14	$36,863	
R5-15	$39,364	
R5-16	$41,784	
R5-17	$26,918	
R5-18	$55,236	

TABLE 32
AVERAGE ANNUAL RESIDUAL DAMAGES - BY REACH
SELECTED PLAN

R5-19	$48,618	
R5-20	$87,777	
R5-21	$27,361	
R5-30	$1,848	CONSTRUCTION REACH FIVE
R5-31	$178	
R5-32	$21,344	
R5-33	$2,550	
R5-34	$852	
R5-35	$2,384	
R5-36	$19,174	
R5-37	$735	
R5-38	$1,918	
R5-39	$308	
R5-40	$26	
R5-41	$54	
R5-42	$28	
R5-43	$37	
R5-44	$0	
R5-45	$0	
R5-46	$2,706	
R5-47	$8,699	
R5-48	$290	
R5-49	$0	
R5-50	$895	
R5-51	$652	
Total	$637,201	

6.4 RISK AND UNCERTAINTY

Analysis of shore protection projects has moved from the traditional deterministic approach to a more comprehensive probabilistic, risk-based methodology. Shore protection projects are now formulated to provide economical protection for storm and erosion prone areas, selecting the plan that maximizes net economic benefits consistent with acceptable risk and functional performance. The technical task of any risk-based analysis is to balance the risk of design exceedance with damages prevented, uncertainty of storm characteristics with design accommodations, and to provide for safe, predictable performance. Risk-based analysis enables risk issues and uncertainty in critical data to be explicitly included in project formulation and evaluation. The uncertainties associated with the sequencing of storms and natural recovery and those associated with storm damages and erosion losses can now take on a very large number of values. Evaluating the effects of each sequence of storms becomes a life cycle analysis problem and many lifecycles must be evaluated in order to quantify the distribution of economic losses both without a storm damage reduction project and with each alternative formulated. The use of the lifecycle approach helps explain the evaluation process for erosion and nourishment much more easily since the lifecycle approach is more realistic and more closely mimics the dynamic coastal conditions.

A major design consideration for this project was to incorporate risk and uncertainty as an integral part of the formulation process. Appendix E of ER 1105-2-100, recommends that storm damage reduction studies should adopt a life cycle approach and probabilistic analysis (and display) of benefits and costs. The Beach-*fx* model which was used for this study incorporates a life cycle approach into the formulation process. Table 32A presents the risk variables, means, standard deviations and probabilities of the BCR less than or greater than one. Table 32B displays the structure and content damages by damaging mechanism, inundation, erosion and wave attack, for each of the 100 life cycle iterations. Again, it should be noted that the values presented in these tables are from Beach-*fx* output which is subject to slight variation due to the 100 life cycle iterations.

TABLE 32A
RISK DAMAGES*

	WITHOUT PROJECT	NED	SELECTED PLAN/LPP
AVERAGE	$88,495,000	$14,975,000	$13,688,000
STANDARD DEVIATION	$746,000	$139,000	$145,000
RISK BENEFITS**			
	WITHOUT PROJECT	NED	SELECTED PLAN/LPP
AVERAGE		$7,344,000	$7,485,000
STANDARD DEVIATION		$36,000	$36,000
RISK BENEFIT TO COST RATIO (BCR)			
		NED	LPP
PROBABILITY BCR < 1.0		26%	38%
PROBABILITY BCR > 1.0		74%	62%

* Present Worth Value 50-year Period of Analysis
**Average Annual Values F Y 2014 Discounting

TABLE 32B
STRUCTURE AND CONTENT DAMAGES BY DAMAGING MECHANISM (VALUES ARE PRESENT WORTH OF LIFE-CYCLE DAMAGES IN THE WITHOUT PROJECT CONDITION)

Iteration	Structure Flood Loss Present Value	Structure Wave Loss Present Value	Structure Erosion Loss Present Value	Contents Flood Loss Present Value	Contents Wave Loss Present Value	Contents Erosion Loss Present Value	Contents Combined Present Value	Structure Combined Present Value
1	$18,453	$452,788	$7,128,710	$19,525	$496	$3,608,939	$3,628,798	$7,568,330
2	$256,459	$1,846,023	$73,502,176	$246,135	$407,243	$28,526,904	$29,006,498	$75,228,740
3	$704,478	$4,548,799	$67,832,307	$577,394	$1,216,865	$24,437,308	$25,823,957	$72,353,339
4	$29,094	$743,651	$7,954,276	$31,577	$896	$3,757,297	$3,789,500	$8,635,453
5	$133,848	$2,048,661	$22,187,070	$124,440	$2,509	$7,983,403	$8,109,401	$24,293,458
6	$68	$444,738	$18,183,705	$90	$345	$5,648,901	$5,649,246	$18,603,280
7	$702,570	$2,961,835	$90,344,932	$616,848	$986,198	$42,539,392	$43,797,902	$93,422,569
8	$7	$131,480	$3,345,951	$12	$0	$1,849,668	$1,849,680	$3,477,384
9	$902	$1,510,963	$14,867,534	$740	$1,996	$5,642,976	$5,644,979	$16,325,780
10	$509,770	$2,847,332	$212,051,012	$467,230	$848,560	$92,459,877	$93,537,201	$214,595,833
11	$230,554	$1,128,962	$16,926,361	$213,075	$418,729	$6,507,411	$7,010,283	$18,026,268
12	$39,412	$1,761,406	$104,005,283	$34,063	$2,976	$43,628,988	$43,665,110	$105,491,530
13	$13,861	$1,150,633	$63,725,945	$14,224	$3,288	$27,550,257	$27,566,937	$64,676,578
14	$1,328,206	$4,654,426	$90,421,783	$1,133,801	$2,793,994	$37,450,873	$40,277,682	$95,039,081
15	$331,009	$1,995,843	$15,382,467	$290,623	$378,274	$5,322,258	$5,871,852	$17,534,343
16	$62,425	$1,640,684	$26,274,449	$71,557	$2,627	$8,920,037	$8,993,431	$27,784,172
17	$237,588	$2,288,492	$85,786,311	$233,503	$366,571	$33,361,307	$33,564,303	$87,878,757
18	$1,295,622	$6,804,348	$100,907,707	$1,115,050	$1,964,162	$45,873,878	$48,221,892	$107,639,605
19	$85,472	$2,906,170	$76,510,878	$85,863	$5,224	$33,075,677	$33,165,605	$78,999,100
20	$655	$1,093,924	$6,683,493	$470	$1,374	$2,942,781	$2,944,155	$7,747,681
21	$654	$1,080,857	$12,737,893	$524	$1,442	$4,747,448	$4,748,890	$13,794,470
22	$147,215	$2,359,894	$117,936,462	$151,284	$2,959	$50,725,974	$50,879,336	$119,843,662
23	$390	$695,753	$18,498,332	$344	$1,470	$6,023,856	$6,025,342	$19,192,228
24	$1,562	$2,050,395	$88,263,126	$1,147	$4,405	$39,145,967	$39,150,377	$90,151,830
25	$25,854	$824,833	$62,180,109	$26,662	$1,150	$24,452,862	$24,480,185	$62,866,652
26	$405,000	$3,124,723	$161,653,181	$308,327	$3,491	$72,289,376	$72,599,930	$164,174,499
27	$530,414	$2,215,227	$51,925,174	$499,734	$715,959	$21,295,356	$22,217,153	$54,201,724
28	$73,470	$2,702,972	$87,082,581	$74,937	$2,655	$36,267,564	$36,344,189	$88,951,051
29	$1,109,846	$5,859,217	$89,873,150	$913,126	$1,613,086	$39,700,816	$41,602,546	$95,412,879
30	$268	$490,729	$5,572,601	$201	$550	$2,632,063	$2,632,624	$6,045,399
31	$1,514,843	$5,412,437	$19,464,142	$1,343,262	$2,151,449	$9,069,395	$11,393,429	$24,942,458
32	$63,214	$1,617,531	$51,210,819	$54,924	$2,740	$18,692,689	$18,749,434	$52,787,042
33	$3,410,063	$9,753,280	$131,022,845	$1,962,076	$4,721,017	$58,540,491	$62,508,204	$137,426,825
34	$245,875	$1,074,904	$19,694,993	$202,076	$313,233	$7,486,359	$7,886,242	$20,760,367
35	$733	$1,422,110	$77,978,071	$709	$2,128	$34,165,992	$34,168,128	$79,199,567
36	$63,713	$2,437,495	$25,336,615	$64,635	$2,895	$9,824,604	$9,891,168	$27,661,021
37	$278,999	$2,051,005	$18,291,960	$251,784	$294,601	$8,052,428	$8,501,823	$20,360,618
38	$202,815	$3,112,884	$30,565,645	$169,716	$3,074	$12,703,257	$12,875,055	$33,563,139
39	$2,525	$3,978,698	$141,840,027	$1,870	$5,438	$60,797,920	$60,803,374	$145,233,727
40	$46,005	$1,994,548	$25,618,359	$41,036	$2,799	$11,182,869	$11,225,758	$27,379,616
41	$101,676	$1,716,526	$33,764,350	$93,754	$2,520	$15,002,322	$15,097,597	$35,284,328
42	$347	$697,950	$16,151,654	$351	$1,123	$6,710,604	$6,711,770	$16,756,037
43	$1,207,706	$5,185,324	$186,182,541	$935,720	$1,983,801	$84,440,396	$85,882,459	$189,698,897
44	$26,740	$713,099	$18,730,171	$23,070	$1,709	$7,658,213	$7,682,482	$19,419,663
45	$1	$159,524	$31,489,882	$2	$565	$11,109,951	$11,110,517	$31,644,200
46	$209,398	$1,677,645	$13,163,783	$185,126	$321,666	$5,735,268	$6,137,745	$14,783,406
47	$784,897	$2,708,303	$18,212,820	$670,573	$1,393,141	$8,365,358	$9,670,569	$20,960,589
48	$93,609	$1,925,663	$76,443,079	$99,210	$2,301	$30,791,104	$30,891,803	$78,289,171
49	$619	$1,235,975	$18,483,551	$502	$1,847	$6,156,970	$6,158,857	$19,578,780
50	$139,094	$2,171,809	$38,442,212	$119,133	$4,197	$16,847,069	$16,968,902	$40,503,798
51	$1,054,307	$4,192,655	$48,886,163	$862,509	$1,634,898	$19,351,505	$21,274,693	$53,229,968
52	$834,429	$3,702,952	$26,467,048	$731,145	$1,453,093	$10,785,427	$12,284,021	$30,137,669

TABLE 32B
STRUCTURE AND CONTENT DAMAGES BY DAMAGING MECHANISM (VALUES ARE PRESENT WORTH OF LIFE-CYCLE DAMAGES IN THE WITHOUT PROJECT CONDITION)

Iteration	Structure Flood Loss Present Value	Structure Wave Loss Present Value	Structure Erosion Loss Present Value	Contents Flood Loss Present Value	Contents Wave Loss Present Value	Contents Erosion Loss Present Value	Contents Combined Present Value	Structure Combined Present Value
53	$950	$1,485,485	$68,765,223	$781	$2,650	$31,655,237	$31,657,939	$70,091,375
54	$953,668	$2,388,920	$157,479,665	$904,963	$2,812,387	$74,860,467	$76,186,028	$159,371,820
55	$21,017	$783,315	$19,708,671	$19,305	$1,005	$7,912,895	$7,932,825	$20,449,502
56	$29,812	$665,314	$6,274,793	$27,089	$1,079	$3,029,961	$3,057,790	$6,905,504
57	$127	$278,315	$3,884,563	$117	$484	$2,037,200	$2,037,683	$4,162,568
58	$1,020	$1,982,444	$24,180,096	$753	$2,099	$7,508,391	$7,510,491	$26,016,550
59	$93	$161,270	$63,227,587	$122	$442	$22,582,641	$22,583,134	$63,376,757
60	$11,623	$743,674	$87,956,889	$12,253	$1,724	$40,807,886	$40,821,336	$88,479,650
61	$1,507,550	$5,314,485	$81,613,496	$1,345,203	$3,657,939	$35,776,425	$38,795,034	$86,648,467
62	$85,448	$1,735,936	$41,054,564	$86,758	$6,502	$14,517,985	$14,608,803	$42,635,326
63	$1,075	$1,702,409	$117,335,550	$790	$2,374	$54,730,210	$54,732,644	$118,979,956
64	$670	$1,050,365	$21,277,597	$558	$1,769	$7,563,633	$7,565,402	$22,269,261
65	$370,192	$1,846,180	$83,195,133	$320,865	$509,551	$32,646,073	$33,278,200	$84,852,064
66	$76,889	$1,247,745	$24,849,415	$75,908	$124,090	$9,456,449	$9,613,300	$26,154,820
67	$1,250	$1,322,337	$36,322,652	$918	$2,844	$12,744,851	$12,747,776	$37,495,090
68	$616,945	$4,523,870	$95,522,243	$531,547	$1,026,968	$42,339,836	$43,553,215	$99,503,982
69	$150,877	$1,077,524	$10,234,969	$135,739	$228,948	$4,746,511	$5,031,713	$11,281,218
70	$20,514	$607,689	$60,743,608	$22,577	$1,348	$23,997,400	$24,021,020	$61,263,609
71	$733,179	$2,427,347	$133,647,740	$596,121	$1,480,012	$56,144,521	$57,078,635	$135,678,269
72	$42,985	$1,133,825	$21,655,911	$42,945	$1,319	$8,228,659	$8,272,433	$22,767,964
73	$483,707	$2,971,744	$183,312,973	$386,220	$749,257	$86,925,918	$87,480,041	$185,357,823
74	$209	$334,133	$8,818,281	$216	$693	$3,777,335	$3,778,029	$9,126,016
75	$895,983	$3,372,183	$13,165,218	$745,775	$1,267,507	$5,304,442	$6,838,517	$16,745,104
76	$16,525	$380,613	$5,457,196	$18,072	$522	$2,750,546	$2,769,088	$5,849,706
77	$425	$752,893	$52,582,998	$439	$1,422	$19,446,777	$19,448,238	$53,251,401
78	$863,904	$3,763,366	$126,417,671	$721,078	$1,317,509	$51,983,828	$53,498,433	$129,779,560
79	$1,066,854	$4,449,825	$112,162,906	$981,200	$1,695,113	$48,009,776	$49,921,131	$115,908,152
80	$57,552	$1,518,588	$112,784,517	$60,396	$2,655	$44,412,396	$44,474,312	$113,977,489
81	$71,705	$1,667,948	$49,394,306	$72,759	$2,261	$23,473,994	$23,548,361	$50,976,476
82	$16,760	$480,663	$10,218,823	$18,873	$730	$4,667,319	$4,686,537	$10,692,393
83	$411,735	$2,072,898	$22,174,176	$348,658	$732,448	$8,190,828	$9,058,903	$24,188,183
84	$152,343	$2,592,608	$100,978,137	$150,668	$4,552	$44,110,521	$44,262,819	$103,203,456
85	$1,013,417	$4,149,306	$54,010,961	$838,832	$1,244,786	$21,650,108	$23,217,248	$58,035,586
86	$567	$670,190	$19,733,962	$472	$1,811	$6,985,467	$6,987,278	$20,366,137
87	$92,294	$1,673,762	$23,715,202	$71,403	$1,709	$8,985,507	$9,058,039	$25,347,191
88	$366,186	$2,271,287	$19,338,576	$313,968	$411,939	$7,178,103	$7,738,670	$21,601,217
89	$163	$380,876	$32,536,956	$213	$789	$12,955,104	$12,955,938	$32,889,529
90	$229,524	$2,878,555	$74,832,358	$188,748	$282,997	$31,378,426	$31,737,383	$77,472,461
91	$167	$394,897	$9,327,148	$157	$605	$3,797,900	$3,798,511	$9,692,099
92	$1,992,097	$3,056,682	$182,806,143	$1,698,841	$734,402	$75,317,630	$77,327,714	$186,898,589
93	$1,262,334	$5,403,022	$180,691,400	$962,387	$1,682,158	$78,596,685	$79,906,297	$184,336,766
94	$322	$600,282	$10,640,437	$288	$1,070	$4,602,468	$4,603,538	$11,206,632
95	$1,468,963	$2,356,134	$65,775,381	$1,292,312	$2,442	$26,695,248	$27,980,245	$69,206,747
96	$3,359,518	$10,917,698	$151,621,572	$2,454,576	$4,665,965	$66,572,559	$70,288,094	$159,911,757
97	$844,410	$4,918,407	$64,636,732	$748,206	$1,526,932	$28,528,056	$30,245,652	$69,383,896
98	$875,318	$4,118,596	$115,131,422	$753,214	$1,501,849	$51,655,801	$53,390,008	$119,148,583
99	$2,520,356	$8,100,535	$84,088,693	$1,950,566	$4,678,100	$38,072,395	$41,466,101	$90,795,863
100	$288	$514,569	$105,802,633	$318	$1,506	$47,656,298	$47,657,642	$106,299,044

6.4.1 Residual Risks

The proposed beach fill plan would greatly reduce average annual storm damages. The selected plan will reduce combined wave and erosion damages by 85 percent. Some wave and erosion damages will still occur, estimated to average about $637,000 per year over the 50-year period of analysis. The project is designed to protect mainly against storm waves and storm-induced erosion, two major categories of storm damage. The project will not prevent any damage from bay side flooding from saltwater that will flow into Choctawhatchee Bay through East Pass Inlet or flooding around the numerous dune lakes. Discussion of flood and wind damage experienced during past storms is provided for further reference in the recent storm history section of Appendix A, Engineering Investigations. Maps of current designated flood prone areas, such as those shown in Appendix A, Engineering Investigations, are available on Walton County are available on Walton County and FEMA websites. Structures will continue to be subject to damage from hurricane winds and windblown debris. Damages from flooding and winds will decrease as older structures are replaced with those meeting floodplain ordinances and wind hazard building construction standards. This is evident by the reduce number of major structural damages seen in more recent years. But even new construction is not immune to damage, especially from severe storm events. Also, the condition of the project at the time of storm occurrence can affect the performance of the project for that event. The proposed beach fill reduces damages, but does not have a specific design level. In other words, the project is not designed to fully withstand a certain category of hurricane or a certain frequency storm event. The project purpose is storm damage reduction, and the berm-and-dune is not designed to prevent loss of life. Loss of life is prevented by the existing procedures of evacuating completely well before expected hurricane landfall and removing the residents from harm's way.

6.4.2 Risk and Uncertainly in Relative Sea Level Rise Assumptions

The Corps planning guidance, specifically Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs EC 1165-2-212 and Appendix E, Section IV, Paragraph E-24 of the Guidance Notebook ER 1105-2-100, requires that potential relative sea level rise be taken into consideration for coastal or estuarine projects at the feasibility level of study and recommends, given the uncertainty of future sea level rise estimates, preference be given to developing strategies that are robust over the entire range of potential sea level rise rates versus those that perform well only over a limited range of potential sea level rise rates.

Systematic long-term tide elevation observations suggest that the elevation of oceanic water bodies is gradually rising and this phenomenon is termed 'sea level rise.' The rate of rise is neither constant with time nor uniform over the globe. In addition to elevation of oceanic water bodies, is the gradual depression or uplifting of land surface along the coast, which becomes an additional factor in the relationship between the land's elevation over time, and that of changing sea levels. Because portions of the coast of the Florida Panhandle is affected by subsidence and global sea level rise (adjusted for local conditions), these factors combine (and are referred to in this analysis) in a single element of “relative” sea level rise. Relative sea level (RSL) rise at a given location, then, is simply the change in mean sea level at that location with respect to an observer standing on or near the shoreline.

Sea-level change can cause a number of impacts in coastal and estuarine zones, including changes in shoreline erosion, inundation, and changes in storm and flood damages. Sea level rise rates over time are the subject of many predictions. Historically, relative sea level rise has been determined by fitting a linear relationship to monthly mean or annual mean sea level, either of which is computed from tide gage observations. The slope of the fitted line gives the rate of sea level rise at the location of the tide gage. The computed rate includes the rate of subsidence or uplift of the location upon which the tide gage is founded, and thus the computed RSL rates may be extended locally or regionally to areas with similar geotechnical and tidal conditions.

Project performance in this study effort was evaluated for both an extrapolation of the observed historic rate plus subsidence, which resulted in RSL rise over a 50-year planning horizon of approximately 0.3 feet and also for higher rates than that historically observed, as calculated based on formulas for the National Research Council (NRC) curves tailored to the Walton County study area as documented in detail in Appendix A, Engineering Investigations, equivalent to up to approximately 2.1 feet over a 50-year planning horizon. The recession rate due to sea level rise based on extrapolation of the historic observed rate of 0.4 feet per year (ft/yr) is not significant when compared to the historical averaged shoreline change of roughly 2.4 ft/yr. The influence of current sea level rise on the project is relatively low as compared to other factors causing erosion (waves, currents, winds and storms). An analysis of shoreline change rate over the time period of 1973 to 2004 indicates that the magnitude of the short-term storm-induced erosion, which was as high as 12.4 ft/year during Hurricane Ivan has a much greater affect along the beaches of Walton County than those indicated by the natural long term shoreline trends.

An increase in relative sea level rise along Walton County of 0.3 to 2.1 feet would increase the areas susceptible to coastal inundation during storm events. The magnitude of this increase and its impact to coastal development is directly associated with the topography of the land, the characteristics of the storms and the development within the area. The majority of Walton County is currently considered by the FEMA and county emergency management to be a flood prone area. The areas immediately along the coast and within the limits of the project are classified as coastal areas with a one percent or greater chance of flooding with an additional hazard associated with storm waves. Increases in RSL rise could increase the areas susceptible upwards of 20 percent of present day. Studies indicate that this calculation which is based on changing the underlying elevation and not using a coastal surge model significantly overestimates the inundation due to neglect of land dissipation (Condon, A., et al). Although this estimate is likely high it clearly demonstrates the potential of increased hazard for the area. The areas of highest susceptibility along the Walton County coast are located within the low-lying regions of dune lakes and projected areas within state parks and cobra zones. Due to potential environmental impacts and laws these areas are not included in the recommended plan.

The increase in shoreline recession would directly impact the beach and dune habitat available to the terrestrial wildlife (i.e. shorebirds, beach mice, sea turtles, etc.) utilizing the coastline of Walton County. The pressure to protect properties and the fronting dune/bluff would likely result in a reduction of the available habitat. Under the projected RSL rise scenarios and associated recession rates of 0.4 to 2.4 ft/yr as much as approximately 270 acres of habitat under the future without project could be impacted by RSL rise.

The selected plan is not a hard structure and adjusts to natural forces. The project is designed to include a significant amount of sacrificial sand in the advance nourishment berm. The optimization of the advance nourishment was performed with a conservative background erosion rate of 5 ft/yr combined with the effects of 46 historic storms with 12 variants of the astronomical tide at the time of landfall. The estimated projected average rate of shoreline recession due to accelerated SLR over the next 50 years based on this analysis would not exceed the 5 ft/yr background erosion rate used in the optimization of the advance nourishment berm. Based on this and the estimated average renourishment interval of every10 years the projected accelerated rise in sea level would not be expected to overwhelm the project before the next nourishment of sand.

An increase in potential shoreline recession as the beach profile attempts to re-establish in response to a rise in sea level would result in increased volume losses from the design template. The additional volume of sand that may be needed to maintain the shoreline could increase on average by approximately 1.3 cy/ft/yr above the standard deviation of the mean nourishment volume under the high modified NRC Curve III RSL scenario.

Regardless of the rate of RSL rise, the beach fill project would be monitored and renourished on average every 10 years. Monitoring data provides input to determining the details of each renourishment of the beach. If an accelerated RSL rise occurs, erosion volumes increase and renourishment volumes will increase, shortening the life of designated borrow areas. A Limited Reevaluation Report (LRR) on borrow sources would be conducted to investigate additional borrow sources should this occur. All alternative plans contain a 5.5-foot NAVD natural berm elevation for the area and all would be affected similarly by accelerated RSL rise. Therefore, no change to the selected plan by accelerated RSL is expected other than possible minor modifications of the berm and dune elevation. There is no expectation that accelerated RSL would result in selection of other major categories of alternative plans such as the nonstructural plan or hard structure plans.

6.4.3 Risk and Uncertainty in the Storm Climate

Walton County is subject to tropical depressions, tropical storms and hurricanes, which contain uncertainties associated with future intensity, frequency and landfall location. The analysis utilized for this study makes use of a set of 46 plausible storms derived from the available storm record (1874 through 2005) for the study area extended with 12 variants of the astronomical tide at the time of landfall. The distribution and sequencing of storms is based on the probabilities determined by the historic record with an applied Poisson distribution to determine the number of storms of each type that will occur in a given hurricane season. With evidence reported by the Intergovernmental Panel on Climate Change (IPCC, 2007) pointing to a warming planet there is a growing body of research in climate change affects. Some research has indicated that hurricane intensity may increase (Knutson et al. 2010) while the frequency of landfalling hurricanes may be less (Wang and Lee, 2008). Studies considering the implication of such increases in hurricane intensity and associated SLR as a result of climate change (Frey, 2010) suggest that such changes will increase the susceptibility of coastal communities to future storm and flood related damages.

6.4.4 Uncertainty in Applied Models

Computation surge, wave and beach response and economic models introduce uncertainty into the analysis. This uncertainty is due to limitations in the model physics and limitations with measured data used to calibrate the model. This uncertainty is carried forward into the statistical analysis. Throughout the report documentation of associated uncertainty in the analysis and an assessment of it relevance to the overall plan selection has been made. In this section focus is made on the uncertainty of the specific sequence of storms that make up the future. The specific sequence of storms is the overwhelming contributor to the uncertainty of the physical and economic performance of the storm damage reduction project. This is demonstrated in Figure 11, which shows the 68 and 90 percent confidence intervals of computed project nourishment volumes relative for those lifecycles that involved the greatest to fewest number of storms. Typically the nourishment volumes which fall outside of plus or minus one standard deviation of the mean are those lifecycles associated with the fewest and greatest number of storms. To empirically incorporate the uncertainty, the physical conditions were evaluated over a wide range of conditions that could evolve given the storm history of the region from 1887-2005. The historical population approach and its performance has been found to be strongly linked to the historic record. Irish, et al., 2011 found that the historical storm population approach for record periods of 100 years and less can give errors in storm surge of 9 percent to 17 percent for return periods between 50 to 1000 years. Irish, et al., 2011 found that the historical population approach remained robust when decadal-scale variability in the storm rate of occurrence is considered. To ensure a robust approach to plan formulation and reduce uncertainty and error that can be typical for historical populations the analysis used 117 years of storm record, which covers decadal scale climate variability along with 12 variants of astronomical tide.

6.4.5 Risk and Uncertainly in Project Reliability

The coastal processes results (i.e. changes in dune height, dune width, berm width, upland width, and cross-shore profiles of erosion) of the project over the simulated life cycle were reviewed to determine its robustness under various simulated plausible storms. Under the smaller simulated events the project primarily undergoes beach berm erosion with little to no dune escarpments; however, under larger simulated storm events (i.e. Hurricane Ivan, Opal, Eloise, etc.) substantial beach berm erosion and escarpment of the constructed dune occurs as a result of the associated higher water levels and waves. In all simulations the project acts as the first line of defense receiving the brunt of the damage, while protecting the existing dune feature. It is important to put emphasis on the fact that the project is a dynamic feature that will continuously undergo changes, both seasonally and annually. The condition of the project at the time of storm occurrence can affect the performance of the project for that event. In addition, as discussed under the risk and uncertainty in the storm climate section the size of the storm as well as the sequencing of events (how quickly one event occurs after another) and natural beach recovery can also greatly affect the project performance and thus reliability. The selected plan would provide a significant degree of reliability; however, as anticipated damage to the project from storm events will occur and maintenance of the project will be required.

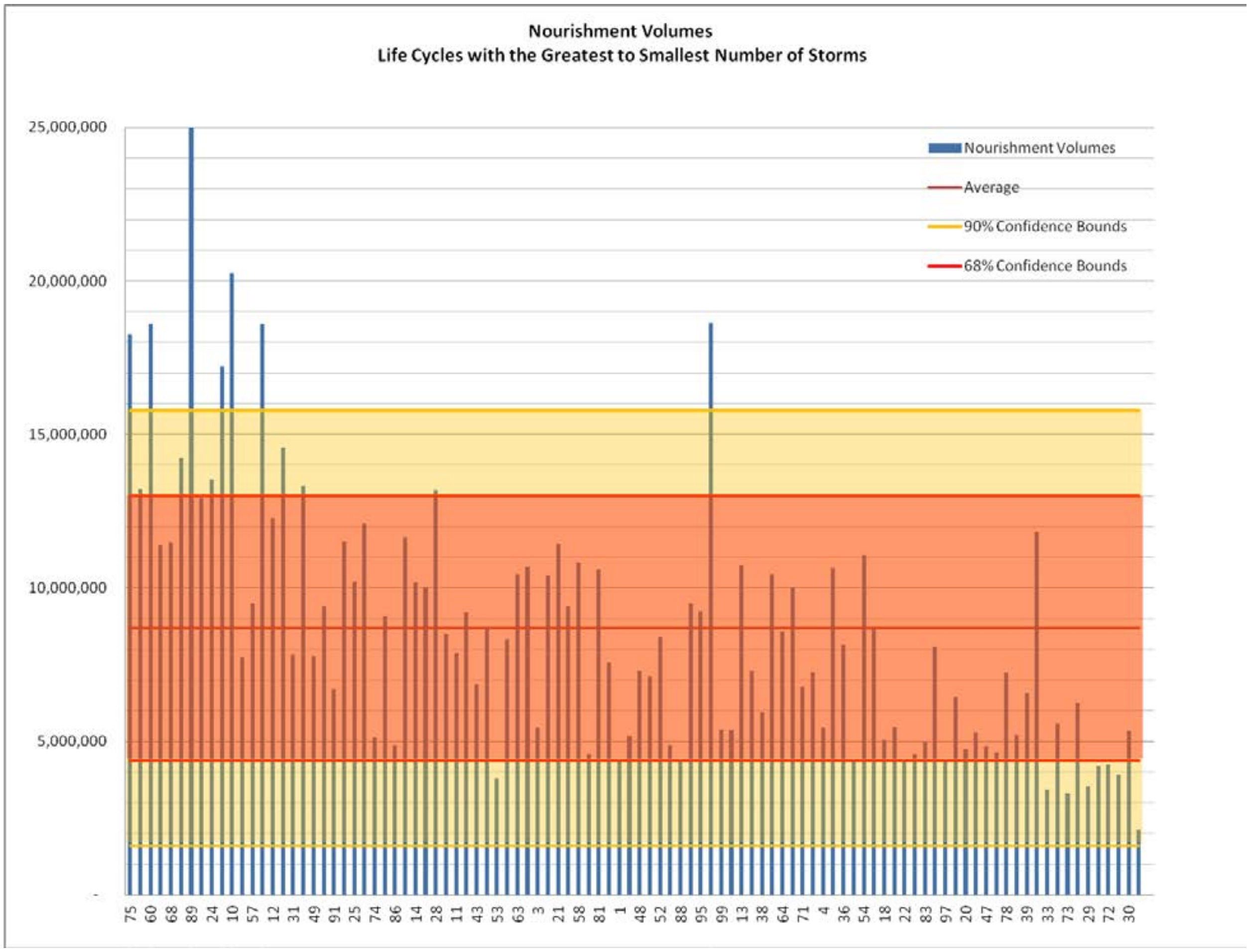


FIGURE 11. NOURISHMENT VOLUMES

6.4.6 Risk and Uncertainly in Borrow Material

The required quantity of fill and borrow over the project life is uncertain. The locally preferred plan is estimated to have a mean value of approximately 11.0 million cubic yards (MCY) and a standard deviation of approximately 4.0 MCY. Fill volume requirements in Beach-*fx* were conservatively estimated considering an overfill ratio of 1.17. For initial fill volume estimates based on 2010 surveys was assumed with a 1.0 overfill. Limit volumes of BA-4 and BA-7 are approximately 18.6 and 5.3 MCY respectively, with a combined limit borrow volume of approximately 23.9 MCY. Estimated effective borrow volumes after accounting for dredging inefficiency are approximately 15.6 MCY and 4.5 MCY for BA-4 and BA-7 respectively, with a combined effective borrow capacity of approximately 20.1 MCY. The combined effective borrow capacity is adequate for the expected fill requirements. BA-7 is proposed to be used only if and after BA-4 is practicably depleted. This is unlikely to occur and will occur late in the project life if at all, but the use of BA-7 is proposed for that contingency.

6.4.7 Risk to Life and Safety

As previously stated under residual risk the project purpose is storm damage reduction. The berm-and-dune is not designed to prevent loss of life. Loss of life is prevented by the existing procedures of evacuating completely well before expected hurricane landfall and removing the residents from harm’s way. The erratic nature and unpredictability of hurricane path and intensity require early and safe evacuation. This policy should be continued both with and without the storm damage reduction project.

6.4.8 Risk Management and Project Performance Summary

Due to the efforts by the study team and non-federal sponsor, there were no significant risks or uncertainties identified during the study that would affect performance of the recommended plan. The expected average annual damages will be reduced by approximately $7,555,000 and the recommended plan reduces the risk of average annual damages due to wave attack and erosion by roughly 92 percent. Several engineering, economic, and environmental methods were used to reduce risk and uncertainty and increase project performance. Considerations included system effects such as tropical storm frequency and intensity, and sea level rise, and the cost and benefit analysis which included funding, parking and access, and the availability of sand to construct the project.

From an engineering and economic perspective, the study team used a Corps’ certified model called Beach fx to reduce risk and uncertainty. This model utilizes a suite of engineering and economic data to develop the most cost effective berm and dune size that maximized storm damage reduction benefits. Detailed geotechnical investigations were also conducted to identify borrow areas containing an adequate supply of compatible material for the project. An updated survey was conducted in 2010 to further ensure an accurate assessment of required fill material was available. And after the BP Horizon oil spill, the borrow areas were inspected to help reduce the risk of the borrow materials having been contaminated.

This study was coordinated with appropriate Federal and state agencies and members of the interested public in accordance with applicable laws and regulations. Interagency coordination meetings were conducted early and throughout the study process, and proved to be key in identifying and resolving environmental issues and concerns early on, as well as incorporating opportunities into the study. This initial coordination determined that the impact and scope of the proposed action were minor and would not require an environmental impact statement or specific mitigation. Impacts on coastal areas as per the Coastal Barrier Resources Act and preservation of unique coastal dune lakes surfaced as issues with the resource agencies, but were resolved by incorporating “avoidance” measures into the project design. Recommendations provided by the interagency team were integrated into the study, which aided in maximizing project performance and reducing risk to the environment. Archeological surveys were also conducted to ensure that no cultural resources would be impacted by the project.

Walton County currently has the second longest evacuation time in the state of Florida. To reduce this life and safety risk, Walton County actively participates in a joint FEMA/USACE funded program for Hurricane Evacuation Planning. This program includes a completed Hurricane Evacuation Study for North West Florida which encompasses the Walton County area. This web based interactive study details evacuation routes which the county can modify for any road closure or scheduled construction work, shelter options such as special needs and emergency support, and a hotel/motel database that includes the number of available rooms along inland routes.

Both the State of Florida Emergency Management Agency (EMA) and the Walton County EMA also participate annually in local training on the USACE computer program called HURRIVAC. This state of the art computer program utilizes NOAA's latest modeling and a multitude of parameters to determine the safest evacuation times and zones for specific storms as they approach.

Additionally, the non-federal sponsor has passed a one half-cent sales tax referendum to fund the expansion of the HWY 331 Bridge across Choctawhatchee Bay. In making this local commitment, the Florida Department of Transportation (FDOT) has agreed to expand the remaining segments of HWY 331 with extra lanes to further reduce evacuation times. They have also reduced risk to environmentally sensitive areas by ensuring that no development occurs within the buffer zones surrounding the coastal dune lakes and outfalls, and within coastal wetland areas (Walton County Comprehensive Plan, Policy C-1.2.1 and C-1.2.2).

6.5 VALUE ENGINEERING

Per ER 11-1-321, Value Engineering, Change 1, dated 1 January 2011, a value engineering (VE) study shall be performed on the earliest document available that satisfies the functional requirements of the project and includes a Micro-Computer Aided Cost Estimating System (MCACES) cost estimate. While all feasibility efforts are directed to define a project that most economically provides the desired project outputs, a VE study can assure that the project design captures that goal and/or may suggest alternatives that could enhance the project. A VE review of the material in the draft report was conducted by a Review Team on September 22, 2010. The Review Team did not suggest any changes to consider for incorporating into this report. Additional VE will be performed during the Pre-Construction Engineering & Design phase as the design of the project goes forward prior to implementation.

6.6 REAL ESTATE

The real estate requirements for construction of the various components of the proposed project are identified in the Real Estate Plan (REP) contained in Appendix C, Real Estate Plan. The real estate requirements are based on a project need to reduce the damaging effects of hurricanes and severe storms to real property along the coast and stabilize or restore the shoreline by eliminating long-term erosion. The REP is tentative in nature for planning purposes only and both the final real property acquisition lines and estimates of value are subject to change even after approval of this report.

The requirements for lands, easements, rights-of-way, relocations, and disposal/borrow areas (LERRDs) include the right to construct a dune and berm system along the shoreline of Walton County as detailed in this report. Based on the real estate planning and research to date, it is estimated that a total of 179.16 acres will be required in Perpetual Storm Damage Reduction Easements. The estimated number of impacted parcels within the proposed project is 960 of which 37 of these are deemed to be publicly-owned. Based on these calculations, 923 Perpetual Storm Damage Reduction Easements will be required on private lands and 37 Perpetual Storm Damage Reduction Easements required for publicly-held lands. All easements will be located landward of the Mean High Water Line or the Erosion Control Line (ECL) once the ECL is surveyed and recorded for the entire Walton County coastline.

The Baseline Cost Estimate for Real Estate is projected at $737,000.00 for the acquisition of project LERRDs is exclusively concentrated on Federal and Non-Federal administrative expenses. The reasoning behind omitting land costs is due to the nature of this proposed shore protection project and Federal regulations pertaining to said project. The Mobile District appraisal section has determined that the value of the lands needed for easement purposes are assessed at zero based on the off-setting benefits appraisal method. The proposed project is deemed to be within the purview of EC 405-1-04, Section V, paragraph 4-44(b) which states "Hurricane protection and shore protection projects will generally be treated in a manner as to not allow credit for LERRDs when the project provides direct (off-setting) benefits such as prevention of erosion or re-establishment of beaches, i.e., those lands subject to shore erosion that are required for the project."

6.7 PRE-CONSTRUCTION ENGINEERING AND DESIGN

During the Pre- Construction Engineering & Design (PED) phase updated surveys as well as relevant monitoring data will be used to compute background erosion rates and construction volumes. Project datum will be converted from NAVD88 to MLLW to meet the requirements of ER 1110-2-8160 in regards to geodetic and tidal datums. In addition, sub-areas of the borrow area will delineated and material fill characteristics for a given nourishment and overfill volumes will be computed. This information will be documented in a Design Documentation Report that will be kept on record and updated with the project.

7.0 RECOMMENDATION

Based on the conclusions of this study, after having given consideration to all significant aspects in the overall public interest, including environmental, social, and economic effects; and engineering feasibility; I recommend the implementation of the selected plan, which consists of five construction reaches for hurricane and storm damage reduction along the shoreline of Walton County, Florida, which will be composed of a 50-foot berm width, a 25-foot berm and an additional 25 feet of advanced nourishment in all construction reaches and will also feature added dune width in all construction reaches of either 10 or 30 feet, with such modifications thereof as in the discretion of the Commander, U.S. Army Corps of Engineers, may be advisable. Figures 11A-11C display the proposed construction reaches along with the study (model) reaches. Summary benefits of the selected plan are presented in Table 33.

TABLE 33
SUMMARY BENEFITS SELECTED PLAN
WALTON COUNTY, FLORIDA - FEASIBILITY

	FY 2013 Dollars	Category
	$61,397,000	2014 Initial Construction
	$16,561,078	2024 Renourishment
	$11,460,605	2034 Renourishment
	$7,930,973	2044 Renourishment
	$5,488,396	2054 Renourishment
Total Economic First Cost	$102,838,052	
Interest During Construction	$760,000	
Total Project Economic First Cost	$103,598,000	
Average Annual Economic First Cost	$4,618,000	
Annual OMRR&R	$168,000	
Total Average Annual Economic Cost	$4,786,000	
Average Annual HSDR Benefits	$7,555,000	
Average Annual Recreation Benefits	$15,000	
Total Average Annual Benefits	$7,570,000	
Benefit-to-Cost Ratio	1.58	
Net Benefits	$2,784,000	

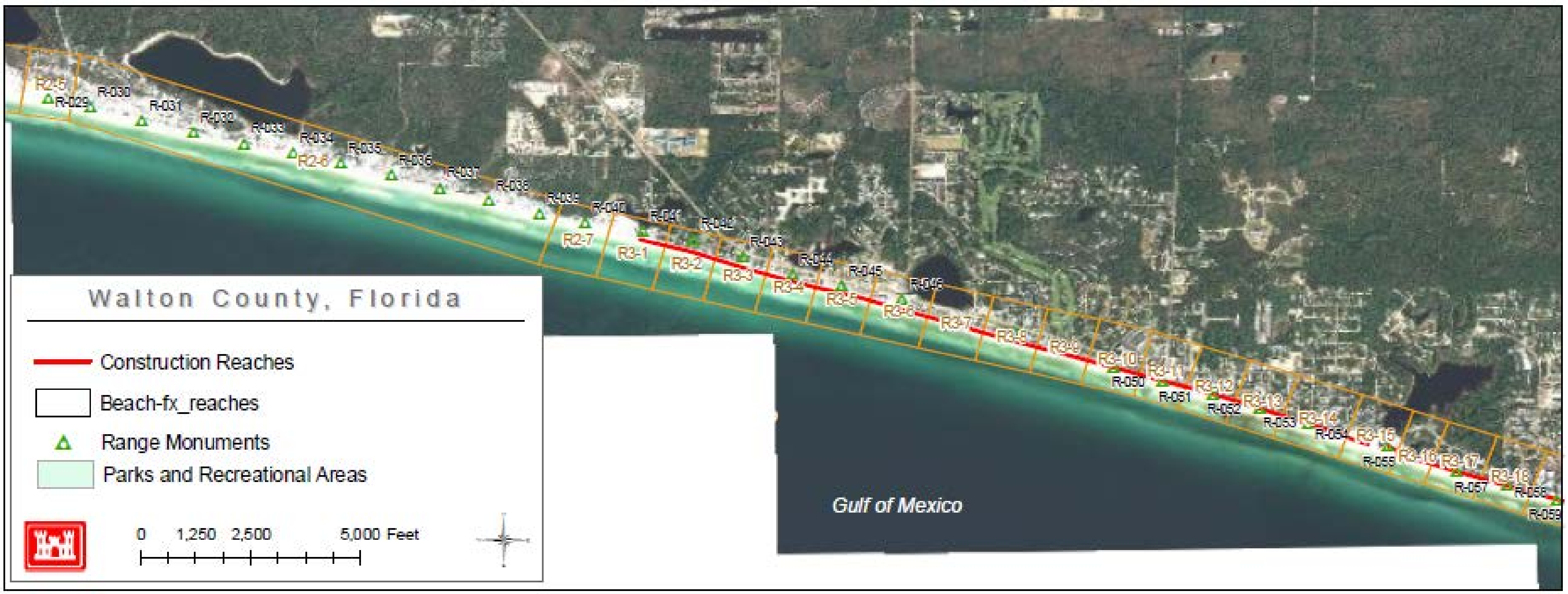


FIGURE 11A. CONSTRUCTION AND STUDY REACHES

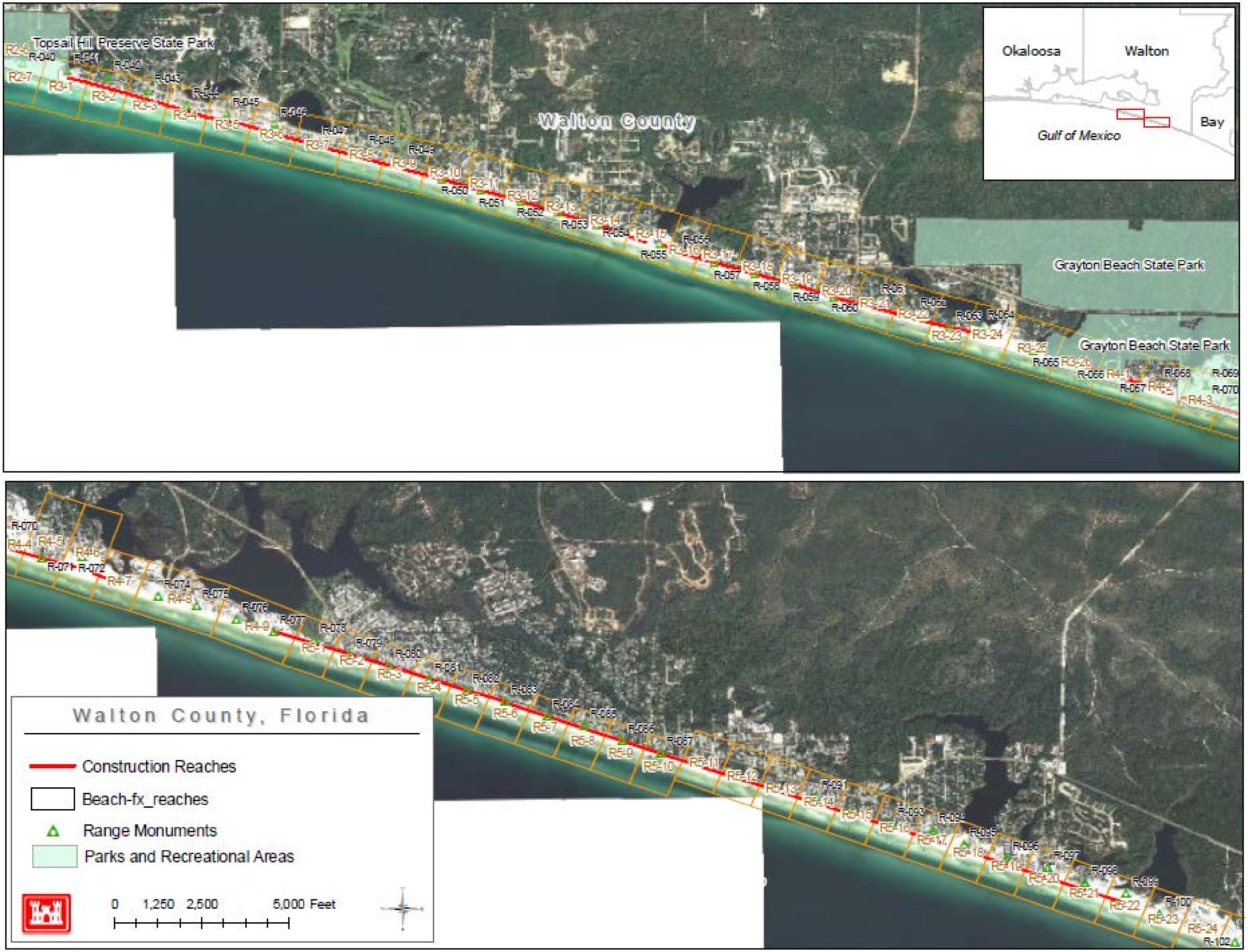


FIGURE 11B. CONSTRUCTION AND STUDY REACHES

Walton County, Florida

Construction Reaches
Beach-fx_reaches
Range Monuments
Parks and Recreational Areas

0 1,250 2,500 5,000 Feet

FIGURE 11C. CONSTRUCTION AND STUDY REACHES

The construction of the proposed project shall be contingent on the non-Federal sponsor giving written assurances satisfactory to the Secretary of the Army that it will satisfy its responsibilities of local cooperation as detailed in a fully coordinated Project Partnership Agreement (PPA) package (to include the non-Federal sponsor's financing plan) prepared subsequent to the approval of the feasibility phase and will reflect the recommendations of this Feasibility Study. The non-Federal sponsor has indicated support of the recommendations presented in this Feasibility Study and desires to execute a PPA for the selected plan. The non-Federal sponsor will:

a. Provide a minimum of at least 35 percent of initial project costs assigned to coastal storm damage reduction, plus 50 percent of initial project costs assigned to protecting undeveloped public lands, plus 50 percent of initial project costs assigned to recreation, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 50 percent of periodic nourishment costs assigned to coastal storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

    (1) Enter into an agreement which provides, prior to execution of the project partnership agreement, the non-Federal share of design costs;

    (2) Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project;

    (3) Provide, during construction, any additional amounts as are necessary to make its total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

    (4) Provide 100 percent of the total project costs that reflect the difference between the National Economic Development (NED) Plan and the Locally Preferred Plan (LPP);

b. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

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

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

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total costs of construction of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

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

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

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

i. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended by (42 U.S.C. 4601 – 4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

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

k. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires the non-Federal interest to participate in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing a Project Cooperation Agreement, and implement the plan not later than one year after completion of construction of the project;

l. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of one percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

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

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

o. Prevent obstructions of or encroachment on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the level of protection it affords, hinder operation and maintenance or future periodic nourishment, or interfere with its proper function, such as any new developments on project lands or the addition of facilities which would degrade the benefits of the project;

p. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

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

r. For so long as the project remains authorized, the non-Federal sponsor shall ensure continued conditions of public ownership, access, and use of the shore upon which the amount of Federal participation is based;

s. Provide, keep and maintain the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal Government;

u. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103 of the Water Resources Development Act of 1986, PL 99-662, as amended (33 U.S.C. 22130, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element; and,

v. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding." However, prior to transmittal to the Congress, the non-Federal sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Steven J. Roemhildt

Steven J. Roemhildt, P.E.
Colonel, Corps of Engineers
District Commander

PLATES

Plates No. 1-11

Photos: Pre-Ivan, Post Ivan, and Post Dennis

Coastal Bluff Erosion Near Hotel, Seagrove Beach, FL: Vegetation was removed from the bluff face by Hurricane Ivan. At the left center of the post-Dennis image, a pile of sand and debris is seen at the foot of the bluff.

PLATE 1

Coastal Bluff Erosion Near Homes, Seagrove, FL: During Hurricane Ivan, coastal erosion at the base of the bluff destroyed stairways. Bluff erosion continued during Hurricane Dennis.

PLATE 2

Coastal Bluff Erosion Near Town Homes: Seagrove, FL: During Hurricane Ivan, vegetation was removed from the steep bluff face. The bluff was eroded landward during Hurricane Dennis threatening structures near the bluff edge.

PLATE 3

Hurricane Ivan

Before

After

Hurricane Ivan

Before

After

PLATE 5

Hurricane Ivan

Before

After

Hurricane Dennis

Before

After

PLATE 7

Hurricane Dennis

Before

After

PLATE 8

Hurricane Dennis

Before

After

PLATE 9

Post Dennis

PLATE 10

Post Dennis

PLATE 11

APPENDIX A

ENGINEERING DESIGN

APPENDIX A
SECTION 1

HYDRAULIC CONSIDERATIONS

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

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GENERAL

Description of Study Area. Walton County is located approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida, Figure A-1-1. The beaches of Walton County encompass approximately 26 miles of shoreline extending from the City of Destin in Okaloosa County, Florida (about six miles to the east of East Pass) to the Walton/Bay County line near Phillips Inlet. The western two-thirds of Walton County are comprised of a coastal peninsula extending from the mainland, and the eastern third is comprised of mainland beaches. Choctawhatchee Bay lies north of the peninsula. Walton County includes 15.7 miles of state-designated critically eroding areas and three State of Florida park areas that cover approximately six miles of the 26 mile shoreline.

The Walton County shoreline is characterized by high dune elevations partly due to the presence of Pleistocene Bluffs formed as a result of an exposed submarine berm formed during inundation of the Florida Peninsula during that geologic period. Primary dune elevations in Walton County range from 11.5 to 44.5 feet North American Vertical Datum, 1988 (NAVD88) and average 25.5 feet. Along the mid-section of Walton County, Bluff elevations exceed 60 feet in height, Figure A-1-2A. Bluff erosion and undercutting occur in this area due to the interface of relatively low flat beaches and the bluff toe. An unusual attribute of the Walton County shoreline is the presence of coastal dune lakes. These lakes are rare worldwide and are almost exclusive to the Gulf Coast within the United States. The lakes are about five feet deep and intermittently breach the dune system and discharge directly into the Gulf of Mexico, Figure A-1-2B.

Mild winters and warm hot summers characterize the project area, with an average in excess of 280 days a year of sunshine. The average daily temperature is 67 degrees Fahrenheit and the average water temperature is about 70 degrees Fahrenheit. The months from June through November constitute the hurricane storm season, and this area is subject to tropical storm and strong hurricane conditions. The highest period of rainfall occurs during the storm season, with an average annual rainfall of 64 inches.

Purpose of Study. The purpose of this study is to assess the needs for hurricane and storm damage reduction and opportunities for environmental restoration and protection for the 26 miles of shoreline in Walton County, Florida.

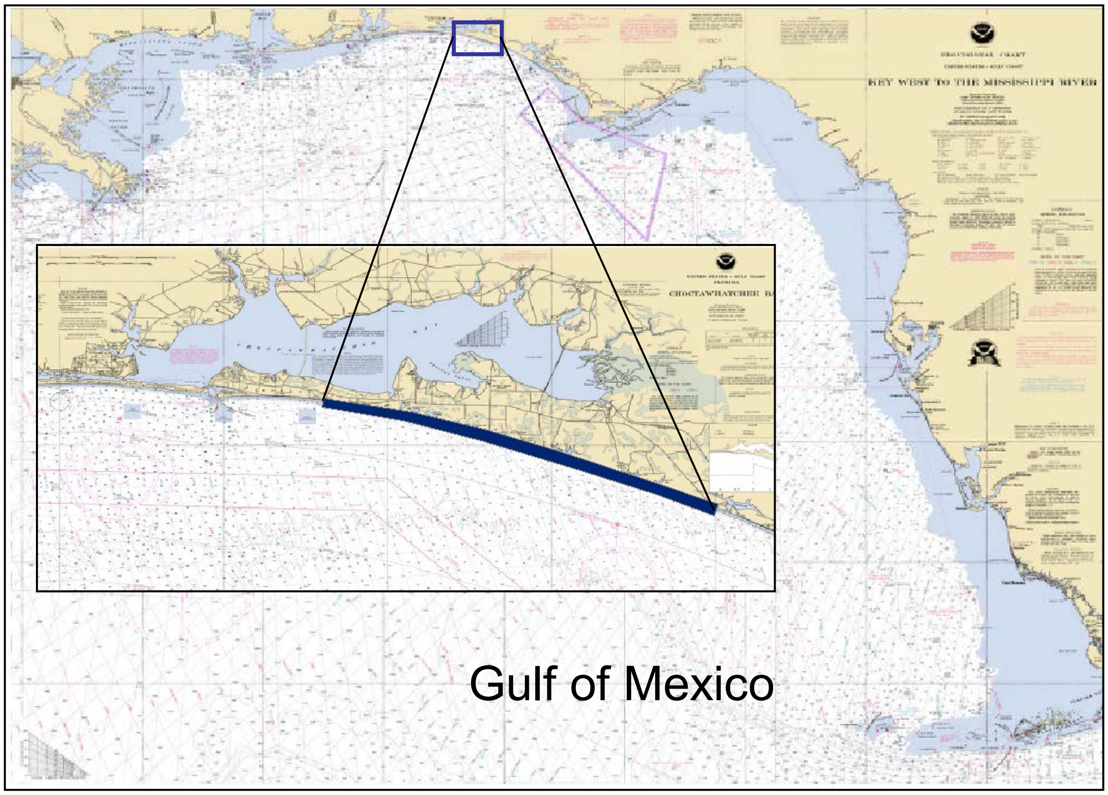

Figure A-1-1. Walton County Location Map

Figure A-1-2A. High Bluffs Western Walton County

Figure A-1-2b. Coastal Dune Lake

Previous Studies and Reports. Previous investigations and reports have been completed for the area. The most recent studies pertinent to the erosion problems at Walton County are listed below:

(1) Leadon, M.E., Nguyen, N.T., and Clark, R.R., 1998. *Hurricane Opal: Beach and Dune Erosion and Structural Damage Along the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems Report No. BCS-98-01, 102 p. This report presents impacts from Hurricane Opal.

(2) Leadon, M.E., Clark, R.R., and Nguyen, N.T., 1999. *Hurricane Earl and Hurricane Georges, Beach and Dune Erosion and Structural Damage Assessment and Post-Storm Recovery Plan for the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems Report No. BCS-99-01, 43 p. This report presents impacts from Hurricane Earl.

(3) "State of the Beaches" of Walton County, Florida 2002, Walton County Tourism Development Council. This report presents data, analysis, and recommendation for managing the Florida coastline. Specific emphasis is placed on determining trends in beach width and explaining the physical and coastal processes that cause the changes.

(4) Beach Management Feasibility Study for Walton County and Destin Florida, Taylor Engineering, Inc., April 2003. The purpose of this study was to determine the most technically feasible and financially acceptable alternatives for protecting 9.2 miles of "critically eroding shoreline." The feasibility study is a six-part study funded by Walton County.

(5) Leadon, M.E. et al, 2004. *Hurricane Ivan: Beach and Dune Erosion and Structural Damage Assessment and Post-storm Recovery Plan for the Panhandle Coast of Florida*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 64 p. This report presents impacts from Hurricane Ivan.

(6) Pickle B., 2005. An Evaluation of Storm Impacts, Cumulative Effect and Long-Term Recovery for Walton County, Florida. Coastal Disasters 2005, Proceedings to Solutions to Coastal Disasters 2005. Retson V.A. America Society of Engineers. This report presents cumulative storm impacts and long term recovery for Walton County.

(7) Clark, R.R., and LaGrone, J., 2006b. *Hurricane Dennis & Hurricane Katrina – Final Report on 2005Hurricane Season Impacts to Northwest Florida*. Publication of the Bureau of Beaches and Coastal Systems, April, 2006, 116 p. This report presents impacts from Hurricanes Dennis and Katrina.

(8) Taylor Engineering, Inc. June 2006. *Post Hurricane Dennis Beach Assessment, Shorefront Development Risk Analysis, and Project Prioritization, Walton County.* This report accessed immediate risks to shorefront development which help prioritize the location of the 2007 emergency nourishment.

(9) Florida Department of Environmental Protection. *Critically Eroded Beaches in Florida*, Bureau of Beaches and Coastal Systems, June 2012.

(10) Trammell M., and Trudnak, M., 2010. Walton County/Destin Beach Restoration Project, Walton County and Okaloosa County, Florida, 2010. Three-Year Post-Construction Monitoring Report, Taylor Engineering, Inc. This report documents project performance for the 2007 emergency nourishment along the eastern 2 miles of Okaloosa County and the western 5 miles of Walton County.

NATURAL FORCES

Winds and Waves. Waves and winds provide important sediment transport mechanisms along the open coast of Walton County. Waves, primarily driven by local wind patterns, transport sand both cross-shore and longshore within the subaqueous regions. Winds provide the primary wave-generating mechanism and directly transport sand on and off the dry beach.

Wind and wave information for the study area were obtained from the U.S. Army Corps of Engineers (USACE) Wave Information Study (WIS) hindcast database (USACE 1995). The WIS hindcast provides wave height, wave period, wave direction, wind speed, and wind direction for a series of output stations along the Gulf of Mexico. Datasets are available for the periods 1956 to 1975, 1976 to 1995, and 1980 to 1999. The 1976 to 1995 and 1980 to 1999 hindcasts included tropical storms. The recently completed 1980 to 1999 hindcast applied an updated version of the hindcast numerical model, state-of-the-art wind fields, and a higher resolution grid allowing higher resolution bathymetry and additional output stations (USACE 2004); therefore, hindcast data for this study were obtained from the 1980 to 1999 dataset. Data from Stations 179, 180, and 181 were used in this study. Figure A-1-3 shows the locations of WIS stations in the study area and Table A-1-1 provides the station number, coordinates, and water depth. Percent occurrence tables of wind and wave statistics are summarized in Attachment I Tables 1, 2, and 3 for WIS Stations 179, 180, and 181, respectively. For the 1980 to 1999 hindcast, the mean wave height is approximately 2.6 feet (0.8 meters) for all stations. Wave heights exceed 2.6 feet (0.8 meters) approximately 25 percent of the time. Although the largest percentages of waves are from the south to southeast, the maximum wave heights greater than 10 feet (3.1 meters) originate from south-southeast to west. Although winds blow from a wide variety of directions; typical prevailing winds are from the east. Overall, wind speeds are less than 25 miles per hour (mph).

Tides. Tides in the region are diurnal. The maximum and minimum water levels under average conditions can approach 2.6 and 0 feet, respectively. The Mean High Water (MHW) elevation was obtained from the Land Boundary Information System (LABINS) database, which provides MHW elevations at numerous locations throughout the study area. The MHW value representative of the entire project area was determined by averaging the tidal datum elevations at representative locations. The MHW for Walton County is +0.63 feet referenced to the North American Vertical Datum of 1988 (NAVD88) (+1.04 feet National Geodetic Vertical Datum of 1929 (NGVD29)). The Mean Low Water (MLW) elevation for Walton County is -0.62 feet NAVD88 (-0.21 feet NGVD29).

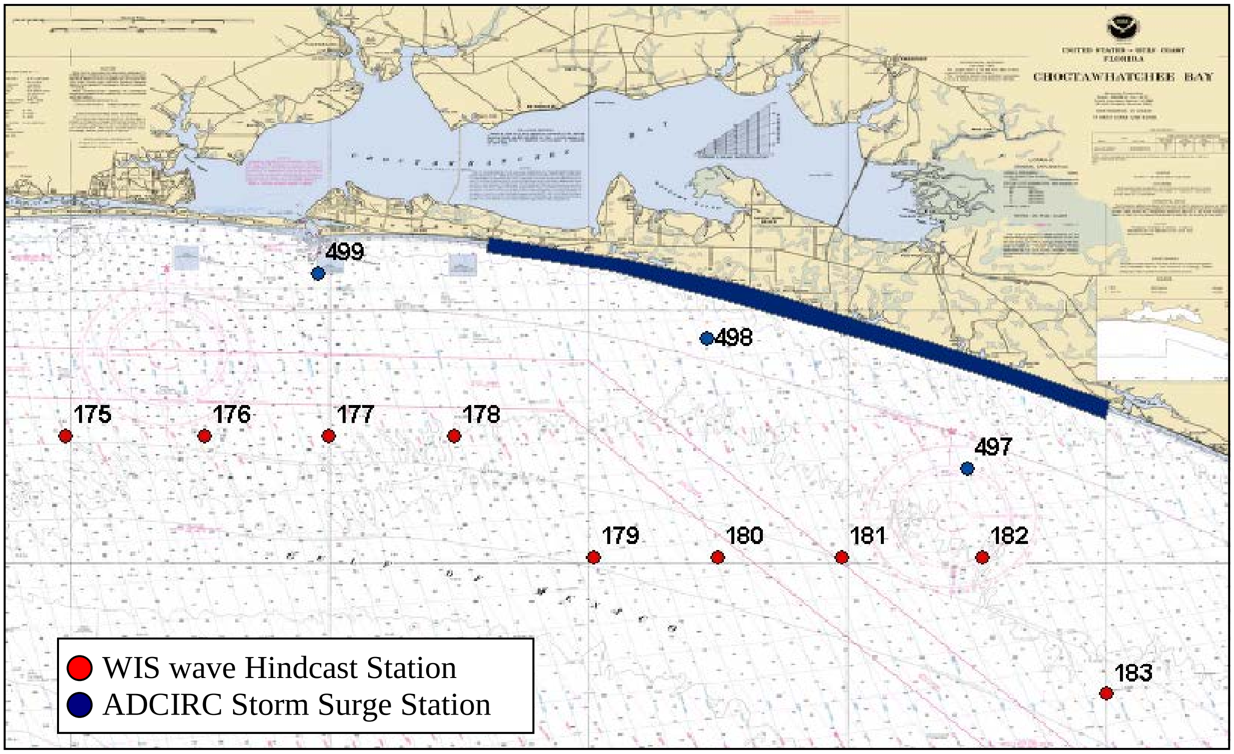

Figure A-1-3. WIS and ADCIRC Stations in the Walton County Vicinity

Table A-1-1. WIS Stations in Walton County Vicinity

Station Number	Latitude (Deg)	Longitude (Deg)	Water Depth (feet)
179	30.17 N	86.33 W	92
180	30.17 N	86.25 W	102
181	30.17 N	86.17 W	102

Storm Surge. The major threats to the shoreline of Walton County are surge and waves caused by tropical depressions, tropical storms, and hurricanes. Storm surge is defined as the rise of the ocean surface above its astronomical tide level due to storm forces. The increased elevation is attributable to a variety of factors, which include waves, wind shear stress, and atmospheric pressure. An estimate of these water level changes is essential to the design of the berm and dune elevations in the beach fill area. Higher water elevations will increase the potential for recession, long-term erosion, and overwash due to severe waves.

Peak storm surge values for 10, 20, 50, and 100-year return period storms were developed by Dean et al., (1990) and updated by Wang, S.Y, et al. (2007) for the 50, 100, 200 and 500-year return period storms by combining historical hurricane statistics with numerical model simulations. The resulting storm surge values for various return periods provided in Table A-1-2 include components of astronomical tide, wind stress, barometric pressure, and dynamic wave set-up. Figure A-1-4 displays storm surge estimates developed as part of an update to the regional hurricane evacuation study, published in 2010. Additional information concerning flood zones including FEMA's Digital Flood Insurance Rate Maps can be found on Walton County, Florida's website: http://www.co.walton.fl.us.

Table A-1-2. Storm Surge Values for Return Periods, Walton County

Return Period (years)	Walton County Storm Surge (feet-NAVD88)		
	East	Middle	West
10	3.4	3.4	3.6
20	5.8	6.1	6.5
50	9.1	9.0	8.8
100	10.6	10.1	10.3
200	10.6	10.1	10.3
500	14.3	13.8	13.6

Figure A-1-4. Walton County Storm Surge Estimates
Source: Walton County Regional Hurricane Evacuation Study, 2010.

Recent Storm History. Table A-1-3 lists the hurricanes which have impacted the Walton County area since 1975. This table does not include tropical storms. Descriptions of the storms causing the greatest damage in recent years are described below.

Table A-1-3. Walton County Significant Storm History, 1975-2004

Storm	Date	Landfall	Estimated Category at Landfall
Hurricane Eloise	October 1975	Walton County, Florida	H3
Hurricane Frederic	September 1979	Mobile County, Alabama	H3
Hurricane Elena	September 1985	Harrison County, Mississippi	H3
Hurricane Erin	July 1995	Santa Rosa County, Florida	H2
Hurricane Opal	October 1995	Santa Rosa County, Florida	H3
Hurricane Danny	July 1997	Baldwin County, Alabama	H1
Hurricane Earl	August 1998	Bay County, Florida	H1
Hurricane Georges	September 1998	Harrison County, Mississippi	H2
Hurricane Ivan	September 2004	Baldwin County, Alabama	H3
Hurricane Dennis	July 2005	Santa Rosa County, Florida	H3
Hurricane Katrina	August 2005	Grand Isle, Louisiana	H4

2 August 1995 - Hurricane Erin. Hurricane Erin was the first storm of any strength to impact the Florida Panhandle in 10 years. The eye of the hurricane came ashore near Pensacola on August 3, 1995, and the strongest winds were measured near Fort Walton Beach. Erin was a Category 2 hurricane at landfall. Erin moved inshore quickly and dissipated in Mississippi. Reports listed Erin as causing minor beach erosion with some inland flooding; however, for the Florida Panhandle, Erin's effects resulted in severe erosion along the beaches.

4 October 1995 - Hurricane Opal. Hurricane Opal made landfall on October 4, 1995 as a Category 3 hurricane. Before landfall, Opal was a Category 4 hurricane. The unique aspect from Opal was that it moved quickly and rapidly increased strength within hours. The maximum winds at landfall were estimated to be 115 mph in Walton County. Opal caused extensive damage to Walton County's beaches due to storm surge and breaking waves. The average reported beach recession was -76 feet while the average dune recession was over -45 feet. High wave uprush limits were seen across the entire county Gulf of Mexico shorefront as measured from debris lines which reached elevations up to and exceeding 20 feet. Although there was some wind damage most of Walton County damage was due to the storm surge, wave impacts and erosion (FDEP, 1998). Florida Department of Environmental Protection (FDEP) reported over 127 buildings as destroyed or sustaining major damage (50 percent or more of the structure sustaining significant damage). Of these 12 were reported to have had their roofs blown off and three were reported to have been picked up and transported landward by flood waters. An additional 22 structures were reported with significant damage to the understructure, 45 with roof significant roof damage and another 10 with significant side damage.

3 September 1998 - Hurricane Earl. Although Hurricane Danny made landfall in Alabama in 1997, the next hurricane that really impacted Walton County was Hurricane Earl. Similar to Hurricane Erin in 1995, Earl was just the beginning. Earl made landfall near Panama City, Florida as a Category 1 hurricane on September 3, 1998. The strongest winds remained well to the east and southeast of the center which resulted in the highest storm surge values in the Big Bend area of Florida, well away from the center. The vastness of Earl caused minor to moderate beach and dune erosion in Walton County and stopped the recovery of the beaches since Hurricane Opal in 1995. Fortunately for Walton County, no buildings were significantly damaged or destroyed.

28 September 1998 - Hurricane Georges. Hurricane Georges made landfall during mid-morning of September 25, 1998 in Key West, Florida with maximum winds of 104 mph. After moving away from Key West, Georges turned more to the northwest, then north-northwest, and again made landfall near Biloxi, Mississippi on the morning of September 28th with estimated maximum sustained winds of 103 mph. After landfall, the system meandered around southern Mississippi and was downgraded to a tropical storm on the afternoon of the 28th. While Georges was a small Category 1 storm, it caused extensive damage to Walton County's beaches. Since Earl had made landfall less than four weeks earlier, the beaches were already in a damaged condition. Georges created substantial storm surge and breaking wave heights in the Gulf. The combined impact of Hurricanes Earl and Georges caused minor to moderate beach and dune erosion, with the average reported beach recession was -9 feet while the average dune recession was approximately -6 feet. Fortunately for Walton County, no buildings were significantly damaged or destroyed.

16 September 2004 - Hurricane Ivan. Hurricane Ivan made landfall as a 120 mph hurricane (Category 3 storm) on September 26, 2004 just west of Gulf Shores, Alabama. The diameter of the eye was 40-50 nautical miles (nm) which resulted in some of the strongest winds occurring over a narrow area near the southern Alabama-western Florida Panhandle border. After Ivan moved across the barrier islands of Alabama, the hurricane turned north-northeastward across eastern Mobile Bay and weakened into a tropical storm over central Alabama. The entire coast of Walton County sustained major beach and dune erosion. Major dune recession categorized as a condition IV by the state, with beach lowering and dune recession greater than 10 feet occurred throughout the county. The storm left a number of locations with the upland habitable development located at or within close proximity (less than 10 to 20 feet) to high dune-bluff escarpments. In all, Walton County sustained moderate structural damage throughout the coastal areas seaward of the Coastal Control Line. In all FDEP reported a total of 11 building that were destroyed or sustained major damage. In addition, reports indicated an additional 49 habitable structures sustained moderate to minor damage to understructure areas and/or sustained moderate to minor roof damage.

4 July 2005 – Hurricane Dennis. Hurricane Dennis made landfall as a 115-120 mph hurricane (Category 3 storm) on July 10, 2005 on Santa Rosa Island, Florida, between the beach communities of Pensacola Beach and Navarre Beach. The hurricane moved northward toward Alabama where it eventually dissipated after bringing flooding rains throughout North Florida, Alabama and Georgia. In Walton County the maximum sustained winds along the coast was generally below hurricane strength, yet the storm tide with wave uprush was 9 to 12 feet (FDEP, 2005). The entire coast of Walton County sustained major beach and dune erosion. Major structural damage was sustained along Walton County's coast as was related to storm tide and waves undermining dwellings supported on foundations that do not conform to current coastal building standards (FDEP, 2005). Wind damage was rarely observed (FDEP, 2005). FDEP reported over 70 structures as destroyed or sustaining major damage (50 percent or more of the structure sustaining significant damage). In addition, reports indicated an additional 24 habitable structures sustained damage to their understructure areas.

23 August 2005 – Hurricane Katrina. Hurricane Katrina made landfall as a 145 mph hurricane (Category 4 storm) between Grand Isle, Louisiana and the mouth of the Mississippi river. The hurricane moved northward through Louisiana and into Mississippi, Alabama and Tennessee where it eventually dissipated after bringing flooding rains throughout Louisiana, Mississippi, Alabama, Georgia and northwest Florida. The entire coast of Walton County sustained minor beach and dune erosion. FDEP reported over 26 structures as destroyed or sustaining major damage (50 percent or more of the structure sustaining significant damage). Nearly all reported damage was due to structure undermining.

Nearshore Currents. The primary currents in the nearshore region are wave-induced longshore currents. These currents are driven by the transformation of obliquely incident waves in the surfzone. The magnitude of the longshore current is generally greatest in the region immediately landward of the point of depth-induced wave breaking, and is primarily a function of the local wind and wave climate. The longshore currents are primarily from east to west. There have been no direct measurements of longshore currents in the study area.

Sea Level Rise. Systematic long-term tide observations suggest that the elevation of oceanic water bodies is gradually rising and this phenomenon is termed 'sea level rise.' The rate of rise is neither constant with time nor uniform over the globe. Present estimates of recent (over about the last 100 years) global average, or eustatic, sea level rise are varied but the average value is about 2 millimeters per year (mm/yr). There is uncertainty as to the future rate of sea level rise, how much sea level will rise at any particular location, what the primary drivers really are and whether the rate of rise will be relatively constant or accelerate.

Planning Guidance Notebook ER-1105-2-100 (Appendix E, Section IV.E-24.k) recommends the Curve III of the 1987 National Research Council (NRC) report *Responding to Changes in Sea Level: Engineering Implications*, or more definitive information, be used as the eustatic (global) component of relative sea level rise (RSL) for future high scenario estimates. In addition, the Water Resource Policies and

Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs EC 1165-2-212 recommends that alternatives be evaluated using “low,” “intermediate,” and “high” rates of future sea-level change.

The Walton County Project is located along the Florida Panhandle between Pensacola and Panama City (Figure A-1-5). The observed historic relative rate of sea level rise along Walton County as indicated by the nearby locations is shown in Table A-1-4. The trend for Pensacola is based on continuous data for 83 years with a standard error of 0.26 mm/yr; while the trend for Panama City is based continuous data of only 33 years with a larger standard error of 0.83 mm/yr. Based on a longer time series with less uncertainty Pensacola would be the preferred station to use as an indicator of the regional trend for the Walton County project. To confirm this, a comparative analysis of the simultaneous observed monthly means was performed using monthly mean sea levels downloaded from the National Oceanic and Atmospheric Administration (NOAA) web-site relative to Mean Sea Level (MSL) datum for the latest Nation Tidal Datum Epoch. Using spreadsheet software plot functions and the linear trend functions, linear trends were computed for each monthly mean data set showing minor differences giving confidence in a regional trend (Figure A-1-6).

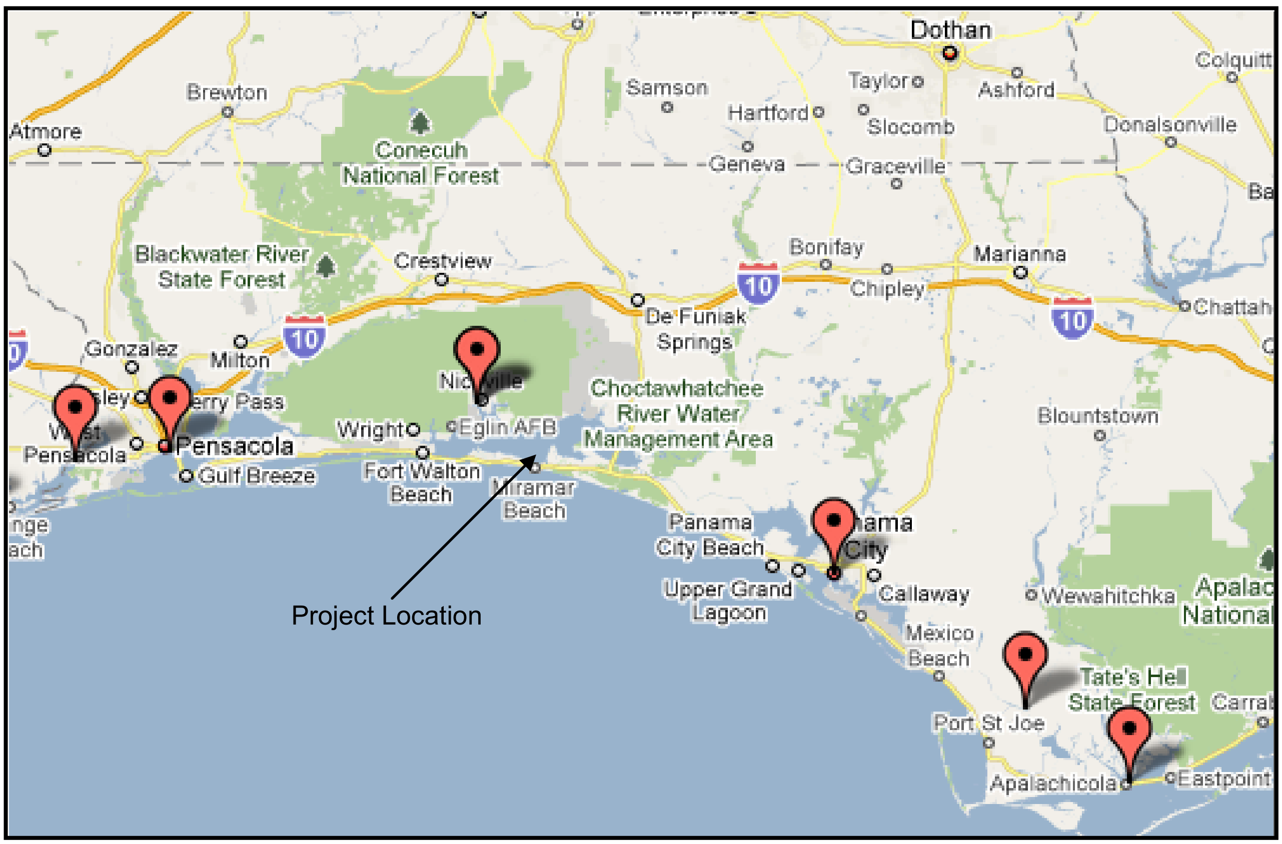

Figure A-1-5. Project Location in Relationship to Pensacola and Panama City Tide Stations

Table A-1-4. Relative Sea Level Rise Rates

Station Name	First Year	Record Length	MSL Trend (mm/yr)	Std. Error (mm/yr)
Panama City	1973	33	0.78	0.83
Pensacola	1923	83	2.10	0.26

Source: NOAA Tides and Currents Sea Level Online

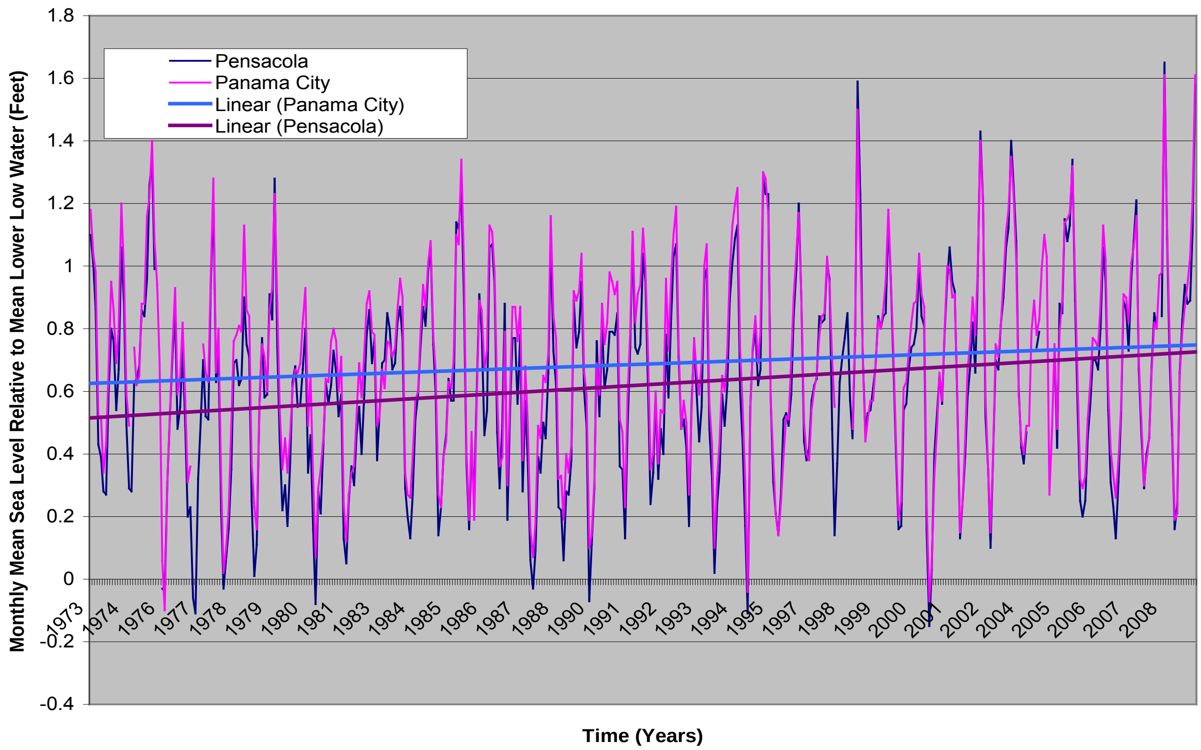

Figure A-1-6. 1967- 2008 Monthly Mean Sea Level

Since the local relative sea level trend at Pensacola can be used as the regional sea level trend for Walton County, the modified NCR Curves can be adjusted to take into account local sea level trends. The NOAA-derived relative sea level trend from the tide station at Pensacola is 2.10 mm/yr and is the sum of the global rate of sea level rise (1.7 mm/yr) plus the local sea level trend (due to the vertical land motion and other long term oceanographic change). Subtracting 1.7 mm/yr from 2.10 mm/yr gives an estimated local (and regional) sea level trend L(t) of 0.4 mm/yr. The global coefficient of 0.0017 is modified by adding L(t) of 0.0004 to get the adjusted NRC curves tailored to the Walton County region.

$$E(t) = 0.0017t + L(t) + bt^2$$

Table A-1-5 shows extrapolated RSL for the period 2014-2064 based on historic rates derived NOAA's Tides and Currents Sea Level Online records (Table A-1-5). Table A-1-6 and Figure A-1-7 show extrapolated estimates of RSL for the period of 2014 -2064 based the modified NRC curves I, II and III.

Table A-1-5. Potential Relative Sea Level Rise Assuming Observed Rates Persist, 2064

Pensacola	
Meters	**Feet**
0.1	0.3

Table A-1-6. Relative Sea Level Rise Estimates by the modified NRC (1987) Methods, 2064

	Pensacola	
Basis	**meters**	**Feet**
Curve I	0.2	0.8
Curve II	0.4	1.5
Curve III	0.6	2.1

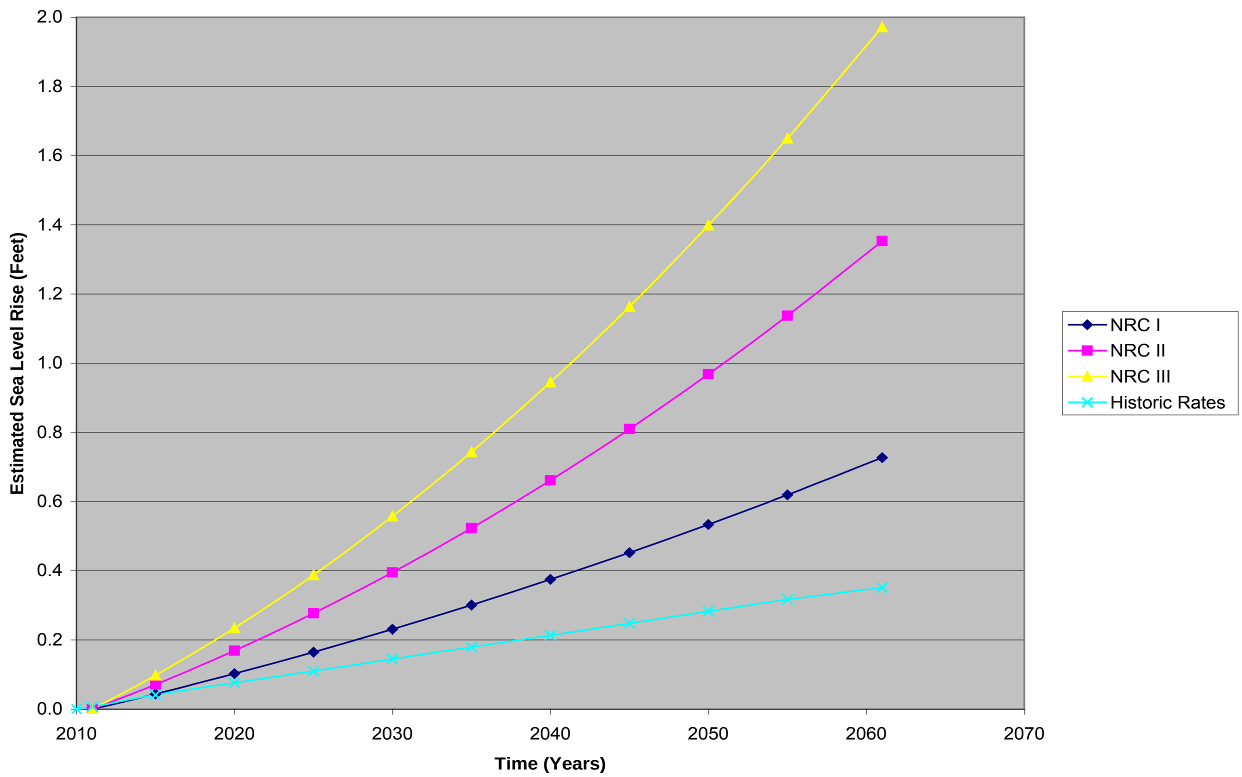

Figure A-1-7. Pensacola, Florida Extrapolated Sea Level Change From Observed Historic Rates and Modified NRC (1987) Sea Level Rise Scenarios

As seen in Figure A-1-6, projected sea level increases at the project location in year 2064 could be on the order of 0.8 feet, 1.5 feet, or 2.1 feet based on the modified NRC curves I, II and III respectively; however, the historic trends (as shown in Figure A-1-6) indicate that the project would only be subject to a 0.3 foot increase in sea level from present day to the year 2064.

Project Sensitivity to Sea Level Rise. As relative sea level rises, the shoreline will be subjected to increased flooding and profile recession. Bruun (1962) proposed a formula for estimating the rate of potential shoreline recession based on the local rate of sea level rise. This methodology also includes consideration of local topography and bathymetry. Bruun's approach assumes that with a rise in sea level, the beach profile will attempt to re-establish the same bottom depths relative to the surface of the sea that existed before the sea level rise. As a result, the beach profile shape relative to the mean water level will re-establish itself. If the longshore littoral transport in and out of a given shoreline area is equal, then the quantity of material required to re-establish the nearshore slope must be derived from erosion of the shore. Shoreline recession resulting from sea level rise can be estimated using Bruun's Rule, as defined below and is summarized in Table A-1-7.

$$x = ab/(h+d)$$

where,

x = shoreline recession (in feet) attributable to sea level rise.
h = elevation of shoreline above NAVD (+5.5 feet berm).
d = depth contour beyond which there is no significant sediment motion (34 feet).
b = horizontal distance of the active beach profile berm elevation to the depth contour d (average 2,176 feet).
a = specified relative sea level rise for time period t.

Table A-1-7. Average Increased Shoreline Recession Rates Based On RSL Estimates (2014-2064)

	Pensacola	
Basis	**Meters/year**	**Feet/year**
Continued Observed Rates (Low)	0.12	0.4
Modified NRC Curve I (Intermediate)	0.24	0.8
Modified NRC Curve II	0.45	1.5
Modified NRC Curve III	0.65	2.4

As seen in Table A-1-7, projected average shoreline recession rates over the project design life at the location could increase on the order of 0.4, 0.8, 1.5 or 2.4 feet/yr under extrapolation of observed historic trends in RSL estimates and the modified NRC curves I, II and III respectively. The recession rate due to sea level rise based on extrapolation of the historic observed rate of 0.4 feet/yr is not significant when compared to the historical averaged shoreline change of roughly 2.4 feet/year. The influence of current sea level rise on the project is relatively low as compared to other factors causing erosion (waves, currents, winds and storms). An analysis of shoreline change rate over the time period of 1973 to 2004 indicates that the magnitude of the short-term storm-induced erosion, which was as high as 12.4 feet/year during Hurricane Ivan has a much greater affect along the beaches of Walton County than those indicated by the natural long term shoreline trends.

The proposed beach nourishment project is not a hard structure and adjusts to natural forces. Nourishment is designed to include a significant amount of sacrificial sand in the advance nourishment berm. The optimization of the advance nourishment was performed with a conservative background erosion rate of 5 feet/year. The estimated projected average rate of shoreline recession due to accelerated sea level rise over the next 50 years based on this analysis would not exceed the 5 feet/year background erosion rate used in the optimization of the advance nourishment berm. Based on this and the estimated average renourishment interval of every 10 years the projected accelerated rise in sea level would not overwhelm the project before the next nourishment of sand.

An increase in potential shoreline recession as the beach profile attempts to re-establish in response to a rise in sea level would result in increased volume losses from the design template. The volume of sand that would be needed to maintain the shoreline in response to accelerated sea level can be estimated from the following equation and is shown in Table A-1-8:

$$V = (d + h)*x$$

d = depth contour beyond which there is no significant sediment motion (34 feet).
h = elevation of shoreline above NAVD (+5.5 feet berm).
x = shoreline recession (in feet) attributable to sea level rise.

Table A-1-8. Estimated Volume to Maintain the Shoreline Due To Accelerated Sea Level Rise

	Volume (cy/feet)		
	Low Observed Long Term Rates	Intermediate Modified NRC Curve I*	High Modified NCR Curve III*
2024 Renourishment	5	5	17
2034 Renourishment	5	6	13
2044 Renourishment	5	7	29
2054 Renourishment	5	9	35

Note: * Estimated volume rates are the rates above the volume required under the Low Observed Long-Term Rates

Additional potential volume increases to account of accelerated sea level rise above the standard deviation of the mean renourishment volumes as predicted by Beach-*fx* may occur under the high modified NRC Curve III RSL scenario. Under the high modified NRC Curve III RSL scenario an estimated additional volume of approximately 1.3 cy/ft/yr above standard deviation of the mean nourishment volume was determined.

An increase in relative sea level rise along Walton County of 0.3 to 2.1 feet would increase the areas susceptible to coastal inundation during storm events. The magnitude of this increase and its impact to coastal development is directly associated with the topography of the land, the characteristics of the storms and the development within the area. The majority of Walton County is currently considered by FEMA and the county emergency management to be a flood prone area. The areas immediately along the coast and within the limits of the project are classified as coastal areas with a one percent or greater chance of flooding with an additional hazard associated with storm waves. Increases in RSL could increase the areas susceptible upwards of 20 percent of present day. Studies indicate that this calculation which is based on changing the underlying elevation and not using a coastal surge model significantly overestimates the inundation due to neglect of land dissipation (Condon, A.J., et al, 2012). Although this estimate is likely high it clearly demonstrates the potential of increased hazard for the area. The areas of highest susceptibility along the Walton County coast are located within the low-lying regions of dune lakes and protected areas within the state parks and cobra zone system. Due to potential environmental impacts and laws these areas are not included in the project.

The increase in shoreline recession would directly impact the beach and dune habitat available to the terrestrial wildlife (i.e. shorebirds, beach mice, sea turtles, etc.) that utilizes the coastline of Walton County. The pressure to protect properties and the fronting dune/bluff would likely result in a reduction of the available habitat. Under the projected RSL scenarios and associated recession rates of 0.4 to 2.4 feet per year as much as approximately 270 acres of habitat under the future without project could be impacted by RSL.

Potential Adaptation Strategies. The selected plan was determined based on simulations that incorporated the observed rate of sea level rise. Given the uncertainty as to the future rate of sea level rise, potential adaption strategies to ensure optimum project performance over the life of the project include:

- Monitoring the response to sea level changes at Walton County to provide documentation.
- Adding additional volume of sand during renourishments to compensate for significant accelerated sea level rise beyond the current observed rate.
- Adding coarser than native sand to reduce the volume requirements that maybe necessary to compensate for increased volumes as a result of significant accelerated sea level rise beyond the current observed rate.

SHORELINE CONDITIONS

Surveys and Imagery. A compilation of historical data was available in the study area. To monitor the 26 miles of shoreline encompassing Walton County, the FDEP periodically collects beach profile data along 127 transects at approximately 1000-foot spacing (Figure A-1-8). The available beach profile datasets from 1977 to 1998 are listed in Table A-1-9. During the spring of 2004, beach profile data were collected through this study, the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) collected airborne coastal mapping data with the Compact Hydrographic Airborne Rapid Total Survey (CHARTS) system (Wozencraft and Millar 2005) providing high resolution bathymetric and topographic data (Figure A-1-8), and aerial photography were collected by the FDEP.

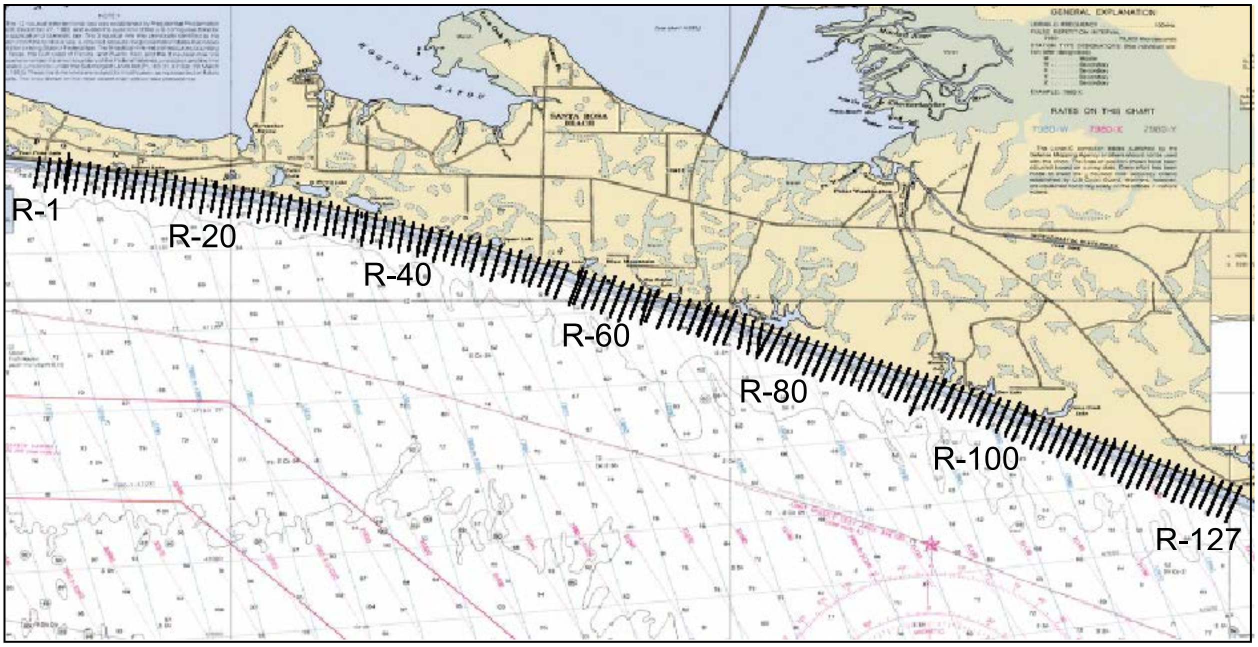

Figure A-1-8. FDEP Beach Profile Survey Layout For Walton County

Table A-1-9. Available Survey and Mapping Data

Beach Profiles	Lidar Survey	Aerial Photography
1975		
1981		
1984		
1987		
1993		
1994		
1995		
1996		
1997		
1998		
2004 May	2004 May	2004 May
2004 November	2004 November	
	2005 October/December	
	2007 July/August 2010 January/March	

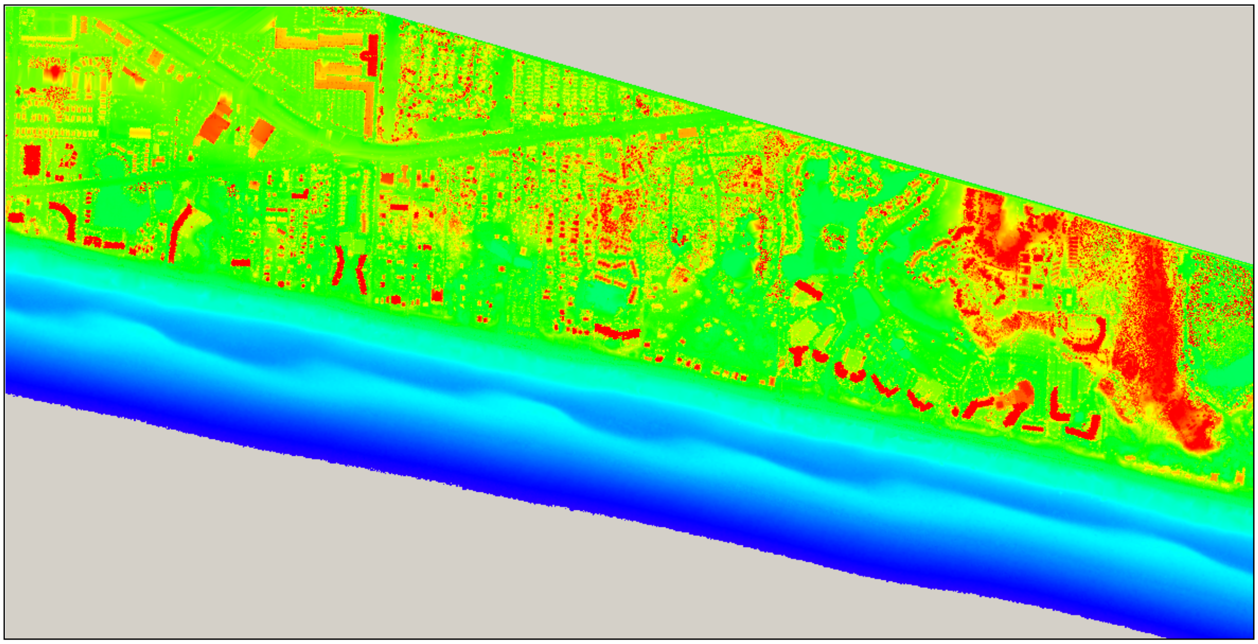

Figure A-1-9. CHARTS Continuous High-Resolution Survey Coverage

The beach profiles were collected coincident with the 127 FDEP transects at approximately 1000-foot intervals. The profiles extended landward to encompass structures (houses etc.) and the back of dune, and seaward to a depth of closure approximately 3,000 feet offshore. The CHARTS surveys provided a seamless survey of the project area with bathymetric lidar data at approximately 16-foot horizontal spacing and topographic lidar at approximately 3-foot horizontal spacing. The surveys covered from the waterline landward to about 1,640 feet, and where water clarity permitted, seaward to about 3,200 feet offshore. Because of the high resolution data and coverage of the CHARTS surveys and a datum issue with the beach profiles collected in 2004, 2004 beach profiles were extracted from the May 2004 CHARTS surveys for this study. These datasets were used to update the study information to existing conditions; however, in September 2004, Hurricane Ivan made landfall as a Category 3 storm in Gulf Shores, Alabama, approximately 90 miles to the west of Walton County. The Walton County shoreline experienced severe erosion as a result of the hurricane. Therefore, post-Hurricane Ivan Charts surveys collected in November 2004 were used to update the existing conditions for this study. Throughout the course of this study additional surveys were collected by various agencies in 2005, 2007 and 2010. These additional surveys were reviewed for significant changes in the project area and to update estimates of initial construction volumes.

Study Reaches and Representative Profiles. The Walton County upland cross section is defined by dune elevations ranging from +9.5 to + 33 feet NAVD88 and a natural berm elevation of +5.5 feet NAVD88. The study region was divided into five study reaches based on structural development and state park areas as shown in Figure A-1-10. Table A-1-10 lists the reach number, FDEP range monuments bounding each reach, approximate shoreline distance each reach encompasses, and local beaches and state park areas within each reach. The historical and 2004 beach surveys were used to develop 11 representative profiles which characterize the existing condition for the five study reaches. The 11 representative profiles were developed through examination and

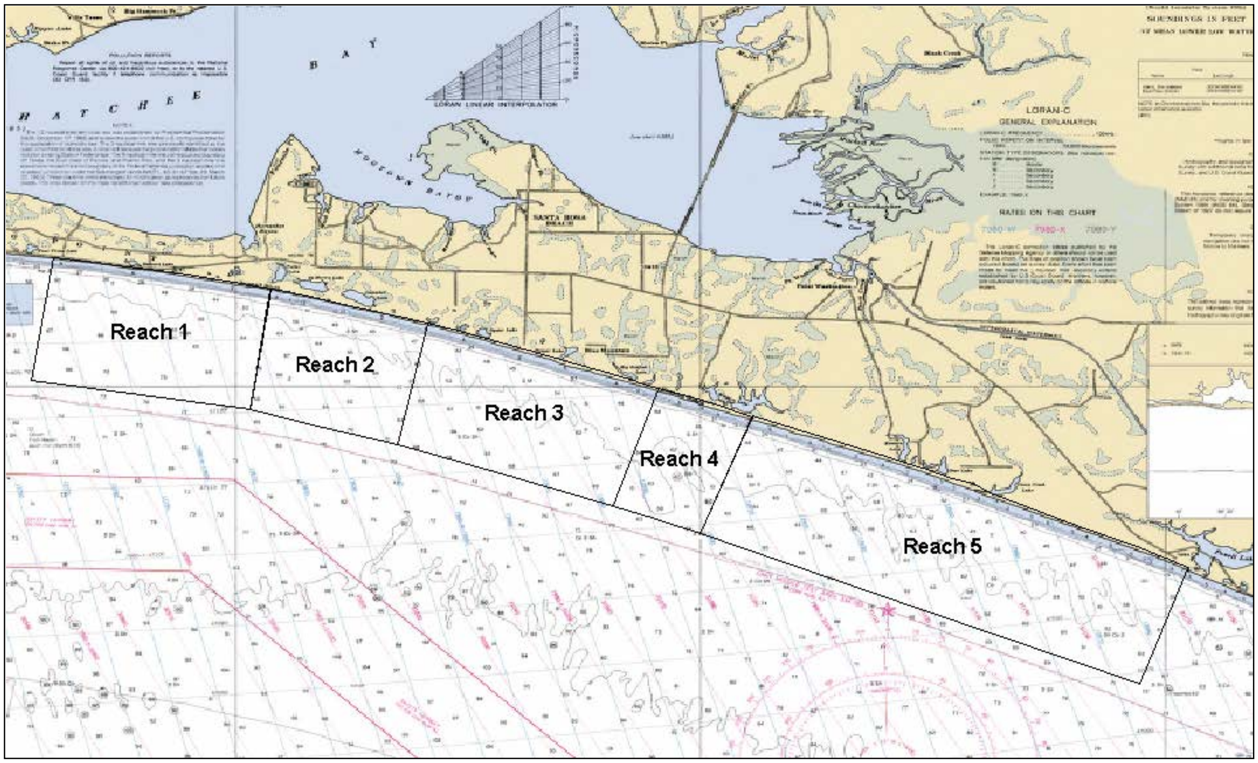

Figure A-1-10. Walton County Study Reaches

Table A-1-10
Walton County Reaches

Reach	FDEP Range Monuments	Distance (miles)	Local Communities	State Parks
1	R-1 to R-22	5.2	Miramar Beach	
2	R-23 to R-40	3.4		Topsail Hill State Preserve
3	R-41 to R-66	5.2	Dune Allen Beach Santa Rosa Beach Blue Mountain Beach	
4	R-67 to R-77	2.6	Grayton Beach	Grayton Beach State Recreational Preserve
5	R-78 to R-127	9.2	Seaside Seagrove Beach Rosemary Beach Inlet Beach	Deer Lake State Park

analysis of the geomorphic characteristics of the upper (dune and berm) and lower (subaqueous) portions of the 127 profiles using the Beach Morphology Analysis Package (BMAP) (Sommerfeld et al. 1994). The point of delineation between upper and lower profile was defined at an elevation of +0.63 feet NAVD88, the MHW elevation. The representative profiles were identified based primarily on similarity in shape of the upper beach profile (dune height and width, berm width, foreshore beach slope, and profile volume) and shape of the offshore profile. Because significant erosion occurred due to Hurricane Ivan in September 2004, the representative profiles were updated using additional post-Ivan data to characterize the upper portion of the beach and to include the post-Ivan data in the submerged portion of the beach. The resulting representative profiles for each study reach are shown in Figures A-1-11 through A-1-15. The primary morphological features (i.e. dune height, dune width, dune slopes berm height, berm width and nearshore and offshore slopes) are represented in each profile. Figure A-1-16 shows the areas characterized by each representative profile and Table A-1-11 lists the study reach, representative profile, and the FDEP survey monuments characterized by the representative profile. The representative profiles were used as input into the storm damage modeling described below, for existing conditions and combined with design templates to characterize the with-project condition for selected design alternatives. The use of representative beach profiles is necessary to make the problem of predicting beach evolution over 5,000 years tenable. As with any model a level of uncertainty is added with increased grid spacing and averaging. To minimize uncertainty and to account for longshore variability in profiles the project was divided into subreaches with common morphological make up as determined from an assessment of historical and current beach profiles to ensure that the variability in the shape (i.e. dune height, width, etc.) of any one profile and reach was acceptable.

Historic MHW Shoreline Analysis. Taylor Engineering (2003) examined the historical shoreline behavior to identify regions of shoreline accretion and erosion. Shoreline changes generally indicate subaerial or dry beach behavior. The historical MHW shoreline position data set included the years 1871-1872, 1934-1945, 1955-1956, 1969-1970, 1973, 1975, 1981, 1984, 1987, and 1993-1998. The FDEP provided all data for the analysis. Analysis indicates a stable or accreting shoreline in Walton County in the absence of severe storms. The FDEP recognized the questionable quality and limited potential usefulness of all data generated prior to 1972 due to source problems. Beach profile surveys from 1972 to 1998 are reliable.

The MHW shoreline changes, calculated with linear regression, represent four periods: the pre-Hurricane opal intermediate-term (1973-1995), the post-Hurricane Opal short-term (1995-1998), the intermediate-term (1973-1998), and the long-term (1872-1998) periods. Figure A-1-16 illustrates the MHW changes at every FDEP monument in Walton County.

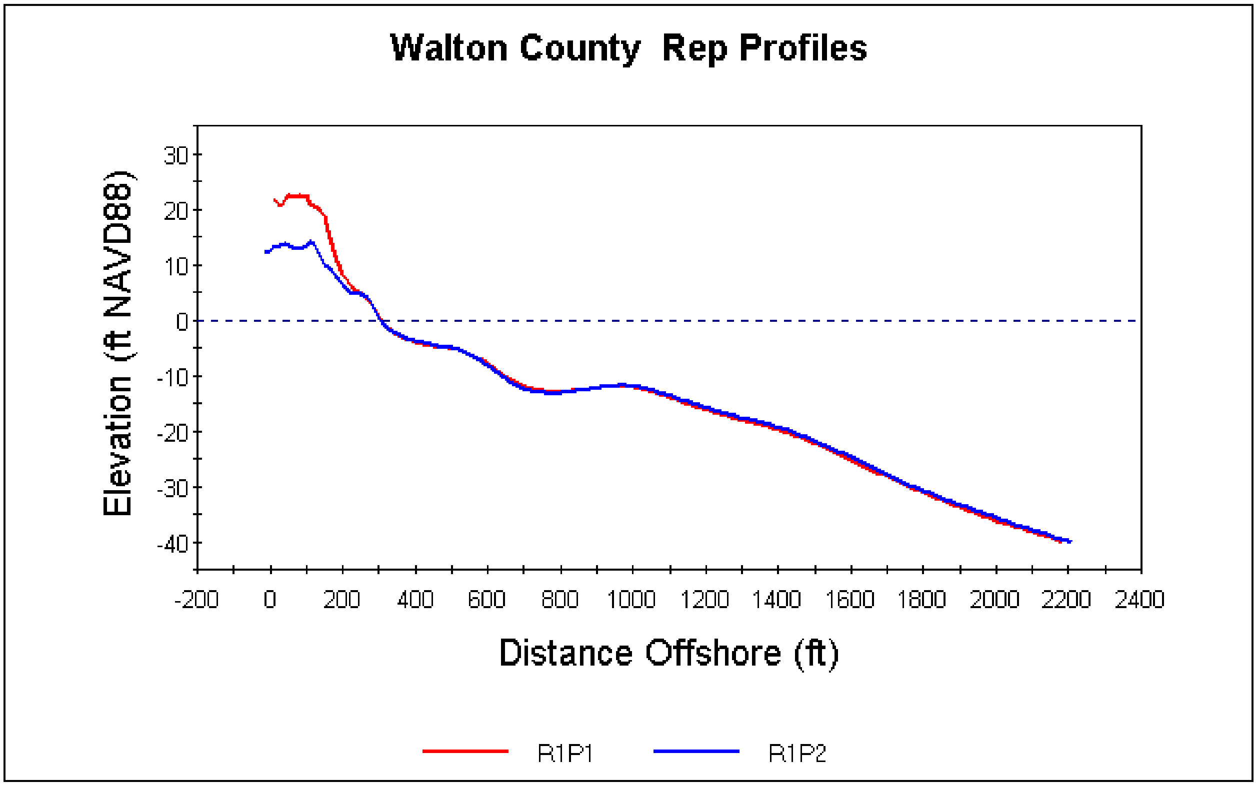

Figure A-1-11. Representative Beach Profiles for Reach 1, R1 To R22

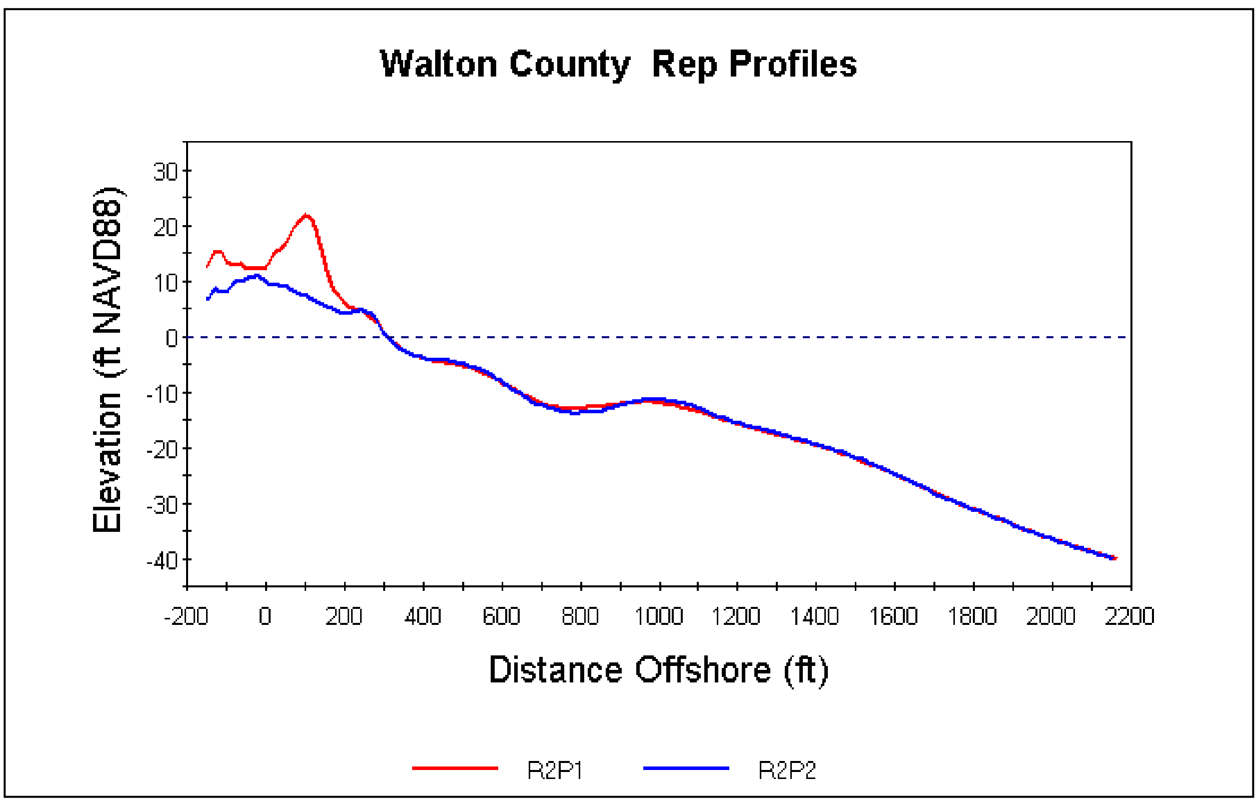

Figure A-1-12. Representative Beach Profiles for Reach 2, R23 to R40

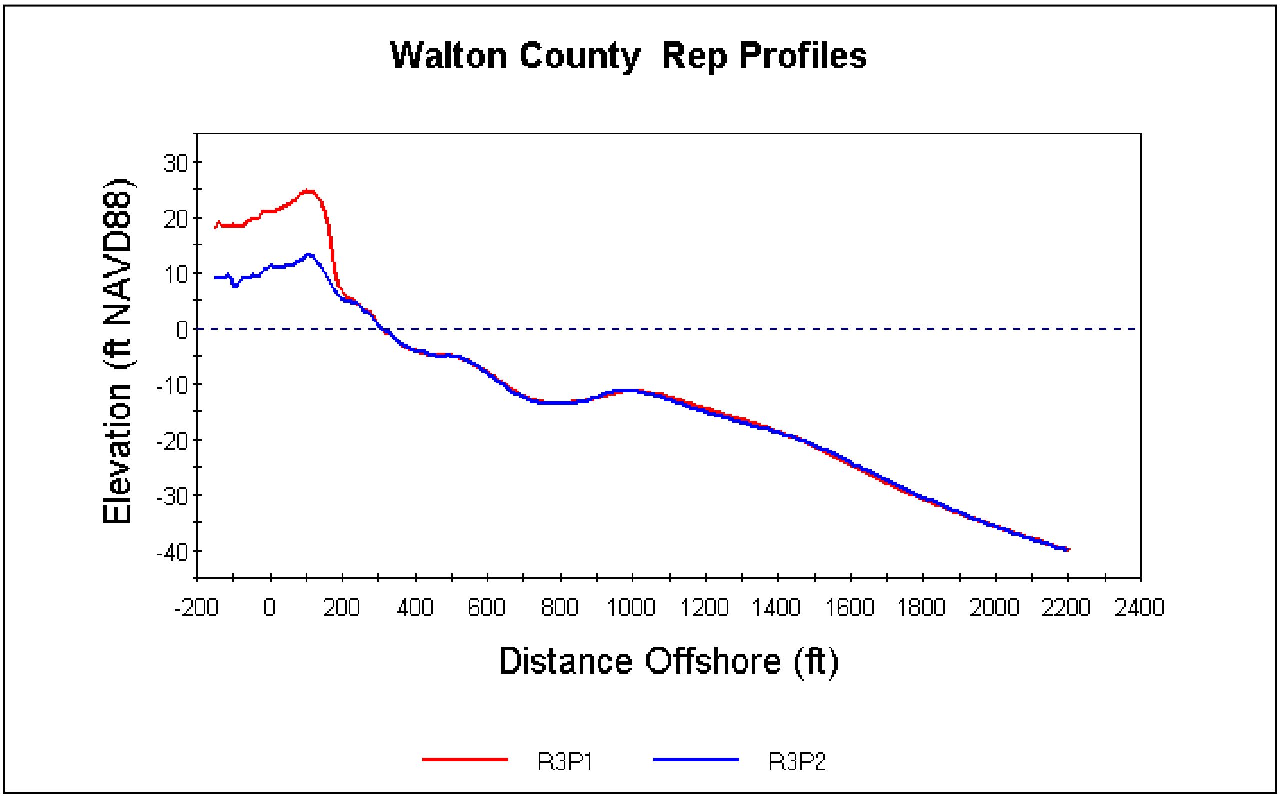

Figure A-1-13. Representative Beach Profiles for Reach 3, R42 to R66

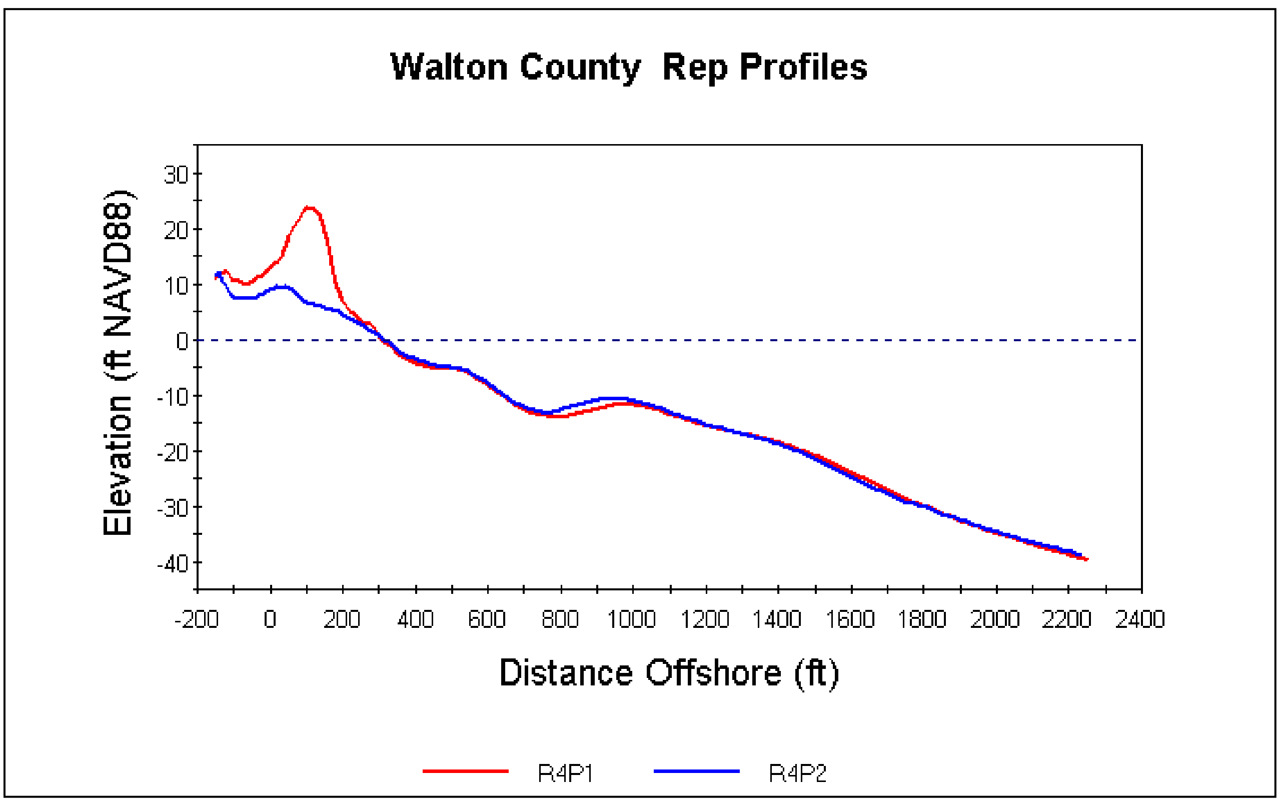

Figure A-1-14. Representative Beach Profiles for Reach 4, R67 to R77

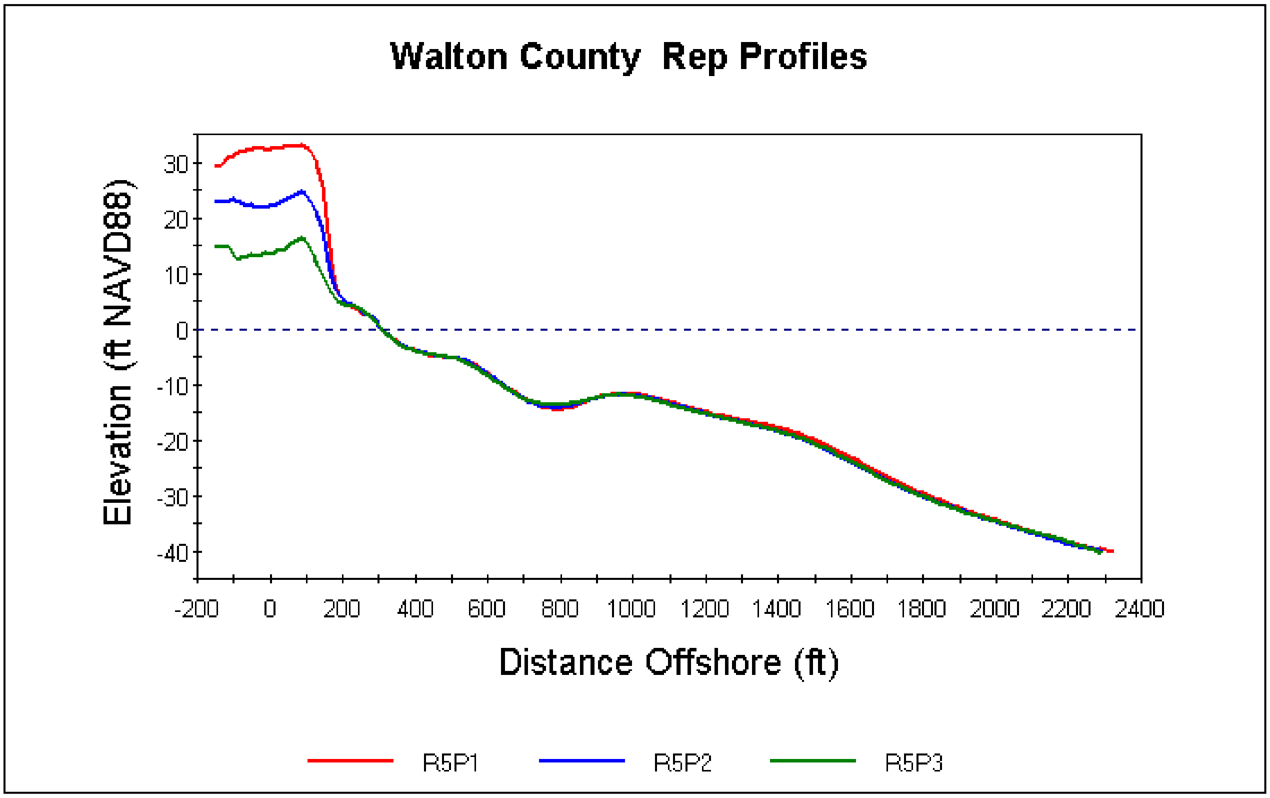

Figure A-1-15. Representative Beach Profiles for Reach 5, R78 to R127

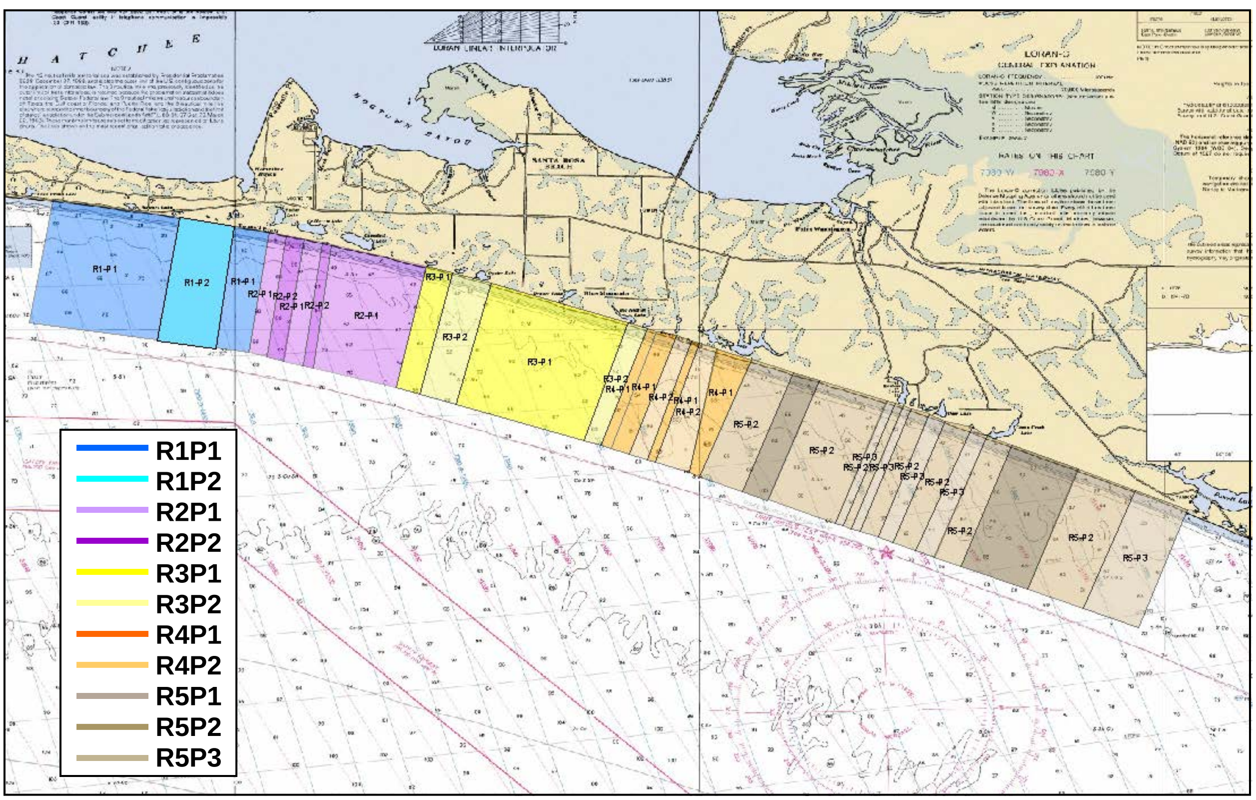

Figure A-1-16. Distribution of Representative Beach Profiles

Table A-1-11. Representative Profiles Characterizing Walton County Shoreline

Reach	Representative Profile	FDEP Monuments
1	R1P1	R1-R12, R19-R22
	R1P2	R13-R18
2	R2P1	R23-R24, R27-R28, R30-R40
	R2P2	R25-R26, R29
3	R3P1	R41-R43, R48-R63
	R3P2	R44-R47, R64-R65
4	R4P1	R66-R68, R71, R74-R77
	R4P2	R69-R70, R72-R73
5	R5P1	R83-R85, R103, R108-R115
	R5P2	R78-R82, R86-R93, R95, R97-R98, R101-R102, R105-R107, R116-R123
	R5P3	R94, R96, R99-R100, R103a-R104, R124-R127

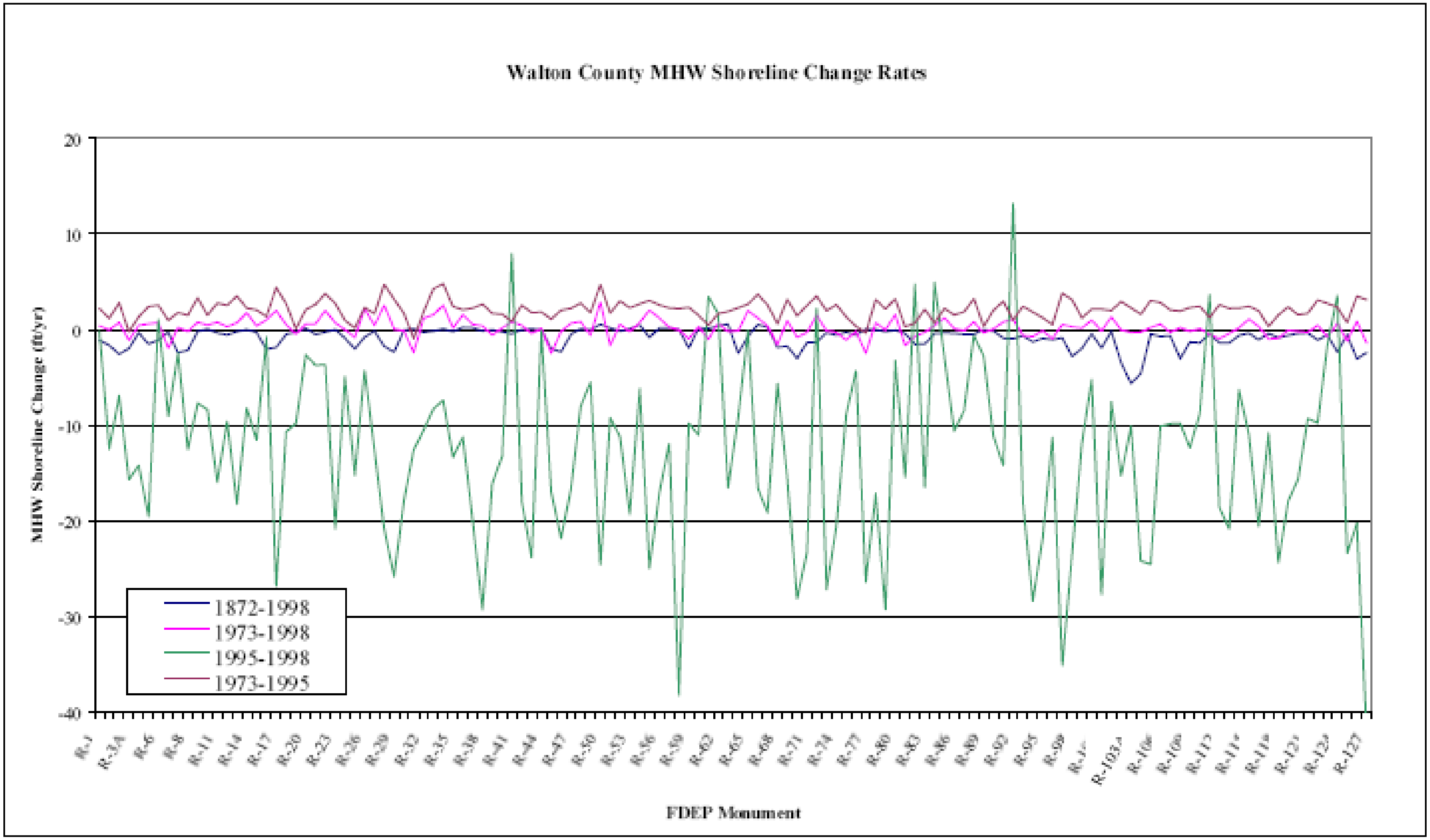

Figure A-1-17. Walton County MHW Shoreline Change Rates

The MHW shoreline experienced similar trends over the Walton County region. In the intermediate term before Hurricane Opal, the shoreline advanced. From 1995-1998, the shoreline receded severely over the region due to the impacts of Hurricane Opal and subsequent storms. Overall, from 1973-1998 the shoreline advanced slightly in every reach except from FDEP monuments R-41 to R-47 and R-109 to R-127. From 1872-1998, the shoreline receded over the region except from FDEP monuments R-48 to R-54. Absalonse, L. and Dean R.G. (2010) provide updated characteristics of shoreline change along the sandy beaches of the State of Florida. Figure A-1-18 demonstrates the shoreline change and standard deviation for the time periods between 1872 to 2007.

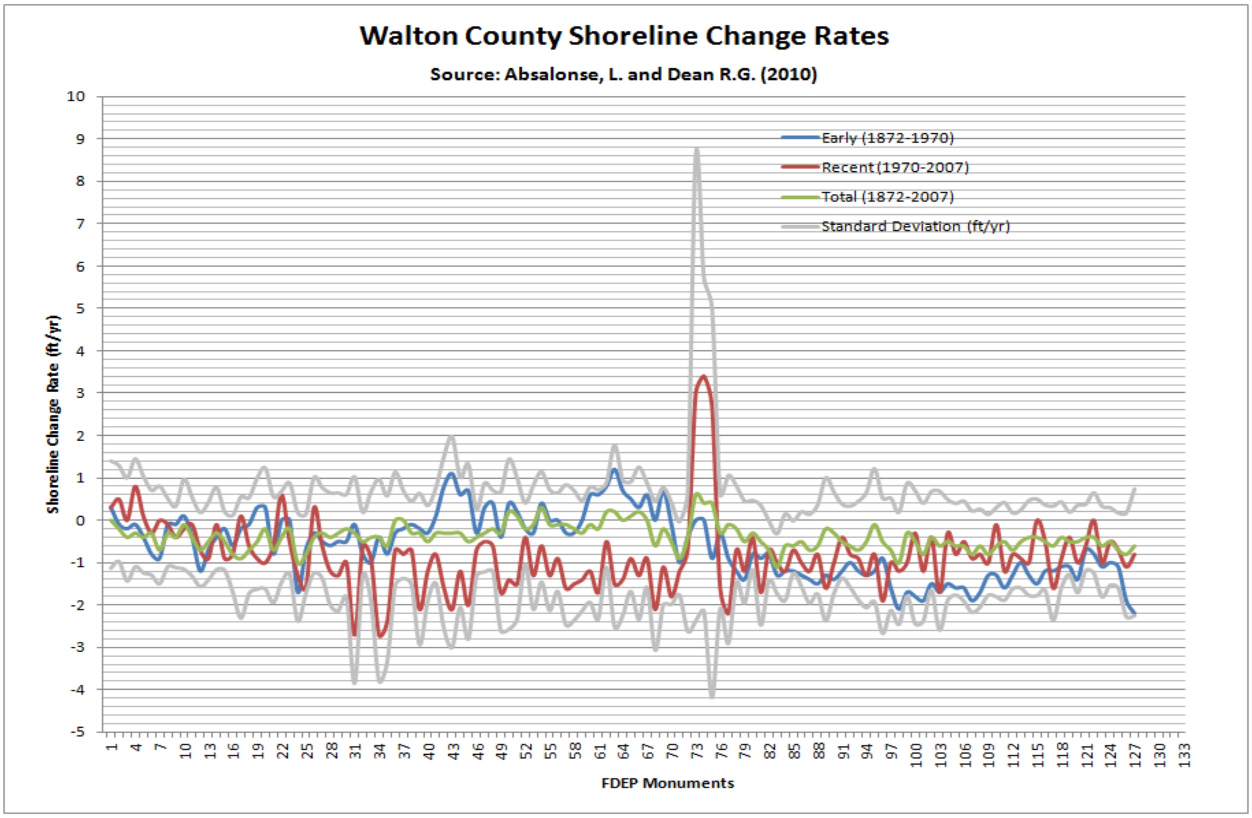

Figure A-1-18. Walton County Shoreline Change Rates

Measurement Uncertainty. It is important to quantify limitations in survey measurements and document potential systematic errors that can be eliminated during quality control procedures (Anders and Byrnes, 1991; Crowell et al., 1991; Byrnes and Hiland, 1995; Baker and Byrnes, 2004). Measurement errors associated with present and past shoreline surveys are considered random. However, data compilation uncertainties should be quantified to gauge the significance of measurements used for engineering applications and management decisions (Byrnes et. al 2012). Table A-1-12 summarizes estimates of potential uncertainties at any given point along the Walton County for shoreline data sets. Because individual uncertainties are considered to represent standard deviations, root-mean square estimates are calculated as a realistic assessment of combined potential uncertainty. Positional random errors for each shoreline can be calculated using the information in Table A-1-12; however, change analysis requires comparing two shorelines from the same geographic area, but different time periods. Table A-1-13 presents a summary of potential random errors associated with change analyses computed for specific time periods. The maximum positional uncertainties are associated with the oldest shorelines. However, the values generally fall within the known variability of shoreline advance or recession rates for the study area.

Table A-1-12. Estimates of Potential Random Error

Traditional Engineering Field Surveys (1872)	
Location of rodded points	3
Location of plane table	7 to 10
Interpretation of high-water shoreline position at rodded points	10 to 13
Error due to sketching between rodded points	Up to 16
Cartographic Uncertainties (1872)	
Inaccurate location of control points on map relative to true field location	Up to 10
Placement of shoreline on map	16
Line width for representing shoreline	10
Digitizer error	3
Operator error	3
GPS Shoreline Surveys (1973, 1995, 1998, 2004 and 2007)	
Delineating high-water shoreline	3 to 10
Position of measured points	3 to 16

Sources: Shalowitz, 1964; Ellis 1978; Anders and Byrnes, 1991; Crowell et al., 1991.

Table A-1-13
Maximum Root-Mean-Square Potential Uncertainty for Shoreline Change Data

	1972	1995	1998	2004	2007
1872	+/- 110.0	+/- 90.6	+/- 90.6	+/- 88.9	+/- 88.9
1972		+/- 32.6	+/- 32.6	+/- 30.9	+/- 30.9
1995			+/- 13.1	+/- 11.5	+/- 11.5
1998				+/- 11.5	+/- 11.5
2004					+/- 9.8

Magnitude of potential uncertainty associated with high-water shoreline position change (feet);

SEDIMENT BUDGET

A sediment budget delineates sediment transport pathways and magnitudes. Establishment of the sources and magnitudes of accreted sand and the magnitude and transport direction of eroded sand require such delineation. Net sediment transport results from complex interacting mechanisms such as wave action, tidal currents, sediment physical characteristics, mechanical bypassing operations, Aeolian processes, and vegetation-associated sediment trapping. Development and calibration of a process-based model to simulate such transport falls outside the capability of current coastal engineering models. As an alternative, this sediment budget analysis employs a simple but efficient box model approach that takes into account the fundamental equation for conservation of sediment volume.

Sediment Budget Development. This study builds on prior sediment budgets developed for Walton County (Taylor Engineering, 2003) which applied three surveys: 1973 (the earliest comprehensive survey), 1995 (pre-Hurricane Opal survey), and 1998 (the latest comprehensive survey at the time of the 2003 study) for analysis. Thus, the 2003 study developed sediment budgets for the periods 1973 - 1995, 1995 - 1998, and 1973 - 1998.

Recent bathymetric survey data for Walton County include May/June (pre-Hurricane Ivan) and October/November (post-Hurricane Ivan) 2004 surveys at all FDEP monuments (R1 – R127). These data sources include both upland surveys by standard surveying techniques and offshore surveys with a fathometer out approximately 3000 feet. Also, two USACE CHARTS LIDAR surveys (May and November 2004) cover the entirety of Walton County. The proximity in time of the May and November USACE surveys to the May/June and October/December FDEP surveys allows comparison of the two surveys (traditional versus LIDAR data acquisition techniques) and provides a convenient check of the data. This study also applies the 1995 FDEP pre-Hurricane Opal survey allowing analysis for the periods 1995 - May 2004, May 2004 - November 2004, and 1995 - November 2004.

An examination of Walton County's geomorphology and general characteristics was conducted to define representative sub areas or cells. This study applies two sets of beach reaches to delineate the cells within the Walton County sediment budget. Analysis A defines 10 reaches identical to those in Taylor Engineering (2003) and Analysis B defines 5 reaches developed by the USACE, Mobile District. The 2003 Beach Management Feasibility Study for Walton County (Taylor Engineering, 2003) defined 10 reaches based on profile geomorphology (dune or bluff profiles), shoreline orientation, nature of upland development (existence of structures encroaching on the active beach profile region), and state-designated critical erosion areas (see Table A-1-14 and Figure A-1-19). The sediment budget analysis defined the subaerial and subaqueous regions of each reach as distinct cells. Thus, 20 cells comprise Walton County for sediment budget computations in Analysis A. Analysis B divides Walton County based on proposed beach nourishment project areas, as shown in Table A-1-13. Based on available data, the net change in volume over the period of interest for each of these cells establishes the sediment loss or accumulation in the cell.

Unfortunately, the spatial availability of data, not the limiting values of topographic and bathymetric change, governs the landward and seaward boundaries. The monument locations define the landward limits of the profile surveys. Unlike the Taylor Engineering (2003) study which contained overwash estimates for Hurricane Opal, the current analysis does not include overwash estimates given the limited availability of recent high quality aerial photographs. For this study the -35 feet NAVD contour defines the seaward limit of reliable profile data; however, the profiles show erratic convergence which indicates that the depth of closure, or the limiting depth of significant sediment movement, lies seaward of the survey limits. Thus, the volume calculations exclude some volume of sand. Notably, the Taylor Engineering (2003) study applies a limiting offshore contour of -38 feet. The following paragraph describes the method used to compute sediment transport through the -35 feet NAVD contour.

The sediment budget assumes all longshore transport occurs below MHW; therefore, longshore transport pathways connect subaqueous cells only. Magnitudes and directions of sediment transport are assigned to the defined pathways. A closed landward boundary is applied that does not allow sediment transport across the boundary. The littoral transport analysis (Taylor Engineering, 2003) provided the net transport magnitude and direction at the longshore boundaries of each reach. The cross-shore transport at the MHW shoreline equaled the net volume change in the adjacent subaerial cell. The net transport at the offshore boundary balanced the net volume change in the adjacent subaqueous cell with the longshore transport entering and exiting the cell and the cross-shore transport at the MHW shoreline.

Measurement Uncertainty in Sediment Budget Calculations. Difficulties inherent to development of the sediment budget development were described previously; however, the two concurrent surveys that apply different survey techniques (traditional versus LIDAR) allow comparison and data verification. Comparison of the concurrent surveys indicated a general offset in the offshore region for both the May and November surveys. Standard datum and unit conversion errors could not explain the differences. Comparison of the 2004 survey data with prior surveys indicated that the 2004 LIDAR surveys provide the best convergence at depths greater than approximately 15 feet (Figures A-1-20 through A-1-22). In the surfzone, nearshore, and upland the 2004 traditional survey data proved a better match with prior surveys. These trends indicate a significant bias in the data sets and generally occurred at FDEP monuments across Walton County. For these reasons the sediment budget calculations apply profiles that merge the onshore portion of the traditional surveys with the offshore portion from the concurrent LIDAR surveys (Figures A-1-23 through A-1-25). The profiles typically merged at approximately -10 feet NAVD88 in a location with adequate convergence.

Table A-1-14. Walton County Reaches: Analysis A

Reach	FDEP Monument Range	Critical Erosion Area[1]	Nature of Upland Development
1	R-1 to R-19	WCE1	Developed
2	R-19 to R-23	WCE1	Developed
3	R-23 to R-41	-	Natural
4	R-41 to R-48	WCE2	Developed
5	R-48 to R-55	WCE2	Developed
6	R-55 to R-64	WCE3	Developed
7	R-64 to R-80	WCE4	Natural
8	R-80 to R-98	WCE5	Developed
9	R-98 to R-109	-	Natural
10	R-109 to R-127	WCE6, WCE7	Developed

[1]State-designated as of June 2005; erosion area limits not coincident with reach limits

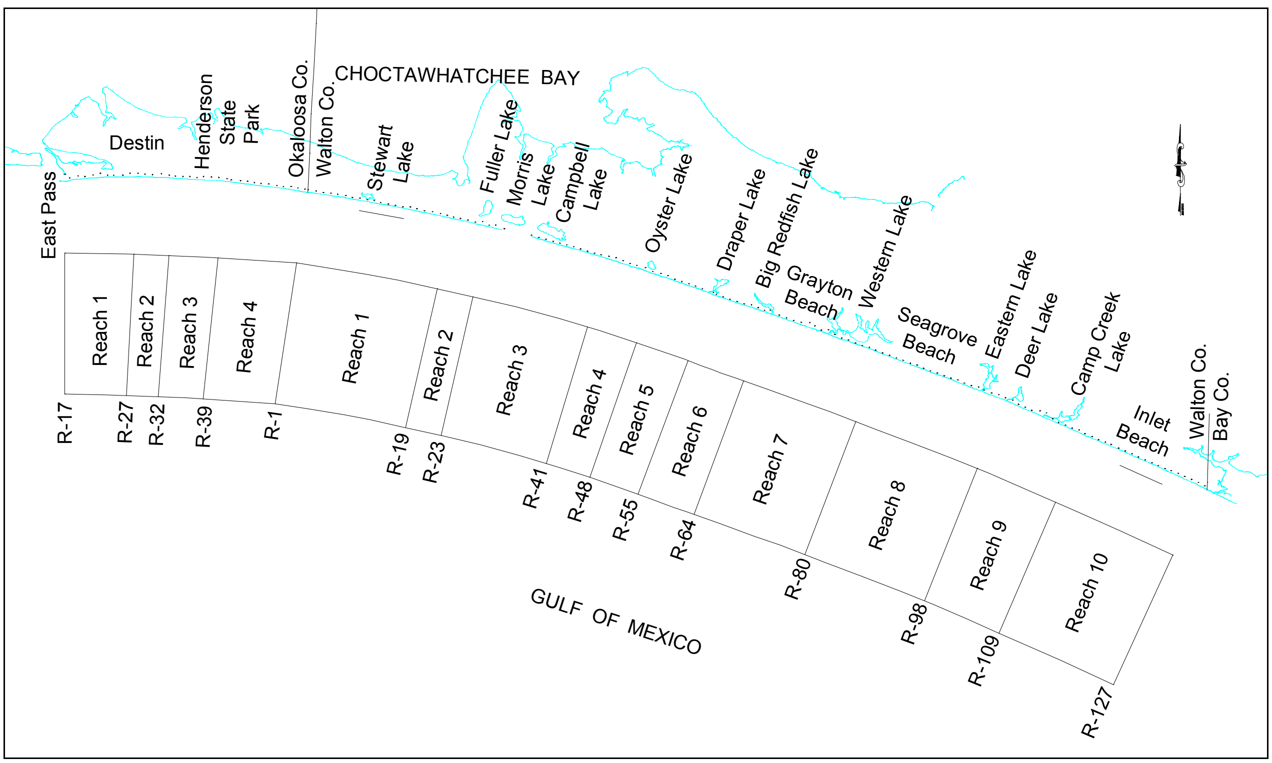

Figure A-1-19. Walton County Reaches: Analysis A

Table A-1-15. Walton County Reaches: Analysis B

Reach	FDEP Monument Range	Classification
1	R-1 to R-23	Proposed Beach Nourishment Area 1
2	R-23 to R-41	Topsail Hill State Preserve
3	R-41 to R-66	Proposed Beach Nourishment Area 2
4	R-66 to R-77	Grayton Beach State Recreation Area
5	R-77 to R-127	Proposed Beach Nourishment Area 3

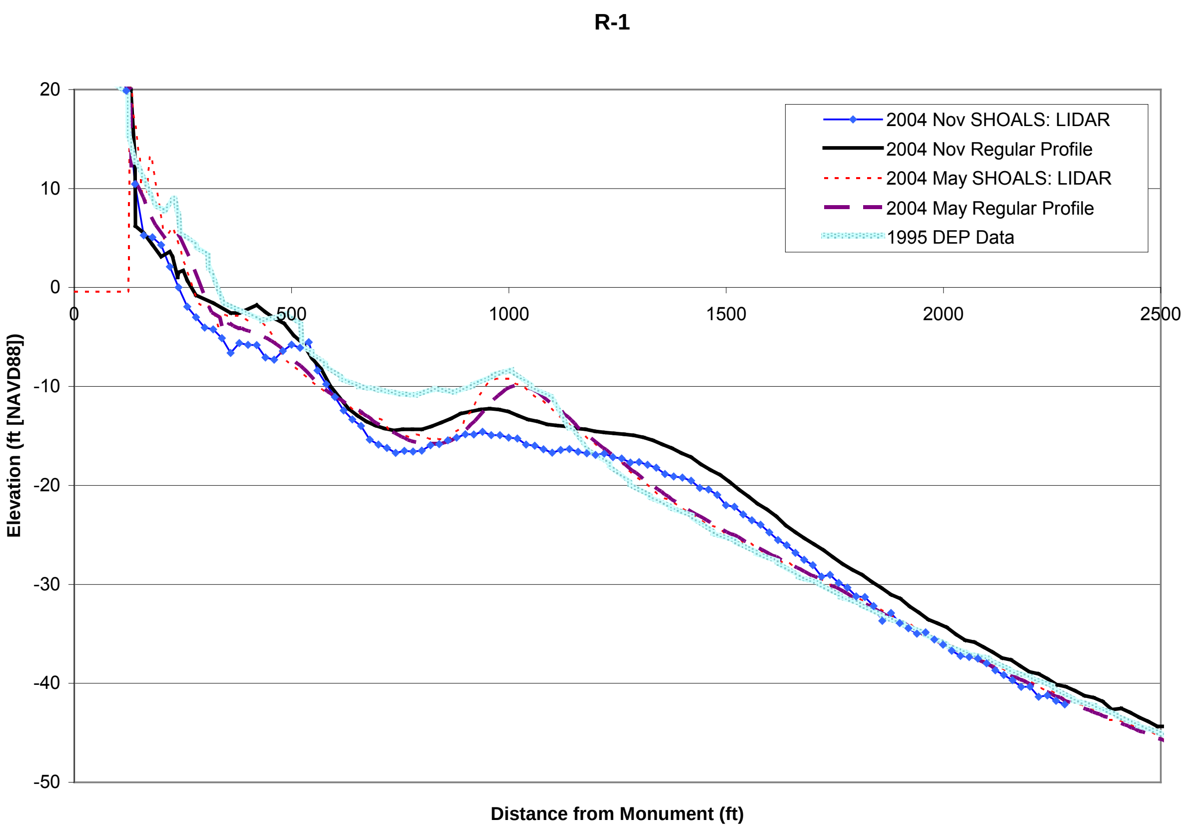

Figure A-1-20. Comparison of Recent Profile Data at R-1

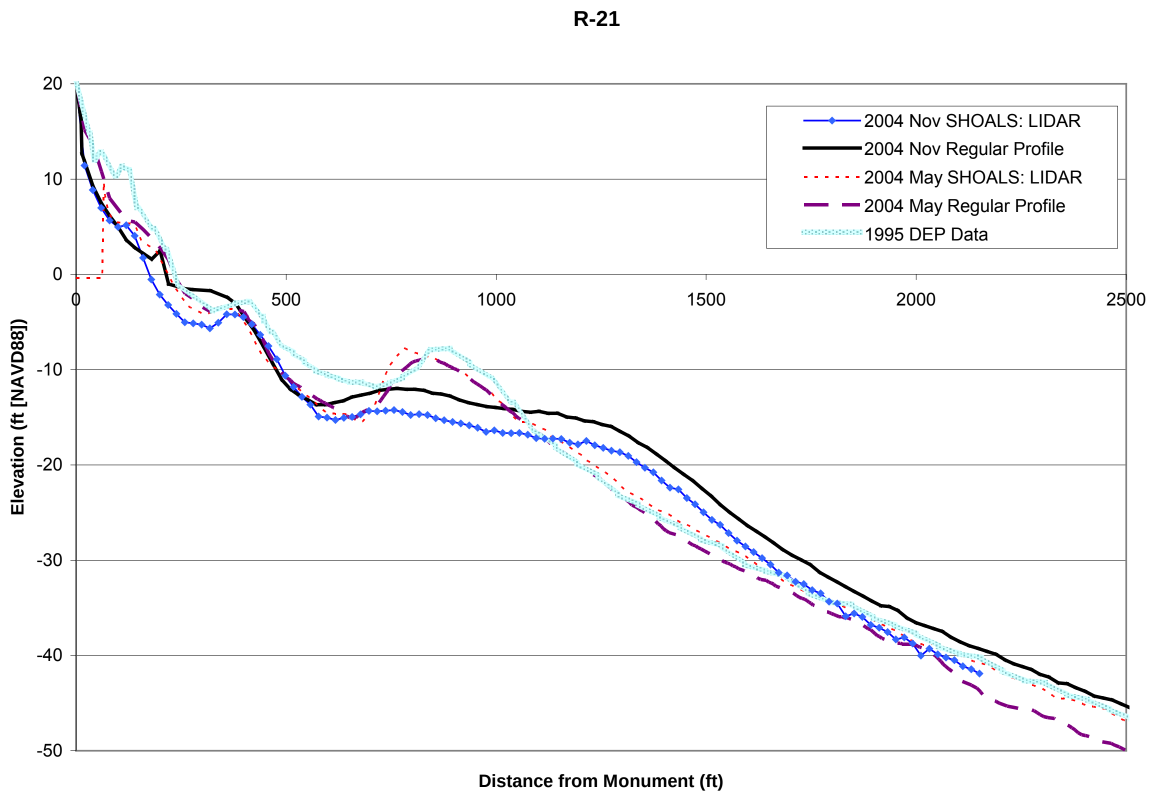

Figure A-1-21. Comparison of Recent Profile Data at R-21

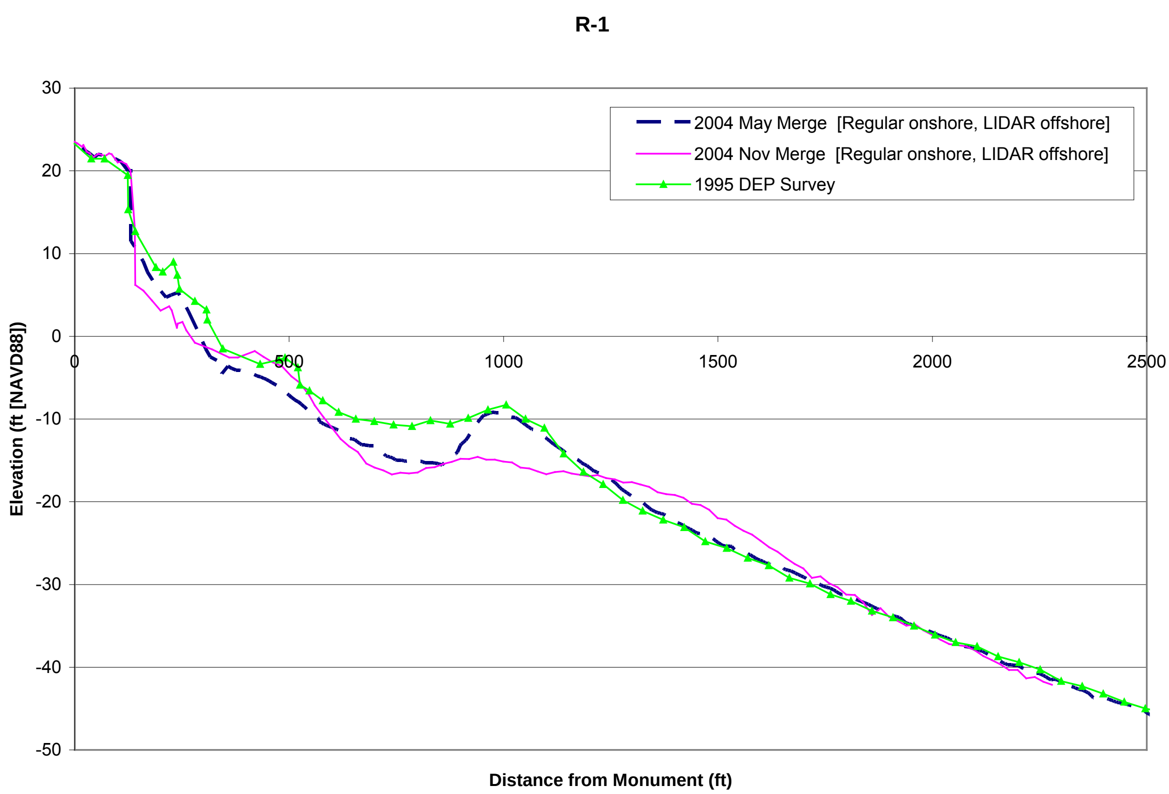

Figure A-1-22. Comparison of Merged Profile Data at R-1

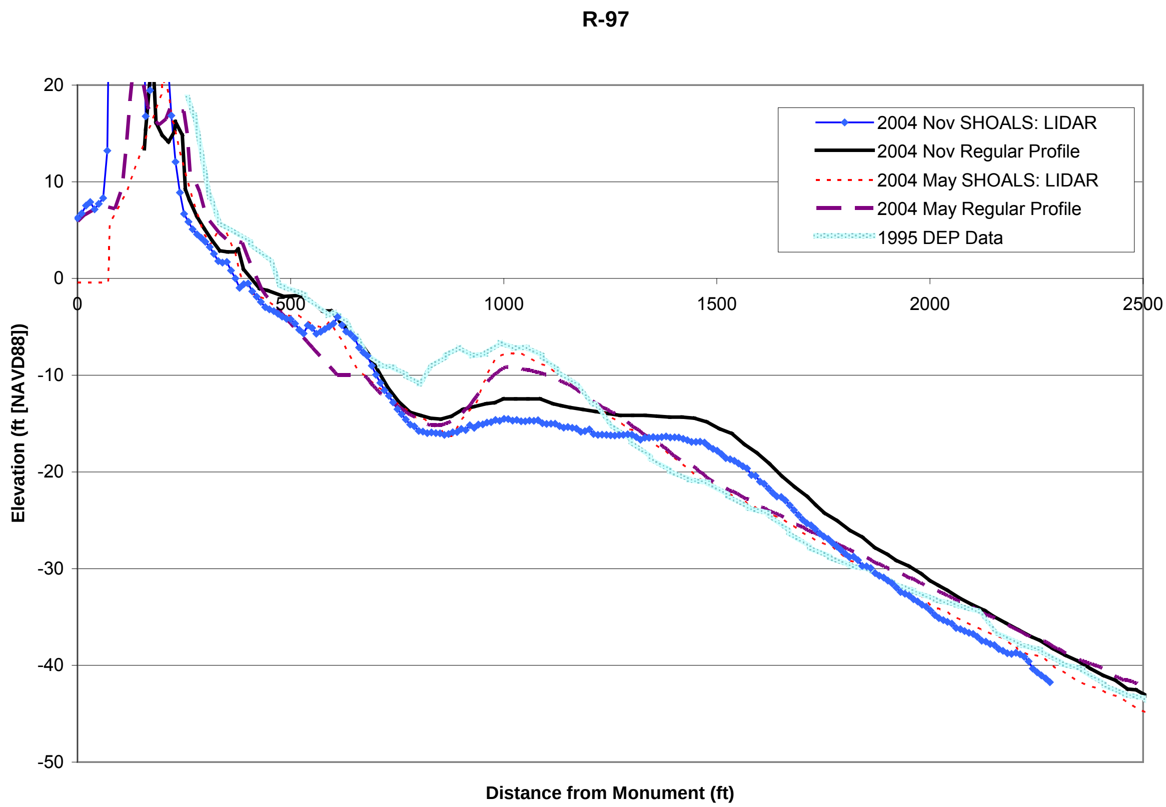

Figure A-1-23. Comparison of Recent Profile Data at R-97

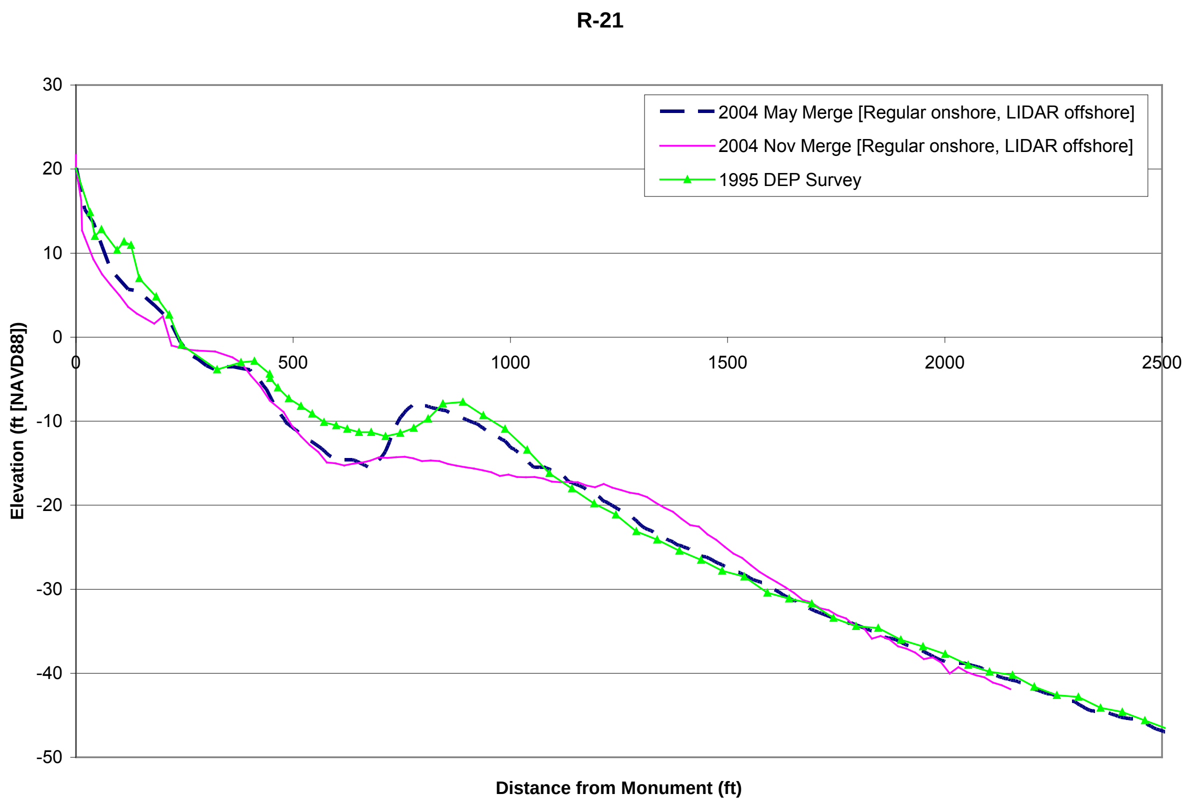

Figure A-1-24. Comparison of Merged Profile Data at R-21

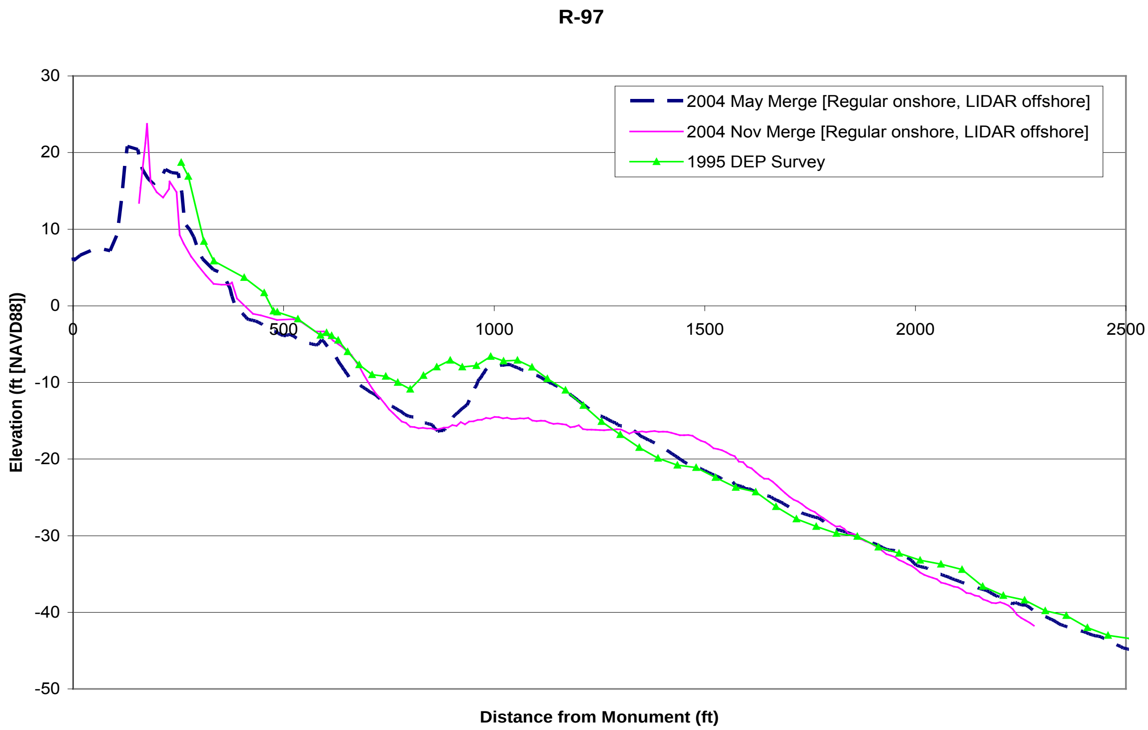

Figure A-1-25. Comparison of Merged Profile Data at R-97

The sediment budgets developed provide estimates of sediment transport pathways and magnitudes for delineated areas in Walton County. Similar to all sediment budgets, limitations in data availability and quality introduce potentially significant uncertainty in the quantities developed within the sediment budget.

As with shoreline data, measurements of seafloor elevation contain inherent uncertainties associated with data acquisition and compilation. It is important to quantify limitations in survey measurements and document potential systematic errors that can be eliminated during quality control procedures (Byrnes et al., 2002; 2012). The density of bathymetry data, survey line orientation, and the magnitude and frequency of terrain irregularities are the most important factors influencing uncertainties in volume change calculations between two bathymetric surfaces (Byrnes et al., 2002; 2012). Root mean square error estimates for the bathymetric surfaces range from approximately +/-0.50 to 1.0 feet across the entire surface.

<u>Sediment Budget for Walton County and Destin</u>. Figures A-1-26 through A-1-28 illustrate the Walton County sediment budgets (in cy/yr) for 1995 to May 2004, May 2004 to November 2004, and 1995 to November 2004 for the 10 reaches delineated in Analysis A. Figures A-1-26A through A-1-28A present sediment budget values in cy/ft/yr. Dividing the total volume change within each reach by the reach length facilitates comparison between reaches of different lengths. The tables present the results in cy/yr with the exception of the May 2004 to November 2004 figure, which present results in cubic yards (cy). Following the same conventions, Figures A-1-29 through A-1-31 illustrate the Walton County sediment budgets (in cy/yr) for 1995 to May 2004, May 2004 to November 2004, and 1995 to November 2004 for the five reaches delineated in Analysis B. Figures A-1-29A through A-1-31A present sediment budget values in cy/ft/yr.

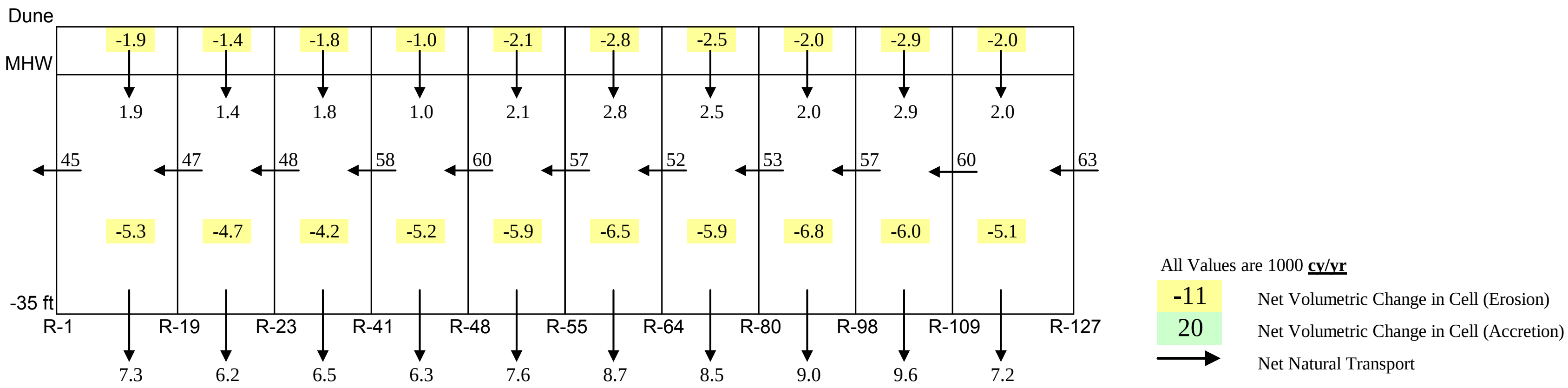

Figure A-1-26. May 1995 – May 2004 Sediment Budget For Walton County, Analysis A

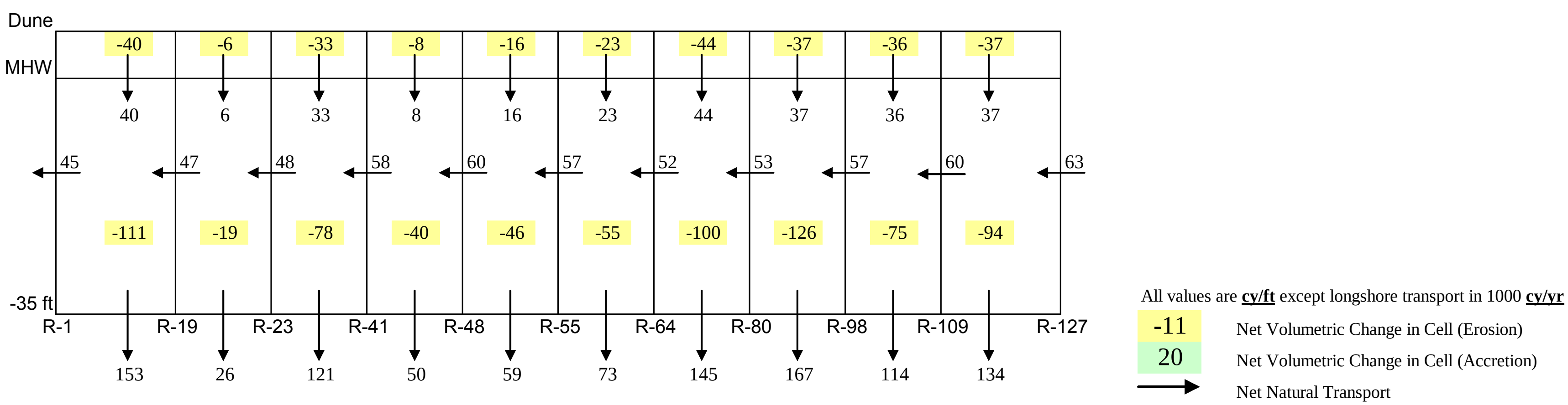

Figure A-1-26A. May 1995 – May 2004 Sediment Budget For Walton County, Analysis A In cy/ft

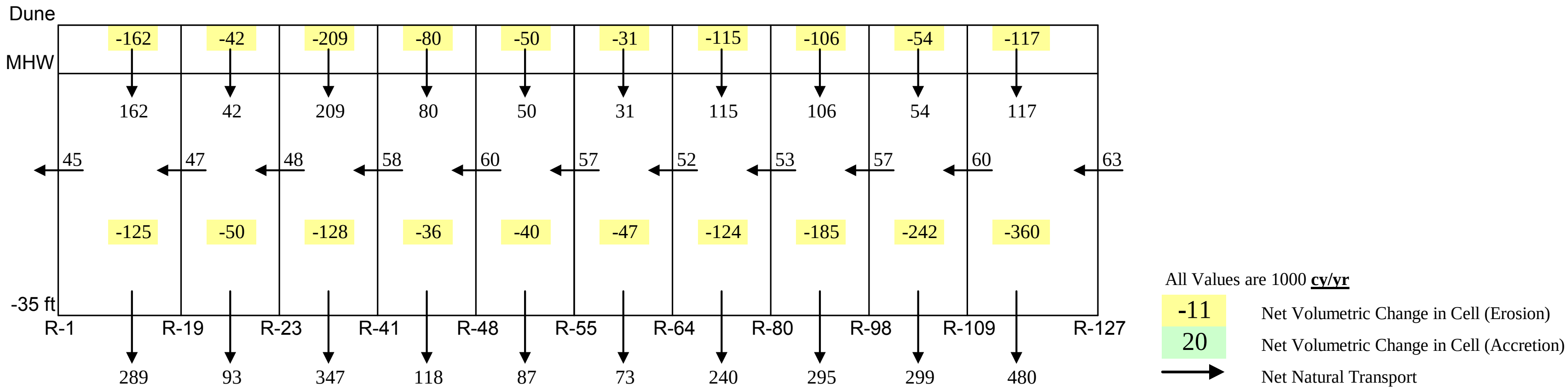

Figure A-1-27. May 2004 – November 2004 Sediment Budget For Walton County, Analysis A

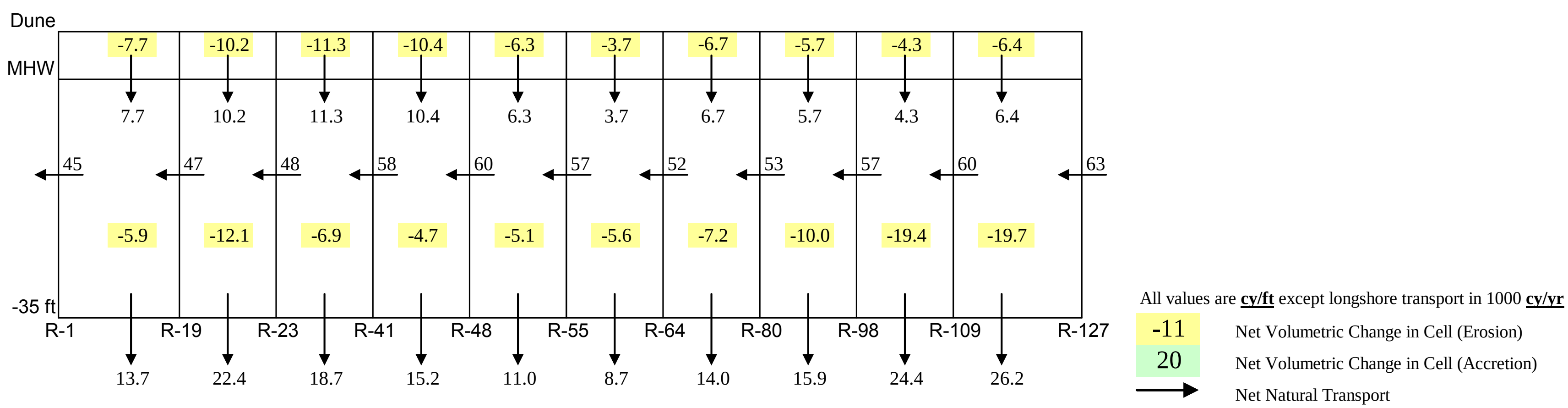

Figure A-1-27A. May 2004 - November 2004 Sediment Budget For Walton County, Analysis A in cy/ft

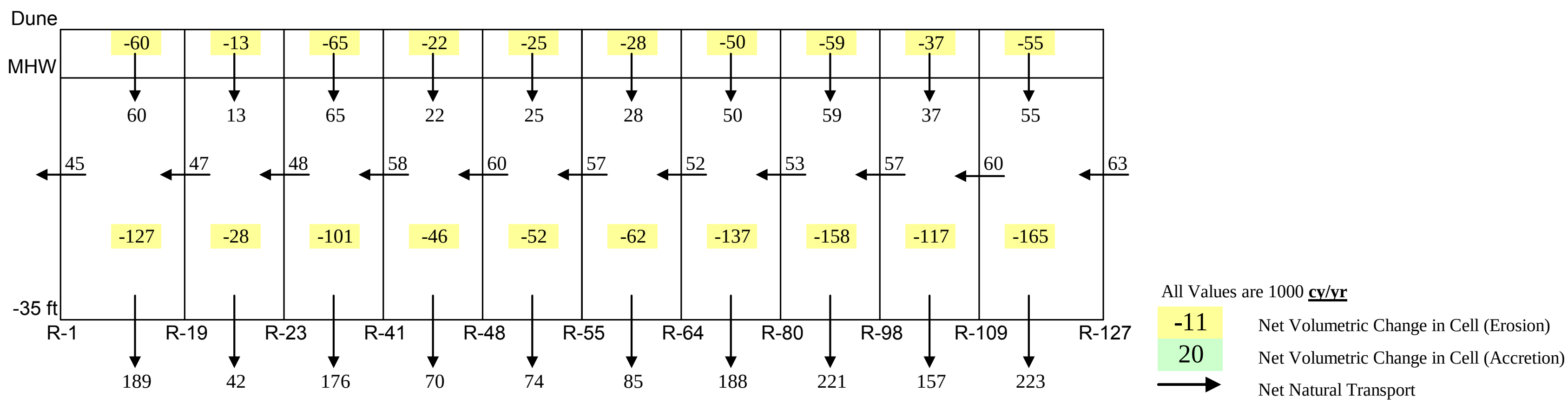

Figure A-1-28. May 1995 – November 2004 Sediment Budget For Walton County, Analysis A

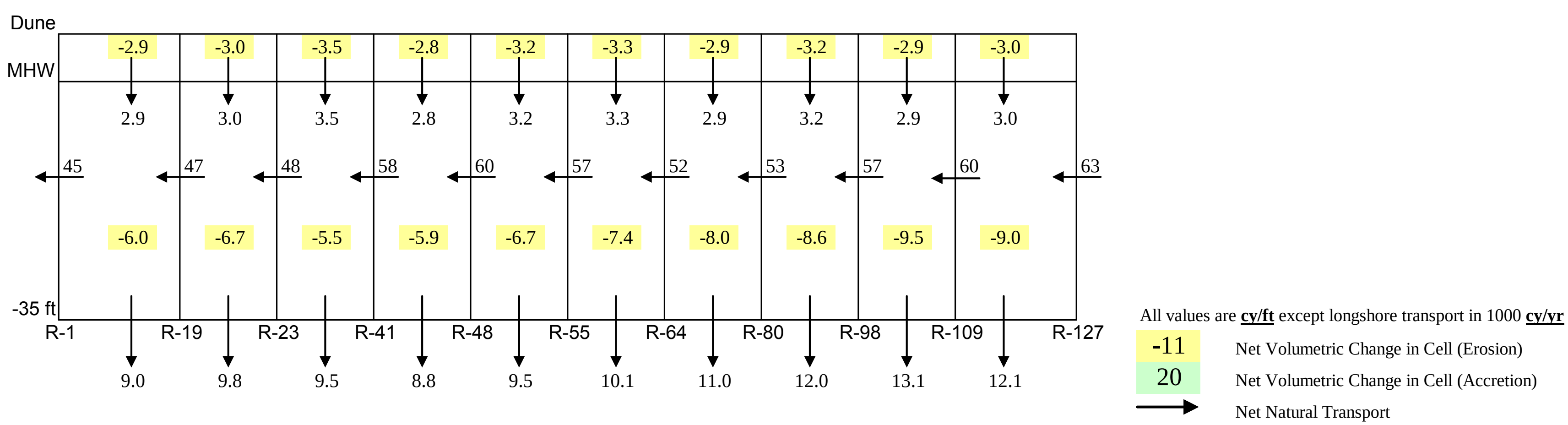

Figure A-1-28A. May 1995 – November 2004 Sediment Budget For Walton County, Analysis A in cy/ft

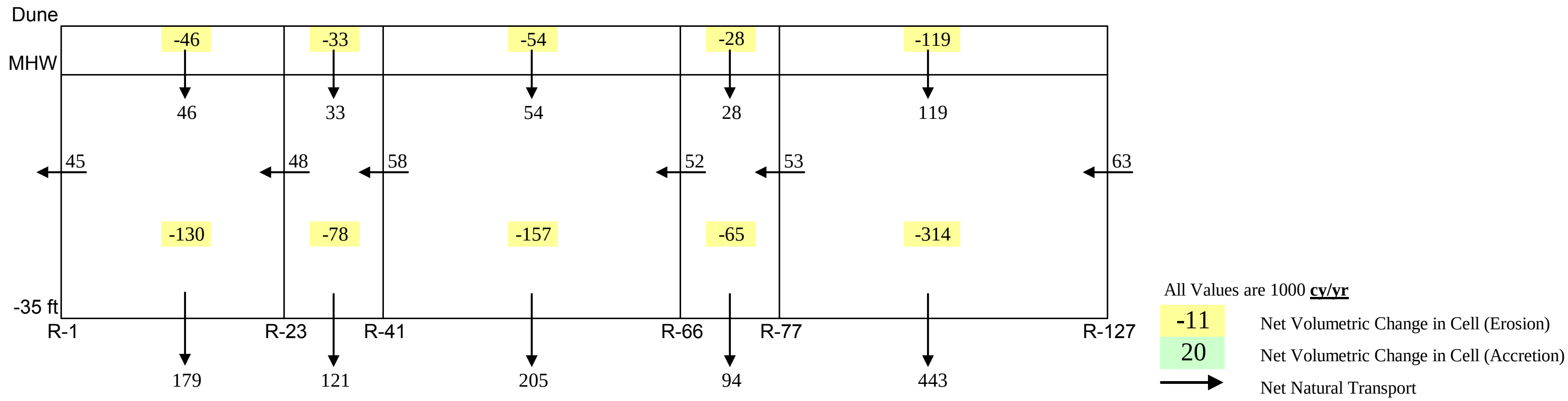

Figure A-1-29. May 1995 – May 2004 Sediment Budget For Walton County, Analysis A

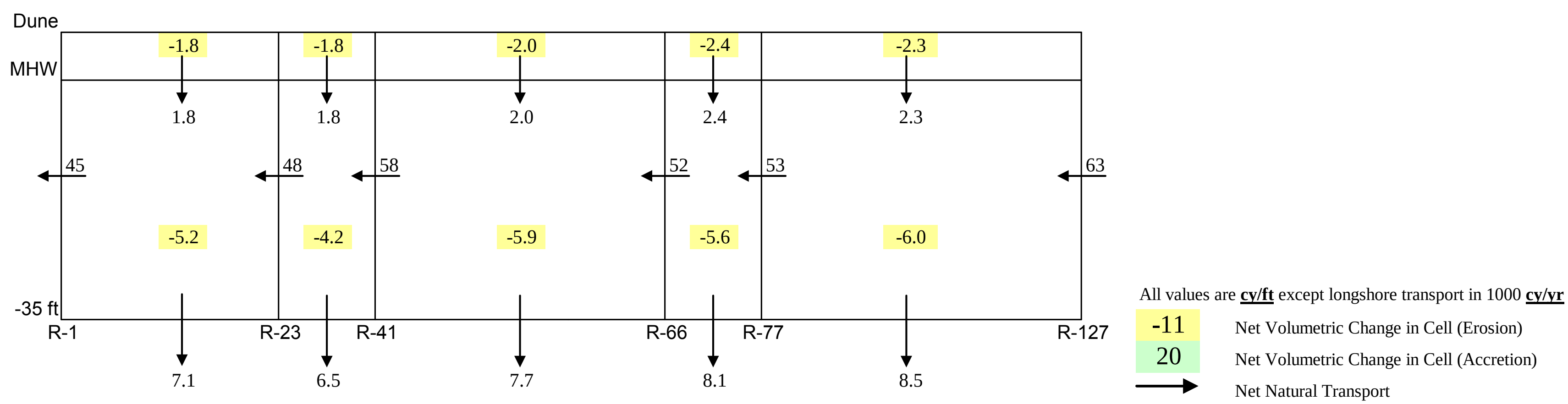

Figure A-1-29A. May 1995 – May 2004 Sediment Budget For Walton County, Analysis A in cy/ft

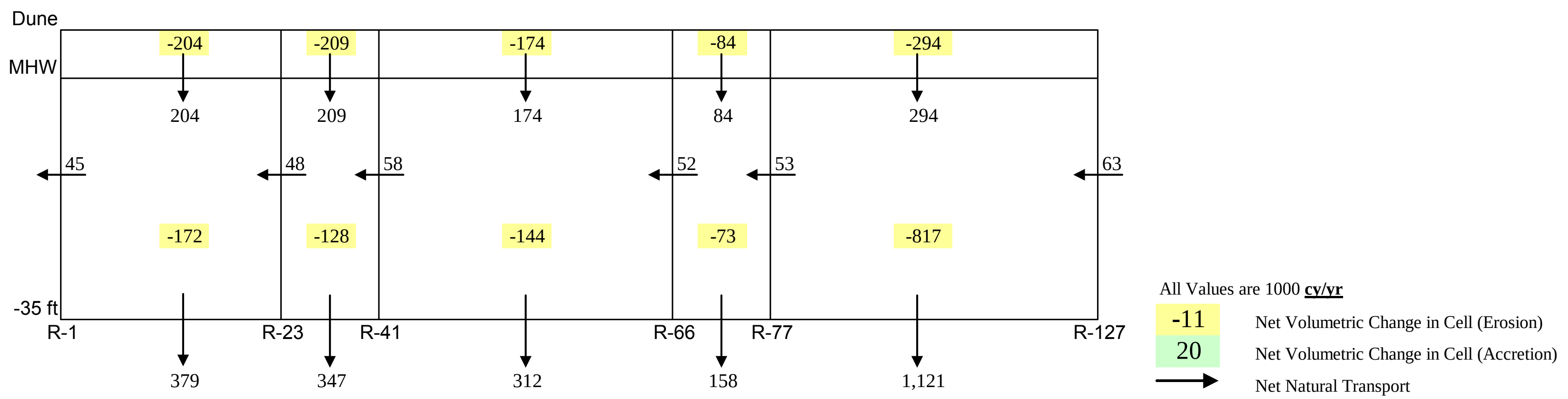

Figure A-1-30. May 2004 – November 2004 Sediment Budget For Walton County, Analysis A

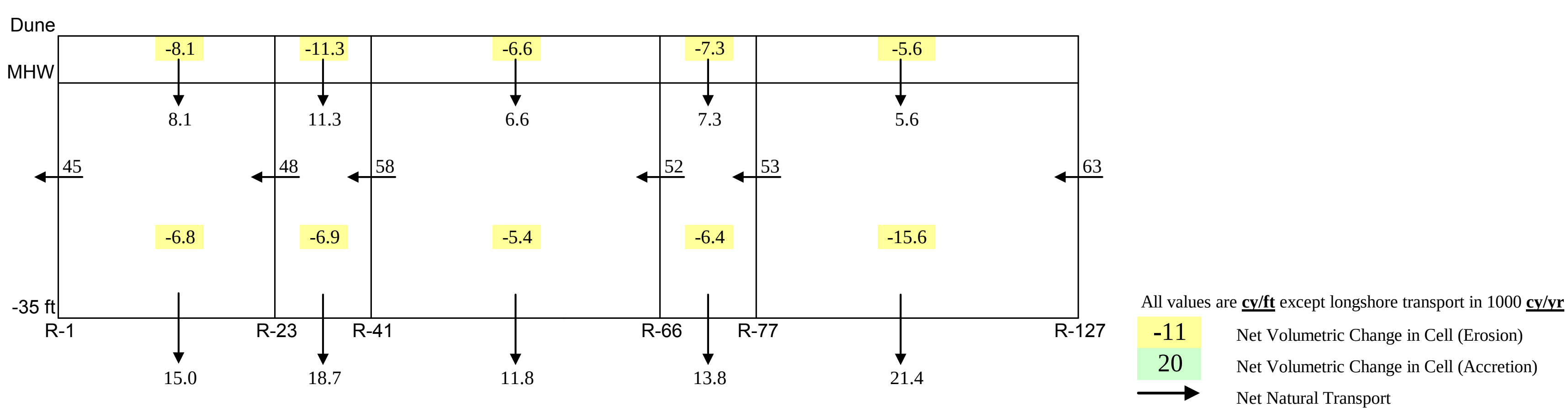

Figure A-1-30A. May 2004 – November 2004 Sediment Budget For Walton County, Analysis A in cy/ft

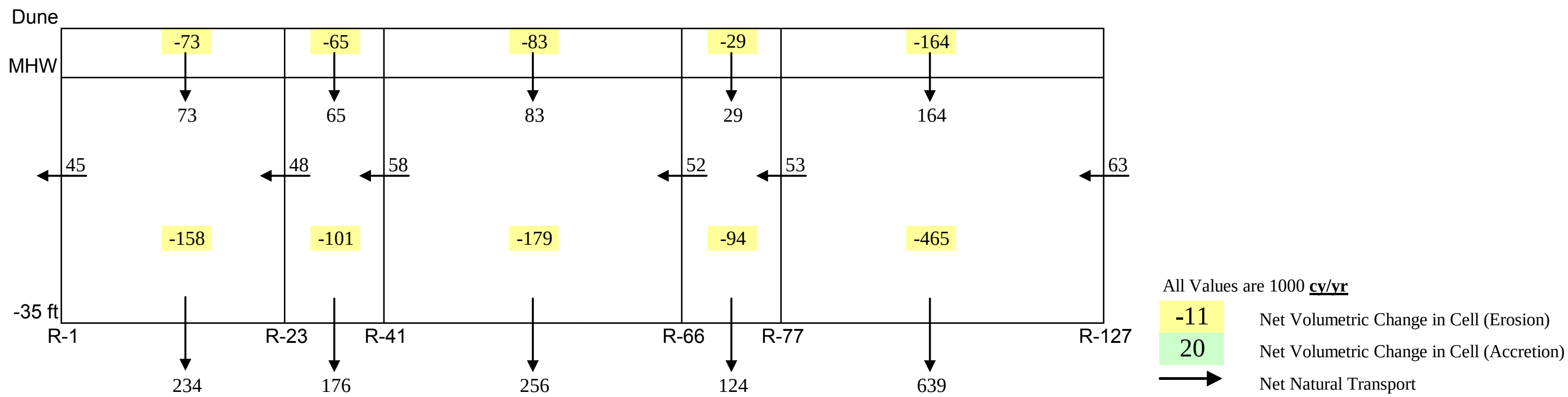

Figure A-1-31. May 1995 – November 2004 Sediment Budget For Walton County, Analysis A

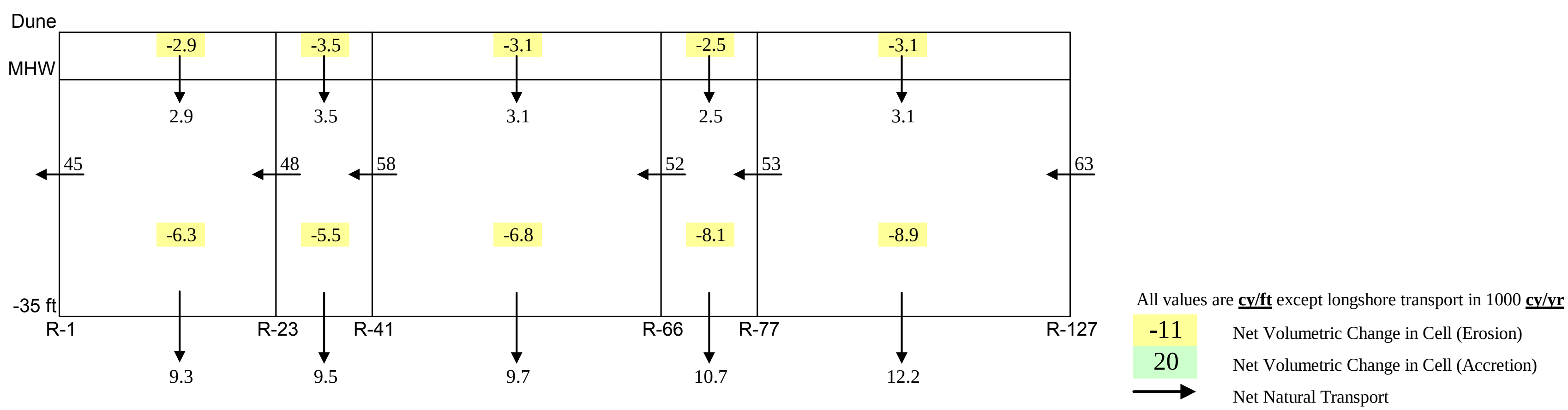

Figure A-1-31A. May 1995 – November 2004 Sediment Budget For Walton County, Analysis A in cy/ft

Numbers in the center of each cell represent the net volume change in that polygon; numbers highlighted in yellow indicate erosion and green highlights indicate accretion. Vertical arrows indicate net cross-shore transport magnitudes and direction, and horizontal arrows indicate net longshore transport. Recall, arrows represent net values of sediment transport; thus, every arrow represents the vector sum of two arrows acting in opposite directions. For example, the net 63,000 cy/yr passing monument R-127 represents two sediment transport rates - a larger rate directed westward and a smaller rate directed eastward. The difference in the rates defines the net transport presented in the sediment budget. Note the transport through the offshore boundary represent losses associated with storm-induced erosion.

In Walton County, all reaches experienced similar trends of net erosion for all subaerial beach and subaqueous regions for the three periods examined. Figure A-1-28 presents the sediment budget for May 1995 to November 2004. Wave induced transport carried the majority of the eroded material seaward of the -35 foot contour. During the 1995 to May 2004 period a number of severe storms, including Hurricanes Opal (1995), Danny (1997), Earl (1998), and Georges (1998) affected Walton County. As noted, this analysis does not include overwash, a common process during severe storms; inclusion of overwash in sediment budget computations would decrease the calculated volumes of sand transported offshore the -35-foot NGVD contour. For the short-term period encompassing Hurricane Ivan (Florida Panhandle landfall September 17, 2004) from May 2004 to November 2004, every cell experienced net erosion (Figure A-1-26). This pattern does not fit the typical storm-induced profile changes of subaerial erosion and subaqueous accretion, a pattern generally evident in Walton County after the impact of Hurricane Opal in 1995 (Taylor Engineering, 2003). The current calculations suggest catastrophic sediment losses, greater than 2.3 million cy across the -35-foot NGVD contour over the May to November 2004 analysis period. The May 1995 (pre-Hurricane Opal) to November 2004 (post-Hurricane Ivan) sediment budget (Figure A-1-28) illustrates the erosive effects from storm activity over the past nine years.

Figures A-1-29 through A-1-31 present sediment budgets for the 1995 to May 2004, May 2004 to November 2004, and 1995 to November 2004 analysis periods with the results delineated by the five reaches of Analysis B. Notably, Analysis B simply presents the volume change data of the prior three figures with different longshore limits for the reaches. Figures A-1-29 through A-1-31 indicates similar features with erosion indicated in every cell for the three analysis periods. Attachment II includes volume change tables and plots for the 1995 to May 2004, May 2004 to November 2004, and 1995 to November 2004 periods.

Trimmell et. al (2010) documents volume and shoreline change rates during three years of post construction monitoring of an emergency sand placement of approximately 2.8 million cy in 2007 along the eastern 2 miles Okaloosa County, Florida and the western 5 miles of the Walton County. The three year post construction monitoring indicates that the project area lost approximately 107,000 cy/yr or 8.7 cy/ft of material from the fill area. It was estimated that approximately 36,100 cy/yr was transported to the adjacent control areas through longshore dispersion of the fill and upwards of 70,600 cy/yr dispersed beyond the control areas and/or the -30 foot contour or may reflect surveying inaccuracies. The results of Trimmell et. al (2010) show similar trends of net erosion with values that generally fall within the range of those computed for the sediment budget. One notable difference is in the dominate direction of longshore dispersion. Over the three year monitoring time period net sediment transport along the western limits of Walton County was to the east. This is based on a very small time period with no major tropical systems impacting the site. None the less a reversal in sediment transport in this area would tend to anchor the fill and increase the stability of the western most segment of the project.

GENESIS SHORELINE CHANGE MODELING

GENESIS Model. The Generalized Model for Simulating Shoreline Change (GENESIS) (Hanson and Kraus 1989) is an elaborate one-line numerical model which simulates changes in shoreline position due to spatial and temporal gradients in longshore sediment transport. One-line sediment transport models, after the theory first outlined by Pelnard-Considere (1956), typically consider the beach profile to retain an equilibrium shape, which shifts landward or seaward parallel to itself. Given this consideration, the position of only one contour requires monitoring. Thus, sediment motion occurs uniformly over the entire active profile confined between two well-defined limiting elevations: the top of the active berm and the depth of closure.

GENESIS simulates changes in shoreline position due to the presence and combinations of beach fills and hard nearshore structures such as groins, jetties, seawalls, and breakwaters. The model allows for sand bypassing around and through groins and jetties, accommodates wave diffraction by long groins (i.e., jetties) and offshore breakwaters, and wave transmission through breakwaters. Wave conditions, which drive the model, consist of wave height, period, and direction and can originate from multiple sources. Boundary conditions are required at the two lateral boundaries (shoreline ends), and shoreline evolution depends directly on their specification. Model application typically occurs phases for site-specific locations: calibration, verification, and predictive simulations. Calibration runs establish site-specific parameters. Verification simulations assure accurate calibration of the model. Predictive simulations estimate the performance of any proposed beach fill or structural modifications.

Model Theory. GENESIS considers longshore sediment transport due to breaking waves only. The dynamic equation or the statement of the longshore sand transport rate, Q, is expressed as

$$Q = H_b^2 C_{g,b} \left(a_1 \sin 2\theta_b - a_2 \cos\theta_b \frac{\partial H_b}{\partial x}\right) \tag{1}$$

where H_b is the breaking wave height, $C_{g,b}$ the breaking wave group velocity, x the longshore direction, and θ_b the angle of breaking waves referenced to the shore-perpendicular direction. The first term in parenthesis considers sediment transport generated by the longshore component of the breaking wave energy flux (e.g., Inman and Bagnold, 1963). The second term modifies the transport rate to account for longshore gradients in breaking wave height. The nondimensional parameters, a_1 and a_2, are defined by

$$a_1 = \frac{K_1}{16(s-1)(1-p)(1.4116)^{5/2}} \tag{2}$$

and

$$a_2 = \frac{K_2}{8(s-1)(1-p)\tan\beta(1.1416)^{7/2}} \tag{3}$$

where K_1 and K_2 are empirical nondimensional constants (calibration parameters), *s* is the specific gravity of sand (~2.65), *p* is the in-place sediment porosity (~0.4), and tan *β* is the average nearshore bottom slope. Using the root mean square (rms) wave height in their calculations, Komar and Inman (1970) recommended K_1 = 0.77; Kraus et al. (1982) suggested K_1 = 0.58 on the basis of sand tracer experiments; Bodge and Kraus (1991) suggested K_1 = 0.32; and Hanson and Kraus (1989) recommended K_2 = 0.5 – 1.0 K_1; however, given the many approximations and assumptions inherent in the model, the nondimensional coefficients serve as calibration parameters. The factor 1.1416 in Equations 2 and 3 converts input significant wave heights to root mean square (rms) values. Notably, the second term (K_2) is typically much smaller than the first term (K_1), except near diffracting structures.

GENESIS then requires a second equation, the continuity equation (a statement of the conservation of sand):

$$\frac{dy}{dt} + \frac{1}{h_* + B}\frac{dQ}{dx} = 0 \tag{4}$$

where *y* is the position of the shoreline, and *B* and h_* are the berm elevation and the depth of closure. Equation 4 simply calculates shoreline advance (accretion) or retreat (erosion) depending on the difference of sand entering and exiting each grid cell.

The internal wave model in GENESIS, which assumes parallel bottom contours, refracts, shoals, and diffracts (if necessary) the given offshore waves to the breaker line. In cases where the modeled reaches exhibit complex offshore bathymetry, and given the degree of sophistication required, a more comprehensive external wave model (e.g., STWAVE; Resio, 1988) can simulate the wave climate to an arbitrary nearshore reference line. From there, the internal wave model of GENESIS takes over the remaining wave transformation calculations.

Model Assumptions and Limitations. GENESIS was designed around the equilibrium profile theory and the assumption that although the profile may recede landward or accrete in a seaward direction, the shape of the profile remains the same. Thus, if the profile shape does not change only one point is needed, with respect to some baseline, to define the position of the beach. The complete beach section is defined by a single contour line, taken as the mean sea level shoreline. For most sandy coastal beaches located along the Gulf of Mexico coast away tidal inlets this is an acceptable and standard assumption used in coastal engineering design.

GENESIS accounts for changes in shoreline position due to longshore sediment transport, however, it does not take cross-shore sediment transport into consideration. With a long time interval, such as for the Walton County study the effects of cross-shore

sediment transport will often average out. In addition, cross-shore storm induced changes are being incorporated through use of SBEACH. For Walton County the GENSIS results are being utilized for assessment of long-term project induced change (spreading of the fill) over the project life. The model is calibrated and validated with shoreline positions and associated volume changes from data collected over extended period of time which can best capture the normal wave climate for the area.
It is assumed in the model that sediment is transported alongshore between two well defined elevations on the beach profile. The landward limit for transport is the top of the active berm, while the seaward limit for transport is the depth of closure. These values are held constant in GENESIS. For sandy coastal areas this is an acceptable and standard assumption used in coastal engineering design.

GENESIS is not capable of handling the effects of wave reflection from structures, tombalo development, nor changing tide levels and there are restrictions on the placement, shape, and orientation of structures. These model limitations however do not impact the Walton County study.

GENESIS Model Setup. To represent the shoreline behavior at the extents of Walton County, the GENESIS model domain was laterally extended to locations where edge effects would not affect model results. Ideally, the lateral extents of the model domain should occur at the terminal points of littoral cells with known transport rates. The eastern lateral boundary of the model domain occurs at FDEP monument R-34 in Bay County, Florida, approximately 7.0 miles from the eastern edge of Walton County. The western lateral boundary lies at East Pass near R-17 in Okaloosa County, Florida, approximately 6.3 miles from the western edge of Walton County. The GENESIS model grid consists of 1336 cells with 150 foot spacing for a total length of 38.0 miles. Aside from the site-specific model parameters, GENESIS requires measured shoreline positions and wave data to calibrate and verify the model setup.

Shoreline Data. Finding concurrent shoreline data for the entire model domain proved difficult given the domain encompassed parts or all of three counties. The GENESIS model applies FDEP monitoring data for the input shoreline locations. All cases during the calibration and verification applied shoreline data from Bay and Okaloosa Counties for the closest time possible to the relevant Walton County survey. Table A-1-16 presents the survey dates for the shoreline data for calibration and verification. A calibration period of July 1984 to July 1995 and a verification period from March 1996 to March 1998 provide the best combination of the relevant parameters: length of record, storm history, data record in main region of interest (Walton County), and data record in bordering counties. All data uniformly reference NAVD88.

Table A-1-16. FDEP Survey Dates For Calibration and Verification Shoreline Data

		Florida County		
		Bay	**Walton**	**Okaloosa**
Calibration	Start	Sep-84	Jul-84	Jul-84
	End	Aug-95	May-95	Apr-95
Verification	Start	Jan-96	Mar-96	Mar-96
	End	Jun-97	Jan-98	Mar-98

Analysis of recent shoreline position data indicates a stable or accreting shoreline in Walton County in the absence of severe storms. Taylor Engineering (2003) presents a regression analysis performed with shoreline position data from 1973 to 1995, a period of generally mild storm events, which documents the stable shoreline trend. Since 1995, a number of severe storms, including Hurricanes Opal, Earl, Georges, and Ivan, have affected Walton County. These hurricanes caused significant shoreline changes generally through cross-shore sediment transport; a process not modeled within GENESIS.

Choosing calibration and verification periods with little hurricane activity allows modeling of transport mainly in the longshore direction; the direction of transport for which GENESIS was designed. GENESIS generates shoreline positions for each 150 foot grid cell from the measured shoreline data. The shoreline measurements generally have a longshore spacing of approximately 1,000 feet (every FDEP monument) or every 3,000 feet (every third FDEP monument).

Wave Data. The WIS hindcast provided the time series of offshore wave conditions (wave height, period, and direction) for the GENESIS model. The 1980-1999 WIS hindcast data for Station 180, located at 30.17°N, 86.25°W, and positioned in deep water (102 foot depth) is unaffected by the complex nearshore bathymetry. Longshore bars that weld onto the shoreline in Walton County can cause significant variability of the shoreline position in the longshore direction. The presence of these bars can alter the bathymetry and therefore affect wave propagation in the nearshore zone. WIS data were obtained for the calibration and verification periods of July 1984 to July 1995 and March 1996 to March 1998, respectively. Table A-1-17 presents the wave height, wave period, and wave direction bands applied in this study.

Table A-1-17. Wave Modeling Study Bins

Bins for Wave Modeling Study		
Wave Height, H (feet)	**Wave Period, T (s)**	**Wave Direction, (deg)**
H < 33	T < 3.3	-90 < Dir < -45
	3.9 < T < 4.5	-45 < Dir < -25
	4.5 < T < 5.5	-25 < Dir < -10
	5.5 < T < 7.5	-10 < Dir < 0
	7.5 < T < 10	0 < Dir < 10
	10.0 < T < 12.5	10 < Dir < 25
	12.5 < T < 15.0	25 < Dir < 45
		45 < Dir < 90

External Wave Model. Successful modeling of longshore transport requires accurate wave transformation of the offshore data. If the offshore bathymetry is irregular, an external wave model may be applied to provide a better representation of wave transformation before wave breaking. The external wave model calculates wave transformation over the actual (irregular) bathymetry from the offshore reference depth to a user-defined nearshore reference line that lies seaward of the breaking zone. For this study the depth of WIS station 180 defines 102 feet as the offshore reference depth with the nearshore reference line defined as 19.7 feet. GENESIS then calculates the transformation, assuming straight and parallel bottom contours, from the user-defined reference depth to the breaking point.

The external wave model Steady-State Spectral Wave (STWAVE) model (Smith et al., 2001) was applied to transform the wave field from WIS Station 180 to a depth outside the breaking zone. The Nearshore Evolution Modeling System (NEMOS) suite of programs within the Coastal Engineering Design and Analysis System (CEDAS) software coupled the STWAVE and GENESIS modeling. The STWAVE grid extends outside the lateral boundaries of the GENESIS domain (i.e., east of R-34 in Bay County and west of East Pass in Okaloosa County) to remove edge effects. Figure A-1-32 presents the GENESIS and STWAVE modeling domains.

The STWAVE model grid contains bathymetry data from the May 2004 USACE CHARTS Light Detection and Ranging (LIDAR) survey in the nearshore and from the U.S. East Coast Advanced Circulation (ADCIRC) Model (USACE, 2002) in the offshore. The CHARTS data, while extending to depths over 55 feet for most longshore locations, provide the benefits of encompassing the entire three county domain into a single survey. Filtering the CHARTS data to a more manageable level reduced the resolution of the data. Merging the CHARTS and ADCIRC data created a uniform transition between data sets. For this study STWAVE model was ran to obtain estimates of alongshore variation in wave conditions due to an irregular offshore bathymetry for input into GENSIS. Waves were transformed from offshore depths of approximately 102 feet to nearshore, but pre breaking depths of approximately 20 feet. Changes to bathymetric relief in these water depths due to hurricane Ivan were minimal with any changes expected to be ephemeral. Consequently, it was not deemed necessary to update the STWAVE grid following hurricane Ivan.

The STWAVE grid consists of 405 and 1509 cells in the cross-shore and longshore directions, respectively. A uniform spacing of 150 feet in the cross-shore and longshore directions defines the grid, with an orientation of 20 degrees clockwise from north to best match the general regional contours and landform.

Calibration/Verification. Model calibration and verification establishes the site-specific model parameters for the predictive simulations. A shoreline without an historical trend, erosive or accretive, presents a challenging environment for a one-line shoreline change model such as GENESIS: numerous forcings can result in no shoreline movement. Matching accepted longshore transport rates within the model domain provides an alternative to matching shoreline positions in the case of a relatively stable shoreline such as Walton County in the absence of storm events (Mark Gravens, personal communication). For this study the calibration and verification procedures compare the longshore transport rates from the published Walton County sediment budget (Taylor Engineering, 2003) with the GENESIS results. Comparing the average longshore transport rates within 10 reaches provides a means to compare the predictive capability of the GENESIS model to historical values. GENESIS provides the net, gross, easterly, and westerly longshore transport values at each cell within the model domain.

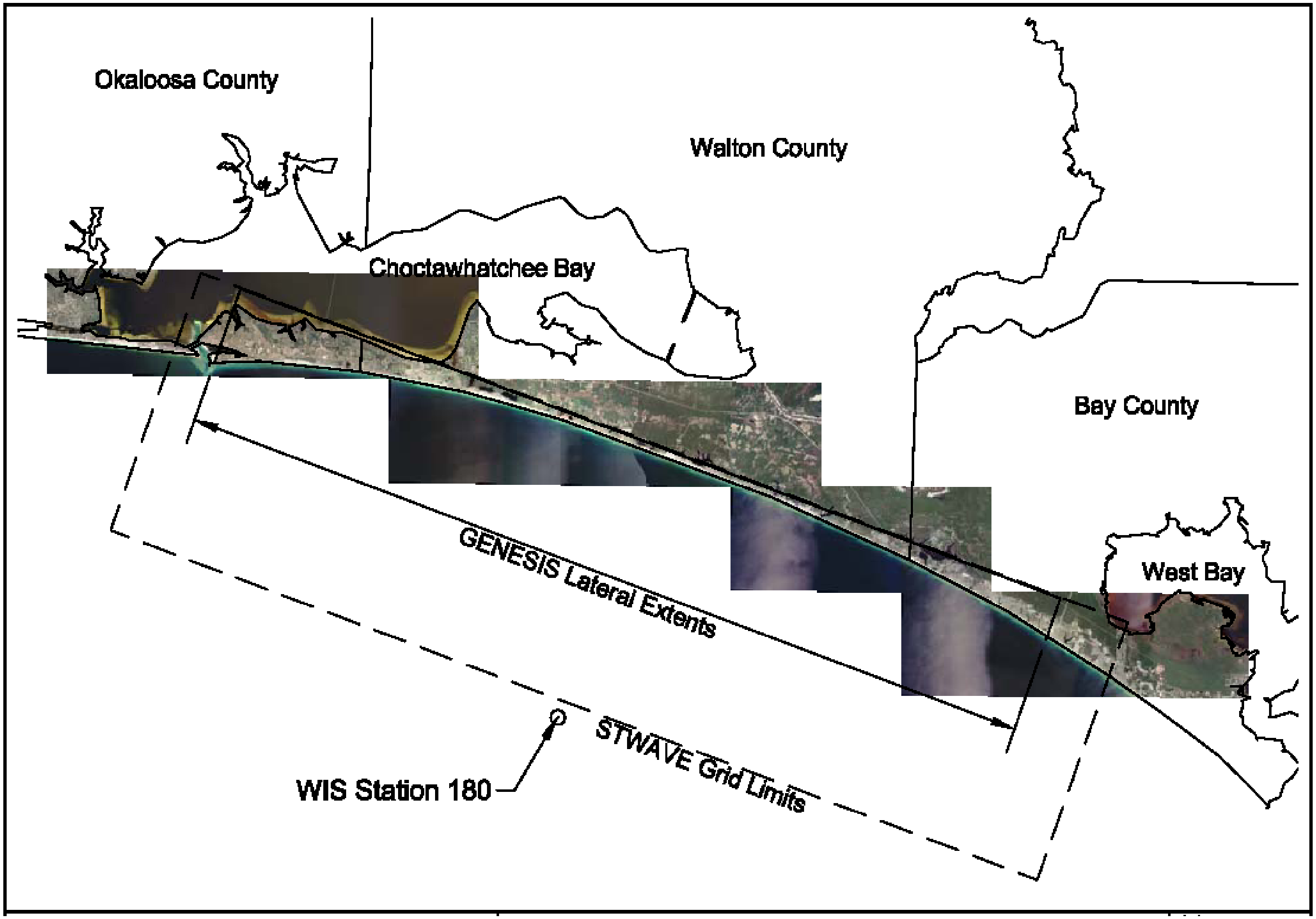

Figure A-1-32. GENESIS and STWAVE Modeling Domains

Site-Specific Model Parameters. Review of beach profile and sediment characteristic data from Walton County (Taylor Engineering, 2003) formed the basis for selecting some of the site-specific model parameters. Selected model parameters, which characterize the Walton County domain, include a median sand grain size, D_{50}, of 0.30 mm, a berm height of 5.0 feet-MHW, and a depth of closure of -30.0 feet-MHW. Notably, the selected values represent average conditions for Walton County, as GENESIS requires a single value of grain size, berm height, and depth of closure to characterize the entire domain. The GENESIS model grid (containing 1336 grid cells, each 150 feet wide) extends from R-34 in Bay County, Florida westward to East Pass (R-17) in Okaloosa County, Florida. The eastern extent of the model grid features a pinned boundary condition. The western extent of the model grid features an open boundary condition with the eastern jetty set to 10 percent permeability. Transport coefficients K_1 and K_2 represent the tuning parameters. Hanson and Kraus (1989) indicate K_2 typically falls between 0.5 to 1.0 times the value of K_1. Transport parameters of K_1 = 0.2 and K_2 = 0.1 served as initial values.

Model Results. An extensive and iterative calibration and verification process optimized the transport coefficients K_1 and K_2 within the Walton County extents (R-1 to R-127). The calibration process compared the GENESIS longshore transport to values from the published sediment budget. Comparing the GENESIS estimated shoreline positions to historical data for the calibration period provided a secondary consideration. Initial modeling was unable to match the published longshore transport values or capture the historical shoreline trends. The initial modeling varied the transport coefficients K_1 and K_2, berm height, depth of closure, lateral boundary conditions, grain size, and the influence of the external wave model in an attempt to match the regional behavior.

After numerous iterations, applying a regional contour trend within GENESIS attempted to match the sediment budget values of longshore transport. In the absence of any obstructing elements, a one-line model (such as GENESIS) will evolve toward a straight line given enough time. Adding a regional contour trend in GENESIS reflects the effect of features and processes that the model does not otherwise represent. The concave curvature of the existing Walton County shoreline required inserting the regional contour, which matches the persistent, regional shape.

Table A-1-17 presents the GENESIS longshore transport estimates with K_1 = 0.13 and K_2 = 0.1 including a regional contour trend for the calibration period July 1984 to July 1995. The two transport coefficient values and the particular regional contour trend produced the best comparison with the data from the sediment budget and measured shoreline data. The longshore transport coefficients and regional contour trend were chosen after much iteration based on the longshore transport and shoreline position errors, with more consideration given to the longshore transport values. Table A-1-18 lists the published longshore transport by reach for comparison and the difference between the sediment budget and GENESIS values. The GENESIS predicted longshore transport values agree well with the data from the sediment budget for each of the 10 longshore reaches that comprise Walton County.

Table A-1-18. Genesis Longshore Transport Results With Regional Contour

		GENESIS	Data from	Absolute Difference
Reach	Monuments	Average by Reach	Sed Budget	Measure-Sed Budget
		[m^3*1000]	[m^3*1000]	Change (m^3*1000)
1	R-1 to R-19	37.9	35.2	2.7
2	R-19 to R-23	40.0	36.7	3.3
3	R-23 to R-41	47.5	44.4	3.1
4	R-41 to R-48	47.5	45.9	1.6
5	R-48 to R-55	45.1	43.6	1.5
6	R-55 to R-64	44.1	39.8	4.4
7	R-64 to R-80	43.6	40.5	3.0
8	R-80 to R-98	45.4	43.6	1.8
9	R-98 to R-109	49.3	45.9	3.4
10	R-109 to R-127	51.9	48.2	3.7
Average of 10 Reaches		45.2	42.4	

The GENESIS model produces an average absolute shoreline error of 20.5 feet for the calibration period. Figure A-1-33 shows the measured shoreline change during the calibration period versus the shoreline change predicted by GENESIS. The GENESIS predicted final shoreline position follows several of the shoreline advance/retreat trends in the longshore direction; however, the magnitude of the GENESIS shoreline changes indicates less shoreline advance, or even retreat. Overall, shoreline measurements for the calibration period indicate an average 1.8 ft/yr accretion for Walton County. The GENESIS predictions indicate an average 0.55 ft/yr accretion, indicating significantly less shoreline advance during the calibration period. Historical data and local storm history suggest that a significant portion of the measured shoreline advancement may result from cross-shore sediment movement, a process GENESIS does not model. Significant variation in the measured and modeled shoreline positions required the application of a 30-point smoothing filter (twice) for the measured and final calculated shoreline positions; this procedure, commonly performed on shoreline position data, removes shoreline variation or noise in the longshore direction.

Judging the GENESIS model and parameters applied to develop Table A-1-18 and Figure A-1-33 as acceptable, after thorough comparison with historical data, the published sediment budget for Walton County, and other modeling iterations, the model was employed for the verification stage.

The model verification period spanned from March 1996 to March 1998. Applying the site-specific parameters developed in the calibration phase (K_1 = 0.13, K_2 = 0.1, and regional contour) to the verification period provides additional confirmation of the modeling capability of the GENESIS model. Table A-1-19 presents the GENESIS longshore transport estimates for the verification period. The table lists the published longshore transport by reach for comparison and the difference between the sediment budget and modeled values. The GENESIS predicted longshore transport values compare reasonably well with the data from the sediment budget, similar to the calibration results, for each of the 10 longshore reaches. On average, a slight over estimation of the longshore transport exists for this period.

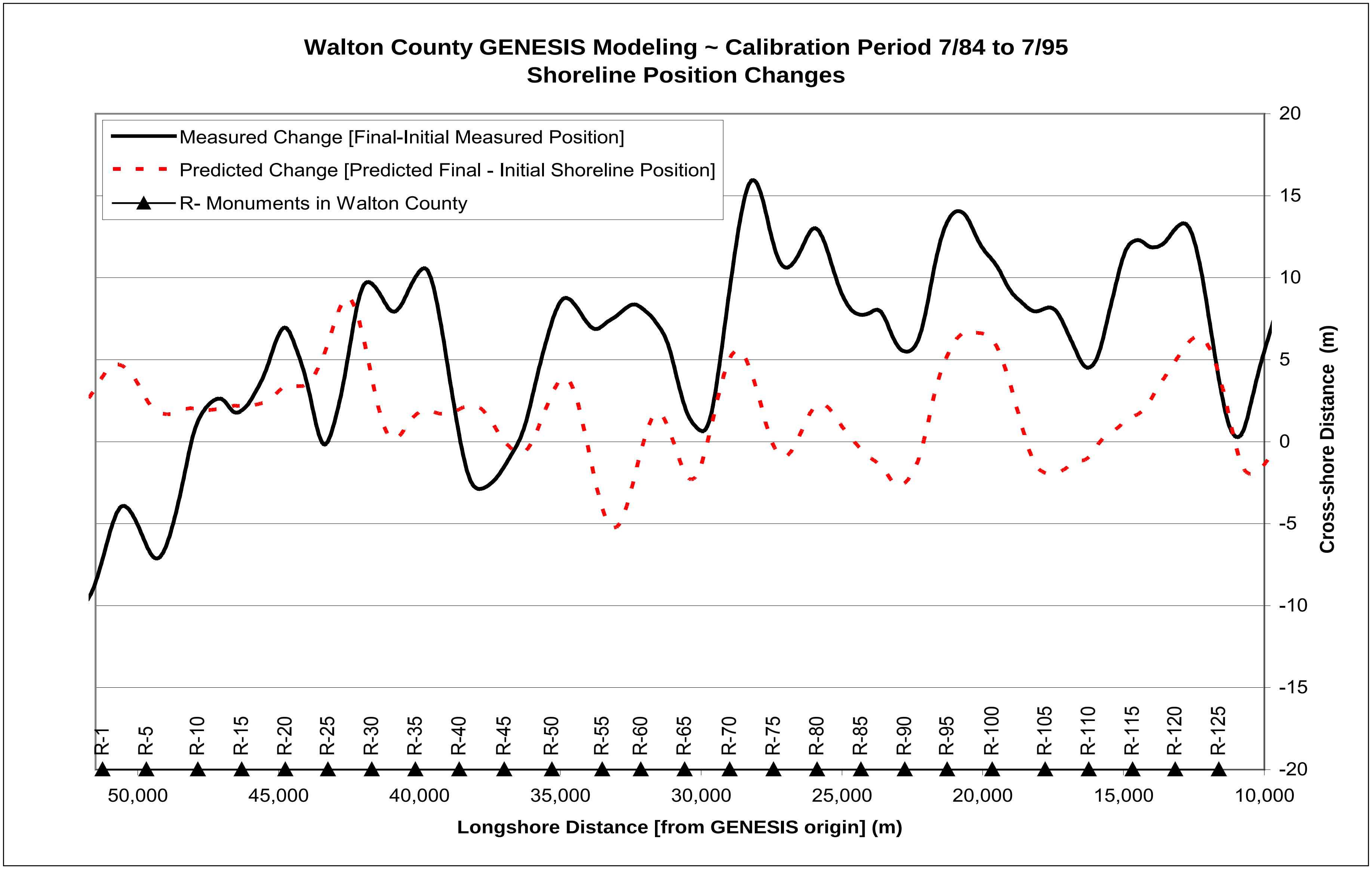

Figure A-1-33. MEASURED vs. GENESIS Predicted Shoreline Change: Calibration Period (7/84 TO 7/95) With K_1=0.13, K_2=0.1

Table A-1-19. Genesis Longshore Transport Results With Regional Contour (K_1=0.13, K_2=0.1) For Verification Period (March 1996 To March 1998)

Reach	Monuments	GENESIS Average by Reach (m^3*1000)	Data From Sediment Budget (m^3*1000)	Absolute Difference Measure Sediment Budget Change (m^3*1000)
1	R-1 to R-19	35.5	35.2	0.3
2	R-19 to R-23	35.3	36.7	1.4
3	R-23 to R-41	46.2	44.4	1.9
4	R-41 to R-48	46.3	45.9	0.4
5	R-48 to R-55	44.3	43.6	0.7
6	R-55 to R-64	41.1	39.8	1.3
7	R-64 to R-80	41.5	40.5	0.9
8	R-80 to R-98	43.1	43.6	0.5
9	R-98 to R-109	48.6	45.9	2.7
10	R-109 to R-127	50.8	48.2	2.6
Average of 10 Reaches		43.3	42.4	

The GENESIS model produces an average absolute shoreline error of 15.5 feet for the verification period. Figure A-1-34 shows the measured shoreline change during the verification period versus the shoreline change GENESIS predicted. The predicted final shoreline position matches many of the shoreline advance/retreat trends in the longshore direction. The most significant deviations in the predicted versus measured values occur in the western portion of Walton County (R-100 to R-127) with the GENESIS model predicting more erosion than measured.

Overall, shoreline measurements for the verification period indicate an average 2.4 ft/yr of shoreline change for Walton County. The GENESIS predictions indicate accretion with an average advance of 2.3 ft/yr. As in the calibration period results, application of a 30-point smoothing filter removed shoreline position noise in the longshore direction. The verification modeling was deemed satisfactory based on the reasonable agreement between the predicted longshore transport values and the sediment budget values, and combined with the fair agreement of the shoreline positions.

GENESIS Modeling. The calibrated and verified GENESIS model allows prediction of future without project conditions and future with project conditions in the Walton County project area. Shoreline modeling in the absence of any beach project in the study area allows estimation of the future shoreline positions: future without project conditions. Insertion of MHW shoreline extensions to represent the planform of a beach fill allows simulation of future with-project conditions in GENSIS. A May 2004 USACE CHARTS survey supplied the shoreline data applied as the initial condition. The CHARTS survey has the benefit of encompassing the entire GENESIS domain (all of Walton County and parts of Bay and Okaloosa counties) in a single survey.

Representative Wave Conditions. The calibrated and verified GENESIS model for Walton County simulated representative wave forcing within the project domain. Applying the entire 20-year WIS record (1980 to 1999) as the offshore wave forcing established a year with average wave conditions. This analysis provides longshore transport (net, gross, left, and right) predictions for each year in the wave record. Comparing the resulting longshore transport predictions within each reach to the values from the sediment budget allows the selection of the most representative wave-year. Table A-1-20 presents the net longshore transport estimates within each reach for each year from 1980 to 1999. The last column lists the values from the sediment budget for comparison. Comparison of the yearly average values within each reach, as well as the gradients between reaches, indicates that the wave-year from January 1, 1993 to December 31, 1993 most closely matches the values from the sediment budget. Thus, the predictive GENESIS models repeat the wave conditions from January 1, 1993 to December 31, 1993 for the length of the predictive run.

Future Without Project Shoreline Position. Figure A-1-35 presents the predicted shoreline change following five years of representative wave conditions. The results indicate significant scatter in the shoreline positions, even with a 30-point moving filter applied. The average shoreline change within the project area measures 0.51 ft/yr indicating slight accretion; however; this average value masks the prevalence of the shoreline fluctuations that generally fall within +/- 6.56 ft/yr.

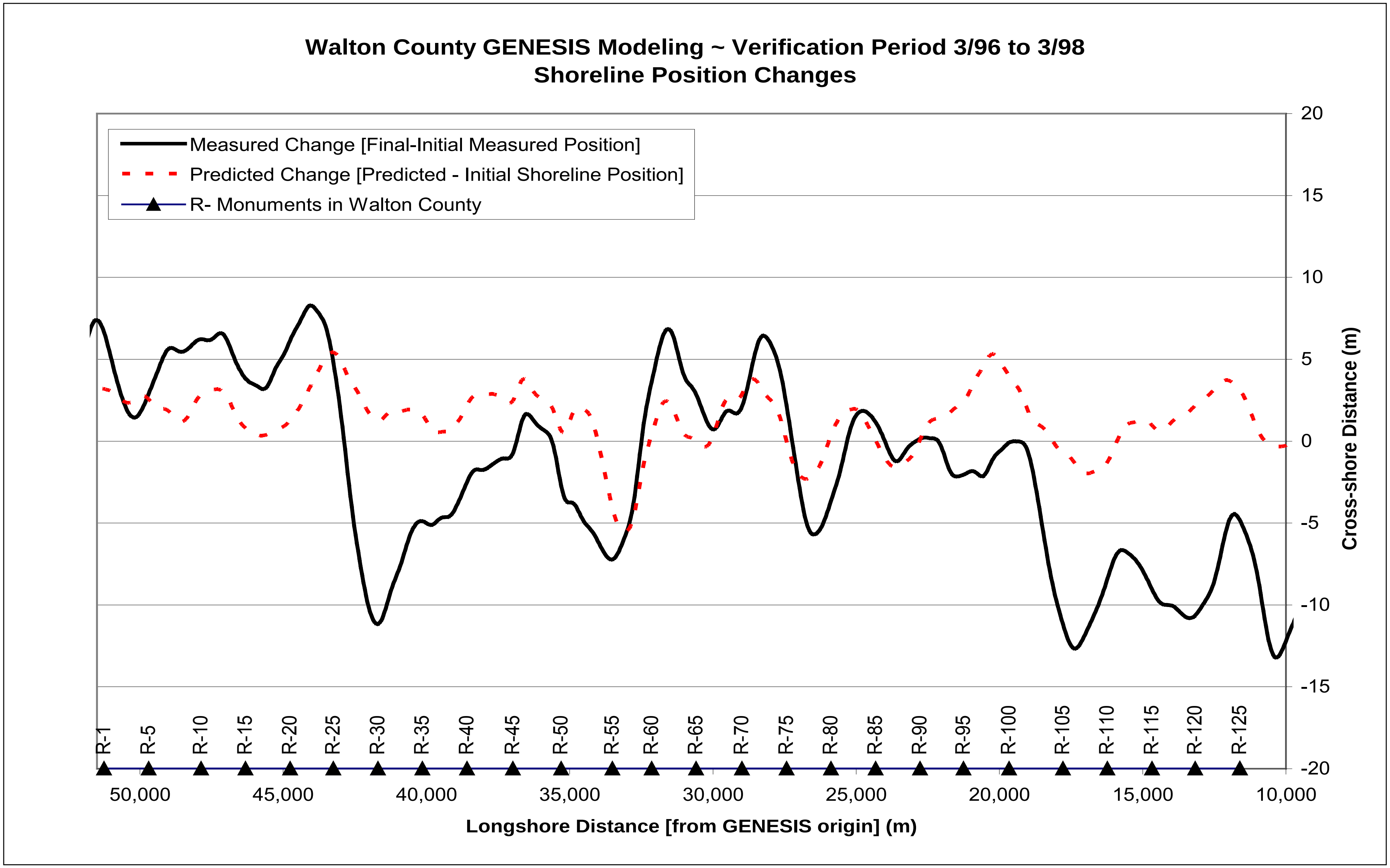

Figure A-1-34. MEASURED vs. GENESIS Predicted Shoreline Change: Verification Period (3/96 To 3/98) With K_1=0.13, K_2=0.1

Table A-1-20. GENESIS Longshore Transport Estimates For Representative Wave-Year Analysis

	Reprentative Wave-Year Analysis ~ Longshore Transport Average by Reach																				
NET TRANSPORT	[m^3*1000]																				**Data from**
end date (annual)	**80_1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Sed Budget**
																					[m^3*1000]
R-1 to R-19	33	47	82	104	34	79	32	29	49	17	35	35	22	38	39	58	45	22	76	47	35
R-19 to R-23	35	49	83	106	35	84	34	30	51	20	35	38	23	39	41	61	47	24	82	49	37
R-23 to R-41	43	58	90	118	41	99	40	35	59	28	39	46	29	46	50	71	55	32	96	55	44
R-41 to R-48	43	59	91	118	41	96	41	35	60	29	39	46	29	45	49	70	56	32	91	55	46
R-48 to R-55	41	55	88	113	39	92	39	32	57	28	38	44	27	43	46	68	53	30	88	52	44
R-55 to R-64	39	55	89	114	38	89	38	32	56	26	37	42	26	42	45	67	52	28	87	53	40
R-64 to R-80	38	54	87	111	38	90	38	31	56	26	37	42	26	41	46	66	51	28	87	52	41
R-80 to R-98	41	56	87	113	39	94	39	32	57	28	37	44	27	43	48	68	53	30	89	53	44
R-98 to R-109	45	61	91	121	43	101	43	35	62	33	39	48	30	46	52	73	58	35	95	56	46
R-109 to R-127	47	64	94	125	44	108	44	36	64	35	40	50	32	48	56	77	61	36	103	59	48
average	41	56	88	114	39	93	39	33	57	27	38	44	27	43	47	68	53	29	89	53	42

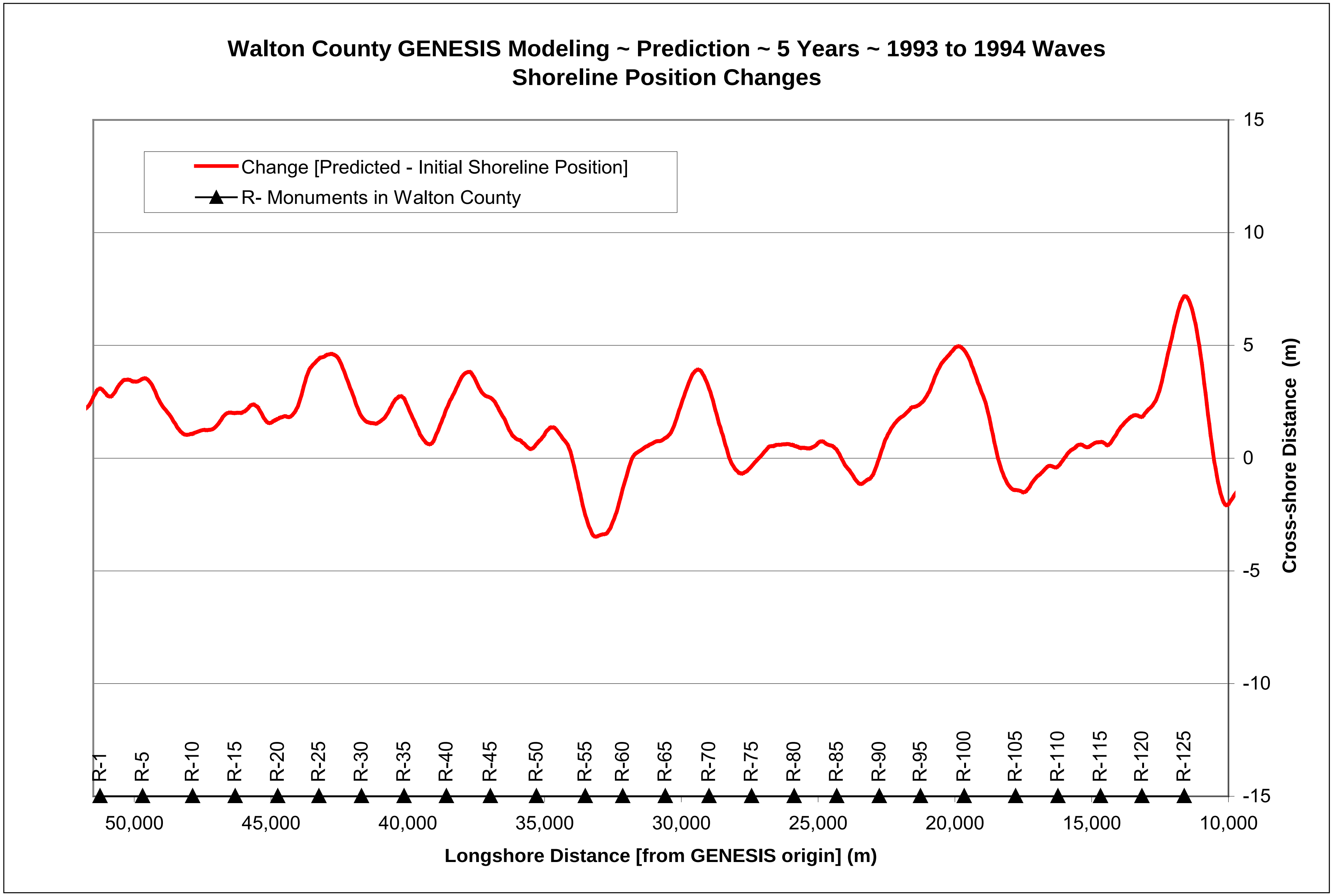

Figure A-1-35. GENESIS Predicted Shoreline Change For Future Without Project Modeling

The formulation of GENESIS, being a longshore transport model, does not include the significance of cross-shore sediment transport due to tropical or extra-tropical storms. The large waves generated by these storms would initiate shoreline changes in GENESIS; however, these changes would result from gradients in the longshore transport and not from the cross-shore sediment transport processes known to play a significant role in the storm-induced shoreline changes. Recent history has shown the considerable role of storms on shoreline change in Walton County. Therefore, to estimate the future without project shoreline conditions, one should apply a method that more completely includes the effects of tropical and extra-tropical storms.

Future Without Project Shoreline Data Assessment. Viewing historical shoreline position data provides another analytic tool to estimate future conditions based on historical data that include the effects of prior storms and the natural response that follows. Examining historical shoreline position data generally indicates dry beach behavior. The existence and availability of shoreline data, as compared to less prevalent but more useful beach profile data, makes examination of beach changes over many time periods useful.

Taylor Engineering (2003) provides MHW shoreline changes, calculated with linear regression, for four periods: the pre-Hurricane Opal intermediate-term (1973 - 1995), the post-Hurricane Opal short-term (1995 - 1998), the intermediate-term (1973 - 1998), and the long-term (1872 - 1998) periods. MHW for Walton County lies at +0.63 feet NAVD88 (+1.1 feet NGVD). Briefly, the pre-Hurricane Opal intermediate-term indicates slight accretion for almost all of Walton County with the majority of the accretion from 1985 to 1995, a period of recovery with few storms. The post-Hurricane Opal short-term period indicates significant erosion for all of Walton County following the major storm.

Including the most recent shoreline position data for Walton County from May 2004 and November 2004 allows assessment of the impact of Hurricane Ivan on shoreline conditions in Walton County. Applying a linear regression analysis of the shoreline position data for time periods including the 2004 data indicates the shoreline behavior over time with different forcing (storm histories) to discern trends caused by storms and periods of recovery characterized by minor storm activity. Table A-1-21 lists the six time periods evaluated with a linear regression analysis in this study: October 1973 to May 1995, October 1973 to May 2004, October 1973 to November 2004, May 1995 to May 2004, May 1995 to November 2004, and May 2004 to November 2004. Shoreline advancement and relatively small storm impacts generally characterize the October 1973 to May 1995 period. The May 1995 to May 2004 period contains the impacts of Hurricanes Opal and Georges and recovery. The May 2004 to November 2004 period contains the effects of Hurricane Ivan. Attachment III presents the shoreline change values for each FDEP monument in Walton County and each period from the regression analysis.

Table A-1-21. Periods Evaluated with Linear Regression Analysis of Shoreline Data

Period	1973 October		1995 May		2004 May		2004 November
1	←	—	→				
2	←	—	→				
3			←	—	→		
4			←	—	→		
5					←	—	→
6					←	—	→

Applying an averaging approach developed the future without project shoreline change rates. The shoreline behavior in Walton County made this averaging necessary for several reasons. First, periodic hurricane events cause significant shoreline erosion through mainly cross-shore sediment transport, which leaves the developed shoreline vulnerable to subsequent storms. Given enough time, cross-shore and longshore transport processes can result in shoreline recovery following large-scale erosion. The averaging procedure represents an attempt to include periods of storm activity (October 1973 to November 2004, May 1995 to May 2004) and periods of recovery (October 1973 to May 1995) to illustrate how Walton County's beaches function during different time periods.

Averaging with a moving five-point average of the shoreline positions (applied twice) removed much of the longshore variability in the shoreline position found in the Walton County data. The five-point moving average covers a longshore distance of approximately 5,000 feet as the shoreline measurements occur approximately every 1000 feet or every FDEP monument. For comparison, the 30-point filter applied in the GENESIS modeling covers 4,500 feet with a grid spacing of 150 feet. As stated, the extreme variation or noise in the shoreline positions may result from longshore bars welding to the shoreline. Having filtered the data in the longshore direction and across several periods, the future without project conditions represents realistic estimates of future shoreline trends with behavior suitable for subsequent numerical modeling.

Figure A-1-36 presents the future without project shoreline change rates. These rates contain the longshore (five-point filter) and time period interval averaging. The shoreline change rates fall generally within +/- 1 ft/yr. The figure also includes the 1973 to 2004 November regression analysis results to demonstrate the significant longshore variability in the data. The dashed line reveals the effect of including the five-point filters. Averaging the October 1973 to November 2004, October 1973 to May 1995, and 1995 May to 2004 May period regression values results in the interval average value. Based on many iterations and simulations, this interval average value presents a realistic future without project shoreline change trend. The interval average values indicate similar shoreline change rate magnitudes when compared to a FDEP analysis that lists rates of +/- 0.5 ft/yr from 1872 to 1997/98 and to Absalosen, L. and Dean, R.G. (2010) to +/- 0.4 to +/-0.8 ft/yr for time periods between 1872, 1970 and 2007 for all locations in Walton County.

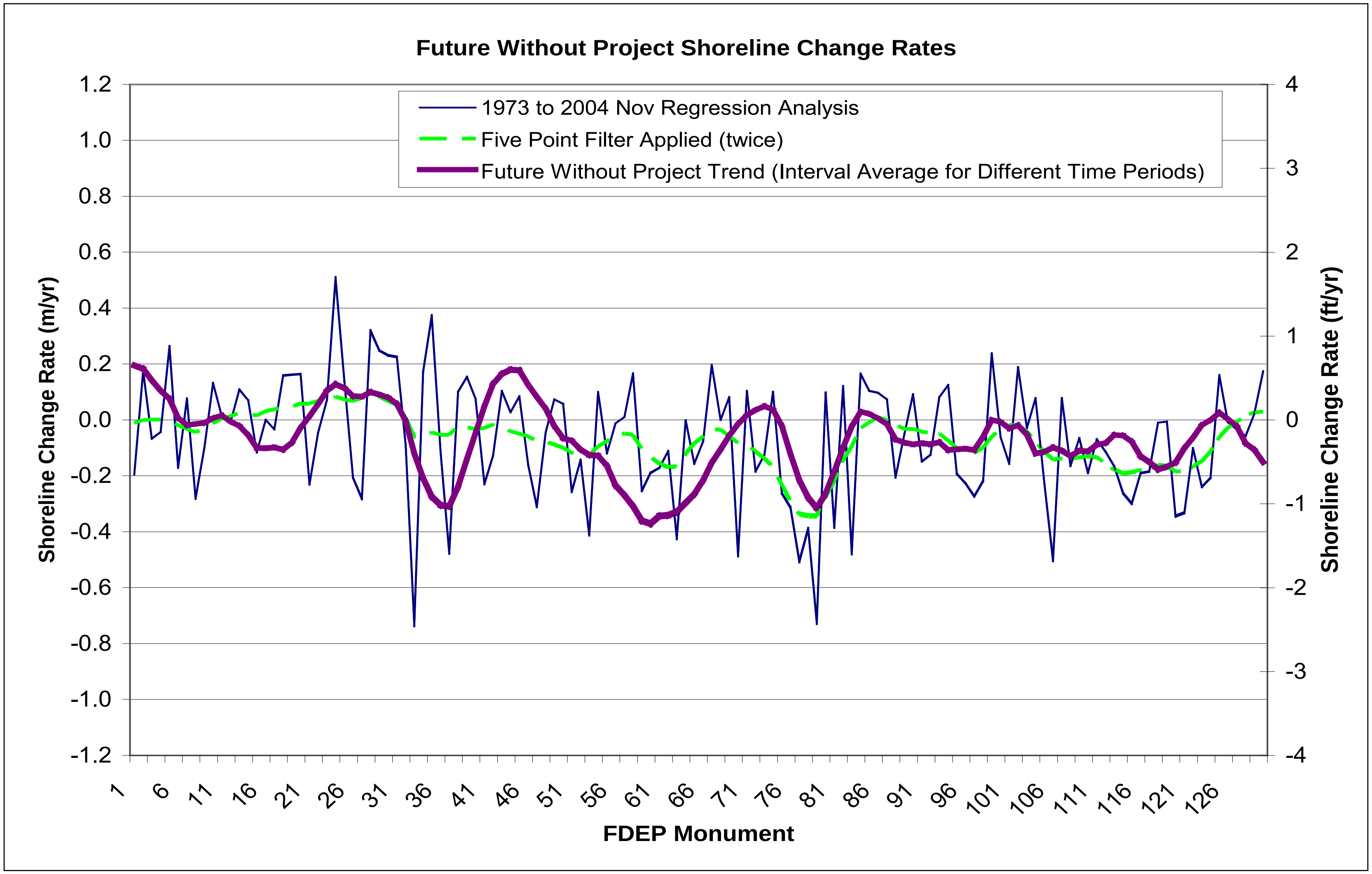

Figure A-1-36. Future Without Project Shoreline Change Rates From Measured Data

Future With-Project Shoreline Position. The USACE, Mobile District provided the proposed beach fill planforms to evaluate in GENESIS: the National Economic Development (NED) Plan and the locally preferred plan (LPP). Table A-1-22 presents details of the plans and indicates five proposed main construction reaches in the Walton County project area. The two plans allow evaluation of different beach fill configurations within the five main construction reaches. With the exception of Construction Reach 1, the LPP matches the NED plan. All construction reaches apply a 25 feet (7.62 meters) berm width extension and 25 feet (7.62 meters) of advance nourishment. With the exception of transition areas, the GENESIS model applies a continuous MHW extension between R-monuments. The GENESIS simulations apply a 450-foot (137.2 m) transition at the ends of each beach fill segment.

Application of the representative wave conditions allowed evaluation of the design beach planform response at five-year intervals. The five-year interval represents the renourishment cycle of the federal Panama City Beach Shore Protection Project in Bay County, Florida, immediately east of Walton County. The with-project analysis simulated nine five-year intervals in GENESIS to evaluate beach planform spreading over a 54-year period of analysis. The design beach fill template, including advance nourishment, provided the initial shoreline position at the start of the analysis. The initial shoreline position for each subsequent five-year analysis combined the design beach fill template including advance nourishment with the final shoreline position of the preceding five-year interval. This procedure "renourishes" the design template and accounts for the shoreline accretion areas outside of the project caused by longshore spreading of the beach fill. As the beach fill evolves with time, the initial shoreline near the project transitions (and outside the construction reach) includes greater amounts of material lost from the design planform.

Figure A-1-37 presents the GENESIS predicted shoreline position relative to the without-project shoreline position for the NED plan. To demonstrate the modeling procedure, Figure A-1-37 only presents results for the first two five-year simulations - labeled as 5 Year and 10 Year shorelines. The results demonstrate the lateral spreading (diffusion) that occurs near the beach fill transitions. As the project evolves, areas outside of the design beach fill template receive sediment from the lateral spreading. For narrow reaches between beach fills, such as R-99 or R-105, the lateral spreading quickly causes the shoreline to advance almost 16 feet (5 meters).

Figure A-1-38 presents the GENESIS predicted shoreline positions for each of the nine five-year simulations for the NED plan. The results demonstrate the lateral spreading (diffusion) that occurs near the beach fill transitions. As the project evolves, areas outside of the design beach fill template receive sediment from the lateral spreading and several areas (in-between nourished segments) have shorelines that advance over 16 feet (5 meters) due to the lateral spreading of beach fill material.

Table A-1-22. Proposed Beach Fill Planforms for NED Plan and LPP

FDEP Monument	Rep. Profile	Const. Reach	Exist Dune Width (feet)	Exist Berm Width (feet)	NED Dune Width (feet)	NED Berm Width (feet)	Scenario 6 NED Alt 1rev	LPP Dune Width (feet)	LPP Berm Width (feet)	Scenario 8 Local Preferred
										transition
R-1	R1P1							65	50	fill
R-2 to R-6	R1P1							65	50	fill
R-7	R1P1							65	50	fill
R-8	R1P1						transition	65	50	fill
R-9	R1P1	CR1	55	20	65	50	fill	65	50	fill
R-10 to R-13	R1P1	CR1	varies	varies	65	50	fill	varies	50	fill
R-14	R1P2	CR1	100	40	130	50	fill	130	50	fill
R-15	R1P2						transition	130	50	fill
R-16	R1P2							130	50	fill
R-17 to R-21	R1P2							varies	50	fill
R-22	R1P1							65	50	fill
R-23	R2P1									transition
R-41	R3P1						transition			transition
R-42	R3P1	CR2	75	50	85	50	fill	85	50	fill
R-43 to R-46	R3P1	CR2	varies	50		50	fill	varies	50	fill
R-47	R3P2	CR2	45	50	55	50	fill	55	50	fill
R-48	R3P1	CR2	75	50	85	50	fill	85	50	fill
R-49 to R-62	R3P1	CR2	75	50	105	50	fill	105	50	fill
R-63	R3P1	CR2	75	50	105	50	fill	105	50	fill
R-64	R3P2						transition			transition
R-66	R4P1						transition			transition
R-67	R4P1	CR3	50	35	60	50	fill	60	50	fill
R-68 to R-71	R4P1	CR3	varies	varies	varies	50	fill	varies	50	fill
R-72	R4P2	CR3	85	110	95	50	fill	95	50	fill
R-73	R4P2						transition			transition
R-77	R4P1						transition			transition
R-78	R5P2	CR4	65	52	75	50	fill	75	50	fill
R-79 to R-97	R5P2	CR4	varies	varies	varies	50	fill	varies	50	fill
R-98	R5P2	CR4	65	52	75	50	fill	75	50	fill
R-99	R5P3						transition			transition
R-105	R5P2						transition			transition
R-106	R5P2	CR5	65	52	75	50	fill	75	50	fill
R-107 to R-126	R5P2	CR5	varies	varies	varies	50	fill	varies	50	fill
R-127	R5P3	CR5	50	65	60	50	fill	60	50	fill
							transition			transition

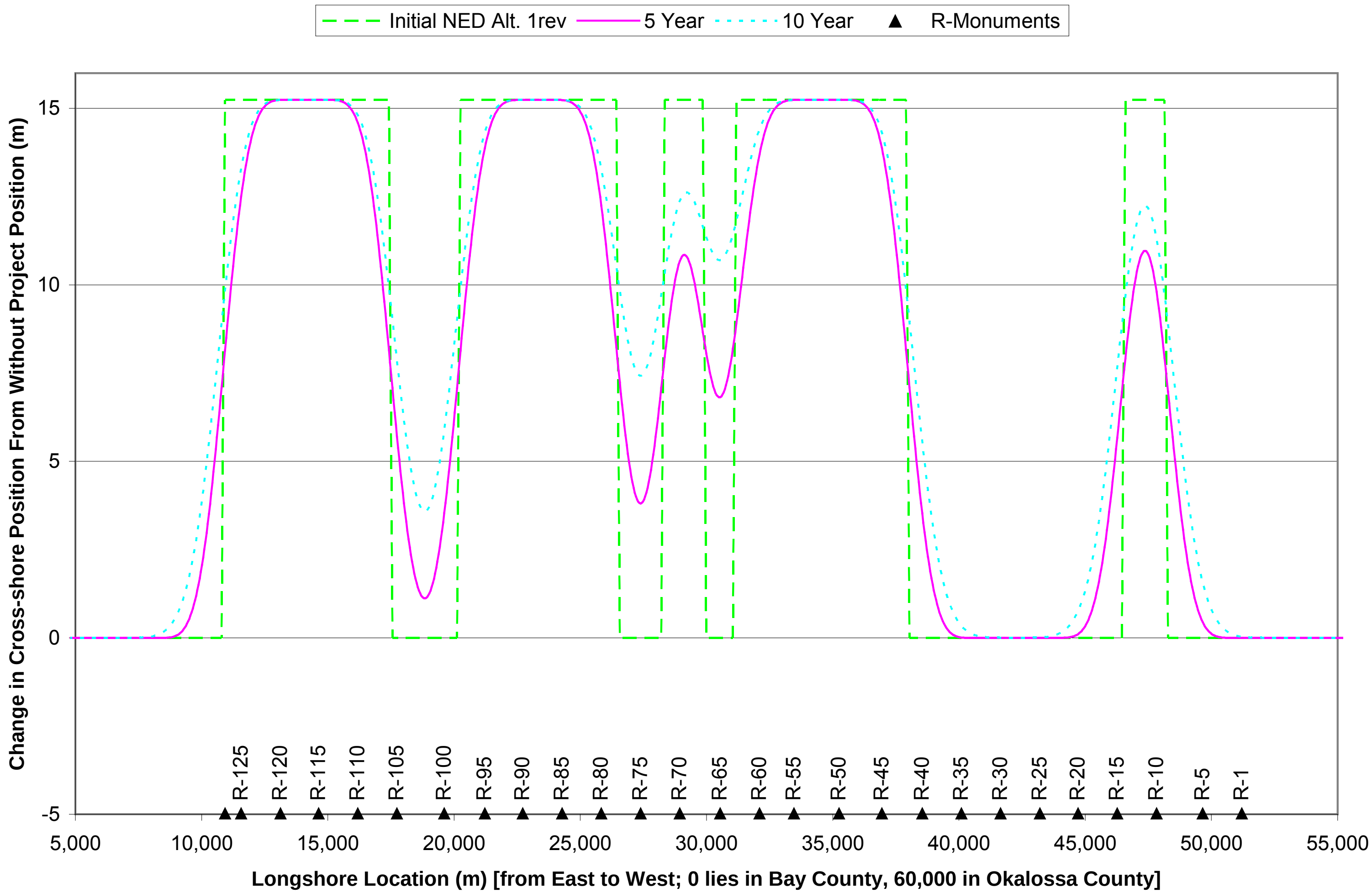

Figure A-1-37. GENESIS Predicted Shoreline Positions for Future With-Project Modeling - NED Plan

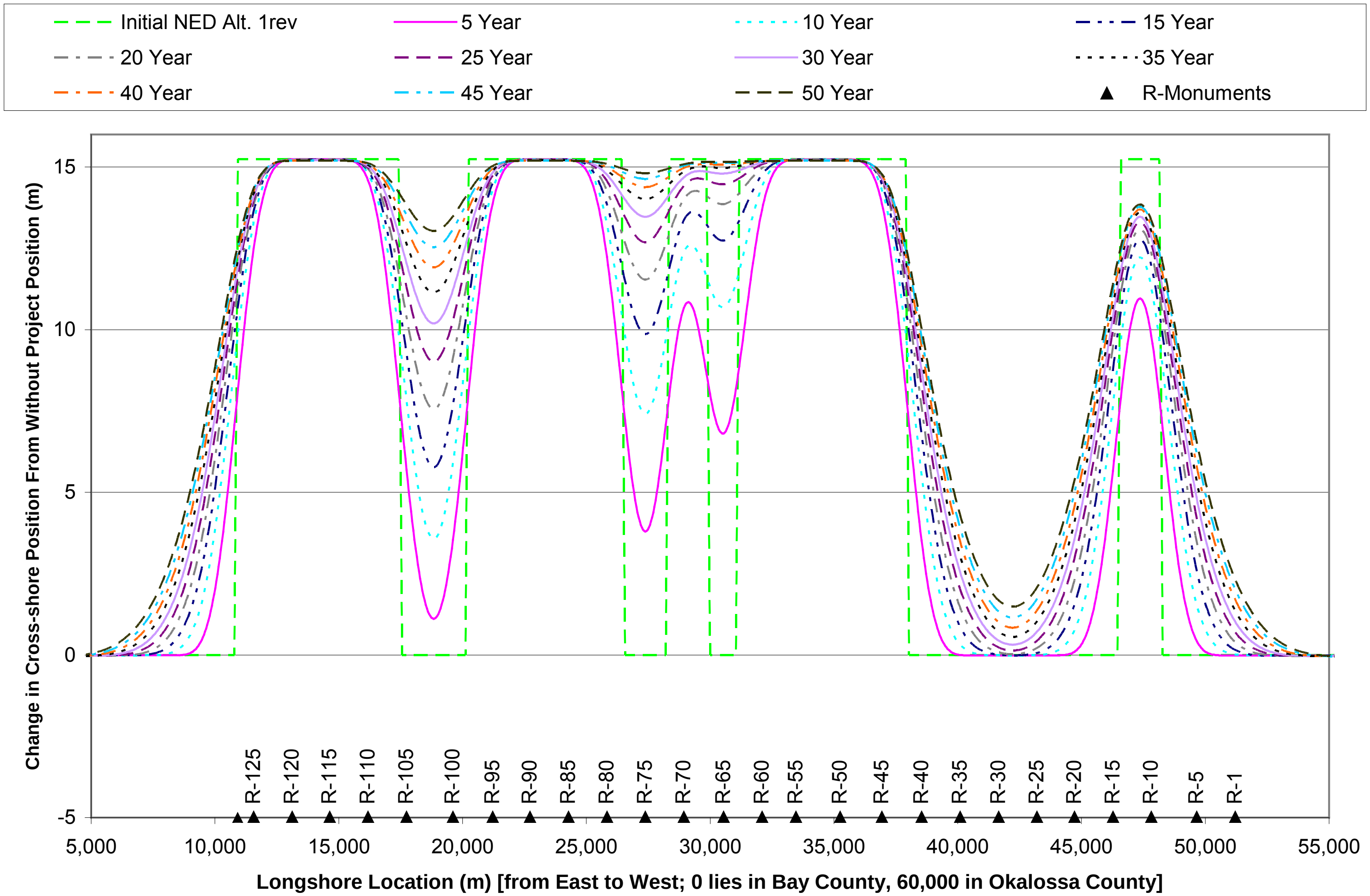

Figure A-1-38. GENESIS Predicted Shoreline Positions - Future With-Project Modeling NED Plan

Figure A-1-39 presents the predicted shoreline change (m/yr) for each of the nine simulations of five-year project evolution for the NED plan. The shoreline change compares the without-project evolution and the with-project for each five-year simulation. The figure clearly indicates that in comparison to the without-project simulations, the erosion occurs only near the transitions at the end of the beach fill segment. The plot also indicates that erosion decreases with each successive renourishment. The shoreline change rates diminish rapidly after the second renourishment with shoreline change rates generally less than 1.5 feet/year (0.5 meters/year) near the transitions. The location of the erosion and the diminishing erosion rates with time follow standard coastal engineering theory and observations of constructed projects.

Figure A-1-40 presents the GENESIS predicted shoreline positions for each of the nine five-year simulations for the LPP. With the exception of a longer beach fill in Construction Reach 1, the LPP features the same planform as the NED Plan. The results demonstrate the lateral spreading (diffusion) that occurs near the beach fill transitions. Similar to Figure A-1-35 for the NED plan, as the project evolves, areas outside of the design beach fill template receive sediment from the lateral spreading and several areas (in-between nourished segments) have shorelines that advance over 5 feet (1.5 meters).

Figure A-1-41 presents the predicted shoreline change (meters/year) for each of the nine simulations of five-year project evolution for the LPP. The shoreline change compares the without-project evolution with the with-project for each five-year simulation. The figure clearly indicates that erosion occurs only near the transitions at the end of beach fill segment and that erosion decreases with each successive renourishment.

The GENESIS results allow estimation of the volume of material required to renourish the design template after each five-year simulation. The GENESIS results provide the cross-shore and longshore extents of material required. Application of berm height and depth of closure values (assigned in the GENESIS model) provides the vertical extent for the renourishment volume calculation. The GENESIS model applies a combined berm height and depth of closure value equal to 34.4 feet (10.5 meters). For the NED Plan and LPP, Figure A-1-42 plots the percentage of the renourishment volume to the initial placement volume for each of nine simulations of five-year project evolution. Overall, because of the longer beach fill in Construction Reach 1, the LPP has the smallest percentage of the renourishment to initial volume (and the highest initial and renourishment volume requirement).

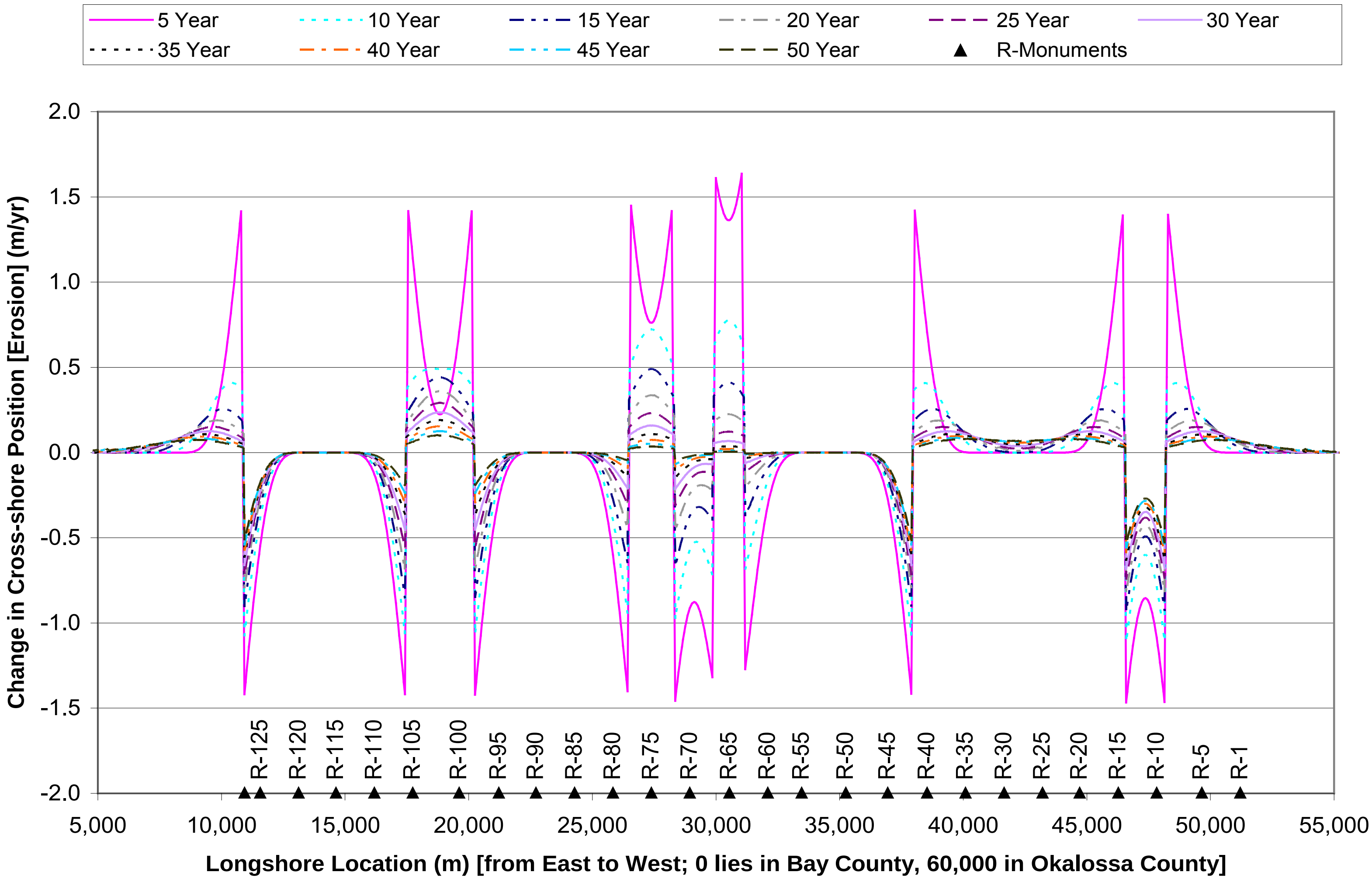

Figure A-1-39. GENESIS Predicted Shoreline Position Changes - Future With-Project NED Plan

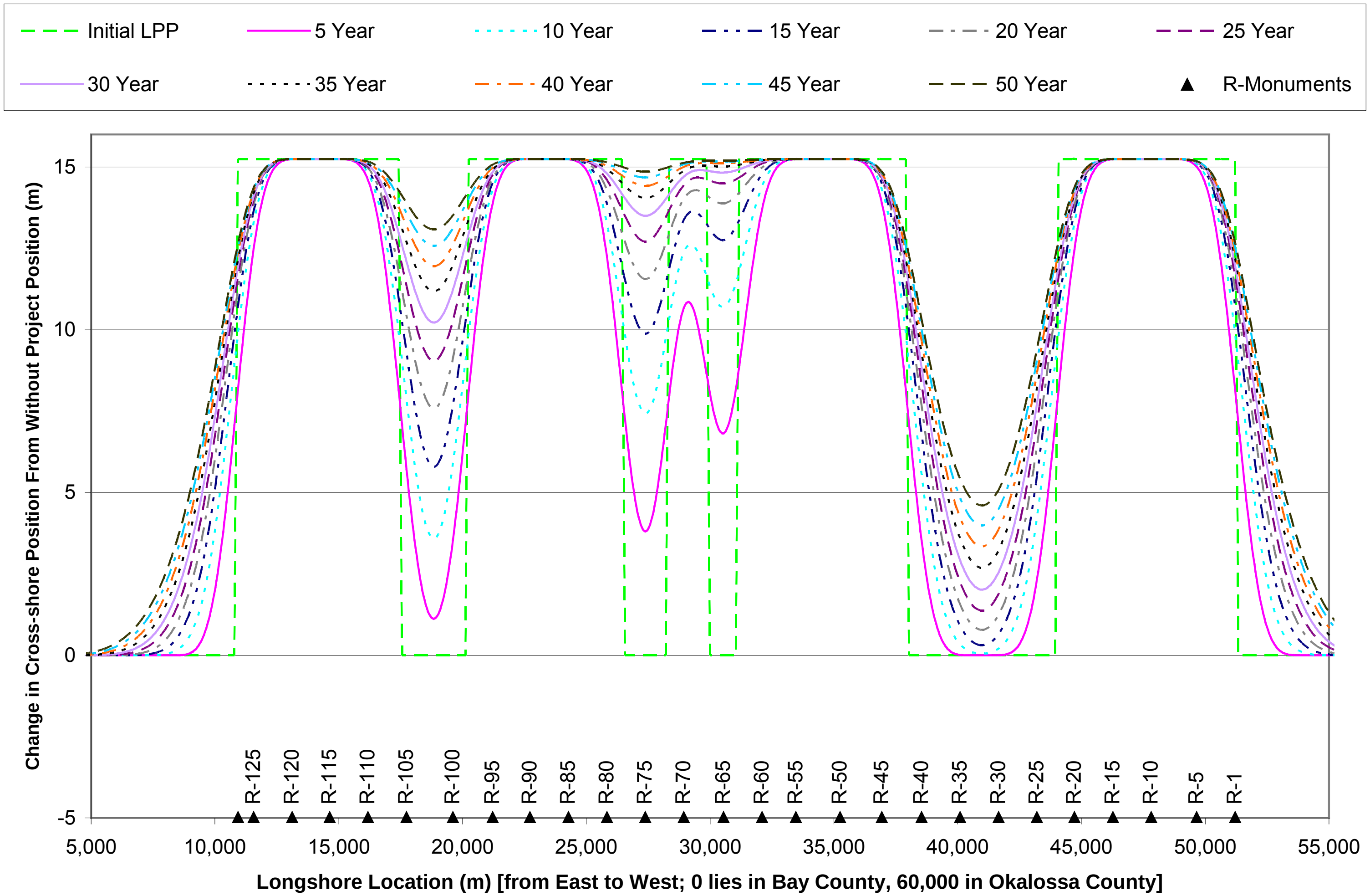

Figure A-1-40. GENESIS Predicted Shoreline Positions - Future With-Project Modeling LPP

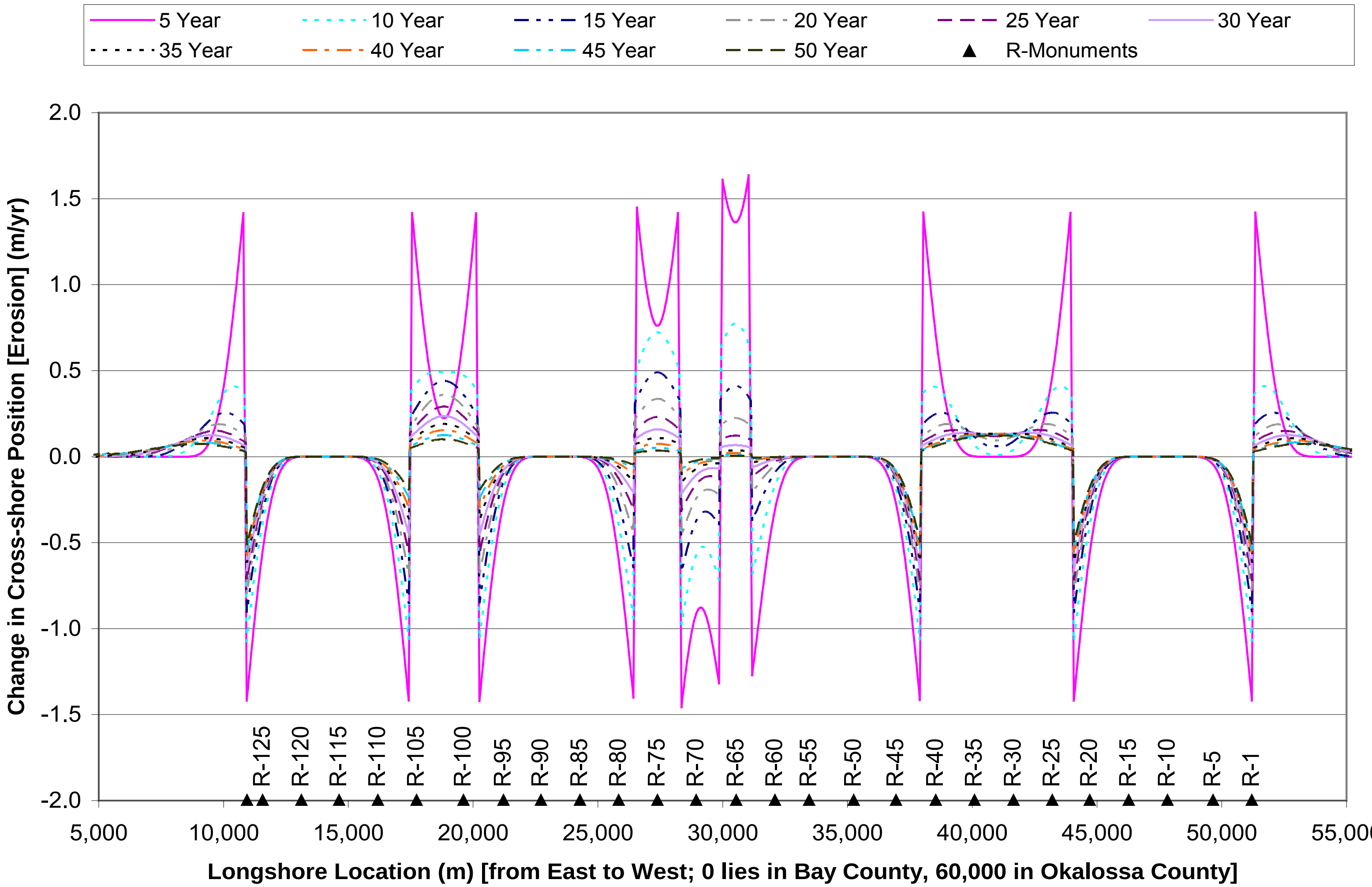

Figure A-1-41. GENESIS Predicted Changes in Shoreline Position - Future With-Project Modeling LPP

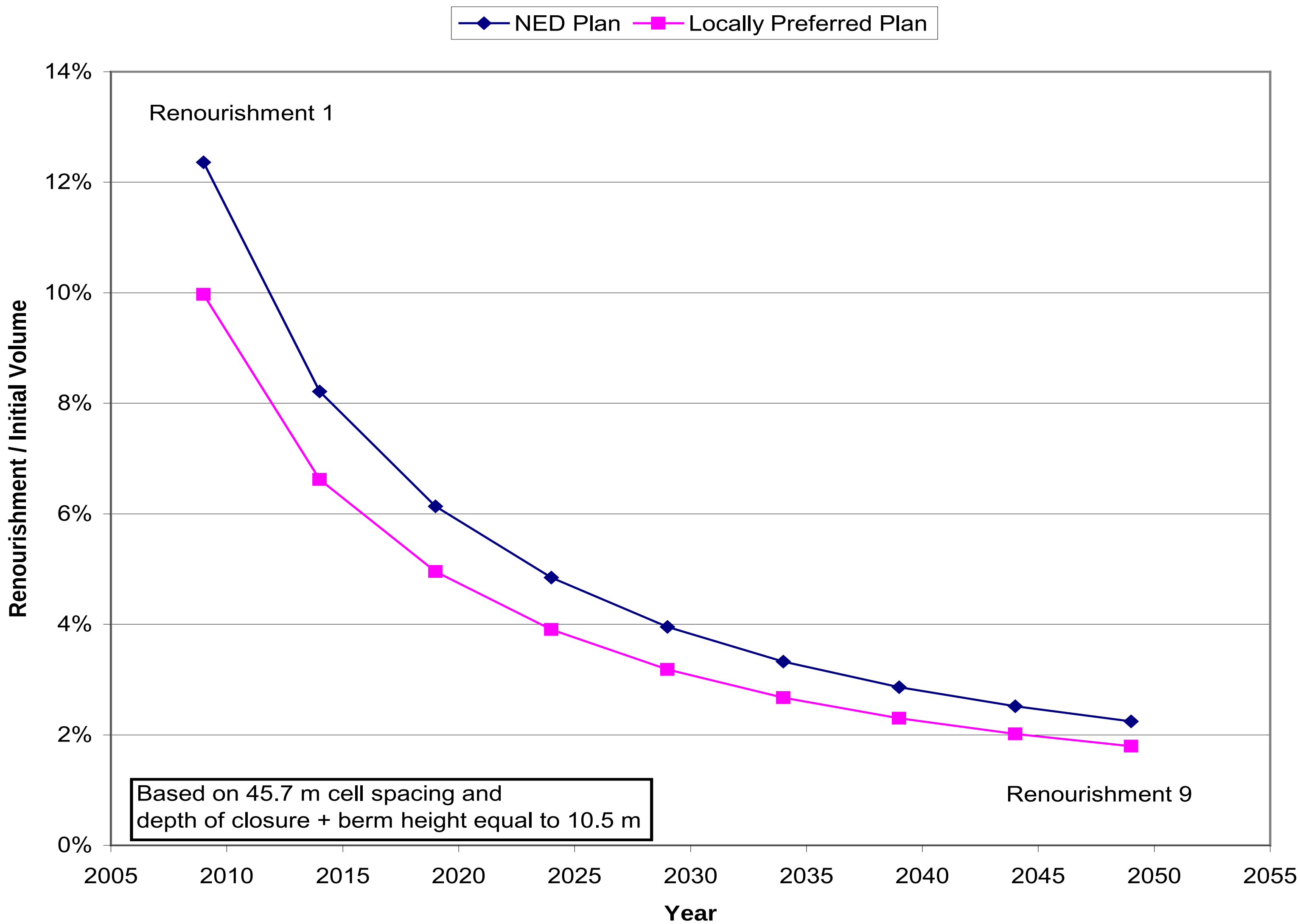

Figure A-1-42. GENESIS Predicted Percentage of Renourishment to Initial Volume for NED and LPP

The formulation of GENESIS, a longshore transport model, does not include the significance of cross-shore sediment transport due to tropical or extra-tropical storms. The large waves generated by these storms would initiate shoreline changes in GENESIS; however, these changes would result from gradients in the longshore transport and not from the cross-shore sediment transport processes known to play a significant role in the storm-induced shoreline changes. Recent history has shown the considerable role of storms on shoreline change in Walton County. Therefore, to estimate the future without-project shoreline conditions, one should apply a method that more completely includes the effects of tropical and extra-tropical storms.

Storm Induced Beach Profile Change. An important task of this study was to develop a capability to numerically simulate storm-induced beach profile change within the Walton County study area. This capability will allow the estimation of storm impacts such as, erosion distance (distance from 0 NGVD88 on initial profile to landward-most point of 1 foot vertical erosion/accretion), erosion volume above 0 NGVD, and other measures of storm impact. The modeled responses are subsequently processed using the USACE Beach-*fx* model, an engineering-economic Monte Carlo simulation model that relates beach profile change to storms, coastal processes, and nourishment programs for economic evaluation.

Storm-Induced BEAch CHange Model (SBEACH). SBEACH (Larson and Kraus 1989a; Larson, Kraus, and Byrnes 1990) is a numerical simulation model for predicting beach, berm, and dune erosion due to storm waves and water levels. SBEACH was initially formulated using data from prototype-scale laboratory experiments and further developed and verified based on field measurements from four sites (Coastal and Hydraulics Laboratory's (CHL) Field Research Facility (FRF) at Duck, North Carolina; Manasquan and Point Pleasant Beach, New Jersey; and Torrey Pines, California) (Larson and Kraus 1989a, Larson, Kraus, and Byrnes 1990) and sensitivity testing (Larson and Kraus 1989a, 1989b). The SBEACH model calculates macroscale beach profile change using an empirical morphologic approach with emphasis on beach and dune erosion. In model simulations, the beach profile progresses to an equilibrium state as a function of the initial profile condition (including median grain size and shoreward boundary conditions) and storm conditions (wave height, period, and direction; wind speed and direction; and water level). The model predicts profile response to storms including wave over-topping and dune lowering (Kraus and Wise 1993, Wise and Kraus 1993). Model improvements including the implementation of a random wave model for wave transformation and sediment transport and the dune overwash algorithm are documented in SBEACH Report 4 (Wise, Smith, and Larson 1996) together with extensive model validation with data collected in both the laboratory and the field.

The SBEACH model is an empirically-based model of beach profile change that was developed with the expressed aim of replicating the dynamics of macroscale features dune and berm erosion using standard data available in most engineering applications (Larson and Kraus 1989a). Much of the following discussion is taken directly from SBEACH Reports 1 (Larson and Kraus 1989a), 2 (Larson, Kraus, and Byrnes 1990), and 4 (Wise, Smith and Larson 1996).

As discussed by Larson and Kraus (1989b), a fundamental assumption in the study of beach profile change is the existence of an equilibrium beach profile, which will be attained for a given beach if exposed to constant wave and water level conditions for a sufficient length of time. The idea is that a profile in the equilibrium state will dissipate all incoming wave energy without significant net change in shape (i.e., a constant rate of energy dissipation across the profile). Without an equilibrium profile, the beach would continue to erode or accrete (given adequate sediment supply) if exposed to the same wave and water level conditions. On a microscale level, equilibrium profiles do not exist in nature or the laboratory because waves, water level, water temperature, and other conditions cannot be held perfectly fixed for duration sufficient for the profile to attain equilibrium. Also, wave turbulence and breaking introduce randomness into the microscale sand motion, resulting in small continuous adjustments of the profile; however, on a macroscale level, equilibrium profile shapes have been approached in which no significant systematic net sand transport occurs. Primary factors controlling the shape of an equilibrium profile include waves, water levels, and beach characteristics (e.g., grain size and distribution).

SBEACH calculates a sediment transport parameter based on a simple analytical expression for the equilibrium beach profile shape developed by Dean (1977), which uses the concept of constant dissipation of wave energy per unit water volume,

$$h = A x^{2/3} \tag{5}$$

where

- h = water depth (meters)
- A = shape parameter, shown by Dean (1977) and Moore (1982) to be dependent on grain size (meters$^{1/3}$)
- x = cross-shore coordinate (meters)

For a profile evolving during a storm, where a bar normally forms in the vicinity of the break point, Equation 5 is expected to apply only to that portion of the surf zone shoreward of the bar where strong turbulence is present and energy dissipation is related to the breaking wave height and water depth. If wave reformation occurs, several areas along the profile may exist in which profile change is controlled by energy dissipation per unit volume and the profile in these areas is expected to be well approximated by Equation 5.

If a beach profile is not in equilibrium with the existing wave and water level climate, SBEACH redistributes sediment across-shore to produce an equilibrium profile shape in which incident wave energy is dissipated without causing further significant net sediment movement. As a beach profile approaches an equilibrium shape dictated by the incident waves, the net cross-shore transport rate decreases asymptotically to approach zero at all points along the profile. This is an idealized situation, which never happens in nature during storm events due to constantly changing conditions and complex microscale processes.

Criteria for predicting whether a beach will erode or accrete through cross-shore sand transport processes typically include one parameter characterizing the incident wave condition and another parameter involving some property of the sediment (grain size or fall speed) and/or beach slope. In development of SBEACH, the deepwater wave steepness H_o/L_o, in which H_o is the deepwater wave height and L_o the deepwater wave length, and the dimensionless fall speed parameter H_o/wT, in which w is the fall speed of the sediment and T is the wave period, were found to give a reasonable distinction between profiles exhibiting mainly bar (offshore directed transport) and berm (onshore directed transport) formation. The criterion for distinguishing erosion and accretion in SBEACH is determined by,

$$\frac{H_o}{L_o} = M\left(\frac{H_o}{wT}\right)^3 \tag{6}$$

in which $M = 0.00070$ was empirically determined, based on a large field data set of documented erosional and accretionary beach change events (Kraus, Larson, and Kriebel 1991). If the left side of Equation 6 is less than the right side, the profile is predicted to erode; otherwise, accretion is predicted.

Based on nearshore wave dynamics and the physical characteristics of sediment transport under various flow conditions, four different zones of transport were introduced (Larson, Kraus, and Sunamura 1988; Larson and Kraus 1989a):

a. Zone I: From the seaward depth of effective sand transport to the break point (pre-breaking zone).
b. Zone II: From the break point to the plunge point (breaker transition zone).
c. Zone III: From the plunge point to the point of wave reformation or to the swash zone (broken wave zone).
d. Zone IV: From the shoreward boundary of the surf zone to the shoreward limit of wave runup (swash zone).

Relationships for cross-shore sediment transport rates were developed for each of the four zones based on physical considerations and analysis of large wave tank data, and are used in SBEACH as follows:

Zone I: $$q = q_b\, e^{-\lambda_1 (x - x_b)} \qquad x_b < x \tag{7a}$$

Zone II: $$q = q_p\, e^{-\lambda_2 (x - x_p)} \qquad x_p < x \le x_b \tag{7b}$$

Zone III: $$\begin{aligned} q &= K\left(D - D_{eq} + \frac{\varepsilon}{K}\frac{dh}{dx}\right), \quad if\ D > \left(D_{eq} - \frac{\varepsilon}{K}\frac{dh}{dx}\right) \\ q &= 0, \qquad if\ D \le \left(D_{eq} - \frac{\varepsilon}{K}\frac{dh}{dx}\right) \qquad x_z \le x \le x_p \end{aligned} \tag{7c}$$

Zone IV: $$q = q_z\left(\frac{x - x_r}{x_z - x_r}\right) \qquad x_r < x < x_z \tag{7d}$$

Where

q = net cross-shore sand transport rate (cu m/year)

$\lambda_{1,2}$ = spatial decay coefficients in Zones I and II, respectively (m^{-1})
x = cross-shore coordinate, directed positive offshore (m)
K = sand transport rate coefficient (quartic m/N)
D = wave energy dissipation per unit water volume (N-m/cu m-sec)
D_{eq} = equilibrium wave energy dissipation per unit water volume, related to equilibrium profile shape (N-m/cu m-sec)
γ = slope-related sand transport rate coefficient (sq m/sec)
h = still-water depth (m)

The subscripts *b*, *p*, *z*, and *r* stand for quantities evaluated at the break point, plunge point, end of surf zone, and runup limit, respectively. The equilibrium wave energy dissipation per unit water volume, D_{eq}, is calculated based on equilibrium profile theory and is related to wave and profile characteristics. The decay coefficient in Zone I was empirically related to median grain size, D_{50}, and breaking wave height H_b as follows,

$$\lambda_1 = 0.4\left(\frac{D_{50}}{H_b}\right)^{0.47} \qquad (8)$$

For Zone II, limited data suggest that

$$\lambda_2 = 0.2\lambda_1 \qquad (9)$$

In calculating the sediment transport rate in Zones I and II, the transport rate is first determined at the plunge point, and then the exponential decay rates are applied seaward in the respective zones. Changes in the beach profile are calculated at each time-step from the distribution of the cross-shore transport rate and the equation of mass conservation of sand,

$$\frac{\partial q}{\partial x} = \frac{\partial h}{\partial t} \qquad (10)$$

where t is time, and the other variables are defined previously.

Dune erosion due to overwash of the dune crest is simulated in SBEACH based on four basic principles: (a) overwash occurs if the calculated limit of runup exceeds the dune crest; (b) overwash causes landward movement of sediment up and over the dune crest; (c) the magnitude of onshore transport occurring during overwash is proportional to (1) the magnitude of transport at the landward boundary of the surf zone and (2) the extent by which calculated runup exceeds the dune crest; and (d) the landward limit of overwash depends on subaerial profile volume and geometry in a similarity relationship described by Wise, Smith, and Larson (1996).

The above relationships for sediment transport in the four profile zones were generalized to random waves by treating the random wave field as a collection of individual waves. A criterion for predicting net transport direction is developed based on the assumption that the random wave field follows a Rayleigh distribution in deep water. Under the assumption of linearity in transport and no wave-wave interactions, the transport rate produced by random waves is obtained by computing the transport rate for each individual wave and averaging over all waves according to

$$q = \frac{1}{N}\sum_{i=1}^{N} q_i \tag{11}$$

The random wave model and its implementation in SBEACH introduce a summation of the form shown in Equation 11 into the sediment transport relationships given in Equation 7. For details related to other complexities introduced by the random wave model the reader is referred to Report 4 in the SBEACH documentation series (Wise, Smith, and Larson 1996). Other detailed information on the SBEACH model formulation, development, and use can found in SBEACH Reports 1, 2, and 3 (Larson and Kraus 1989a; Larson, Kraus, and Byrnes 1990; and Rosati, Wise, Kraus, and Larson 1993).

Model Limitations and Assumptions. A basic assumption of SBEACH is that profile change is produced solely by cross-shore processes, resulting in a redistribution of sediment across the profile with no net gain or loss of material. For all storms within the shoreline response database (SRD) for Walton County with measured data this assumption is valid except hurricane Ivan. Measured data from Hurricane Ivan showed relatively large losses offshore of the depth of closure. In this instance SBEACH simulations will tend to under estimate offshore profile responses as clearly shown in the calibration. Since SBEACH was able to simulate the upper profile shape in response to the storm, which is the area that storm damages are realized the model was determined suitable for use in the study. Longshore transport processes are assumed to be uniform and therefore can be neglected in the calculation of beach profile change. This assumption is expected to be valid for short-term storm-induced profile response on open coasts away from tidal inlets and coastal structures, which is the case for the Walton County study. A limitation of SBEACH is it is only capable of treating intermediate inundations by individual waves and does not treat inundation overwash when the dune or bluff feature is fully inundated by the qausi-steady flood levels. Walton County beach morphology is a high dune bluff area with elevations ranging from 11.5 to 44.5 feet NAVD88 and averaging 25.5 feet. To check the validity of the model for use in Walton County a review of maximum stage level during each storm in the SRD along with the varying tidal constituents were reviewed to determine the maximum stage level. The maximum stage contained with the SRD is approximately 9 feet NAVD88, therefore this limitation does not affect the reliability of SBEACH results for this study.

SBEACH Model Calibration. Calibration of the SBEACH model was performed for Walton County using available pre and post Hurricane Ivan data. Model calibration is conducted to determine optimal model settings for the project region and to provide a measure of model accuracy in reproducing observed profile change for a given time period. Model settings obtained through the calibration will be used in model simulations of storm erosion for the without- and with-project conditions.

Calibration Data. Required input data for model calibration include pre- and post-storm beach profiles, time histories of storm waves and water levels, and median sediment grain size. Hurricane Ivan made landfall in Gulf Shore, Alabama on September 16, 2004. USACE CHARTS surveys were collected over coastal Alabama and the Florida Panhandle in May 2004 establishing the pre-Ivan survey dataset. CHARTS surveys were collected over the same area after Hurricane Ivan in November 2004. Pre and post-Hurricane Ivan beach profiles coincident with the 127 FDEP survey monument transects were extracted from the CHARTS datasets. Profile lines R-10, R-50, and R-102 from Reaches 1, 3, and 5 were used in the SBEACH model calibration.

To obtain wave information for model calibration, pre and post hurricane Ivan data from the National Data Buoy Center (NDBC) Stations 42039 and 42040 were evaluated. Station 42039 is located approximately 115 nautical miles (nm) east, southeast of Pensacola, Florida, and Station 42040 is located approximately 64 nm south of Dauphin Island, Alabama. Wave height, wave period (dominant and average), and wave direction are plotted in Figure A-1-43 for both stations. As shown in Figure A-1-43, Station 42040 failed just prior to the peak of the storm; therefore, only wave information from Station 40239 was used for calibration. Time series of deep water wave height, period, and direction were transformed to a 50-foot water depth, using the WIS Phase III transformation technique, to provide storm conditions for the Walton County vicinity. Corresponding water-levels were obtained from the National Oceans Service (NOS) tide station 8729840 located at Pensacola, Florida. The Hurricane Ivan storm conditions (13 September to 19 September 2004) used for model calibration are plotted in Figure A-1-44. The peak wave height was approximately 25 feet and peak water level was approximately 5.5 feet.

Model Setup. The SBEACH model was configured to simulate Hurricane Ivan from September 13, 2004 0000 hours through September 19 2004 1100 hours (total of 142 hours) using a two minute time step. A variable grid was set up across the profiles with 5 ft grid spacing over the subaerial beach, 10 foot spacing over the surf zone, and 25 foot spacing for the region offshore of the breaker line.

Calibration. SBEACH calibration parameters include sediment transport rate coefficient (K), coefficient for slope-dependent transport term (ε), and depth of foreshore (DFS). The sediment transport rate coefficient is the primary calibration parameter and controls the rate at which the profile erodes towards an equilibrium shape. The slope-dependent transport term coefficient controls the effect of local profile slope on the transport rate. The depth of foreshore defines the transition depth between surf zone and swash zone, and influences profile response on the upper profile.

Simulations were performed using a range of values for each calibration parameter to determine optimal values. The final selected calibration parameter values are: K = 1.0 10^{-6} m^4/N, ε = 0.002 m^2/sec, and DFS = 1 foot. A median sediment grain size of 0.33 millimeter was used in the calibration simulations based on previous sediment analysis conducted by Taylor Engineering (Taylor Engineering, 2003).

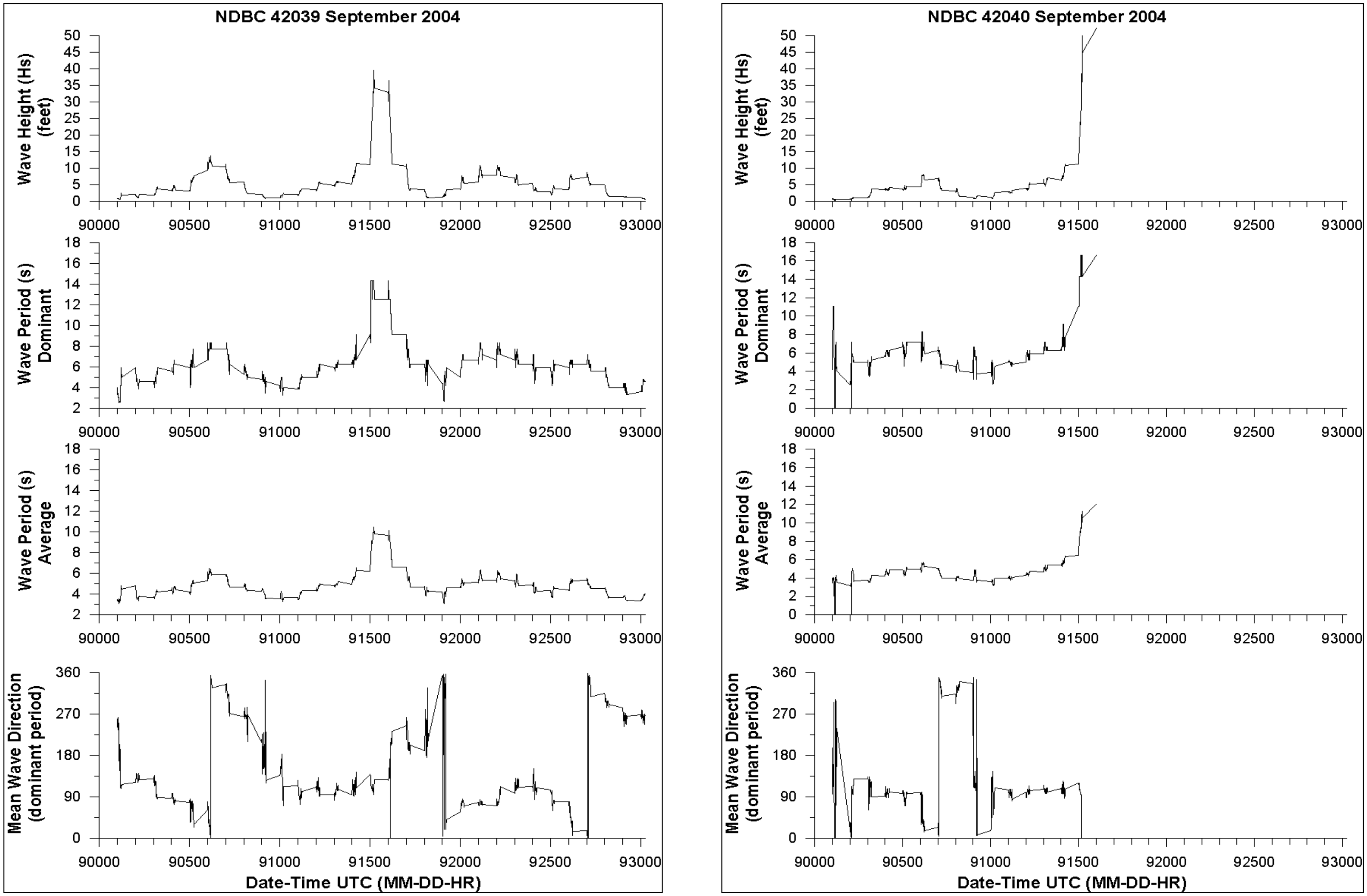

Figure A-1-43. NDBC Buoy 42039 and 42040 Offshore Wave Data - Hurricane Ivan

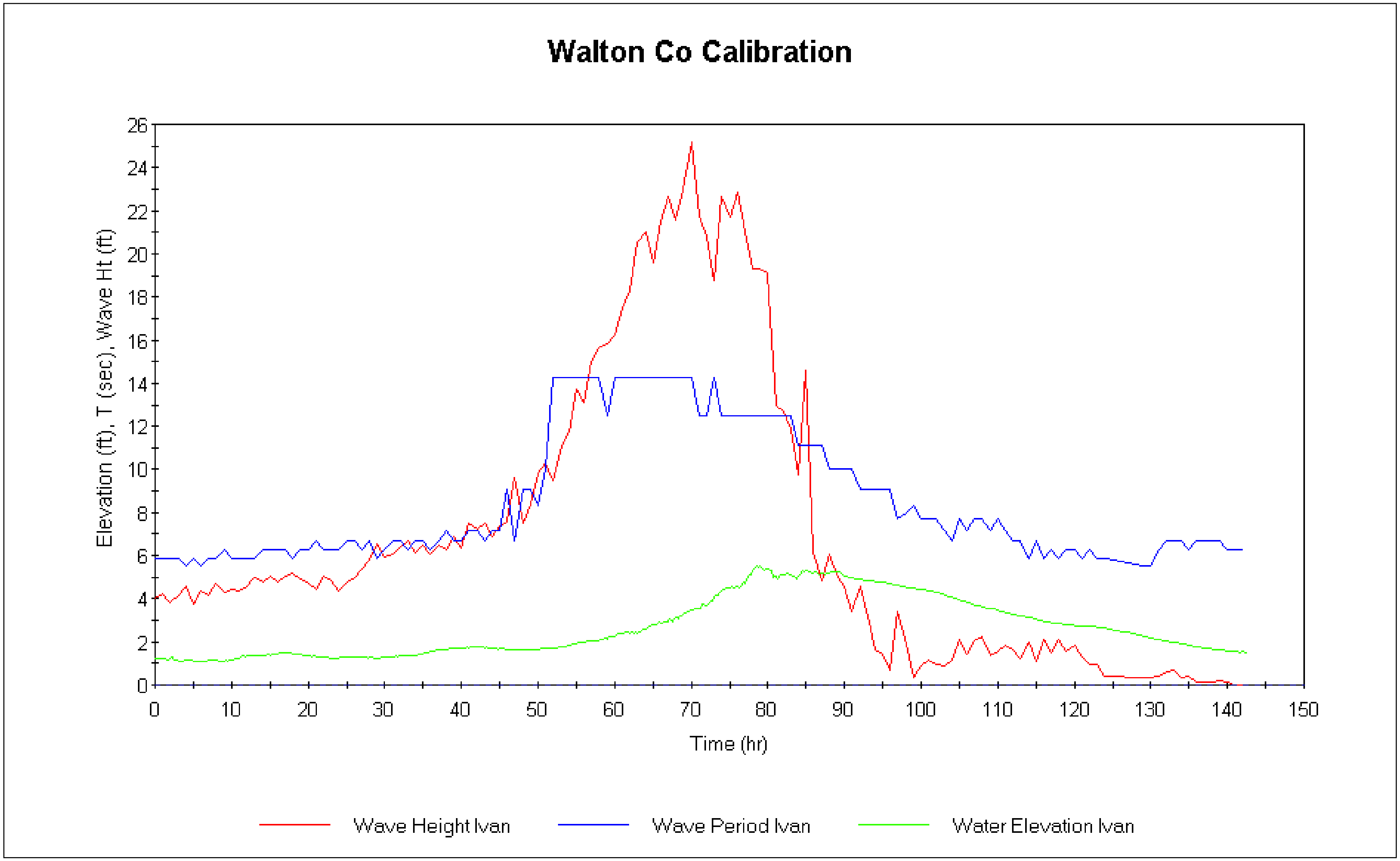

Figure A-1-44. Environmental Forcing For SBEACH Calibration (Hurricane Ivan: 13 September Through 19 September 2004)

Figures A-1-45, A-1-46, and A-1-47 show calibration results for profiles R-10, R-50, and R-102, respectively. The SBEACH results compare well with the measurements in the dry or upper portion of the beach, corresponding to the area of damages to be quantified in this study. The model reasonably reproduced the erosion of the dune and berm. The post Hurricane Ivan measurements show that the bar feature eroded or moved offshore during the storm; however, comparisons for the submerged offshore portion of the profile show that the model under predicted the erosion of the bar. The overall quality of the calibration results is reasonable since the storm impacts to the upper portion of the beach are the focus of this study.

Environmental Forcing Parameters for Tropical Storm Events. Primary environmental forcing parameters required for input to the SBEACH model include a time series of total water level (tide plus surge) together with a concurrent time history of wave conditions. In this study, a total of 46 historical hurricane events were identified and used to characterize the storm climatology within the Walton County study area. With the exception of Hurricane Ivan the ADCIRC model (Luettich et al., 1994; Westerink et al., 1992) provided estimates of storm surge associated with the individual historical storm event. ADCIRC water level results from the Dredging Research Program, Tropical Strom Surge Database for the Atlantic and Gulf of Mexico (Scheffner et al., 1994) were utilized for all storms within the SRD for this study, with the exception of hurricane Ivan which utilized measurements from local gauges. Wave information was obtained from the WIS wave hindcast and NDBC Station 40239.

<u>Representation of Astronomical Tides</u>. Astronomical tides were estimated using tidal constituents generated from a harmonic analysis of ADCIRC generated tidal elevations (Scheffner 1994) at ADCIRC Stations 497 and 498 located along the Walton County study area (Figure A-1-3). A 20-year equilibrium tide was generated and analyzed in order to estimate the average values of the tidal amplitude for Spring, Neap, and mean tidal conditions. ADCIRC Station 497 is located offshore of the eastern portion of Walton County and used for Reaches 4 and 5, and Station 498 is located offshore of the western portion of Walton County and used for Reaches 1, 2, and 3. The mean tidal amplitude was estimated as a simple arithmetic mean of all the maximum tidal amplitudes in the 20-year equilibrium tide record. The average Spring tidal amplitude was estimated as the arithmetic mean of the largest 25 percent of the maximum tidal amplitudes. The average Neap tidal amplitude was estimated as the arithmetic mean of the smallest 25 percent of the maximum tidal amplitudes.

To best account for the influence of total still water level (tide plus surge) on erosion calculations within SBEACH, each storm surge (from ADCIRC calculations obtained from the Tropical Strom Surge Database for the Atlantic and Gulf of Mexico) was combined with tidal ranges corresponding to Spring, Mean, and Neap conditions. Furthermore, each storm surge was combined with four different phases of the tidal cycle by aligning the peak storm surge with high tide (Phase 1), mean falling tide (Phase 2), low tide (Phase 3), and mean rising tide. The tide phases are illustrated in Figure A-1-46. Figure A-1-47 provides an example of the procedure using the Spring tidal range at Station 498 and the ADCIRC-calculated surge time history for Hurricane Georges which occurred in September 1998.

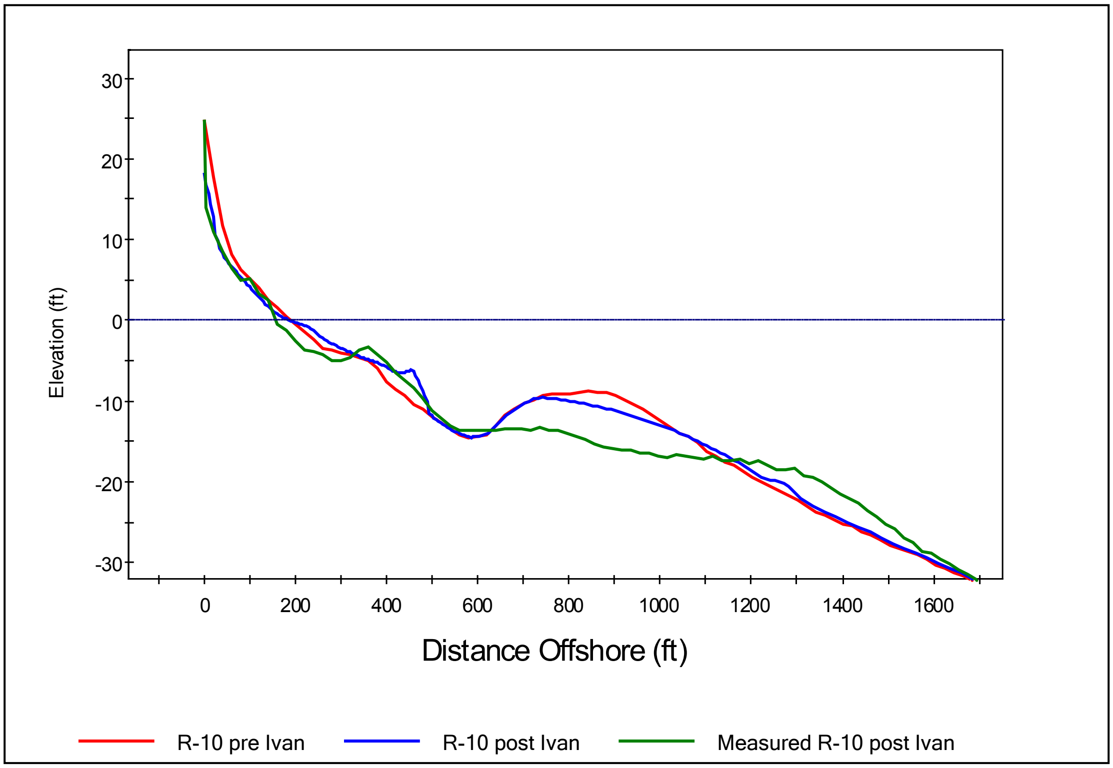

Figure A-1-45. SBEACH Calibration Profile R-10

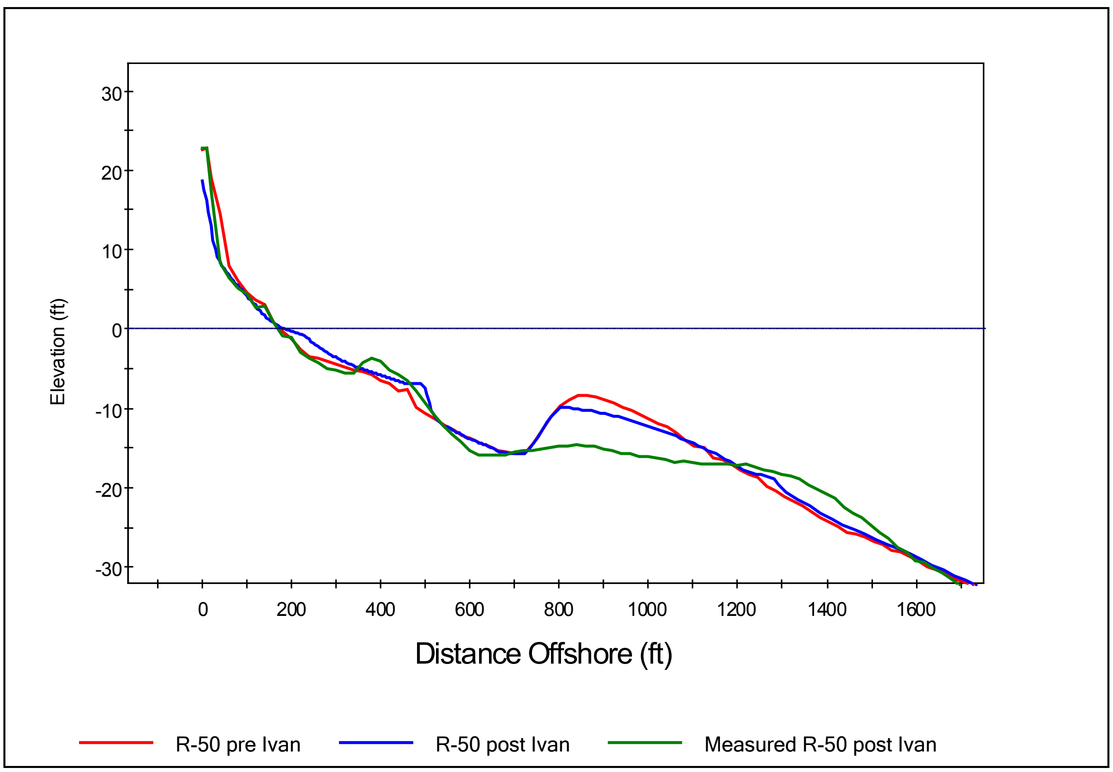

Figure A-1-46. SBEACH Calibration Profile R-50

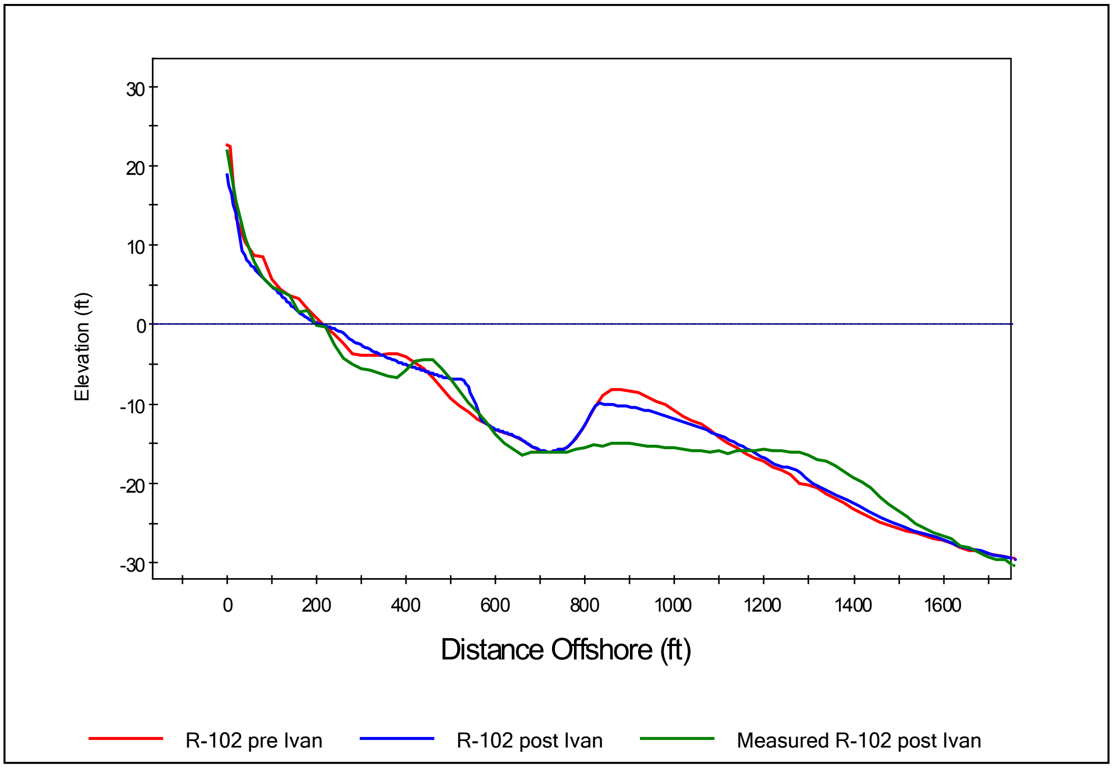

Figure A-1-47. SBEACH Calibration Profile R-102

Representation of Tropical Storm Events. Storm surge time series were obtained from the USACE Dredging Research Program (DRP) tropical storm database (Scheffner et al, 1994), which consists of storm surge elevation and current hydrographs corresponding to selected WIS and nearshore stations along the East and Gulf coasts of the United States and Puerto Rico. The database was originally constructed by numerically simulating 134 historically based hurricanes that have impacted the eastern and Gulf coasts of the United States during the period 1886 to 1989. The source of data for these simulations is the National Oceanic and Atmospheric Administration's National Hurricane Centers HURDAT (HURricane DATabase), described by Jarvinen, Neumann, and Davis (1988). The storm surge database was updated to include hurricanes from 1990 through 2001.

Figure A-1-3 on page A-1-5 displays the station locations where ADCIRC storm surge data from the Tropical Strom Surge Database for the Atlantic and Gulf of Mexico are available in the vicinity of Walton County. The offshore nodes correspond to the WIS stations with the corresponding nearshore station locations selected to provide most accurate storm surge values. Stations 497 and 498 were utilized for this study. Significant tropical events were extracted from the database based on storm surge values exceeding select threshold conditions. For the 100-plus years of coverage, 46 events were identified using a minimum storm surge threshold of one foot. Time series of storm surge were coupled with astronomical tide data to serve as input to the Storm-Induced Beach Change (SBEACH) model for storm damage assessment. By combining the 46 storm events with the three tidal ranges at four different tidal phases results in a total of 552 storm events for input to SBEACH.

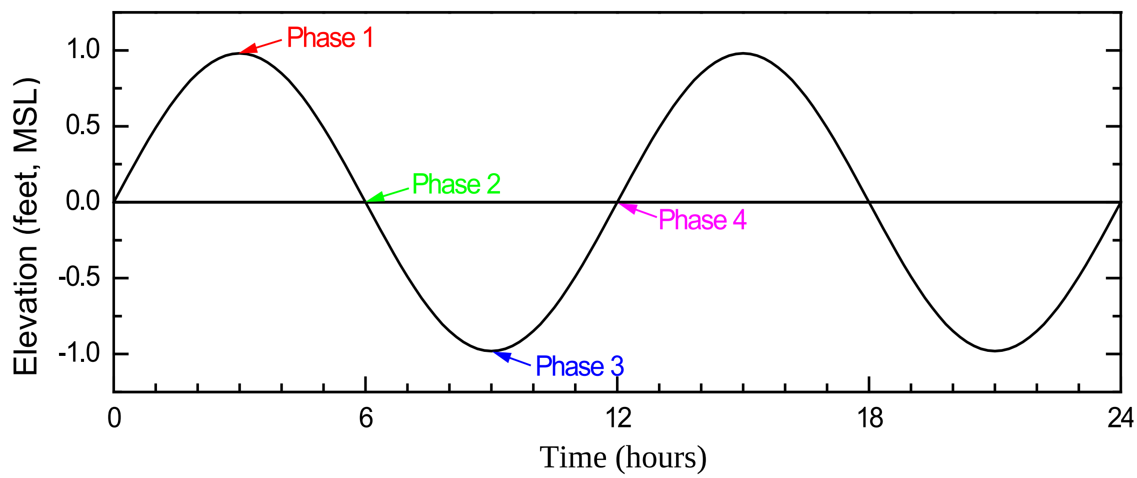

Figure A-1-48. Four Tide Phases of Tidal Cycle

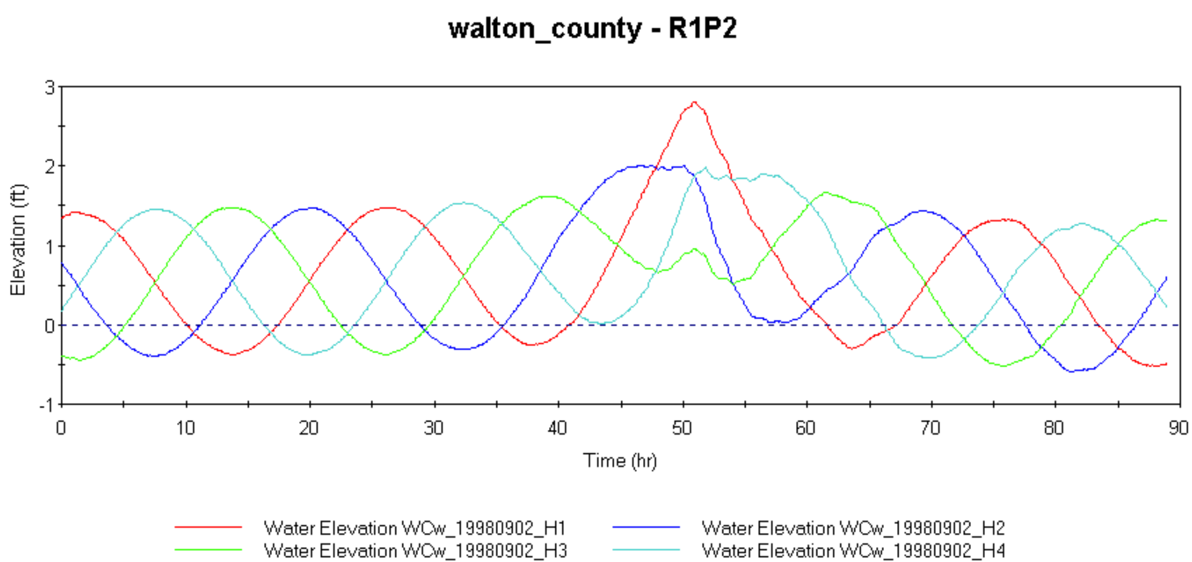

Figure A-1-49. Applied Tide Phase Sequencing, Spring Tidal Range

SBEACH Simulations. SBEACH model simulations were performed to develop the existing condition, future without project, and with project shoreline response database for subsequent input for the Beach-*fx* model. Beach-*fx* is an engineering-economics Monte Carlo simulation model used to develop statistics on probable benefits and costs of shore protection alternatives. The model simulates coastal engineering processes resulting in shoreline change due to storms and derives damages based on those coastal engineering processes.

Without Project Conditions. A true beach profile is complex. For purposes of Beach-*fx* modeling, a simplified beach profile represented by key points is used, Figure A-1-50. The simplified profile represents a single trapezoidal dune, with a horizontal berm. The submerged profile is represented by either a detailed series of points, or an approximate functional representation. Some of the values of the profile are taken as constant, i.e. they do not vary with the storm response. The beach variables that are taken as changing with storms are dune width, dune height, berm width, and upland elevation. The constant values are dune slope, berm height, foreslope, and shape of the submerged profile. Thus, in response to a given storm, the berm can be eroded or accreted (change in berm width), the dune can change height and/or width, and can translate landward or seaward (change in upland width). The 11 representative beach profiles were simplified to meet the requirements of the Beach-*fx* model. The resulting configurations of the simplified beach profiles are provided in Table A-1-23. Comparisons of the representative and simplified beach profiles for Reaches 1 through 5 are plotted in Figures A-1-51 through A-1-55.

SBEACH simulations were conducted to develop a database of pre-generated beach profile responses to storms, for a range of storms and profiles, for Walton County.

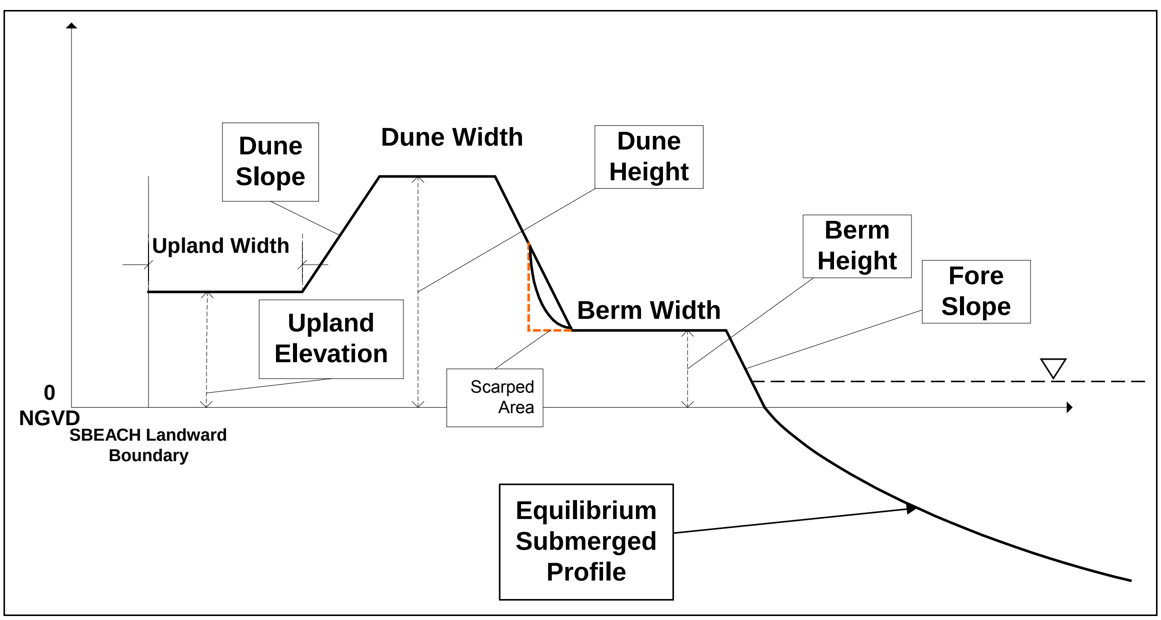

Figure A-1-50. Simplified Beach Profile for Beach-*FX* Model

Table A-1-23. Simplified Beach Profile Configurations, Existing Conditions

Profile	Dune Height (feet)	Dune Width (feet)	Berm Height (feet)	Bern Width (feet)	Upland Elevation (feet)	Upland Width (feet)	Dune Slope	Foreshore Slope	Maximum FEMA Dune Width (feet)	Maximum FEMA Berm Width (feet)
R1P1	22.2	55.0	5.5	23.0	21.0	298.0	0.143	0.087	70.0	30.0
R1P2	13.6	100.0	5.5	40.0	12.1	298.0	0.091	0.087	130.0	70.0
R2P1	21.0	50.0	5.5	69.0	13.0	195.0	0.143	0.087	50.0	80.0
R2P2	10.0	70.0	5.5	85.0	9.5	273.0	0.029	0.087	70.0	110.0
R3P1	23.0	76.5	5.5	50.0	20.0	286.0	0.350	0.087	95.0	70.0
R3P2	12.5	45.0	5.5	50.0	10.5	218.0	0.111	0.087	80.0	90.0
P4P1	23.0	50.25	5.5	35.0	11.0	182.0	0.341	0.087	50.0	60.0
R4P2	10.0	82.0	5.5	110.0	10.0	300.0	0.556	0.087	82.0	110.0
R5P1	32.0	183.25	5.5	40.0	27.0	267.5	0.286	0.087	190.0	50.0
R5P2	24.0	64.0	5.5	52.0	22.5	306.5	0.235	0.087	78.0	70.0
R5P3	15.5	49.0	5.5	65.5	13.5	262.0	0.133	0.087	70.0	90.0

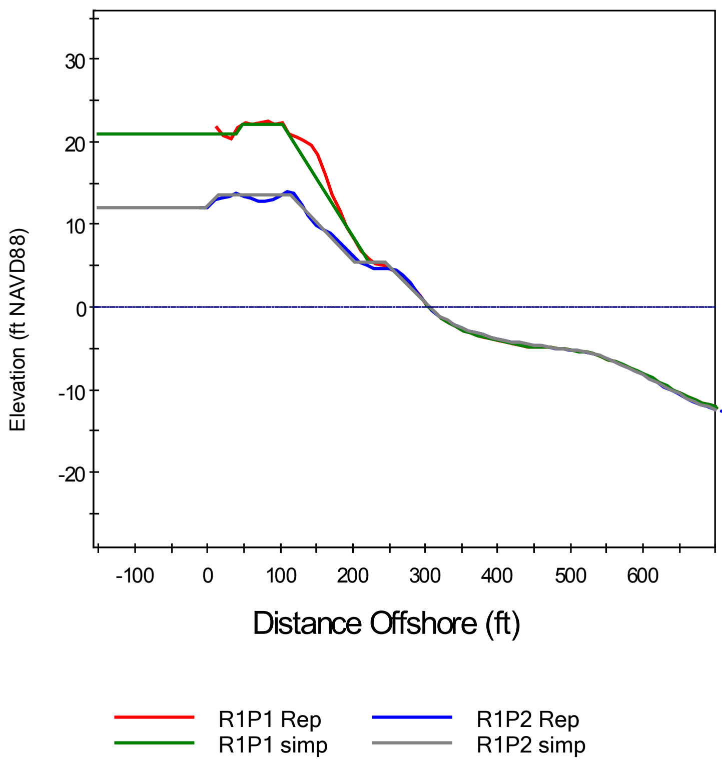

Figure A-1-51. Simplified Representative Beach Profiles - Reach 1

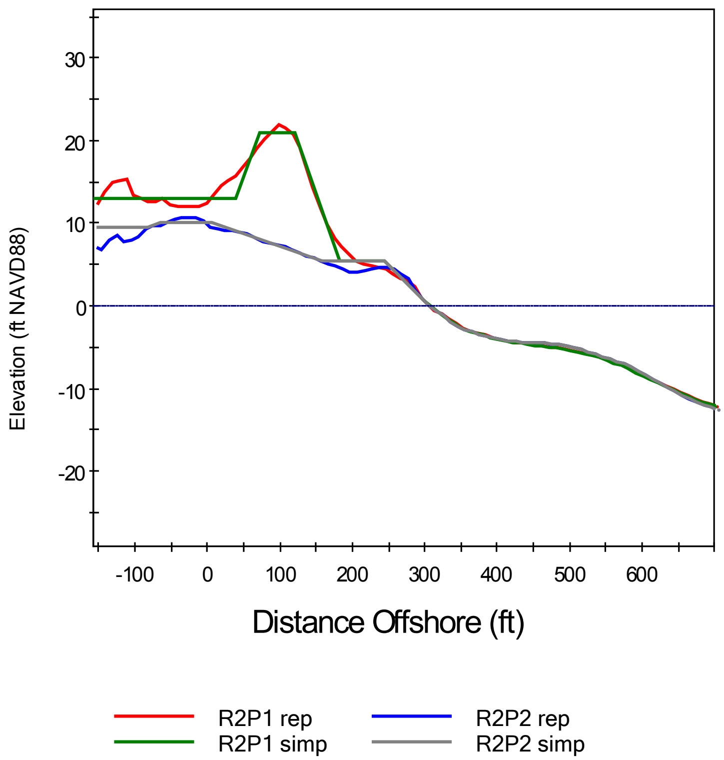

Figure A-1-52. Simplified Representative Beach Profiles - Reach 2

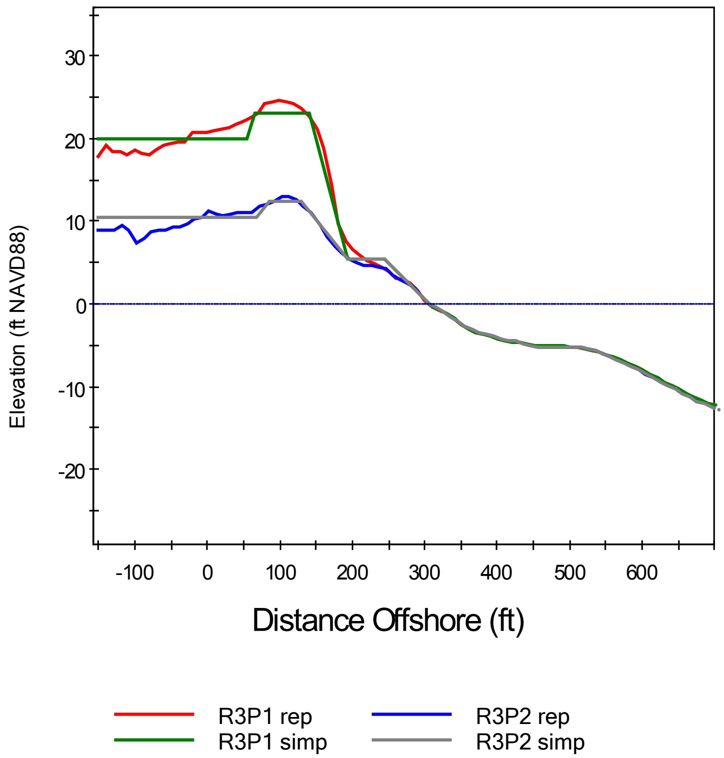

Figure A-1-53. Simplified Representative Beach Profiles - Reach 3

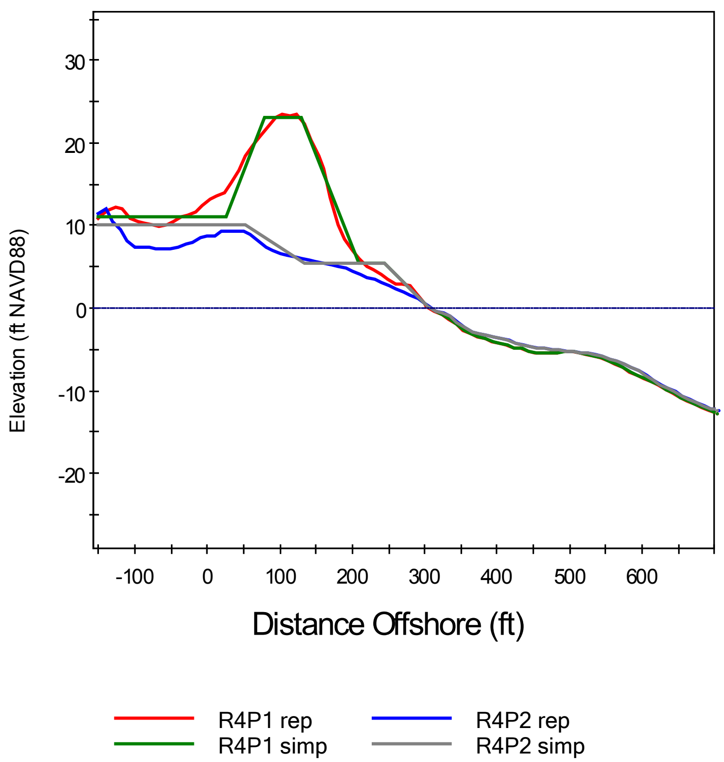

Figure A-1-54. Simplified Representative Beach Profiles - Reach 4

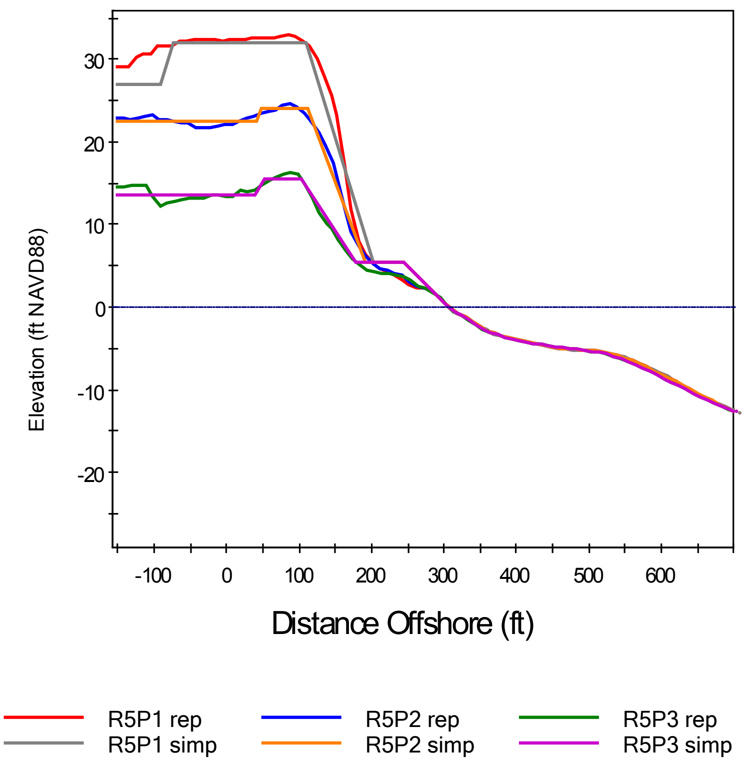

Figure A-1-55. Simplified Representative Beach Profiles - Reach 5

The 11 simplified beach profiles were modified for various berm and dune configurations as listed in Table A-1-24. Approximately 436 dune and berm configurations were generated to represent existing conditions. Maximum dune and berm widths were determined based on volumes provided by the Federal Emergency Management Agency (FEMA) post-Hurricane Ivan emergency beach nourishment. FEMA funded the placement of an average of 6 to 8 cy per linear foot of shoreline at specific locations. This study assumes the FEMA emergency nourishment volumes are placed over the entire domain, and emergency placement will be implemented once the existing post-Hurricane Ivan shoreline conditions are reached. Dune widths were modeled in 5 to 10 foot increments from the maximum emergency nourishment width to the existing width. For each dune width, associated berm widths were modeled in 10 foot increments from the maximum emergency nourishment width to a zero berm width (Figure A-1-56). The SBEACH simulations were conducted to predict the response of each dune and berm configuration to the 552 storms developed for this study. Approximately 240,000 SBEACH simulations were conducted to develop the shoreline responses for the Beach-*fx* shoreline response database.

With Project Conditions. The with period of analysis of 54 years from January 2010 through and including all of the year 2063, and there are four pre-project base years, 2010 through 2013. Therefore, to estimate the future with project conditions, Beach-*fx* simulations were run for a 54-year period of analysis. The dune and berm widths for the with project simulations were determined based on the results of the without project simulations.

Table A-1-24. Existing Condition SBEACH Dune/Berm Configurations

Representative Profile	Dune Width (feet)	Berm Width (feet)											
R1P1	55	0	10	20	30								
	60	0	10	20	30								
	65	0	10	20									
	70	0	10	20									
R1P2	100	0	10	20	30	40	50	60	70				
	105	0	10	20	30	40	50	60	70				
	110	0	10	20	30	40	50	60					
	115	0	10	20	30	40	50	60					
	120	0	10	20	30	40	50						
	125	0	10	20	30	40	50						
	130	0	10	20	30	40							
R2P1	30	0	10	20	30	40	50	60	70	80			
	40	0	10	20	30	40	50	60	70	80			
	50	0	10	20	30	40	50	60	70	80			
R2P2	20	0	10	20	30	40	50	60	70	80	90	100	110
	30	0	10	20	30	40	50	60	70	80	90	100	110
	40	0	10	20	30	40	50	60	70	80	90	100	110
	50	0	10	20	30	40	50	60	70	80	90	100	110
	60	0	10	20	30	40	50	60	70	80	90	100	110
	70	0	10	20	30	40	50	60	70	80	90	100	110
R3P1	75	0	10	20	30	40	50	60	70				
	80	0	10	20	30	40	50	60	70				
	85	0	10	20	30	40	50	60					
	90	0	10	20	30	40	50	60					
	95	0	10	20	30	40	50						
R3P2	45	0	10	20	30	40	50	60	70	80	90		
	50	0	10	20	30	40	50	60	70	80			
	55	0	10	20	30	40	50	60	70	80			
	60	0	10	20	30	40	50	60	70				
	65	0	10	20	30	40	50	60	70				
	70	0	10	20	30	40	50	60					
	75	0	10	20	30	40	50	60					
	80	0	10	20	30	40	50						

Table A-1-24 (Continued). Existing Condition SBEACH Dune/Berm Configurations

Representative Profile	Dune Width (feet)	Berm Width (feet)											
R4P1	30	0	10	20	30	40	50	60					
	40	0	10	20	30	40	50	60					
	50	0	10	20	30	40	50	60					
R4P2	35	0	10	20	30	40	50	60	70	80	90	100	110
	45	0	10	20	30	40	50	60	70	80	90	100	110
	55	0	10	20	30	40	50	60	70	80	90	100	110
	65	0	10	20	30	40	50	60	70	80	90	100	110
	75	0	10	20	30	40	50	60	70	80	90	100	110
	85	0	10	20	30	40	50	60	70	80	90	100	110
R5P1	185	0	10	20	30	40	50						
	190	0	10	20	30	40							
R5P2	65	0	10	20	30	40	50	60	70				
	70	0	10	20	30	40	50	60					
	75	0	10	20	30	40	50	60					
	80	0	10	20	30	40	50						
R5P3	50	0	10	20	30	40	50	60	70	80	90		
	55	0	10	20	30	40	50	60	70	80			
	60	0	10	20	30	40	50	60	70	80			
	65	0	10	20	30	40	50	60	70				
	70	0	10	20	30	40	50	60	70				

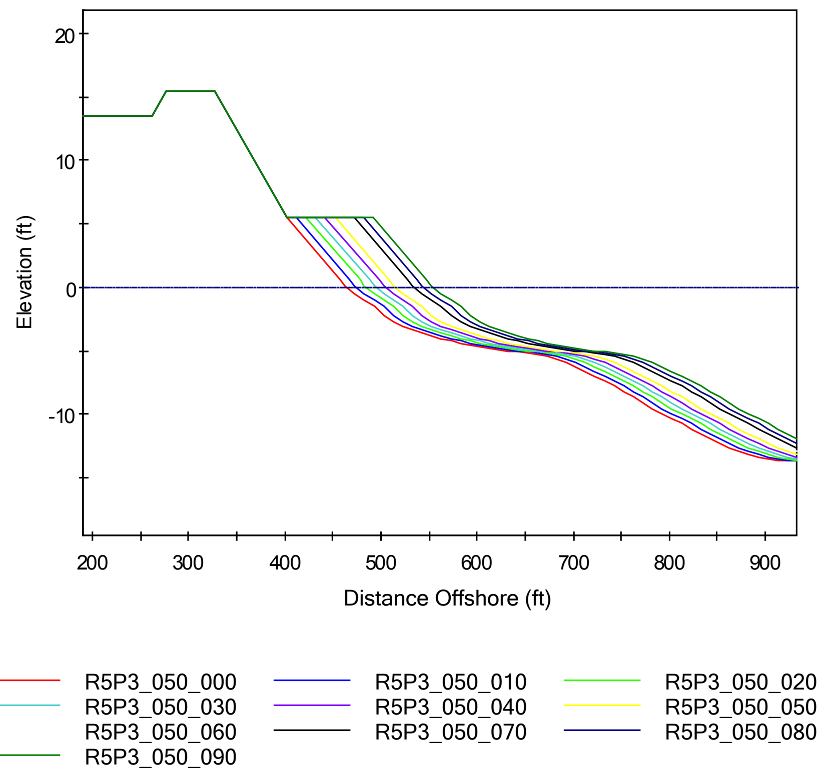

Figure A-1-56. Example SBEACH Dune and Berm Configurations for SRD

R1P1 required a minimum design berm width of 25 feet and the remaining profiles would require a minimum berm width of 50 feet. Dune widening was necessary for representative profiles R4P1 and R4P2; however, the existing dune widths were used for the remaining representative profiles. The with-project berm and dune widths were further refined to determine the NED Plan and LPP through the Beach-*fx* modeling as described in detail in Appendix B - Economic Investigations. For the with-project SBEACH simulations, the additional berm and dune configurations were generated to evaluate the increased dune and berm widths for the with project alternative conditions, Table A-1-25. Similar to the without project conditions, dune widths were modeled in 5 to 10 foot increments, and for each dune width, associated berm widths were modeled in 10 foot increments. Approximately 645 dune and berm configurations were generated, and approximately 356,000 SBEACH simulations were conducted to predict the response of the with project conditions to the 552 storms. The initial and predicted responses of each dune and berm configuration were incorporated into the shoreline response database for subsequent Beach-*fx* model simulations as described in detail in Appendix B - Economic Investigations.

Table A-1-25. With-Project Condition SBEACH Dune/Berm Configurations

Representative Profile	Dune Width (ft)	Berm Width (ft)													
R1P1	55		40	50	60	70	80	90	100	110	110	120	130	140	150
	60		40	50	60	70	80	90	100	110	110	120	130	140	150
	65	30	40	50	60	70	80	90	100	110	110	120	130	140	150
	70	30	40	50	60	70	80	90	100	110	110	120	130	140	150
R1P2	100				80	90	100	110	120	130	140	150	160	170	180
	105				80	90	100	110	120	130	140	150	160	170	180
	110			70	80	90	100	110	120	130	140	150	160	170	180
	115			70	80	90	100	110	120	130	140	150	160	170	180
	120		60	70	80	90	100	110	120	130	140	150	160	170	180
	125		60	70	80	90	100	110	120	130	140	150	160	170	180
	130	50	60	70	80	90	100	110	120	130	140	150	160	170	180
R3P1	75			80	90	100	110	120	130	140	150	160	170	180	
	80			80	90	100	110	120	130	140	150	160	170	180	
	85		70	80	90	100	110	120	130	140	150	160	170	180	
	90		70	80	90	100	110	120	130	140	150	160	170	180	
	95	60	70	80	90	100	110	120	130	140	150	160	170	180	
R3P2	45					100	110	120	130	140	150	160	170	180	
	50				90	100	110	120	130	140	150	160	170	180	
	55				90	100	110	120	130	140	150	160	170	180	
	60			80	90	100	110	120	130	140	150	160	170	180	
	65			80	90	100	110	120	130	140	150	160	170	180	
	70		70	80	90	100	110	120	130	140	150	160	170	180	
	75		70	80	90	100	110	120	130	140	150	160	170	180	
	80	60	70	80	90	100	110	120	130	140	150	160	170	180	
R4P1	30	0	10	20	30	40	50	60	70	80	90	100	110	120	130
		140	150												
	40	0	10	20	30	40	50	60	70	80	90	100	110	120	130
		140	150												
	50	0	10	20	30	40	50	60	70	80	90	100	110	120	130
		140	150												
	60	0	10	20	30	40	50	60	70	80	90	100	110	120	130
		140	150												
	70	0	10	20	30	40	50	60	70	80	90	100	110	120	130
		140	150												

Table A-1-25 (Continued). With-Project Condition SBEACH Dune/Berm Configurations

Representative Profile	Dune Width (ft)	Berm Width (ft)													
R4P2	35	120	130	140	150	160	170	180							
	45	120	130	140	150	160	170	180							
	55	120	130	140	150	160	170	180							
	65	120	130	140	150	160	170	180							
	75	120	130	140	150	160	170	180							
	85	120	130	140	150	160	170	180							
R5P1	185		60	70	80	90	100	110	120	130	140	150	160	170	180
	190	50	60	70	80	90	100	110	120	130	140	150	160	170	180
R5P2	65			80	90	100	110	120	130	140	150	160	170	180	
	70		70	80	90	100	110	120	130	140	150	160	170	180	
	75		70	80	90	100	110	120	130	140	150	160	170	180	
	80	60	70	80	90	100	110	120	130	140	150	160	170	180	
R5P3	50			100	110	120	130	140	150	160	170	180			
	55		90	100	110	120	130	140	150	160	170	180			
	60		90	100	110	120	130	140	150	160	170	180			
	65	80	90	100	110	120	130	140	150	160	170	180			
	70	80	90	100	110	120	130	140	150	160	170	180			

BEACH-*FX* MONTE CARLO SIMULATION MODEL

Because Federal participation in Hurricane and Storm Damage Reduction Projects requires a favorable economic justification, or the benefits exceed the costs, a suitable economic analysis must take into account the probabilistic nature of storm-associated damage to structures. This damage is a function of structure location and character, storm intensity, and the degree of protection provided by the natural or constructed beach. Thus, meteorological and coastal processes are significant in determining the damages. The Walton County study is a test case for the Beach-*fx* model recently developed by the USACE. The Beach-*fx* model is an engineering-economic Monte Carlo simulation model that relates beach profile change to storms, coastal processes, and nourishment programs. The model relies on a pre-computed SRD of beach profile responses to storms for a range of storms and profiles. SBEACH was used to predict beach profile response to a suite of plausible tropical storm events derived from the historical record of tropical storms impacting the Walton County area (Attachment I-A, Table 1-A). When the Beach-*fx* model is run for multiple iterations, statistics on probable benefits and costs of various shore protection alternatives can be calculated and used for the economic evaluation.

Beach-*fx* Overview. The Beach-*fx* model is an event-driven life cycle Monte Carlo simulation model. A shore protection project life cycle (i.e. 50 years) is simulated by determining the beach and structure response to a set of storms (the events driving the process). The associated damages are determined for each structure that is modeled. This simulation is repeated for many different sets of storms, and the results averaged. Input data to the model is stored in databases, and, wherever possible, information needed to localize, parameterize, and modify model behavior is also stored as data (datA-1-driven modeling).

Beach-*fx* simulates beach response over time as storms, natural recovery, and management methods alter the beach profile. Events of interest (storms, beach nourishment) take place at calculated times. As each event takes place, the model simulates the physical and economic responses associated with that event. Structural damages include losses due to flooding, erosion, and wave impact. Simplified beach profiles, as defined by key data points, are tracked as the beach profile evolves over time.

The model makes use of a SRD that is a pre-generated set of beach profile responses to storms, for a range of storms and profiles. The model uses “plausible storms”, based on historic storms, as initiating events (Attachment I-A, Table I-A). The shoreline modification due to a storm is determined through use of a shoreline response model. The SBEACH (Larson and Kraus 1989), a cross-shore storm response model was used in this study. The SRD contains information on the input (pre-storm) profile, the storm, and the response (post-storm) profile, for many combinations of storms and pre-storm profiles. The Monte Carlo simulation model then reads information from the SRD as needed to determine shoreline change following a storm event.

As each storm is processed, the shoreline response is determined, and a post-storm beach configuration is calculated, as well as profiles of maximum water level, wave height, and erosion during the storm. This information is used to determine economic damages, based on empirical curves (damage functions) relating the percentage loss of value of structure and contents to “damage-driving parameters” calculated from the aforementioned profiles and characteristics of the structure. The nature of the data used by the model is shown in Figure A-1-57.

The key features of the model, described in more detail in the following sections, are: 1) Representation Framework of Beach and Structures, 2) Storm generation methodology. 3) Shoreline response database (SRD) construction and use, 4) Damage Calculations, 5) Nourishment, and 6) User Interface.

Representative Framework of Beach and Structures. The overall unit of analysis is the “project”, a shoreline area for which the analysis is to be performed. The project is divided, for purposes of analysis, into reaches, which are contiguous, morphologically homogeneous areas. The structures on a reach are referred to as Damage Elements (DEs), and are located on lots. All locations are geospatially referenced by state plane coordinates, as shown schematically in Figure A-1-58, in which a shoreline is linearized into reaches. For this study, the Walton County shoreline was divided into 117 reaches for the Beach-*fx* model.

Each reach is associated with a beach profile describing the shape of the cross-shore profile, and the beach composition. Thus, within a project, multiple reaches can share the same profile. The profile is the basic unit of beach response.

For purposes of Beach-*fx* modeling, a simplified beach profile, represented by key points, is used, as shown in Figure A-1-50. The simplified profiles used for the Beach-*fx* modeling are detailed in Table A-1-23. The five project reaches, the Beach-*fx* reach number and reach name, and the associated representative or simplified beach profile are provided in Table A-1-26.

The model uses a set of pre-developed “plausible storms”, as described in Representation of Tropical Storm Events of this report. Each storm is processed through SBEACH, for a variety of different input profiles, with the results stored in the SRD. Within SBEACH, a storm is represented as time histories of wave height, wave period, and total water elevation (tide plus surge). Optionally, wave direction and wind speed and direction can also be specified, but these capabilities are not used in the current effort. Thus, it is necessary to have time series representing the storm history for each of the plausible storms. A total of 552 storms were developed for this study (Table I-A)

Shoreline Response Database (SRD). The Shoreline Response Database (SRD) is a relational database used to pre-store results of SBEACH runs for all plausible storms, and a range of pre-defined profiles, as expressed by ranges of berm width, dune width, and dune height. Two kinds of results are stored: changes in berm width, dune width, dune height, and upland width, and cross-shore profiles of erosion, wave height, and water depth.

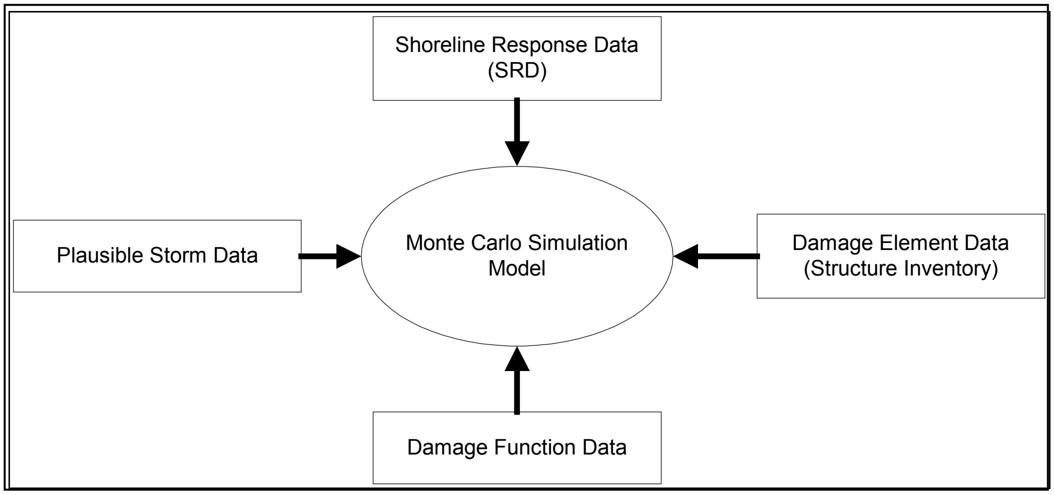

Figure A-1-57. Data Used By The Beach-*Fx* Model

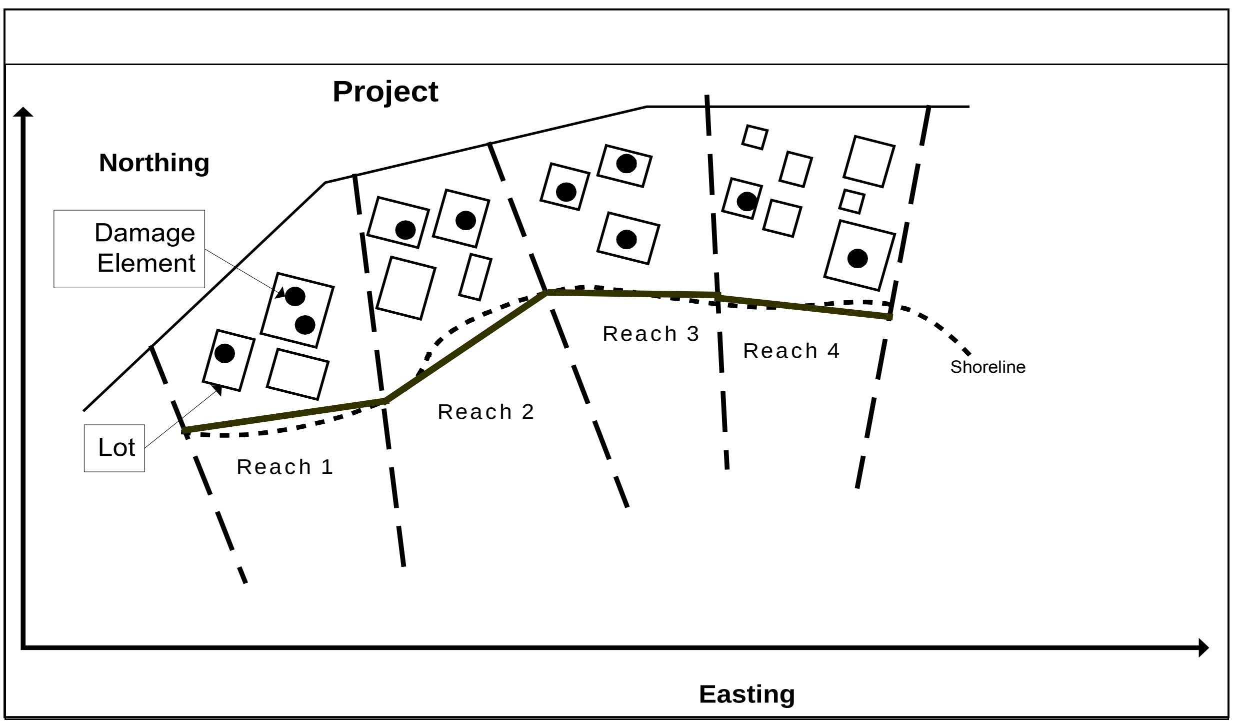

Figure A-1-58. Beach-*FX* Model Representation

Table A-1-26. Project Reaches, Beach-*FX* Reaches, Representative Profiles

Project Reach	Reach Number	Beach-*fx* Reach Name	Representative Profile
Reach 1	1	R1-1	R1P1
	2	R1-2	R1P1
	3	R1-3	R1P1
	4	R1-4	R1P1
	5	R1-5	R1P1
	6	R1-6	R1P1
	7	R1-7	R1P1
	8	R1-8	R1P1
	9	R1-9	R1P1
	10	R1-10	R1P1
	11	R1-11	R1P1
	12	R1-12	R1P1
	13	R1-13	R1P1
	14	R1-14	R1P1
	15	R1-15	R1P2
	16	R1-16	R1P2
	17	R1-17	R1P2
	18	R1-18	R1P2
	19	R1-19	R1P2
	20	R1-20	R1P2
	21	R1-21	R1P1
	22	R1-22	R1P1
	23	R1-23	R1P1
	24	R1-24	R1P1
Reach 2	25	R2-1	R2P1
	26	R2-2	R2P1
	27	R2-3	R2P2
	28	R2-4	R2P1
	29	R2-5	R2P2
	30	R2-6	R2P1
	31	R2-7	R2P1
Reach 3	32	R3-1	R3P1
	33	R3-2	R3P1
	34	R3-3	R3P1
	35	R3-4	R3P2
	36	R3-5	R3P2
	37	R3-6	R3P2
	38	R3-7	R3P2

Table A-1-26 (Cont'd). Project Reaches, Beach-*FX* Reaches, Representative Profiles

Project Reach	Reach Number	Beach-*fx* Reach Name	Representative Profile
Reach 3	39	R3-8	R3P1
	40	R3-9	R3P1
	41	R3-10	R3P1
	42	R3-11	R3P1
	43	R3-12	R3P1
	44	R3-13	R3P1
	45	R3-14	R3P1
	46	R3-15	R3P1
	47	R3-16	R3P1
	48	R3-17	R3P1
	49	R3-18	R3P1
	50	R3-19	R3P1
	51	R3-20	R3P1
	52	R3-21	R3P1
	53	R3-22	R3P1
	54	R3-23	R3P1
	55	R3-24	R3P2
	56	R3-25	R3P2
	57	R3-26	R4P1
	58	R4-1	R4P1
	59	R4-2	R4P1
	60	R4-3	R4P2
Reach 4	61	R4-4	R4P2
	62	R4-5	R4P1
	63	R4-6	R4P2
	64	R4-7	R4P2
	65	R4-8	R4P1
Reach 5	66	R4-9	R4P1
	67	R5-1	R5P2
	68	R5-2	R5P2
	69	R5-3	R5P2
	70	R5-4	R5P2
	71	R5-5	R5P2
	72	R5-6	R5P1
	73	R5-7	R5P1
	74	R5-8	R5P1
	75	R5-9	R5P2
	76	R5-10	R5P2
	77	R5-11	R5P2
	78	R5-12	R5P2

Table A-1-26 (Cont'd). Project Reaches, Beach-*FX* Reaches, Representative Profiles

Project Reach	Reach Number	Beach-fx Reach Name	Representative Profile
Reach 5	79	R5-13	R5P2
	80	R5-14	R5P2
	81	R5-15	R5P2
	82	R5-16	R5P2
	83	R5-17	R5P3
	84	R5-18	R5P2
	85	R5-19	R5P3
	86	R5-20	R5P2
	87	R5-21	R5P2
	88	R5-22	R5P3
	89	R5-23	R5P3
	90	R5-24	R5P2
	91	R5-25	R5P2
	92	R5-26	R5P1
	93	R5-27	R5P3
	94	R5-28	R5P3
	95	R5-29	R5P2
	96	R5-30	R5P2
	97	R5-31	R5P2
	98	R5-32	R5P1
	99	R5-33	R5P1
	100	R5-34	R5P1
	101	R5-35	R5P1
	102	R5-36	R5P1
	103	R5-37	R5P1
	104	R5-38	R5P1
	105	R5-39	R5P1
	106	R5-40	R5P2
	107	R5-41	R5P2
	108	R5-42	R5P2
	109	R5-43	R5P2
	110	R5-44	R5P2
	111	R5-45	R5P2
	112	R5-46	R5P2
	113	R5-47	R5P2
	114	R5-48	R5P3
	115	R5-49	R5P3
	116	R5-50	R5P3
	117	R5-51	R5P3

The SRD is site and study specific, that is, it is created for each shore protection study. The SRD, once generated, is used as a 'lookup table' by the Monte Carlo simulation. Within the Monte Carlo simulation, the shoreline modifications are tracked continuously by the simplified profile representation (primarily dune width and height and berm width). The driving force for profile change is the list of plausible storms. These plausible storms are then used to create SBEACH input, which is run against a range of profiles that is expected to cover the range of natural and managed profiles.

For each such pair (storm and profile), both simplified and detailed SBEACH results are stored in the SRD. The output of SBeach for a given run is an ascii file that describes the initial, final, maximum, and minimum cross-shore profiles, and the water and wave heights along the cross-shore. This file must be post-processed by software that extracts the values of changes in berm width, dune width, and dune height, and stores the information in the SRD. Approximately 596,000 (240,000 without project and 356,000 with project) storm and profile pairs were developed through SBEACH for this study.

The Monte Carlo simulation uses the same set of storms that were used to create the SRD. As a given storm event from the simulated sequence takes place, the current profile is used to look up the results that are associated with that storm in the SRD for the profile that is 'closest' to the pre-storm profile as tracked in the simulation. These results are then used to define the post-storm profile, to track volume changes, and to determine within-storm erosion, wave heights and water elevations due to the storm along the cross-shore profile.

Damage Calculations. As shown in Figure A-1-58, a hierarchy exists within a reach, such that damage elements (a generalization of the term 'structures') are located on lots located in the reach. Each damage element is geographically referenced, and characterized as to usage, construction type, foundation type, value of contents, value of structures, and ground and first floor elevation. Because the location of the DE is known, the position of the DE (in the cross-shore) with regard to the water depth, wave, and erosion profiles is known, so that each of these parameters can be calculated at the DE location. These values are then used to calculate "damage-driving parameters", which vary by the type of damages and the structure and foundation type.

Following each storm event, damages are calculated for each reach, lot, and damage element. The storm event determines the water level and erosion profiles, which are obtained from lookups in the SRD. These response profiles exist at the profile (and thus the reach) level, and are constant for all DE's within a reach.

Three "factors" are thus available in the form of percent- damage caused by inundation, erosion, and wave. These are then used to calculate a combined impact. This combined impact is used to reduce the current value of the damage element. The total of all damages (reductions in value) is the economic loss that can be mitigated by shore protection projects.

Inundation damages in Beach-*fx* are computed based on water levels obtained from the SBEACH simulations. If a given reach is susceptible to "back bay' flooding the specified maximum tide plus surge input value associated with the specific storm is used to determine inundation damages. In the case that the combined tide, surge and wave set up values exceeds the dune crest then the inundation elevation is extended beyond the SBEACH line. Otherwise, inundation damages are restricted to damage elements which are located seaward of the dune crest. Erosion damages are computed based on SBEACH simulated profiles which are stored within the SRD. Information on the input (pre-storm) profile, the storm, and the response (post-storm) profile, for many combinations of storms and pre-storm profiles are stored in the SRD. The Beach-*fx* Monte Carlo simulation model reads information from the SRD that most closely matches the current condition based background erosion and nourishments as needed to determine shoreline change following a storm event. As each storm is processed, the shoreline response is determined, and a post-storm beach configuration is calculated. **Wave damages are computed based on the profile of maximum water level and wave height computed from SBEACH simulations for a given profile subjected to the simulated storm**. This information is used to determine economic damages, based on empirical curves (damage functions) relating the percentage loss of value of structure and contents to "damage-driving parameters" calculated from the aforementioned profiles and characteristics of the structure.

Overall Processing. Processing starts with a storm event. Storm event sequences are generated based on seasonal probabilities of tropical/extratropical storms. For each season of each year of simulation, a Poisson probability distribution is used to determine the number of storms of each type that occur in the given season. Then, using a bootstrap sampling with replacement approach, storms are selected from the plausible storm set for the appropriate storm type and season. The timing of each such storm is chosen randomly within the storm season, with a minimum storm inter-arrival time to preclude two storms being too close in time. This approach allows for the generation of any desired number of sequences of plausible storms. Each storm event of the generated sequence is processed in order. For each storm event, all profiles are processed in turn. For each profile, all reaches using the profile are processed.

Reach processing involves determination of the post-storm and post-recovery berm width, dune width, and dune height, through lookup into the SRD, choosing the information that best fits the pre-storm reach configuration. Post-storm berm width recovery of 90 percent is applied. For each lot within the reach, and for each damage element within the lot, wave, flooding, and erosion damages are calculated.

Nourishment Event. Planned and emergency nourishment are based on design templates and nourishment cycles. Nourishment cycles are defined as periodic (i.e. every three years). An order of reach nourishment is defined in the database, as well as reach-level design templates (dune width/height, berm width), and placement rates. Emergency nourishment occurs when a defined minimum dune/berm width is reached in the simulation. The emergency nourishment dune and berm width triggers and the associated emergency fill widths are provided in Table A-1-27.

Table A-1-27. Emergency Nourishment Triggers and Templates

	Emergency Nourishment Trigger			Emergency Template		
Rep Profile	**Dune Height**	**Dune Width**	**Berm Width**	**Dune Height**	**Dune Width**	**Berm Width**
R1P1	0	56	0	22.2	69.7	6.3
R1P2	0	100	0	13.6	128.3	11.7
R2P1	0	0	0	0	0	0
R2P2	0	0	0	0	0	0
R3P1	0	45	0	12.5	79.0	16.0
R3P2	0	76.5	0	23.0	95.0	31.5
R4P1	0	0	0	0	0	0
R4P2	0	0	0	0	0	0
R5P1	0	65	0	24.0	78.5	38.5
R5P2	0	184.3	0	32.0	190.3	34.0
R5P3	0	50	0	15.5	69.5	46.0

All reaches to be nourished are examined, to determine if mobilization is warranted. The existing reach profile is compared to the design template, and nourishment volume is determined. If the total nourishment volume for all reaches exceeds a user-defined threshold, then mobilization and nourishment take place.

If nourishment is required, then nourishment time is determined based on placement rates. A start nourishment and end nourishment event for the first reach are created. At the end nourishment event, the reach profile is set to the design template, and the next reach in processing order is examined, to see if nourishment is required. The process continues into all reaches have been handled.

Cost of nourishment, including mobilization and placement costs, is calculated based on nourishment volumes and user-defined cost-related parameters.

Beach-*fx* Calibration. For the coastal processes simulations, the Beach-*fx* model was calibrated to the historic shoreline erosion rates developed through the shoreline analysis conducted for this study. A historic erosion rate was calculated for each Beach-*fx* reach. Numerous simulations were conducted to evaluate adjustments to an applied historic erosion rate. The applied erosion rates were adjusted with constant adjustments over the entire domain. Results of the simulations indicated adjustments were necessary at the project reach level. All simulations were run using a zero percent recovery factor for the dune height and width and a 90 percent recovery factor for the berm width. Additional testing was conducted to ensure a sufficient number of iterations were run which reproduced repeatable predictions. The analysis indicated that 500 iterations for the 54-year period of analysis were sufficient for the coastal processes simulations. A comparison of the historic shoreline erosion rates and the Beach-*fx* model predicted historic shoreline erosion for each Beach-*fx* model reach is plotted in Figure A-1-59.

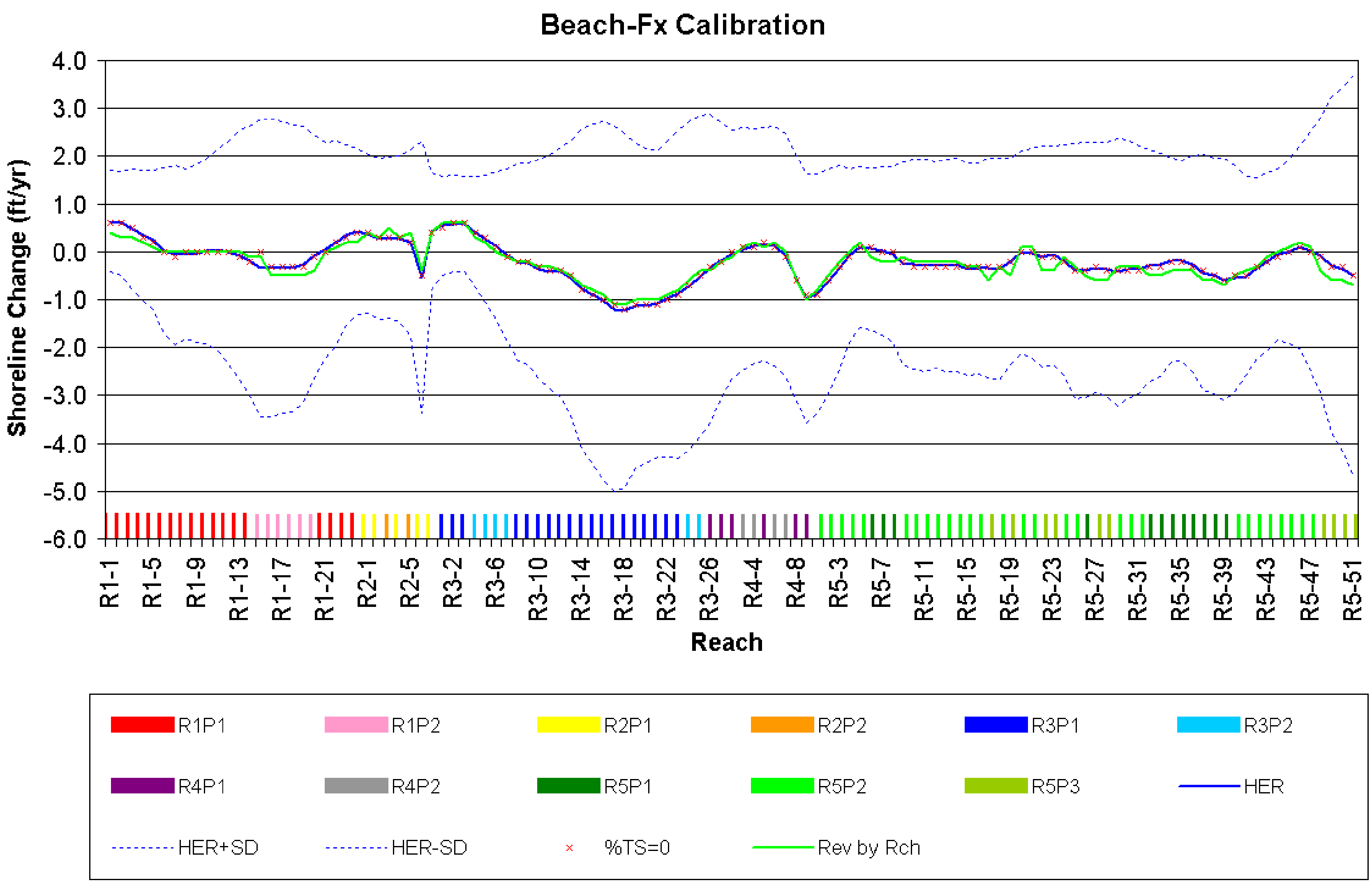

Figure A-1-59. Coastal Processes Calibration, Beach-*Fx* Model

Future Without Project Conditions. The period of analysis is 54 years from January, 2010 through and including all of the year 2063, and there are four pre-project base years, 2010 through 2013. Therefore, to estimate the future without project conditions, Beach-*fx* simulations were run for a 54-year period of analysis for project Reaches 1, 3, 4, and 5. Reach 2 was not simulated since beach nourishment will not be conducted in the State Park and coastal barrier resource area. Table A-1-28 lists project reach, Beach-*fx* reach number and name, the corresponding representative beach profile, and the associated existing condition beach profile configurations (dune height, dune width, berm width, and upland width) input to the Beach-*fx* model.

The future without project conditions were then averaged over the Beach-*fx* reaches comprising each of the 11 representative profiles. For each representative profile, the corresponding dune height, dune width, and berm width for the existing and future without project (54-year) condition are tabulated in Table A-1-29. Over the 54-year period of analysis, the dune height and width are maintained in Reaches 1, 3, and 5 due to the emergency nourishment triggers applied in the Beach-*fx* simulations. Because emergency nourishment is only applied to the dune, the berm retreats as indicated in Table A-1-29. Emergency nourishment was not applied to Reach 4, which encompasses the state park area, resulting in both dune and berm retreat. Table A-1-29 indicates that significant berm erosion occurs over the entire Walton County shoreline.

Future With Project Conditions. The with project period of analysis is 54 years from January, 2010 through and including all of the year 2063, with four pre-project base years, 2010 through 2013. To estimate the future with project conditions, Beach-*fx* simulations were run for a 54-year period of analysis. Through use of a seed file the same storm suite was used for the with and without project 54 year iteration. The with project analysis is described in detail in Appendix B - Economic Investigations.

Table A-1-28. Existing Conditions Configuration

Project Reach	Reach Number	Beach-fx Reach Name	Rep Profile	Dune Height	Dune Width	Berm Width
Reach 1	1	R1-1	R1P1	22.2	55.0	23.0
	2	R1-2	R1P1	22.2	55.0	23.0
	3	R1-3	R1P1	22.2	55.0	23.0
	4	R1-4	R1P1	22.2	55.0	23.0
	5	R1-5	R1P1	22.2	55.0	23.0
	6	R1-6	R1P1	22.2	55.0	23.0
	7	R1-7	R1P1	22.2	55.0	23.0
	8	R1-8	R1P1	22.2	55.0	23.0
	9	R1-9	R1P1	22.2	55.0	23.0
	10	R1-10	R1P1	22.2	55.0	23.0
	11	R1-11	R1P1	22.2	55.0	23.0
	12	R1-12	R1P1	22.2	55.0	23.0
	13	R1-13	R1P1	22.2	55.0	23.0
	14	R1-14	R1P1	22.2	55.0	23.0
	15	R1-15	R1P2	13.6	99.0	40.0
	16	R1-16	R1P2	13.6	99.0	40.0
	17	R1-17	R1P2	13.6	99.0	40.0
	18	R1-18	R1P2	13.6	99.0	40.0
	19	R1-19	R1P2	13.6	99.0	40.0
	20	R1-20	R1P2	13.6	99.0	40.0
	21	R1-21	R1P1	22.2	55.0	23.0
	22	R1-22	R1P1	22.2	55.0	23.0
	23	R1-23	R1P1	22.2	55.0	23.0
	24	R1-24	R1P1	22.2	55.0	23.0
Reach 3	32	R3-1	R3P1	23.0	75.5	50.0
	33	R3-2	R3P1	23.0	75.5	50.0
	34	R3-3	R3P1	23.0	75.5	50.0
	35	R3-4	R3P2	12.5	44.0	50.0
	36	R3-5	R3P2	12.5	44.0	50.0
	37	R3-6	R3P2	12.5	44.0	50.0
	38	R3-7	R3P2	12.5	44.0	50.0
	39	R3-8	R3P1	23.0	75.5	50.0
	40	R3-9	R3P1	23.0	75.5	50.0
	41	R3-10	R3P1	23.0	75.5	50.0
	42	R3-11	R3P1	23.0	75.5	50.0
	43	R3-12	R3P1	23.0	75.5	50.0
	44	R3-13	R3P1	23.0	75.5	50.0
	45	R3-14	R3P1	23.0	75.5	50.0
	46	R3-15	R3P1	23.0	75.5	50.0
	47	R3-16	R3P1	23.0	75.5	50.0
	48	R3-17	R3P1	23.0	75.5	50.0
	49	R3-18	R3P1	23.0	75.5	50.0
	50	R3-19	R3P1	23.0	75.5	50.0
	51	R3-20	R3P1	23.0	75.5	50.0

Table A-1-28 (Cont'd). Existing Conditions Configuration

Project Reach	Reach Number	Beach-fx Reach Name	Rep Profile	Dune Height	Dune Width	Berm Width
Reach 3	52	R3-21	R3P1	23.0	75.5	50.0
	53	R3-22	R3P1	23.0	75.5	50.0
	54	R3-23	R3P1	23.0	75.5	50.0
	55	R3-24	R3P2	12.5	44.0	50.0
	56	R3-25	R3P2	12.5	44.0	50.0
	57	R3-26	R4P1	23.0	50.3	35.0
	58	R4-1	R4P1	23.0	50.3	35.0
	59	R4-2	R4P1	23.0	50.3	35.0
	60	R4-3	R4P2	10.0	82.0	110.0
Reach 4	61	R4-4	R4P2	10.0	82.0	110.0
	62	R4-5	R4P1	23.0	50.3	35.0
	63	R4-6	R4P2	10.0	82.0	110.0
	64	R4-7	R4P2	10.0	82.0	110.0
	65	R4-8	R4P1	23.0	50.3	35.0
Reach 5	66	R4-9	R4P1	23.0	50.3	35.0
	67	R5-1	R5P2	24.0	64.0	52.0
	68	R5-2	R5P2	24.0	64.0	52.0
	69	R5-3	R5P2	24.0	64.0	52.0
	70	R5-4	R5P2	24.0	64.0	52.0CIRC
	71	R5-5	R5P2	24.0	64.0	52.0
	72	R5-6	R5P1	32.0	183.3	40.0
	73	R5-7	R5P1	32.0	183.3	40.0
	74	R5-8	R5P1	32.0	183.3	40.0
	75	R5-9	R5P1	24.0	64.0	52.0
	76	R5-10	R5P1	24.0	64.0	52.0
	77	R5-11	R5P1	24.0	64.0	52.0
	78	R5-12	R5P2	24.0	64.0	52.0
	79	R5-13	R5P2	24.0	64.0	52.0
	80	R5-14	R5P2	24.0	64.0	52.0
	81	R5-15	R5P2	24.0	64.0	52.0
	82	R5-16	R5P2	24.0	64.0	52.0
	83	R5-17	R5P3	15.5	49.0	65.5
	84	R5-18	R5P2	24.0	64.0	52.0
	85	R5-19	R5P3	15.5	49.0	65.5
	86	R5-20	R5P2	24.0	64.0	52.0
	87	R5-21	R5P2	24.0	64.0	52.0
	88	R5-22	R5P3	15.5	49.0	65.5
	89	R5-23	R5P3	15.5	49.0	65.5
	90	R5-24	R5P2	24.0	64.0	52.0
	91	R5-25	R5P2	24.0	64.0	52.0
	92	R5-26	R5P1	32.0	183.3	40.0
	93	R5-27	R5P3	15.5	49.0	65.5
	94	R5-28	R5P3	15.5	49.0	65.5
	95	R5-29	R5P2	24.0	64.0	52.0
	96	R5-30	R5P2	24.0	64.0	52.0

Table A-1-28 (Cont'd). Existing Conditions Configuration

Project Reach	Reach Number	Beach-fx Reach Name	Rep Profile	Dune Height	Dune Width	Berm Width
Reach 5	97	R5-31	R5P2	24.0	64.0	52.0
	98	R5-32	R5P1	32.0	183.3	40.0
	99	R5-33	R5P1	32.0	183.3	40.0
	100	R5-34	R5P1	32.0	183.3	40.0
	101	R5-35	R5P1	32.0	183.3	40.0
	102	R5-36	R5P1	32.0	183.3	40.0
	103	R5-37	R5P1	32.0	183.3	40.0
	104	R5-38	R5P1	32.0	183.3	40.0
	105	R5-39	R5P1	32.0	183.3	40.0
	106	R5-40	R5P2	24.0	64.0	52.0
	107	R5-41	R5P2	24.0	64.0	52.0
	108	R5-42	R5P2	24.0	64.0	52.0
	109	R5-43	R5P2	24.0	64.0	52.0
	110	R5-44	R5P2	24.0	64.0	52.0
	111	R5-45	R5P2	24.0	64.0	52.0
	112	R5-46	R5P2	24.0	64.0	52.0
	113	R5-47	R5P2	24.0	64.0	52.0
	114	R5-48	R5P3	15.5	49.0	65.5
	115	R5-49	R5P3	15.5	49.0	65.5
	116	R5-50	R5P3	15.5	49.0	65.5
	117	R5-51	R5P3	15.5	49.0	65.5

Table A-1-29. Future Without Project Conditions, 54-Yr Period of Analysis

Reach	Rep Profile	Dune Height (feet)				Dune width (feet)				Berm Width (feet)			
		Exist	54 yr Avg	St Dev (+/-)	Diff	Exist	54 yr Avg	St Dev (+/-)	Diff	Exist	54 yr Avg	St Dev (+/-)	Diff
1	R1P1	22.2	22.2	0.0	0.0	55.0	66.8	3.9	11.8	23.0	4.3	1.6	-18.7
	R1P2	13.6	13.6	0.0	0.0	99.0	118.5	20.1	19.5	40.0	0.0	0.0	-40.0
3	R3P1	23.0	22.9	0.3	-0.1	75.5	67.0	30.5	-8.5	50.0	0.7	2.1	-49.3
	R3P2	20.3	19.8	0.5	-0.5	66.2	61.2	28.9	-5.0	49.3	0.7	1.8	-48.7
4	R4P1	23.0	13.4	4.2	-9.6	50.3	0.0	0.2	-50.3	35.0	2.8	2.3	-32.2
	R4P2	10.0	10.0	0.0	0.0	82.0	82.0	0.0	0.0	110.0	36.0	17.5	-74.0
5	R5P1	32.1	32.0	0.0	0.0	183.3	168.7	29.9	-14.5	40.0	0.4	1.6	-39.6
	R5P2	24.0	24.0	0.1	0.0	64.0	58.3	24.2	-5.7	52.0	0.1	.5	-51.9
	R5P3	15.5	15.5	0.1	0.0	49.0	57.4	19.9	8.4	65.5	0.2	0.9	-65.3

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ATTACHMENT I

WAVE INFORMATION STUDY (WIS) WIND AND WIND STATISTICS

Attachment: Wave Information Study Wind and Wind Statistics

Table 1. Percent Occurrence Tables, WIS Station 179

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF WAVE HEIGHT BY MONTH

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 0.49	1.50	1.32	1.61	1.91	2.61	3.20	3.62	4.34	3.85	2.48	1.77	1.40	28563	29.6
0.50 - 0.99	3.45	2.74	3.12	3.33	4.07	3.82	4.19	3.36	2.87	4.51	3.46	3.42	40826	42.3
1.00 - 1.49	2.20	2.02	1.91	1.90	1.50	0.92	0.65	0.63	1.20	1.19	1.88	2.27	17614	18.3
1.50 - 1.99	0.71	0.85	1.01	0.72	0.27	0.21	0.02	0.09	0.20	0.10	0.57	0.71	5280	5.5
2.00 - 2.49	0.33	0.42	0.46	0.21	0.02	0.04	.	0.03	0.04	0.07	0.29	0.39	2211	2.3
2.50 - 2.99	0.18	0.19	0.26	0.08	0.01	0.01	.	0.02	0.03	0.03	0.13	0.19	1096	1.1
3.00 - 3.49	0.08	0.11	0.07	0.04	0.02	0.01	.	0.00	0.01	0.01	0.08	0.08	492	0.5
3.50 - 3.99	0.02	0.05	0.02	0.01	.	.	.	0.00	0.00	0.01	0.03	0.02	157	0.2
4.00 - 4.49	0.01	0.03	0.02	.	.	.	.	0.00	0.00	0.04	0.00	0.01	101	0.1
4.50 - 4.99	0.00	0.01	0.01	.	.	.	.	0.00	0.00	0.01	.	0.01	42	0.0
5.00 - GREATER	.	.	.	.	.	.	.	0.01	0.01	0.03	.	.	39	0.0
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF PEAK PERIOD BY MONTH

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
3.0 - 3.9	3.93	2.93	3.12	3.46	4.18	4.70	6.38	6.08	5.38	5.84	4.28	3.89	52224	54.2
4.0 - 4.9	2.38	2.28	2.09	2.21	2.60	1.93	1.64	1.47	1.68	1.57	2.05	2.45	23488	24.4
5.0 - 5.9	0.87	1.01	1.14	1.27	1.22	0.87	0.34	0.47	0.40	0.43	0.64	0.85	9180	9.5
6.0 - 6.9	0.67	0.63	1.17	0.90	0.33	0.51	0.08	0.23	0.25	0.22	0.57	0.69	6037	6.3
7.0 - 7.9	0.34	0.53	0.62	0.27	0.07	0.11	0.04	0.07	0.22	0.20	0.34	0.38	3080	3.2
8.0 - 8.9	0.19	0.22	0.26	0.09	0.08	0.05	.	0.07	0.08	0.06	0.19	0.15	1371	1.4
9.0 - 9.9	0.05	0.10	0.06	0.01	0.00	0.03	.	0.02	0.05	0.04	0.06	0.03	434	0.5
10.0 - 10.9	0.04	0.03	0.03	0.01	.	0.01	.	0.02	0.04	0.02	0.02	0.04	257	0.3
11.0 - 13.9	0.01	0.01	0.00	.	.	.	.	0.06	0.08	0.08	0.06	0.01	303	0.3
14.0 - LONGER	.	.	.	.	.	.	.	0.01	0.02	0.02	.	.	47	0.0
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF MEAN DIRECTION BY MONTH

Dp(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
348.75 - 11.24 (0.0)	1.22	1.07	0.84	0.70	0.67	0.54	0.54	0.53	0.69	1.16	1.05	1.19	4055	4.2
11.25 - 33.74 (22.5)	0.90	0.95	0.83	0.69	0.64	0.53	0.54	0.56	0.74	1.02	0.99	1.08	3346	3.5
33.75 - 56.24 (45.0)	0.98	0.80	0.78	0.77	0.66	0.55	0.60	0.58	1.09	1.55	1.01	1.10	4321	4.5
56.25 - 78.74 (67.5)	0.87	0.85	0.83	0.79	0.70	0.63	0.77	0.71	1.38	1.72	1.24	0.96	5264	5.5
78.75 - 101.24 (90.0)	1.08	1.10	0.99	0.99	1.15	1.07	0.87	1.26	1.85	1.70	1.46	1.08	8288	8.6
101.25 - 123.74 (112.5)	1.05	1.08	1.11	1.00	1.41	1.12	1.00	0.99	1.21	1.02	1.33	1.07	7106	7.4
123.75 - 146.24 (135.0)	1.09	1.20	1.55	1.57	1.80	1.62	1.57	1.74	1.64	1.39	1.39	1.55	11665	12.1
146.25 - 168.74 (157.5)	1.41	1.36	1.81	1.50	2.33	1.79	1.95	2.07	1.70	1.48	1.33	1.44	13669	14.2
168.75 - 191.24 (180.0)	1.28	1.19	1.69	1.55	1.57	1.79	1.43	1.44	1.28	0.90	1.08	1.17	10007	10.4
191.25 - 213.74 (202.5)	0.94	1.10	1.04	1.06	1.10	1.30	1.25	0.95	0.83	0.63	0.96	0.90	5849	6.1
213.75 - 236.24 (225.0)	0.76	0.80	0.84	0.95	0.88	1.15	1.25	1.09	0.64	0.56	0.71	0.78	4255	4.4
236.25 - 258.74 (247.5)	0.77	0.83	0.85	1.01	0.88	1.33	1.35	1.30	0.79	0.56	0.66	0.80	4955	5.1
258.75 - 281.24 (270.0)	0.86	0.85	0.83	1.11	0.67	1.05	1.32	1.21	0.63	0.58	0.74	0.75	4440	4.6
281.25 - 303.74 (292.5)	1.06	0.86	0.81	0.88	0.63	0.64	0.89	0.88	0.55	0.65	0.74	0.78	3253	3.4
303.75 - 326.24 (315.0)	1.13	0.86	0.86	0.86	0.67	0.57	0.63	0.62	0.57	0.72	0.75	0.77	2898	3.0
326.25 - 348.74 (337.5)	1.07	0.82	0.82	0.80	0.71	0.54	0.53	0.56	0.62	0.84	0.78	1.07	3050	3.2
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 1 (Cont'd). Percent Occurrence Tables, WIS Station 179

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR ALL DIRECTIONS

Hmo(m)	Tp(sec) 3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-13.9	14.0-LONGER	CASES	PERCENT OF TOTAL
0.00 - 0.49	21.91	3.65	1.81	1.01	0.52	0.38	0.15	0.14	0.04	0.02	28563	29.62
0.50 - 0.99	30.58	7.38	2.80	1.04	0.33	0.12	0.06	0.02	0.02	.	40826	42.34
1.00 - 1.49	1.67	11.90	3.04	1.19	0.32	0.07	0.02	0.00	0.04	0.01	17614	18.27
1.50 - 1.99	.	1.37	1.64	1.87	0.42	0.05	0.02	0.02	0.07	0.01	5280	5.48
2.00 - 2.49	.	0.05	0.23	0.92	0.88	0.15	0.02	0.01	0.03	.	2211	2.29
2.50 - 2.99	.	.	0.01	0.20	0.51	0.34	0.05	0.01	0.02	.	1096	1.14
3.00 - 3.49	.	.	.	0.02	0.18	0.23	0.05	0.01	0.01	.	492	0.51
3.50 - 3.99	.	.	.	.	0.03	0.06	0.04	0.02	0.02	.	157	0.16
4.00 - 4.49	.	.	.	0.00	.	0.02	0.03	0.02	0.03	.	101	0.10
4.50 - 4.99	.	.	.	.	0.00	.	0.02	0.01	0.01	.	42	0.04
5.00 - GREATER	.	.	.	.	.	0.00	0.00	0.01	0.02	0.01	39	0.04
CASES THIS BAND	52224	23488	9180	6037	3080	1371	434	257	303	47	96421	100.00

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF WIND SPEED BY MONTH

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 1.99	0.12	0.16	0.24	0.26	0.34	0.37	0.08	0.18	0.37	0.28	0.16	0.20	2666	2.8
2.00 - 3.99	0.97	0.96	1.18	1.37	2.00	2.37	2.54	3.08	2.26	1.30	1.00	0.92	19249	20.0
4.00 - 5.99	2.01	1.55	2.29	2.29	2.86	3.36	4.09	3.54	2.76	2.29	1.94	1.72	29604	30.7
6.00 - 7.99	2.24	1.86	1.99	2.37	2.39	1.59	1.48	1.34	1.51	2.53	2.27	2.29	22993	23.8
8.00 - 9.99	1.52	1.56	1.52	1.19	0.73	0.42	0.25	0.25	0.85	1.43	1.57	1.67	12502	13.0
10.00 - 11.99	0.94	0.89	0.79	0.55	0.10	0.09	0.05	0.04	0.38	0.48	0.86	1.06	6007	6.2
12.00 - 13.99	0.55	0.47	0.34	0.17	0.06	0.01	.	0.02	0.05	0.12	0.34	0.45	2477	2.6
14.00 - 15.99	0.11	0.25	0.12	0.01	0.01	.	.	0.01	0.01	0.04	0.05	0.11	696	0.7
16.00 - 17.99	0.02	0.03	0.03	.	.	.	.	0.02	0.00	0.01	0.00	0.06	178	0.2
18.00 - 19.99	.	0.01	0.00	.	.	.	.	0.00	0.00	0.01	0.00	.	31	0.0
20.00 - GREATER	.	.	.	.	.	.	.	.	0.01	.	0.01	.	18	0.0
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 179 LAT: 30.17 N, LON:-86.33 W, DEPTH: 28 M
PERCENT OCCURRENCES OF WIND DIRECTION BY MONTH

WD(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT TOTAL
348.75 - 11.24 (0.0)	1.21	0.92	0.67	0.48	0.42	0.22	0.15	0.25	0.51	0.98	0.79	1.05	7382	7.7
11.25 - 33.74 (22.5)	0.72	0.74	0.67	0.43	0.31	0.21	0.19	0.24	0.52	0.78	0.84	0.91	6322	6.6
33.75 - 56.24 (45.0)	0.80	0.61	0.72	0.58	0.50	0.46	0.48	0.49	1.50	1.87	1.04	0.86	9564	9.9
56.25 - 78.74 (67.5)	0.48	0.55	0.52	0.43	0.54	0.47	0.48	0.72	1.42	1.41	0.89	0.43	8052	8.4
78.75 - 101.24 (90.0)	0.68	0.69	0.65	0.71	1.22	0.86	0.71	1.21	1.51	0.97	1.01	0.74	10545	10.9
101.25 - 123.74 (112.5)	0.41	0.45	0.73	0.49	0.92	0.62	0.58	0.69	0.59	0.47	0.62	0.63	6936	7.2
123.75 - 146.24 (135.0)	0.47	0.57	0.66	0.70	0.87	0.64	0.61	0.63	0.44	0.55	0.68	0.82	7360	7.6
146.25 - 168.74 (157.5)	0.42	0.38	0.66	0.62	0.71	0.41	0.54	0.49	0.23	0.18	0.38	0.52	5359	5.6
168.75 - 191.24 (180.0)	0.45	0.36	0.60	0.49	0.55	0.68	0.66	0.41	0.24	0.15	0.36	0.40	5173	5.4
191.25 - 213.74 (202.5)	0.23	0.28	0.28	0.38	0.41	0.64	0.63	0.24	0.14	0.06	0.16	0.20	3530	3.7
213.75 - 236.24 (225.0)	0.18	0.24	0.26	0.35	0.36	0.60	0.62	0.33	0.10	0.07	0.13	0.22	3331	3.5
236.25 - 258.74 (247.5)	0.21	0.19	0.25	0.34	0.29	0.62	0.61	0.49	0.20	0.08	0.13	0.19	3458	3.6
258.75 - 281.24 (270.0)	0.22	0.30	0.34	0.61	0.35	0.83	0.82	0.78	0.24	0.10	0.17	0.24	4816	5.0
281.25 - 303.74 (292.5)	0.30	0.35	0.32	0.46	0.27	0.40	0.67	0.56	0.10	0.13	0.18	0.25	3844	4.0
303.75 - 326.24 (315.0)	0.93	0.59	0.61	0.68	0.36	0.34	0.49	0.61	0.20	0.33	0.42	0.41	5752	6.0
326.25 - 348.74 (337.5)	0.77	0.53	0.56	0.48	0.41	0.21	0.25	0.33	0.27	0.36	0.41	0.60	4997	5.2
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 1 (Cont'd). Percent Occurrence Tables, WIS Station 179

STATION: 179 GOM
SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1980	1.11	1.05	1.45	1.03	0.80	0.62	0.64	0.54	0.50	0.72	0.94	0.84	0.85
1981	0.89	1.18	1.15	0.73	0.80	0.58	0.48	0.56	0.48	0.69	0.87	1.19	0.80
1982	1.36	1.05	0.82	1.03	0.57	0.74	0.49	0.57	0.56	0.80	0.92	1.49	0.86
1983	0.90	1.49	1.34	1.19	0.83	0.73	0.55	0.54	0.73	0.72	1.19	1.37	0.96
1984	0.91	0.93	0.91	1.10	0.89	0.53	0.60	0.52	0.69	0.72	1.01	0.70	0.79
1985	1.10	1.15	0.97	0.96	0.64	0.66	0.51	0.77	0.87	1.07	0.94	0.93	0.88
1986	0.83	1.11	1.12	0.59	0.63	0.47	0.59	0.55	0.57	0.76	0.88	0.93	0.75
1987	1.23	1.08	1.17	0.75	0.62	0.75	0.55	0.47	0.49	0.69	0.95	1.07	0.82
1988	1.11	0.89	0.98	1.06	0.67	0.60	0.58	0.69	0.99	0.57	1.14	0.75	0.84
1989	0.80	1.00	0.98	0.69	0.73	0.87	0.71	0.47	0.59	0.69	0.73	1.00	0.77
1990	0.77	1.19	0.86	0.83	0.76	0.51	0.64	0.47	0.44	0.69	0.78	0.99	0.74
MEAN	1.00	1.10	1.07	0.90	0.72	0.64	0.58	0.56	0.63	0.74	0.94	1.02	

STATION: 179 GOM
MAX Hmo(m) WITH ASSOCIATED Tp(sec) AND Dm(deg) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN
1980	2.8 8 163	2.4 7 263	3.5 8 168	3.2 9 232	2.0 6 133	2.1 7 261
1981	3.2 8 262	5.0 10 161	4.7 10 245	2.3 7 154	1.9 6 251	1.7 5 95
1982	4.8 10 173	2.9 9 227	2.0 5 300	2.3 7 281	2.0 7 228	2.1 6 128
1983	2.9 6 126	4.5 9 159	4.7 11 157	3.3 9 261	2.0 6 135	1.3 6 167
1984	3.5 8 205	4.0 8 168	4.7 10 269	2.6 7 158	3.3 9 199	1.5 6 267
1985	3.1 8 185	3.8 8 259	3.4 8 142	3.0 8 190	1.5 6 235	2.0 6 153
1986	3.2 8 192	3.0 7 198	3.3 8 162	2.0 6 265	1.4 5 108	1.2 4 112
1987	3.7 8 163	3.4 8 164	3.5 8 148	2.1 7 277	1.4 6 139	2.1 6 202
1988	3.5 8 162	3.3 8 275	2.3 7 209	3.8 8 262	1.6 6 219	1.7 5 117
1989	2.4 7 186	3.5 8 200	2.2 7 162	2.4 7 216	1.8 6 221	3.1 9 196
1990	2.1 6 281	3.5 8 155	3.0 8 154	2.0 7 139	2.2 7 172	1.6 5 252
MAX	4.8 10 173	5.0 10 161	4.7 10 269	3.8 8 262	3.3 9 199	3.1 9 196

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1980	1.4 5 281	1.7 10 188	1.6 6 263	3.0 8 172	2.9 7 149	2.3 7 276	3.5 8 17
1981	1.1 5 239	1.5 6 227	1.4 5 195	2.6 7 153	2.6 7 209	3.6 8 184	5.0 10 17
1982	0.9 4 101	1.4 5 103	1.3 5 93	1.4 5 97	2.8 8 162	3.8 8 142	4.8 10 18
1983	1.1 5 113	1.5 5 129	1.7 6 244	1.6 5 271	3.7 10 152	4.8 10 154	4.8 10 16
1984	1.5 6 201	1.8 6 151	1.6 5 105	1.9 6 138	3.7 8 146	2.1 6 143	4.7 10 27
1985	1.4 5 184	5.8 14 166	5.7 11 156	5.8 14 167	4.4 9 200	3.2 8 187	5.8 14 17
1986	1.7 6 274	1.5 6 153	1.4 5 155	2.7 7 153	3.1 8 165	3.5 8 168	3.5 8 17
1987	1.2 5 90	1.1 5 261	1.1 4 342	1.3 5 3	3.0 7 148	3.5 8 164	3.7 8 17
1988	1.6 5 87	3.0 7 158	2.8 10 171	1.2 4 17	3.4 8 165	2.6 7 150	3.8 8 27
1989	1.6 6 223	1.3 5 159	2.0 5 105	1.5 5 309	2.6 7 280	2.6 7 174	3.5 8 21
1990	1.5 6 241	1.3 5 268	1.2 4 4	2.0 5 325	3.8 9 263	2.9 8 179	3.8 9 27
MAX	1.7 6 274	5.8 14 166	5.7 11 156	5.8 14 167	4.4 9 200	4.8 10 154	

MAX Hmo(m): 5.8   MAX Tp(sec): 14.   MAX Dp(deg): 166.   DATE(gmt): 85083023

MAX WIND SPEED(m/sec): 29.   MAX WIND DIRECTION(deg): 74.   DATE(gmt): 85090203

MEAN Hmo(m): 0.8   MEAN Tp(sec): 4.

STANDARD DEVIATION Hmo(m): 0.6   STANDARD DEVIATION Tp(sec): 1.4

Table 2. Percent Occurrence Tables, WIS Station 180

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WAVE HEIGHT BY MONTH

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 0.49	1.64	1.52	1.74	2.01	2.74	3.28	3.67	4.43	3.94	2.71	1.91	1.57	30034	31.1
0.50 - 0.99	3.61	2.86	3.19	3.43	4.07	3.79	4.17	3.33	2.91	4.58	3.66	3.65	41694	43.2
1.00 - 1.49	1.98	1.85	1.77	1.74	1.39	0.92	0.62	0.58	1.11	0.91	1.59	1.98	15859	16.4
1.50 - 1.99	0.64	0.75	0.95	0.70	0.24	0.17	0.02	0.09	0.17	0.10	0.53	0.65	4829	5.0
2.00 - 2.49	0.34	0.38	0.45	0.21	0.02	0.04	.	0.03	0.04	0.07	0.30	0.35	2139	2.2
2.50 - 2.99	0.17	0.21	0.26	0.08	0.01	0.01	.	0.01	0.02	0.03	0.12	0.18	1062	1.1
3.00 - 3.49	0.07	0.10	0.07	0.05	0.02	0.01	.	0.00	0.01	0.01	0.08	0.08	477	0.5
3.50 - 3.99	0.02	0.04	0.02	0.01	.	.	.	0.00	0.00	0.03	0.03	0.02	156	0.2
4.00 - 4.49	0.01	0.03	0.02	.	.	.	.	0.00	0.01	0.03	0.00	0.00	91	0.1
4.50 - 4.99	0.00	0.01	0.01	.	.	.	.	0.00	0.00	0.01	.	0.01	50	0.1
5.00 - GREATER	.	0.00	.	.	.	.	.	0.01	0.00	0.02	.	.	30	0.0
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURRENCES OF PEAK PERIOD BY MONTH

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
3.0 - 3.9	4.31	3.15	3.31	3.64	4.31	4.71	6.43	6.15	5.50	6.21	4.68	4.30	54685	56.7
4.0 - 4.9	1.96	2.04	1.90	1.98	2.42	1.85	1.57	1.39	1.52	1.17	1.63	2.01	20681	21.4
5.0 - 5.9	0.90	1.00	1.14	1.30	1.24	0.91	0.36	0.48	0.38	0.44	0.65	0.86	9302	9.6
6.0 - 6.9	0.67	0.65	1.18	0.89	0.35	0.53	0.09	0.24	0.28	0.24	0.60	0.69	6177	6.4
7.0 - 7.9	0.34	0.54	0.63	0.29	0.07	0.12	0.04	0.07	0.25	0.20	0.32	0.40	3160	3.3
8.0 - 8.9	0.19	0.22	0.24	0.09	0.09	0.06	.	0.06	0.08	0.06	0.19	0.16	1385	1.4
9.0 - 9.9	0.05	0.11	0.06	0.01	.	0.02	.	0.02	0.05	0.04	0.07	0.02	442	0.5
10.0 - 10.9	0.04	0.03	0.02	0.01	.	0.01	.	0.02	0.04	0.02	0.02	0.04	246	0.3
11.0 - 13.9	0.01	0.01	0.00	.	.	.	.	0.05	0.08	0.08	0.06	0.01	289	0.3
14.0 - LONGER	.	.	.	.	.	.	.	0.01	0.02	0.02	0.01	.	54	0.1
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURRENCES OF MEAN DIRECTION BY MONTH

Dp(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
348.75 - 11.24 (0.0)	0.96	0.88	0.68	0.62	0.59	0.51	0.52	0.52	0.62	0.92	0.93	1.02	2662	2.8
11.25 - 33.74 (22.5)	0.87	0.88	0.82	0.67	0.62	0.51	0.54	0.54	0.71	1.04	0.97	1.08	3147	3.3
33.75 - 56.24 (45.0)	0.99	0.83	0.78	0.77	0.67	0.55	0.62	0.59	1.13	1.59	1.06	1.11	4523	4.7
56.25 - 78.74 (67.5)	0.87	0.87	0.83	0.80	0.71	0.64	0.76	0.72	1.41	1.72	1.26	0.96	5351	5.5
78.75 - 101.24 (90.0)	1.03	1.06	0.94	0.94	1.08	1.02	0.82	1.20	1.75	1.61	1.38	1.01	7576	7.9
101.25 - 123.74 (112.5)	1.06	1.08	1.10	0.97	1.41	1.08	1.00	1.00	1.21	1.01	1.32	1.07	7044	7.3
123.75 - 146.24 (135.0)	1.08	1.17	1.54	1.55	1.77	1.58	1.45	1.66	1.60	1.36	1.39	1.54	11287	11.7
146.25 - 168.74 (157.5)	1.40	1.40	1.82	1.50	2.33	1.84	2.01	2.14	1.74	1.50	1.31	1.44	13914	14.4
168.75 - 191.24 (180.0)	1.36	1.27	1.71	1.62	1.66	1.83	1.49	1.43	1.31	0.95	1.11	1.22	10567	11.0
191.25 - 213.74 (202.5)	0.94	1.11	1.10	1.08	1.12	1.31	1.24	0.97	0.87	0.66	0.97	0.91	6049	6.3
213.75 - 236.24 (225.0)	0.78	0.82	0.84	0.96	0.90	1.16	1.27	1.12	0.64	0.56	0.74	0.78	4408	4.6
236.25 - 258.74 (247.5)	0.78	0.85	0.86	1.04	0.90	1.36	1.37	1.34	0.80	0.57	0.66	0.82	5166	5.4
258.75 - 281.24 (270.0)	0.87	0.87	0.85	1.14	0.70	1.06	1.34	1.21	0.63	0.59	0.74	0.75	4563	4.7
281.25 - 303.74 (292.5)	1.09	0.87	0.83	0.89	0.64	0.65	0.88	0.88	0.55	0.66	0.78	0.82	3424	3.6
303.75 - 326.24 (315.0)	1.28	0.90	0.97	0.94	0.73	0.58	0.64	0.62	0.60	0.80	0.79	0.90	3618	3.8
326.25 - 348.74 (337.5)	1.12	0.88	0.81	0.73	0.65	0.53	0.53	0.54	0.64	0.94	0.81	1.06	3122	3.2
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 2 (Cont'd). Percent Occurrence Tables, WIS Station 180

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURANCE OF WAVE HEIGHT AND PEAK PERIOD FOR ALL DIRECTIONS

Hmo(m)	Tp(sec) 3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-13.9	14.0-LONGER	CASES	PERCENT OF TOTAL
0.00 - 0.49	22.83	3.89	1.97	1.10	0.57	0.41	0.15	0.15	0.04	0.02	30034	31.15
0.50 - 0.99	32.14	6.45	2.86	1.17	0.39	0.13	0.06	0.01	0.03	.	41694	43.24
1.00 - 1.49	1.75	10.05	2.96	1.23	0.33	0.06	0.01	0.00	0.04	0.01	15859	16.45
1.50 - 1.99	.	1.02	1.62	1.74	0.43	0.05	0.04	0.02	0.07	0.01	4829	5.01
2.00 - 2.49	.	0.03	0.21	0.95	0.82	0.16	0.02	0.01	0.03	0.00	2139	2.22
2.50 - 2.99	.	.	0.02	0.21	0.51	0.30	0.04	0.01	0.01	0.00	1062	1.10
3.00 - 3.49	.	.	.	0.01	0.19	0.24	0.04	0.01	0.01	0.00	477	0.49
3.50 - 3.99	.	.	.	.	0.02	0.05	0.04	0.01	0.03	0.00	156	0.16
4.00 - 4.49	.	.	.	0.00	0.00	0.02	0.03	0.02	0.02	.	91	0.09
4.50 - 4.99	.	.	.	.	0.00	0.00	0.02	0.01	0.01	0.00	50	0.05
5.00 - GREATER	.	.	.	.	.	.	0.00	0.01	0.01	0.01	30	0.05
CASES THIS BAND	54685	20681	9302	6177	3160	1385	442	246	289	54	96421	100.00

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WIND SPEED BY MONTH

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 1.99	0.12	0.16	0.24	0.27	0.36	0.38	0.08	0.18	0.38	0.29	0.16	0.21	2726	2.8
2.00 - 3.99	0.98	0.97	1.19	1.39	2.00	2.39	2.55	3.10	2.26	1.31	1.00	0.92	19332	20.0
4.00 - 5.99	2.00	1.56	2.28	2.28	2.87	3.35	4.09	3.54	2.75	2.28	1.96	1.73	29610	30.7
6.00 - 7.99	2.25	1.85	1.97	2.38	2.36	1.57	1.47	1.33	1.51	2.53	2.27	2.28	22923	23.8
8.00 - 9.99	1.50	1.56	1.51	1.17	0.73	0.43	0.25	0.25	0.86	1.44	1.57	1.66	12471	12.9
10.00 - 11.99	0.95	0.89	0.79	0.55	0.10	0.09	0.05	0.04	0.37	0.48	0.85	1.06	5982	6.2
12.00 - 13.99	0.54	0.47	0.34	0.17	0.06	0.01	.	0.01	0.05	0.11	0.34	0.45	2455	2.5
14.00 - 15.99	0.11	0.25	0.12	0.01	0.01	.	.	0.01	0.01	0.04	0.05	0.11	694	0.7
16.00 - 17.99	0.03	0.03	0.03	.	.	.	.	0.02	0.01	0.01	0.00	0.06	181	0.2
18.00 - 19.99	.	0.01	0.00	.	.	.	.	0.00	0.00	0.00	0.00	.	27	0.0
20.00 - GREATER	.	.	.	.	.	.	.	.	0.01	.	0.01	.	20	0.0
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 180 LAT: 30.17 N, LON:-86.25 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WIND DIRECTION BY MONTH

WD(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT TOTAL
348.75 - 11.24 (0.0)	1.21	0.92	0.67	0.49	0.41	0.22	0.16	0.25	0.50	0.97	0.78	1.06	7376	7.6
11.25 - 33.74 (22.5)	0.71	0.73	0.66	0.43	0.31	0.22	0.18	0.24	0.52	0.78	0.85	0.91	6311	6.5
33.75 - 56.24 (45.0)	0.81	0.60	0.72	0.58	0.50	0.46	0.48	0.50	1.50	1.89	1.05	0.86	9591	9.9
56.25 - 78.74 (67.5)	0.50	0.55	0.53	0.43	0.55	0.48	0.49	0.73	1.43	1.42	0.89	0.43	8111	8.4
78.75 - 101.24 (90.0)	0.67	0.70	0.65	0.71	1.24	0.86	0.71	1.21	1.51	0.95	1.01	0.74	10559	11.0
101.25 - 123.74 (112.5)	0.40	0.45	0.72	0.48	0.89	0.62	0.58	0.70	0.59	0.47	0.63	0.63	6909	7.2
123.75 - 146.24 (135.0)	0.47	0.56	0.66	0.69	0.87	0.63	0.61	0.61	0.43	0.54	0.66	0.82	7278	7.5
146.25 - 168.74 (157.5)	0.41	0.39	0.65	0.62	0.71	0.41	0.54	0.50	0.23	0.19	0.38	0.52	5351	5.5
168.75 - 191.24 (180.0)	0.45	0.36	0.60	0.49	0.55	0.66	0.68	0.41	0.23	0.14	0.36	0.40	5159	5.4
191.25 - 213.74 (202.5)	0.23	0.28	0.29	0.38	0.41	0.65	0.62	0.24	0.14	0.06	0.17	0.21	3548	3.7
213.75 - 236.24 (225.0)	0.18	0.23	0.26	0.35	0.35	0.60	0.63	0.32	0.10	0.06	0.12	0.22	3303	3.4
236.25 - 258.74 (247.5)	0.21	0.19	0.25	0.34	0.29	0.62	0.61	0.49	0.20	0.08	0.13	0.19	3475	3.6
258.75 - 281.24 (270.0)	0.22	0.31	0.34	0.62	0.35	0.84	0.81	0.79	0.24	0.10	0.18	0.23	4851	5.0
281.25 - 303.74 (292.5)	0.30	0.35	0.31	0.46	0.27	0.38	0.66	0.55	0.10	0.14	0.17	0.25	3797	3.9
303.75 - 326.24 (315.0)	0.93	0.59	0.62	0.68	0.37	0.35	0.50	0.61	0.19	0.34	0.42	0.41	5795	6.0
326.25 - 348.74 (337.5)	0.77	0.53	0.56	0.48	0.42	0.20	0.24	0.32	0.28	0.36	0.42	0.60	5007	5.2
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 2 (Cont'd). Percent Occurrence Tables, WIS Station 180

STATION: 180 GOM
SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1980	1.10	1.00	1.42	1.02	0.79	0.61	0.64	0.53	0.49	0.69	0.90	0.80	0.83
1981	0.84	1.15	1.12	0.71	0.79	0.57	0.48	0.55	0.46	0.66	0.83	1.16	0.77
1982	1.31	1.01	0.80	1.00	0.55	0.73	0.49	0.56	0.54	0.76	0.89	1.45	0.84
1983	0.87	1.44	1.32	1.17	0.81	0.73	0.54	0.53	0.72	0.69	1.17	1.32	0.94
1984	0.87	0.90	0.89	1.09	0.87	0.52	0.60	0.52	0.65	0.70	0.96	0.68	0.77
1985	1.07	1.11	0.94	0.93	0.63	0.65	0.51	0.75	0.85	1.03	0.92	0.88	0.85
1986	0.81	1.08	1.08	0.57	0.61	0.46	0.59	0.54	0.55	0.73	0.85	0.89	0.73
1987	1.20	1.05	1.15	0.74	0.60	0.73	0.54	0.47	0.48	0.64	0.91	1.03	0.79
1988	1.06	0.86	0.96	1.04	0.66	0.59	0.57	0.68	0.96	0.54	1.10	0.70	0.81
1989	0.76	0.96	0.96	0.67	0.71	0.87	0.71	0.46	0.58	0.67	0.71	0.96	0.75
1990	0.75	1.16	0.83	0.79	0.73	0.51	0.63	0.47	0.43	0.66	0.74	0.96	0.72
MEAN	0.97	1.06	1.04	0.88	0.70	0.63	0.57	0.55	0.61	0.71	0.91	0.98	

STATION: 180 GOM
MAX Hmo(m) WITH ASSOCIATED Tp(sec) AND Dm(deg) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN
1980	2.9 7 272	2.5 7 262	3.4 8 170	3.3 9 261	2.0 6 134	2.1 6 258
1981	3.3 8 262	5.0 10 163	4.8 10 245	2.3 7 155	1.9 6 251	1.5 5 97
1982	4.8 10 175	2.9 9 229	2.0 5 299	2.2 7 278	2.0 7 227	2.1 6 129
1983	2.7 6 126	4.5 9 161	4.7 11 158	3.3 9 261	2.0 6 137	1.3 6 169
1984	3.5 8 204	3.9 8 177	4.8 10 268	2.6 7 160	3.3 9 200	1.5 6 267
1985	3.2 8 186	3.8 8 257	3.3 7 144	3.0 8 190	1.5 6 235	2.0 6 155
1986	3.3 8 193	3.0 7 198	3.4 7 164	2.0 6 265	1.2 5 181	1.2 4 113
1987	3.7 8 166	3.4 8 169	3.4 7 151	2.1 7 277	1.5 6 141	2.1 6 203
1988	3.5 8 164	3.3 8 275	2.3 7 213	3.8 9 275	1.6 6 219	1.5 5 124
1989	2.4 7 189	3.6 8 201	2.3 6 164	2.4 7 217	1.8 6 221	3.2 8 195
1990	2.1 6 280	3.5 8 157	3.1 8 156	2.0 7 138	2.3 7 173	1.6 5 251
MAX	4.8 10 175	5.0 10 163	4.8 10 268	3.8 9 275	3.3 9 200	3.2 8 195

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1980	1.4 5 281	1.7 10 190	1.6 6 261	3.0 8 171	2.9 7 151	2.3 7 273	3.4 8 17
1981	1.1 5 240	1.5 6 226	1.4 5 194	2.6 7 154	2.6 7 208	3.6 8 185	5.0 10 17
1982	0.9 4 210	1.2 5 102	1.2 4 89	1.2 5 155	2.8 8 164	3.9 8 143	4.8 10 18
1983	1.1 4 113	1.5 5 130	1.7 6 242	1.6 6 267	3.7 9 153	4.8 9 156	4.8 9 16
1984	1.5 6 201	1.8 6 152	1.4 5 107	1.9 6 139	3.6 8 147	2.1 6 144	4.8 10 27
1985	1.4 5 184	5.3 14 167	5.4 11 156	5.7 10 165	4.3 9 200	3.2 8 188	5.7 10 17
1986	1.7 6 274	1.5 5 154	1.4 5 156	2.7 7 155	3.1 7 168	3.5 8 175	3.5 8 18
1987	1.1 4 85	1.1 5 257	1.0 4 335	1.2 4 31	3.0 7 150	3.3 7 168	3.7 8 17
1988	1.4 5 85	2.8 7 161	2.8 7 158	1.1 4 27	3.3 8 214	2.4 6 152	3.8 9 28
1989	1.6 6 222	1.2 5 158	1.9 5 105	1.5 5 308	2.6 7 280	2.6 7 176	3.6 8 21
1990	1.5 6 239	1.3 5 268	1.1 4 28	2.0 5 322	3.9 9 264	2.9 8 179	3.9 9 27
MAX	1.7 6 274	5.3 14 167	5.4 11 156	5.7 10 165	4.3 9 200	4.8 9 156	

MAX Hmo(m): 5.7 MAX Tp(sec): 10. MAX Dp(deg): 165. DATE(gmt): 85103119

MAX WIND SPEED(m/sec): 29. MAX WIND DIRECTION(deg): 79. DATE(gmt): 85090203

MEAN Hmo(m): 0.8 MEAN Tp(sec): 4.

STANDARD DEVIATION Hmo(m): 0.6 STANDARD DEVIATION Tp(sec): 1.4

Table 3. Percent Occurrence Tables, WIS Station 181

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WAVE HEIGHT BY MONTH

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 0.49	1.72	1.57	1.79	2.06	2.82	3.34	3.71	4.47	4.04	2.81	1.98	1.61	30772	31.9
0.50 - 0.99	3.67	2.92	3.26	3.53	4.17	3.84	4.20	3.41	3.05	4.64	3.78	3.82	42707	44.3
1.00 - 1.49	1.85	1.81	1.73	1.63	1.23	0.81	0.56	0.47	0.90	0.76	1.45	1.84	14501	15.0
1.50 - 1.99	0.65	0.69	0.92	0.65	0.22	0.16	0.02	0.08	0.15	0.09	0.51	0.62	4598	4.8
2.00 - 2.49	0.35	0.39	0.45	0.21	0.02	0.04	.	0.03	0.04	0.08	0.28	0.32	2118	2.2
2.50 - 2.99	0.15	0.20	0.23	0.08	0.01	0.01	.	0.01	0.02	0.03	0.11	0.18	991	1.0
3.00 - 3.49	0.08	0.09	0.06	0.04	0.02	0.01	.	0.00	0.01	0.01	0.07	0.08	442	0.5
3.50 - 3.99	0.01	0.04	0.02	0.01	.	.	.	0.00	0.01	0.04	0.02	0.01	152	0.2
4.00 - 4.49	0.00	0.03	0.02	.	.	.	.	0.01	0.00	0.02	0.00	0.00	82	0.1
4.50 - 4.99	0.00	0.01	0.01	.	.	.	.	.	0.00	0.01	.	0.01	45	0.0
5.00 - GREATER	.	.	.	.	.	.	.	.	0.00	0.01	.	.	13	0.0
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF PEAK PERIOD BY MONTH

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
3.0 - 3.9	4.44	3.28	3.41	3.74	4.44	4.81	6.51	6.23	5.74	6.40	4.87	4.53	56306	58.4
4.0 - 4.9	1.85	1.94	1.82	1.87	2.31	1.73	1.48	1.30	1.30	0.98	1.46	1.81	19131	19.8
5.0 - 5.9	0.89	0.96	1.13	1.32	1.21	0.93	0.38	0.49	0.36	0.43	0.65	0.87	9274	9.6
6.0 - 6.9	0.67	0.66	1.19	0.89	0.36	0.54	0.08	0.23	0.31	0.25	0.61	0.66	6229	6.5
7.0 - 7.9	0.34	0.55	0.64	0.30	0.09	0.12	0.04	0.07	0.23	0.21	0.30	0.39	3162	3.3
8.0 - 8.9	0.18	0.20	0.23	0.08	0.08	0.06	.	0.06	0.08	0.06	0.18	0.15	1314	1.4
9.0 - 9.9	0.06	0.10	0.05	0.01	.	0.02	.	0.02	0.05	0.04	0.07	0.02	428	0.4
10.0 - 10.9	0.03	0.03	0.02	0.01	.	0.01	.	0.02	0.04	0.03	0.02	0.04	240	0.2
11.0 - 13.9	0.01	0.01	0.00	.	.	.	.	0.06	0.08	0.08	0.05	0.01	283	0.3
14.0 - LONGER	.	.	.	.	.	.	.	0.00	0.02	0.03	0.01	.	54	0.1
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF MEAN DIRECTION BY MONTH

Dp(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
348.75 - 11.24 (0.0)	1.04	0.91	0.72	0.61	0.59	0.51	0.53	0.52	0.63	1.00	0.94	1.06	2949	3.1
11.25 - 33.74 (22.5)	0.93	0.91	0.85	0.70	0.64	0.51	0.54	0.55	0.75	1.15	1.04	1.16	3613	3.7
33.75 - 56.24 (45.0)	0.99	0.82	0.79	0.79	0.68	0.57	0.64	0.59	1.16	1.65	1.08	1.10	4674	4.8
56.25 - 78.74 (67.5)	0.87	0.87	0.83	0.78	0.72	0.65	0.78	0.72	1.45	1.66	1.31	0.94	5384	5.6
78.75 - 101.24 (90.0)	0.98	1.02	0.87	0.88	1.01	0.95	0.77	1.17	1.61	1.51	1.22	0.93	6677	6.9
101.25 - 123.74 (112.5)	1.05	1.08	1.07	0.96	1.38	1.06	0.99	0.98	1.20	0.99	1.29	1.09	6884	7.1
123.75 - 146.24 (135.0)	1.08	1.14	1.55	1.52	1.76	1.55	1.36	1.56	1.56	1.33	1.41	1.51	10929	11.3
146.25 - 168.74 (157.5)	1.36	1.43	1.79	1.52	2.33	1.87	2.02	2.22	1.76	1.51	1.32	1.45	14058	14.6
168.75 - 191.24 (180.0)	1.40	1.27	1.73	1.64	1.72	1.87	1.56	1.41	1.36	0.99	1.13	1.24	10889	11.3
191.25 - 213.74 (202.5)	0.93	1.12	1.13	1.07	1.12	1.31	1.24	0.99	0.90	0.67	0.95	0.93	6114	6.3
213.75 - 236.24 (225.0)	0.81	0.83	0.87	0.97	0.92	1.17	1.29	1.15	0.65	0.57	0.77	0.78	4599	4.8
236.25 - 258.74 (247.5)	0.80	0.86	0.88	1.08	0.91	1.38	1.40	1.38	0.79	0.58	0.67	0.84	5374	5.6
258.75 - 281.24 (270.0)	0.88	0.89	0.87	1.18	0.72	1.07	1.35	1.23	0.64	0.60	0.76	0.78	4794	5.0
281.25 - 303.74 (292.5)	1.14	0.89	0.87	0.93	0.67	0.65	0.88	0.86	0.56	0.68	0.82	0.82	3631	3.8
303.75 - 326.24 (315.0)	1.21	0.88	0.92	0.86	0.68	0.57	0.64	0.62	0.59	0.78	0.75	0.88	3271	3.4
326.25 - 348.74 (337.5)	1.00	0.82	0.76	0.72	0.65	0.52	0.51	0.53	0.60	0.82	0.76	0.99	2581	2.7
TOTAL CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 3 (Cont'd). Percent Occurrence Tables, WIS Station 181

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR ALL DIRECTIONS

Hmo(m)	Tp(sec) 3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-13.9	14.0-LONGER	CASES	PERCENT OF TOTAL
0.00 - 0.49	23.13	4.15	2.04	1.17	0.59	0.44	0.18	0.15	0.04	0.03	30772	31.91
0.50 - 0.99	33.34	6.24	2.89	1.21	0.40	0.12	0.06	0.01	0.03	.	42707	44.29
1.00 - 1.49	1.93	8.51	2.83	1.26	0.35	0.06	0.02	0.01	0.07	0.01	14501	15.04
1.50 - 1.99	.	0.90	1.62	1.65	0.43	0.05	0.03	0.01	0.05	0.02	4598	4.77
2.00 - 2.49	.	0.04	0.22	0.93	0.84	0.13	0.02	0.01	0.02	0.00	2118	2.20
2.50 - 2.99	.	.	0.02	0.20	0.49	0.26	0.03	0.01	0.01	0.00	991	1.03
3.00 - 3.49	.	.	0.00	0.03	0.15	0.23	0.02	0.01	0.01	0.00	442	0.46
3.50 - 3.99	.	.	.	0.00	0.03	0.05	0.03	0.01	0.03	.	152	0.16
4.00 - 4.49	.	.	.	.	0.00	0.02	0.03	0.02	0.01	0.00	82	0.09
4.50 - 4.99	.	.	.	.	0.00	0.00	0.02	0.01	0.01	.	45	0.05
5.00 - GREATER	.	.	.	.	.	.	0.00	0.01	0.00	.	13	0.05
CASES THIS BAND	56306	19131	9274	6229	3162	1314	428	240	283	54	96421	100.00

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WIND SPEED BY MONTH

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT
0.00 - 1.99	0.12	0.16	0.25	0.27	0.37	0.39	0.07	0.18	0.38	0.29	0.16	0.22	2755	2.9
2.00 - 3.99	1.01	0.97	1.22	1.42	2.02	2.40	2.56	3.10	2.29	1.31	1.00	0.93	19501	20.2
4.00 - 5.99	1.99	1.58	2.25	2.30	2.89	3.35	4.08	3.53	2.74	2.29	1.97	1.73	29602	30.7
6.00 - 7.99	2.25	1.84	2.02	2.34	2.35	1.56	1.48	1.34	1.50	2.51	2.26	2.30	22905	23.8
8.00 - 9.99	1.50	1.54	1.48	1.16	0.71	0.42	0.25	0.25	0.87	1.44	1.57	1.64	12365	12.8
10.00 - 11.99	0.95	0.89	0.79	0.56	0.10	0.09	0.05	0.04	0.36	0.48	0.85	1.05	5975	6.2
12.00 - 13.99	0.53	0.47	0.33	0.16	0.05	0.01	.	0.01	0.05	0.11	0.33	0.44	2409	2.5
14.00 - 15.99	0.11	0.24	0.11	0.01	0.01	.	.	0.01	0.01	0.05	0.05	0.11	684	0.7
16.00 - 17.99	0.03	0.03	0.03	.	.	.	.	0.02	0.01	0.01	0.00	0.06	182	0.2
18.00 - 19.99	.	0.01	.	.	.	.	.	0.00	0.00	0.00	0.00	.	22	0.0
20.00 - GREATER	.	.	.	.	.	.	.	.	0.01	.	0.01	.	21	0.0
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

1980-1990 GOM WIS STATION: 181 LAT: 30.17 N, LON:-86.17 W, DEPTH: 31 M
PERCENT OCCURRENCES OF WIND DIRECTION BY MONTH

WD(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	CASES	PCT TOTAL
348.75 - 11.24 (0.0)	1.22	0.94	0.66	0.49	0.40	0.22	0.16	0.25	0.50	0.98	0.77	1.05	7361	7.6
11.25 - 33.74 (22.5)	0.72	0.71	0.66	0.43	0.32	0.22	0.18	0.23	0.53	0.78	0.85	0.91	6304	6.5
33.75 - 56.24 (45.0)	0.79	0.60	0.71	0.57	0.50	0.46	0.48	0.51	1.50	1.90	1.06	0.86	9593	9.9
56.25 - 78.74 (67.5)	0.50	0.54	0.53	0.44	0.55	0.48	0.48	0.73	1.44	1.41	0.88	0.44	8128	8.4
78.75 - 101.24 (90.0)	0.67	0.71	0.65	0.70	1.25	0.86	0.71	1.20	1.50	0.95	1.01	0.73	10547	10.9
101.25 - 123.74 (112.5)	0.38	0.45	0.73	0.49	0.87	0.62	0.58	0.71	0.59	0.47	0.63	0.65	6915	7.2
123.75 - 146.24 (135.0)	0.48	0.57	0.66	0.69	0.88	0.63	0.62	0.62	0.43	0.53	0.66	0.81	7309	7.6
146.25 - 168.74 (157.5)	0.41	0.38	0.65	0.61	0.70	0.41	0.53	0.49	0.22	0.19	0.37	0.52	5284	5.5
168.75 - 191.24 (180.0)	0.45	0.37	0.59	0.48	0.55	0.67	0.68	0.42	0.24	0.14	0.36	0.40	5145	5.3
191.25 - 213.74 (202.5)	0.22	0.28	0.29	0.37	0.41	0.65	0.61	0.25	0.14	0.06	0.17	0.21	3533	3.7
213.75 - 236.24 (225.0)	0.18	0.23	0.26	0.35	0.36	0.60	0.63	0.32	0.10	0.06	0.11	0.22	3291	3.4
236.25 - 258.74 (247.5)	0.21	0.18	0.25	0.36	0.29	0.62	0.63	0.51	0.20	0.08	0.13	0.19	3513	3.6
258.75 - 281.24 (270.0)	0.22	0.31	0.35	0.63	0.35	0.86	0.81	0.79	0.24	0.10	0.17	0.23	4895	5.1
281.25 - 303.74 (292.5)	0.30	0.34	0.30	0.45	0.28	0.37	0.65	0.55	0.10	0.14	0.17	0.24	3776	3.9
303.75 - 326.24 (315.0)	0.94	0.61	0.62	0.67	0.36	0.35	0.50	0.61	0.19	0.33	0.43	0.42	5819	6.0
326.25 - 348.74 (337.5)	0.77	0.52	0.58	0.48	0.43	0.21	0.24	0.31	0.28	0.36	0.42	0.60	5008	5.2
NUMBER OF CASES	8173	7464	8184	7920	8184	7920	8184	8184	7920	8184	7920	8184	96421	

Table 3 (Cont'd). Percent Occurrence Tables, WIS Station 181

STATION: 181 GOM
SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1980	1.08	0.99	1.39	1.00	0.77	0.61	0.63	0.51	0.47	0.67	0.87	0.78	0.82
1981	0.84	1.12	1.11	0.68	0.77	0.55	0.48	0.54	0.45	0.65	0.82	1.14	0.76
1982	1.29	0.99	0.78	0.98	0.54	0.73	0.49	0.55	0.52	0.73	0.86	1.42	0.82
1983	0.85	1.41	1.30	1.15	0.79	0.71	0.54	0.52	0.72	0.66	1.15	1.29	0.92
1984	0.86	0.88	0.88	1.07	0.85	0.51	0.59	0.51	0.63	0.68	0.94	0.65	0.75
1985	1.06	1.08	0.92	0.90	0.62	0.65	0.50	0.71	0.83	0.96	0.90	0.87	0.83
1986	0.79	1.07	1.05	0.56	0.59	0.45	0.59	0.54	0.53	0.71	0.83	0.88	0.71
1987	1.19	1.03	1.12	0.73	0.57	0.72	0.53	0.47	0.48	0.64	0.88	0.99	0.78
1988	1.02	0.84	0.94	1.03	0.65	0.57	0.56	0.66	0.91	0.53	1.06	0.68	0.79
1989	0.74	0.94	0.94	0.66	0.69	0.86	0.70	0.45	0.56	0.65	0.69	0.95	0.74
1990	0.73	1.13	0.80	0.77	0.72	0.50	0.63	0.46	0.42	0.64	0.73	0.94	0.70
MEAN	0.95	1.04	1.02	0.87	0.69	0.62	0.57	0.54	0.59	0.68	0.88	0.96	

STATION: 181 GOM
MAX Hmo(m) WITH ASSOCIATED Tp(sec) AND Dm(deg) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN
1980	3.0 7 270	2.5 7 264	3.4 8 168	3.5 9 262	2.0 6 135	2.1 6 257
1981	3.3 8 262	4.9 10 166	4.8 10 248	2.3 7 156	1.9 6 250	1.3 5 98
1982	4.8 10 176	2.8 9 233	2.0 5 298	2.2 7 278	2.0 7 228	2.2 6 130
1983	2.6 10 128	4.5 9 163	4.5 11 158	3.3 9 262	1.9 6 138	1.2 6 171
1984	3.5 8 205	3.9 8 178	4.8 9 272	2.6 7 161	3.3 9 202	1.5 6 267
1985	3.2 8 187	3.7 8 257	3.1 7 146	3.0 8 191	1.5 6 235	2.0 6 153
1986	3.2 8 195	3.0 7 206	3.3 7 167	2.0 6 265	1.2 5 182	1.1 4 119
1987	3.5 8 170	3.2 7 170	3.2 7 154	2.1 7 277	1.4 5 141	2.1 6 203
1988	3.3 8 173	3.3 8 275	2.3 7 216	3.8 9 276	1.6 6 219	1.4 6 128
1989	2.3 7 190	3.5 8 202	2.1 6 165	2.4 7 218	1.8 6 221	3.1 8 196
1990	2.1 6 279	3.4 8 158	3.1 8 158	2.0 7 138	2.3 7 173	1.6 5 251
MAX	4.8 10 176	4.9 10 166	4.8 9 272	3.8 9 276	3.3 9 202	3.1 8 196

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1980	1.4 6 280	1.5 13 196	1.6 6 260	3.0 8 172	2.8 7 151	2.2 7 272	3.5 9 27
1981	1.1 5 241	1.5 6 225	1.4 5 194	2.6 7 155	2.6 7 209	3.6 8 191	4.9 10 17
1982	0.9 4 199	1.2 4 99	1.1 4 57	1.2 5 160	2.8 8 165	3.8 8 145	4.8 10 18
1983	1.1 4 76	1.4 5 133	1.7 6 241	1.6 6 239	3.7 9 154	4.7 9 157	4.7 9 16
1984	1.5 6 204	1.8 6 152	1.3 4 107	1.9 6 139	3.5 8 148	2.0 6 145	4.8 9 28
1985	1.3 5 185	4.3 14 165	5.2 11 158	5.5 10 174	4.2 9 201	3.1 8 189	5.5 10 18
1986	1.7 6 274	1.5 5 154	1.4 5 157	2.5 6 155	3.0 7 170	3.3 8 176	3.3 8 18
1987	1.1 4 82	1.1 5 256	1.0 4 337	1.2 4 28	2.8 7 151	3.1 8 170	3.5 8 18
1988	1.2 5 82	2.6 6 165	2.7 10 168	1.1 4 324	3.3 8 215	2.2 6 153	3.8 9 28
1989	1.6 6 222	1.2 5 159	1.6 6 113	1.5 5 305	2.7 7 280	2.6 7 176	3.5 8 21
1990	1.5 6 239	1.3 5 268	1.1 4 27	2.0 5 322	3.9 9 265	2.9 8 183	3.9 9 27
MAX	1.7 6 274	4.3 14 165	5.2 11 158	5.5 10 174	4.2 9 201	4.7 9 157	

MAX Hmo(m): 5.5 MAX Tp(sec): 10. MAX Dp(deg): 174. DATE(gmt): 85103120

MAX WIND SPEED(m/sec): 28. MAX WIND DIRECTION(deg): 84. DATE(gmt): 85090203

MEAN Hmo(m): 0.8 MEAN Tp(sec): 4.

STANDARD DEVIATION Hmo(m): 0.5 STANDARD DEVIATION Tp(sec): 1.4

ATTACHMENT I-A

WALTON COUNTY
PAUSIBLE STORM SUITE

ATTACHMENT I-A: Walton County Plausible Storm Suite

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
Not Named	1886	Franklin County, Florida	H2	85	973	18860630_H1	1.2	2.5	10.2	6.8
						18860630_H2	1.2	2.1	10.2	6.8
						18860630_H3	1.2	2.1	10.2	6.8
						18860630_H4	1.2	2.1	10.2	6.8
						18860630_M1	1.2	2.3	10.2	6.8
						18860630_M2	1.2	1.8	10.2	6.8
						18860630_M3	1.2	1.9	10.2	6.8
						18860630_M4	1.2	1.8	10.2	6.8
						18860630_L1	1.2	2.0	10.2	6.8
						18860630_L2	1.2	1.6	10.2	6.8
						18860630_L3	1.2	1.7	10.2	6.8
						18860630_L4	1.2	1.6	10.2	6.8
Not Named	1887	Okaloosa County, Florida	H1	75	981	18870727_H1	3.5	5.1	15.0	8.2
						18870727_H2	3.5	4.2	15.0	8.2
						18870727_H3	3.5	3.2	15.0	8.2
						18870727_H4	3.5	4.2	15.0	8.2
						18870727_M1	3.5	4.8	15.0	8.2
						18870727_M2	3.5	4.2	15.0	8.2
						18870727_M3	3.5	3.5	15.0	8.2
						18870727_M4	3.5	4.2	15.0	8.2
						18870727_L1	3.5	4.6	15.0	8.2
						18870727_L2	3.5	4.2	15.0	8.2
						18870727_L3	3.5	3.7	15.0	8.2
						18870727_L4	3.5	4.2	15.0	8.2
Not Named	1889	Baldwin County, Alabama	TS	60	985	18890923_H1	2.1	3.6	11.1	7.1
						18890923_H2	2.1	2.7	11.1	7.1
						18890923_H3	2.1	1.8	11.1	7.1

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Surge Peak	TWL Peak	Hmo Peak	Tp Peak
							Beach-fx Parameters			
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						18890923_H4	2.1	2.7	11.1	7.1
						18890923_M1	2.1	3.3	11.1	7.1
						18890923_M2	2.1	2.7	11.1	7.1
						18890923_M3	2.1	2.0	11.1	7.1
						18890923_M4	2.1	2.7	11.1	7.1
						18890923_L1	2.1	3.1	11.1	7.1
						18890923_L2	2.1	2.7	11.1	7.1
						18890923_L3	2.1	2.2	11.1	7.1
						18890923_L4	2.1	2.7	11.1	7.1
Not Named	1893	Taylor County, Florida	TS	60	N/A	18930615_H1	1	2.3	9.7	6.6
						18930615_H2	1	2.0	9.7	6.6
						18930615_H3	1	2.0	9.7	6.6
						18930615_H4	1	1.9	9.7	6.6
						18930615_M1	1	2.0	9.7	6.6
						18930615_M2	1	1.7	9.7	6.6
						18930615_M3	1	1.7	9.7	6.6
						18930615_M4	1	1.6	9.7	6.6
						18930615_L1	1	1.8	9.7	6.6
						18930615_L2	1	1.5	9.7	6.6
						18930615_L3	1	1.5	9.7	6.6
						18930615_L4	1	1.4	9.7	6.6
Not Named	1893	Jackson County, Mississippi*	H2	95	N/A	18931002_H1	2.4	3.9	35.9	12.8
						18931002_H2	2.4	3.6	35.9	12.8
						18931002_H3	2.4	3.1	35.9	12.8
						18931002_H4	2.4	3.3	35.9	12.8
						18931002_M1	2.4	3.6	35.9	12.8
						18931002_M2	2.4	3.4	35.9	12.8
						18931002_M3	2.4	2.9	35.9	12.8
						18931002_M4	2.4	3.1	35.9	12.8

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						18931002_L1	2.4	3.4	35.9	12.8
						18931002_L2	2.4	3.2	35.9	12.8
						18931002_L3	2.4	2.7	35.9	12.8
						18931002_L4	2.4	3.0	35.9	12.8
Not Named	1894	Bay County, Florida	H3	105	955	18941008_H1	1.7	3.0	8.5	6.2
						18941008_H2	1.7	2.9	8.5	6.2
						18941008_H3	1.7	2.8	8.5	6.2
						18941008_H4	1.7	2.7	8.5	6.2
						18941008_M1	1.7	2.7	8.5	6.2
						18941008_M2	1.7	2.6	8.5	6.2
						18941008_M3	1.7	2.5	8.5	6.2
						18941008_M4	1.7	2.5	8.5	6.2
						18941008_L1	1.7	2.5	8.5	6.2
						18941008_L2	1.7	2.4	8.5	6.2
						18941008_L3	1.7	2.3	8.5	6.2
						18941008_L4	1.7	2.3	8.5	6.2
Not Named	1896	Okaloosa County, Florida	H2	85	973	18960707_H1	2.8	3.9	15.8	8.5
						18960707_H2	2.8	3.2	15.8	8.5
						18960707_H3	2.8	2.8	15.8	8.5
						18960707_H4	2.8	3.0	15.8	8.5
						18960707_M1	2.8	3.6	15.8	8.5
						18960707_M2	2.8	3.0	15.8	8.5
						18960707_M3	2.8	2.6	15.8	8.5
						18960707_M4	2.8	3.0	15.8	8.5
						18960707_L1	2.8	3.4	15.8	8.5
						18960707_L2	2.8	2.9	15.8	8.5
						18960707_L3	2.8	2.6	15.8	8.5
						18960707_L4	2.8	2.9	15.8	8.5

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
Not Named	1901	Jackson County, Mississippi*	H1	80	973	19010815_H1	1.5	2.9	23.2	10.3
						19010815_H2	1.5	2.7	23.2	10.3
						19010815_H3	1.5	2.3	23.2	10.3
						19010815_H4	1.5	2.7	23.2	10.3
						19010815_M1	1.5	2.6	23.2	10.3
						19010815_M2	1.5	2.4	23.2	10.3
						19010815_M3	1.5	2.1	23.2	10.3
						19010815_M4	1.5	2.5	23.2	10.3
						19010815_L1	1.5	2.4	23.2	10.3
						19010815_L2	1.5	2.2	23.2	10.3
						19010815_L3	1.5	1.9	23.2	10.3
						19010815_L4	1.5	2.3	23.2	10.3
Not Named	1906	Jackson County, Mississippi	H2	95	N/A	19060926_H1	2.5	3.9	8.2	6.1
						19060926_H2	2.5	3.4	8.2	6.1
						19060926_H3	2.5	3.1	8.2	6.1
						19060926_H4	2.5	3.8	8.2	6.1
						19060926_M1	2.5	3.6	8.2	6.1
						19060926_M2	2.5	3.2	8.2	6.1
						19060926_M3	2.5	2.9	8.2	6.1
						19060926_M4	2.5	3.5	8.2	6.1
						19060926_L1	2.5	3.4	8.2	6.1
						19060926_L2	2.5	3.1	8.2	6.1
						19060926_L3	2.5	2.8	8.2	6.1
						19060926_L4	2.5	3.3	8.2	6.1
Not Named	1912	Mobile County, Alabama	H1	65	988	19120913_H1	1	2.4	19.8	9.5
						19120913_H2	1	2.3	19.8	9.5
						19120913_H3	1	2.1	19.8	9.5
						19120913_H4	1	2.2	19.8	9.5

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed MPH	Approximate Landfall Pressure MB	Storm Identifier	Beach-fx Parameters Surge Peak ft (MSL)	TWL Peak ft (MSL)	Hmo Peak ft	Tp Peak sec
						19120913_M1	1	2.1	19.8	9.5
						19120913_M2	1	2.0	19.8	9.5
						19120913_M3	1	1.9	19.8	9.5
						19120913_M4	1	1.9	19.8	9.5
						19120913_L1	1	1.9	19.8	9.5
						19120913_L2	1	1.8	19.8	9.5
						19120913_L3	1	1.6	19.8	9.5
						19120913_L4	1	1.7	19.8	9.5
Not Named	1915	Lafourche Parish, Lousiana	H3	110	944	19150929_H1	2.1	3.5	29.7	11.6
						19150929_H2	2.1	3.3	29.7	11.6
						19150929_H3	2.1	3.1	29.7	11.6
						19150929_H4	2.1	3.1	29.7	11.6
						19150929_M1	2.1	3.2	29.7	11.6
						19150929_M2	2.1	3.1	29.7	11.6
						19150929_M3	2.1	2.8	29.7	11.6
						19150929_M4	2.1	2.9	29.7	11.6
						19150929_L1	2.1	3.0	29.7	11.6
						19150929_L2	2.1	2.9	29.7	11.6
						19150929_L3	2.1	2.6	29.7	11.6
						19150929_L4	2.1	2.7	29.7	11.6
Not Named	1916	Mobile County, Alabama	H3	105	950	19160705_H1	1.2	2.6	16.4	8.6
						19160705_H2	1.2	2.3	16.4	8.6
						19160705_H3	1.2	2.4	16.4	8.6
						19160705_H4	1.2	2.4	16.4	8.6
						19160705_M1	1.2	3.9	16.4	8.6
						19160705_M2	1.2	3.3	16.4	8.6
						19160705_M3	1.2	2.6	16.4	8.6
						19160705_M4	1.2	3.3	16.4	8.6
						19160705_L1	1.2	3.7	16.4	8.6

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19160705_L2	1.2	3.3	16.4	8.6
						19160705_L3	1.2	2.9	16.4	8.6
						19160705_L4	1.2	3.3	16.4	8.6
Not Named	1916	Santa Rosa County, Florida	H2	95	970	19161018_H1	2.7	4.2	18.2	9.1
						19161018_H2	2.7	3.3	18.2	9.1
						19161018_H3	2.7	2.4	18.2	9.1
						19161018_H4	2.7	3.3	18.2	9.1
						19161018_M1	2.7	3.9	18.2	9.1
						19161018_M2	2.7	3.3	18.2	9.1
						19161018_M3	2.7	2.6	18.2	9.1
						19161018_M4	2.7	3.3	18.2	9.1
						19161018_L1	2.7	3.7	18.2	9.1
						19161018_L2	2.7	3.3	18.2	9.1
						19161018_L3	2.7	2.9	18.2	9.1
						19161018_L4	2.7	3.3	18.2	9.1
Not Named	1917	Okaloosa County, Florida	H3	100	949	19170929_H1	4	5.6	29.9	11.7
						19170929_H2	4	4.7	29.9	11.7
						19170929_H3	4	3.7	29.9	11.7
						19170929_H4	4	4.7	29.9	11.7
						19170929_M1	4	5.3	29.9	11.7
						19170929_M2	4	4.7	29.9	11.7
						19170929_M3	4	4.0	29.9	11.7
						19170929_M4	4	4.7	29.9	11.7
						19170929_L1	4	5.1	29.9	11.7
						19170929_L2	4	4.7	29.9	11.7
						19170929_L3	4	4.2	29.9	11.7
						19170929_L4	4	4.7	29.9	11.7
Not Named	1919	Kleberg County, Texas	H3	100	950	19190912_H1	1.2	2.5	6.6	5.5

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19190912_H2	1.2	2.4	6.6	5.5
						19190912_H3	1.2	2.2	6.6	5.5
						19190912_H4	1.2	4.8	6.6	5.5
						19190912_M1	1.2	2.3	6.6	5.5
						19190912_M2	1.2	2.1	6.6	5.5
						19190912_M3	1.2	1.9	6.6	5.5
						19190912_M4	1.2	2.2	6.6	5.5
						19190912_L1	1.2	2.0	6.6	5.5
						19190912_L2	1.2	1.9	6.6	5.5
						19190912_L3	1.2	1.7	6.6	5.5
						19190912_L4	1.2	1.9	6.6	5.5
Not Named	1924	Gulf County, Florida	H2	75	980	19240915_H1	1.6	2.9	12.7	7.6
						19240915_H2	1.6	2.6	12.7	7.6
						19240915_H3	1.6	2.5	12.7	7.6
						19240915_H4	1.6	2.4	12.7	7.6
						19240915_M1	1.6	2.6	12.7	7.6
						19240915_M2	1.6	2.3	12.7	7.6
						19240915_M3	1.6	2.2	12.7	7.6
						19240915_M4	1.6	2.2	12.7	7.6
						19240915_L1	1.6	2.4	12.7	7.6
						19240915_L2	1.6	2.1	12.7	7.6
						19240915_L3	1.6	2.0	12.7	7.6
						19240915_L4	1.6	2.1	12.7	7.6
Not Named	1926	Baldwin County, Alabama	H2	95	955	19260920_H1	3	4.5	19.8	9.5
						19260920_H2	3	3.9	19.8	9.5
						19260920_H3	3	2.9	19.8	9.5
						19260920_H4	3	3.8	19.8	9.5
						19260920_M1	3	4.2	19.8	9.5
						19260920_M2	3	3.7	19.8	9.5

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19260920_M3	3	2.9	19.8	9.5
						19260920_M4	3	3.7	19.8	9.5
						19260920_L1	3	4.0	19.8	9.5
						19260920_L2	3	3.6	19.8	9.5
						19260920_L3	3	3.1	19.8	9.5
						19260920_L4	3	3.6	19.8	9.5
Not Named	1930	Pinellas County, Florida	TS	35	N/A	19300908_H1	1.6	2.9	16.3	8.6
						19300908_H2	1.6	2.7	16.3	8.6
						19300908_H3	1.6	2.4	16.3	8.6
						19300908_H4	1.6	2.7	16.3	8.6
						19300908_M1	1.6	2.6	16.3	8.6
						19300908_M2	1.6	2.5	16.3	8.6
						19300908_M3	1.6	2.1	16.3	8.6
						19300908_M4	1.6	2.4	16.3	8.6
						19300908_L1	1.6	2.4	16.3	8.6
						19300908_L2	1.6	2.2	16.3	8.6
						19300908_L3	1.6	1.9	16.3	8.6
						19300908_L4	1.6	2.2	16.3	8.6
Not Named	1932	Alabama - Baldwin County	H1	70	N/A	19320831_H1	1.3	2.7	9.9	6.7
						19320831_H2	1.3	2.1	9.9	6.7
						19320831_H3	1.3	1.9	9.9	6.7
						19320831_H4	1.3	2.3	9.9	6.7
						19320831_M1	1.3	2.4	9.9	6.7
						19320831_M2	1.3	2.0	9.9	6.7
						19320831_M3	1.3	1.7	9.9	6.7
						19320831_M4	1.3	2.0	9.9	6.7
						19320831_L1	1.3	2.2	9.9	6.7
						19320831_L2	1.3	1.9	9.9	6.7
						19320831_L3	1.3	1.4	9.9	6.7

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19320831_L4	1.3	1.9	9.9	6.7
Not Named	1933	Tamaulipas, Mexico	TS	60	981	19330802_H1	1	2.4	20.5	9.7
						19330802_H2	1	2.2	20.5	9.7
						19330802_H3	1	2.0	20.5	9.7
						19330802_H4	1	2.3	20.5	9.7
						19330802_M1	1	2.1	20.5	9.7
						19330802_M2	1	2.0	20.5	9.7
						19330802_M3	1	1.7	20.5	9.7
						19330802_M4	1	2.0	20.5	9.7
						19330802_L1	1	1.9	20.5	9.7
						19330802_L2	1	1.7	20.5	9.7
						19330802_L3	1	1.5	20.5	9.7
						19330802_L4	1	1.8	20.5	9.7
Not Named	1936	Okaloosa County, Florida	H1	80	973	19360731_H1	2.7	4.1	22.4	10.1
						19360731_H2	2.7	3.3	22.4	10.1
						19360731_H3	2.7	2.3	22.4	10.1
						19360731_H4	2.7	3.4	22.4	10.1
						19360731_M1	2.7	3.8	22.4	10.1
						19360731_M2	2.7	3.3	22.4	10.1
						19360731_M3	2.7	2.5	22.4	10.1
						19360731_M4	2.7	3.3	22.4	10.1
						19360731_L1	2.7	3.6	22.4	10.1
						19360731_L2	2.7	3.2	22.4	10.1
						19360731_L3	2.7	2.8	22.4	10.1
						19360731_L4	2.7	3.2	22.4	10.1
Not Named	1940	Cameron Parish, Lousiana*	H1	70	N/A	19400804_H1	1	2.4	19.7	9.5
						19400804_H2	1	2.3	19.7	9.5
						19400804_H3	1	2.1	19.7	9.5

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Surge Peak	TWL Peak	Hmo Peak	Tp Peak
							Beach-fx Parameters			
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19400804_H4	1	2.3	19.7	9.5
						19400804_M1	1	2.1	19.7	9.5
						19400804_M2	1	2.0	19.7	9.5
						19400804_M3	1	1.8	19.7	9.5
						19400804_M4	1	2.0	19.7	9.5
						19400804_L1	1	1.9	19.7	9.5
						19400804_L2	1	1.8	19.7	9.5
						19400804_L3	1	1.6	19.7	9.5
						19400804_L4	1	1.8	19.7	9.5
Not Named	1947	St. Benard Parish, Lousiana*	H1	80	N/A	19470919_H1	1.5	2.9	11.2	7.1
						19470919_H2	1.5	2.1	11.2	7.1
						19470919_H3	1.5	2.2	11.2	7.1
						19470919_H4	1.5	2.4	11.2	7.1
						19470919_M1	1.5	2.6	11.2	7.1
						19470919_M2	1.5	2.0	11.2	7.1
						19470919_M3	1.5	1.9	11.2	7.1
						19470919_M4	1.5	2.2	11.2	7.1
						19470919_L1	1.5	2.4	11.2	7.1
						19470919_L2	1.5	2.0	11.2	7.1
						19470919_L3	1.5	1.7	11.2	7.1
						19470919_L4	1.5	2.0	11.2	7.1
Florence	1953	Walton County, Florida	H1	80	N/A	19530926_H1	3.2	4.5	21.0	9.8
						19530926_H2	3.2	3.7	21.0	9.8
						19530926_H3	3.2	2.7	21.0	9.8
						19530926_H4	3.2	3.6	21.0	9.8
						19530926_M1	3.2	4.2	21.0	9.8
						19530926_M2	3.2	3.6	21.0	9.8
						19530926_M3	3.2	3.0	21.0	9.8

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Surge Peak	TWL Peak	Hmo Peak	Tp Peak
							Beach-fx Parameters			
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19530926_M4	3.2	3.6	21.0	9.8
						19530926_L1	3.2	4.0	21.0	9.8
						19530926_L2	3.2	3.6	21.0	9.8
						19530926_L3	3.2	3.2	21.0	9.8
						19530926_L4	3.2	3.6	21.0	9.8
Flossy	1956	Okaloosa County, Florida*	H1	80	N/A	19560924_H1	2.8	4.2	29.8	11.6
						19560924_H2	2.8	3.3	29.8	11.6
						19560924_H3	2.8	2.3	29.8	11.6
						19560924_H4	2.8	3.4	29.8	11.6
						19560924_M1	2.8	3.9	29.8	11.6
						19560924_M2	2.8	3.3	29.8	11.6
						19560924_M3	2.8	2.6	29.8	11.6
						19560924_M4	2.8	3.3	29.8	11.6
						19560924_L1	2.8	3.7	29.8	11.6
						19560924_L2	2.8	3.2	29.8	11.6
						19560924_L3	2.8	2.8	29.8	11.6
						19560924_L4	2.8	3.3	29.8	11.6
Ethel	1960	Harrison County, Mississippi	TS	60	N/A	19600915_H1	1	2.4	18.9	9.3
						19600915_H2	1	2.2	18.9	9.3
						19600915_H3	1	2.2	18.9	9.3
						19600915_H4	1	2.3	18.9	9.3
						19600915_M1	1	2.1	18.9	9.3
						19600915_M2	1	2.0	18.9	9.3
						19600915_M3	1	1.9	18.9	9.3
						19600915_M4	1	2.0	18.9	9.3
						19600915_L1	1	1.9	18.9	9.3
						19600915_L2	1	1.8	18.9	9.3
						19600915_L3	1	1.7	18.9	9.3
						19600915_L4	1	1.8	18.9	9.3

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
Hilda	1964	St. Mary Parish, Lousiana	H2	95	959	19641004_H1	2.3	3.7	30.8	11.8
						19641004_H2	2.3	2.8	30.8	11.8
						19641004_H3	2.3	2.2	30.8	11.8
						19641004_H4	2.3	2.9	30.8	11.8
						19641004_M1	2.3	3.4	30.8	11.8
						19641004_M2	2.3	2.8	30.8	11.8
						19641004_M3	2.3	2.1	30.8	11.8
						19641004_M4	2.3	2.8	30.8	11.8
						19641004_L1	2.3	3.2	30.8	11.8
						19641004_L2	2.3	2.8	30.8	11.8
						19641004_L3	2.3	2.4	30.8	11.8
						19641004_L4	2.3	2.8	30.8	11.8
Betsy	1965	Lafourche Parish, Lousiana*	H4	135	941	19650910_H1	1.3	2.7	19.9	9.5
						19650910_H2	1.3	2.1	19.9	9.5
						19650910_H3	1.3	2.3	19.9	9.5
						19650910_H4	1.3	2.6	19.9	9.5
						19650910_M1	1.3	2.4	19.9	9.5
						19650910_M2	1.3	2.0	19.9	9.5
						19650910_M3	1.3	2.1	19.9	9.5
						19650910_M4	1.3	2.3	19.9	9.5
						19650910_L1	1.3	2.2	19.9	9.5
						19650910_L2	1.3	1.9	19.9	9.5
						19650910_L3	1.3	1.9	19.9	9.5
						19650910_L4	1.3	2.1	19.9	9.5
Camille	1969	Hancock County, Mississippi *	H5	165	909	19690817_H1	3.1	4.5	51.6	15.3
						19690817_H2	3.1	4.1	51.6	15.3

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed MPH	Approximate Landfall Pressure MB	Storm Identifier	Beach-fx Parameters Surge Peak ft (MSL)	TWL Peak ft (MSL)	Hmo Peak ft	Tp Peak sec
						19690817_H3	3.1	3.3	51.6	15.3
						19690817_H4	3.1	4.0	51.6	15.3
						19690817_M1	3.1	4.2	51.6	15.3
						19690817_M2	3.1	3.9	51.6	15.3
						19690817_M3	3.1	3.1	51.6	15.3
						19690817_M4	3.1	3.8	51.6	15.3
						19690817_L1	3.1	4.0	51.6	15.3
						19690817_L2	3.1	3.8	51.6	15.3
						19690817_L3	3.1	3.2	51.6	15.3
						19690817_L4	3.1	3.7	51.6	15.3
Sub Tropical 1	1969	Okaloosa County, Florida	SD	30	996	19691002_H1	3.1	2.2	28.1	11.3
						19691002_H2	3.1	1.9	28.1	11.3
						19691002_H3	3.1	1.7	28.1	11.3
						19691002_H4	3.1	1.8	28.1	11.3
						19691002_M1	3.1	1.9	28.1	11.3
						19691002_M2	3.1	1.7	28.1	11.3
						19691002_M3	3.1	1.4	28.1	11.3
						19691002_M4	3.1	1.6	28.1	11.3
						19691002_L1	3.1	1.7	28.1	11.3
						19691002_L2	3.1	1.5	28.1	11.3
						19691002_L3	3.1	1.3	28.1	11.3
						19691002_L4	3.1	1.5	28.1	11.3
Agnes	1972	Bay County, Florida	H1	65	983	19720619_H1	1.4	2.7	23.2	10.3
						19720619_H2	1.4	2.2	23.2	10.3
						19720619_H3	1.4	2.1	23.2	10.3
						19720619_H4	1.4	2.5	23.2	10.3
						19720619_M1	1.4	2.2	23.2	10.3
						19720619_M2	1.4	2.0	23.2	10.3
						19720619_M3	1.4	1.8	23.2	10.3

Table I-A - Walton County Plausible Storm Suite

							Beach-fx Parameters			
Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19720619_M4	1.4	2.2	23.2	10.3
						19720619_L1	1.4	2.2	23.2	10.3
						19720619_L2	1.4	1.8	23.2	10.3
						19720619_L3	1.4	1.6	23.2	10.3
						19720619_L4	1.4	2.0	23.2	10.3
Sub Tropical 1	1974	Pinellas County, Florida	SS	45	N/A	19740907_H1	1	2.4	17.3	8.9
						19740907_H2	1	2.2	17.3	8.9
						19740907_H3	1	2.2	17.3	8.9
						19740907_H4	1	2.3	17.3	8.9
						19740907_M1	1	2.1	17.3	8.9
						19740907_M2	1	2.0	17.3	8.9
						19740907_M3	1	2.0	17.3	8.9
						19740907_M4	1	2.0	17.3	8.9
						19740907_L1	1	1.9	17.3	8.9
						19740907_L2	1	1.7	17.3	8.9
						19740907_L3	1	1.7	17.3	8.9
						19740907_L4	1	1.8	17.3	8.9
Eloise	1975	Walton County, Florida	H3	110	955	19750923_H1	5.6	6.6	28.5	11.4
						19750923_H2	5.6	5.7	28.5	11.4
						19750923_H3	5.6	4.8	28.5	11.4
						19750923_H4	5.6	5.7	28.5	11.4
						19750923_M1	5.6	6.4	28.5	11.4
						19750923_M2	5.6	5.7	28.5	11.4
						19750923_M3	5.6	5.1	28.5	11.4
						19750923_M4	5.6	5.7	28.5	11.4
						19750923_L1	5.6	6.1	28.5	11.4
						19750923_L2	5.6	5.7	28.5	11.4
						19750923_L3	5.6	5.3	28.5	11.4
						19750923_L4	5.6	5.7	28.5	11.4

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19851031_M1	1.9	3.1	17.6	14.6
						19851031_M2	1.9	2.7	17.6	14.6
						19851031_M3	1.9	1.8	17.6	14.6
						19851031_M4	1.9	2.4	17.6	14.6
						19851031_L1	1.9	2.8	17.6	14.6
						19851031_L2	1.9	2.6	17.6	14.6
						19851031_L3	1.9	2.0	17.6	14.6
						19851031_L4	1.9	2.4	17.6	14.6
Kate	1985	Gulf County, Florida	H2	85	967	19851121_H1	1.8	3.1	13.5	15.0
						19851121_H2	1.8	2.8	13.5	15.0
						19851121_H3	1.8	2.5	13.5	15.0
						19851121_H4	1.8	2.8	13.5	15.0
						19851121_M1	1.8	2.8	13.5	15.0
						19851121_M2	1.8	2.5	13.5	15.0
						19851121_M3	1.8	2.2	13.5	15.0
						19851121_M4	1.8	2.5	13.5	15.0
						19851121_L1	1.8	2.6	13.5	15.0
						19851121_L2	1.8	2.4	13.5	15.0
						19851121_L3	1.8	2.0	13.5	15.0
						19851121_L4	1.8	2.3	13.5	15.0
Florence	1988	Plaqumines Parish, Louisana	H1	70	984	19880909_H1	1	2.3	8.7	13.4
						19880909_H2	1	2.2	8.7	13.4
						19880909_H3	1	2.0	8.7	13.4
						19880909_H4	1	2.1	8.7	13.4
						19880909_M1	1	2.0	8.7	13.4
						19880909_M2	1	1.9	8.7	13.4
						19880909_M3	1	1.7	8.7	13.4
						19880909_M4	1	1.8	8.7	13.4
						19880909_L1	1	1.8	8.7	13.4

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed MPH	Approximate Landfall Pressure MB	Storm Identifier	Beach-fx Parameters Surge Peak ft (MSL)	TWL Peak ft (MSL)	Hmo Peak ft	Tp Peak sec
						19880909_L2	1	1.7	8.7	13.4
						19880909_L3	1	1.5	8.7	13.4
						19880909_L4	1	1.6	8.7	13.4
Andrew	1992	St. Mary Parish, Louisana*	H4	120	955	19920825_H1	1.2	2.6	7.0	11.9
						19920825_H2	1.2	2.3	7.0	11.9
						19920825_H3	1.2	2.0	7.0	11.9
						19920825_H4	1.2	2.3	7.0	11.9
						19920825_M1	1.2	2.3	7.0	11.9
						19920825_M2	1.2	2.0	7.0	11.9
						19920825_M3	1.2	1.8	7.0	11.9
						19920825_M4	1.2	2.1	7.0	11.9
						19920825_L1	1.2	2.1	7.0	11.9
						19920825_L2	1.2	1.8	7.0	11.9
						19920825_L3	1.2	1.5	7.0	11.9
						19920825_L4	1.2	1.9	7.0	11.9
Alberto	1994	Okaloosa County, Florida	TS	55	993	19940703_H1	2.4	3.8	19.0	10.0
						19940703_H2	2.4	2.9	19.0	10.0
						19940703_H3	2.4	2.2	19.0	10.0
						19940703_H4	2.4	3.0	19.0	10.0
						19940703_M1	2.4	3.5	19.0	10.0
						19940703_M2	2.4	2.9	19.0	10.0
						19940703_M3	2.4	2.2	19.0	10.0
						19940703_M4	2.4	2.9	19.0	10.0
						19940703_L1	2.4	3.3	19.0	10.0
						19940703_L2	2.4	2.9	19.0	10.0
						19940703_L3	2.4	2.4	19.0	10.0
						19940703_L4	2.4	2.9	19.0	10.0
Erin	1995	Santa Rosa County, Florida*	H2	80	974	19950803_H1	2.1	3.6	15.7	9.2

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19950803_H2	2.1	2.8	15.7	9.2
						19950803_H3	2.1	1.9	15.7	9.2
						19950803_H4	2.1	2.7	15.7	9.2
						19950803_M1	2.1	3.3	15.7	9.2
						19950803_M2	2.1	2.7	15.7	9.2
						19950803_M3	2.1	2.0	15.7	9.2
						19950803_M4	2.1	2.7	15.7	9.2
						19950803_L1	2.1	3.1	15.7	9.2
						19950803_L2	2.1	2.7	15.7	9.2
						19950803_L3	2.1	2.3	15.7	9.2
						19950803_L4	2.1	2.7	15.7	9.2
Opal	1995	Santa Rosa County, Florida*	H3	110	938	19951004_H1	7	8.8	27.3	13.6
						19951004_H2	7	7.8	27.3	13.6
						19951004_H3	7	6.9	27.3	13.6
						19951004_H4	7	7.8	27.3	13.6
						19951004_M1	7	8.5	27.3	13.6
						19951004_M2	7	7.8	27.3	13.6
						19951004_M3	7	7.2	27.3	13.6
						19951004_M4	7	7.8	27.3	13.6
						19951004_L1	7	8.3	27.3	13.6
						19951004_L2	7	7.8	27.3	13.6
						19951004_L3	7	7.4	27.3	13.6
						19951004_L4	7	7.8	27.3	13.6
Earl	1998	Bay County, Florida	H1	70	987	19980902_H1	1.7	2.9	18.9	12.4
						19980902_H2	1.7	2.1	18.9	12.4
						19980902_H3	1.7	1.6	18.9	12.4
						19980902_H4	1.7	2.1	18.9	12.4
						19980902_M1	1.7	2.6	18.9	12.4
						19980902_M2	1.7	2.0	18.9	12.4

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Beach-fx Parameters Surge Peak	TWL Peak	Hmo Peak	Tp Peak
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						19980902_M3	1.7	1.4	18.9	12.4
						19980902_M4	1.7	2.0	18.9	12.4
						19980902_L1	1.7	2.4	18.9	12.4
						19980902_L2	1.7	2.0	18.9	12.4
						19980902_L3	1.7	1.6	18.9	12.4
						19980902_L4	1.7	2.0	18.9	12.4
Georges	1998	Harrison County, Mississippi	H2	90	964	19980927_H1	1.7	3.1	21.9	13.4
						19980927_H2	1.7	2.9	21.9	13.4
						19980927_H3	1.7	2.6	21.9	13.4
						19980927_H4	1.7	2.9	21.9	13.4
						19980927_M1	1.7	2.8	21.9	13.4
						19980927_M2	1.7	2.6	21.9	13.4
						19980927_M3	1.7	2.4	21.9	13.4
						19980927_M4	1.7	2.6	21.9	13.4
						19980927_L1	1.7	2.6	21.9	13.4
						19980927_L2	1.7	2.4	21.9	13.4
						19980927_L3	1.7	2.2	21.9	13.4
						19980927_L4	1.7	2.4	21.9	13.4
Barry	2001	Walton County, Florida	TS	60	992	20010805_H1	2.5	3.8	20.7	9.7
						20010805_H2	2.5	2.9	20.7	9.7
						20010805_H3	2.5	2.2	20.7	9.7
						20010805_H4	2.5	3.0	20.7	9.7
						20010805_M1	2.5	3.5	20.7	9.7
						20010805_M2	2.5	2.9	20.7	9.7
						20010805_M3	2.5	2.2	20.7	9.7
						20010805_M4	2.5	2.9	20.7	9.7
						20010805_L1	2.5	3.3	20.7	9.7
						20010805_L2	2.5	2.9	20.7	9.7
						20010805_L3	2.5	2.4	20.7	9.7

Table I-A - Walton County Plausible Storm Suite

Storm Name	Year	Landfall	Estimated Category at Landfall	Approximate Landfall Wind Speed	Approximate Landfall Pressure	Storm Identifier	Surge Peak	TWL Peak	Hmo Peak	Tp Peak
							Beach-fx Parameters			
				MPH	MB		ft (MSL)	ft (MSL)	ft	sec
						20010805_L4	2.5	2.9	20.7	9.7
Ivan	2004	Baldwin County, Alabama	H3	105	943	20040915_H1	5.1	6.5	25.2	14.3
						20040915_H2	5.1	6.5	25.2	14.3
						20040915_H3	5.1	5.7	25.2	14.3
						20040915_H4	5.1	6.2	25.2	14.3
						20040915_M1	5.1	6.2	25.2	14.3
						20040915_M2	5.1	6.2	25.2	14.3
						20040915_M3	5.1	5.6	25.2	14.3
						20040915_M4	5.1	6.0	25.2	14.3
						20040915_L1	5.1	6.0	25.2	14.3
						20040915_L2	5.1	6.0	25.2	14.3
						20040915_L3	5.1	5.6	25.2	14.3
						20040915_L4	5.1	5.8	25.2	14.3

ATTACHMENT II

SEDIMENT BUDGET VOLUME CHANGE TABLE AND PLOTS

ATTACHMENT II: Sediment Budget Volume Change Table and Plots: 1995 to May 2004, May 2004 to November 2004, and 1995 to November 2004 Periods

Table 1. Volume Change by Reach: Analysis A

		May 95 (pre-Opal) – May 04 (pre-Ivan)	May 04 (pre-Ivan) – Nov 04 (post-Ivan)	May 95 (pre-Opal) – Nov 04 (post-Ivan)
	Interval (yr)	9.0	-	9.5
		Volume Change		
	Reach	cy/ft/yr	cy/ft	cy/ft/yr
Dune to MHW	R1 – R19	-1.9	-15.9	-2.9
	R19 – R23	-1.4	-21.2	-3.2
	R23 – R41	-1.8	-22.7	-3.5
	R41 – R48	-1.1	-20.2	-2.8
	R48 – R55	-2.1	-12.7	-3.2
	R55 – R64	-2.8	-8.6	-3.4
	R64 – R80	-2.6	-13.7	-3.0
	R80 – R98	-2.1	-11.1	-3.2
	R–98 – R109	-2.9	-7.4	-3.0
	R–109 – R127	-2.0	-12.2	-3.0
MHW to MLW	R1 – R19	-0.2	0.2	-0.2
	R19 – R23	-0.2	-0.9	-0.2
	R23 – R41	-0.1	-0.9	-0.2
	R41 – R48	-0.2	-0.9	-0.2
	R48 – R55	-0.3	0.4	-0.2
	R55 – R64	-0.3	0.6	-0.2
	R64 – R80	-0.3	-0.2	-0.3
	R80 – R98	-0.2	-0.2	-0.3
	R–98 – R109	-0.3	-0.5	-0.2
	R–109 – R127	-0.3	-0.7	-0.3
MLW to -35 ft	R1 – R19	-5.3	-11.1	-5.9
	R19 – R23	-5.2	-21.5	-7.0
	R23 – R41	-4.1	-13.8	-5.3
	R41 – R48	-4.9	-8.0	-5.5
	R48 – R55	-5.5	-10.4	-6.3
	R55 – R64	-6.4	-12.5	-7.4
	R64 – R80	-5.9	-14.3	-7.9
	R80 – R98	-6.5	-19.9	-8.3
	R–98 – R109	-5.8	-38.4	-9.3
	R–109 – R127	-4.9	-38.8	-8.8
Dune to -35 ft	R1 – R19	-7.4	-25.6	-8.9
	R19 – R23	-6.7	-43.0	-9.7
	R23 – R41	-6.0	-37.3	-9.1
	R41 – R48	-6.2	-29.1	-8.6
	R48 – R55	-7.8	-22.7	-9.7
	R55 – R64	-9.6	-20.4	-11.1
	R64 – R80	-8.3	-28.2	-11.1
	R80 – R98	-8.8	-31.2	-11.8
	R–98 – R109	-8.4	-45.8	-11.4
	R–109 – R127	-7.2	-51.8	-12.1

Table 2. Volume Change by Reach: Analysis B

		May 95 (pre-Opal)	May 04 (pre-Ivan)	May 95 (pre-Opal)
		May 04 (pre-Ivan)	Nov 04 (post-Ivan)	Nov 04 (post-Ivan)
	Interval (yr)	9.0	-	9.5
		Volume Change		
	Reach	cy/ft/yr	cy/ft	cy/ft/yr
Dune to MHW	R1 – R23	-1.8	-16.7	-3.0
	R23 – R41	-1.8	-22.7	-3.5
	R41 – R66	-2.1	-13.0	-3.2
	R66 – R77	-2.4	-14.1	-2.7
	R77 – R127	-2.3	-11.0	-3.2
MHW to MLW	R1 – R23	-0.2	0.1	-0.2
	R23 – R41	-0.1	-0.9	-0.2
	R41 – R66	-0.3	0.1	-0.2
	R66 – R77	-0.3	-0.1	-0.2
	R77 – R127	-0.3	-0.4	-0.3
MLW to -35 ft	R1 – R23	-5.2	-14.2	-6.1
	R23 – R41	-4.1	-13.8	-5.3
	R41 – R66	-5.6	-11.7	-6.6
	R66 – R77	-5.4	-13.3	-7.7
	R77 – R127	-5.7	-30.9	-8.6
Dune to -35 ft	R1 – R23	-7.2	-29.6	-9.1
	R23 – R41	-6.0	-37.3	-9.1
	R41 – R66	-8.0	-24.6	-10.0
	R66 – R77	-7.5	-27.5	-10.7
	R77 – R127	-8.1	-42.1	-11.7

Table 3. Cumulative Volume Change (R1 – R127)

	May 1995 (pre-Opal) – May 2004 (pre-Ivan)	May 2004 (pre-Ivan) – November 2004 (post-Ivan)	May 1995 (pre-Opal) – November 2004 (post-Ivan)
	Volume Change (cy)		
Dune to MHW	-2,519,000	-1,930,000	-3,931,000
MHW to MLW	-278,000	-37,000	-297,000
MLW to -35 ft	-6,414,000	-2,637,000	-9,137,000
Dune to -35 ft	-9,211,000	-4,604,000	-13,365,000

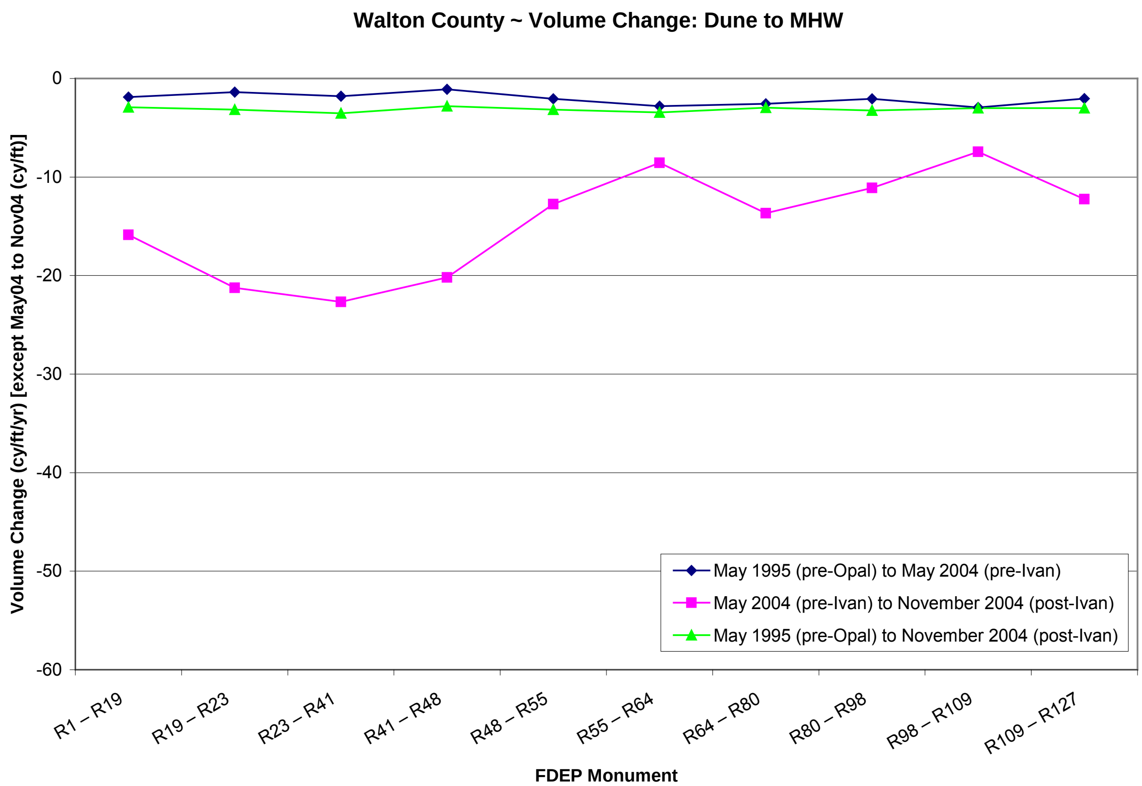

Figure 1. Dune to MHW Volume Change by Reach: Analysis A

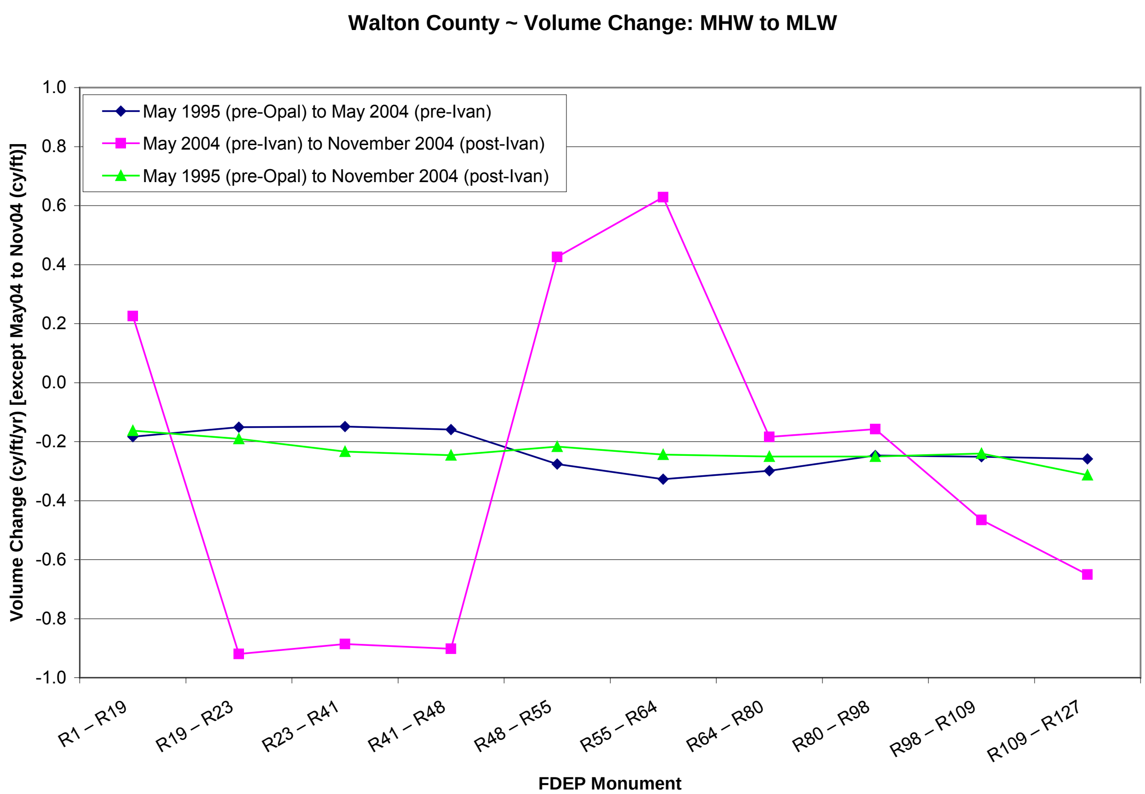

Figure 2. MHW to MLW Volume Change by Reach: Analysis A

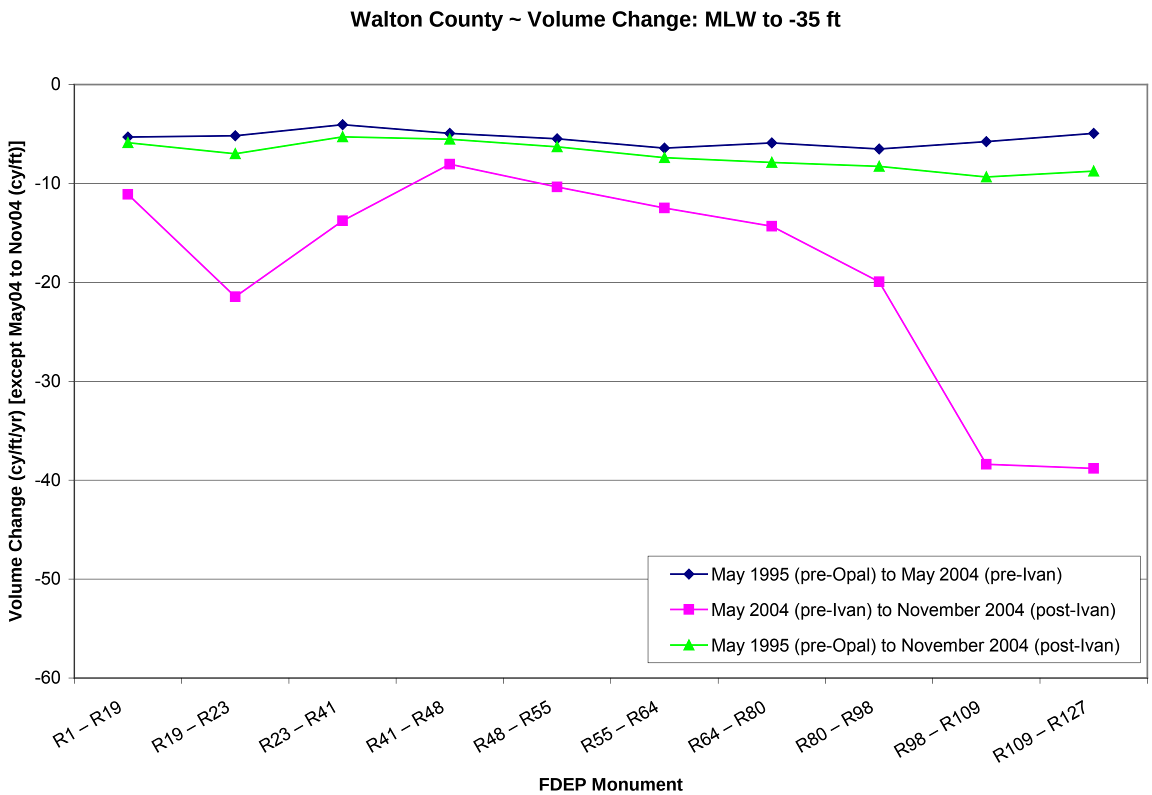

Figure 3. MLW to -35 feet Volume Change by Reach: Analysis A

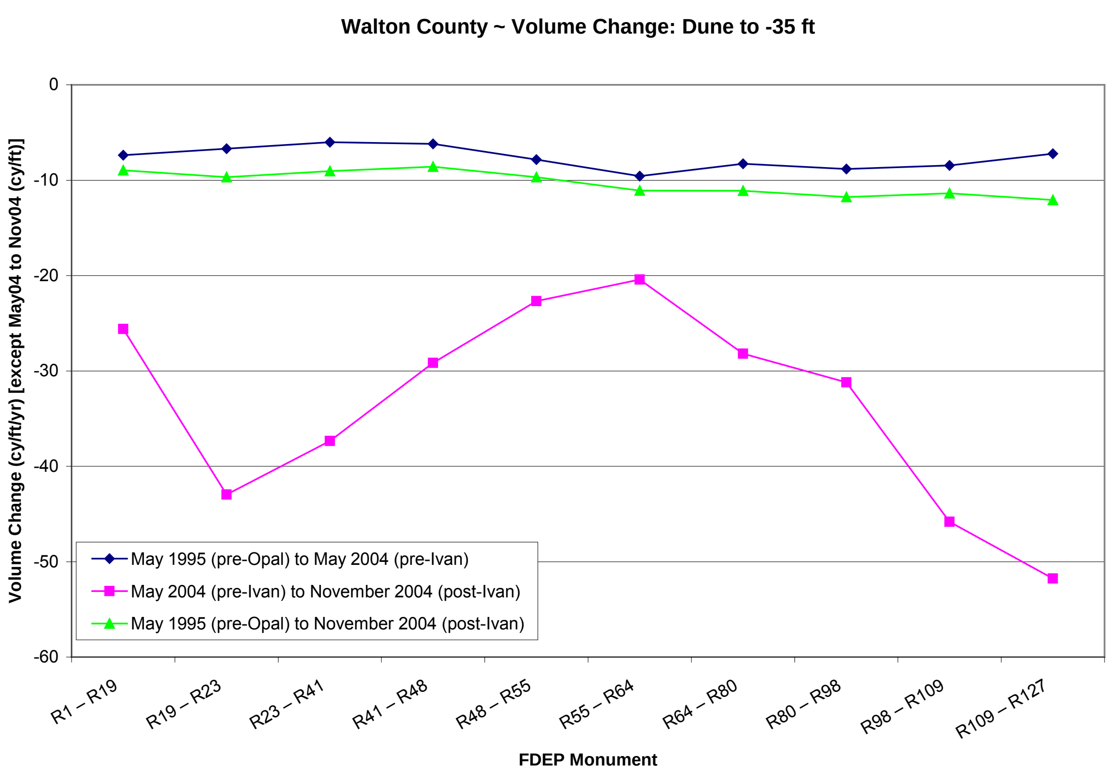

Figure 4. Dune to -35 ft Volume Change by Reach: Analysis A

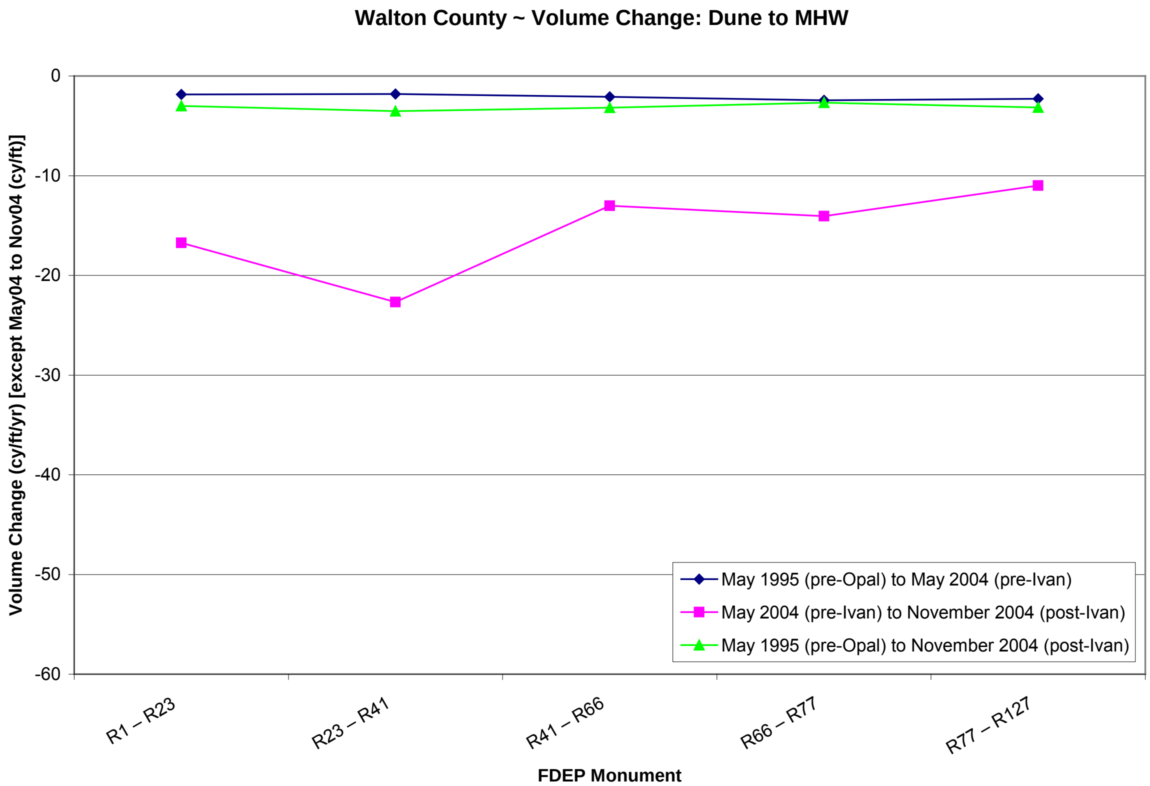

Figure 5. Dune to MHW Volume Change by Reach: Analysis B

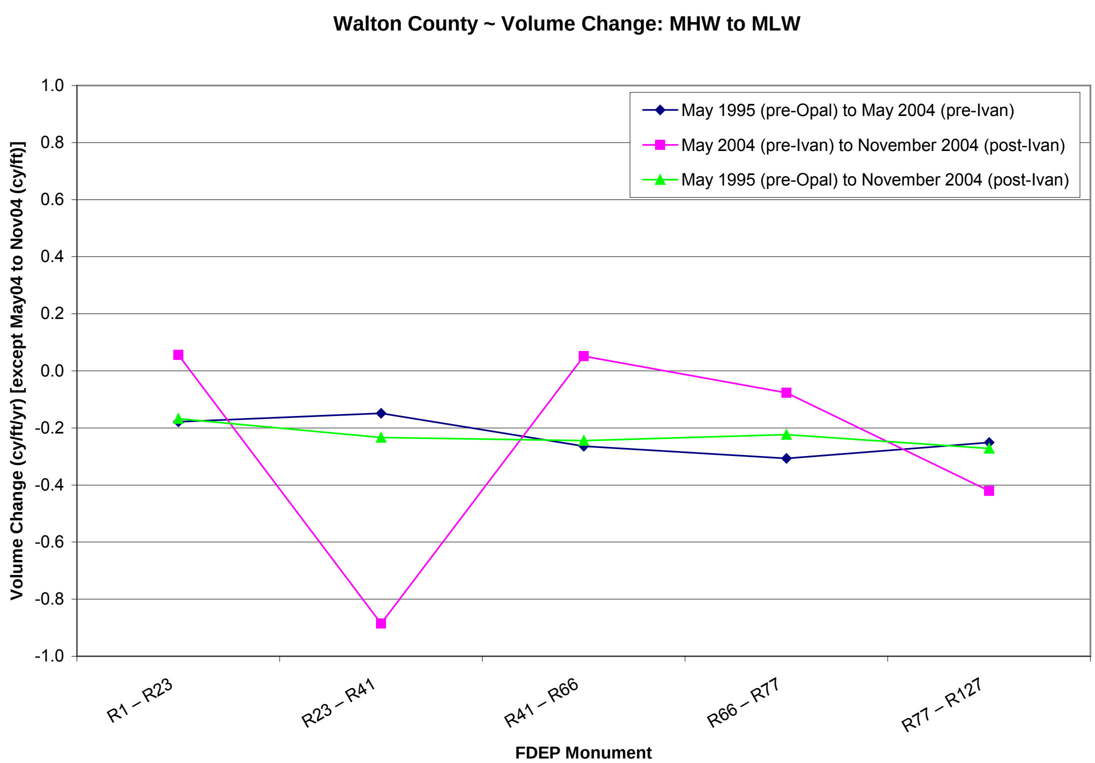

Figure 6. MHW to MLW Volume Change by Reach: Analysis B

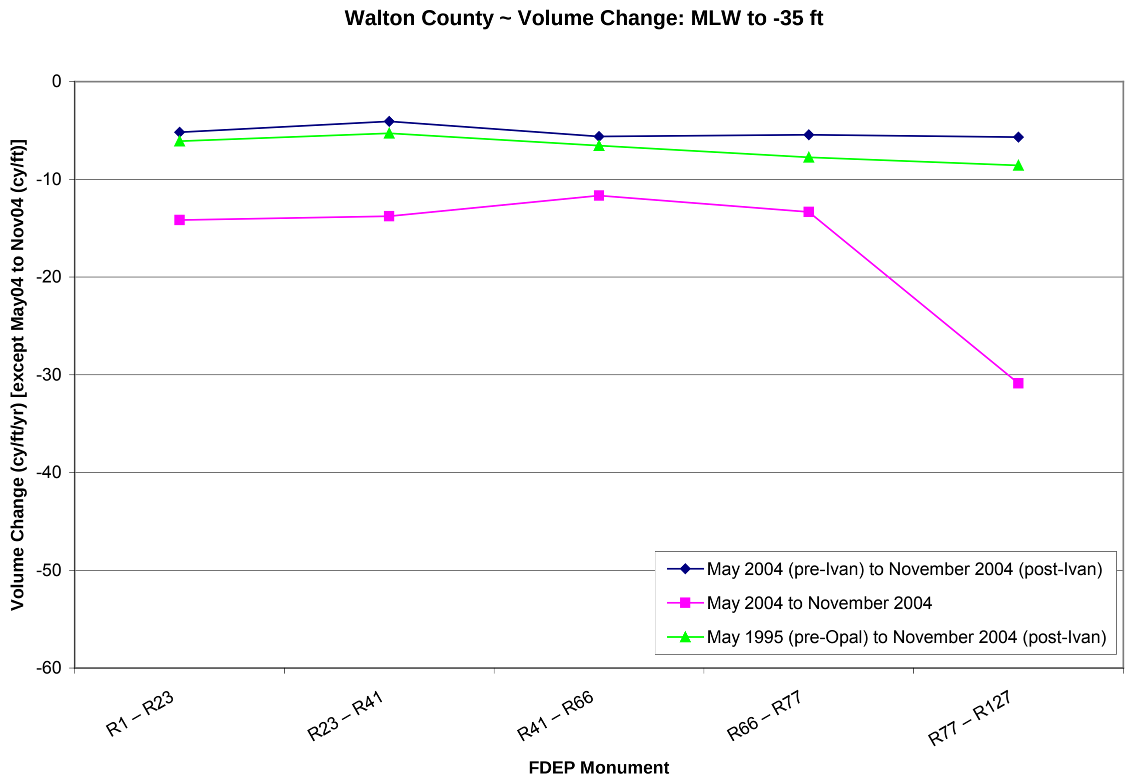

Figure 7. MLW to -35 feet Volume Change by Reach: Analysis B

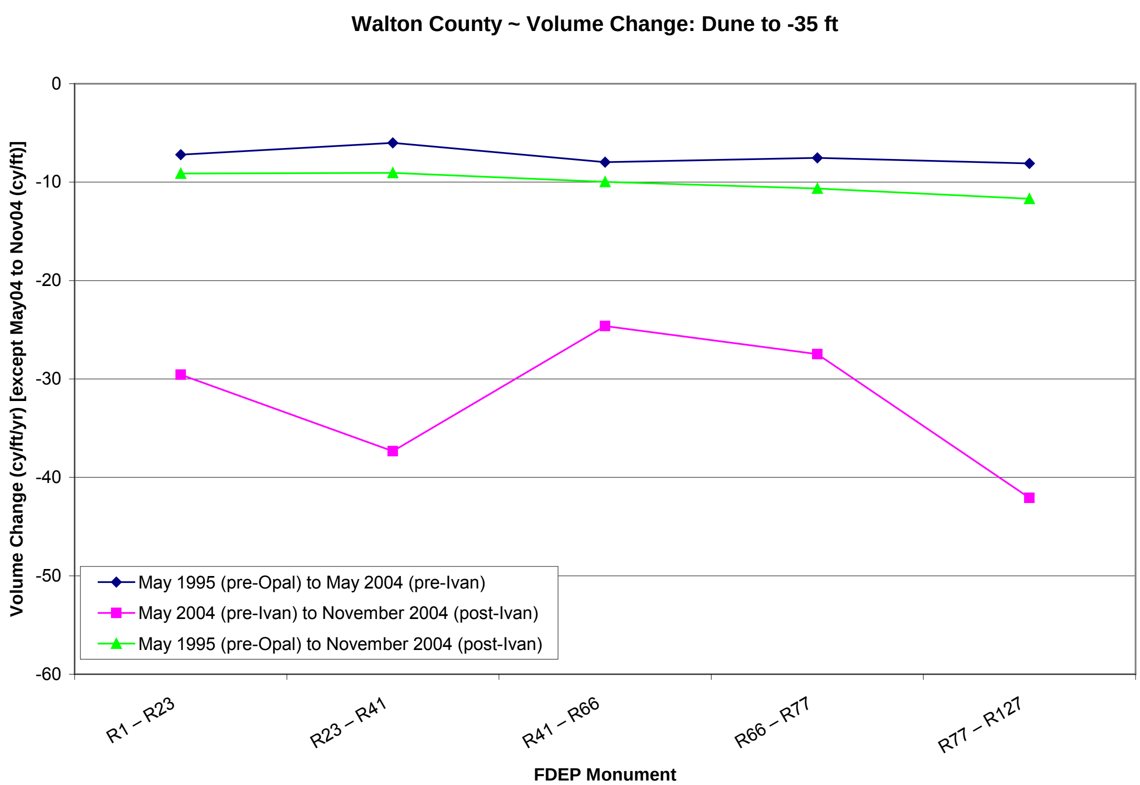

Figure 8. Dune to -35 ft Volume Change by Reach: Analysis B

ATTACHMENT III

REGRESSION ANALYSIS FOR SHORELINE CHANGE RATES

ATTACHMENT III: Regression Analysis for Shoreline Change Rates

Table 1. Shoreline Change Rates Following Linear Regression Analysis

	1973 – 2004 Nov	1973 – 2004 May	1973 – 1995 May	1995 May – 2004 May	1995 May – 2004 Nov	2004 May – 2004 Nov
Monument	Slope	Slope	Slope	Slope	Slope	Slope
	(ft/yr)	(ft/yr)	(ft/yr)	(ft/yr)	(ft/yr)	(ft/yr)
Average	-0.22	-0.02	2.13	-2.59	-2.45	-12.41
St. Dev.	0.70	0.74	1.00	2.87	2.31	36.09
R-1	-0.64	-0.13	2.16	-1.85	-3.52	-38.10
R-2	0.58	0.69	1.15	6.12	3.36	-69.84
R-3	-0.22	0.30	2.61	-3.95	-4.91	-32.41
R-3a	-0.14	0.07	1.62	-2.11	-2.20	-13.27
R-4	0.87	0.93	1.27	4.90	2.86	-56.75
R-5	-0.56	-0.29	2.35	-7.13	-5.79	16.86
R-6	0.25	0.12	2.58	-3.33	-0.05	78.31
R-6a	-0.93	-0.86	0.58	0.37	-0.53	-41.08
R-7	-0.33	-0.18	1.76	-3.19	-2.70	8.80
R-8	0.44	0.08	1.50	1.05	2.58	27.77
R-9	0.04	0.44	3.35	-3.21	-4.02	-30.32
R-10	-0.03	-0.04	1.49	-2.84	-1.10	35.29
R-11	0.36	0.56	2.75	-1.55	-1.75	-16.41
R-12	0.23	-0.13	2.51	-2.45	1.44	81.64
R-13	-0.38	-0.06	3.52	-6.16	-5.30	7.24
R-14	0.00	0.50	2.20	-3.92	-4.10	-3.28
R-15	-0.11	-0.09	2.05	-2.95	-1.81	13.82
R-16	0.53	0.54	1.37	-3.12	-1.65	33.74
R-17	0.53	0.76	4.39	-5.51	-3.89	21.52
R-18	0.54	0.37	2.72	-1.33	1.12	40.65
R-19	-0.76	-0.60	0.10	-2.21	-2.40	-12.36
R-20	-0.15	-0.15	2.05	-4.73	-4.73	0.00
R-21	0.24	0.51	2.63	0.80	-0.09	-26.36
R-22	1.68	1.74	3.76	0.39	0.65	4.96
R-23	0.45	0.89	2.63	0.73	-1.64	-71.93
R-24	-0.68	-0.40	1.42	-4.14	-3.38	12.99
R-25	-0.93	-1.32	0.14	-2.72	-0.11	53.38
R-26	1.06	1.45	2.26	-1.12	-1.95	-19.42
R-27	0.82	0.60	1.61	0.71	2.28	14.27
R-28	0.76	0.93	3.19	-1.74	-1.37	-6.80
R-29	0.74	0.88	3.94	-2.07	-1.42	-8.80
R-30	-0.30	-0.13	1.67	-1.41	-1.58	-32.53
R-31	-2.42	-2.23	-0.95	-1.68	-2.74	-35.00
R-32	0.57	0.98	1.83	-2.62	-3.37	-28.62
R-33	1.23	1.55	4.28	-7.84	-0.47	-

Table 1 (Cont'd): Shoreline Change Rates Following Linear Regression Analysis

R-34	-0.38	0.13	1.65	-2.12	-3.97	-53.02
R-35	-1.57	-1.13	2.35	-11.00	-8.34	48.23
R-36	0.34	0.66	2.06	-7.93	-6.55	17.63
R-37	0.51	0.64	2.20	-0.53	-0.78	-21.61
R-38	0.25	0.60	2.68	-1.01	-2.24	-52.85
R-39	-0.76	-0.28	1.69	0.94	-1.74	-91.63
R-40	-0.42	-0.04	1.57	-2.48	-3.61	-37.57
R-41	0.34	0.60	0.88	-0.63	-1.54	-16.33
R-42	0.09	0.37	2.57	0.54	-0.46	-47.71
R-43	0.28	0.42	1.73	4.99	2.39	-76.62
R-44	-0.53	0.11	1.83	-0.72	-3.32	-64.35
R-45	-1.03	-0.66	1.06	-3.42	-4.10	-29.48
R-46	-0.15	0.03	1.93	-0.23	-1.01	-31.98
R-47	0.24	0.23	1.90	-2.20	-1.09	13.66
R-48	0.19	0.17	2.69	-3.03	-1.59	28.84
R-49	-0.85	-0.77	1.72	0.54	0.73	3.23
R-50	-0.47	-0.42	1.22	-6.02	-3.97	29.64
R-51	-1.36	-1.33	1.69	-2.59	-1.31	11.40
R-52	0.33	0.47	2.94	-2.20	-1.90	-4.36
R-53	-0.40	-0.29	2.18	-0.46	-0.95	-23.82
R-54	-0.04	0.37	2.59	-5.92	-5.27	-1.00
R-55	0.04	0.14	1.55	-5.66	-3.87	24.60
R-56	0.55	0.62	2.57	-5.01	-3.22	27.24
R-57	-0.84	-0.49	2.28	-7.65	-6.22	18.58
R-58	-0.63	-0.41	2.23	-7.16	-5.56	1.55
R-59	-0.57	-0.85	2.32	-1.18	0.60	33.52
R-60	-0.37	-0.15	1.48	-5.07	-3.98	10.08
R-61	-1.40	-1.38	0.45	-3.80	-2.93	21.10
R-62	0.00	-0.02	1.93	-4.98	-2.80	49.21
R-63	-0.52	-0.19	2.47	-5.16	-4.45	-8.78
R-64	-0.25	0.25	2.84	-3.99	-4.58	-21.82
R-65	0.65	0.90	2.48	-4.78	-3.63	25.60
R-66	0.00	0.54	3.65	-6.41	-6.07	-17.02
R-67	0.27	0.14	2.54	-2.62	-0.72	29.00
R-68	-1.60	-1.78	2.49	2.64	1.93	-9.75
R-69	0.34	0.91	3.11	-3.76	-4.34	-47.70
R-70	-0.61	-0.72	1.43	-3.62	-1.94	14.72
R-71	-0.41	-0.39	2.50	-2.62	-1.87	-0.67
R-72	0.33	0.89	3.50	-2.11	-3.14	-19.35
R-73	-0.87	-1.08	5.37	3.20	3.54	9.15
R-74	-1.03	-1.01	2.40	-4.04	-2.94	-12.73
R-75	-1.67	-1.43	1.30	-4.68	-3.93	3.95
R-76	-1.28	-1.14	0.54	-3.76	-3.57	-18.55
R-77	-2.40	-2.61	-0.38	-5.58	-3.12	38.25
R-78	0.32	0.52	3.14	-1.96	-1.33	-12.81
R-79	-1.27	-1.04	2.11	-4.27	-4.34	-38.73
R-80	0.40	1.07	3.20	-3.10	-5.05	-49.94

Table 1 (Cont'd): Shoreline Change Rates Following Linear Regression Analysis

R-81	-1.58	-1.52	0.30	-1.07	-1.34	-29.63
R-82	0.55	0.63	1.70	1.69	0.79	-20.86
R-83	0.35	0.34	3.08	-2.17	-1.03	14.55
R-84	0.32	0.32	0.68	-2.38	-2.38	0.00
R-85	0.24	0.77	2.11	0.44	-2.30	-72.05
R-86	-0.68	-0.62	1.46	-6.29	-4.21	40.50
R-87	-0.17	-0.18	1.82	-0.75	0.02	4.28
R-88	0.30	0.58	3.16	-4.27	-3.71	5.88
R-89	-0.49	-0.33	0.24	-0.37	-1.30	-24.26
R-90	-0.41	-0.03	1.98	-4.71	-4.67	-23.82
R-91	0.27	0.70	2.93	-1.30	-2.77	-46.24
R-92	0.41	0.57	0.94	-2.16	-1.98	13.30
R-93	-0.64	-0.63	2.39	-2.25	-0.73	4.63
R-94	-0.75	-1.08	1.77	-2.42	-0.27	30.88
R-95	-0.90	-0.53	1.93	-7.70	-5.97	23.60
R-96	-0.72	-0.81	0.52	1.08	0.76	-12.55
R-97	0.78	0.90	3.83	0.06	0.01	-28.39
R-98	-0.20	0.05	3.11	-3.01	-2.91	-13.96
R-99	-0.52	-0.23	1.18	-4.35	-3.91	-7.20
R-100	0.62	0.93	2.12	-0.33	-1.49	-32.05
R-101	-0.10	0.00	2.14	1.12	0.12	-41.69
R-102	0.26	0.56	1.99	-8.88	-6.80	33.11
R-103	-0.75	-0.32	2.91	-5.57	-5.76	-21.30
R-103a	-1.66	-1.02	-	1.46	-2.75	-99.53
R-104	0.26	-0.11	1.59	-0.95	1.06	30.00
R-105	-0.54	-0.09	3.00	-5.82	-5.46	-33.28
R-106	-0.21	0.30	2.78	-2.31	-4.34	-61.85
R-107	-0.63	-0.63	2.03	-5.87	-5.87	0.00
R-108	-0.23	0.31	1.88	-0.15	-2.42	-72.07
R-109	-0.38	-0.38	2.28	-4.50	-4.50	-
R-110	-0.55	-0.04	2.44	-2.35	-3.92	-52.01
R-111	-0.87	-0.50	1.28	1.95	-0.57	-56.67
R-112	-0.99	-0.68	2.60	-1.21	-2.81	-71.21
R-113	-0.63	-0.57	2.20	-4.85	-3.32	5.51
R-114	-0.61	-0.04	2.18	-2.21	-4.38	-62.24
R-115	-0.03	0.35	2.46	-7.57	-6.58	9.09
R-116	-0.02	0.40	1.91	-2.24	-3.67	-70.05
R-117	-1.14	-1.01	0.30	-1.53	-1.76	-24.57
R-118	-1.10	-0.47	1.53	-0.70	-4.32	-89.32
R-119	-0.33	0.01	2.36	-1.90	-3.19	-63.41
R-120	-0.79	-0.24	1.48	-1.80	-4.14	-83.53
R-121	-0.69	-0.38	1.74	-2.69	-3.62	-37.81
R-122	0.53	0.77	3.00	0.18	-0.99	-41.07
R-123	-0.03	-0.08	2.73	-3.13	-0.78	21.89
R-124	-0.11	0.41	2.15	0.59	-2.16	-60.97
R-125	-0.19	0.05	2.51	-6.05	-4.98	-11.56
R-126	0.07	0.43	3.28	-4.27	-3.54	-13.28
R-127	0.57	0.84	5.19	-8.23	-5.82	-3.97

APPENDIX A
SECTION 2

GEOTECHNICAL CONSIDERATIONS

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

APPENDIX A - ENGINEERING DESIGN
SECTION 2 - GEOTECHNICAL CONSIDERATIONS

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HURRICANE AND STORM DAMAGE REDUCTION
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1. GENERAL

The purpose of this study is to assess the needs for hurricane and storm damage reduction and opportunities for environmental restoration and protection along the Gulf Coast of Walton County, Florida. The most immediate and critical needs of the local communities are to address gulf front beach and dune erosion and include environmental protection opportunities. The study area is located in Walton County, Florida. The Walton County shoreline extends along the northern Gulf of Mexico and comprises 26 miles of shoreline including six miles of state parks. A coastal peninsula extending west from the mainland characterizes the western two-thirds of the coastline, and a mainland beach characterizes the eastern third. The Choctawhatchee Bay lies north of the peninsula. Walton County begins from the City of Destin in Okaloosa County, Florida; eastward to the beginning of Bay County, Florida. Walton County is situated approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida.

Walton County's shoreline is receding and its protective dunes and high bluffs are being adversely impacted by hurricane and coastal storm forces. The impacts of these storms to property and infrastructure are considerable and can possibly be reduced through a beach restoration and stabilization project. Behind the dune system, upland drainage feeds several freshwater lakes that intermittently breach the dune system and discharge directly into the Gulf. Primary dune elevations range from 13 to 45 feet National Geodetic Vertical Datum (NGVD) and average 26 feet NGVD. During the late 1990s, the area endured several strong hurricanes resulting in extensive shoreline erosion. This information was detailed in a Beach Management Feasibility Study for Walton County and Destin Florida conducted by Taylor Engineering, Inc.; in April 2003 (A copy of the Taylor (2003) report is attached). In 2004 the area was affected severely by Hurricane Ivan (Sep 04) and early into the 2005 hurricane season it was impacted by Hurricanes Arlene (June 05) and Dennis (July 05).

Walton County's 26 miles of coastline initially was subdivided into reaches that very nearly coincided with the neighborhood divisions that already existed in the county's coastal community. That division resulted in 10 major reaches initially formulated for economic reach delineation. Surveys were taken every 1,000 feet and were used to develop the beach profile. There are 117 model reaches in the Walton County study which are about 1,000 feet in length.

Due to the effects of Hurricane Ivan on the beach the Project Delivery Team (PDT) decided that the project existing conditions had changed significantly. As a result new surveys of the beach were ordered and obtained. A new existing condition was established and named post-Ivan. That existing condition then became the initial point of beach condition (base condition) for the 54-year period of analysis accommodating a 50-year project life.

Further the PDT sought out, briefed and obtained from all the affected stakeholders approval of an expedited study plan which resulted in a revised Project Management Plan. That plan included reducing the number of study reaches to five (Table A-2-1). This was made possible because the hurricane had removed the physiographic differences in the shoreline, thus reducing the number of representative profiles needed to account for variation between and among reaches.

Table A-2-1. Study Reaches

Reach	FDEP Range Monuments	Distance (miles)	Local Communities	State Parks
1	R-1 to R-22	5.2	Miramar Beach Sandestin and 4 Mile Village	
2	R-23 to R-40	3.4		Topsail Hill State Recreation Area
3	R-41 to R-66	5.2	Beach Highlands, Dune Allen Beach, Santa Rosa Beach, Blue Mountain Beach	
4	R-67 to R-77	2.6	Grayton Beach	Grayton Beach State Recreation Area
5	R-78 to R-127	9.2	Seaside, Seagrove Beach, Rosemary Beach, Inlet Beach	Deer Lake State Recreation Area

The hurricane season of 2005 started early and the project was significantly affected by Hurricanes Arlene and Dennis. It was decided that the without project condition should remain as post Ivan and continue the study with that existing condition even though that condition had changed significantly.

2. STUDY REACHES AND REPRESENTATIVE PROFILES

The Walton County upland cross section is defined by dune elevations ranging from +9.5 to + 33 feet NAVD88 and a natural berm elevation of +5.5 feet NAVD88. The study region was divided into five study reaches based on structural development and state park areas, Figure A-2-1. The historical and 2004 beach surveys were used to develop 11 representative profiles which characterize the existing condition for the five study reaches. The representative profiles were identified based on similarity in shape of the upper beach profile (dune height and width, berm width, foreshore beach slope, and profile volume) and shape of the offshore profile. Because significant erosion occurred due to Hurricane Ivan in September 2004, the representative profiles were revised using the post-Ivan data to characterize the upper portion of the beach and to include the post-Ivan data in the submerged portion of the beach.

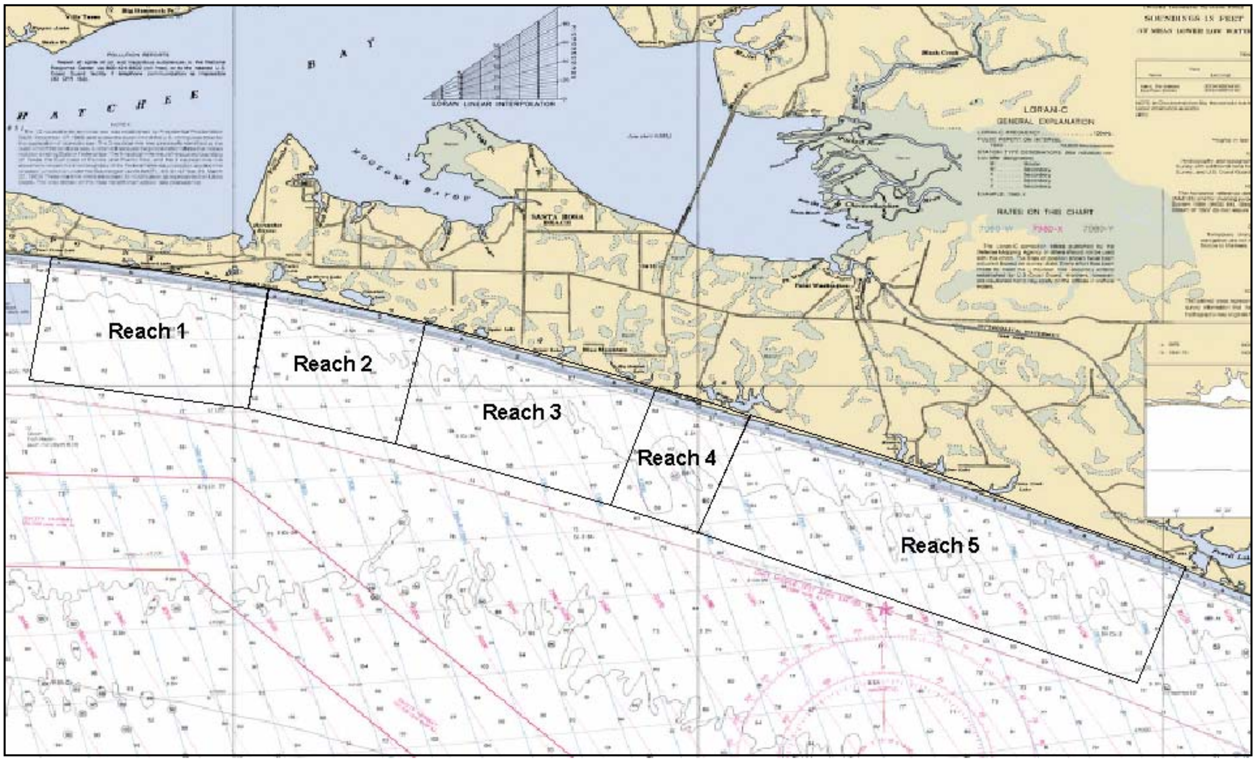

Figure A-2-1. Walton County Study Reaches

The Generalized Model for Simulating Shoreline Change (GENESIS) (Hanson and Kraus 1989) was applied to estimate the existing and future without project shoreline positions in the Walton County area. The shoreline data from the May 2004 CHARTS survey encompassing all of Walton County and parts of Bay and Okaloosa Counties was used for the initial condition. The results indicate significant scatter in the shoreline positions. The average shoreline change within the project area measures 0.51 feet/year indicating slight accretion. However; this average value masks the prevalence of the shoreline fluctuations that generally fall within +/- 6.56 feet/year. The Storm-Induced BEAch CHange Model (SBEACH) (Larson and Kraus 1989a; Larson, Kraus, and Byrnes 1990) for predicting beach, berm, and dune erosion due to storm waves and water levels was used to develop an existing condition and future without project storm response database of storm-induced beach profile change within the Walton County study area. The modeled responses were subsequently processed using the USACE Beach-*fx* model. A total of 46 historical hurricane events were identified and used to characterize the storm climatology within the Walton County study area. With the exception of Hurricane Ivan, the ADCIRC model (Luettich et al., 1994; Westerink et al., 1992) was used to estimate the storm surge associated with the individual historical storm event. Wave information was obtained from the WIS wave hindcast and NDBC Station 40239 for Hurricane Ivan conditions.

For purposes of Beach-*fx* modeling, a simplified beach profiles were developed representing a single trapezoidal dune, with a horizontal berm. The submerged profile is represented by a series of points or an approximate functional representation. The beach variables which change with storms are dune width, dune height, berm width, and upland elevation. Constant values are upland elevation, dune slope, berm height, foreslope, and shape of the submerged profile. Thus, in response to a given storm, the berm can be eroded or accreted; the dune height and/or width can change and translate landward or seaward. The 11 representative beach profiles simplified to meet the requirements of the Beach-*fx* model and comparisons of the representative and simplified beach profiles for Reaches 1 through 5 are located in Appendix A.

SBEACH simulations were conducted to develop a database of pre-generated beach profile responses to storms, for a range of storms and profiles, for the Walton County. The 11 simplified beach profiles were modified for various berm and dune configurations as listed in Appendix A. Maximum dune and berm widths were determined based on volumes provided by the Federal Emergency Management Agency (FEMA) post-Hurricane Ivan emergency beach nourishment. FEMA funded the placement of an average of six to eight cubic yards (cy) per linear foot of shoreline at specific locations on the western end. This study assumes the FEMA emergency nourishment volumes are placed over the entire domain, and emergency placement will be implemented once the existing post-Hurricane Ivan shoreline conditions are reached. The SBEACH simulations were conducted to predict the response of each dune and berm configuration to the 552 storms developed for this study. Approximately 240,000 SBEACH simulations were conducted to develop the shoreline responses for the Beach-*fx* storm response database.

3. ALTERNATIVES

A process was followed for initial screening of alternatives and resulted in the recommendation of a set of preliminary alternatives to further evaluate in feasibility. The design looked at both historical and current dune heights and dune widths and berm heights and berm widths over the study area as defined in each representative profile. In Reaches 1, 3, and 5 the dune height is preserved as a result of the emergency nourishment action. Because emergency nourishment is only applied to the dune, the erosion is most significant to the berm. The PDT determined project alternatives for evaluation generally would vary the berm width in 50-, 75-, 100-, and 125-foot increments. The optimized section was found to be a 50-foot berm with a set dune height and width against the existing dune. The engineering effort tailored the required berm and dune quantity to the existing condition at a given location. The typical sections for these efforts are illustrated in Figure A-2-2.

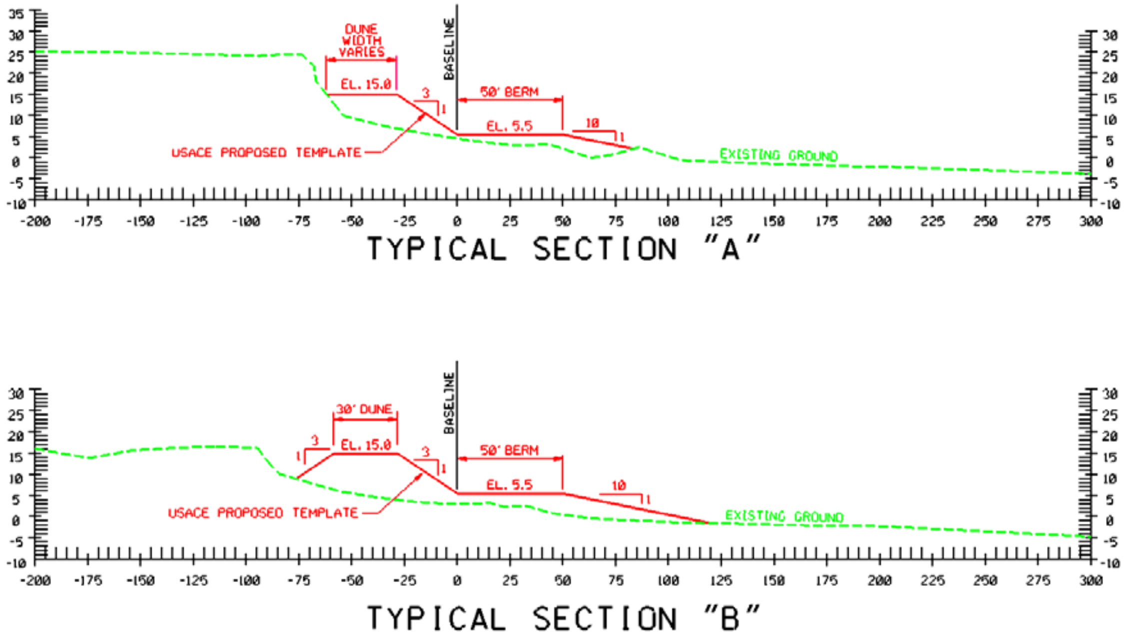

Figure A-2-2. Typical Project Sections

Estimated fill requirements for the NED plan and a Locally Preferred Plan (LPP) are indicated in Table A-2-2. The two plans maintain the same placement template but the LPP extends the coverage area to the westernmost limits of the county where the NED plan could not justify the coverage. The typical sections indicated, except that the width of dune crest was varied to match the existing el 15 contour at most locations if this contour occurred within 150 feet of the project baseline rather than using the indicated 1V:3H landward slope, were applied to conditions indicated by the survey over the previously determined reaches and using the previously determined baseline and reaches. The width of the dune crest was varied as described to avoid creating a trough landward of the dune that would cause poor drainage resulting in ponding during dredging and after storms. The latest (as of Nov 2011) available survey was used for the estimates, which is a Light Detection and Ranging (LIDAR) survey made Apr 2010. The indicated depletion rates are based on Beach-*fx* model results. The indicated estimates are based in part on the midpoint of fill placement for initial nourishment occurring approximately Apr 2014. A construction start of Jan 2014 was assumed to estimate the midpoint date.

The fill volumes in Table A-2-2 are estimates of fill template volumes. Estimates of depletion and renourishments are based on depletion from Beach-*fx* model studies. The borrow volumes are effective volumes, excluding volumes of soil expected to remain within the borrow area limits after effective depletion. The borrow capacity needs to be larger than these values to take into account the possibility of fill placement above the beach fill template, survey inaccuracies, and some unsatisfactory material being encountered in the borrow areas. For this assessment, it was assumed that an effective borrow capacity of 125 percent of the required fill template volumes will be needed for borrow.

Table A-2-2. Estimates Of Required Beach Fill and Borrow

Description	NED Plan	LPP
Depletion rate (cy/yr, mean)	158,500	178,900
Depletion rate (cy/yr, mean + standard deviation)	245,800	280,100
Depletion period for initial nourishment (yr)	4.00	4.00
Renourishment period (yr)	10.00	10.00
No. of renourishments	4	4
Initial nourishment, surveyed component (cy)	2,639,000	3,152,000
Initial nourishment, est. depletion component (cy, mean)	634,000	716,000
Initial nourishment (cy, mean)	3,273,000	3,868,000
Renourishment (cy/10yr, mean)	1,585,000	1,789,000
Renourishment (cy/10yr, mean + st. dev. renourishment)	2,458,000	2,801,000
Fill, project life (cy, mean)	9,613,000	11,024,000
Fill, project life (cy, mean + st. dev renourishment)	13,105,000	15,072,000
Borrow / fill ratio	1.25	1.25
Borrow, project life (cy, mean)	12,016,000	13,780,000
Borrow, project life (cy, mean + st. dev renourishment)	16,381,000	18,840,000

4. GEOLOGY

The general geology of the Walton County beaches is somewhat unique due to the lack of a true barrier island immediately offshore. The shoreline is characterized by a coastal peninsula fronting Choctawhatchee Bay in the western two-thirds of the county and by Pleistocene bluffs that range in elevation from 10 to 45 feet in the eastern portion. The present day beach is of the Holocene age and consists of over 95 percent quartz and the wave action has broken down and polished the granules to the current consistency. Sediment at the ebb tide delta is typically medium sand, generally well sorted. Offshore on the linear shoal, quality material is almost exclusively moderately well sorted medium sand.

5. INVESTIGATIONS

Investigations and studies to identify native beach material properties and suitable offshore borrow areas for the project were performed by Taylor Engineering, Inc. (2003). The borrow source investigation included an area offshore of Walton County and the eastern part of Okaloosa County, as shown in Figure A-2-3 and on drawing F-100. The borrow investigations were conducted in two phases, each with different levels of detail. The reconnaissance phase covered a relatively large area with information obtained at large spacing. The detailed phase focused on smaller areas with samples collected at closer spacing. The investigated area for borrow comprises approximately 53.1 square miles, with this area based on limits extending to 1000 feet outside of the perimeter of boring locations.

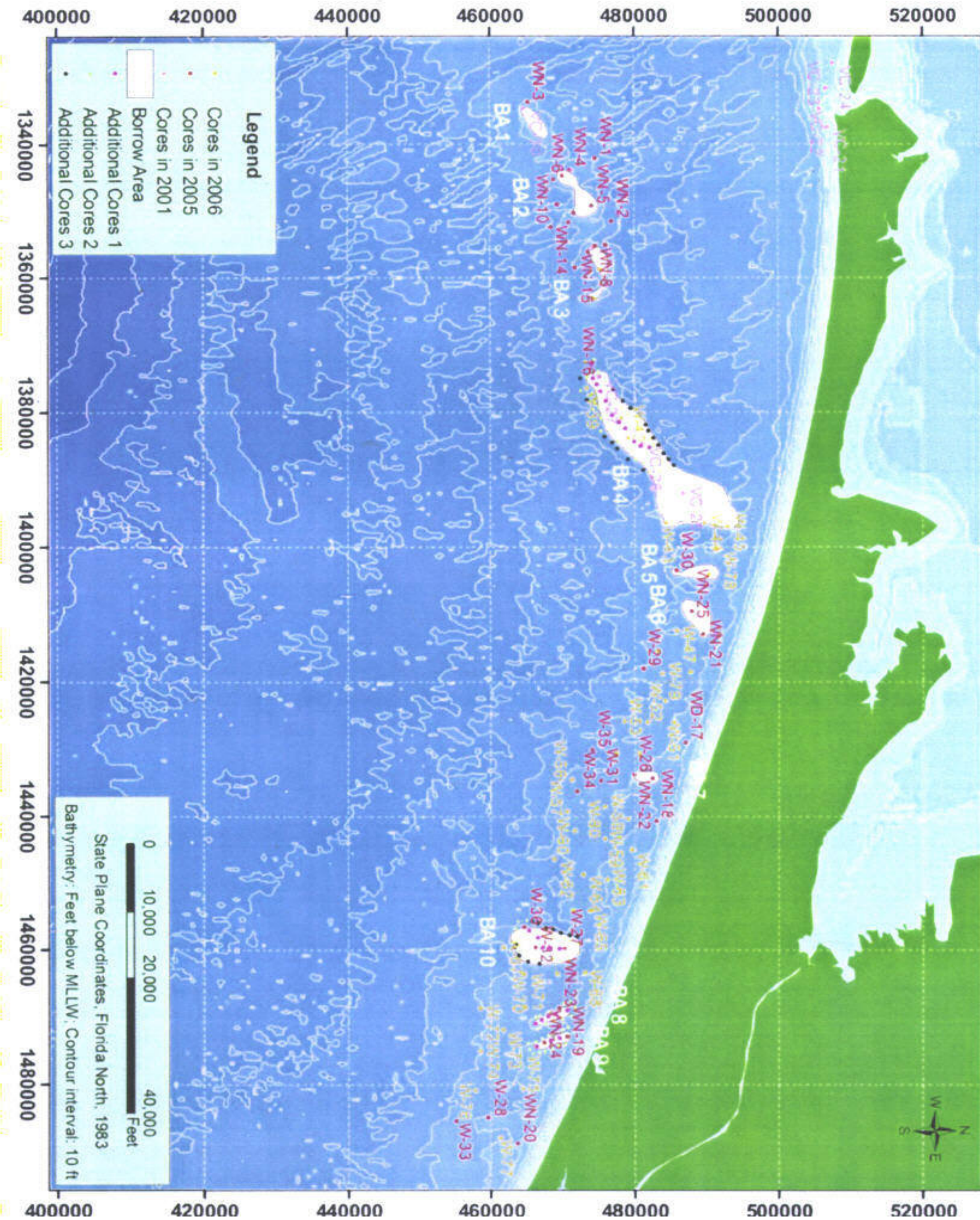

Figure A-2-3. Borrow Area Investigation Locations

The reconnaissance phase borrow investigation was conducted 2001 to 2006 and was a geophysical, lithological and granulometric investigation (See Appendix A). Sub-bottom profiles were used initially to locate prospective core locations to identify high quality sand sources for beach nourishment. An investigation was undertaken as described in detail herein. Vibracore borings and selected seismic records were interpreted in an attempt to confirm the presence and quality of sand off Walton County.

The reconnaissance phase borings were identified as borings WN-1 to WN-25 and W-26 to W-80. The locations of the cores are shown on Figure A-2-3 and on drawings F-100. Coordinates are listed in Table I and seismic lines are presented in Figure A-2-2 in the main Taylor Report (2003) in Appendix A. The reconnaissance phase borings were made in an irregular pattern with variable spacing. Based on the 80 borings within a 40.5 square mile area defined at the perimeter of the boring locations, average boring spacing for the reconnaissance phase borings was approximately equal to that of borings on a 3750 feet square grid.

Acoustic data was obtained during the reconnaissance phase from seismic lines run parallel and near perpendicular to the coast. These were interpreted and reflectors calibrated using lithological interpretation.

Vibracores and sub-bottom (seismic) profiles were obtained by Alpine. The cores were split longitudinally, prepared for analysis, photographed and lithologically logged. Sediment samples were extracted at the surface of each core and at approximately 1.5 foot. intervals. Sediment samples were washed and prepared for granulometric description. Where they occurred, carbonates (shell) were determined as a percentage of the sample (see section on carbonate determination). Dry sieving was accomplished at 0.25 phi intervals using an ultrasonic siever. The high resolution seismic reflection profiles were collected with an ORE (Geopulse boomer-type" profiling system). The seismic data are generally of high quality and they allowed predictions of sand thickness when calibrated to the vibracores.

Ten potential borrow areas, BA-1 to BA-10, were identified for detailed investigation after evaluation of the reconnaissance phase information. The limits of these 10 areas are shown on Figure A-2-3 and on drawing F-100.

Detailed phase offshore borrow investigations were conducted by Taylor Engineering Inc. (2003) within or near five of the potential borrow areas to supplement the reconnaissance phase information. The detailed phase investigations included 99 additional vibracore borings which were comprised of 51 WA- series borings at an area near BA-4; 2 WB- series borings at an area within BA-10; 2 WC- series borings at an area within BA-8; 2 WD- series borings at an area near BA-9; and 42 WE- series borings near BA-7. As may be deduced by the numbers of borings at the areas, the area near BA-4 and the area near BA-7 were investigated in much more detail than the other areas. From this point forward unless otherwise stated, BA-4 and BA-7 refer to the areas that were investigated in detail rather than the areas identified in reconnaissance phase with these names.

Most but not all procedures for obtaining and recording data from the detailed phase vibracore borings were very similar to those used during the reconnaissance phase. Notable exceptions were that drilling logs on USACE ENG Form 1836 were prepared. The cores were split longitudinally, prepared for analysis, photographed and lithologically logged. Sediment samples were extracted at the surface of each core and at approximately 1.5 foot intervals. Sediment samples were washed and prepared for granulometric description. Dry sieving was accomplished at 0.25 phi intervals using an ultrasonic siever.

6. NATIVE BEACH MATERIALS

Taylor Engineering in 2003 collected total of 314 samples from the dune vegetation, dune toe, mid-berm, mean high water (MHW), and mean low water (MLW) at approximately one-mile intervals throughout Walton County. Ellis & Associates, Inc. tested the native beach material samples in the laboratory to determine the carbonate content and grain size distribution for each sample. The grain size distribution tests originally conducted on the native beach sand samples were made using 0.5 phi intervals. Ellis & Associates retested the samples using 0.25 phi intervals. The summaries in this study are obtained from the Ellis & Associates grain size test data.

Ellis & Associates conducted acid digestion tests on the native beach sand samples to determine carbonate percentage. The results indicate that the native beach sand contains predominantly quartzitic sand with minimal carbonates. The maximum percentage of calcium carbonate is 1.24% (MLW at R-115), the minimum is 0%, and the average is 0.23%.

The native beach material consists of well- to moderately well-sorted medium sand (grain size between 1 and 2 phi). The largest and smallest mean grain sizes both occur at R-115: MLW has mean grain size 1.045 phi (0.485mm), and the dune vegetation has mean grain size 2.091 phi (0.235 mm). The largest sorting - 0.737 phi (0.24 mm) - occurred at MLW at R-125, and the smallest - 0.284 phi (0.05 mm) - occurred at the mid-berm at R-85. The subaerial beach has a smaller mean grain size and better sorting than the intertidal zone. Based on all the data, the subaerial beach in Walton County has a mean grain size of 0.28 mm and the intertidal zone has a mean grain size of 0.34 mm. Overall the native beach sand of Walton County has a mean grain size of 0.30 mm (1.72 phi) and a sorting of 0.48 phi.

The fines content of the native beach material, defined as the percentage by weight that passes through US Standard Sieve size 230, ranges from 0.0% to 0.3%.

Taylor Engineering (2003) identified the color of 313 of 314 native beach samples in moist condition to be Munsell color 5Y 8/1 (white). The one exception, R-115 from the dune vegetation, had Munsell color 2.5Y 7/2, or light gray. These samples are representative of the majority of beach and dune sand, but are not representative of some darker bluff sands or peat and clay deposits exposed by hurricanes.

7. PROPOSED BORROW AREAS

Requirements for beach nourishment fill material in the state of Florida are given in Chapter 62B-41 “Rules and Procedures for Coastal Construction Permits” of the Florida Administrative Code. The most relevant requirements are stated verbatim in the following paragraph from paragraph 62B-41.007.

To protect the environmental functions of Florida’s beaches, only beach compatible fill shall be placed on the beach or in any associated dune system. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system. Such material shall be predominately of carbonate, quartz or similar material with a particle size distribution ranging between 0.062mm (4.0φ) and 4.76mm (-2.25φ) (classified as sand by either the Unified Soils or the Wentworth classification), shall be similar in color and grain size distribution (sand grain frequency, mean and median grain size and sorting coefficient) to the material in the existing coastal system at the disposal site and shall not contain:

1. Greater than 5 percent, by weight, silt, clay or colloids passing the #230 sieve (4.0φ);
2. Greater than 5 percent, by weight, fine gravel retained on the #4 sieve (-2.25φ);
3. Coarse gravel, cobbles or material retained on the 3/4 inch sieve in a percentage or size greater than found on the native beach;
4. Construction debris, toxic material or other foreign matter; and
5. Not result in cementation of the beach.

Other criteria for satisfactory material for beach material for this project were developed and provided in the “Revised Sand Quality Control and Quality Assurance Plan” dated Oct 2008 by Taylor Engineering. Paraphrasing, this document stated that acceptable limits for the material will be 0 to 2.5% for silt content, 0 to 5.0% for shell content, 0.24 to 0.49 mm for mean grain size, 5Y 7/2 or lighter for Munsell color of moist material; where silt content is defined as the portion of material by weight passing the #230 sieve and shell content is synonymous with carbonate content.

Based on interpretation of similar requirements in Quality Assurance/Quality Control plans at other projects, it is assumed that some deviation from the above criteria is acceptable, but only if the spatial extent of the deviations does not exceed 10,000 continuous square feet at the beach fill placement site. Furthermore these criteria refer to the characteristics of the soil as it will exist when placed on the beach, which may differ from characteristics observed in samples from the borrow areas. Some lightening of the soil, often of one-half to one Munsell value unit, typically occurs due to washing of the soil during dredging. Further lightening typically occurs after drying, exposure to sun, and weathering. Where grain size varies spatially within the zone of dredging, typically there is some mixing of grain sizes during the dredging and fill placement processes.

Taylor Engineering evaluated the investigation data and developed a plan for a 1.58 square mile borrow area encompassing approximately the southwestern two-thirds of the area near BA-4 that was investigated in detail to be used for an initial nourishment. This planned borrow area was comprised of 3 contiguous areas with bottom elevations of -79.0, -78.3, and -76.3 feet NAVD88. Taylor Engineering estimated the limit volume of the planned borrow area to be 9,023,000 cy. Assuming that 1 foot will remain on average after depletion of the area, the effective capacity of the borrow area is estimated to be 7,388,000 cy.

An evaluation to further assess the suitability and quantity of available borrow material relative to the capacity needed for the full project life was conducted by USACE, Mobile

District Jan-Feb 2012. This evaluation was based on boring and sample data provided by Taylor Engineering. Except where comparison is made to the Taylor Engineering. evaluation and borrow area plan, the remainder of this paragraph (Proposed Borrow Areas) describes the USACE, Mobile District evaluation. For this evaluation, the thickness of satisfactory material extending downward from ground surface and its bottom elevation was estimated at each boring. For the purpose of this estimate, samples or intervals of vibracore were considered to be satisfactory material if it was predominately sand with the following properties, as observed in borrow area vibracore samples or vibracore photographs:

(1) mean grain size between 0.24 and 0.48 mm inclusive;
(2) moist Munsell color value of 6 or more, provided that soil with Munsell color value 6 is present only in small quantity; and
(3) fines content greater than or equal to 2.5%, with fines content defined as the percent passing the #230 sieve.

Isolated samples of unsatisfactory material not meeting the above criteria were included in the estimated thickness of satisfactory material, but only if each such sample or interval were immediately underlain by at least two samples or at least three feet of vibracore possessing all of the above properties. This requirement was used in the evaluation to avoid excluding sometimes large thicknesses of satisfactory material that underlies one unsatisfactory sample near the surface.

It was considered in developing these borrow area selection criteria that the relatively small quantity of unsatisfactory material represented by the isolated samples of unsatisfactory material will be sufficiently blended with satisfactory material in the processes of dredging and fill placement that the resulting partially blended soil will be satisfactory. No blending other than that obtained by usual dredging and fill placement procedures is proposed. In choosing Munsell color value of 6 for the criteria it was considered, based on testing and past experience with similar soil, that moist sand with Munsell color value 6 will typically lighten by either 1 or 2 Munsell color values unit after washing during dredging and by waves and rainfall, drying and bleaching from exposure sun, and other weathering; and thus will become similar to the native beach material if it comprises only a small fraction of the borrow material.

The bottom depths of satisfactory moist Munsell color at 189 borings from the reconnaissance and detailed phase investigations were estimated from vibracore photographs. Sieve analyses results were available for at least upper parts of 179 of these borings but were unavailable at 10 borings (W-47, WB-5, WC-2, WC-5, WD-2, WD-5, WE-44, WE-45, WE-46, and WE-47). The depth of tested samples in the 179 vibracore borings that were tested varied from zero to 19.5 feet and averaged 10.4 feet. Sieve testing of samples was likely typically terminated at depths where it became visually apparent that the material was unsatisfactory. Therefore the deeper untested materials were assumed to be unsatisfactory and were likely at least predominately so. The thickness and bottom elevation at the 10 borings without sieve analyses were estimated exclusively from moist color of soil, so estimates of thickness and bottom elevation of surficial satisfactory materials at those locations are not completely reliable with regard to grain size suitability. The thickness and bottom elevation of the surficial satisfactory material generally varies greatly. The thickness of the surficial satisfactory material encountered at boring locations in the overall investigated area varies from zero to 18.0 feet, averages 6.1 feet with standard deviation of 4.8 feet, and varies as shown in Figure A-2-4, Figure A-2-5, and Figure A-2-6. The bottom of the surficial satisfactory material as encountered in the borings varies from elevation -85.0 to -53.9 feet, averages elevation -71.6 feet with standard deviation of 8.1 feet, and varies spatially as shown Figure A-2-7, Figure A-2-8, and Figure A-2-9. The total volume of satisfactory material meeting the above-given criteria, including the volume represented by a few isolated unsatisfactory samples, is estimated based on Theissen polygon method of analysis to be on order of 135,000,000 cy. However this estimate is based on reconnaissance level of investigation over most of the area and includes much material unusable for borrow because of intermingling with unsatisfactory material. Volumes of satisfactory material indicated by reconnaissance level of detail are frequently greatly reduced when investigated in detail.

The preceding and other following estimates of borrow volumes where described as being made by the “Theissen polygon” method were made by computing the volume represented by each boring as the area of its associated Theissen polygon multiplied by the thickness of material at that boring. A Theissen polygon is associated with each considered boring location in this case and is the region which is closer to that boring than to any other point in a set of borings being considered. The 53.1 square mile overall investigated area and the Theissen polygons along the perimeter of this area include a 1000-foot horizontal offset from the perimeter of the borings. Similar analyses made for the areas with detailed investigations instead included a 500-foot horizontal offset from the perimeter of the more closely spaced borings. A horizontal offset not exceeding half of the average boring spacing was considered to be appropriate in each case. Hydrographic surveys were not used in the estimates unless otherwise stated; e.g. the average ground surface elevation over the Thiessen polygon area was typically assumed to be the same as the ground surface elevation measured at the boring location.

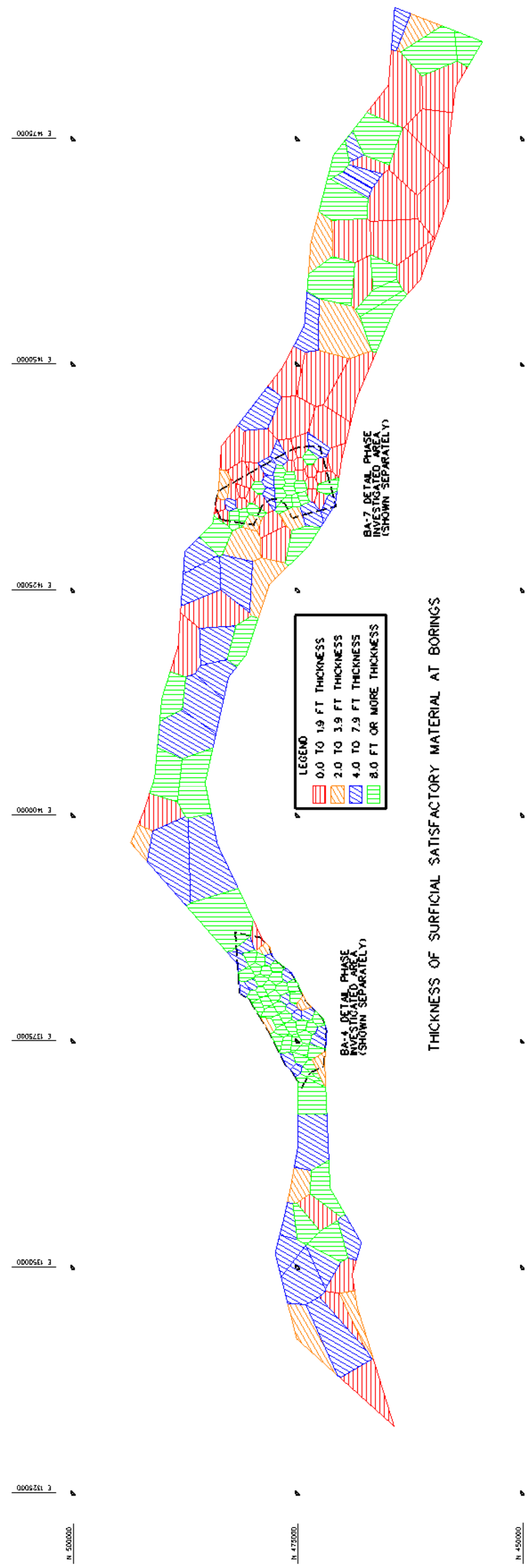

Figure A-2-4. Thickness of Surficial Satisfactory Material at Investigation Area

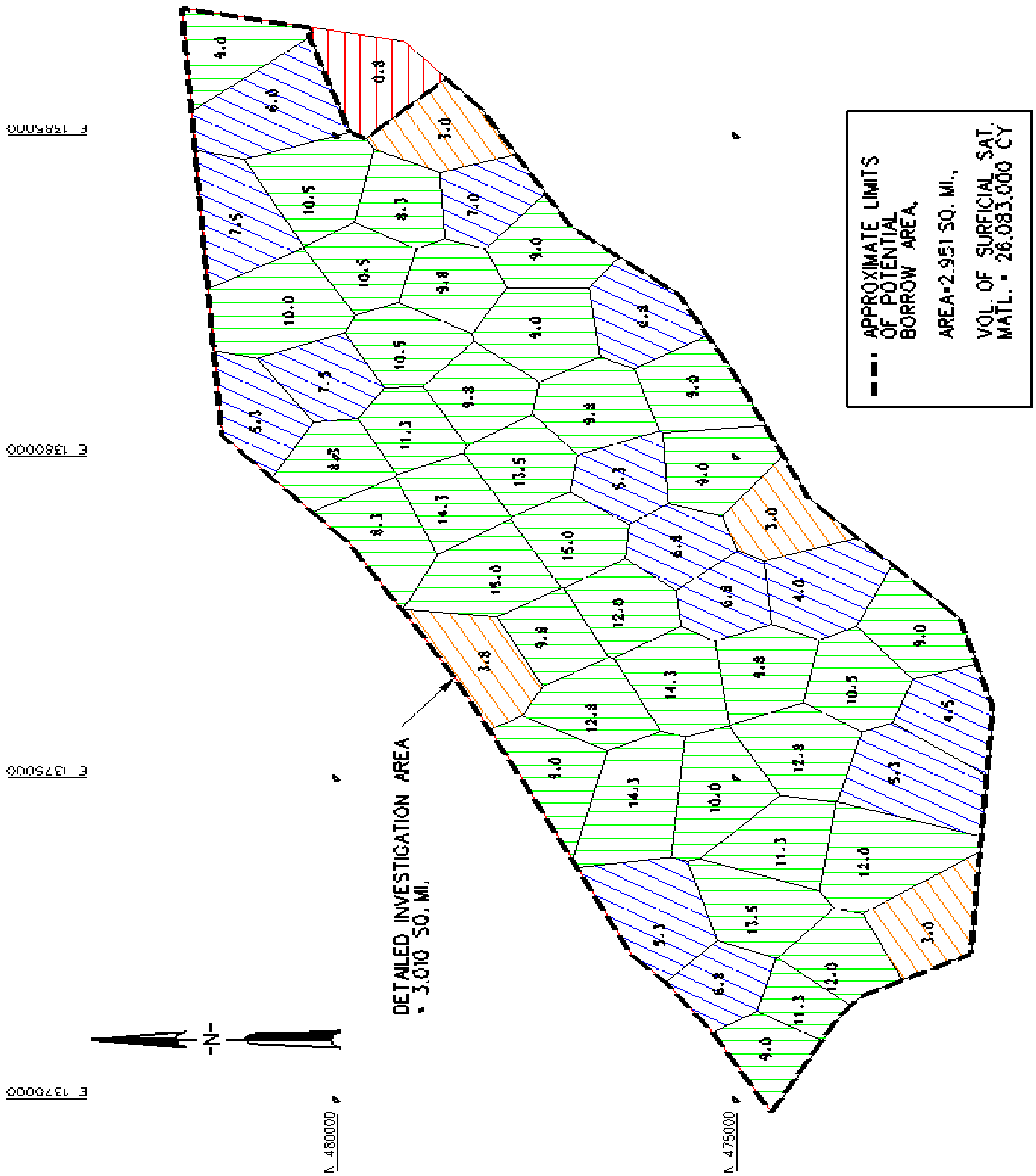

Figure A-2-5. Thickness of Surficial Satisfactory Material at BA-4

Figure A-2-5 notes: See Figure A-2-4 for legend. Spot thicknesses of surficial satisfactory material and Theissen polygons associated with boring locations are shown.

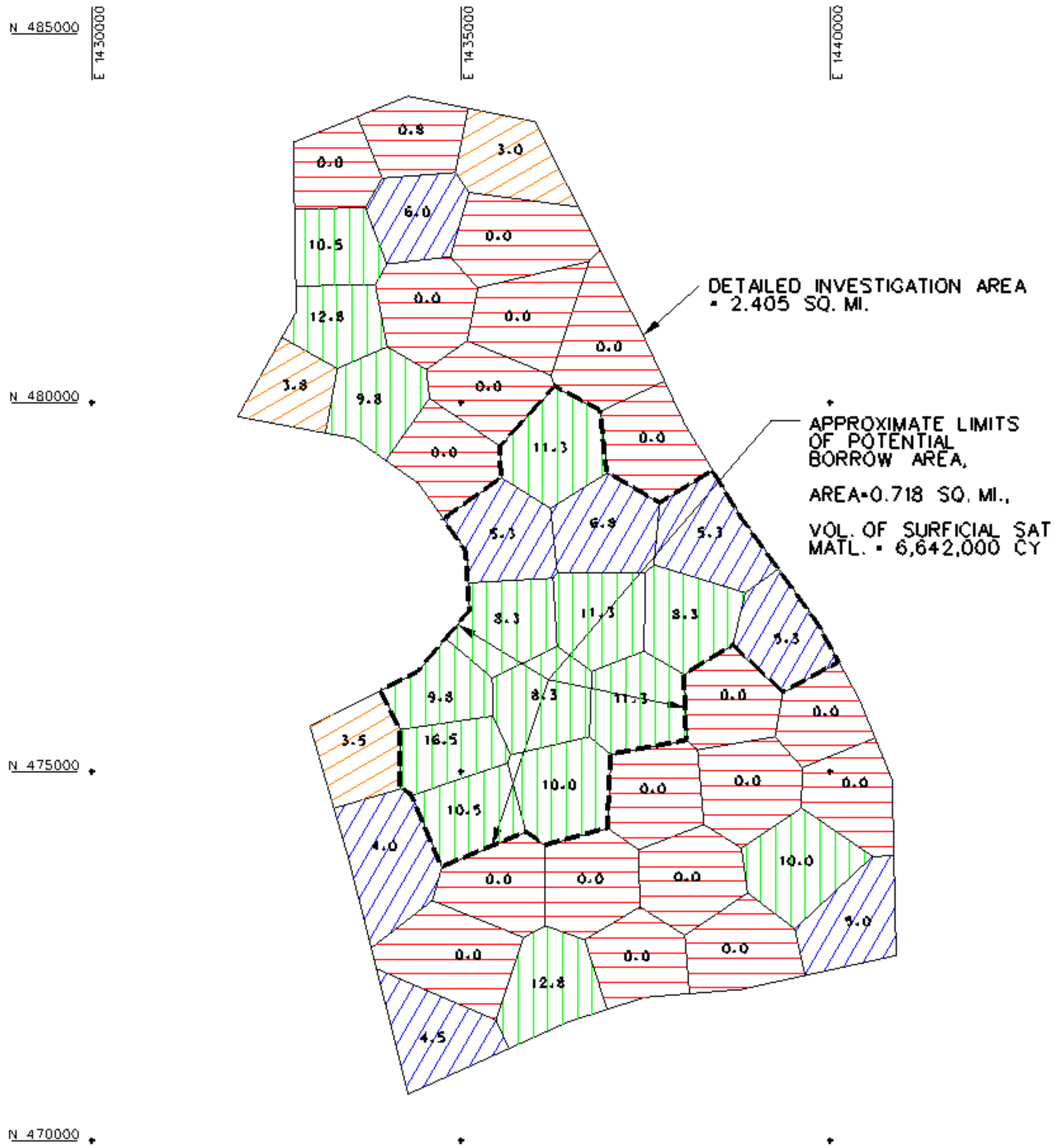

Figure A-2-6. Thickness of Surficial Satisfactory Material at BA-7

Figure A-2-6 notes: See Figure A-2-4 for legend. Spot thicknesses of surficial satisfactory material and Theissen polygons associated with boring locations are shown.

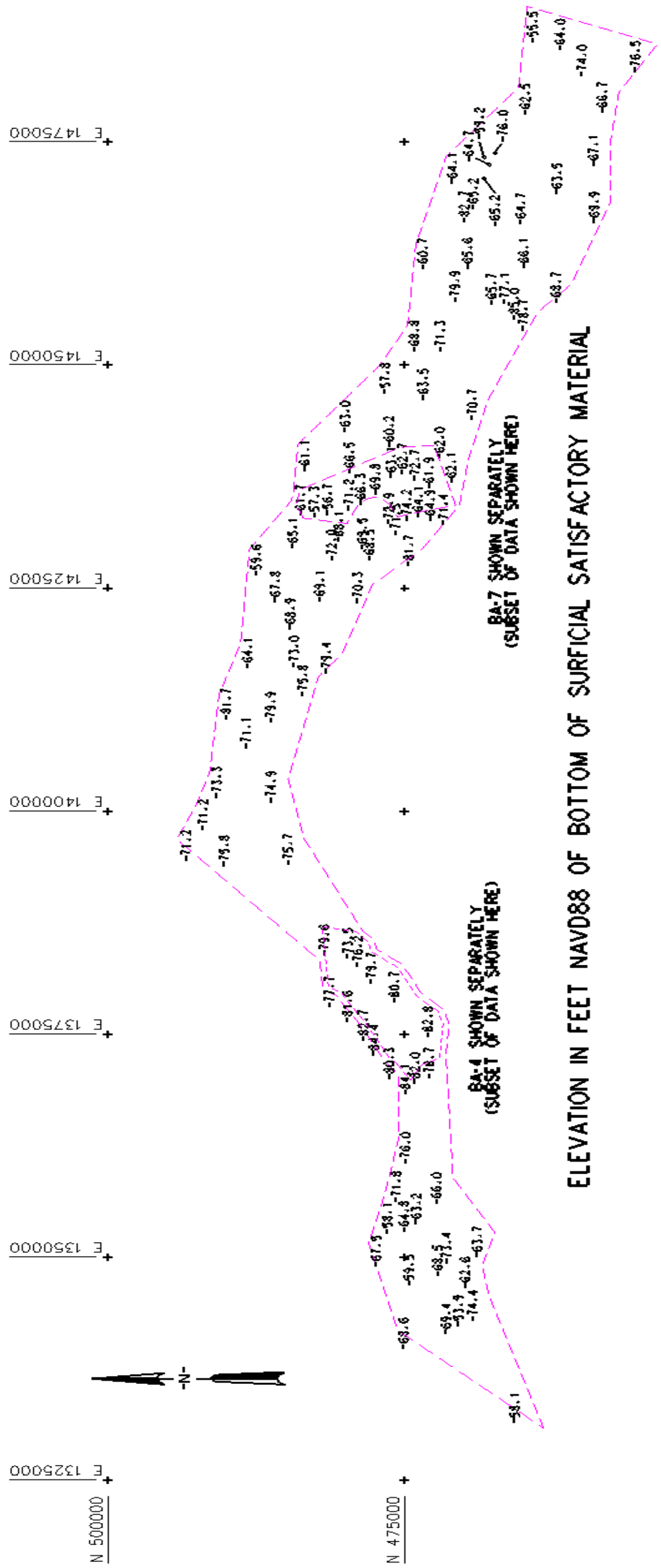

Figure A-2-7. Bottom Elevation of Satisfactory Surficial Material at Investigation Area

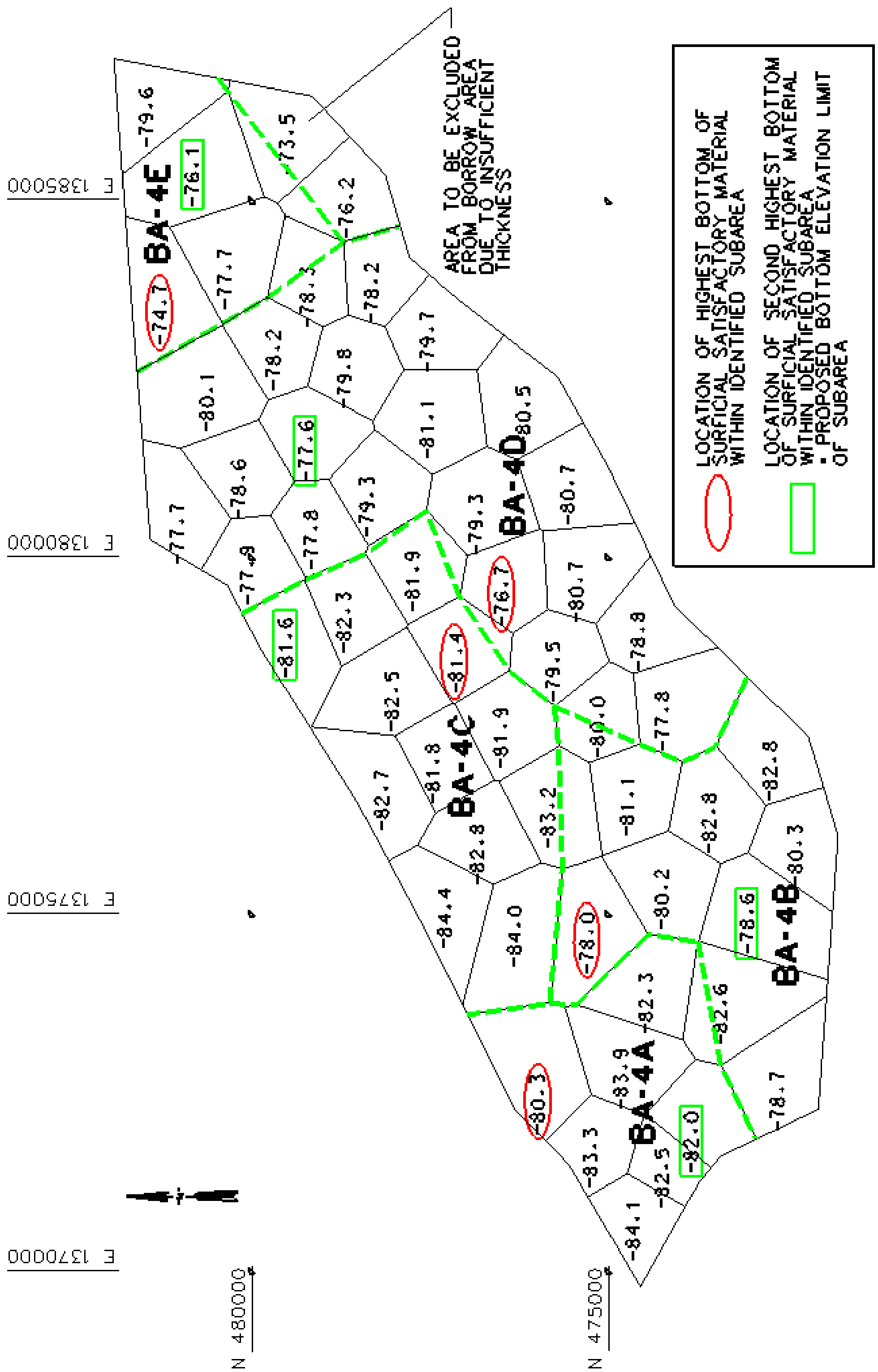

Figure A-2-8. Bottom Elevation of Satisfactory Surficial Material at BA-4

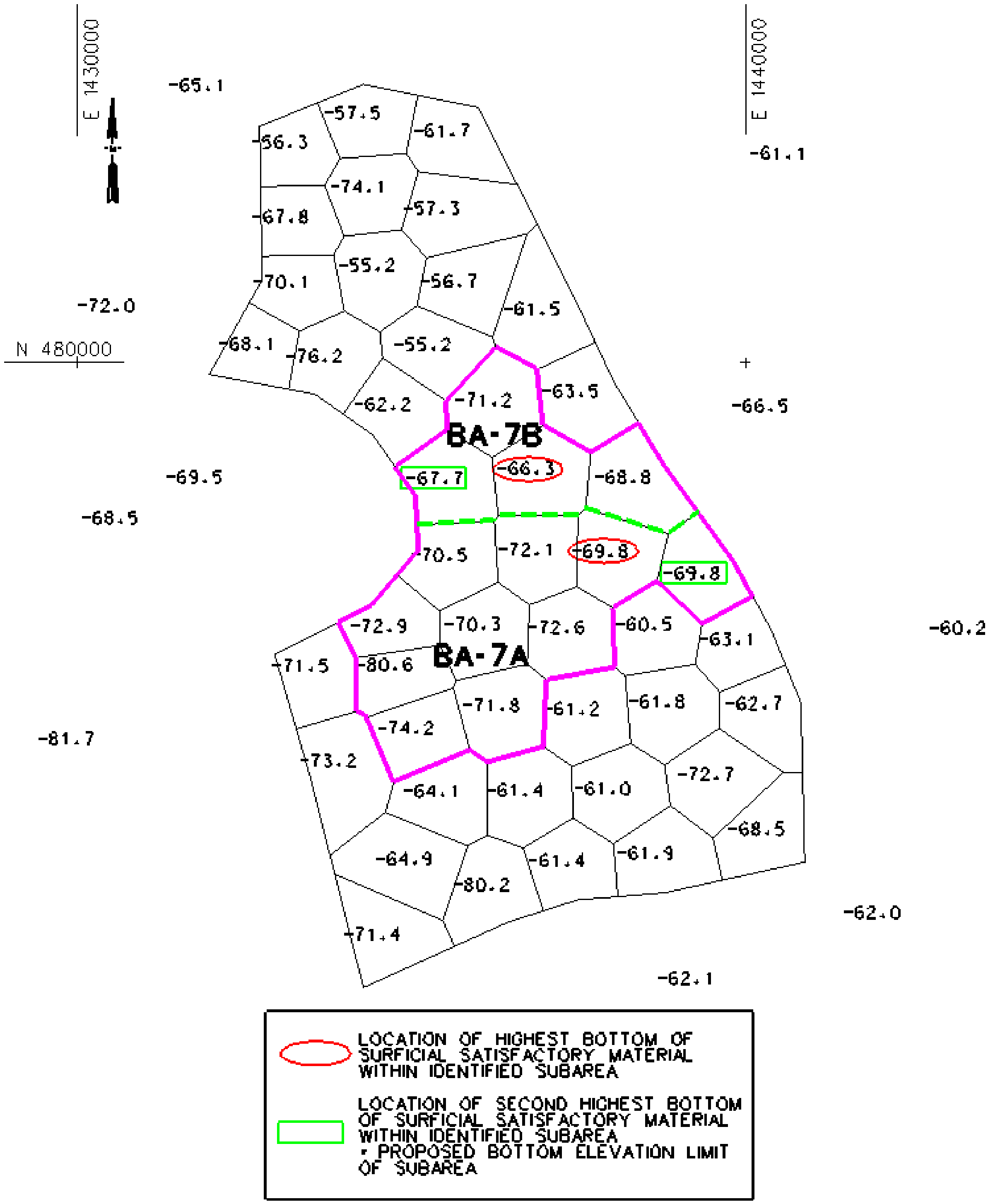

Figure A-2-9. Bottom Elevation of Satisfactory Surficial Material at BA-7

In additional to establishing criteria for and determining the existence of a quantity of satisfactory material larger than the fill requirement, consideration several other factors is necessary for selection and design of a borrow area and determination of its capacity. These factors include:

(1) A sufficient volume of contiguously located satisfactory material is required within the borrow area limits. A minimum limit volume of approximately 3,000,000 cy is desirable at a borrow area, so as to keep the number of mobilizations to different borrow areas and associated costs reasonably small. The volume within the selected borrow area limits should include only material that has been investigated in sufficient detail to be reliably known to be predominately satisfactory material.

(2) An average thickness of at least four feet of material within the borrow area limit volume is desirable for dredging efficiency.

(3) The borrow area should have a constant bottom elevation, or at most just a few different bottom elevations, for dredging efficiency.

(4) Borrow areas close to the beach fill placement are better than borrow areas far away so as to minimize hauling cost if other considerations are equal.

Much of the satisfactory material for beach nourishment fill occurs in zones that are too small or is intermingled with unsatisfactory material to a degree that it is unsuitable for borrow. The areas investigated at only reconnaissance level are insufficiently investigated to rely on for design of borrow areas, but may be used to identify potential borrow areas for detailed investigations of other areas.

Approximate horizontal limits of two potential borrow areas, corresponding approximately with contiguous Theissen polygons at boring locations with at least three to four feet of surficial satisfactory material within the areas investigated in detail, are shown on the preceding Figure A-2-5 and Figure A-2-6. Estimated volumes of the surficial satisfactory material within these approximate limits are 26,083,000 cy at the 2.951 square mile area near BA-4 shown on Figure A-2-5 and 6,642,000 cy at the 0.718 square mile area near BA-7 shown on Figure A-2-6. These volumes include satisfactory material that cannot be effectively used in borrow areas because of geometric criteria and intermingling with unsatisfactory material. Both of these areas possibly could be enlarged if further detailed investigation is conducted, as sufficient thickness of satisfactory material was found at several borings along the perimeter of both of these areas.

The part of the BA-4 investigation area that was considered suitable for borrow was subdivided into five contiguous areas identified as BA-4A to BA-4E. A small area on the east end of BA-4 had insufficient thickness of satisfactory material to be included. Proposed limits of the BA-4 borrow area are shown in Figure A-2-8. The limits were based primarily on generally similar bottom of satisfactory material elevations within each area. Limiting bottom elevations of -82.0, -78.6, -81.6, -77.6, and -76.1 feet NAVD88 were chosen for BA-4A, BA-4B, BA-4C, BA-4D, and BA-4E respectively. The bottom elevations of each area were chosen to coincide with the second highest elevation bottom of surficial satisfactory material of the borings within that area. This will typically include one sample indicating unsatisfactory material near the bottom limit at one boring in each subarea, but is expected to be adequate to obtain predominately satisfactory material at each subarea. The chosen horizontal limit points generally are points on Theissen polygons, but some of the polygon points were omitted as to reduce the number of sharp bends at the borrow area limits. The estimated limit volume of BA-4 is 18,643,000 cy based on computation with Inroads considering an April 2007 hydrographic survey and 1V:5H excavation slopes located just inside the shown borrow area limits. The area within the top of excavation slope lines is 80,686,000 square feet and the average thickness of material above the bottom limits is 6.238 feet. Assuming an average thickness of one-foot will remain in the area after its effective depletion, the effective capacity of the borrow area is estimated to be approximately 15,654,000 cy. The soil within the proposed BA-4 limits is typically moderately well sorted medium sand. The composite mean grain size is approximately 0.311 mm or 1.69 phi. The composite fines content is approximately 0.21 percent. Five of the 325 samples within the borrow area limits when considered individually were indicated to be unsatisfactory by the QA/QC grain-size criteria but were considered to be isolated samples. One of these had larger mean grain size than 0.48 mm and four had mean grain size smaller than 0.24 mm. All but one sample within the borrow area limits had less than 2.5 fines content, the lone exception being 3.2%.

The proposed horizontal and vertical limits of BA-7 were selected similarly to those of BA-7. An area with sufficient thickness of surficial satisfactory material was identified and defined using Thiessen polygons at boring locations, two subareas, identified as BA-7A and BA-7B, with somewhat similar elevations of bottom of surficial satisfactory material were selected. Limiting bottom elevations of -69.8 and -67.7 feet NAVD88 were chosen for BA-7A and BA-7B respectively. The bottom elevations of each area were chosen to coincide with the second highest elevation bottom of surficial satisfactory material of the borings within that area. A hydrographic survey of the area was unavailable. A limit volume of 5,260,000 cy was estimated using the Thiessen polygon method from the boring elevations. The area within the shown limits is 20,105,000 square feet and the average thickness of material above the bottom limits is 7.064 feet. Assuming an average thickness of one-foot will remain in the area after its effective depletion, the effective capacity of the borrow area is estimated to be approximately 4,515,000 cy. The soil within the proposed BA-7 limits is predominately moderately well sorted medium sand. The composite mean grain size is 0.361 mm or 1.47 phi. The composite fines content is 0.13 percent. Eight of the 80 samples within the borrow area limits when considered individually were indicated to be unsatisfactory by the QA/QC grain-size criteria but were considered to be isolated samples. Five of these had larger mean grain size than 0.48 mm and three had mean grain size smaller than 0.24 mm. All samples within the BA-7 limits had less than 2.5 fines content.

The B-4 borrow area is the largest and best source of borrow. All materials used for beach nourishment will be excavated by hopper dredge, transported to the placement area offshore and pumped into the beach template. Small bulldozers will be used on land to shape the material to the prescribed template. Estimates indicate that most likely BA-4 will have sufficient borrow capacity for the project life, but that there is a significant possibility that it will not. In the event that BA-4 is depleted, use of an area at BA-7 with limits approximately as shown on Figures A-2-6 is proposed. Considering approximate estimated effective capacities of 15,654,000 cy for BA-4 and 4,515,000 cy for BA-7, the combined effective capacity of these two area is estimated to be approximately 20,199,000 cy. Monitoring of the borrow discharges will be a constant requirement for compliance with color and grain size criteria. Borrow area approval permits are only valid for 10 years and additional testing and analysis at that time will be necessary.

8. CONDITIONS AT OTHER INVESTIGATED AREAS

The initial data indicated pockets of viable sand bodies along the study site. The west flank of the study area in Okaloosa County has high quality sand associated with the eastern part of the Destin East Pass ebb-tide delta. Alternate sites that deserved additional reconnaissance were located offshore in approximately 65 to 70 feet of water. This sand body is associated with the Holocene transgression and an abandoned barrier island that migrated across the mid-inner shelf to its present location. A cursory evaluation indicated that it varies in elevation above the sea bed from 13 feet to 26 feet due south of Destin. The remainder of the material is generally poor in quality to the Walton County line and is characterized by highly chaotic reflectors in the seismic data, when calibrated with the cores. This analysis indicated the presence of organic-rich sediments and shell. While high quality sand does exist off Walton County, it is intermittent and restricted to pockets. A poor quality, organic-rich suite of sandy silt and clay material occurs intermittently in the shallow sub-bottom along numerous locations. The high quality material, however, does occur over large enough areas to warrant further and more detailed investigation in this area.

Vibracores were taken through sediments on the inner shelf and nearshore Walton County. Figure 2, Attachment II, shows the location of these cores and core photos, interpretive logs and grain size distribution are provided in the Attachment II. Inspection of the core photos, interpretive logs, and grain size data suggest that the geology of the shore is complex. Several cores penetrated through what we interpret as old, lagoonal sediments containing organic material, silts and clay. The recent impacts of numerous storms/hurricanes have significantly impacted the shelf off Walton County and exposed considerably more of these sediments than were ordinarily expected. Correlation of these vibracores to subsurface stratigraphic architecture is difficult because the first multiple obscures much of the seismic records representative of coring sites. As an example, the profile of the ebb-tide delta in the area is clearly evident and parts of the record seaward of delta-front suggest that an irregular reflection marked in Figure 3 of the Attachment II is probably representative of the shelf over which the delta appears to be prograding. Many vibracores from this area confirm a thick sequence of high quality sand that appears to be compatible in color arid size with requirements for local beach nourishment projects.

Several cores are located at the northeastern end of the inner shelf ridge that trends northeast-southwest across the inner shelf (Figure A-2-2). The northeast end of this ridge is characterized by less relief and more complex morphology than other parts of this feature where vibracores were acquired. The core photographs and interpretive logs of several cores indicated that quartz-rich sand overlies finer grained and organic rich deposits interpreted as being below the shell ravinement created by the rise of sea level during the Holocene (Figure A-2-4). The sandy tops of some of these vibracores are shell-rich, discolored, and probably not viable candidates for a beach nourishment project.

At the site of Vibracore 27 (seismic Line 105), Figure 5, Attachment II, the ridge varies in thickness from 5-8 m (16-26 feet) Although the seismic data show an irregular profile to the ridge, the vibracoring site is comparatively uniform in thickness and the ridge sediments rest on a well-defined and relatively flat surface. This surface is interpreted as the ravinement formed as sea level rose across the shelf following the latest Pleistocene glacial maximum. The vibracore photograph and interpretive log illustrates that about 5 m (16 feet) of high quality sand is present at this location. Vibracoring results correlate well with the seismic data acquired near the coring site. Vibracores 28 and 29 are associated with a broad buildup in the northeast-southwest trending submarine ridge (Figure 6 appendix A). The base of the buildup, as interpreted from high-resolution seismic data, is 6-7 m (20-23 feet) below the seafloor. Both Vibracores 28 and 29 display high quality quartz sand approximately 5 meters (16 feet) thick. Although the seismic line shown in Figure 6 is probably a good representation of the bottom conditions at the Vibracore 29 site. Vibracore 28 is located at a considerable distance from seismic Line 97 and therefore the correlation of sand thickness to ridge morphology is a tenuous one. However, both coring sites support sufficient sand to be considered as a viable borrow site. Seismic line 93 (Figure 7 Attachment II) shows that Vibracore 30 was acquired on the edge of a continuous part of the submarine ridge under investigation. Seismic data suggest that the sediments comprising this ridge are approximately 5 meters (16 feet) thick. The photograph and interpretive log indicate high quality white quartz sand that is over 4 meters (13 feet) thick at a site slightly to the southwest of seismic Line 93. Organically stained, highly burrowed, and shell-rich sediments are observed stratigraphically below the sands that could he considered for beach restoration purposes.

ATTACHMENT I

CONSTRUCTION DRAWINGS

(Note: Digital version of these drawings is included on CD attached at end of report)

MARCH 2012

US Army Corps
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Mobile District

CONSTRUCTION PLANS FOR

SOLICITATION NO.
–

WALTON COUNTY BEACHES RESTORATION

WALTON COUNTY, FLORIDA

WALTON COUNTY
FLORIDA

THIS FOLIO HAS BEEN REDUCED
TO ONE HALF THE ORIGINAL SCALE

SHEET REF.	TITLE OF DRAWINGS
X-001	INDEX OF DRAWINGS
F-100	OVERALL SITE PLAN
F-101	SITE PLAN
F-102	SITE PLAN
F-103	SITE PLAN
F-104	SITE PLAN
F-105	SITE PLAN
F-106	SITE PLAN
F-107	SITE PLAN
F-108	SITE PLAN
F-109	SITE PLAN
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F-111	SITE PLAN
F-112	SITE PLAN
F-113	SITE PLAN
F-114	SITE PLAN
F-115	SITE PLAN
F-116	SITE PLAN
F-117	PROPOSED BORROW AREA BA-4
F-118	PROPOSED BORROW AREA BA-7
F-300	CROSS SECTIONS
F-301	CROSS SECTIONS
F-302	CROSS SECTIONS
F-303	CROSS SECTIONS
F-304	CROSS SECTIONS
F-305	CROSS SECTIONS
F-306	CROSS SECTIONS
F-307	CROSS SECTIONS
F-308	CROSS SECTIONS
F-309	CROSS SECTIONS
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F-324	CROSS SECTIONS
F-325	CROSS SECTIONS
F-326	CROSS SECTIONS
F-327	CROSS SECTIONS

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Date: MARCH 2012
File No.: X
I.S.O. Sheet File Name: X001.DGN

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

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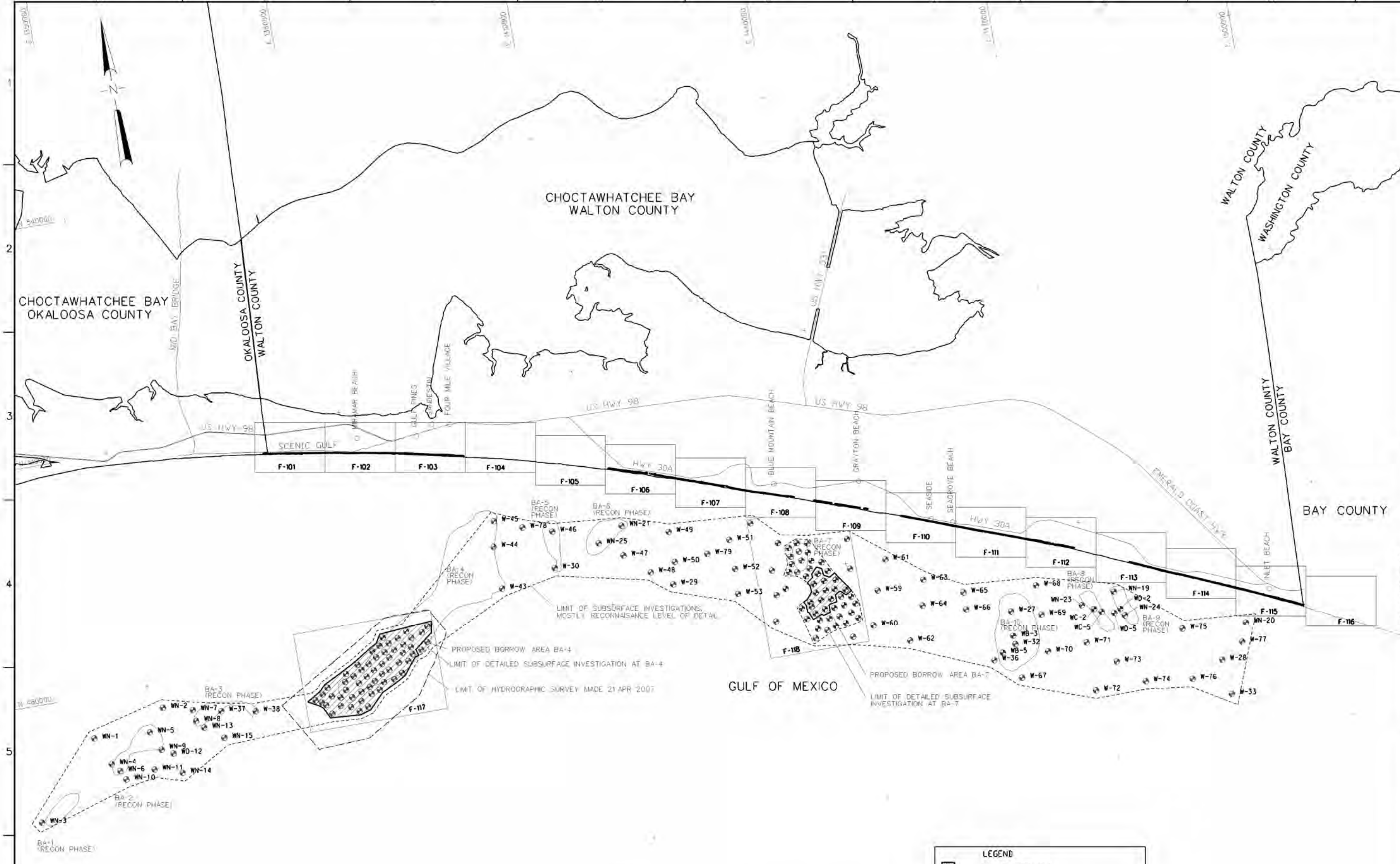
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA

INDEX OF DRAWINGS

Sheet Reference Number: X-001



NOTES:

1. COORDINATE GRID IS BASED ON SPCS NAD83, FLORIDA NORTH ZONE IN U.S. SURVEY FEET.

2. BA-1 TO BA-10 (RECON PHASE) WERE POTENTIAL AREAS THAT WERE IDENTIFIED FOR FURTHER INVESTIGATION DURING RECONNASAINCE PHASE INVESTIGATIONS, BUT ARE NOT PRESENTLY PROPOSED BORROW AREAS. THE PRESENTLY PROPOSED BORROW AREAS ARE IDENTIFIED AS BA-4 AND BA-7 BUT HAVE DIFFERING LIMITS THAN THE RECON AREAS OF THESE NAMES.

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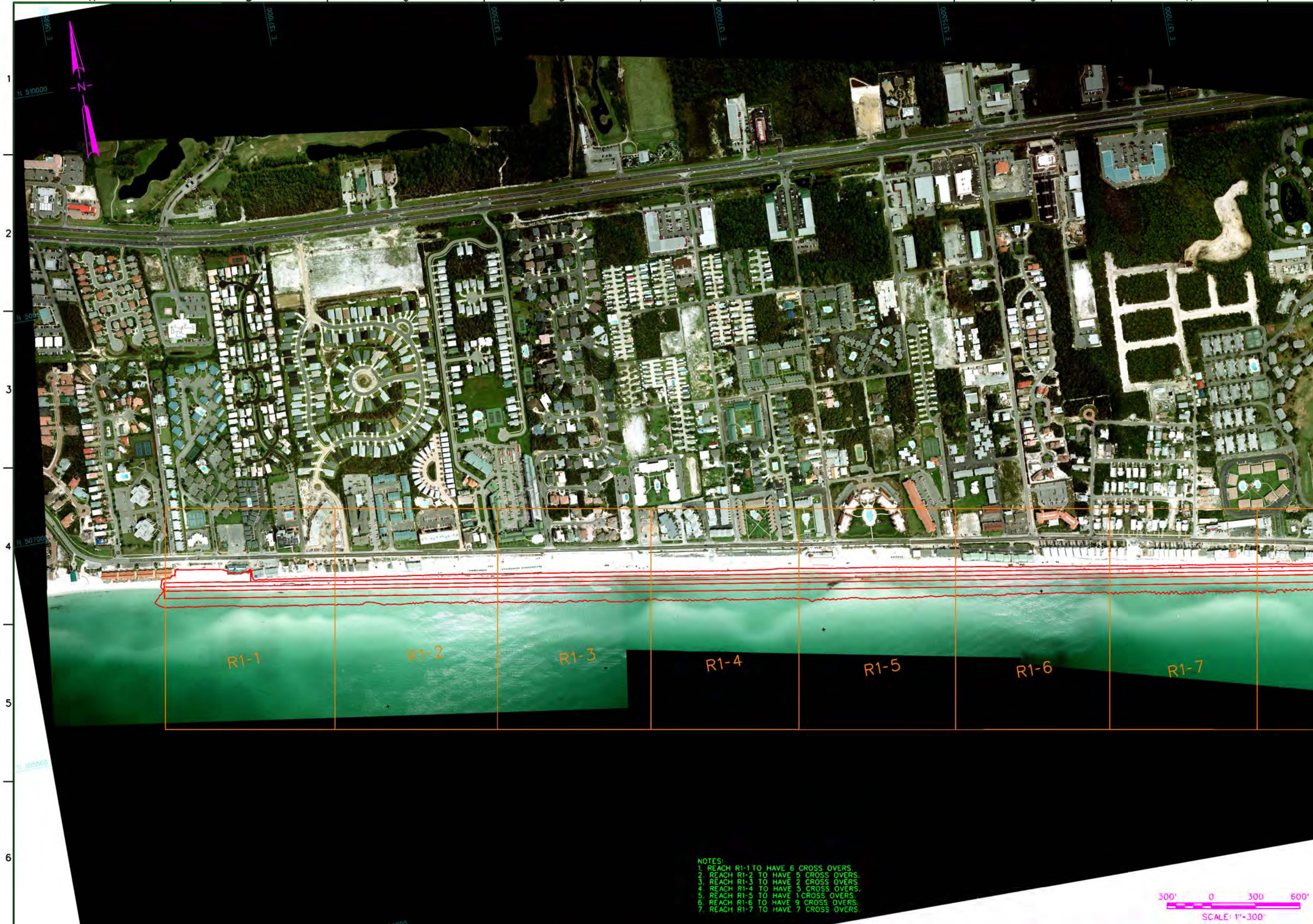
WALTON COUNTY, FLORIDA

OVERALL SITE PLAN

Sheet Reference Number:
F-100



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5. REACH R1-5 TO HAVE 1 CROSS OVERS.
6. REACH R1-6 TO HAVE 9 CROSS OVERS.
7. REACH R1-7 TO HAVE 7 CROSS OVERS.

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WALTON COUNTY, FLORIDA

SITE PLAN

Sheet Reference Number:
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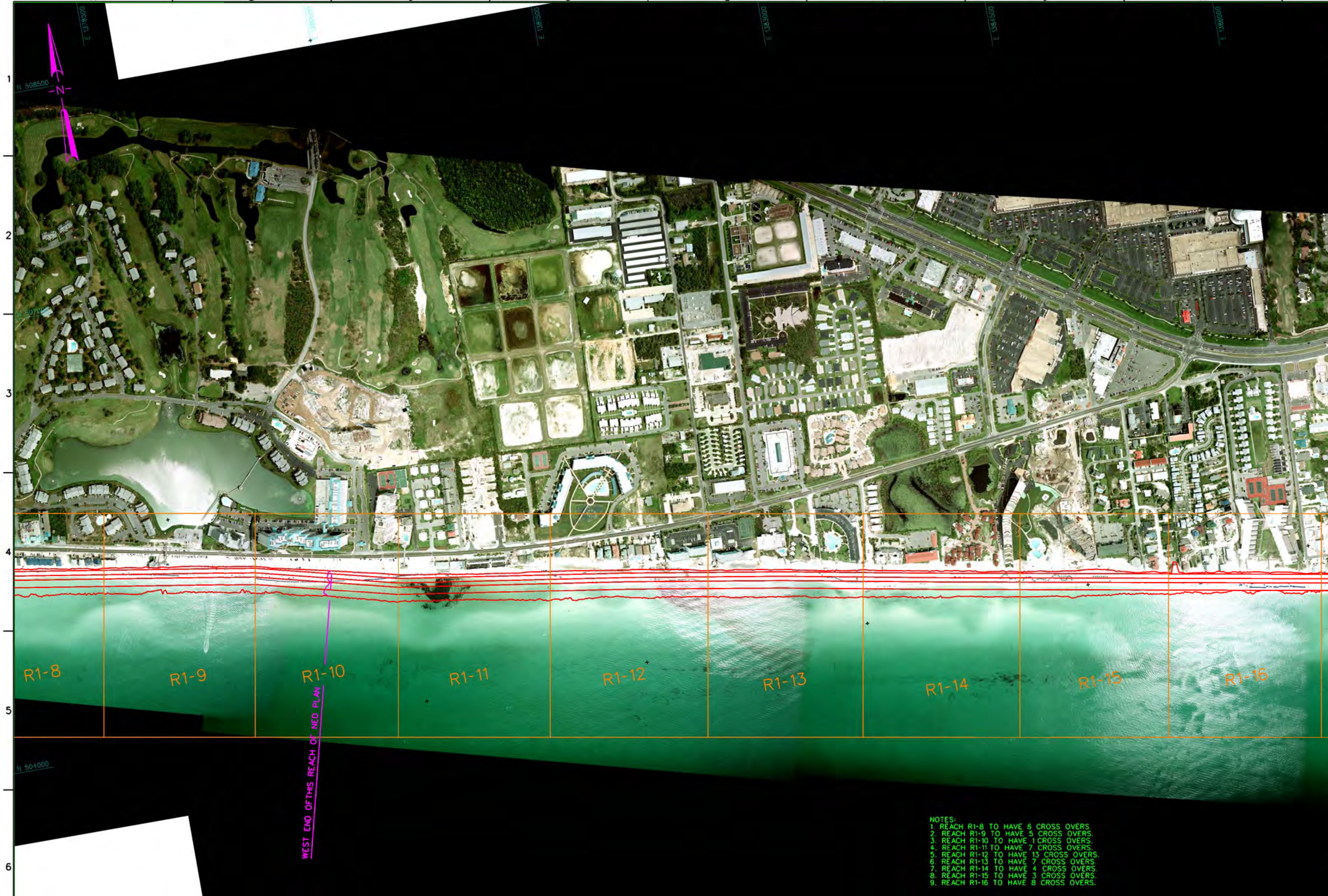

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4. REACH R1-11 TO HAVE 7 CROSS OVERS.
5. REACH R1-12 TO HAVE 13 CROSS OVERS.
6. REACH R1-13 TO HAVE 7 CROSS OVERS.
7. REACH R1-14 TO HAVE 4 CROSS OVERS.
8. REACH R1-15 TO HAVE 3 CROSS OVERS.
9. REACH R1-16 TO HAVE 8 CROSS OVERS.

300' 0 300' 600'
SCALE: 1"=300'

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WALTON COUNTY, FLORIDA
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SITE PLAN
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Sheet Reference Number:
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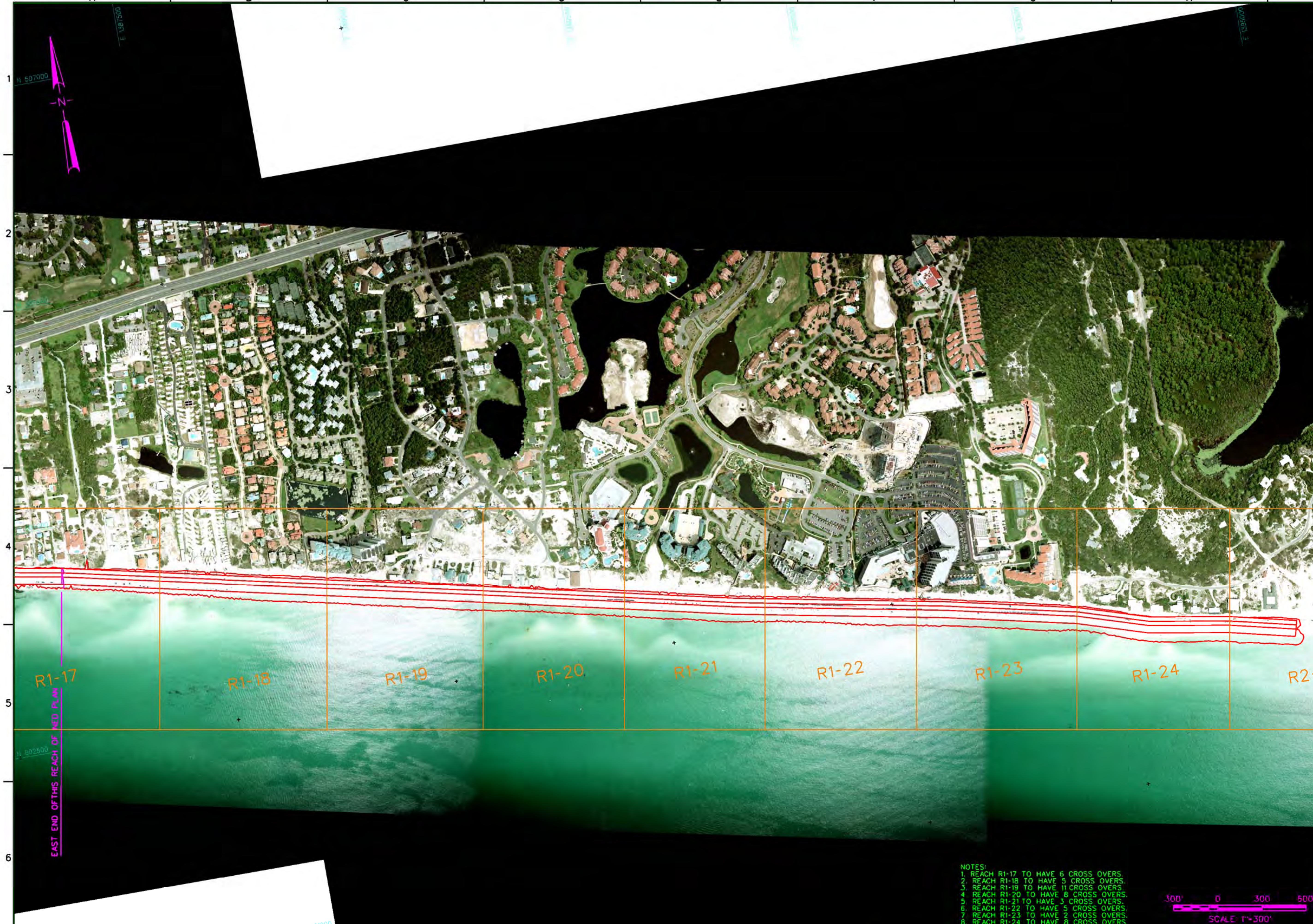

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3. REACH R1-19 TO HAVE 11 CROSS OVERS.
4. REACH R1-20 TO HAVE 8 CROSS OVERS.
5. REACH R1-21 TO HAVE 3 CROSS OVERS.
6. REACH R1-22 TO HAVE 5 CROSS OVERS.
7. REACH R1-23 TO HAVE 2 CROSS OVERS.
8. REACH R1-24 TO HAVE 8 CROSS OVERS.
9. REACH R2-1 TO HAVE 3 CROSS OVERS.

300' 0 300 600'
SCALE: 1"=300'

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WALTON COUNTY, FLORIDA
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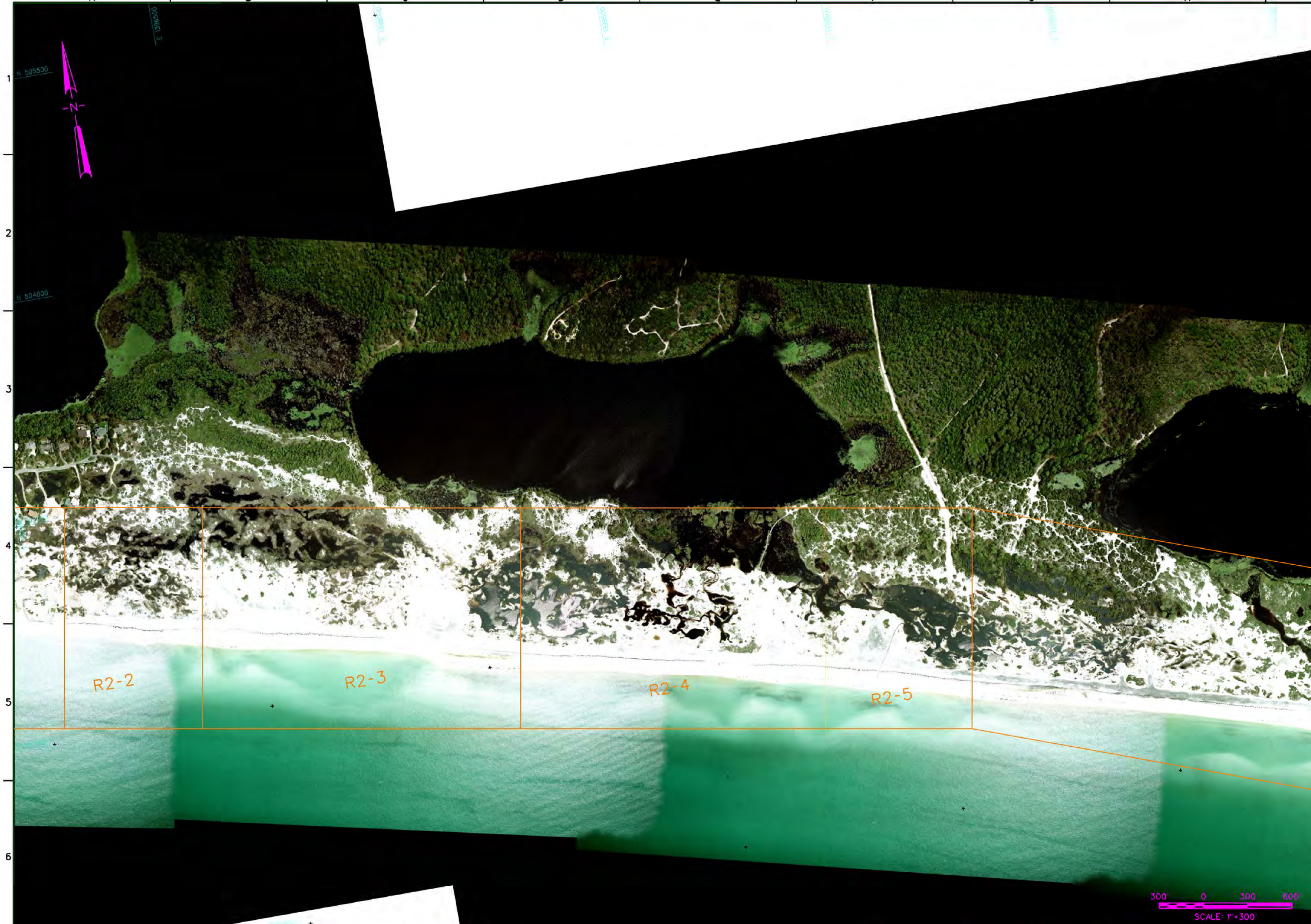

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SITE PLAN

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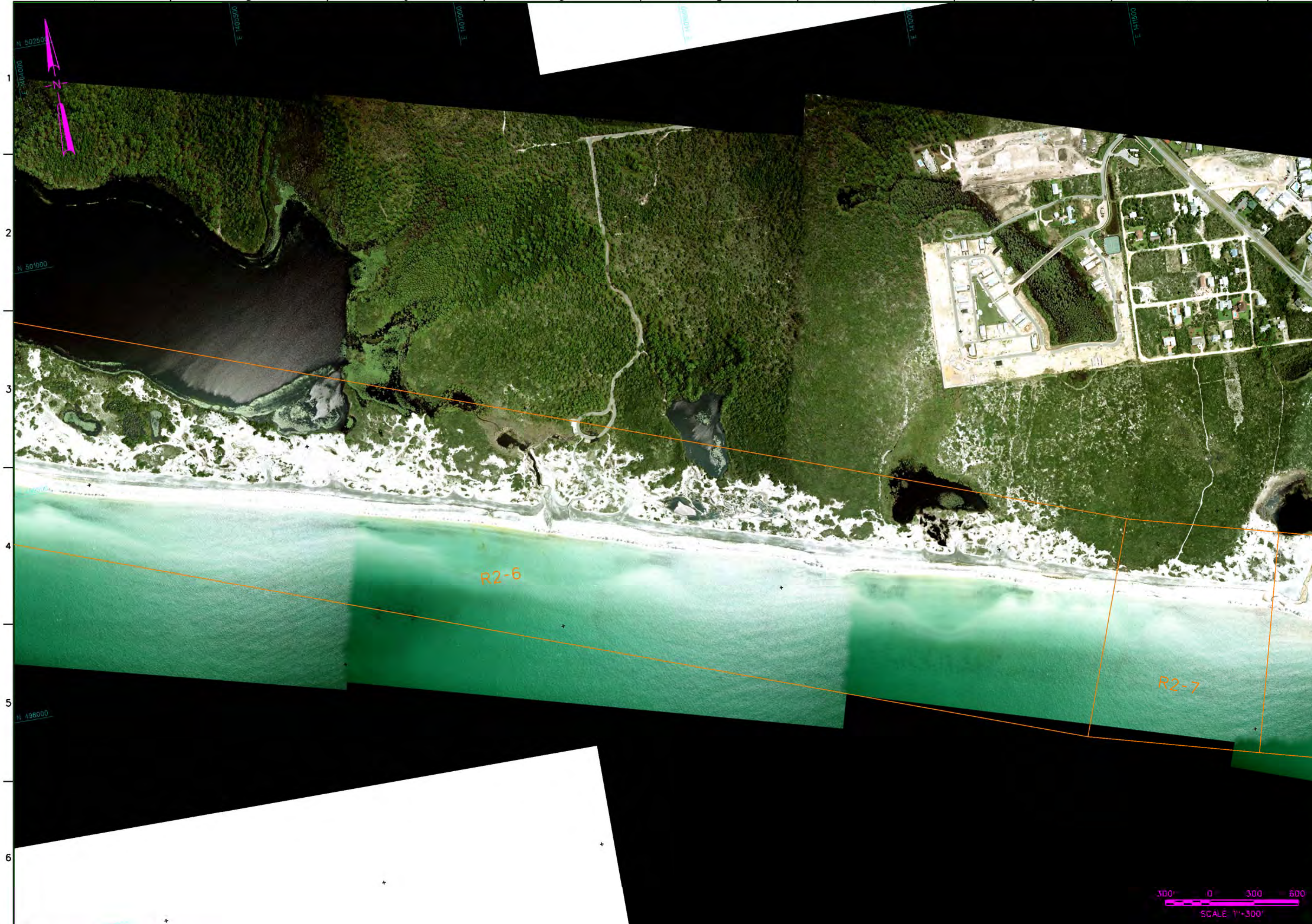

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F-105

NOTES:
1. REACH R3-1 TO HAVE 2 CROSS OVERS.
2. REACH R3-2 TO HAVE 8 CROSS OVERS.
3. REACH R3-3 TO HAVE 9 CROSS OVERS.
4. REACH R3-4 TO HAVE 2 CROSS OVERS.
5. REACH R3-5 TO HAVE 9 CROSS OVERS.
6. REACH R3-6 TO HAVE 11 CROSS OVERS.
7. REACH R3-7 TO HAVE 8 CROSS OVERS.
8. REACH R3-8 TO HAVE 5 CROSS OVERS.
9. REACH R3-9 TO HAVE 10 CROSS OVERS.

300' 0 300 600'
SCALE: 1"=300'

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Sheet Reference Number:
F-106

NOTES:
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2. REACH R3-11 TO HAVE 9 CROSS OVERS.
3. REACH R3-12 TO HAVE 9 CROSS OVERS.
4. REACH R3-13 TO HAVE 4 CROSS OVERS.
5. REACH R3-14 TO HAVE 15 CROSS OVERS.
6. REACH R3-15 TO HAVE 3 CROSS OVERS.
7. REACH R3-16 TO HAVE 1 CROSS OVERS.
8. REACH R3-17 TO HAVE 2 CROSS OVERS.

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WALTON COUNTY, FLORIDA

SITE PLAN

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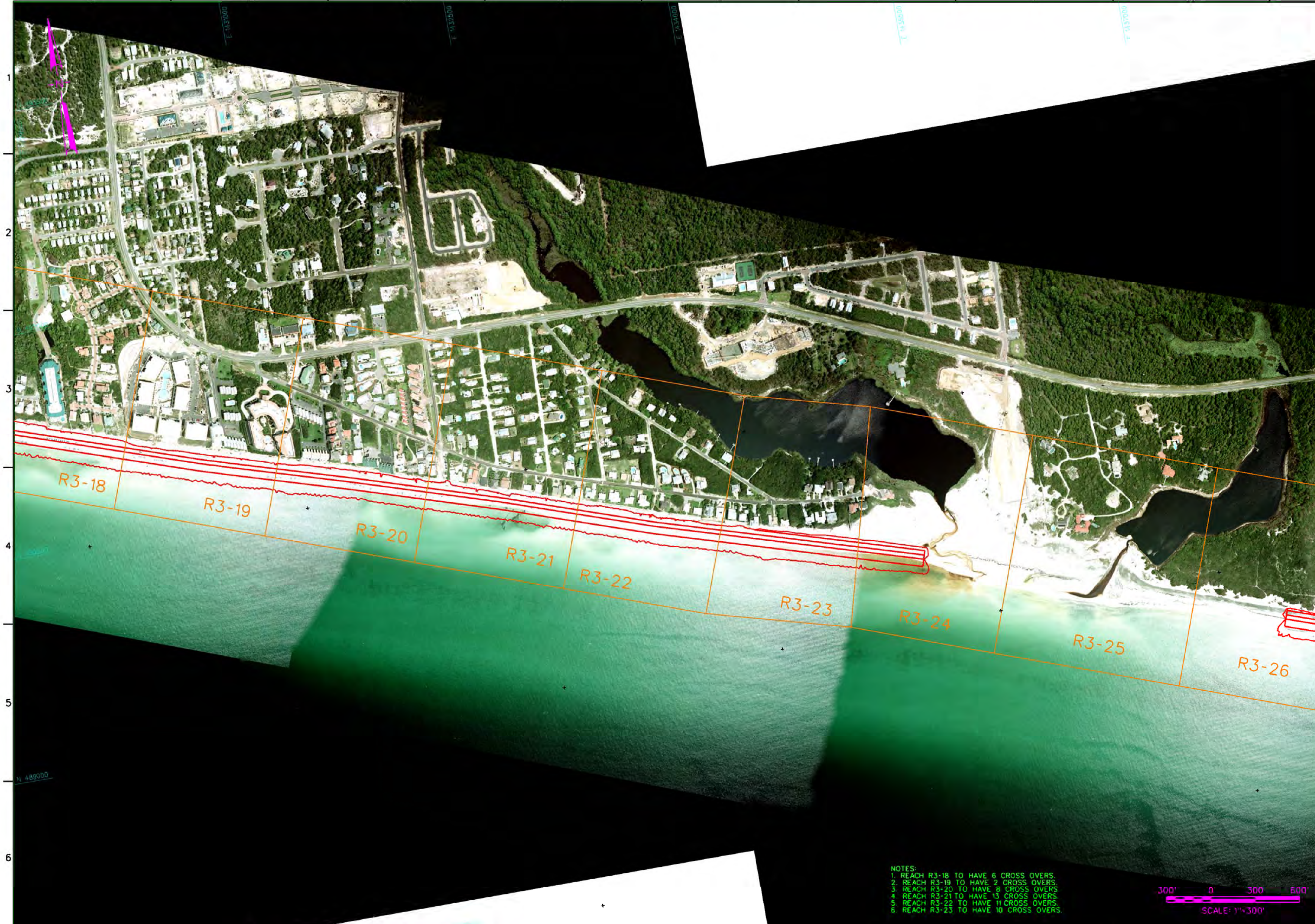

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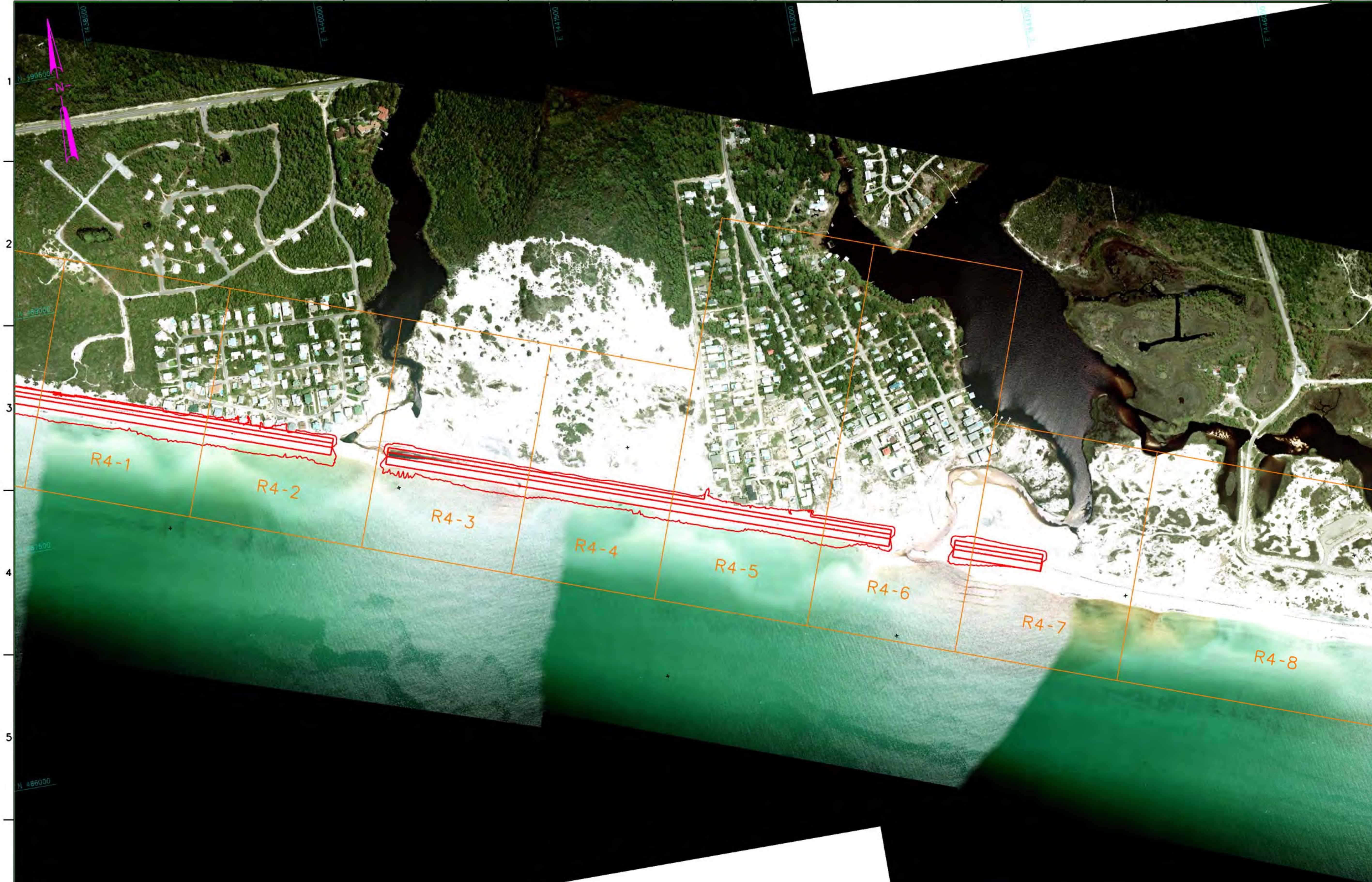

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5. REACH R4-5 TO HAVE 5 CROSS OVERS.
6. REACH R4-6 TO HAVE 1 CROSS OVERS.

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F-109

NOTES:
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2. REACH R5-2 TO HAVE 2 CROSS OVERS.
3. REACH R5-3 TO HAVE 4 CROSS OVERS.
4. REACH R5-4 TO HAVE 2 CROSS OVERS.
5. REACH R5-5 TO HAVE 6 CROSS OVERS.
6. REACH R5-6 TO HAVE 11 CROSS OVERS.

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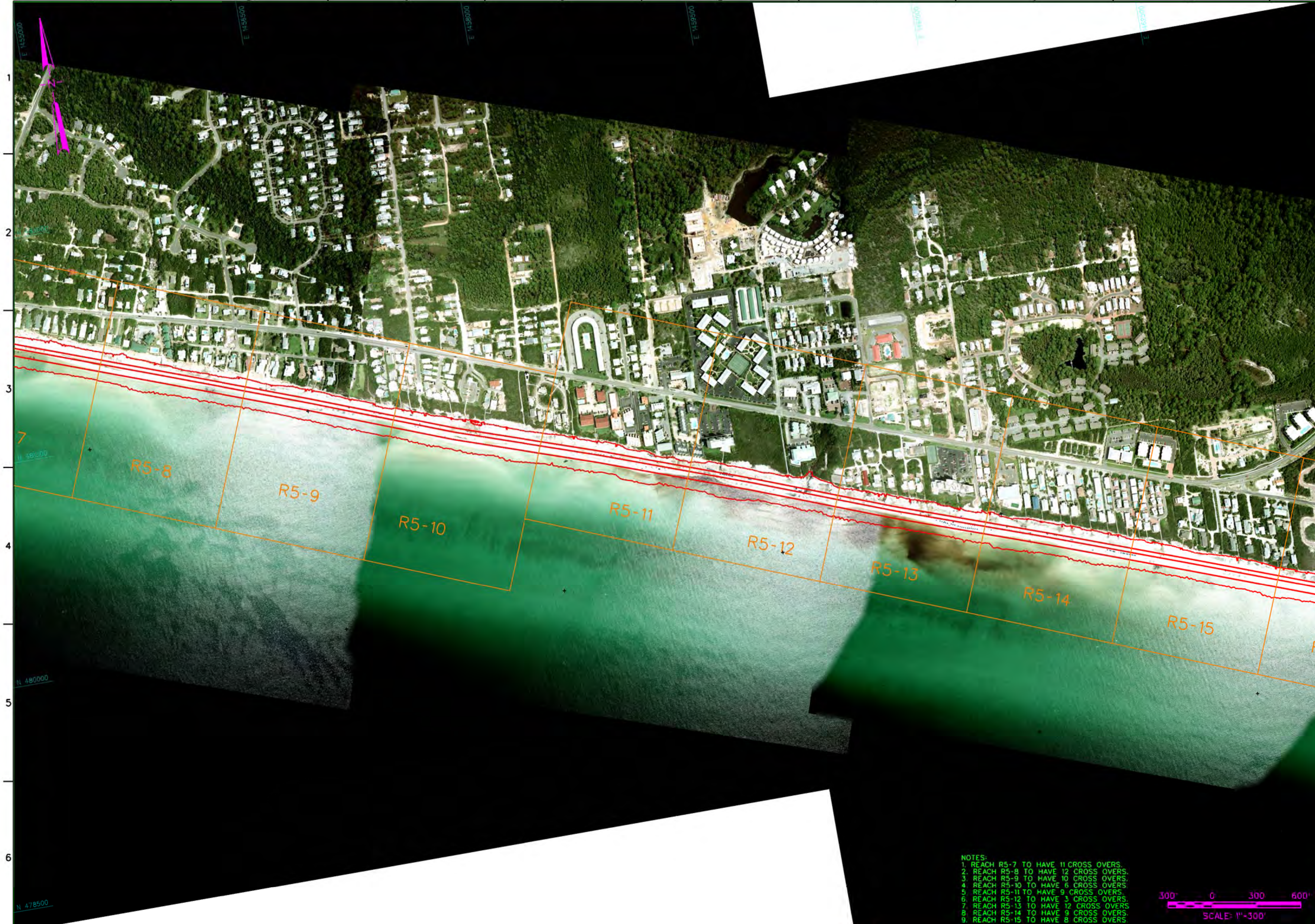

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WALTON COUNTY, FLORIDA
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SITE PLAN
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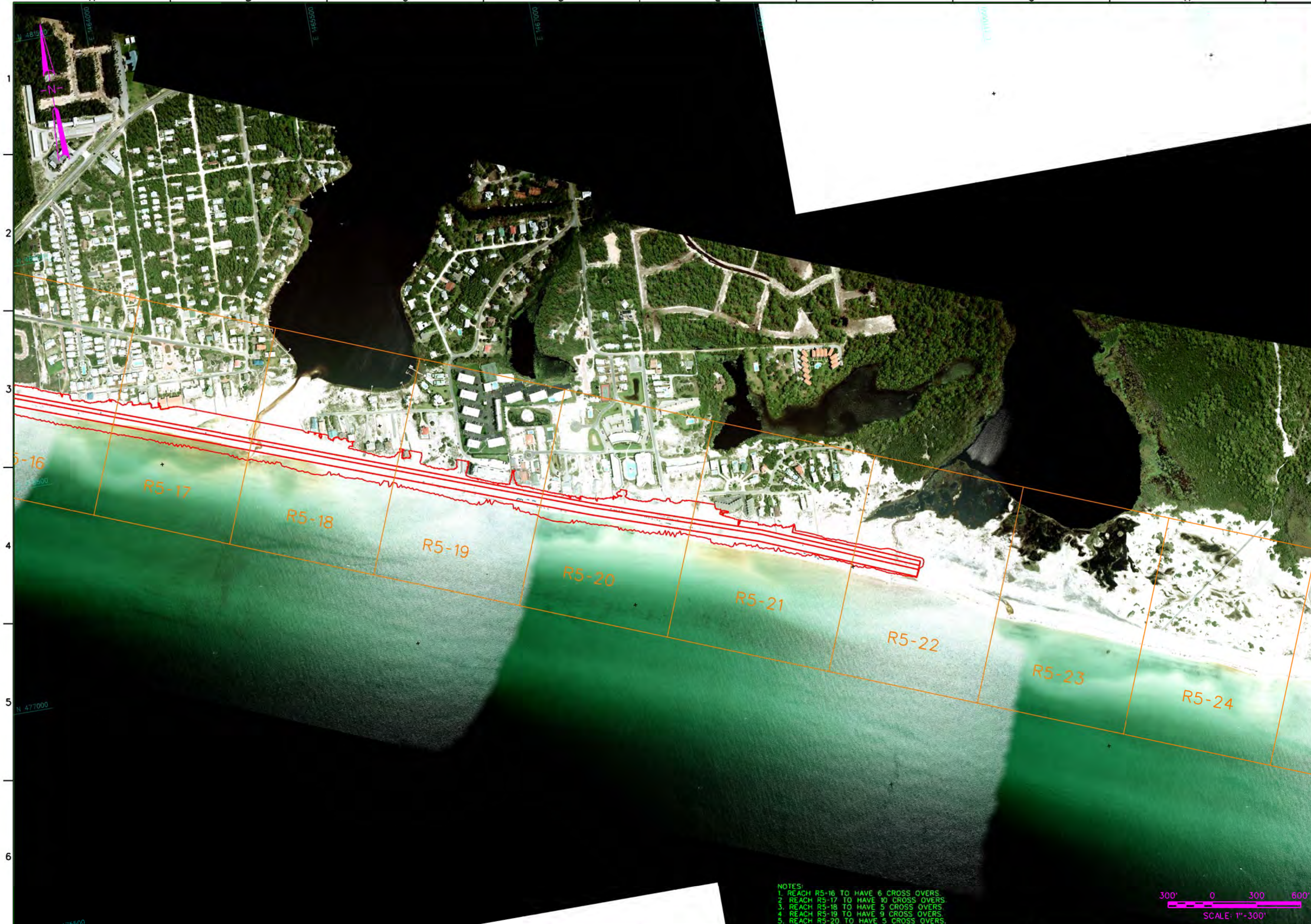

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5. REACH R5-20 TO HAVE 5 CROSS OVERS.
6. REACH R5-21 TO HAVE 4 CROSS OVERS.

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WALTON COUNTY, FLORIDA

SITE PLAN

Sheet Reference Number:
F-112

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4. REACH R5-33 TO HAVE 8 CROSS OVERS.

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Reviewed By: E. HERMAN	Solicitation Number: -

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MOBILE, ALABAMA

WALTON COUNTY, FLORIDA

SITE PLAN

Sheet Reference Number:
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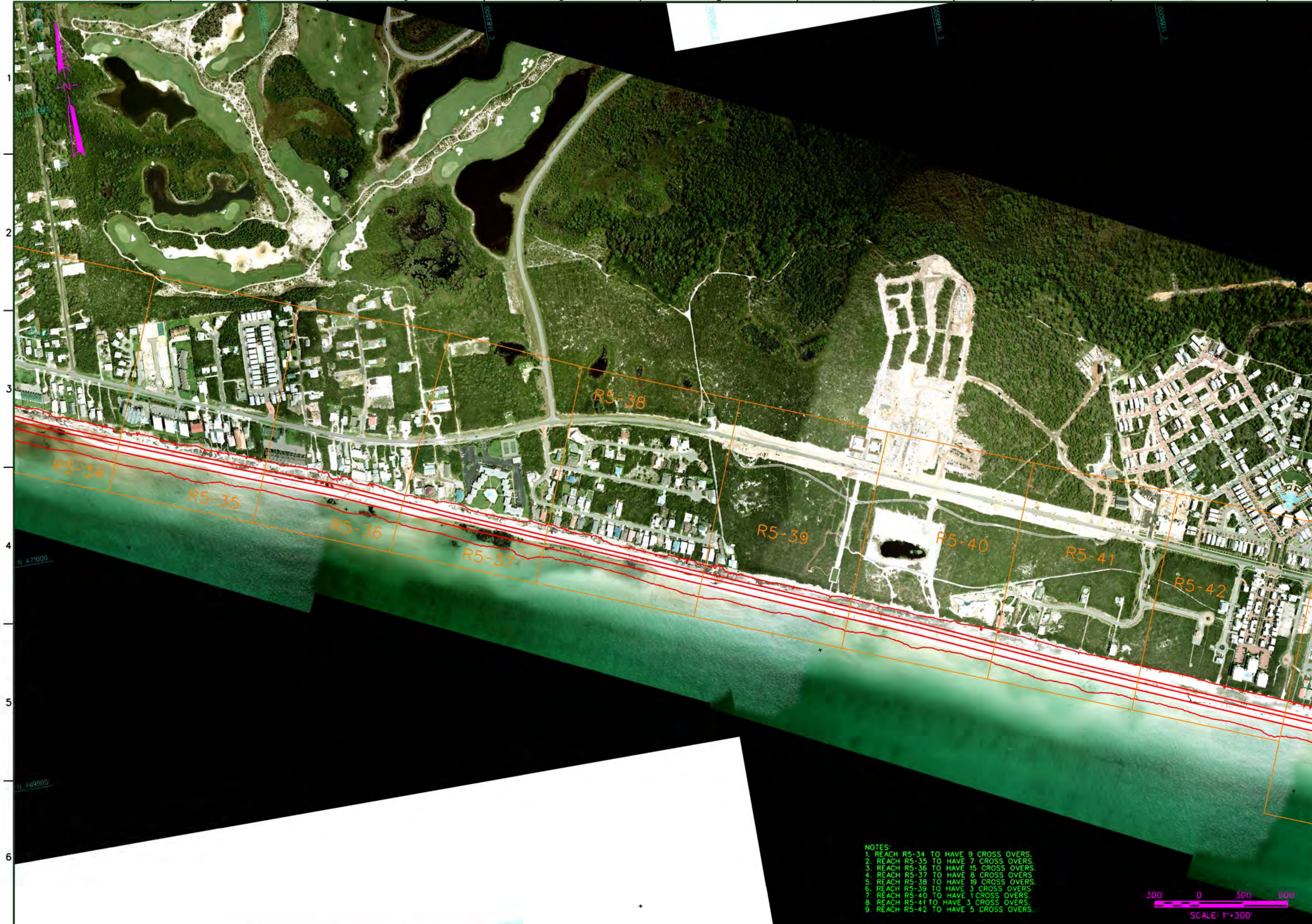

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9. REACH R5-42 TO HAVE 5 CROSS OVERS.

300' 0 300' 600'
SCALE: 1" = 300'

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Designed By: M. MCKOWN	Date: -	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MOBILE, ALABAMA
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Checked By: M. MCKOWN	I.S.O. Sheet File Name: F-114.DGN	
Reviewed By: E. HERMAN	Solicitation Number: -	

WALTON COUNTY, FLORIDA
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SITE PLAN
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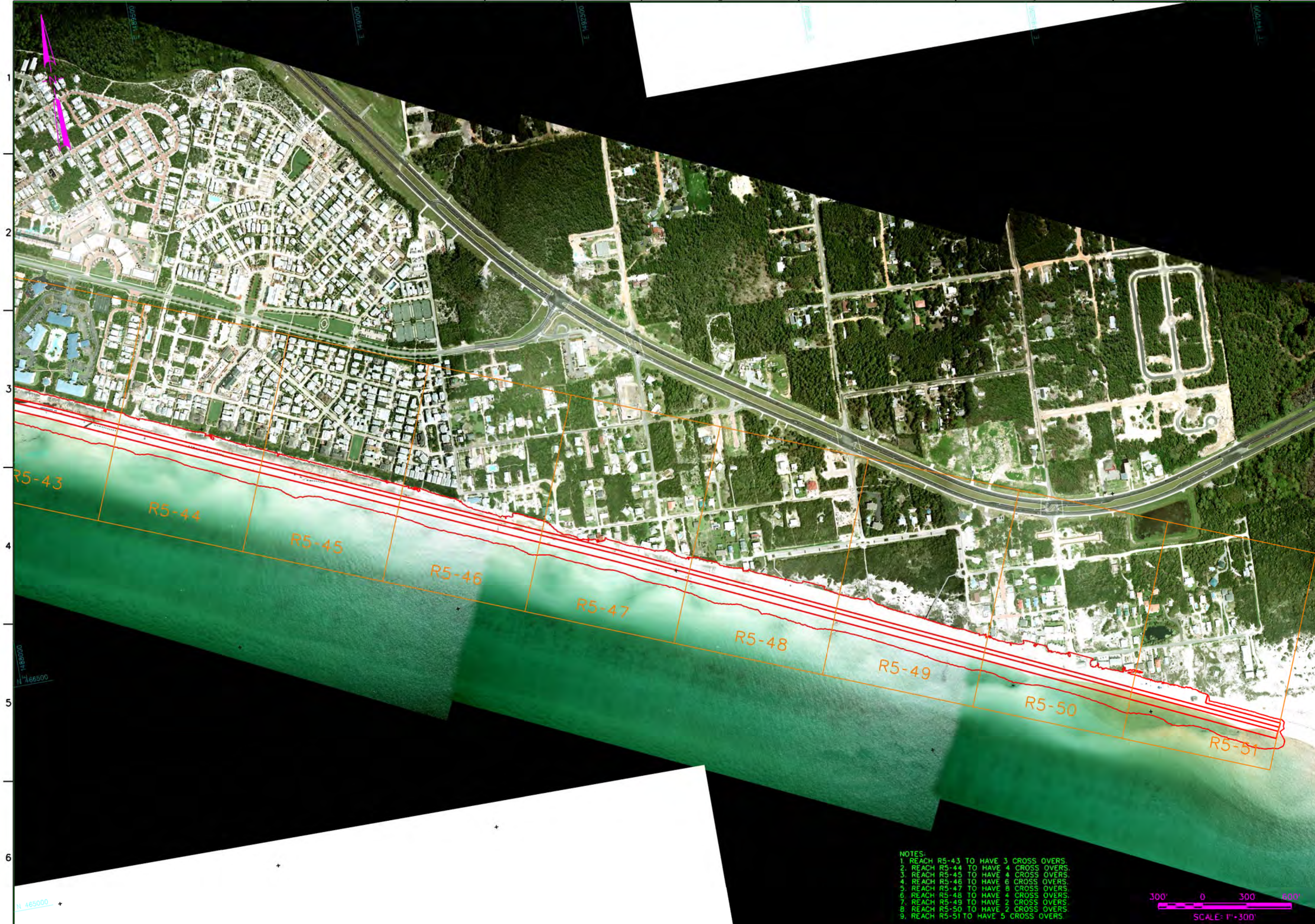
Sheet Reference Number:
F-114



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8. REACH R5-50 TO HAVE 2 CROSS OVERS.
9. REACH R5-51 TO HAVE 5 CROSS OVERS.

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Drawn By: S. TURNER
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Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: F-115.DGN
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WALTON COUNTY, FLORIDA

SITE PLAN

Sheet Reference Number: F-115

300' 0 300 600'

SCALE: 1"=300'

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Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date:
File No.:
I.S.O. Sheet File Name: F-116.DGN
Solicitation Number:

U.S. ARMY ENGINEER DISTRICT
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MOBILE, ALABAMA

WALTON COUNTY, FLORIDA

SITE PLAN

Sheet Reference Number:

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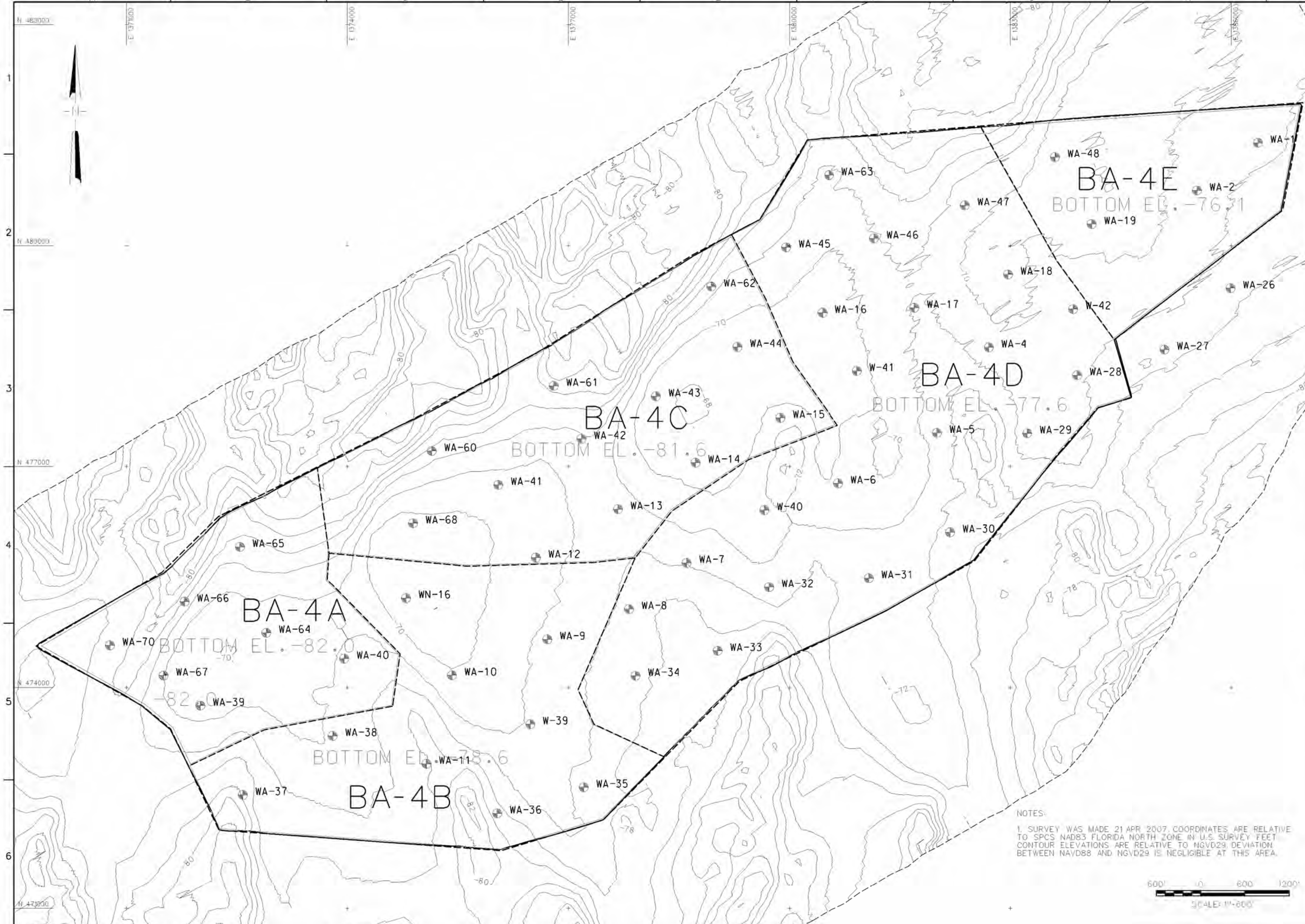

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Symbol	Description	Date	Approved

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Checked By: -	I.S.O. Sheet File Name: F-117.DGN
Reviewed By: -	Solicitation Number: -

U.S. ARMY ENGINEER DISTRICT
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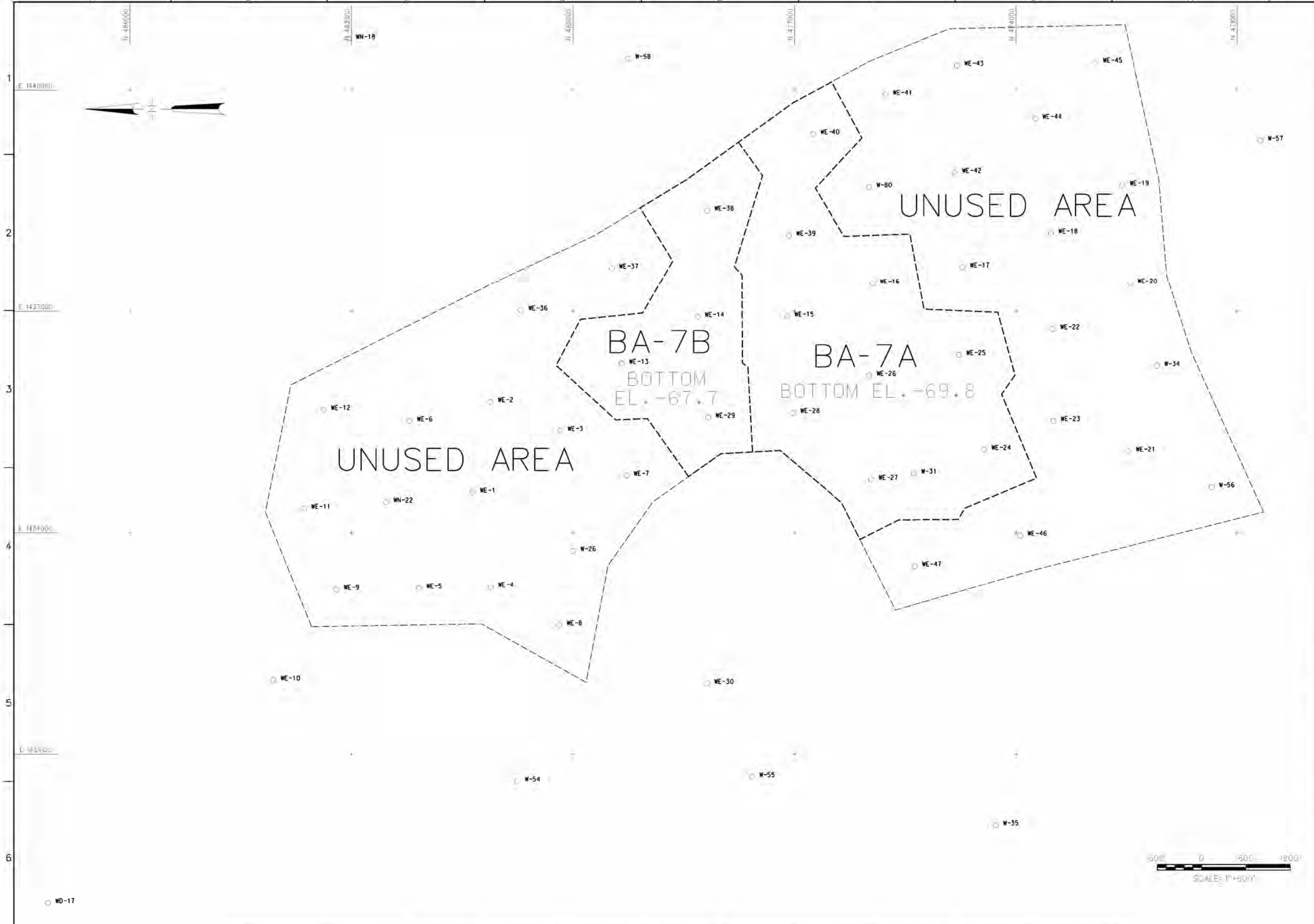
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA

PROPOSED BORROW AREA BA-4

Sheet Reference Number: F-117



US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

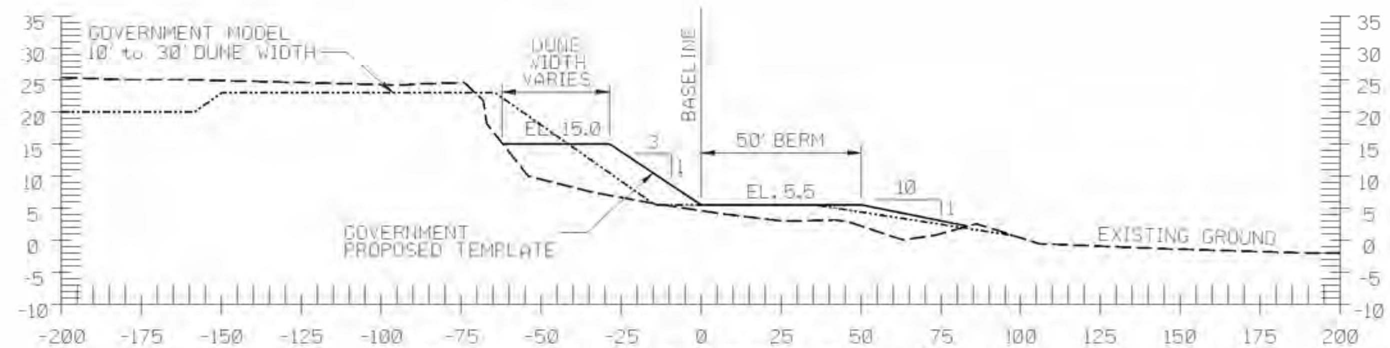
Date: FEB 2012
Designed By: -
Drawn By: R. NETTLES
Checked By: -
Reviewed By: -
File No.: -
I.S.O. Sheet File Name: F-118.DGN
Solicitation Number: -

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

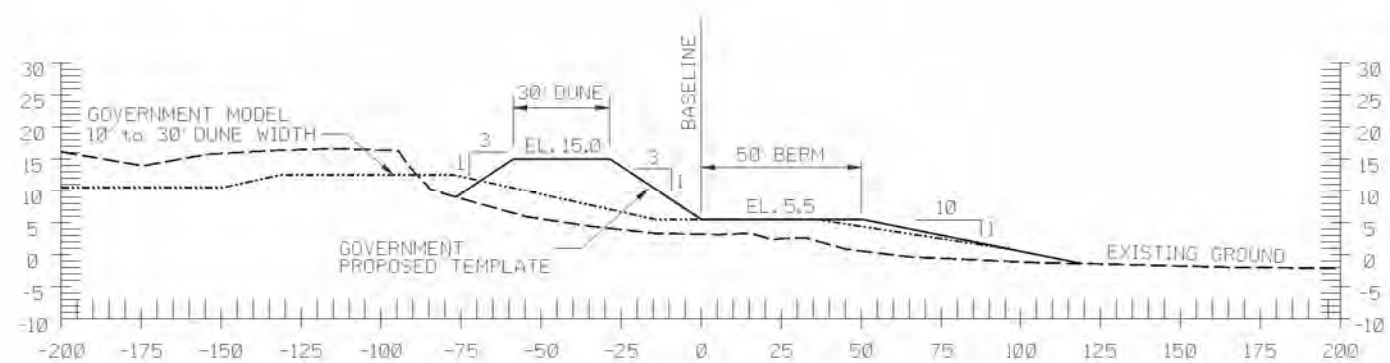
WALTON COUNTY, FLORIDA

PROPOSED BORROW
AREA BA-7

Sheet Reference Number:
F-118



TYPICAL SECTION "A"



TYPICAL SECTION "B"

US Army Corps of Engineers
Mobile District

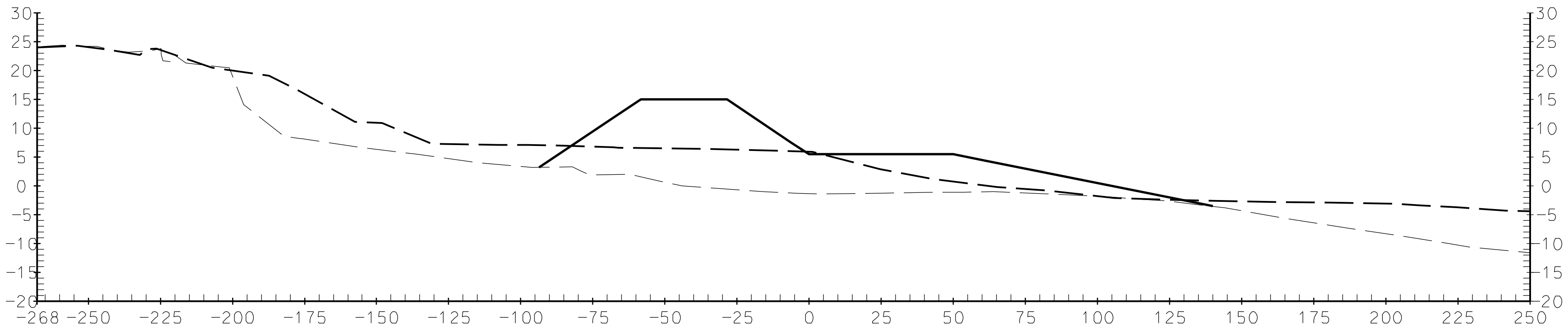
Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date:
File No.:
U.S.D. Sheet File Name: F-300.DGN
Solicitation Number:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

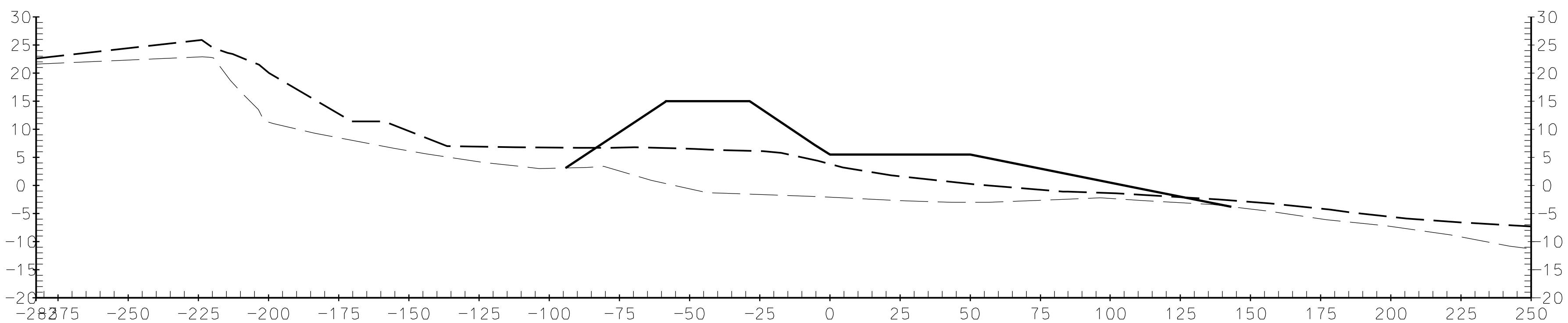
WALTON COUNTY, FLORIDA

TYPICAL SECTIONS

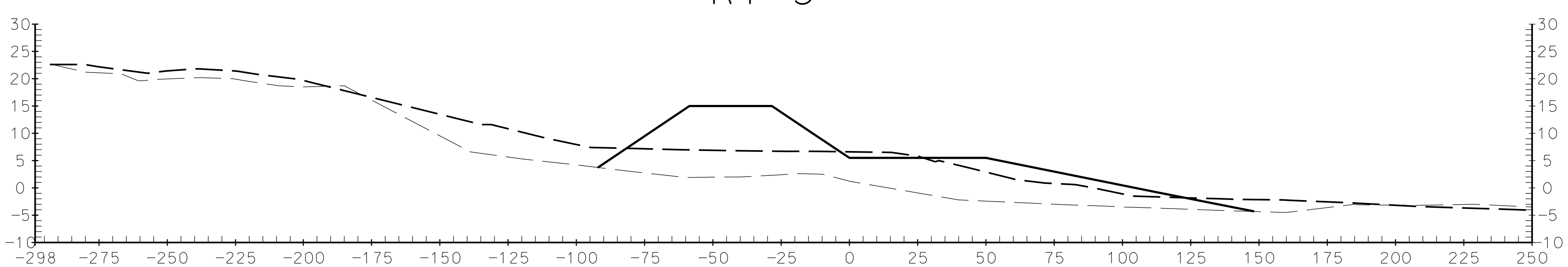
Sheet Reference Number
F-300



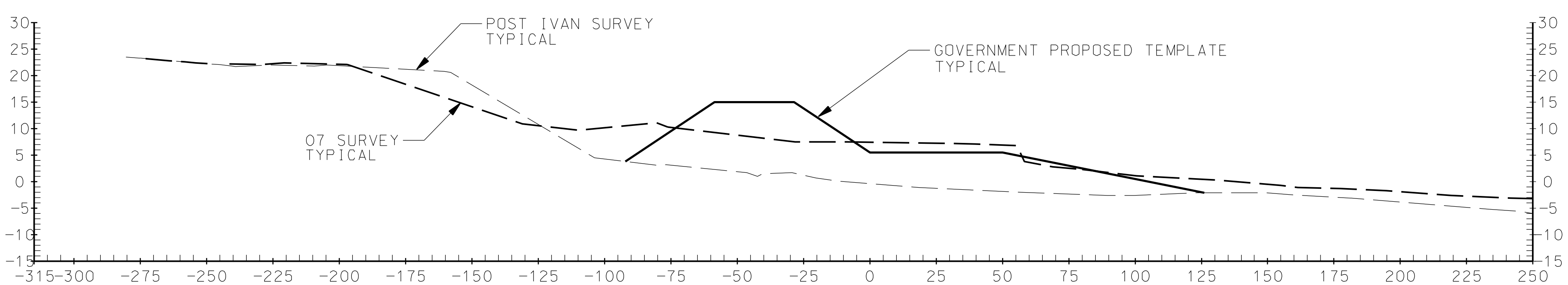
R1-4



R1-3



R1-2



R1-1

US Army Corps of Engineers
Mobile District

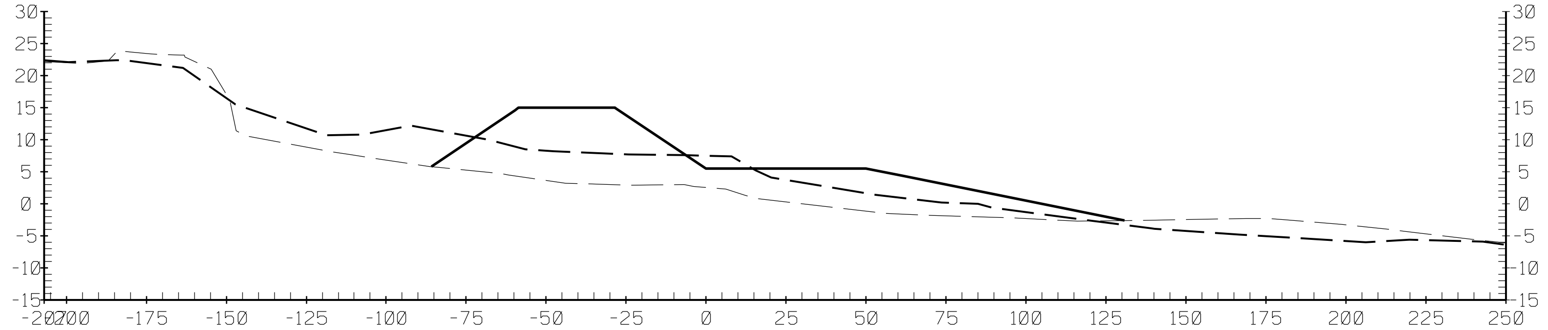
Symbol	Description	Date	Approved

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-301



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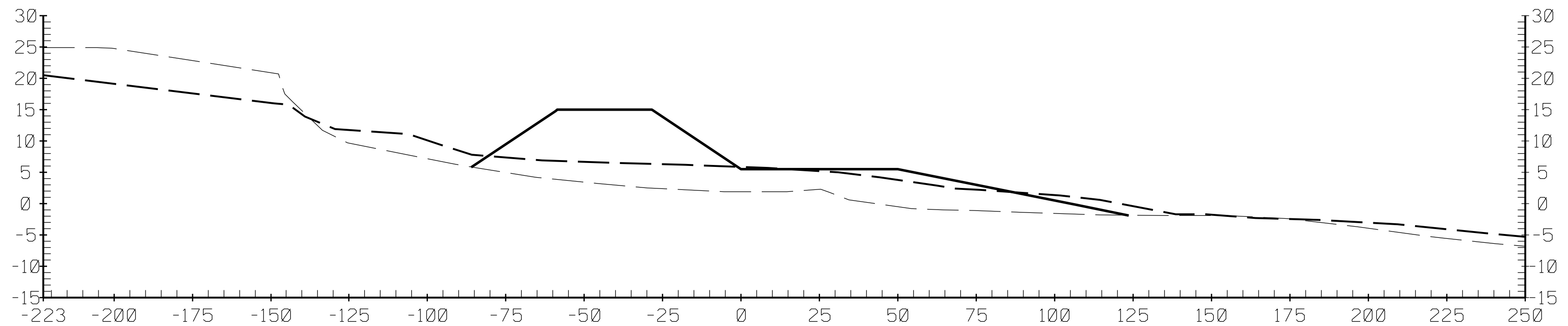
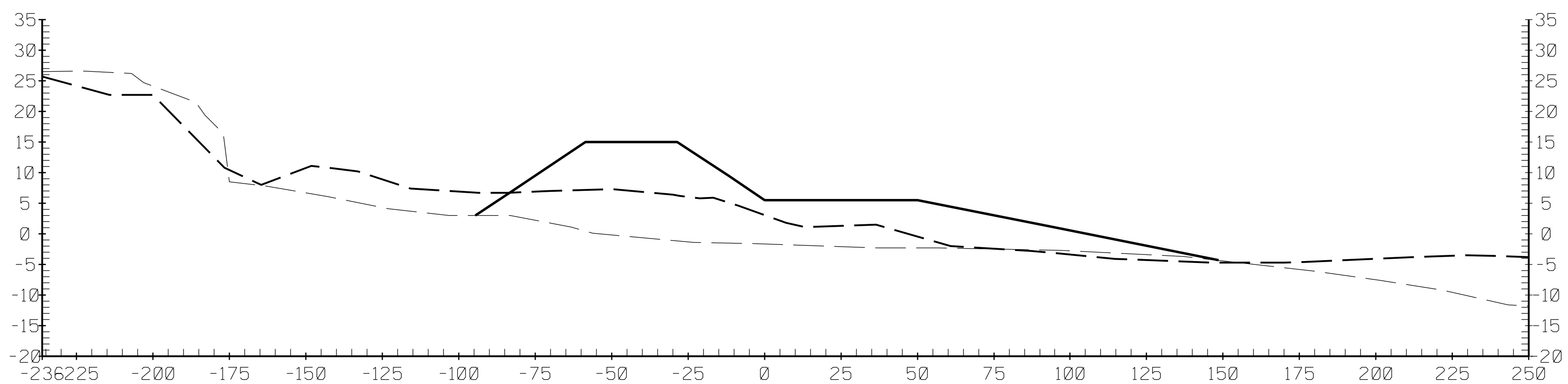
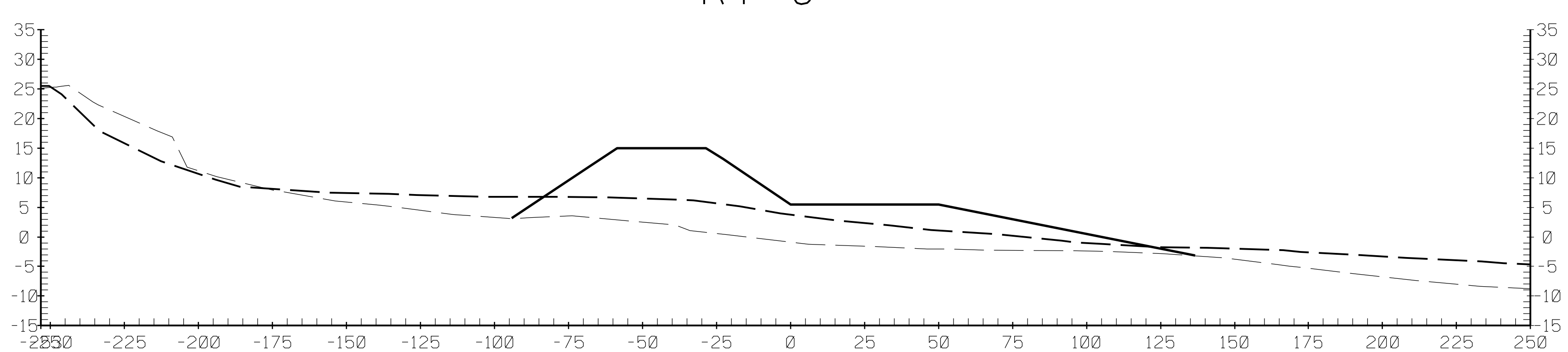


R1-7



R1-6



R1-5

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

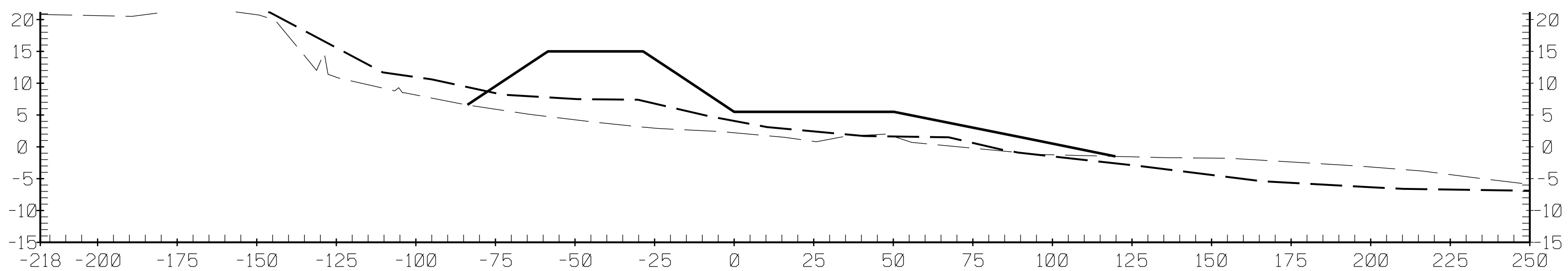
Description

Date: -	File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn	Solicitation Number: -
Designed By: M. MCKOWN	Drawn By: S. TURNER
Checked By: M. MCKOWN	Reviewed By: E. HERMAN

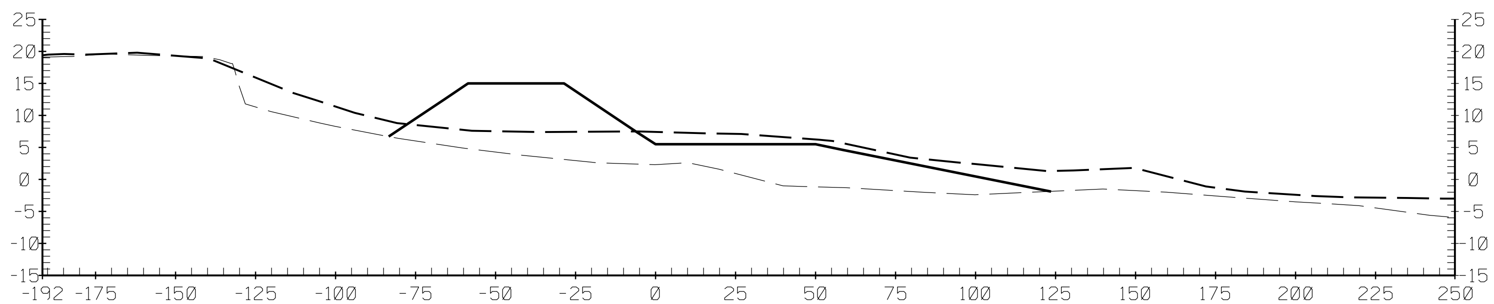
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-302



R1-10



R1-9

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

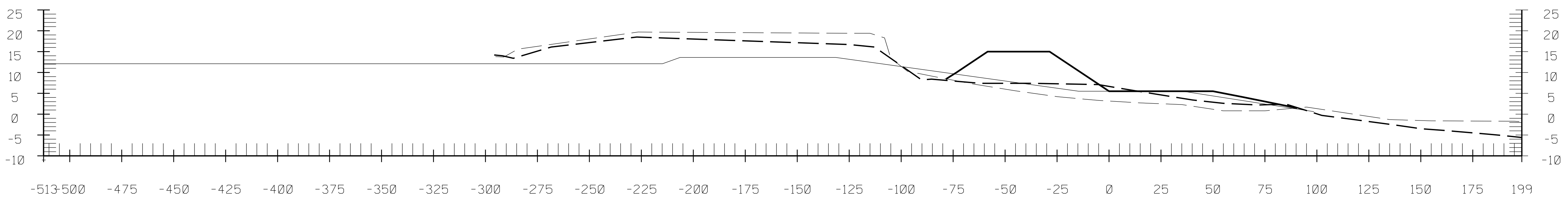
Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

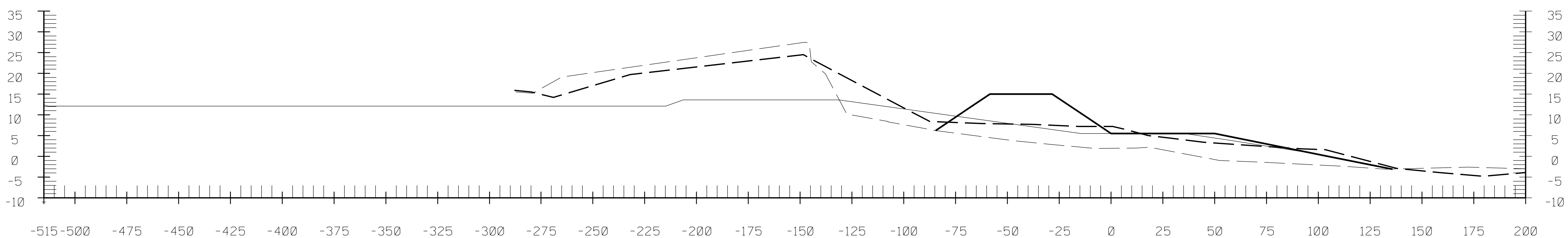
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
-
CROSS SECTIONS
-

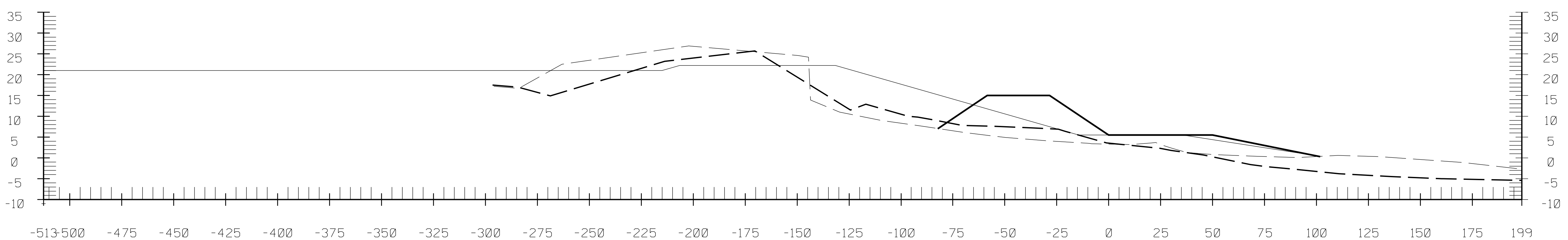
Sheet Reference Number:
F-303



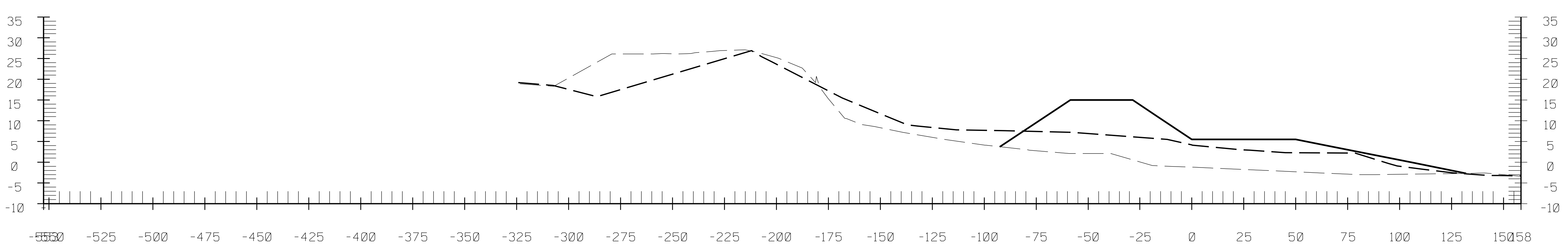
RI-14



R1-13



R1-12



R1-11

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

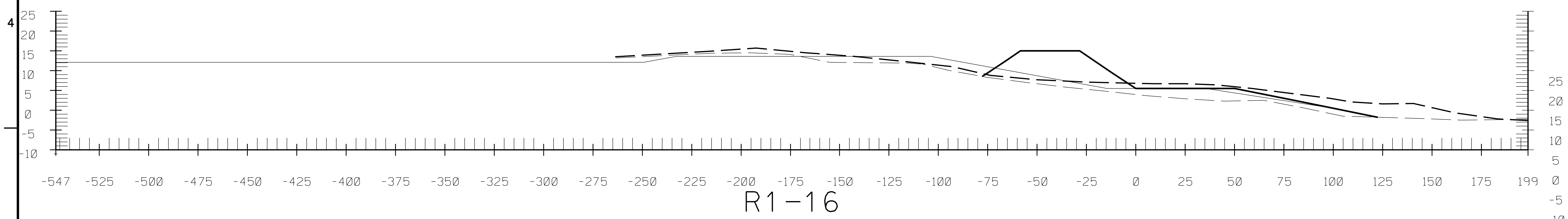
Description

Designed By: M. MCKOWN	Date: -
Drawn By: S. TURNER	File No. -
Checked By: M. MCKOWN	I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Reviewed By: E. HERMAN	Solicitation Number: -

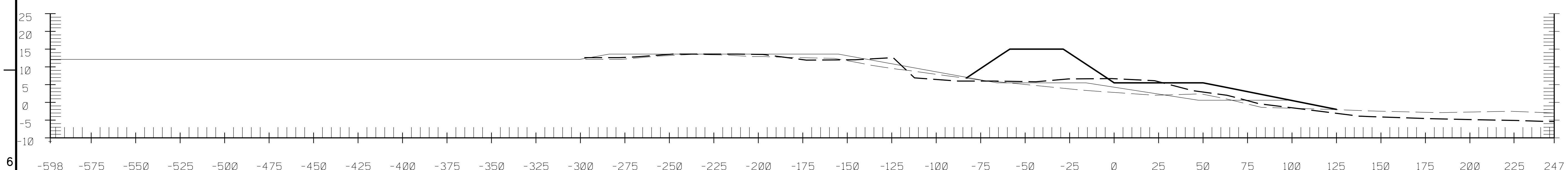
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-304



R1-16



R1-15

US Army Corps of Engineers
Mobile District

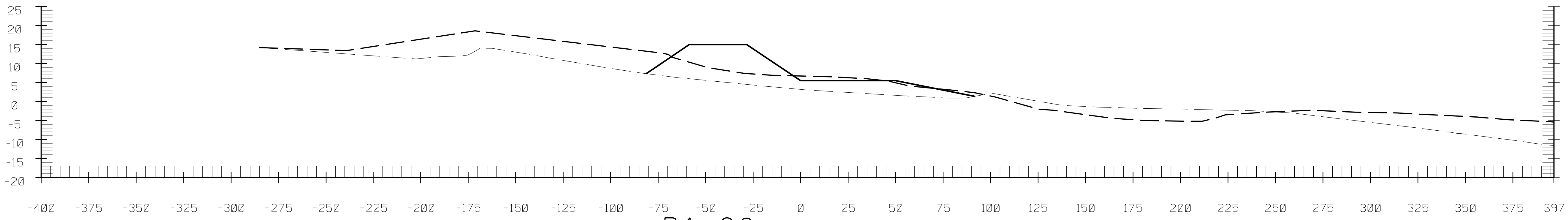
Symbol	Description	Date	Approved

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

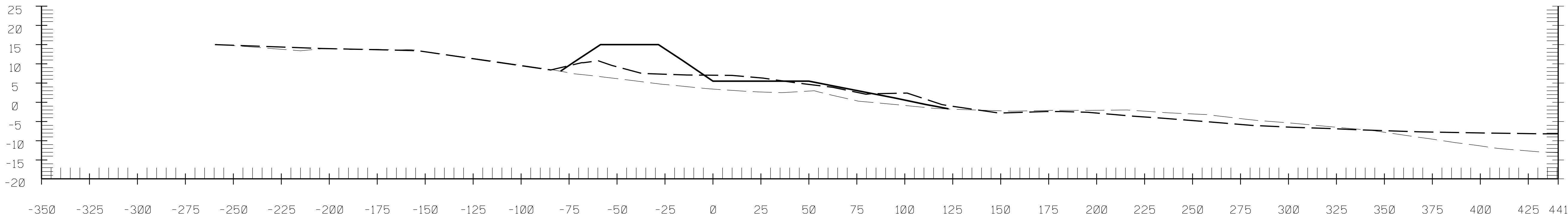
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

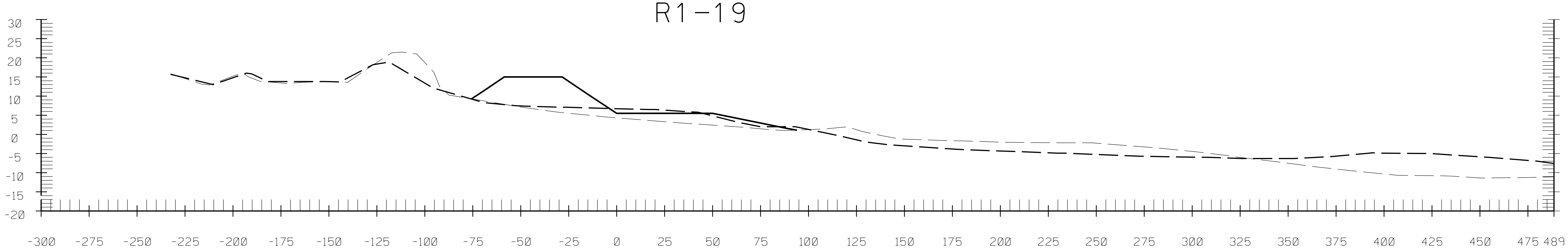
Sheet Reference Number:
F-305



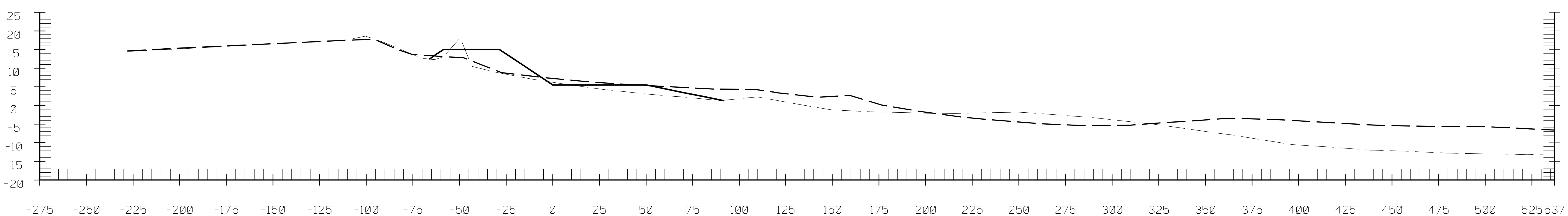
R1-20



R1-19



R1-18



R1-17

US Army Corps of Engineers
Mobile District

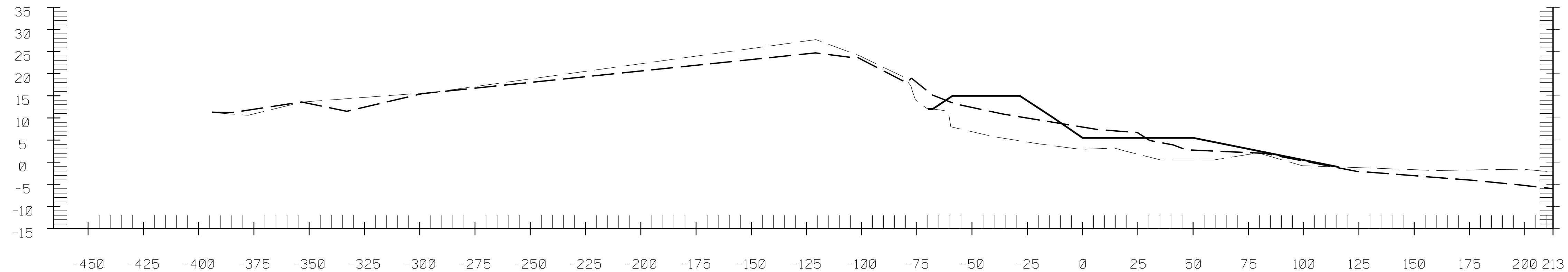
Symbol	Description	Date	Approved

Designed By: M. MCKOWN	Date: -
Drawn By: S. TURNER	File No. -
Checked By: M. MCKOWN	I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Reviewed By: E. HERMAN	Solicitation Number: -

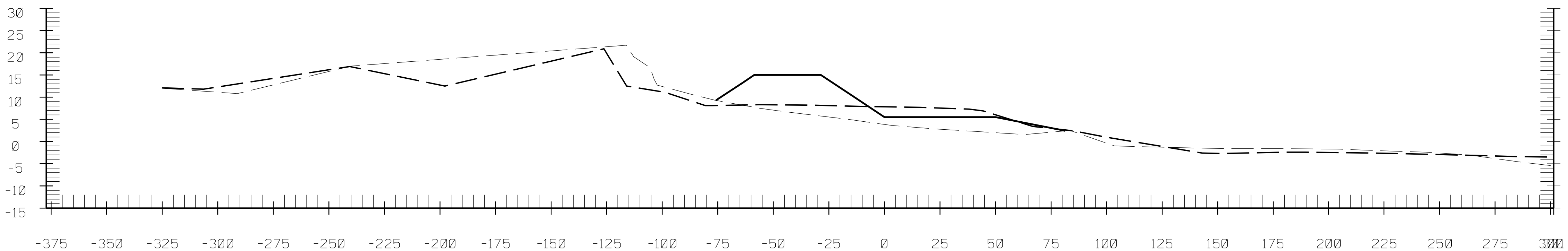
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

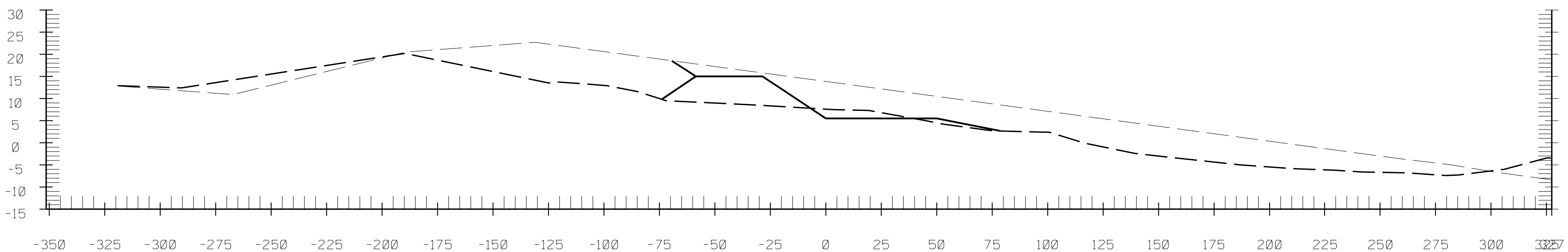
Sheet Reference Number:
F-306



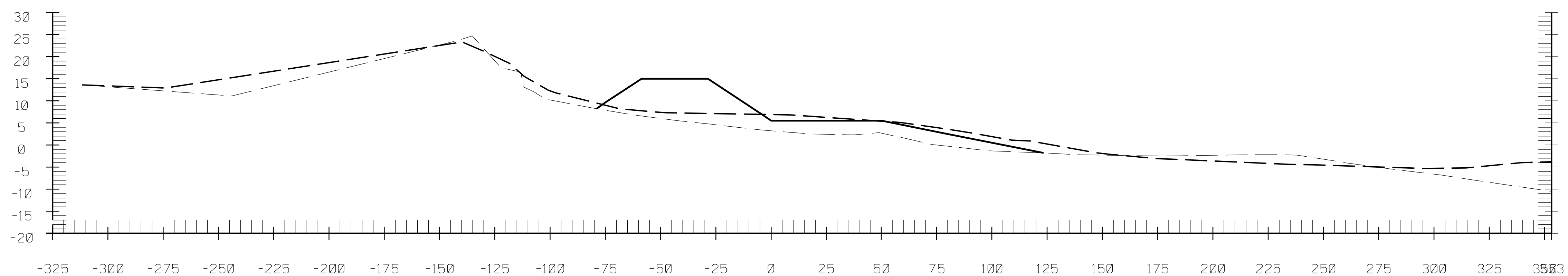
R1-24



R1-23



R1-22



R1-21

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

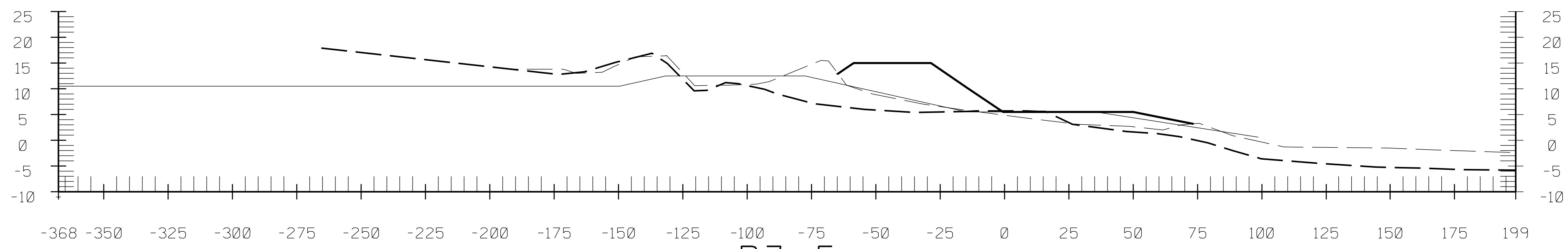
Description

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

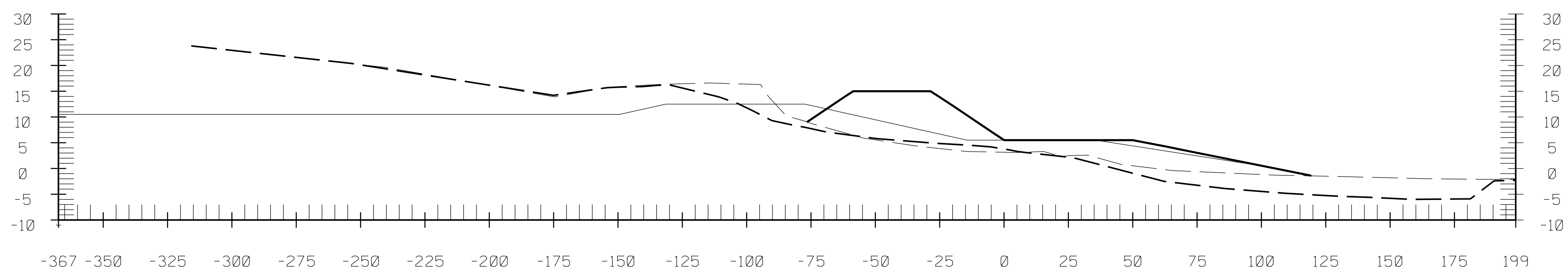
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-307



R3-5



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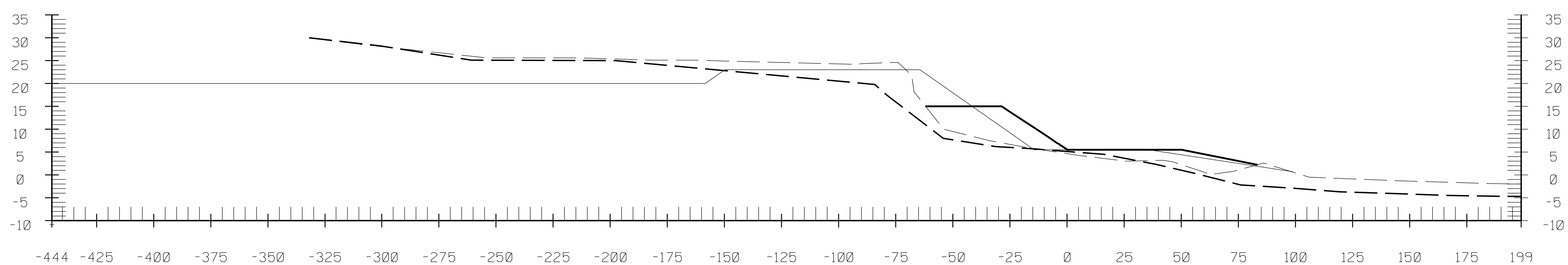
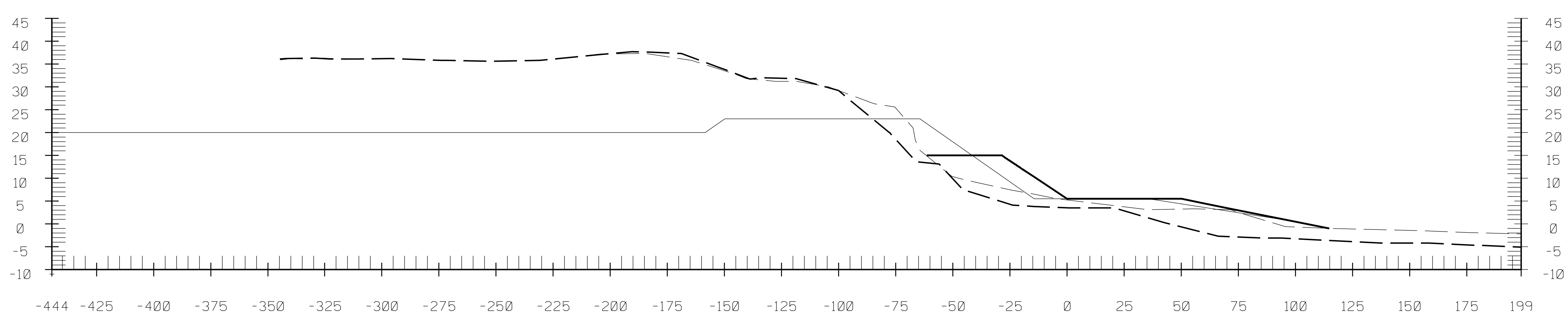


R3-3



R3-2

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

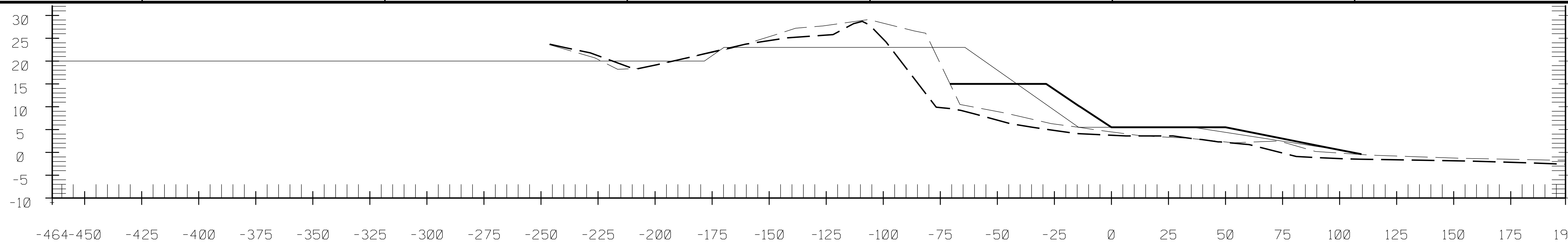
Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
AREA 2
-

Sheet Reference Number:
F-308



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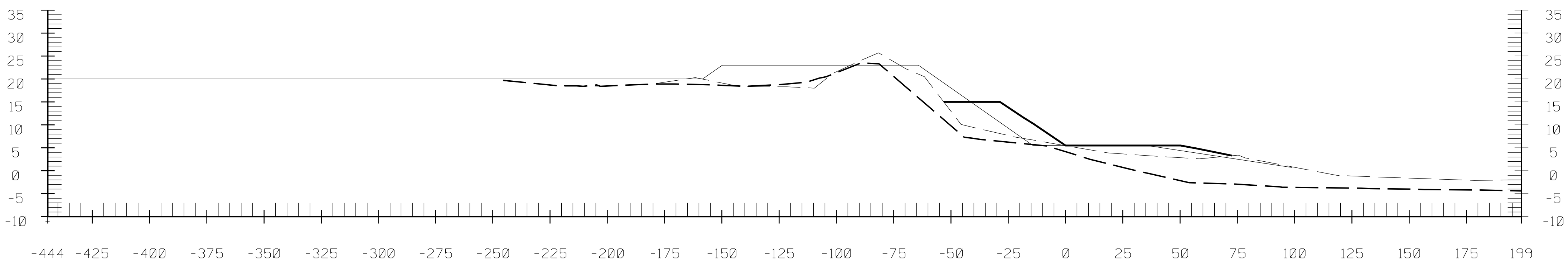

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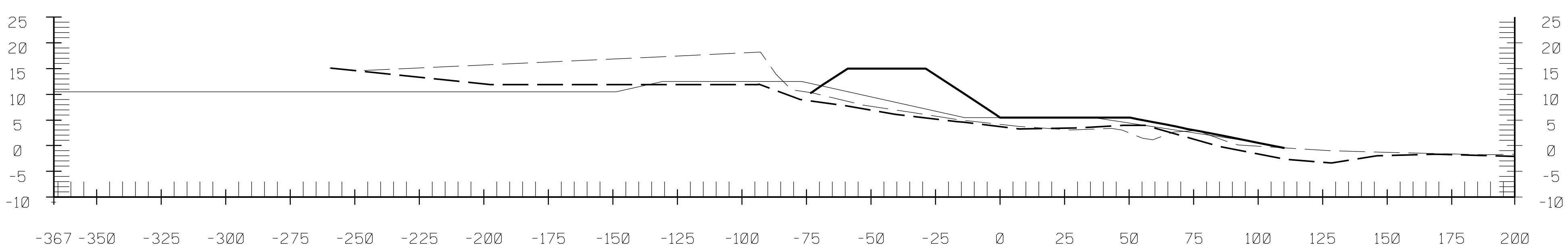

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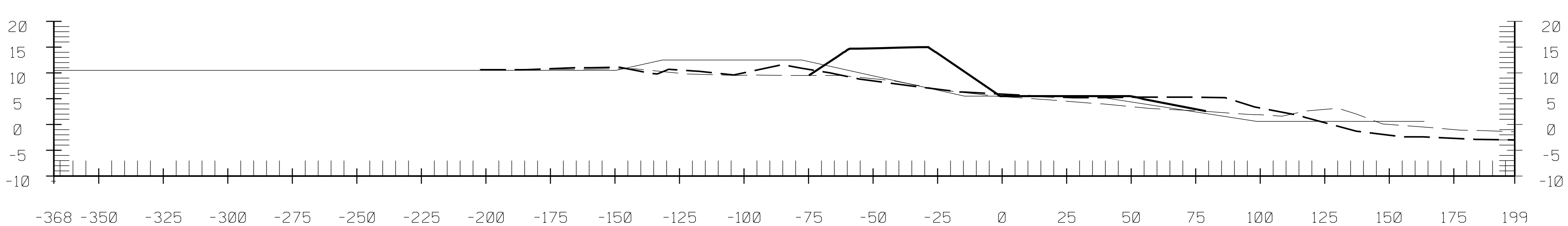


R3-6

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

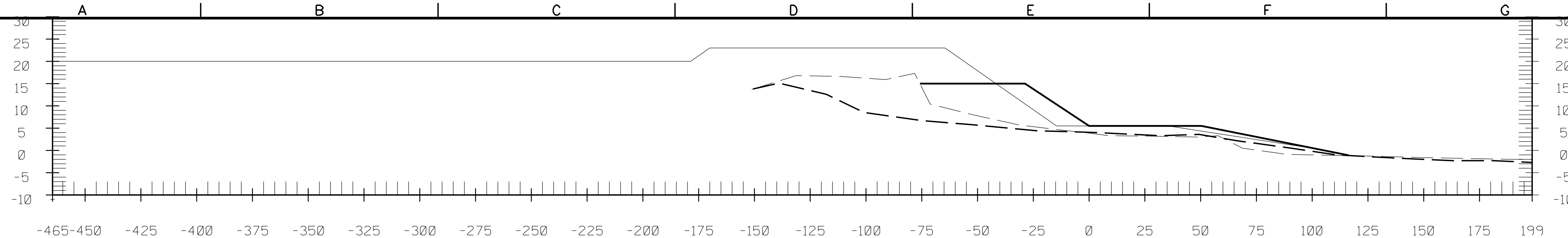
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-309



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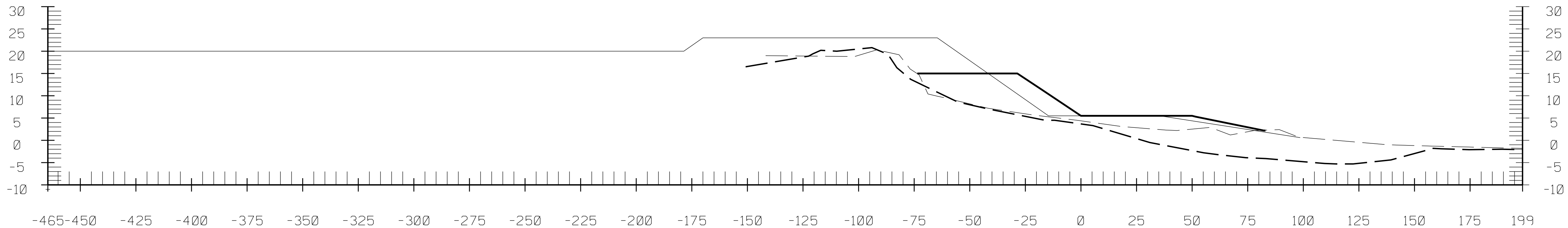

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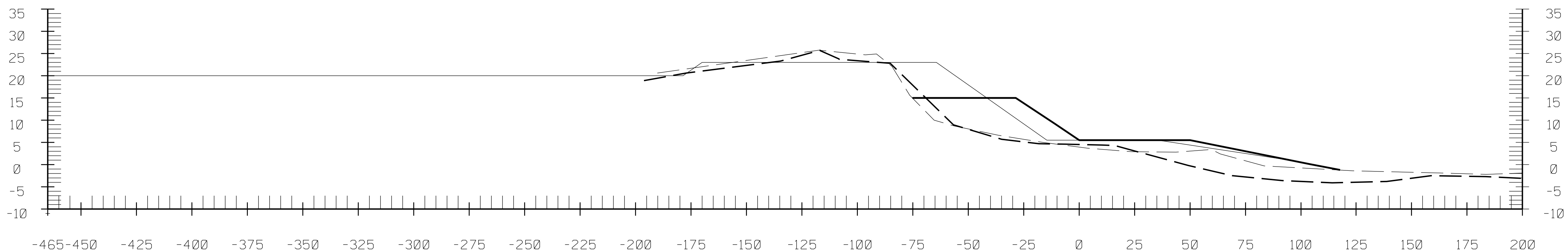
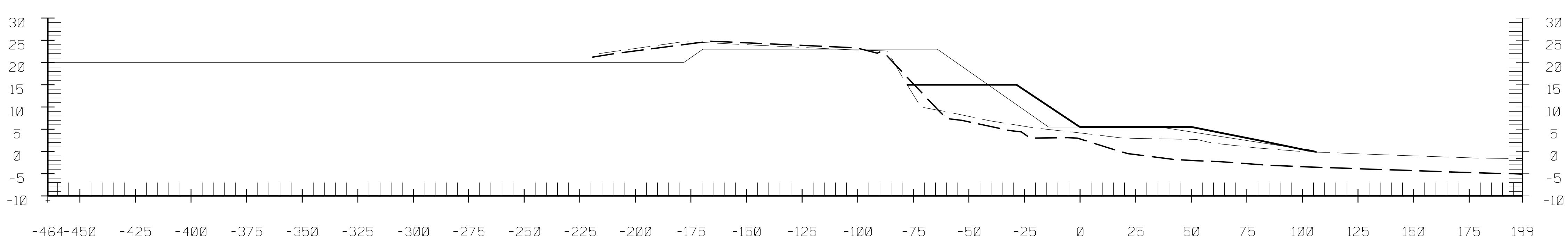


R3-11



R3-10

US Army Corps of Engineers
Mobile District

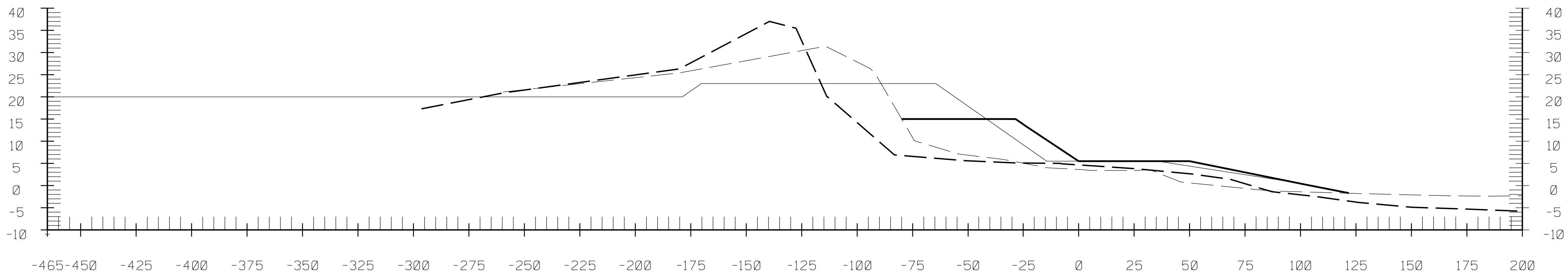
Symbol	Description	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

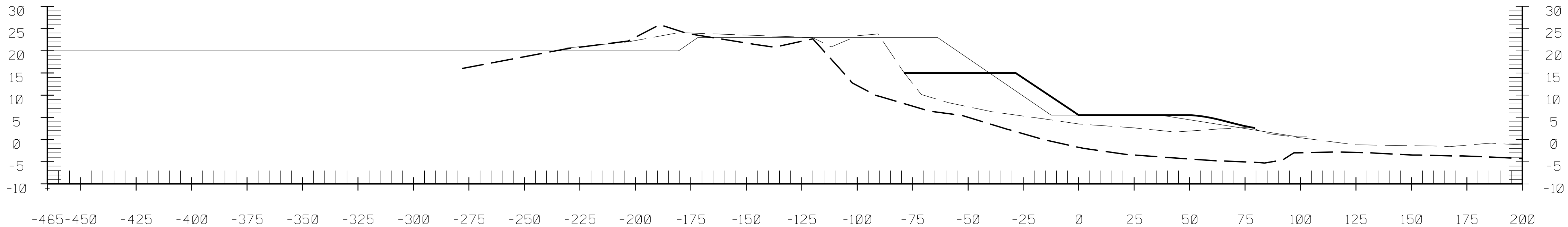
Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
-

Sheet Reference Number:
F-310



R3-17



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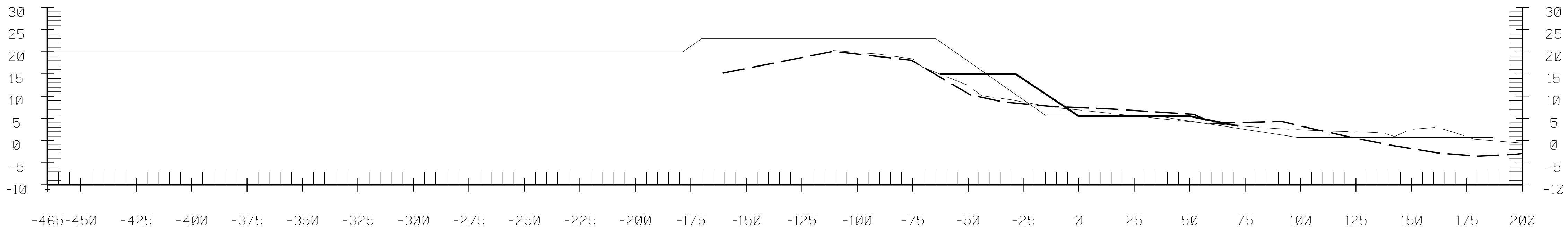
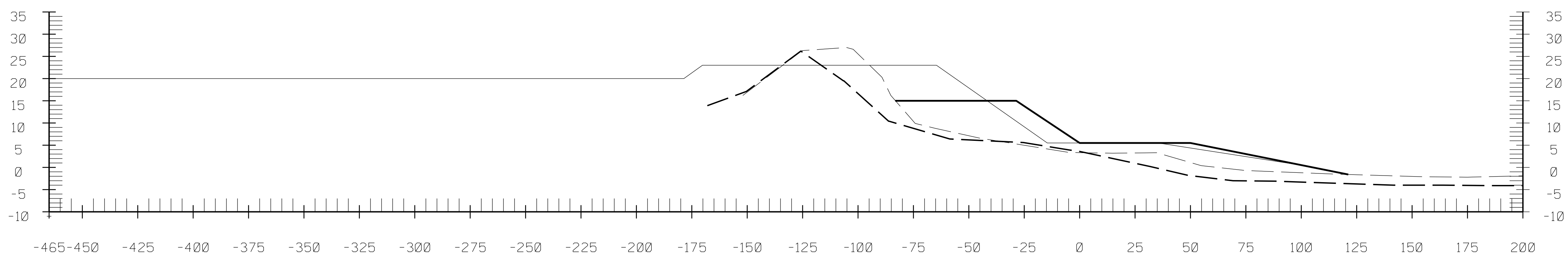


R3-15



R3-14

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

WALTON COUNTY, FLORIDA
-
-
CROSS SECTIONS
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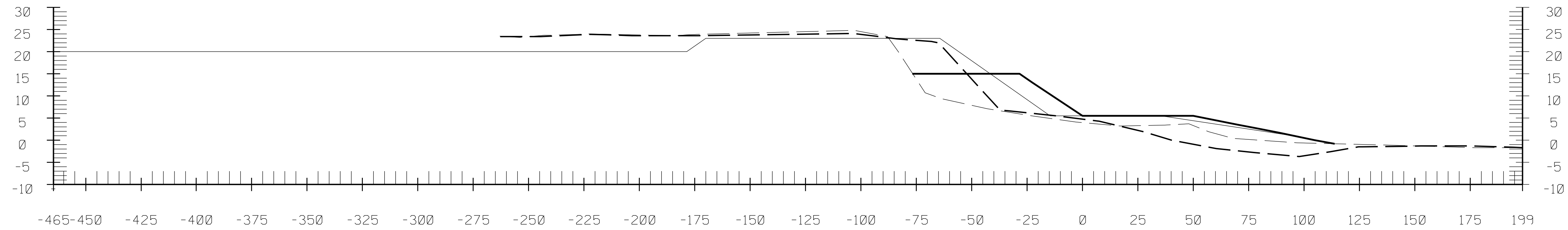
Sheet Reference Number:
F-311



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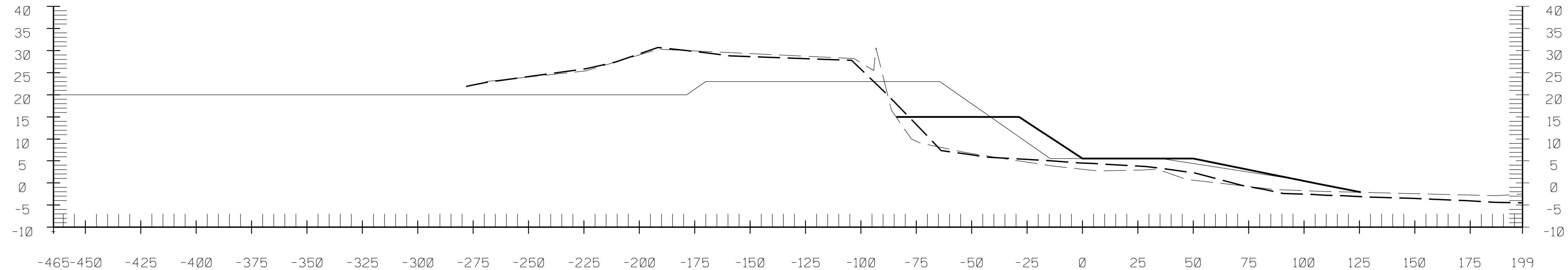
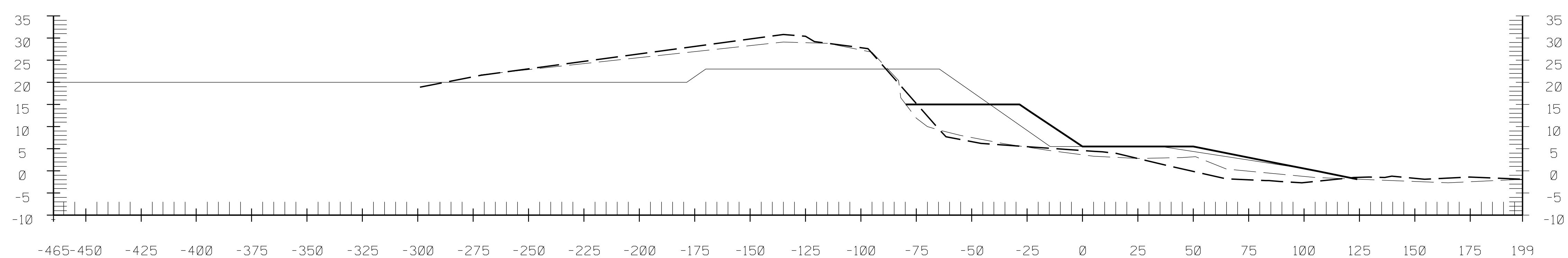


R3-20

R3-19



R3-18

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
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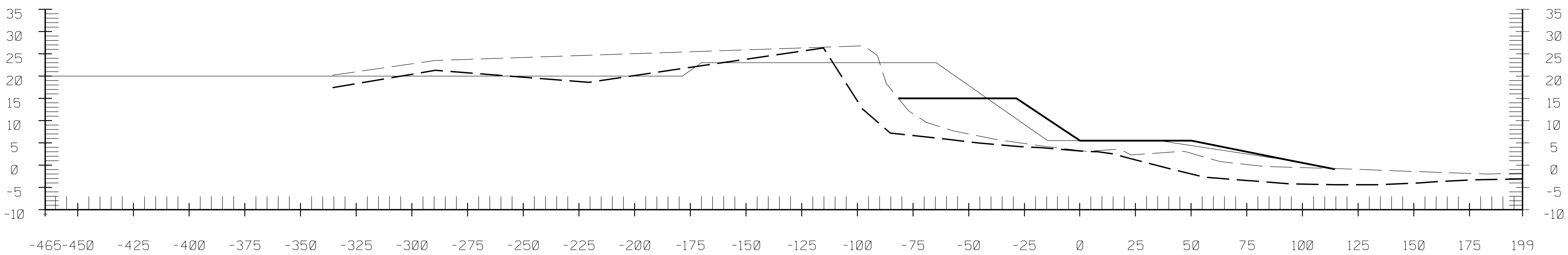
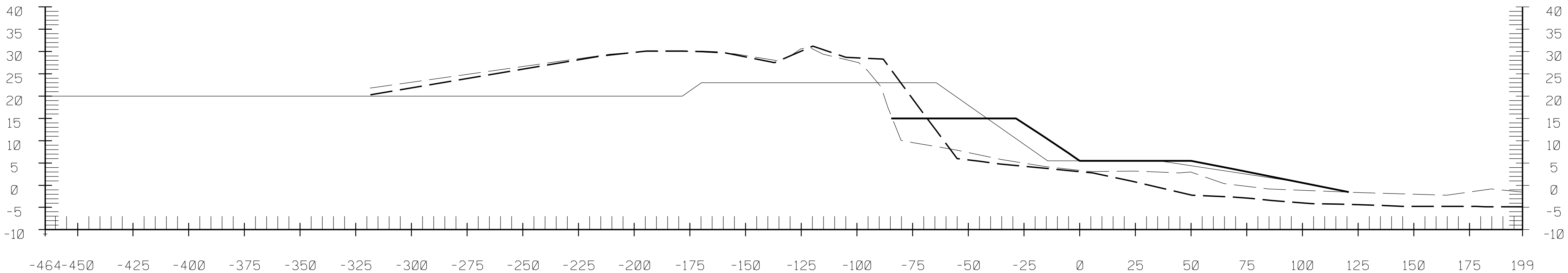
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTION
- -

Sheet Reference Number:
F-312



R3-23



R3-22

US Army Corps of Engineers
Mobile District

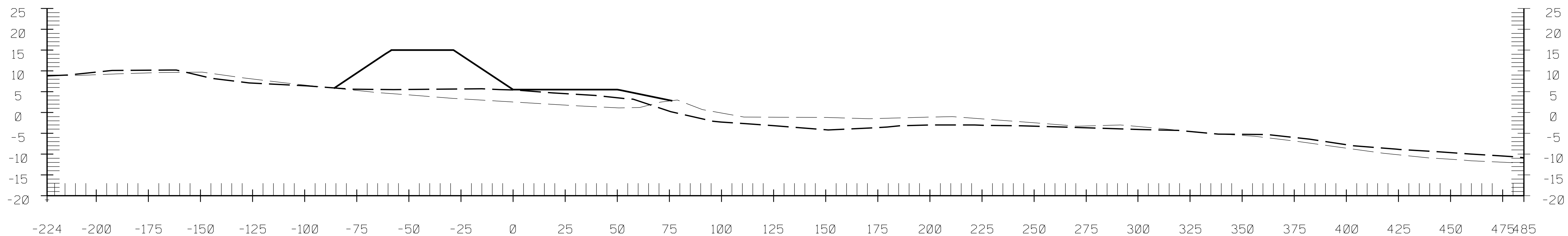
Symbol	Description	Date	Approved

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
Solicitation Number: -

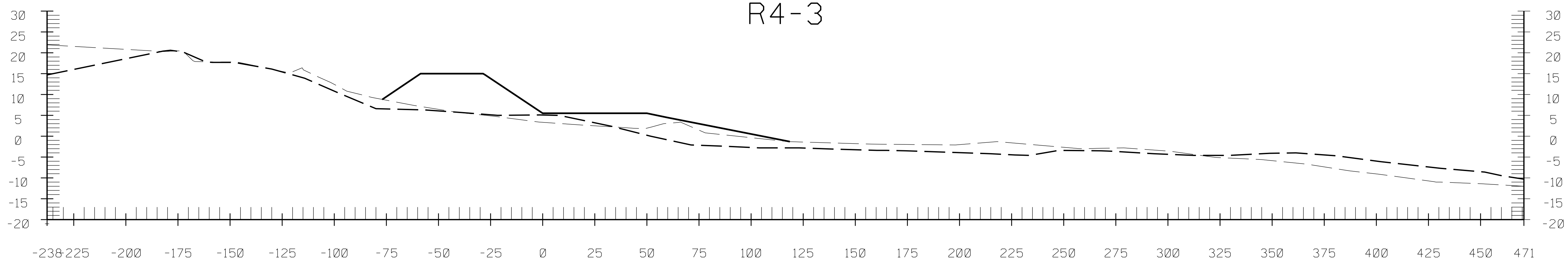
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
-
CROSS SECTIONS
- -

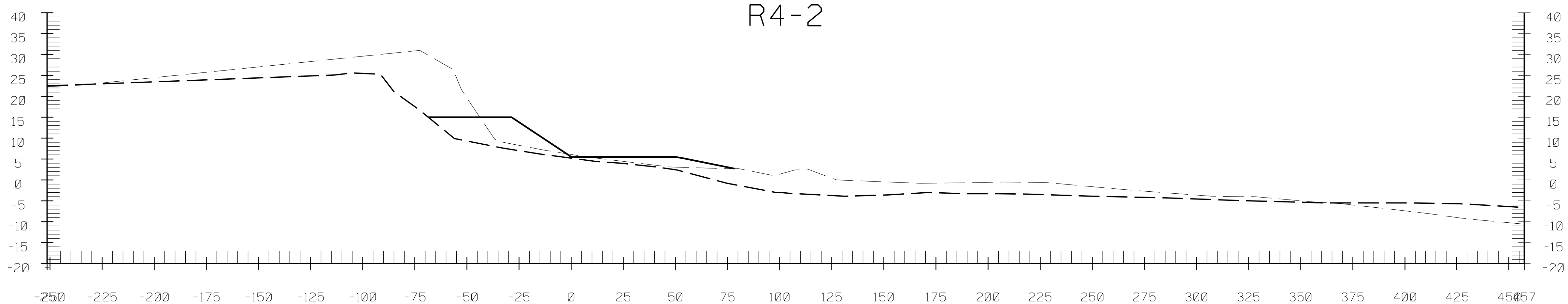
Sheet Reference Number:
F-313



R4-3



R4-2



R4-1

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

WALTON COUNTY, FLORIDA
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CROSS SECTIONS
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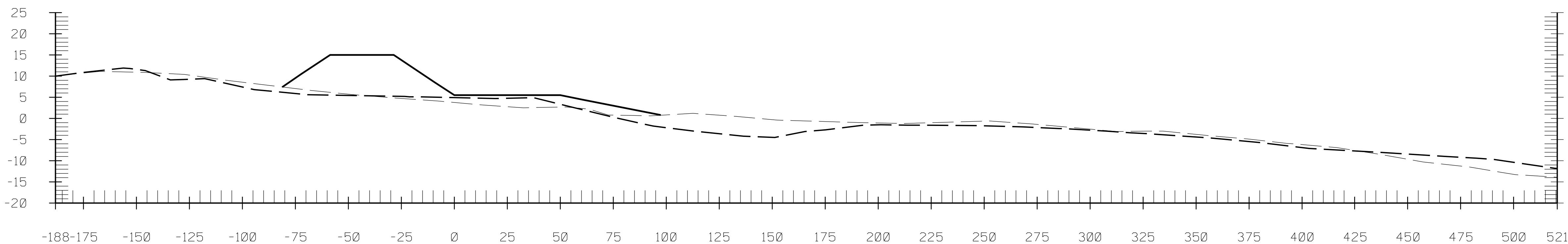

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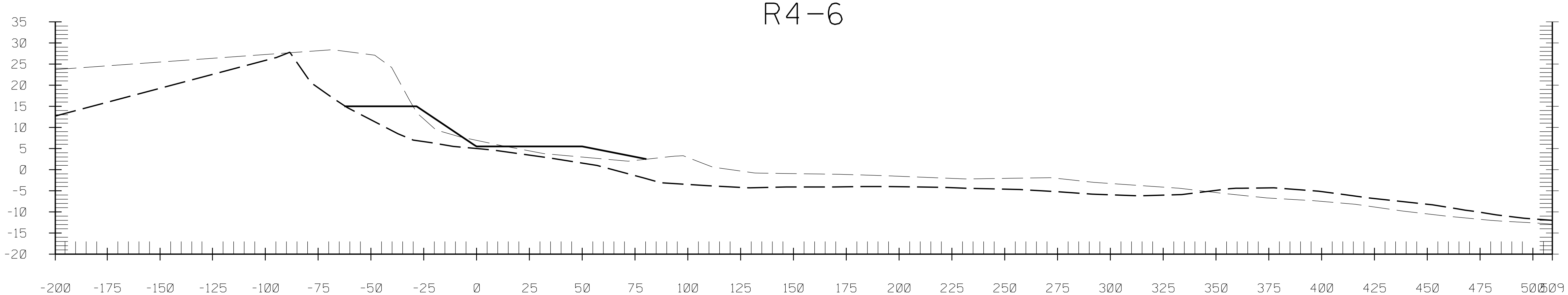

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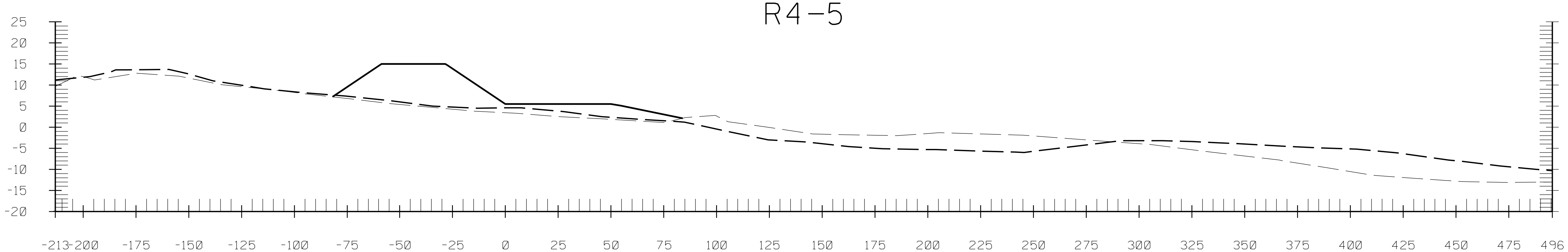

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US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

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Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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CROSS SECTIONS
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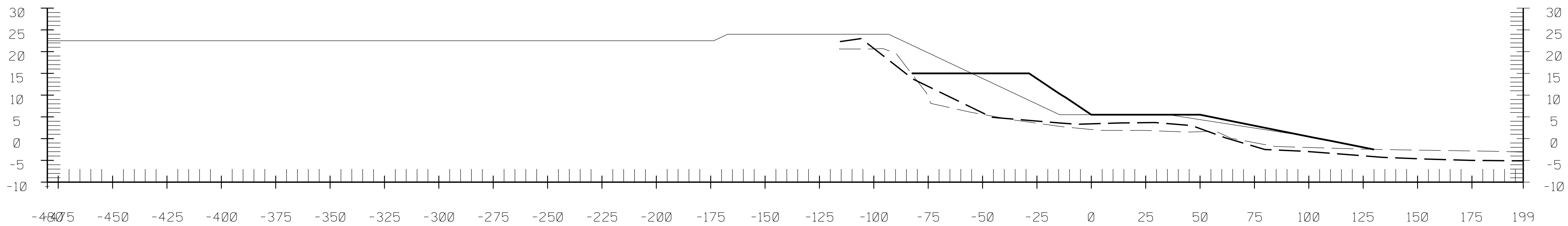

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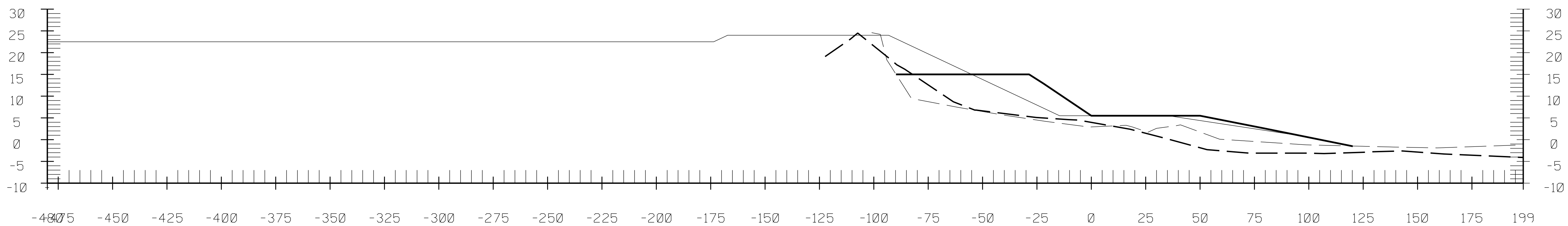

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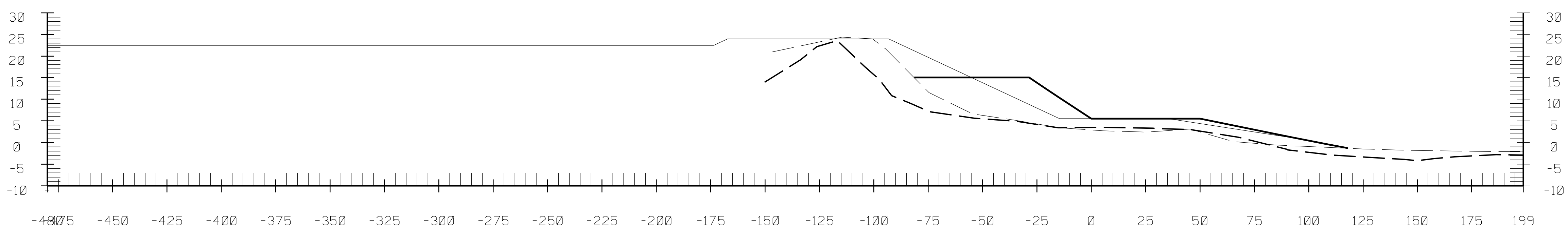

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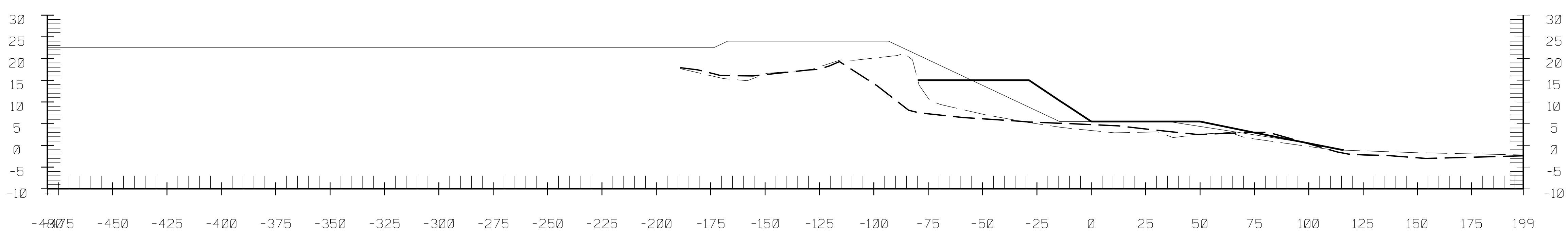

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US Army Corps of Engineers
Mobile District

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U.S. ARMY ENGINEER DISTRICT
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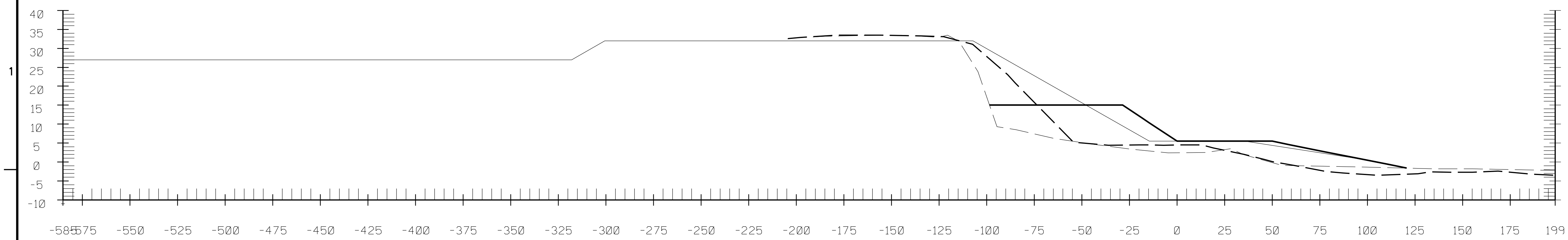

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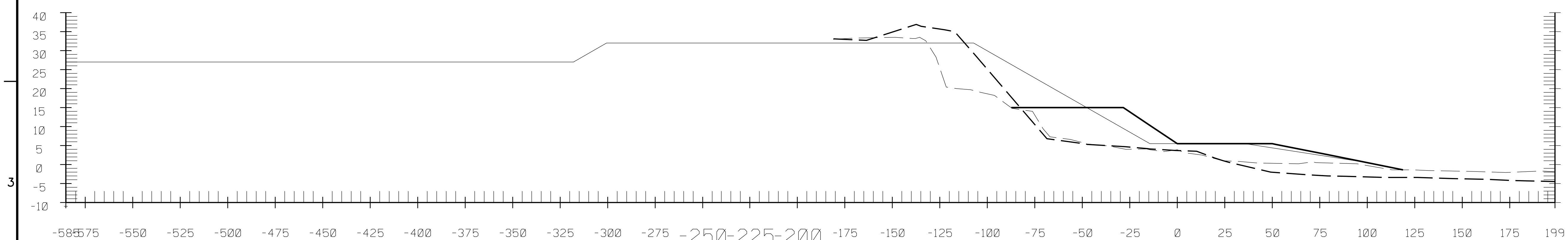

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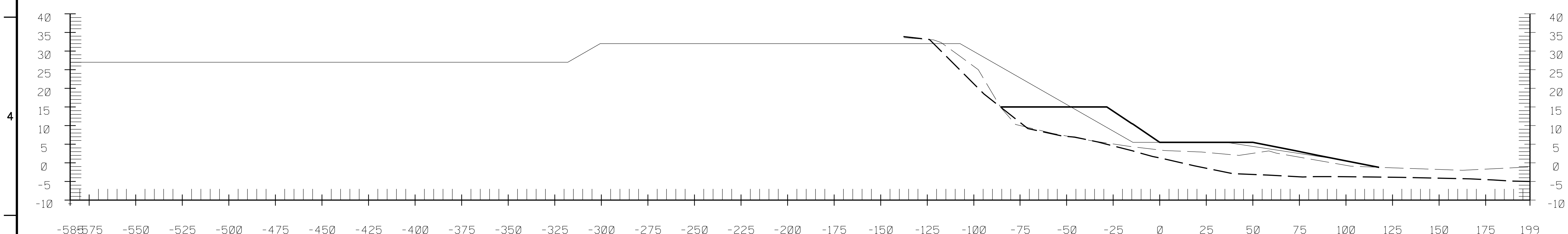

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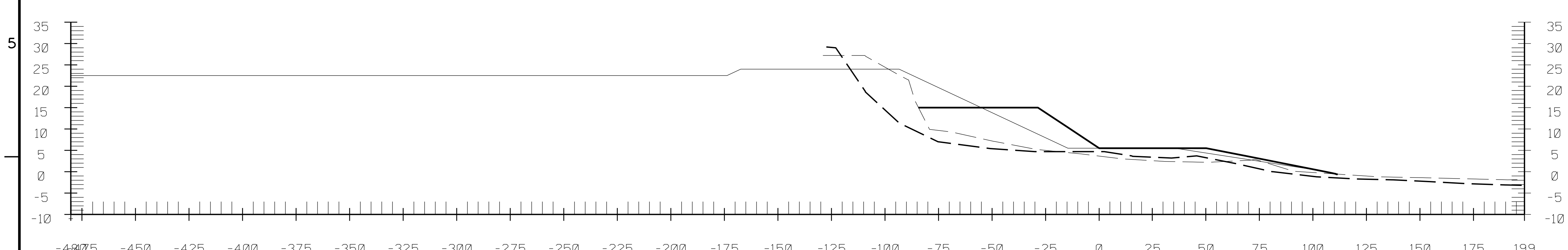

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US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

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File No. -
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Solicitation Number: -

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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WALTON COUNTY, FLORIDA
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CROSS SECTIONS
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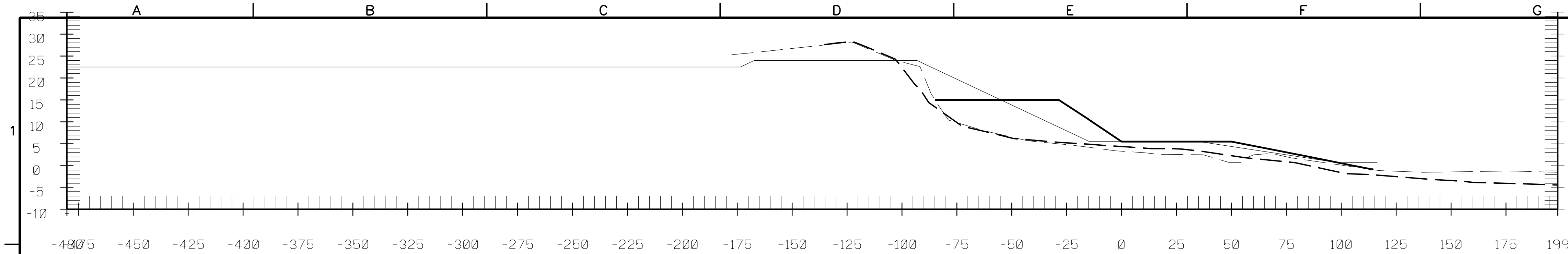

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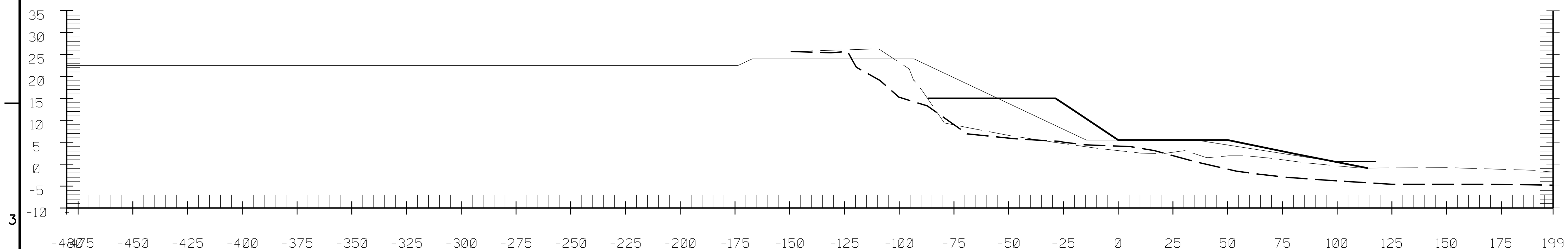

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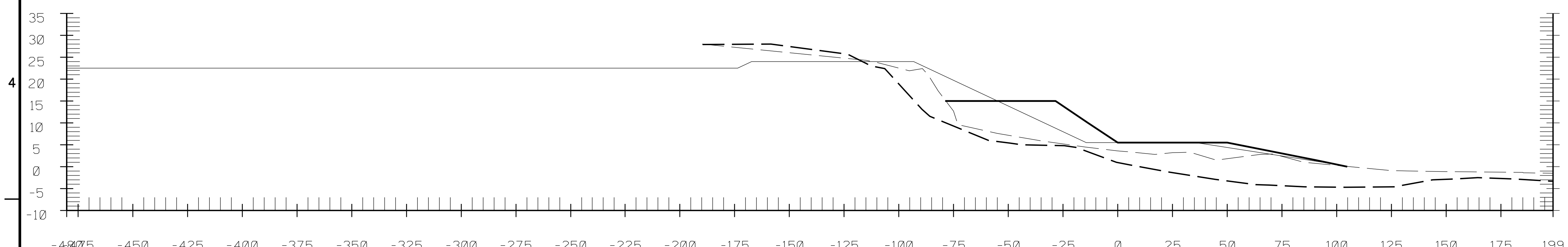

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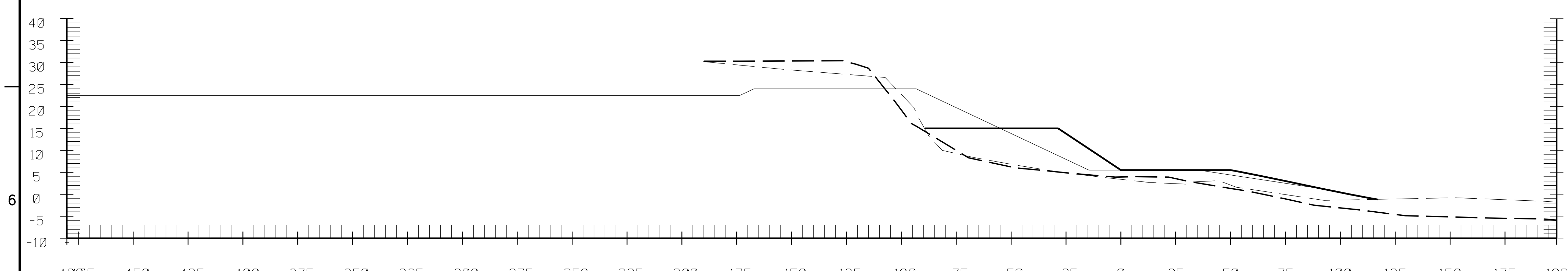

R5-9

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

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Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date: -
File No. -
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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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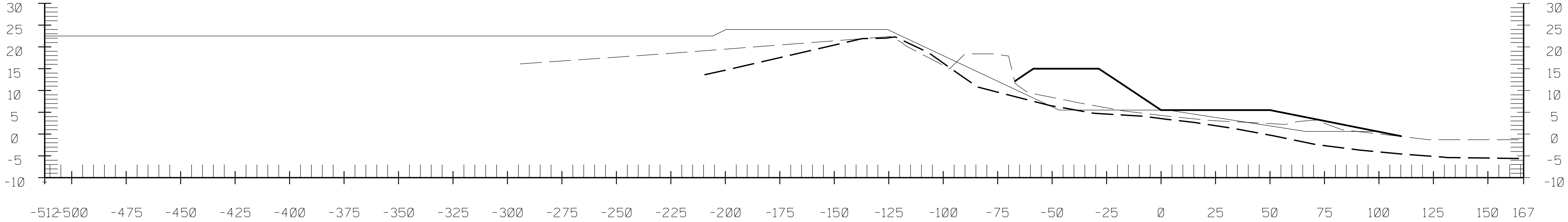

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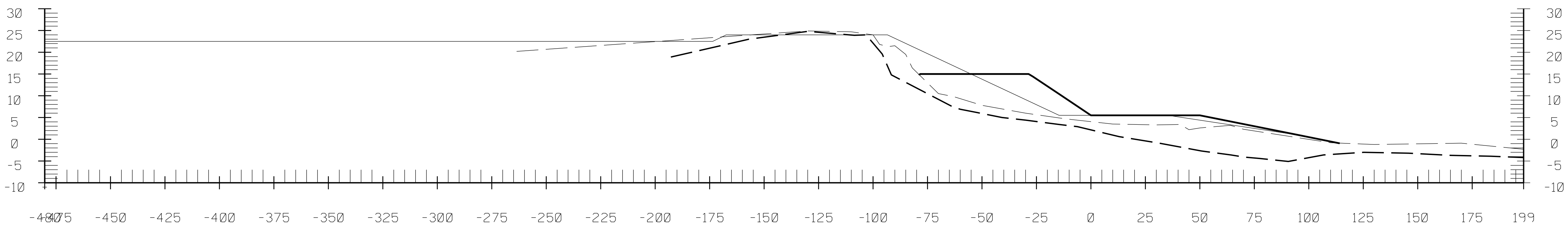

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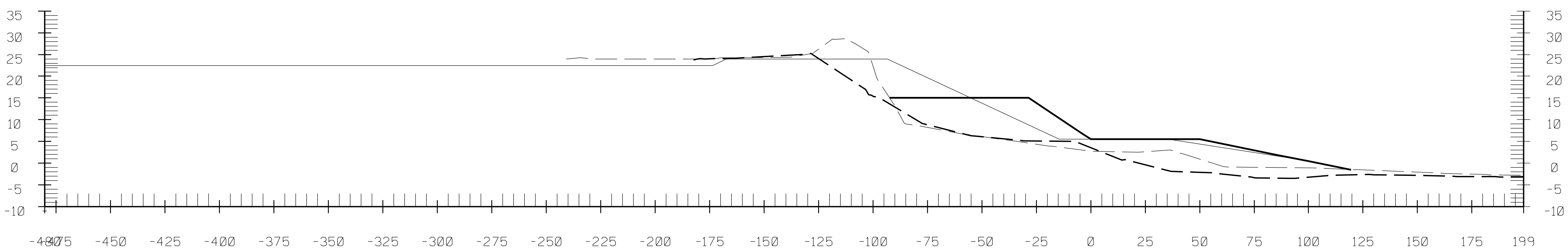

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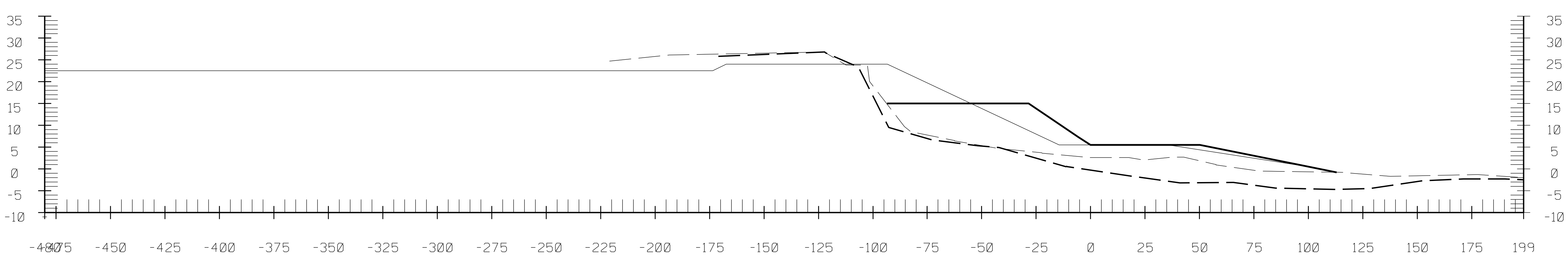

R5-13

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

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Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_lp_out.dgn
Solicitation Number: -

U.S. ARMY ENGINEER DISTRICT
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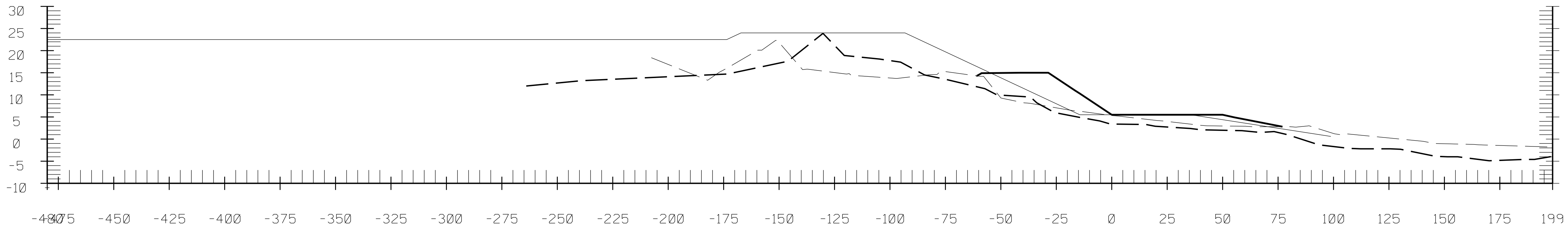
CROSS SECTIONS
-

Sheet Reference Number: F-319



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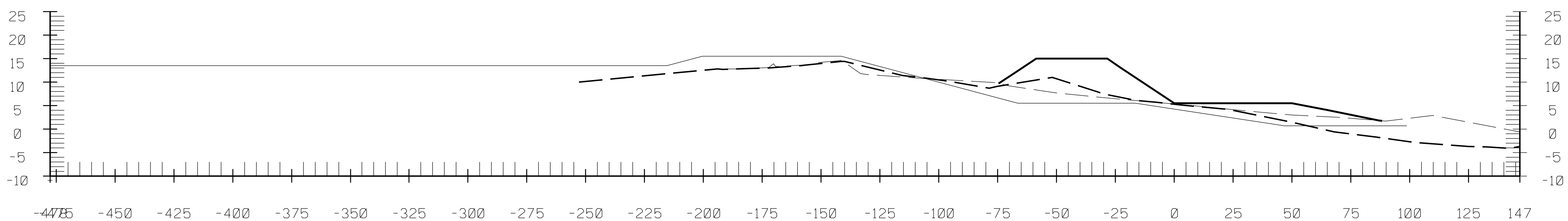

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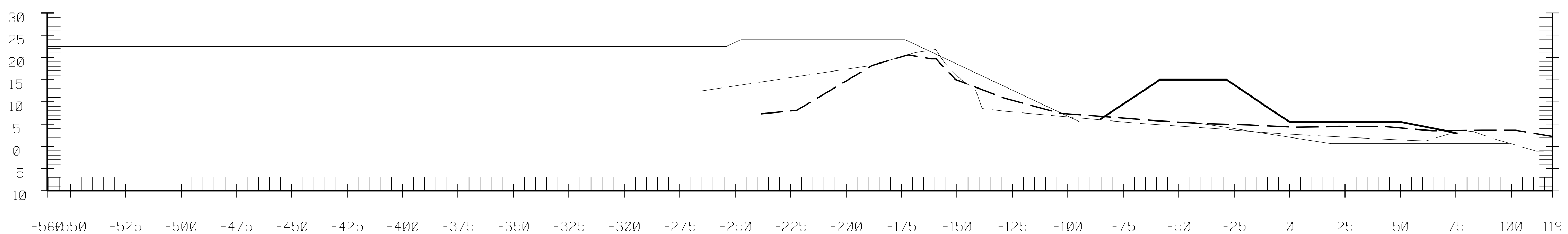

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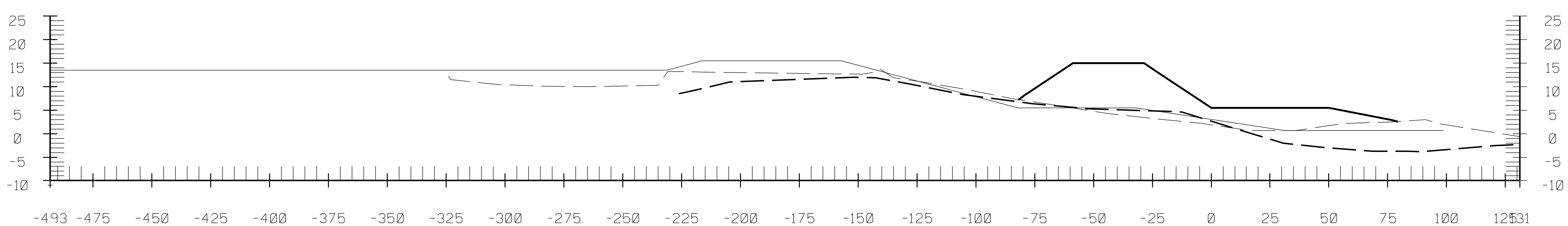

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US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MOBILE, ALABAMA

Designed By: M. MCKOWN
Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN

Date: -
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I.S.O. Sheet File Name: 22x34b_ip_out.dgn
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Sheet Reference Number:
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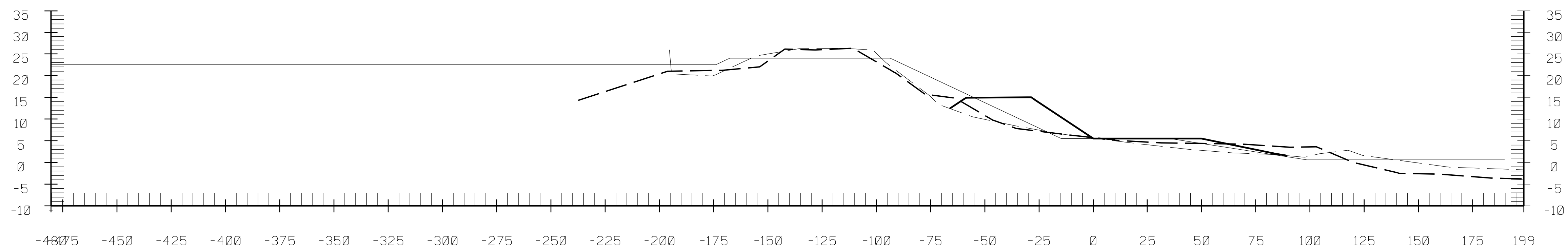

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US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

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Drawn By: S. TURNER
Checked By: M. MCKOWN
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U.S. ARMY ENGINEER DISTRICT
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CROSS SECTIONS
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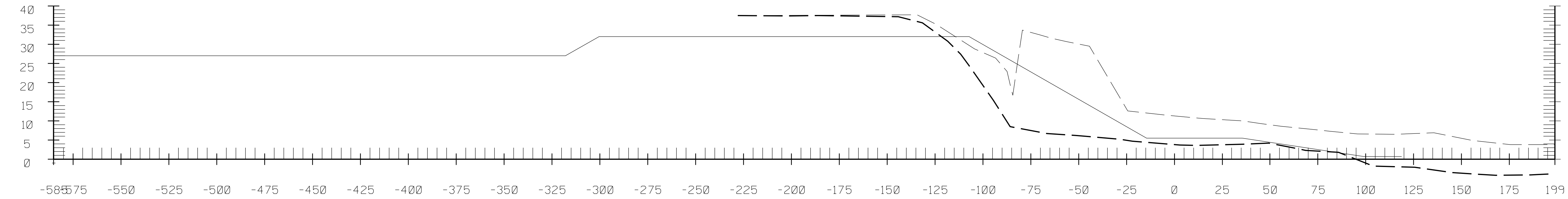

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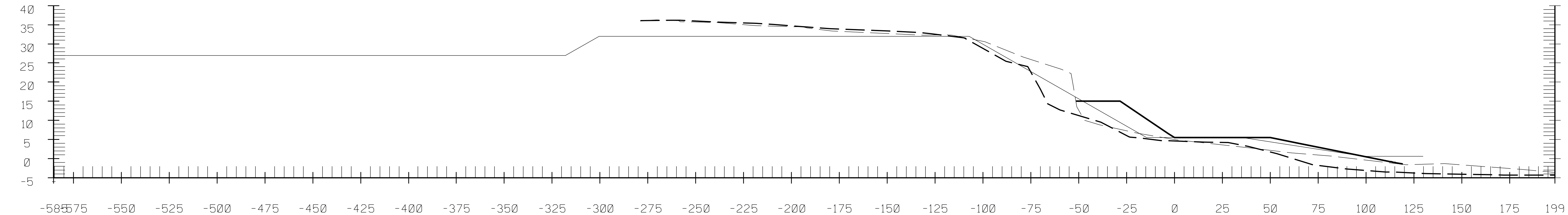

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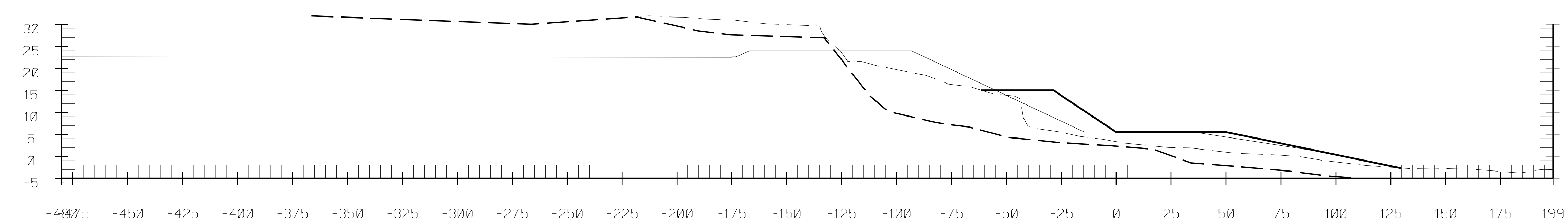

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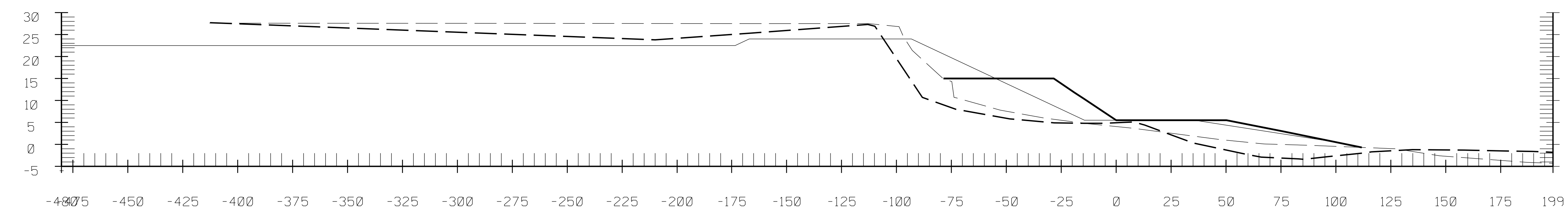

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US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

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Checked By: M. MCKOWN
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U.S. ARMY ENGINEER DISTRICT
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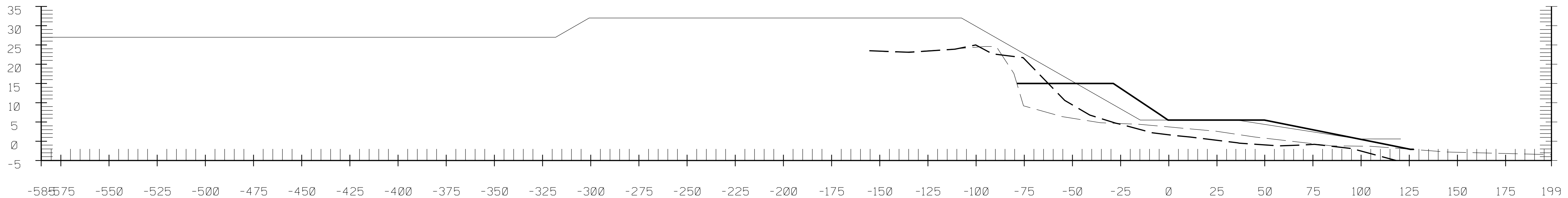

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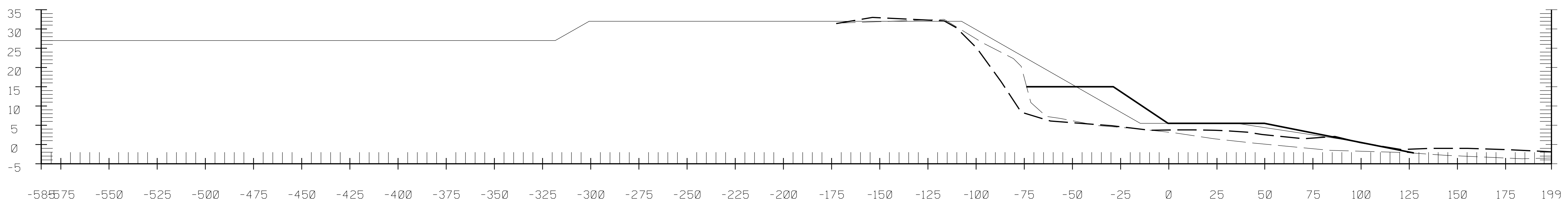

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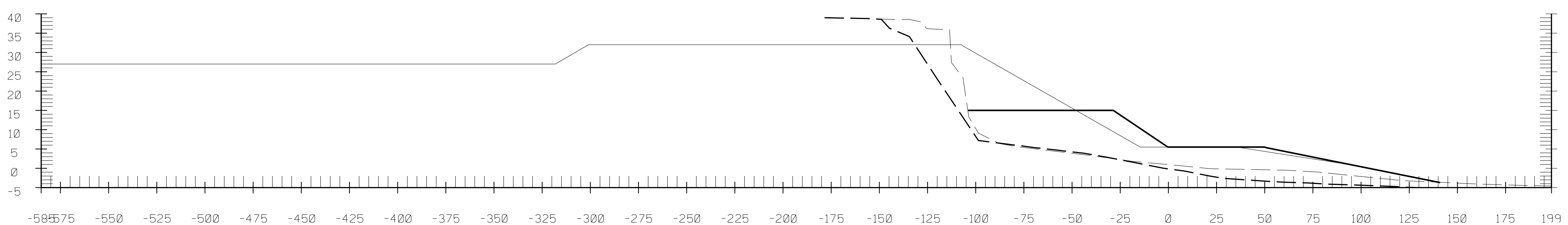

R5-34

US Army Corps of Engineers
Mobile District

Symbol	Description	Date	Approved

Description

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Checked By: M. MCKOWN
Reviewed By: E. HERMAN

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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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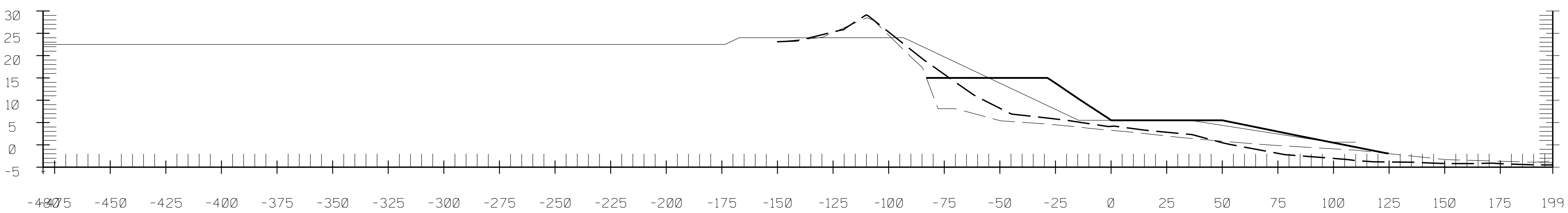

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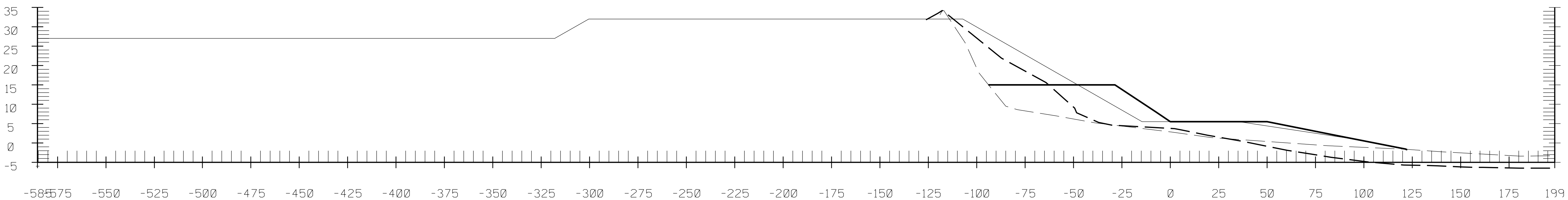

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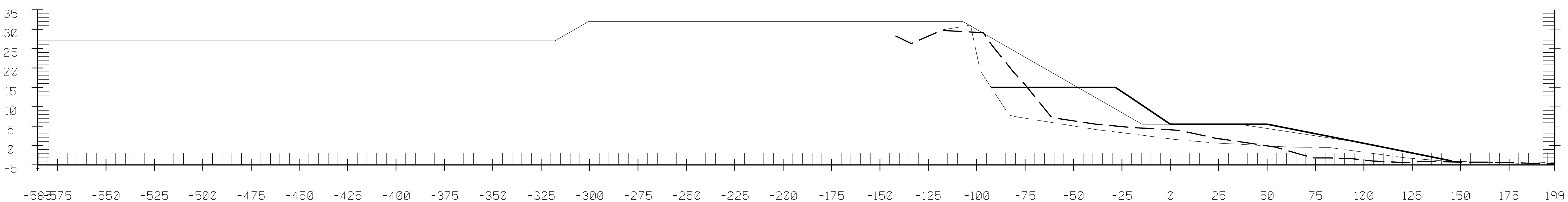

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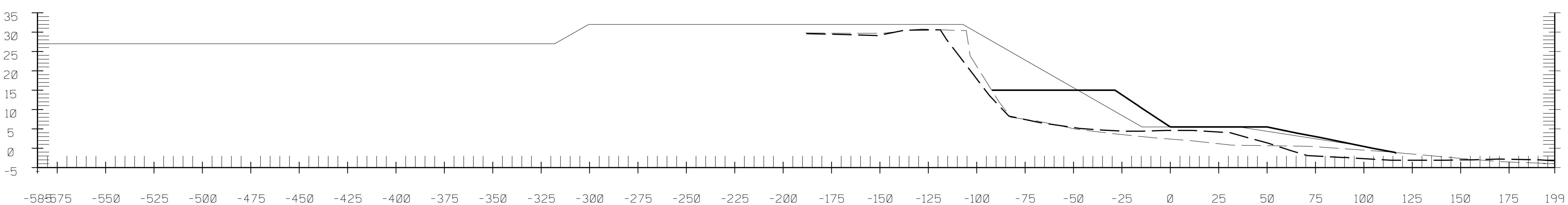

R5-37

US Army Corps of Engineers
Mobile District

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Drawn By: S. TURNER
Checked By: M. MCKOWN
Reviewed By: E. HERMAN
Date: -
File No. -
I.S.O. Sheet File Name: 22x34b_ip_out.dgn
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U.S. ARMY ENGINEER DISTRICT
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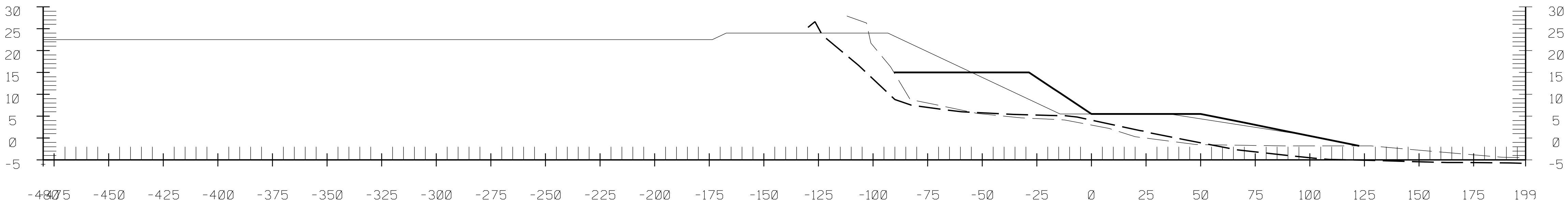

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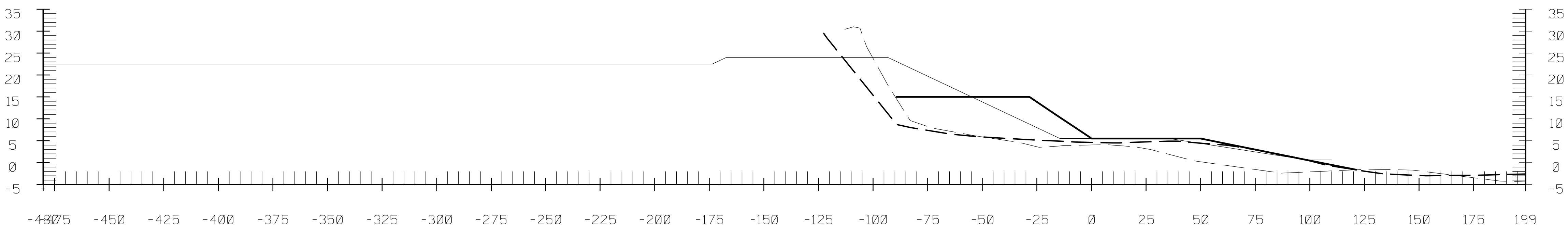

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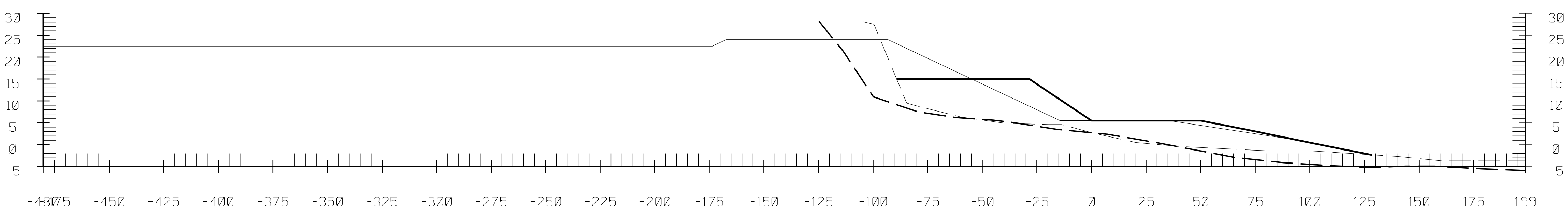

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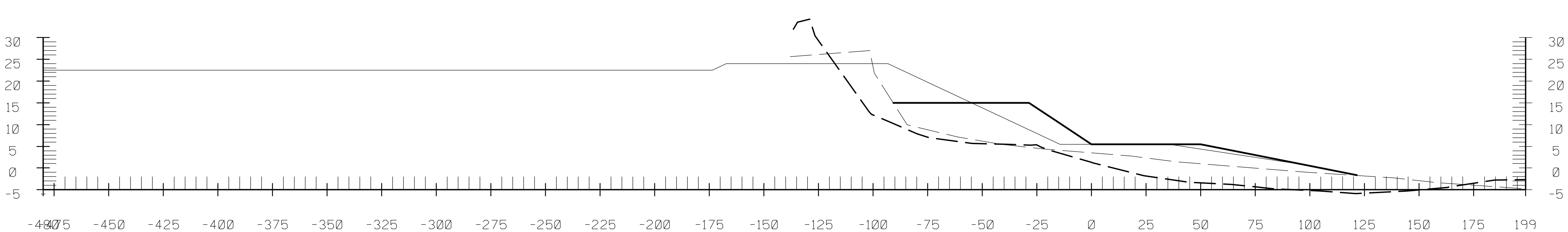

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US Army Corps of Engineers
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U.S. ARMY ENGINEER DISTRICT
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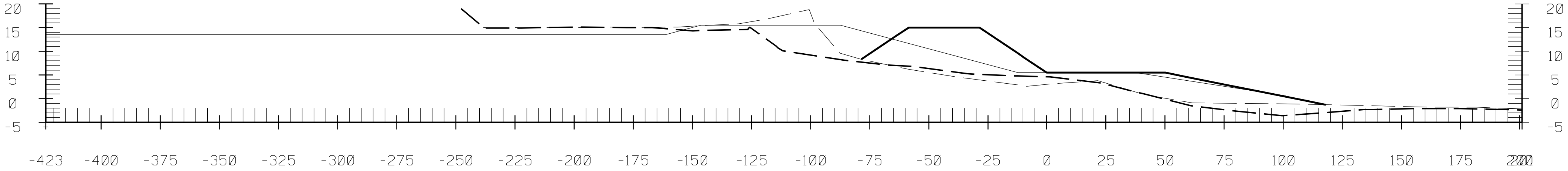

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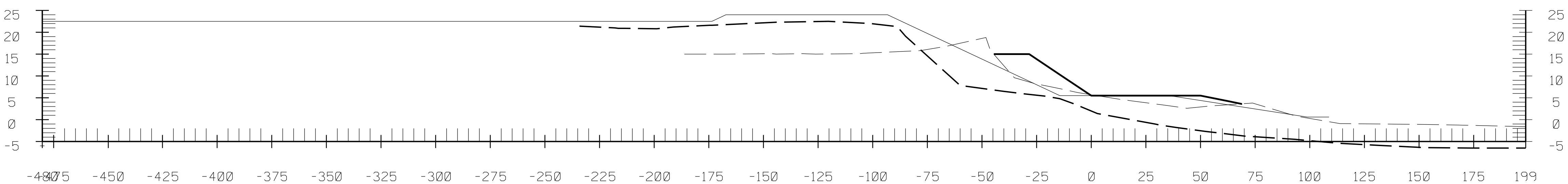

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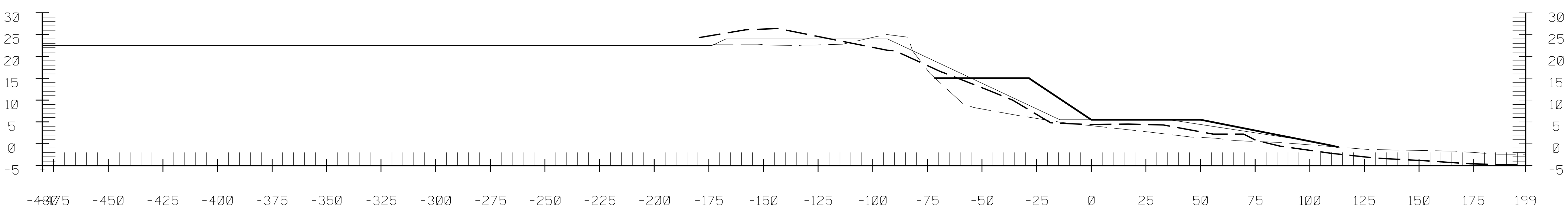

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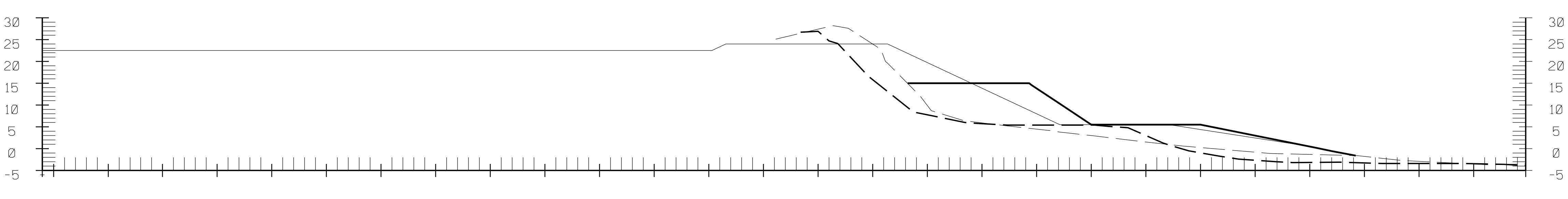

R5-45

US Army Corps of Engineers
Mobile District

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U.S. ARMY ENGINEER DISTRICT
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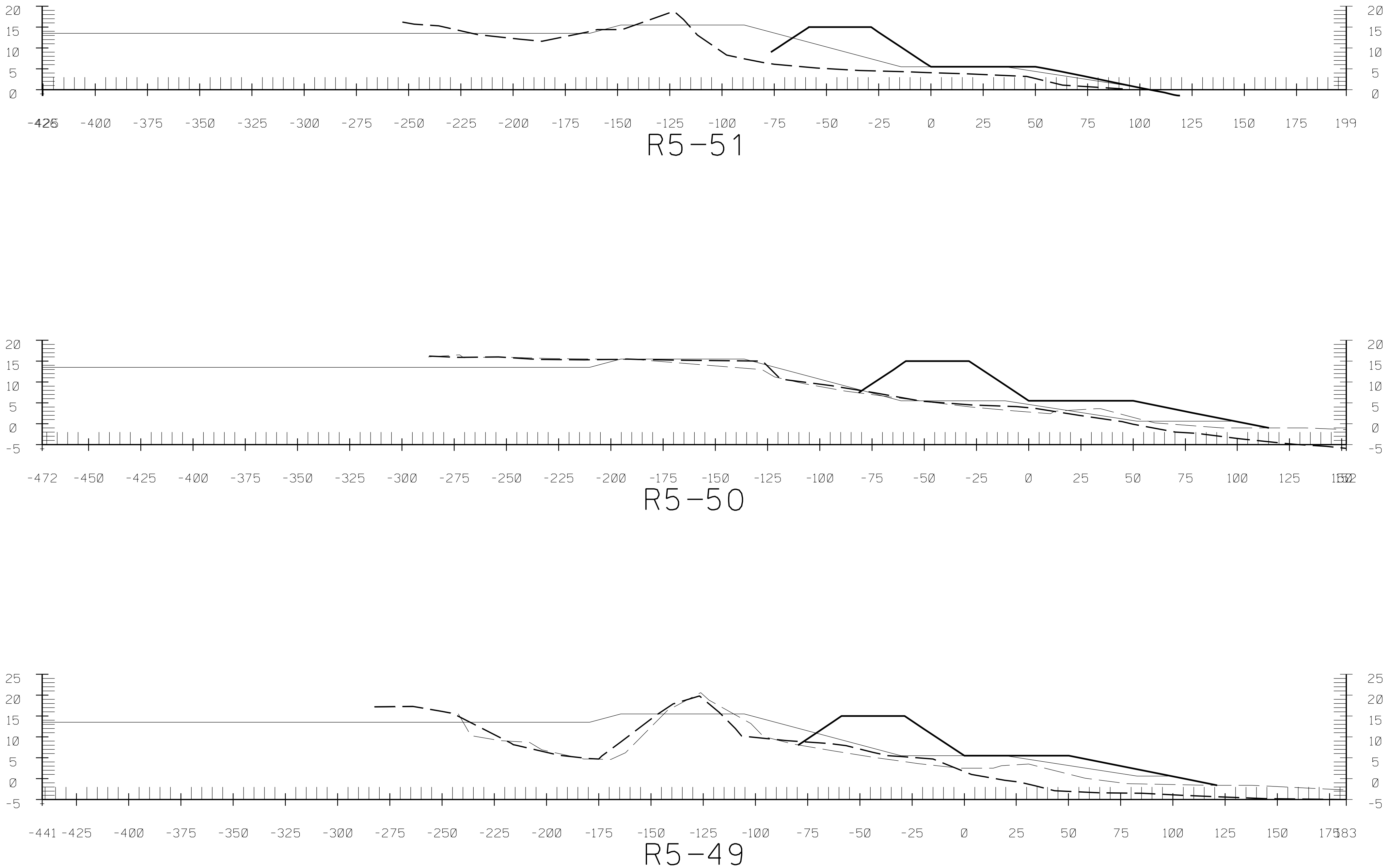

US Army Corps of Engineers
Mobile District

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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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CROSS SECTIONS
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Sheet Reference Number:
F-327

ATTACHMENT II

WALTON COUNTY SAND SOURCE INVESTIGATION GEOPHYSICAL AND GEOTECHNICAL DATA ANALYSIS

(Digital data only – CD attached at end of report)

ATTACHMENT III

BEACH MANAGEMENT FEASIBILITY STUDY FOR WALTON COUNTY AND DESTIN FLORIDA, TAYLOR ENGINEERING, INC. APRIL 2003

(Digital data only – CD attached at end of report)

APPENDIX A
SECTION 3

COST ENGINEERING

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION

GENERAL INVESTIGATIONS STUDY
FINAL REPORT

APPENDIX A - ENGINEERING DESIGN
SECTION 3 – COST ENGINEERING

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LIST OF ATTACHMENTS

ATTACHMENT I

COST CERTIFICATION

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For

Hurricane and Storm Damage Reduction –
Walton County, Florida

The Hurricane and Storm Damage Reduction – Walton County project, as presented by Mobile District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of October 24, 2012, the Cost MCX certifies the estimated total project cost of:

NED:
FY 2014 Price Level: $148,362,000
Fully Funded Amount: $209,767,000

LPP:
FY 2014 Price Level: $170,197,000
Fully Funded Amount: $239,469,000

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.

SKARBEK.JOHN.P.1229040665
Digitally signed by SKARBEK.JOHN.P.1229040665
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=SKARBEK.JOHN.P.1229040665
Date: 2012.10.24 12:36:49 -07'00'

John P. Skarbek
Chief, Cost Engineering
Walla Walla District

US Army Corps of Engineers®

ATTACHMENT II

TOTAL PROJECT COST SUMMARY

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

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL

DISTRICT: SAM Mobile PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

This Estimate reflects the scope and schedule per PDT
GI (Feasibility Study)

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13								
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-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	NED INITIAL + RENOURISHMENTS													
17	DREDGING	$100,086	$26,684	27%	$126,770	3.5%	$103,549	$27,607	$131,156			$146,296	$40,389	$186,685
17	BEACH WORK	$4,194	$839	20%	$5,033	3.5%	$4,339	$868	$5,207			$4,392	$878	$5,270
17	PLANTING	$2,875	$575	20%	$3,450	3.5%	$2,974	$595	$3,569			$3,010	$602	$3,612
17	ENVIRONMENTAL	$450	$120	27%	$570	3.5%	$466	$124	$590			$658	$182	$840
			-			-								
	CONSTRUCTION ESTIMATE TOTALS:	$107,605	$28,217		$135,822	3.5%	$111,328	$29,194	$140,522			$154,355	$42,051	$196,407
01	LANDS AND DAMAGES	$589	$147	25%	$736	3.5%	$609	$152	$762			$609	$152	$762
30	PLANNING, ENGINEERING & DESIGN	$3,224	$845	26%	$4,069	4.4%	$3,365	$882	$4,247			$5,868	$1,633	$7,500
31	CONSTRUCTION MANAGEMENT	$2,149	$563	26%	$2,712	4.4%	$2,243	$588	$2,831			$3,989	$1,109	$5,099
	PROJECT COST TOTALS:	$113,567	$29,773	26%	$143,340		$117,545	$30,816	**$148,362**			$164,822	$44,945	$209,767

George L. Brown
George L. Brown, COST ENGINEERING, SAM
mandatory

David Newell
David Newell, PROJECT MANAGER SAM
mandatory

James R. Mullens
James R. Mullens, REAL ESTATE,Chief of PM&C, S.
mandatory

*ESTIMATED FEDERAL COST: **30.0%** **$62,930**
*ESTIMATED NON-FEDERAL COST: **70.0%** **$146,837**

ESTIMATED TOTAL PROJECT COST: **$209,767**

NOTES:
***Subject to Cost Share Apportionment**
Based on Economic Analysis.

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL
This Estimate reflects the scope and schedule per PDT
GI (Feasibility Study)

DISTRICT: SAM Mobile PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12				Program Year (Budget EC): 2014								
		Effective Price Level: 1-Oct-12				Effective Price Level Date: 1 OCT 13								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	NED INITIAL BEACH NOURISHMENT													
17	DREDGING	$33,422	$6,684	20%	$40,106	3.5%	$34,579	$6,916	$41,494	2014Q4	1.2%	$34,996	$6,999	$41,995
17	BEACH WORK	$4,194	$839	20%	$5,033	3.5%	$4,339	$868	$5,207	2014Q4	1.2%	$4,392	$878	$5,270
17	PLANTING	$2,875	$575	20%	$3,450	3.5%	$2,974	$595	$3,569	2014Q4	1.2%	$3,010	$602	$3,612
17	ENVIRONMENTAL	$150	$30	20%	$180	3.5%	$155	$31	$186	2014Q4	1.2%	$157	$31	$188
	CONSTRUCTION ESTIMATE TOTALS:	$40,641	$8,128	20%	**$48,769**		$42,047	$8,409	$50,457			$42,555	$8,511	$51,066
01	LANDS AND DAMAGES	$589	$147	25%	$736	3.5%	$609	$152	$762	2014Q1		$609	$152	$762
	Easement Acquisition ($518) & PPA ($25k)													
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$85	$17	20%	$102	4.4%	$89	$18	$106	2014Q1		$89	$18	$106
0.09%	Planning & Environmental Compliance	$37	$7	20%	$44	4.4%	$39	$8	$46	2014Q1		$39	$8	$46
1.89%	Engineering & Design	$768	$154	20%	$922	4.4%	$802	$160	$962	2014Q1		$802	$160	$962
0.09%	Engineering Tech Review ITR & VE	$37	$7	20%	$44	4.4%	$39	$8	$46	2014Q1		$39	$8	$46
0.24%	Real Estate &Contracting	$98	$20	20%	$118	4.4%	$102	$20	$123	2014Q1		$102	$20	$123
0.21%	Engineering During Construction	$85	$17	20%	$102	4.4%	$89	$18	$106	2014Q4	2.8%	$91	$18	$109
0.18%	Planning During Construction	$73	$15	20%	$88	4.4%	$76	$15	$91	2014Q4	2.8%	$78	$16	$94
0.09%	Project Operations	$37	$7	20%	$44	4.4%	$39	$8	$46	2014Q1		$39	$8	$46
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$569	$114	20%	$683	4.4%	$594	$119	$713	2014Q4	2.8%	$611	$122	$733
0.40%	Project Operation:	$163	$33	20%	$196	4.4%	$170	$34	$204	2014Q4	2.8%	$175	$35	$210
0.20%	Project Management	$81	$16	20%	$97	4.4%	$85	$17	$101	2014Q4	2.8%	$87	$17	$104
	CONTRACT COST TOTALS:	$43,263	$8,682		**$51,945**		$44,778	$8,986	$53,765			$45,315	$9,093	**$54,408**

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

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

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL
This Estimate reflects the scope and schedule in report;
GI (Feasibility Study)

DISTRICT: SAM Mobile PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13								
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*
	BEACH RENOURISHMENT 2024													
17	BEACH REPLENISHMENT	$16,666	$5,000	30%	$21,666	3.5%	$17,243	$5,173	$22,416	2024Q4	21.1%	$20,875	$6,262	$27,137
17	ENVIRONMENTAL	$75	$23	30%	$98	3.5%	$78	$23	$101	2024Q4	21.1%	$94	$28	$122
	CONSTRUCTION ESTIMATE TOTALS:	$16,741	$5,022	30%	**$21,763**		$17,320	$5,196	$22,516			$20,969	$6,291	$27,259
01	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$35	$11	30%	$46	4.4%	$37	$11	$47	2024Q1	41.3%	$52	$15	$67
0.09%	Planning & Environmental Compliance	$15	$5	30%	$20	4.4%	$16	$5	$20	2024Q1	41.3%	$22	$7	$29
1.89%	Engineering & Design	$316	$95	30%	$411	4.4%	$330	$99	$429	2024Q1	41.3%	$466	$140	$606
0.09%	Engineering Tech Review ITR & VE	$15	$5	30%	$20	4.4%	$16	$5	$20	2024Q1	41.3%	$22	$7	$29
0.24%	Contracting & Reprographics	$40	$12	30%	$52	4.4%	$42	$13	$54	2024Q1	41.3%	$59	$18	$77
0.21%	Engineering During Construction	$35	$11	30%	$46	4.4%	$37	$11	$47	2024Q4	44.5%	$53	$16	$69
0.18%	Planning During Construction	$30	$9	30%	$39	4.4%	$31	$9	$41	2024Q4	44.5%	$45	$14	$59
0.09%	Project Operations	$15	$5	30%	$20	4.4%	$16	$5	$20	2024Q1	41.3%	$22	$7	$29
31	CONSTRUCTION MANAGEMENT													
1.4%	Construction Management	$234	$70	30%	$304	4.4%	$244	$73	$317	2024Q4	44.5%	$353	$106	$459
0.4%	Project Operation:	$67	$20	30%	$87	4.4%	$70	$21	$91	2024Q4	44.5%	$101	$30	$131
0.2%	Project Management	$33	$10	30%	$43	4.4%	$34	$10	$45	2024Q4	44.5%	$50	$15	$65
	CONTRACT COST TOTALS:	$17,576	$5,273		**$22,849**		$18,192	$5,458	$23,649			$22,213	$6,664	**$28,877**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL
This Estimate reflects the scope and schedule in report;
GI (Feasibility Study)

DISTRICT: SAM Mobile
PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			1-Sep-12	Program Year (Budget EC):			2014					
		Effective Price Level:			1-Oct-12	Effective Price Level Date:			1 OCT 13					
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*
	BEACH RENOURISHMENT 2034													
17	BEACH REPLENISHMENT	$16,666	$5,000	30%	$21,666	3.5%	$17,243	$5,173	$22,416	2034Q4	44.7%	$24,951	$7,485	$32,437
17	ENVIRONMENTAL	$75	$23	30%	$98	3.5%	$78	$23	$101	2034Q4	44.7%	$112	$34	$146
	CONSTRUCTION ESTIMATE TOTALS:	$16,741	$5,022	30%	**$21,763**		$17,320	$5,196	$22,516			$25,064	$7,519	$32,583
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.2%	Project Management	$35	$11	30%	$46	4.4%	$37	$11	$47	2034Q1	89.0%	$69	$21	$90
0.1%	Planning & Environmental Compliance	$15	$5	30%	$20	4.4%	$16	$5	$20	2034Q1	89.0%	$30	$9	$38
1.9%	Engineering & Design	$316	$95	30%	$411	4.4%	$330	$99	$429	2034Q1	89.0%	$623	$187	$810
0.1%	Engineering Tech Review ITR & VE	$15	$5	30%	$20	4.4%	$16	$5	$20	2034Q1	89.0%	$30	$9	$38
0.2%	Contracting & Reprographics	$40	$12	30%	$52	4.4%	$42	$13	$54	2034Q1	89.0%	$79	$24	$103
0.2%	Engineering During Construction	$35	$11	30%	$46	4.4%	$37	$11	$47	2034Q4	92.8%	$70	$21	$92
0.2%	Planning During Construction	$30	$9	30%	$39	4.4%	$31	$9	$41	2034Q4	92.8%	$60	$18	$78
0.1%	Project Operations	$15	$5	30%	$20	4.4%	$16	$5	$20	2034Q1	89.0%	$30	$9	$38
31	CONSTRUCTION MANAGEMENT													
1.4%	Construction Management	$234	$70	30%	$304	4.4%	$244	$73	$317	2034Q4	92.8%	$471	$141	$612
0.4%	Project Operation:	$67	$20	30%	$87	4.4%	$70	$21	$91	2034Q4	92.8%	$135	$40	$175
0.2%	Project Management	$33	$10	30%	$43	4.4%	$34	$10	$45	2034Q4	92.8%	$66	$20	$86
	CONTRACT COST TOTALS:	$17,576	$5,273		**$22,849**		$18,192	$5,458	$23,649			$26,727	$8,018	**$34,745**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL
This Estimate reflects the scope and schedule in report;
GI (Feasibility Study)

DISTRICT: SAM Mobile
POC: George L. Brown, COST ENGINEERING, SAM
PREPARED: 10/10/2012

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
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*
	BEACH RENOURISHMENT 2044													
17	BEACH REPLENISHMENT	$16,666	$5,000	30%	$21,666	3.5%	$17,243	$5,173	$22,416	2044Q4	73.0%	$29,824	$8,947	$38,772
17	ENVIRONMENTAL	$75	$23	30%	$98	3.5%	$78	$23	$101	2044Q4	73.0%	$134	$40	$174
	#N/A													
	#N/A													
	#N/A													
	CONSTRUCTION ESTIMATE TOTALS:	$16,741	$5,022	30%	**$21,763**		$17,320	$5,196	$22,516			$29,959	$8,988	$38,946
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.2%	Project Management	$35	$11	30%	$46	4.4%	$37	$11	$47	2044Q1	138.1%	$87	$26	$113
0.1%	Planning & Environmental Compliance	$15	$5	30%	$20	4.4%	$16	$5	$20	2044Q1	138.1%	$37	$11	$48
1.9%	Engineering & Design	$316	$95	30%	$411	4.4%	$330	$99	$429	2044Q1	138.1%	$785	$236	$1,021
0.1%	Engineering Tech Review ITR & VE	$15	$5	30%	$20	4.4%	$16	$5	$20	2044Q1	138.1%	$37	$11	$48
0.2%	Contracting & Reprographics	$40	$12	30%	$52	4.4%	$42	$13	$54	2044Q1	138.1%	$99	$30	$129
0.2%	Engineering During Construction	$35	$11	30%	$46	4.4%	$37	$11	$47	2044Q4	142.9%	$89	$27	$115
0.2%	Planning During Construction	$30	$9	30%	$39	4.4%	$31	$9	$41	2044Q4	142.9%	$76	$23	$99
0.1%	Project Operations	$15	$5	30%	$20	4.4%	$16	$5	$20	2044Q1	138.1%	$37	$11	$48
31	CONSTRUCTION MANAGEMENT													
1.4%	Construction Management	$234	$70	30%	$304	4.4%	$244	$73	$317	2044Q4	142.9%	$593	$178	$771
0.4%	Project Operation:	$67	$20	30%	$87	4.4%	$70	$21	$91	2044Q4	142.9%	$170	$51	$221
0.2%	Project Management	$33	$10	30%	$43	4.4%	$34	$10	$45	2044Q4	142.9%	$84	$25	$109
	CONTRACT COST TOTALS:	$17,576	$5,273		**$22,849**		$18,192	$5,458	$23,649			$32,054	$9,616	**$41,670**

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

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

PROJECT: Walton County Storm Damage Reduction Project- NED
LOCATION: Walton County, FL
This Estimate reflects the scope and schedule in report;
GI (Feasibility Study)

DISTRICT: SAM Mobile PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
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*
	BEACH RENOURISHMENT 2054													
17	BEACH REPLENISHMENT	$16,666	$5,000	30%	$21,666	3.5%	$17,243	$5,173	$22,416	2054Q4	106.7%	$35,649	$10,695	$46,344
17	ENVIRONMENTAL	$75	$23	30%	$98	3.5%	$78	$23	$101	2054Q4	106.7%	$160	$48	$209
	#N/A													
	#N/A													
	#N/A													
	CONSTRUCTION ESTIMATE TOTALS:	$16,741	$5,022	30%	**$21,763**		$17,320	$5,196	$22,516			$35,810	$10,743	$46,552
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.2%	Project Management	$35	$11	30%	$46	4.4%	$37	$11	$47	2054Q1	207.0%	$112	$34	$146
0.1%	Planning & Environmental Compliance	$15	$5	30%	$20	4.4%	$16	$5	$20	2054Q1	207.0%	$48	$14	$62
1.9%	Engineering & Design	$316	$95	30%	$411	4.4%	$330	$99	$429	2054Q1	207.0%	$1,013	$304	$1,316
0.1%	Engineering Tech Review ITR & VE	$15	$5	30%	$20	4.4%	$16	$5	$20	2054Q1	207.0%	$48	$14	$62
0.2%	Contracting & Reprographics	$40	$12	30%	$52	4.4%	$42	$13	$54	2054Q1	207.0%	$128	$38	$167
0.2%	Engineering During Construction	$35	$11	30%	$46	4.4%	$37	$11	$47	2054Q4	213.8%	$115	$34	$149
0.2%	Planning During Construction	$30	$9	30%	$39	4.4%	$31	$9	$41	2054Q4	213.8%	$98	$29	$128
0.1%	Project Operations	$15	$5	30%	$20	4.4%	$16	$5	$20	2054Q1	207.0%	$48	$14	$62
31	CONSTRUCTION MANAGEMENT													
1.4%	Construction Management	$234	$70	30%	$304	4.4%	$244	$73	$317	2054Q4	213.8%	$766	$230	$996
0.4%	Project Operation:	$67	$20	30%	$87	4.4%	$70	$21	$91	2054Q4	213.8%	$219	$66	$285
0.2%	Project Management	$33	$10	30%	$43	4.4%	$34	$10	$45	2054Q4	213.8%	$108	$32	$140
	CONTRACT COST TOTALS:	$17,576	$5,273		**$22,849**		$18,192	$5,458	$23,649			$38,513	$11,554	**$50,067**

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

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL

DISTRICT: SAM Mobile
POC: George L. Brown, COST ENGINEERING, SAM
PREPARED: 10/10/2012

This Estimate reflects the scope and schedule per PDT

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13								
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-11 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	LP INITIAL + 4 RENOURISHMENTS													
17	DREDGING	$113,938	$31,388	28%	$145,326	3.5%	$117,881	$32,474	$150,355			$165,747	$47,264	$213,011
17	BEACH WORK	$4,946	$1,039	21%	$5,985	3.5%	$5,117	$1,075	$6,192			$5,179	$1,088	$6,266
17	PLANTING	$3,325	$698	21%	$4,023	3.5%	$3,440	$722	$4,162			$3,482	$731	$4,213
17	ENVIRONMENTAL	$450	$125	28%	$575	3.5%	$466	$129	$594			$658	$188	$846
				-		-								
	CONSTRUCTION ESTIMATE TOTALS:	$122,659	$33,250		$155,909	3.5%	$126,903	$34,400	$161,304			$175,066	$49,271	$224,337
01	LANDS AND DAMAGES	$589	$147	25%	$736	3.5%	$609	$152	$762			$609	$152	$762
30	PLANNING, ENGINEERING & DESIGN	$3,680	$998	27%	$4,678	4.4%	$3,841	$1,041	$4,882			$6,649	$1,911	$8,560
31	CONSTRUCTION MANAGEMENT	$2,450	$664	27%	$3,114	4.4%	$2,557	$693	$3,250			$4,514	$1,297	$5,811
	PROJECT COST TOTALS:	$129,378	$35,059	27%	$164,437		$133,910	$36,287	$170,197			$186,837	$52,631	$239,469

George L. Brown
George L. Brown, COST ENGINEERING, SAM
mandatory

David W. Newell
David Newell, PROJECT MANAGER SAM
mandatory

James R. Mullens
James R. Mullens, REAL ESTATE,Chief of PM&C, SAI
mandatory

ESTIMATED FEDERAL COST:	26.0%	$62,262
ESTIMATED NON-FEDERAL COST:	74.0%	$177,207
ESTIMATED TOTAL PROJECT COST:		**$239,469**

O&M OUTSIDE OF TOTAL PROJECT COST:

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

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

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL
GI (Feasibility Study)
This Estimate reflects the scope and schedule per PDT

DISTRICT: SAM Mobile
PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared: 1-Sep-12				Program Year (Budget EC): 2014								
		Effective Price Level: 1-Oct-12				Effective Price Level Date: 1 OCT 13								
				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*
	LP INITIAL BEACH NOURISHMENT													
17	DREDGING	$39,326	$8,258	21%	$47,584	3.5%	$40,687	$8,544	$49,231	2014Q4	1.2%	$41,178	$8,647	$49,825
17	BEACH WORK	$4,946	$1,039	21%	$5,985	3.5%	$5,117	$1,075	$6,192	2014Q4	1.2%	$5,179	$1,088	$6,266
17	PLANTING	$3,325	$698	21%	$4,023	3.5%	$3,440	$722	$4,162	2014Q4	1.2%	$3,482	$731	$4,213
17	ENVIRONMENTAL	$150	$32	21%	$182	3.5%	$155	$33	$188	2014Q4	1.2%	$157	$33	$190
	CONSTRUCTION ESTIMATE TOTALS:	$47,747	$10,027	21%	**$57,774**		$49,399	$10,374	$59,773			$49,996	$10,499	$60,495
01	LANDS AND DAMAGES	$589	$147	25%	$736	3.5%	$609	$152	$762	2014Q1		$609	$152	$762
	Easement Acquisition ($518) & PPA ($25k)													
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$100	$21	21%	$121	4.4%	$104	$22	$126	2014Q1		$104	$22	$126
0.09%	Planning & Environmental Compliance	$43	$9	21%	$52	4.4%	$45	$9	$54	2014Q1		$45	$9	$54
1.89%	Engineering & Design	$902	$189	21%	$1,091	4.4%	$941	$198	$1,139	2014Q1		$941	$198	$1,139
0.09%	Engineering Tech Review ITR & VE	$43	$9	21%	$52	4.4%	$45	$9	$54	2014Q1		$45	$9	$54
0.24%	Contracting & Reprographics	$115	$24	21%	$139	4.4%	$120	$25	$145	2014Q1		$120	$25	$145
0.21%	Engineering During Construction	$100	$21	21%	$121	4.4%	$104	$22	$126	2014Q4	2.8%	$107	$23	$130
0.18%	Planning During Construction	$86	$18	21%	$104	4.4%	$90	$19	$109	2014Q4	2.8%	$92	$19	$112
0.09%	Project Operations	$43	$9	21%	$52	4.4%	$45	$9	$54	2014Q1		$45	$9	$54
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$668	$140	21%	$808	4.4%	$697	$146	$844	2014Q4	2.8%	$717	$151	$867
0.40%	Project Operation:	$191	$40	21%	$231	4.4%	$199	$42	$241	2014Q4	2.8%	$205	$43	$248
0.20%	Project Management	$95	$20	21%	$115	4.4%	$99	$21	$120	2014Q4	2.8%	$102	$21	$123
	CONTRACT COST TOTALS:	$50,722	$10,675		**$61,397**		$52,499	$11,049	$63,548			$53,129	$11,181	**$64,310**

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

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

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL
GI (Feasibility Study)
This Estimate reflects the scope and schedule per PDT

DISTRICT: SAM Mobile PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12				Program Year (Budget EC): 2014								
		Effective Price Level: 1-Oct-12				Effective Price Level Date: 1 OCT 13								
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*
	BEACH RENOURISHMENT 2024													
17	BEACH REPLENISHMENT	$18,653	$5,782	31%	$24,435	3.5%	$19,298	$5,983	$25,281	2024Q4	21.1%	$23,363	$7,243	$30,606
17	ENVIRONMENTAL	$75	$23	31%	$98	3.5%	$78	$24	$102	2024Q4	21.1%	$94	$29	$123
	CONSTRUCTION ESTIMATE TOTALS:	$18,728	$5,806	31%	**$24,534**		$19,376	$6,007	$25,383			$23,457	$7,272	$30,729
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$39	$12	31%	$51	4.4%	$41	$13	$53	2024Q1	41.3%	$57	$18	$75
0.09%	Planning & Environmental Compliance	$17	$5	31%	$22	4.4%	$18	$5	$23	2024Q1	41.3%	$25	$8	$33
1.89%	Engineering & Design	$354	$110	31%	$464	4.4%	$369	$115	$484	2024Q1	41.3%	$522	$162	$684
0.09%	Engineering Tech Review ITR & VE	$17	$5	31%	$22	4.4%	$18	$5	$23	2024Q1	41.3%	$25	$8	$33
0.24%	Contracting & Reprographics	$45	$14	31%	$59	4.4%	$47	$15	$62	2024Q1	41.3%	$66	$21	$87
0.21%	Engineering During Construction	$39	$12	31%	$51	4.4%	$41	$13	$53	2024Q4	44.5%	$59	$18	$77
0.18%	Planning During Construction	$34	$11	31%	$45	4.4%	$35	$11	$46	2024Q4	44.5%	$51	$16	$67
0.09%	Project Operations	$17	$5	31%	$22	4.4%	$18	$5	$23	2024Q1	41.3%	$25	$8	$33
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$262	$81	31%	$343	4.4%	$273	$85	$358	2024Q4	44.5%	$395	$123	$518
0.40%	Project Operation:	$75	$23	31%	$98	4.4%	$78	$24	$103	2024Q4	44.5%	$113	$35	$148
0.20%	Project Management	$37	$11	31%	$48	4.4%	$39	$12	$51	2024Q4	44.5%	$56	$17	$73
	CONTRACT COST TOTALS:	$19,664	$6,096		**$25,760**		$20,353	$6,309	$26,662			$24,853	$7,704	**$32,557**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL
GI (Feasibility Study)
This Estimate reflects the scope and schedule per PDT

DISTRICT: SAM Mobile
POC: George L. Brown, COST ENGINEERING, SAM
PREPARED: 10/10/2012

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			1-Sep-12	Program Year (Budget EC):			2014					
		Effective Price Level:			1-Oct-12	Effective Price Level Date:			1 OCT 13					
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*
	BEACH RENOURISHMENT 2034													
17	BEACH REPLENISHMENT	$18,653	$5,782	31%	$24,435	3.5%	$19,298	$5,983	$25,281	2034Q4	44.7%	$27,926	$8,657	$36,583
17	ENVIRONMENTAL	$75	$23	31%	$98	3.5%	$78	$24	$102	2034Q4	44.7%	$112	$35	$147
	CONSTRUCTION ESTIMATE TOTALS:	$18,728	$5,806	31%	**$24,534**		$19,376	$6,007	$25,383			$28,039	$8,692	$36,731
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$39	$12	31%	$51	4.4%	$41	$13	$53	2034Q1	89.0%	$77	$24	$101
0.09%	Planning & Environmental Compliance	$17	$5	31%	$22	4.4%	$18	$5	$23	2034Q1	89.0%	$34	$10	$44
1.89%	Engineering & Design	$354	$110	31%	$464	4.4%	$369	$115	$484	2034Q1	89.0%	$698	$216	$915
0.09%	Engineering Tech Review ITR & VE	$17	$5	31%	$22	4.4%	$18	$5	$23	2034Q1	89.0%	$34	$10	$44
0.24%	Contracting & Reprographics	$45	$14	31%	$59	4.4%	$47	$15	$62	2034Q1	89.0%	$89	$28	$116
0.21%	Engineering During Construction	$39	$12	31%	$51	4.4%	$41	$13	$53	2034Q4	92.8%	$78	$24	$103
0.18%	Planning During Construction	$34	$11	31%	$45	4.4%	$35	$11	$46	2034Q4	92.8%	$68	$21	$90
0.09%	Project Operations	$17	$5	31%	$22	4.4%	$18	$5	$23	2034Q1	89.0%	$34	$10	$44
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$262	$81	31%	$343	4.4%	$273	$85	$358	2034Q4	92.8%	$527	$163	$691
0.40%	Project Operation:	$75	$23	31%	$98	4.4%	$78	$24	$103	2034Q4	92.8%	$151	$47	$198
0.20%	Project Management	$37	$11	31%	$48	4.4%	$39	$12	$51	2034Q4	92.8%	$74	$23	$98
	CONTRACT COST TOTALS:	$19,664	$6,096		**$25,760**		$20,353	$6,309	$26,662			$29,903	$9,270	**$39,172**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL
GI (Feasibility Study)
This Estimate reflects the scope and schedule per PDT

DISTRICT: SAM Mobile
POC: George L. Brown, COST ENGINEERING, SAM
PREPARED: 10/10/2012

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2014 Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
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*
	BEACH RENOURISHMENT 2044													
17	BEACH REPLENISHMENT	$18,653	$5,782	31%	$24,435	3.5%	$19,298	$5,983	$25,281	2044Q4	73.0%	$33,380	$10,348	$43,728
17	ENVIRONMENTAL	$75	$23	31%	$98	3.5%	$78	$24	$102	2044Q4	73.0%	$134	$42	$176
	CONSTRUCTION ESTIMATE TOTALS:	$18,728	$5,806	31%	**$24,534**		$19,376	$6,007	$25,383			$33,514	$10,389	$43,904
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$39	$12	31%	$51	4.4%	$41	$13	$53	2044Q1	138.1%	$97	$30	$127
0.09%	Planning & Environmental Compliance	$17	$5	31%	$22	4.4%	$18	$5	$23	2044Q1	138.1%	$42	$13	$55
1.89%	Engineering & Design	$354	$110	31%	$464	4.4%	$369	$115	$484	2044Q1	138.1%	$880	$273	$1,152
0.09%	Engineering Tech Review ITR & VE	$17	$5	31%	$22	4.4%	$18	$5	$23	2044Q1	138.1%	$42	$13	$55
0.24%	Contracting & Reprographics	$45	$14	31%	$59	4.4%	$47	$15	$62	2044Q1	138.1%	$112	$35	$146
0.21%	Engineering During Construction	$39	$12	31%	$51	4.4%	$41	$13	$53	2044Q4	142.9%	$99	$31	$130
0.18%	Planning During Construction	$34	$11	31%	$45	4.4%	$35	$11	$46	2044Q4	142.9%	$86	$27	$113
0.09%	Project Operations	$17	$5	31%	$22	4.4%	$18	$5	$23	2044Q1	138.1%	$42	$13	$55
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$262	$81	31%	$343	4.4%	$273	$85	$358	2044Q4	142.9%	$664	$206	$870
0.40%	Project Operation:	$75	$23	31%	$98	4.4%	$78	$24	$103	2044Q4	142.9%	$190	$59	$249
0.20%	Project Management	$37	$11	31%	$48	4.4%	$39	$12	$51	2044Q4	142.9%	$94	$29	$123
	CONTRACT COST TOTALS:	$19,664	$6,096		**$25,760**		$20,353	$6,309	$26,662			$35,863	$11,117	**$46,980**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Walton County Storm Damage Reduction Project- LP
LOCATION: Walton County, FL
GI (Feasibility Study)
This Estimate reflects the scope and schedule per PDT

DISTRICT: SAM Mobile
PREPARED: 10/10/2012
POC: George L. Brown, COST ENGINEERING, SAM

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1-Sep-12				Program Year (Budget EC): 2014								
		Effective Price Level: 1-Oct-12				Effective Price Level Date: 1 OCT 13				FULLY FUNDED PROJECT ESTIMATE				
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*
	BEACH RENOURISHMENT 2054													
17	BEACH REPLENISHMENT	$18,653	$5,782	31%	$24,435	3.5%	$19,298	$5,983	$25,281	2054Q4	106.7%	$39,899	$12,369	$52,268
17	ENVIRONMENTAL	$75	$23	31%	$98	3.5%	$78	$24	$102	2054Q4	106.7%	$160	$50	$210
	CONSTRUCTION ESTIMATE TOTALS:	$18,728	$5,806	31%	**$24,534**		$19,376	$6,007	$25,383			$40,060	$12,419	$52,478
	LANDS AND DAMAGES			25%										
30	PLANNING, ENGINEERING & DESIGN													
0.21%	Project Management	$39	$12	31%	$51	4.4%	$41	$13	$53	2054Q1	207.0%	$125	$39	$164
0.09%	Planning & Environmental Compliance	$17	$5	31%	$22	4.4%	$18	$5	$23	2054Q1	207.0%	$54	$17	$71
1.89%	Engineering & Design	$354	$110	31%	$464	4.4%	$369	$115	$484	2054Q1	207.0%	$1,134	$352	$1,486
0.09%	Engineering Tech Review ITR & VE	$17	$5	31%	$22	4.4%	$18	$5	$23	2054Q1	207.0%	$54	$17	$71
0.24%	Contracting & Reprographics	$45	$14	31%	$59	4.4%	$47	$15	$62	2054Q1	207.0%	$144	$45	$189
0.21%	Engineering During Construction	$39	$12	31%	$51	4.4%	$41	$13	$53	2054Q4	213.8%	$128	$40	$167
0.18%	Planning During Construction	$34	$11	31%	$45	4.4%	$35	$11	$46	2054Q4	213.8%	$111	$35	$146
0.09%	Project Operations	$17	$5	31%	$22	4.4%	$18	$5	$23	2054Q1	207.0%	$54	$17	$71
31	CONSTRUCTION MANAGEMENT													
1.40%	Construction Management	$262	$81	31%	$343	4.4%	$273	$85	$358	2054Q4	213.8%	$858	$266	$1,124
0.40%	Project Operation:	$75	$23	31%	$98	4.4%	$78	$24	$103	2054Q4	213.8%	$246	$76	$322
0.20%	Project Management	$37	$11	31%	$48	4.4%	$39	$12	$51	2054Q4	213.8%	$121	$38	$159
	CONTRACT COST TOTALS:	$19,664	$6,096		**$25,760**		$20,353	$6,309	$26,662			$43,091	$13,358	**$56,449**

ATTACHMENT III

PROGRAMMING & PLANNING NARRATIVE

NARRATIVE: BASIS of COST ESTIMATE and RATIONALE

Estimates are Comparative-Level Type and are based on Historical Data, Recent Pricing, and Estimator's Judgment. Anticipated bidding conditions and construction duration with reasonable schedules are considered Normal. Unit costs, as shown in estimates, are fair and reasonable rates based on fair market value.

DOCUMENTS

Estimate Format is MII (MCACES) structured by feature accounts, and Corps of Engineer Dredge Estimating Program (CEDEP) incorporated into the Total Project Cost Summary (TPCS).

- A **Schedule** was developed and provided by the Planning Study and Project Manager.

- **MII** 4.1 (MCACES 2nd generation) was structured by feature account incorporating input cost from CEDEP. MII itemized the supporting items for Beach work and Planting cost.

- Corps of Engineers Dredge Estimating Program (**CEDEP**) was used for development of the Dredging Cost. The CEDEP output is only for USACE Cost Engineering. It will be distributed on a per request basis.

- Total Project Cost Summary (**TPCS**) was updated per schedule for both the NED and the LP Plans. The TPCS will be updated pending change to Risk Analysis contingency. The TPCS is based on schedule and the following:
    1. Real Estate Cost (01 feature account) was prepared and provided by the Mobile District Real Estate Division. The costs will not change due to the acquisition opposed to the purchase of the easements.
    2. EIS & Environmental (17 feature account previously 22 account) were provided by Study Manager, Joseph Paine.
    3. Planning, Engineering & Design (30 feature account) was developed and assigned at 3% by the PDT. This is the percentage that has historically been used for these types of civil works projects.
    4. Construction Management (31 feature account) was developed and assigned at 2% by the PDT. This is the percentage that has historically been used for these types of civil works projects.
    5. Escalation factors are based on the CWCCIS and were used to escalate the effective pricing level to the anticipated feature midpoint.
    6. 30 % FEDERAL/ 70% NON-FEDERAL cost-sharing for the NED plan. 26 % FEDERAL/ 74% NON-FEDERAL cost-sharing for the NED plan.

SCHEDULE

All Project items were based on:

- A price level of OCT FY2011
- Program Year Price Level FY 2014
- Initial Construction if FY14
- Renourishment Construction is FY24, 34, 44, 54
- Midpoint is FY 14 last Quarter for Construction for Construction Items (17 Account)
- Midpoint is FY14 1st Quarter for Real Estate (01 Account)
- Midpoint is FY2014 1st Quarter for Design (30 Account)
- Midpoint is FY 14 last Quarter for Construction Management (31 Account)

GENERAL CONSIDERATIONS

A. Acquisition

Estimate is structured and priced as a general prime dredging contractor supported by minor subcontractors for beach crossovers with exception to planting. Planting is structured and priced as a separate contract with a general prime contractor.

B. Markups

For both prime and subcontractors, mark-ups are included in the unit prices and include such items as field overheads, home office expenses, profit, bond and insurance. Detail backup is included in the CEDEP estimates.

C. Risk Analysis

Construction Contingency was developed using the Cost Risk Analysis method. Risk Analysis is a requirement for development of contingency on Civil Works for all decision documents requiring authorization for projects exceeding 40 million dollars. The contingency factor used does not vary throughout the cost estimate except for Real Estate which is 25% determined by the Real Estate team. Risk Analysis was developed as a team effort by the PD Team and Walla Walla DX (Glen Matlock) in 2010 and updated in 2012.

2010 Cost Schedule Risk Analysis (CSRA) was prepared for the Draft Feasibility Report. The 2012 Cost CSRA was an update for cost certification. A Risk Register was developed by the PD Team. The Risk Model was prepared by Walla Walla, Glenn Matlock and was customized using commercially available "Crystal Ball" software. After the model was run the results were documented by extracting the sensitivity chart, the forecast chart and the percentiles table for major items. The percentiles were used to determine the contingency at the 80% confidence level. The CSRA serves for both NED and LP contingency developing.

A separate CSRA was developed for the initial and renourishment years. A separate CSRA was developed for the LP and NED plans.

PROJECT ITEMS

A. DREDGING

1. Mobilization & Demobilization

Reference CEDEP for Cost Derivation. Fuel and Economic Conditions are June 2012 price level.

2. Dredging

Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions are based according to Price level of estiamte. Beach Shaping & Grading is a separate project item of the CEDEP monthly costs based on a crew in the MII software. The latest quantity due to continuing erosion and latest LIDAR surveys was provided by the PDT designers. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The CEDEP program included the additional yardage of dredging required to reach placement quantity.

3. Borrow Area Activities

Quantity and Cost is based on historical data.

4. Beach Shaping & Grading

Land Base Equipment & Labor Unit Costs are based on a crew in the MII software. Duration of beach work is based on 100% dredging duration.

5. Sea Turtle/ Gulf Sturgeon Observer

The item is included in CEDEP as a monthly charge based on $625/ day (historical data). Therefore the MII project item reads as no quantity because this cost is included in CEDEP monthly charges. The duration of the observer varies for each plan based on the dredging duration

Mobilization & Demobilization of the Trawler

Basis is historical data within CEDEP.

6. Sea Turtle/ Gulf Sturgeon Trawling

The Unit Costs is based on historical data. In the current estimate, the duration varies for each plan based on the dredging duration.

B. BEACH WORK ITEMS

1. Crossovers, Composite Wood type

The crossovers are quantified by the PDT. The composite wood (public) crossovers have been identified as 4' width. As the PDT looked more closely, there are many more 10 foot reaches (75%) than 30 foot reaches (25%). The length of crossovers is based on 30' for the 10 foot reaches and 50' for the 30' reaches. The cost is based on the sponsors provided invoice.

2. Crossover, TREX type

The TREX crossovers cost is based on the latest invoice provided by the sponsor (Provided 2012) for a public crossover. The quantity (22) of public crossovers were counted by the PDT and provided which is approximately 5% of the total.

3. Miscellaneous Site Items

Assuming signage, debris removal, storm drainage and small odd jobs that may not be included

C. PLANTINGS

1. Sea Oats

The cost is a result of a quote from a past supplier near the area in the spring 2012. The quote took into consideration the number of sea oats that would be planted.

The quantity provided by the PDT designer was increased 15% for re-plantings. The 15% re-planting is conservative. Pascagoula, Mississippi beaches (W91278-09-D-0001-TO11) (approximately 15 miles west of Walton County) had 10% re-planting built into the estimate.

2. Sand Fencing

The costs of sand fencing is consistent with $15/LF. The latest contract that used the sand fencing is Pascagoula beach- Phase II (W91278-09-D-0001-TO11).

POINTS OF CONTACT

The table below lists the all Cost Engineering Personnel that worked or furnished Cost information.

Joseph H. Ellsworth	Lead Cost Engineer	CESAM	251-690-2628
Rita B.Perkins	Cost Engineer	CESAM	251-694-3749
George F. Rush	Civil Engineer -Dredging	CESAM	251-694-3715
John G. Miller	Hydraulic Engineer	CESAM	251-690-3115
Elizabeth S. Godsey	Hydraulic/Planning Engineer	CESAM	251-694-3848
Russell W Blount	Real Estate Specialist	CESAM	251-694-3675
Joseph W. Paine	Planning Study Manager	CESAM	251-694-3832
Larry E. Parsons	Planning Environmental	CESAM	251-690-3139

ATTACHMENT IV

MCACES (MII) OUTPUT REPORT

Walton County Storm Damage Reduction-Feasibilty, Florida "NED" Beach Nourishment Plan

Walton County is located along the Florida panhandle. The beaches of Walton County encompass approximately 26 miles of shoreline. The proposed project includes periodic nourishments of suitable material on an approximate 16 mile stretch of shoreline at appropriate interval of time to maintain the optimized beach fill design template. The nourishments include an initial along with four smaller nourishments at 10 year intervals. The initial will include the extension of existing beach crossovers as well as beach and dune plantings for protection.

BASIS of COST ESTIMATE and RATIONALE

Revisions made on September 24, 2012 per Cost DX...(requested changes are documented)

Reference excel file:MII-walton-county-fl-storm-damage-reduction-feasibility-summary-ned-initial plan-SEP12.xls

Estimates are Comparative-Level Type and are based on Historical Data, Recent Pricing, and Estimator's Judgment. Estimate is structured and priced as a general prime dredging contractor supported by minor subcontractors, and a separate contract for planting feature. Anticipated bidding conditions and construction duration with reasonable schedules are considered Normal. Unit cost as shown in estimates, are fair and reasonable rates based on fair market value. O&M is outside of total project cost.

-MII (MCACES 2nd generation) was structured by feature account incorporating input cost from CEDEP. MII itemized the supporting items for Beach work and Planting cost.

Construction Start is FY 14

Estimated by	CESAM-EN-E, Cost Engineering Branch
Designed by	CESAM-EN-E, Mobile District, Corps of Engineers
Prepared by	Joseph Ellsworth & Rita Perkins
Preparation Date	9/25/2012
Effective Date of Pricing	10/1/2011
Estimated Construction Time	550 Days

Designed by
CESAM-EN-E, Mobile District, Corps of Engineers
Estimated by
CESAM-EN-E, Cost Engineering Branch
Prepared by
Joseph Ellsworth & Rita Perkins

Design Document	Prepared by Mobile District, CESAM-EN-E
Document Date	9/25/2012
District	Mobile District
Contact	Rita Perkins/ Joseph Ellsworth
Budget Year	2014
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost
Unit Cost

Timeline/Currency

Preparation Date	9/25/2012
Escalation Date	10/1/2011
Eff. Pricing Date	10/1/2011
Estimated Duration	550 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB08EB: MII English Cost Book 2008

Labor FL12: SAM2012- Walton County, FL Labor library

ww.wdol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. Only Land Equipment Operator

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP11R03: MII Equipment 2011 Region 03

03 SOUTHEAST

Sales Tax	8.35
Working Hours per Year	1,530
Labor Adjustment Factor	1.00
Cost of Money	2.00
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.090
Gas	3.550
Diesel Off-Road	3.800
Diesel On-Road	3.800

Shipping Rates

Over 0 CWT	15.58
Over 240 CWT	14.19
Over 300 CWT	12.14
Over 400 CWT	10.20
Over 500 CWT	6.13
Over 700 CWT	6.13
Over 800 CWT	9.25

Date	Author	Note
9/25/2012	Rita Perkins	New Project NotePer Cost DX changes made are the following:Additional notes which most come from other supporting documents.Change the date of price level to October 1 2012 therefore assume a FY 13 price level. cHANGED ALL DOCUMENT DATES TO 9/2012Instead of using current rental contract rates, Cost DX insists to use an equipment and labor library to create a crew for Beach Grading & Shaping.A labor library was created for Walton County, FL. Regional Equipment library and Davis Bacon Wages were utilized . A mark-up of 16% OH % 10% profit was applied.Rates for cross-overs were checked as a sub-bid (Rates are prime cost to government with sub-contractor mark-ups.).CEDEP revised to include Borrow Area Activities. New unit cost applied in MII.Added cost for Environmental Coordination during construction.

Description	UOM	Quantity	Contractor	ContractCost
New Section				107,605,464
Initial Beach Nourishment (2014)	CY	3,273,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	40,640,774
Federal & Non-Federal Costs	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	40,640,774
(Note: Federal & non-Federal construction costs are included)				
NED Initial Beach Nourishment (2014)	CY	2,000,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	40,640,774
Hopper Dredging	CY	3,273,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	33,421,774
(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew from the regional equipment and labor libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling and Borrow Area Activities.)				
(Note: Reference CEDEP for Cost Derivation.)				
(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED initial plan will take approximately 10.5 months. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)				
Beach & Dune Planting	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	2,875,000
(Note: (updated June 2012) Contractor shall be required to guarantee that 80% of the planted vegetation is in good condition one (1) year after initial planting. Planting shall be accomplished by hand. Fertilizer shall be placed in the bottom of hole at required rate. Cost furnished by Miriam Huffstutler June 2012. Quantity provided by EN design. 15% re-planting assumed.)				
Beach Work Items	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	4,194,000
(Note: Quantities for Beach Cross-Overs were furnished by the Project Delivery Team. The type Cross-Overs were based on the Local Sponsors' previously constructed designs. Wood type is estimated at 555ea @30-50 lf/ea @ 95% = 18,480 lf. Trex type is estimated at 555 ea @ 50 lf/ea @ 5% = 1400 lf. Total unit contract cost for material, labor, and equipment was developed and based on reported costs from prior projects from the Local Sponsor and marked. Even though the Cross-Overs are derived from recently constructed projects, the linear foot cost appears to be fair and reasonable as compared to historical data of similar construction along the Gulf Coast Area. It is anticipated that the final unit prices will be updated to reflect the detailed design when completed. ASsumed to be sub-contracted.)				
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	150,000
(Note: Per PDT, the cost incurred by the contractor includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)				
Beach Renourishment Typical Cost (2024, 2034, 2044, 2054)	EA	1.0000		66,964,690
Federal / Non-Federal Costs	EA	1.0000		66,964,690
(Note: Federal & non-Federal construction costs are included)				

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2024)	CY	1,585,000.0000		16,741,173
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost incurred by the contractor includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Description	UOM	Quantity	Contractor	ContractCost
Hopper Dredging	CY	1,585,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	16,666,173

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED renourishment plans will take approximately 5 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2034)	CY	1,585,000.0000		16,741,173
Hopper Dredging	CY	1,585,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	16,666,173

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED renourishment plans will take approximately 5 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost incurred by the contractor includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2044)	CY	1,585,000.0000		16,741,173
Hopper Dredging	CY	1,585,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	16,666,173

Description	UOM	Quantity	Contractor	ContractCost

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED renourishment plans will take approximately 5 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost incurred by the contractor includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2054)	CY	1,585,000.0000		16,741,173
Hopper Dredging	CY	1,585,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	16,666,173

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED renourishment plans will take approximately 5 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost incurred by the contractor includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Walton County Storm Damage Reduction-Feasibilty, Florida "LP" Beach Nourishment Plan

Walton County is located along the Florida panhandle. The beaches of Walton County encompass approximately 26 miles of shoreline. The proposed project includes periodic nourishments of suitable material on an approximate 16 mile stretch of shoreline at appropriate interval of time to maintain the optimized beach fill design template. The nourishments include an initial along with four smaller nourishments at 10 year intervals. The initial will include the extension of existing beach crossovers as well as beach and dune plantings for protection.

BASIS of COST ESTIMATE and RATIONALE

Revisions made on September 24, 2012 per Cost DX...(requested changes are documented)

Estimates are Comparative-Level Type and are based on Historical Data, Recent Pricing, and Estimator's Judgment. Estimate is structured and priced as a general prime dredging contractor supported by minor beach work subcontractors, and a separate contract for planting feature. Anticipated bidding conditions and construction duration with reasonable schedules are considered Normal. Unit cost as shown in estimates, are fair and reasonable rates based on fair market value. O&M is outside of total project cost.

-MII (MCACES 2nd generation) was structured by feature account incorporating input cost from CEDEP. MII itemized the supporting items for Beach work and Planting cost.

Construction Start is FY 14

Estimated by	CESAM-EN-E, Cost Engineering Branch
Designed by	CESAM-EN-E, Mobile District, Corps of Engineers
Prepared by	Joseph Ellsworth & Rita Perkins
Preparation Date	9/25/2012
Effective Date of Pricing	10/1/2011
Estimated Construction Time	550 Days

Designed by
CESAM-EN-E, Mobile District, Corps of Engineers
Estimated by
CESAM-EN-E, Cost Engineering Branch
Prepared by
Joseph Ellsworth & Rita Perkins

Design Document	Prepared by Mobile District, CESAM-EN-E
Document Date	9/25/2012
District	Mobile District
Contact	Rita Perkins/ Joseph Ellsworth
Budget Year	2014
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost
Unit Cost

Timeline/Currency

Preparation Date	9/25/2012
Escalation Date	10/1/2011
Eff. Pricing Date	10/1/2011
Estimated Duration	550 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB08EB: MII English Cost Book 2008

Labor FL12: SAM2012- Walton County, FL Labor library
ww.wdol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. Only Land Equipment Operator

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP11R03: MII Equipment 2011 Region 03

03 SOUTHEAST

Sales Tax	8.35
Working Hours per Year	1,530
Labor Adjustment Factor	1.00
Cost of Money	2.00
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.087
Gas	3.550
Diesel Off-Road	3.800
Diesel On-Road	3.800

Shipping Rates

Over 0 CWT	15.58
Over 240 CWT	14.19
Over 300 CWT	12.14
Over 400 CWT	10.20
Over 500 CWT	6.13
Over 700 CWT	6.13
Over 800 CWT	9.25

Date	Author	Note
9/25/2012	Rita Perkins	New Project NotePer Cost DX changes made are the following:Additional notes which most come from other supporting documents.Change the date of price level to October 1 2012 therefore assume a FY 13 price level. cHANGED ALL DOCUMENT DATES TO 9/2012Instead of using current rental contract rates, Cost DX insists to use an equipment and labor library to create a crew for Beach Grading & Shaping.A labor library was created for Walton County. Regional Equipment and labor rates were utilized. A mark-up of 16% OH % 10% profit was applied.Rates for cross-overs were a prime contractor rate with subcontractor mark-ups applied.CEDEP revised to include Borrow Area Activities. New unit cost applied in MII.Added cost for Environmental Coordination during construction.

Description	UOM	Quantity	Contractor	ContractCost
New Section				122,660,731
Initial Beach Nourishment (2014)	CY	2,000,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	47,747,102
Federal & Non-Federal Costs	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	47,747,102
(Note: All federal & non-federal construction work included)				
LP Initial Beach Nourishment (2014)	CY	2,000,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	47,747,102
Hopper Dredging	CY	3,868,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	39,326,102
(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on recent (FY 12) rental contracts. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling and Borrow Area Activities.)				
(Note: Reference CEDEP for Cost Derivation.)				
(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. NED initial plan will take approximately 10.5 months. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)				
Beach & Dune Planting	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	3,325,000
(Note: (updated June 2012) Contractor shall be required to guarantee that 80% of the planted vegetation is in good condition one (1) year after initial planting. Planting shall be accomplished by hand. Fertilizer shall be placed in the bottom of hole at required rate. Cost furnished by Miriam Huffstutler June 2012. Quantity provided by EN design. 15% re-planting assumed.)				
Beach Work Items	LS	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	4,946,000
(Note: Quantities for Beach Cross-Overs were furnished by the Project Delivery Team. The type Cross-Overs were based on the Local Sponsors' previously constructed designs. Wood type Estimate is 655 @30-50 lf ea @ 95% = 21,850 lf. Trex type is estimated at 655 cross-overs @ 50 lf ea @ 5% = 1,650 lf. Total unit cost (Cost to Prime) for material, labor, and equipment was developed and based on reported costs from prior projects from the Local Sponsor. Even though the Cross-Overs are derived from recently constructed projects, the linear foot cost appears to be fair and reasonable as compared to historical data of similar construction along the Gulf Coast Area. It is anticipated that the final unit prices will be updated to reflect the detailed design when completed.)				
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	150,000
(Note: Per PDT, the cost includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)				
Beach Renourishment Typical Cost (2024, 2034, 2044, 2054)	EA	1.0000		74,913,629
Federal & Non-Federal Costs	EA	1.0000		74,913,629
(Note: All federal & non-federal construction work included)				

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2024)	CY	1,789,000.0000		18,728,407
Hopper Dredging	CY	1,789,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	18,653,407

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. LP renourishment plans will take approximately 5.75 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2034)	CY	1,789,000.0000		18,728,407
Hopper Dredging	CY	1,789,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	18,653,407

(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)

(Note: Reference CEDEP for Cost Derivation.)

(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. LP renourishment plans will take approximately 5.75 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)

Description	UOM	Quantity	Contractor	ContractCost
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000

(Note: Per PDT, the cost includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)

Description	UOM	Quantity	Contractor	ContractCost
Beach Renourishment Typical Cost (2044)	CY	1,789,000.0000		18,728,407
Hopper Dredging	CY	1,789,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	18,653,407

Description	UOM	Quantity	Contractor	ContractCost
(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)				
(Note: Reference CEDEP for Cost Derivation.)				
(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. LP renourishment plans will take approximately 5.75 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)				
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000
(Note: Per PDT, the cost includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)				
Beach Renourishment Typical Cost (2054)	CY	1,789,000.0000		18,728,407
Hopper Dredging	CY	1,789,000.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	18,653,407
(Note: Assumption remains with a large hopper (7600 CY). Fuel and Economic conditions were changed accordingly in CEDEP to June 2012 level based on www.eia.gov/petroleum/gasdiese prices, http://www.treasurydirect.gov/govt/rates/tcir/tcir_opdprmt2.htm , and APP E of EP-1110-1-8 . Fuel costs were increased. Beach Shaping & Grading are not included in CEDEP dredging monthly costs. The Beach Grading costs are based on a crew using appropriate libraries. The Sea Turtle / Gulf Sturgeon Observer is included in the CEDEP monthly costs. The additional yardage of dredging the contractor will likely incur to meet a placement template is included within CEDEP. Joe Ellsworth validated cost of Sea Turtle Trawling .)				
(Note: Reference CEDEP for Cost Derivation.)				
(Note: Land Base Equipment & Labor Unit Costs are based created Walton County Labor Library & Regional Equipment library . Duration of beach work is based on dredging duration. LP renourishment plans will take approximately 5.75 months each. Cost Basis: •working 12 hrs/day 30 days/ mo. •3-D8 Dozers & Operator •1 FE Loader & Operator •5 Laborers)				
Environmental	EA	1.0000	[AA] Prime Contractor All Dredging (CEDEP) Markups	75,000
(Note: Per PDT, the cost includes all government agency coordination required during the construction due to environmental windows that may be encountered. Turtle Trawling & Bird Monitoring)				

ATTACHMENT V

PROJECT COST AND SCHEDULE RISK ANALYSIS REPORT

US Army Corps of Engineers®

Walton County Hurricane and Storm Damage Reduction
Walton County, Florida
General Investigations Study
National Economic Development (NED) Plan
Project Cost and Schedule Risk Analysis Report

Prepared for:

U.S. Army Corps of Engineers,
Mobile District

Prepared by:

U.S. Army Corps of Engineers
Cost Engineering Directory of Expertise, Walla Walla

October 12, 2012

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EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Mobile District, this report presents a recommendation for the total project cost and schedule contingencies for the Walton County Hurricane and Storm Damage Reduction General Investigations Study. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the Walton County project, the base case project cost for the National Economic Development (NED) Plan is estimated at approximately $114 Million ($43 Million for the initial construction and $70 Million for the four subsequent nourishment activities). Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (Walla Walla District) recommends a contingency value of $30 Million, or 27%. This contingency includes $9 Million (20%) for the initial construction and $21 Million (30%) for the four subsequent nourishment activities.

Walla Walla Cost MCX performed risk analysis using the *Monte Carlo* technique, producing the aforementioned contingencies and identifying key risk drivers.

The following tables ES-1, ES-2, and ES-3 portray the development of contingencies (27% overall). The contingency is based on an 80% confidence level, as per USACE Civil Works guidance.

Table ES-1. Contingency Analysis Table - Overall

Base Case Cost Estimate	**$113,528,738**	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$111,424,376	-1.85%
50%	$132,295,391	16.53%
80%	**$143,734,612**	**26.61%**
95%	$154,652,530	36.22%

Table ES-2. Contingency Analysis Table - Initial

Base Case Cost Estimate	$43,215,813	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$40,771,214	-5.66%
50%	$48,128,699	11.37%
80%	**$52,057,949**	**20.46%**
95%	$55,777,293	29.07%

Table ES-3. Contingency Analysis Table – Out-Years

Base Case Cost Estimate	$70,312,925	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$70,653,162	0.48%
50%	$84,166,693	19.70%
80%	**$91,676,663**	**30.38%**
95%	$98,875,237	40.62%

The following table ES-2 portrays the full costs of the recommended alternative based on the anticipated contracts. The costs are intended to address the congressional request of estimates to implement the project. The contingency is based on an 80% confidence level, as per accepted USACE Civil Works guidance.

Table ES-4. Cost Summary

WALTON COUNTY HURRICANE AND STORM DAMAGE REDUCTION FRM FEATURE ACCOUNTS		COST ($1,000)	CNTG ($1,000)	TOTAL ($1,000)
01	FISH AND WILDLIFE FACILITIES	543	136	679
17	CHANNELS AND CANALS	107,605	28,630	136,235
30	PLANNING, ENGINEERING, AND DESIGN	3,228	859	4,087
31	CONSTRUCTION MANAGEMENT	2,152	573	2,725
	TOTAL PROJECT COSTS	**113,529**	**30,197**	**143,725**

Notes:
1) Costs include the recommended contingency of 27% with the exception of the 01 Account (Lands and Damages), which used a contingency of 25%, as prepared by the District Real Estate Office.
2) Costs exclude O&M and Life Cycle Cost estimates.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

For Risks I-2 (Scope Growth/Reduction) and I-1 (Scope Definition), although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

For Risk I-5 (Fuel Prices), dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 63 percent of the statistical cost variance.

For Risk I-5 (Fuel Prices), dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

For Risk I-2 (Scope Growth/Reduction), although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 62 percent of the statistical schedule variance.

For Risk E-1 (Weather), the PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For Risk E-2 (Funding Delays), the PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

For Risk E-2 (Funding Delays), the PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For Risk E-1 (Weather), the PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the PED phase, and proactive monitoring and control of risk identified in this study.

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Mobile District, this report presents a recommendation for the total project cost and schedule contingencies for the Walton County Hurricane and Storm Damage Reduction Project.

2.0 BACKGROUND

Walton County is located approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida. The beaches of Walton County encompass approximately 26 miles of shoreline extending from the City of Destin in Okaloosa County, Florida (about six miles to the east of East Pass) to the Walton/Bay County line near Phillips Inlet. The western two-thirds of Walton County are comprised of a coastal peninsula extending from the mainland, and the eastern third is comprised of mainland beaches. Choctawhatchee Bay lies north of the peninsula. Walton County includes 11.9 miles of state-designated critically eroding areas and three State of Florida park areas that cover approximately six miles of the 26-mile shoreline.

The Walton County shoreline is characterized by high dune elevations partly due to the presence of Pleistocene bluffs formed as a result of an exposed submarine berm formed during inundation of the Florida Peninsula during that geologic period. Primary dune elevations in Walton County range from 11.5 to 44.5 feet North American Vertical Datum, 1988 (NAVD88) and average 25.5 feet. Along the mid-section of Walton County, Bluff elevations exceed 60 feet in height. Bluff erosion and undercutting occur in this area due to the interface of relatively low flat beaches and the bluff toe. An unusual attribute of the Walton County shoreline is the presence of coastal dune lakes. These lakes are rare worldwide and are almost exclusive to the Gulf Coast within the United States. The lakes are about five feet deep and intermittently breach the dune system and discharge directly into the Gulf of Mexico.

Mild winters and warm hot summers characterize the project area, with an average in excess of 280 days a year of sunshine. The average daily temperature is 67 degrees Fahrenheit and the average water temperature is about 70 degrees Fahrenheit. The months from June through November constitute the hurricane storm season, and this area is subject to tropical storm and strong hurricane conditions. The highest period of rainfall occurs during the storm season, with an average annual rainfall of 64 inches.

Walton County’s shoreline is receding; the protective dunes and high bluffs are being destroyed by hurricane and storm forces that are occurring more frequently than before.

The impacts of these storms to property and infrastructure are considerable and can possibly be reduced through a beach restoration and stabilization project.

As a part of this effort, Mobile District requested that the USACE Cost Engineering Mandatory Center of Expertise for Civil Works (Cost Engineering MCX) provide an agency technical review (ATR) of the cost estimate and schedule for Recommended Project Plan. That tasking also included providing a risk analysis study to establish the resulting contingencies.

3.0 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 cost risks for all project features. The study and presentation does not include consideration for life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the base case Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the Mobile District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of problems, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. 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.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to 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 analysis 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, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

4.0 METHODOLOGY / PROCESS

The Walla Walla Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local Mobile District staff to provide information gathering. The Mobile District PDT conducted risk identification and qualitative analysis to produce a risk register that served as the framework for the risk analysis. Participants in risk identification meeting included the following:

Name	Organization	Title
Joseph H. Ellsworth	USACE - SAM	Lead Cost Engineer
Bernard E. Moseby	USACE - SAM	Planning Economics
Julie M. Watkins	USACE - SAM	Planning Economics
Elizabeth S. Godsey	USACE - SAM	Hydraulic Engineer
Michael A. McKown	USACE - SAM	Structural Engineer - GeoTech
Russell W Blount	USACE - SAM	Real Estate Specialist
Joseph W. Paine	USACE - SAM	Planning Study Manager
Larry E. Parsons	USACE - SAM	Planning Environmental

The first cost risk model was completed February 11, 2010. However, scope and estimate updates since then, as well as agency technical review, necessitated a rerun of the original model. The final results were completed and reported to Mobile on October 5, 2012.

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 the desired level of cost confidence. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

In simple terms, contingency is an amount added to an estimate 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 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 averse 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 selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

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. 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 are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative 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.

A formal PDT meeting was held with the Mobile District office for the purposes of identifying and assessing risk factors. The meeting included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, and real estate

The initial formal meetings 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. Subsequent meetings focused primarily on risk factor assessment and quantification.

Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were 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 involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following 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

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 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 support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 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 baseline 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.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the Walton County Hurricane and Storm Damage Reduction project.

a. The Mobile District provided MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The MII and CWE files transmitted and downloaded on October 5, 2012 was the basis for the final cost and schedule risk analyses.

b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level.

c. Schedules are analyzed for impact to the project cost in terms of both uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.

Specific to the Walton County Hurricane and Storm Damage Reduction project, the schedule was analyzed only for impacts due to residual fixed costs.

d. Per the CWCCIS Historical State Adjustment Factors in EM 1110-2-1304, State Adjustment Factor for the State of Florida is 0.93, meaning that the average inflation for the project area is assumed to be 7% lower than the national average for inflation. Therefore, it is assumed that the project inflations experienced are similar (or better) to OMB inflation factors for future construction. Thus, the risk analyses accounted for no escalation over and above the national average.

e. Per the data in the estimate, the Overhead percentage for the Prime Contractor is 16%. The analysis assumed that approximately half of this amount is Job Office Overhead (JOOH). Thus, the assumed residual fixed cost rate for this project is 8%. For the P80 schedule, this comprises approximately 4% of the total contingency for the initial activity and 5% of the total contingency for the subsequent nourishments. This is due to the accrual of residual fixed costs associated with delay associated with the implementation schedule of each nourishment.

f. The Cost MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.

g. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list”.

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing 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 feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes only.

Contingency was quantified as approximately $36 Million at the P80 confidence level (31% of the baseline cost estimate). For comparison, the cost contingency at the P50 and P100 confidence levels was quantified as 19% and 70% of the baseline cost estimate, respectively.

Table 1. Project Cost Contingency Summary

Risk Analysis Forecast	Baseline Estimate	Total Contingency[1,2] ($)	Total Contingency (%)
50% Confidence Level			
Project Cost	$132,295,391	$18,766,653	16.53%
80% Confidence Level			
Project Cost	$143,734,612	$30,205,874	26.61%
100% Confidence Level			
Project Cost	$180,295,353	$66,766,615	58.81%

Notes:
1) These figures combine uncertainty in the baseline cost estimates and schedule.
2) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of "unknown unknowns") makes 100% confidence a theoretical impossibility.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

Figure 1. Cost Sensitivity Analysis - Initial

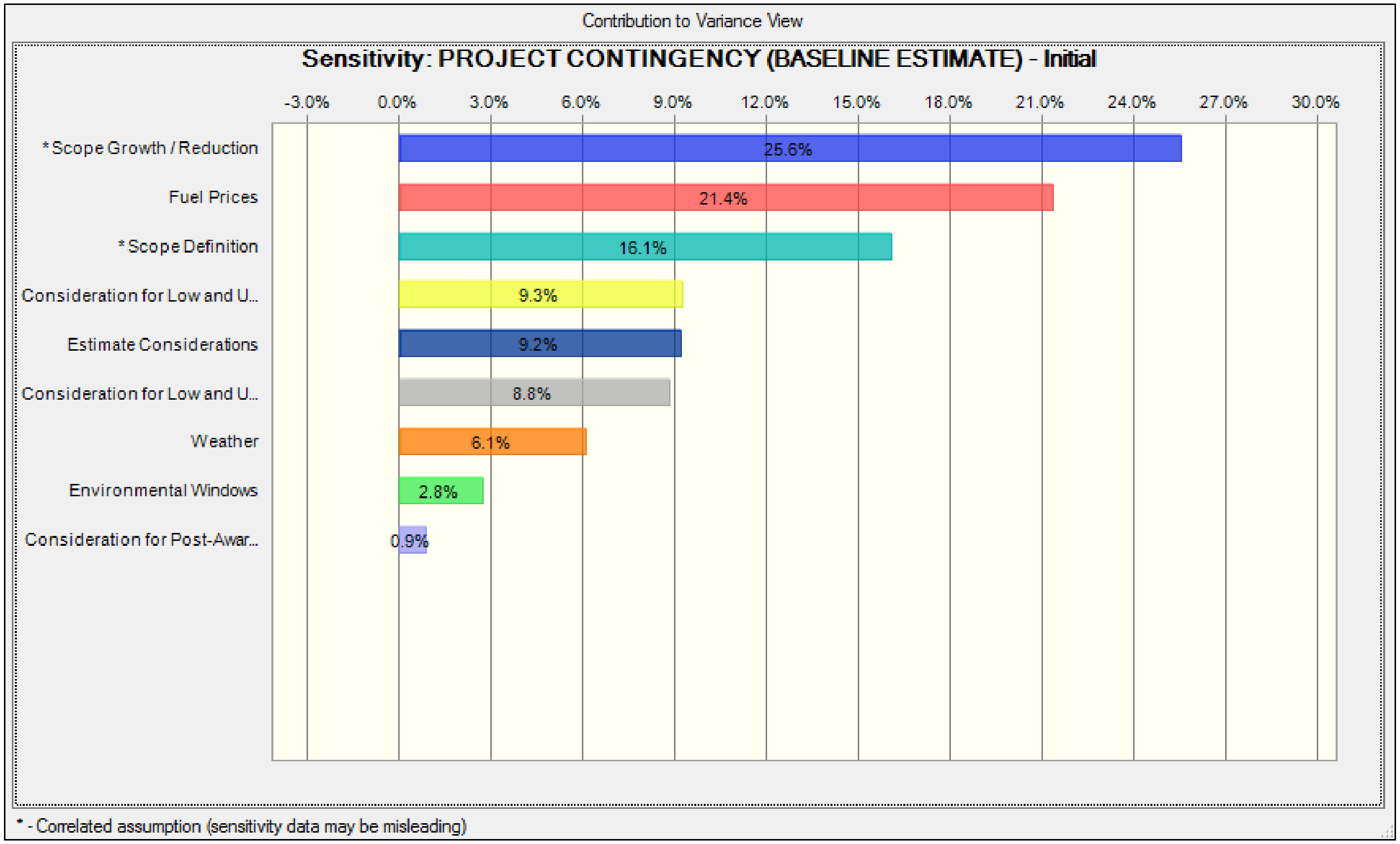


Figure 2. Cost Sensitivity Analysis – Out-Years

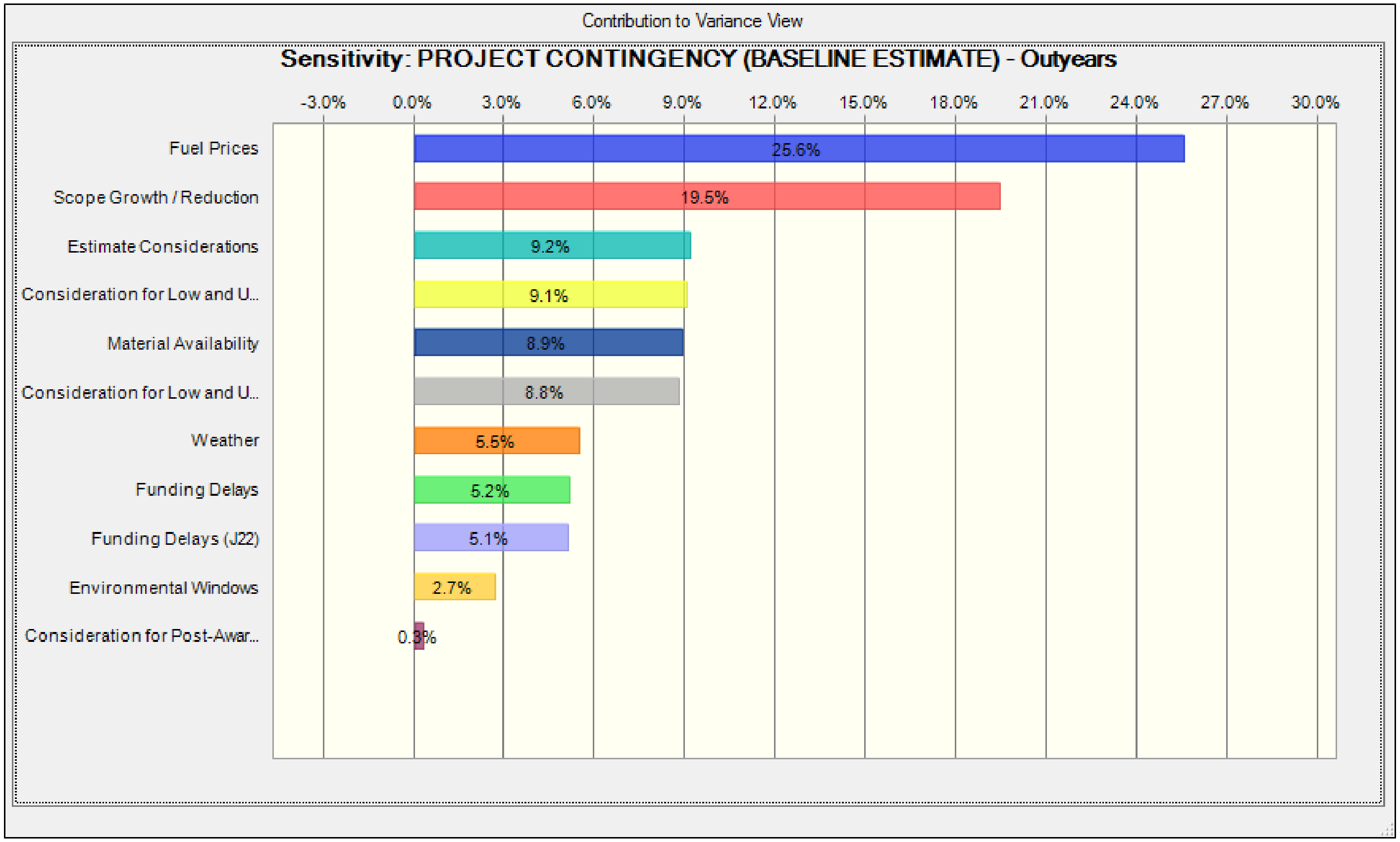


Figure 3. Schedule Sensitivity Analysis - Initial

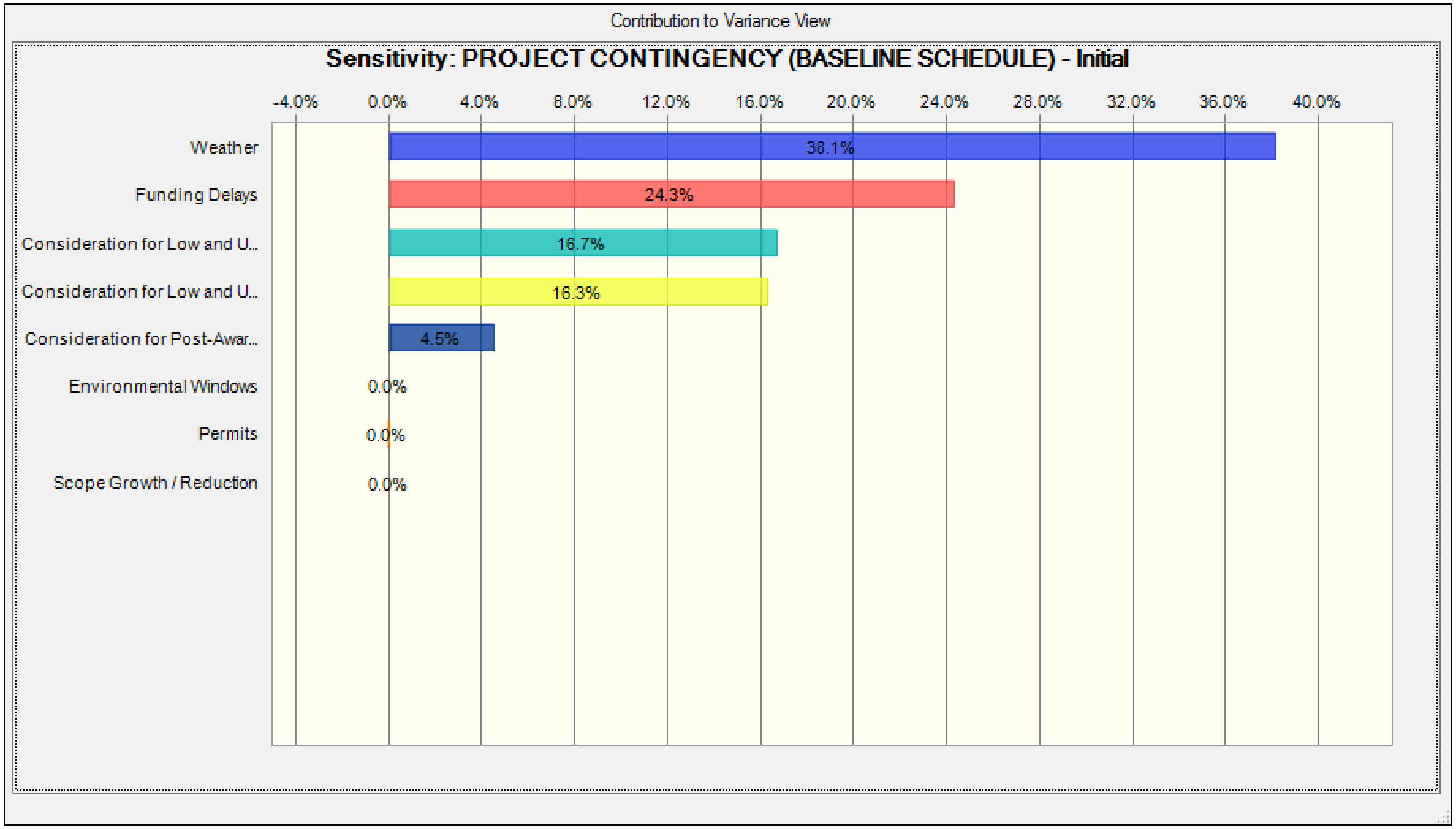
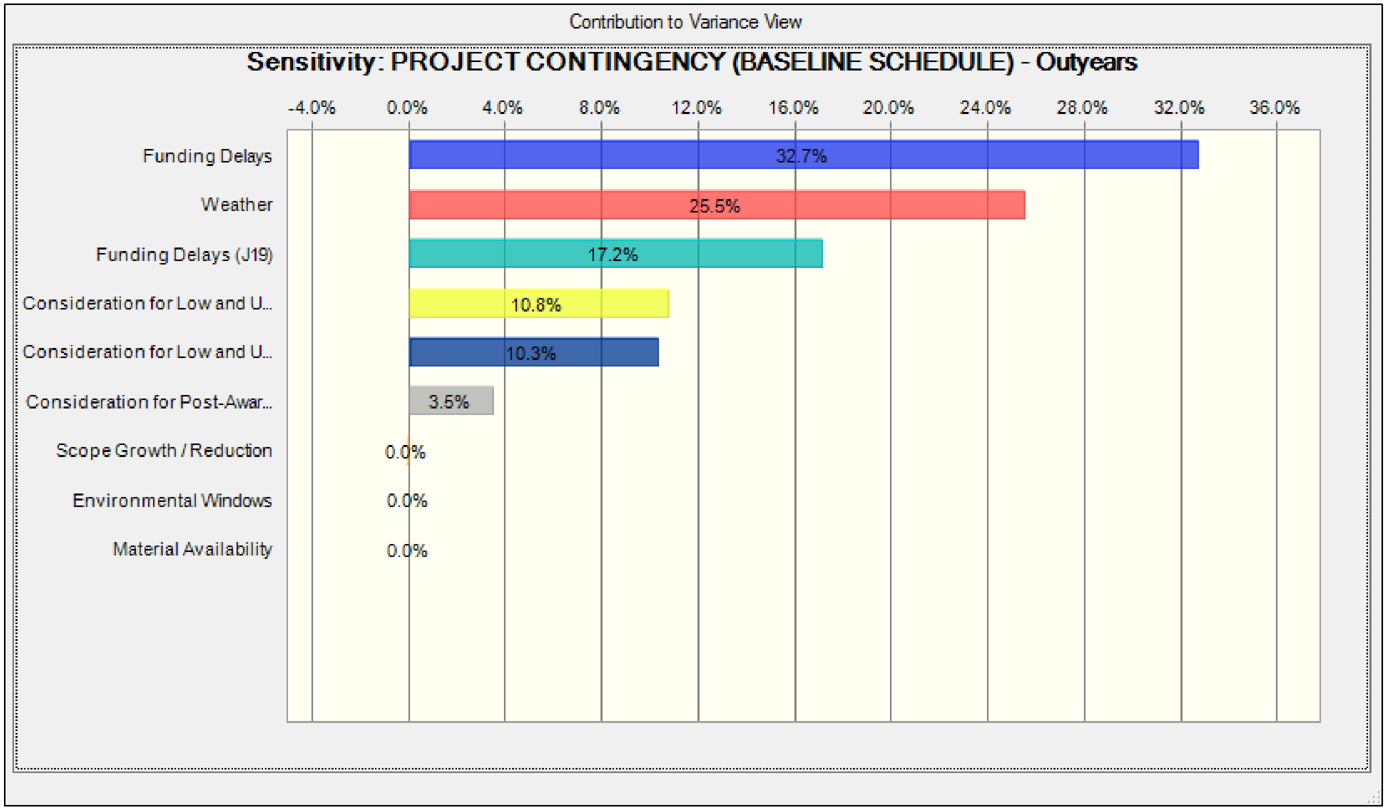


Figure 4. Schedule Sensitivity Analysis – Out-Years



7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Major Findings/Observations

Project cost comparison summaries are provided in Table 3 and Figure 3. Additional major findings and observations of the risk analysis are listed below.

1. For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

2. For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 62 percent of the statistical schedule variance.

3. For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 63 percent of the statistical cost variance.

4. For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

5. Operation and maintenance activities were not included in the cost estimate or schedules. Therefore, a full life cycle risk analysis could not be performed. Risk analysis results or conclusions could be significantly different if the necessary operation and maintenance activities were included.

Table 3. Project Cost Comparison Summary (Uncertainty Analysis)

Confidence Level	Project Cost ($)	Contingency ($)	Contingency (%)
P0	**$88,376,081**	**($25,152,656)**	**-22.16%**
P5	**$111,424,376**	**($2,104,361)**	**-1.85%**
P10	**$115,773,066**	**$2,244,328**	**1.98%**
P15	**$118,834,107**	**$5,305,370**	**4.67%**
P20	**$121,342,374**	**$7,813,636**	**6.88%**
P25	**$123,435,964**	**$9,907,227**	**8.73%**
P30	**$125,326,828**	**$11,798,090**	**10.39%**
P35	**$127,129,811**	**$13,601,073**	**11.98%**
P40	**$128,924,353**	**$15,395,615**	**13.56%**
P45	**$130,591,246**	**$17,062,509**	**15.03%**
P50	**$132,295,391**	**$18,766,653**	**16.53%**
P55	**$133,982,493**	**$20,453,756**	**18.02%**
P60	**$135,679,950**	**$22,151,212**	**19.51%**
P65	**$137,458,028**	**$23,929,290**	**21.08%**
P70	**$139,366,177**	**$25,837,439**	**22.76%**
P75	**$141,396,794**	**$27,868,057**	**24.55%**
P80	**$143,734,612**	**$30,205,874**	**26.61%**
P85	**$146,392,429**	**$32,863,692**	**28.95%**
P90	**$149,796,945**	**$36,268,207**	**31.95%**
P95	**$154,652,530**	**$41,123,792**	**36.22%**
P100	**$180,295,353**	**$66,766,615**	**58.81%**

Figure 3. Project Cost Summary (Uncertainty Analysis)

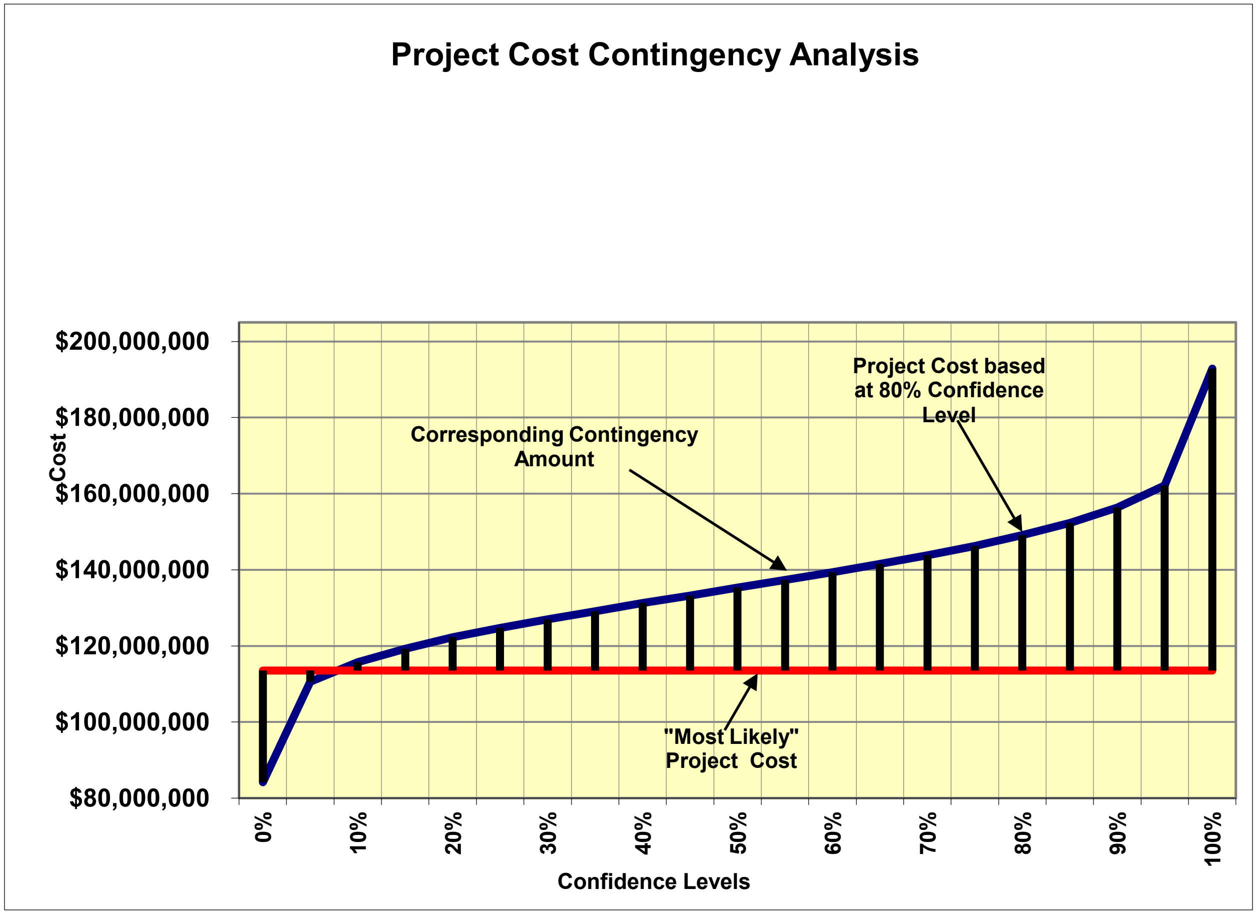
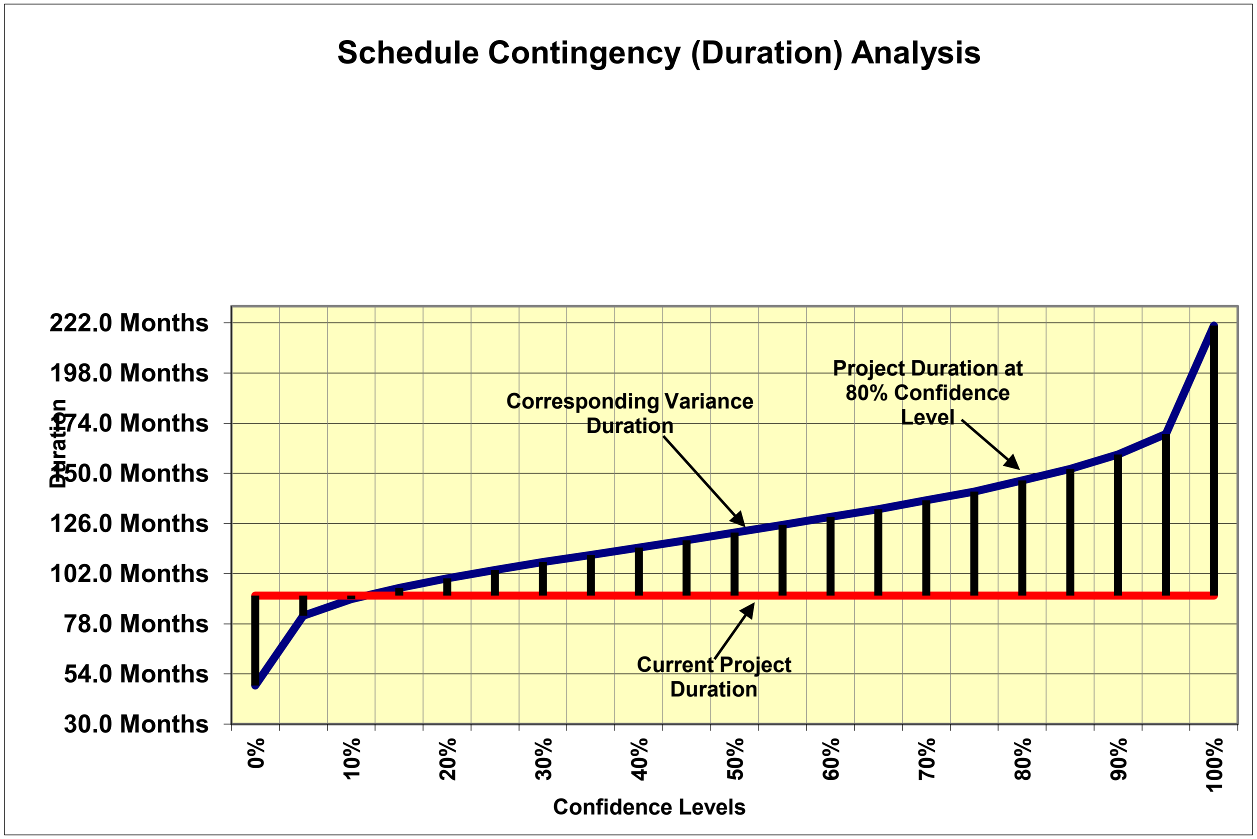


Figure 4. Project Duration Summary (Uncertainty Analysis)



7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *4th edition*, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

1. Key Cost Risk Drivers: For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 63 percent of the statistical cost variance.

a) Scope Growth/Reduction and Scope Definition: Although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

b) Fuel Prices: Dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

2. Key Schedule Risk Drivers: For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 62 percent of the statistical schedule variance.

For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

a) Funding Delays: The PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

b) Weather: The PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

3. Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Risk Level

Likelihood of Occurrence	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	High

Impact or Consequence of Occurrence

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule			Responsibility/POC	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.)											
	INTERNAL RISKS										
I-1	Scope Definition	Scope is fairly well defined for standard civil works features. There is also less uncertainty now than in the first CSRA iteration.	Scope may change based on permitting. The PDT has indicated that the scope definition would not impact the outyears dredging, and if anything, would reduce the structural additions in the initial nourishment.	LIKELY	Marginal	MODERATE	VERY Unlikely	MARGINAL	LOW	Project Manager/Planner	Project Cost & Schedule
I-2	Scope Growth / Reduction	Scope is fairly well defined for standard civil works features. However, there is the chance of experiencing scope growth or reduction due to erosion over time and funding limitations.	The pumping plant has potential of VE savings through better data and VE. While there is confidence in quantities for the initial nourishment, quantities for the out-year renourishments may change significantly.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Project Manager/Planner	Project Cost & Schedule
I-3	Equipment Availability/Pricing	Estimate assumes medium size hopper dredges will performed the subject work. Since this project is planned so far in advance and O&M is already on the industry's radar. The industry will plan accordingly. The contract could even be moved a few months forward to accommodate for the availability if the industry doesn't fit this profitable dredging job into their schedule.	Availability is not a problem. Based on passed similar projects within the area medium size hoppers were used, Panama City Beaches being the most recent.	LIKELY	MARGINAL	MODERATE	UNLIKELY	MARGINAL	LOW	Cost Engineering	Project Cost & Schedule
I-4	Material Availability	Borrow sources are provided and indicated on drawings. However, there may be more concern and risk in the out-year renourishments.	Per the design Engineer and based on current surveys, quality and quantity of beach fill material is available at all sites for the initial nourishment.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Design Engineer	Project Cost & Schedule
I-5	Fuel Prices	$3.45 per gallon was used in the September 2012 updated CEDEP Estimates. Increases in fuel prices will effect equipment and delivery or materials.	Fuel cost fluctuations can significantly impact dredging cost.	VERY LIKELY	SIGNIFICANT	HIGH	UNLIKELY	NEGLIGIBLE	LOW	Cost Engineering	Project Cost & Schedule
I-6	Permits	Permitting delays may occur due to Florida State policy. This is likely to impact the ultimate schedule more so than the costs.	This could impact the cost and schedule.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Planning/Regulatory	Project Cost & Schedule
I-7	Environmental Windows	Project site is a natural habitat for various species of threatened wildlife that utilize the project vicinity during Spring and Winter months.	Gulf sturgeon incidental takes during dredging and Sea Turtle and Bird Nesting may have Impact during Construction. There may also be unknown restrictions for the out-year renourishments.	LIKELY	SIGNIFICANT	HIGH	LIKELY	SIGNIFICANT	HIGH	Project Manager/Planner	Project Cost & Schedule
I-8	Acquisition Plan (Strategy)	The estimate was based on full and open competition, with minimal tiering of contractor subs.	The Acq Plan has not been finalized, therefore there is a potential for additional tiering of the contracts. Since this is dreding work, past experience will likely dictate the most cost effective methodology for contract procurement.	UNLIKELY	MARGINAL	LOW	UNLIKELY	MARGINAL	LOW	Acquisition Strategy Board	Project Cost & Schedule
I-9	VE Study	VE study will be performed prior to Final Feasibility Report.	This could impact the cost and schedule, but likely would not have significant impact.	UNLIKELY	MARGINAL	LOW	UNLIKELY	MARGINAL	LOW	Project Manager/Planner	Project Cost & Schedule
	CONSTRUCTION RISKS										
INT-MOD	Consideration for Post-Award Construction Claims and Modifications	There is inherent risk of construction modifications and claims that arise after contract award due to issues such as weather, schedules dictated by O&M cycles, differing site conditions, user directed changes or omissions, inaccurate surveys, and variations in estimated quantities (minor).	Post-award construction contract modifications and claims could impact the ultimate contract costs and delay the overall schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	Project Cost & Schedule

	ESTIMATE AND SCHEDULE RISKS										
EST-1	Estimate Considerations	This item is added based on the ATR Cost review. The estimate makes no considerations for labor fluctuations, overtime, soil conditions, productivity, or fluctuating indirect costs (overhead). This is added to the CSRA model for consideration, as these issues may cause a cost variance.	Estimate assumptions may not accurately capture the ultimate costs, therefore this could have an impact either positively or negatively on the costs.	Likely	Significant	HIGH	Very Unlikely	Negligible	LOW	Project Manager/Planner	Project Cost & Schedule
	LOW AND UNKNOWN INTERNAL RISKS										
INT-1	Consideration for Low and Unknown Internal Risk	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns.	This could impact cost and schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	Project Cost & Schedule
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)									
E-1	Weather	Florida is subject to bad weather during Hurricane Season which can cause Schedule delays.	Weather days are generally incorporated into schedule.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	N/A	Project Cost & Schedule
E-2	Funding Delays	PM feels Adequate Congressional funding to complete project will be available, particularly for the initial nourishment. However, if the project is delayed, it could increase the quantities to be dredged and delay the overal schedule.	This could impact the cost and schedule for the outyear renourishment cycles.	LIKELY	MARGINAL	MODERATE	LIKELY	Significant	HIGH	Project Manager	Project Cost & Schedule
EXT-1	Consideration for Low and Unknown External Risk	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns.	This could impact cost and schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	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.

SAM - Walton County Storm Damage Reduction Project, GI Study - NE

Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost (Most Likely) ->	**$113,528,738**
Baseline Estimate Cost Contingency Amount ->	$24,848,127
Baseline Estimate Construction Cost (80% Confidence) ->	**$138,376,864**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**35.7 Months**
Schedule Contingency Duration ->	55.0 Months
Project Schedule Duration (80% Confidence) ->	**90.7 Months**
Project Schedule Contingency Amount (80% Confidence) ->	**$5,357,747**

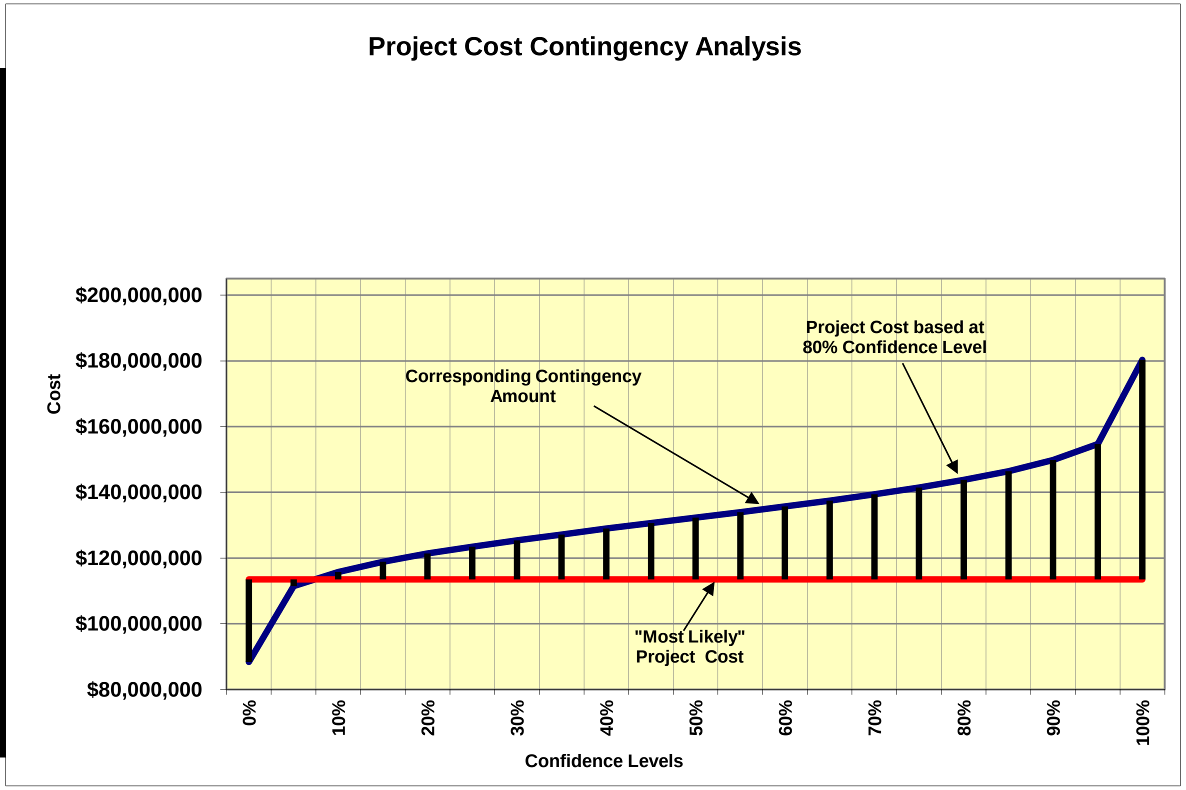
Project Contingency	80% Confidence Project Cost
Project Contingency Amount (80% Confidence) ->	**$30,205,874**
Project Contingency Percentage (80% Confidence) ->	**27%**

Project Cost (80% Confidence) ->	**$143,734,612**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

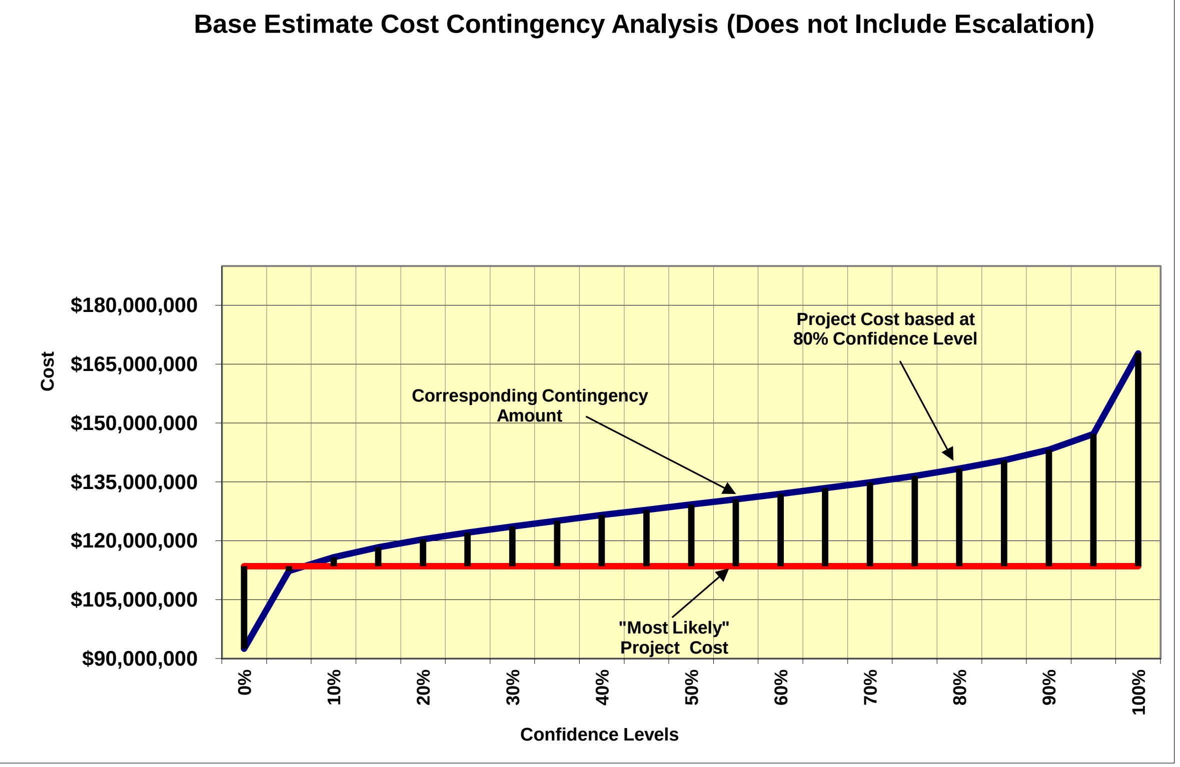
Most Likely Cost Estimate	$113,528,738		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$88,376,081	($25,152,656)	-22.16%
5%	$111,424,376	($2,104,361)	-1.85%
10%	$115,773,066	$2,244,328	1.98%
15%	$118,834,107	$5,305,370	4.67%
20%	$121,342,374	$7,813,636	6.88%
25%	$123,435,964	$9,907,227	8.73%
30%	$125,326,828	$11,798,090	10.39%
35%	$127,129,811	$13,601,073	11.98%
40%	$128,924,353	$15,395,615	13.56%
45%	$130,591,246	$17,062,509	15.03%
50%	$132,295,391	$18,766,653	16.53%
55%	$133,982,493	$20,453,756	18.02%
60%	$135,679,950	$22,151,212	19.51%
65%	$137,458,028	$23,929,290	21.08%
70%	$139,366,177	$25,837,439	22.76%
75%	$141,396,794	$27,868,057	24.55%
80%	$143,734,612	$30,205,874	26.61%
85%	$146,392,429	$32,863,692	28.95%
90%	$149,796,945	$36,268,207	31.95%
95%	$154,652,530	$41,123,792	36.22%
100%	$180,295,353	$66,766,615	58.81%



- BASE CONTINGENCY DEVELOPMENT -

Contingency Analysis

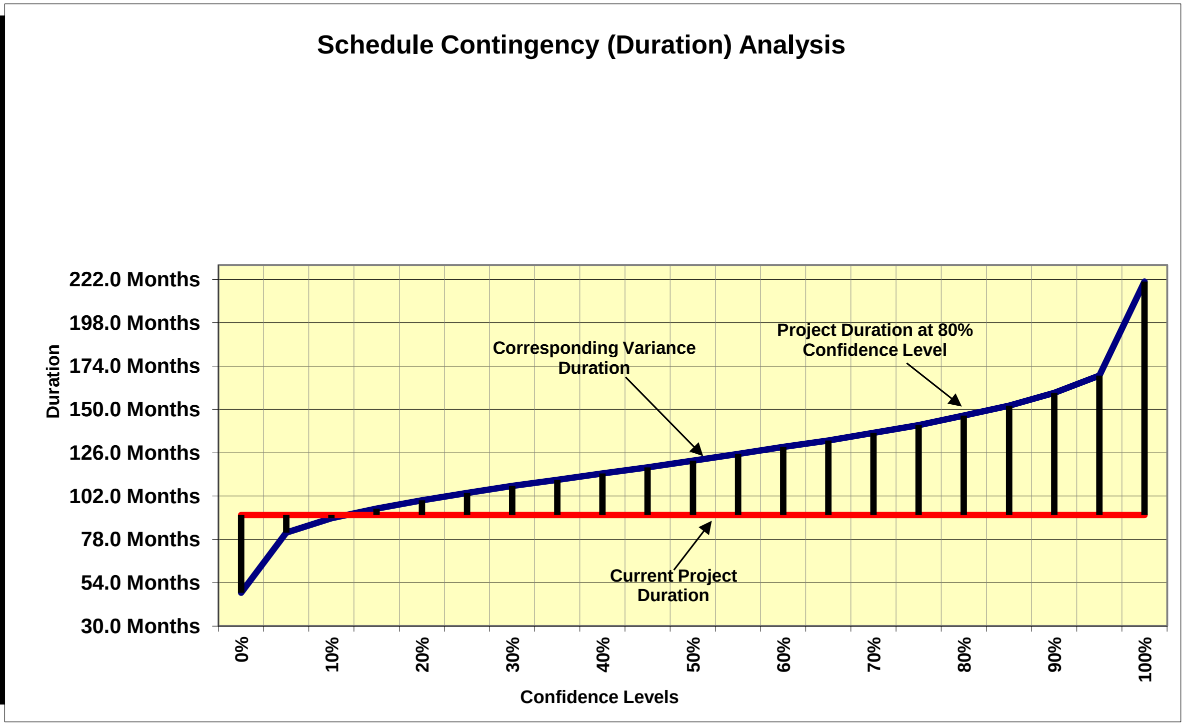
Most Likely Cost Estimate	$113,528,738		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$92,538,306	($20,990,432)	-18.49%
5%	$112,279,315	($1,249,422.81)	-1.10%
10%	$115,841,894	$2,313,156.44	2.04%
15%	$118,374,178	$4,845,440.09	4.27%
20%	$120,429,513	$6,900,774.95	6.08%
25%	$122,136,476	$8,607,738.29	7.58%
30%	$123,655,055	$10,126,316.99	8.92%
35%	$125,129,186	$11,600,448.36	10.22%
40%	$126,589,144	$13,060,406.58	11.50%
45%	$127,925,568	$14,396,830.09	12.68%
50%	$129,285,301	$15,756,563.19	13.88%
55%	$130,617,723	$17,088,985.55	15.05%
60%	$131,964,136	$18,435,397.99	16.24%
65%	$133,393,218	$19,864,480.71	17.50%
70%	$134,900,419	$21,371,681.66	18.82%
75%	$136,533,284	$23,004,546.62	20.26%
80%	$138,376,864	$24,848,126.71	21.89%
85%	$140,499,296	$26,970,558.52	23.76%
90%	$143,241,457	$29,712,719.58	26.17%
95%	$147,170,151	$33,641,413.85	29.63%
100%	$167,736,451	$54,207,713.86	47.75%



- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

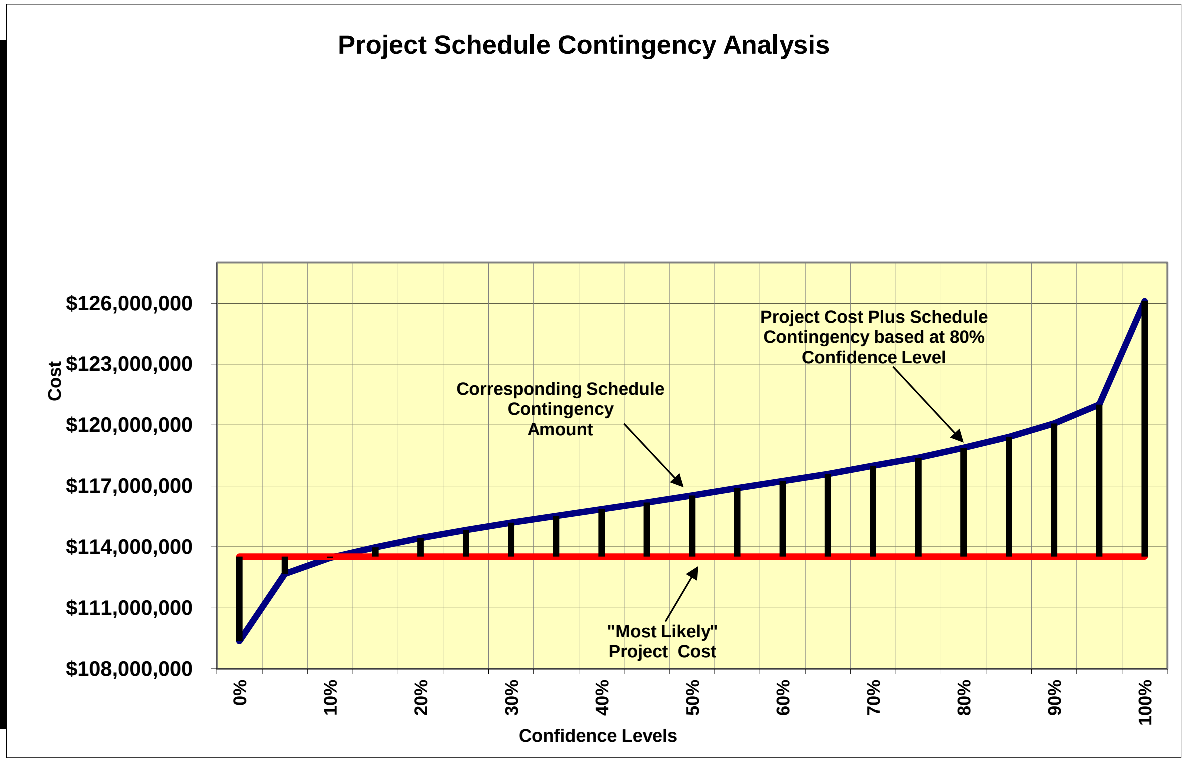
Most Likely Schedule Duration	91.6 Months		
Confidence Level	**Project Duration**	**Contingency**	**Contingency %**
0%	48.4 Months	-43.1 Months	-47.09%
5%	81.9 Months	-9.7 Months	-10.59%
10%	89.8 Months	-1.8 Months	-1.91%
15%	95.1 Months	3.6 Months	3.91%
20%	99.7 Months	8.2 Months	8.95%
25%	103.7 Months	12.1 Months	13.25%
30%	107.6 Months	16.0 Months	17.48%
35%	111.0 Months	19.4 Months	21.24%
40%	114.5 Months	22.9 Months	25.04%
45%	118.0 Months	26.4 Months	28.85%
50%	121.6 Months	30.0 Months	32.82%
55%	125.4 Months	33.8 Months	36.92%
60%	129.2 Months	37.6 Months	41.09%
65%	132.8 Months	41.3 Months	45.11%
70%	137.1 Months	45.5 Months	49.71%
75%	141.3 Months	49.7 Months	54.33%
80%	146.6 Months	55.0 Months	60.09%
85%	152.1 Months	60.6 Months	66.17%
90%	159.1 Months	67.5 Months	73.77%
95%	168.8 Months	77.2 Months	84.33%
100%	220.8 Months	129.2 Months	141.17%



- SCHEDULE CONTINGENCY (AMOUNT) DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$113,528,738		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$109,366,513	($4,162,225)	-3.67%
5%	$112,673,799	($854,938)	-0.75%
10%	$113,459,909	($68,828)	-0.06%
15%	$113,988,667	$459,930	0.41%
20%	$114,441,599	$912,861	0.80%
25%	$114,828,226	$1,299,488	1.14%
30%	$115,200,511	$1,671,774	1.47%
35%	$115,529,362	$2,000,625	1.76%
40%	$115,863,946	$2,335,209	2.06%
45%	$116,194,416	$2,665,679	2.35%
50%	$116,538,828	$3,010,090	2.65%
55%	$116,893,508	$3,364,770	2.96%
60%	$117,244,552	$3,715,814	3.27%
65%	$117,593,547	$4,064,809	3.58%
70%	$117,994,495	$4,465,757	3.93%
75%	$118,392,248	$4,863,510	4.28%
80%	$118,886,485	$5,357,747	4.72%
85%	$119,421,871	$5,893,133	5.19%
90%	$120,084,225	$6,555,487	5.77%
95%	$121,011,116	$7,482,378	6.59%
100%	$126,087,639	$12,558,901	11.06%



SAM - Walton County Storm Damage Reduction Project, GI Study - NE

Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost (Most Likely) ->	**$43,215,813**
Baseline Estimate Cost Contingency Amount ->	$6,933,327
Baseline Estimate Construction Cost (80% Confidence) ->	**$50,149,140**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**18.3 Months**
Schedule Contingency Duration ->	10.1 Months
Project Schedule Duration (80% Confidence) ->	**28.4 Months**
Project Schedule Contingency Amount (80% Confidence) ->	**$1,908,809**

Project Contingency	80% Confidence Project Cost
Project Contingency Amount (80% Confidence) ->	**$8,842,136**
Project Contingency Percentage (80% Confidence) ->	**20%**

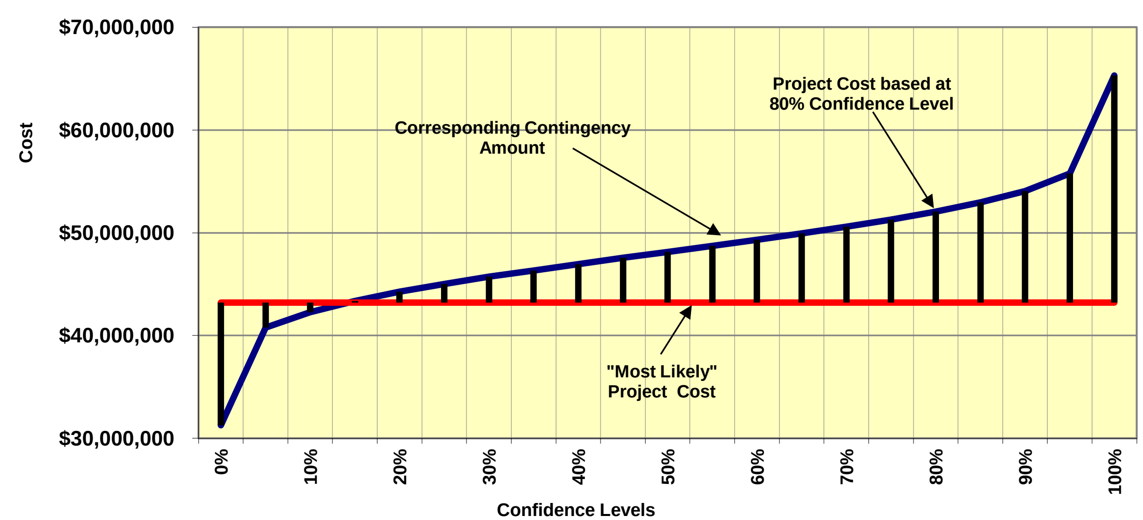
Project Cost (80% Confidence) ->	**$52,057,949**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$43,215,813		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$31,263,060	($11,952,753)	-27.66%
5%	$40,771,214	($2,444,599)	-5.66%
10%	$42,284,567	($931,245)	-2.15%
15%	$43,355,983	$140,171	0.32%
20%	$44,267,582	$1,051,770	2.43%
25%	$45,025,441	$1,809,628	4.19%
30%	$45,722,057	$2,506,244	5.80%
35%	$46,338,482	$3,122,669	7.23%
40%	$46,949,282	$3,733,470	8.64%
45%	$47,563,354	$4,347,541	10.06%
50%	$48,128,699	$4,912,886	11.37%
55%	$48,731,228	$5,515,415	12.76%
60%	$49,305,991	$6,090,179	14.09%
65%	$49,931,763	$6,715,951	15.54%
70%	$50,603,221	$7,387,408	17.09%
75%	$51,267,253	$8,051,440	18.63%
80%	**$52,057,949**	**$8,842,136**	**20.46%**
85%	$52,955,152	$9,739,340	22.54%
90%	$54,057,350	$10,841,537	25.09%
95%	$55,777,293	$12,561,480	29.07%
100%	$65,317,306	$22,101,493	51.14%

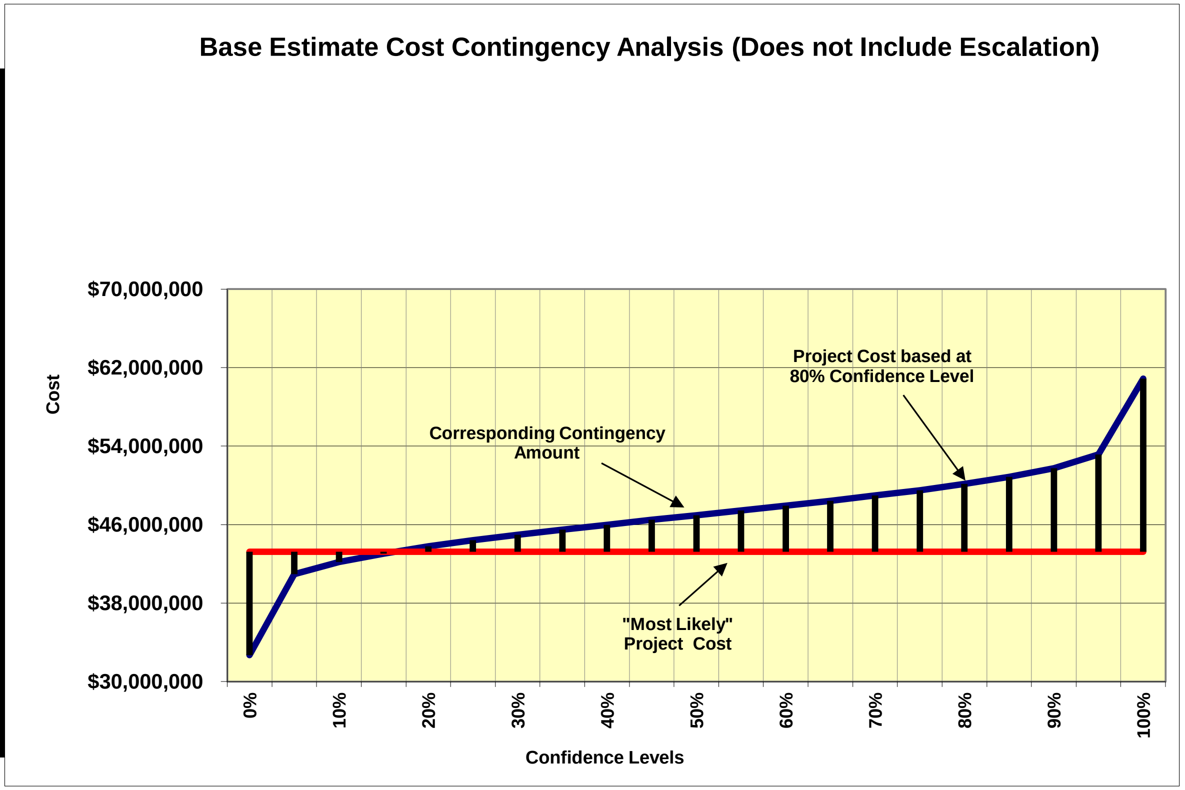
Project Cost Contingency Analysis



- BASE CONTINGENCY DEVELOPMENT -

Contingency Analysis

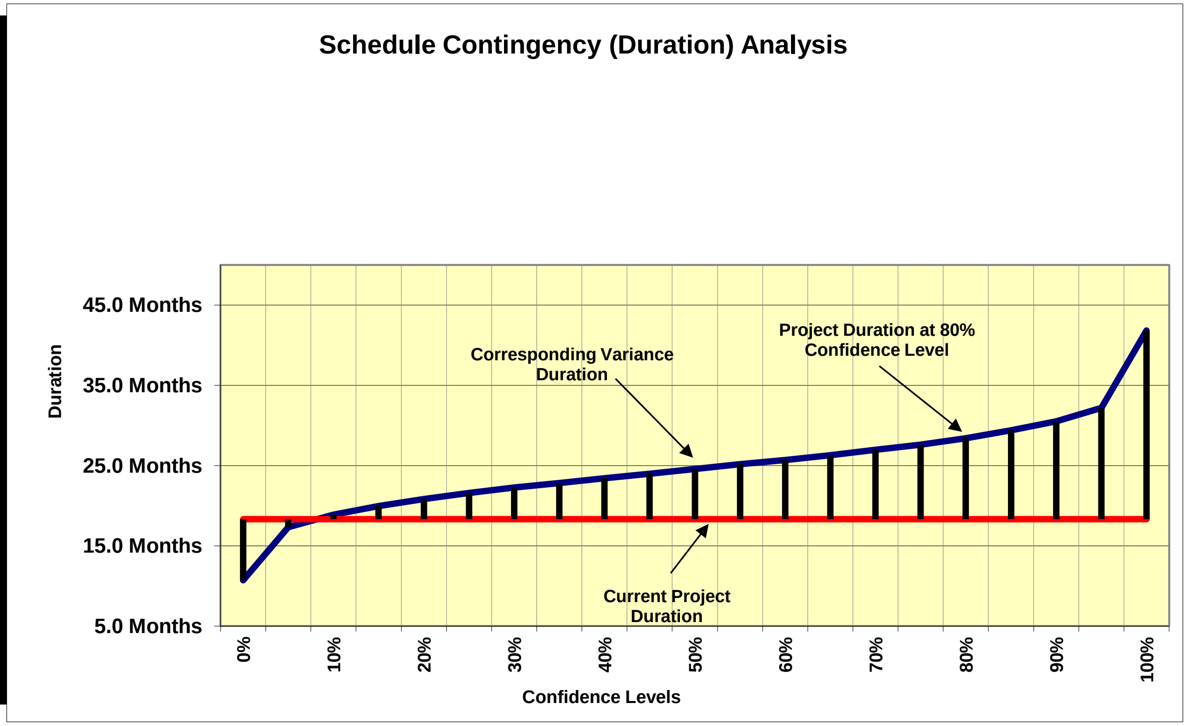
Most Likely Cost Estimate	$43,215,813		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$32,697,930	($10,517,883.00)	-24.34%
5%	$40,956,731	($2,259,081.53)	-5.23%
10%	$42,173,738	($1,042,074.28)	-2.41%
15%	$43,044,571	($171,241.42)	-0.40%
20%	$43,789,421	$573,607.96	1.33%
25%	$44,405,073	$1,189,260.24	2.75%
30%	$44,976,017	$1,760,204.02	4.07%
35%	$45,483,283	$2,267,470.50	5.25%
40%	$45,981,082	$2,765,269.03	6.40%
45%	$46,489,046	$3,273,233.48	7.57%
50%	$46,944,744	$3,728,931.79	8.63%
55%	$47,435,325	$4,219,512.04	9.76%
60%	$47,912,788	$4,696,975.69	10.87%
65%	$48,426,166	$5,210,353.01	12.06%
70%	$48,967,200	$5,751,387.49	13.31%
75%	$49,507,860	$6,292,047.38	14.56%
80%	$50,149,140	$6,933,327.50	16.04%
85%	$50,863,667	$7,647,854.74	17.70%
90%	$51,750,010	$8,534,197.79	19.75%
95%	$53,159,922	$9,944,108.96	23.01%
100%	$60,879,277	$17,663,464.11	40.87%



- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

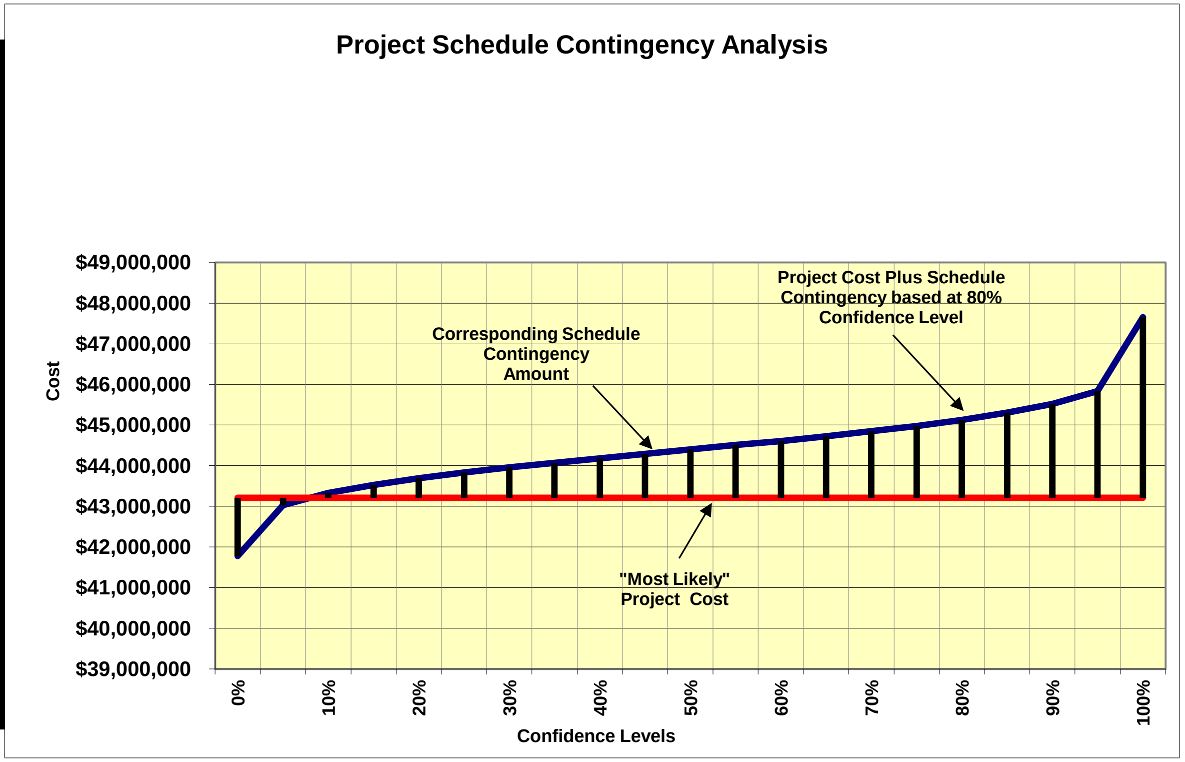
Most Likely Schedule Duration	18.3 Months		
Confidence Level	Project Duration	Contingency	Contingency %
0%	10.7 Months	-7.6 Months	-41.50%
5%	17.3 Months	-1.0 Months	-5.37%
10%	18.9 Months	0.6 Months	3.21%
15%	20.0 Months	1.6 Months	9.01%
20%	20.8 Months	2.5 Months	13.83%
25%	21.6 Months	3.3 Months	17.94%
30%	22.3 Months	4.0 Months	21.58%
35%	22.8 Months	4.5 Months	24.74%
40%	23.4 Months	5.1 Months	28.00%
45%	24.0 Months	5.7 Months	31.07%
50%	24.6 Months	6.3 Months	34.25%
55%	25.2 Months	6.9 Months	37.48%
60%	25.7 Months	7.4 Months	40.30%
65%	26.3 Months	8.0 Months	43.55%
70%	27.0 Months	8.7 Months	47.32%
75%	27.6 Months	9.3 Months	50.89%
80%	28.4 Months	10.1 Months	55.21%
85%	29.4 Months	11.1 Months	60.50%
90%	30.5 Months	12.2 Months	66.74%
95%	32.2 Months	13.9 Months	75.71%
100%	41.8 Months	23.5 Months	128.37%



- SCHEDULE CONTINGENCY (AMOUNT) DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$43,215,813		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$41,780,943	($1,434,870)	-3.32%
5%	$43,030,296	($185,517)	-0.43%
10%	$43,326,642	$110,829	0.26%
15%	$43,527,225	$311,412	0.72%
20%	$43,693,974	$478,162	1.11%
25%	$43,836,181	$620,368	1.44%
30%	$43,961,853	$746,040	1.73%
35%	$44,071,011	$855,199	1.98%
40%	$44,184,013	$968,200	2.24%
45%	$44,290,120	$1,074,308	2.49%
50%	$44,399,767	$1,183,954	2.74%
55%	$44,511,715	$1,295,903	3.00%
60%	$44,609,016	$1,393,203	3.22%
65%	$44,721,410	$1,505,598	3.48%
70%	$44,851,833	$1,636,021	3.79%
75%	$44,975,206	$1,759,393	4.07%
80%	$45,124,621	$1,908,809	4.42%
85%	$45,307,298	$2,091,485	4.84%
90%	$45,523,152	$2,307,339	5.34%
95%	$45,833,184	$2,617,371	6.06%
100%	$47,653,842	$4,438,029	10.27%



SAM - Walton County Storm Damage Reduction Project, GI Study - NE

Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost (Most Likely) ->	**$70,312,925**
Baseline Estimate Cost Contingency Amount ->	$17,914,799
Baseline Estimate Construction Cost (80% Confidence) ->	**$88,227,724**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**18.3 Months**
Schedule Contingency Duration ->	44.9 Months
Project Schedule Duration (80% Confidence) ->	**63.2 Months**
Project Schedule Contingency Amount (80% Confidence) ->	**$3,448,939**

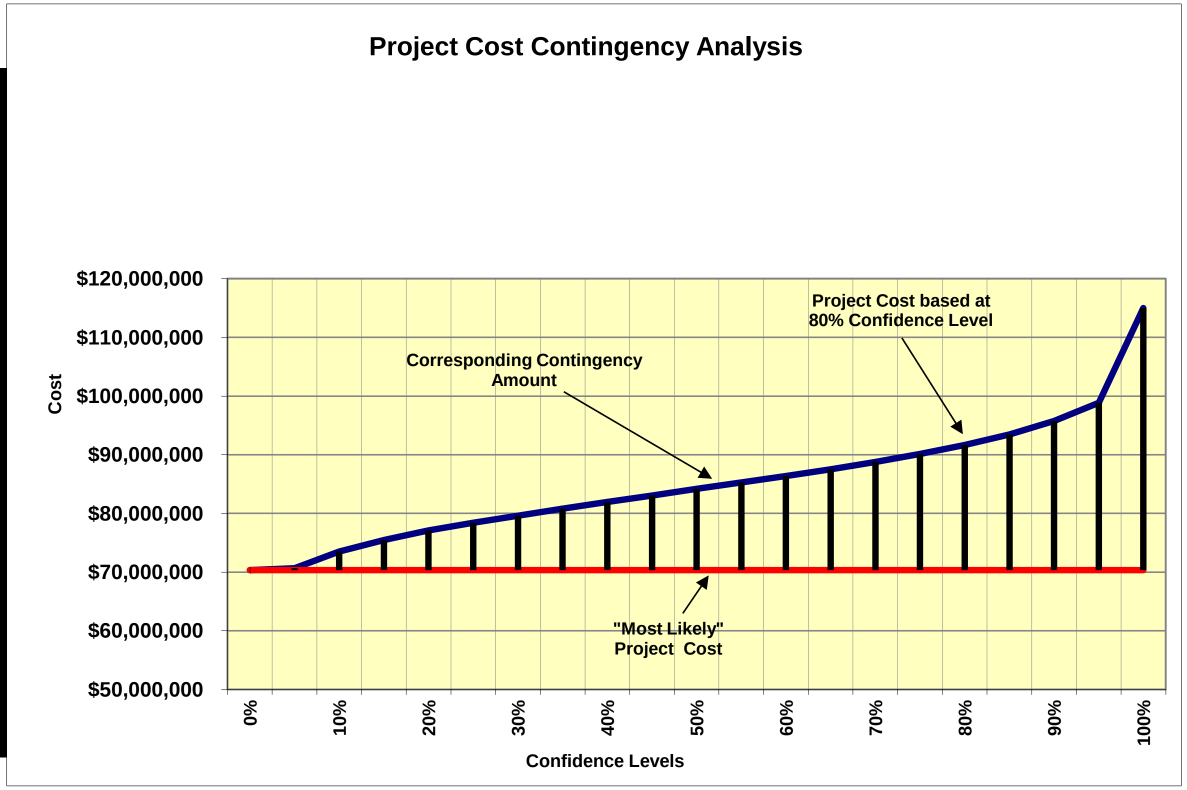
Project Contingency	80% Confidence Project Cost
Project Contingency Amount (80% Confidence) ->	**$21,363,738**
Project Contingency Percentage (80% Confidence) ->	**30%**

Project Cost (80% Confidence) ->	**$91,676,663**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

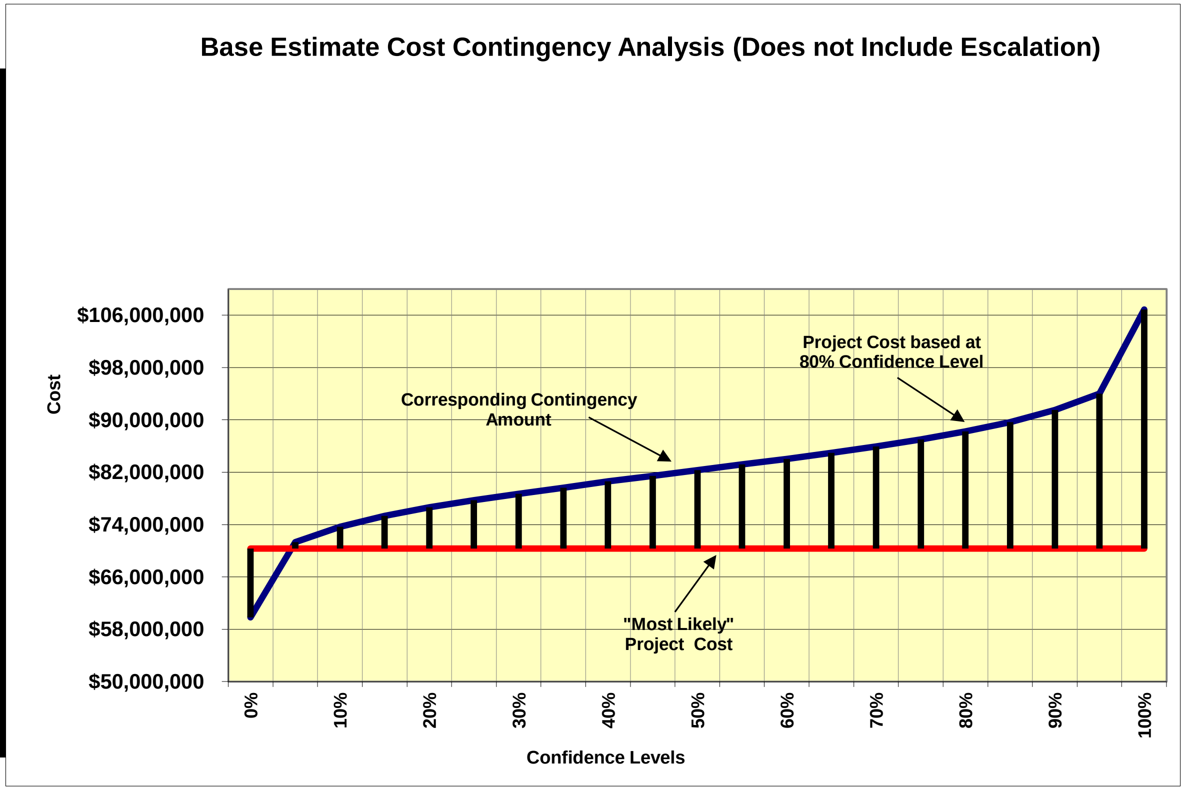
Most Likely Cost Estimate	$70,312,925		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$70,312,925	($13,199,904)	0.00%
5%	$70,653,162	$340,237	0.48%
10%	$73,488,498	$3,175,573	4.52%
15%	$75,478,124	$5,165,199	7.35%
20%	$77,074,792	$6,761,867	9.62%
25%	$78,410,523	$8,097,598	11.52%
30%	$79,604,771	$9,291,846	13.21%
35%	$80,791,329	$10,478,404	14.90%
40%	$81,975,071	$11,662,146	16.59%
45%	$83,027,893	$12,714,968	18.08%
50%	$84,166,693	$13,853,768	19.70%
55%	$85,251,266	$14,938,341	21.25%
60%	$86,373,959	$16,061,034	22.84%
65%	$87,526,264	$17,213,339	24.48%
70%	$88,762,956	$18,450,031	26.24%
75%	$90,129,541	$19,816,616	28.18%
80%	$91,676,663	$21,363,738	30.38%
85%	$93,437,277	$23,124,352	32.89%
90%	$95,739,595	$25,426,670	36.16%
95%	$98,875,237	$28,562,312	40.62%
100%	$114,978,047	$44,665,122	63.52%



- BASE CONTINGENCY DEVELOPMENT -

Contingency Analysis

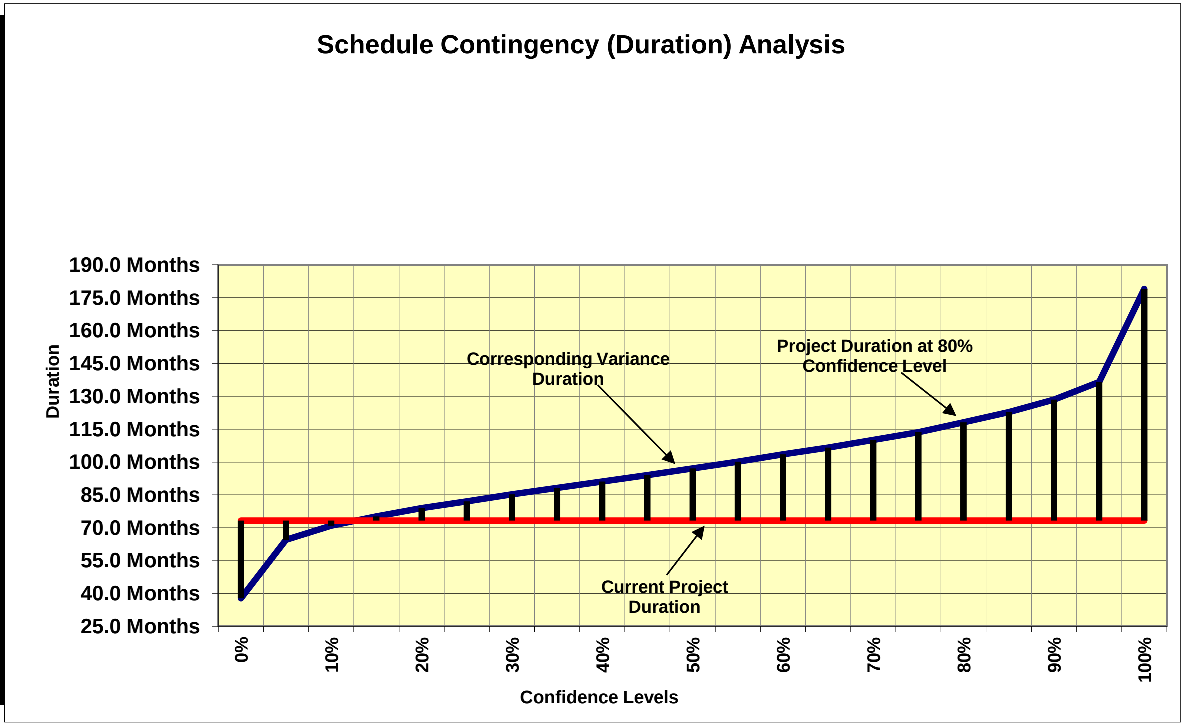
Most Likely Cost Estimate	$70,312,925		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$59,840,376	($10,472,548.90)	-14.89%
5%	$71,322,584	$1,009,658.72	1.44%
10%	$73,668,156	$3,355,230.72	4.77%
15%	$75,329,607	$5,016,681.51	7.13%
20%	$76,640,092	$6,327,166.99	9.00%
25%	$77,731,403	$7,418,478.05	10.55%
30%	$78,679,038	$8,366,112.97	11.90%
35%	$79,645,903	$9,332,977.86	13.27%
40%	$80,608,063	$10,295,137.55	14.64%
45%	$81,436,522	$11,123,596.62	15.82%
50%	$82,340,556	$12,027,631.40	17.11%
55%	$83,182,399	$12,869,473.51	18.30%
60%	$84,051,347	$13,738,422.30	19.54%
65%	$84,967,053	$14,654,127.70	20.84%
70%	$85,933,219	$15,620,294.18	22.22%
75%	$87,025,424	$16,712,499.24	23.77%
80%	$88,227,724	$17,914,799.21	25.48%
85%	$89,635,629	$19,322,703.78	27.48%
90%	$91,491,447	$21,178,521.79	30.12%
95%	$94,010,230	$23,697,304.89	33.70%
100%	$106,857,175	$36,544,249.75	51.97%



- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

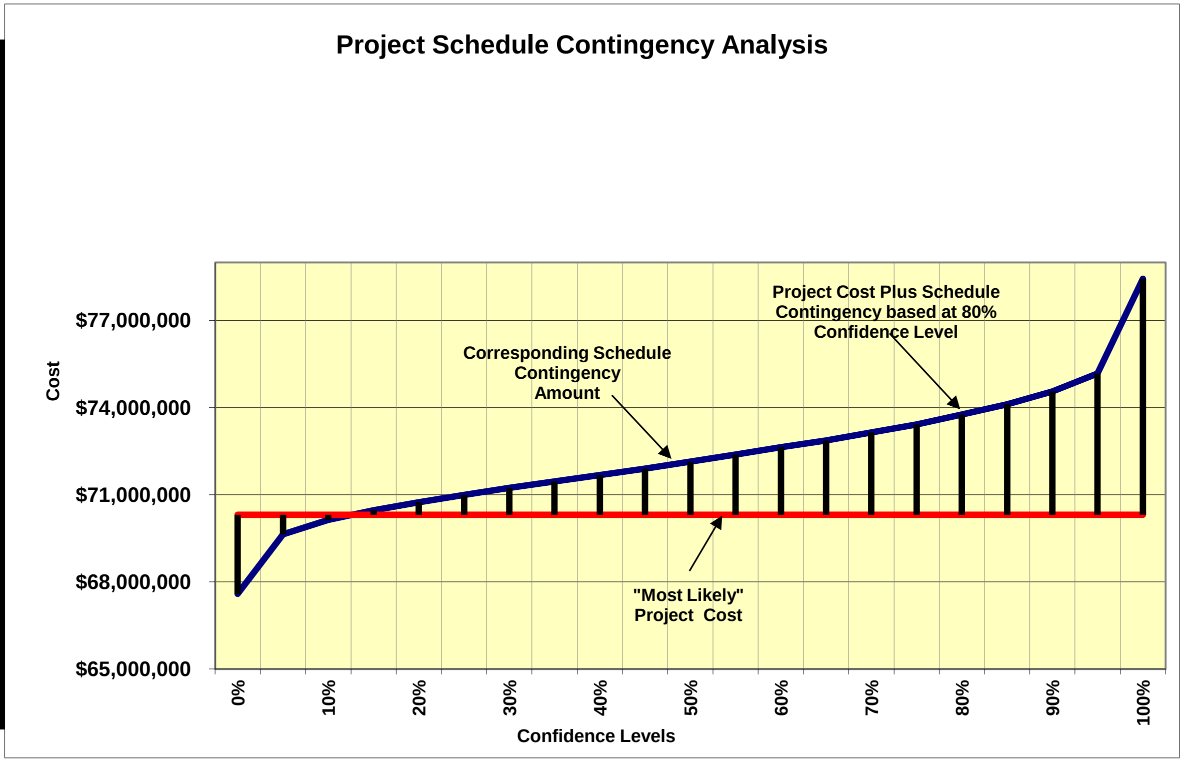
Most Likely Schedule Duration	73.2 Months		
Confidence Level	Project Duration	Contingency	Contingency %
0%	37.7 Months	-35.5 Months	-48.49%
5%	64.5 Months	-8.7 Months	-11.90%
10%	70.9 Months	-2.3 Months	-3.19%
15%	75.2 Months	1.9 Months	2.64%
20%	78.9 Months	5.7 Months	7.73%
25%	82.1 Months	8.8 Months	12.07%
30%	85.3 Months	12.1 Months	16.46%
35%	88.2 Months	14.9 Months	20.36%
40%	91.0 Months	17.8 Months	24.30%
45%	94.0 Months	20.7 Months	28.29%
50%	97.0 Months	23.8 Months	32.46%
55%	100.2 Months	26.9 Months	36.78%
60%	103.5 Months	30.2 Months	41.29%
65%	106.6 Months	33.3 Months	45.50%
70%	110.1 Months	36.8 Months	50.31%
75%	113.7 Months	40.4 Months	55.18%
80%	118.1 Months	44.9 Months	61.31%
85%	122.7 Months	49.5 Months	67.58%
90%	128.6 Months	55.3 Months	75.52%
95%	136.6 Months	63.3 Months	86.49%
100%	179.0 Months	105.7 Months	144.37%



- SCHEDULE CONTINGENCY (AMOUNT) DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$70,312,925		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$67,585,570	($2,727,355)	-3.88%
5%	$69,643,504	($669,421)	-0.95%
10%	$70,133,268	($179,657)	-0.26%
15%	$70,461,443	$148,518	0.21%
20%	$70,747,625	$434,700	0.62%
25%	$70,992,045	$679,120	0.97%
30%	$71,238,658	$925,733	1.32%
35%	$71,458,351	$1,145,426	1.63%
40%	$71,679,933	$1,367,008	1.94%
45%	$71,904,296	$1,591,371	2.26%
50%	$72,139,061	$1,826,136	2.60%
55%	$72,381,792	$2,068,867	2.94%
60%	$72,635,536	$2,322,611	3.30%
65%	$72,872,137	$2,559,212	3.64%
70%	$73,142,662	$2,829,737	4.02%
75%	$73,417,042	$3,104,117	4.41%
80%	$73,761,864	$3,448,939	4.91%
85%	$74,114,573	$3,801,648	5.41%
90%	$74,561,073	$4,248,148	6.04%
95%	$75,177,932	$4,865,007	6.92%
100%	$78,433,797	$8,120,872	11.55%



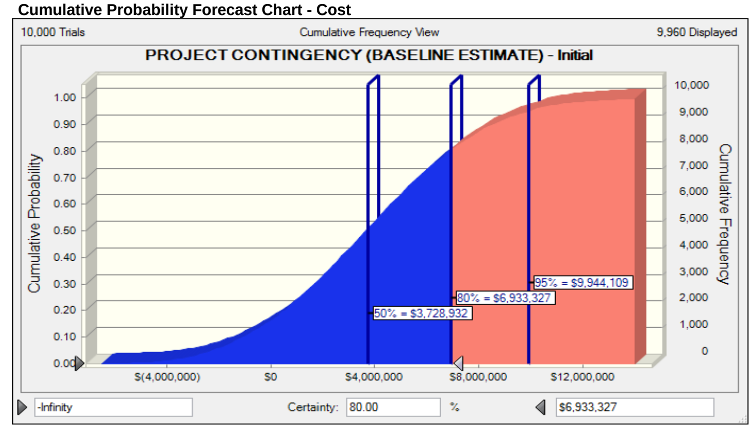
SAM - Walton County Storm Damage Reduction Project, GI Study - NED

		Project Cost						Crystal Ball Simulation							
								Expected Values ($$$)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM INTERNAL RISKS														
I-1	Scope Definition	LIKELY	SIGNIFICANT	HIGH	Yes-No/Uniform	I-2	65%	$ (1,048,500)	$ -	$ -	$ -	*Correlated to Risk I-2 by a factor of 0.75*	-2.43%	0.00%	0.00%
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform	I-1	100%	$ (2,160,791)	$ -	$ 4,321,581	$ -	*Correlated to Risk I-1 by a factor of 0.75*	-5.00%	0.00%	10.00%
I-5	Fuel Prices	VERY LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ (1,407,390)	$ -	$ 4,811,310	$ -		-3.26%	0.00%	11.13%
I-6	Permits	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ -	$ -	$ 2,032,039	$ -		0.00%	0.00%	4.70%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	Moderate	Triangular		100%	$ -	$ -	$ 1,219,223	$ -		0.00%	0.00%	2.82%
	ESTIMATE AND SCHEDULE RISKS														
EST-1	Estimate Considerations	Likely	Significant	HIGH	Triangular		100%	$ (2,032,039)	$ -	$ 2,032,039	$ -		-4.70%	0.00%	4.70%
	LOW AND UNKNOWN INTERNAL RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (2,032,039)	$ -	$ 2,032,039	$ -		-4.70%	0.00%	4.70%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ (1,219,223)	$ -	$ 2,032,039	$ -		-2.82%	0.00%	4.70%
E-2	Funding Delays	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*The original risk register and current assumption indicate this is not high risk for the initial activity, but is for the out-years*	N/A	N/A	N/A
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (2,032,039)	$ -	$ 2,032,039	$ -		-4.70%	0.00%	4.70%
											$ -				

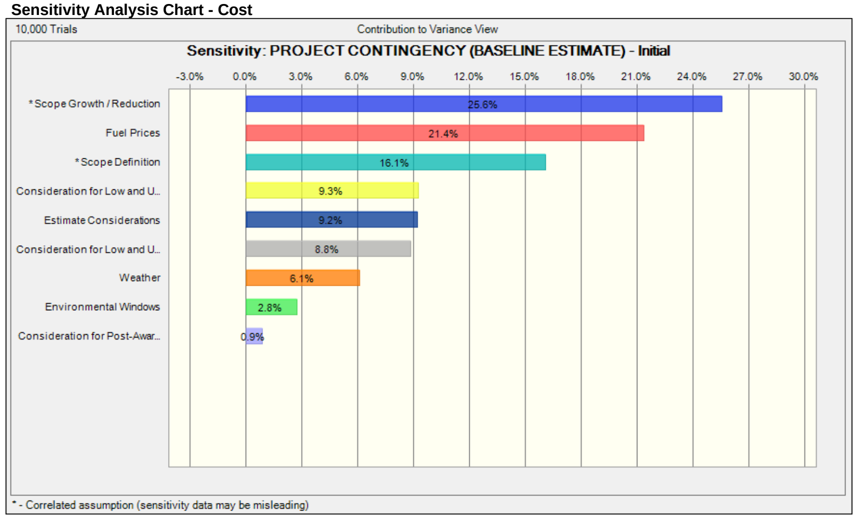
Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	$43,215,813	($10,517,883)	**$32,697,930**	**-24.34%**
	5%	$43,215,813	($2,259,082)	**$40,956,731**	**-5.23%**
	10%	$43,215,813	($1,042,074)	**$42,173,738**	**-2.41%**
	15%	$43,215,813	($171,241)	**$43,044,571**	**-0.40%**
	20%	$43,215,813	$573,608	**$43,789,421**	**1.33%**
	25%	$43,215,813	$1,189,260	**$44,405,073**	**2.75%**
	30%	$43,215,813	$1,760,204	**$44,976,017**	**4.07%**
	35%	$43,215,813	$2,267,471	**$45,483,283**	**5.25%**
	40%	$43,215,813	$2,765,269	**$45,981,082**	**6.40%**
	45%	$43,215,813	$3,273,233	**$46,489,046**	**7.57%**
	50%	$43,215,813	$3,728,932	**$46,944,744**	**8.63%**
	55%	$43,215,813	$4,219,512	**$47,435,325**	**9.76%**
	60%	$43,215,813	$4,696,976	**$47,912,788**	**10.87%**
	65%	$43,215,813	$5,210,353	**$48,426,166**	**12.06%**
	70%	$43,215,813	$5,751,387	**$48,967,200**	**13.31%**
	75%	$43,215,813	$6,292,047	**$49,507,860**	**14.56%**
	80%	$43,215,813	$6,933,327	**$50,149,140**	**16.04%**
	85%	$43,215,813	$7,647,855	**$50,863,667**	**17.70%**
	90%	$43,215,813	$8,534,198	**$51,750,010**	**19.75%**
	95%	$43,215,813	$9,944,109	**$53,159,922**	**23.01%**
	100%	$43,215,813	$17,663,464	**$60,879,277**	**40.87%**

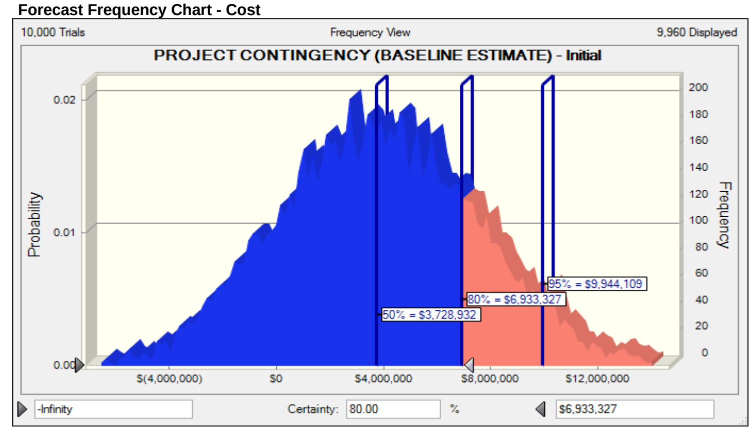
Cumulative Probability Forecast Chart - Cost



Sensitivity Analysis Chart - Cost



Forecast Frequency Chart - Cost



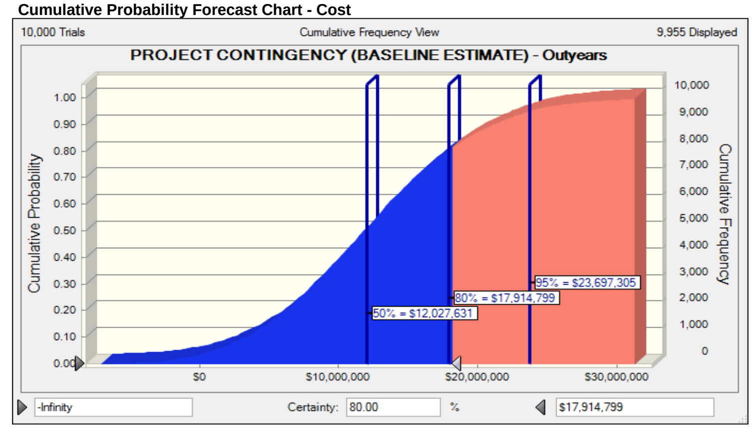
SAM - Walton County Storm Damage Reduction Project, GI Study - NED

		Project Cost						Crystal Ball Simulation: Expected Values ($$$)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM INTERNAL RISKS														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform	I-1	100%	$ (3,515,646)	$ -	$ 7,031,293	$ -		-5.00%	0.00%	10.00%
I-4	Material Availability	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ -	$ -	$ 6,657,000	$ -		0.00%	0.00%	9.47%
I-5	Fuel Prices	VERY LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ (1,997,100)	$ -	$ 9,319,800	$ -		-2.84%	0.00%	13.25%
I-6	Permits	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ -	$ -	$ 3,333,235	$ -		0.00%	0.00%	4.74%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	Moderate	Triangular		100%	$ -	$ -	$ 1,499,956	$ -		0.00%	0.00%	2.13%
	ESTIMATE AND SCHEDULE RISKS														
EST-1	Estimate Considerations	Likely	Significant	HIGH	Triangular		100%	$ (3,333,235)	$ -	$ 3,333,235	$ -		-4.74%	0.00%	4.74%
	LOW AND UNKNOWN INTERNAL RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (3,333,235)	$ -	$ 3,333,235	$ -		-4.74%	0.00%	4.74%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ (1,999,941)	$ -	$ 3,333,235	$ -		-2.84%	0.00%	4.74%
E-2	Funding Delays	LIKELY	MARGINAL	MODERATE	Yes-No/Triangular		65%	$ -	$ -	$ 8,080,330	$ -		0.00%	0.00%	11.49%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (3,333,235)	$ -	$ 3,333,235	$ -		-4.74%	0.00%	4.74%
											$ -				

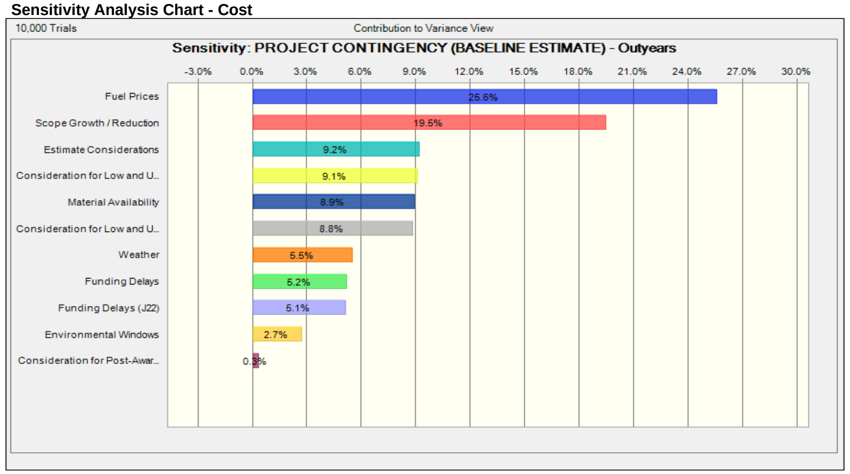
Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	$70,312,925	($10,472,549)	**$59,840,376**	**-14.89%**
	5%	$70,312,925	$1,009,659	**$71,322,584**	**1.44%**
	10%	$70,312,925	$3,355,231	**$73,668,156**	**4.77%**
	15%	$70,312,925	$5,016,682	**$75,329,607**	**7.13%**
	20%	$70,312,925	$6,327,167	**$76,640,092**	**9.00%**
	25%	$70,312,925	$7,418,478	**$77,731,403**	**10.55%**
	30%	$70,312,925	$8,366,113	**$78,679,038**	**11.90%**
	35%	$70,312,925	$9,332,978	**$79,645,903**	**13.27%**
	40%	$70,312,925	$10,295,138	**$80,608,063**	**14.64%**
	45%	$70,312,925	$11,123,597	**$81,436,522**	**15.82%**
	50%	$70,312,925	$12,027,631	**$82,340,556**	**17.11%**
	55%	$70,312,925	$12,869,474	**$83,182,399**	**18.30%**
	60%	$70,312,925	$13,738,422	**$84,051,347**	**19.54%**
	65%	$70,312,925	$14,654,128	**$84,967,053**	**20.84%**
	70%	$70,312,925	$15,620,294	**$85,933,219**	**22.22%**
	75%	$70,312,925	$16,712,499	**$87,025,424**	**23.77%**
	80%	$70,312,925	$17,914,799	**$88,227,724**	**25.48%**
	85%	$70,312,925	$19,322,704	**$89,635,629**	**27.48%**
	90%	$70,312,925	$21,178,522	**$91,491,447**	**30.12%**
	95%	$70,312,925	$23,697,305	**$94,010,230**	**33.70%**
	100%	$70,312,925	$36,544,250	**$106,857,175**	**51.97%**

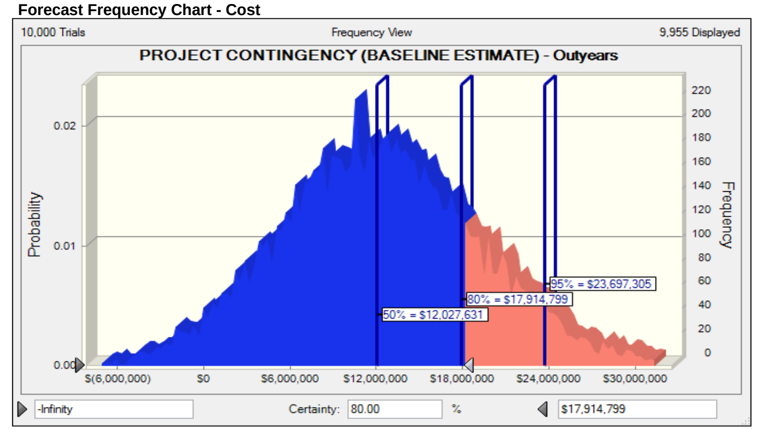
Cumulative Probability Forecast Chart - Cost



Sensitivity Analysis Chart - Cost



Forecast Frequency Chart - Cost



USACE Mobile District District
SAM - Walton County Storm Damage Reduction Project, GI Study - NED

CWWBS No.	Project Cost
01 Lands and Damages	$543,000.00
17 Dredging	$100,086,464.41
17 Beach Work	$4,194,000.00
17 Planting	$2,875,000.00
17 Environmental	$450,000.00
30 Planning, Engineering, and Design	$3,228,163.93
31 Construction Management	$2,152,109.29
Total	$113,528,737.63

Category	Project Cost
Labor Cost	$2,106,212.35
Equipment Cost	$3,253,684.51
Material Cost	$0.00
Sub Bid Cost	$5,269,000.00
User Cost	$95,400,460.00
Direct Cost	$106,029,356.86
Contract Cost	$107,605,464.41
Project Cost	$113,528,737.63

Initial - 2014	Project Cost
01 Lands and Damages	$543,000.00
17 Hopper Dredging	$33,421,773.93
17 Beach & Dune Planting	$2,875,000.00
17 Beach Work Items	$4,194,000.00
17 Environmental	$150,000.00
30 Planning, Engineering, and Design	$1,219,223.22
31 Construction Management	$812,815.48
Total	$43,215,812.63

Out-Years 2024, 2034, 2044, 2054	Project Cost
17 Hopper Dredging	$16,666,172.62
17 Environmental	$75,000.00
30 Planning, Engineering, and Design	$502,235.18
31 Construction Management	$334,823.45
Total	$17,578,231.25

SAM - Walton County Storm Damage Reduction Project, GI Study - NED

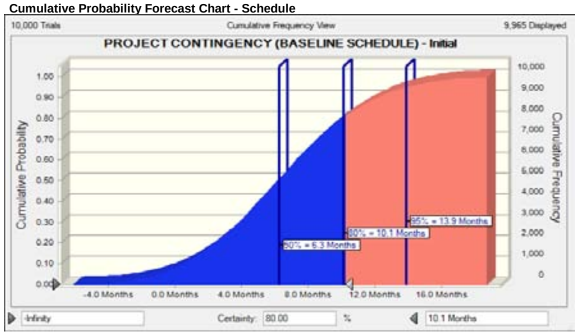
								Crystal Ball Simulation							
		Project Schedule						Expected Values (Months)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM MGMT														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform		100%	-4.0 Months	0.0 Months	6.0 Months	0.0 Months		-21.85%	0.00%	32.77%
I-6	Permits	LIKELY	MARGINAL	MODERATE	Triangular		100%	0.0 Months	0.0 Months	6.0 Months	0.0 Months		0.00%	0.00%	32.77%
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	MODERATE	Triangular		100%	0.0 Months	0.0 Months	3.0 Months	0.0 Months		0.00%	0.00%	16.38%
	ECONOMICS RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	6.0 Months	0.0 Months		-16.38%	0.00%	32.77%
E-2	Funding Delays	LIKELY	Significant	HIGH	Yes-No/Uniform		65%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
											0.0 Months				

Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

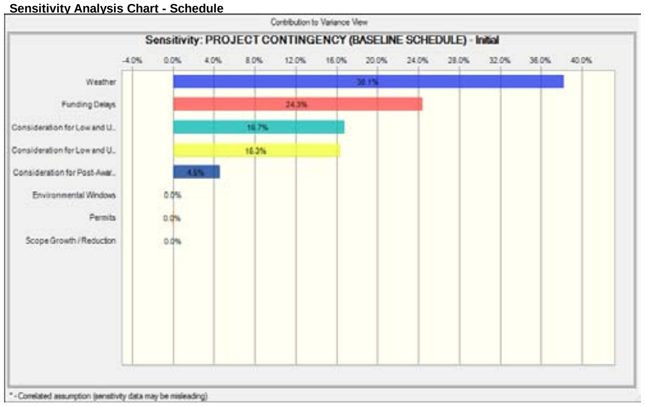
Contingency Summary Table - Schedule

PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	18.3 Months	-7.6 Months	**10.7 Months**	**-41.50%**
	5%	18.3 Months	-1.0 Months	**17.3 Months**	**-5.37%**
	10%	18.3 Months	0.6 Months	**18.9 Months**	**3.21%**
	15%	18.3 Months	1.6 Months	**20.0 Months**	**9.01%**
	20%	18.3 Months	2.5 Months	**20.8 Months**	**13.83%**
	25%	18.3 Months	3.3 Months	**21.6 Months**	**17.94%**
	30%	18.3 Months	4.0 Months	**22.3 Months**	**21.58%**
	35%	18.3 Months	4.5 Months	**22.8 Months**	**24.74%**
	40%	18.3 Months	5.1 Months	**23.4 Months**	**28.00%**
	45%	18.3 Months	5.7 Months	**24.0 Months**	**31.07%**
	50%	18.3 Months	6.3 Months	**24.6 Months**	**34.25%**
	55%	18.3 Months	6.9 Months	**25.2 Months**	**37.48%**
	60%	18.3 Months	7.4 Months	**25.7 Months**	**40.30%**
	65%	18.3 Months	8.0 Months	**26.3 Months**	**43.55%**
	70%	18.3 Months	8.7 Months	**27.0 Months**	**47.32%**
	75%	18.3 Months	9.3 Months	**27.6 Months**	**50.89%**
	80%	18.3 Months	10.1 Months	**28.4 Months**	**55.21%**
	85%	18.3 Months	11.1 Months	**29.4 Months**	**60.50%**
	90%	18.3 Months	12.2 Months	**30.5 Months**	**66.74%**
	95%	18.3 Months	13.9 Months	**32.2 Months**	**75.71%**
	100%	18.3 Months	23.5 Months	**41.8 Months**	**128.37%**

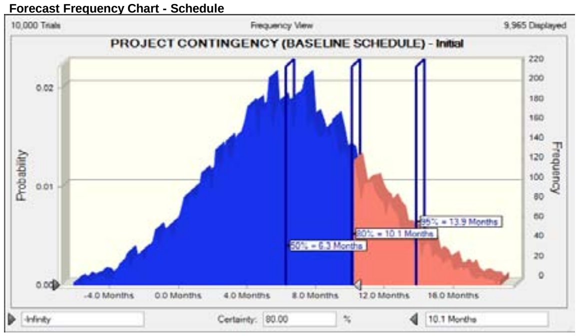
Cumulative Probability Forecast Chart - Schedule



Sensitivity Analysis Chart - Schedule



Forecast Frequency Chart - Schedule



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

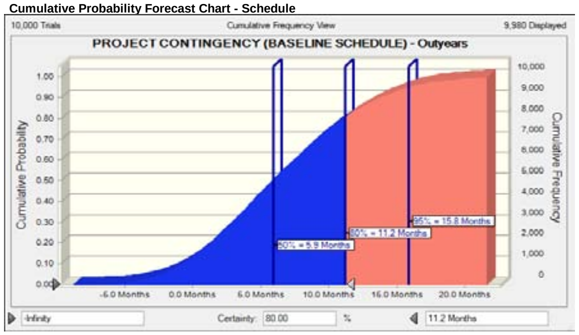
								Crystal Ball Simulation							
		Project Schedule						Expected Values (Months)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM MGMT														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform		100%	-4.0 Months	0.0 Months	6.0 Months	0.0 Months		-21.85%	0.00%	32.77%
I-4	Material Availability	LIKELY	MARGINAL	MODERATE	Triangular		100%	0.0 Months	0.0 Months	2.0 Months	0.0 Months		0.00%	0.00%	10.92%
I-6	Permits	LIKELY	MARGINAL	MODERATE	Triangular		N/A	N/A	N/A	N/A	N/A	*Removed from Schedule Risk Model, as there will be enough time to obtain permits for outyear nourishments*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	MODERATE	Triangular		100%	0.0 Months	0.0 Months	3.0 Months	0.0 Months		0.00%	0.00%	16.38%
	ECONOMICS RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	6.0 Months	0.0 Months		-16.38%	0.00%	32.77%
E-2	Funding Delays	LIKELY	Significant	HIGH	Yes-No/Uniform		65%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
											0.0 Months				

Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

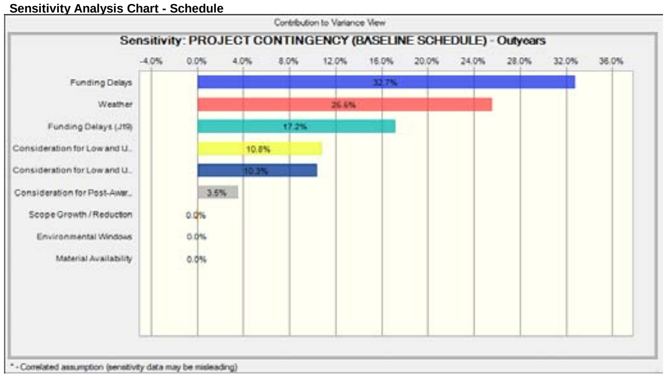
Contingency Summary Table - Schedule

PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	18.3 Months	-8.9 Months	**9.4 Months**	**-48.49%**
	5%	18.3 Months	-2.2 Months	**16.1 Months**	**-11.90%**
	10%	18.3 Months	-0.6 Months	**17.7 Months**	**-3.19%**
	15%	18.3 Months	0.5 Months	**18.8 Months**	**2.64%**
	20%	18.3 Months	1.4 Months	**19.7 Months**	**7.73%**
	25%	18.3 Months	2.2 Months	**20.5 Months**	**12.07%**
	30%	18.3 Months	3.0 Months	**21.3 Months**	**16.46%**
	35%	18.3 Months	3.7 Months	**22.0 Months**	**20.36%**
	40%	18.3 Months	4.4 Months	**22.8 Months**	**24.30%**
	45%	18.3 Months	5.2 Months	**23.5 Months**	**28.29%**
	50%	18.3 Months	5.9 Months	**24.3 Months**	**32.46%**
	55%	18.3 Months	6.7 Months	**25.0 Months**	**36.78%**
	60%	18.3 Months	7.6 Months	**25.9 Months**	**41.29%**
	65%	18.3 Months	8.3 Months	**26.6 Months**	**45.50%**
	70%	18.3 Months	9.2 Months	**27.5 Months**	**50.31%**
	75%	18.3 Months	10.1 Months	**28.4 Months**	**55.18%**
	80%	18.3 Months	11.2 Months	**29.5 Months**	**61.31%**
	85%	18.3 Months	12.4 Months	**30.7 Months**	**67.58%**
	90%	18.3 Months	13.8 Months	**32.1 Months**	**75.52%**
	95%	18.3 Months	15.8 Months	**34.1 Months**	**86.49%**
	100%	18.3 Months	26.4 Months	**44.7 Months**	**144.37%**

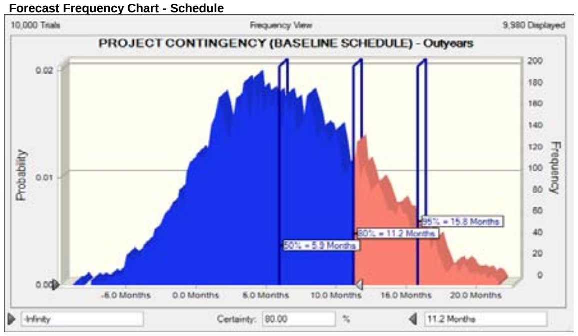
Cumulative Probability Forecast Chart - Schedule



Sensitivity Analysis Chart - Schedule



Forecast Frequency Chart - Schedule



SAM - Walton County Storm Damage Reduction Project, GI Study -

Enter Estimated Total Project Cost (Price Level)	$ 43,215,813
Max. Anticipated Annual Amount	$28,338,556
Enter Current OMB Escalation Rate	1.80%
Enter Current Project Location Escalation Rate	1.80%
Enter Assumed Monthly Recurring Cost Rate	8.00%

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	12-Jul-13			
Enter Baseline Project Completion	20-Jan-15			
Project Completion at 0% Confidence	2-Jun-14		($1,434,869.88)	($1,434,869.88)
Project Completion at 5% Confidence	21-Dec-14		($185,517.11)	($185,517.11)
Project Completion at 10% Confidence	6-Feb-15		$110,829.03	$110,829.03
Project Completion at 15% Confidence	11-Mar-15		$311,411.98	$311,411.98
Project Completion at 20% Confidence	7-Apr-15		$478,161.80	$478,161.80
Project Completion at 25% Confidence	29-Apr-15		$620,367.97	$620,367.97
Project Completion at 30% Confidence	20-May-15		$746,040.27	$746,040.27
Project Completion at 35% Confidence	6-Jun-15		$855,198.64	$855,198.64
Project Completion at 40% Confidence	24-Jun-15		$968,200.49	$968,200.49
Project Completion at 45% Confidence	12-Jul-15		$1,074,307.61	$1,074,307.61
Project Completion at 50% Confidence	29-Jul-15		$1,183,954.18	$1,183,954.18
Project Completion at 55% Confidence	16-Aug-15		$1,295,902.86	$1,295,902.86
Project Completion at 60% Confidence	1-Sep-15		$1,393,202.95	$1,393,202.95
Project Completion at 65% Confidence	19-Sep-15		$1,505,597.77	$1,505,597.77
Project Completion at 70% Confidence	10-Oct-15		$1,636,020.56	$1,636,020.56
Project Completion at 75% Confidence	30-Oct-15		$1,759,392.94	$1,759,392.94
Project Completion at 80% Confidence	23-Nov-15		$1,908,808.83	$1,908,808.83
Project Completion at 85% Confidence	22-Dec-15		$2,091,485.01	$2,091,485.01
Project Completion at 90% Confidence	26-Jan-16		$2,307,339.45	$2,307,339.45
Project Completion at 95% Confidence	16-Mar-16		$2,617,371.21	$2,617,371.21
Project Completion at 100% Confidence	4-Jan-17		$4,438,028.99	$4,438,028.99

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$17,578,231**
Max. Anticipated Annual Amount	**$11,526,838**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	17-Apr-23			
Enter Baseline Project Completion	25-Oct-24			
Project Completion at 0% Confidence	28-Jan-24		($681,838.66)	($681,838.66)
Project Completion at 5% Confidence	19-Aug-24		($167,355.34)	($167,355.34)
Project Completion at 10% Confidence	7-Oct-24		($44,914.37)	($44,914.37)
Project Completion at 15% Confidence	8-Nov-24		$37,129.41	$37,129.41
Project Completion at 20% Confidence	7-Dec-24		$108,674.90	$108,674.90
Project Completion at 25% Confidence	31-Dec-24		$169,780.09	$169,780.09
Project Completion at 30% Confidence	24-Jan-25		$231,433.31	$231,433.31
Project Completion at 35% Confidence	15-Feb-25		$286,356.54	$286,356.54
Project Completion at 40% Confidence	9-Mar-25		$341,752.03	$341,752.03
Project Completion at 45% Confidence	31-Mar-25		$397,842.73	$397,842.73
Project Completion at 50% Confidence	23-Apr-25		$456,534.03	$456,534.03
Project Completion at 55% Confidence	17-May-25		$517,216.82	$517,216.82
Project Completion at 60% Confidence	11-Jun-25		$580,652.81	$580,652.81
Project Completion at 65% Confidence	5-Jul-25		$639,802.89	$639,802.89
Project Completion at 70% Confidence	1-Aug-25		$707,434.21	$707,434.21
Project Completion at 75% Confidence	28-Aug-25		$776,029.28	$776,029.28
Project Completion at 80% Confidence	1-Oct-25		$862,234.64	$862,234.64
Project Completion at 85% Confidence	5-Nov-25		$950,412.00	$950,412.00
Project Completion at 90% Confidence	19-Dec-25		$1,062,037.00	$1,062,037.00
Project Completion at 95% Confidence	18-Feb-26		$1,216,251.79	$1,216,251.79
Project Completion at 100% Confidence	7-Jan-27		$2,030,218.06	$2,030,218.06

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$17,578,231**
Max. Anticipated Annual Amount	**$11,526,838**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	18-Apr-33			
Enter Baseline Project Completion	27-Oct-34			
Project Completion at 0% Confidence	29-Jan-34		($681,838.66)	($681,838.66)
Project Completion at 5% Confidence	21-Aug-34		($167,355.34)	($167,355.34)
Project Completion at 10% Confidence	9-Oct-34		($44,914.37)	($44,914.37)
Project Completion at 15% Confidence	10-Nov-34		$37,129.41	$37,129.41
Project Completion at 20% Confidence	9-Dec-34		$108,674.90	$108,674.90
Project Completion at 25% Confidence	2-Jan-35		$169,780.09	$169,780.09
Project Completion at 30% Confidence	26-Jan-35		$231,433.31	$231,433.31
Project Completion at 35% Confidence	17-Feb-35		$286,356.54	$286,356.54
Project Completion at 40% Confidence	11-Mar-35		$341,752.03	$341,752.03
Project Completion at 45% Confidence	2-Apr-35		$397,842.73	$397,842.73
Project Completion at 50% Confidence	25-Apr-35		$456,534.03	$456,534.03
Project Completion at 55% Confidence	19-May-35		$517,216.82	$517,216.82
Project Completion at 60% Confidence	13-Jun-35		$580,652.81	$580,652.81
Project Completion at 65% Confidence	7-Jul-35		$639,802.89	$639,802.89
Project Completion at 70% Confidence	3-Aug-35		$707,434.21	$707,434.21
Project Completion at 75% Confidence	30-Aug-35		$776,029.28	$776,029.28
Project Completion at 80% Confidence	3-Oct-35		$862,234.64	$862,234.64
Project Completion at 85% Confidence	7-Nov-35		$950,412.00	$950,412.00
Project Completion at 90% Confidence	21-Dec-35		$1,062,037.00	$1,062,037.00
Project Completion at 95% Confidence	20-Feb-36		$1,216,251.79	$1,216,251.79
Project Completion at 100% Confidence	8-Jan-37		$2,030,218.06	$2,030,218.06

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$17,578,231**
Max. Anticipated Annual Amount	**$11,526,838**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	20-Apr-43			
Enter Baseline Project Completion	28-Oct-44			
Project Completion at 0% Confidence	31-Jan-44		($681,838.66)	($681,838.66)
Project Completion at 5% Confidence	22-Aug-44		($167,355.34)	($167,355.34)
Project Completion at 10% Confidence	10-Oct-44		($44,914.37)	($44,914.37)
Project Completion at 15% Confidence	11-Nov-44		$37,129.41	$37,129.41
Project Completion at 20% Confidence	10-Dec-44		$108,674.90	$108,674.90
Project Completion at 25% Confidence	3-Jan-45		$169,780.09	$169,780.09
Project Completion at 30% Confidence	27-Jan-45		$231,433.31	$231,433.31
Project Completion at 35% Confidence	18-Feb-45		$286,356.54	$286,356.54
Project Completion at 40% Confidence	12-Mar-45		$341,752.03	$341,752.03
Project Completion at 45% Confidence	3-Apr-45		$397,842.73	$397,842.73
Project Completion at 50% Confidence	26-Apr-45		$456,534.03	$456,534.03
Project Completion at 55% Confidence	20-May-45		$517,216.82	$517,216.82
Project Completion at 60% Confidence	14-Jun-45		$580,652.81	$580,652.81
Project Completion at 65% Confidence	8-Jul-45		$639,802.89	$639,802.89
Project Completion at 70% Confidence	4-Aug-45		$707,434.21	$707,434.21
Project Completion at 75% Confidence	31-Aug-45		$776,029.28	$776,029.28
Project Completion at 80% Confidence	4-Oct-45		$862,234.64	$862,234.64
Project Completion at 85% Confidence	8-Nov-45		$950,412.00	$950,412.00
Project Completion at 90% Confidence	22-Dec-45		$1,062,037.00	$1,062,037.00
Project Completion at 95% Confidence	21-Feb-46		$1,216,251.79	$1,216,251.79
Project Completion at 100% Confidence	10-Jan-47		$2,030,218.06	$2,030,218.06

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$17,578,231**
Max. Anticipated Annual Amount	**$11,526,838**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	21-Apr-53			
Enter Baseline Project Completion	30-Oct-54			
Project Completion at 0% Confidence	1-Feb-54		($681,838.66)	($681,838.66)
Project Completion at 5% Confidence	24-Aug-54		($167,355.34)	($167,355.34)
Project Completion at 10% Confidence	12-Oct-54		($44,914.37)	($44,914.37)
Project Completion at 15% Confidence	13-Nov-54		$37,129.41	$37,129.41
Project Completion at 20% Confidence	12-Dec-54		$108,674.90	$108,674.90
Project Completion at 25% Confidence	5-Jan-55		$169,780.09	$169,780.09
Project Completion at 30% Confidence	29-Jan-55		$231,433.31	$231,433.31
Project Completion at 35% Confidence	20-Feb-55		$286,356.54	$286,356.54
Project Completion at 40% Confidence	14-Mar-55		$341,752.03	$341,752.03
Project Completion at 45% Confidence	5-Apr-55		$397,842.73	$397,842.73
Project Completion at 50% Confidence	28-Apr-55		$456,534.03	$456,534.03
Project Completion at 55% Confidence	22-May-55		$517,216.82	$517,216.82
Project Completion at 60% Confidence	16-Jun-55		$580,652.81	$580,652.81
Project Completion at 65% Confidence	10-Jul-55		$639,802.89	$639,802.89
Project Completion at 70% Confidence	6-Aug-55		$707,434.21	$707,434.21
Project Completion at 75% Confidence	2-Sep-55		$776,029.28	$776,029.28
Project Completion at 80% Confidence	6-Oct-55		$862,234.64	$862,234.64
Project Completion at 85% Confidence	10-Nov-55		$950,412.00	$950,412.00
Project Completion at 90% Confidence	24-Dec-55		$1,062,037.00	$1,062,037.00
Project Completion at 95% Confidence	23-Feb-56		$1,216,251.79	$1,216,251.79
Project Completion at 100% Confidence	11-Jan-57		$2,030,218.06	$2,030,218.06

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-1	Scope Definition - Initial	LIKELY	MARGINAL	MODERATE	Yes-No/Uniform	I-2	0.75	($1,048,500)	$0	$0	*Correlated to Risk I-2 by a factor of 0.75*
I-1	Scope Definition - Out-years	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-1	Scope Definition - Initial	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-1	Scope Definition - Out-years	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	Scope is fairly well defined for standard civil works features. Scope may change based on permitting. The risk of the scope definition has been greatly reduced since the initial risk analysis, as the PDT has well-defined the scope.
Development of Low Values	The best case scenario is that there could be reduction in structural additions in the initial nourishments. Assume up to 25% reduction in the beach work items.
Development of High Values	The worst case scenario is that the scope would be contained to match funding allocation.

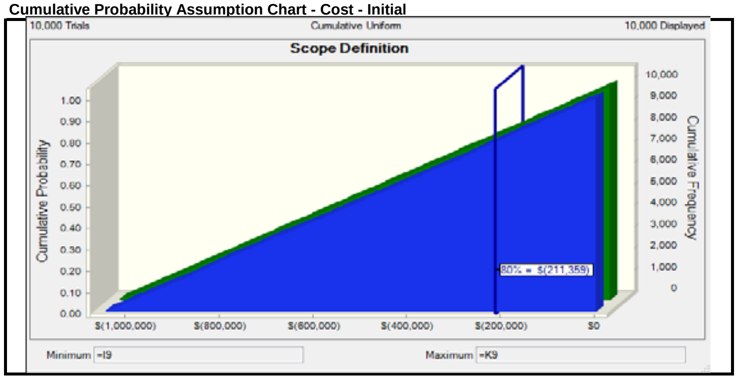
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($1,048,481)	N/A
10%	($941,849)	N/A
20%	($836,443)	N/A
30%	($734,415)	N/A
40%	($630,025)	N/A
50%	($521,656)	N/A
60%	($413,690)	N/A
70%	($307,310)	N/A
80%	($211,359)	N/A
90%	($108,359)	N/A
100%	($175)	N/A

Outyears

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 - Initial



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-2	Scope Growth / Reduction - Initial	LIKELY	MARGINAL	MODERATE	Uniform	I-1	0.75	($2,160,791)	$0	$4,321,581	*Correlated to Risk I-1 by a factor of 0.75*
I-2	Scope Growth / Reduction - Out-years	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	($3,515,646)	$0	$7,031,293	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-2	Scope Growth / Reduction - Initial	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	-4.0 Months	0.0 Months	6.0 Months	
I-2	Scope Growth / Reduction - Out-years	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	-4.0 Months	0.0 Months	6.0 Months	

Description	Scope is fairly well defined for standard civil works features. The pumping plant has potential of VE savings through better data and VE. While there is confidence in quantities for the initial nourishment, quantities for the out-year renourishments may change significantly.
Development of Low Values	The best case scenario is that the current baseline estimate could be reduced by up to 5% and that the project completion date could finish early due to reduction in scope, by up to 4 months.
Development of High Values	The worst case scenario is that the current baseline estimate could increase by up to 10% and that the project completion date could change due to increase in scope, by up to 6 months.

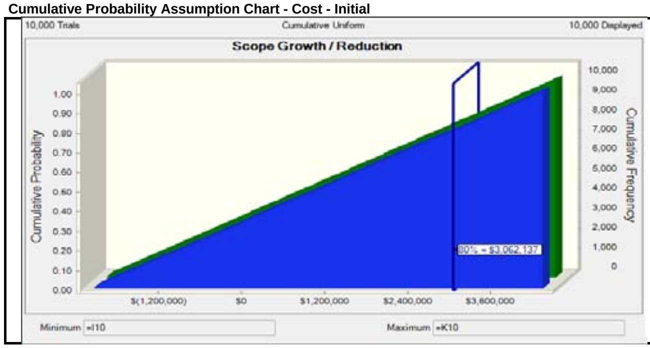
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,160,616)	'-4.0 Months
10%	($1,523,067)	'-3.0 Months
20%	($860,261)	'-2.0 Months
30%	($212,455)	'-1.0 Months
40%	$420,968	'-0.1 Months
50%	$1,087,610	1.0 Months
60%	$1,710,418	2.0 Months
70%	$2,362,568	3.0 Months
80%	$3,062,137	4.0 Months
90%	$3,689,825	5.0 Months
100%	$4,320,758	6.0 Months

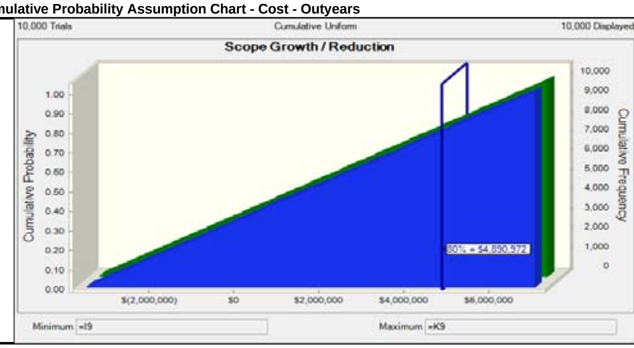
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,515,312)	'-4.0 Months
10%	($2,461,960)	'-3.0 Months
20%	($1,421,004)	'-2.1 Months
30%	($355,961)	'-1.1 Months
40%	$652,232	0.0 Months
50%	$1,739,750	1.0 Months
60%	$2,795,326	2.0 Months
70%	$3,845,523	3.0 Months
80%	$4,890,972	4.0 Months
90%	$5,952,761	5.0 Months
100%	$7,028,361	6.0 Months

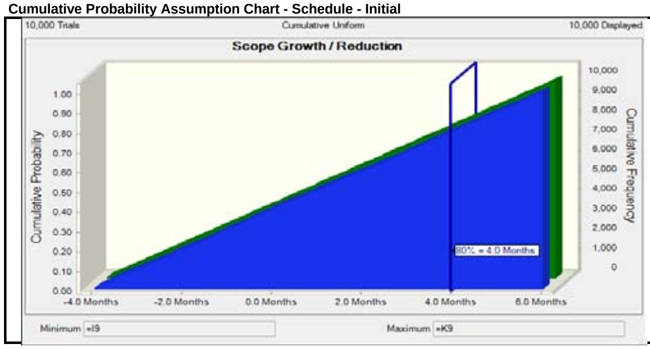
Cumulative Probability Assumption Chart - Cost - Initial



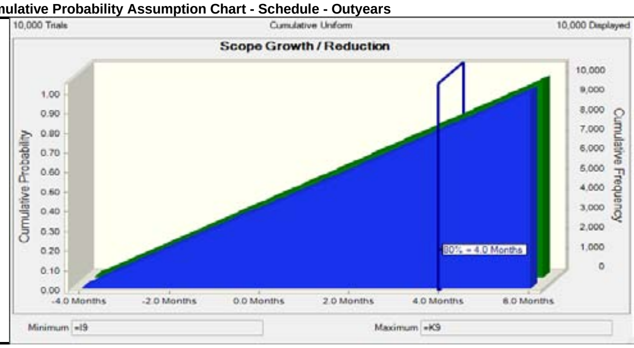
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-4	Material Availability - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-4	Material Availability - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$6,657,000	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-4	Material Availability - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-4	Material Availability - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	0.0 Months	0.0 Months	2.0 Months	

Description	Borrow sources are provided and indicated on drawings. Per the design Engineer and based on current surveys, quality and quantity of beach fill material is available at all sites.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that issues with material and equipment availability could delay the project completion date by up to 2 months. Assume that the average one-way distance to haul site increases to 16 miles for 2 renourishments.

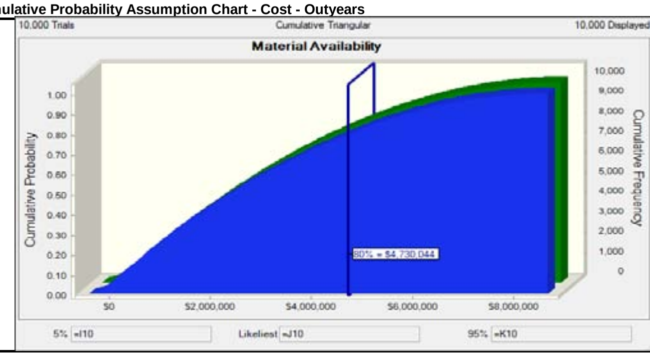
Initial

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

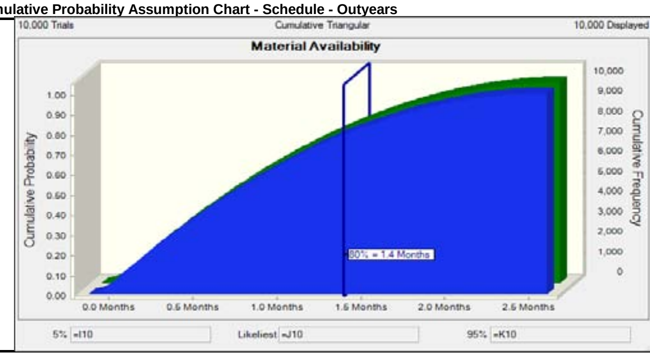
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($430,220)	'-0.1 Months
10%	$223,053	0.1 Months
20%	$681,071	0.2 Months
30%	$1,184,815	0.4 Months
40%	$1,741,576	0.5 Months
50%	$2,359,355	0.7 Months
60%	$3,032,336	0.9 Months
70%	$3,826,345	1.1 Months
80%	$4,730,044	1.4 Months
90%	$5,878,695	1.7 Months
100%	$8,532,940	2.6 Months

Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-5	Fuel Prices - Initial	VERY LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	($1,407,390)	$0	$4,811,310	
I-5	Fuel Prices - Out-years	VERY LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	($1,997,100)	$0	$9,319,800	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-5	Fuel Prices - Initial	UNLIKELY	NEGLIGIBLE	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-5	Fuel Prices - Out-years	UNLIKELY	NEGLIGIBLE	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	$3.45 per gallon was used in the Sep 2012 CEDEP Estimates, increases will effect equipment and delivery or materials. Fuel cost fluctuations can significantly impact dredging cost.
Development of Low Values	The best case scenario is that the cost of fuel adjusted for price level decreases to $3.00/gallon.
Development of High Values	The worst case scenario is that the cost of fuel adjusted for price level increases to $5.00/gallon.

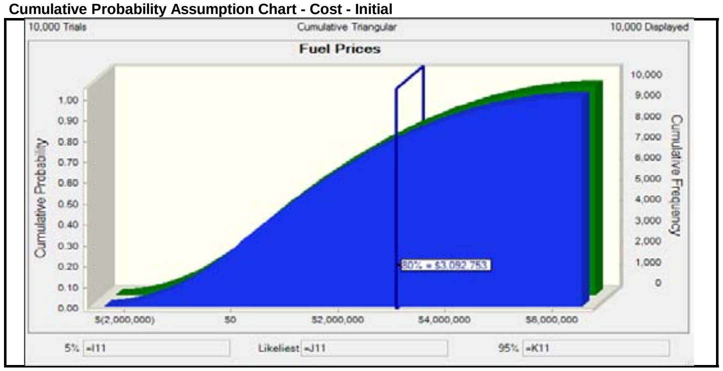
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,406,851)	N/A
10%	($999,483)	N/A
20%	($371,697)	N/A
30%	$122,712	N/A
40%	$614,499	N/A
50%	$1,123,532	N/A
60%	$1,691,274	N/A
70%	$2,317,997	N/A
80%	$3,092,753	N/A
90%	$4,079,540	N/A
100%	$6,494,242	N/A

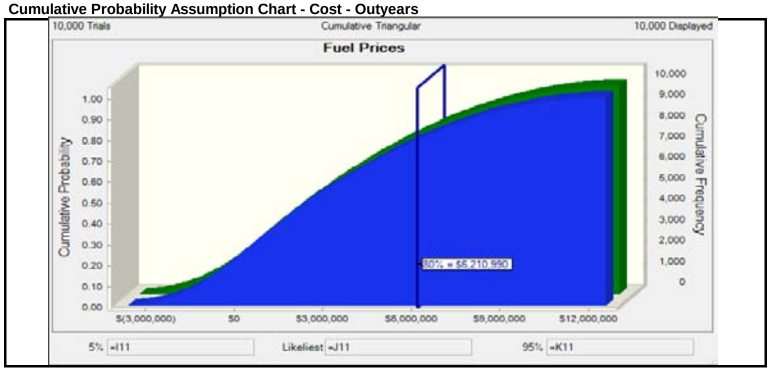
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,642,817)	N/A
10%	($1,256,740)	N/A
20%	($229,044)	N/A
30%	$635,644	N/A
40%	$1,501,186	N/A
50%	$2,421,475	N/A
60%	$3,542,955	N/A
70%	$4,813,078	N/A
80%	$6,210,990	N/A
90%	$8,042,401	N/A
100%	$12,336,371	N/A

Cumulative Probability Assumption Chart - Cost - Initial



Cumulative Probability Assumption Chart - Cost - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-6	Permits - Initial	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*
I-6	Permits - Out-years	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-6	Permits - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	0.0 Months	0.0 Months	6.0 Months	
I-6	Permits - Out-years	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Schedule Risk Model, as there will be enough time to obtain permits for outyear nourishments*

Description	Permitting delays may occur due to Florida State policy. This could impact the cost and schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that issues with issuing of permits from the State of Florida could delay the project completion date by up to 6 months.

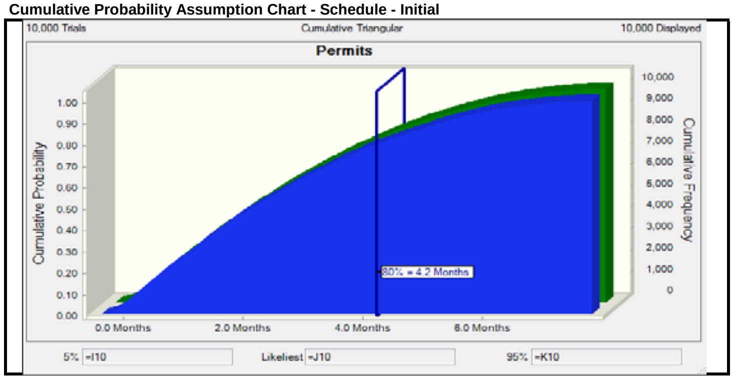
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	N/A	'-0.4 Months
10%	N/A	0.2 Months
20%	N/A	0.6 Months
30%	N/A	1.1 Months
40%	N/A	1.6 Months
50%	N/A	2.1 Months
60%	N/A	2.7 Months
70%	N/A	3.4 Months
80%	N/A	4.2 Months
90%	N/A	5.3 Months
100%	N/A	7.6 Months

Outyears

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 - Schedule - Initial



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-7	Environmental Windows - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$2,032,039	
I-7	Environmental Windows - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$3,333,235	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-7	Environmental Windows - Initial	LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	
I-7	Environmental Windows - Out-years	LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	

Description	The concern is that :Project site is a natural habitat for various species of threatened wildlife that utilize the project vicinity during Spring and Winter months. The PDT feels that :Gulf sturgeon incidental takes during dredging and Sea Turtle and Bird Nesting may have Impact during Construction. There may also be unknown restrictions for the out-year renourishments.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that environmental windows and restrictions to have a significant impact on dredging operations and effective work times, potentially increasing the contract costs by up to 5%. Also, assume that the project completion date could change due to challenges with environmental work windows and restrictions, by up to 12 months.

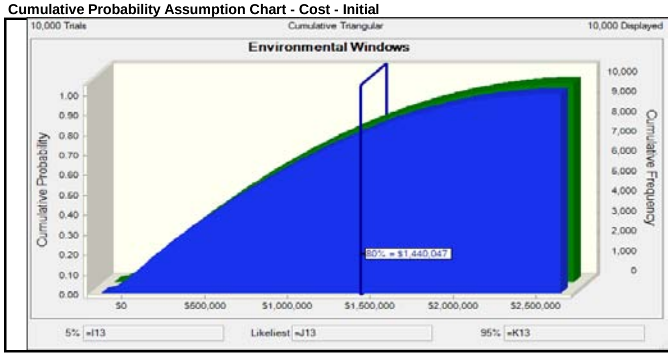
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($132,703)	'-0.8 Months
10%	$70,495	0.4 Months
20%	$212,591	1.3 Months
30%	$365,454	2.2 Months
40%	$543,627	3.2 Months
50%	$729,562	4.2 Months
60%	$938,216	5.4 Months
70%	$1,164,838	6.8 Months
80%	$1,440,047	8.4 Months
90%	$1,783,565	10.5 Months
100%	$2,614,469	15.3 Months

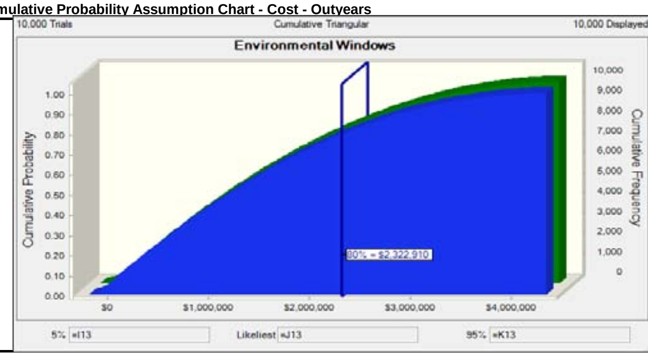
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($204,042)	'-0.8 Months
10%	$104,931	0.4 Months
20%	$356,116	1.3 Months
30%	$611,864	2.2 Months
40%	$886,747	3.2 Months
50%	$1,188,393	4.2 Months
60%	$1,519,035	5.4 Months
70%	$1,877,877	6.7 Months
80%	$2,322,910	8.4 Months
90%	$2,888,443	10.5 Months
100%	$4,315,062	15.5 Months

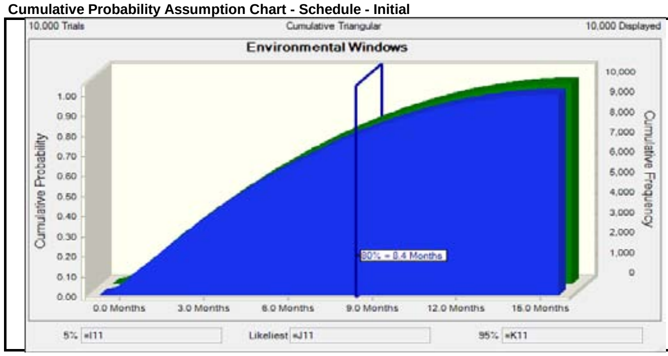
Cumulative Probability Assumption Chart - Cost - Initial



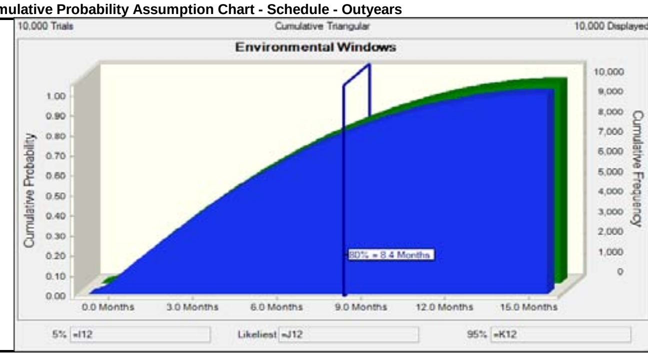
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Cost	INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Initial	Likely	Marginal	Moderate	Triangular	N/A	N/A	$0	$0	$1,219,223	
	INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Out-years	Likely	Marginal	Moderate	Triangular	N/A	N/A	$0	$0	$1,499,956	

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Schedule	INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Initial	Likely	Marginal	Moderate	Triangular	N/A	N/A	0.0 Months	0.0 Months	3.0 Months	
	INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Out-years	Likely	Marginal	Moderate	Triangular	N/A	N/A	0.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk of construction modifications and claims that arise after contract award. Post-award construction contract modifications and claims could impact the ultimate contract costs and delay the overall schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that direct costs increase by up to 3% and the overall schedule is delayed by up to 3 months.

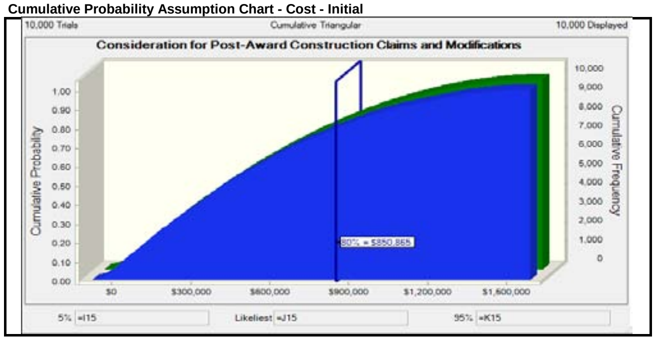
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($80,148)	'-0.2 Months
10%	$41,609	0.1 Months
20%	$126,958	0.3 Months
30%	$221,715	0.5 Months
40%	$321,821	0.8 Months
50%	$424,092	1.1 Months
60%	$548,456	1.4 Months
70%	$679,448	1.7 Months
80%	$850,865	2.1 Months
90%	$1,063,805	2.6 Months
100%	$1,568,903	3.9 Months

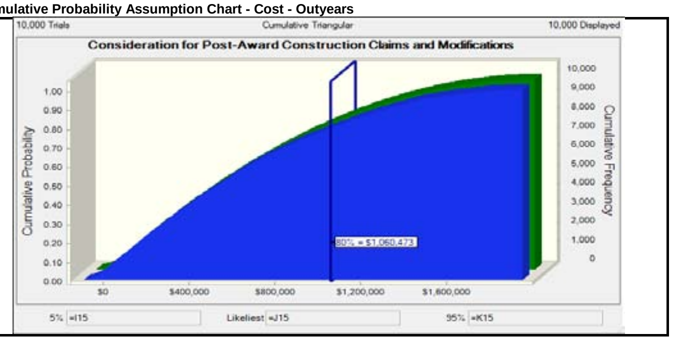
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($95,692)	'-0.2 Months
10%	$52,110	0.1 Months
20%	$161,173	0.3 Months
30%	$274,711	0.5 Months
40%	$395,775	0.8 Months
50%	$531,930	1.1 Months
60%	$667,807	1.4 Months
70%	$844,054	1.7 Months
80%	$1,060,473	2.1 Months
90%	$1,320,767	2.6 Months
100%	$1,919,089	3.9 Months

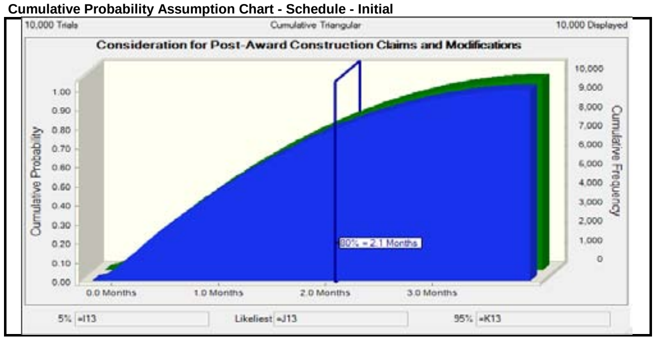
Cumulative Probability Assumption Chart - Cost - Initial



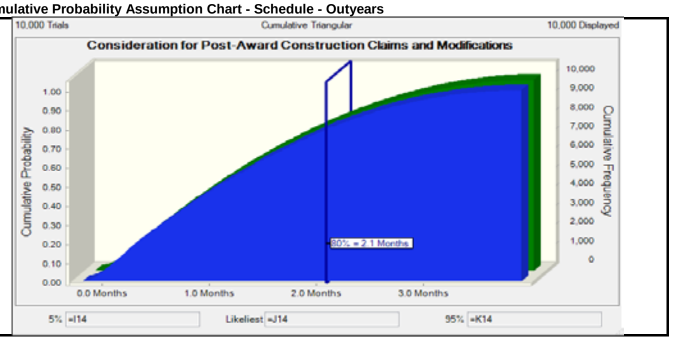
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EST-1	Estimate Considerations - Initial	Likely	Significant	High	Triangular	N/A	N/A	($2,032,039)	$0	$2,032,039	
EST-1	Estimate Considerations - Out-years	Likely	Significant	High	Triangular	N/A	N/A	($3,333,235)	$0	$3,333,235	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EST-1	Estimate Considerations - Initial	Very Unlikely	Negligible	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
EST-1	Estimate Considerations - Out-years	Very Unlikely	Negligible	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	This is added to the CSRA model for consideration, as these issues may cause a cost variance. Estimate assumptions may not accurately capture the ultimate costs.
Development of Low Values	The best case scenario is that rates, crews and productivities are either flawed or too optimistic compared to actual ultimate costs, decreasing up to 5% on overall construction productivities.
Development of High Values	The worst case scenario is that rates, crews and productivities are either flawed or too optimistic compared to actual ultimate costs, decreasing up to 5% on overall construction productivities.

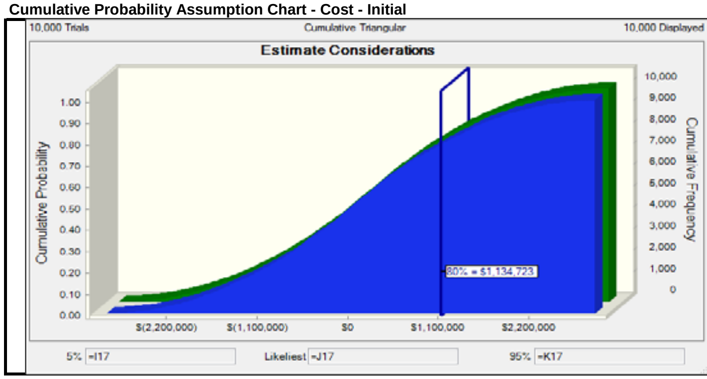
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,938,464)	N/A
10%	($1,660,190)	N/A
20%	($1,095,860)	N/A
30%	($645,511)	N/A
40%	($283,923)	N/A
50%	$21,778	N/A
60%	$337,681	N/A
70%	$698,068	N/A
80%	$1,134,723	N/A
90%	$1,651,086	N/A
100%	$2,939,466	N/A

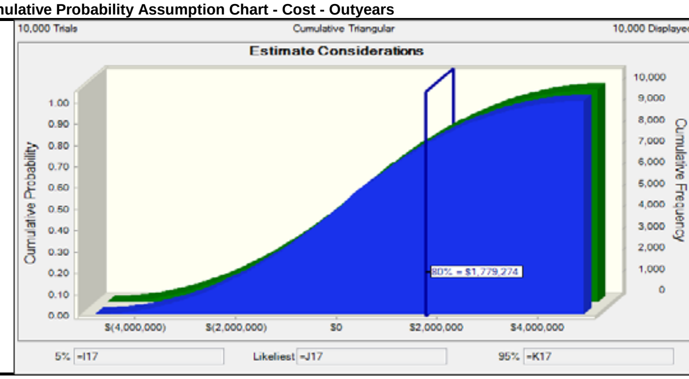
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($4,798,803)	N/A
10%	($2,657,158)	N/A
20%	($1,787,546)	N/A
30%	($1,093,247)	N/A
40%	($501,325)	N/A
50%	$26,126	N/A
60%	$523,331	N/A
70%	$1,124,269	N/A
80%	$1,779,274	N/A
90%	$2,651,445	N/A
100%	$4,804,833	N/A

Cumulative Probability Assumption Chart - Cost - Initial



Cumulative Probability Assumption Chart - Cost - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-1	Consideration for Low and Unknown Internal Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($2,032,039)	$0	$2,032,039	
INT-1	Consideration for Low and Unknown Internal Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($3,333,235)	$0	$3,333,235	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-1	Consideration for Low and Unknown Internal Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	
INT-1	Consideration for Low and Unknown Internal Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns. This could impact cost and schedule.
Development of Low Values	The best case scenario is that costs improve by up to 5% and schedule is improved by up to 3 months.
Development of High Values	The worst case scenario is that project costs increase by up to 5% and the overall schedule is delayed by up to 3 months.

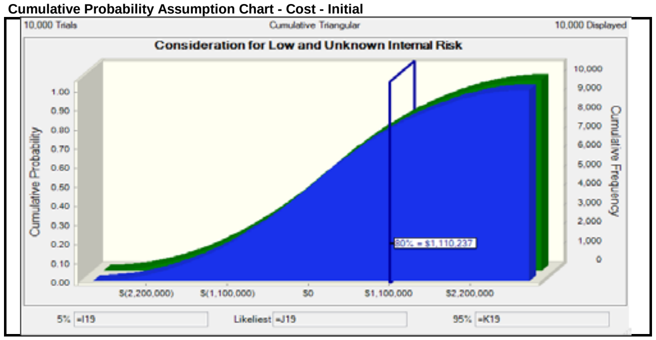
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,926,820)	'-4.4 Months
10%	($1,635,048)	'-2.4 Months
20%	($1,069,535)	'-1.6 Months
30%	($647,724)	'-1.0 Months
40%	($298,993)	'-0.5 Months
50%	$22,731	0.0 Months
60%	$334,370	0.5 Months
70%	$695,828	1.0 Months
80%	$1,110,237	1.6 Months
90%	$1,659,837	2.5 Months
100%	$2,946,390	4.3 Months

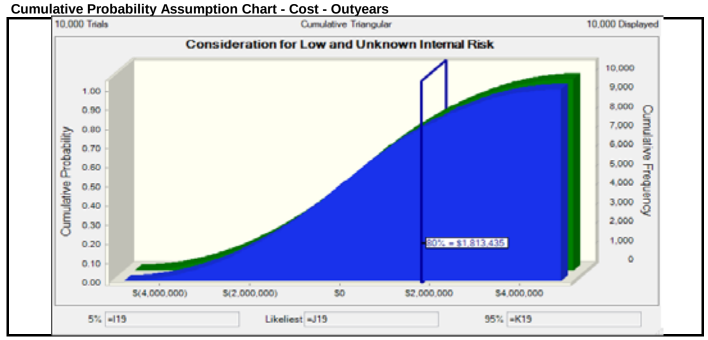
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($4,805,422)	'-4.4 Months
10%	($2,721,105)	'-2.4 Months
20%	($1,840,556)	'-1.6 Months
30%	($1,139,356)	'-1.0 Months
40%	($530,974)	'-0.5 Months
50%	$6,590	0.0 Months
60%	$532,624	0.5 Months
70%	$1,104,296	1.0 Months
80%	$1,813,435	1.6 Months
90%	$2,708,271	2.4 Months
100%	$4,839,952	4.3 Months

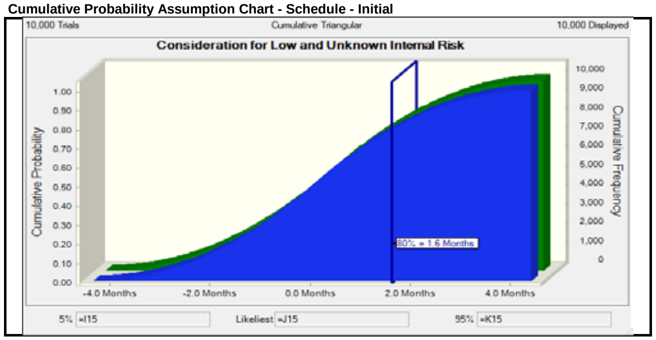
Cumulative Probability Assumption Chart - Cost - Initial



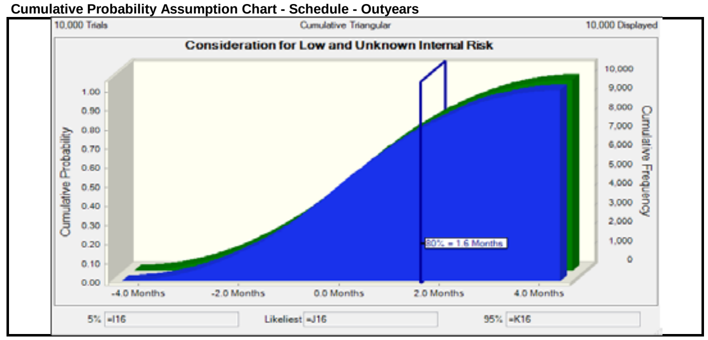
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
E-1	Weather - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	($1,219,223)	$0	$2,032,039	
E-1	Weather - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	($1,999,941)	$0	$3,333,235	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
E-1	Weather - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	6.0 Months	
E-1	Weather - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	6.0 Months	

Description	Florida is subject to bad weather during Hurricane Season which can cause Schedule delays. Weather days are generally incorporated into schedule.
Development of Low Values	The best case scenario is that weather has less impact on dredging operations and effective work time than currently contemplated in the current baseline estimate, reducing the overall costs by up to 3%. Also assume that favorable weather conditions could improve the schedule by up to 3 months.
Development of High Values	The worst case scenario is that weather has more impact on dredging operations and effective work time than currently contemplated in the current baseline estimate, increasing the overall costs by up to 5%. Also assume that unfavorable weather conditions could delay the schedule by up to 6 months.

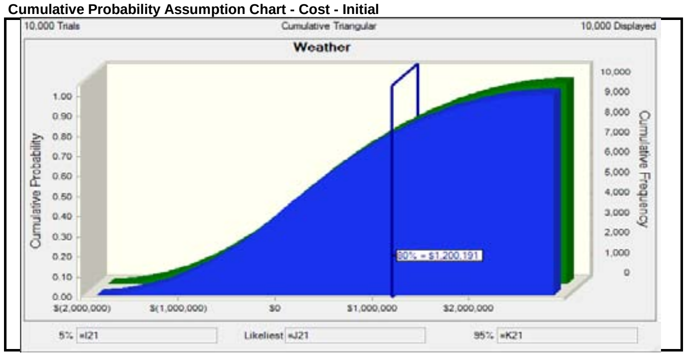
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($1,865,032)	'-4.7 Months
10%	($954,908)	'-2.3 Months
20%	($559,718)	'-1.3 Months
30%	($241,130)	'-0.5 Months
40%	$6,253	0.2 Months
50%	$257,884	0.9 Months
60%	$526,580	1.7 Months
70%	$829,526	2.6 Months
80%	$1,200,191	3.7 Months
90%	$1,670,960	5.1 Months
100%	$2,817,608	8.2 Months

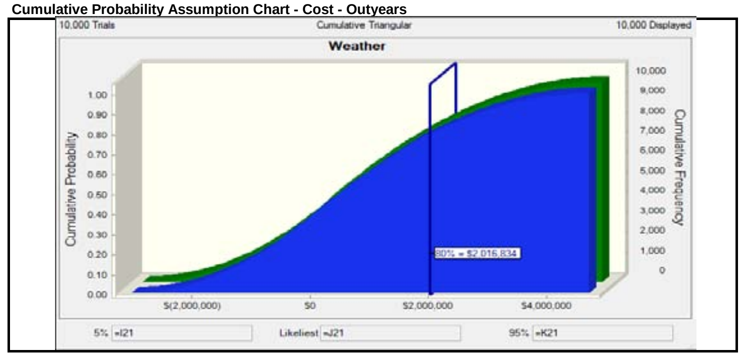
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,053,519)	'-4.7 Months
10%	($1,523,134)	'-2.3 Months
20%	($867,395)	'-1.2 Months
30%	($376,678)	'-0.5 Months
40%	$49,984	0.2 Months
50%	$471,055	0.9 Months
60%	$932,714	1.7 Months
70%	$1,429,097	2.6 Months
80%	$2,016,834	3.6 Months
90%	$2,826,446	5.1 Months
100%	$4,653,244	8.2 Months

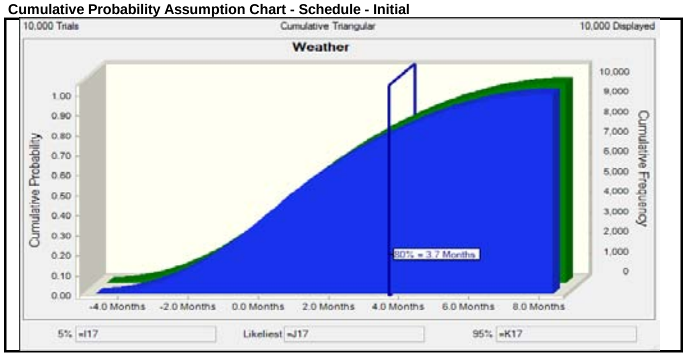
Cumulative Probability Assumption Chart - Cost - Initial



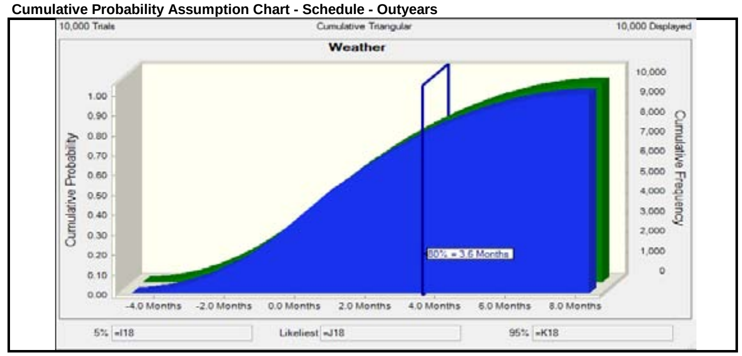
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Cost	E-2	Funding Delays - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	*The original risk register and current assumption indicate this is not high risk for the initial activity, but is for the out-years*
	E-2	Funding Delays - Out-years	LIKELY	MARGINAL	MODERATE	Yes-No/Triangular	N/A	N/A	$0	$0	$8,080,330	

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Schedule	E-2	Funding Delays - Initial	LIKELY	Significant	HIGH	Yes-No/Uniform	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	
	E-2	Funding Delays - Out-years	LIKELY	Significant	HIGH	Yes-No/Uniform	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	

Description	PM feels Adequate Congressional funding to complete project will be available. However, if the project is delayed, it could increase the quantities to be dredged and delay the overal schedule. This could impact the cost and schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that funding delays experienced for out-year renourishments may make the project vulnerable to accumulation of more dredge material due to prolonged storm surge exposure. Assume up to 15% more material for each nourishment. Also, assume that funding issues could move the entire construction schedule by up to one fiscal year.

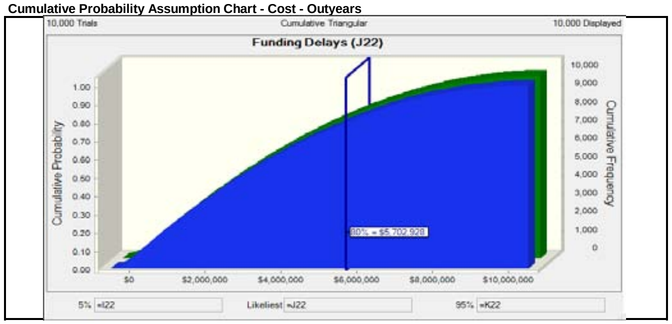
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	N/A	0.0 Months
10%	N/A	1.2 Months
20%	N/A	2.4 Months
30%	N/A	3.6 Months
40%	N/A	4.9 Months
50%	N/A	6.1 Months
60%	N/A	7.3 Months
70%	N/A	8.5 Months
80%	N/A	9.7 Months
90%	N/A	10.8 Months
100%	N/A	12.0 Months

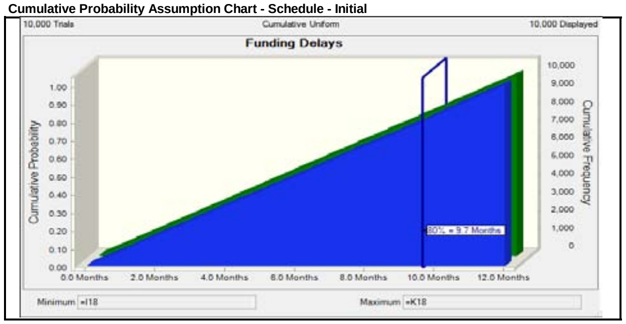
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($535,018)	0.0 Months
10%	$283,368	1.2 Months
20%	$860,761	2.4 Months
30%	$1,477,326	3.7 Months
40%	$2,159,306	4.9 Months
50%	$2,885,780	6.0 Months
60%	$3,697,028	7.2 Months
70%	$4,606,170	8.4 Months
80%	$5,702,928	9.6 Months
90%	$7,051,458	10.8 Months
100%	$10,454,851	12.0 Months

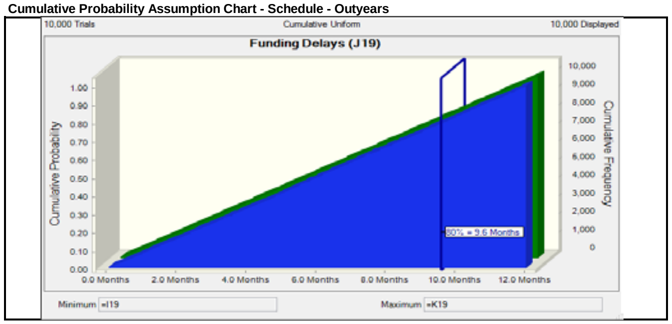
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - NED

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EXT-1	Consideration for Low and Unknown External Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($2,032,039)	$0	$2,032,039	
EXT-1	Consideration for Low and Unknown External Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($3,333,235)	$0	$3,333,235	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EXT-1	Consideration for Low and Unknown External Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	
EXT-1	Consideration for Low and Unknown External Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns. This could impact cost and schedule.
Development of Low Values	The best case scenario is that costs improve by up to 5% and schedule is improved by up to 3 months.
Development of High Values	The worst case scenario is that project costs increase by up to 5% and the overall schedule is delayed by up to 3 months.

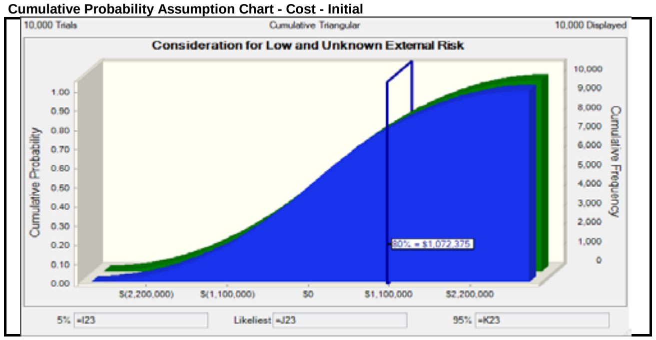
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,956,338)	'-4.3 Months
10%	($1,641,362)	'-2.4 Months
20%	($1,064,986)	'-1.6 Months
30%	($671,079)	'-1.0 Months
40%	($314,763)	'-0.5 Months
50%	($366)	0.0 Months
60%	$308,932	0.5 Months
70%	$646,627	1.0 Months
80%	$1,072,375	1.6 Months
90%	$1,635,380	2.4 Months
100%	$2,918,222	4.3 Months

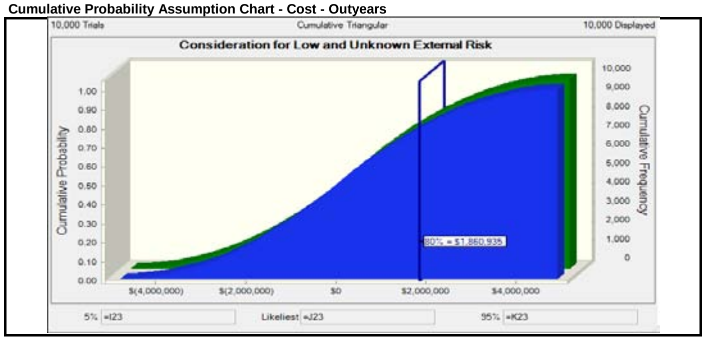
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($4,814,949)	'-4.3 Months
10%	($2,688,463)	'-2.4 Months
20%	($1,811,625)	'-1.6 Months
30%	($1,127,771)	'-1.0 Months
40%	($537,889)	'-0.5 Months
50%	($7,038)	0.0 Months
60%	$528,730	0.5 Months
70%	$1,152,430	1.0 Months
80%	$1,860,935	1.6 Months
90%	$2,746,292	2.4 Months
100%	$4,791,342	4.3 Months

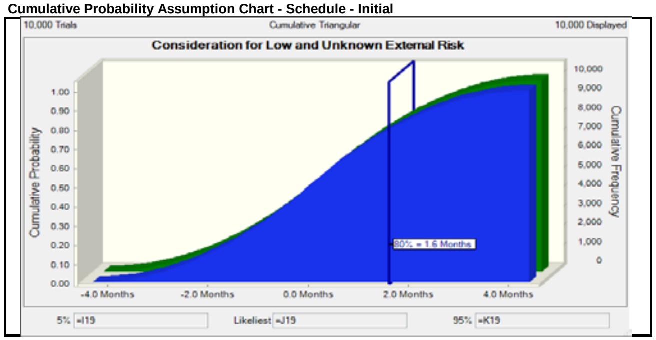
Cumulative Probability Assumption Chart - Cost - Initial



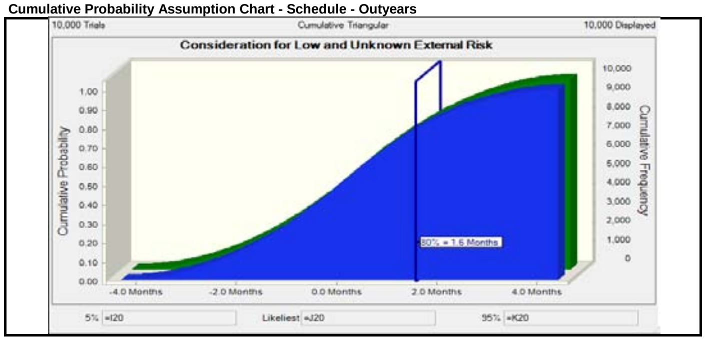
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



Crystal Ball Report - Full
Simulation started on 10/9/2012 at 9:08 PM
Simulation stopped on 10/9/2012 at 9:09 PM

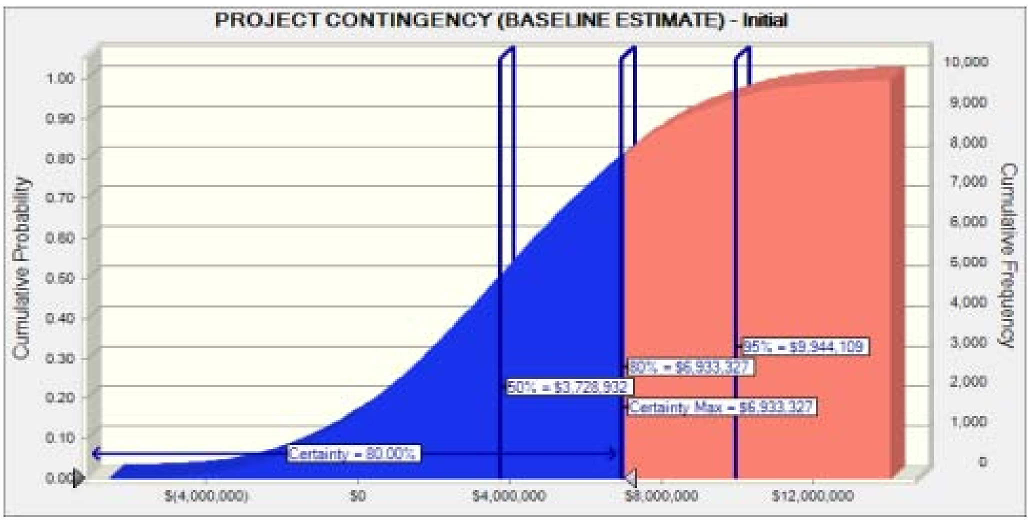
Run preferences:	
Number of trials run	10,000
Monte Carlo	
Seed	999
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	18.52
Trials/second (average)	540
Random numbers per sec	20,513
Crystal Ball data	
Assumptions	38
Correlations	1
Correlated groups	1
Decision variables	0
Forecasts	4

Forecasts

Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Cost Risk Model - Ir

Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial **Cell: L25**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to $6,933,327
Entire range is from $(10,517,883) to $17,663,464
Base case is $0
After 10,000 trials, the std. error of the mean is $36,989



Statistics:	**Forecast values**
Trials	**10,000**
Base Case	**$0**
Mean	**$3,760,153**
Median	**$3,728,957**
Mode	**---**
Standard Deviation	**$3,698,931**
Variance	**$13,682,090,030,107**
Skewness	**0.0504**
Kurtosis	**2.82**
Coeff. of Variability	**0.9837**
Minimum	**$(10,517,883)**
Maximum	**$17,663,464**
Range Width	**$28,181,347**
Mean Std. Error	**$36,989**

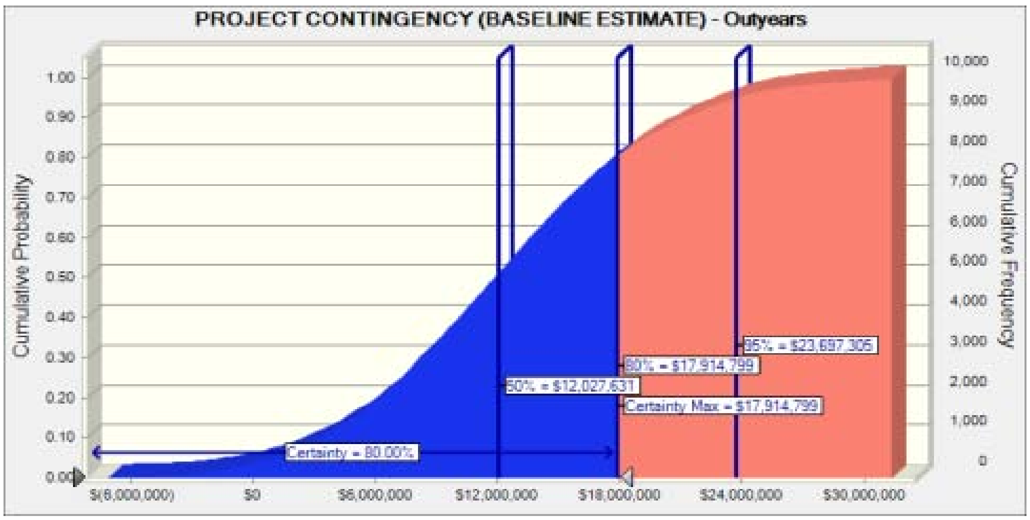
Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial (cont'd) **Cell: L25**

Percentiles:	Forecast values
0%	$(10,517,883)
10%	$(1,042,074)
20%	$573,608
30%	$1,760,204
40%	$2,765,269
50%	$3,728,932
60%	$4,696,976
70%	$5,751,387
80%	$6,933,327
90%	$8,534,198
100%	$17,663,464

Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Cost Risk Model - C

Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears **Cell: L25**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to $17,914,799
Entire range is from $(10,472,549) to $36,544,250
Base case is $0
After 10,000 trials, the std. error of the mean is $69,030



Statistics:	**Forecast values**
Trials	**10,000**
Base Case	**$0**
Mean	**$12,149,281**
Median	**$12,028,400**
Mode	**---**
Standard Deviation	**$6,903,012**
Variance	**$47,651,570,751,271**
Skewness	**0.1384**
Kurtosis	**2.94**
Coeff. of Variability	**0.5682**
Minimum	**$(10,472,549)**
Maximum	**$36,544,250**
Range Width	**$47,016,799**
Mean Std. Error	**$69,030**

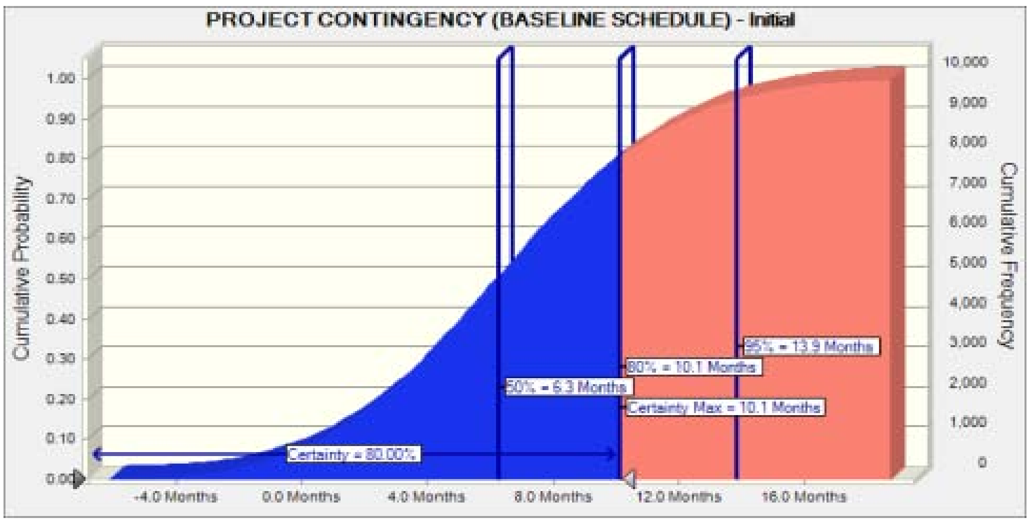
Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears (cont'd) **Cell: L25**

Percentiles:	Forecast values
0%	$(10,472,549)
10%	$3,355,231
20%	$6,327,167
30%	$8,366,113
40%	$10,295,138
50%	$12,027,631
60%	$13,738,422
70%	$15,620,294
80%	$17,914,799
90%	$21,178,522
100%	$36,544,250

Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Schedule Risk Mod

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial **Cell: L21**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to 10.1 Months
Entire range is from -7.6 Months to 23.5 Months
Base case is 0.0 Months
After 10,000 trials, the std. error of the mean is 0.0 Months



Statistics:	**Forecast values**
Trials	**10,000**
Base Case	**0.0 Months**
Mean	**6.3 Months**
Median	**6.3 Months**
Mode	**---**
Standard Deviation	**4.5 Months**
Variance	**20.0 Months**
Skewness	**0.0766**
Kurtosis	**2.85**
Coeff. of Variability	**0.7059**
Minimum	**-7.6 Months**
Maximum	**23.5 Months**
Range Width	**31.1 Months**
Mean Std. Error	**0.0 Months**

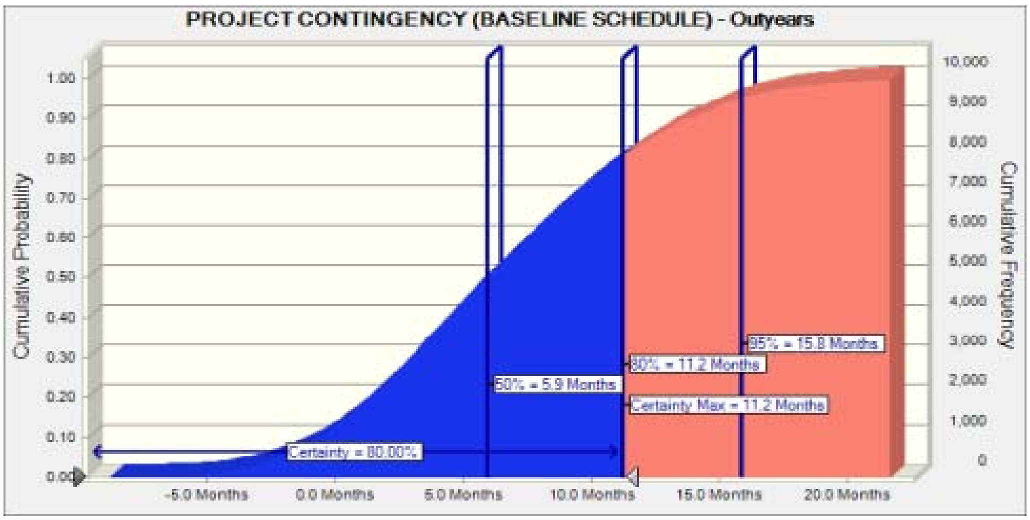
Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial (cont'd) **Cell: L21**

Percentiles:	Forecast values
0%	-7.6 Months
10%	0.6 Months
20%	2.5 Months
30%	4.0 Months
40%	5.1 Months
50%	6.3 Months
60%	7.4 Months
70%	8.7 Months
80%	10.1 Months
90%	12.2 Months
100%	23.5 Months

Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Schedule Risk Mod

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears **Cell: L22**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to 11.2 Months
Entire range is from -8.9 Months to 26.4 Months
Base case is 0.0 Months
After 10,000 trials, the std. error of the mean is 0.1 Months



Statistics:	Forecast values
Trials	10,000
Base Case	0.0 Months
Mean	6.3 Months
Median	5.9 Months
Mode	---
Standard Deviation	5.5 Months
Variance	30.5 Months
Skewness	0.2412
Kurtosis	2.63
Coeff. of Variability	0.8746
Minimum	-8.9 Months
Maximum	26.4 Months
Range Width	35.3 Months
Mean Std. Error	0.1 Months

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears (cont'd **Cell: L22**

Percentiles:	Forecast values
0%	-8.9 Months
10%	-0.6 Months
20%	1.4 Months
30%	3.0 Months
40%	4.4 Months
50%	5.9 Months
60%	7.6 Months
70%	9.2 Months
80%	11.2 Months
90%	13.8 Months
100%	26.4 Months

End of Forecasts

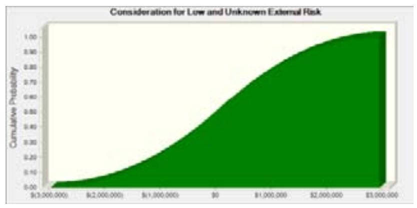
Assumptions

Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Cost Risk Model - Ir

Assumption: Consideration for Low and Unknown External Risk **Cell: J23**

Triangular distribution with parameters:

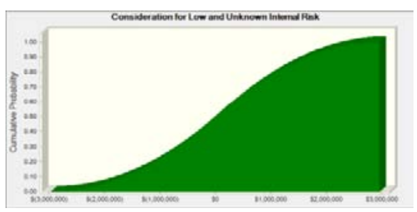
5%	$(2,032,039)	(=I23)
Likeliest	$0	(=J23)
95%	$2,032,039	(=K23)



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J19**

Triangular distribution with parameters:

5%	$(2,032,039)	(=I19)
Likeliest	$0	(=J19)
95%	$2,032,039	(=K19)



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J15**

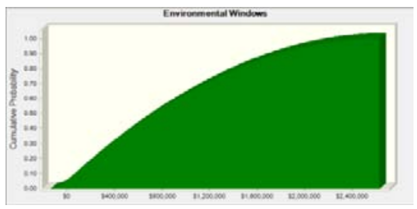
Triangular distribution with parameters:

5%	$0	(=I15)
Likeliest	$0	(=J15)
95%	$1,219,223	(=K15)

Assumption: Consideration for Post-Award Construction Claims and Modifications (cont'd) **Cell: J15**

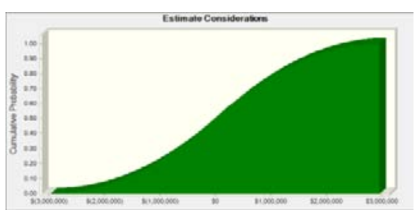
Assumption: Environmental Windows **Cell: J13**

Triangular distribution with parameters:		
5%	**$0**	**(=I13)**
Likeliest	**$0**	**(=J13)**
95%	**$2,032,039**	**(=K13)**



Assumption: Estimate Considerations **Cell: J17**

Triangular distribution with parameters:		
5%	**$(2,032,039)**	**(=I17)**
Likeliest	**$0**	**(=J17)**
95%	**$2,032,039**	**(=K17)**



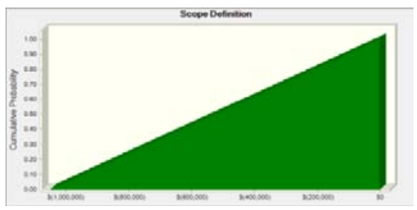
Assumption: Fuel Prices **Cell: J11**

Triangular distribution with parameters:		
5%	**$(1,407,390)**	**(=I11)**
Likeliest	**$0**	**(=J11)**
95%	**$4,811,310**	**(=K11)**

Assumption: Fuel Prices (cont'd) **Cell: J11**

Assumption: Scope Definition **Cell: J9**

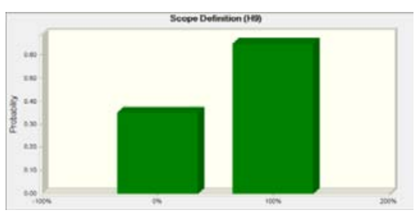
Uniform distribution with parameters:		
Minimum	**$(1,048,500)**	**(=I9)**
Maximum	**$0**	**(=K9)**



Correlated with:	**Coefficient**
Scope Growth / Reduction (J10)	**0.75**

Assumption: Scope Definition (H9) **Cell: H9**

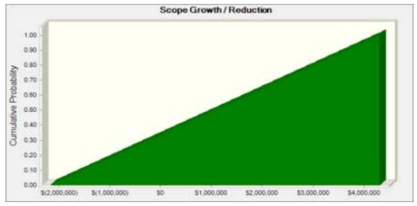
Yes-No distribution with parameters:		
Probability of Yes(1)	**0.65**	**(=H9)**



Assumption: Scope Growth / Reduction **Cell: J10**

Uniform distribution with parameters:		
Minimum	**$(2,160,791)**	**(=I10)**
Maximum	**$4,321,581**	**(=K10)**

Assumption: Scope Growth / Reduction (cont'd) **Cell: J10**

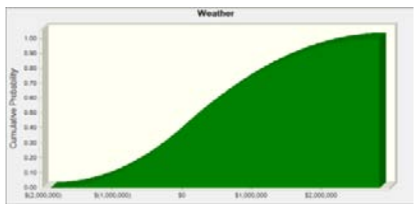


Correlated with:	Coefficient
Scope Definition (J9)	0.75

Assumption: Weather **Cell: J21**

Triangular distribution with parameters:

5%	$(1,219,223)	(=I21)
Likeliest	$0	(=J21)
95%	$2,032,039	(=K21)

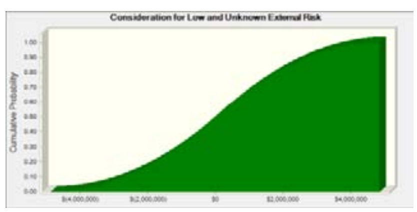


Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Cost Risk Model - C

Assumption: Consideration for Low and Unknown External Risk **Cell: J23**

Triangular distribution with parameters:

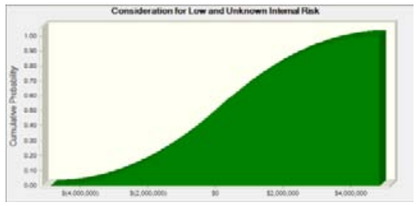
5%	$(3,333,235)	(=I23)
Likeliest	$0	(=J23)
95%	$3,333,235	(=K23)



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J19**

Triangular distribution with parameters:

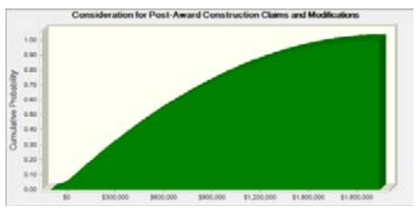
5%	**$(3,333,235)**	**(=I19)**
Likeliest	**$0**	**(=J19)**
95%	**$3,333,235**	**(=K19)**



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J15**

Triangular distribution with parameters:

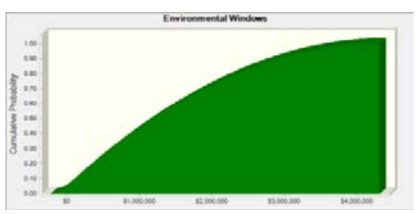
5%	**$0**	**(=I15)**
Likeliest	**$0**	**(=J15)**
95%	**$1,499,956**	**(=K15)**



Assumption: Environmental Windows **Cell: J13**

Triangular distribution with parameters:

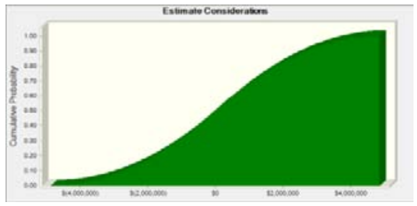
5%	**$0**	**(=I13)**
Likeliest	**$0**	**(=J13)**
95%	**$3,333,235**	**(=K13)**



Assumption: Estimate Considerations **Cell: J17**

Triangular distribution with parameters:

5%	**$(3,333,235)**	**(=I17)**
Likeliest	**$0**	**(=J17)**
95%	**$3,333,235**	**(=K17)**



Assumption: Fuel Prices **Cell: J11**

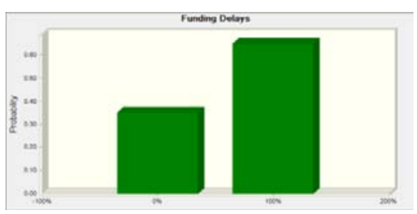
Triangular distribution with parameters:

5%	**$(1,997,100)**	**(=I11)**
Likeliest	**$0**	**(=J11)**
95%	**$9,319,800**	**(=K11)**

Assumption: Funding Delays **Cell: H22**

Yes-No distribution with parameters:

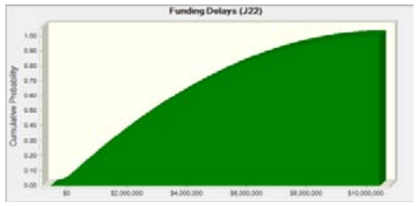
Probability of Yes(1)	**0.65**	**(=H22)**



Assumption: Funding Delays (J22) **Cell: J22**

Triangular distribution with parameters:

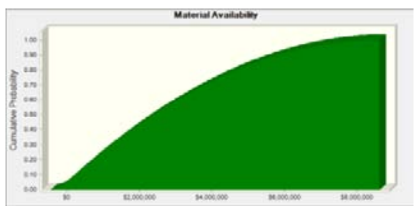
5%	**$0**	**(=I22)**
Likeliest	**$0**	**(=J22)**
95%	**$8,080,330**	**(=K22)**



Assumption: Material Availability **Cell: J10**

Triangular distribution with parameters:

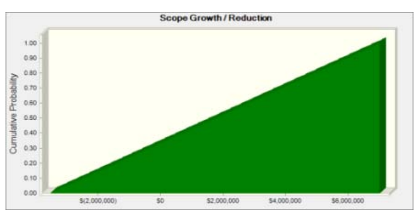
5%	**$0**	**(=I10)**
Likeliest	**$0**	**(=J10)**
95%	**$6,657,000**	**(=K10)**



Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

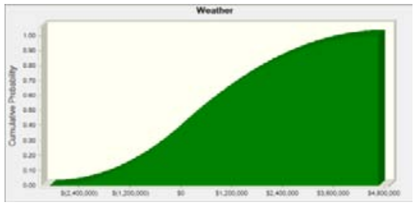
Minimum	**$(3,515,646)**	**(=I9)**
Maximum	**$7,031,293**	**(=K9)**



Assumption: Weather **Cell: J21**

Triangular distribution with parameters:

5%	**$(1,999,941)**	**(=I21)**
Likeliest	**$0**	**(=J21)**
95%	**$3,333,235**	**(=K21)**



Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Schedule Risk Mod

Assumption: Consideration for Low and Unknown External Risk **Cell: J19**

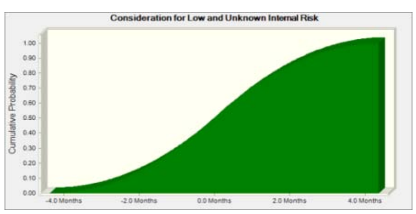
Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I19)**
Likeliest	**0.0 Months**	**(=J19)**
95%	**3.0 Months**	**(=K19)**

Assumption: Consideration for Low and Unknown Internal Risk **Cell: J15**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I15)**
Likeliest	**0.0 Months**	**(=J15)**
95%	**3.0 Months**	**(=K15)**



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J13**

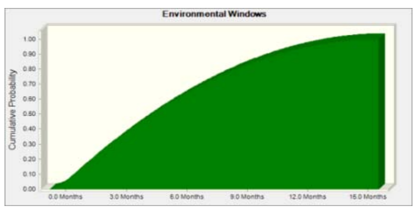
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I13)**
Likeliest	**0.0 Months**	**(=J13)**
95%	**3.0 Months**	**(=K13)**

Assumption: Environmental Windows **Cell: J11**

Triangular distribution with parameters:

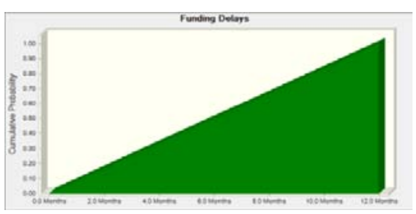
5%	**0.0 Months**	**(=I11)**
Likeliest	**0.0 Months**	**(=J11)**
95%	**12.0 Months**	**(=K11)**



Assumption: Funding Delays **Cell: J18**

Uniform distribution with parameters:

Minimum	**0.0 Months**	**(=I18)**
Maximum	**12.0 Months**	**(=K18)**



Assumption: Permits **Cell: J10**

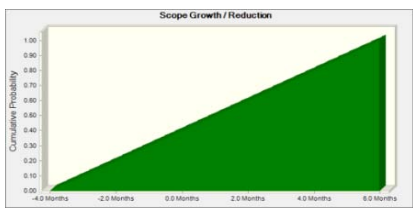
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I10)**
Likeliest	**0.0 Months**	**(=J10)**
95%	**6.0 Months**	**(=K10)**

Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

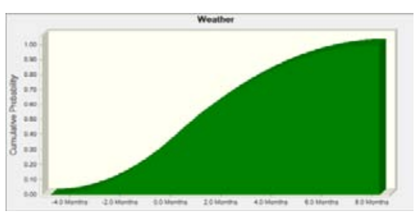
Minimum	**-4.0 Months**	**(=I9)**
Maximum	**6.0 Months**	**(=K9)**



Assumption: Weather **Cell: J17**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I17)**
Likeliest	**0.0 Months**	**(=J17)**
95%	**6.0 Months**	**(=K17)**

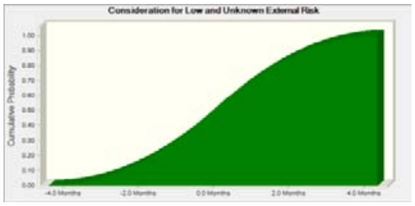


Worksheet: [Copy of SAM - Walton County CSRA Updated 10-2012 - Rev. 1.xlsx]Schedule Risk Mod

Assumption: Consideration for Low and Unknown External Risk **Cell: J20**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I20)**
Likeliest	**0.0 Months**	**(=J20)**
95%	**3.0 Months**	**(=K20)**



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J16**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I16)**
Likeliest	**0.0 Months**	**(=J16)**
95%	**3.0 Months**	**(=K16)**

Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J14**

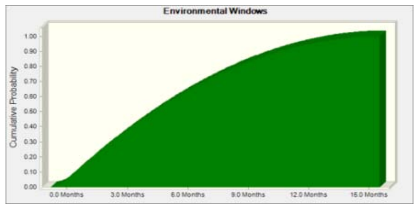
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I14)**
Likeliest	**0.0 Months**	**(=J14)**
95%	**3.0 Months**	**(=K14)**

Assumption: Environmental Windows **Cell: J12**

Triangular distribution with parameters:

5%	**0.0 Months**	**(=I12)**
Likeliest	**0.0 Months**	**(=J12)**
95%	**12.0 Months**	**(=K12)**



Assumption: Funding Delays **Cell: H19**

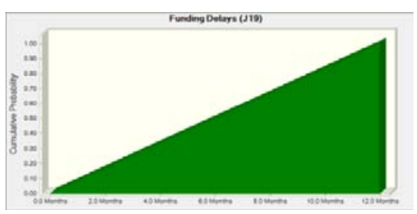
Yes-No distribution with parameters:

Probability of Yes(1)	**0.65**	**(=H19)**

Assumption: Funding Delays (J19) **Cell: J19**

Uniform distribution with parameters:

Minimum	**0.0 Months**	**(=I19)**
Maximum	**12.0 Months**	**(=K19)**



Assumption: Material Availability **Cell: J10**

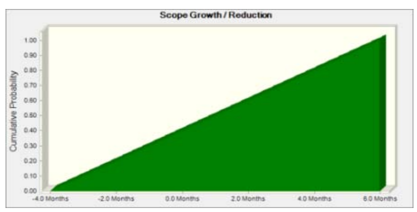
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I10)**
Likeliest	**0.0 Months**	**(=J10)**
95%	**2.0 Months**	**(=K10)**

Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

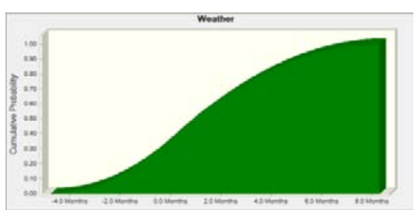
Minimum	**-4.0 Months**	**(=I9)**
Maximum	**6.0 Months**	**(=K9)**



Assumption: Weather **Cell: J18**

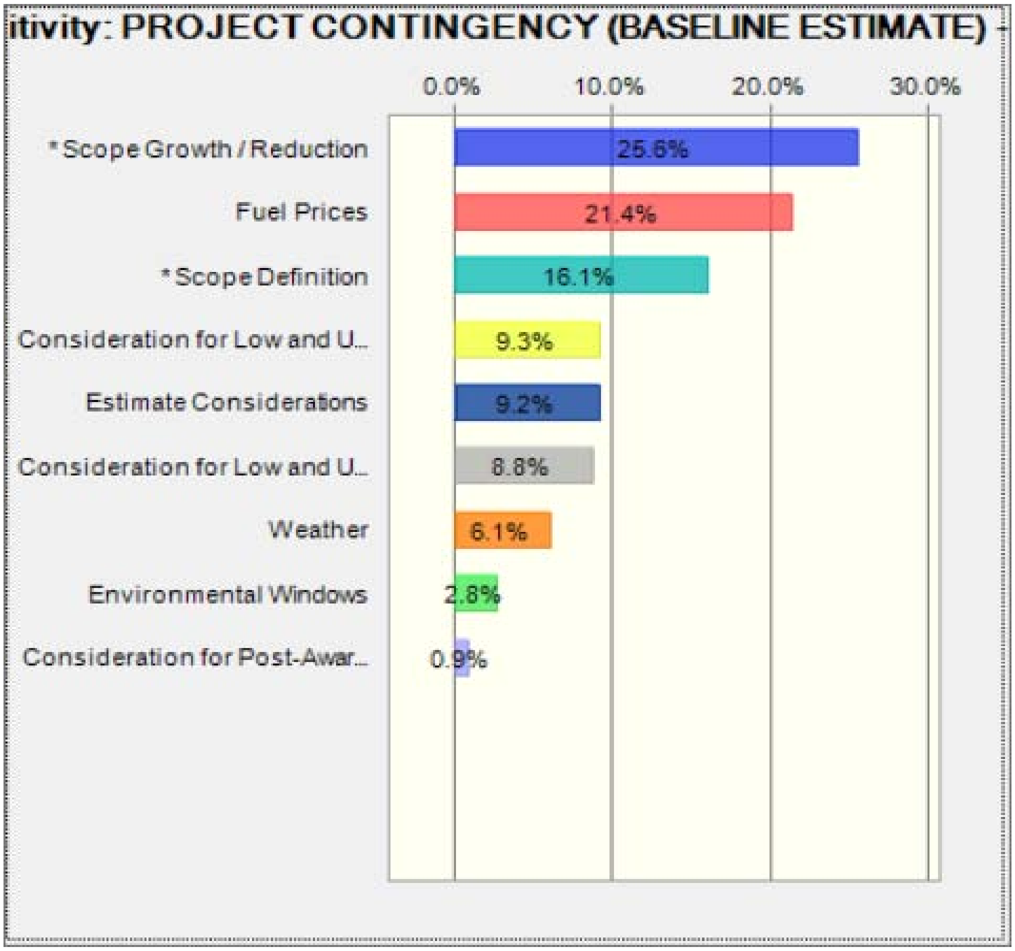
Triangular distribution with parameters:

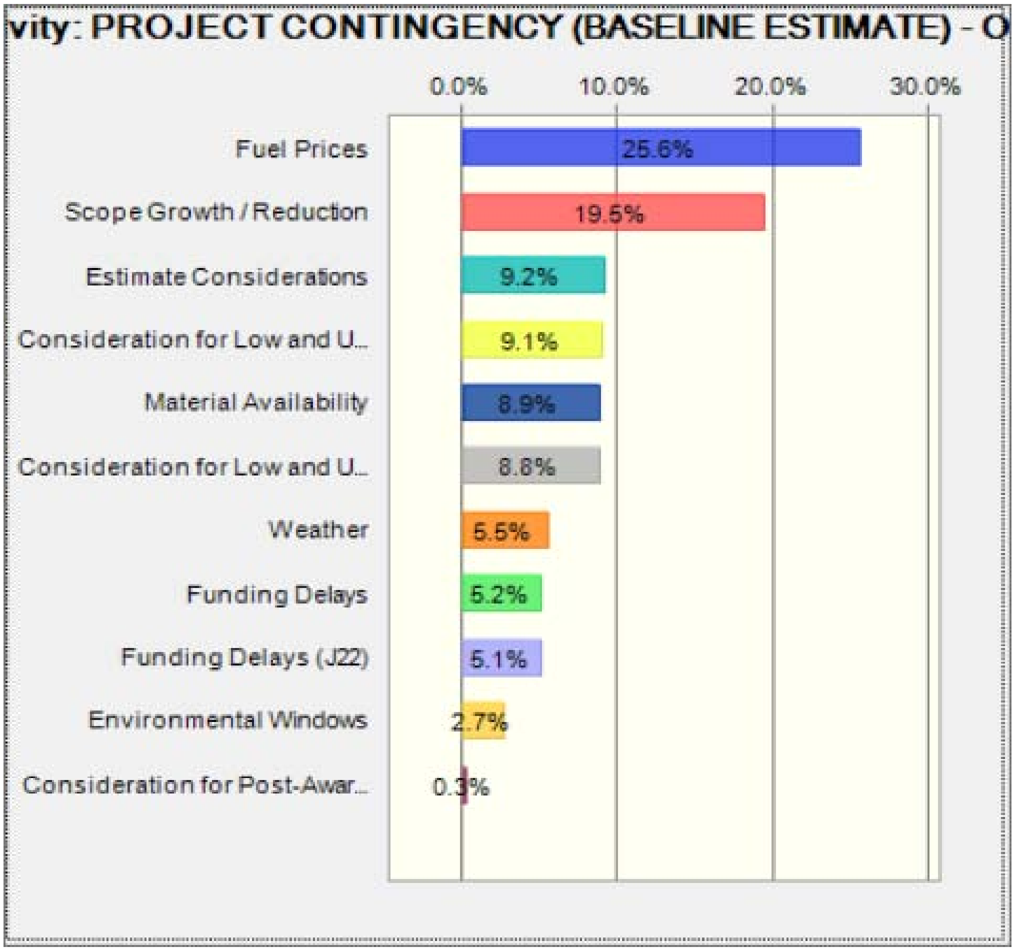
5%	**-3.0 Months**	**(=I18)**
Likeliest	**0.0 Months**	**(=J18)**
95%	**6.0 Months**	**(=K18)**

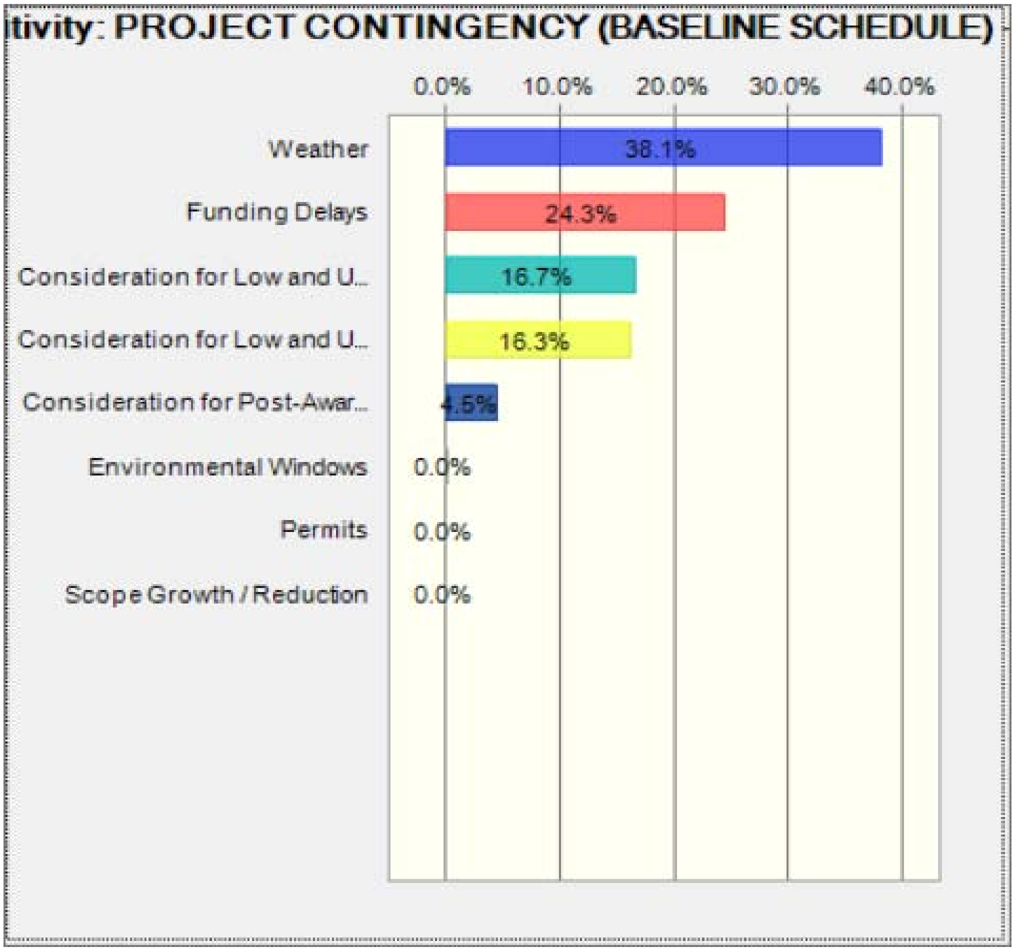


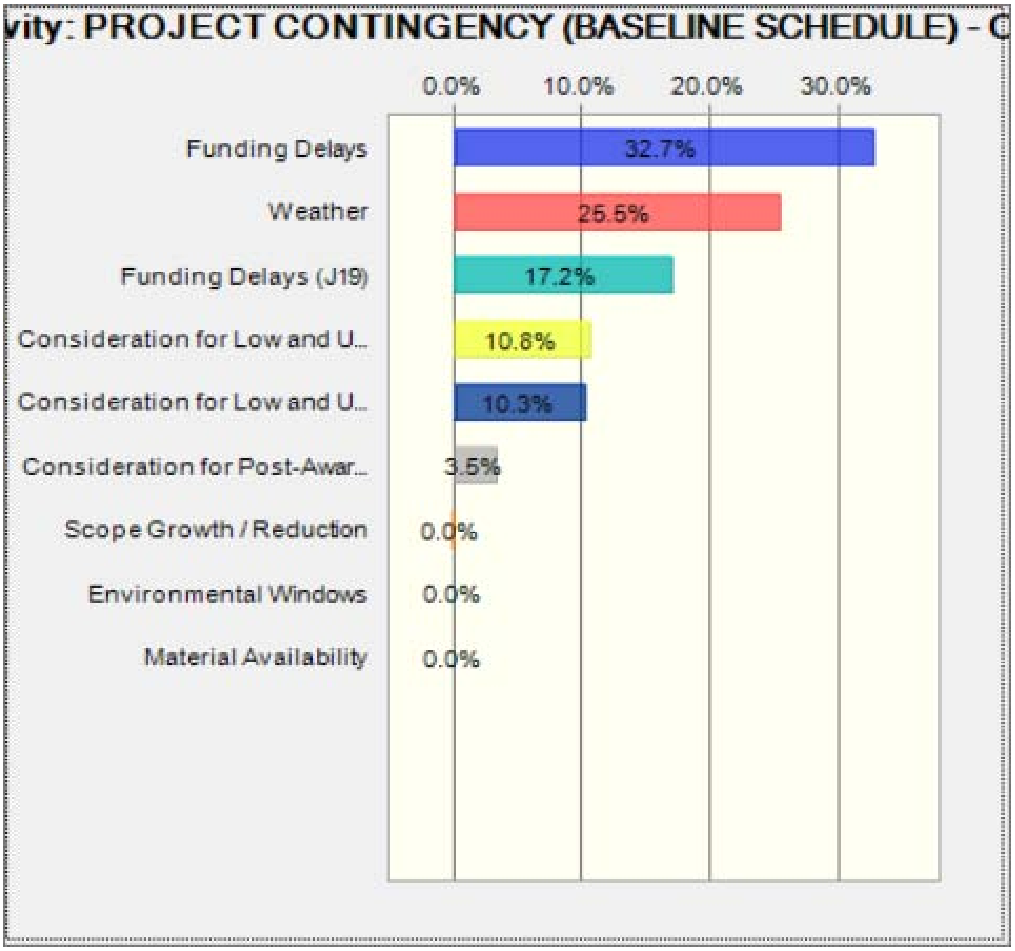
End of Assumptions

Sensitivity Charts




vity: PROJECT CONTINGENCY (BASELINE ESTIMATE) - O
0.0%
10.0%
20.0%
30.0%
Fuel Prices
25.6%
Scope Growth / Reduction
19.5%
Estimate Considerations
9.2%
Consideration for Low and U...
9.1%
Material Availability
8.9%
Consideration for Low and U...
8.8%
Weather
5.5%
Funding Delays
5.2%
Funding Delays (J22)
5.1%
Environmental Windows
2.7%
Consideration for Post-Awar...
0.3%


tivity: PROJECT CONTINGENCY (BASELINE SCHEDULE)
0.0%
10.0%
20.0%
30.0%
40.0%
Weather
38.1%
Funding Delays
24.3%
Consideration for Low and U...
16.7%
Consideration for Low and U...
16.3%
Consideration for Post-Awar...
4.5%
Environmental Windows
0.0%
Permits
0.0%
Scope Growth / Reduction
0.0%



End of Sensitivity Charts

US Army Corps of Engineers®

Walton County Hurricane and Storm Damage Reduction
Walton County, Florida
General Investigations Study
Locally Preferred Plan (LPP)
Project Cost and Schedule Risk Analysis Report

Prepared for:

U.S. Army Corps of Engineers,
Mobile District

Prepared by:

U.S. Army Corps of Engineers
Cost Engineering Directory of Expertise, Walla Walla

October 12, 2012

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EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Mobile District, this report presents a recommendation for the total project cost and schedule contingencies for the Walton County Hurricane and Storm Damage Reduction General Investigations Study. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the Walton County project, the base case project cost for the Locally Preferred Plan (LPP) is estimated at approximately $129 Million ($51 Million for the initial construction and $79 Million for the four subsequent nourishment activities). Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (Walla Walla District) recommends a contingency value of $34 Million, or 27%. This contingency includes $10 Million (21%) for the initial construction and $24 Million (31%) for the four subsequent nourishment activities.

Walla Walla Cost MCX performed risk analysis using the *Monte Carlo* technique, producing the aforementioned contingencies and identifying key risk drivers.

The following tables ES-1, ES-2, and ES-3 portray the development of contingencies (27% overall). The contingency is based on an 80% confidence level, as per USACE Civil Works guidance.

Table ES-1. Contingency Analysis Table - Overall

Base Case Cost Estimate	**$129,336,768**	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$126,907,427	-1.88%
50%	$150,691,083	16.51%
80%	**$163,752,140**	**26.61%**
95%	$176,220,998	36.25%

Table ES-2. Contingency Analysis Table - Initial

Base Case Cost Estimate	$50,677,457	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$47,808,835	-5.66%
50%	$56,451,737	11.39%
80%	**$61,075,892**	**20.52%**
95%	$65,450,609	29.15%

Table ES-3. Contingency Analysis Table – Out-Years

Base Case Cost Estimate	$78,659,310	
Confidence Level	**Value ($$)**	**Contingency (%)**
5%	$79,098,591	0.56%
50%	$94,239,346	19.81%
80%	**$102,676,248**	**30.53%**
95%	$110,770,388	40.82%

The following table ES-2 portrays the full costs of the recommended alternative based on the anticipated contracts. The costs are intended to address the congressional request of estimates to implement the project. The contingency is based on an 80% confidence level, as per accepted USACE Civil Works guidance.

Table ES-4. Cost Summary

WALTON COUNTY HURRICANE AND STORM DAMAGE REDUCTION FRM FEATURE ACCOUNTS		COST ($1,000)	CNTG ($1,000)	TOTAL ($1,000)
01	FISH AND WILDLIFE FACILITIES	543	136	679
17	CHANNELS AND CANALS	122,661	32,639	155,300
30	PLANNING, ENGINEERING, AND DESIGN	3,680	979	4,659
31	CONSTRUCTION MANAGEMENT	2,453	653	3,106
	TOTAL PROJECT COSTS	**129,337**	**34,407**	**163,744**

Notes:
1) Costs include the recommended contingency of 27% with the exception of the 01 Account (Lands and Damages), which used a contingency of 25%, as prepared by the District Real Estate Office.
2) Costs exclude O&M and Life Cycle Cost estimates.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

For Risks I-2 (Scope Growth/Reduction) and I-1 (Scope Definition), although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

For Risk I-5 (Fuel Prices), dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 45 percent of the statistical cost variance.

For Risk I-5 (Fuel Prices), dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

For Risk I-2 (Scope Growth/Reduction), although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 62 percent of the statistical schedule variance.

For Risk E-1 (Weather), the PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For Risk E-2 (Funding Delays), the PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

For Risk E-2 (Funding Delays), the PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

For Risk E-1 (Weather), the PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the PED phase, and proactive monitoring and control of risk identified in this study.

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Mobile District, this report presents a recommendation for the total project cost and schedule contingencies for the Walton County Hurricane and Storm Damage Reduction Project.

2.0 BACKGROUND

Walton County is located approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida. The beaches of Walton County encompass approximately 26 miles of shoreline extending from the City of Destin in Okaloosa County, Florida (about six miles to the east of East Pass) to the Walton/Bay County line near Phillips Inlet. The western two-thirds of Walton County are comprised of a coastal peninsula extending from the mainland, and the eastern third is comprised of mainland beaches. Choctawhatchee Bay lies north of the peninsula. Walton County includes 11.9 miles of state-designated critically eroding areas and three State of Florida park areas that cover approximately six miles of the 26-mile shoreline.

The Walton County shoreline is characterized by high dune elevations partly due to the presence of Pleistocene bluffs formed as a result of an exposed submarine berm formed during inundation of the Florida Peninsula during that geologic period. Primary dune elevations in Walton County range from 11.5 to 44.5 feet North American Vertical Datum, 1988 (NAVD88) and average 25.5 feet. Along the mid-section of Walton County, Bluff elevations exceed 60 feet in height. Bluff erosion and undercutting occur in this area due to the interface of relatively low flat beaches and the bluff toe. An unusual attribute of the Walton County shoreline is the presence of coastal dune lakes. These lakes are rare worldwide and are almost exclusive to the Gulf Coast within the United States. The lakes are about five feet deep and intermittently breach the dune system and discharge directly into the Gulf of Mexico.

Mild winters and warm hot summers characterize the project area, with an average in excess of 280 days a year of sunshine. The average daily temperature is 67 degrees Fahrenheit and the average water temperature is about 70 degrees Fahrenheit. The months from June through November constitute the hurricane storm season, and this area is subject to tropical storm and strong hurricane conditions. The highest period of rainfall occurs during the storm season, with an average annual rainfall of 64 inches.

Walton County's shoreline is receding; the protective dunes and high bluffs are being destroyed by hurricane and storm forces that are occurring more frequently than before.

The impacts of these storms to property and infrastructure are considerable and can possibly be reduced through a beach restoration and stabilization project.

As a part of this effort, Mobile District requested that the USACE Cost Engineering Mandatory Center of Expertise for Civil Works (Cost Engineering MCX) provide an agency technical review (ATR) of the cost estimate and schedule for Recommended Project Plan. That tasking also included providing a risk analysis study to establish the resulting contingencies.

3.0 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 cost risks for all project features. The study and presentation does not include consideration for life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the base case Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the Mobile District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of problems, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. 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.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to 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 analysis 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, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.

- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.

- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

4.0 METHODOLOGY / PROCESS

The Walla Walla Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local Mobile District staff to provide information gathering. The Mobile District PDT conducted risk identification and qualitative analysis to produce a risk register that served as the framework for the risk analysis. Participants in risk identification meeting included the following:

Name	Organization	Title
Joseph H. Ellsworth	USACE - SAM	Lead Cost Engineer
Bernard E. Moseby	USACE - SAM	Planning Economics
Julie M. Watkins	USACE - SAM	Planning Economics
Elizabeth S. Godsey	USACE - SAM	Hydraulic Engineer
Michael A. McKown	USACE - SAM	Structural Engineer - GeoTech
Russell W Blount	USACE - SAM	Real Estate Specialist
Joseph W. Paine	USACE - SAM	Planning Study Manager
Larry E. Parsons	USACE - SAM	Planning Environmental

The first cost risk model was completed February 11, 2010. However, scope and estimate updates since then, as well as agency technical review, necessitated a rerun of the original model. The final results were completed and reported to Mobile on October 5, 2012.

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 the desired level of cost confidence. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

In simple terms, contingency is an amount added to an estimate 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 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 averse 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 selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

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. 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 are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative 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.

A formal PDT meeting was held with the Mobile District office for the purposes of identifying and assessing risk factors. The meeting included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, and real estate

The initial formal meetings 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. Subsequent meetings focused primarily on risk factor assessment and quantification.

Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were 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 involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following 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

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 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 support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 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 baseline 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.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the Walton County Hurricane and Storm Damage Reduction project.

a. The Mobile District provided MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The MII and CWE files transmitted and downloaded on October 5, 2012 was the basis for the final cost and schedule risk analyses.

b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level.

c. Schedules are analyzed for impact to the project cost in terms of both uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.

Specific to the Walton County Hurricane and Storm Damage Reduction project, the schedule was analyzed only for impacts due to residual fixed costs.

d. Per the CWCCIS Historical State Adjustment Factors in EM 1110-2-1304, State Adjustment Factor for the State of Florida is 0.93, meaning that the average inflation for the project area is assumed to be 7% lower than the national average for inflation. Therefore, it is assumed that the project inflations experienced are similar (or better) to OMB inflation factors for future construction. Thus, the risk analyses accounted for no escalation over and above the national average.

e. Per the data in the estimate, the Overhead percentage for the Prime Contractor is 16%. The analysis assumed that approximately half of this amount is Job Office Overhead (JOOH). Thus, the assumed residual fixed cost rate for this project is 8%. For the P80 schedule, this comprises approximately 4% of the total contingency for the initial activity and 5% of the total contingency for the subsequent nourishments. This is due to the accrual of residual fixed costs associated with delay associated with the implementation schedule of each nourishment.

f. The Cost MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.

g. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk "watch list".

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing 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 feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes only.

Contingency was quantified as approximately $36 Million at the P80 confidence level (31% of the baseline cost estimate). For comparison, the cost contingency at the P50 and P100 confidence levels was quantified as 19% and 70% of the baseline cost estimate, respectively.

Table 1. Project Cost Contingency Summary

Risk Analysis Forecast	Baseline Estimate	Total Contingency[1,2] ($)	Total Contingency (%)
50% Confidence Level			
Project Cost	$154,122,363	$24,785,596	19.16%
80% Confidence Level			
Project Cost	$169,848,864	$40,512,096	31.32%
100% Confidence Level			
Project Cost	$219,864,829	$90,528,061	69.99%

Notes:
1) These figures combine uncertainty in the baseline cost estimates and schedule.
2) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of "unknown unknowns") makes 100% confidence a theoretical impossibility.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

Figure 1. Cost Sensitivity Analysis - Initial

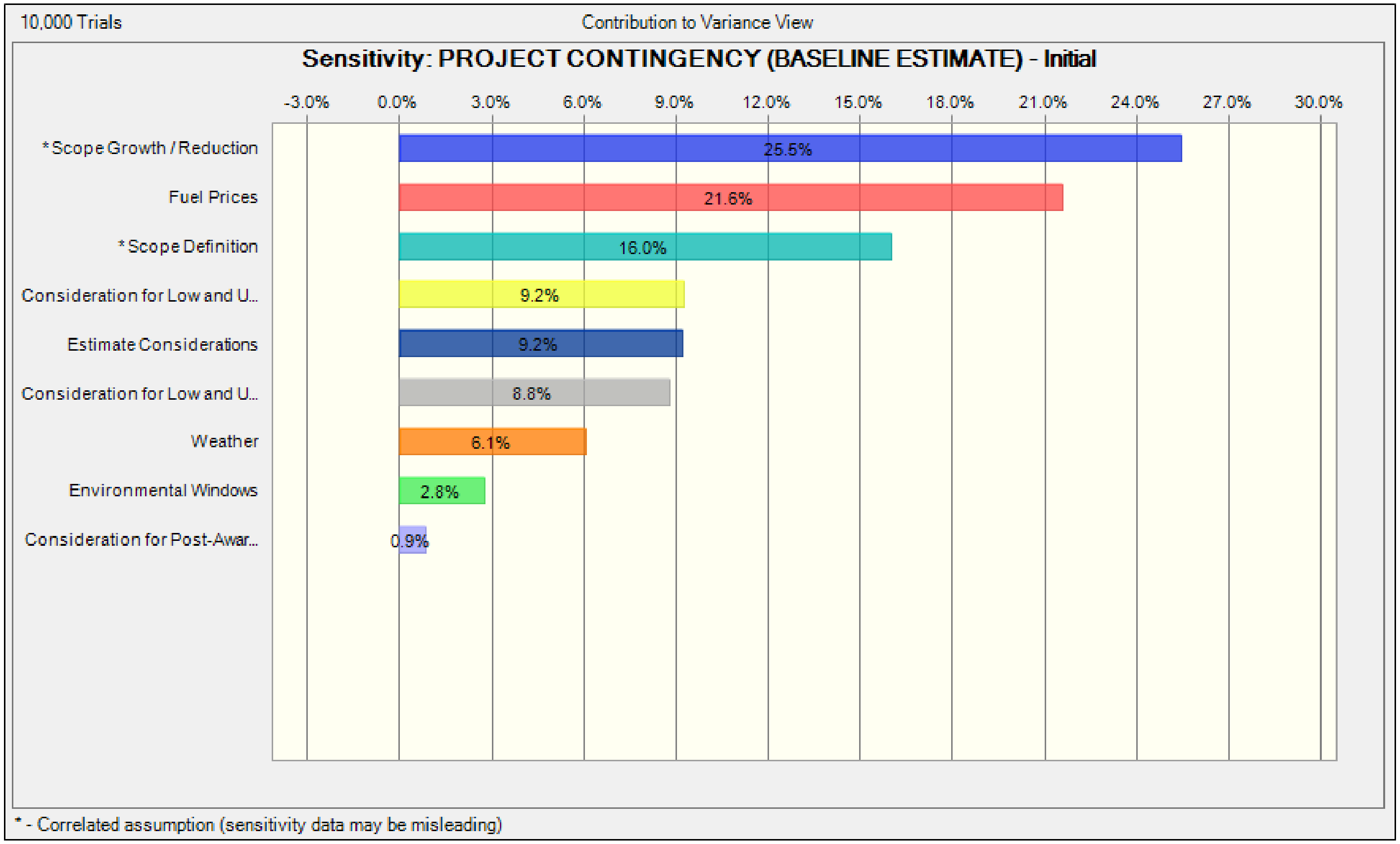


Figure 2. Cost Sensitivity Analysis – Out-Years

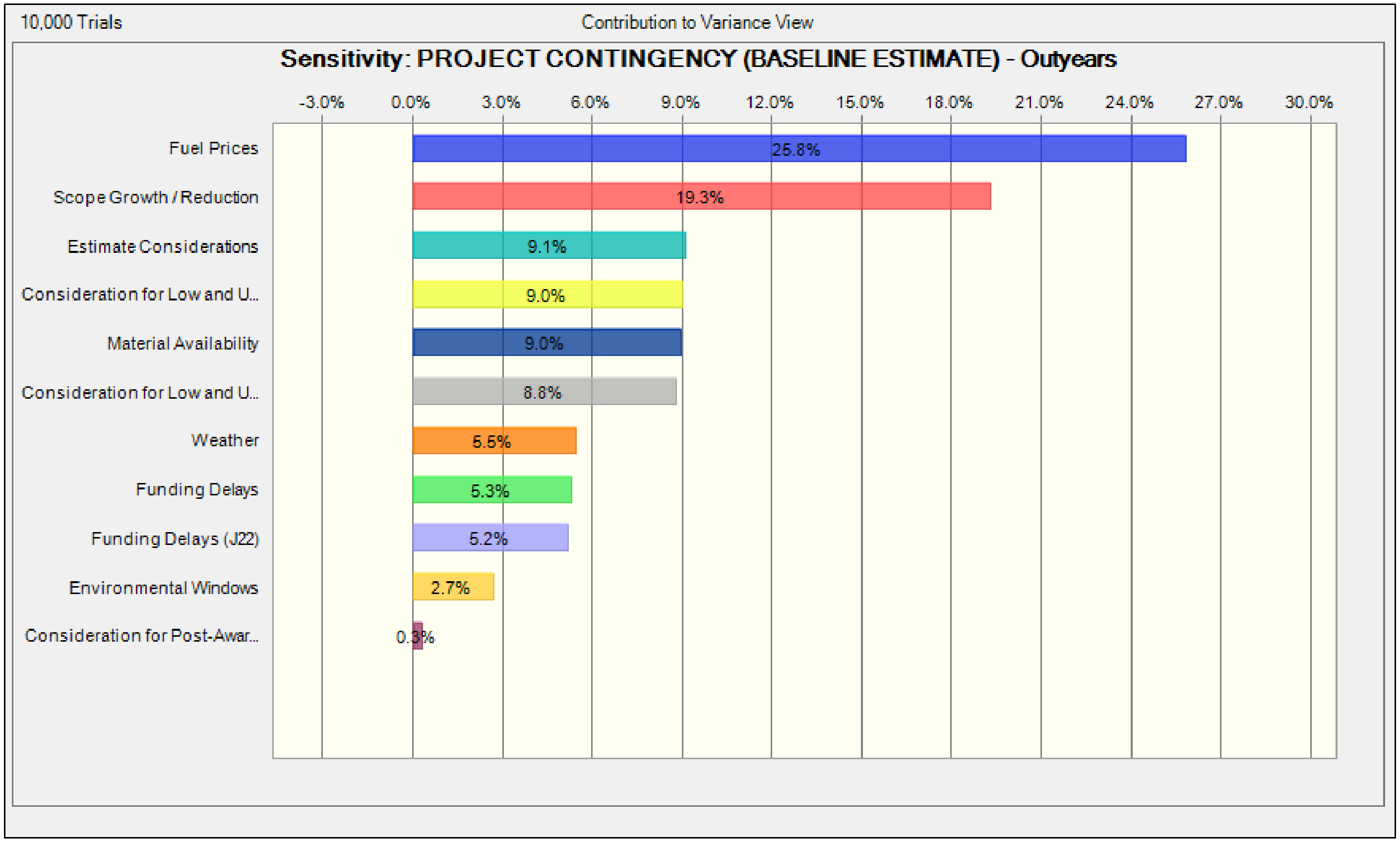


Figure 3. Schedule Sensitivity Analysis – Initial

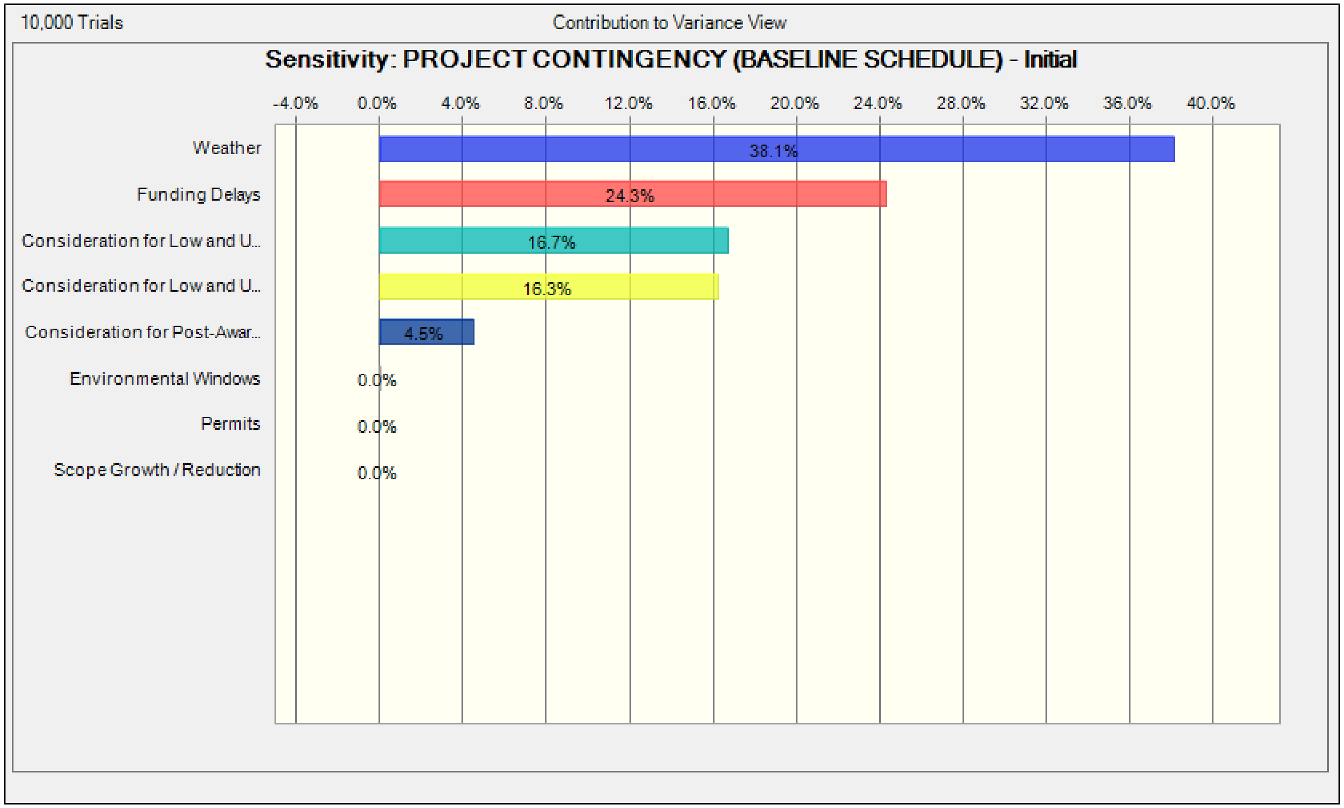
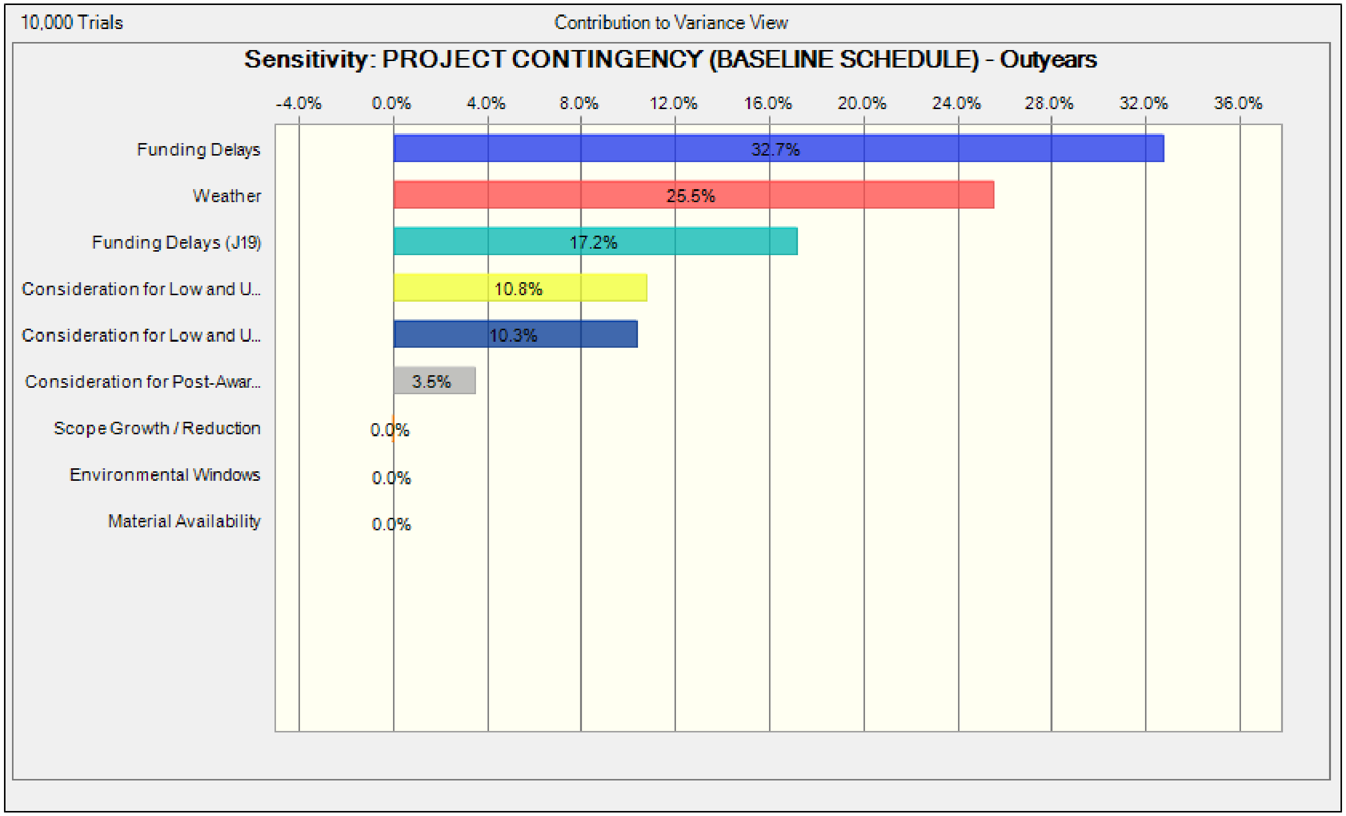


Figure 4. Schedule Sensitivity Analysis – Out-Years



7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Major Findings/Observations

Project cost comparison summaries are provided in Table 3 and Figure 3. Additional major findings and observations of the risk analysis are listed below.

1. For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

2. For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 45 percent of the statistical schedule variance.

3. For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 63 percent of the statistical cost variance.

4. For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

5. Operation and maintenance activities were not included in the cost estimate or schedules. Therefore, a full life cycle risk analysis could not be performed. Risk analysis results or conclusions could be significantly different if the necessary operation and maintenance activities were included.

Table 3. Project Cost Comparison Summary (Uncertainty Analysis)

Confidence Level	Project Cost ($)	Contingency ($)	Contingency (%)
P0	**$95,778,087**	**($33,558,681)**	**-25.95%**
P5	**$125,940,994**	**($3,395,773)**	**-2.63%**
P10	**$131,759,933**	**$2,423,166**	**1.87%**
P15	**$135,859,021**	**$6,522,253**	**5.04%**
P20	**$139,249,288**	**$9,912,520**	**7.66%**
P25	**$142,086,556**	**$12,749,789**	**9.86%**
P30	**$144,660,598**	**$15,323,831**	**11.85%**
P35	**$147,087,096**	**$17,750,329**	**13.72%**
P40	**$149,515,085**	**$20,178,318**	**15.60%**
P45	**$151,784,317**	**$22,447,549**	**17.36%**
P50	**$154,122,363**	**$24,785,596**	**19.16%**
P55	**$156,455,880**	**$27,119,112**	**20.97%**
P60	**$158,786,146**	**$29,449,378**	**22.77%**
P65	**$161,224,719**	**$31,887,951**	**24.65%**
P70	**$163,836,971**	**$34,500,203**	**26.67%**
P75	**$166,614,500**	**$37,277,733**	**28.82%**
P80	**$169,848,864**	**$40,512,096**	**31.32%**
P85	**$173,499,382**	**$44,162,615**	**34.15%**
P90	**$178,165,673**	**$48,828,906**	**37.75%**
P95	**$184,732,784**	**$55,396,017**	**42.83%**
P100	**$219,864,829**	**$90,528,061**	**69.99%**

Figure 3. Project Cost Summary (Uncertainty Analysis)

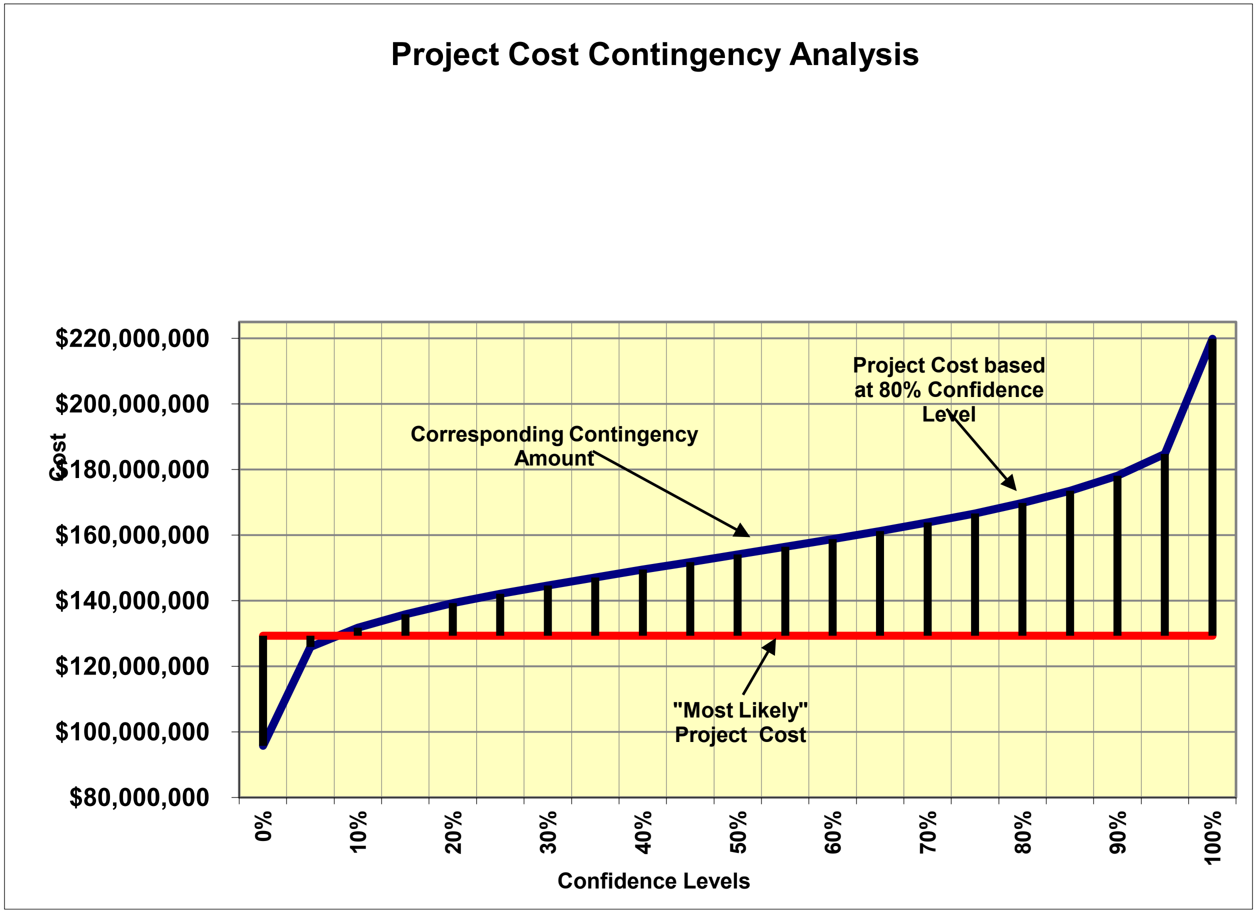
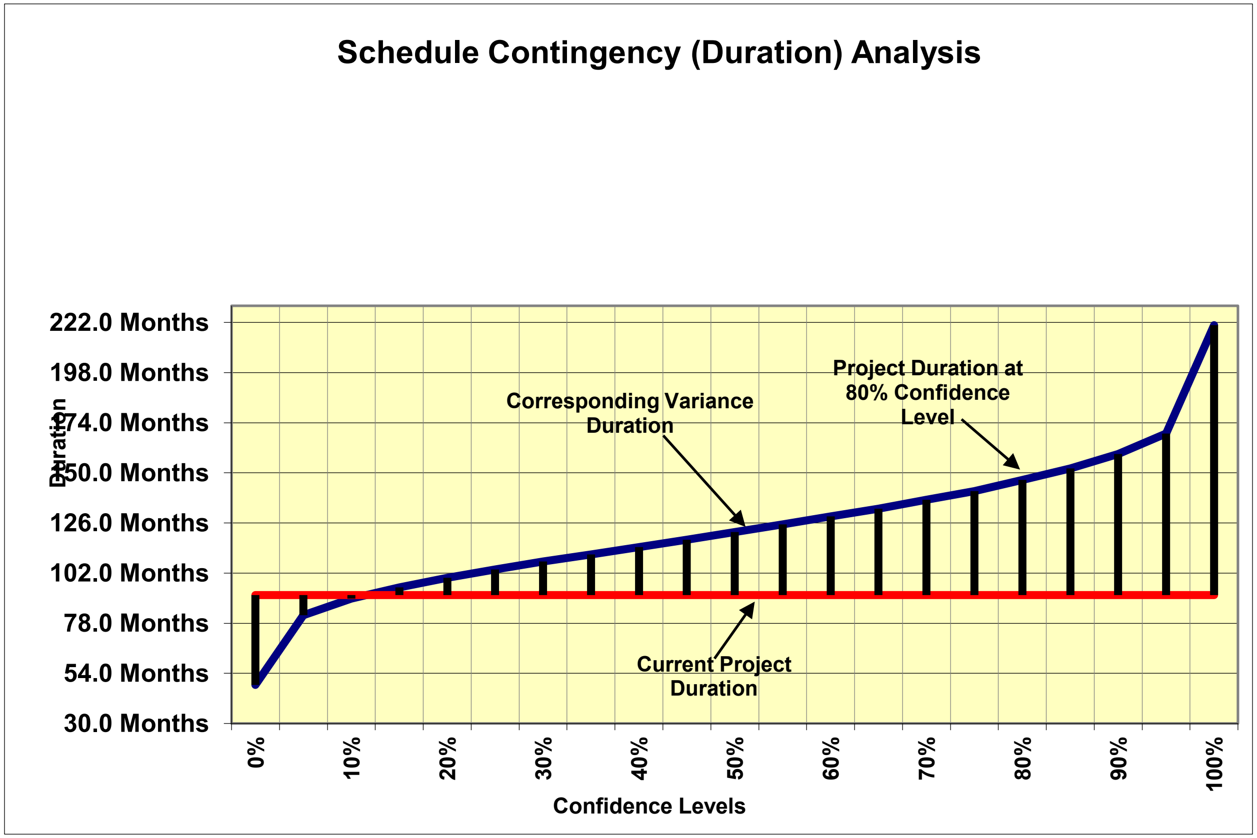


Figure 4. Project Duration Summary (Uncertainty Analysis)



7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *4th edition*, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

1. Key Cost Risk Drivers: For the initial activity, the key cost risk drivers identified through sensitivity analysis are Risks I-2 (Scope Growth/Reduction), I-5 (Fuel Prices), and I-1 (Scope Definition), which together contribute over 63 percent of the statistical cost variance.

For the subsequent nourishments, the key cost risk drivers identified through sensitivity analysis are Risks I-5 (Fuel Prices) and I-2 (Scope Growth/Reduction), which together contribute over 45 percent of the statistical cost variance.

a) Scope Growth/Reduction and Scope Definition: Although the scope has been fairly well defined, there is risk of growth or reduction in scope due to the effects of erosion over time, particularly if the project is delayed. Any necessary reductions in scope would likely impact the amount of structural additions in the initial activity. The PDT should make efforts to minimize uncertainty with project scope, as well as implement a change management process to reduce the quantity and impact of post-awards modifications, equitably adjustments, and/or claims.

b) Fuel Prices: Dredging costs are particularly sensitive to the cost of fuel per gallon (marine diesel). Since the trend is that fuel prices will likely increase, potentially significantly, this will likely increase the overall cost of construction. The PDT should continue to perform market research and analysis of trends within the construction industry. Ultimately, this uncertainty cannot be mitigated until more information is available. This should be communicated to management, and an adequate amount of contingency should be reserved to capture this risk.

2. Key Schedule Risk Drivers: For the initial activity, the key schedule risk drivers identified through sensitivity analysis are Risks E-1 (Weather) and E-2 (Funding Delays), which together contribute over 62 percent of the statistical schedule variance.

For the subsequent nourishments, the key schedule risk drivers identified through sensitivity analysis are Risks E-2 (Funding Delays) and E-1 (Weather), which together contribute over 75 percent of the statistical schedule variance.

a) Funding Delays: The PDT is concerned that the timing and availability of funds for the project may not occur according to current plans, either in terms of schedule or increments. Also, if the project is not funded, it would effectively stop the project. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

b) Weather: The PDT acknowledges that the project area is subject to severe weather, including hurricanes, which could significantly impact the subsurface conditions and prevent or delay work from occurring according to schedule. Project leadership should communicate this risk to management for awareness and assistance. Ultimately, this is an external risk, and an adequate amount of contingency should be reserved to capture this risk.

3. Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Risk Level

Likelihood of Occurrence	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	High

Impact or Consequence of Occurrence

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost			Project Schedule			Responsibility/POC	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.)											
INTERNAL RISKS											
I-1	Scope Definition	Scope is fairly well defined for standard civil works features. There is also less uncertainty now than in the first CSRA iteration.	Scope may change based on permitting. The PDT has indicated that the scope definition would not impact the outyears dredging, and if anything, would reduce the structural additions in the initial nourishment.	LIKELY	Marginal	MODERATE	VERY Unlikely	MARGINAL	LOW	Project Manager/Planner	Project Cost & Schedule
I-2	Scope Growth / Reduction	Scope is fairly well defined for standard civil works features. However, there is the chance of experiencing scope growth or reduction due to erosion over time and funding limitations.	The pumping plant has potential of VE savings through better data and VE. While there is confidence in quantities for the initial nourishment, quantities for the out-year renourishments may change significantly.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Project Manager/Planner	Project Cost & Schedule
I-3	Equipment Availability/Pricing	Estimate assumes medium size hopper dredges will performed the subject work. Since this project is planned so far in advance and O&M is already on the industry's radar. The industry will plan accordingly. The contract could even be moved a few months forward to accommodate for the availability if the industry doesn't fit this profitable dredging job into their schedule.	Availability is not a problem. Based on passed similar projects within the area medium size hoppers were used, Panama City Beaches being the most recent.	LIKELY	MARGINAL	MODERATE	UNLIKELY	MARGINAL	LOW	Cost Engineering	Project Cost & Schedule
I-4	Material Availability	Borrow sources are provided and indicated on drawings. However, there may be more concern and risk in the out-year renourishments.	Per the design Engineer and based on current surveys, quality and quantity of beach fill material is available at all sites for the initial nourishment.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Design Engineer	Project Cost & Schedule
I-5	Fuel Prices	$3.45 per gallon was used in the September 2012 updated CEDEP Estimates. Increases in fuel prices will effect equipment and delivery or materials.	Fuel cost fluctuations can significantly impact dredging cost.	VERY LIKELY	SIGNIFICANT	HIGH	UNLIKELY	NEGLIGIBLE	LOW	Cost Engineering	Project Cost & Schedule
I-6	Permits	Permitting delays may occur due to Florida State policy. This is likely to impact the ultimate schedule more so than the costs.	This could impact the cost and schedule.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	Planning/Regulatory	Project Cost & Schedule
I-7	Environmental Windows	Project site is a natural habitat for various species of threatened wildlife that utilize the project vicinity during Spring and Winter months.	Gulf sturgeon incidental takes during dredging and Sea Turtle and Bird Nesting may have Impact during Construction. There may also be unknown restrictions for the out-year renourishments.	LIKELY	SIGNIFICANT	HIGH	LIKELY	SIGNIFICANT	HIGH	Project Manager/Planner	Project Cost & Schedule
I-8	Acquisition Plan (Strategy)	The estimate was based on full and open competition, with minimal tiering of contractor subs.	The Acq Plan has not been finalized, therefore there is a potential for additional tiering of the contracts. Since this is dreding work, past experience will likely dictate the most cost effective methodology for contract procurement.	UNLIKELY	MARGINAL	LOW	UNLIKELY	MARGINAL	LOW	Acquisition Strategy Board	Project Cost & Schedule
I-9	VE Study	VE study will be performed prior to Final Feasibility Report.	This could impact the cost and schedule, but likely would not have significant impact.	UNLIKELY	MARGINAL	LOW	UNLIKELY	MARGINAL	LOW	Project Manager/Planner	Project Cost & Schedule
CONSTRUCTION RISKS											
INT-MOD	Consideration for Post-Award Construction Claims and Modifications	There is inherent risk of construction modifications and claims that arise after contract award due to issues such as weather, schedules dictated by O&M cycles, differing site conditions, user directed changes or omissions, inaccurate surveys, and variations in estimated quantities (minor).	Post-award construction contract modifications and claims could impact the ultimate contract costs and delay the overall schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	Project Cost & Schedule

	ESTIMATE AND SCHEDULE RISKS										
EST-1	Estimate Considerations	This item is added based on the ATR Cost review. The estimate makes no considerations for labor fluctuations, overtime, soil conditions, productivity, or fluctuating indirect costs (overhead). This is added to the CSRA model for consideration, as these issues may cause a cost variance.	Estimate assumptions may not accurately capture the ultimate costs, therefore this could have an impact either positively or negatively on the costs.	Likely	Significant	HIGH	Very Unlikely	Negligible	LOW	Project Manager/Planner	Project Cost & Schedule
	LOW AND UNKNOWN INTERNAL RISKS										
INT-1	Consideration for Low and Unknown Internal Risk	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns.	This could impact cost and schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	Project Cost & Schedule
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)									
E-1	Weather	Florida is subject to bad weather during Hurricane Season which can cause Schedule delays.	Weather days are generally incorporated into schedule.	LIKELY	MARGINAL	MODERATE	LIKELY	MARGINAL	MODERATE	N/A	Project Cost & Schedule
E-2	Funding Delays	PM feels Adequate Congressional funding to complete project will be available, particularly for the initial nourishment. However, if the project is delayed, it could increase the quantities to be dredged and delay the overal schedule.	This could impact the cost and schedule for the outyear renourishment cycles.	LIKELY	MARGINAL	MODERATE	LIKELY	Significant	HIGH	Project Manager	Project Cost & Schedule
EXT-1	Consideration for Low and Unknown External Risk	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns.	This could impact cost and schedule.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE	Project Manager/Planner	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.

SAM - Walton County Storm Damage Reduction Project, GI Study - LP

Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost (Most Likely) ->	**$50,677,457**
Baseline Estimate Cost Contingency Amount ->	$8,160,051
Baseline Estimate Construction Cost (80% Confidence) ->	**$58,837,508**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**18.3 Months**
Schedule Contingency Duration ->	10.1 Months
Project Schedule Duration (80% Confidence) ->	**28.4 Months**
Project Schedule Contingency Amount (80% Confidence) ->	**$2,238,384**

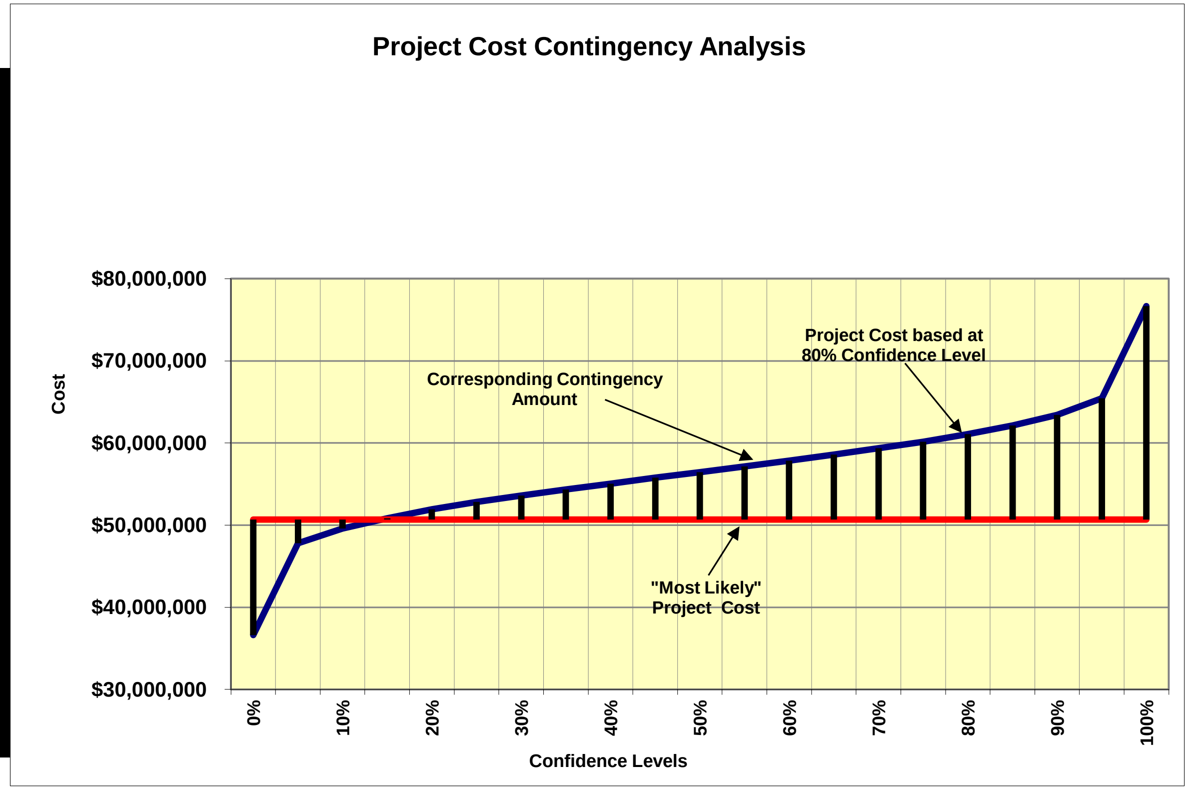
Project Contingency	80% Confidence Project Cost
Project Contingency Amount (80% Confidence) ->	**$10,398,435**
Project Contingency Percentage (80% Confidence) ->	**21%**

Project Cost (80% Confidence) ->	**$61,075,892**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

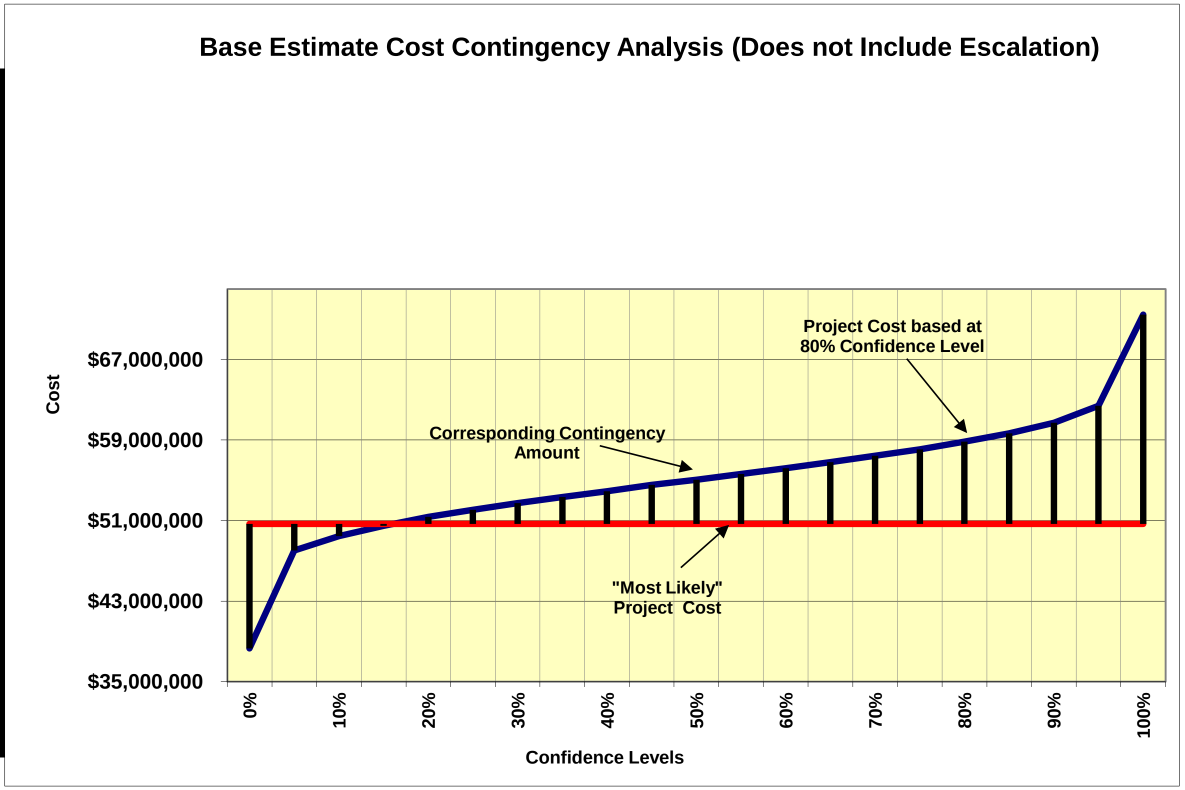
Most Likely Cost Estimate	$50,677,457		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$36,626,901	($14,050,557)	-27.73%
5%	$47,808,835	($2,868,622)	-5.66%
10%	$49,577,304	($1,100,154)	-2.17%
15%	$50,844,000	$166,542	0.33%
20%	$51,916,680	$1,239,223	2.45%
25%	$52,804,931	$2,127,474	4.20%
30%	$53,614,518	$2,937,061	5.80%
35%	$54,347,985	$3,670,528	7.24%
40%	$55,059,476	$4,382,019	8.65%
45%	$55,792,589	$5,115,131	10.09%
50%	$56,451,737	$5,774,280	11.39%
55%	$57,158,757	$6,481,300	12.79%
60%	$57,836,635	$7,159,178	14.13%
65%	$58,569,087	$7,891,629	15.57%
70%	$59,353,437	$8,675,980	17.12%
75%	$60,152,222	$9,474,765	18.70%
80%	$61,075,892	$10,398,435	20.52%
85%	$62,125,579	$11,448,122	22.59%
90%	$63,429,620	$12,752,162	25.16%
95%	$65,450,609	$14,773,152	29.15%
100%	$76,658,457	$25,981,000	51.27%



- BASE CONTINGENCY DEVELOPMENT -

Contingency Analysis

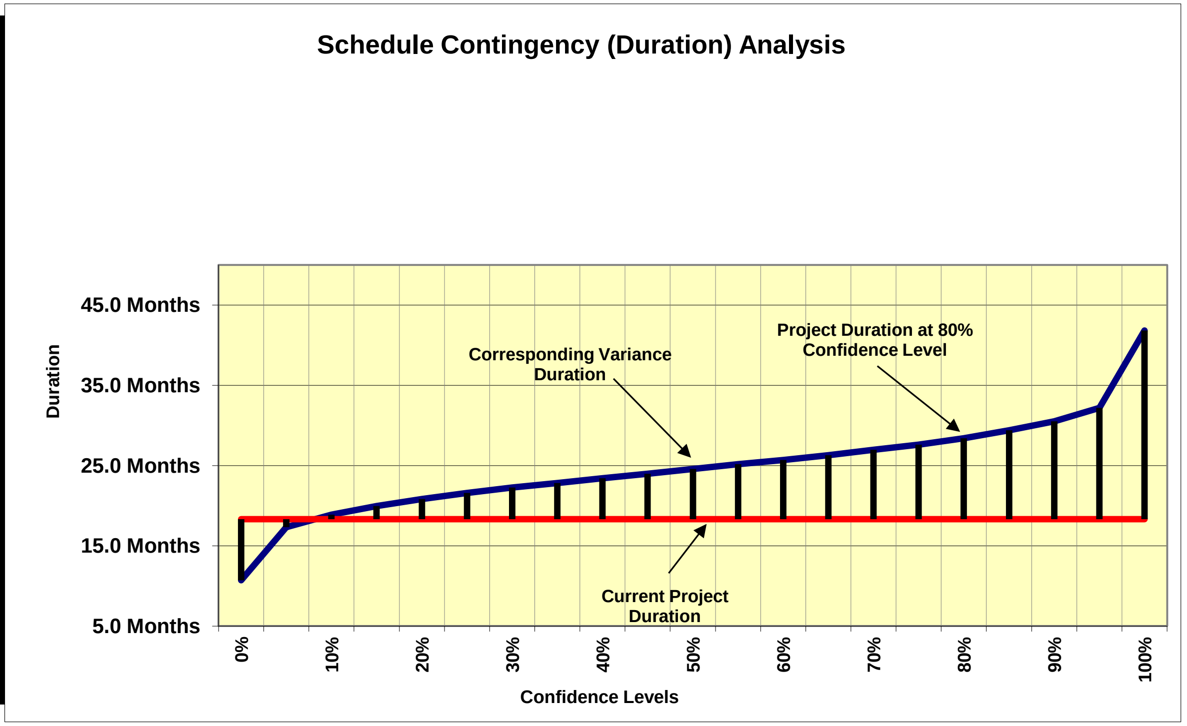
Most Likely Cost Estimate	$50,677,457		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$38,309,515	($12,367,942.04)	-24.41%
5%	$48,026,384	($2,651,073.46)	-5.23%
10%	$49,447,339	($1,230,118.45)	-2.43%
15%	$50,478,819	($198,637.96)	-0.39%
20%	$51,355,959	$678,501.85	1.34%
25%	$52,077,451	$1,399,993.42	2.76%
30%	$52,739,667	$2,062,209.65	4.07%
35%	$53,345,128	$2,667,670.50	5.26%
40%	$53,924,106	$3,246,648.63	6.41%
45%	$54,532,791	$3,855,333.87	7.61%
50%	$55,063,361	$4,385,903.80	8.65%
55%	$55,639,103	$4,961,646.22	9.79%
60%	$56,202,882	$5,525,424.63	10.90%
65%	$56,803,532	$6,126,075.04	12.09%
70%	$57,434,941	$6,757,483.56	13.33%
75%	$58,089,052	$7,411,595.04	14.63%
80%	$58,837,508	$8,160,050.85	16.10%
85%	$59,672,978	$8,995,520.96	17.75%
90%	$60,723,895	$10,046,437.51	19.82%
95%	$62,381,323	$11,703,865.46	23.09%
100%	$71,454,158	$20,776,700.30	41.00%



- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

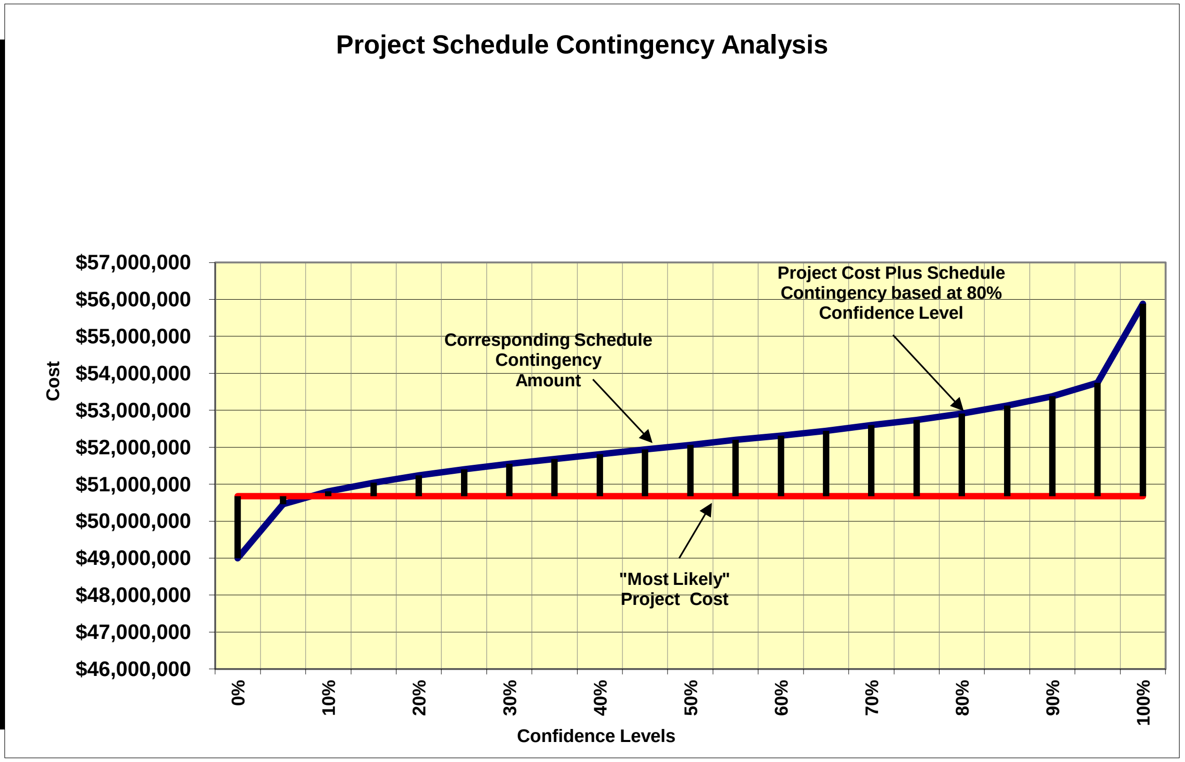
Most Likely Schedule Duration	18.3 Months		
Confidence Level	**Project Duration**	**Contingency**	**Contingency %**
0%	10.7 Months	-7.6 Months	-41.50%
5%	17.3 Months	-1.0 Months	-5.37%
10%	18.9 Months	0.6 Months	3.21%
15%	20.0 Months	1.6 Months	9.01%
20%	20.8 Months	2.5 Months	13.83%
25%	21.6 Months	3.3 Months	17.94%
30%	22.3 Months	4.0 Months	21.58%
35%	22.8 Months	4.5 Months	24.74%
40%	23.4 Months	5.1 Months	28.00%
45%	24.0 Months	5.7 Months	31.07%
50%	24.6 Months	6.3 Months	34.25%
55%	25.2 Months	6.9 Months	37.48%
60%	25.7 Months	7.4 Months	40.30%
65%	26.3 Months	8.0 Months	43.55%
70%	27.0 Months	8.7 Months	47.32%
75%	27.6 Months	9.3 Months	50.89%
80%	28.4 Months	10.1 Months	55.21%
85%	29.4 Months	11.1 Months	60.50%
90%	30.5 Months	12.2 Months	66.74%
95%	32.2 Months	13.9 Months	75.71%
100%	41.8 Months	23.5 Months	128.37%



- SCHEDULE CONTINGENCY (AMOUNT) DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$50,677,457		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$48,994,843	($1,682,615)	-3.32%
5%	$50,459,909	($217,549)	-0.43%
10%	$50,807,422	$129,965	0.26%
15%	$51,042,638	$365,180	0.72%
20%	$51,238,178	$560,721	1.11%
25%	$51,404,938	$727,481	1.44%
30%	$51,552,309	$874,852	1.73%
35%	$51,680,315	$1,002,857	1.98%
40%	$51,812,827	$1,135,370	2.24%
45%	$51,937,255	$1,259,798	2.49%
50%	$52,065,833	$1,388,376	2.74%
55%	$52,197,111	$1,519,654	3.00%
60%	$52,311,211	$1,633,753	3.22%
65%	$52,443,012	$1,765,554	3.48%
70%	$52,595,953	$1,918,496	3.79%
75%	$52,740,627	$2,063,170	4.07%
80%	$52,915,841	$2,238,384	4.42%
85%	$53,130,058	$2,452,601	4.84%
90%	$53,383,182	$2,705,725	5.34%
95%	$53,746,744	$3,069,287	6.06%
100%	$55,881,757	$5,204,299	10.27%



SAM - Walton County Storm Damage Reduction Project, GI Study - LP

Contingency on Base Estimate	80% Confidence Project Cost
Baseline Estimate Cost (Most Likely) ->	**$78,659,310**
Baseline Estimate Cost Contingency Amount ->	$20,158,599
Baseline Estimate Construction Cost (80% Confidence) ->	**$98,817,909**

Contingency on Schedule	80% Confidence Project Schedule
Project Schedule Duration (Most Likely) ->	**18.3 Months**
Schedule Contingency Duration ->	44.9 Months
Project Schedule Duration (80% Confidence) ->	**63.2 Months**
Project Schedule Contingency Amount (80% Confidence) ->	**$3,858,339**

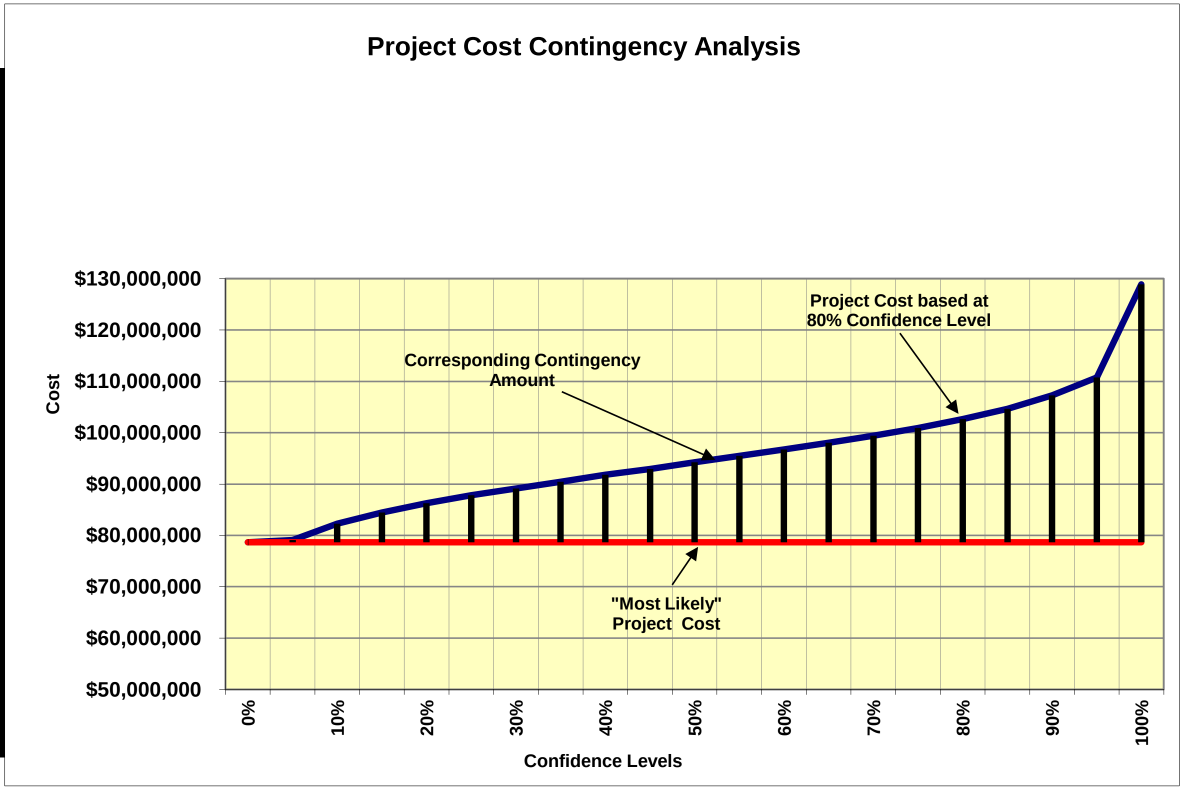
Project Contingency	80% Confidence Project Cost
Project Contingency Amount (80% Confidence) ->	**$24,016,938**
Project Contingency Percentage (80% Confidence) ->	**31%**

Project Cost (80% Confidence) ->	**$102,676,248**

- PROJECT CONTINGENCY DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$78,659,310		
Confidence Level	Project Cost	Contingency	Contingency %
0%	$78,659,310	($14,774,408)	0.00%
5%	$79,098,591	$439,281	0.56%
10%	$82,253,648	$3,594,338	4.57%
15%	$84,483,694	$5,824,383	7.40%
20%	$86,285,586	$7,626,276	9.70%
25%	$87,794,410	$9,135,100	11.61%
30%	$89,135,607	$10,476,297	13.32%
35%	$90,454,862	$11,795,551	15.00%
40%	$91,790,962	$13,131,652	16.69%
45%	$92,951,658	$14,292,348	18.17%
50%	$94,239,346	$15,580,036	19.81%
55%	$95,463,020	$16,803,710	21.36%
60%	$96,717,444	$18,058,133	22.96%
65%	$98,027,079	$19,367,769	24.62%
70%	$99,399,402	$20,740,092	26.37%
75%	$100,926,522	$22,267,211	28.31%
80%	$102,676,248	$24,016,938	30.53%
85%	$104,668,286	$26,008,975	33.07%
90%	$107,277,911	$28,618,601	36.38%
95%	$110,770,388	$32,111,078	40.82%
100%	$128,917,225	$50,257,915	63.89%

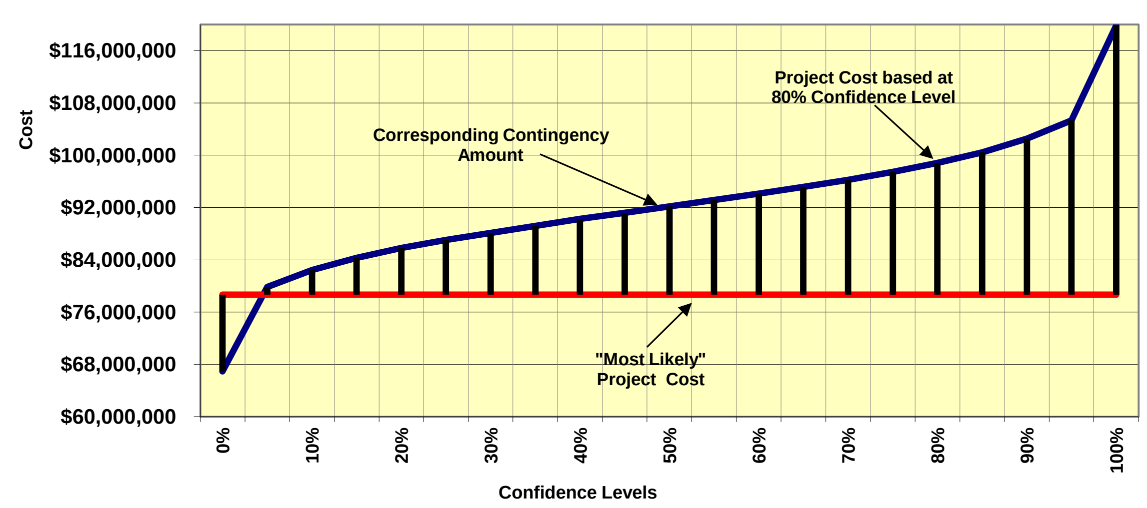


- BASE CONTINGENCY DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$78,659,310		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$66,936,003	($11,723,307.41)	-14.90%
5%	$79,847,475	$1,188,164.97	1.51%
10%	$82,454,632	$3,795,321.64	4.83%
15%	$84,317,546	$5,658,236.11	7.19%
20%	$85,799,286	$7,139,976.07	9.08%
25%	$87,034,676	$8,375,365.38	10.65%
30%	$88,099,986	$9,440,675.88	12.00%
35%	$89,173,470	$10,514,159.26	13.37%
40%	$90,261,686	$11,602,375.49	14.75%
45%	$91,171,386	$12,512,076.00	15.91%
50%	$92,196,441	$13,537,130.99	17.21%
55%	$93,148,572	$14,489,261.27	18.42%
60%	$94,119,131	$15,459,820.28	19.65%
65%	$95,164,080	$16,504,770.05	20.98%
70%	$96,233,766	$17,574,455.34	22.34%
75%	$97,453,935	$18,794,625.03	23.89%
80%	$98,817,909	$20,158,598.79	25.63%
85%	$100,415,369	$21,756,058.69	27.66%
90%	$102,525,493	$23,866,183.02	30.34%
95%	$105,327,888	$26,668,577.76	33.90%
100%	$119,832,377	$41,173,067.01	52.34%

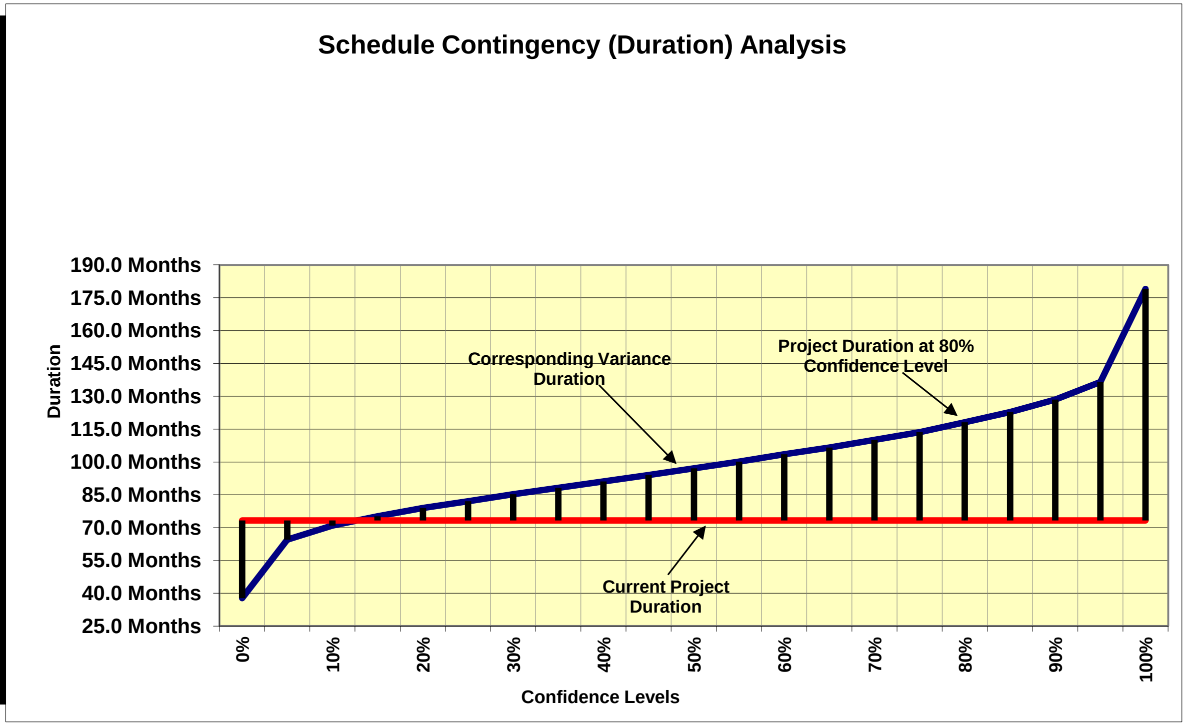
Base Estimate Cost Contingency Analysis (Does not Include Escalation)



- SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Contingency Analysis

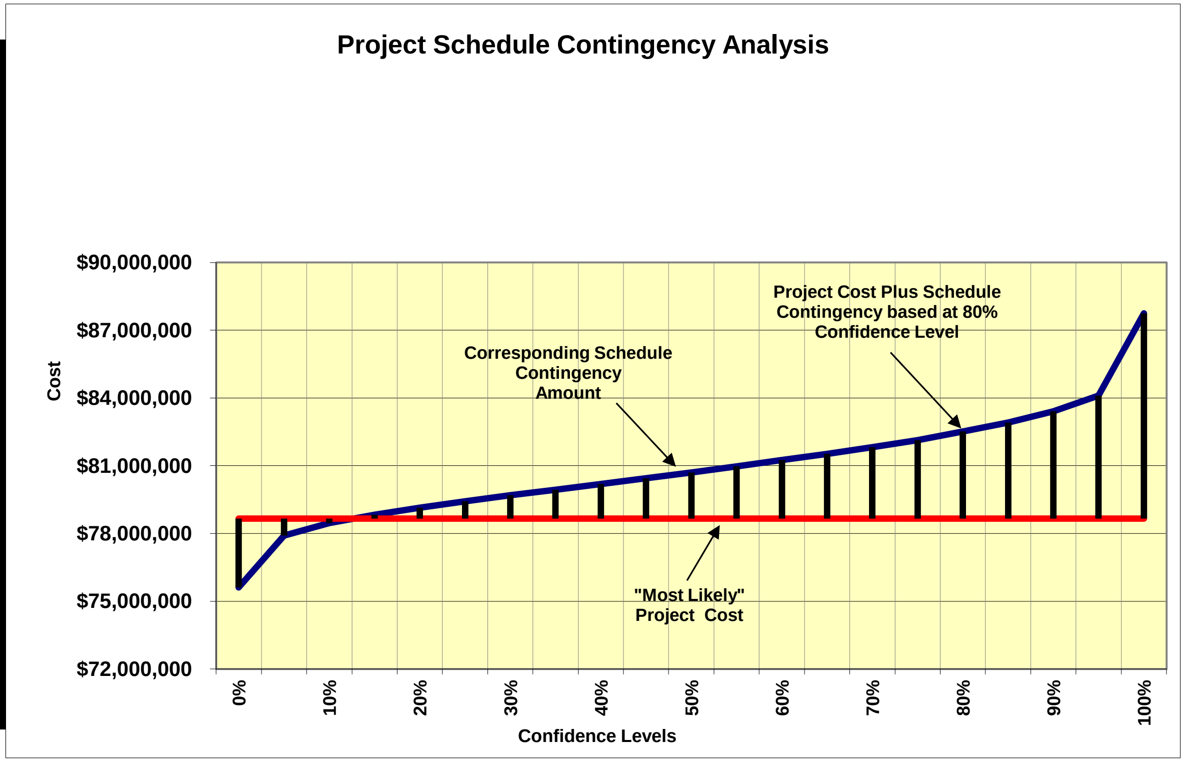
Most Likely Schedule Duration	73.2 Months		
Confidence Level	**Project Duration**	**Contingency**	**Contingency %**
0%	37.7 Months	-35.5 Months	-48.49%
5%	64.5 Months	-8.7 Months	-11.90%
10%	70.9 Months	-2.3 Months	-3.19%
15%	75.2 Months	1.9 Months	2.64%
20%	78.9 Months	5.7 Months	7.73%
25%	82.1 Months	8.8 Months	12.07%
30%	85.3 Months	12.1 Months	16.46%
35%	88.2 Months	14.9 Months	20.36%
40%	91.0 Months	17.8 Months	24.30%
45%	94.0 Months	20.7 Months	28.29%
50%	97.0 Months	23.8 Months	32.46%
55%	100.2 Months	26.9 Months	36.78%
60%	103.5 Months	30.2 Months	41.29%
65%	106.6 Months	33.3 Months	45.50%
70%	110.1 Months	36.8 Months	50.31%
75%	113.7 Months	40.4 Months	55.18%
80%	118.1 Months	44.9 Months	61.31%
85%	122.7 Months	49.5 Months	67.58%
90%	128.6 Months	55.3 Months	75.52%
95%	136.6 Months	63.3 Months	86.49%
100%	179.0 Months	105.7 Months	144.37%



- SCHEDULE CONTINGENCY (AMOUNT) DEVELOPMENT -

Contingency Analysis

Most Likely Cost Estimate	$78,659,310		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
0%	$75,608,209	($3,051,101)	-3.88%
5%	$77,910,426	($748,884)	-0.95%
10%	$78,458,327	($200,983)	-0.26%
15%	$78,825,457	$166,147	0.21%
20%	$79,145,610	$486,300	0.62%
25%	$79,419,045	$759,734	0.97%
30%	$79,694,931	$1,035,621	1.32%
35%	$79,940,702	$1,281,392	1.63%
40%	$80,188,587	$1,529,277	1.94%
45%	$80,439,582	$1,780,272	2.26%
50%	$80,702,215	$2,042,905	2.60%
55%	$80,973,759	$2,314,449	2.94%
60%	$81,257,623	$2,598,313	3.30%
65%	$81,522,309	$2,862,999	3.64%
70%	$81,824,947	$3,165,636	4.02%
75%	$82,131,897	$3,472,586	4.41%
80%	$82,517,650	$3,858,339	4.91%
85%	$82,912,227	$4,252,917	5.41%
90%	$83,411,728	$4,752,418	6.04%
95%	$84,101,810	$5,442,500	6.92%
100%	$87,744,158	$9,084,848	11.55%



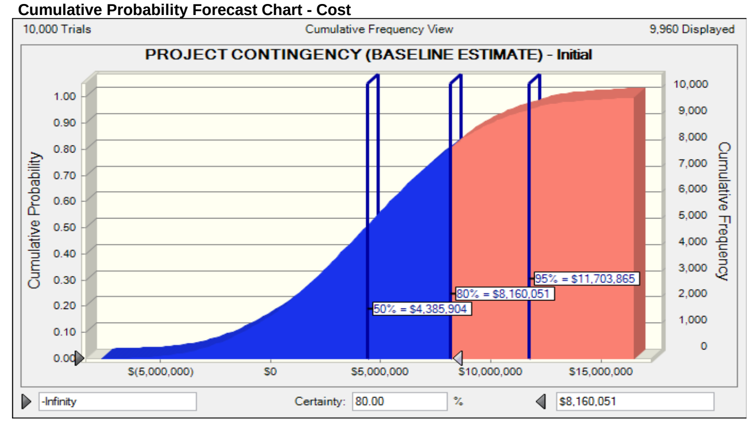
SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

		Project Cost						Crystal Ball Simulation							
								Expected Values ($$$)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM INTERNAL RISKS														
I-1	Scope Definition	LIKELY	SIGNIFICANT	HIGH	Yes-No/Uniform	I-2	65%	$ (1,236,500)	$ -	$ -	$ -	*Correlated to Risk I-2 by a factor of 0.75*	-2.44%	0.00%	0.00%
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform	I-1	100%	$ (2,533,873)	$ -	$ 5,067,746	$ -	*Correlated to Risk I-1 by a factor of 0.75*	-5.00%	0.00%	10.00%
I-5	Fuel Prices	VERY LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ (1,663,240)	$ -	$ 5,685,960	$ -		-3.28%	0.00%	11.22%
I-6	Permits	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ -	$ -	$ 2,387,355	$ -		0.00%	0.00%	4.71%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	Moderate	Triangular		100%	$ -	$ -	$ 1,432,413	$ -		0.00%	0.00%	2.83%
	ESTIMATE AND SCHEDULE RISKS														
EST-1	Estimate Considerations	Likely	Significant	HIGH	Triangular		100%	$ (2,387,355)	$ -	$ 2,387,355	$ -		-4.71%	0.00%	4.71%
	LOW AND UNKNOWN INTERNAL RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (2,387,355)	$ -	$ 2,387,355	$ -		-4.71%	0.00%	4.71%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ (1,432,413)	$ -	$ 2,387,355	$ -		-2.83%	0.00%	4.71%
E-2	Funding Delays	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*The original risk register and current assumption indicate this is not high risk for the initial activity, but is for the out-years*	N/A	N/A	N/A
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (2,387,355)	$ -	$ 2,387,355	$ -		-4.71%	0.00%	4.71%
											$ -				

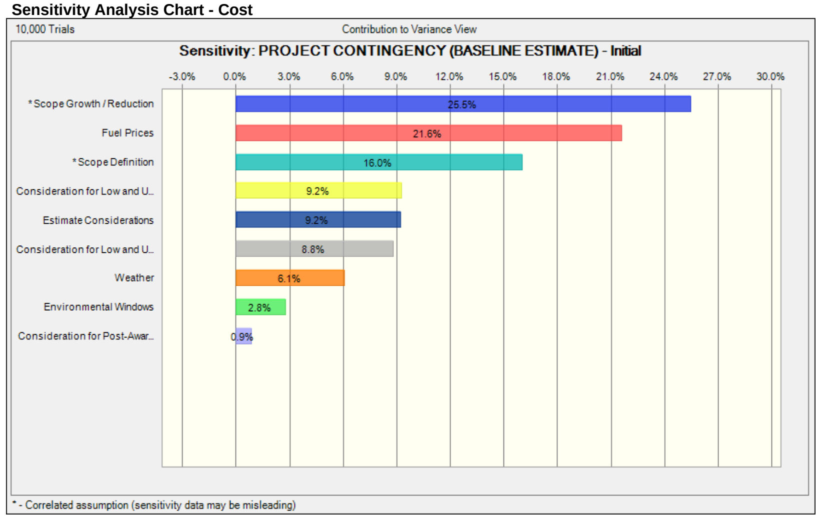
Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	$50,677,457	($12,367,942)	**$38,309,515**	**-24.41%**
	5%	$50,677,457	($2,651,073)	**$48,026,384**	**-5.23%**
	10%	$50,677,457	($1,230,118)	**$49,447,339**	**-2.43%**
	15%	$50,677,457	($198,638)	**$50,478,819**	**-0.39%**
	20%	$50,677,457	$678,502	**$51,355,959**	**1.34%**
	25%	$50,677,457	$1,399,993	**$52,077,451**	**2.76%**
	30%	$50,677,457	$2,062,210	**$52,739,667**	**4.07%**
	35%	$50,677,457	$2,667,671	**$53,345,128**	**5.26%**
	40%	$50,677,457	$3,246,649	**$53,924,106**	**6.41%**
	45%	$50,677,457	$3,855,334	**$54,532,791**	**7.61%**
	50%	$50,677,457	$4,385,904	**$55,063,361**	**8.65%**
	55%	$50,677,457	$4,961,646	**$55,639,103**	**9.79%**
	60%	$50,677,457	$5,525,425	**$56,202,882**	**10.90%**
	65%	$50,677,457	$6,126,075	**$56,803,532**	**12.09%**
	70%	$50,677,457	$6,757,484	**$57,434,941**	**13.33%**
	75%	$50,677,457	$7,411,595	**$58,089,052**	**14.63%**
	80%	$50,677,457	$8,160,051	**$58,837,508**	**16.10%**
	85%	$50,677,457	$8,995,521	**$59,672,978**	**17.75%**
	90%	$50,677,457	$10,046,438	**$60,723,895**	**19.82%**
	95%	$50,677,457	$11,703,865	**$62,381,323**	**23.09%**
	100%	$50,677,457	$20,776,700	**$71,454,158**	**41.00%**

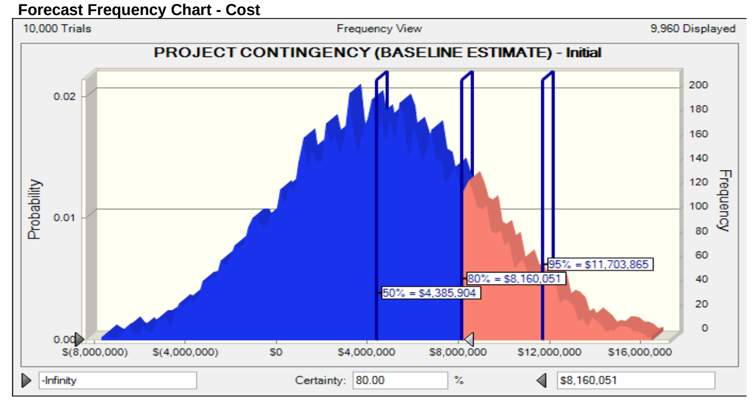
Cumulative Probability Forecast Chart - Cost



Sensitivity Analysis Chart - Cost



Forecast Frequency Chart - Cost



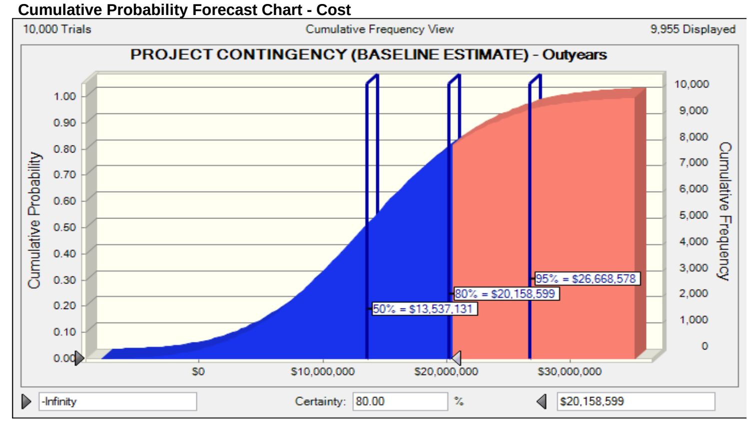
SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

		Project Cost						Crystal Ball Simulation							
								Expected Values ($$$)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM INTERNAL RISKS														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform	I-1	100%	$ (3,932,966)	$ -	$ 7,865,931	$ -		-5.00%	0.00%	10.00%
I-4	Material Availability	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ -	$ -	$ 7,513,800	$ -		0.00%	0.00%	9.55%
I-5	Fuel Prices	VERY LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ (2,254,140)	$ -	$ 10,519,320	$ -		-2.87%	0.00%	13.37%
I-6	Permits	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	$ -	$ -	$ 3,730,681	$ -		0.00%	0.00%	4.74%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	Moderate	Triangular		100%	$ -	$ -	$ 1,678,807	$ -		0.00%	0.00%	2.13%
	ESTIMATE AND SCHEDULE RISKS														
EST-1	Estimate Considerations	Likely	Significant	HIGH	Triangular		100%	$ (3,730,681)	$ -	$ 3,730,681	$ -		-4.74%	0.00%	4.74%
	LOW AND UNKNOWN INTERNAL RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (3,730,681)	$ -	$ 3,730,681	$ -		-4.74%	0.00%	4.74%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	$ (2,238,409)	$ -	$ 3,730,681	$ -		-2.85%	0.00%	4.74%
E-2	Funding Delays	LIKELY	MARGINAL	MODERATE	Yes-No/Triangular		65%	$ -	$ -	$ 9,170,416	$ -		0.00%	0.00%	11.66%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	$ (3,730,681)	$ -	$ 3,730,681	$ -		-4.74%	0.00%	4.74%
											$ -				

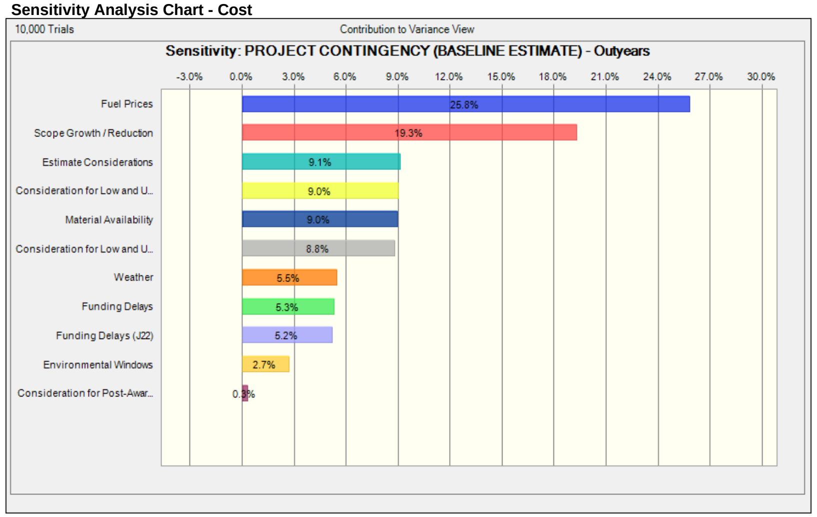
Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	$78,659,310	($11,723,307)	**$66,936,003**	**-14.90%**
	5%	$78,659,310	$1,188,165	**$79,847,475**	**1.51%**
	10%	$78,659,310	$3,795,322	**$82,454,632**	**4.83%**
	15%	$78,659,310	$5,658,236	**$84,317,546**	**7.19%**
	20%	$78,659,310	$7,139,976	**$85,799,286**	**9.08%**
	25%	$78,659,310	$8,375,365	**$87,034,676**	**10.65%**
	30%	$78,659,310	$9,440,676	**$88,099,986**	**12.00%**
	35%	$78,659,310	$10,514,159	**$89,173,470**	**13.37%**
	40%	$78,659,310	$11,602,375	**$90,261,686**	**14.75%**
	45%	$78,659,310	$12,512,076	**$91,171,386**	**15.91%**
	50%	$78,659,310	$13,537,131	**$92,196,441**	**17.21%**
	55%	$78,659,310	$14,489,261	**$93,148,572**	**18.42%**
	60%	$78,659,310	$15,459,820	**$94,119,131**	**19.65%**
	65%	$78,659,310	$16,504,770	**$95,164,080**	**20.98%**
	70%	$78,659,310	$17,574,455	**$96,233,766**	**22.34%**
	75%	$78,659,310	$18,794,625	**$97,453,935**	**23.89%**
	80%	$78,659,310	$20,158,599	**$98,817,909**	**25.63%**
	85%	$78,659,310	$21,756,059	**$100,415,369**	**27.66%**
	90%	$78,659,310	$23,866,183	**$102,525,493**	**30.34%**
	95%	$78,659,310	$26,668,578	**$105,327,888**	**33.90%**
	100%	$78,659,310	$41,173,067	**$119,832,377**	**52.34%**

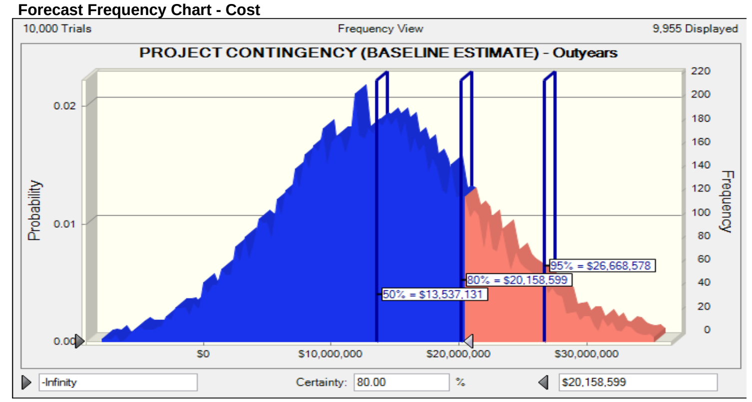
Cumulative Probability Forecast Chart - Cost



Sensitivity Analysis Chart - Cost



Forecast Frequency Chart - Cost



USACE Mobile District District
SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

CWWBS No.	Project Cost
01 Lands and Damages	$543,000.00
17 Dredging	$113,939,730.96
17 Beach Work	$4,946,000.00
17 Planting	$3,325,000.00
17 Environmental	$450,000.00
30 Planning, Engineering, and Design	$3,679,821.93
31 Construction Management	$2,453,214.62
Total	$129,336,767.51

Category	Project Cost
Labor Cost	$2,460,622.61
Equipment Cost	$3,787,689.38
Material Cost	$0.00
Sub Bid Cost	$6,021,000.00
User Cost	$108,556,260.00
Direct Cost	$120,825,571.99
Contract Cost	$122,660,730.96

Initial - 2014	Project Cost
01 Lands and Damages	$543,000.00
17 Hopper Dredging	$39,326,102.12
17 Beach & Dune Planting	$3,325,000.00
17 Beach Work Items	$4,946,000.00
17 Environmental	$150,000.00
30 Planning, Engineering, and Design	$1,432,413.06
31 Construction Management	$954,942.04
Total	$50,677,457.23

Out-Years 2024, 2034, 2044, 2054	Project Cost
17 Hopper Dredging	$18,653,407.21
17 Environmental	$75,000.00
30 Planning, Engineering, and Design	$561,852.22
31 Construction Management	$374,568.14
Total	$19,664,827.57

SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

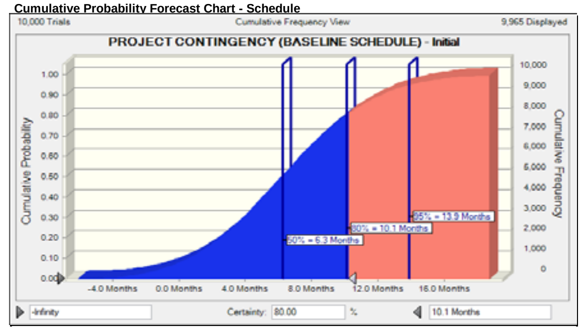
		Project Schedule						Crystal Ball Simulation							
								Expected Values (Months)					Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM MGMT														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform		100%	-4.0 Months	0.0 Months	6.0 Months	0.0 Months		-21.85%	0.00%	32.77%
I-6	Permits	LIKELY	MARGINAL	MODERATE	Triangular		100%	0.0 Months	0.0 Months	6.0 Months	0.0 Months		0.00%	0.00%	32.77%
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	MODERATE	Triangular		100%	0.0 Months	0.0 Months	3.0 Months	0.0 Months		0.00%	0.00%	16.38%
	ECONOMICS RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	6.0 Months	0.0 Months		-16.38%	0.00%	32.77%
E-2	Funding Delays	LIKELY	Significant	HIGH	Yes-No/Uniform		65%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
											0.0 Months				

Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

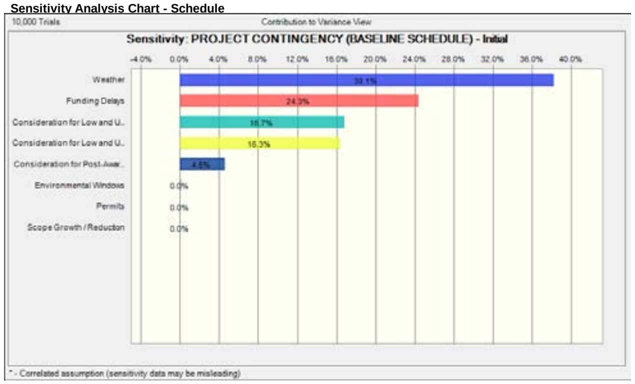
Contingency Summary Table - Schedule

PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	18.3 Months	-7.6 Months	**10.7 Months**	**-41.50%**
	5%	18.3 Months	-1.0 Months	**17.3 Months**	**-5.37%**
	10%	18.3 Months	0.6 Months	**18.9 Months**	**3.21%**
	15%	18.3 Months	1.6 Months	**20.0 Months**	**9.01%**
	20%	18.3 Months	2.5 Months	**20.8 Months**	**13.83%**
	25%	18.3 Months	3.3 Months	**21.6 Months**	**17.94%**
	30%	18.3 Months	4.0 Months	**22.3 Months**	**21.58%**
	35%	18.3 Months	4.5 Months	**22.8 Months**	**24.74%**
	40%	18.3 Months	5.1 Months	**23.4 Months**	**28.00%**
	45%	18.3 Months	5.7 Months	**24.0 Months**	**31.07%**
	50%	18.3 Months	6.3 Months	**24.6 Months**	**34.25%**
	55%	18.3 Months	6.9 Months	**25.2 Months**	**37.48%**
	60%	18.3 Months	7.4 Months	**25.7 Months**	**40.30%**
	65%	18.3 Months	8.0 Months	**26.3 Months**	**43.55%**
	70%	18.3 Months	8.7 Months	**27.0 Months**	**47.32%**
	75%	18.3 Months	9.3 Months	**27.6 Months**	**50.89%**
	80%	18.3 Months	10.1 Months	**28.4 Months**	**55.21%**
	85%	18.3 Months	11.1 Months	**29.4 Months**	**60.50%**
	90%	18.3 Months	12.2 Months	**30.5 Months**	**66.74%**
	95%	18.3 Months	13.9 Months	**32.2 Months**	**75.71%**
	100%	18.3 Months	23.5 Months	**41.8 Months**	**128.37%**

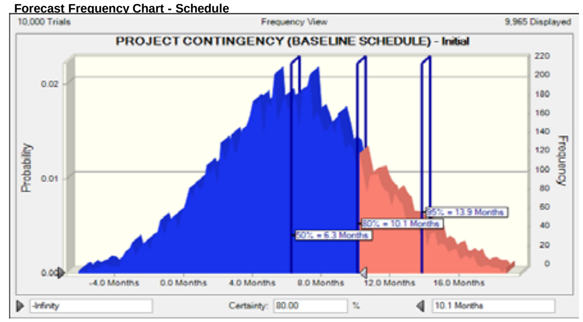
Cumulative Probability Forecast Chart - Schedule



Sensitivity Analysis Chart - Schedule



Forecast Frequency Chart - Schedule



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

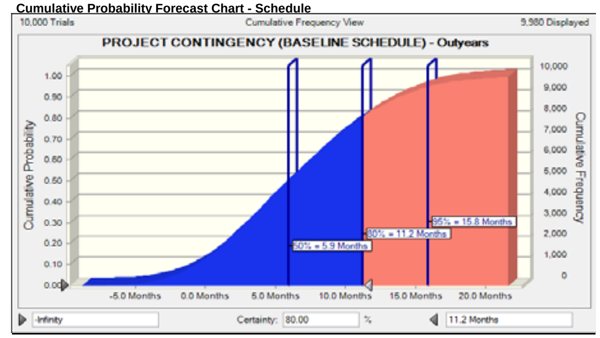
								Crystal Ball Simulation								
		Project Schedule						Expected Values (Months)						Expected Values (%s)		
Risk No.	Risk/Opportunity Event	Likelihood*	Impact*	Risk Level*	Variance Distribution	Correlation to Other(s)	Probability of Occurrence	Low	Most Likely	High	Contingency Model	Notes	Low	Most Likely	High
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)															
	PROJECT & PROGRAM MGMT														
I-2	Scope Growth / Reduction	LIKELY	MARGINAL	MODERATE	Uniform		100%	-4.0 Months	0.0 Months	6.0 Months	0.0 Months		-21.85%	0.00%	32.77%
I-4	Material Availability	LIKELY	MARGINAL	MODERATE	Triangular		100%	0.0 Months	0.0 Months	2.0 Months	0.0 Months		0.00%	0.00%	10.92%
I-6	Permits	LIKELY	MARGINAL	MODERATE	Triangular		N/A	N/A	N/A	N/A	N/A	*Removed from Schedule Risk Model, as there will be enough time to obtain permits for outyear nourishments*	N/A	N/A	N/A
I-7	Environmental Windows	LIKELY	SIGNIFICANT	HIGH	Triangular		100%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
	CONSTRUCTION RISKS														
INT-MOD	Consideration for Post-Award Construction Claims and	Likely	Marginal	MODERATE	Triangular		100%	0.0 Months	0.0 Months	3.0 Months	0.0 Months		0.00%	0.00%	16.38%
	ECONOMICS RISKS														
INT-1	Consideration for Low and Unknown Internal Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
	Programmatic Risks														
E-1	Weather	LIKELY	MARGINAL	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	6.0 Months	0.0 Months		-16.38%	0.00%	32.77%
E-2	Funding Delays	LIKELY	Significant	HIGH	Yes-No/Uniform		65%	0.0 Months	0.0 Months	12.0 Months	0.0 Months		0.00%	0.00%	65.54%
EXT-1	Consideration for Low and Unknown External Risk	Likely	Marginal	MODERATE	Triangular		100%	-3.0 Months	0.0 Months	3.0 Months	0.0 Months		-16.38%	0.00%	16.38%
											0.0 Months				

Percentages are calculated as the variance from the assumption value to facilitate iteration of the model should the cost values change throughout the project phases. Uniform distribution percentages reflect variation from the total project cost.

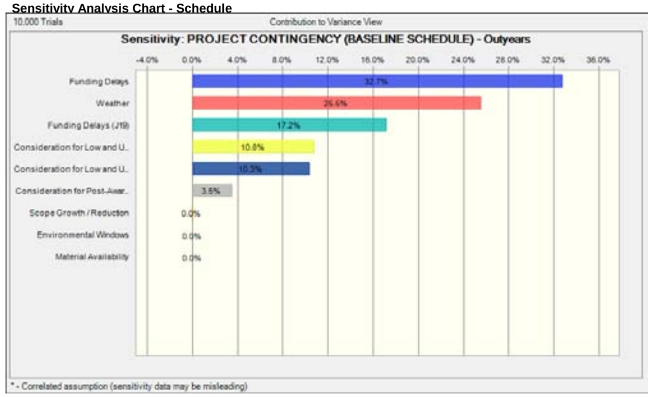
Contingency Summary Table - Schedule

PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears	Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
	0%	18.3 Months	-8.9 Months	**9.4 Months**	**-48.49%**
	5%	18.3 Months	-2.2 Months	**16.1 Months**	**-11.90%**
	10%	18.3 Months	-0.6 Months	**17.7 Months**	**-3.19%**
	15%	18.3 Months	0.5 Months	**18.8 Months**	**2.64%**
	20%	18.3 Months	1.4 Months	**19.7 Months**	**7.73%**
	25%	18.3 Months	2.2 Months	**20.5 Months**	**12.07%**
	30%	18.3 Months	3.0 Months	**21.3 Months**	**16.46%**
	35%	18.3 Months	3.7 Months	**22.0 Months**	**20.36%**
	40%	18.3 Months	4.4 Months	**22.8 Months**	**24.30%**
	45%	18.3 Months	5.2 Months	**23.5 Months**	**28.29%**
	50%	18.3 Months	5.9 Months	**24.3 Months**	**32.46%**
	55%	18.3 Months	6.7 Months	**25.0 Months**	**36.78%**
	60%	18.3 Months	7.6 Months	**25.9 Months**	**41.29%**
	65%	18.3 Months	8.3 Months	**26.6 Months**	**45.50%**
	70%	18.3 Months	9.2 Months	**27.5 Months**	**50.31%**
	75%	18.3 Months	10.1 Months	**28.4 Months**	**55.18%**
	80%	18.3 Months	11.2 Months	**29.5 Months**	**61.31%**
	85%	18.3 Months	12.4 Months	**30.7 Months**	**67.58%**
	90%	18.3 Months	13.8 Months	**32.1 Months**	**75.52%**
	95%	18.3 Months	15.8 Months	**34.1 Months**	**86.49%**
	100%	18.3 Months	26.4 Months	**44.7 Months**	**144.37%**

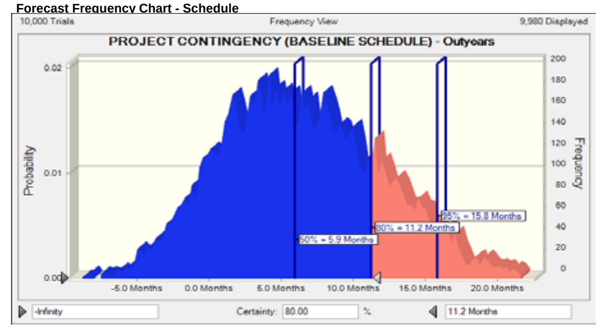
Cumulative Probability Forecast Chart - Schedule



Sensitivity Analysis Chart - Schedule



Forecast Frequency Chart - Schedule



SAM - Walton County Storm Damage Reduction Project, GI Study -

Enter Estimated Total Project Cost (Price Level)	$ 50,677,457
Max. Anticipated Annual Amount	$33,231,492
Enter Current OMB Escalation Rate	1.80%
Enter Current Project Location Escalation Rate	1.80%
Enter Assumed Monthly Recurring Cost Rate	8.00%

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	12-Jul-13			
Enter Baseline Project Completion	20-Jan-15			
Project Completion at 0% Confidence	2-Jun-14		($1,682,614.59)	($1,682,614.59)
Project Completion at 5% Confidence	21-Dec-14		($217,548.50)	($217,548.50)
Project Completion at 10% Confidence	6-Feb-15		$129,964.78	$129,964.78
Project Completion at 15% Confidence	11-Mar-15		$365,180.39	$365,180.39
Project Completion at 20% Confidence	7-Apr-15		$560,721.24	$560,721.24
Project Completion at 25% Confidence	29-Apr-15		$727,480.74	$727,480.74
Project Completion at 30% Confidence	20-May-15		$874,851.63	$874,851.63
Project Completion at 35% Confidence	6-Jun-15		$1,002,857.28	$1,002,857.28
Project Completion at 40% Confidence	24-Jun-15		$1,135,370.04	$1,135,370.04
Project Completion at 45% Confidence	12-Jul-15		$1,259,797.63	$1,259,797.63
Project Completion at 50% Confidence	29-Jul-15		$1,388,375.78	$1,388,375.78
Project Completion at 55% Confidence	16-Aug-15		$1,519,653.52	$1,519,653.52
Project Completion at 60% Confidence	1-Sep-15		$1,633,753.45	$1,633,753.45
Project Completion at 65% Confidence	19-Sep-15		$1,765,554.37	$1,765,554.37
Project Completion at 70% Confidence	10-Oct-15		$1,918,495.97	$1,918,495.97
Project Completion at 75% Confidence	30-Oct-15		$2,063,169.83	$2,063,169.83
Project Completion at 80% Confidence	23-Nov-15		$2,238,383.87	$2,238,383.87
Project Completion at 85% Confidence	22-Dec-15		$2,452,600.93	$2,452,600.93
Project Completion at 90% Confidence	26-Jan-16		$2,705,724.80	$2,705,724.80
Project Completion at 95% Confidence	16-Mar-16		$3,069,286.67	$3,069,286.67
Project Completion at 100% Confidence	4-Jan-17		$5,204,299.32	$5,204,299.32

Entry Required
Do Not Overwrite
Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$19,664,828**
Max. Anticipated Annual Amount	**$12,895,114**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	17-Apr-23			
Enter Baseline Project Completion	25-Oct-24			
Project Completion at 0% Confidence	28-Jan-24		($762,775.24)	($762,775.24)
Project Completion at 5% Confidence	19-Aug-24		($187,221.00)	($187,221.00)
Project Completion at 10% Confidence	7-Oct-24		($50,245.86)	($50,245.86)
Project Completion at 15% Confidence	8-Nov-24		$41,536.80	$41,536.80
Project Completion at 20% Confidence	7-Dec-24		$121,574.99	$121,574.99
Project Completion at 25% Confidence	31-Dec-24		$189,933.57	$189,933.57
Project Completion at 30% Confidence	24-Jan-25		$258,905.24	$258,905.24
Project Completion at 35% Confidence	15-Feb-25		$320,348.05	$320,348.05
Project Completion at 40% Confidence	9-Mar-25		$382,319.17	$382,319.17
Project Completion at 45% Confidence	31-Mar-25		$445,068.02	$445,068.02
Project Completion at 50% Confidence	23-Apr-25		$510,726.18	$510,726.18
Project Completion at 55% Confidence	17-May-25		$578,612.23	$578,612.23
Project Completion at 60% Confidence	11-Jun-25		$649,578.29	$649,578.29
Project Completion at 65% Confidence	5-Jul-25		$715,749.68	$715,749.68
Project Completion at 70% Confidence	1-Aug-25		$791,409.08	$791,409.08
Project Completion at 75% Confidence	28-Aug-25		$868,146.62	$868,146.62
Project Completion at 80% Confidence	1-Oct-25		$964,584.85	$964,584.85
Project Completion at 85% Confidence	5-Nov-25		$1,063,229.16	$1,063,229.16
Project Completion at 90% Confidence	19-Dec-25		$1,188,104.44	$1,188,104.44
Project Completion at 95% Confidence	18-Feb-26		$1,360,625.05	$1,360,625.05
Project Completion at 100% Confidence	7-Jan-27		$2,271,211.91	$2,271,211.91

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$19,664,828**
Max. Anticipated Annual Amount	**$12,895,114**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	18-Apr-33			
Enter Baseline Project Completion	27-Oct-34			
Project Completion at 0% Confidence	29-Jan-34		($762,775.24)	($762,775.24)
Project Completion at 5% Confidence	21-Aug-34		($187,221.00)	($187,221.00)
Project Completion at 10% Confidence	9-Oct-34		($50,245.86)	($50,245.86)
Project Completion at 15% Confidence	10-Nov-34		$41,536.80	$41,536.80
Project Completion at 20% Confidence	9-Dec-34		$121,574.99	$121,574.99
Project Completion at 25% Confidence	2-Jan-35		$189,933.57	$189,933.57
Project Completion at 30% Confidence	26-Jan-35		$258,905.24	$258,905.24
Project Completion at 35% Confidence	17-Feb-35		$320,348.05	$320,348.05
Project Completion at 40% Confidence	11-Mar-35		$382,319.17	$382,319.17
Project Completion at 45% Confidence	2-Apr-35		$445,068.02	$445,068.02
Project Completion at 50% Confidence	25-Apr-35		$510,726.18	$510,726.18
Project Completion at 55% Confidence	19-May-35		$578,612.23	$578,612.23
Project Completion at 60% Confidence	13-Jun-35		$649,578.29	$649,578.29
Project Completion at 65% Confidence	7-Jul-35		$715,749.68	$715,749.68
Project Completion at 70% Confidence	3-Aug-35		$791,409.08	$791,409.08
Project Completion at 75% Confidence	30-Aug-35		$868,146.62	$868,146.62
Project Completion at 80% Confidence	3-Oct-35		$964,584.85	$964,584.85
Project Completion at 85% Confidence	7-Nov-35		$1,063,229.16	$1,063,229.16
Project Completion at 90% Confidence	21-Dec-35		$1,188,104.44	$1,188,104.44
Project Completion at 95% Confidence	20-Feb-36		$1,360,625.05	$1,360,625.05
Project Completion at 100% Confidence	8-Jan-37		$2,271,211.91	$2,271,211.91

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$19,664,828**
Max. Anticipated Annual Amount	**$12,895,114**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	20-Apr-43			
Enter Baseline Project Completion	28-Oct-44			
Project Completion at 0% Confidence	31-Jan-44		($762,775.24)	($762,775.24)
Project Completion at 5% Confidence	22-Aug-44		($187,221.00)	($187,221.00)
Project Completion at 10% Confidence	10-Oct-44		($50,245.86)	($50,245.86)
Project Completion at 15% Confidence	11-Nov-44		$41,536.80	$41,536.80
Project Completion at 20% Confidence	10-Dec-44		$121,574.99	$121,574.99
Project Completion at 25% Confidence	3-Jan-45		$189,933.57	$189,933.57
Project Completion at 30% Confidence	27-Jan-45		$258,905.24	$258,905.24
Project Completion at 35% Confidence	18-Feb-45		$320,348.05	$320,348.05
Project Completion at 40% Confidence	12-Mar-45		$382,319.17	$382,319.17
Project Completion at 45% Confidence	3-Apr-45		$445,068.02	$445,068.02
Project Completion at 50% Confidence	26-Apr-45		$510,726.18	$510,726.18
Project Completion at 55% Confidence	20-May-45		$578,612.23	$578,612.23
Project Completion at 60% Confidence	14-Jun-45		$649,578.29	$649,578.29
Project Completion at 65% Confidence	8-Jul-45		$715,749.68	$715,749.68
Project Completion at 70% Confidence	4-Aug-45		$791,409.08	$791,409.08
Project Completion at 75% Confidence	31-Aug-45		$868,146.62	$868,146.62
Project Completion at 80% Confidence	4-Oct-45		$964,584.85	$964,584.85
Project Completion at 85% Confidence	8-Nov-45		$1,063,229.16	$1,063,229.16
Project Completion at 90% Confidence	22-Dec-45		$1,188,104.44	$1,188,104.44
Project Completion at 95% Confidence	21-Feb-46		$1,360,625.05	$1,360,625.05
Project Completion at 100% Confidence	10-Jan-47		$2,271,211.91	$2,271,211.91

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study

Enter Estimated Total Project Cost (Price Level)	**$19,664,828**
Max. Anticipated Annual Amount	**$12,895,114**
Enter Current OMB Escalation Rate	**1.80%**
Enter Current Project Location Escalation Rate	**1.80%**
Enter Assumed Monthly Recurring Cost Rate	**8.00%**

	Date	Escalation Delta Amount	Monthly Recurring Cost Amount	Total Schedule Contingency
Enter Current Project Start	21-Apr-53			
Enter Baseline Project Completion	30-Oct-54			
Project Completion at 0% Confidence	1-Feb-54		($762,775.24)	($762,775.24)
Project Completion at 5% Confidence	24-Aug-54		($187,221.00)	($187,221.00)
Project Completion at 10% Confidence	12-Oct-54		($50,245.86)	($50,245.86)
Project Completion at 15% Confidence	13-Nov-54		$41,536.80	$41,536.80
Project Completion at 20% Confidence	12-Dec-54		$121,574.99	$121,574.99
Project Completion at 25% Confidence	5-Jan-55		$189,933.57	$189,933.57
Project Completion at 30% Confidence	29-Jan-55		$258,905.24	$258,905.24
Project Completion at 35% Confidence	20-Feb-55		$320,348.05	$320,348.05
Project Completion at 40% Confidence	14-Mar-55		$382,319.17	$382,319.17
Project Completion at 45% Confidence	5-Apr-55		$445,068.02	$445,068.02
Project Completion at 50% Confidence	28-Apr-55		$510,726.18	$510,726.18
Project Completion at 55% Confidence	22-May-55		$578,612.23	$578,612.23
Project Completion at 60% Confidence	16-Jun-55		$649,578.29	$649,578.29
Project Completion at 65% Confidence	10-Jul-55		$715,749.68	$715,749.68
Project Completion at 70% Confidence	6-Aug-55		$791,409.08	$791,409.08
Project Completion at 75% Confidence	2-Sep-55		$868,146.62	$868,146.62
Project Completion at 80% Confidence	6-Oct-55		$964,584.85	$964,584.85
Project Completion at 85% Confidence	10-Nov-55		$1,063,229.16	$1,063,229.16
Project Completion at 90% Confidence	24-Dec-55		$1,188,104.44	$1,188,104.44
Project Completion at 95% Confidence	23-Feb-56		$1,360,625.05	$1,360,625.05
Project Completion at 100% Confidence	11-Jan-57		$2,271,211.91	$2,271,211.91

Entry Required

Do Not Overwrite

Summary Data -- Do Not Overwrite

SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-1	Scope Definition - Initial	LIKELY	MARGINAL	MODERATE	Yes-No/Uniform	I-2	0.75	($1,236,500)	$0	$0	*Correlated to Risk I-2 by a factor of 0.75*
I-1	Scope Definition - Out-years	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-1	Scope Definition - Initial	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-1	Scope Definition - Out-years	VERY Unlikely	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	Scope is fairly well defined for standard civil works features. Scope may change based on permitting. The risk of the scope definition has been greatly reduced since the initial risk analysis, as the PDT has well-defined the scope.
Development of Low Values	The best case scenario is that there could be reduction in structural additions in the initial nourishments. Assume up to 25% reduction in the beach work items.
Development of High Values	The worst case scenario is that the scope would be contained to match funding allocation.

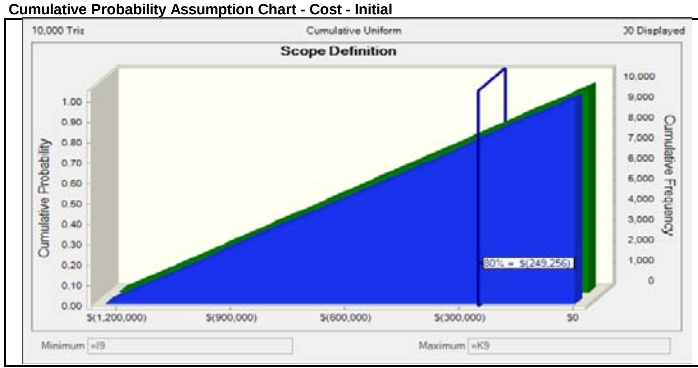
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($1,236,478)	N/A
10%	($1,110,726)	N/A
20%	($986,421)	N/A
30%	($866,098)	N/A
40%	($742,991)	N/A
50%	($615,190)	N/A
60%	($487,867)	N/A
70%	($362,412)	N/A
80%	($249,256)	N/A
90%	($127,789)	N/A
100%	($206)	N/A

Outyears

Confidence	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 - Initial



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Cost	I-2	Scope Growth / Reduction - Initial	LIKELY	MARGINAL	MODERATE	Uniform	I-1	0.75	($2,533,873)	$0	$5,067,746	*Correlated to Risk I-1 by a factor of 0.75*
	I-2	Scope Growth / Reduction - Out-years	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	($3,932,966)	$0	$7,865,931	

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Schedule	I-2	Scope Growth / Reduction - Initial	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	-4.0 Months	0.0 Months	6.0 Months	
	I-2	Scope Growth / Reduction - Out-years	LIKELY	MARGINAL	MODERATE	Uniform	N/A	N/A	-4.0 Months	0.0 Months	6.0 Months	

Description	Scope is fairly well defined for standard civil works features. The pumping plant has potential of VE savings through better data and VE. While there is confidence in quantities for the initial nourishment, quantities for the out-year renourishments may change significantly.
Development of Low Values	The best case scenario is that the current baseline estimate could be reduced by up to 5% and that the project completion date could finish early due to reduction in scope, by up to 4 months.
Development of High Values	The worst case scenario is that the current baseline estimate could increase by up to 10% and that the project completion date could change due to increase in scope, by up to 6 months.

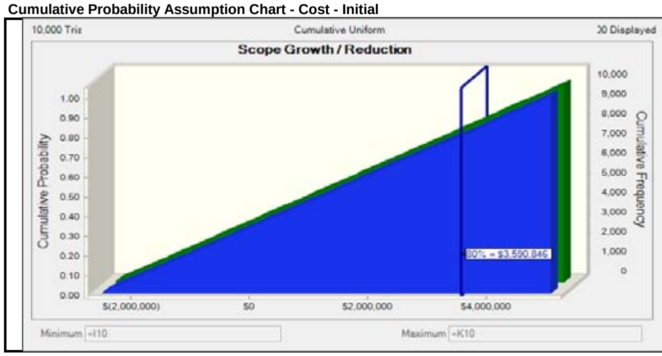
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,533,668)	'-4.0 Months
10%	($1,786,040)	'-3.0 Months
20%	($1,008,793)	'-2.0 Months
30%	($249,137)	'-1.0 Months
40%	$493,653	'-0.1 Months
50%	$1,275,397	1.0 Months
60%	$2,005,739	2.0 Months
70%	$2,770,489	3.0 Months
80%	$3,590,846	4.0 Months
90%	$4,326,910	5.0 Months
100%	$5,066,780	6.0 Months

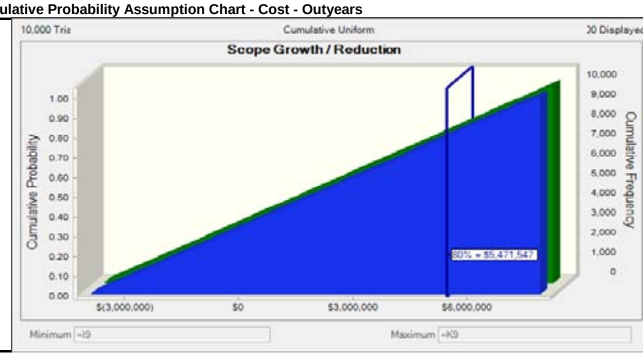
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,932,592)	'-4.0 Months
10%	($2,754,203)	'-3.0 Months
20%	($1,589,682)	'-2.1 Months
30%	($398,215)	'-1.1 Months
40%	$729,654	0.0 Months
50%	$1,946,264	1.0 Months
60%	$3,127,141	2.0 Months
70%	$4,302,000	3.0 Months
80%	$5,471,547	4.0 Months
90%	$6,659,374	5.0 Months
100%	$7,862,652	6.0 Months

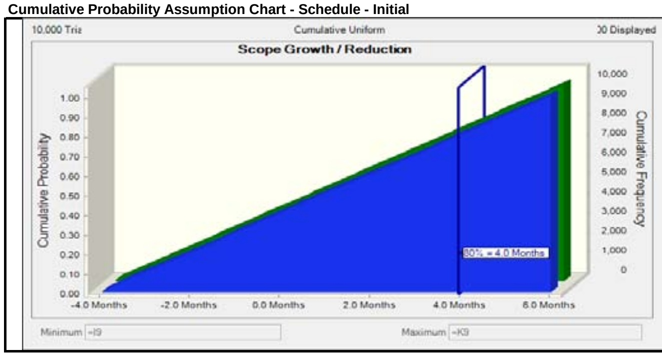
Cumulative Probability Assumption Chart - Cost - Initial



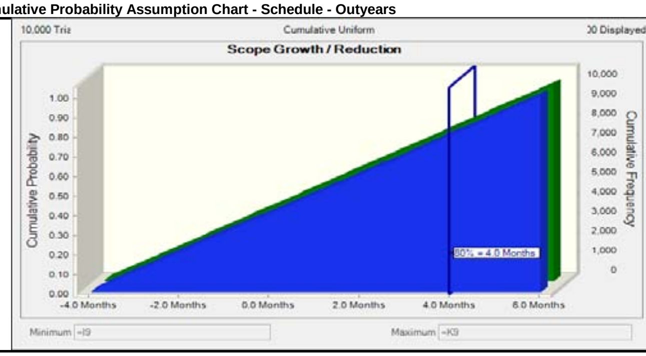
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-4	Material Availability - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-4	Material Availability - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$7,513,800	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-4	Material Availability - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-4	Material Availability - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	0.0 Months	0.0 Months	2.0 Months	

Description	Borrow sources are provided and indicated on drawings. Per the design Engineer and based on current surveys, quality and quantity of beach fill material is available at all sites.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that issues with material and equipment availability could delay the project completion date by up to 2 months. Assume that the average one-way distance to haul site increases to 16 miles for 2 renourishments.

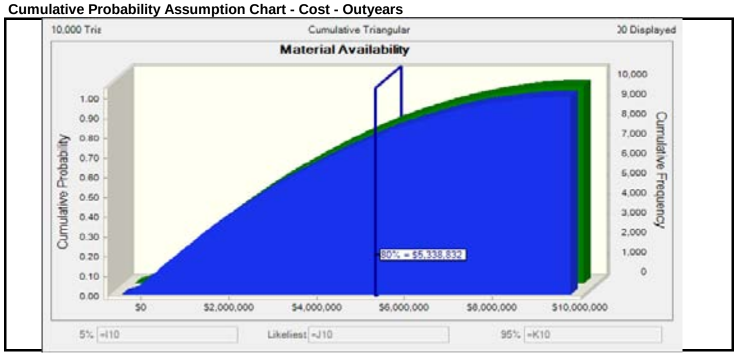
Initial

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

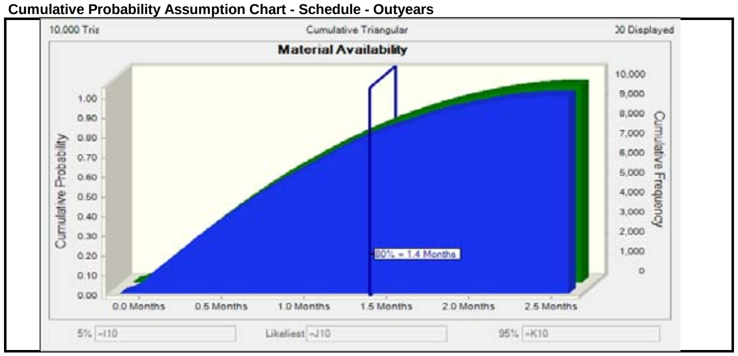
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($485,592)	'-0.1 Months
10%	$251,761	0.1 Months
20%	$768,729	0.2 Months
30%	$1,337,308	0.4 Months
40%	$1,965,729	0.5 Months
50%	$2,663,020	0.7 Months
60%	$3,422,617	0.9 Months
70%	$4,318,821	1.1 Months
80%	$5,338,832	1.4 Months
90%	$6,635,322	1.7 Months
100%	$9,631,186	2.6 Months

Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-5	Fuel Prices - Initial	VERY LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	($1,663,240)	$0	$5,685,960	
I-5	Fuel Prices - Out-years	VERY LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	($2,254,140)	$0	$10,519,320	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-5	Fuel Prices - Initial	UNLIKELY	NEGLIGIBLE	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
I-5	Fuel Prices - Out-years	UNLIKELY	NEGLIGIBLE	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	$3.45 per gallon was used in the Sep 2012 CEDEP Estimates, increases will effect equipment and delivery or materials. Fuel cost fluctuations can significantly impact dredging cost.
Development of Low Values	The best case scenario is that the cost of fuel adjusted for price level decreases to $3.00/gallon.
Development of High Values	The worst case scenario is that the cost of fuel adjusted for price level increases to $5.00/gallon.

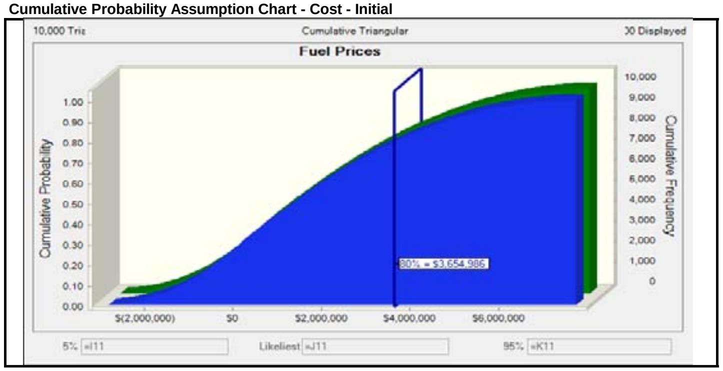
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,844,394)	N/A
10%	($1,181,179)	N/A
20%	($439,267)	N/A
30%	$145,020	N/A
40%	$726,209	N/A
50%	$1,327,779	N/A
60%	$1,998,732	N/A
70%	$2,739,387	N/A
80%	$3,654,986	N/A
90%	$4,821,161	N/A
100%	$7,674,833	N/A

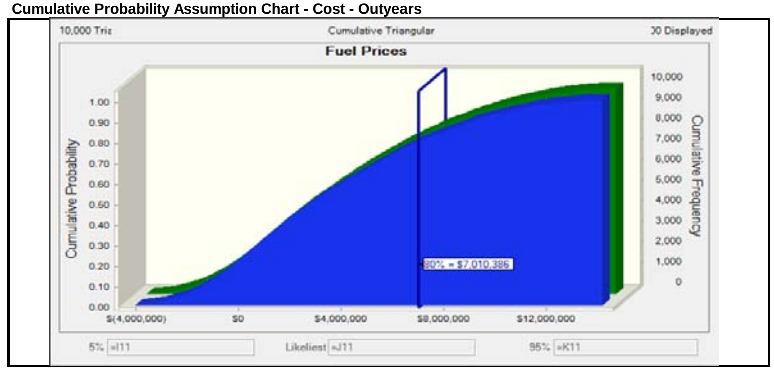
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($4,111,672)	N/A
10%	($1,418,491)	N/A
20%	($258,523)	N/A
30%	$717,456	N/A
40%	$1,694,398	N/A
50%	$2,733,135	N/A
60%	$3,998,957	N/A
70%	$5,432,553	N/A
80%	$7,010,386	N/A
90%	$9,077,511	N/A
100%	$13,924,143	N/A

Cumulative Probability Assumption Chart - Cost - Initial



Cumulative Probability Assumption Chart - Cost - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-6	Permits - Initial	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*
I-6	Permits - Out-years	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Cost Risk Model as this is captured in the Schedule Risk Model*

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-6	Permits - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	0.0 Months	0.0 Months	6.0 Months	
I-6	Permits - Out-years	LIKELY	MARGINAL	MODERATE	N/A	N/A	N/A	N/A	N/A	N/A	*Removed from Schedule Risk Model, as there will be enough time to obtain permits for outyear nourishments*

Description	Permitting delays may occur due to Florida State policy. This could impact the cost and schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that issues with issuing of permits from the State of Florida could delay the project completion date by up to 6 months.

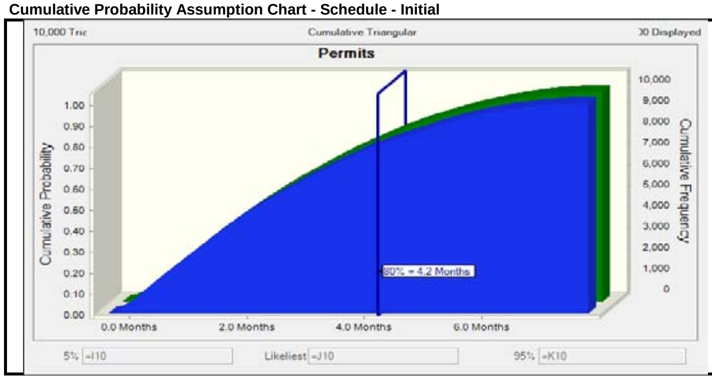
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	N/A	'-0.4 Months
10%	N/A	0.2 Months
20%	N/A	0.6 Months
30%	N/A	1.1 Months
40%	N/A	1.6 Months
50%	N/A	2.1 Months
60%	N/A	2.7 Months
70%	N/A	3.4 Months
80%	N/A	4.2 Months
90%	N/A	5.3 Months
100%	N/A	7.6 Months

Outyears

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 - Schedule - Initial



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Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-7	Environmental Windows - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$2,387,355	
I-7	Environmental Windows - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	$0	$0	$3,730,681	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
I-7	Environmental Windows - Initial	LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	
I-7	Environmental Windows - Out-years	LIKELY	SIGNIFICANT	HIGH	Triangular	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	

Description	The concern is that :Project site is a natural habitat for various species of threatened wildlife that utilize the project vicinity during Spring and Winter months. The PDT feels that :Gulf sturgeon incidental takes during dredging and Sea Turtle and Bird Nesting may have Impact during Construction. There may also be unknown restrictions for the out-year renourishments.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that environmental windows and restrictions to have a significant impact on dredging operations and effective work times, potentially increasing the contract costs by up to 5%. Also, assume that the project completion date could change due to challenges with environmental work windows and restrictions, by up to 12 months.

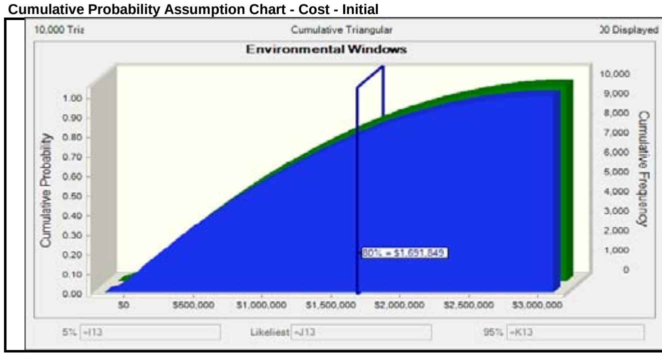
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($155,907)	'-0.8 Months
10%	$82,822	0.4 Months
20%	$249,764	1.3 Months
30%	$429,356	2.2 Months
40%	$638,684	3.2 Months
50%	$857,131	4.2 Months
60%	$1,102,270	5.4 Months
70%	$1,368,518	6.8 Months
80%	$1,691,849	8.4 Months
90%	$2,095,434	10.5 Months
100%	$3,071,627	15.3 Months

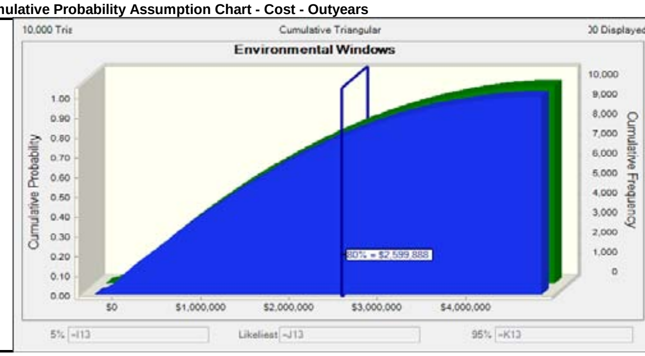
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($228,371)	'-0.8 Months
10%	$117,442	0.4 Months
20%	$398,578	1.3 Months
30%	$684,821	2.2 Months
40%	$992,481	3.2 Months
50%	$1,330,094	4.2 Months
60%	$1,700,161	5.4 Months
70%	$2,101,790	6.7 Months
80%	$2,599,888	8.4 Months
90%	$3,232,854	10.5 Months
100%	$4,829,580	15.5 Months

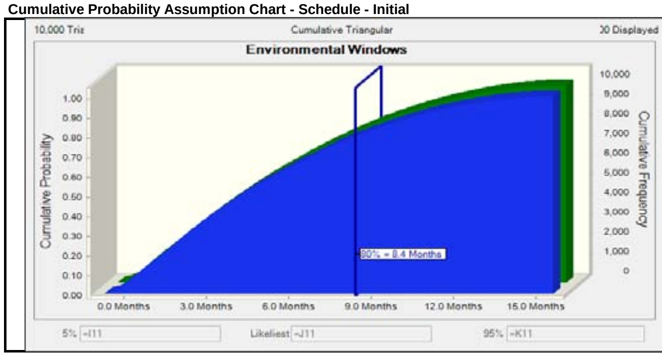
Cumulative Probability Assumption Chart - Cost - Initial



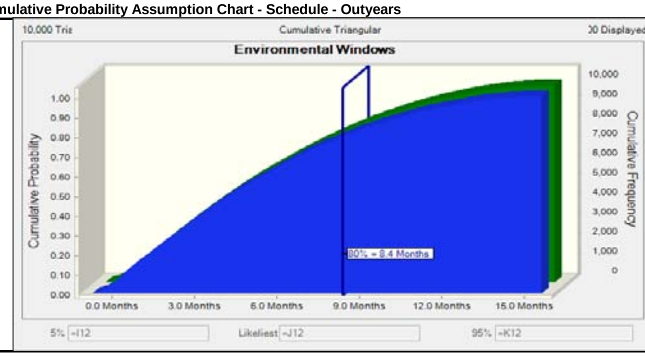
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



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Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Initial	Likely	Marginal	Moderate	Triangular	N/A	N/A	$0	$0	$1,432,413	
INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Out-years	Likely	Marginal	Moderate	Triangular	N/A	N/A	$0	$0	$1,678,807	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Initial	Likely	Marginal	Moderate	Triangular	N/A	N/A	0.0 Months	0.0 Months	3.0 Months	
INT-MOD	Consideration for Post-Award Construction Claims and Modifications - Out-years	Likely	Marginal	Moderate	Triangular	N/A	N/A	0.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk of construction modifications and claims that arise after contract award. Post-award construction contract modifications and claims could impact the ultimate contract costs and delay the overall schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that direct costs increase by up to 3% and the overall schedule is delayed by up to 3 months.

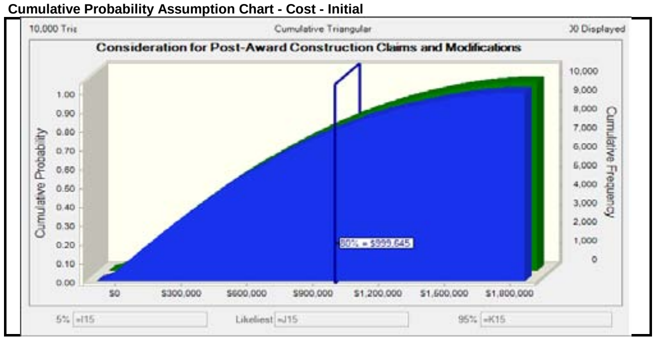
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($94,163)	'-0.2 Months
10%	$48,884	0.1 Months
20%	$149,158	0.3 Months
30%	$260,483	0.5 Months
40%	$378,093	0.8 Months
50%	$498,248	1.1 Months
60%	$644,357	1.4 Months
70%	$798,254	1.7 Months
80%	$999,645	2.1 Months
90%	$1,249,819	2.6 Months
100%	$1,843,237	3.9 Months

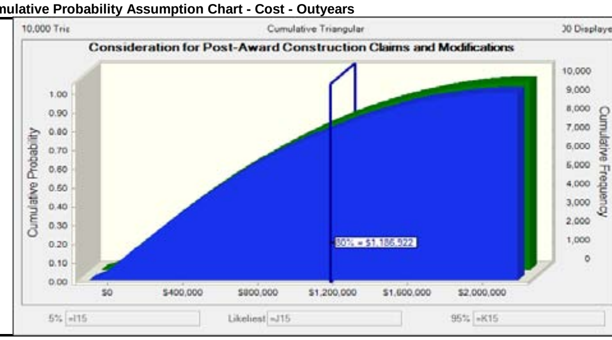
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($107,102)	'-0.2 Months
10%	$58,323	0.1 Months
20%	$180,391	0.3 Months
30%	$307,467	0.5 Months
40%	$442,966	0.8 Months
50%	$595,356	1.1 Months
60%	$747,435	1.4 Months
70%	$944,697	1.7 Months
80%	$1,186,922	2.1 Months
90%	$1,478,252	2.6 Months
100%	$2,147,916	3.9 Months

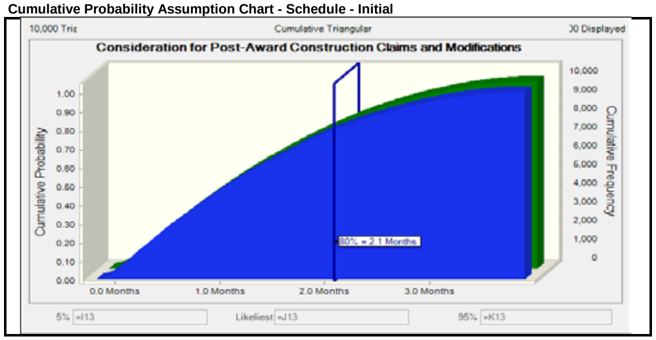
Cumulative Probability Assumption Chart - Cost - Initial



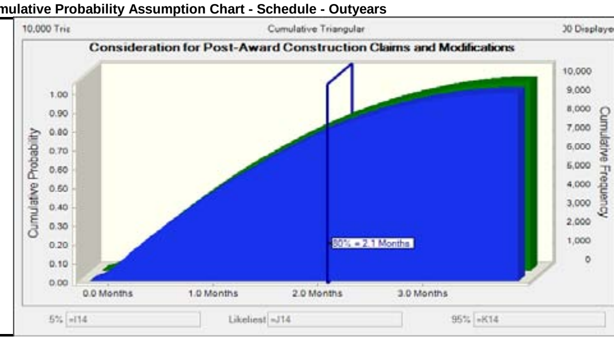
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



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	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Cost	EST-1	Estimate Considerations - Initial	Likely	Significant	High	Triangular	N/A	N/A	($2,387,355)	$0	$2,387,355	
	EST-1	Estimate Considerations - Out-years	Likely	Significant	High	Triangular	N/A	N/A	($3,730,681)	$0	$3,730,681	

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Schedule	EST-1	Estimate Considerations - Initial	Very Unlikely	Negligible	LOW	N/A	N/A	N/A	N/A	N/A	N/A	
	EST-1	Estimate Considerations - Out-years	Very Unlikely	Negligible	LOW	N/A	N/A	N/A	N/A	N/A	N/A	

Description	This is added to the CSRA model for consideration, as these issues may cause a cost variance. Estimate assumptions may not accurately capture the ultimate costs.
Development of Low Values	The best case scenario is that rates, crews and productivities are either flawed or too optimistic compared to actual ultimate costs, decreasing up to 5% on overall construction productivities.
Development of High Values	The worst case scenario is that rates, crews and productivities are either flawed or too optimistic compared to actual ultimate costs, decreasing up to 5% on overall construction productivities.

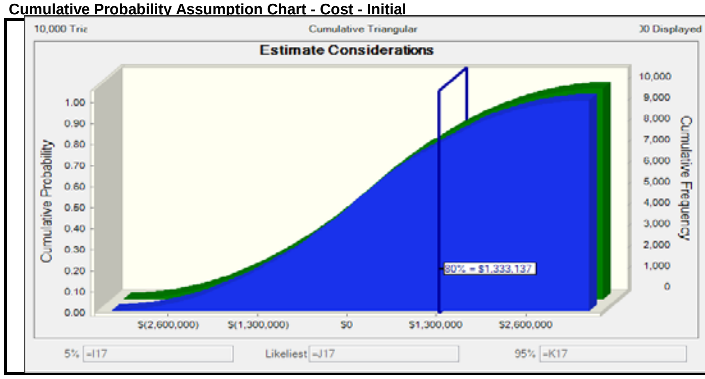
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,452,275)	N/A
10%	($1,950,486)	N/A
20%	($1,287,479)	N/A
30%	($758,384)	N/A
40%	($333,569)	N/A
50%	$25,587	N/A
60%	$396,727	N/A
70%	$820,130	N/A
80%	$1,333,137	N/A
90%	$1,939,790	N/A
100%	$3,453,453	N/A

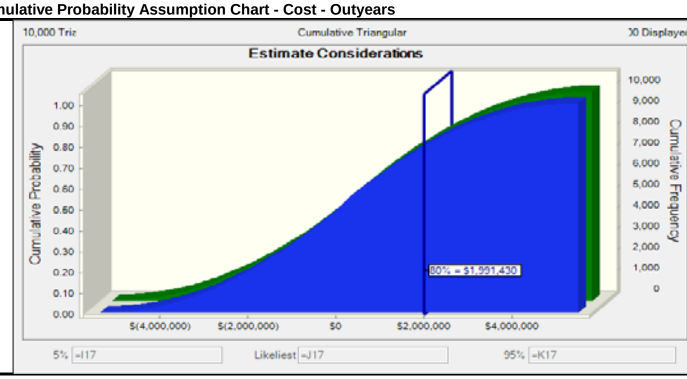
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($5,371,001)	N/A
10%	($2,973,991)	N/A
20%	($2,000,688)	N/A
30%	($1,223,604)	N/A
40%	($561,102)	N/A
50%	$29,241	N/A
60%	$585,732	N/A
70%	$1,258,324	N/A
80%	$1,991,430	N/A
90%	$2,967,597	N/A
100%	$5,377,750	N/A

Cumulative Probability Assumption Chart - Cost - Initial



Cumulative Probability Assumption Chart - Cost - Outyears



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Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-1	Consideration for Low and Unknown Internal Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($2,387,355)	$0	$2,387,355	
INT-1	Consideration for Low and Unknown Internal Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($3,730,681)	$0	$3,730,681	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
INT-1	Consideration for Low and Unknown Internal Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	
INT-1	Consideration for Low and Unknown Internal Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns. This could impact cost and schedule.
Development of Low Values	The best case scenario is that costs improve by up to 5% and schedule is improved by up to 3 months.
Development of High Values	The worst case scenario is that project costs increase by up to 5% and the overall schedule is delayed by up to 3 months.

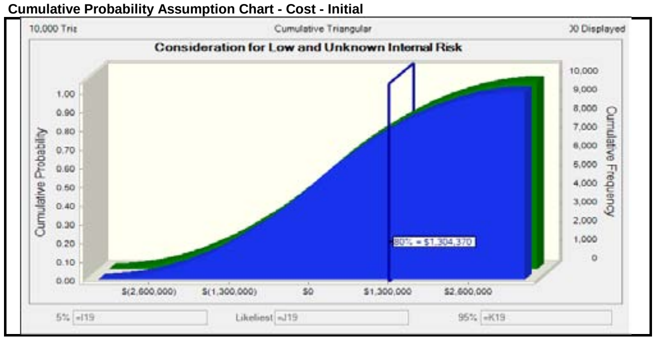
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,438,595)	'-4.4 Months
10%	($1,920,948)	'-2.4 Months
20%	($1,256,551)	'-1.6 Months
30%	($760,984)	'-1.0 Months
40%	($351,274)	'-0.5 Months
50%	$26,706	0.0 Months
60%	$392,837	0.5 Months
70%	$817,499	1.0 Months
80%	$1,304,370	1.6 Months
90%	$1,950,071	2.5 Months
100%	$3,461,587	4.3 Months

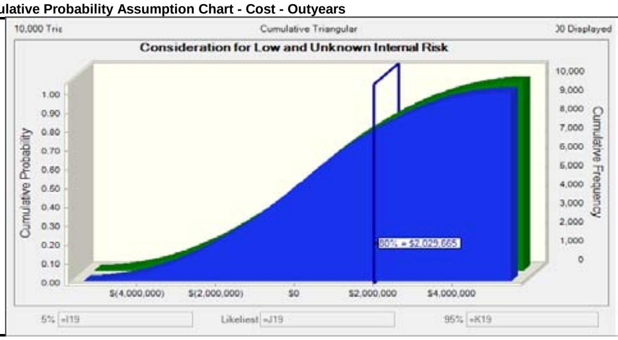
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($5,378,409)	'-4.4 Months
10%	($3,045,563)	'-2.4 Months
20%	($2,060,020)	'-1.6 Months
30%	($1,275,211)	'-1.0 Months
40%	($594,287)	'-0.5 Months
50%	$7,376	0.0 Months
60%	$596,133	0.5 Months
70%	$1,235,970	1.0 Months
80%	$2,029,665	1.6 Months
90%	$3,031,199	2.4 Months
100%	$5,417,057	4.3 Months

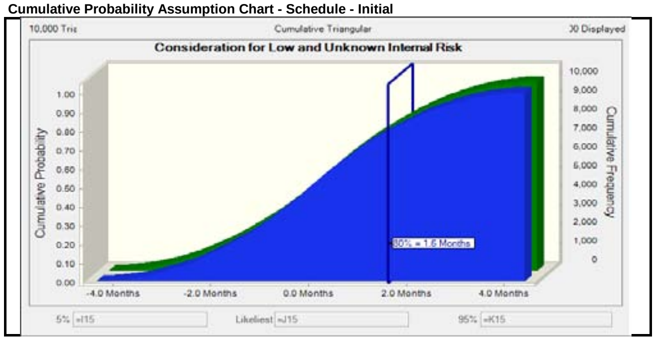
Cumulative Probability Assumption Chart - Cost - Initial



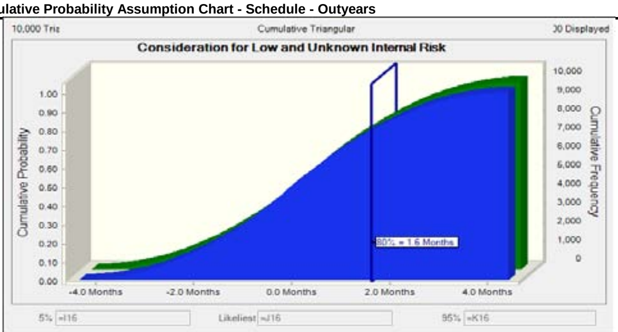
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Cost	E-1	Weather - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	($1,432,413)	$0	$2,387,355	
	E-1	Weather - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	($2,238,409)	$0	$3,730,681	

	Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
Schedule	E-1	Weather - Initial	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	6.0 Months	
	E-1	Weather - Out-years	LIKELY	MARGINAL	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	6.0 Months	

Description	Florida is subject to bad weather during Hurricane Season which can cause Schedule delays. Weather days are generally incorporated into schedule.
Development of Low Values	The best case scenario is that weather has less impact on dredging operations and effective work time than currently contemplated in the current baseline estimate, reducing the overall costs by up to 3%. Also assume that favorable weather conditions could improve the schedule by up to 3 months.
Development of High Values	The worst case scenario is that weather has more impact on dredging operations and effective work time than currently contemplated in the current baseline estimate, increasing the overall costs by up to 5%. Also assume that unfavorable weather conditions could delay the schedule by up to 6 months.

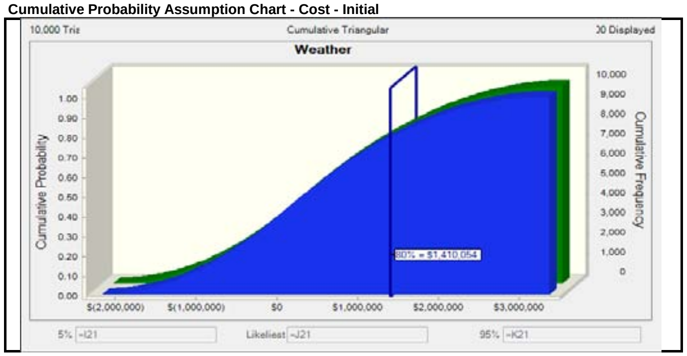
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($2,191,146)	'-4.7 Months
10%	($1,121,880)	'-2.3 Months
20%	($657,588)	'-1.3 Months
30%	($283,293)	'-0.5 Months
40%	$7,346	0.2 Months
50%	$302,977	0.9 Months
60%	$618,657	1.7 Months
70%	$974,574	2.6 Months
80%	$1,410,054	3.7 Months
90%	$1,963,139	5.1 Months
100%	$3,310,286	8.2 Months

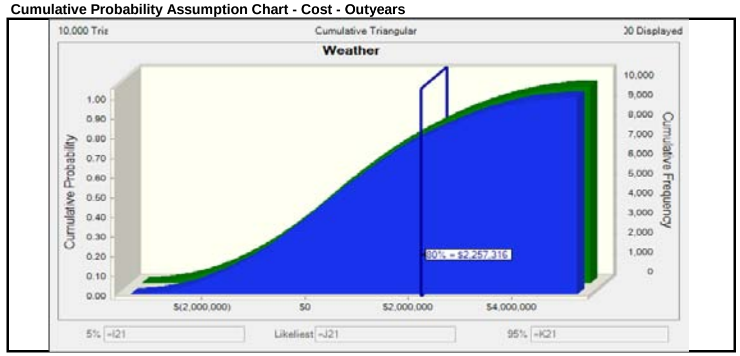
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,417,613)	'-4.7 Months
10%	($1,704,749)	'-2.3 Months
20%	($970,822)	'-1.2 Months
30%	($421,592)	'-0.5 Months
40%	$55,945	0.2 Months
50%	$527,222	0.9 Months
60%	$1,043,929	1.7 Months
70%	$1,599,499	2.6 Months
80%	$2,257,316	3.6 Months
90%	$3,163,465	5.1 Months
100%	$5,208,086	8.2 Months

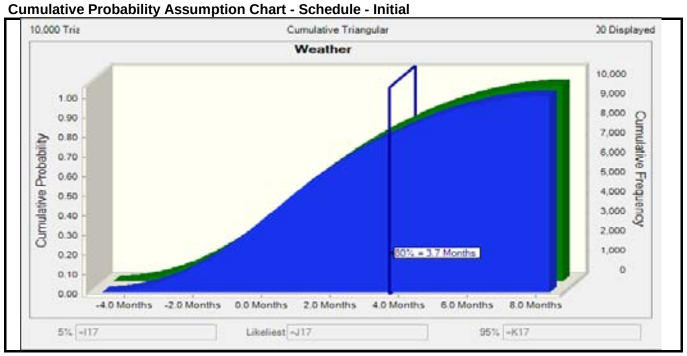
Cumulative Probability Assumption Chart - Cost - Initial



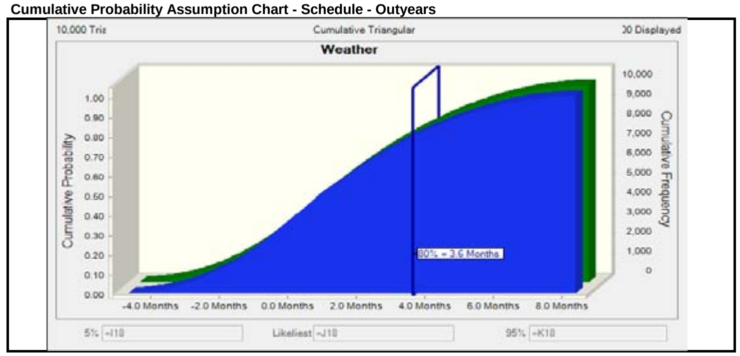
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
E-2	Funding Delays - Initial	UNLIKELY	MARGINAL	LOW	N/A	N/A	N/A	N/A	N/A	N/A	*The original risk register and current assumption indicate this is not high risk for the initial activity, but is for the out-years*
E-2	Funding Delays - Out-years	LIKELY	MARGINAL	MODERATE	Yes-No/Triangular	N/A	N/A	$0	$0	$9,170,416	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
E-2	Funding Delays - Initial	LIKELY	Significant	HIGH	Yes-No/Uniform	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	
E-2	Funding Delays - Out-years	LIKELY	Significant	HIGH	Yes-No/Uniform	N/A	N/A	0.0 Months	0.0 Months	12.0 Months	

Description	PM feels Adequate Congressional funding to complete project will be available. However, if the project is delayed, it could increase the quantities to be dredged and delay the overal schedule. This could impact the cost and schedule.
Development of Low Values	The best case scenario is that there is no change to the baseline estimate or schedule.
Development of High Values	The worst case scenario is that funding delays experienced for out-year renourishments may make the project vulnerable to accumulation of more dredge material due to prolonged storm surge exposure. Assume up to 15% more material for each nourishment. Also, assume that funding issues could move the entire construction schedule by up to one fiscal year.

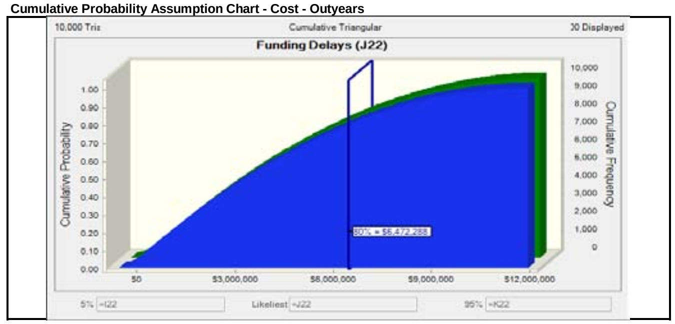
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	N/A	0.0 Months
10%	N/A	1.2 Months
20%	N/A	2.4 Months
30%	N/A	3.6 Months
40%	N/A	4.9 Months
50%	N/A	6.1 Months
60%	N/A	7.3 Months
70%	N/A	8.5 Months
80%	N/A	9.7 Months
90%	N/A	10.8 Months
100%	N/A	12.0 Months

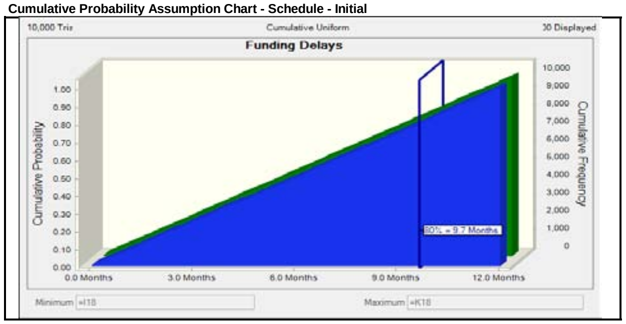
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($607,195)	0.0 Months
10%	$321,596	1.2 Months
20%	$976,883	2.4 Months
30%	$1,676,627	3.7 Months
40%	$2,450,610	4.9 Months
50%	$3,275,090	6.0 Months
60%	$4,195,780	7.2 Months
70%	$5,227,571	8.4 Months
80%	$6,472,288	9.6 Months
90%	$8,002,743	10.8 Months
100%	$11,865,275	12.0 Months

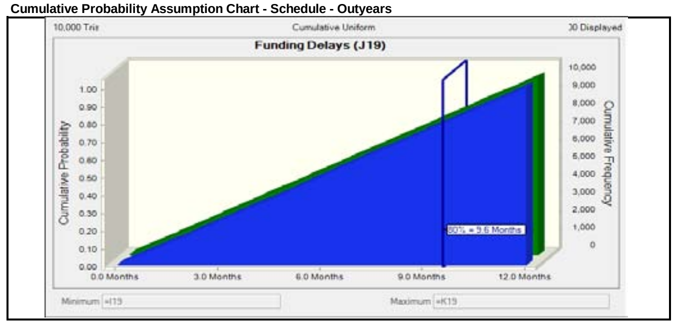
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



SAM - Walton County Storm Damage Reduction Project, GI Study - LPP

Cost

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EXT-1	Consideration for Low and Unknown External Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($2,387,355)	$0	$2,387,355	
EXT-1	Consideration for Low and Unknown External Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	($3,730,681)	$0	$3,730,681	

Schedule

Risk Reference No.	Risk Event	Likelihood	Impact	Risk Level	Distribution	Correlation	Correlation Factor	Low	Most Likely	High	Notes
EXT-1	Consideration for Low and Unknown External Risk - Initial	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	
EXT-1	Consideration for Low and Unknown External Risk - Out-years	Likely	Marginal	MODERATE	Triangular	N/A	N/A	-3.0 Months	0.0 Months	3.0 Months	

Description	There is inherent risk in all projects that could contribute to cost and schedule variance due to uknowns. This could impact cost and schedule.
Development of Low Values	The best case scenario is that costs improve by up to 5% and schedule is improved by up to 3 months.
Development of High Values	The worst case scenario is that project costs increase by up to 5% and the overall schedule is delayed by up to 3 months.

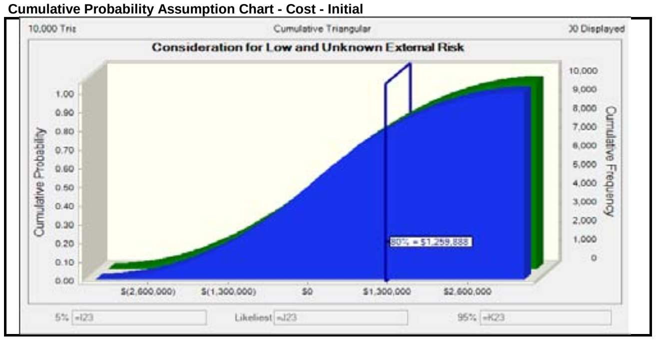
Initial

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($3,473,275)	'-4.3 Months
10%	($1,928,366)	'-2.4 Months
20%	($1,251,206)	'-1.6 Months
30%	($788,422)	'-1.0 Months
40%	($369,802)	'-0.5 Months
50%	($430)	0.0 Months
60%	$362,950	0.5 Months
70%	$759,694	1.0 Months
80%	$1,259,888	1.6 Months
90%	$1,921,338	2.4 Months
100%	$3,428,494	4.3 Months

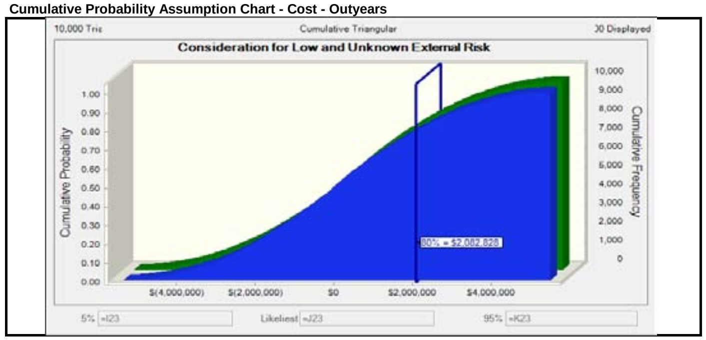
Outyears

Confidence Percentile	Assumption values (in dollars)	Assumption values (in months)
0%	($5,389,073)	'-4.3 Months
10%	($3,009,029)	'-2.4 Months
20%	($2,027,639)	'-1.6 Months
30%	($1,262,243)	'-1.0 Months
40%	($602,026)	'-0.5 Months
50%	($7,877)	0.0 Months
60%	$591,774	0.5 Months
70%	$1,289,843	1.0 Months
80%	$2,082,828	1.6 Months
90%	$3,073,753	2.4 Months
100%	$5,362,650	4.3 Months

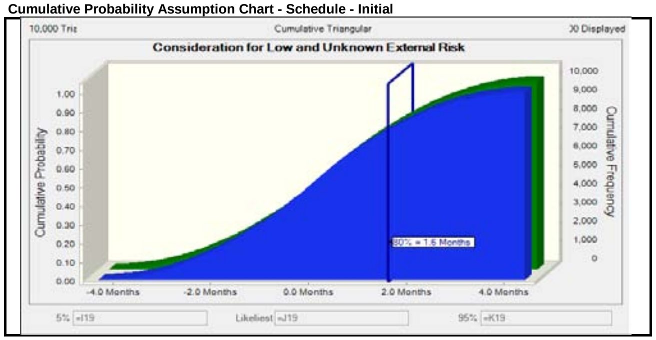
Cumulative Probability Assumption Chart - Cost - Initial



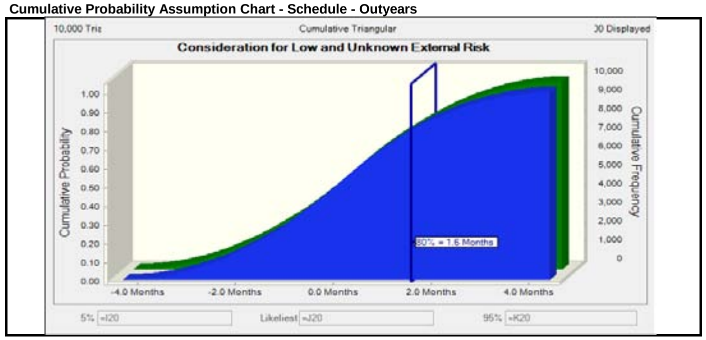
Cumulative Probability Assumption Chart - Cost - Outyears



Cumulative Probability Assumption Chart - Schedule - Initial



Cumulative Probability Assumption Chart - Schedule - Outyears



Crystal Ball Report - Full
Simulation started on 10/10/2012 at 11:12:03
Simulation stopped on 10/10/2012 at 11:13:40

Run preferences:	
Number of trials run	**10,000**
Monte Carlo	
Seed	**999**
Precision control on	
Confidence level	**95.00%**
Run statistics:	
Total running time (sec)	**97.44**
Trials/second (average)	**103**
Random numbers per sec	**3,900**
Crystal Ball data	
Assumptions	**38**
Correlations	**1**
Correlated groups	**1**
Decision variables	**0**
Forecasts	**4**

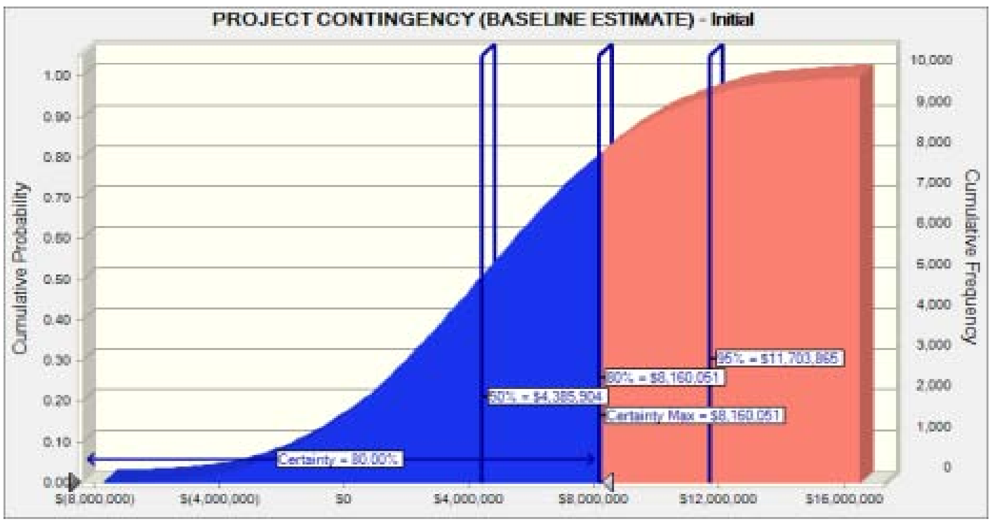
Forecasts

Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Cost Risk Model - Initial

Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial **Cell: L25**

Summary:

Certainty level is 80.00%
Certainty range is from -Infinity to $8,160,051
Entire range is from $(12,367,942) to 20,776,700
Base case is $0
After 10,000 trials, the std. error of the mean is $43,506



Statistics:	**Forecast values**
Trials	**10,000**
Mean	**$4,423,081**
Median	**$4,387,004**
Mode	**---**
Standard Deviation	**$4,350,615**
Variance	**###############**
Skewness	**0.0510**
Kurtosis	**2.82**
Coeff. of Variability	**0.9836**
Minimum	**$(12,367,942)**
Maximum	**$20,776,700**
Range Width	**$33,144,642**
Mean Std. Error	**$43,506**

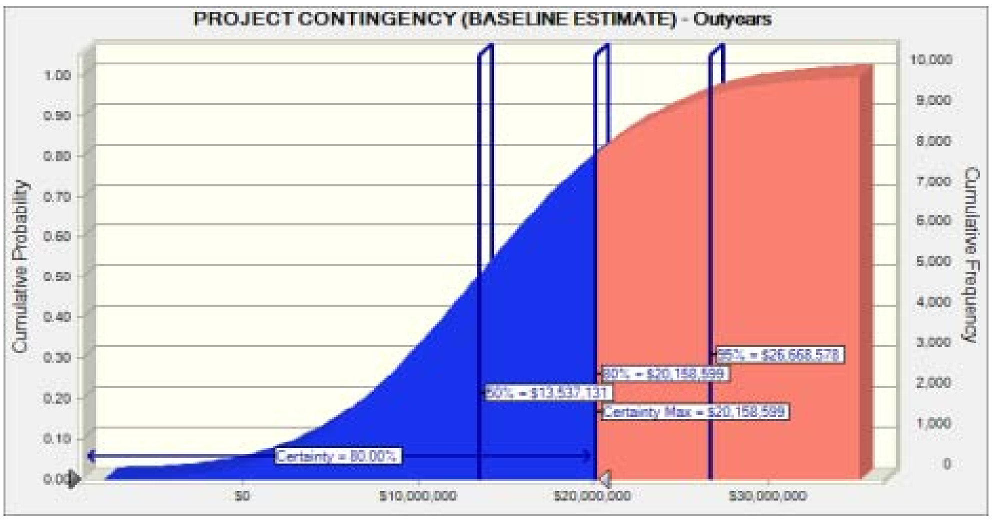
Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Initial (cont'd) **Cell: L25**

Percentiles:	Forecast values
0%	$(12,367,942)
10%	$(1,230,118)
20%	$678,502
30%	$2,062,210
40%	$3,246,649
50%	$4,385,904
60%	$5,525,425
70%	$6,757,484
80%	$8,160,051
90%	$10,046,438
100%	$20,776,700

Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Cost Risk Model - Outyear:

Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears **Cell: L25**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to $20,158,599
Entire range is from $(11,723,307) to $41,173,067
Base case is $0
After 10,000 trials, the std. error of the mean is $77,628



Statistics:	**Forecast values**
Trials	**10,000**
Mean	**$13,684,694**
Median	**$13,537,839**
Mode	**---**
Standard Deviation	**$7,762,756**
Variance	**###############**
Skewness	**0.1409**
Kurtosis	**2.94**
Coeff. of Variability	**0.5673**
Minimum	**$(11,723,307)**
Maximum	**$41,173,067**
Range Width	**$52,896,374**
Mean Std. Error	**$77,628**

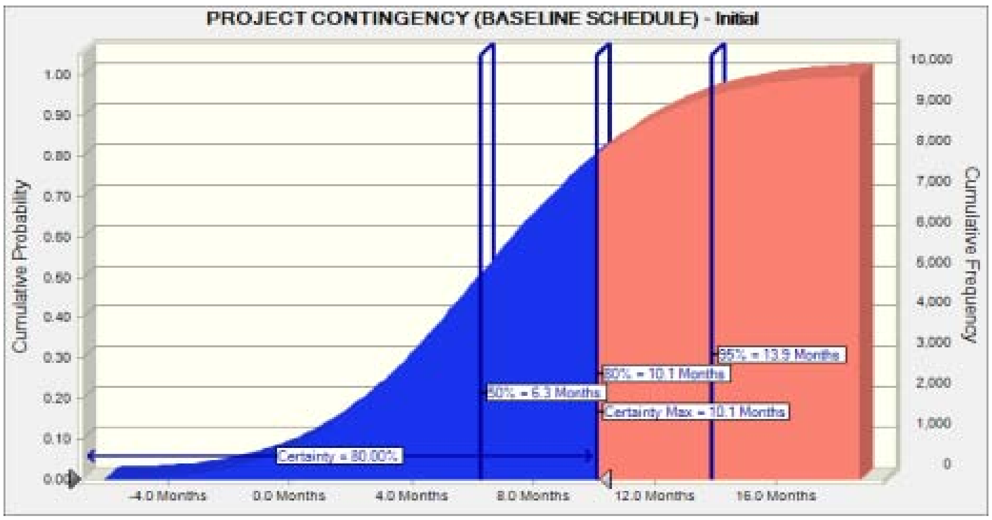
Forecast: PROJECT CONTINGENCY (BASELINE ESTIMATE) - Outyears (cont'd) **Cell: L25**

Percentiles:	Forecast values
0%	$(11,723,307)
10%	$3,795,322
20%	$7,139,976
30%	$9,440,676
40%	$11,602,375
50%	$13,537,131
60%	$15,459,820
70%	$17,574,455
80%	$20,158,599
90%	$23,866,183
100%	$41,173,067

Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Schedule Risk Model - Initi

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial **Cell: L21**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to 10.1 Months
Entire range is from -7.6 Months to 23.5 Months
Base case is 0.0 Months
After 10,000 trials, the std. error of the mean is 0.0 Month



Statistics:	**Forecast values**
Trials	**10,000**
Mean	**6.3 Months**
Median	**6.3 Months**
Mode	**---**
Standard Deviation	**4.5 Months**
Variance	**20.0 Months**
Skewness	**0.0766**
Kurtosis	**2.85**
Coeff. of Variability	**0.7059**
Minimum	**-7.6 Months**
Maximum	**23.5 Months**
Range Width	**31.1 Months**
Mean Std. Error	**0.0 Months**

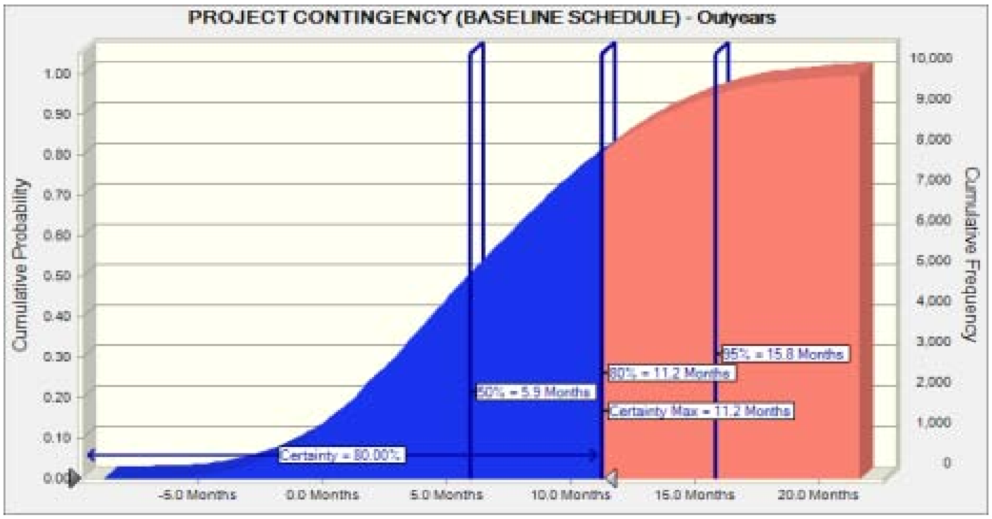
Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Initial (cont'd) **Cell: L21**

Percentiles:	Forecast values
0%	-7.6 Months
10%	0.6 Months
20%	2.5 Months
30%	4.0 Months
40%	5.1 Months
50%	6.3 Months
60%	7.4 Months
70%	8.7 Months
80%	10.1 Months
90%	12.2 Months
100%	23.5 Months

Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Schedule Risk Model - Out

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears **Cell: L22**

Summary:
Certainty level is 80.00%
Certainty range is from -Infinity to 11.2 Months
Entire range is from -8.9 Months to 26.4 Months
Base case is 0.0 Months
After 10,000 trials, the std. error of the mean is 0.1 Month



Statistics:	**Forecast values**
Trials	**10,000**
Mean	**6.3 Months**
Median	**5.9 Months**
Mode	**---**
Standard Deviation	**5.5 Months**
Variance	**30.5 Months**
Skewness	**0.2412**
Kurtosis	**2.63**
Coeff. of Variability	**0.8746**
Minimum	**-8.9 Months**
Maximum	**26.4 Months**
Range Width	**35.3 Months**
Mean Std. Error	**0.1 Months**

Forecast: PROJECT CONTINGENCY (BASELINE SCHEDULE) - Outyears (cont'd) **Cell: L22**

Percentiles:	Forecast values
0%	-8.9 Months
10%	-0.6 Months
20%	1.4 Months
30%	3.0 Months
40%	4.4 Months
50%	5.9 Months
60%	7.6 Months
70%	9.2 Months
80%	11.2 Months
90%	13.8 Months
100%	26.4 Months

End of Forecasts

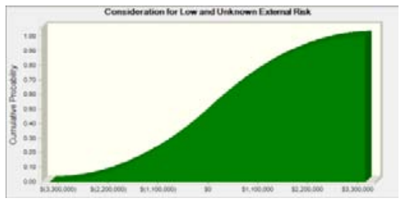
Assumptions

Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Cost Risk Model - Initial

Assumption: Consideration for Low and Unknown External Risk — **Cell: J23**

Triangular distribution with parameters:

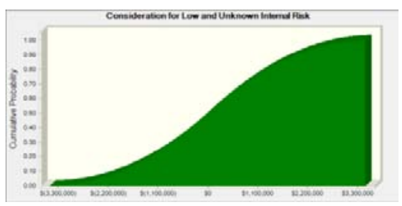
5%	$(2,387,355)	(=I23)
Likeliest	$0	(=J23)
95%	$2,387,355	(=K23)



Assumption: Consideration for Low and Unknown Internal Risk — **Cell: J19**

Triangular distribution with parameters:

5%	$(2,387,355)	(=I19)
Likeliest	$0	(=J19)
95%	$2,387,355	(=K19)

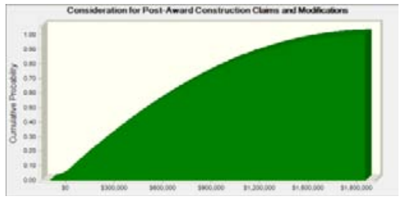


Assumption: Consideration for Post-Award Construction Claims and Modifications — **Cell: J15**

Triangular distribution with parameters:

5%	$0	(=I15)
Likeliest	$0	(=J15)
95%	$1,432,413	(=K15)

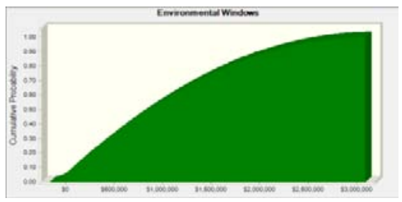
Assumption: Consideration for Post-Award Construction Claims and Modifications (cont'd) **Cell: J15**



Assumption: Environmental Windows **Cell: J13**

Triangular distribution with parameters:

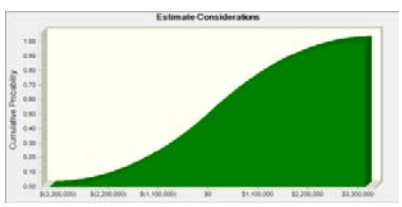
5%	**$0**	**(=I13)**
Likeliest	**$0**	**(=J13)**
95%	**$2,387,355**	**(=K13)**



Assumption: Estimate Considerations **Cell: J17**

Triangular distribution with parameters:

5%	**$(2,387,355)**	**(=I17)**
Likeliest	**$0**	**(=J17)**
95%	**$2,387,355**	**(=K17)**



Assumption: Fuel Prices **Cell: J11**

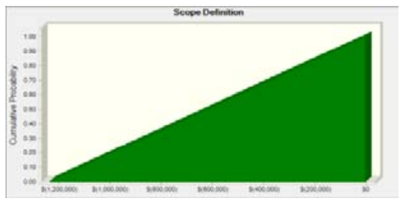
Triangular distribution with parameters:

5%	**$(1,663,240)**	**(=I11)**
Likeliest	**$0**	**(=J11)**
95%	**$5,685,960**	**(=K11)**

Assumption: Fuel Prices (cont'd) **Cell: J11**

Assumption: Scope Definition **Cell: J9**

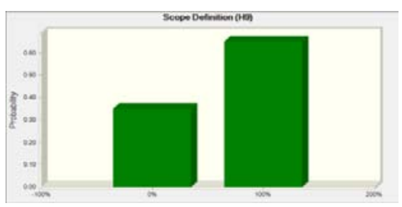
Uniform distribution with parameters:		
Minimum	**$(1,236,500)**	**(=I9)**
Maximum	**$0**	**(=K9)**



Correlated with:	**Coefficient**
Scope Growth / Reduction (J10)	**0.75**

Assumption: Scope Definition (H9) **Cell: H9**

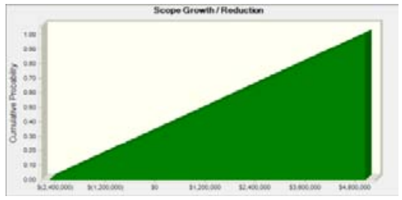
Yes-No distribution with parameters:		
Probability of Yes(1)	**0.65**	**(=H9)**



Assumption: Scope Growth / Reduction **Cell: J10**

Uniform distribution with parameters:		
Minimum	**$(2,533,873)**	**(=I10)**
Maximum	**$5,067,746**	**(=K10)**

Assumption: Scope Growth / Reduction (cont'd) **Cell: J10**

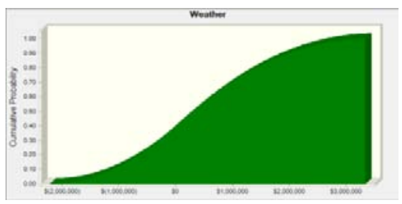


Correlated with:	**Coefficient**
Scope Definition (J9)	**0.75**

Assumption: Weather **Cell: J21**

Triangular distribution with parameters:

5%	**$(1,432,413)**	**(=I21)**
Likeliest	**$0**	**(=J21)**
95%	**$2,387,355**	**(=K21)**

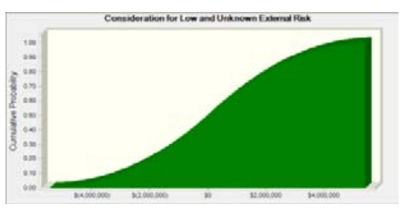


Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Cost Risk Model - Outyears

Assumption: Consideration for Low and Unknown External Risk **Cell: J23**

Triangular distribution with parameters:

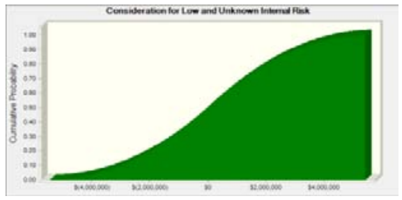
5%	**$(3,730,681)**	**(=I23)**
Likeliest	**$0**	**(=J23)**
95%	**$3,730,681**	**(=K23)**



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J19**

Triangular distribution with parameters:

5%	**$(3,730,681)**	**(=I19)**
Likeliest	**$0**	**(=J19)**
95%	**$3,730,681**	**(=K19)**



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J15**

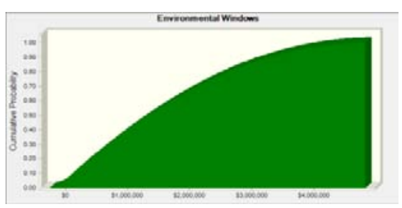
Triangular distribution with parameters:

5%	**$0**	**(=I15)**
Likeliest	**$0**	**(=J15)**
95%	**$1,678,807**	**(=K15)**

Assumption: Environmental Windows **Cell: J13**

Triangular distribution with parameters:

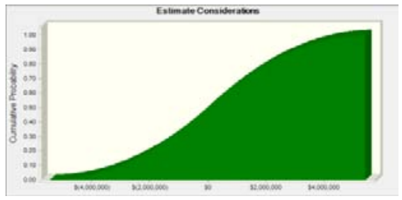
5%	**$0**	**(=I13)**
Likeliest	**$0**	**(=J13)**
95%	**$3,730,681**	**(=K13)**



Assumption: Estimate Considerations **Cell: J17**

Triangular distribution with parameters:

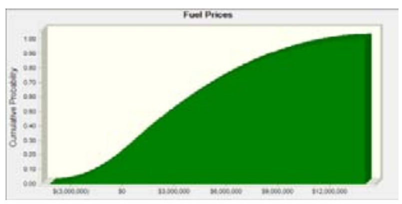
5%	**$(3,730,681)**	**(=I17)**
Likeliest	**$0**	**(=J17)**
95%	**$3,730,681**	**(=K17)**



Assumption: Fuel Prices **Cell: J11**

Triangular distribution with parameters:

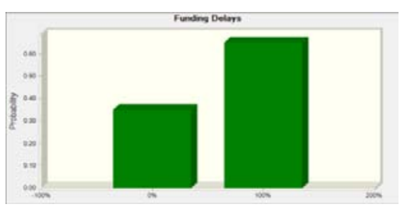
5%	**$(2,254,140)**	**(=I11)**
Likeliest	**$0**	**(=J11)**
95%	**$10,519,320**	**(=K11)**



Assumption: Funding Delays **Cell: H22**

Yes-No distribution with parameters:

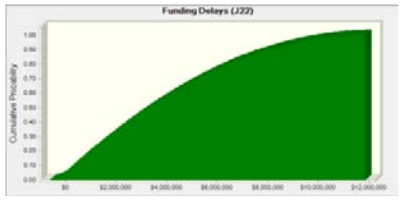
Probability of Yes(1)	**0.65**	**(=H22)**



Assumption: Funding Delays (J22) **Cell: J22**

Triangular distribution with parameters:

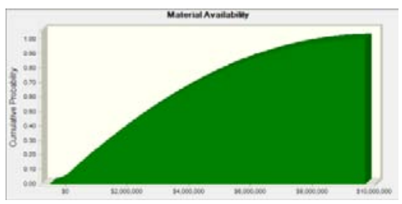
5%	**$0**	**(=I22)**
Likeliest	**$0**	**(=J22)**
95%	**$9,170,416**	**(=K22)**



Assumption: Material Availability **Cell: J10**

Triangular distribution with parameters:

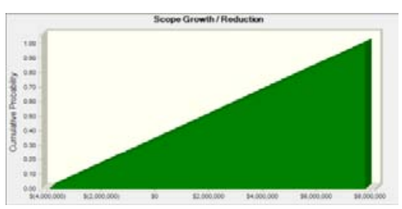
5%	**$0**	**(=I10)**
Likeliest	**$0**	**(=J10)**
95%	**$7,513,800**	**(=K10)**



Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

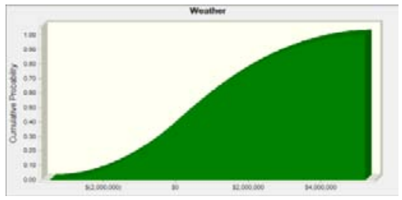
Minimum	**$(3,932,966)**	**(=I9)**
Maximum	**$7,865,931**	**(=K9)**



Assumption: Weather **Cell: J21**

Triangular distribution with parameters:

5%	**$(2,238,409)**	**(=I21)**
Likeliest	**$0**	**(=J21)**
95%	**$3,730,681**	**(=K21)**

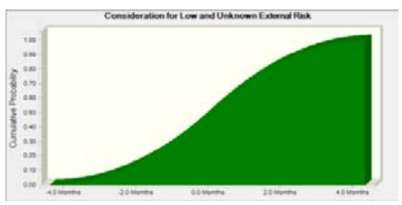


Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Schedule Risk Model - Initi

Assumption: Consideration for Low and Unknown External Risk **Cell: J19**

Triangular distribution with parameters:

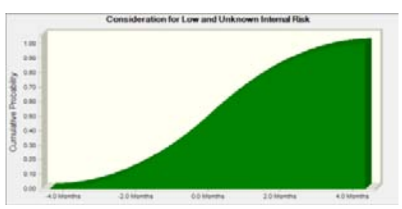
5%	**-3.0 Months**	**(=I19)**
Likeliest	**0.0 Months**	**(=J19)**
95%	**3.0 Months**	**(=K19)**



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J15**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I15)**
Likeliest	**0.0 Months**	**(=J15)**
95%	**3.0 Months**	**(=K15)**



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J13**

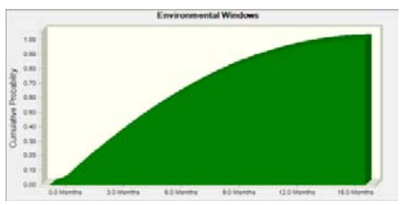
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I13)**
Likeliest	**0.0 Months**	**(=J13)**
95%	**3.0 Months**	**(=K13)**

Assumption: Environmental Windows **Cell: J11**

Triangular distribution with parameters:

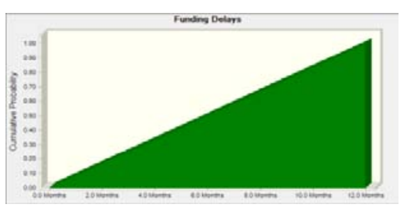
5%	**0.0 Months**	**(=I11)**
Likeliest	**0.0 Months**	**(=J11)**
95%	**12.0 Months**	**(=K11)**



Assumption: Funding Delays **Cell: J18**

Uniform distribution with parameters:

Minimum	**0.0 Months**	**(=I18)**
Maximum	**12.0 Months**	**(=K18)**



Assumption: Permits **Cell: J10**

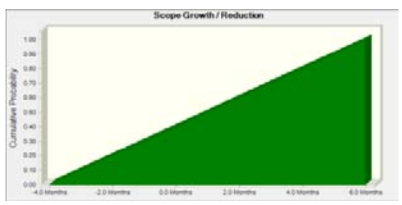
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I10)**
Likeliest	**0.0 Months**	**(=J10)**
95%	**6.0 Months**	**(=K10)**

Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

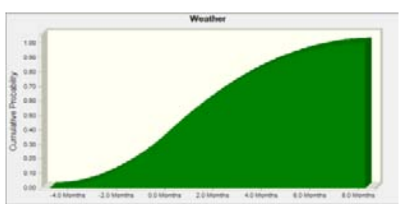
Minimum	**-4.0 Months**	**(=I9)**
Maximum	**6.0 Months**	**(=K9)**



Assumption: Weather **Cell: J17**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I17)**
Likeliest	**0.0 Months**	**(=J17)**
95%	**6.0 Months**	**(=K17)**

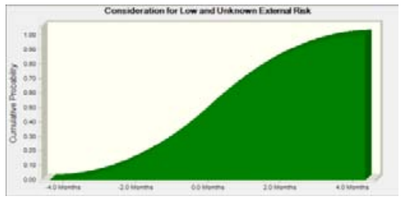


Worksheet: [SAM - Walton County CSRA Updated 10-2012 - LPP.xlsx]Schedule Risk Model - Out

Assumption: Consideration for Low and Unknown External Risk **Cell: J20**

Triangular distribution with parameters:

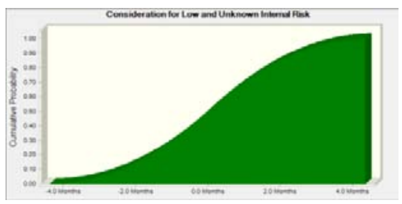
5%	**-3.0 Months**	**(=I20)**
Likeliest	**0.0 Months**	**(=J20)**
95%	**3.0 Months**	**(=K20)**



Assumption: Consideration for Low and Unknown Internal Risk **Cell: J16**

Triangular distribution with parameters:

5%	**-3.0 Months**	**(=I16)**
Likeliest	**0.0 Months**	**(=J16)**
95%	**3.0 Months**	**(=K16)**



Assumption: Consideration for Post-Award Construction Claims and Modifications **Cell: J14**

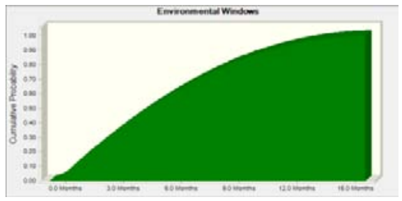
Triangular distribution with parameters:

5%	**0.0 Months**	**(=I14)**
Likeliest	**0.0 Months**	**(=J14)**
95%	**3.0 Months**	**(=K14)**

Assumption: Environmental Windows **Cell: J12**

Triangular distribution with parameters:

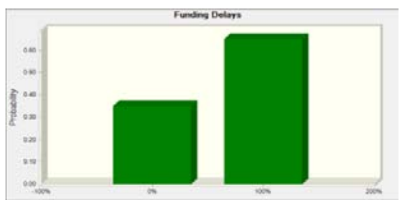
5%	**0.0 Months**	**(=I12)**
Likeliest	**0.0 Months**	**(=J12)**
95%	**12.0 Months**	**(=K12)**



Assumption: Funding Delays **Cell: H19**

Yes-No distribution with parameters:

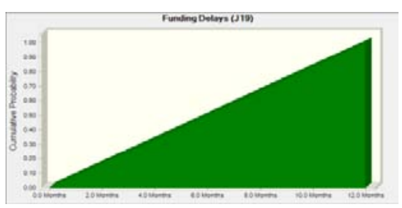
Probability of Yes(1)	**0.65**	**(=H19)**



Assumption: Funding Delays (J19) **Cell: J19**

Uniform distribution with parameters:

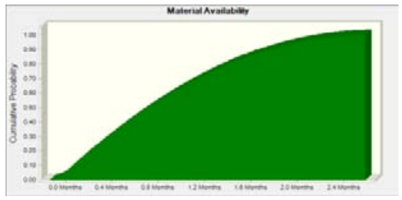
Minimum	**0.0 Months**	**(=I19)**
Maximum	**12.0 Months**	**(=K19)**



Assumption: Material Availability **Cell: J10**

Triangular distribution with parameters:

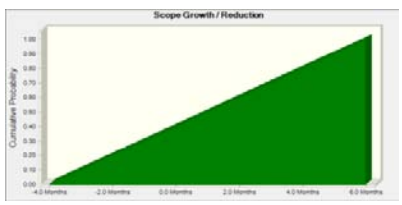
5%	**0.0 Months**	**(=I10)**
Likeliest	**0.0 Months**	**(=J10)**
95%	**2.0 Months**	**(=K10)**



Assumption: Scope Growth / Reduction **Cell: J9**

Uniform distribution with parameters:

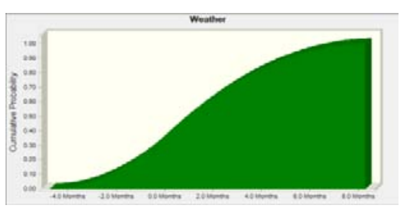
Minimum	**-4.0 Months**	**(=I9)**
Maximum	**6.0 Months**	**(=K9)**



Assumption: Weather **Cell: J18**

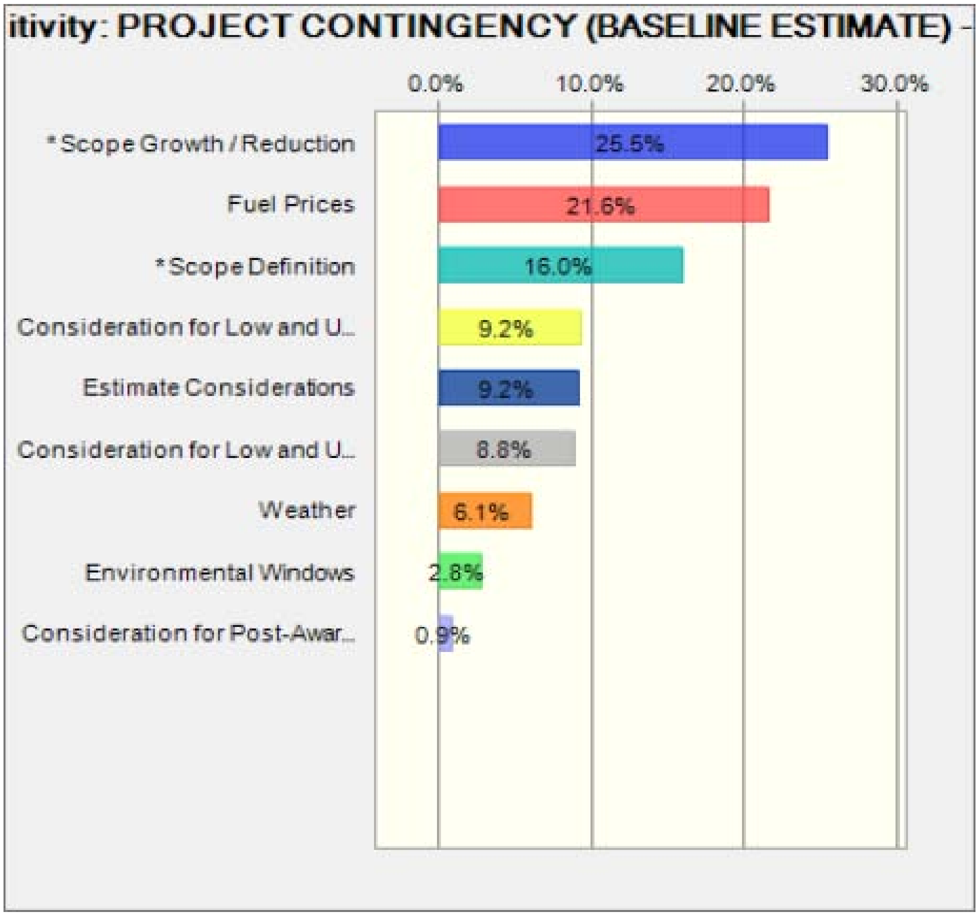
Triangular distribution with parameters:

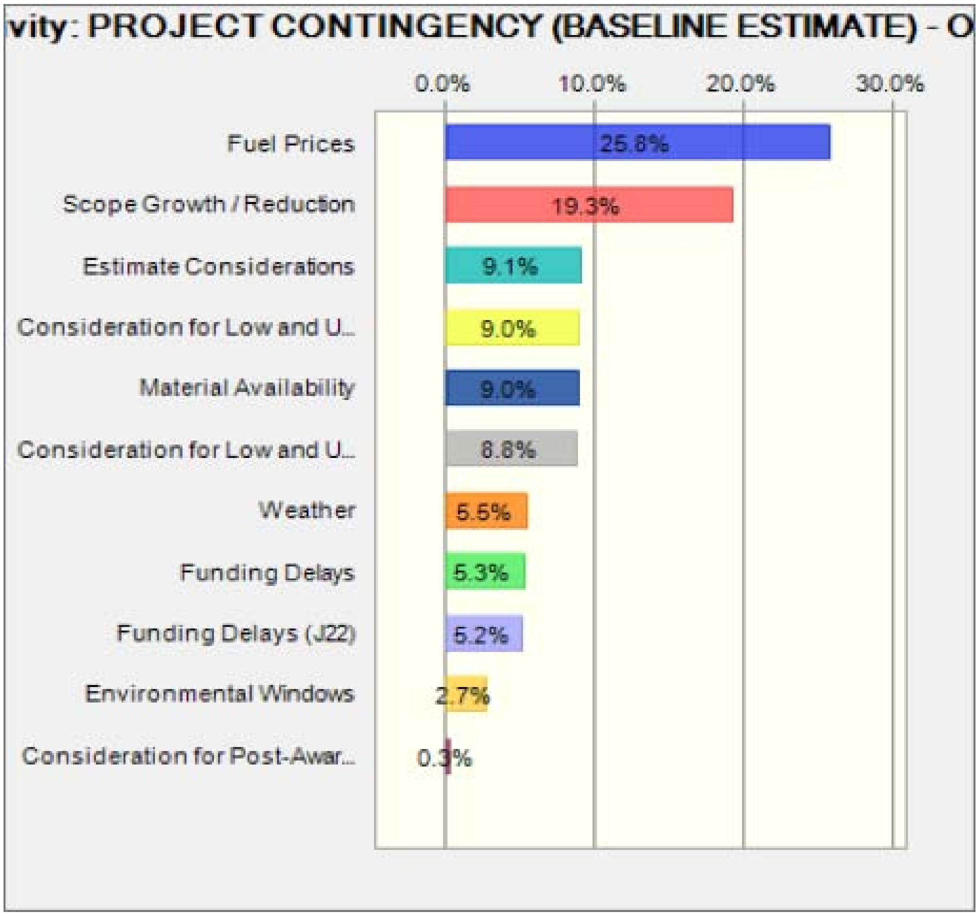
5%	**-3.0 Months**	**(=I18)**
Likeliest	**0.0 Months**	**(=J18)**
95%	**6.0 Months**	**(=K18)**

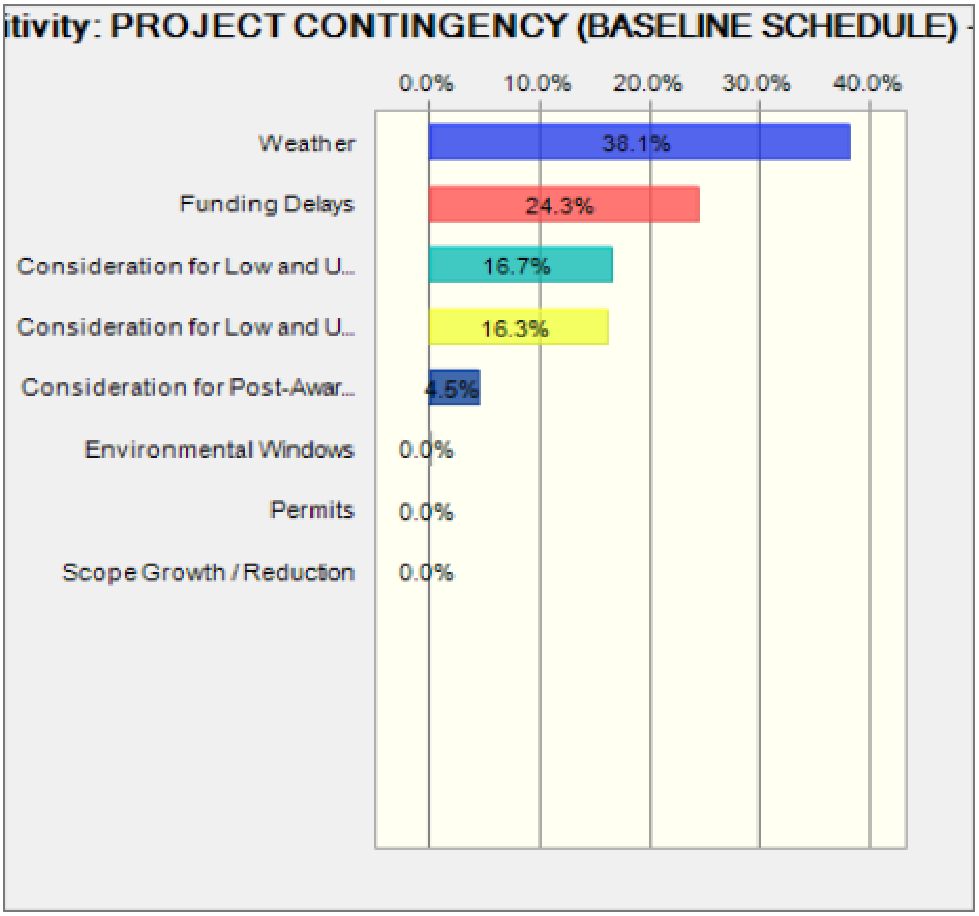


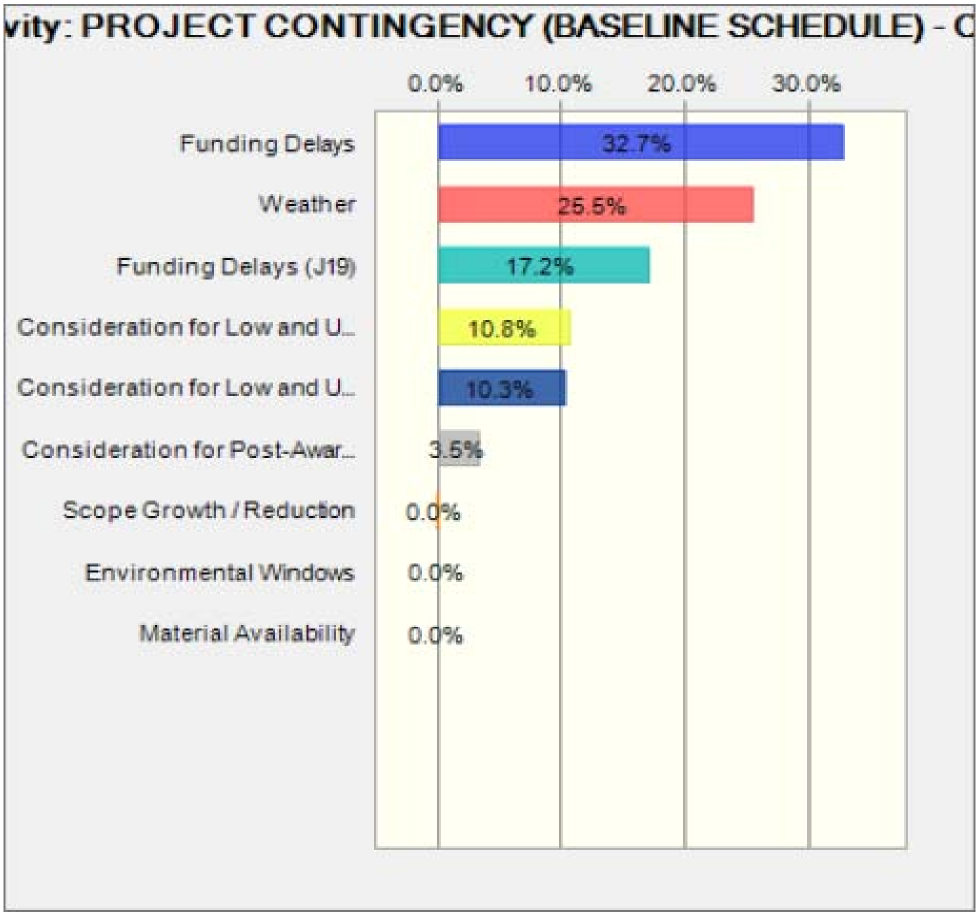
End of Assumptions

Sensitivity Charts




vity: PROJECT CONTINGENCY (BASELINE ESTIMATE) - O
0.0%
10.0%
20.0%
30.0%
Fuel Prices
25.8%
Scope Growth / Reduction
19.3%
Estimate Considerations
9.1%
Consideration for Low and U...
9.0%
Material Availability
9.0%
Consideration for Low and U...
8.8%
Weather
5.5%
Funding Delays
5.3%
Funding Delays (J22)
5.2%
Environmental Windows
2.7%
Consideration for Post-Awar...
0.3%


itivity: PROJECT CONTINGENCY (BASELINE SCHEDULE)
0.0%
10.0%
20.0%
30.0%
40.0%
Weather
38.1%
Funding Delays
24.3%
Consideration for Low and U...
16.7%
Consideration for Low and U...
16.3%
Consideration for Post-Awar...
4.5%
Environmental Windows
0.0%
Permits
0.0%
Scope Growth / Reduction
0.0%



End of Sensitivity Charts

ATTACHMENT V

PROJECT SCHEDULE

Walton County, Florida
Hurricane and Storm Damage Reduction Project
Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Walton County HSDR Project**	**15,144 days**	**Tue, 05/13/2014**	**Fri, 10/30/2043**	
2	**Authorization**	**1 days**	**Tue, 05/13/2014**	**Tue, 05/13/2014**	
3	**Initial Construction**	**397 days**	**Fri, 07/11/2014**	**Mon, 01/18/2016**	
4	Funding	1 days	Fri, 07/11/2014	Fri, 07/11/2014	2
5	Design	120 days	Fri, 08/15/2014	Thu, 01/29/2015	4
6	Advertise	30 days	Mon, 02/16/2015	Fri, 03/27/2015	5
7	Award	1 day	Mon, 04/13/2015	Mon, 04/13/2015	6
8	Construct	200 days	Tue, 04/14/2015	Mon, 01/18/2016	7
9					
10	**First Renourishment**	**400 days**	**Mon, 04/15/2024**	**Tue, 10/14/2025**	
11	**Surveys**	**44 days**	**Mon, 04/15/2024**	**Thu, 06/13/2024**	
12	Borrow Availability	14 days	Mon, 04/15/2024	Thu, 05/2/2024	
13	Beach Template	30 days	Fri, 05/3/2024	Thu, 06/13/2024	12
14	Quantity Estimate	14 days	Fri, 06/14/2024	Wed, 07/3/2024	13
15	**Environmental Coordination**	**156 days**	**Mon, 06/10/2024**	**Mon, 01/13/2025**	
16	Permit Preparation	90 days	Mon, 06/10/2024	Fri, 10/11/2024	
17	Permit Approval	66 days	Mon, 10/14/2024	Mon, 01/13/2025	16
18	Plan Preparation	207 days	Mon, 04/15/2024	Tue, 01/28/2025	
19	Advertise	30 days	Fri, 02/14/2025	Thu, 03/27/2025	18
20	Award Construct	1 day	Tue, 04/1/2025	Tue, 04/1/2025	19
21	Construct	140 days	Wed, 04/2/2025	Tue, 10/14/2025	20
22					
23	**Second Renourishment**	**400 days**	**Mon, 04/17/2034**	**Fri, 10/26/2035**	
24	**Surveys**	**44 days**	**Mon, 04/17/2034**	**Thu, 06/15/2034**	
25	Borrow Availability	14 days	Mon, 04/17/2034	Thu, 05/4/2034	
26	Beach Template	30 days	Fri, 05/5/2034	Thu, 06/15/2034	25
27	Quantity Estimate	14 days	Fri, 06/16/2034	Wed, 07/5/2034	26
28	**Environmental Coordination**	**156 days**	**Mon, 06/12/2034**	**Mon, 01/15/2035**	
29	Permit Preparation	90 days	Mon, 06/12/2034	Fri, 10/13/2034	
30	Permit Approval	66 days	Mon, 10/16/2034	Mon, 01/15/2035	29
31	Plan Preparation	207 days	Mon, 04/17/2034	Tue, 01/30/2035	
32	Advertise	30 days	Fri, 02/16/2035	Thu, 03/29/2035	31
33	Award Construct	1 day	Fri, 04/13/2035	Fri, 04/13/2035	32
34	Construct	140 days	Mon, 04/16/2035	Fri, 10/26/2035	33
35					
36	**Third Renourishment**	**400 days**	**Mon, 04/18/2044**	**Fri, 10/27/2045**	
37	**Surveys**	**44 days**	**Mon, 04/18/2044**	**Thu, 06/16/2044**	
38	Borrow Availability	14 days	Mon, 04/18/2044	Wed, 05/4/2044	
39	Beach Template	30 days	Fri, 05/6/2044	Thu, 06/16/2044	38
40	Quantity Estimate	14 days	Fri, 06/17/2044	Wed, 07/6/2044	39
41	**Environmental Coordination**	**156 days**	**Mon, 06/13/2044**	**Mon, 01/16/2045**	
42	Permit Preparation	90 days	Mon, 06/13/2044	Fri, 10/14/2044	
43	Permit Approval	66 days	Mon, 10/17/2044	Mon, 01/16/2045	42
44	Plan Preparation	207 days	Mon, 04/18/2044	Mon, 01/30/2045	
45	Advertise	30 days	Fri, 02/17/2045	Thu, 03/30/2045	44
46	Award Construct	1 day	Fri, 04/14/2045	Fri, 04/14/2045	45
47	Construct	140 days	Mon, 04/17/2045	Fri, 10/27/2045	46
48					
49	**Fourth Renourishment**	**400 days**	**Mon, 04/20/2054**	**Fri, 10/29/2055**	
50	**Surveys**	**44 days**	**Mon, 04/20/2054**	**Thu, 06/17/2055**	
51	Borrow Availability	14 days	Mon, 04/20/2054	Thu, 05/7/2054	
52	Beach Template	30 days	Fri, 05/8/2054	**Thu, 06/18/2054**	51
53	Quantity Estimate	14 days	Fri, 06/19/2054	Wed, 07/8/2054	52
54	**Environmental Coordination**	**156 days**	**Mon, 06/15/2054**	**Sat, 01/16/2055**	
55	Permit Preparation	90 days	Mon, 06/15/2054	Thu, 10/15/2054	
56	Permit Approval	66 days	Mon, 10/19/2054	Fri, 01/15/2055	55
57	Plan Preparation	207 days	Mon, 04/20/2054	Mon, 02/1/2055	
58	Advertise	30 days	Fri, 02/19/2055	Thu, 04/1/2055	57
59	Award Construct	1 day	Fri, 04/16/2055	Fri, 04/16/2055	58
60	Construct	140 days	Mon, 04/19/2055	Fri, 10/29/2055	59

APPENDIX B

ECONOMIC INVESTIGATIONS

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

APPENDIX B – ECONOMIC INVESTIGATIONS

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LIST OF FIGURES

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WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

APPENDIX B – ECONOMIC INVESTIGATIONS

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (Corps), Mobile District has evaluated the feasibility of a hurricane and storm damage reduction project in Walton County, Florida. The results of those investigations are presented here and in the accompanying attachments.

1.1 PROBLEM STATEMENT

Walton County's shore line is receding; portions of the study area have experienced steady erosion which has resulted in increased exposure and risk of structural damage. The protective dunes and high bluffs are being destroyed by hurricane and storm forces. The impacts of these storms to property and infrastructure are considerable and can possibly be reduced through a beach restoration and stabilization project.

1.2 PURPOSE

The purpose of this Economic Appendix is to document the economic investigations completed to determine the National Economic Development (NED) Plan and to formulate a hurricane and storm damage reduction project for Walton County, Florida, which will reduce the damaging effects of hurricanes and severe storms to properties along the coast and stabilize or restore the shoreline. The project will be constructible, acceptable to the public, environmentally sustainable and justified by an economic evaluation.

1.3 STUDY AREA

Walton County comprises 26 miles of shoreline including six miles of state parks. A coastal peninsula extending west from the mainland characterizes the western two-thirds of the coastline, and a mainland beach characterizes the eastern third. The Walton County shoreline is characterized by high dune elevations along the mid-section of Walton County. Choctawhatchee Bay lies north of the peninsula. Behind the dune system, upland drainage feeds several freshwater lakes that intermittently breach the dune system and discharge directly into the Gulf. Primary dune elevations range from 13 to 45 feet National Geodetic Vertical Datum (NGVD) and average 26 feet NGVD. During the late 1990s, the area endured several strong hurricanes resulting in extensive shoreline erosion (Taylor Engineering, 2003).

In 2004 the area was affected by Hurricane Ivan and early in the 2005 hurricane season it was impacted again by Hurricanes Arlene and Dennis.

1.4 FEDERAL INTEREST

Congress has authorized Federal participation in hurricane and storm damage reduction projects to prevent or reduce damages caused by wind and tidal generated waves and currents along the Nation's ocean coasts and Great Lakes shores.

1.5 ASSUMPTIONS AND CONSTRAINTS

The economic analysis is based on the following assumptions and constraints:

Assumptions:

- The Fiscal Year (FY) 2013 Federal discount rate of 3.75 percent is used in this evaluation. The period of study is 54 years, beginning in 2010 and concludes after the year 2063 there are four pre-base years from 2010 thru 2013. The base year is FY 2014. Benefits begin to accrue to the project in the base year of FY 2014.
- The price level is in constant FY 2013 dollars.
- The analysis will consider expected future beachfront development.
- Critically eroding beach along Reach 1 will be protected to some level by local project to be constructed as a one-time fill funded by state and county jointly.
- Structure values will be based on depreciated replacement costs.
- Land use zoning and construction codes will not change during the period of analysis.
- Damaged or destroyed properties will be repaired to pre-storm conditions.
- Lost land will be valued at near shore prices.
- Empirical storm frequencies based on historical records for the study area are assumed to be predictive of the probability of future events.
- Beach mice will continue to be a protected species and there will be no changes to existing environmental laws.
- Existing state and county owned public park limits would remain the same in the future.

Constraints:

- The analysis recognizes the State of Florida Coastal Zone Management as well as the Threatened and Endangered Species Act and the Coastal Barrier Resources Act.
- The analysis also assumes that there will be a sufficient quantity of suitable sand for placement on the beaches.
- There is a requirement for the benefit-to-cost ratio (BCR) to be greater than 1-to-1.

The project will be formulated to avoid impacts to dune, lake and Gulf connections.

2.0 SOCIO-ECONOMIC OVERVIEW

2.1 DEMOGRAPHICS

Walton County is located in the State of Florida. Today the county incorporates 1,058 square miles the 2010 estimated population is 55,043 persons, a 36 percent increase over the base population estimate of 40,601 in 2000 making it one of the fastest growing counties in Florida. The estimated number of housing units in 2010 was 5,132 and 53 persons per square mile. The median household income was $47,273. Fourteen point six percent of Walton's population was living below the poverty level. The median value of owner-occupied housing was $199,800. The makeup of the county in 2010 was estimated at 89.5 percent white, 6.2 percent African American,.9 percent American Indian and Alaska Native, 1.0 percent Asian, 2.2 percent reported two or more races and there were 5.5 percent of Hispanic or Latino origin. Because the Gulf of Mexico borders Walton County to the south, the county along with neighboring counties share over 200 miles of beautiful beaches. In Figure B-1 starting from the west side of Florida going east, the counties are as followed: Santa Rosa, Okaloosa, Walton, Bay, and Gulf.

2.2 POPULATION

The population of the five counties is shown for 1990, 2000, and 2010, in Table B-1. All five counties experienced population growth from 1990 to 2010. Combined, the counties grew by about 46 percent, roughly equaling the growth rate of Florida for that same timeframe. Out of the five counties, Okaloosa County has the highest population, 180,882, and Gulf County the lowest, 15,863. Most the growth took place in Santa Rosa and Walton Counties. Walton County led in growth from 1990 to 2010 by increasing over 98 percent followed by Santa Rosa County growth of 85 percent.

FIGURE B-1. COUNTIES OF INTEREST

TABLE B-1
SELECTED POPULATION CHARACTERISTICS[1]

Counties	1990	2000	2010	Percent Change 1990-2000	Percent Change 1990-2010	Land Area Year 2010 Sq. Miles	2010 Persons Per Sq. Mile
Florida	12,937,926	15,982,378	18,801,311	24%	45%	53,624	351
Santa Rosa	81,608	117,743	151,372	44%	85%	1,011	150
Okaloosa	143,777	170,498	180,882	19%	26%	930	182.2
Walton	27,759	40,601	55,043	46%	98%	1,037	53
Bay	126,994	148,217	168,852	17%	33%	758	223
Gulf	11,504	13,332	15,863	16%	38%	564	28
Total ROI	391,642	490,391	572,012	25%	46%	4,300	636.2

[1] Geostat Center: County and City Data Book
http://fisher.lib.virginia.edu/collections/stats/ccdb/
http://quickfacts.census.gov/qfd/states/12/12131.html

2.3 EMPLOYMENT

From 1990 to 2010 the number of persons in Florida's labor force increased by 49.3 percent. Four of the five counties in the study area exceeded the state's increase except for Gulf County which had only a 31.2 percent increase. The highest percentage labor force increase occurred in Walton County, a 151.4 percent increase, Santa Rosa County was the second highest gaining county with a 91 percent increase. The state's unemployment rate for 2010 was a high 11.3 percent but all five counties in the study area had lower rates. Bay County the highest with 10.3 percent and the lowest was 8.1 percent in Okaloosa County.

TABLE B-2
SELECTED EMPLOYMENT CHARACTERISTICS[2]

Counties	Civil Labor Force				Civil Unemployment	
	1990	2000	2010	1990-2010	2010	rate in 2010
Florida	6,167,236	7,490,307	9,209,000	49.32%	1,024,904	11.30%
Santa Rosa	37,398	53,318	71,449	91.05%	7026	9.80%
Okaloosa	62,371	82,486	96,350	54.48%	7,789	8.10%
Walton	12,354	16,404	31,064	151.45%	2,535	8.20%
Bay	57,068	64,938	90,215	58.08%	9249	10.30%
Gulf	4,834	4,861	6,342	31.20%	684	10.8%
Total	174,025	222,007	295,420	69.76%	27,283	9.24%

2.4 INDUSTRY EMPLOYMENT

Selected employment characteristics by place of work for the state and counties for 2007 are shown in Table B-3. Florida had 10,679,883 non-farm workers employed in 2007. The Finance and Service trade industry leads all industries by having 6,080,653 workers within the state. Similarly, the greatest numbers of non-farm workers for the five counties combined are employed in the Finance and Service trade industry also. Okaloosa County had the highest numbers of non-farm workers employed with 130,560 and Gulf County with least amount with 6,118 non-farm workers employed.

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[2] Geostat Center: County and City Data Book
http://fisher.lib.virginia.edu/collections/stats/ccdb/
http://quickfacts.census.gov/qfd/states/12000.html
www.eflorida.com

TABLE B-3
EMPLOYMENT BY INDUSTRY[3]

Counties	2007						
	Total	Agriculture, Mining, & Construction	Manufacturing	Transportation	Wholesale & Retail Trade	Finance and Services	Government
Florida	10,679,883	1,010,779	420,891	350,553	1,608,023	6,080,653	1,208,984
Santa Rosa	51,132	7,337	1,163	1,001	6,926	26,690	8,015
Okaloosa	130,560	10,085	4,641	1,803	16,869	66,057	31,105
Walton	28,759	4,951	639	508	4,407	15,045	3,209
Bay	102,871	10,594	3,597	1,956	15,691	52,890	18,143
Gulf	6,118	940	205	211	665	2,568	1,529
Total	319,440	33,907	10,245	5,479	44,558	163,250	62,001

2.5 HOUSEHOLDS

Table B-4 displays selected household characteristics for Florida and the five counties. All five counties experienced a significant increase in the number of households from 1990 to 2010. Santa Rosa and Walton Counties had the greatest growth in the number of households. Of the five counties, Okaloosa led with 72,400 households in 2010. The median household income also increased from 1989 to 2010 for the five counties. Of the five counties, Okaloosa County had the highest median household income in 2010, but Walton County had the greatest percentage increase from 1989 to 2010, 122 percent. The median household income for Santa Rosa, Bay and Okaloosa Counties were higher than that of the State of Florida in 2010.

2.6 PER CAPITA INCOME

Table B-5 displays the per capita income for Florida and the five counties. In 2010, Okaloosa had the highest per capita income out of the five counties; however, except for Okaloosa and Walton County, the remaining counties had a lower per capita income compared to the State of Florida. Florida per capita income was $ 26,551 in 2010 and Okaloosa County per capita income was $28,621 for that same year. Gulf County had the highest percentage of persons living below the poverty level when compared to the State of Florida.

[3] Bureau of Economic Analysis
http://www.bea.doc.gov/bea/regional/reis/
http://quickfacts.census.gov/qfd/states/12000.html

TABLE B-4
SELECTED HOUSEHOLD CHARACTERISTICS[4]

Counties	Household			Percent Change	Median Household Income			Percent Change
	1990	2000	2010	1990-10	1989	1999	2010	1989-2010
Florida	5,134,869	6,337,929	7,152,844	39%	$27,483	$38,819	$47,661	73.42%
Santa Rosa	29,900	43,793	54,860	83%	$27,584	$41,881	$55,129	99.86%
Okaloosa	53,313	66,269	72,442	36%	$27,941	$41,474	$54,242	94.13%
Walton	11,294	16,548	22,916	103%	$21,297	$32,407	$47,273	121.97%
Bay	48,938	59,597	68,807	41%	$24,684	$36,092	$47,770	93.53%
Gulf	4,324	4,931	5,347	24%	$21,866	$30,276	$39,178	79.17%

TABLE B-5
PER CAPITA INCOME

Counties	Per Capita Income				Percent Change	Percent Change	Percent Change	Percent Persons
	1990	1998	2007	2010	1990-98	1998-2007	2007-2010	Below Poverty Level - 2010
Florida	$18,539	$26,845	$38,417	$26,551	44.80%	43.10%	-30.89%	13.80%
Santa Rosa	$13,565	$21,808	$31,145	$25,382	60.80%	42.80%	-18.50%	11.30%
Okaloosa	$15,803	$24,655	$39,158	$28,621	56.00%	58.80%	-26.91%	10.60%
Walton	$11,588	$16,664	$28,235	$27,746	43.80%	69.40%	-1.73%	12.50%
Bay	$14,814	$22,163	$33,106	$25,003	49.60%	49.40%	-24.48%	12.40%
Gulf	$12,429	$16,754	$23,233	$17,968	34.80%	38.70%	-22.66%	19.50%

[4] Geostat Center: County and City Data Book
http://fisher.lib.virginia.edu/collections/stats/ccdb/
http://quickfacts.census.gov/qfd/states/12000.html

2.7 TRANSPORTATION AND UTILITIES

Walton County is serviced by one Federal Interstate, I-10, and three U.S. Highways; US90, US98 and US331 and four state highways; SR-20, SR81, SR83 and SR-85. One railroad provides rail service, the CSX Main Line. The nearest airport with scheduled commercial airline service is in neighboring Okaloosa Regional Airport. A general aviation airport is located at the DeFuniak Springs Municipal Airport. The local deep water port is 45 miles to the east in neighboring Bay County, the Panama City Port Authority.

There are two natural gas companies providing service, City of DeFuniak Springs and Okaloosa County Gas District. One telephone company, Sprint, provides residential and business services. Five water and sewer companies, City of DeFuniak Springs, City of Freeport, Regional Utilities, South Walton Utilities and Mossy Head Water Works compete in the area.

There are five elementary and five secondary public schools with a current enrollment of 6,522 students served by 323 educators for the county. Okaloosa-Walton Community College and the Walton County Vocational Technical School provide for education beyond the secondary level.

Walton County has three local radio stations two locally printed newspapers 12 banks, three credit unions and two hospitals, Health Mark Regional Medical Center and Sacred Heart Hospital on the Emerald Coast.

3.0 STUDY METHODOLOGY

3.1 EVALUATION FRAMEWORK

Shore protection projects are formulated to provide hurricane and storm damage reduction while recreation benefits are incidental. Engineering Regulation (ER) 1165-2-130 provides policies and guidelines for determining the extent of Federal participation in potential Federal projects for protection from shore erosion, hurricanes, and abnormal tidal and lake flooding that result in damages or losses to coastal resources and/or development. Federal participation in shore protection projects must produce economic justification from storm damage reduction benefits or a combination of damage reduction benefits and recreation benefits not to exceed 50 percent of the total benefits required for justification.

The general economic principles and guidelines for assessing NED benefits are documented in the Water Resources Council's Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies, Chapter II - National Economic Development Benefit Evaluation Procedures (March 10, 1983).

The specific methodologies that will be used for the benefit study are based on the P&G and are documented in ER 1105-2-100, 22 April 2000, Planning – Planning Guidance Notebook, Section I – Hurricane and Storm Damage Reduction, Appendix D – Economic and Social Considerations, and Appendix E – Civil Works Missions and

Evaluation Procedures. Furthermore, the P&G recommends a life-cycle approach and risk and uncertainty analysis:

> "Storm damage reduction studies should adopt a life cycle approach and probabilistic analysis (and display) of benefits and costs. Key considerations are listed below. At a minimum, those with the greatest effect on plan formulation should be explicitly incorporated in the analysis.
>
> a) The erosion damage function
> b) The stage-damage function
> c) The wave-damage function
> d) Storm-related parameters such as peak wave height and period storm duration, peak surge elevation, and timing with respect to tidal phasing
> e) Wave height above the dune
> f) Wave penetration
> g) The shoreline retreat or eroded volume
> h) The natural post-storm recovery

3.2 INCORPORATING RISK AND UNCERTAINTY

The benefits and costs of shoreline protection and storm damage reduction projects are highly uncertain. Predicted costs and benefits are dependent upon a variety of engineering and economic models and assumptions. Future damages are dependent on the sequence of storms, their characteristics, property inventory, erosion, wind, and wave effects and a multitude of other factors.

In order to provide analytical support for projects involving shoreline protection and storm damage reduction, a unified risk-based engineering-economic model has been developed and is being applied to the Walton County Feasibility Study as a test bed application for the estimation of expected annual benefits of various hurricane and storm damage reduction alternatives using the certified hurricane and storm damage simulation model, Beach-*fx*.

3.3 BEACH-*fx* THE HURRICANE AND STORM DAMAGE SIMULATION MODEL

The Beach-*fx* model is an engineering-economic Monte Carlo simulation model that relates beach profile change to storms, coastal processes, and nourishment programs. It is an event-based, data-driven Monte Carlo simulation model. This structure has been used successfully in the past in a large number of Corps studies.

Beach-*fx* represents an improvement on previous models in this arena by being strongly based on representation of the coastal and engineering processes, incorporating the impact of multiple storms, and incorporating uncertainty in damage functions, physical characteristics of structures, and economic valuations. Expected structural damages generated through the simulations are expressed as losses due to flooding, erosion and waves.

3.4 MONTE CARLO SIMULATION

The complexities of the combined engineering-economic problem of risk-based analysis, in which there are uncertainties associated with the physical performance of systems and the economic consequences of that performance, are typically addressed through the use of Monte Carlo simulation techniques. Monte Carlo simulation is particularly useful for physically based real-world problems, where the results of the simulation can be tested against historical and reasonable behaviors.

3.5 ENGINEERING

3.5.1 Representative Profiles

Costal process models need to use a detailed distance versus elevation (x, z) representation of the shoreline. The amount of data required for such a representation is not needed in an economic-engineering type model such as Beach-*fx* and so a simplified representation for the profile has been adopted. This simplified representation for the profile uses five key features, which are dune width, dune height, dune slope, berm width, and berm height.

Figure B-2 is a depiction of the simplified Beach-*fx* profile. This representation is founded on three assumptions: 1) a single dune, 2) a single berm (no separate construction berm), and 3) an equilibrium submerged profile.

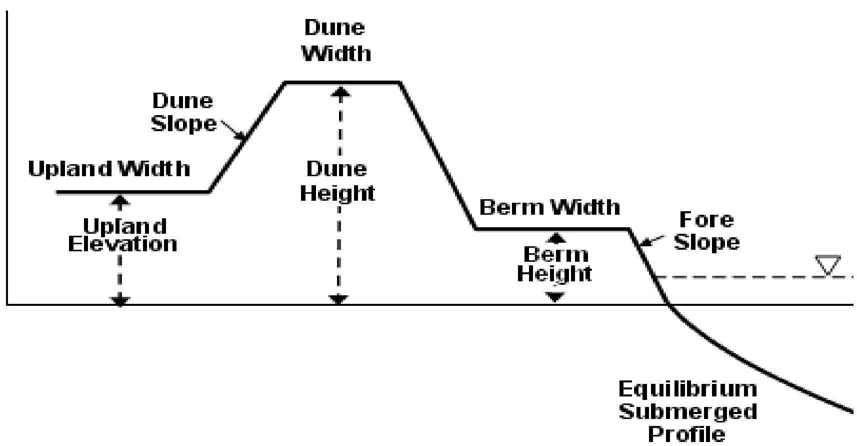

FIGURE B-2. BEACH-*fx* SIMPLIFIED BEACH PROFILE

The beach variables that change with storms are dune width, dune height, berm width, and upland width. Beach variables that are unchanged and remain constant throughout the analysis are upland elevation, dune slope, berm height, foreslope, and shape of the submerged profile. Thus, in response to a given storm, the berm can be eroded or accreted (change in berm width), the dune can change height and/or width, and can translate landward or seaward (change in upland width).

Figure B-3 is a depiction of the simplified Beach-*fx* profile with damage elements viewed in Beach-*fx* model.

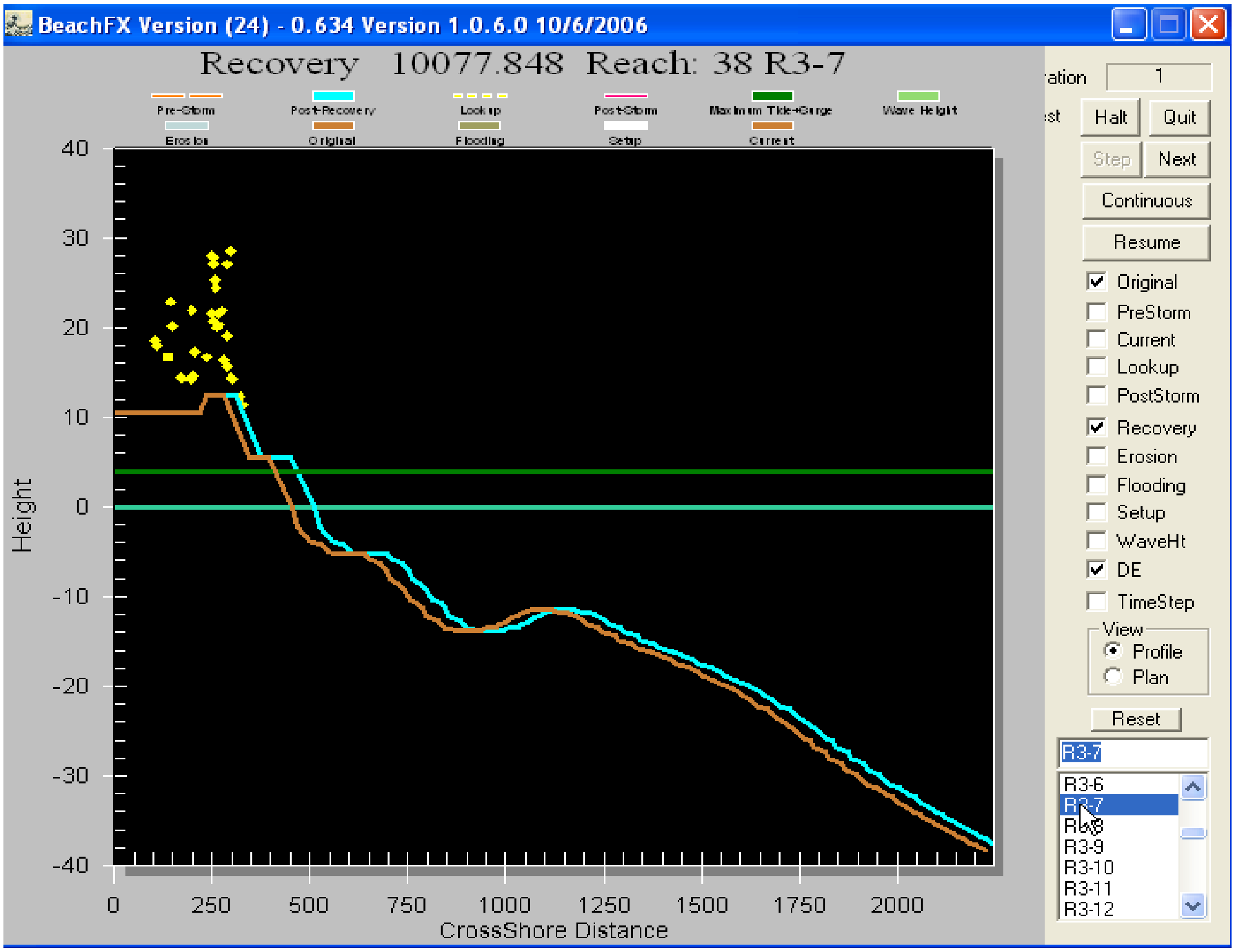

FIGURE B-3. CHARACTERIZATION OF A REPRESENTATIVE PROFILE WITH DAMAGE ELEMENTS IN BEACH-*fx*

3.6 STORM SET

The set of plausible storms include all historical storms that have occurred in the Walton County area and have caused at least one foot of surge.

The Monte Carlo simulation uses the same set of storms that were used to create the Shore Response Database (SRD). As a given storm event from the simulated sequence takes place, the current profile is used to look up the results that are associated with that storm in the SRD for the profile that is 'closest' to the pre-storm profile as tracked in the simulation. These results are then used to define the post-storm profile, to track volume changes, and to determine within-storm erosion, wave heights and water elevations due to the storm along the cross-shore profile.

3.6.1 Storm Seasons and Probability

There are three storm seasons for hurricanes season one June and July, season two August and September and season three October and November. The number of storms in a season divided by the number of years gives the probability of a storm in that season (see Table B-6).

TABLE B-6
STORM SEASONS

			Storm Seasons			
Description	Start Month	Start Day	End Month	End Day	Probability	Probability Of Tropical Storm
No Storms	December	1	May	31	0	0
June Storms	June	1	June	30	0	0.0252
July Storms	July	1	July	31	0	0.042
August Storms	August	1	August	31	0	0.0672
September Storm	September	1	September	30	0	0.1849
October Storms	October	1	October	31	0	0.0588
November Storms	November	1	November	30	0	0.0084
	0	0	0	0	0	0

3.6.2 Storm-Induced Beach Change Model (SBEACH)

A pre-computed database of beach profile responses to storms for a range of storms and profiles was generated utilizing the Storm-Induced BEAch CHange Model (SBEACH), (Larson and Kraus 1989).

SBEACH provided estimates of the short-term cross-shore response to a suite of plausible tropical storm events derived from the historical record of tropical storms impacting the Walton County area.

3.6.3 Shoreline Response Database (SRD)

The SRD is a relational database used to pre-store results of SBEACH runs for all plausible storms, and a range of pre-defined profiles, as expressed by ranges of berm width, dune width, and dune height. Two kinds of results are stored: changes in berm width, dune width, dune height, and upland width, and cross-shore profiles of erosion, wave height, and water depth. The SRD is site and study specific, that is, it is created for each hurricane and storm damage reduction study. The SRD, once generated, is used as a ‘lookup table’ by the Monte Carlo simulation. Within the Monte Carlo simulation, the shoreline modifications are tracked continuously by the simplified profile representation (primarily dune width and height and berm width). The driving force for profile change is the list of plausible storms. These plausible storms are then used to create SBEACH input, which is run against a range of profiles that is expected to cover the range of natural and managed profiles.

For each such pair (storm and profile), both simplified and detailed SBEACH results are stored in the SRD. The output of SBEACH for a given run is an ASCII file that describes the initial, final, maximum, and minimum cross-shore profiles, and the water and wave heights along the cross-shore. This file must be post-processed by software that extracts the values of changes in berm width, dune width, and dune height, and stores the information in the SRD.

The Monte Carlo simulation uses the same set of storms that were used to create the SRD. As a given storm event from the simulated sequence takes place, the current profile is used to look up the results that are associated with that storm in the SRD for the profile that is ‘closest’ to the pre-storm profile as tracked in the simulation. These results are then used to define the post-storm profile, to track volume changes, and to determine within-storm erosion, wave heights and water elevations due to the storm along the cross-shore profile.

3.6.4 Generalized Model for Simulating Shoreline Change (GENESIS)

The Generalized Model for Simulating Shoreline Change (GENESIS) (Hanson and Kraus 1989) provided estimates of long-term shoreline response to existing and without project conditions.

The SBEACH and GENESIS models were developed by the Corps Research and Development Center (ERDC-CHL). Beach-*fx* is run for multiple project life-cycles and provides statistics on probable benefits and costs of the evaluated hurricane and storm damage reduction design alternatives, which is used to determine the economic justification of the project.

Beach-*fx* simulates beach response over time as storms, natural recovery, and management methods alter the beach profile. Events of interest (storms, beach nourishment) take place at calculated times. As each event takes place, the model simulates the physical and economic responses associated with that event. A set of simplified beach profiles, as defined by key data points, are tracked by the simulation model as the beach profile evolves over time.

The model makes use of an SRD that is a pre-generated set of beach profile responses to storms, for a range of storms and profiles. The model uses “plausible storms”, based on historic storms, as initiating events.

The shoreline modification due to a storm is determined through use of a shoreline response model. The SBEACH, cross-shore storm response model and the GENESIS long-term shoreline response model were used to evaluate existing and without project configurations for this study. The SRD contains information on the input (pre-storm) profile, the storm, and the response (post-storm) profile, for many combinations of storms and pre-storm profiles. Beach-*fx* then reads information from the SRD as needed to determine shoreline change following a storm event.

As each storm is processed, the shoreline response is determined, and a post-storm beach configuration is calculated, as well as profiles of maximum water level, wave height, and erosion during the storm. This information is used to determine economic damages, based on empirical curves (damage functions) relating the percentage loss of value of structure and contents to “damage-driving parameters” calculated from the aforementioned profiles and characteristics of the structure. A flowchart of the Beach-*fx* modeling methodology is provided in Figure B-4.

Beach-*fx* relies on external coastal process models to predict the morphologic response of the beach profile to storm events and shoreline response to long-term processes.

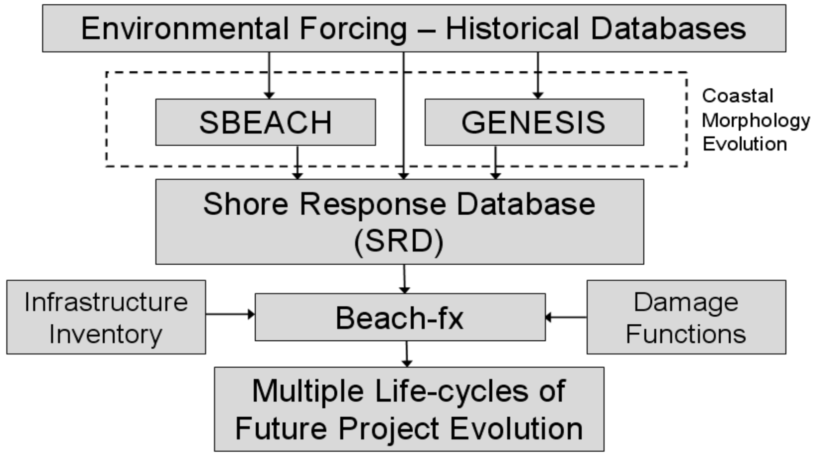

FIGURE B-4. BEACH-*fx* MODELING METHODOLOGY

4.0 EXISTING CONDITIONS

Walton County's 26 miles of coastline initially was subdivided into reaches that very nearly coincided with the neighborhood divisions that already existed in the county's coastal community. That division resulted in 10 major reaches initially formulated for economic reach delineation (see Table B-7).

Due to the effects of Hurricane Ivan on the beach the Project Delivery Team (PDT) decided that the project existing conditions had changed significantly. As a result new surveys of the beach were ordered and obtained. A new existing condition was established and named post-Ivan. That existing condition then became the initial point of beach condition (base condition) for the 54-year period of study accommodating a 50-year period of analysis.

Further the PDT sought out, briefed and obtained from all the affected stakeholders approval of an expedited study plan which resulted in a revised Project Management Plan (PMP). The PMP included reducing the number of study reaches to five. Table B-8 and Figure B-5 lays out the revised major study reaches. Within these reaches there are 117 sub-reaches or Beach-*fx* model reaches, which are the same except for their naming convention. The sub-reaches average about 1,000 feet in length and are numbered from west to east.

TABLE B-7
INITIAL MAJOR STUDY REACHES

Reach	Reach Name
1	Miramar Beach to Sandestin
2	Sandestin and 4 Mile Village
3	Topsail Hill Preserve State Park
4	Beach Highlands and Dune Allen
5	Santa Rosa Beach
6	Blue Mountain Beach
7	Gulf Trace, Grayton Beach, Grayton Beach State Park and Watercolor
8	Seaside and Seagrove
9	Dear Lake State Recreation Area, Watersound and Seacrest West
10	Seacrest West, Rosemary beach and Inlet Beach

TABLE B-8
REVISED MAJOR STUDY REACHES

Reach	Reach Name
1	Miramar Beach, Sandestin and Four Mile Village
2	Topsail Hill Preserve State Park
3	Beach Highlands, Dune Allen, Santa Rosa Beach, Blue Mountain and Gulf Trace
4	Grayton Beach State Park, Grayton Beach,
5	Watercolor, Seaside, Seagrove, Watersound Seacrest Rosemary and Inlet Beach

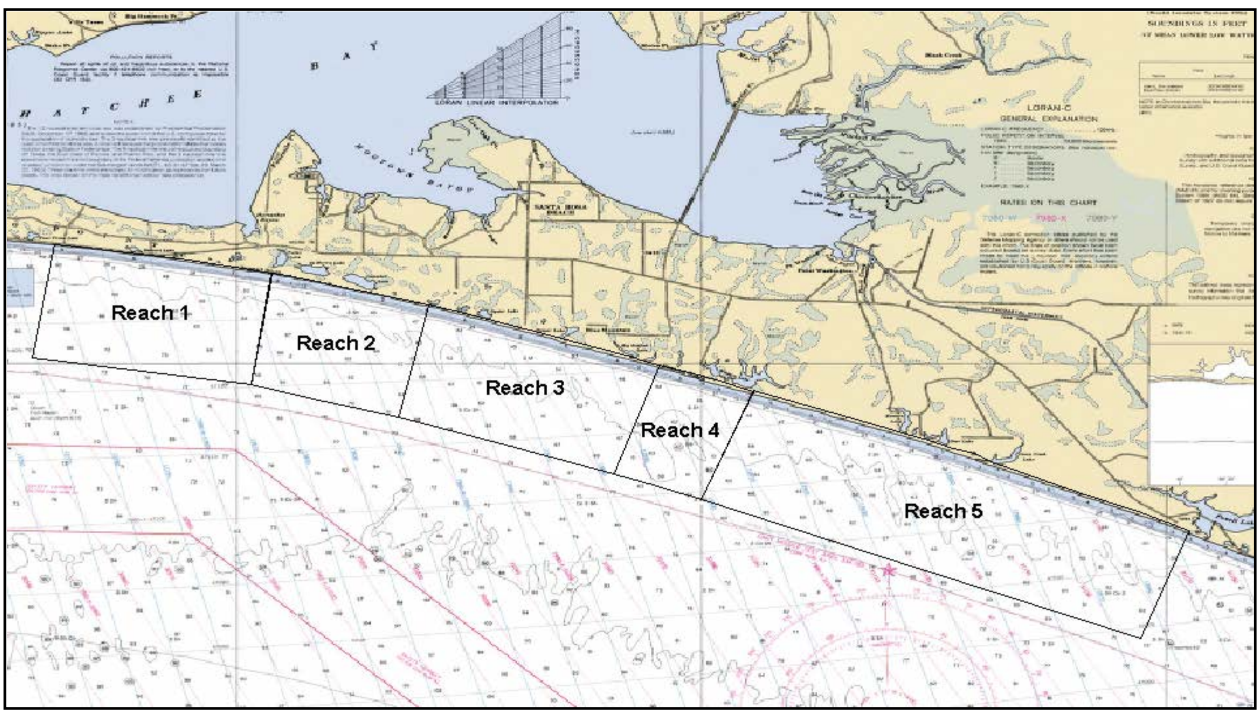

FIGURE B-5. REVISED STUDY REACHES

The post-Ivan survey data was employed to produce revised representative profiles. The result of which reduced the number of representative profiles to 11. Reaches 1, 2, 3, and 4 could be represented by two profiles each while reach 5 required 3 representative profiles. These representative profiles characterized the typical without project beach morphology for input into Beach-*fx*.

In the with project condition these profiles are combined with alternative design templates to characterize that condition for various beach fill alternatives. Table B-9 lists the various reaches and associated profiles.

TABLE B-9
WALTON COUNTY STUDY AREA
SUB-REACHES, MODEL REACHES AND PROFILES

Model Reach	FDEP Monument	Beach-Fx Reach	Representative Profile	Study Reach
1	R-1	R1-1	R1P1	**1**
2	R-2	R1-2	R1P1	**1**
3	R-3	R1-3	R1P1	**1**
4	R-3A	R1-4	R1P1	**1**
5	R-4	R1-5	R1P1	**1**
6	R-5	R1-6	R1P1	**1**
7	R-6	R1-7	R1P1	**1**
8	R-6A	R1-8	R1P1	**1**
9	R-7	R1-9	R1P1	**1**
10	R-8	R1-10	R1P1	**1**
11	R-9	R1-11	R1P1	**1**
12	R-10	R1-12	R1P1	**1**
13	R-11	R1-13	R1P1	**1**
14	R-12	R1-14	R1P1	**1**
15	R-13	R1-15	R1P2	**1**
16	R-14	R1-16	R1P2	**1**
17	R-15	R1-17	R1P2	**1**
18	R-16	R1-18	R1P2	**1**
19	R-17	R1-19	R1P2	**1**
20	R-18	R1-20	R1P2	**1**
21	R-19	R1-21	R1P1	**1**
22	R-20	R1-22	R1P1	**1**
23	R-21	R1-23	R1P1	**1**
24	R-22	R1-24	R1P1	**1**
25	R-23	R2-1	R2P1	**2**
26	R-24	R2-2	R2P1	**2**
27	R-25	R2-3	R2P2	**2**
28	R-27	R2-4	R2P1	**2**
29	R-29	R2-5	R2P2	**2**
30	R-30	R2-6	R2P1	**2**
31	R-40	R2-7	R2P1	**2**
32	R-41	R3-1	R3P1	**3**

TABLE B-9 (CONTINUED)
WALTON COUNTY STUDY AREA
SUB-REACHES, MODEL REACHES AND PROFILES

33	R-42	R3-2	R3P1	**3**
34	R-43	R3-3	R3P1	**3**
35	R-44	R3-4	R3P2	**3**
36	R-45	R3-5	R3P2	**3**
37	R-46	R3-6	R3P2	**3**
38	R-47	R3-7	R3P2	**3**
39	R-48	R3-8	R3P1	**3**
40	R-49	R3-9	R3P1	**3**
41	R-50	R3-10	R3P1	**3**
42	R-51	R3-11	R3P1	**3**
43	R-52	R3-12	R3P1	**3**
44	R-53	R3-13	R3P1	**3**
45	R-54	R3-14	R3P1	**3**
46	R-55	R3-15	R3P1	**3**
47	R-56	R3-16	R3P1	**3**
48	R-57	R3-17	R3P1	**3**
49	R-58	R3-18	R3P1	**3**
50	R-59	R3-19	R3P1	**3**
51	R-60	R3-20	R3P1	**3**
52	R-61	R3-21	R3P1	**3**
53	R-62	R3-22	R3P1	**3**
54	R-63	R3-23	R3P1	**3**
55	R-64	R3-24	R3P2	**3**
56	R-65	R3-25	R3P2	**3**
57	R-66	R3-26	R4P1	**4**
58	R-67	R4-1	R4P1	**4**
59	R-68	R4-2	R4P1	**4**
60	R-69	R4-3	R4P2	**4**
61	R-70	R4-4	R4P2	**4**
62	R-71	R4-5	R4P1	**4**
63	R-72	R4-6	R4P2	**4**
64	R-73	R4-7	R4P2	**4**
65	R-74	R4-8	R4P1	**4**
66	R-76	R4-9	R4P1	**4**
67	R-78	R5-1	R5P2	**5**
68	R-79	R5-2	R5P2	**5**
69	R-80	R5-3	R5P2	**5**
70	R-81	R5-4	R5P2	**5**
71	R-82	R5-5	R5P2	**5**
72	R-83	R5-6	R5P1	**5**
73	R-84	R5-7	R5P1	**5**
74	R-85	R5-8	R5P1	**5**
75	R-86	R5-9	R5P2	**5**
76	R-87	R5-10	R5P2	**5**
77	R-88	R5-11	R5P2	**5**
78	R-89	R5-12	R5P2	**5**
79	R-90	R5-13	R5P2	**5**

TABLE B-9 (CONTINUED)
WALTON COUNTY STUDY AREA
SUB-REACHES, MODEL REACHES AND PROFILES

80	R-91	R5-14	R5P2	**5**
81	R-92	R5-15	R5P2	**5**
82	R-93	R5-16	R5P2	**5**
83	R-94	R5-17	R5P3	**5**
84	R-95	R5-18	R5P2	**5**
85	R-96	R5-19	R5P3	**5**
86	R-97	R5-20	R5P2	**5**
87	R-98	R5-21	R5P2	**5**
88	R-99	R5-22	R5P3	**5**
89	R-100	R5-23	R5P3	**5**
90	R-101	R5-24	R5P2	**5**
91	R-102	R5-25	R5P2	**5**
92	R-103	R5-26	R5P1	**5**
93	R-103A	R5-27	R5P3	**5**
94	R-104	R5-28	R5P3	**5**
95	R-105	R5-29	R5P2	**5**
96	R-106	R5-30	R5P2	**5**
97	R-107	R5-31	R5P2	**5**
98	R-108	R5-32	R5P1	**5**
99	R-109	R5-33	R5P1	**5**
100	R-110	R5-34	R5P1	**5**
101	R-111	R5-35	R5P1	**5**
102	R-112	R5-36	R5P1	**5**
103	R-113	R5-37	R5P1	**5**
104	R-114	R5-38	R5P1	**5**
105	R-115	R5-39	R5P1	**5**
106	R-116	R5-40	R5P2	**5**
107	R-117	R5-41	R5P2	**5**
108	R-118	R5-42	R5P2	**5**
109	R-119	R5-43	R5P2	**5**
110	R-120	R5-44	R5P2	**5**
111	R-121	R5-45	R5P2	**5**
112	R-122	R5-46	R5P2	**5**
113	R-123	R5-47	R5P2	**5**
114	R-124	R5-48	R5P3	**5**
115	R-125	R5-49	R5P3	**5**
116	R-126	R5-50	R5P3	**5**
117	R-127	R5-51	R5P3	**5**

4.1 LAND USE

The coastal beach community layout is somewhat typical of other beach and shoreline development along the Gulf Coast; a checkerboard pattern of single and multi-family residential areas intermixed with few commercial areas. Walton County's beach shore side development has less commercial trade on the front row shoreline probably due to the high cost of the land and real estate taxes which affects profitability. Instead most commercial trade establishments prefer to locate on the north side of the beach road.

The current trend in land use on the shoreline continues to be principally single and multi-family development, with little commercial trade development.

4.2 FUTURE DEVELOPMENT

Development is both ongoing and continuous at Walton County, as it is likely to continue into the immediate and the near future until the small amount of remaining beachfront, save the state and county properties, is completely developed. The characteristic of the existing beachfront is composed of single and multi-family housing. The multi-family housing includes 29 multi-floored condominiums and resort complexes consisting of four floors or more.

4.3 PROPERTY INVENTORY

Recent beach front development in Walton County has predominately been high-rise condominiums, residential-resorts and residential communities. Most of the coastal area that is not state or county property is highly developed. Construction of new single and multi-family residential structures is on-going at a brisk pace. The few remaining undeveloped large private holdings are showing signs of infrastructure preparations for development.

In the spring of 2004 a complete property inventory of existing structures that may benefit from a storm damage reduction project was undertaken. In 2010, a windshield survey of the study area was undertaken. That survey revealed no significant changes had occurred since the last inventory was completed. Some structures that were under construction are now fully constructed. They were already entered in the initial property inventory along with their values. The 2004 property inventory structure values were also updated. A sample of structures by type was collected and an update factor was computed. That factor was used to update structure values. The purpose of this inventory is to gather data required for the Beach-*fx* data inputs and to obtain a database that would facilitate the gathering of critical metrics that locate the structure spatially in relation to the shoreline and the beach profile as well as its elevation.

Beach-*fx* considers the inventory of structures (damage elements) as items that are containerized in 'lots'. Lots form boundaries that contain damage elements. Lots are defined as quadrilaterals that approximate lot parcels as delineated in the tax assessor's files, databases and Geographic Interface Systems (GIS). An aggregation of lots that are for the most part contiguous composes a reach. All reaches taken in aggregate compose the study area.

Photos of structures along with pertinent statistics of construction and foundation type, number of floors, and accompanying detached structures that may benefit from a project were also collected.

The result of that inventory is displayed in Table B-10.

TABLE B-10
STRUCTURE INVENTORY COUNT BY REACH BY TYPE

Damage Element	Major Study Reaches				
	1	2	3	4	5
Commercial	10		1	7	13
Single-Family	99		268	118	348
Multi-Family	62		37	21	99
Walkovers	151		189	20	263
Pool	36		12	9	84
Gazebo	4		7		7
Jacuzzi	4				
Total	366		514	175	814
Grand Total	1869				

4.4 VALUE OF COASTAL INVENTORY

4.4.1 Structure Value

The depreciated replacement cost of structures in the study area is required for the economic analysis to determine NED benefits.

The Mobile District Real Estate Division (RE) conducted investigations to determine the depreciated replacement cost for single family residential structures. Depreciated replacement cost is based on a combination of adjusting criterion using a formula that takes into account the category and age of the structure. Replacement cost is the cost of physically replacing the structure. Depreciation accounts for deterioration occurring prior to flooding and variations in remaining useful life of the structure. Depreciated replacement cost was calculated for a representative sample of fifty structures. Tax assessor assessed values for improvements (net of land value) are compared to the calculated depreciated replacement cost to yield a ratio to estimate that is used to estimate the remaining structures depreciated replacement cost. The point estimate served as the mean or average value random variable in Beach-*fx*. The low and high estimates around the mean were developed by using plus and minus ten percent of the mean value to represent plus and minus one standard deviation's variance around the likely value. Tax assessor's records were examined and studied on the current inventory. Variables of interest relating to assessed value, date of construction, type of construction, number of floors, square footage, recent sales and selling prices, along with other information was analyzed. Sampling techniques, professional judgment, professional guidelines, and consultations with the tax assessor's office and field visits composed of methods used to complete the investigations.

Some of the findings from that analysis were that there were two significantly different classes of valuations between the types of development in Walton County: pre-1990 construction and post-1990 construction. The handful of pre-1990 typical construction was generally less than 1,800 square foot one story structures. Many were on grade and most were of masonry or brick construction and only a few made of wood. Assessed values for these structures were very low when compared to calculated depreciated replacement costs. The value of the land has outgrown the value of the structure. When these structures are sold they are usually torn down for larger and more expensive ones. On average they were assessed about one-half of their depreciated replacement cost. The Walton County inventory for these structures saw their assessed value increased by 200 percent to arrive at their true depreciated replacement cost.

Post-1990 construction was much larger than 1,800 square feet and most are multi-storied structures the majority of which are higher than four floors. The division between masonry, and wood was about equal for the majority of structure while the remaining minority was brick or wood. A representative sample of 51 properties were selected and used by the Mobile District's appraiser to calculate the depreciated replacement cost to determine the ratio to convert the remaining structure to depreciated replacement cost. The agreed upon methodology for determining depreciated replacement cost was to estimate replacement cost as 125 percent of assessed value.

A relationship between assessed values and depreciated replacement cost for multi-family structures was found to be highly variable and not reliable. The methodology that would render the best estimate of depreciated replacement cost for these structures was to begin with current per square foot construction costs and depreciates that value by two percent each year of age. Current construction costs developed from recent activity was estimated to be $160.00 a square foot for construction less than 20,000 square feet and $175.00 per square foot for construction greater than 20,000 square feet.

Telephonic conversations with the Walton County Tax Assessor about trends in the market from 2008 to date reveals that for South Walton County, all lands south of Choctawhatchee Bay, began to show a slight decline of about 5.7 percent. The decline continued into 2009 and 2010 with 22 and 18 percent reductions. The fall slowed in 2011 showing 4.5 percent and increased just slightly in 2012 by one-tenth of one percent, just enough to signal a possible turnaround.

Walkovers were valued at an average $200.00 per linear foot for wood structures and $320.00 per square foot for structures constructed from a commercially produced composite called 'Trex' that was used for public access provided by the Walton County Tourist Development Council's (TDC) public accesses. The TDC obtained these values from recent invoices for walkovers and their own access construction costs. Pool values were based on an average updated composite value obtained by interviews and sampling for an earlier study in neighboring Bay County. The few jacuzzis and tennis court values were based on typical sized units at current costs.

4.4.2 Content Value – Structure-Content Ratio

The National Flood Insurance Agency claims database was searched for paid claim history in Walton and the neighboring counties of Bay, Okaloosa and Fort Walton. These records show the date of the loss and what was paid for building and content loss for each claim. No claims were found for any of these counties.

A web search of trade associations of homeowner casualty underwriters revealed that insurers generally use a content to structure ratio between 50 and 75 percent of replacement cost. The Walton County inventory is valued at depreciated replacement cost not full replacement cost. The average insurer's content to structure ratio of 62.5 percent was used to estimate the value of contents for Walton County based on depreciated structure replacement cost. The range between 50 and 75 percent is 25 percent, so assuming six standard deviations in the range one standard deviation is about 4.16 percent. The Beach-*fx* triangular distribution used the mean structure-to-content ratio, 62.5 percent plus and minus 10 percent, to specify the low and high value, plus and minus 6.25 percent, which is a little larger than the one standard deviation of 4.16 percent.

Table B-11 presents the structure and content value of damageable property value based on depreciated replacement cost. Damageable property value is used here to reflect that only the lower two floors of multi-storied structures were valued in the property inventory as they alone were susceptible to modeling damages.

TABLE B-11
VALUE OF WALTON COUNTY
STRUCTURE AND CONTENT VALUE BY REACH
(DOLLARS IN MILLIONS)

	Reach				
	1	2	3	4	5
Damage Elements	366		514	175	814
Structure Value	$317.3		$164.9	$33.7	$276.9
Content Value	$156.1		$78.9	$16.2	$133.5
Total	$473.4		$243.8	$49.9	$410.4
Grand Total	$1,177.5				

5.0 ECONOMIC BENEFIT EVALUATION

5.1 ASSUMPTIONS

The economic benefits are from four categories: storm damage reduction, lost land reduction, elimination of emergency nourishment costs and recreation. The primary benefit category is the storm damage reduction as mandated in ER 1105-2-100, hurricane and storm damage reduction projects are to be formulated to provide for storm damage reduction.

Benefits are stated in constant FY 2013 dollars. The period of analysis is 50 years from January 2014 through and including all of the year 2063, there are four pre-project base years, 2010 through 2013, making the period of study 54 years. The base year is FY 2014. The structure inventory is valued at FY 2013 dollars.

5.2 STORM DAMAGE REDUCTION

Beach-*fx* calculates the storm damage reduction from inundation, storm-induced erosion, long-term erosion and wave attack on a damage element-by-damage element basis for each storm event for the study period for a large number of iterations.

5.2.1 Damage Functions

The damage functions used in Beach-*fx* are those developed for the Institute for Water Resources (IWR). A Coastal Storm Damage Workshop (CSDW) was held in Alexandria, Virginia to solicit expert-opinion for economic consequence assessment of coastal storm damage. The workshop is part of longer-term research effort whose objective is to develop a peer-reviewed, step-by-step methodology for estimating coastal storm damages.

The objective of that workshop was to discuss and recommend damage relationships needed to predict structural damage from coastal storms as functions of hazard intensity levels, with associated uncertainties, resulting from erosion, waves, inundation, and their combined effects. Because information on the relationship between residential structural damage and storm parameters is limited, this workshop used expert opinion as a means of gaining information on these relationships (see Ayyub 2001). A report describing the results of the workshop both in terms of damage relationships and future information needs identified by the experts at the workshop is included in Attachment II – Coastal Storm Damage Relationships Based on Expert Opinion Elicitation.

The CSDW, resulted in a set of lookup curves, defined for various damage types and foundation types, to calculate percentage loss associated with structure and contents. For each damage type, the input to these curves, or the “damage driving parameter”, has been defined by the CSDW. The appropriate damage-driving parameters for each damage type are:

Flooding:

Depth of water over walking surface of lowest walking floor

Waves:

Difference between the top of wave (crest) and the bottom of the lowest horizontal member

Erosion:

Percent of footprint compromised

Damage functions for each damage type (erosion, inundation, and wave) are currently associated with damage element type (single family residential, multi-family residential, walkway, etc.) foundation type (shallow piles, deep piles, slab, etc.) and construction type (wood frame concrete, masonry, etc.) and armor type (No armor, sheet pile, etc.) are used to select the appropriate damage function.

Damages are calculated at the damage element level, following each storm. For each damage type, a damage driving parameter is calculated for each damage element, and used as a lookup into stored damage functions. The participants in the CSDW developed the triangular distributions using a mid, high and low value to describe each increment of the damage function which is sampled by Beach-*fx* during the simulation runs.

5.2.2 Damage Element

Damages are estimated based on the concept of a “damage element”. Damage elements are structures, walkways, etc., anything that can incur economic losses. In Beach-*fx*’s system hierarchy reaches contain lots, and lots contain damage elements. For each storm, damages are estimated by examining the reach, lots, and damage elements within the lots. Thus, the basic unit on which damages are calculated at present is the damage element. Damage elements have attributes relating to type, geographic location, and value. Each damage element has information relating to structure and content value (treated as a three-parameter distribution for purposes of incorporating uncertainty). For location information, a structure’s center point is referenced, as well as its width and length. A single value of ground elevation is specified, which also includes a three-parameter distribution for describing the first floor elevation and uncertainty.

5.2.3 Damage Estimation

Damages are estimated, based on calculation of the value of a “damage-driving parameter” for the damage element, which is then used as the independent variable to use for lookup into the stored damage functions. These damage functions provide the percentage loss for structure and contents.

5.2.4 Structure and Content Damages

The determination of structure and content damage was calculated using the IWR damage functions. These damage functions generally give the percent damage as related to a water level for inundation damages, and the percent of structure footprint compromised to calculate storm induced and long-term erosion damages.

5.2.5 Inundation Damages

Inundation damages occur when storm surge elevations exceed the elevation of the dune line, or when waves break over the dunes. Inundation damages were assumed to begin for existing conditions when the maximum water level exceeded the first floor elevation of structure, since there is not always a continuous dune system.

5.3 LOST LAND REDUCTION

The P&G states that erosion protection benefits include loss of land, structural damage prevention, reduced emergency costs, reduced maintenance of existing structures and incidental benefits. The loss of land benefit is measured as the value of near shore upland. Near shore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore.

A hurricane and storm damage reduction project that prevents the loss of land due to erosion accrues benefits to that project alternative. The land lost reduction benefit was calculated for eroding reaches by calculating amount of land that would be lost during the study period times the value of near shore upland.

5.4 LOSS OF LAND BENEFIT

With a project in place land that would be lost in the without project future condition would be preserved by a project. The design template that represents the project that provides full benefits to protected properties would be in place for the period of analysis preserved through of process of periodic renourishment. This benefit is based upon the value of near shore lands. Normally determinations of the market value for the land losses are based on the value of near shore upland. Near shore upland is sufficiently removed from the shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant (inland) from the shore. Other valuation methods could be acceptable, if it can be shown that the use of near shore values does not provide a realistic estimate of the value of lost land. For this project, near shore values were estimated by RE. The criterion used was near shore lands are those parcels that are sufficiently removed from the shore to lose any direct water frontage value. These parcels have; no Gulf frontage, no view of the water, no access point to the Gulf as part of any deeded subdivision rights. The methodology used was to track 2005 and 2006 sales of near shore parcels in Walton County. Since property values varied according to location and sale prices also varied broadly due to the pause in the market caused by the storm activity on the Gulf in 2004 and 2005, a range of values, a low and a high, price per square foot was calculated. Then the average of the high and low was used to estimate the value of land lost. The value used represents a long-term value suitable for the period of evaluation.

Table B-12 shows near shore value, annual erosion rate and land lost benefit by reach. Accreting reaches have positive values and eroding reaches show negative values.

TABLE B-12
VALUE OF LAND LOST BY REACH

Sub-Reach	Model Reach	Reach Length (ft)	Representative Profile	Average Annual Erosion	Near Shore Land Value per Sq. Ft.	Value of Land Loss
1	R1-1	1149.8	R1P1	0.6808	$70.00	$54,794.87
2	R1-2	1101.6	R1P1	0.6435	$70.00	$49,621.57
3	R1-3	1043.6	R1P1	0.5137	$70.00	$37,526.81
4	R1-4	1001.8	R1P1	0.3958	$70.00	$27,755.87
5	R1-5	1061.8	R1P1	0.3077	$70.00	$22,870.11
6	R1-6	1044.6	R1P1	0.0926	$70.00	$6,771.10
7	R1-7	1002.7	R1P1	0.0063	$70.00	$442.19
8	R1-8	1061.4	R1P1	0.0156	$70.00	$1,159.05
9	R1-9	1013.6	R1P1	0.0284	$70.00	$2,015.04
10	R1-10	959.4	R1P1	0.0926	$70.00	$6,218.83
11	R1-11	1021.2	R1P1	0.1216	$70.00	$8,692.45
12	R1-12	1056.7	R1P1	0.0508	$70.00	$3,757.63
13	R1-13	1040.1	R1P2	-0.0008	$70.00	-$58.25
14	R1-14	1050.6	R1P2	-0.1008	$70.00	-$7,413.03
15	R1-15	997.9	R1P2	-0.1155	$70.00	-$8,068.02
16	R1-16	1024.7	R1P2	-0.1263	$85.00	-$11,000.67
17	R1-17	1113.6	R1P2	-0.1183	$85.00	-$11,197.80
18	R1-18	1133.1	R1P2	-0.1323	$85.00	-$12,742.28
19	R1-19	1058.4	R1P2	-0.0633	$85.00	-$5,694.72
20	R1-20	961	R1P1	0.1033	$85.00	$8,438.06
21	R1-21	952.1	R1P1	0.1122	$85.00	$9,080.18
22	R1-22	1028	R1P1	0.2459	$85.00	$21,486.74
23	R1-23	1085.9	R1P1	0.3952	$85.00	$36,477.55
24	R1-24	1038.7	R1P1	0.4652	$85.00	$41,072.28
25	R2-1	990	R2P1	0.3687	$85.00	$31,026.11
26	R2-2	935.5	R2P1	0.2417	$45.00	$10,174.97
27	R2-3	2160.3	R2P2	0.3044	$45.00	$29,591.79
28	R2-4	2065.5	R2P1	0.2417	$45.00	$22,465.41
29	R2-5	1001.3	R2P2	0.1844	$45.00	$8,308.79
30	R2-6	10078.2	R2P1	-0.5495	$45.00	-$249,208.69
31	R2-7	1040.4	R2P1	0.3869	$45.00	$18,113.88
32	R3-1	1147	R3P1	0.4031	$45.00	$20,806.01
33	R3-2	1037.4	R3P1	0.4283	$45.00	$19,994.33
34	R3-3	1051.6	R3P1	0.4316	$45.00	$20,424.18
35	R3-4	1026	R3P2	0.5535	$45.00	$25,555.10
36	R3-5	1120.7	R3P2	0.4180	$45.00	$21,080.37
37	R3-6	1184.9	R3P2	0.2885	$45.00	$15,382.96
38	R3-7	1155.8	R3P2	0.0960	$45.00	$4,993.06
39	R3-8	1102.9	R3P1	-0.2985	$45.00	-$14,814.70

TABLE B-12 (CONTINUED)
VALUE OF LAND LOST BY REACH

Sub-Reach	Model Reach	Reach Length (ft)	Representative Profile	Average Annual Erosion	Near Shore Land Value per Sq. Ft.	Value of Land Loss
40	R3-9	1057.8	R3P1	-0.3588	$45.00	-$17,079.24
41	R3-10	1068.2	R3P1	-0.4446	$45.00	-$21,371.48
42	R3-11	1044.7	R3P1	-0.5076	$45.00	-$23,863.04
43	R3-12	1006.8	R3P1	-0.4978	$75.00	-$37,588.88
44	R3-13	1004	R3P1	-0.5924	$75.00	-$44,607.72
45	R3-14	1345	R3P1	-0.7700	$75.00	-$77,673.75
46	R3-15	1061.8	R3P1	-0.8489	$75.00	-$67,602.15
47	R3-16	731.7	R3P1	-0.9596	$75.00	-$52,660.45
48	R3-17	1016.6	R3P1	-1.0926	$75.00	-$83,305.29
49	R3-18	1039.4	R3P1	-1.1151	$75.00	-$86,927.62
50	R3-19	1036	R3P1	-1.0589	$75.00	-$82,276.53
51	R3-20	1026.7	R3P1	-1.0373	$75.00	-$79,874.69
52	R3-21	1029	R3P1	-1.0106	$75.00	-$77,993.06
53	R3-22	978	R3P1	-0.9243	$75.00	-$67,797.41
54	R3-23	855.4	R3P1	-0.8319	$75.00	-$53,370.54
55	R3-24	1115	R3P2	-0.5435	$75.00	-$45,450.19
56	R3-25	1274	R3P2	-0.3414	$75.00	-$32,620.77
57	R3-26	1082.2	R4P1	-0.3292	$75.00	-$26,719.52
58	R4-1	1082	R4P1	-0.6703	$75.00	-$54,394.85
59	R4-2	1125.7	R4P1	-0.5439	$75.00	-$45,920.12
60	R4-3	981.5	R4P2	0.0509	$75.00	$3,746.88
61	R4-4	942.1	R4P2	0.1131	$75.00	$7,991.36
62	R4-5	998.1	R4P1	-0.2903	$75.00	-$21,731.13
63	R4-6	971.4	R4P2	0.0925	$75.00	$6,739.09
64	R4-7	1060.9	R4P2	-0.1046	$75.00	-$8,322.76
65	R4-8	2119.2	R4P1	-0.5521	$75.00	-$87,750.77
66	R4-9	2074.7	R4P1	-0.9889	$75.00	-$153,875.31
67	R5-1	993.1	R5P2	-0.8973	$112.50	-$100,249.72
68	R5-2	1003	R5P2	-0.6237	$112.50	-$70,376.75
69	R5-3	1039.4	R5P2	-0.3263	$112.50	-$38,155.07
70	R5-4	1303.7	R5P2	-0.0772	$112.50	-$11,322.63
71	R5-5	1009.2	R5P2	0.1001	$112.50	$11,364.85
72	R5-6	1061.5	R5P1	-0.2592	$112.50	-$30,953.34
73	R5-7	1037.5	R5P1	-0.3266	$112.50	-$38,120.34
74	R5-8	991.6	R5P1	-0.4109	$67.50	-$27,502.77
75	R5-9	1026.5	R5P2	-0.2260	$67.50	-$15,659.26
76	R5-10	1010.7	R5P2	-0.2626	$67.50	-$17,915.16
77	R5-11	1022.2	R5P2	-0.2847	$67.50	-$19,643.87

TABLE B-12 (CONTINUED)
VALUE OF LAND LOST BY REACH

Sub-Reach	Model Reach	Reach Length (ft)	Representative Profile	Average Annual Erosion	Near Shore Land Value per Sq. Ft.	Value of Land Loss
78	R5-12	1018	R5P2	-0.2734	$67.50	-$18,786.68
79	R5-13	1016.5	R5P2	-0.2876	$67.50	-$19,733.31
80	R5-14	1005.3	R5P2	-0.2623	$67.50	-$17,799.09
81	R5-15	1011	R5P2	-0.3549	$67.50	-$24,219.26
82	R5-16	1035.2	R5P2	-0.3543	$67.50	-$24,757.07
83	R5-17	942.6	R5P3	-0.2078	$67.50	-$13,221.38
84	R5-18	999.9	R5P2	-0.3578	$67.50	-$24,149.08
85	R5-19	1010.9	R5P3	-0.0820	$35.00	-$2,901.28
86	R5-20	1028.6	R5P2	0.0051	$35.00	$183.61
87	R5-21	1122	R5P2	-0.0141	$35.00	-$553.71
88	R5-22	1029.7	R5P3	-0.0545	$35.00	-$1,964.15
89	R5-23	1013.1	R5P3	-0.0144	$35.00	-$510.60
90	R5-24	1021.7	R5P2	-0.1929	$35.00	-$6,898.01
91	R5-25	1054.4	R5P2	-0.4140	$35.00	-$15,278.26
92	R5-26	884.4	R5P1	-0.4138	$35.00	-$12,808.77
93	R5-27	1044.2	R5P3	-0.2764	$35.00	-$10,101.59
94	R5-28	1058.5	R5P3	-0.3145	$35.00	-$11,651.44
95	R5-29	986.7	R5P2	-0.4391	$87.50	-$37,910.25
96	R5-30	1021.8	R5P2	-0.3674	$87.50	-$32,848.32
97	R5-31	1014.9	R5P2	-0.3815	$87.50	-$33,878.63
98	R5-32	984.6	R5P1	-0.7184	$87.50	-$61,891.96
99	R5-33	1025.3	R5P1	-0.6970	$87.50	-$62,530.48
100	R5-34	1037.8	R5P1	-0.5918	$87.50	-$53,739.88
101	R5-35	1002.2	R5P1	-0.6019	$87.50	-$52,782.12
102	R5-36	943.7	R5P1	-0.6839	$87.50	-$56,472.19
103	R5-37	1019.9	R5P1	-0.9037	$87.50	-$80,647.32
104	R5-38	1094.1	R5P1	-0.9874	$87.50	-$94,527.50
105	R5-39	1024.2	R5P1	-1.1019	$87.50	-$98,749.52
106	R5-40	1009.7	R5P2	-0.5617	$87.50	-$49,625.49
107	R5-41	1003.7	R5P2	-0.5106	$87.50	-$44,842.81
108	R5-42	1022.6	R5P2	-0.3367	$87.50	-$30,127.07
109	R5-43	1002.2	R5P2	-0.2136	$87.50	-$18,731.12
110	R5-44	1000.5	R5P2	-0.0640	$87.50	-$5,602.80
111	R5-45	968.6	R5P2	0.0031	$87.50	$262.73
112	R5-46	987.6	R5P2	0.0848	$87.50	$7,327.99
113	R5-47	1030.6	R5P2	0.0123	$77.50	$982.42
114	R5-48	1026.4	R5P3	0.0289	$77.50	$2,298.88
115	R5-49	1041.1	R5P3	-0.1516	$77.50	-$12,231.88
116	R5-50	1031.8	R5P3	-0.2372	$77.50	-$18,967.58
117	R5-51	1025.9	R5P3	-0.3640	$77.50	-$28,940.64

5.5 RECREATION

To determine the recreation benefits of a plan, an economic value must be placed on the recreation experience at the Walton County beaches. This value can be applied to the visitation which results from the project to determine the NED recreation benefits. For this report, unit day values (UDV) are used to determine the economic value of recreation using a point system that takes into account the following factors: recreation experience, availability of opportunity, carrying capacity, accessibility, and environmental (esthetics) quality. A good deal of judgment is required in the assessment of point values. A group of planning professionals with knowledge of the study area made independent judgments of the UDV values which were averaged. The UDV point totals convert to a recreation value of $5.07 for the without project condition and $5.16 for the with project condition. These values were applied to the visitation over the study period. The difference between the without and with project value of recreation determines the NED and LPP recreation benefits. The complete recreation analysis can to found in the attachments to the Economic Appendix.

5.6 STORM INDUCED AND LONG-TERM EROSION DAMAGES

Storm induced erosion is defined as the horizontal distance from 0 NGVD on the pre-storm profile to the landward most position where vertical erosion during the storm exceeds 0.5 feet. Recession is calculated, averaged and a standard deviation computed for each model reach over the simulation period.

A project-induced planform change rate, which accounts for the longshore dispersion of the beach nourishment material, is specified for each Beach-*fx* reach. GENESIS was used to estimate the long-term planform change rate for the future without and future without project conditions. GENESIS simulates changes in shoreline position due to the presence and combinations of beach fills and near shore structures such as groins, jetties, seawalls, and breakwaters. GENESIS was used to predict and optimize the performance of the NED Plan and renourishment requirements given various design transitions.

5.7 WAVE ATTACK DAMAGES

Wave conditions, which drive the model, consist of wave height, period, and direction and can originate from multiple sources. Predictive simulations estimate the performance of any proposed beach fill or structural modifications.

Damage elements along the shoreline can be damaged from wave run-up or from waves breaking directly on the damage element when storm surge elevations are high. These damages are determined using the IWR expert elicitation damage functions.

5.8 EMERGENCY NOURISHMENT

In the without project condition it is assumed that emergency nourishment will be performed as needed, over the 54-year period of study When a disaster is declared for a particular county, the Federal Emergency Management Agency (FEMA) will provide up to six cubic yards (cy) per square foot to mitigate for loss. There is a cost sharing provision requirement by FEMA that can be as low as zero percent (0%). The non-Federal sponsor indicated that, in the absence of a Federal project, they will, acquire funding to pursue the FEMA renourishing action after each significant storm. Historically, on at least six previous occasions FEMA has provided this emergency nourishment action.

The non-Federal sponsor has completed a dune restoration project to partially replace the erosion losses due to Hurricane Ivan in 2004 to provide storm protection for existing infrastructure, mainly Scenic Highway 98 and Gulf-front development. The current most threatened areas that were the beneficiaries of this effort are; Miramar Beach, Dune Allen and the Inlet Beach areas. The funding was provided by FEMA.

The fact that the non-Federal sponsor has deferred emergency work in anticipation of a project should be viewed as a temporary anomaly that will be accomplished if project implementation is delayed for some reason.

Beach-*fx* executes a nourishing action after each hurricane event, which averages about 125,000 cy of material on the beach. This material is trucked in for placement on the beach and has a cost of about $30 per cy. Reach 2, which is all State Park Lands and Reach 4 which is primarily State Park Lands do not receive emergency nourishment. Table B-13 presents the emergency nourishment template and accompanying nourishment triggers.

TABLE B-13
EMERGENCY NOURISHMENT TRIGGERS AND TEMPLATES

	Emergency Nourishment Trigger			Emergency Template		
Rep Profile	**Dune Width**	**Dune Height**	**Berm Width**	**Dune Width**	**Dune Height**	**Berm Width**
R1P1	0	56	0	22.2	69.7	6.3
R1P2	0	100	0	13.6	128.3	11.7
R2P1	0	0	0	0	0	0
R2P2	0	0	0	0	0	0
R3P1	0	45	0	12.5	79.0	16.0
R3P2	0	76.5	0	23.0	95.0	31.5
R4P1	0	0	0	0	0	0
R4P2	0	0	0	0	0	0
R5P1	0	65	0	24.0	78.5	38.5
R5P2	0	184.3	0	32.0	190.3	34.0
R5P3	0	50	0	15.5	69.5	46.0

5.9 REBUILDING

The model allows the user to define a distribution (triangular, you provide minimum, most likely, and maximum) of the number of days required for rebuilding, at the damage element level, that is, the distribution can be changed for each damage element. Thus, the user might enter 350, 365, or 380 to get a distribution around one year. At the start of each iteration, a value is drawn for the sample, setting the rebuilding time for the damage element for that iteration. The Walton County existing condition rebuilding parameters for single and multi-family construction was 365, 730 and 1,825 days. Walkovers, pools, jacuzzis, were assigned 365, 548 and 730 days. The number of times rebuilding could occur was unlimited if sufficient room on the lot permitted rebuilding.

If a damage element is damaged to any degree, and has not been "rebuilt" more times than the maximum allowable, then a "rebuilding event" is set at a time in the future corresponding to the random rebuilding time. When the simulation reaches that time, the lot on which the damage element exists is checked to see if it is buildable. At present, the model makes a simple check based on whether or not the landward toe of the dune has retreated past the center point of the lot. If so, the lot is not buildable, and rebuilding does not take place.

If the lot is rebuildable at the time of rebuilding, then structure and contents values are restored to their initial values at the start of the simulation, such that they are able to be taken as damages again at the next storm event, and the number of times the damage element is rebuilt is incremented by one.

5.10 COMBINING DAMAGES – COMPOSITE DAMAGE FUNCTION

Total damage element damages are calculated using a composite damage function that takes into account damages for all damage mechanisms present while avoiding double counting. Because a structure may be damaged by more than one storm damage hazard a methodology was needed to be developed for combining the damages. This methodology was defined during the IWR workshop and is included in Attachment II – Coastal Storm Damage Relationships Based on Expert Opinion Elicitation.

6.0 FUTURE WITHOUT PROJECT CONDITION

6.1 DAMAGES

Table B-14 presents the summary statistics from 100 Beach-*fx* iterations showing existing damages to structure and content by model reach. Also shown is the average cost of emergency nourishment. Table B-14A shows average annual damages by type for the future without project condition to illustrate what is being damaged comparatively.

7.0 WITH PROJECT CONDITION

7.1 PLAN FORMULATION

ER 1105-2-100 requires that the effects of alternatives are to be determined and evaluated in terms of four accounts: national economic development (NED); environmental quality (EQ); regional economic development (RED) and other social effects (OSE). The relevant effects of a hurricane and storm damage project for Walton County are: prevention of land loss and other physical damage; reduction in maintenance costs of existing protection works; reduction of emergency costs to structures; increased recreational usage; changes in shore processes and equilibrium conditions; accretion or erosion along down-drift shores and prevention of loss of historic and scenic aspects of the environment.

Various beach fill alternatives were developed based on the experience gained from the Hurricane and storm Damage Reduction Project in neighboring Bay County. Planning Hurricane and storm damage reduction measures developed for evaluation took into account some heuristics and prior experience from similar constructed projects. The PDT decided that any alternative plans would not change the existing natural berm or dune height.

Dune height alternatives were not evaluated because the predominate morphology type was high upland. Walton County beaches are essentially bluff-backed beaches and increasing the elevation of the bluffs was not considered necessary and lowering of the bluff was not considered practical.

Berm height alternatives were not evaluated. Beaches have a natural berm height. Constructing a beach higher than the natural berm height results in scarping; likewise, building a beach lower than the natural berm height results in ponding. The Mobile District has experienced both (severe scarping and ponding) at a nearby project. Historical surveys were used to determine the natural berm elevation at Walton County.

Projects are formulated in accordance with policies, principles and procedures contained in ER 1105-2-100 and related regulations (e.g., ER 200-2-2) describing the planning process developed to implement the Water Resources Council's Principles and Guidelines, the National Environmental Policy Act, Executive Order (EO) 11988, EO 11990 and other requirements. Consideration should be given to structural and nonstructural solutions. Plan formulation should be accomplished systematically to arrive at the best solution, considering all factors, including engineering, economic, environmental, and social.

Hurricane and storm damage reduction projects are formulated first to provide for hurricane and storm damage reduction. Recreation associated with this type of project is considered incidental for cost sharing purposes, although recreation benefits are NED benefits to be included in the economic analysis.

TABLE B-14

WITHOUT PROJECT DAMAGES

AVERAGE VALUES - PER 54-YEAR ITERATION (EXCEPT AVERAGE ANNUAL VALUES)

Sub-Reach	Model Reach	Average Structure Damage	Average Content Damage	Average Total Damage	Average Annual Damages	Average Emergency Nourishment	Average Annual Emergency Nourishment	Average Planned Nourishment
1	R1-1	$50,117	$427	$50,545	$2,715	$210,235	$11,294	$0
2	R1-2	$40,446	$0	$40,446	$2,173	$202,076	$10,856	$0
3	R1-3	$64,666	$0	$64,666	$3,474	$193,084	$10,373	$0
4	R1-4	$32,576	$0	$32,576	$1,750	$188,153	$10,108	$0
5	R1-5	$14,520	$287	$14,807	$795	$202,570	$10,883	$0
6	R1-6	$41,270	$0	$41,270	$2,217	$205,658	$11,048	$0
7	R1-7	$53,340	$0	$53,340	$2,866	$200,548	$10,774	$0
8	R1-8	$30,294	$0	$30,294	$1,627	$211,196	$11,346	$0
9	R1-9	$93,288	$727	$94,015	$5,051	$200,816	$10,788	$0
10	R1-10	$137,835	$0	$137,835	$7,405	$188,602	$10,132	$0
11	R1-11	$1,673,284	$814,249	$2,487,533	$133,636	$199,266	$10,705	$0
12	R1-12	$153,035	$0	$153,035	$8,221	$209,070	$11,232	$0
13	R1-13	$2,483,443	$1,167,888	$3,651,331	$196,158	$207,395	$11,142	$0
14	R1-14	$1,311,396	$623,940	$1,935,337	$103,971	$210,513	$11,309	$0
15	R1-15	$4,145,546	$1,996,276	$6,141,823	$329,953	$227,928	$12,245	$0
16	R1-16	$2,810,420	$1,362,102	$4,172,523	$224,157	$233,960	$12,569	$0
17	R1-17	$81,623	$1,669	$83,291	$4,475	$254,152	$13,654	$0
18	R1-18	$163,611	$18,038	$181,649	$9,759	$258,933	$13,910	$0
19	R1-19	$213,952	$1,878	$215,830	$11,595	$240,546	$12,923	$0
20	R1-20	$292,531	$1,295	$293,825	$15,785	$215,394	$11,571	$0
21	R1-21	$42,898	$0	$42,898	$2,305	$184,809	$9,928	$0
22	R1-22	$109,209	$747	$109,955	$5,907	$194,173	$10,431	$0
23	R1-23	$26,547	$0	$26,547	$1,426	$202,474	$10,877	$0
24	R1-24	$73,102	$21,646	$94,748	$5,090	$192,222	$10,327	$0
25	R2-1	$9,908	$0	$9,908	$532	$181,819	$9,768	$0
26	R2-2	$0	$0	$0	$0	$0	$0	$0
27	R2-3	$0	$0	$0	$0	$0	$0	$0
28	R2-4	$0	$0	$0	$0	$0	$0	$0
29	R2-5	$0	$0	$0	$0	$0	$0	$0
30	R2-6	$0	$0	$0	$0	$0	$0	$0
31	R2-7	$0	$0	$0	$0	$0	$0	$0
32	R3-1	$207,420	$530	$207,950	$11,172	$820,547	$44,082	$0
33	R3-2	$1,932,007	$694,282	$2,626,289	$141,090	$741,838	$39,853	$0
34	R3-3	$247,201	$398	$247,599	$13,302	$751,778	$40,387	$0
35	R3-4	$21,358	$1,229	$22,587	$1,213	$286,621	$15,398	$0
36	R3-5	$280,340	$117	$280,457	$15,067	$314,992	$16,922	$0
37	R3-6	$163,071	$12,307	$175,378	$9,422	$335,789	$18,039	$0
38	R3-7	$147,602	$0	$147,602	$7,930	$337,549	$18,134	$0
39	R3-8	$293,875	$1,778	$295,653	$15,883	$812,055	$43,625	$0
40	R3-9	$735,296	$0	$735,296	$39,502	$780,096	$41,909	$0
41	R3-10	$4,002,045	$1,538,725	$5,540,770	$297,663	$785,917	$42,221	$0
42	R3-11	$961,646	$161,692	$1,123,339	$60,348	$768,099	$41,264	$0

TABLE B-14 (CONTINUED)
WITHOUT PROJECT DAMAGES
AVERAGE VALUES - PER 54-YEAR ITERATION (EXCEPT AVERAGE ANNUAL VALUES)

Sub-Reach	Model Reach	Average Structure Damage	Average Content Damage	Average Total Damage	Average Annual Damages	Average Emergency Nourishment	Average Annual Emergency Nourishment	Average Planned Nourishment
43	R3-12	$2,291,254	$966,434	$3,257,688	$175,010	$738,643	$39,682	$0
44	R3-13	$153,720	$39,309	$193,030	$10,370	$740,706	$39,792	$0
45	R3-14	$1,432,360	$261,037	$1,693,397	$90,973	$1,008,234	$54,165	$0
46	R3-15	$44,152	$0	$44,152	$2,372	$800,802	$43,021	$0
47	R3-16	$17,318	$0	$17,318	$930	$556,499	$29,896	$0
48	R3-17	$152,269	$0	$152,269	$8,180	$778,391	$41,817	$0
49	R3-18	$403,306	$0	$403,306	$21,666	$796,171	$42,772	$0
50	R3-19	$218,233	$42,849	$261,082	$14,026	$790,257	$42,454	$0
51	R3-20	$3,243,409	$1,402,474	$4,645,883	$249,587	$780,754	$41,944	$0
52	R3-21	$1,511,011	$0	$1,511,011	$81,175	$781,102	$41,963	$0
53	R3-22	$442,603	$0	$442,603	$23,778	$739,214	$39,712	$0
54	R3-23	$318,197	$0	$318,197	$17,094	$643,180	$34,553	$0
55	R3-24	$28,729	$0	$28,729	$1,543	$349,327	$18,767	$0
56	R3-25	$305,862	$143,211	$449,074	$24,125	$394,881	$21,214	$0
57	R3-26	$0	$0	$0	$0	$0	$0	$0
58	R4-1	$151,745	$0	$151,745	$8,152	$804,015	$43,194	$0
59	R4-2	$674,262	$0	$674,262	$36,223	$830,989	$44,643	$0
60	R4-3	$0	$0	$0	$0	$0	$0	$0
61	R4-4	$0	$0	$0	$0	$0	$0	$0
62	R4-5	$1,244,757	$590,213	$1,834,970	$98,579	$722,149	$38,795	$0
63	R4-6	$1,792,369	$964,484	$2,756,852	$148,104	$279,394	$15,010	$0
64	R4-7	$0	$0	$0	$0	$306,342	$16,457	$0
65	R4-8	$0	$0	$0	$0	$0	$0	$0
66	R4-9	$0	$0	$0	$0	$0	$0	$0
67	R5-1	$107,028	$0	$107,028	$5,750	$442,843	$23,791	$0
68	R5-2	$45,667	$0	$45,667	$2,453	$416,320	$22,366	$0
69	R5-3	$344,988	$130,902	$475,890	$25,566	$410,365	$22,046	$0
70	R5-4	$52,778	$1,604	$54,381	$2,921	$497,669	$26,736	$0
71	R5-5	$104,374	$28,540	$132,915	$7,140	$372,486	$20,011	$0
72	R5-6	$2,083,512	$772,412	$2,855,923	$153,427	$597,458	$32,097	$0
73	R5-7	$2,627,546	$1,074,778	$3,702,324	$198,897	$588,485	$31,615	$0
74	R5-8	$1,283,261	$478,631	$1,761,892	$94,653	$568,693	$30,551	$0
75	R5-9	$81,080	$0	$81,080	$4,356	$398,857	$21,427	$0
76	R5-10	$100,176	$0	$100,176	$5,382	$394,823	$21,211	$0
77	R5-11	$286,009	$27,790	$313,799	$16,858	$401,084	$21,547	$0
78	R5-12	$172,319	$0	$172,319	$9,257	$398,147	$21,389	$0
79	R5-13	$350,899	$133,846	$484,745	$26,042	$398,685	$21,418	$0
80	R5-14	$129,147	$0	$129,147	$6,938	$391,709	$21,044	$0
81	R5-15	$101,192	$0	$101,192	$5,436	$398,018	$21,382	$0
82	R5-16	$202,544	$72,417	$274,961	$14,772	$406,363	$21,831	$0
83	R5-17	$89,887	$25	$89,913	$4,830	$229,470	$12,328	$0

TABLE B-14 (CONTINUED)
WITHOUT PROJECT DAMAGES
AVERAGE VALUES - PER 54-YEAR ITERATION (EXCEPT AVERAGE ANNUAL VALUES)

Sub-Reach	Model Reach	Average Structure Damage	Average Content Damage	Average Total Damage	Average Annual Damages	Average Emergency Nourishment	Average Annual Emergency Nourishment	Average Planned Nourishment
84	R5-18	$184,933	$1,379	$186,312	$10,009	$393,436	$21,136	$0
85	R5-19	$346,545	$486	$347,031	$18,643	$245,542	$13,191	$0
86	R5-20	$127,695	$8,744	$136,439	$7,330	$375,168	$20,155	$0
87	R5-21	$115,553	$0	$115,553	$6,208	$413,353	$22,206	$0
88	R5-22	$0	$0	$0	$0	$0	$0	$0
89	R5-23	$0	$0	$0	$0	$0	$0	$0
90	R5-24	$0	$0	$0	$0	$0	$0	$0
91	R5-25	$0	$0	$0	$0	$0	$0	$0
92	R5-26	$0	$0	$0	$0	$0	$0	$0
93	R5-27	$0	$0	$0	$0	$0	$0	$0
94	R5-28	$0	$0	$0	$0	$0	$0	$0
95	R5-29	$0	$0	$0	$0	$0	$0	$0
96	R5-30	$104,662	$143	$104,805	$5,630	$397,892	$21,376	$0
97	R5-31	$159,905	$54,514	$214,419	$11,519	$395,055	$21,223	$0
98	R5-32	$1,521,295	$385,609	$1,906,904	$102,443	$572,711	$30,767	$0
99	R5-33	$622,017	$0	$622,017	$33,416	$590,106	$31,702	$0
100	R5-34	$253,618	$0	$253,618	$13,625	$585,324	$31,445	$0
101	R5-35	$407,198	$0	$407,198	$21,876	$566,648	$30,442	$0
102	R5-36	$1,549,347	$504,940	$2,054,288	$110,361	$540,441	$29,034	$0
103	R5-37	$255,864	$0	$255,864	$13,746	$606,722	$32,594	$0
104	R5-38	$619,179	$0	$619,179	$33,264	$659,680	$35,440	$0
105	R5-39	$113,477	$0	$113,477	$6,096	$628,131	$33,745	$0
106	R5-40	$10,764	$0	$10,764	$578	$400,241	$21,502	$0
107	R5-41	$31,317	$0	$31,317	$1,682	$398,352	$21,400	$0
108	R5-42	$13,030	$0	$13,030	$700	$382,964	$20,574	$0
109	R5-43	$25,748	$0	$25,748	$1,383	$368,776	$19,812	$0
110	R5-44	$158,802	$78,936	$237,738	$12,772	$360,811	$19,384	$0
111	R5-45	$748,064	$371,844	$1,119,908	$60,164	$342,801	$18,416	$0
112	R5-46	$229,544	$64,593	$294,137	$15,802	$343,659	$18,462	$0
113	R5-47	$427,506	$178,669	$606,175	$32,565	$362,261	$19,462	$0
114	R5-48	$9,480	$2,929	$12,409	$667	$238,738	$12,826	$0
115	R5-49	$175,814	$87,341	$263,155	$14,137	$243,899	$13,103	$0
116	R5-50	$32,351	$9	$32,360	$1,738	$242,799	$13,044	$0
117	R5-51	$95,314	$20,604	$115,918	$6,227	$239,386	$12,860	$0

TABLE B-14A
AVERAGE ANNUAL WITHOUT PROJECT STRUCTURE AND CONTENT DAMAGES BY TYPE

Type	Average Annual Structure Damage	Average Annual Content Damage
Private Access	$7,835	$0
Public Access	$21,111	$0
Commercial	$14,782	$6,954
Gazebo	$54,185	$4,705
Jacuzzi	$766	$0
Small Multi-Family	$55,580	$22,056
Medium Multi Family	$370,640	$182,143
Large Multi Family	$343	$16,689
Pool	$83,474	$2,914
Single Family Residential	$1,508,554	$707,273
Walkovers	$774,781	$0
Average Annual Damages	$2,892,051	$942,730

7.1.1 Non-Structural Alternatives

Beach nourishment and periodic renourishment will meet the study objectives for shoreline erosion protection in the most economically efficient and environmentally acceptable manner. Hard structures, such as groins, breakwaters and seawalls would have a negative impact on endangered species such as nesting sea turtles, therefore these types of structures were not considered for this analysis.

A non-structural measure, property acquisition, was considered as a hurricane and storm damage reduction measure. Property acquisition would involve the purchase of the damageable property and relocating the residents. This alternative for hurricane and storm damage reduction would eliminate storm damage to approximately 81percent of the approximately 814 damage elements in the study area. To evaluate this alternative the value of the acquisition would have to be determined and compared to other evaluated alternatives to determine if this is a least costly alternative.

The typical 50-foot front row lot averages one million dollars each, appraised value. There are approximately 20 lots per sub-reach, multiplied by 117 sub-reaches equals about 2,340 lots. At one million dollars each lot, multiplied by 2,340 lots yields about $2.34 billion dollars in land value. When this land value is added to $1.18 billion dollars in damageable structure value (remember only the first two floors' value, for multi-storied structures were counted in the damageable structure inventory), the approximate $3.42 billion dollars would more than eclipse the cost of any beach fill alternative. Thus, the alternative measure of property acquisition was dismissed from further consideration

7.1.2 Structural Alternatives - Beach Fill Alternatives

A range of beach fill alternative plans were formulated by the PDT. Since both berm width and dune width alternatives were to be evaluated Phase I would involve maximizing berm width which would be followed by Phase II to optimize dune width.

8.0 NED BENEFIT ANALYSIS

8.1 PHASE I BERM WIDTH OPTIMIZATION

Table B-15 displays the six berm width optimization alternatives that were evaluated and their specifications. The existing dune height was not altered.

TABLE B-15
BERM WIDTH OPTIMIZATION

Reach	Representative Profile	Existing Dune Height (Feet)	Existing Dune Width (Feet)	Alternative Dune Width (Feet)	Alternative Berm Width (Feet)					
					Zero	MiniMin	Min	Small	Medium	Maximum
1	R1P1	22.2	55	75	0	10	25	50	75	100
	R1P2	13.6	100	120	0	25	50	75	100	125
3	R3P1	23	75	95	0	25	50	75	100	125
	R3P2	12.5	45	65	0	25	50	75	100	125
4	R4P1	23	50	70	0	25	50	75	100	125
	R4P2	10	82	100	0	25	50	75	100	125
5	R5P1	32	185	205	0	25	50	75	100	125
	R5P2	24	65	85	0	25	50	75	100	125
	R5P3	15.5	50	70	0	25	50	75	100	125

8.1.1 Berm Width Optimization Alternatives

The Phase I berm width optimization was formulated around six alternative berm width templates; Zero, MiniMin, Minimum, Small, Medium and Maximum. In order to maintain consistency for comparison and evaluation purposes each alternative was run with +20 feet of dune width added to the existing dune width. Phase I berm width alternative specifications are shown in Table B-16.

8.1.2 Results of Berm Width Optimization

The results of these runs indicated that the minimum berm template was the alternative with the greatest net benefits (see Table B-17 – B-22). Also, there were significant added benefits that accrue to alternative designs that included additional dune width. All alternatives were formulated with a +20 added dune width. Table B-23 presents the summarized berm width optimization.

TABLE B-16
BERM WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Zero Berm Width Template	+20 Feet Added Dune Width	MiniMin Berm Width Template	+20 Feet Added Dune Width	Minimum Berm Width Template	+20 Feet Added Dune Width	Small Berm Width Template	+20 Feet Added Dune Width	Medium Berm Width Template	+20 Feet Added Dune Width	Maximum Berm Width Template	+20 Feet Added Dune Width
1	R1-1	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
2	R1-2	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
3	R1-3	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
4	R1-4	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
5	R1-5	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
6	R1-6	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
7	R1-7	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
8	R1-8	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
9	R1-9	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
10	R1-10	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
11	R1-11	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
12	R1-12	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
13	R1-13	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
14	R1-14	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
15	R1-15	R1P2	0	120	25	120	50	120	75	120	100	120	125	120
16	R1-16	R1P2	0	120	25	120	50	120	75	120	100	120	125	120
17	R1-17	R1P2	0	120	25	120	50	120	75	120	100	120	125	120
18	R1-18	R1P2	0	120	25	120	50	120	75	120	100	120	125	120
19	R1-19	R1P2	0	120	25	120	50	120	75	120	100	120	125	120
20	R1-20	R1P2	0	120	10	120	50	120	75	120	100	120	125	120
21	R1-21	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
22	R1-22	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
23	R1-23	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
24	R1-24	R1P1	0	75	10	75	25	75	50	75	75	75	100	75
25	R2-1	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
26	R2-2	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
27	R2-3	R2P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

TABLE B-16 (CONTINUED)
BERM WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Zero Berm Width Template	+20 Feet Added Dune Width	MiniMin Berm Width Template	+20 Feet Added Dune Width	Minimum Berm Width Template	+20 Feet Added Dune Width	Small Berm Width Template	+20 Feet Added Dune Width	Medium Berm Width Template	+20 Feet Added Dune Width	Maximum Berm Width Template	+20 Feet Added Dune Width
28	R2-4	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
29	R2-5	R2P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
30	R2-6	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
31	R2-7	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
32	R3-1	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
33	R3-2	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
34	R3-3	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
35	R3-4	R3P2	0	65	25	65	50	65	75	65	100	65	125	65
36	R3-5	R3P2	0	65	25	65	50	65	75	65	100	65	125	65
37	R3-6	R3P2	0	65	25	65	50	65	75	65	100	65	125	65
38	R3-7	R3P2	0	65	25	65	50	65	75	65	100	65	125	65
39	R3-8	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
40	R3-9	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
41	R3-10	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
42	R3-11	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
43	R3-12	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
44	R3-13	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
45	R3-14	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
46	R3-15	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
47	R3-16	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
48	R3-17	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
49	R3-18	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
50	R3-19	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
51	R3-20	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
52	R3-21	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
53	R3-22	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
54	R3-23	R3P1	0	95	25	95	50	95	75	95	100	95	125	95
55	R3-24	R3P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

TABLE B-16 (CONTINUED)
BERM WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Zero Berm Width Template	+20 Feet Added Dune Width	MiniMin Berm Width Template	+20 Feet Added Dune Width	Minimum Berm Width Template	+20 Feet Added Dune Width	Small Berm Width Template	+20 Feet Added Dune Width	Medium Berm Width Template	+20 Feet Added Dune Width	Maximum Berm Width Template	+20 Feet Added Dune Width
56	R3-25	R3P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
57	R3-26	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
58	R4-1	R4P1	0	70	25	70	50	70	75	70	100	70	125	70
59	R4-2	R4P1	0	70	25	70	50	70	75	70	100	70	125	70
60	R4-3	R4P2	0	105	25	105	50	105	75	105	100	105	125	105
61	R4-4	R4P2	0	105	25	105	50	105	75	105	100	105	125	105
62	R4-5	R4P1	0	70	25	70	50	70	75	70	100	70	125	70
63	R4-6	R4P2	0	105	25	105	50	105	75	105	100	105	125	105
64	R4-7	R4P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
65	R4-8	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
66	R4-9	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
67	R5-1	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
68	R5-2	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
69	R5-3	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
70	R5-4	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
71	R5-5	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
72	R5-6	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
73	R5-7	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
74	R5-8	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
75	R5-9	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
76	R5-10	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
77	R5-11	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
78	R5-12	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
79	R5-13	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
80	R5-14	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
81	R5-15	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
82	R5-16	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
83	R5-17	R5P3	0	70	25	70	50	70	75	70	100	70	125	70

TABLE B-16 (CONTINUED)
BERM WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Zero Berm Width Template	+20 Feet Added Dune Width	MiniMin Berm Width Template	+20 Feet Added Dune Width	Minimum Berm Width Template	+20 Feet Added Dune Width	Small Berm Width Template	+20 Feet Added Dune Width	Medium Berm Width Template	+20 Feet Added Dune Width	Maximum Berm Width Template	+20 Feet Added Dune Width
84	R5-18	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
85	R5-19	R5P3	0	70	25	70	50	70	75	70	100	70	125	70
86	R5-20	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
87	R5-21	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
88	R5-22	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
89	R5-23	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
90	R5-24	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
91	R5-25	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
92	R5-26	R5P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
93	R5-27	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
94	R5-28	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
95	R5-29	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
96	R5-30	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
97	R5-31	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
98	R5-32	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
99	R5-33	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
100	R5-34	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
101	R5-35	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
102	R5-36	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
103	R5-37	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
104	R5-38	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
105	R5-39	R5P1	0	205	25	205	50	205	75	205	100	205	125	205
106	R5-40	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
107	R5-41	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
108	R5-42	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
109	R5-43	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
110	R5-44	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
111	R5-45	R5P2	0	85	25	85	50	85	75	85	100	85	125	85

TABLE B-16 (CONTINUED)
BERM WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Zero Berm Width Template	+20 Feet Added Dune Width	MiniMin Berm Width Template	+20 Feet Added Dune Width	Minimum Berm Width Template	+20 Feet Added Dune Width	Small Berm Width Template	+20 Feet Added Dune Width	Medium Berm Width Template	+20 Feet Added Dune Width	Maximum Berm Width Template	+20 Feet Added Dune Width
112	R5-46	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
113	R5-47	R5P2	0	85	25	85	50	85	75	85	100	85	125	85
114	R5-48	R5P3	0	70	25	70	50	70	75	70	100	70	125	70
115	R5-49	R5P3	0	70	25	70	50	70	75	70	100	70	125	70
116	R5-50	R5P3	0	70	25	70	50	70	75	70	100	70	125	70
117	R5-51	R5P3	0	70	25	70	50	70	75	70	100	70	125	70

Note: Shaded areas are State Park Areas which received neither emergency nor planned nourishments
Alternative Berm Widths
Existing Dune width + 20 feet of additive dune width

TABLE B-17
BERM WIDTH OPTIMIZATION ZERO BERM WIDTH

Model Reach	Damage Reduction ZERO Added Berm Width	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits ZERO Added Berm Width	Summed Net Benefits ZERO Added Berm Width
R1-1	$1,948	$109	$54,795	$109	$50,461	$2,818	0.0386	-$2,709	
R1-2	$3,826	$214	$49,622	$214	$307,103	$17,148	0.0125	-$16,934	
R1-3	$4,595	$257	$37,527	$257	$289,566	$16,169	0.0159	-$15,912	
R1-4	$8,113	$453	$27,756	$453	$315,586	$17,622	0.0257	-$17,169	
R1-5	$2,489	$139	$22,870	$139	$310,413	$17,333	0.0080	-$17,194	
R1-6	$9,389	$524	$6,771	$524	$390,468	$21,803	0.0240	-$21,279	
R1-7	$19,099	$1,066	$442	$1,066	$365,607	$20,415	0.0522	-$19,348	
R1-8	$10,983	$613	$1,159	$613	$369,255	$20,618	0.0297	-$20,005	
R1-9	$20,923	$1,168	$2,015	$1,168	$338,711	$18,913	0.0618	-$17,745	
R1-10	$10,259	$573	$6,219	$573	$290,304	$16,210	0.0353	-$15,637	
R1-11	$1,172,970	$65,496	$8,692	$65,496	$825,107	$46,072	1.4216	$19,424	
R1-12	$84,001	$4,690	$3,758	$4,690	$789,098	$44,062	0.1065	-$39,371	
R1-13	$3,426,140	$191,309	-$58	$191,367	$704,870	$39,359	4.8621	$152,009	
R1-14	$1,919,253	$107,167	-$7,413	$114,580	$773,596	$43,196	2.6526	$71,384	
R1-15	$1,999,896	$111,670	-$8,068	$119,738	$686,273	$38,320	3.1247	$81,418	
R1-16	$2,781,169	$155,295	-$11,001	$166,296	$272,863	$15,236	10.9145	$151,060	**$435,924**
R1-17	$43,837	$2,448	-$11,198	$13,646	$233,472	$13,037	1.0467	$609	
R1-18	$57,515	$3,212	-$12,742	$15,954	$244,312	$13,642	1.1695	$2,312	
R1-19	$44,420	$2,480	-$5,695	$8,175	$284,463	$15,884	0.5147	-$7,709	
R1-20	$47,614	$2,659	$8,438	$2,659	$237,378	$13,255	0.2006	-$10,596	
R1-21	$132	$7	$9,080	$7	$327,538	$18,289	0.0004	-$18,282	
R1-22	$10,380	$580	$21,487	$580	$346,408	$19,343	0.0300	-$18,763	
R1-23	$3,509	$196	$36,478	$196	$319,206	$17,824	0.0110	-$17,628	
R1-24	$69,363	$3,873	$41,072	$3,873	$337,696	$18,856	0.2054	-$14,983	
R2-1	-$113	-$6	$31,026	-$6	$21,736	$1,214	-	-	
R2-2	$0	$0	$10,175	$0	$0	$0	-	-	
R2-3	$0	$0	$29,592	$0	$0	$0	-	-	
R2-4	$0	$0	$22,465	$0	$0	$0	-	-	
R2-5	$0	$0	$8,309	$0	$0	$0	-	-	
R2-6	$0	$0	-$249,209	$249,209	$0	$0	-	-	
R2-7	$0	$0	$18,114	$0	$0	$0	-	-	
R3-1	$180,060	$10,054	$20,806	$10,054	$510,349	$28,497	0.3528	-$18,443	
R3-2	$2,127,566	$118,799	$19,994	$118,799	$420,973	$23,506	5.0539	$95,293	
R3-3	$185,528	$10,360	$20,424	$10,360	$418,120	$23,347	0.4437	-$12,988	
R3-4	$16,961	$947	$25,555	$947	$116,056	$6,480	0.1461	-$5,533	
R3-5	$38,865	$2,170	$21,080	$2,170	$170,861	$9,541	0.2275	-$7,370	
R3-6	$36,127	$2,017	$15,383	$2,017	$180,985	$10,106	0.1996	-$8,089	
R3-7	$49,783	$2,780	$4,993	$2,780	$153,870	$8,592	0.3235	-$5,812	
R3-8	$77,074	$4,304	-$14,815	$19,118	$1,188,033	$66,337	0.2882	-$47,219	
R3-9	$434,870	$24,282	-$17,079	$41,362	$983,765	$54,932	0.7530	-$13,570	
R3-10	$2,275,811	$127,077	-$21,371	$148,448	$871,568	$48,667	3.0503	$99,782	
R3-11	$689,120	$38,479	-$23,863	$62,342	$707,891	$39,527	1.5772	$22,815	
R3-12	$1,301,736	$72,686	-$37,589	$110,275	$627,570	$35,042	3.1469	$75,233	
R3-13	$216,357	$12,081	-$44,608	$56,689	$595,132	$33,231	1.7059	$23,458	

TABLE B-17 (CONTINUED)
BERM WIDTH OPTIMIZATION ZERO BERM WIDTH

Model Reach	Damage Reduction ZERO Added Berm Width	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits ZERO Added Berm Width	Summed Net Benefits ZERO Added Berm Width
R3-14	$1,392,192	$77,737	-$77,674	$155,411	$915,085	$51,097	3.0415	$104,314	
R3-15	$19,409	$1,084	-$67,602	$68,686	$631,136	$35,241	1.9490	$33,444	
R3-16	$5,471	$306	-$52,660	$52,966	$449,998	$25,127	2.1079	$27,839	
R3-17	$112,493	$6,281	-$83,305	$89,587	$704,264	$39,325	2.2781	$50,262	
R3-18	$261,843	$14,621	-$86,928	$101,548	$748,371	$41,788	2.4301	$59,761	
R3-19	$312,734	$17,462	-$82,277	$99,739	$752,150	$41,999	2.3748	$57,740	
R3-20	$3,906,773	$218,147	-$79,875	$298,021	$879,468	$49,108	6.0687	$248,914	
R3-21	$826,335	$46,141	-$77,993	$124,134	$1,095,124	$61,150	2.0300	$62,984	
R3-22	$230,587	$12,876	-$67,797	$80,673	$1,241,432	$69,319	1.1638	$11,354	
R3-23	$198,400	$11,078	-$53,371	$64,449	$577,522	$32,248	1.9986	$32,201	**$904,813**
R3-24	$5,384	$301	-$45,450	$45,751	$0	$0	-	$45,751	
R3-25	$0	$0	-$32,621	$32,621	$0	$0	-	$32,621	
R3-26	$0	$0	-$26,720	$26,720	$0	$0	-	$26,720	
R4-1	-$3,878	-$217	-$54,395	$54,178	$21,736	$1,214	44.6383	$52,965	
R4-2	-$52,104	-$2,909	-$45,920	$43,011	$108,682	$6,069	7.0874	$36,942	
R4-3	$0	$0	$3,747	$0	$131,501	$7,343	0.0000	-$7,343	
R4-4	$0	$0	$7,991	$0	$63,490	$3,545	0.0000	-$3,545	
R4-5	-$7,370	-$412	-$21,731	$21,320	$36,227	$2,023	10.5393	$19,297	
R4-6	$0	$0	$6,739	$0	$7,245	$405	0.0000	-$405	**$97,911**
R4-7	$0	$0	-$8,323	$8,323	$0	$0	-	$8,323	
R4-8	$0	$0	-$87,751	$87,751	$0	$0	-	$87,751	
R4-9	$0	$0	-$153,875	$153,875	$0	$0	-	$153,875	
R5-1	$15,438	$862	-$100,250	$101,112	$610,041	$34,064	2.9683	$67,048	
R5-2	$17,990	$1,005	-$70,377	$71,381	$450,461	$25,153	2.8379	$46,228	
R5-3	$22,538	$1,258	-$38,155	$39,414	$254,921	$14,234	2.7689	$25,179	
R5-4	$15,298	$854	-$11,323	$12,177	$150,467	$8,402	1.4493	$3,775	
R5-5	$88,997	$4,969	$11,365	$4,969	$109,553	$6,117	0.8124	-$1,148	
R5-6	$2,650,675	$148,009	-$30,953	$178,962	$681,942	$38,078	4.6998	$140,884	
R5-7	$3,625,676	$202,451	-$38,120	$240,571	$671,166	$37,477	6.4192	$203,095	
R5-8	$1,610,350	$89,919	-$27,503	$117,422	$666,522	$37,217	3.1550	$80,204	
R5-9	$26,850	$1,499	-$15,659	$17,159	$148,123	$8,271	2.0746	$8,888	
R5-10	$28,066	$1,567	-$17,915	$19,482	$124,348	$6,943	2.8059	$12,539	
R5-11	$162,780	$9,089	-$19,644	$28,733	$154,963	$8,653	3.3207	$20,080	
R5-12	$29,720	$1,660	-$18,787	$20,446	$98,745	$5,514	3.7082	$14,932	
R5-13	$107,222	$5,987	-$19,733	$25,720	$173,554	$9,691	2.6541	$16,030	
R5-14	$36,816	$2,056	-$17,799	$19,855	$143,238	$7,998	2.4824	$11,857	
R5-15	$34,184	$1,909	-$24,219	$26,128	$149,193	$8,331	3.1364	$17,797	
R5-16	$169,360	$9,457	-$24,757	$34,214	$155,831	$8,701	3.9320	$25,512	
R5-17	$11,667	$651	-$13,221	$13,873	$186,092	$10,391	1.3351	$3,482	
R5-18	$55,805	$3,116	-$24,149	$27,265	$231,108	$12,905	2.1128	$14,360	**$710,743**
R5-19	$25,774	$1,439	-$2,901	$4,340	$284,340	$15,877	0.2734	-$11,537	
R5-20	$24,031	$1,342	$184	$1,342	$492,932	$27,524	0.0488	-$26,183	
R5-21	$24,141	$1,348	-$554	$1,902	$52,932	$2,956	0.6434	-$1,054	
R5-22	$0	$0	-$1,964	$1,964	$0	$0	$0	$1,964	
R5-23	$0	$0	-$511	$511	$0	$0	$0	$511	

TABLE B-17 (CONTINUED)
BERM WIDTH OPTIMIZATION ZERO BERM WIDTH

Model Reach	Damage Reduction ZERO Added Berm Width	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits ZERO Added Berm Width	Summed Net Benefits ZERO Added Berm Width
R5-24	$0	$0	-$6,898	$6,898	$0	$0	$0	$6,898	
R5-25	$0	$0	-$15,278	$15,278	$0	$0	$0	$15,278	
R5-26	$0	$0	-$12,809	$12,809	$0	$0	$0	$12,809	
R5-27	$0	$0	-$10,102	$10,102	$0	$0	$0	$10,102	
R5-28	$0	$0	-$11,651	$11,651	$0	$0	$0	$11,651	
R5-29	$0	$0	-$37,910	$37,910	$0	$0	$0	$37,910	
R5-30	$21,881	$1,222	-$32,848	$34,070	$570,396	$31,850	1.0697	$2,220	
R5-31	$190,849	$10,657	-$33,879	$44,535	$445,772	$24,891	1.7892	$19,644	
R5-32	$1,168,474	$65,245	-$61,892	$127,137	$914,183	$51,046	2.4906	$76,091	
R5-33	$448,520	$25,044	-$62,530	$87,575	$810,845	$45,276	1.9342	$42,299	
R5-34	$186,335	$10,405	-$53,740	$64,144	$728,303	$40,667	1.5773	$23,477	
R5-35	$281,354	$15,710	-$52,782	$68,492	$665,830	$37,179	1.8422	$31,314	
R5-36	$1,475,011	$82,362	-$56,472	$138,834	$689,576	$38,505	3.6056	$100,329	
R5-37	$199,615	$11,146	-$80,647	$91,793	$704,586	$39,343	2.3332	$52,451	
R5-38	$462,079	$25,802	-$94,528	$120,329	$822,896	$45,949	2.6188	$74,380	
R5-39	$93,495	$5,221	-$98,750	$103,970	$697,510	$38,948	2.6695	$65,022	
R5-40	$5,107	$285	-$49,625	$49,911	$117,928	$6,585	7.5796	$43,326	
R5-41	$13,715	$766	-$44,843	$45,609	$121,375	$6,777	6.7296	$38,831	
R5-42	$4,930	$275	-$30,127	$30,402	$125,668	$7,017	4.3326	$23,385	
R5-43	$8,731	$488	-$18,731	$19,219	$100,872	$5,632	3.4121	$13,586	
R5-44	$0	$0	-$5,603	$5,603	$98,536	$5,502	1.0183	$101	
R5-45	$0	$0	$263	$0	$101,165	$5,649	0.0000	-$5,649	
R5-46	$151,476	$8,458	$7,328	$8,458	$119,182	$6,655	1.2710	$1,803	
R5-47	$342,659	$19,133	$982	$19,133	$157,559	$8,798	2.1748	$10,336	
R5-48	$1,667	$93	$2,299	$93	$157,803	$8,811	0.0106	-$8,718	
R5-49	$59	$3	-$12,232	$12,235	$251,788	$14,059	0.8703	-$1,824	
R5-50	-$1,386	-$77	-$18,968	$18,890	$414,026	$23,118	0.8171	-$4,228	
R5-51	$15,690	$876	-$28,941	$29,817	$142,154	$7,938	3.7564	$21,879	**$636,087**

TABLE B-18
BERM WIDTH OPTIMIZATION MINIMIN

Model Reach	Damage Reduction MiniMin	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits MiniMin	Summed Net Benefits MiniMin
R1-1	$2,041	$114	$54,795	$114	$274,975	$15,354	0.007	-$15,240	
R1-2	$2,937	$164	$49,622	$164	$259,078	$14,466	0.011	-$14,302	
R1-3	$6,090	$340	$37,527	$340	$262,142	$14,638	0.023	-$14,297	
R1-4	$14,228	$794	$27,756	$794	$260,803	$14,563	0.055	-$13,768	
R1-5	$3,159	$176	$22,870	$176	$289,454	$16,163	0.011	-$15,986	
R1-6	$11,961	$668	$6,771	$668	$319,307	$17,829	0.037	-$17,162	
R1-7	$12,727	$711	$442	$711	$320,142	$17,876	0.040	-$17,165	
R1-8	$6,970	$389	$1,159	$389	$337,451	$18,843	0.021	-$18,453	
R1-9	$45,221	$2,525	$2,015	$2,525	$317,766	$17,743	0.142	-$15,218	
R1-10	$69,776	$3,896	$6,219	$3,896	$290,478	$16,220	0.240	-$12,324	
R1-11	$1,209,040	$67,510	$8,692	$67,510	$305,451	$17,056	3.958	$50,455	
R1-12	$52,096	$2,909	$3,758	$2,909	$326,404	$18,226	0.160	-$15,317	
R1-13	$2,635,212	$147,145	-$58	$147,203	$328,141	$18,323	8.034	$128,881	
R1-14	$1,687,921	$94,250	-$7,413	$101,663	$358,888	$20,040	5.073	$81,624	
R1-15	$2,135,356	$119,234	-$8,068	$127,302	$417,759	$23,327	5.457	$103,975	
R1-16	$1,387,942	$77,500	-$11,001	$88,501	$422,690	$23,602	3.750	$64,898	**$414,516**
R1-17	$22,827	$1,275	-$11,198	$12,472	$449,252	$25,085	0.497	-$12,613	
R1-18	$45,418	$2,536	-$12,742	$15,278	$467,280	$26,092	0.586	-$10,814	
R1-19	$71,857	$4,012	-$5,695	$9,707	$432,380	$24,143	0.402	-$14,436	
R1-20	$86,383	$4,823	$8,438	$4,823	$381,923	$21,326	0.226	-$16,502	
R1-21	$758	$42	$9,080	$42	$298,425	$16,663	0.003	-$16,621	
R1-22	$32,710	$1,826	$21,487	$1,826	$283,634	$15,838	0.115	-$14,011	
R1-23	$3,143	$175	$36,478	$175	$289,250	$16,151	0.011	-$15,976	
R1-24	$78,386	$4,377	$41,072	$4,377	$258,932	$14,458	0.303	-$10,081	
R2-1	$0	$0	$0	$0	$0	$0	-	$0	
R2-2	$0	$0	$0	$0	$0	$0	-	$0	
R2-3	$0	$0	$0	$0	$0	$0	-	$0	
R2-4	$0	$0	$0	$0	$0	$0	-	$0	
R2-5	$0	$0	$0	$0	$0	$0	-	$0	
R2-6	$0	$0	$0	$0	$0	$0	-	$0	
R2-7	$0	$0	$0	$0	$0	$0	-	$0	
R3-1	$152,011	$8,488	$20,806	$8,488	$182,143	$10,171	0.835	-$1,683	
R3-2	$1,580,357	$88,244	$19,994	$88,244	$135,295	$7,555	11.681	$80,689	
R3-3	$142,895	$7,979	$20,424	$7,979	$118,312	$6,606	1.208	$1,373	
R3-4	$4,762	$266	$25,555	$266	$228,754	$12,773	0.021	-$12,507	
R3-5	$35,529	$1,984	$21,080	$1,984	$258,804	$14,451	0.137	-$12,467	
R3-6	$15,315	$855	$15,383	$855	$285,477	$15,940	0.054	-$15,085	
R3-7	$568,877	$31,765	$4,993	$31,765	$300,837	$16,798	1.891	$14,967	
R3-8	$6,113,916	$341,389	-$14,815	$356,204	$144,408	$8,063	44.175	$348,140	
R3-9	$430,930	$24,062	-$17,079	$41,142	$136,660	$7,631	5.391	$33,511	
R3-10	$2,308,403	$128,897	-$21,371	$150,268	$139,959	$7,815	19.228	$142,453	
R3-11	$578,808	$32,320	-$23,863	$56,183	$139,268	$7,776	7.225	$48,406	
R3-12	$1,273,739	$71,123	-$37,589	$108,712	$142,474	$7,955	13.665	$100,757	

TABLE B-18 (CONTINUED)
BERM WIDTH OPTIMIZATION MINIMIN

Model Reach	Damage Reduction MiniMiN	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits MiniMin	Summed Net Benefits MiniMin
R3-13	$126,295	$7,052	-$44,608	$51,660	$151,976	$8,486	6.088	$43,174	
R3-14	$1,006,547	$56,204	-$77,674	$133,877	$235,616	$13,156	10.176	$120,721	
R3-15	$8,570	$479	-$67,602	$68,081	$185,633	$10,365	6.568	$57,715	
R3-16	$1,186	$66	-$52,660	$52,727	$133,781	$7,470	7.058	$45,257	
R3-17	$78,722	$4,396	-$83,305	$87,701	$200,161	$11,177	7.847	$76,524	
R3-18	$213,582	$11,926	-$86,928	$98,854	$212,061	$11,841	8.348	$87,013	
R3-19	$211,341	$11,801	-$82,277	$94,077	$200,097	$11,173	8.420	$82,904	
R3-20	$3,331,546	$186,027	-$79,875	$265,902	$200,283	$11,183	23.776	$254,718	
R3-21	$882,610	$49,283	-$77,993	$127,276	$197,209	$11,012	11.558	$116,265	
R3-22	$271,324	$15,150	-$67,797	$82,948	$180,633	$10,086	8.224	$72,861	
R3-23	$188,911	$10,548	-$53,371	$63,919	$151,593	$8,465	7.551	$55,454	**$1,742,843**
R3-24	-$2,376	-$133	-$45,450	$45,318	-$88,842	-$4,961	-9.135	$50,278	
R3-25	$12,626	$705	-$32,621	$33,326	-$95,074	-$5,309	-6.278	$38,635	
R3-26	$0	$0	-$26,720	$26,720	$0	$0	-	$26,720	
R4-1	$106,031	$5,921	-$54,395	$60,315	-$25,737	-$1,437	-41.970	$61,753	
R4-2	$434,853	$24,281	-$45,920	$70,201	-$35,420	-$1,978	-35.496	$72,179	
R4-3	$0	$0	$3,747	$0	$37,319	$2,084	-	-$2,084	
R4-4	$0	$0	$7,991	$0	$35,780	$1,998	-	-$1,998	
R4-5	$75,567	$4,220	-$21,731	$25,951	-$24,814	-$1,386	-18.730	$27,336	
R4-6	$113,924	$6,361	$6,739	$6,361	-$50,306	-$2,809	-2.265	$9,170	**$166,356**
R4-7	$0	$0	-$8,323	$8,323	-$82,072	-$4,583	-1.816	$12,905	
R4-8	$0	$0	-$87,751	$87,751	$0	$0	-	$87,751	
R4-9	$0	$0	-$153,875	$153,875	$0	$0	-	$153,875	
R5-1	$43,616	$2,435	-$100,250	$102,685	$142,449	$7,954	12.910	$94,731	
R5-2	$19,089	$1,066	-$70,377	$71,443	$132,534	$7,400	9.654	$64,042	
R5-3	$43,477	$2,428	-$38,155	$40,583	$117,872	$6,582	6.166	$34,001	
R5-4	$25,173	$1,406	-$11,323	$12,728	$148,012	$8,265	1.540	$4,464	
R5-5	$77,022	$4,301	$11,365	$4,301	$109,058	$6,090	0.706	-$1,789	
R5-6	$2,699,955	$150,760	-$30,953	$181,714	$263,263	$14,700	12.361	$167,014	
R5-7	$3,750,500	$209,421	-$38,120	$247,541	$256,600	$14,328	17.277	$233,213	
R5-8	$1,579,802	$88,213	-$27,503	$115,716	$246,338	$13,755	8.413	$101,961	
R5-9	$26,153	$1,460	-$15,659	$17,120	$110,886	$6,192	2.765	$10,928	
R5-10	$32,678	$1,825	-$17,915	$19,740	$113,228	$6,322	3.122	$13,417	
R5-11	$157,366	$8,787	-$19,644	$28,431	$115,561	$6,453	4.406	$21,978	
R5-12	$57,724	$3,223	-$18,787	$22,010	$113,589	$6,343	3.470	$15,667	
R5-13	$102,154	$5,704	-$19,733	$25,437	$114,631	$6,401	3.974	$19,037	
R5-14	$45,814	$2,558	-$17,799	$20,357	$112,306	$6,271	3.246	$14,086	
R5-15	$34,303	$1,915	-$24,219	$26,135	$118,865	$6,637	3.938	$19,497	
R5-16	$159,543	$8,909	-$24,757	$33,666	$119,141	$6,653	5.061	$27,013	
R5-17	$14,763	$824	-$13,221	$14,046	$128,126	$7,154	1.963	$6,891	
R5-18	$89,871	$5,018	-$24,149	$29,167	$117,340	$6,552	4.452	$22,615	**$868,767**
R5-19	$65,847	$3,677	-$2,901	$6,578	$125,655	$7,016	0.938	-$438	
R5-20	$48,044	$2,683	$184	$2,683	$115,197	$6,432	0.417	-$3,750	
R5-21	$33,664	$1,880	-$554	$2,433	$130,899	$7,309	0.333	-$4,876	

TABLE B-18 (CONTINUED)
BERM WIDTH OPTIMIZATION MINIMIN

Model Reach	Damage Reduction MiniMiN	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits MiniMin	Summed Net Benefits MiniMin
R5-22	$0	$0	-$1,964	$1,964	$0	$0	-	$1,964	
R5-23	$0	$0	-$511	$511	$0	$0	-	$511	
R5-24	$0	$0	-$6,898	$6,898	$0	$0	-	$6,898	
R5-25	$0	$0	-$15,278	$15,278	$0	$0	-	$15,278	
R5-26	$0	$0	-$12,809	$12,809	$0	$0	-	$12,809	
R5-27	$0	$0	-$10,102	$10,102	$0	$0	-	$10,102	
R5-28	$0	$0	-$11,651	$11,651	$0	$0	-	$11,651	
R5-29	$0	$0	-$37,910	$37,910	$0	$0	-	$37,910	
R5-30	$40,984	$2,288	-$32,848	$35,137	$124,760	$6,966	5.044	$28,170	
R5-31	$243,829	$13,615	-$33,879	$47,494	$121,361	$6,777	7.008	$40,717	
R5-32	$1,311,296	$73,220	-$61,892	$135,112	$242,871	$13,561	9.963	$121,551	
R5-33	$504,917	$28,194	-$62,530	$90,724	$250,355	$13,979	6.490	$76,745	
R5-34	$212,729	$11,878	-$53,740	$65,618	$250,146	$13,968	4.698	$51,651	
R5-35	$323,740	$18,077	-$52,782	$70,859	$243,446	$13,594	5.213	$57,266	
R5-36	$1,566,492	$87,470	-$56,472	$143,942	$232,341	$12,973	11.095	$130,969	
R5-37	$221,294	$12,357	-$80,647	$93,004	$252,865	$14,119	6.587	$78,884	
R5-38	$512,353	$28,609	-$94,528	$123,136	$269,422	$15,044	8.185	$108,092	
R5-39	$100,001	$5,584	-$98,750	$104,333	$257,359	$14,370	7.260	$89,963	
R5-40	$4,749	$265	-$49,625	$49,891	$124,057	$6,927	7.202	$42,964	
R5-41	$12,566	$702	-$44,843	$45,544	$125,219	$6,992	6.514	$38,552	
R5-42	$5,003	$279	-$30,127	$30,406	$110,913	$6,193	4.910	$24,213	
R5-43	$7,974	$445	-$18,731	$19,176	$112,675	$6,292	3.048	$12,885	
R5-44	$1,173	$66	-$5,603	$5,668	$112,664	$6,291	0.901	-$623	
R5-45	$37,031	$2,068	$263	$2,068	$107,526	$6,004	0.344	-$3,936	
R5-46	$124,750	$6,966	$7,328	$6,966	$105,737	$5,904	1.180	$1,062	
R5-47	$299,564	$16,727	$982	$16,727	$121,527	$6,786	2.465	$9,941	
R5-48	-$137	-$8	$2,299	-$8	$132,480	$7,397	-0.001	-$7,405	
R5-49	$9,710	$542	-$12,232	$12,774	$167,165	$9,334	1.369	$3,440	
R5-50	$320	$18	-$18,968	$18,985	$208,754	$11,656	1.629	$7,329	
R5-51	$10,808	$603	-$28,941	$29,544	$168,378	$9,402	3.142	$20,142	**$932,571**

TABLE B-19
BERM WIDTH OPTIMIZATION MINIMUM

Model Reach	Damage Reduction Minimum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Minimum	Summed Net Benefits Minimum
R1-1	$ 7,892	$ 441	$ 54,795	$ 441	$ 503,608	$ 28,121	0.016	$ -27,680	
R1-2	$ 3,206	$ 179	$ 49,622	$ 179	$ 480,331	$ 26,821	0.007	$ -26,642	
R1-3	$ 11,050	$ 617	$ 37,527	$ 617	$ 469,071	$ 26,192	0.024	$ -25,575	
R1-4	$ 16,748	$ 935	$ 27,756	$ 935	$ 462,134	$ 25,805	0.036	$ -24,869	
R1-5	$ 4,134	$ 231	$ 22,870	$ 231	$ 505,522	$ 28,227	0.008	$ -27,997	
R1-6	$ 14,179	$ 792	$ 6,771	$ 792	$ 534,501	$ 29,846	0.027	$ -29,054	
R1-7	$ 13,108	$ 732	$ 442	$ 732	$ 531,757	$ 29,692	0.025	$ -28,960	
R1-8	$ 9,206	$ 514	$ 1,159	$ 514	$ 558,676	$ 31,195	0.016	$ -30,681	
R1-9	$ 50,118	$ 2,799	$ 2,015	$ 2,799	$ 526,231	$ 29,384	0.095	$ -26,585	
R1-10	$ 74,855	$ 4,180	$ 6,219	$ 4,180	$ 488,438	$ 27,273	0.153	$ -23,094	
R1-11	$ 1,425,818	$ 79,615	$ 8,692	$ 79,615	$ 513,690	$ 28,683	2.776	$ 50,931	
R1-12	$ 56,079	$ 3,131	$ 3,758	$ 3,131	$ 543,351	$ 30,340	0.103	$ -27,208	
R1-13	$ 2,671,857	$ 149,191	$ -58	$ 149,250	$ 543,541	$ 30,350	4.918	$ 118,899	
R1-14	$ 1,777,549	$ 99,255	$ -7,413	$ 106,668	$ 587,067	$ 32,781	3.254	$ 73,887	
R1-15	$ 3,078,837	$ 171,916	$ -8,068	$ 179,984	$ 713,334	$ 39,831	4.519	$ 140,153	
R1-16	$ 2,036,531	$ 113,716	$ -11,001	$ 124,717	$ 723,284	$ 40,387	3.088	$ 84,330	$ 440,993
R1-17	$ 25,204	$ 1,407	$ -11,198	$ 12,605	$ 779,482	$ 43,525	0.290	$ -30,920	
R1-18	$ 52,547	$ 2,934	$ -12,742	$ 15,676	$ 800,373	$ 44,691	0.351	$ -29,015	
R1-19	$ 89,401	$ 4,992	$ -5,695	$ 10,687	$ 744,199	$ 41,555	0.257	$ -30,868	
R1-20	$ 121,703	$ 6,796	$ 8,438	$ 6,796	$ 662,742	$ 37,006	0.184	$ -30,211	
R1-21	$ -34	$ -2	$ 9,080	$ -2	$ 502,158	$ 28,040	-0.000	$ -28,041	
R1-22	$ 38,887	$ 2,171	$ 21,487	$ 2,171	$ 492,109	$ 27,478	0.079	$ -25,307	
R1-23	$ 2,995	$ 167	$ 36,478	$ 167	$ 506,191	$ 28,265	0.006	$ -28,098	
R1-24	$ 80,930	$ 4,519	$ 41,072	$ 4,519	$ 461,076	$ 25,746	0.176	$ -21,227	
R2-1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-3	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-4	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-5	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R2-7	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R3-1	$ 150,199	$ 8,387	$ 20,806	$ 8,387	$ 290,733	$ 16,234	0.517	$ -7,847	
R3-2	$ 1,701,715	$ 95,020	$ 19,994	$ 95,020	$ 231,823	$ 12,945	7.341	$ 82,076	
R3-3	$ 152,882	$ 8,537	$ 20,424	$ 8,537	$ 222,029	$ 12,398	0.689	$ -3,861	
R3-4	$ 5,870	$ 328	$ 25,555	$ 328	$ 472,146	$ 26,364	0.012	$ -26,036	
R3-5	$ 48,294	$ 2,697	$ 21,080	$ 2,697	$ 528,293	$ 29,499	0.091	$ -26,802	
R3-6	$ 44,517	$ 2,486	$ 15,383	$ 2,486	$ 573,348	$ 32,015	0.078	$ -29,529	
R3-7	$ 1,065,098	$ 59,473	$ 4,993	$ 59,473	$ 580,324	$ 32,404	1.835	$ 27,069	
R3-8	$ 6,260,926	$ 349,598	$ -14,815	$ 364,413	$ 268,892	$ 15,014	24.271	$ 349,398	
R3-9	$ 454,907	$ 25,401	$ -17,079	$ 42,480	$ 263,438	$ 14,710	2.888	$ 27,770	
R3-10	$ 2,716,745	$ 151,698	$ -21,371	$ 173,069	$ 265,271	$ 14,812	11.684	$ 158,257	
R3-11	$ 647,190	$ 36,138	$ -23,863	$ 60,001	$ 264,251	$ 14,755	4.066	$ 45,246	
R3-12	$ 1,530,959	$ 85,486	$ -37,589	$ 123,075	$ 251,788	$ 14,059	8.754	$ 109,015	
R3-13	$ 131,842	$ 7,362	$ -44,608	$ 51,970	$ 261,368	$ 14,594	3.561	$ 37,375	
R3-14	$ 1,087,125	$ 60,703	$ -77,674	$ 138,377	$ 374,382	$ 20,905	6.619	$ 117,472	

TABLE B-19 (CONTINUED)
BERM WIDTH OPTIMIZATION MINIMUM

Model Reach	Damage Reduction Minimum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Minimum	Summed Net Benefits Minimum
R3-15	$ 7,229	$ 404	$ -67,602	$ 68,006	$ 304,471	$ 17,001	4.000	$ 51,005	
R3-16	$ 17	$ 1	$ -52,660	$ 52,661	$ 217,142	$ 12,125	4.343	$ 40,537	
R3-17	$ 85,986	$ 4,801	$ -83,305	$ 88,107	$ 314,729	$ 17,574	5.014	$ 70,533	
R3-18	$ 235,179	$ 13,132	$ -86,928	$ 100,060	$ 329,401	$ 18,393	5.440	$ 81,666	
R3-19	$ 212,623	$ 11,872	$ -82,277	$ 94,149	$ 314,241	$ 17,547	5.366	$ 76,602	
R3-20	$ 3,461,887	$ 193,305	$ -79,875	$ 273,180	$ 310,874	$ 17,359	15.737	$ 255,821	
R3-21	$ 951,735	$ 53,143	$ -77,993	$ 131,136	$ 309,901	$ 17,304	7.578	$ 113,832	
R3-22	$ 293,381	$ 16,382	$ -67,797	$ 84,179	$ 287,290	$ 16,042	5.248	$ 68,137	
R3-23	$ 204,513	$ 11,420	$ -53,371	$ 64,790	$ 244,743	$ 13,666	4.741	$ 51,124	$1,676,708
R3-24	$ -626	$ -35	$ -45,450	$ 45,415	$ -99,313	$ -5,545	-8.190	$ 50,961	
R3-25	$ -153	$ -9	$ -32,621	$ 32,612	$ -106,985	$ -5,974	-5.459	$ 38,586	
R3-26	$ -	$ -	$ -26,720	$ 26,720	$ -	$ -	-	$ 26,720	
R4-1	$ 106,445	$ 5,944	$ -54,395	$ 60,339	$ 292,684	$ 16,343	3.692	$ 43,996	
R4-2	$ 440,609	$ 24,603	$ -45,920	$ 70,523	$ 295,830	$ 16,519	4.269	$ 54,004	
R4-3	$ -	$ -	$ 3,747	$ -	$ 51,808	$ 2,893	-	$ -2,893	
R4-4	$ -	$ -	$ 7,991	$ -	$ 48,298	$ 2,697	-	$ -2,697	
R4-5	$ 47,026	$ 2,626	$ -21,731	$ 24,357	$ 253,245	$ 14,141	1.722	$ 10,216	
R4-6	$ 4,422	$ 247	$ 6,739	$ 247	$ -8,400	$ -469	-0.526	$ 716	$ 103,342
R4-7	$ -	$ -	$ -8,323	$ 8,323	$ -90,637	$ -5,061	-1.644	$ 13,384	
R4-8	$ -	$ -	$ -87,751	$ 87,751	$ -	$ -	-	$ 87,751	
R4-9	$ -	$ -	$ -153,875	$ 153,875	$ -	$ -	-	$ 153,875	
R5-1	$ 57,546	$ 3,213	$ -100,250	$ 103,463	$ 410,195	$ 22,905	4.517	$ 80,558	
R5-2	$ 18,932	$ 1,057	$ -70,377	$ 71,434	$ 399,628	$ 22,314	3.201	$ 49,119	
R5-3	$ 17,360	$ 969	$ -38,155	$ 39,124	$ 390,896	$ 21,827	1.792	$ 17,298	
R5-4	$ 25,354	$ 1,416	$ -11,323	$ 12,738	$ 472,071	$ 26,360	0.483	$ -13,621	
R5-5	$ 74,997	$ 4,188	$ 11,365	$ 4,188	$ 353,227	$ 19,723	0.212	$ -15,536	
R5-6	$ 2,641,306	$ 147,485	$ -30,953	$ 178,439	$ 495,493	$ 27,667	6.449	$ 150,771	
R5-7	$ 3,653,734	$ 204,017	$ -38,120	$ 242,138	$ 483,558	$ 27,001	8.968	$ 215,137	
R5-8	$ 1,532,336	$ 85,563	$ -27,503	$ 113,065	$ 460,545	$ 25,716	4.397	$ 87,350	
R5-9	$ 25,488	$ 1,423	$ -15,659	$ 17,082	$ 373,027	$ 20,829	0.820	$ -3,747	
R5-10	$ 34,347	$ 1,918	$ -17,915	$ 19,833	$ 371,421	$ 20,739	0.956	$ -906	
R5-11	$ 134,846	$ 7,530	$ -19,644	$ 27,173	$ 378,259	$ 21,121	1.287	$ 6,052	
R5-12	$ 67,648	$ 3,777	$ -18,787	$ 22,564	$ 373,000	$ 20,828	1.083	$ 1,736	
R5-13	$ 87,316	$ 4,876	$ -19,733	$ 24,609	$ 376,788	$ 21,039	1.170	$ 3,570	
R5-14	$ 47,104	$ 2,630	$ -17,799	$ 20,429	$ 369,208	$ 20,616	0.991	$ -187	
R5-15	$ 32,243	$ 1,800	$ -24,219	$ 26,020	$ 379,959	$ 21,216	1.226	$ 4,804	
R5-16	$ 175,148	$ 9,780	$ -24,757	$ 34,537	$ 388,329	$ 21,684	1.593	$ 12,853	
R5-17	$ 18,186	$ 1,015	$ -13,221	$ 14,237	$ 318,052	$ 17,759	0.802	$ -3,523	
R5-18	$ 101,263	$ 5,654	$ -24,149	$ 29,803	$ 375,009	$ 20,940	1.423	$ 8,864	$ 600,593
R5-19	$ 125,484	$ 7,007	$ -2,901	$ 9,908	$ 319,026	$ 17,814	0.556	$ -7,906	
R5-20	$ 50,883	$ 2,841	$ 184	$ 2,841	$ 365,008	$ 20,381	0.139	$ -17,540	
R5-21	$ 42,456	$ 2,371	$ -554	$ 2,924	$ 399,731	$ 22,320	0.131	$ -19,396	
R5-22	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-23	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	

TABLE B-19 (CONTINUED)
BERM WIDTH OPTIMIZATION MINIMUM

Model Reach	Damage Reduction Minimum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Minimum	Summed Net Benefits Minimum
R5-24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-26	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-27	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-28	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-29	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
R5-30	$ 45,922	$ 2,564	$ -32,848	$ 35,413	$ 385,009	$ 21,498	1.647	$ 13,914	
R5-31	$ 209,721	$ 11,710	$ -33,879	$ 45,589	$ 382,832	$ 21,377	2.133	$ 24,212	
R5-32	$ 1,337,460	$ 74,681	$ -61,892	$ 136,573	$ 453,964	$ 25,348	5.388	$ 111,225	
R5-33	$ 493,839	$ 27,575	$ -62,530	$ 90,105	$ 472,323	$ 26,374	3.417	$ 63,732	
R5-34	$ 208,706	$ 11,654	$ -53,740	$ 65,394	$ 475,927	$ 26,575	2.461	$ 38,819	
R5-35	$ 320,502	$ 17,896	$ -52,782	$ 70,678	$ 459,083	$ 25,634	2.757	$ 45,044	
R5-36	$ 1,577,668	$ 88,094	$ -56,472	$ 144,566	$ 435,732	$ 24,330	5.942	$ 120,236	
R5-37	$ 216,881	$ 12,110	$ -80,647	$ 92,758	$ 472,679	$ 26,393	3.514	$ 66,364	
R5-38	$ 503,723	$ 28,127	$ -94,528	$ 122,654	$ 503,394	$ 28,109	4.364	$ 94,546	
R5-39	$ 98,521	$ 5,501	$ -98,750	$ 104,251	$ 473,313	$ 26,429	3.945	$ 77,822	
R5-40	$ 4,536	$ 253	$ -49,625	$ 49,879	$ 392,403	$ 21,911	2.276	$ 27,968	
R5-41	$ 11,686	$ 653	$ -44,843	$ 45,495	$ 385,290	$ 21,514	2.115	$ 23,981	
R5-42	$ 4,836	$ 270	$ -30,127	$ 30,397	$ 381,023	$ 21,276	1.429	$ 9,122	
R5-43	$ 7,069	$ 395	$ -18,731	$ 19,126	$ 362,725	$ 20,254	0.944	$ -1,128	
R5-44	$ -2,515	$ -140	$ -5,603	$ 5,462	$ 353,716	$ 19,751	0.277	$ -14,288	
R5-45	$ 8,139	$ 454	$ 263	$ 454	$ 338,398	$ 18,895	0.024	$ -18,441	
R5-46	$ 126,084	$ 7,040	$ 7,328	$ 7,040	$ 340,711	$ 19,025	0.370	$ -11,984	
R5-47	$ 311,781	$ 17,409	$ 982	$ 17,409	$ 366,202	$ 20,448	0.851	$ -3,039	
R5-48	$ 4,488	$ 251	$ 2,299	$ 251	$ 318,501	$ 17,785	0.014	$ -17,534	
R5-49	$ -5,228	$ -292	$ -12,232	$ 11,940	$ 374,206	$ 20,895	0.571	$ -8,955	
R5-50	$ 3,368	$ 188	$ -18,968	$ 19,156	$ 421,657	$ 23,545	0.814	$ -4,389	
R5-51	$ 11,951	$ 667	$ -28,941	$ 29,608	$ 385,630	$ 21,533	1.375	$ 8,075	$ 645,301

TABLE B-20
SMALL BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Small	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Small	Summed Net Benefits Small
R1-1	$ 9,176	$ 512	$ 54,795	$ 512	$ 1,015,253	$ 56,690	0.009	$ -56,177	
R1-2	$ 3,314	$ 185	$ 49,622	$ 185	$ 948,708	$ 52,974	0.003	$ -52,789	
R1-3	$ 11,797	$ 659	$ 37,527	$ 659	$ 904,743	$ 50,519	0.013	$ -49,860	
R1-4	$ 17,026	$ 951	$ 27,756	$ 951	$ 880,934	$ 49,190	0.019	$ -48,239	
R1-5	$ 4,287	$ 239	$ 22,870	$ 239	$ 946,723	$ 52,863	0.005	$ -52,624	
R1-6	$ 14,393	$ 804	$ 6,771	$ 804	$ 973,586	$ 54,363	0.015	$ -53,559	
R1-7	$ 13,135	$ 733	$ 442	$ 733	$ 948,920	$ 52,986	0.014	$ -52,252	
R1-8	$ 9,594	$ 536	$ 1,159	$ 536	$ 1,000,692	$ 55,877	0.010	$ -55,341	
R1-9	$ 51,309	$ 2,865	$ 2,015	$ 2,865	$ 952,453	$ 53,183	0.054	$ -50,318	
R1-10	$ 77,136	$ 4,307	$ 6,219	$ 4,307	$ 888,389	$ 49,606	0.087	$ -45,299	
R1-11	$ 1,432,725	$ 80,001	$ 8,692	$ 80,001	$ 938,330	$ 52,395	1.527	$ 27,606	
R1-12	$ 56,458	$ 3,152	$ 3,758	$ 3,152	$ 983,136	$ 54,896	0.057	$ -51,744	
R1-13	$ 2,680,629	$ 149,681	$ -58	$ 149,739	$ 977,628	$ 54,589	2.743	$ 95,151	
R1-14	$ 1,783,427	$ 99,583	$ -7,413	$ 106,996	$ 1,020,682	$ 56,993	1.877	$ 50,003	
R1-15	$ 3,219,894	$ 179,793	$ -8,068	$ 187,861	$ 1,094,204	$ 61,098	3.075	$ 126,762	
R1-16	$ 2,055,151	$ 114,756	$ -11,001	$ 125,756	$ 1,113,819	$ 62,194	2.022	$ 63,563	**$ 311,341**
R1-17	$ 24,693	$ 1,379	$ -11,198	$ 12,577	$ 1,204,398	$ 67,251	0.187	$ -54,675	
R1-18	$ 53,453	$ 2,985	$ -12,742	$ 15,727	$ 1,231,009	$ 68,737	0.229	$ -53,010	
R1-19	$ 91,785	$ 5,125	$ -5,695	$ 10,820	$ 1,146,340	$ 64,009	0.169	$ -53,190	
R1-20	$ 126,344	$ 7,055	$ 8,438	$ 7,055	$ 1,035,242	$ 57,806	0.122	$ -50,751	
R1-21	$ -34	$ -2	$ 9,080	$ -2	$ 904,277	$ 50,493	-0.000	$ -50,495	
R1-22	$ 40,372	$ 2,254	$ 21,487	$ 2,254	$ 925,028	$ 51,652	0.044	$ -49,398	
R1-23	$ 3,013	$ 168	$ 36,478	$ 168	$ 989,278	$ 55,239	0.003	$ -55,071	
R1-24	$ 82,307	$ 4,596	$ 41,072	$ 4,596	$ 879,424	$ 49,105	0.094	$ -44,509	
R2-1	-	-	-	-	-	-	-	-	
R2-2	-	-	-	-	-	-	-	-	
R2-3	-	-	-	-	-	-	-	-	
R2-4	-	-	-	-	-	-	-	-	
R2-5	-	-	-	-	-	-	-	-	
R2-6	-	-	-	-	-	-	-	-	
R2-7	-	-	-	-	-	-	-	-	
R3-1	$ 152,810	$ 8,533	$ 20,806	$ 8,533	$ 701,247	$ 39,156	0.218	$ -30,624	
R3-2	$ 1,755,660	$ 98,033	$ 19,994	$ 98,033	$ 588,113	$ 32,839	2.985	$ 65,194	
R3-3	$ 158,305	$ 8,839	$ 20,424	$ 8,839	$ 580,848	$ 32,433	0.273	$ -23,594	
R3-4	$ 5,926	$ 331	$ 25,555	$ 331	$ 866,059	$ 48,359	0.007	$ -48,028	
R3-5	$ 49,758	$ 2,778	$ 21,080	$ 2,778	$ 956,547	$ 53,412	0.052	$ -50,633	
R3-6	$ 51,714	$ 2,888	$ 15,383	$ 2,888	$ 1,026,222	$ 57,302	0.050	$ -54,415	
R3-7	$ 1,258,860	$ 70,292	$ 4,993	$ 70,292	$ 1,019,942	$ 56,952	1.234	$ 13,341	
R3-8	$ 6,281,693	$ 350,758	$ -14,815	$ 365,572	$ 644,847	$ 36,007	10.153	$ 329,565	
R3-9	$ 468,968	$ 26,186	$ -17,079	$ 43,265	$ 623,166	$ 34,796	1.243	$ 8,469	
R3-10	$ 3,037,964	$ 169,634	$ -21,371	$ 191,006	$ 631,892	$ 35,284	5.413	$ 155,722	
R3-11	$ 688,435	$ 38,441	$ -23,863	$ 62,304	$ 625,019	$ 34,900	1.785	$ 27,404	
R3-12	$ 1,716,647	$ 95,854	$ -37,589	$ 133,443	$ 599,084	$ 33,452	3.989	$ 99,991	
R3-13	$ 135,826	$ 7,584	$ -44,608	$ 52,192	$ 604,537	$ 33,756	1.546	$ 18,436	

TABLE B-20 (CONTINUED)
SMALL BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Small	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Small	Summed Net Benefits Small
R3-14	$ 1,115,521	$ 62,289	$ -77,674	$ 139,962	$ 826,607	$ 46,156	3.032	$ 93,806	
R3-15	$ 7,229	$ 404	$ -67,602	$ 68,006	$ 661,119	$ 36,916	1.842	$ 31,090	
R3-16	$ 17	$ 1	$ -52,660	$ 52,661	$ 461,502	$ 25,769	2.044	$ 26,892	
R3-17	$ 90,784	$ 5,069	$ -83,305	$ 88,375	$ 658,922	$ 36,793	2.402	$ 51,582	
R3-18	$ 247,257	$ 13,806	$ -86,928	$ 100,734	$ 681,852	$ 38,073	2.646	$ 62,661	
R3-19	$ 215,887	$ 12,055	$ -82,277	$ 94,331	$ 664,039	$ 37,079	2.544	$ 57,253	
R3-20	$ 3,513,631	$ 196,194	$ -79,875	$ 276,069	$ 656,271	$ 36,645	7.534	$ 239,424	
R3-21	$ 995,982	$ 55,614	$ -77,993	$ 133,607	$ 653,170	$ 36,472	3.663	$ 97,135	
R3-22	$ 304,502	$ 17,003	$ -67,797	$ 84,800	$ 614,639	$ 34,320	2.471	$ 50,480	
R3-23	$ 211,931	$ 11,834	$ -53,371	$ 65,204	$ 530,014	$ 29,595	2.203	$ 35,609	**$ 1,287,383**
R3-24	$ -626	$ -35	$ -45,450	$ 45,415	$ -99,376	$ -5,549	-8.184	$ 50,964	
R3-25	$ -153	$ -9	$ -32,621	$ 32,612	$ -107,041	$ -5,977	-5.456	$ 38,589	
R3-26	$ -	$ -	$ -26,720	$ 26,720	$ -	$ -	-	$ 26,720	
R4-1	$ 104,716	$ 5,847	$ -54,395	$ 60,242	$ 693,703	$ 38,735	1.555	$ 21,507	
R4-2	$ 430,906	$ 24,061	$ -45,920	$ 69,981	$ 710,659	$ 39,682	1.764	$ 30,299	
R4-3	$ -	$ -	$ 3,747	$ -	$ 99,491	$ 5,555	-	$ -5,555	
R4-4	$ -	$ -	$ 7,991	$ -	$ 95,704	$ 5,344	-	$ -5,344	
R4-5	$ 46,487	$ 2,596	$ -21,731	$ 24,327	$ 623,914	$ 34,838	0.698	$ -10,511	
R4-6	$ 4,422	$ 247	$ 6,739	$ 247	$ 138,232	$ 7,719	0.032	$ -7,472	**$ 22,924**
R4-7	$ -	$ -	$ -8,323	$ 8,323	$ -90,640	$ -5,061	-1.644	$ 13,384	
R4-8	$ -	$ -	$ -87,751	$ 87,751	$ -	$ -	-	$ 87,751	
R4-9	$ -	$ -	$ -153,875	$ 153,875	$ -	$ -	-	$ 153,875	
R5-1	$ 59,809	$ 3,340	$ -100,250	$ 103,589	$ 787,654	$ 43,981	2.355	$ 59,608	
R5-2	$ 19,219	$ 1,073	$ -70,377	$ 71,450	$ 780,370	$ 43,574	1.640	$ 27,876	
R5-3	$ 17,377	$ 970	$ -38,155	$ 39,125	$ 783,145	$ 43,729	0.895	$ -4,604	
R5-4	$ 25,904	$ 1,446	$ -11,323	$ 12,769	$ 966,043	$ 53,942	0.237	$ -41,173	
R5-5	$ 74,100	$ 4,138	$ 11,365	$ 4,138	$ 727,985	$ 40,649	0.102	$ -36,512	
R5-6	$ 2,631,049	$ 146,913	$ -30,953	$ 177,866	$ 877,129	$ 48,977	3.632	$ 128,889	
R5-7	$ 3,646,101	$ 203,591	$ -38,120	$ 241,712	$ 854,230	$ 47,699	5.067	$ 194,013	
R5-8	$ 1,520,880	$ 84,923	$ -27,503	$ 112,426	$ 814,236	$ 45,465	2.473	$ 66,960	
R5-9	$ 26,646	$ 1,488	$ -15,659	$ 17,147	$ 1,406,397	$ 78,530	0.218	$ -61,383	
R5-10	$ 34,915	$ 1,950	$ -17,915	$ 19,865	$ 755,797	$ 42,202	0.471	$ -22,337	
R5-11	$ 141,856	$ 7,921	$ -19,644	$ 27,565	$ 763,795	$ 42,649	0.646	$ -15,084	
R5-12	$ 72,145	$ 4,028	$ -18,787	$ 22,815	$ 757,088	$ 42,274	0.540	$ -19,459	
R5-13	$ 86,268	$ 4,817	$ -19,733	$ 24,550	$ 757,425	$ 42,293	0.580	$ -17,743	
R5-14	$ 47,336	$ 2,643	$ -17,799	$ 20,442	$ 747,504	$ 41,739	0.490	$ -21,297	
R5-15	$ 32,476	$ 1,813	$ -24,219	$ 26,033	$ 761,324	$ 42,511	0.612	$ -16,478	
R5-16	$ 170,919	$ 9,544	$ -24,757	$ 34,301	$ 778,288	$ 43,458	0.789	$ -9,157	
R5-17	$ 18,900	$ 1,055	$ -13,221	$ 14,277	$ 668,898	$ 37,350	0.382	$ -23,073	
R5-18	$ 102,312	$ 5,713	$ -24,149	$ 29,862	$ 753,492	$ 42,074	0.710	$ -12,212	**$ 176,833**
R5-19	$ 140,173	$ 7,827	$ -2,901	$ 10,728	$ 697,446	$ 38,944	0.275	$ -28,216	
R5-20	$ 51,526	$ 2,877	$ 184	$ 2,877	$ 750,127	$ 41,886	0.069	$ -39,008	
R5-21	$ 43,232	$ 2,414	$ -554	$ 2,968	$ 821,592	$ 45,876	0.065	$ -42,908	
R5-22	-	-	-	-	-	-	-	-	

TABLE B-20 (CONTINUED)
SMALL BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Small	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Small	Summed Net Benefits Small
R5-23	-	-	-	-	-	-	-	-	
R5-24	-	-	-	-	-	-	-	-	
R5-25	-	-	-	-	-	-	-	-	
R5-26	-	-	-	-	-	-	-	-	
R5-27	-	-	-	-	-	-	-	-	
R5-28	-	-	-	-	-	-	-	-	
R5-29	-	-	-	-	-	-	-	-	
R5-30	$ 46,546	$ 2,599	$ -32,848	$ 35,447	$ 769,230	$ 42,952	0.825	$ -7,505	
R5-31	$ 209,791	$ 11,714	$ -33,879	$ 45,593	$ 764,591	$ 42,693	1.068	$ 2,900	
R5-32	$ 1,315,226	$ 73,440	$ -61,892	$ 135,332	$ 808,247	$ 45,131	2.999	$ 90,201	
R5-33	$ 487,339	$ 27,212	$ -62,530	$ 89,743	$ 841,029	$ 46,961	1.911	$ 42,781	
R5-34	$ 206,178	$ 11,513	$ -53,740	$ 65,252	$ 846,053	$ 47,242	1.381	$ 18,010	
R5-35	$ 317,192	$ 17,711	$ -52,782	$ 70,494	$ 816,666	$ 45,601	1.546	$ 24,892	
R5-36	$ 1,567,713	$ 87,538	$ -56,472	$ 144,010	$ 773,572	$ 43,195	3.334	$ 100,815	
R5-37	$ 214,192	$ 11,960	$ -80,647	$ 92,607	$ 838,153	$ 46,801	1.979	$ 45,807	
R5-38	$ 496,364	$ 27,716	$ -94,528	$ 122,243	$ 895,096	$ 49,980	2.446	$ 72,263	
R5-39	$ 97,773	$ 5,459	$ -98,750	$ 104,209	$ 839,227	$ 46,861	2.224	$ 57,348	
R5-40	$ 4,540	$ 254	$ -49,625	$ 49,879	$ 772,429	$ 43,131	1.156	$ 6,748	
R5-41	$ 11,686	$ 653	$ -44,843	$ 45,495	$ 761,534	$ 42,523	1.070	$ 2,973	
R5-42	$ 4,836	$ 270	$ -30,127	$ 30,397	$ 766,785	$ 42,816	0.710	$ -12,419	
R5-43	$ 7,083	$ 396	$ -18,731	$ 19,127	$ 739,402	$ 41,287	0.463	$ -22,160	
R5-44	$ -2,515	$ -140	$ -5,603	$ 5,462	$ 730,588	$ 40,795	0.134	$ -35,332	
R5-45	$ 8,139	$ 454	$ 263	$ 454	$ 704,259	$ 39,324	0.012	$ -38,870	
R5-46	$ 126,175	$ 7,045	$ 7,328	$ 7,045	$ 709,016	$ 39,590	0.178	$ -32,545	
R5-47	$ 312,126	$ 17,428	$ 982	$ 17,428	$ 755,623	$ 42,193	0.413	$ -24,764	
R5-48	$ 4,488	$ 251	$ 2,299	$ 251	$ 713,208	$ 39,824	0.006	$ -39,574	
R5-49	$ -5,228	$ -292	$ -12,232	$ 11,940	$ 782,716	$ 43,705	0.273	$ -31,765	
R5-50	$ 3,786	$ 211	$ -18,968	$ 19,179	$ 851,822	$ 47,564	0.403	$ -28,385	
R5-51	$ 12,342	$ 689	$ -28,941	$ 29,630	$ 781,092	$ 43,615	0.679	$ -13,985	**$ 177,435**

TABLE B-21
MEDIUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Medium	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Medium	Summed Net Benefits Medium
R1-1	$10,309	$576	$54,795	$576	$1,585,115	$88,510	0.007	-$87,934	
R1-2	$3,393	$189	$49,622	$189	$1,470,574	$82,114	0.002	-$81,925	
R1-3	$12,449	$695	$37,527	$695	$1,388,648	$77,539	0.009	-$76,844	
R1-4	$17,231	$962	$27,756	$962	$1,335,347	$74,563	0.013	-$73,601	
R1-5	$4,439	$248	$22,870	$248	$1,427,171	$79,690	0.003	-$79,443	
R1-6	$14,587	$815	$6,771	$815	$1,448,675	$80,891	0.010	-$80,077	
R1-7	$13,135	$733	$442	$733	$1,403,660	$78,378	0.009	-$77,644	
R1-8	$9,778	$546	$1,159	$546	$1,481,528	$82,726	0.007	-$82,180	
R1-9	$52,220	$2,916	$2,015	$2,916	$1,408,126	$78,627	0.037	-$75,711	
R1-10	$79,279	$4,427	$6,219	$4,427	$1,319,661	$73,687	0.060	-$69,261	
R1-11	$1,432,775	$80,003	$8,692	$80,003	$1,397,684	$78,044	1.025	$1,959	
R1-12	$56,614	$3,161	$3,758	$3,161	$1,457,664	$81,393	0.039	-$78,232	
R1-13	$2,691,015	$150,261	-$58	$150,319	$1,443,421	$80,598	1.865	$69,721	
R1-14	$1,783,738	$99,600	-$7,413	$107,014	$1,497,103	$83,595	1.280	$23,418	
R1-15	$3,211,165	$179,305	-$8,068	$187,373	$1,516,990	$84,706	2.212	$102,667	
R1-16	$2,063,909	$115,245	-$11,001	$126,245	$1,551,061	$86,608	1.458	$39,637	**$159,172**
R1-17	$23,555	$1,315	-$11,198	$12,513	$1,677,084	$93,645	0.134	-$81,132	
R1-18	$18,354	$1,025	-$12,742	$13,767	$1,713,788	$95,695	0.144	-$81,927	
R1-19	$92,392	$5,159	-$5,695	$10,854	$1,597,008	$89,174	0.122	-$78,320	
R1-20	$127,491	$7,119	$8,438	$7,119	$1,443,702	$80,614	0.088	-$73,495	
R1-21	-$34	-$2	$9,080	-$2	$1,345,694	$75,141	-0.000	-$75,143	
R1-22	$41,537	$2,319	$21,487	$2,319	$1,397,060	$78,009	0.030	-$75,690	
R1-23	$3,040	$170	$36,478	$170	$1,522,279	$85,001	0.002	-$84,831	
R1-24	$82,344	$4,598	$41,072	$4,598	$1,340,748	$74,865	0.061	-$70,267	
R2-1	-	-	-	-	-	-	-	-	
R2-2	-	-	-	-	-	-	-	-	
R2-3	-	-	-	-	-	-	-	-	
R2-4	-	-	-	-	-	-	-	-	
R2-5	-	-	-	-	-	-	-	-	
R2-6	-	-	-	-	-	-	-	-	
R2-7	-	-	-	-	-	-	-	-	
R3-1	$156,951	$8,764	$20,806	$8,764	$1,177,095	$65,727	0.133	-$56,963	
R3-2	$1,806,978	$100,898	$19,994	$100,898	$1,011,762	$56,495	1.786	$44,403	
R3-3	$162,447	$9,071	$20,424	$9,071	$1,007,524	$56,258	0.161	-$47,187	
R3-4	$5,955	$333	$25,555	$333	$1,304,791	$72,857	0.005	-$72,525	
R3-5	$49,724	$2,776	$21,080	$2,776	$1,432,849	$80,008	0.035	-$77,231	
R3-6	$54,941	$3,068	$15,383	$3,068	$1,528,578	$85,353	0.036	-$82,285	
R3-7	$1,296,393	$72,388	$4,993	$72,388	$1,507,226	$84,161	0.860	-$11,773	
R3-8	$6,289,117	$351,172	-$14,815	$365,987	$1,088,835	$60,798	6.020	$305,188	
R3-9	$479,887	$26,796	-$17,079	$43,875	$1,050,590	$58,663	0.748	-$14,788	
R3-10	$3,328,224	$185,842	-$21,371	$207,213	$1,057,204	$59,032	3.510	$148,181	
R3-11	$721,598	$40,293	-$23,863	$64,156	$1,036,322	$57,866	1.109	$6,289	
R3-12	$1,915,343	$106,949	-$37,589	$144,538	$995,527	$55,588	2.600	$88,950	
R3-13	$137,873	$7,699	-$44,608	$52,306	$998,387	$55,748	0.938	-$3,442	

TABLE B-21 (CONTINUED)
MEDIUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Medium	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Medium	Summed Net Benefits Medium
R3-14	$1,126,723	$62,914	-$77,674	$140,588	$1,355,326	$75,679	1.858	$64,909	
R3-15	$7,229	$404	-$67,602	$68,006	$1,075,196	$60,037	1.133	$7,969	
R3-16	$17	$1	-$52,660	$52,661	$743,931	$41,540	1.268	$11,122	
R3-17	$93,353	$5,213	-$83,305	$88,518	$1,050,443	$58,655	1.509	$29,863	
R3-18	$255,578	$14,271	-$86,928	$101,199	$1,078,613	$60,228	1.680	$40,971	
R3-19	$217,733	$12,158	-$82,277	$94,434	$1,060,681	$59,226	1.594	$35,208	
R3-20	$3,515,078	$196,275	-$79,875	$276,150	$1,049,099	$58,580	4.714	$217,570	
R3-21	$1,030,080	$57,518	-$77,993	$135,511	$1,050,589	$58,663	2.310	$76,848	
R3-22	$312,382	$17,443	-$67,797	$85,240	$991,818	$55,381	1.539	$29,859	
R3-23	$217,045	$12,119	-$53,371	$65,490	$861,084	$48,081	1.362	$17,409	**$815,509**
R3-24	-$626	-$35	-$45,450	$45,415	-$99,396	-$5,550	-8.183	$50,965	
R3-25	-$153	-$9	-$32,621	$32,612	-$107,051	-$5,978	(5.456	$38,590	
R3-26	$0	$0	-$26,720	$26,720	$0	$0	-	$26,720	
R4-1	$101,999	$5,695	-$54,395	$60,090	$1,145,680	$63,973	0.939	-$3,882	
R4-2	$418,257	$23,355	-$45,920	$69,275	$1,182,108	$66,007	1.050	$3,268	
R4-3	$0	$0	$3,747	$0	$441,076	$24,629	-	-$24,629	
R4-4	$0	$0	$7,991	$0	$417,647	$23,321	-	-$23,321	
R4-5	$46,548	$2,599	-$21,731	$24,330	$1,041,718	$58,167	0.418	-$33,837	
R4-6	$4,422	$247	$6,739	$247	$630,047	$35,181	0.007	-$34,934	**-$117,334**
R4-7	-	-	-	-	-	-	-	-	
R4-8	-	-	-	-	-	-	-	-	
R4-9	-	-	-	-	-	-	-	-	
R5-1	$59,591	$3,327	-$100,250	$103,577	$1,198,561	$66,925	1.548	$36,652	
R5-2	$19,416	$1,084	-$70,377	$71,461	$1,195,167	$66,736	1.071	$4,725	
R5-3	$17,381	$971	-$38,155	$39,126	$1,209,309	$67,525	0.579	-$28,400	
R5-4	$25,665	$1,433	-$11,323	$12,756	$1,504,034	$83,982	0.152	-$71,227	
R5-5	$74,321	$4,150	$11,365	$4,150	$1,152,305	$64,342	0.064	-$60,193	
R5-6	$2,619,573	$146,272	-$30,953	$177,225	$1,320,684	$73,744	2.403	$103,481	
R5-7	$3,639,343	$203,214	-$38,120	$241,334	$1,286,996	$71,863	3.358	$169,471	
R5-8	$1,512,868	$84,476	-$27,503	$111,978	$1,228,020	$68,570	1.633	$43,408	
R5-9	$25,972	$1,450	-$15,659	$17,109	$1,178,196	$65,788	0.260	-$48,679	
R5-10	$35,536	$1,984	-$17,915	$19,899	$1,161,017	$64,829	0.307	-$44,930	
R5-11	$160,038	$8,936	-$19,644	$28,580	$1,174,535	$65,584	0.436	-$37,004	
R5-12	$73,154	$4,085	-$18,787	$22,871	$1,166,462	$65,133	0.351	-$42,262	
R5-13	$86,268	$4,817	-$19,733	$24,550	$1,166,039	$65,109	0.377	-$40,559	
R5-14	$47,431	$2,648	-$17,799	$20,448	$1,150,395	$64,236	0.318	-$43,788	
R5-15	$32,605	$1,821	-$24,219	$26,040	$1,166,474	$65,134	0.400	-$39,094	
R5-16	$170,973	$9,547	-$24,757	$34,304	$1,192,336	$66,578	0.515	-$32,274	
R5-17	$19,071	$1,065	-$13,221	$14,286	$1,043,715	$58,279	0.245	-$43,993	
R5-18	$102,784	$5,739	-$24,149	$29,888	$1,150,078	$64,218	0.465	-$34,330	**-$208,993**
R5-19	$146,130	$8,160	-$2,901	$11,061	$1,100,401	$61,444	0.180	-$50,383	
R5-20	$52,076	$2,908	$184	$2,908	$1,164,980	$65,050	0.045	-$62,142	
R5-21	$43,783	$2,445	-$554	$2,998	$1,268,615	$70,837	0.042	-$67,839	

TABLE B-21 (CONTINUED)
MEDIUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Medium	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Medium	Summed Net Benefits Medium
R5-22	-	-	-	-	-	-	-	-	
R5-23	-	-	-	-	-	-	-	-	
R5-24	-	-	-	-	-	-	-	-	
R5-25	-	-	-	-	-	-	-	-	
R5-26	-	-	-	-	-	-	-	-	
R5-27	-	-	-	-	-	-	-	-	
R5-28	-	-	-	-	-	-	-	-	
R5-29	-	-	-	-	-	-	-	-	
R5-30	$47,012	$2,625	-$32,848	$35,473	$1,173,724	$65,538	0.541	-$30,065	
R5-31	$209,791	$11,714	-$33,879	$45,593	$1,165,878	$65,100	0.700	-$19,507	
R5-32	$1,309,143	$73,100	-$61,892	$134,992	$1,197,146	$66,846	2.019	$68,146	
R5-33	$485,176	$27,091	-$62,530	$89,622	$1,245,693	$69,557	1.288	$20,065	
R5-34	$205,399	$11,469	-$53,740	$65,209	$1,255,449	$70,102	0.930	-$4,893	
R5-35	$315,610	$17,623	-$52,782	$70,405	$1,210,541	$67,594	1.042	$2,811	
R5-36	$1,557,481	$86,967	-$56,472	$143,439	$1,143,984	$63,878	2.246	$79,561	
R5-37	$212,598	$11,871	-$80,647	$92,518	$1,238,610	$69,162	1.338	$23,357	
R5-38	$492,803	$27,517	-$94,528	$122,045	$1,323,893	$73,924	1.651	$48,121	
R5-39	$96,564	$5,392	-$98,750	$104,141	$1,239,818	$69,229	1.504	$34,912	
R5-40	$4,436	$248	-$49,625	$49,873	$1,164,996	$65,051	0.767	-$15,178	
R5-41	$11,110	$620	-$44,843	$45,463	$1,149,689	$64,196	0.708	-$18,733	
R5-42	$4,494	$251	-$30,127	$30,378	$1,158,034	$64,662	0.470	-$34,284	
R5-43	$6,658	$372	-$18,731	$19,103	$1,122,922	$62,702	0.305	-$43,599	
R5-44	-$2,515	-$140	-$5,603	$5,462	$1,112,408	$62,115	0.088	-$56,652	
R5-45	$8,139	$454	$263	$454	$1,072,186	$59,869	0.008	-$59,414	
R5-46	$122,651	$6,849	$7,328	$6,849	$1,089,110	$60,814	0.113	-$53,965	
R5-47	$307,357	$17,162	$982	$17,162	$1,149,106	$64,164	0.267	-$47,002	
R5-48	$4,116	$230	$2,299	$230	$1,112,680	$62,130	0.004	-$61,900	
R5-49	-$5,228	-$292	-$12,232	$11,940	$1,205,108	$67,291	0.177	-$55,351	
R5-50	$3,805	$212	-$18,968	$19,180	$1,291,714	$72,127	0.266	-$52,947	
R5-51	$12,271	$685	-$28,941	$29,626	$1,184,685	$66,151	0.448	-$36,525	**-$313,043**

TABLE B-22
MAXIMUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Maximum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Maximum	Summed Net Benefits Maximum
R1-1	$10,762	$601	$54,795	$601	$2,134,999	$119,214	0.005	-$118,613	
R1-2	$3,432	$192	$49,622	$192	$1,967,387	$109,855	0.002	-$109,663	
R1-3	$12,629	$705	$37,527	$705	$1,845,597	$103,055	0.007	-$102,349	
R1-4	$17,325	$967	$27,756	$967	$1,774,179	$99,067	0.010	-$98,099	
R1-5	$4,474	$250	$22,870	$250	$1,889,553	$105,509	0.002	-$105,259	
R1-6	$14,700	$821	$6,771	$821	$1,902,621	$106,239	0.008	-$105,418	
R1-7	$13,135	$733	$442	$733	$1,837,455	$102,600	0.007	-$101,867	
R1-8	$9,823	$549	$1,159	$549	$1,939,851	$108,318	0.005	-$107,769	
R1-9	$52,475	$2,930	$2,015	$2,930	$1,842,605	$102,888	0.028	-$99,957	
R1-10	$80,208	$4,479	$6,219	$4,479	$1,727,641	$96,468	0.046	-$91,989	
R1-11	$1,432,785	$80,004	$8,692	$80,004	$1,827,729	$102,057	0.784	-$22,053	
R1-12	$56,670	$3,164	$3,758	$3,164	$1,904,588	$106,349	0.030	-$103,184	
R1-13	$2,691,068	$150,264	-$58	$150,322	$1,883,895	$105,193	1.429	$45,129	
R1-14	$1,783,823	$99,605	-$7,413	$107,018	$1,941,226	$108,394	0.987	-$1,376	
R1-15	$3,218,199	$179,698	-$8,068	$187,766	$1,938,980	$108,269	1.734	$79,497	
R1-16	$2,062,817	$115,184	-$11,001	$126,184	$1,983,231	$110,740	1.139	$15,445	$13,458
R1-17	$23,718	$1,324	-$11,198	$12,522	$2,148,197	$119,951	0.104	-$107,429	
R1-18	-$20,081	-$1,121	-$12,742	$11,621	$2,188,694	$122,212	0.095	-$110,591	
R1-19	$92,307	$5,154	-$5,695	$10,849	$2,042,219	$114,034	0.095	-$103,185	
R1-20	$128,005	$7,148	$8,438	$7,148	$1,853,636	$103,503	0.069	-$96,356	
R1-21	-$34	-$2	$9,080	-$2	$1,754,450	$97,965	-0.000	-$97,967	
R1-22	$41,974	$2,344	$21,487	$2,344	$1,846,677	$103,115	0.023	-$100,771	
R1-23	$3,053	$170	$36,478	$170	$2,026,061	$113,131	0.002	-$112,961	
R1-24	$82,352	$4,598	$41,072	$4,598	$1,781,496	$99,475	0.046	-$94,877	
R2-1	-	-	-	-	-	-	-	-	
R2-2	-	-	-	-	-	-	-	-	
R2-3	-	-	-	-	-	-	-	-	
R2-4	-	-	-	-	-	-	-	-	
R2-5	-	-	-	-	-	-	-	-	
R2-6	-	-	-	-	-	-	-	-	
R2-7	-	-	-	-	-	-	-	-	
R3-1	$157,105	$8,772	$20,806	$8,772	$1,694,786	$94,634	0.093	-$85,861	
R3-2	$1,804,751	$100,774	$19,994	$100,774	$1,451,670	$81,058	1.243	$19,715	
R3-3	$162,114	$9,052	$20,424	$9,052	$1,445,742	$80,727	0.112	-$71,675	
R3-4	$5,962	$333	$25,555	$333	$1,738,807	$97,092	0.003	-$96,759	
R3-5	$49,500	$2,764	$21,080	$2,764	$1,905,124	$106,378	0.026	-$103,614	
R3-6	$55,445	$3,096	$15,383	$3,096	$2,024,200	$113,027	0.027	-$109,932	
R3-7	$1,277,146	$71,313	$4,993	$71,313	$1,994,040	$111,343	0.640	-$40,030	
R3-8	$6,282,344	$350,794	-$14,815	$365,609	$1,542,687	$86,141	4.244	$279,468	
R3-9	$476,518	$26,608	-$17,079	$43,687	$1,482,119	$82,759	0.528	-$39,072	
R3-10	$3,298,864	$184,202	-$21,371	$205,574	$1,496,756	$83,576	2.460	$121,998	
R3-11	$712,559	$39,788	-$23,863	$63,651	$1,467,622	$81,949	0.777	-$18,298	
R3-12	$1,881,447	$105,056	-$37,589	$142,645	$1,414,410	$78,978	1.806	$63,667	
R3-13	$136,627	$7,629	-$44,608	$52,237	$1,414,466	$78,981	0.661	-$26,744	

TABLE B-22 (CONTINUED)
MAXIMUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Maximum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Maximum	Summed Net Benefits Maximum
R3-14	$1,123,117	$62,713	-$77,674	$140,386	$1,912,906	$106,813	1.314	$33,574	
R3-15	$7,229	$404	-$67,602	$68,006	$1,515,538	$84,625	0.804	-$16,619	
R3-16	$17	$1	-$52,660	$52,661	$1,047,787	$58,506	0.900	-$5,845	
R3-17	$92,551	$5,168	-$83,305	$88,473	$1,465,190	$81,813	1.081	$6,660	
R3-18	$254,696	$14,222	-$86,928	$101,149	$1,504,550	$84,011	1.204	$17,138	
R3-19	$217,430	$12,141	-$82,277	$94,417	$1,484,583	$82,896	1.139	$11,521	
R3-20	$3,511,646	$196,084	-$79,875	$275,958	$1,468,553	$82,001	3.365	$193,957	
R3-21	$1,031,007	$57,569	-$77,993	$135,562	$1,466,275	$81,874	1.656	$53,688	
R3-22	$312,466	$17,447	-$67,797	$85,245	$1,385,542	$77,366	1.102	$7,879	
R3-23	$216,781	$12,105	-$53,371	$65,475	$1,205,636	$67,320	0.973	-$1,845	**$26**
R3-24	-$626	-$35	-$45,450	$45,415	-$99,388	-$5,550	-8.183	$50,965	
R3-25	-$153	-$9	-$32,621	$32,612	-$107,028	-$5,976	-5.457	$38,588	
R3-26	$0	$0	-$26,720	$26,720	$0	$0	-	$26,720	
R4-1	$101,728	$5,680	-$54,395	$60,075	$1,118,155	$62,436	0.962	-$2,360	
R4-2	$418,852	$23,388	-$45,920	$69,308	$1,153,386	$64,403	1.076	$4,905	
R4-3	$0	$0	$3,747	$0	$433,890	$24,228	-	-$24,228	
R4-4	$0	$0	$7,991	$0	$409,776	$22,881	-	-$22,881	
R4-5	$46,432	$2,593	-$21,731	$24,324	$1,013,088	$56,569	0.430	-$32,245	
R4-6	$4,422	$247	$6,739	$247		$0	-	$247	**-$76,562**
R4-7	$0	$0	-$8,323	$8,323		$0	-	$8,323	
R4-8	$0	$0	-$87,751	$87,751	$0	$0	-	$87,751	
R4-9	$0	$0	-$153,875	$153,875	$0	$0	-	$153,875	
R5-1	$59,698	$3,333	-$100,250	$103,583	$1,588,869	$88,719	1.168	$14,864	
R5-2	$19,564	$1,092	-$70,377	$71,469	$1,587,894	$88,665	0.806	-$17,196	
R5-3	$17,388	$971	-$38,155	$39,126	$1,619,658	$90,439	0.433	-$51,313	
R5-4	$25,685	$1,434	-$11,323	$12,757	$2,015,645	$112,550	0.113	-$99,793	
R5-5	$74,599	$4,165	$11,365	$4,165	$1,547,617	$86,416	0.048	-$82,250	
R5-6	$2,619,442	$146,265	-$30,953	$177,218	$1,738,919	$97,098	1.825	$80,120	
R5-7	$3,639,359	$203,215	-$38,120	$241,335	$1,695,245	$94,659	2.550	$146,676	
R5-8	$1,509,989	$84,315	-$27,503	$111,818	$1,617,198	$90,301	1.238	$21,516	
R5-9	$26,021	$1,453	-$15,659	$17,112	$1,576,822	$88,047	0.194	-$70,934	
R5-10	$35,994	$2,010	-$17,915	$19,925	$1,553,803	$86,761	0.230	-$66,836	
R5-11	$170,531	$9,522	-$19,644	$29,166	$1,570,939	$87,718	0.332	-$58,552	
R5-12	$73,446	$4,101	-$18,787	$22,888	$1,561,285	$87,179	0.263	-$64,291	
R5-13	$85,424	$4,770	-$19,733	$24,503	$1,559,447	$87,076	0.281	-$62,573	
R5-14	$46,453	$2,594	-$17,799	$20,393	$1,539,123	$85,942	0.237	-$65,549	
R5-15	$31,611	$1,765	-$24,219	$25,984	$1,555,814	$86,874	0.299	-$60,889	
R5-16	$170,952	$9,546	-$24,757	$34,303	$1,588,672	$88,708	0.387	-$54,406	
R5-17	$18,616	$1,039	-$13,221	$14,261	$1,403,496	$78,369	0.182	-$64,108	
R5-18	$101,654	$5,676	-$24,149	$29,825	$1,532,922	$85,595	0.348	-$55,770	**-$611,285**
R5-19	$145,101	$8,102	-$2,901	$11,003	$1,484,754	$82,906	0.133	-$71,902	
R5-20	$50,274	$2,807	$184	$2,807	$1,553,799	$86,761	0.032	-$83,954	
R5-21	$42,671	$2,383	-$554	$2,936	$1,692,035	$94,480	0.031	-$91,544	

TABLE B-22 (CONTINUED)
MAXIMUM BERM WIDTH ALTERNATIVE

Model Reach	Damage Reduction Maximum	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Benefits	Additional Cost	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits Maximum	Summed Net Benefits Maximum
R5-22	-	-	-	-	-	-	-	-	
R5-23	-	-	-	-	-	-	-	-	
R5-24	-	-	-	-	-	-	-	-	
R5-25	-	-	-	-	-	-	-	-	
R5-26	-	-	-	-	-	-	-	-	
R5-27	-	-	-	-	-	-	-	-	
R5-28	-	-	-	-	-	-	-	-	
R5-29	-	-	-	-	-	-	-	-	
R5-30	$45,897	$2,563	-$32,848	$35,411	$1,560,078	$87,112	0.407	-$51,701	
R5-31	$208,754	$11,656	-$33,879	$45,535	$1,548,130	$86,445	0.527	-$40,910	
R5-32	$1,284,362	$71,716	-$61,892	$133,608	$1,575,770	$87,988	1.518	$45,620	
R5-33	$476,279	$26,595	-$62,530	$89,125	$1,637,718	$91,447	0.975	-$2,322	
R5-34	$200,403	$11,190	-$53,740	$64,930	$1,650,238	$92,146	0.705	-$27,216	
R5-35	$309,448	$17,279	-$52,782	$70,061	$1,591,104	$88,844	0.789	-$18,783	
R5-36	$1,525,065	$85,157	-$56,472	$141,629	$1,502,376	$83,890	1.688	$57,739	
R5-37	$209,650	$11,706	-$80,647	$92,354	$1,622,994	$90,625	1.019	$1,729	
R5-38	$484,937	$27,078	-$94,528	$121,605	$1,737,112	$96,997	1.254	$24,608	
R5-39	$95,068	$5,308	-$98,750	$104,058	$1,625,177	$90,747	1.147	$13,311	
R5-40	$4,381	$245	-$49,625	$49,870	$1,535,101	$85,717	0.582	-$35,847	
R5-41	$11,110	$620	-$44,843	$45,463	$1,517,212	$84,718	0.537	-$39,255	
R5-42	$4,494	$251	-$30,127	$30,378	$1,538,287	$85,895	0.354	-$55,517	
R5-43	$6,658	$372	-$18,731	$19,103	$1,492,780	$83,354	0.229	-$64,251	
R5-44	-$2,515	-$140	-$5,603	$5,462	$1,480,759	$82,683	0.066	-$77,220	
R5-45	$8,139	$454	$263	$454	$1,431,074	$79,908	0.006	-$79,454	
R5-46	$120,290	$6,717	$7,328	$6,717	$1,454,580	$81,221	0.083	-$74,504	
R5-47	$302,612	$16,897	$982	$16,897	$1,531,887	$85,538	0.198	-$68,640	
R5-48	$4,116	$230	$2,299	$230	$1,495,274	$83,493	0.003	-$83,263	
R5-49	-$5,228	-$292	-$12,232	$11,940	$1,607,225	$89,744	0.133	-$77,804	
R5-50	$4,010	$224	-$18,968	$19,191	$1,717,824	$95,920	0.200	-$76,728	
R5-51	$12,352	$690	-$28,941	$29,630	$1,571,982	$87,776	0.338	-$58,146	**-$788,554**

TABLE B-23
SUMMARIZED BERM WIDTH OPTIMIZATION

Model Reach	Profile	Net Benefits Zero Berm option	Net Benefits MiniMin option	Net Benefits Minimum option	Net Benefits Small Alternative	Net Benefits Medium Alternative	Net Benefits Maximum Alternative	Maximum Net Benefit Alternative
R1-1	R1P1	-$2,709.00	-$15,240.00	-$27,680.00	-$56,177.00	-$87,934.00	-$118,613.00	Zero
R1-2	R1P1	-$16,934.00	-$14,302.00	-$26,642.00	-$52,789.00	-$81,925.00	-$109,663.00	MiniMin
R1-3	R1P1	-$15,912.00	-$14,297.00	-$25,575.00	-$49,860.00	-$76,844.00	-$102,349.00	MiniMin
R1-4	R1P1	-$17,169.00	-$13,768.00	-$24,869.00	-$48,239.00	-$73,601.00	-$98,099.00	MiniMin
R1-5	R1P1	-$17,194.00	-$15,986.00	-$27,997.00	-$52,624.00	-$79,443.00	-$105,259.00	MiniMin
R1-6	R1P1	-$21,279.00	-$17,162.00	-$29,054.00	-$53,559.00	-$80,077.00	-$105,418.00	MiniMin
R1-7	R1P1	-$19,348.00	-$17,165.00	-$28,960.00	-$52,252.00	-$77,644.00	-$101,867.00	MiniMin
R1-8	R1P1	-$20,005.00	-$18,453.00	-$30,681.00	-$55,341.00	-$82,180.00	-$107,769.00	MiniMin
R1-9	R1P1	-$17,745.00	-$15,218.00	-$26,585.00	-$50,318.00	-$75,711.00	-$99,957.00	MiniMin
R1-10	R1P1	-$15,637.00	-$12,324.00	-$23,094.00	-$45,299.00	-$69,261.00	-$91,989.00	MiniMin
R1-11	R1P1	$19,424.00	$50,455.00	$50,931.00	$27,606.00	$1,959.00	-$22,053.00	Minimum
R1-12	R1P1	-$39,371.00	-$15,317.00	-$27,208.00	-$51,744.00	-$78,232.00	-$103,184.00	MiniMin
R1-13	R1P1	$152,009.00	$128,881.00	$118,899.00	$95,151.00	$69,721.00	$45,129.00	Zero
R1-14	R1P1	$71,384.00	$81,624.00	$73,887.00	$50,003.00	$23,418.00	-$1,376.00	MiniMin
R1-15	R1P2	$81,418.00	$103,975.00	$140,153.00	$126,762.00	$102,667.00	$79,497.00	Minimum
R1-16	R1P2	$151,060.00	$64,898.00	$84,330.00	$63,563.00	$39,637.00	$15,445.00	Zero
R1-17	R1P2	$609.00	-$12,613.00	-$30,920.00	-$54,675.00	-$81,132.00	-$107,429.00	Zero
R1-18	R1P2	$2,312.00	-$10,814.00	-$29,015.00	-$53,010.00	-$81,927.00	-$110,591.00	Zero
R1-19	R1P2	-$7,709.00	-$14,436.00	-$30,868.00	-$53,190.00	-$78,320.00	-$103,185.00	Zero
R1-20	R1P2	-$10,596.00	-$16,502.00	-$30,211.00	-$50,751.00	-$73,495.00	-$96,356.00	Zero
R1-21	R1P1	-$18,282.00	-$16,621.00	-$28,041.00	-$50,495.00	-$75,143.00	-$97,967.00	MiniMin
R1-22	R1P1	-$18,763.00	-$14,011.00	-$25,307.00	-$49,398.00	-$75,690.00	-$100,771.00	MiniMin
R1-23	R1P1	-$17,628.00	-$15,976.00	-$28,098.00	-$55,071.00	-$84,831.00	-$112,961.00	MiniMin
R1-24	R1P1	-$14,983.00	-$10,081.00	-$21,227.00	-$44,509.00	-$70,267.00	-$94,877.00	MiniMin
R2-1	R2P1			-	-	-	-	
R2-2	R2P1			-	-	-	-	
R2-3	R2P2			-	-	-	-	
R2-4	R2P1			-	-	-	-	
R2-5	R2P2			-	-	-	-	
R2-6	R2P1			-	-	-	-	
R2-7	R2P1			-	-	-	-	
R3-1	R3P1	-$18,443.00	-$1,683.00	-$7,847.00	-$30,624.00	-$56,963.00	-$85,861.00	MiniMin
R3-2	R3P1	$95,293.00	$80,689.00	$82,076.00	$65,194.00	$44,403.00	$19,715.00	Zero
R3-3	R3P1	-$12,988.00	$1,373.00	-$3,861.00	-$23,594.00	-$47,187.00	-$71,675.00	MiniMin
R3-4	R3P2	-$5,533.00	-$12,507.00	-$26,036.00	-$48,028.00	-$72,525.00	-$96,759.00	Zero
R3-5	R3P2	-$7,370.00	-$12,467.00	-$26,802.00	-$50,633.00	-$77,231.00	-$103,614.00	Zero
R3-6	R3P2	-$8,089.00	-$15,085.00	-$29,529.00	-$54,415.00	-$82,285.00	-$109,932.00	Zero
R3-7	R3P2	-$5,812.00	$14,967.00	$27,069.00	$13,341.00	-$11,773.00	-$40,030.00	Minimum
R3-8	R3P1	-$47,219.00	$348,140.00	$349,398.00	$329,565.00	$305,188.00	$279,468.00	Minimum
R3-9	R3P1	-$13,570.00	$33,511.00	$27,770.00	$8,469.00	-$14,788.00	-$39,072.00	MiniMin
R3-10	R3P1	$99,782.00	$142,453.00	$158,257.00	$155,722.00	$148,181.00	$121,998.00	Minimum

TABLE B-23 (CONTINUED)
SUMMARIZED BERM WIDTH OPTIMIZATION

Model Reach	Profile	Net Benefits Zero Berm option	Net Benefits MiniMin option	Net Benefits Minimum option	Net Benefits Small Alternative	Net Benefits Medium Alternative	Net Benefits Maximum Alternative	Maximum Net Benefit Alternative
R3-11	R3P1	$22,815.00	$48,406.00	$45,246.00	$27,404.00	$6,289.00	-$18,298.00	MiniMin
R3-12	R3P1	$75,233.00	$100,757.00	$109,015.00	$99,991.00	$88,950.00	$63,667.00	Minimum
R3-13	R3P1	$23,458.00	$43,174.00	$37,375.00	$18,436.00	-$3,442.00	-$26,744.00	MiniMin
R3-14	R3P1	$104,314.00	$120,721.00	$117,472.00	$93,806.00	$64,909.00	$33,574.00	MiniMin
R3-15	R3P1	$33,444.00	$57,715.00	$51,005.00	$31,090.00	$7,969.00	-$16,619.00	MiniMin
R3-16	R3P1	$27,839.00	$45,257.00	$40,537.00	$26,892.00	$11,122.00	-$5,845.00	MiniMin
R3-17	R3P1	$50,262.00	$76,524.00	$70,533.00	$51,582.00	$29,863.00	$6,660.00	MiniMin
R3-18	R3P1	$59,761.00	$87,013.00	$81,666.00	$62,661.00	$40,971.00	$17,138.00	MiniMin
R3-19	R3P1	$57,740.00	$82,904.00	$76,602.00	$57,253.00	$35,208.00	$11,521.00	MiniMin
R3-20	R3P1	$248,914.00	$254,718.00	$255,821.00	$239,424.00	$217,570.00	$193,957.00	Minimum
R3-21	R3P1	$62,984.00	$116,265.00	$113,832.00	$97,135.00	$76,848.00	$53,688.00	MiniMin
R3-22	R3P1	$11,354.00	$72,861.00	$68,137.00	$50,480.00	$29,859.00	$7,879.00	MiniMin
R3-23	R3P1	$32,201.00	$55,454.00	$51,124.00	$35,609.00	$17,409.00	-$1,845.00	MiniMin
R3-24	R3P2	-	-	-	-	-	-	
R3-25	R3P2	-	-	-	-	-	-	
R3-26	R4P1	-	-	-	-	-	-	
R4-1	R4P1	$52,965.00	$61,753.00	$43,996.00	$21,507.00	-$3,882.00	-$2,360.00	MiniMin
R4-2	R4P1	$36,942.00	$72,179.00	$54,004.00	$30,299.00	$3,268.00	$4,905.00	MiniMin
R4-3	R4P2	-$7,343.00	-$2,084.00	-$2,893.00	-$5,555.00	-$24,629.00	-$24,228.00	MiniMin
R4-4	R4P2	-$3,545.00	-$1,998.00	-$2,697.00	-$5,344.00	-$23,321.00	-$22,881.00	MiniMin
R4-5	R4P1	$19,297.00	$27,336.00	$10,216.00	-$10,511.00	-$33,837.00	-$32,245.00	MiniMin
R4-6	R4P2	-$405.00	$9,170.00	$716.00	-$7,472.00	-$34,934.00	$247.00	MiniMin
R4-7	R4P2	-	-	-	-	-	-	
R4-8	R4P1	-	-	-	-	-	-	
R4-9	R4P1	-	-	-	-	-	-	
R5-1	R5P2	$67,048.00	$94,731.00	$80,558.00	$59,608.00	$36,652.00	$14,864.00	MiniMin
R5-2	R5P2	$46,228.00	$64,042.00	$49,119.00	$27,876.00	$4,725.00	-$17,196.00	MiniMin
R5-3	R5P2	$25,179.00	$34,001.00	$17,298.00	-$4,604.00	-$28,400.00	-$51,313.00	MiniMin
R5-4	R5P2	$3,775.00	$4,464.00	-$13,621.00	-$41,173.00	-$71,227.00	-$99,793.00	MiniMin
R5-5	R5P2	-$1,148.00	-$1,789.00	-$15,536.00	-$36,512.00	-$60,193.00	-$82,250.00	Zero
R5-6	R5P1	$140,884.00	$167,014.00	$150,771.00	$128,889.00	$103,481.00	$80,120.00	MiniMin
R5-7	R5P1	$203,095.00	$233,213.00	$215,137.00	$194,013.00	$169,471.00	$146,676.00	MiniMin
R5-8	R5P1	$80,204.00	$101,961.00	$87,350.00	$66,960.00	$43,408.00	$21,516.00	MiniMin
R5-9	R5P2	$8,888.00	$10,928.00	-$3,747.00	-$61,383.00	-$48,679.00	-$70,934.00	MiniMin
R5-10	R5P2	$12,539.00	$13,417.00	-$906.00	-$22,337.00	-$44,930.00	-$66,836.00	MiniMin
R5-11	R5P2	$20,080.00	$21,978.00	$6,052.00	-$15,084.00	-$37,004.00	-$58,552.00	MiniMin
R5-12	R5P2	$14,932.00	$15,667.00	$1,736.00	-$19,459.00	-$42,262.00	-$64,291.00	MiniMin
R5-13	R5P2	$16,030.00	$19,037.00	$3,570.00	-$17,743.00	-$40,559.00	-$62,573.00	MiniMin
R5-14	R5P2	$11,857.00	$14,086.00	-$187.00	-$21,297.00	-$43,788.00	-$65,549.00	MiniMin
R5-15	R5P2	$17,797.00	$19,497.00	$4,804.00	-$16,478.00	-$39,094.00	-$60,889.00	MiniMin
R5-16	R5P2	$25,512.00	$27,013.00	$12,853.00	-$9,157.00	-$32,274.00	-$54,406.00	MiniMin
R5-17	R5P3	$3,482.00	$6,891.00	-$3,523.00	-$23,073.00	-$43,993.00	-$64,108.00	MiniMin

TABLE B-23 (CONTINUED)
SUMMARIZED BERM WIDTH OPTIMIZATION

Model Reach	Profile	Net Benefits Zero Berm option	Net Benefits MiniMin option	Net Benefits Minimum option	Net Benefits Small Alternative	Net Benefits Medium Alternative	Net Benefits Maximum Alternative	Maximum Net Benefit Alternative
R5-18	R5P2	$14,360.00	$22,615.00	$8,864.00	-$12,212.00	-$34,330.00	-$55,770.00	MiniMin
R5-19	R5P3	-$11,537.00	-$438.00	-$7,906.00	-$28,216.00	-$50,383.00	-$71,902.00	MiniMin
R5-20	R5P2	-$26,183.00	-$3,750.00	-$17,540.00	-$39,008.00	-$62,142.00	-$83,954.00	MiniMin
R5-21	R5P2	-$1,054.00	-$4,876.00	-$19,396.00	-$42,908.00	-$67,839.00	-$91,544.00	Zero
R5-22	R5P3	$1,964.00	$1,964.00	$1,964.00	$1,964.00	$1,964.00	$1,964.00	Zero
R5-23	R5P3	$511.00	$511.00	$511.00	$511.00	$511.00	$511.00	Minimum
R5-24	R5P2	$6,898.00	$6,898.00	$6,898.00	$6,898.00	$6,898.00	$6,898.00	Zero
R5-25	R5P2	$15,278.00	$15,278.00	$15,278.00	$15,278.00	$15,278.00	$15,278.00	Zero
R5-26	R5P1	$12,809.00	$12,809.00	$12,809.00	$12,809.00	$12,809.00	$12,809.00	Minimum
R5-27	R5P3	$10,102.00	$10,102.00	$10,102.00	$10,102.00	$10,102.00	$10,102.00	Minimum
R5-28	R5P3	$11,651.00	$11,651.00	$11,651.00	$11,651.00	$11,651.00	$11,651.00	Zero
R5-29	R5P2	$37,910.00	$37,910.00	$37,910.00	$37,910.00	$37,910.00	$37,910.00	Zero
R5-30	R5P2	$2,220.00	$28,170.00	$13,914.00	-$7,505.00	-$30,065.00	-$51,701.00	MiniMin
R5-31	R5P2	$19,644.00	$40,717.00	$24,212.00	$2,900.00	-$19,507.00	-$40,910.00	MiniMin
R5-32	R5P1	$76,091.00	$121,551.00	$111,225.00	$90,201.00	$68,146.00	$45,620.00	MiniMin
R5-33	R5P1	$42,299.00	$76,745.00	$63,732.00	$42,781.00	$20,065.00	-$2,322.00	MiniMin
R5-34	R5P1	$23,477.00	$51,651.00	$38,819.00	$18,010.00	-$4,893.00	-$27,216.00	MiniMin
R5-35	R5P1	$31,314.00	$57,266.00	$45,044.00	$24,892.00	$2,811.00	-$18,783.00	MiniMin
R5-36	R5P1	$100,329.00	$130,969.00	$120,236.00	$100,815.00	$79,561.00	$57,739.00	MiniMin
R5-37	R5P1	$52,451.00	$78,884.00	$66,364.00	$45,807.00	$23,357.00	$1,729.00	MiniMin
R5-38	R5P1	$74,380.00	$108,092.00	$94,546.00	$72,263.00	$48,121.00	$24,608.00	MiniMin
R5-39	R5P1	$65,022.00	$89,963.00	$77,822.00	$57,348.00	$34,912.00	$13,311.00	MiniMin
R5-40	R5P2	$43,326.00	$42,964.00	$27,968.00	$6,748.00	-$15,178.00	-$35,847.00	Zero
R5-41	R5P2	$38,831.00	$38,552.00	$23,981.00	$2,973.00	-$18,733.00	-$39,255.00	Zero
R5-42	R5P2	$23,385.00	$24,213.00	$9,122.00	-$12,419.00	-$34,284.00	-$55,517.00	MiniMin
R5-43	R5P2	$13,586.00	$12,885.00	-$1,128.00	-$22,160.00	-$43,599.00	-$64,251.00	Zero
R5-44	R5P2	$101.00	-$623.00	-$14,288.00	-$35,332.00	-$56,652.00	-$77,220.00	Zero
R5-45	R5P2	-$5,649.00	-$3,936.00	-$18,441.00	-$38,870.00	-$59,414.00	-$79,454.00	MiniMin
R5-46	R5P2	$1,803.00	$1,062.00	-$11,984.00	-$32,545.00	-$53,965.00	-$74,504.00	Zero
R5-47	R5P2	$10,336.00	$9,941.00	-$3,039.00	-$24,764.00	-$47,002.00	-$68,640.00	Zero
R5-48	R5P3	-$8,718.00	-$7,405.00	-$17,534.00	-$39,574.00	-$61,900.00	-$83,263.00	MiniMin
R5-49	R5P3	-$1,824.00	$3,440.00	-$8,955.00	-$31,765.00	-$55,351.00	-$77,804.00	MiniMin
R5-50	R5P3	-$4,228.00	$7,329.00	-$4,389.00	-$28,385.00	-$52,947.00	-$76,728.00	MiniMin
R5-51	R5P3	$21,879.00	$20,142.00	$8,075.00	-$13,985.00	-$36,525.00	-$58,146.00	Zero

8.2 FORMULATION OF CONSTRUCTION REACHES

Another revelation from the runs was that not all model reaches were going to be cost justified. When the cost of construction per unit of benefited shore length is not reasonable uniform for the entire project area, the project should be subdivided into elements (reaches) within which this condition is met.

Five possible construction reaches (Table B-24) were forming as candidates for economic justification. Those five construction reaches were identified, numbered 1 through 5 from the west to east which formed the basis for subsequent alternative analyses.

8.3 BERM WIDTH OPTIMIZATION BY CONSTRUCTION REACH

The PDT team noted that the MiniMin Berm width alternative maximized net benefits when all construction reaches as a whole are evaluated, but the minimum alternative maximized net benefits in Construction Reach 1.

TABLE B-24
WALTON COUNTY CONSTRUCTION REACHES

Construction Reach	Beginning Model Reach	Ending Model Reach
1	R1-11	R1-16
2	R3-2	R3-23
3	R4-1	R4-6
4	R5-1	R5-18
5	R5-30	R5-51

TABLE B-25
MINIMIN AND MINIMUM DESIGN ALTERNATIVES

Representative Profile	ZERO	MiniMin	Minimum	Small	Medium	Maximum
R1P1	0	10	25	50	75	100
R1P2	0	25	50	75	100	125
R2P1	0	25	50	75	100	125
R2P2	0	25	50	75	100	125
R3P1	0	25	50	75	100	125
R3P2	0	25	50	75	100	125
R4P1	0	25	50	75	100	125
R4P2	0	25	50	75	100	125
R5P1	0	25	50	75	100	125
R5P2	0	25	50	75	100	125
R5P3	0	25	50	75	100	125

8.4 THE OPTIMIZED BERM WIDTH ALTERNATIVE

A comparison of the net benefits, Table B-26, between the MiniMin and the Minimum Alternative reveals that in Construction Reach 1 the Minimum alternative maximizes net benefits and the MiniMin alternative maximizes net benefits in Construction Reaches 2, 3, 4 and 5. Construction Reach 1 is composed of profiles R1P1 and R1P2. R1P1 in the Minimum alternative has a berm width of 25 feet whereas profile R1P1 in the MiniMin alternative has a berm width of 10 feet.

TABLE B-26
WALTON COUNTY CONSTRUCTION REACHES BERM WIDTH OPTIMIZATION

Construction Reach	Beginning Model Reach	Ending Model Reach	Net Benefits Zero Berm	Net Benefits MiniMin Berm	Net Benefits Minimum Berm	Net Benefits Small Berm	Net Benefits Medium Berm	Net Benefits Maximum Berm
1	R1-11	R1-16	$435,924	$414516	$440,993	$311,341	$159,172	$13,458
2	R3-2	R3-23	$904,813	$1,742,843	$1,676,708	$1,287,383	$815,509	$26
3	R4-1	R4-6	$97,911	$166,356	$103,342	$22,924	-$117,384	-$76,562
4	R5-1	R5-18	$710,743	$868,767	$600,593	$176,833	-$208,993	-$611,285
5	R5-30	R5-51	$636,087	$932,571	$645,701	$177,435	-$313,043	-$788,554
Total NED			**$2,785,478**	**$4,125,053**	**$3,467,337**	**$1,975,916**	**$335,261**	**-$1,462,917**

Table B-27 shows the Optimized Berm Width Alternative is the minimum beach fill in Construction Reach 1 and the MiniMin beachfill in Construction Reaches 2 through 5. The optimized berm width alternative then is one with berm widths of 25 feet in all construction reaches as illustrated in the next table.

TABLE B-27
OPTIMIZED BERM WIDTH ALTERNATIVE

Representative Profile	Zero Berm Width	MiniMin Berm Width	Minimum Berm Width	Optimized Berm Width
R1P1	0	10	25	25
R1P2	0	25	50	25
R2P1	0	25	50	25
R2P2	0	25	50	25
R3P1	0	25	50	25
R3P2	0	25	50	25
R4P1	0	25	50	25
R4P2	0	25	50	25
R5P1	0	25	50	25
R5P2	0	25	50	25
R5P3	0	25	50	25

8.5 PHASE II OPTIMIZED DUNE WIDTH FORMULATION

A second round of alternatives was formulated to optimize on added dune width.

8.5.1 Optimized Dune Width Alternatives

Added dune width alternatives of 0, 10, 20, 30 and 40 feet were run with the optimized berm width alternative of 25 feet (Optimized berm template of 50 feet, 25 berm width plus 25 feet of advanced nourishment).

Table B-28 lays out the four dune width optimization alternatives.

8.5.2 Results of Dune Width Optimization

The results of the dune width optimization runs are presented in Table B-29. The maximized net benefit by model reach column identifies the added dune width alternative for each reach.

8.6 DUNE WIDTH OPTIMIZATION BY MODEL REACH

The best alternative plan based solely on an economic criterion is based on net excess benefits defines. The suggested NED Plan would be the maximized net benefits dune and berm width optimization. The optimization by model reach NED Plan describes an alternative with jagged added dune widths.

On the other hand the project must also be constructible, publicly acceptable and environmentally sustainable. Coastal engineering and constructability issues would point to a uniform smoothed and connected robust beach fill.

An additional beach fill question that arose while evaluating the results of the dune width optimization results was what would be the smallest segment of beach fill that could be constructed and yet perform adequately. Coastal engineering experience suggests that a beach fills as small as 2,000 feet would perform very poorly due to their small size.

If material is placed irregularly alongshore, i.e. gaps along the placement, then the near shore contours will be altered by the presence of the fill. Wave refraction over irregular contours will tend to cause a systematic pattern of convergence and divergence of breaking waves. Different wave heights and directions along the beach will produce areas of varying erosion and accretion. If the material is not placed over a sufficient length of beach, the material will diffuse or spread laterally to the adjacent areas and the project will perform poorly. The longer the original fill distance, the longer the material will remain in the original fill area.

Using both engineering and sound coastal engineering principles and previous experience a constructible NED Plan was formulated. That plan modified the economic NED Plan in the following attributes.

TABLE B-28
DUNE WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Optimized Berm Template	+00 Feet Added Dune Width	Optimized Berm Template	+10 Feet Added Dune Width	Optimized Berm Template	+20 Feet Added Dune Width	Optimized Berm Template	+30 Feet Added Dune Width	Optimized Berm Template	+40 Feet Added Dune Width
1	R1-1	R1P1	50	55	50	65	50	75	50	85	50	95
2	R1-2	R1P1	50	55	50	65	50	75	50	85	50	95
3	R1-3	R1P1	50	55	50	65	50	75	50	85	50	95
4	R1-4	R1P1	50	55	50	65	50	75	50	85	50	95
5	R1-5	R1P1	50	55	50	65	50	75	50	85	50	95
6	R1-6	R1P1	50	55	50	65	50	75	50	85	50	95
7	R1-7	R1P1	50	55	50	65	50	75	50	85	50	95
8	R1-8	R1P1	50	55	50	65	50	75	50	85	50	95
9	R1-9	R1P1	50	55	50	65	50	75	50	85	50	95
10	R1-10	R1P1	50	55	50	65	50	75	50	85	50	95
11	R1-11	R1P1	50	55	50	65	50	75	50	85	50	95
12	R1-12	R1P1	50	55	50	65	50	75	50	85	50	95
13	R1-13	R1P1	50	55	50	65	50	75	50	85	50	95
14	R1-14	R1P1	50	55	50	65	50	75	50	85	50	95
15	R1-15	R1P2	50	100	50	110	50	120	50	130	50	140
16	R1-16	R1P2	50	100	50	110	50	120	50	130	50	140
17	R1-17	R1P2	50	100	50	110	50	120	50	130	50	140
18	R1-18	R1P2	50	100	50	110	50	120	50	130	50	140
19	R1-19	R1P2	50	100	50	110	50	120	50	130	50	140
20	R1-20	R1P2	50	100	50	110	50	120	50	130	50	140
21	R1-21	R1P1	50	55	50	65	50	75	50	85	50	95
22	R1-22	R1P1	50	55	50	65	50	75	50	85	50	95
23	R1-23	R1P1	50	55	50	65	50	75	50	85	50	95
24	R1-24	R1P1	50	55	50	65	50	75	50	85	50	95
25	R2-1	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
26	R2-2	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
27	R2-3	R2P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
28	R2-4	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
29	R2-5	R2P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
30	R2-6	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
31	R2-7	R2P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

TABLE B-28 (CONTINUED)
DUNE WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Optimized Berm Template	+00 Feet Added Dune Width	Optimized Berm Template	+10 Feet Added Dune Width	Optimized Berm Template	+20 Feet Added Dune Width	Optimized Berm Template	+30 Feet Added Dune Width	Optimized Berm Template	+40 Feet Added Dune Width
32	R3-1	R3P1	50	75	50	85	50	95	50	105	50	115
33	R3-2	R3P1	50	75	50	85	50	95	50	105	50	115
34	R3-3	R3P1	50	75	50	85	50	95	50	105	50	115
35	R3-4	R3P2	50	45	50	55	50	65	50	75	50	85
36	R3-5	R3P2	50	45	50	55	50	65	50	75	50	85
37	R3-6	R3P2	50	45	50	55	50	65	50	75	50	85
38	R3-7	R3P2	50	45	50	55	50	65	50	75	50	85
39	R3-8	R3P1	50	75	50	85	50	95	50	105	50	115
40	R3-9	R3P1	50	75	50	85	50	95	50	105	50	115
41	R3-10	R3P1	50	75	50	85	50	95	50	105	50	115
42	R3-11	R3P1	50	75	50	85	50	95	50	105	50	115
43	R3-12	R3P1	50	75	50	85	50	95	50	105	50	115
44	R3-13	R3P1	50	75	50	85	50	95	50	105	50	115
45	R3-14	R3P1	50	75	50	85	50	95	50	105	50	115
46	R3-15	R3P1	50	75	50	85	50	95	50	105	50	115
47	R3-16	R3P1	50	75	50	85	50	95	50	105	50	115
48	R3-17	R3P1	50	75	50	85	50	95	50	105	50	115
49	R3-18	R3P1	50	75	50	85	50	95	50	105	50	115
50	R3-19	R3P1	50	75	50	85	50	95	50	105	50	115
51	R3-20	R3P1	50	75	50	85	50	95	50	105	50	115
52	R3-21	R3P1	50	75	50	85	50	95	50	105	50	115
53	R3-22	R3P1	50	75	50	85	50	95	50	105	50	115
54	R3-23	R3P1	50	75	50	85	50	95	50	105	50	115
55	R3-24	R3P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
56	R3-25	R3P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
57	R3-26	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
58	R4-1	R4P1	50	50	50	60	50	70	50	80	50	90
59	R4-2	R4P1	50	50	50	60	50	70	50	80	50	90
60	R4-3	R4P2	50	85	50	95	50	105	50	115	50	125
61	R4-4	R4P2	50	85	50	95	50	105	50	115	50	125
62	R4-5	R4P1	50	50	50	60	50	70	50	80	50	90

TABLE B-28 (CONTINUED)
DUNE WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Optimized Berm Template	+00 Feet Added Dune Width	Optimized Berm Template	+10 Feet Added Dune Width	Optimized Berm Template	+20 Feet Added Dune Width	Optimized Berm Template	+30 Feet Added Dune Width	Optimized Berm Template	+40 Feet Added Dune Width
63	R4-6	R4P2	50	85	50	95	50	105	50	115	50	125
64	R4-7	R4P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
65	R4-8	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
66	R4-9	R4P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
67	R5-1	R5P2	50	65	50	75	50	85	50	95	50	105
68	R5-2	R5P2	50	65	50	75	50	85	50	95	50	105
69	R5-3	R5P2	50	65	50	75	50	85	50	95	50	105
70	R5-4	R5P2	50	65	50	75	50	85	50	95	50	105
71	R5-5	R5P2	50	65	50	75	50	85	50	95	50	105
72	R5-6	R5P1	50	185	50	195	50	205	50	215	50	225
73	R5-7	R5P1	50	185	50	195	50	205	50	215	50	225
74	R5-8	R5P1	50	185	50	195	50	205	50	215	50	225
75	R5-9	R5P2	50	65	50	75	50	85	50	95	50	105
76	R5-10	R5P2	50	65	50	75	50	85	50	95	50	105
77	R5-11	R5P2	50	65	50	75	50	85	50	95	50	105
78	R5-12	R5P2	50	65	50	75	50	85	50	95	50	105
79	R5-13	R5P2	50	65	50	75	50	85	50	95	50	105
80	R5-14	R5P2	50	65	50	75	50	85	50	95	50	105
81	R5-15	R5P2	50	65	50	75	50	85	50	95	50	105
82	R5-16	R5P2	50	65	50	75	50	85	50	95	50	105
83	R5-17	R5P3	50	50	50	60	50	70	50	80	50	90
84	R5-18	R5P2	50	65	50	75	50	85	50	95	50	105
85	R5-19	R5P3	50	50	50	60	50	70	50	80	50	90
86	R5-20	R5P2	50	65	50	75	50	85	50	95	50	105
87	R5-21	R5P2	50	65	50	75	50	85	50	95	50	105
88	R5-22	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
89	R5-23	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
90	R5-24	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
91	R5-25	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
92	R5-26	R5P1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
93	R5-27	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
94	R5-28	R5P3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

TABLE B-28 (CONTINUED)
DUNE WIDTH OPTIMIZATION TEMPLATE

Sub-Reach	Model Reach	Profile	Optimized Berm Template	+00 Feet Added Dune Width	Optimized Berm Template	+10 Feet Added Dune Width	Optimized Berm Template	+20 Feet Added Dune Width	Optimized Berm Template	+30 Feet Added Dune Width	Optimized Berm Template	+40 Feet Added Dune Width
95	R5-29	R5P2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
96	R5-30	R5P2	50	65	50	75	50	85	50	95	50	105
97	R5-31	R5P2	50	65	50	75	50	85	50	95	50	105
98	R5-32	R5P1	50	185	50	195	50	205	50	215	50	225
99	R5-33	R5P1	50	185	50	195	50	205	50	215	50	225
100	R5-34	R5P1	50	185	50	195	50	205	50	215	50	225
101	R5-35	R5P1	50	185	50	195	50	205	50	215	50	225
102	R5-36	R5P1	50	185	50	195	50	205	50	215	50	225
103	R5-37	R5P1	50	185	50	195	50	205	50	215	50	225
104	R5-38	R5P1	50	185	50	195	50	205	50	215	50	225
105	R5-39	R5P1	50	185	50	195	50	205	50	215	50	225
106	R5-40	R5P2	50	65	50	75	50	85	50	95	50	105
107	R5-41	R5P2	50	65	50	75	50	85	50	95	50	105
108	R5-42	R5P2	50	65	50	75	50	85	50	95	50	105
109	R5-43	R5P2	50	65	50	75	50	85	50	95	50	105
110	R5-44	R5P2	50	65	50	75	50	85	50	95	50	105
111	R5-45	R5P2	50	65	50	75	50	85	50	95	50	105
112	R5-46	R5P2	50	65	50	75	50	85	50	95	50	105
113	R5-47	R5P2	50	65	50	75	50	85	50	95	50	105
114	R5-48	R5P3	50	50	50	60	50	70	50	80	50	90
115	R5-49	R5P3	50	50	50	60	50	70	50	80	50	90
116	R5-50	R5P3	50	50	50	60	50	70	50	80	50	90
117	R5-51	R5P3	50	50	50	60	50	70	50	80	50	90

TABLE B-29
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No Added Dune Width	Summed Net Benefits 10 feet of Added Dune Width	Summed Net Benefits 20 feet of Added Dune Width	Summed Net Benefits 30 feet of Added Dune Width	Summed Net Benefits 40 feet of Added Dune Width	Profile	Constructible Added Dune Width
R1-1	-21973	-24268	-29633	-32663	-$70,656	R1P1	
R1-2	-20560	-23275	-28261	-31277	-$64,626	R1P1	
R1-3	-19452	-22450	-26062	-28842	-$59,847	R1P1	
R1-4	-20515	-21875	-26597	-29331	-$59,152	R1P1	
R1-5	-22644	-24528	-27754	-30620	-$62,686	R1P1	
R1-6	-26738	-25173	-31575	-34387	-$66,491	R1P1	
R1-7	-25776	-24932	-30447	-33119	-$64,351	R1P1	
R1-8	-27070	-26652	-31812	-34591	-$67,592	R1P1	
R1-9	-23183	-23071	-27636	-30195	-$60,899	R1P1	
R1-10	-19414	-20251	-22745	-25250	-$53,615	R1P1	
R1-11	30826	56895	68085	66491	$34,057	R1P1	10
R1-12	-24859	-21595	-29833	-32618	-$64,658	R1P1	10
R1-13	163848	164890	159465	156755	$120,973	R1P1	10
R1-14	74404	76523	72382	69860	$34,592	R1P1	10
R1-15	108037	131552	189573	212157	$204,933	R1P2	30
R1-16	108817	119998	151449	162735	$137,214	R1P2	30
R1-17	-10947	-8672	-12337	-13249	-$44,213	R1P2	
R1-18	-6686	-4787	-8185	-10136	$12,779	R1P2	
R1-19	-16464	-11762	-16353	-16455	-$44,967	R1P2	
R1-20	-18102	-14543	-17092	-16619	-$41,608	R1P2	
R1-21	-23864	-24628	-28267	-30742	-$60,704	R1P1	
R1-22	-22459	-22298	-26891	-29509	-$59,756	R1P1	
R1-23	-22482	-24929	-28360	-31250	-$65,072	R1P1	
R1-24	-18535	-19329	-25302	-28140	-$58,971	R1P1	
R2-1	-	-	-	-		R2P1	
R2-2	-	-	-	-		R2P1	
R2-3	-	-	-	-		R2P2	
R2-4	-	-	-	-		R2P1	
R2-5	-	-	-	-		R2P2	
R2-6	-	-	-	-		R2P1	
R2-7	-	-	-	-		R2P1	
R3-1	-6480	-1676	-523	-1133	-$48,529	R3P1	
R3-2	60918	88440	99635	105914	$67,319	R3P1	10
R3-3	-3637	2903	495	-467	-$39,895	R3P1	10
R3-4	-8604	-8046	-11455	-12306	-$36,443	R3P2	10
R3-5	-10952	-7497	-13443	-14081	-$40,631	R3P2	10
R3-6	-13879	-9546	-16724	-17106	-$44,795	R3P2	10

TABLE B-29 (CONTINUED)
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No Added Dune Width	Summed Net Benefits 10 feet of Added Dune Width	Summed Net Benefits 20 feet of Added Dune Width	Summed Net Benefits 30 feet of Added Dune Width	Summed Net Benefits 40 feet of Added Dune Width	Profile	Constructible Added Dune Width
R3-7	-12437	-9368	-15972	-16624	-$44,681	R3P2	10
R3-8	6269	10978	10427	10154	-$33,177	R3P1	10
R3-9	21777	33172	32887	33918	-$7,904	R3P1	30
R3-10	54721	115738	157575	194603	$178,292	R3P1	30
R3-11	29313	44573	49252	53628	$13,442	R3P1	30
R3-12	46295	80649	104132	127568	$103,900	R3P1	30
R3-13	37990	42943	42354	41955	$656	R3P1	30
R3-14	107187	125032	125659	128119	$74,087	R3P1	30
R3-15	53578	57577	56864	56257	$11,006	R3P1	30
R3-16	42516	44866	45067	44743	$13,220	R3P1	30
R3-17	70535	75378	76840	77139	$32,760	R3P1	30
R3-18	76242	84878	86728	88165	$42,842	R3P1	30
R3-19	77587	81617	83045	82970	$38,210	R3P1	30
R3-20	239534	274140	287533	294440	$252,339	R3P1	30
R3-21	90529	112124	118304	123926	$80,356	R3P1	30
R3-22	60602	71894	70982	72274	$30,460	R3P1	30
R3-23	45841	55004	53541	54111	$17,947	R3P1	30
R3-24	-	-	-	-		R3P2	
R3-25	-	-	-	-		R3P2	
R3-26	-	-	-	-		R4P1	
R4-1	57579	60774	59376	59220	-$1,796	R4P1	10
R4-2	56114	69534	65479	66614	-$9,366	R4P1	10
R4-3	-5402	-1372	-6935	-7651	$1,532	R4P2	10
R4-4	-1736	-1313	-3208	-3895	$1,471	R4P2	10
R4-5	22248	25615	23096	22401	-$848	R4P1	10
R4-6	-405	3772	3267	2791	-$3,672	R4P2	10
R4-7	-	-	-	-		R4P2	
R4-8	-	-	-	-		R4P1	
R4-9	-	-	-	-		R4P1	
R5-1	101205	98415	95873	95109	$5,332	R5P2	10
R5-2	70355	68018	64932	63312	$5,423	R5P2	10
R5-3	37513	37398	33074	31024	$4,439	R5P2	10
R5-4	11335	10860	6833	3971	$4,502	R5P2	10
R5-5	1	3602	-1157	-3562	$1,157	R5P2	10
R5-6	140226	157419	154409	151764	-$14,183	R5P1	10
R5-7	200024	214153	209752	206797	-$9,729	R5P1	10
R5-8	86384	100229	95839	93221	-$9,455	R5P1	10

TABLE B-29 (CONTINUED)
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No Added Dune Width	Summed Net Benefits 10 feet of Added Dune Width	Summed Net Benefits 20 feet of Added Dune Width	Summed Net Benefits 30 feet of Added Dune Width	Summed Net Benefits 40 feet of Added Dune Width	Profile	Constructible Added Dune Width
R5-9	12641	15448	8646	6694	$3,995	R5P2	10
R5-10	16735	17865	12965	11068	$3,770	R5P2	10
R5-11	22492	25100	18724	16681	$3,768	R5P2	10
R5-12	19276	19473	16094	14321	$3,182	R5P2	10
R5-13	17898	23227	15965	13943	$1,934	R5P2	10
R5-14	15842	18371	12358	10452	$3,484	R5P2	10
R5-15	22419	23919	18097	15770	$4,322	R5P2	10
R5-16	25421	31720	27972	26043	-$2,551	R5P2	10
R5-17	6949	10436	4477	3815	$2,472	R5P3	10
R5-18	24250	25944	22209	20851	$2,041	R5P2	10
R5-19	462	4253	70	647	$392	R5P3	10
R5-20	-563	825	-3538	-5666	$2,975	R5P2	10
R5-21	135	985	-3266	-5468	$3,401	R5P2	10
R5-22						R5P3	
R5-23						R5P3	
R5-24						R5P2	
R5-25						R5P2	
R5-26						R5P1	
R5-27						R5P3	
R5-28						R5P3	
R5-29						R5P2	
R5-30	31359	32542	27446	25763	-$4,716	R5P2	10
R5-31	39204	40628	34506	32596	$2,163	R5P2	10
R5-32	93797	116901	120434	119260	$77,242	R5P1	10
R5-33	70338	76230	72162	69274	$25,221	R5P1	10
R5-34	47939	51558	46369	43212	-$235	R5P1	10
R5-35	52939	56658	52726	49924	$8,037	R5P1	10
R5-36	97937	124305	126632	126125	$83,916	R5P1	10
R5-37	76094	79651	74974	71484	$28,353	R5P1	10
R5-38	97013	107768	99436	95873	$48,203	R5P1	10
R5-39	90626	91422	88855	86031	$41,575	R5P1	10
R5-40	49424	47040	44289	42296	$11,247	R5P2	10
R5-41	44150	42989	39376	37311	$6,701	R5P2	10
R5-42	28280	28539	23859	21635	-$8,858	R5P2	10
R5-43	17851	17377	13587	11494	-$17,881	R5P2	10
R5-44	3985	4253	-3	-2204	-$26,622	R5P2	10
R5-45	-1618	-1157	-5345	-7562	-$15,038	R5P2	10

TABLE B-29 (CONTINUED)
DUNE WIDTH OPTIMIZATION

Model Reach	Summed Net Benefits No Added Dune Width	Summed Net Benefits 10 feet of Added Dune Width	Summed Net Benefits 20 feet of Added Dune Width	Summed Net Benefits 30 feet of Added Dune Width	Summed Net Benefits 40 feet of Added Dune Width	Profile	Constructible Added Dune Width
R5-46	621	6642	2709	408	-$27,913	R5P2	10
R5-47	2923	17635	15037	13057	-$1,926	R5P2	10
R5-48	-4635	-3737	-7661	-8418	-$31,424	R5P3	10
R5-49	5033	4860	3240	2480	-$20,329	R5P3	10
R5-50	9987	9714	7843	7514	-$20,651	R5P3	10
R5-51	21836	23141	19461	18844	-$6,300	R5P3	10

LEGEND

CONSTRUCTION TEMPLATE 10 FEET OF ADDED DUNE WIDTH	+10
CONSTRUCTION TEMPLATE 30 FEET OF ADDED DUNE WIDTH	+30
ECONOMICALLY JUSTIFIED MODEL REACHES	

8.6.1 Constructible Dune Width Alternative

In construction reach 1, (R1-1 to R1-16), unjustified reach R1-12 was added for constructability reasons. Filling this reach ties R1-11 into the larger neighboring reach which would present a robust beach fill of about 6,000 feet. Dune widths were standardized, 10 feet of added dune width in reaches R1-11 to R1-14 and 30 feet of added dune width for reaches R1-15 and R1-16.

In Construction Reach 2, (R3-2 to R3-23), the 2000-foot justified segment R3-2 and R3-3 is too small of a beach fill segment and would perform too poorly to provide a robust hurricane and storm reduction project. Filling the unjustified reaches R3-4 to R3-7 would tie this smaller segment in with the larger segment Reach R3-9 through R3-23. A robust beach fill segment from R3-2 to R3-23 would be constructed. Two uniform dune widths would be constructed, 10 feet of added dune with in reaches R3-2 to R3-8 and 30 feet of added dune width in reaches R3-9 to R3-23.

In Construction Reach 3, (R4-1 to R4-6), the unjustified reaches R4-3 and R4-4 would be filled to provide a uniform and high performing beach fill. This would also eliminate the need for transitions that would have been required in the unjustified reaches. The predominate 10 feet of added dune width is recommended for this construction reach.

In Construction Reach 4, (R5-1 to R5-21), reaches R5-1 to R5-4 would receive 10 feet of added dune width based on constructability and engineering performance reasons to match the 10 feet of added dune with optimized for the remainder of this construction segment.

In construction reach 5, (R5-30 to R5-51), unjustified reaches R5-45 and R5-48 would receive full beach fill based on engineering and constructability reasons.

8.7 THE CONSTRUCTIBLE NED PLAN

In Table B-29 the constructible added dune width column identifies the constructible economic NED Plan. This plan is a robust design, it is based on economics, engineering performance characteristics, and constructability and beach fill uniformity.

Table B-30 summarizes the optimum added dune width within the five construction reaches by representative profile.

TABLE B-30
OPTIMUM ADDED DUNE WIDTH – REPRESENTATIVE PROFILE

Construction Reach	Representative Profile	Existing Dune Width	Optimum Added Dune Width	Construction Reach Length w/o transitions (feet)	Construction Reach Length w/o transitions (miles)
CR1	R1P1	55	+10		
	R1P2	100	+30		
				6,191	1.2
CR2	R3P1	76	+10 & +30		
	R3P2	45	+10		
				22,980	4.4
CR3	R4P1	50	+10		
	R4P2	85	+10		
				6,101	1.2
CR4	R5P1	185	+10		
	R5P2	65	+10		
	R5P3	50	+10		
				21,688	4.1
CR5	R5P1	185	+10		
	R5P2	65	+10		
	R5P3	50	+10		
				22,319	4.2

8.8 PERIODIC NOURISHMENT – CONSTRUCTIBLE NED PLAN

Periodic nourishment is placement of suitable material on a beach at appropriate intervals of time to maintain the design template. Periodic nourishment plans for Walton County do not include any form of retaining structures that would reduce littoral drift from reaching down-drift beaches.

Beach-*fx* examines all reaches to be nourished to determine if mobilization is warranted. The existing reach profile is compared to the design template, and a nourishment volume is determined. If the total nourishment volume for all reaches exceeds a user-defined threshold, then mobilization and nourishment take place. If nourishment is required, then nourishment time is determined based on placement rates. A start nourishment and end nourishment event for the first reach are created. At the end nourishment event, the reach profile is set to the design template, and the next reach in processing order is examined, to see if nourishment is required. The process continues until all reaches have been handled. The cost of nourishment, including mobilization and placement costs, is calculated based on nourishment volumes and user-defined cost-related parameters.

Once the NED template was determined then GENESIS runs were undertaken to determine the effect of longshore transport on the constructed project. These results were incorporated into the Beach-*fx* model and rerun then re-examined to determine renourishment quantities and cycles.

The results of the Beach-*fx* runs with GENESIS information for the NED constructible alternative revealed that the renourishment cycle would average one initial fill and four renourishments during the life of the project. That would suggest a 10-year renourishment cycle. From the 100 different realizations of alternative futures came the total project life volume of 9,613,000 cy for five nourishment cycles, the initial and four renourishments.

The initial fill is estimated to require on average 3,273,000 cy and each of the four renourishments averaging 1,585,000 cy. Renourishment summary statistics are presented in Tables B-31 and B-32. A frequency distribution of renourishment cycles obtained from one hundred possible realizations is produced in Table B-33.

8.8.1 Comparison With Other Renourishment Projects

With the determination that the renourishment cycle for this project will be a 10-year cycle, it would be prudent to compare this with any adjacent renourishment projects to insure that they will perform in concert with this project. The only adjacent Federal project is Panama City Beach, which is immediately updrift in Bay County. The average renourishment interval of five years was found to produce the lowest total average equivalent cost in the 1996 Panama City Beaches, Florida General Reevaluation Report (GRR). However, the Panama City Beaches, Florida Beach Erosion Control and Storm Damage Reduction Project 5-year Monitoring Report showed that the 1998/1999 constructed beach project (R-l to R- 91.5) performed above expectations. The 5-year monitoring data showed that the project had retained 85 percent of the as-built fill within the Federal project limits and suggested that the design standard had been violated only at R-84, R-85 and R-86. The post-construction monitoring supports the notion that the average beach nourishment cycle for the project is much greater than five years. In addition, the 2009 limited reevaluation study for Carillon Beach and Pinnacle Port updated the economics to determine whether the currently authorized yet federally un-constructed Carillon Beach and Pinnacle Port portion of the Panama City Beaches, Florida Beach Erosion Control and Storm Damage Reduction project was still economically justified. To calculate erosion, wave attack and inundation benefits the engineering-economic Monte Carlo simulation model, Beach-*fx*, which relates beach profile change to storms, coastal processes and nourishment programs was used. The average periodic nourishment for this reach was determined to be on average every 10 years based on 100 iterations in Beach-*fx*.· Initially 300 iterations were simulated. Convergence appeared acceptable at about 100 iterations. Typically, early estimates are close to the starting value. Discarding the first 25 iterations found the recalculated average differed by two percent.

TABLE B-31
NED PLAN PERIODIC NOURISHMENT SUMMARY STATISTICS
(VOLUMES IN CUBIC YARDS)

	Average	Standard Deviation
Average Total Nourishment Volume	9,613,000	3,828,971
Average Initial Construction Volume	3,273,000	1,418,378
Average Total Renourishment Volume	6,340,000	3,525,053
Average Number of Renourishment	4	
Average Renourishment Volume	1,585,000	

TABLE B-32
NED PLAN PERIODIC NOURISHMENT CONFIDENCE INTERVALS
(VOLUMES IN CUBIC YARDS)

Average Initial Construction Volume	2,639,000	
Standard Deviation	1,418,378	
95% Confidence Interval	1,534,626	2,090,620
90% Confidence Interval	1,579,321	2,045,926
Average Total Renourishment Volume	6,341,000	
Standard Deviation	3,525,053	
95% Confidence Interval	5,182,321	6,564,117
90% Confidence Interval	5,293,399	6,453,038

TABLE B-33
NOURISHMENT FREQUENCY DISTRIBUTION
100 POSSIBLE FUTURE REALIZATIONS

Number of renourishment	Number of Occurrences
0	0
1	0
2	1
3	11
4	32
5	30
6	19
7	7
8	0
9	0
10	0

8.9 SUMMARY BENEFIT ANALYSIS – CONSTRUCTIBLE NED PLAN

Table B-34 presents the benefits by reach, profile and added dune width for the NED Plan. Total project benefits are $7,365,000.

TABLE B-34
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R1-1	R1P1		
R1-2	R1P1		
R1-3	R1P1		
R1-4	R1P1		
R1-5	R1P1		
R1-6	R1P1		
R1-7	R1P1		
R1-8	R1P1		
R1-9	R1P1		
R1-10	R1P1		
R1-11	R1P1	+10	$98,294
R1-12	R1P1	+10	$9,794
R1-13	R1P1	+10	$296,297
R1-14	R1P1	+10	$215,054
R1-15	R1P2	+30	$317,002
R1-16	R1P2	+30	$281,671
R1-17	R1P2		
R1-18	R1P2		
R1-19	R1P2		
R1-20	R1P2		
R1-21	R1P1		
R1-22	R1P1		
R1-23	R1P1		
R1-24	R1P1		
SUBTOTALS CONSTRUCTION REACH 1			**$1,218,113**

TABLE B-34 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R2-1	R2P1		
R2-2	R2P1		
R2-3	R2P2		
R2-4	R2P1		
R2-5	R2P2		
R2-6	R2P1		
R2-7	R2P1		
R3-1	R3P1		
R3-2	R3P1	+10	$169,461
R3-3	R3P1	+10	$37,805
R3-4	R3P2	+10	$7,948
R3-5	R3P2	+10	$10,704
R3-6	R3P2	+10	$10,761
R3-7	R3P2	+10	$15,941
R3-8	R3P1	+10	$59,368
R3-9	R3P1	+30	$89,601
R3-10	R3P1	+30	$289,553
R3-11	R3P1	+30	$122,795
R3-12	R3P1	+30	$224,146
R3-13	R3P1	+30	$115,949
R3-14	R3P1	+30	$264,479
R3-15	R3P1	+30	$138,857
R3-16	R3P1	+30	$105,845
R3-17	R3P1	+30	$170,314
R3-18	R3P1	+30	$189,434
R3-19	R3P1	+30	$182,301
R3-20	R3P1	+30	$456,390
R3-21	R3P1	+30	$222,335
R3-22	R3P1	+30	$158,430
R3-23	R3P1	+30	$126,316
R3-24	R3P2		
R3-25	R3P2		
R3-26	R4P1		
SUBTOTALS CONSTRUCTION REACH 2			**$3,168,734**

TABLE B-34 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R4-1	R4P1	+10	$76,345
R4-2	R4P1	+10	$58,509
R4-3	R4P2	+10	$0
R4-4	R4P2	+10	$0
R4-5	R4P1	+10	$38,623
R4-6	R4P2	+10	$6,393
R4-7	R4P2		
R4-8	R4P1		
R4-9	R4P1		
SUBTOTALS CONSTRUCTION REACH 3			**$179,869**
R5-1	R5P2	+10	$117,676
R5-2	R5P2	+10	$82,862
R5-3	R5P2	+10	$50,371
R5-4	R5P2	+10	$22,137
R5-5	R5P2	+10	$16,725
R5-6	R5P1	+10	$233,802
R5-7	R5P1	+10	$331,560
R5-8	R5P1	+10	$151,955
R5-9	R5P2	+10	$27,704
R5-10	R5P2	+10	$30,968
R5-11	R5P2	+10	$42,879
R5-12	R5P2	+10	$32,155
R5-13	R5P2	+10	$39,259
R5-14	R5P2	+10	$31,682
R5-15	R5P2	+10	$37,354
R5-16	R5P2	+10	$47,849
R5-17	R5P3	+10	$24,884
R5-18	R5P2	+10	$39,545
R5-19	R5P3	+10	$14,251
R5-20	R5P2	+10	$12,748
R5-21	R5P2	+10	$13,455

TABLE B-34 (CONTINUED)
WALTON COUNTY - NATIONAL ECONOMIC DEVELOPMENT PLAN
HSDR BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-22	R5P3		
R5-23	R5P3		
R5-24	R5P2		
R5-25	R5P2		
R5-26	R5P1		
R5-27	R5P3		
R5-28	R5P3		
R5-29	R5P2		
SUBTOTALS CONSTRUCTION REACH 4			**$1,401,821**
R5-30	R5P2	+10	$44,418
R5-31	R5P2	+10	$65,465
R5-32	R5P1	+10	$155,933
R5-33	R5P1	+10	$100,098
R5-34	R5P1	+10	$71,709
R5-35	R5P1	+10	$77,531
R5-36	R5P1	+10	$167,208
R5-37	R5P1	+10	$104,887
R5-38	R5P1	+10	$134,131
R5-39	R5P1	+10	$112,222
R5-40	R5P2	+10	$60,081
R5-41	R5P2	+10	$57,009
R5-42	R5P2	+10	$40,735
R5-43	R5P2	+10	$28,111
R5-44	R5P2	+10	$12,618
R5-45	R5P2	+10	$9,751
R5-46	R5P2	+10	$18,854
R5-47	R5P2	+10	$32,467
R5-48	R5P3	+10	$7,395
R5-49	R5P3	+10	$23,488
R5-50	R5P3	+10	$29,643
R5-51	R5P3	+10	$42,392
SUBTOTALS CONSTRUCTION REACH 5			**$1,396,145**
TOTALS ALL CONSTRUCTION REACHES			**$7,364,682**

8.10 CONSTRUCTIBLE NED PLAN AND RENOURISHMENTS

Modeling with Beach-*fx* began in January 2005 using the post-Hurricane Ivan surveys. Post Ivan, the very active 2005 hurricane season sent five named storms to the State of Florida. In the Gulf of Mexico, Hurricane Katrina, which made landfall in Mississippi and several other storms since then, Hurricane Dennis for example, have devastated the beaches of Northwest Florida of which Walton County is no exception. These conditions have changed the morphology of the study area in significant ways since the post Hurricane Ivan surveys.

The Beach-*fx* modeling efforts have predicted an initial fill requirement of 2,639,000 cy for the NED Plan. However, surveys have shown that the erosion activity that has occurred since the post Hurricane Ivan surveys would require an equivalent NED placement of approximately 3,273,000 cy to fill the initial construction template. Renourishments will still be on a 10-year cycle and the renourishment volume is 1,585,000 for the NED Plan.

The FY 2013 initial construction costs are $51,945,000 and a single renourishment FY 2013 cost is $22,849,000. Renourishment costs for each fill are lower than the FY 2014 cost due to present worthing. Total project first cost including Interest during construction for this plan is $90,724,000. The annualized cost including Operation, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) is $4,168,000. The annualized benefits, $7,380,000include both HSDR benefits of about $7,365,000 and recreation benefits of about $15,000. The benefit-to-cost ratio (BCR) is 1.77 to 1 which yields net benefits of about $3,212,000.

Table B-35 summarized the costs, benefits and other pertinent information on project justification for the NED Plan without recreation benefits.

TABLE B-35
SUMMARY BENEFITS NED PLAN WITHOUT RECREATION BENEFITS
WALTON COUNTY, FLORIDA – FEASIBILITY

	$51,945,000	2014 Initial Construction
	$15,240,459	2024 Renourishment
	$10,546,710	2034 Renourishment
	$7,298,539	2044 Renourishment
	$5,050,738	2054 Renourishment
Total Economic First Cost	$90,081,000	
Interest During Construction	$643,000	
Total Project Economic First Cost	$90,724,000	
Average Annual Economic First Cost	$4,044,000	
Annual OMRR&R	$124,500	
Total Average Annual Economic Cost	$4,168,000	
Average Annual HSDR Benefits	$7,365,000	
Benefit-to-Cost Ratio	1.77	
Net Benefits	$3,197,000	

Table B-35A summarizes the costs, benefits and other pertinent information on project justification for the NED Plan with recreation benefits. There is a small amount of recreation benefits because the future with project is characterized by added dune width. The added dune width is gained at the expense of berm width which results in less beach to recreate on and no recreation is permitted on the dunes.

TABLE B-35A
SUMMARY BENEFITS NED PLAN
WALTON COUNTY, FLORIDA – FEASIBILITY

	FY 2013 Dollars	Category
	$51,945,000	2014 Initial Construction
	$15,240,459	2024 Renourishment
	$10,546,710	2034 Renourishment
	$7,298,539	2044 Renourishment
	$5,050,738	2054 Renourishment
Total Economic First Cost	$90,081,000	
Interest During Construction	$643,000	
Total Project Economic First Cost	$90,724,000	
Average Annual Economic First Cost	$4,044,000	
Annual OMRR&R	$124,500	
Total Average Annual Economic Cost	$4,168,000	
Average Annual HSDR Benefits	$7,365,000	
Average Annual Recreation Benefits	$15,000	
Total Average Annual Benefits	$7,380,000	
Benefit-to-Cost Ratio	1.77	
Net Benefits	$3,212,000	

8.11 RECREATION BENEFITS

In order to determine the recreation benefits of the selected plan an economic value must be placed on the recreation experience at the Walton County beaches. This value can then be applied to visitation of the project to determine the NED recreation benefits. For this report, UDV are used to determine the economic value of recreation at Walton County beaches. The UDV are administratively determined values which represent the NED recreation values for typical types of recreation. Guidance for their use is provided by ER 1105-2-100.

The UDV are determined using a point system that takes into account the following factors: recreation experience, availability of opportunity, carrying capacity, accessibility, and environmental (esthetics) quality. A good deal of judgment is required in the assessment of point values. A group of planning professionals with knowledge of the study area made independent judgments of the UDV values which were averaged. The UDV point totals convert to a recreation value of $5.07 for the without project condition and $5.16 for the with project condition. There values were applied to the increase in visitation over the study period. The difference between the without and with project value of recreation determines the NED and LPP recreation benefits. The complete recreation analysis can to found in the attachments to the Economic Appendix.

8.12 LOCALLY PREFERRED PLAN (LPP)

The PDT met with the non-Federal sponsor and presented the Constructible NED Plan. The non-Federal sponsor approved of the plan and committed to supporting that conclusion. When asked if that plan was also the non-Federal sponsor's preferred plan, the non-Federal sponsor indicated that they would like to have added to the project the unjustified reaches R1-1 to R1-10. The non-Federal sponsor has just recently constructed a similar project in those reaches. Also they would like to have Reaches R1-17 to R1-24 added to the project. The beach fill will match the neighboring recommended beach fill, a 50-foot berm width and 30 feet of added dune in profile R1P2 and 10 feet of added dune width in profile R1P1. Table B-36 outlines the features of the Locally Preferred Plan.

TABLE B-36
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R1-1	-$21,973	-$24,268	-$29,633	-$32,663	-$70,656	+00	R1P1	+10
R1-2	-$20,560	-$23,275	-$28,261	-$31,277	-$64,626	+00	R1P1	+10
R1-3	-$19,452	-$22,450	-$26,062	-$28,842	-$59,847	+00	R1P1	+10
R1-4	-$20,515	-$21,875	-$26,597	-$29,331	-$59,152	+00	R1P1	+10
R1-5	-$22,644	-$24,528	-$27,754	-$30,620	-$62,686	+00	R1P1	+10
R1-6	-$26,738	-$25,173	-$31,575	-$34,387	-$66,491	+10	R1P1	+10
R1-7	-$25,776	-$24,932	-$30,447	-$33,119	-$64,351	+10	R1P1	+10
R1-8	-$27,070	-$26,652	-$31,812	-$34,591	-$67,592	+10	R1P1	+10
R1-9	-$23,183	-$23,071	-$27,636	-$30,195	-$60,899	+10	R1P1	+10
R1-10	-$19,414	-$20,251	-$22,745	-$25,250	-$53,615	+00	R1P1	+10
R1-11	$30,826	$56,895	$68,085	$66,491	$34,057	+20	R1P1	+10
R1-12	-$24,859	-$21,595	-$29,833	-$32,618	-$64,658	+10	R1P1	+10
R1-13	$163,848	$164,890	$159,465	$156,755	$120,973	+10	R1P1	+10
R1-14	$74,404	$76,523	$72,382	$69,860	$34,592	+10	R1P1	+10
R1-15	$108,037	$131,552	$189,573	$212,157	$204,933	+30	R1P2	+30
R1-16	$108,817	$119,998	$151,449	$162,735	$137,214	+30	R1P2	+30
R1-17	-$10,947	-$8,672	-$12,337	-$13,249	-$44,213	+10	R1P2	+30
R1-18	-$6,686	-$4,787	-$8,185	-$10,136	$12,779	+10	R1P2	+30
R1-19	-$16,464	-$11,762	-$16,353	-$16,455	-$44,967	+10	R1P2	+30
R1-20	-$18,102	-$14,543	-$17,092	-$16,619	-$41,608	+10	R1P2	+30
R1-21	-$23,864	-$24,628	-$28,267	-$30,742	-$60,704	+00	R1P1	+10
R1-22	-$22,459	-$22,298	-$26,891	-$29,509	-$59,756	+10	R1P1	+10
R1-23	-$22,482	-$24,929	-$28,360	-$31,250	-$65,072	+00	R1P1	+10
R1-24	-$18,535	-$19,329	-$25,302	-$28,140	-$58,971	+00	R1P1	+10

TABLE B-36 CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R3-1	-$6,480	-$1,676	-$523	-$1,133	-$48,529	+20	R3P1	
R3-2	$60,918	$88,440	$99,635	$105,914	$67,319	+30	R3P1	+10
R3-3	-$3,637	$2,903	$495	-$467	-$39,895	+10	R3P1	+10
R3-4	-$8,604	-$8,046	-$11,455	-$12,306	-$36,443	+10	R3P2	+10
R3-5	-$10,952	-$7,497	-$13,443	-$14,081	-$40,631	+10	R3P2	+10
R3-6	-$13,879	-$9,546	-$16,724	-$17,106	-$44,795	+10	R3P2	+10
R3-7	-$12,437	-$9,368	-$15,972	-$16,624	-$44,681	+10	R3P2	+10
R3-8	$6,269	$10,978	$10,427	$10,154	-$33,177	+10	R3P1	+10
R3-9	$21,777	$33,172	$32,887	$33,918	-$7,904	+30	R3P1	+30
R3-10	$54,721	$115,738	$157,575	$194,603	$178,292	+30	R3P1	+30
R3-11	$29,313	$44,573	$49,252	$53,628	$13,442	+30	R3P1	+30
R3-12	$46,295	$80,649	$104,132	$127,568	$103,900	+30	R3P1	+30
R3-13	$37,990	$42,943	$42,354	$41,955	$656	+10	R3P1	+30
R3-14	$107,187	$125,032	$125,659	$128,119	$74,087	+30	R3P1	+30
R3-15	$53,578	$57,577	$56,864	$56,257	$11,006	+10	R3P1	+30
R3-16	$42,516	$44,866	$45,067	$44,743	$13,220	+20	R3P1	+30
R3-17	$70,535	$75,378	$76,840	$77,139	$32,760	+30	R3P1	+30
R3-18	$76,242	$84,878	$86,728	$88,165	$42,842	+30	R3P1	+30
R3-19	$77,587	$81,617	$83,045	$82,970	$38,210	+20	R3P1	+30
R3-20	$239,534	$274,140	$287,533	$294,440	$252,339	+30	R3P1	+30
R3-21	$90,529	$112,124	$118,304	$123,926	$80,356	+30	R3P1	+30
R3-22	$60,602	$71,894	$70,982	$72,274	$30,460	+30	R3P1	+30
R3-23	$45,841	$55,004	$53,541	$54,111	$17,947	+10	R3P1	+30
R4-1	$57,579	$60,774	$59,376	$59,220	-$1,796	+10	R4P1	+10
R4-2	$56,114	$69,534	$65,479	$66,614	-$9,366	+10	R4P1	+10
R4-3	-$5,402	-$1,372	-$6,935	-$7,651	$1,532	+10	R4P2	+10
R4-4	-$1,736	-$1,313	-$3,208	-$3,895	$1,471	+10	R4P2	+10
R4-5	$22,248	$25,615	$23,096	$22,401	-$848	+10	R4P1	+10
R4-6	-$405	$3,772	$3,267	$2,791	-$3,672	+10	R4P2	+10

TABLE B-36 (CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R5-1	$101,205	$98,415	$95,873	$95,109	$5,332	+00	R5P2	+10
R5-2	$70,355	$68,018	$64,932	$63,312	$5,423	+00	R5P2	+10
R5-3	$37,513	$37,398	$33,074	$31,024	$4,439	+00	R5P2	+10
R5-4	$11,335	$10,860	$6,833	$3,971	$4,502	+00	R5P2	+10
R5-5	$1	$3,602	-$1,157	-$3,562	$1,157	+10	R5P2	+10
R5-6	$140,226	$157,419	$154,409	$151,764	-$14,183	+10	R5P1	+10
R5-7	$200,024	$214,153	$209,752	$206,797	-$9,729	+10	R5P1	+10
R5-8	$86,384	$100,229	$95,839	$93,221	-$9,455	+10	R5P1	+10
R5-9	$12,641	$15,448	$8,646	$6,694	$3,995	+10	R5P2	+10
R5-10	$16,735	$17,865	$12,965	$11,068	$3,770	+10	R5P2	+10
R5-11	$22,492	$25,100	$18,724	$16,681	$3,768	+10	R5P2	+10
R5-12	$19,276	$19,473	$16,094	$14,321	$3,182	+10	R5P2	+10
R5-13	$17,898	$23,227	$15,965	$13,943	$1,934	+10	R5P2	+10
R5-14	$15,842	$18,371	$12,358	$10,452	$3,484	+10	R5P2	+10
R5-15	$22,419	$23,919	$18,097	$15,770	$4,322	+10	R5P2	+10
R5-16	$25,421	$31,720	$27,972	$26,043	-$2,551	+10	R5P2	+10
R5-17	$6,949	$10,436	$4,477	$3,815	$2,472	+10	R5P3	+10
R5-18	$24,250	$25,944	$22,209	$20,851	$2,041	+10	R5P2	+10
R5-19	$462	$4,253	$70	$647	$392	+10	R5P3	+10
R5-20	-$563	$825	-$3,538	-$5,666	$2,975	+10	R5P2	+10
R5-21	$135	$985	-$3,266	-$5,468	$3,401	+10	R5P2	+10
R5-30	$31,359	$32,542	$27,446	$25,763	-$4,71	+10	R5P2	+10
R5-31	$39,204	$40,628	$34,506	$32,596	$2,163	+10	R5P2	+10
R5-32	$93,797	$116,901	$120,434	$119,260	$77,242	+20	R5P1	+10
R5-33	$70,338	$76,230	$72,162	$69,274	$25,221	+10	R5P1	+10
R5-34	$47,939	$51,558	$46,369	$43,212	-$235	+10	R5P1	+10
R5-35	$52,939	$56,658	$52,726	$49,924	$8,037	+10	R5P1	+10
R5-36	$97,937	$124,305	$126,632	$126,125	$83,916	+20	R5P1	+10
R5-37	$76,094	$79,651	$74,974	$71,484	$28,353	+10	R5P1	+10
R5-38	$97,013	$107,768	$99,436	$95,873	$48,203	+10	R5P1	+10
R5-39	$90,626	$91,422	$88,855	$86,031	$41,575	+10	R5P1	+10
R5-40	$49,424	$47,040	$44,289	$42,296	$11,247	+00	R5P2	+10

TABLE B-36 (CONTINUED)
LOCALLY PREFERRED PLAN
ADDED REACHES R1-1 TO R1-10 AND R1-17 TO R1-24

Model Reach	Summed Net Benefits No added Dune Width	Summed Net Benefits 10-ft added Dune Width	Summed Net Benefits 20-ft added Dune Width	Summed Net Benefits 30-ft added Dune Width	Summed Net Benefits 40-ft added Dune Width	Maximized Added Dune width by Sub-Reach	Profile	LPP Added Dune Width
R5-41	$44,150	$42,989	$39,376	$37,311	$6,701	+00	R5P2	+10
R5-42	$28,280	$28,539	$23,859	$21,635	-$8,858	+10	R5P2	+10
R5-43	$17,851	$17,377	$13,587	$11,494	-$17,881	+00	R5P2	+10
R5-44	$3,985	$4,253	-$3	-$2,204	-$26,622	+10	R5P2	+10
R5-45	-$1,618	-$1,157	-$5,345	-$7,562	-$15,038	+10	R5P2	+10
R5-46	$621	$6,642	$2,709	$408	-$27,913	+10	R5P2	+10
R5-47	$2,923	$17,635	$15,037	$13,057	-$1,926	+10	R5P2	+10
R5-48	-$4,635	-$3,737	-$7,661	-$8,418	-$31,424	+10	R5P3	+10
R5-49	$5,033	$4,860	$3,240	$2,480	-$20,329	+00	R5P3	+10
R5-50	$9,987	$9,714	$7,843	$7,514	-$20,651	+00	R5P3	+10
R5-51	$21,836	$23,141	$19,461	$18,844	-$6,300	+10	R5P3	+10

LEGEND

CONSTRUCTION TEMPLATE 10 FEET OF ADDED DUNE WIDTH	+10
CONSTRUCTION TEMPLATE 30 FEET OF ADDED DUNE WIDTH	+30
ECONOMICALLY JUSTIFIED MODEL REACHES	

8.13 PERIODIC NOURISHMENT – LOCALLY PREFERRED PLAN

The results of the Beach-*fx* runs with GENESIS information for the LPP alternative revealed that the nourishment cycle would also average five cycles, the initial fill and four renourishments suggesting a 10-year renourishment cycle.

From the 100 different realizations of alternative futures came the total project life nourishment volume of 11,024,000 cy and five nourishment cycles, the initial and four renourishments. The initial fill is estimated to require on average 3,868,000 cy and 7,156,000 cy total for the four renourishments an average 1,789,000 cy each. Renourishment summary statistics are presented in Tables B-37 and B-38. A frequency distribution of renourishment cycles obtained from one hundred possible realizations is produced in Table B-39.

TABLE B-37
LOCALLY PREFERRED PLAN PERIODIC NOURISHMENT SUMMARY STATISTICS (VOLUMES IN CUBIC YARDS)

	Average
Average Total Nourishment Volume	11,024,000
Average Initial Construction Volume	3,868,000
Average Total Renourishment Volume	7,156,000
Average Number of Renourishments	4
Average Renourishment Volume	1,789,000

TABLE B-38
LOCALLY PREFERRED PLAN PERIODIC NOURISHMENT CONFIDENCE INTERVALS (VOLUMES IN CUBIC YARDS)

Average Initial Construction Volume	3,152,000	
Standard Deviation	1,599,545	
95% Confidence Interval	1,913,051	2,237,091
90% Confidence Interval	1,862,647	2,287,494
Average Total Renourishment Volume	7,156,000	
Standard Deviation	4,088,020	
95% Confidence Interval	5,388,314	6,990,788
90% Confidence Interval	5,517,131	6,861,970

TABLE B-39
NOURISHMENT FREQUENCY DISTRIBUTION
100 POSSIBLE FUTURE REALIZATIONS

Number of Nourishments	Number of Occurrences
0	0
1	0
2	0
3	14
4	34
5	29
6	19
7	4
8	0
9	0
10	0

8.14 LOCALLY PREFERRED PLAN AND RENOURISHMENTS

Beach-*fx* simulation runs supplemented with the GENESIS long-term transport data suggested an average of four renourishment cycles over the 50-year project life for the LPP.

8.15 SUMMARY BENEFIT ANALYSIS – LOCALLY PREFERRED PLAN

The NED Plan and the LPP maintain the same placement template (see Figure B-6) but the LPP extends the coverage area to the westernmost limits of the county where the NED Plan could not justify the coverage. Table B-40 presents the LPP benefits by reach and Table B-41 summarized the costs, benefits and other pertinent information on project justification for the LPP.

The Beach-*fx* modeling efforts have predicted initial fill requirements of 3,152,000 cy for the LPP. Recent surveys have shown that the erosion activity that has occurred since the post-Hurricane Ivan surveys would require an equivalent LPP placement. If the long-term erosion rate is applied to the predicted construction timeframe of FY 14, then the necessary beach fill requirements will be 3,868,000 cy. Renourishments will still be on a 10-year cycle and the renourishment volume is 1,789,000 for the LPP.

The FY 2013 initial construction costs are $61,397,000 and a single renourishment FY 2013 cost is $26,760,000. Renourishment costs for each fill are lower than the FY 2013 cost due to present worthing. Total project cost including interest during construction for this plan is $103,598,300. The average annual construction cost is about $4,618,000 and annual OMRR&R is $168,000 making total average annual costs of $4,786,000. The annualized benefits, $7,570,000, include both HSDR benefits of about $7,555,000 and recreation benefits of about $15,000. The BCR is 1.58 to 1 which yields net benefits of about $2,784,000. Tables B-40 and B-41 summarize the costs, benefits and other pertinent information on project justification for the LPP.

The average annual incremental cost of the LPP over the NED Plan is $618,000. The average annual incremental benefits of the LPP verses the NED Plan is $190,000. The incremental cost between the LPP and the NED Plan is 100 percent non-Federal responsibility.

TABLE B-40
WALTON COUNTY - LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R1-1	R1P1	+10	$2,968
R1-2	R1P1	+10	$1,996
R1-3	R1P1	+10	$2,193
R1-4	R1P1	+10	$2,328
R1-5	R1P1	+10	$2,021
R1-6	R1P1	+10	$2,809
R1-7	R1P1	+10	$3,555
R1-8	R1P1	+10	$3,116
R1-9	R1P1	+10	$3,833
R1-10	R1P1	+10	$2,655
R1-11	R1P1	+10	$120,608
R1-12	R1P1	+10	$9,880
R1-13	R1P1	+10	$299,683
R1-14	R1P1	+10	$217,062
R1-15	R1P2	+30	$341,492
R1-16	R1P2	+30	$280,917
R1-17	R1P2	+30	$32,987
R1-18	R1P2	+30	$38,156
R1-19	R1P2	+30	$26,922
R1-20	R1P2	+30	$9,227
R1-21	R1P1	+10	$1,880
R1-22	R1P1	+10	$2,732
R1-23	R1P1	+10	$2,028
R1-24	R1P1	+10	$10,942
R2-1	R2P1		
R2-2	R2P1		
R2-3	R2P2		
R2-4	R2P1		
R2-5	R2P2		
R2-6	R2P1		
R2-7	R2P1		
R3-1	R3P1		
R3-2	R3P1	+10	$151,815
R3-3	R3P1	+10	$36,755
R3-4	R3P2	+10	$7,900

TABLE B-40 (CONTINUED)
WALTON COUNTY - LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R3-5	R3P2	+10	$10,419
R3-6	R3P2	+10	$10,386
R3-7	R3P2	+10	$15,819
R3-8	R3P1	+10	$60,253
R3-9	R3P1	+30	$90,386
R3-10	R3P1	+30	$294,486
R3-11	R3P1	+30	$122,825
R3-12	R3P1	+30	$223,182
R3-13	R3P1	+30	$115,932
R3-14	R3P1	+30	$264,362
R3-15	R3P1	+30	$138,857
R3-16	R3P1	+30	$105,845
R3-17	R3P1	+30	$170,269
R3-18	R3P1	+30	$189,346
R3-19	R3P1	+30	$182,292
R3-20	R3P1	+30	$456,983
R3-21	R3P1	+30	$222,634
R3-22	R3P1	+30	$158,622
R3-23	R3P1	+30	$126,427
R3-24	R3P2		
R3-25	R3P2		
R3-26	R4P1		
R4-1	R4P1	+10	$74,910
R4-2	R4P1	+10	$54,127
R4-3	R4P2	+10	$0
R4-4	R4P2	+10	$0
R4-5	R4P1	+10	$36,920
R4-6	R4P2	+10	$6,393
R4-7	R4P2		
R4-8	R4P1		
R4-9	R4P1		
R5-1	R5P2	+10	$117,769
R5-2	R5P2	+10	$82,853
R5-3	R5P2	+10	$50,375
R5-4	R5P2	+10	$22,139
R5-5	R5P2	+10	$16,720

TABLE B-40 (CONTINUED)
WALTON COUNTY - LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-6	R5P1	+10	$233,335
R5-7	R5P1	+10	$331,279
R5-8	R5P1	+10	$151,886
R5-9	R5P2	+10	$27,686
R5-10	R5P2	+10	$30,961
R5-11	R5P2	+10	$42,883
R5-12	R5P2	+10	$32,159
R5-13	R5P2	+10	$39,251
R5-14	R5P2	+10	$31,676
R5-15	R5P2	+10	$37,350
R5-16	R5P2	+10	$47,828
R5-17	R5P3	+10	$24,882
R5-18	R5P2	+10	$39,531
R5-19	R5P3	+10	$14,183
R5-20	R5P2	+10	$12,654
R5-21	R5P2	+10	$13,454
R5-22	R5P3		
R5-23	R5P3		
R5-24	R5P2		
R5-25	R5P2		
R5-26	R5P1		
R5-27	R5P3		
R5-28	R5P3		
R5-29	R5P2		
R5-30	$41,615	+10	$44,315
R5-31	$54,424	+10	$65,452
R5-32	$135,413	+10	$155,318
R5-33	$89,447	+10	$100,014
R5-34	$64,991	+10	$71,684
R5-35	$68,957	+10	$77,470
R5-36	$147,407	+10	$166,641
R5-37	$98,230	+10	$104,860
R5-38	$123,595	+10	$134,036

TABLE B-40 (CONTINUED)
WALTON COUNTY - LOCALLY PREFERRED PLAN
BENEFITS

Model Reach	Profile	Constructed Added Dune Width	Average Annual Benefits
R5-39	$108,862	+10	$112,205
R5-40	$57,539	+10	$60,081
R5-41	$54,804	+10	$57,009
R5-42	$39,019	+10	$40,735
R5-43	$26,194	+10	$28,107
R5-44	$11,719	+10	$12,618
R5-45	$8,952	+10	$9,751
R5-46	$15,328	+10	$18,678
R5-47	$24,451	+10	$32,068
R5-48	$6,763	+10	$7,394
R5-49	$23,356	+10	$23,588
R5-50	$29,212	+10	$29,640
R5-51	$41,083	+10	$42,370
Average Annual Benefits LPP			**$7,554,927**

TABLE B-41
SUMMARY BENEFITS LPP
WALTON COUNTY, FLORIDA – FEASIBILITY

	FY 2013 Dollars	Category
	$61,397,000	2014 Initial Construction
	$16,561,078	2024 Renourishment
	$11,460,605	2034 Renourishment
	$7,930,973	2044 Renourishment
	$5,488,396	2054 Renourishment
Total Economic First Cost	$102,838,052	
Interest During Construction	$760,000	
Total Project Economic First Cost	$103,598,000	
Average Annual Economic First Cost	$4,618,000	
Annual OMRR&R	$168,000	
Total Average Annual Economic Cost	$4,786,000	
Average Annual HSDR Benefits	$7,555,000	
Average Annual Recreation Benefits	$15,000	
Total Average Annual Benefits	$7,570,000	
Benefit-to-Cost Ratio	1.58	
Net Benefits	$2,784,000	

Attachment IV of this Appendix displays access points and associated parking.

8.16 SYSTEM OF ACCOUNTS

Principles and Guidelines prescribe for an evaluation of project benefits for the final array of alternatives and the selected plan according to the four accounts: National Economic Development (NED), Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ).

The NED benefits were fully and illustratively presented throughout the economic analysis. Regional Economic Development Benefits are calculated using the Economic Impact Forecasting System (EIFS). EIFS is an regional economic impact assessment model that uses economic multipliers and a database of economic and financial statistics by county to measure the economic and financial impact to a community through various increases and/or decreases in economic activity in that community.

The evaluation of the System of Accounts is displayed in Table B-42.

TABLE B-42
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
A. PLAN DESCRIPTION	No Federal Action	Buyout all row one damageable elements and land	Construct a 50-foot beach fill project in five reaches	Construct a 50-foot beach fill project in five reaches
B. IMPACT ASSESSMENT				
1. National Economic Development				
a. Beneficial Impacts				
(1) Damages Prevented	$0	$3,106,000	$7,365,000	$7,555,000
(2) Emergency Costs Avoided	$0	$0	$0	$0
(3) Recreation	$0	$0	$15,000	$15,000
(4) Total Beneficial Impacts	None.	$3,106,000	$7,380,000	$7,570,000
b. Adverse Impacts				
(1) Project Cost	$0	$3,420,000,000	$90,081,000	$102,838,000
(2) Interest During Construction	$0	$32,665,600	$643,000	$760,000
(3) Average Annual First Cost	N/A	$193,303,000	$4,044,000	$4,618,000
(4) Annual OMRR&R	$0		$124,500	$168,000
(5) Total Avg. Annual Costs	$0	$193,303,000	$4,168,000	$4,786,000
2. Environmental Quality (EQ)				
(1) Ecosystem Restoration	No ecosystem restoration benefits.	Significantly Increased dune habitat from added dune width	Increased habitat from added dune and berm width	Increased habitat from added dune and berm width
(2) Water Circulation	No anticipated effect on water circulation.	No anticipated effect on water circulation.	No anticipated effect on water circulation.	No anticipated effect on water circulation.
(3) Noise Level Changes	No change in noise levels	No change in noise levels	Temporary increase in noise levels during construction	Temporary increase in noise levels during construction
(4) Public Facilities	N/A	N/A	N/A	N/A
(5) Aesthetic Values	No significant change in aesthetic values	Significant increase to aesthetic improvement	Significant increase to aesthetic improvement	Significant increase to aesthetic improvement
(6) Natural Resources	No impact.	Alternative would result in restoration of coastal marsh resources.	Alternative would result in restoration of coastal marsh resources.	Alternative would result in restoration of coastal marsh resources.
(7) Biological Resources	No impact.	Biological resources would be improved versus the no-action alternative.	Biological resources would be improved versus the no-action alternative.	Biological resources would be improved versus the no-action alternative.
(8) Air Quality	Alternative would have no anticipated effect on air quality	Air emission would be de minimus	Air emission would be de minimus	Air emission would be de minimus

TABLE B-42 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
(9) Water Quality	No impact.	No impact.	Temporary negative impacts to water quality due to construction.	Temporary negative impacts to water quality due to construction.
(10) Public Services	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events	Public services to community would continue to be interrupted during storm events
(11) Cultural and Historical Preservation	No impact.	No impact.	No impact.	No impact.
(12) Total Quality of the Environment	No impact.	Environmental quality would be improved.	Environmental quality would be improved.	Environmental quality would be improved.
3. Regional Economic Development (RED)				
(1) Impact on Sales Volume	No impact.	Decrease of **$47,819,840** in sales volume.	Increase of **$167,576,000** in additional sales volume.	Increase of **$192,354,000** in additional sales volume.
(2) Impact on Income	No impact.	Decrease of **$35,723,610** in local income.	Increase of **$30,595,000** in additional local income.	Increase of **$35,119,000** in additional local income.
(3) Impact on Employment	No impact.	Decrease of **1141** jobs.	Increase of **1055** new jobs.	Increase of **1210** new jobs.
(4) Tax Changes	No impact.	Would result in loss of some local tax revenue due to acquisition of properties.	No Change	No Change
4. Other Social Effects (OSE)				
a. Beneficial Impacts				
(1) Security of Life, Health, and Safety	Continued risks to life, health and safety	Major reduction in potential loss of life of persons and property.	No appreciable difference	No appreciable difference
(2) Community Cohesion	No negative impact on community cohesion.	Community would be dispersed and/or relocated	No negative impact on community cohesion.	No negative impact on community cohesion.
(3) Tax Values	No Impact.	Ownership and land use changes would impact tax value	Increase due to enhanced property values	Increase due to enhanced property values
(4) Community Growth	No Impact.	No Impact.	No Impact.	No Impact.

TABLE B-42 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
(5) Property Values	No Impact.	Minor temporary negative impact to adjacent properties during acquisition phase.	Minor Positive impact to protected properties.	Minor Positive impact to protected properties.
(6) Displacement of Businesses	N/A	N/A	N/A	N/A
(7) Public Facilities	N/A	Enhances opportunities for additional public facilities for recreation	Minor improvement to recreational activities from increased beach	Minor improvement to recreational activities from increased beach
(8) Injurious Displacement of Farms	N/A	N/A	N/A	N/A
b. Preservation of loss of life	No Impact.	Some reduction in potential loss of life.	No Change	No Change
C. PLAN EVALUATION				
1. Contributions to Planning Objectives				
a. Flood, Hurricane and/or Storm Damage Reduction	No Improvement.	Total reduction in damages at project site and less stress on dune system.	Significant reduction of storm damages and loss of land	Significant reduction of storm damages and loss of land
b. Recovery of lost environmental resources	Continued loss of environmental resources.	Significant opportunity to recover environmental resources negatively impacted in past	Some Recovery of environmental resources through additional dune area for nesting birds, beach mice and turtles	Some Recovery of environmental resources through additional dune area for nesting birds, beach mice and turtles
2. Response to Planning Constraints				
a. Avoid environmental impacts and minimize induced damages	Continued loss of environmental resources.	Positive effect on environmental resources.	Positive effect on environmental resources.	Positive effect on environmental resources.
b. Institutional Acceptability	Not supported by state or local government	Not supported by state or local government	Is supported by local and state governments	Is supported by local and state governments
3. Response to Evaluation Criteria				
a. Acceptability	NO	NO	YES	YES
b. Completeness	NO	YES	YES	YES
c. Effectiveness	NO	YES	YES	YES
d. Efficiency (Cost-Effectiveness; i.e., most efficient use of Federal and Non-Federal Funds)	NO	NO	YES	Yes
e. Integration	N/A	N/A	N/A	N/A
f. Reversibility	N/A	NO - land could not be resold for development	YES - project nourishment can be abandoned	YES - project nourishment can be abandoned

TABLE B-42 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
4. Stakeholder Preference Score (From MCDA weightings analysis)				
a. Summary Score	N/A	N/A	N/A	N/A
Cluster Group A	N/A	N/A	N/A	N/A
Cluster Group B	N/A	N/A	N/A	N/A
Cluster Group C	N/A	N/A	N/A	N/A
Cluster Group D	N/A	N/A	N/A	N/A
b. Stakeholder Preference	NO	NO	Stakeholder would approve.	Stakeholder Preference
D. Implementation Responsibility	No implementation responsibilities	Joint Federal/Non-Federal implementation responsibility.	Joint Federal/Non-Federal implementation responsibility.	Joint Federal/Non-Federal implementation responsibility.
E. State and other Non-Federal Coordination	No State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities	Would require State or other Non-Federal coordination activities
F. Risk Evaluation				
1. Risk and Vulnerabilities				
a. Risk of Failure	N/A	Very low risk of failure	Moderate risk of failure.	Moderate risk of failure.
b. Residual Risk	Residual risk of all actions will remain substantial due to storm surge.	Residual risk of all properties purchased virtually eliminated	Residual risk of all actions will remain substantial due to storm surge.	Residual risk of all actions will remain substantial due to storm surge.
c. Reliability	N/A	This plan would provide a significant degree of reliability to properties purchased. Residents are moved out of harm's way.	This plan would provide a significant degree of reliability, would receive damage from storm events, and would require maintenance.	This plan would provide a significant degree of reliability, would receive damage from storm events, and would require maintenance.
d. Relative Sea Level Rise	Problems will be substantially exacerbated by an increasing relative rise of sea level	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis	This Plan will be minimally impacted by an increasing relative rise of sea level over the period of analysis
e. Risk of Ecosystem Damage	Ecosystem damage will continue to accrue at a rate at least that of recent history with substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at least that of recent history with substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at less than that of recent history with less substantial negative outcomes.	Ecosystem damage will continue to accrue at a rate at less than that of recent history with less substantial negative outcomes.

TABLE B-42 (CONTINUED)
SYSTEM OF ACCOUNTS

Problem Area: Walton County, Florida				
Problems ID: Damages suffered by hurricane-induced surge and wave attack; Potential future damages from storm and hurricane events.				
Item	**No Action**	**Acquisition**	**NED Plan**	**LPP**
f. Risk to Life and Safety	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents will be substantial.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures would be eliminated.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents substantially reduced.	Significant threats to Life and Safety from storm surge will continue. Damages to front row structures and contents substantially reduced.
g. Risk to Mental and Physical Health	N/A	N/A	N/A	N/A
2. Recommendations and Preferences				
a. Federal Recommendation			The NED Plan is the plan that maximizes net benefits	
b. Stakeholder Preference	No clear stakeholder preference indicated, but all action plans preferred to no action plan.			The Locally Preferred Plan provides a higher level of protection over the NED Plan but is more costly. The sponsor is willing to pay 100 percent of the additional cost for this added level of protection

9.0 SELECTING A PLAN

Based on plan comparison, it is apparent that implementation of a beach fill plan will satisfy the study objectives and provide hurricane and storm damage reduction and environmental restoration along the coastline of Walton County, Florida. Further, both the NED and LPP beach fill plans were found superior to the Acquisition and No Action plans in each of the System of Accounts. Of the plans considered the non-Federal sponsor has expressed their desire to implement the LPP. Projects may deviate from the NED Plan if requested by the non-Federal sponsor and approved by the Assistant Secretary of the Army for Civil Works (ASA (CW)). A waiver, that the LPP be considered for recommendation, was requested and on February 7, 2012, was approved by the ASA (CW). As such, the LPP is the selected plan.

9.1 PLAN DETAILS

9.1.1 NED and Selected Plan for Construction with Renourishments

The modeling efforts have predicted initial fill requirements of 2,639,000 cy for the NED Plan and a selected plan requirement of 3,152,000 cy. The two plans maintain the same placement template (see Figure B-6) but the selected plan extends the coverage area to the westernmost limits of the county where the NED Plan could not justify the coverage. If this condition accounts for depletion rates to the predicted construction timeframe of FY 14, then the necessary beach fill requirements will be 3,273,000 cy and 3,868,000 cy for the NED and selected plan, respectively.

Renourishments will still be on a 10-year cycle and the renourishment volumes are 1,585,000 and 1,789,000 for the NED and selected plan, respectively. The nearness of the renourishment volumes for both plans is explained by the characteristics of the 18 added selected plan reaches on the western end of the project which is a generally accreting area. Only three of the 18 reaches are eroding while the remaining are generally accreting.

Approved and sufficient borrow sources lie offshore within the State of Florida waters.

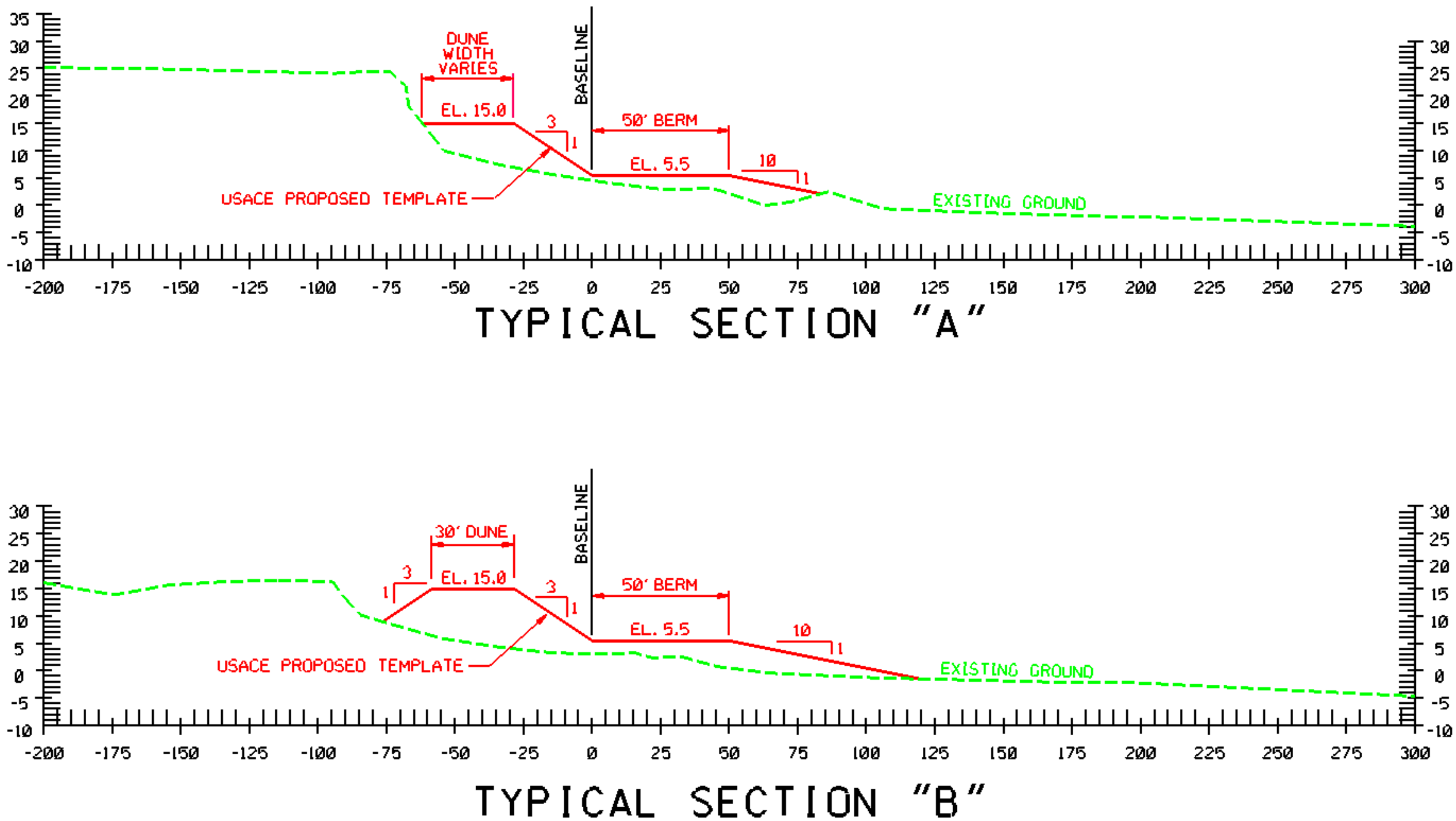

FIGURE B-6. TYPICAL PROJECT SECTIONS TO BE CONSTRUCTED

10.0 COST SHARE

Federal cost sharing in the ratio of 65 to 35 on developed private land, 0 to 100 percent on undeveloped private lands, 50 to 50 on undeveloped public land 65 to 35 on developed public lands, is authorized when reaches are found to be constructible, environmentally sustainable and economically justified. Portions of the project which do not meet these criteria are a 100 percent non-Federal partner's expense. The NED cost share percentages are 30 percent Federal and 70 percent non-Federal. The selected plan cost share percentages are 26 percent Federal and 74 percent non-Federal. Tables B-43 and B-44 present the calculated Federal and non-Federal cost share both plans. Tables B-45 and B-45A exhibit the difference between the NED and the selected plan. Note that while some sub-reaches qualify for Federal participation based on parking and access, sub-reaches that contain an asterisk in the last column designate that all or a portion of the reach is in a CBRA zone. Only work outside the CBRA zone can be cost shared. Any work within the CBRA would be 100 percent non-Federal funded.

Table B-46 demonstrates if a particular reach qualifies for cost share based on adequacy of public access and parking. The analysis of adequate parking along the beaches requires either a beach capacity or peak user day point of view. Since the beach capacity is greater than the peak day visitation, the peak user day analysis is used. The most recent peak day visitation at Walton County beaches, which occurred on the past July 4, 2009 holiday, was estimated at 13,537 visits. The location of beach access points is publicly available on the World Wide Web supported by Walton County. Assumptions of the analysis are (1) The demand for public parking originates from both resident and non-residents population; (2) Beach rentals on the beach that have access to the beach contribute to the supply of parking in absolute parking space terms without turnover; (3) The large county beach access and parking available at Miramar Beach and other such large day use areas, are very popular and highly attended areas. These will on peak day operate at full parking capacity; the average daily turnover rate on purely public parking is 1.5 times. Assuming 4.5 persons per vehicle each parking space accommodates 6.75 visits per day[5]. Surplus and deficits in any reach is available to be used within a quarter mile radius of the loci of the parking supply except near the large day use areas whose supply is completely used.

Parking and access reflected in this report is what is anticipated at the time of project implementation and the non-Federal sponsor has accepted the requirement to fund those reaches that do not provide adequate parking. The non-Federal sponsor has indicated that over the project life it is possible that additional parking and access may be provided which would change cost sharing in the future.

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[5] Statistics obtained from on the ground observations in neighboring Bay County Florida and used in the Panama City Beach, Florida Hurricane and Storm Damage Feasibility Report, revised 1996

TABLE B-43
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
			65%	0%	50%	65%	65%	0%	50%	65%					
			35%	100%	50%	35%	35%	100%	50%	35%					
1	R1-1	1150	1,150	0	0	0	0	0%	0%	0%		0.0%	0.0000		
2	R1-2	1102	560	0	0	0	0	0%	0%	0%		0.0%	0.0000		
3	R1-3	1044	0	0	0	0	0	0%	0%	0%		0.0%	0.0000		
4	R1-4	1002	102	0	0	0	0	0%	0%	0%		0.0%	0.0000		
5	R1-5	1062	1,062	0	0	0	0	0%	0%	0%		0.0%	0.0000		
6	R1-6	1045	998	0	0	0	0	0%	0%	0%		0.0%	0.0000		
7	R1-7	1003	1,003	0	0	0	0	0%	0%	0%		0.0%	0.0000		
8	R1-8	1061	984	0	0	0	0	0%	0%	0%		0.0%	0.0000		
9	R1-9	1014	984	0	0	0	0	0%	0%	0%		0.0%	0.0000		
10	R1-10	959	100	0	0	0	0	0%	0%	0%	0.0012	0.0%	0.0000	100.00%	
11	R1-11	1021	955	66	0	0	94%	6%	0%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach One
12	R1-12	1057	1057	0	0	0	100%	0%	0%	0%	0.0132	65.0%	0.0086	35.00%	
13	R1-13	1040	1,040	0	0	0	100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
14	R1-14	1051	1,051	0	0	0	100%	0%	0%	0%	0.0131	65.0%	0.0085	35.00%	
15	R1-15	998	923	75	0	0	92%	8%	0%	0%	0.0124	60.1%	0.0075	39.89%	
16	R1-16	1025	883	142	0	0	86%	14%	0%	0%	0.0128	56.0%	0.0071	44.01%	
17	R1-17	1114	100	0	0	0	0	0%	0%	0%	0.0012	62.3%	0.0080	37.66%	
18	R1-18	1133	1,033	100	0	0	0	9%	0%	0%		0.0%	0.0000		
19	R1-19	1058	1,058	0	0	0	0	0%	0%	0%		0.0%	0.0000		
20	R1-20	961	961	0	0	0	0	0%	0%	0%		0.0%	0.0000		
21	R1-21	952	952	0	0	0	0	0%	0%	0%		0.0%	0.0000		
22	R1-22	1028	1,028	0	0	0	0	0%	0%	0%		0.0%	0.0000		
23	R1-23	1086	956	130	0	0	0	12%	0%	0%		0.0%	0.0000		
24	R1-24	1139	1139	0	0	0	0	0%	0%	0%		0.0%	0.0000		
Construction Reach One Sub Totals													0.0481		6391.2

TABLE B-43 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
25	R2-1	495	0	0	0	0	0%	0%	0%	0%					
26	R2-2	936	0	0	0	0	0%	0%	0%	0%					
27	R2-3	2160	0	0	0	0	0%	0%	0%	0%					
28	R2-4	2066	0	0	0	0	0%	0%	0%	0%					
29	R2-5	1001	0	0	0	0	0%	0%	0%	0%					
30	R2-6	10078	0	0	0	0	0%	0%	0%	0%					
31	R2-7	1040	0	0	0	0	0%	0%	0%	0%					
32	R3-1	1147	0	0	100	0	0%	0%	9%	0%	0.0012	0.0%	0.0000	100.00%	*
33	R3-2	1037	838	199	0	0	81%	19%	0%	0%	0.0129	0.0%	0.0000	100.00%	Construction Reach Two
34	R3-3	1052	904	148	0	0	86%	14%	0%	0%	0.0131	0.0%	0.0000	100.00%	
35	R3-4	1026	914	112	0	0	89%	11%	0%	0%	0.0128	57.9%	0.0074	42.10%	
36	R3-5	1121	1,121	0	0	0	100%	0%	0%	0%	0.0140	65.0%	0.0091	35.00%	
37	R3-6	1185	1,115	70	0	0	94%	6%	0%	0%	0.0148	0.0%	0.0000	100.00%	
38	R3-7	1156	1,120	36	0	0	97%	3%	0%	0%	0.0144	0.0%	0.0000	100.00%	
39	R3-8	1103	909	194	0	0	82%	18%	0%	0%	0.0137	53.6%	0.0074	46.43%	
40	R3-9	1058	875	183	0	0	83%	17%	0%	0%	0.0132	53.8%	0.0071	46.25%	
41	R3-10	1068	1,068	0	0	0	100%	0%	0%	0%	0.0133	65.0%	0.0086	35.00%	
42	R3-11	1045	794	55	196	0	76%	5%	19%	0%	0.0130	58.8%	0.0076	41.24%	
43	R3-12	1007	824	100	83	0	82%	10%	8%	0%	0.0125	57.3%	0.0072	42.69%	
44	R3-13	1004	716	288	0	0	71%	29%	0%	0%	0.0125	46.4%	0.0058	53.65%	
45	R3-14	1345	960	385	0	0	71%	29%	0%	0%	0.0168	46.4%	0.0078	53.61%	
46	R3-15	1062	997	65	0	0	94%	6%	0%	0%	0.0132	0.0%	0.0000	100.00%	*
47	R3-16	732	732	0	0	0	100%	0%	0%	0%	0.0091	0.0%	0.0000	100.00%	*
48	R3-17	1017	758	259	0	0	75%	25%	0%	0%	0.0127	0.0%	0.0000	100.00%	
49	R3-18	1039	667	372	0	0	64%	36%	0%	0%	0.0129	0.0%	0.0000	100.00%	
50	R3-19	1036	1,036	0	0	0	100%	0%	0%	0%	0.0129	0.0%	0.0000	100.00%	
51	R3-20	1027	922	0	105	0	90%	0%	10%	0%	0.0128	63.5%	0.0081	36.53%	
52	R3-21	1029	903	126	0	0	88%	12%	0%	0%	0.0128	57.0%	0.0073	42.96%	

TABLE B-43 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
53	R3-22	978	978	0	0	0	100%	0%	0%	0%	0.0122	65.0%	0.0079	35.00%	
54	R3-23	855	775	80	100	0	91%	9%	12%	0%	0.0107	0.0%	0.0000	100.00%	
55	R3-24	1115	0	200	100	0	0%	18%	9%	0%	0.0139	4.5%	0.0006	95.52%	
Construction Reach Two Sub Totals													0.0913		23,180.4
56	R3-25	1274	0	200	0	0	0%	16%	0%	0%	0.0159	0.0%	0.0000	100.00%	
57	R3-26	1082	0	100	0	0	0%	9%	0%	0%	0.0135	0.0%	0.0000	100.00%	
58	R4-1	1082	922	160	100	0	85%	15%	9%	0%	0.0135	0.0%	0.0000	100.00%	Construction Reach Three
59	R4-2	1126	970	156	0	0	86%	14%	0%	0%	0.0140	0.0%	0.0000	100.00%	
60	R4-3	982	0	0	982	0	0%	0%	100%	0%	0.0122	0.0%	0.0000	100.00%	
61	R4-4	942	0	0	942	0	0%	0%	100%	0%	0.0117	0.0%	0.0000	100.00%	
62	R4-5	998	786	70	142	0	79%	7%	14%	0%	0.0124	58.3%	0.0072	41.70%	
63	R4-6	971	0	0	971	0	0%	0%	100%	0%	0.0121	50.0%	0.0061	50.00%	
64	R4-7	1061	0	0		100	0%	0%	0%	9%	0.0000	0.0%	0.0000	100.00%	
Construction Reach Three Sub Totals													0.0139		6,300.8
65	R4-8	2119	0				0%	0%	0%	0%					
66	R4-9	2075	0			100	0%	0%	0%	5%	0.0000	0.0%	0.0000	100.00%	*
67	R5-1	993	993	0	100	0	100%	0%	10%	0%	0.0124	0.0%	0.0000	100.00%	Construction Reach Four
68	R5-2	1003	805	198	0	0	80%	20%	0%	0%	0.0125	52.2%	0.0065	47.83%	
69	R5-3	1039	809	230	0	0	78%	22%	0%	0%	0.0129	50.6%	0.0066	49.38%	
70	R5-4	1304	1,224	80	0	0	94%	6%	0%	0%	0.0162	61.0%	0.0099	38.99%	
71	R5-5	1009	773	236	0	0	77%	23%	0%	0%	0.0126	49.8%	0.0063	50.20%	
72	R5-6	1062	858	204	0	0	81%	19%	0%	0%	0.0132	52.5%	0.0069	47.49%	
73	R5-7	1038	1,038	0	0	0	100%	0%	0%	0%	0.0129	65.0%	0.0084	35.00%	
74	R5-8	992	992	0	0	0	100%	0%	0%	0%	0.0124	0.0%	0.0000	100.00%	
75	R5-9	1027	881	146	0	0	86%	14%	0%	0%	0.0128	55.8%	0.0071	44.25%	
76	R5-10	1011	744	129	138	0	74%	13%	14%	0%	0.0126	54.7%	0.0069	45.34%	

TABLE B-43 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
77	R5-11	1022	1,022	0	0	0	100%	0%	0%	0%	0.0127	65.0%	0.0083	35.00%	
78	R5-12	1018	578	440	0	0	57%	43%	0%	0%	0.0127	36.9%	0.0047	63.09%	
79	R5-13	1017	965	52	0	0	95%	5%	0%	0%	0.0127	61.7%	0.0078	38.33%	
80	R5-14	1005	876	129	0	0	87%	13%	0%	0%	0.0125	56.7%	0.0071	43.34%	
81	R5-15	1011	744	267	0	0	74%	26%	0%	0%	0.0126	47.8%	0.0060	52.17%	
82	R5-16	1035.2	443	592	0	0	43%	57%	0%	0%	0.0129	27.8%	0.0036	72.17%	
83	R5-17	942.6	824	119	0	0	87%	13%	0%	0%	0.0117	56.8%	0.0067	43.21%	
84	R5-18	999.9	689	311	0	0	69%	31%	0%	0%	0.0125	44.8%	0.0056	55.22%	
85	R5-19	1010.9	719	292	0	0	71%	29%	0%	0%	0.0126	46.2%	0.0058	53.78%	
86	R5-20	1028.6	487	168	374	0	47%	16%	36%	0%	0.0128	0.0%	0.0000	100.00%	*
87	R5-21	1122	684	438	100	0	61%	39%	9%	0%	0.0140	0.0%	0.0000	100.00%	*
88	R5-22	1029.7	0		100		0%	0%	10%	0%	0.0012	0.0%	0.0000	100.00%	
Construction Reach Four Sub Totals													0.1141		21,888.4
89	R5-23	1013	0				0%	0%	0%	0%					
90	R5-24	1022	0				0%	0%	0%	0%					
91	R5-25	1054	0				0%	0%	0%	0%					
92	R5-26	884	0				0%	0%	0%	0%					
93	R5-27	1044	0				0%	0%	0%	0%					
94	R5-28	1059	0				0%	0%	0%	0%					
95	R5-29	987	0	0	100		0%	0%	10%	0%	0.0000	0.0%	0.0000	100.00%	*
96	R5-30	1022	556	466	100		54%	46%	10%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach Five
97	R5-31	1015	737	278	0		73%	27%	0%	0%	0.0126	0.0%	0.0000	100.00%	
98	R5-32	985	985	0	0		100%	0%	0%	0%	0.0123	0.0%	0.0000	100.00%	
99	R5-33	1025	854	171	0		83%	17%	0%	0%	0.0128	54.2%	0.0069	45.84%	
100	R5-34	1038	936	102	0		90%	10%	0%	0%	0.0129	58.6%	0.0076	41.39%	
101	R5-35	1002	945	57	0		94%	6%	0%	0%	0.0125	61.3%	0.0077	38.70%	
102	R5-36	944	826	118	0		87%	13%	0%	0%	0.0118	0.0%	0.0000	100.00%	
103	R5-37	1020	820	200	0		80%	20%	0%	0%	0.0127	0.0%	0.0000	100.00%	

TABLE B-43 (CONTINUED)
NED PLAN COST SHARE FEDERAL AND NON-FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
104	R5-38	1094	945	149	0		86%	14%	0%	0%	0.0136	0.0%	0.0000	100.00%	
105	R5-39	1024	925	99	0		90%	10%	0%	0%	0.0128	0.0%	0.0000	100.00%	
106	R5-40	1010	848	162	0		84%	16%	0%	0%	0.0126	0.0%	0.0000	100.00%	
107	R5-41	1004	274	730	0		27%	73%	0%	0%	0.0125	0.0%	0.0000	100.00%	
108	R5-42	1023	0	1,023	0		0%	100%	0%	0%	0.0127	0.0%	0.0000	100.00%	
109	R5-43	1002	918	84	0		92%	8%	0%	0%	0.0125	0.0%	0.0000	100.00%	
110	R5-44	1001	1,001	0	0		100%	0%	0%	0%	0.0125	0.0%	0.0000	100.00%	
111	R5-45	969	969	0	0		100%	0%	0%	0%	0.0121	0.0%	0.0000	100.00%	
112	R5-46	988	682	306	0		69%	31%	0%	0%	0.0123	44.9%	0.0055	55.14%	
113	R5-47	1031	675	356	0		65%	35%	0%	0%	0.0128	42.5%	0.0055	57.45%	
114	R5-48	1026	1,026	0	0		100%	0%	0%	0%	0.0128	65.0%	0.0083	35.00%	
115	R5-49	1041	1,041	0	0		100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
116	R5-50	1032	862	170	0		84%	16%	0%	0%	0.0129	54.3%	0.0070	45.71%	
117	R5-51	1126	943	83	100		84%	7%	9%	0%	0.0140	58.9%	0.0083	41.12%	
Construction Reach Five Sub Totals													0.0651		22,519.2
	Reach with Transition Zone														
* Designates that all or portion of reach is in a CBRA zone (all work in CBRA zone will be 100% non-Federal funded)															
TOTAL FEDERAL COST SHARE													0.3320		
TOTAL NON FEDERAL COST SHARE													0.6680		
TOTAL CONSTRUCTED PROJECT LENGTH							80,280								80280.0

TABLE B-44

SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
			65%	0%	50%	65%	65%	0%	50%	65%					
			35%	100%	50%	35%	35%	100%	50%	35%					
1	R1-1	1250	1,250	0	0	0	100%	0%	0%	0%	0.0127	0.0%	0.0000	100.00%	*
2	R1-2	1102	560	0	542	0	51%	0%	49%	0%	0.0112	0.0%	0.0000	100.00%	*
3	R1-3	1044	0	0	1,044	0	0%	0%	100%	0%	0.0106	0.0%	0.0000	100.00%	*
4	R1-4	1002	102	0	900	0	10%	0%	90%	0%	0.0102	0.0%	0.0000	100.00%	*
5	R1-5	1062	1,062	0	0	0	100%	0%	0%	0%	0.0108	0.0%	0.0000	100.00%	Construction Reach One
6	R1-6	1045	998	47	0	0	96%	4%	0%	0%	0.0106	0.0%	0.0000	100.00%	
7	R1-7	1003	1,003	0	0	0	100%	0%	0%	0%	0.0102	0.0%	0.0000	100.00%	
8	R1-8	1061	984	77	0	0	93%	7%	0%	0%	0.0108	0.0%	0.0000	100.00%	
9	R1-9	1014	984	30	0	0	97%	3%	0%	0%	0.0103	0.0%	0.0000	100.00%	
10	R1-10	959	761	198	0	0	79%	21%	0%	0%	0.0097	0.0%	0.0000	100.00%	
11	R1-11	1021	955	66	0	0	94%	6%	0%	0%	0.0104	0.0%	0.0000	100.00%	
12	R1-12	1057	1,057	0	0	0	100%	0%	0%	0%	0.0107	65.0%	0.0070	35.00%	
13	R1-13	1040	1,040	0	0	0	100%	0%	0%	0%	0.0106	65.0%	0.0069	35.00%	
14	R1-14	1051	1,051	0	0	0	100%	0%	0%	0%	0.0107	65.0%	0.0069	35.00%	
15	R1-15	998	923	75	0	0	92%	8%	0%	0%	0.0101	60.1%	0.0061	39.89%	
16	R1-16	1025	883	142	0	0	86%	14%	0%	0%	0.0104	56.0%	0.0058	44.01%	
17	R1-17	1114	667	447	0	0	60%	40%	0%	0%	0.0113	0.0%	0.0000	100.00%	
18	R1-18	1133	1,033	100	0	0	91%	9%	0%	0%	0.0115	0.0%	0.0000	100.00%	
19	R1-19	1058	1,058	0	0	0	100%	0%	0%	0%	0.0107	0.0%	0.0000	100.00%	
20	R1-20	961	961	0	0	0	100%	0%	0%	0%	0.0098	0.0%	0.0000	100.00%	
21	R1-21	952	952	0	0	0	100%	0%	0%	0%	0.0097	0.0%	0.0000	100.00%	
22	R1-22	1028	1,028	0	0	0	100%	0%	0%	0%	0.0104	0.0%	0.0000	100.00%	
23	R1-23	1086	956	130	0	0	88%	12%	0%	0%	0.0110	0.0%	0.0000	100.00%	
24	R1-24	1039	1039	0	0	0	100%	0%	0%	0%	0.0105	0.0%	0.0000	100.00%	
25	R2-1	495	100	0	0	0	20%	0%	0%	0%	0.0010	13.1%	0.0001	86.87%	
Construction Reach One Sub Totals															25,202.3

TABLE B-44 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
26	R2-2	936	0	0	0	0	0%	0%	0%	0%					
27	R2-3	2160	0	0	0	0	0%	0%	0%	0%					
28	R2-4	2066	0	0	0	0	0%	0%	0%	0%					
29	R2-5	1001	0	0	0	0	0%	0%	0%	0%					
30	R2-6	10078	0	0	0	0	0%	0%	0%	0%					
31	R2-7	1040	0	0	0	0	0%	0%	0%	0%					
32	R3-1	1147	0	0	100	0	0%	0%	9%	0%	0.0012	0.0%	0.0000	100.00%	*
33	R3-2	1037	838	199	0	0	81%	19%	0%	0%	0.0129	0.0%	0.0000	100.00%	Construction Reach Two
34	R3-3	1052	904	148	0	0	86%	14%	0%	0%	0.0131	0.0%	0.0000	100.00%	
35	R3-4	1026	914	112	0	0	89%	11%	0%	0%	0.0128	57.9%	0.0074	42.10%	
36	R3-5	1121	1,121	0	0	0	100%	0%	0%	0%	0.0140	65.0%	0.0091	35.00%	
37	R3-6	1185	1,115	70	0	0	94%	6%	0%	0%	0.0148	0.0%	0.0000	100.00%	
38	R3-7	1156	1,120	36	0	0	97%	3%	0%	0%	0.0144	0.0%	0.0000	100.00%	
39	R3-8	1103	909	194	0	0	82%	18%	0%	0%	0.0137	53.6%	0.0074	46.43%	
40	R3-9	1058	875	183	0	0	83%	17%	0%	0%	0.0132	53.8%	0.0071	46.25%	
41	R3-10	1068	1,068	0	0	0	100%	0%	0%	0%	0.0133	65.0%	0.0086	35.00%	
42	R3-11	1045	794	55	196	0	76%	5%	19%	0%	0.0130	58.8%	0.0076	41.24%	
43	R3-12	1007	824	100	83	0	82%	10%	8%	0%	0.0125	57.3%	0.0072	42.69%	
44	R3-13	1004	716	288	0	0	71%	29%	0%	0%	0.0125	46.4%	0.0058	53.65%	
45	R3-14	1345	960	385	0	0	71%	29%	0%	0%	0.0168	46.4%	0.0078	53.61%	
46	R3-15	1062	997	65	0	0	94%	6%	0%	0%	0.0132	0.0%	0.0000	100.00%	*
47	R3-16	732	732	0	0	0	100%	0%	0%	0%	0.0091	0.0%	0.0000	100.00%	*
48	R3-17	1017	758	259	0	0	75%	25%	0%	0%	0.0127	0.0%	0.0000	100.00%	
49	R3-18	1039	667	372	0	0	64%	36%	0%	0%	0.0129	0.0%	0.0000	100.00%	
50	R3-19	1036	1,036	0	0	0	100%	0%	0%	0%	0.0129	0.0%	0.0000	100.00%	
51	R3-20	1027	922	0	105	0	90%	0%	10%	0%	0.0128	63.5%	0.0081	36.53%	
52	R3-21	1029	903	126	0	0	88%	12%	0%	0%	0.0128	57.0%	0.0073	42.96%	

TABLE B-44 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
53	R3-22	978	978	0	0	0	100%	0%	0%	0%	0.0122	65.0%	0.0079	35.00%	
54	R3-23	855	775	80	100	0	91%	9%	12%	0%	0.0107	0.0%	0.0000	100.00%	
55	R3-24	1115	0	200	100	0	0%	18%	9%	0%	0.0139	4.5%	0.0006	95.52%	
Construction Reach Two Sub Totals															23,180.4
56	R3-25	1274	0	200	0	0	0%	16%	0%	0%	0.0159	0.0%	0.0000	100.00%	
57	R3-26	1082	0	100	0	0	0%	9%	0%	0%	0.0135	0.0%	0.0000	100.00%	
58	R4-1	1082	922	160	100	0	85%	15%	9%	0%	0.0135	0.0%	0.0000	100.00%	Construction Reach Three
59	R4-2	1126	970	156	0	0	86%	14%	0%	0%	0.0140	0.0%	0.0000	100.00%	
60	R4-3	982	0	0	982	0	0%	0%	100%	0%	0.0122	0.0%	0.0000	100.00%	
61	R4-4	942	0	0	942	0	0%	0%	100%	0%	0.0117	0.0%	0.0000	100.00%	
62	R4-5	998	786	70	142	0	79%	7%	14%	0%	0.0124	58.3%	0.0072	41.70%	
63	R4-6	971	0	0	971	0	0%	0%	100%	0%	0.0121	50.0%	0.0061	50.00%	
64	R4-7	1061	0	0		100	0%	0%	0%	9%	0.0000	0.0%	0.0000	100.00%	
Construction Reach Three Sub Totals															6,300.8
65	R4-8	2119	0				0%	0%	0%	0%					
66	R4-9	2075	0			100	0%	0%	0%	5%	0.0000	0.0%	0.0000	100.00%	*
67	R5-1	993	993	0	100	0	100%	0%	10%	0%	0.0124	0.0%	0.0000	100.00%	Construction Reach Four
68	R5-2	1003	805	198	0	0	80%	20%	0%	0%	0.0125	52.2%	0.0065	47.83%	
69	R5-3	1039	809	230	0	0	78%	22%	0%	0%	0.0129	50.6%	0.0066	49.38%	
70	R5-4	1304	1,224	80	0	0	94%	6%	0%	0%	0.0162	61.0%	0.0099	38.99%	
71	R5-5	1009	773	236	0	0	77%	23%	0%	0%	0.0126	49.8%	0.0063	50.20%	
72	R5-6	1062	858	204	0	0	81%	19%	0%	0%	0.0132	52.5%	0.0069	47.49%	
73	R5-7	1038	1,038	0	0	0	100%	0%	0%	0%	0.0129	65.0%	0.0084	35.00%	
74	R5-8	992	992	0	0	0	100%	0%	0%	0%	0.0124	0.0%	0.0000	100.00%	
75	R5-9	1027	881	146	0	0	86%	14%	0%	0%	0.0128	55.8%	0.0071	44.25%	
76	R5-10	1011	744	129	138	0	74%	13%	14%	0%	0.0126	54.7%	0.0069	45.34%	

TABLE B-44 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
77	R5-11	1022	1,022	0	0	0	100%	0%	0%	0%	0.0127	65.0%	0.0083	35.00%	
78	R5-12	1018	578	440	0	0	57%	43%	0%	0%	0.0127	36.9%	0.0047	63.09%	
79	R5-13	1017	965	52	0	0	95%	5%	0%	0%	0.0127	61.7%	0.0078	38.33%	
80	R5-14	1005	876	129	0	0	87%	13%	0%	0%	0.0125	56.7%	0.0071	43.34%	
81	R5-15	1011	744	267	0	0	74%	26%	0%	0%	0.0126	47.8%	0.0060	52.17%	
82	R5-16	1035.2	443	592	0	0	43%	57%	0%	0%	0.0129	27.8%	0.0036	72.17%	
83	R5-17	942.6	824	119	0	0	87%	13%	0%	0%	0.0117	56.8%	0.0067	43.21%	
84	R5-18	999.9	689	311	0	0	69%	31%	0%	0%	0.0125	44.8%	0.0056	55.22%	
85	R5-19	1010.9	719	292	0	0	71%	29%	0%	0%	0.0126	46.2%	0.0058	53.78%	
86	R5-20	1028.6	487	168	374	0	47%	16%	36%	0%	0.0128	0.0%	0.0000	100.00%	*
87	R5-21	1122	684	438	100	0	61%	39%	9%	0%	0.0140	0.0%	0.0000	100.00%	*
88	R5-22	1029.7	0		100		0%	0%	10%	0%	0.0012	0.0%	0.0000	100.00%	
Construction Reach Four Sub Totals															21,888.4
89	R5-23	1013	0				0%	0%	0%	0%					
90	R5-24	1022	0				0%	0%	0%	0%					
91	R5-25	1054	0				0%	0%	0%	0%					
92	R5-26	884	0				0%	0%	0%	0%					
93	R5-27	1044	0				0%	0%	0%	0%					
94	R5-28	1059	0				0%	0%	0%	0%					
95	R5-29	987	0	0	100		0%	0%	10%	0%	0.0000	0.0%	0.0000	100.00%	*
96	R5-30	1022	556	466	100		54%	46%	10%	0%	0.0127	0.0%	0.0000	100.00%	Construction Reach Five
97	R5-31	1015	737	278	0		73%	27%	0%	0%	0.0126	0.0%	0.0000	100.00%	
98	R5-32	985	985	0	0		100%	0%	0%	0%	0.0123	0.0%	0.0000	100.00%	
99	R5-33	1025	854	171	0		83%	17%	0%	0%	0.0128	54.2%	0.0069	45.84%	
100	R5-34	1038	936	102	0		90%	10%	0%	0%	0.0129	58.6%	0.0076	41.39%	
101	R5-35	1002	945	57	0		94%	6%	0%	0%	0.0125	61.3%	0.0077	38.70%	
102	R5-36	944	826	118	0		87%	13%	0%	0%	0.0118	0.0%	0.0000	100.00%	
103	R5-37	1020	820	200	0		80%	20%	0%	0%	0.0127	0.0%	0.0000	100.00%	

TABLE B-44 (CONTINUED)
SELECTED PLAN COST SHARE FEDERAL AND NON FEDERAL

Reach	Model Reach	Reach Length (ft)	Developed Private	Un Developed Private	Undeveloped Public	Developed Public	Percent Developed Private	Percent Undeveloped Private	Percent Undeveloped Public	Percent Developed Public	Ratio of Reach length	Federal Participation	Federal Share	Non Federal Participation	Construction Reach Length (FEET)
104	R5-38	1094	945	149	0		86%	14%	0%	0%	0.0136	0.0%	0.0000	100.00%	
105	R5-39	1024	925	99	0		90%	10%	0%	0%	0.0128	0.0%	0.0000	100.00%	
106	R5-40	1010	848	162	0		84%	16%	0%	0%	0.0126	0.0%	0.0000	100.00%	
107	R5-41	1004	274	730	0		27%	73%	0%	0%	0.0125	0.0%	0.0000	100.00%	
108	R5-42	1023	0	1,023	0		0%	100%	0%	0%	0.0127	0.0%	0.0000	100.00%	
109	R5-43	1002	918	84	0		92%	8%	0%	0%	0.0125	0.0%	0.0000	100.00%	
110	R5-44	1001	1,001	0	0		100%	0%	0%	0%	0.0125	0.0%	0.0000	100.00%	
111	R5-45	969	969	0	0		100%	0%	0%	0%	0.0121	0.0%	0.0000	100.00%	
112	R5-46	988	682	306	0		69%	31%	0%	0%	0.0123	44.9%	0.0055	55.14%	
113	R5-47	1031	675	356	0		65%	35%	0%	0%	0.0128	42.5%	0.0055	57.45%	
114	R5-48	1026	1,026	0	0		100%	0%	0%	0%	0.0128	65.0%	0.0083	35.00%	
115	R5-49	1041	1,041	0	0		100%	0%	0%	0%	0.0130	65.0%	0.0084	35.00%	
116	R5-50	1032	862	170	0		84%	16%	0%	0%	0.0129	54.3%	0.0070	45.71%	
117	R5-51	1126	943	83	100		84%	7%	9%	0%	0.0140	58.9%	0.0083	41.12%	
Construction Reach Five Sub Totals															22,519.2
	Reach with Transition Zone														
* Designates that all or portion of reach is in a CBRA zone (all work in CBRA zone will be 100% non-Federal funded)															
TOTAL CONSTRUCTED PROJECT LENGTH							99,091								99,091

TABLE B-45						
NED AND SELECTED PLAN - COSTS AND COST SHARE						
	NED Plan ($)	Percent	Selected Plan ($)	Percent	Change ($)	Change (%)
Initial Construction Cost	$51,945,000		$61,397,000		$9,452,000	
Federal	$17,298,000	33%	$17,298,000	28%	$0	-5%
Non-Federal	$34,647,000	67%	$44,099,000	72%	$9,452,000	5%
Total Renourishment Cost	$38,136,000		$41,441,000		$3,305,000	0%
Federal	$9,915,000	26%	$9,915,000	23%	$0	-2%
Non-Federal	$28,221,000	74%	$31,526,000	77%	$3,305,000	2%
Total Construction Cost	$90,081,000		$102,838,000		$12,757,000	0%
Federal	$27,072,000	30%	$27,072,000	26%	$0	-4%
Non-Federal	$63,009,000	70%	$75,766,000	74%	$12,757,000	4%

TABLE B-45A						
NED AND SELECTED PLAN AVERAGE ANNUAL EQUIVALENT COSTS AND COST SHARE						
	NED Plan ($)	Percent	Selected Plan ($)	Percent	Change ($)	Change (%)
Initial Construction Cost	$2,418,000		$2,858,000		$440,000	
Federal	$805,000	33%	$805,000	28%	$0	-2.5%
Non-Federal	$1,613,000	67%	$2,053,000	72%	$440,000	2.5%
Total Renourishment Cost	$1,775,000		$1,929,000		$154,000	
Federal	$462,000	26%	$462,000	23%	$0	-2.0%
Non-Federal	$1,314,000	74%	$1,468,000	77%	$154,000	2.0%
Total Construction Cost	$4,193,000		$4,787,000		$594,000	
Federal	$1,260,000	30%	$1,260,000	26%	$0	-2.3%
Non-Federal	$2,933,000	70%	$3,527,000	74%	$594,000	2.3%

Table B-46															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
1	R1-1					0	0	55	0	0	0	Not Adequate		Not Adequate	No ***
2	R1-2					0	0	55	22	99	99	Not Adequate		Adequate	No ***
3	R1-3	A1a	Miramar Beach Regional Access W (Parking/Access)	2375 Scenic Gulf Drive	2375 Scenic Gulf Drive	85	574	574	28	126	700	Adequate		Adequate	No ***
4	R1-4	A1b	Miramar Beach Regional Access E (Parking/Access)	2375 Scenic Gulf Drive		85	574	55	15	68	641	Adequate		Adequate	No ***
5	R1-5					0	0	55	16	72	72	Adequate		Adequate	No ***
6	R1-6					0	0	55	18	81	0	Not Adequate		Not Adequate	No ***
7	R1-7					0	0	55	0	0	0	Not Adequate		Not Adequate	No ***
8	R1-8					0	0	55	10	45	0	Not Adequate		Not Adequate	No ***
9	R1-9					0	0	55	3	14	14	Adequate	R1-10	Adequate	No ***
10	R1-10	A2	Scenic Gulf Drive Access ROW (Parking/Access)	Scenic Gulf Drive		100	675	55	33	149	824	Adequate		Adequate	No ***
11	R1-11					0	0	55	16	72	0	Not Adequate		Not Adequate	No
12	R1-12					0	0	55	31	140	140	Adequate		Adequate	Yes
13	R1-13	A3	Geronimo Street (Access)	735 Scenic Gulf Drive	735 Scenic Gulf Drive	0	0	55	76	342	342	Adequate		Adequate	Yes
14	R1-14					0	0	55	33	149	149	Adequate		Adequate	Yes
15	R1-15	A4	Norwood Drive (Access)	132 Norwood Drive	132 Norwood Drive	0	0	55	77	347	347	Adequate		Adequate	Yes

Table B-46 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
16	R1-16	A5	Open Gulf (Access)	213 Open Gulf St.	Open Gulf Street	6	41	55	103	464	504	Adequate		Adequate	Yes
17	R1-17	A6, A7	Sand Trap & Tango De Mer (Parking & Access)	253 Sand Trap Rd & End of Tango De Mer	253 Sand Trap Road	3	20	55	4	18	38	Adequate	R1-16	Adequate	No ***
18	R1-18		Access at End of Tango De Mer	Access at End of Tango De Mer	End of Tango De Mer	0	0	55	0	0	0	Adequate	R1-19	Adequate	No ***
19	R1-19					0	0	55	55	248	0	Not Adequate		Not Adequate	No ***
20	R1-20					0	0	55	81	365	0	Not Adequate		Not Adequate	No ***
21	R1-21					0	0	55	146	657	657	Adequate		Adequate	No ***
22	R1-22	A8	Sand Destin Day Use Area (Parking & Access)		San Destin Day Use Area	110	743	743	92	414	1,157	Adequate		Adequate	No ***
23	R1-23					0	0	55	155	698	698	Adequate		Not Adequate	No ***
24	R1-24					0	0	55	0	0	0	Adequate	R1-23	Not Adequate	No ***
25	R2-1					0	0	55	0	0	0				
26	R2-2					0	0	55	0	0	0				
27	R2-3					0	0	55	0	0	0				
28	R2-4					0	0	55	0	0	0				
29	R2-5		State Park (Parking & Access)	719 Top Sail Hill Road		0	0	55	0	0	0				
30	R2-6					0	0	55	0	0	0				
31	R2-7					0	0	55	0	0	0				
32	R3-1	A10	Stallworth Preserve North (Access)	140 Stallworth Blvd.		5	34	55	0	0	34				

Table B-46 (Continued)

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
33	R3-2	A11, A12	Beach Highland & Bullard Beach Neighborhood Access (Parking & Access)	127 & 363 Highland Avenue	127 & 363 Highland Avenue	3	20	55	0	0	20	Not Adequate		Adequate	No
34	R3-3					0	0	55	5	23	23	Not Adequate		Adequate	No
35	R3-4					5	34	55	7	32	65	Adequate		Adequate	Yes
36	R3-5	A13	Dune Allen (Parking & Access)	5753 W. Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A	75	506	506	0	0	506	Adequate		Adequate	Yes
37	R3-6	A14	West Allen (Access)	5605 Co. Hwy 30-A		0	0	55	0	0	55	Adequate	R3-5	Adequate	Yes
38	R3-7	A15	Palms Ave W (Parking & Access)	4850 W. Co Hwy 30A		0	0	55	0	0	0	Not Adequate		Adequate	No
39	R3-8	A16a	Palms Ave E (Parking & Access)	4850 W. Co Hwy 30A		0	0	55	12	54	54	Adequate	R3-9	Adequate	Yes
40	R3-9	A16b	Lake Causeway (Access)	5173 Co Hwy 30A	4850 & 4991 & 5605 Co Hwy 30A	15	101	55	0	0	101	Adequate		Adequate	Yes
41	R3-10	A17a, A17b	Gulf Place West and Middle (Access)		4850 w. Co Hwy 30A	5	34	55	0	0	34	Adequate	R3-9	Adequate	Yes
42	R3-11	A17c, A18	Gulf Place East & Ed Walline Regional Beach Access (Parking & Access)	4447 W Co Hwy 30A	4447 W Co Hwy 30A & Gulf Place West Access Point	55	371	55	13	59	430	Adequate		Adequate	Yes
43	R3-12	A19	Spooky Lane & Shellseekers (Access and Parking)	92 South Spooky Lane & 4201 W. Co. Rd. Hwy 30-A	92 South Spooky Lane & Gulf Place East Access Point	13	88	55	0	0	88	Adequate		Adequate	Yes

Table B-46 (Continued)

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
44	R3-13	A20				14	95	55	16	72	167	Adequate		Adequate	Yes
45	R3-14	A21	Gulfview Heights (Parking & Access)	186 Gulfview Heights St	4201 Co. Hwy 30A & 186 Gulf View Heights Street	30	203	55	0	0	203	Adequate		Adequate	Yes
46	R3-15					0	0	55	0	0	0	Adequate	R3-14	Not Adequate	No
47	R3-16					0	0	55	0	0	0	Not Adequate		Not Adequate	No
48	R3-17					0	0	55	0	0	0	Not Adequate		Not Adequate	No
49	R3-18					0	0	55	24	108	0	Not Adequate		Not Adequate	No
50	R3-19					0	0	55	111	500	0	Not Adequate		Not Adequate	No
51	R3-20					0	0	55	23	104	104	Adequate		Adequate	Yes
52	R3-21	A22, A23	Blue Mountain and Gulf Point (Parking & Access)	2365 S Co Hwy 83 & 446 Blue Mountain Road	2365 S. Co Hwy 83 & 446, 590 and 726 Blue Mountain Road	37	250	55	0	0	250	Adequate		Adequate	Yes
53	R3-22	A24	Seagrade Road Neighborhood Access (Access)	590 Blue Mountain Road		0	0	55	0	0	0	Adequate	R3-21	Adequate	Yes
54	R3-23	A25	Blue Lake (Access)	726 Blue Mountain Road		0	0	55	0	0	0	Not Adequate		Adequate	No
55	R3-24					0	0	55	0	0	0				
56	R3-25					0	0	55	0	0	0				
57	R3-26					0	0	55	0	0	0				
58	R4-1	A26	Grayton State Park (Access & Parking)			0	0	55	0	0	0	Not Adequate		Adequate	No
59	R4-2					0	0	55	0	0	0	Not Adequate		Not Adequate	No

Table B-46 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
60	R4-3					0	0	55	0	0	0	Not Adequate		Not Adequate	No
61	R4-4					0	0	55	0	0	0	Not Adequate	R4-5	Not Adequate	No
62	R4-5	A27	Ray's Multi-Moutain (Access)	125 Sandy Lane	125 Sandy Lane	12	81	55	0	0	81	Adequate		Adequate	Yes
63	R4-6	A28, A29	Grayton Dunes and Weston (Parking & Access)	288 Garfield St & 208 Holtz Ave	288 Garfield St. & 199 Banfill St.& 208 Holtz Avenue & 913 Main Park Road	82	554	554	0	0	554	Adequate		Adequate	Yes
64	R4-7				91 Boat Ramp Road	0	0	55	0	0	0		R4-6		
65	R4-8	A301, A30B, A30C	Grayton State Park (Access & Parking)			0	0	55	0	0	0				
66	R4-9					0	0	55	0	0	0				
67	R5-1					0	0	55	0	0	0	Not Adequate		Not Adequate	No
68	R5-2	A31	Van Ness Butler (Parking and Access)	1931 E Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A & Water Color Park Gargae and Access	100	675	675	11	50	725	Adequate		Adequate	Yes
69	R5-3					0	0	0	0	0	0	Adequate	R5-4	Adequate	Yes
70	R5-4	A32	Seaside (Access and Parking)			60	405	55	0	0	405	Adequate		Adequate	No
71	R5-5	A33	Dogwood/Thyme (Access)	2560 E. Co Hwy 30A	2560 Co Hwy 30A	0	0	55	0	0	0	Adequate	R5-6	Adequate	Yes

Table B-46 (Continued)

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
72	R5-6	A34, A35, A36	Nightcap, Live Oak, Hickory (Access)	30A at End of Nightcap Street, 2680 E. Co Hwy 30A, 2624 E. Co Hwy 30A	2624, 2680, ~2750 and 2790 Co Hwy 30 A	32	216	55	0	0	216	Adequate		Adequate	Yes
73	R5-7	A37, A38, A39	Hollywood, Azela, Hwy 395 (Access)	2790, 2845, 2920 E. Co. Hwy 30-A	2845 and 2920 Co Hwy 30A	0	0	55	0	0	0	Adequate	R5-6	Adequate	Yes
74	R5-8	A40, A41, A42	Headland, Greenwood, Gardenia (Access)	3020 Co Hwy 30A, 30 & 118 Montgomery	3020 Co Hwy 30A	4	27	55	0	0	27	Not Adequate		Adequate	No
75	R5-9	A43, A44	Dothan and Andalusia (Access)	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	0	0	55	0	0	0	Adequate	R5-9	Adequate	Yes
76	R5-10	A45, A46, A47	Santa Clara, Santa Juan, Pelayo & Montego (Parking & Access)	3458, 3512, 3468, & 3576 E. Co Hwy 30A	3458, 3512 and 3576 E. Co Hwy 30A - San Juan & Pelaya Neighborhood G A	20	135	55	0	0	135	Adequate		Adequate	Yes
77	R5-11	A48, A49	Campbell	3694 E Co Hwy 30A		0	0	55	71	320	320	Adequate		Adequate	Yes
78	R5-12	A50	Beachwood villas (Access)	3874 E. Co Hwy 30A	3694 and 3874 E. Co Hwy 30 A - (Campbell Street)	95	641	641	50	225	866	Adequate		Adequate	Yes
79	R5-13	A51	One Seagrove (Access)		57 Seagrove Place	9	61	55	70	315	376	Adequate		Adequate	Yes
80	R5-14	A52	Sugar Cliffs (Access)			0	0	55	137	617	617	Adequate		Adequate	Yes

Table B-46 (Continued)															
Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
81	R5-15					0	0	55	0	0	0	Adequate	R5-14	Adequate	Yes
82	R5-16	A53	Ramsgate (Access)	679 Eastern Lake Rd	679 and 491 Eastern Lake Road	0	0	55	2	9	9	Adequate	R5-17	Adequate	Yes
83	R5-17	A54	Eastern Lake (Parking & Access)	28 Lakewood Dr		0	0	55	36	162	162	Adequate		Adequate	Yes
84	R5-18	A55	Port Property (Access)	188 San Roy Rd	188 San Roy Road	6	41	55	0	0	41	Adequate	R5-17, R5-19	Adequate	Yes
85	R5-19	A56	Sugar Dunes (Access)	11 Beachside Drive	11 Beachside Dune - Sugar Dune	16	108	55	0	0	108	Adequate		Adequate	Yes
86	R5-20					10	68	55	51	230	297	Adequate		Adequate	Yes
87	R5-21	A57	Walton Dunes (Access)	258 Beachfront Taril - Walton Dune	258 Beachfront Taril - Walton Dune - Beachside Drive & Deer Lake State Park	0	0	55	9	41	41	Adequate	R5-20, R5-22	Adequate	Yes
88	R5-22					27	182	55	0	0	182				
89	R5-23					0	0	55	0	0	0				
90	R5-24					0	0	55	0	0	0				
91	R5-25					0	0	55	0	0	0				
92	R5-26					0	0	55	0	0	0				
93	R5-27					0	0	55	0	0	0				
94	R5-28					0	0	55	0	0	0				
95	R5-29					0	0	55	0	0	0				
96	R5-30					0	0	55	0	0	0	Not Adequate		Not Adequate	No
97	R5-31					0	0	55	0	0	0	Not Adequate		Adequate	No

Table B-46 (Continued)

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
98	R5-32	A58	Gulf Lake (Access)	8040 E. Co Highway 30A	8040 E Co Hwy 30A - Gulf Lakes Neighborhood	0	0	55	0	0	0	Not Adequate		Adequate	No
99	R5-33	A59	Sea Breeze (Access)	8286 E. Co Hwy 30A	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	0	0	55	13	59	59	Adequate		Adequate	Yes
100	R5-34		Seacrest (Access)	8520 E Co Hwy 30A	Saint Lucia Lane & Rosemary Avenue & 8520 E Co Hwy30A - Seacrest Dr.	10	68	55	4	18	86	Adequate		Adequate	Yes
101	R5-35					100	675	675	6	27	702	Adequate		Adequate	Yes
102	R5-36					0	0	55	0	0	0	Not Adequate		Not Adequate	No
103	R5-37					0	0	55	0	0	0	Not Adequate		Not Adequate	No
104	R5-38					0	0	55	0	0	0	Not Adequate		Not Adequate	No
105	R5-39					0	0	55	0	0	0	Not Adequate		Not Adequate	No
106	R5-40					0	0	55	0	0	0	Not Adequate		Not Adequate	No
107	R5-41					0	0	55	0	0	0	Not Adequate		Not Adequate	No
108	R5-42					0	0	55	13	59	0	Not Adequate		Not Adequate	No
109	R5-43					0	0	55	0	0	0	Not Adequate		Not Adequate	No
110	R5-44					0	0	55	0	0	0	Not Adequate		Not Adequate	No
111	R5-45					0	0	55	0	0	0	Not Adequate		Not Adequate	No

Table B-46 (Continued)

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle multiplied by 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
112	R5-46	A61	Inlet beach Neighborhood (Access)	188 Winston Lane	188 Winstor Lane	105	709	709	0	0	709	Adequate		Adequate	Yes
113	R5-47	A62	Wall Street (Access)	264 South Wall Street	435 West Park Place Ave. & 264 South Wall Street	76	513	513	0	0	513	Adequate		Adequate	Yes
114	R5-48	A63A	Inlet Beach Regional Access West (Parking & Access)	438 South Orange Street Center	438 South Orange Street	67	452	452	0	0	452	Adequate		Adequate	Yes
115	R5-49	A63B	Inlet Beach Regional Access Middle & East (Parking and Access)	438 South Orange Street Center	118 West Park Place Avenue FL #20	67	452	452	0	0	452	Adequate		Adequate	Yes
116	R5-50	A64	Philips Inlet (Access)	202 South Walton Lakeshore Drive	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101	55	0	0	101	Adequate		Adequate	Yes
117	R5-51					0	0	55	0	0	0	Adequate	R5-49, R5-50	Adequate	Yes
TOTALS						1,559	10,523	13537**	1,698	7,641	16,743				

* Assuming Large Public Day Use Area Parking is fully utilized and remainder of parking demand is distributed uniformly throughout the study area

** Peak Day Demand (July 4th)

*** LPP Reaches not economically justified, not eligible for cost sharing

Rental Parking disqualified - No Public Access Available

LPP Construction Reaches

11.0 RESIDUAL DAMAGES AND RISK

With a project in place to reduce hurricane and storm damage not all damages will be prevented only reduced. It is important to provide information on residual damages to demonstrate project performance and communicate that fact that the project will not eliminate all risks. Table B-47 shows the average annual remaining damages that were returned by the Beach-*fx* model provided as output from the Beach-*fx* model runs. No alternatives investigated changed the natural berm or dune heights. Therefore, there is no significant reduction in water levels with and without a plan in place. This results in virtually no inundation or wave attack reduction in damages with a plan in place. However, all measurable damage categories from Beach-*fx* including wave attack, inundation and erosion are accounted for in the residual damages. Table B-47A presents risk damages, risk benefits, and the respective mean and standard deviation of these values. Table B-47B displays the structure and content damages by damaging mechanism, inundation, erosion and wave attack, for each of the 100 life cycle iterations. It should be noted that the values presented in these tables are from Beach-*fx* output which is subject to slight variation due to the 100 life cycle iterations.

TABLE B-47
AVERAGE ANNUAL RESIDUAL DAMAGES - BY REACH
SELECTED PLAN

R1-1	$1,269	CONSTRUCTION REACH ONE
R1-2	$191	
R1-3	$850	
R1-4	$424	
R1-5	$152	
R1-6	$399	
R1-7	$91	
R1-8	$170	
R1-9	$1,079	
R1-10	$2,078	
R1-11	$33,131	
R1-12	$355	
R1-13	$2,002	
R1-14	$2,454	
R1-15	$67,074	
R1-16	$35,344	
R1-17	$391	
R1-18	$2,813	
R1-19	$3,363	
R1-20	$6,797	
R1-21	$1	
R1-22	$1,591	
R1-23	$105	
R1-24	$161	
R3-1	$0	CONSTRUCTION REACH TWO
R3-2	$56,062	
R3-3	$4,591	
R3-4	$206	

TABLE B-47
AVERAGE ANNUAL RESIDUAL DAMAGES - BY REACH
SELECTED PLAN

R3-5	$3,390	
R3-6	$4,858	
R3-7	$1,401	
R3-8	$9,174	
R3-9	$4,088	
R3-10	$74,956	
R3-11	$10,543	
R3-12	$52,398	
R3-13	$890	
R3-14	$5,541	
R3-15	$0	
R3-16	$0	
R3-17	$1,096	
R3-18	$2,634	
R3-19	$609	
R3-20	$11,506	
R3-21	$9,640	
R3-22	$2,553	
R3-23	$1,216	
R4-1	$13,929	CONSTRUCTION REACH THREE
R4-2	$14,809	
R4-3	$0	
R4-4	$0	
R4-5	$12,246	
R4-6	$2,127	
R5-1	$108,531	CONSTRUCTION REACH FOUR
R5-2	$85,810	
R5-3	$60,595	
R5-4	$53,694	
R5-5	$33,177	
R5-6	$81,725	
R5-7	$80,035	
R5-8	$77,521	
R5-9	$36,777	
R5-10	$36,976	
R5-11	$37,804	
R5-12	$37,415	
R5-13	$37,577	
R5-14	$36,863	
R5-15	$39,364	
R5-16	$41,784	
R5-17	$26,918	
R5-18	$55,236	
R5-19	$48,618	
R5-20	$87,777	
R5-21	$27,361	

TABLE B-47
AVERAGE ANNUAL RESIDUAL DAMAGE – BY REACH
SELECTED PLAN

R5-30	$1,848	CONSTRUCTION REACH FIVE
R5-31	$178	
R5-32	$21,344	
R5-33	$2,550	
R5-34	$852	
R5-35	$2,384	
R5-36	$19,174	
R5-37	$735	
R5-38	$1,918	
R5-39	$308	
R5-40	$26	
R5-41	$54	
R5-42	$28	
R5-43	$37	
R5-44	$0	
R5-45	$0	
R5-46	$2,706	
R5-47	$8,699	
R5-48	$290	
R5-49	$0	
R5-50	$895	
R5-51	$652	
Total	$637,201	

TABLE B-47A
RISK DAMAGES*

	WITHOUT PROJECT	NED	SELECTED PLAN/LPP
AVERAGE	$88,495,000	$14,974,942	$13,688,459
STANDARD DEVIATION	$746,000	$139,000	$145,000
RISK BENEFITS**			
	WITHOUT PROJECT	NED	SELECTED PLAN/LPP
AVERAGE		$7,344,000	$7,485,000
STANDARD DEVIATION		$36,000	$36,000
RISK BENEFIT TO COST RATIO (BCR)			
		NED	LPP
PROBABILITY BCR < 1.0		26%	38%
PROBABILITY BCR > 1.0		74%	62%

* Present Worth Value 50-year Period of Analysis
**Average Annual Values Fiscal Year 2014
Discounting

TABLE B-47B
STRUCTURE AND CONTENT DAMAGES BY DAMAGING MECHANISM
(VALUES ARE PRESENT WORTH OF LIFE-CYCLE DAMAGES IN THE WITHOUT PROJECT CONDITION)

Iteration	Structure Flood Loss Present Value	Structure Wave Loss Present Value	Structure Erosion Loss Present Value	Contents Flood Loss Present Value	Contents Wave Loss Present Value	Contents Erosion Loss Present Value	Contents Combined Present Value	Structure Combined Present Value
1	$18,453	$452,788	$7,128,710	$19,525	$496	$3,608,939	$3,628,798	$7,568,330
2	$256,459	$1,846,023	$73,502,176	$246,135	$407,243	$28,526,904	$29,006,498	$75,228,740
3	$704,478	$4,548,799	$67,832,307	$577,394	$1,216,865	$24,437,308	$25,823,957	$72,353,339
4	$29,094	$743,651	$7,954,276	$31,577	$896	$3,757,297	$3,789,500	$8,635,453
5	$133,848	$2,048,661	$22,187,070	$124,440	$2,509	$7,983,403	$8,109,401	$24,293,458
6	$68	$444,738	$18,183,705	$90	$345	$5,648,901	$5,649,246	$18,603,280
7	$702,570	$2,961,835	$90,344,932	$616,848	$986,198	$42,539,392	$43,797,902	$93,422,569
8	$7	$131,480	$3,345,951	$12	$0	$1,849,668	$1,849,680	$3,477,384
9	$902	$1,510,963	$14,867,534	$740	$1,996	$5,642,976	$5,644,979	$16,325,780
10	$509,770	$2,847,332	$212,051,012	$467,230	$848,560	$92,459,877	$93,537,201	$214,595,833
11	$230,554	$1,128,962	$16,926,361	$213,075	$418,729	$6,507,411	$7,010,283	$18,026,268
12	$39,412	$1,761,406	$104,005,283	$34,063	$2,976	$43,628,988	$43,665,110	$105,491,530
13	$13,861	$1,150,633	$63,725,945	$14,224	$3,288	$27,550,257	$27,566,937	$64,676,578
14	$1,328,206	$4,654,426	$90,421,783	$1,133,801	$2,793,994	$37,450,873	$40,277,682	$95,039,081
15	$331,009	$1,995,843	$15,382,467	$290,623	$378,274	$5,322,258	$5,871,852	$17,534,343
16	$62,425	$1,640,684	$26,274,449	$71,557	$2,627	$8,920,037	$8,993,431	$27,784,172
17	$237,588	$2,288,492	$85,786,311	$233,503	$366,571	$33,361,307	$33,564,303	$87,878,757
18	$1,295,622	$6,804,348	$100,907,707	$1,115,050	$1,964,162	$45,873,878	$48,221,892	$107,639,605
19	$85,472	$2,906,170	$76,510,878	$85,863	$5,224	$33,075,677	$33,165,605	$78,999,100
20	$655	$1,093,924	$6,683,493	$470	$1,374	$2,942,781	$2,944,155	$7,747,681
21	$654	$1,080,857	$12,737,893	$524	$1,442	$4,747,448	$4,748,890	$13,794,470
22	$147,215	$2,359,894	$117,936,462	$151,284	$2,959	$50,725,974	$50,879,336	$119,843,662
23	$390	$695,753	$18,498,332	$344	$1,470	$6,023,856	$6,025,342	$19,192,228
24	$1,562	$2,050,395	$88,263,126	$1,147	$4,405	$39,145,967	$39,150,377	$90,151,830
25	$25,854	$824,833	$62,180,109	$26,662	$1,150	$24,452,862	$24,480,185	$62,866,652
26	$405,000	$3,124,723	$161,653,181	$308,327	$3,491	$72,289,376	$72,599,930	$164,174,499
27	$530,414	$2,215,227	$51,925,174	$499,734	$715,959	$21,295,356	$22,217,153	$54,201,724
28	$73,470	$2,702,972	$87,082,581	$74,937	$2,655	$36,267,564	$36,344,189	$88,951,051
29	$1,109,846	$5,859,217	$89,873,150	$913,126	$1,613,086	$39,700,816	$41,602,546	$95,412,879
30	$268	$490,729	$5,572,601	$201	$550	$2,632,063	$2,632,624	$6,045,399
31	$1,514,843	$5,412,437	$19,464,142	$1,343,262	$2,151,449	$9,069,395	$11,393,429	$24,942,458
32	$63,214	$1,617,531	$51,210,819	$54,924	$2,740	$18,692,689	$18,749,434	$52,787,042
33	$3,410,063	$9,753,280	$131,022,845	$1,962,076	$4,721,017	$58,540,491	$62,508,204	$137,426,825
34	$245,875	$1,074,904	$19,694,993	$202,076	$313,233	$7,486,359	$7,886,242	$20,760,367
35	$733	$1,422,110	$77,978,071	$709	$2,128	$34,165,992	$34,168,128	$79,199,567
36	$63,713	$2,437,495	$25,336,615	$64,635	$2,895	$9,824,604	$9,891,168	$27,661,021
37	$278,999	$2,051,005	$18,291,960	$251,784	$294,601	$8,052,428	$8,501,823	$20,360,618
38	$202,815	$3,112,884	$30,565,645	$169,716	$3,074	$12,703,257	$12,875,055	$33,563,139
39	$2,525	$3,978,698	$141,840,027	$1,870	$5,438	$60,797,920	$60,803,374	$145,233,727
40	$46,005	$1,994,548	$25,618,359	$41,036	$2,799	$11,182,869	$11,225,758	$27,379,616
41	$101,676	$1,716,526	$33,764,350	$93,754	$2,520	$15,002,322	$15,097,597	$35,284,328
42	$347	$697,950	$16,151,654	$351	$1,123	$6,710,604	$6,711,770	$16,756,037
43	$1,207,706	$5,185,324	$186,182,541	$935,720	$1,983,801	$84,440,396	$85,882,459	$189,698,897
44	$26,740	$713,099	$18,730,171	$23,070	$1,709	$7,658,213	$7,682,482	$19,419,663
45	$1	$159,524	$31,489,882	$2	$565	$11,109,951	$11,110,517	$31,644,200
46	$209,398	$1,677,645	$13,163,783	$185,126	$321,666	$5,735,268	$6,137,745	$14,783,406
47	$784,897	$2,708,303	$18,212,820	$670,573	$1,393,141	$8,365,358	$9,670,569	$20,960,589
48	$93,609	$1,925,663	$76,443,079	$99,210	$2,301	$30,791,104	$30,891,803	$78,289,171
49	$619	$1,235,975	$18,483,551	$502	$1,847	$6,156,970	$6,158,857	$19,578,780
50	$139,094	$2,171,809	$38,442,212	$119,133	$4,197	$16,847,069	$16,968,902	$40,503,798

TABLE B-47B
STRUCTURE AND CONTENT DAMAGES BY DAMAGING MECHANISM
(VALUES ARE PRESENT WORTH OF LIFE-CYCLE DAMAGES IN THE WITHOUT PROJECT CONDITION)

Iteration	Structure Flood Loss Present Value	Structure Wave Loss Present Value	Structure Erosion Loss Present Value	Contents Flood Loss Present Value	Contents Wave Loss Present Value	Contents Erosion Loss Present Value	Contents Combined Present Value	Structure Combined Present Value
51	$1,054,307	$4,192,655	$48,886,163	$862,509	$1,634,898	$19,351,505	$21,274,693	$53,229,968
52	$834,429	$3,702,952	$26,467,048	$731,145	$1,453,093	$10,785,427	$12,284,021	$30,137,669
53	$950	$1,485,485	$68,765,223	$781	$2,650	$31,655,237	$31,657,939	$70,091,375
54	$953,668	$2,388,920	$157,479,665	$904,963	$2,812,387	$74,860,467	$76,186,028	$159,371,820
55	$21,017	$783,315	$19,708,671	$19,305	$1,005	$7,912,895	$7,932,825	$20,449,502
56	$29,812	$665,314	$6,274,793	$27,089	$1,079	$3,029,961	$3,057,790	$6,905,504
57	$127	$278,315	$3,884,563	$117	$484	$2,037,200	$2,037,683	$4,162,568
58	$1,020	$1,982,444	$24,180,096	$753	$2,099	$7,508,391	$7,510,491	$26,016,550
59	$93	$161,270	$63,227,587	$122	$442	$22,582,641	$22,583,134	$63,376,757
60	$11,623	$743,674	$87,956,889	$12,253	$1,724	$40,807,886	$40,821,336	$88,479,650
61	$1,507,550	$5,314,485	$81,613,496	$1,345,203	$3,657,939	$35,776,425	$38,795,034	$86,648,467
62	$85,448	$1,735,936	$41,054,564	$86,758	$6,502	$14,517,985	$14,608,803	$42,635,326
63	$1,075	$1,702,409	$117,335,550	$790	$2,374	$54,730,210	$54,732,644	$118,979,956
64	$670	$1,050,365	$21,277,597	$558	$1,769	$7,563,633	$7,565,402	$22,269,261
65	$370,192	$1,846,180	$83,195,133	$320,865	$509,551	$32,646,073	$33,278,200	$84,852,064
66	$76,889	$1,247,745	$24,849,415	$75,908	$124,090	$9,456,449	$9,613,300	$26,154,820
67	$1,250	$1,322,337	$36,322,652	$918	$2,844	$12,744,851	$12,747,776	$37,495,090
68	$616,945	$4,523,870	$95,522,243	$531,547	$1,026,968	$42,339,836	$43,553,215	$99,503,982
69	$150,877	$1,077,524	$10,234,969	$135,739	$228,948	$4,746,511	$5,031,713	$11,281,218
70	$20,514	$607,689	$60,743,608	$22,577	$1,348	$23,997,400	$24,021,020	$61,263,609
71	$733,179	$2,427,347	$133,647,740	$596,121	$1,480,012	$56,144,521	$57,078,635	$135,678,269
72	$42,985	$1,133,825	$21,655,911	$42,945	$1,319	$8,228,659	$8,272,433	$22,767,964
73	$483,707	$2,971,744	$183,312,973	$386,220	$749,257	$86,925,918	$87,480,041	$185,357,823
74	$209	$334,133	$8,818,281	$216	$693	$3,777,335	$3,778,029	$9,126,016
75	$895,983	$3,372,183	$13,165,218	$745,775	$1,267,507	$5,304,442	$6,838,517	$16,745,104
76	$16,525	$380,613	$5,457,196	$18,072	$522	$2,750,546	$2,769,088	$5,849,706
77	$425	$752,893	$52,582,998	$439	$1,422	$19,446,777	$19,448,238	$53,251,401
78	$863,904	$3,763,366	$126,417,671	$721,078	$1,317,509	$51,983,828	$53,498,433	$129,779,560
79	$1,066,854	$4,449,825	$112,162,906	$981,200	$1,695,113	$48,009,776	$49,921,131	$115,908,152
80	$57,552	$1,518,588	$112,784,517	$60,396	$2,655	$44,412,396	$44,474,312	$113,977,489
81	$71,705	$1,667,948	$49,394,306	$72,759	$2,261	$23,473,994	$23,548,361	$50,976,476
82	$16,760	$480,663	$10,218,823	$18,873	$730	$4,667,319	$4,686,537	$10,692,393
83	$411,735	$2,072,898	$22,174,176	$348,658	$732,448	$8,190,828	$9,058,903	$24,188,183
84	$152,343	$2,592,608	$100,978,137	$150,668	$4,552	$44,110,521	$44,262,819	$103,203,456
85	$1,013,417	$4,149,306	$54,010,961	$838,832	$1,244,786	$21,650,108	$23,217,248	$58,035,586
86	$567	$670,190	$19,733,962	$472	$1,811	$6,985,467	$6,987,278	$20,366,137
87	$92,294	$1,673,762	$23,715,202	$71,403	$1,709	$8,985,507	$9,058,039	$25,347,191
88	$366,186	$2,271,287	$19,338,576	$313,968	$411,939	$7,178,103	$7,738,670	$21,601,217
89	$163	$380,876	$32,536,956	$213	$789	$12,955,104	$12,955,938	$32,889,529
90	$229,524	$2,878,555	$74,832,358	$188,748	$282,997	$31,378,426	$31,737,383	$77,472,461
91	$167	$394,897	$9,327,148	$157	$605	$3,797,900	$3,798,511	$9,692,099
92	$1,992,097	$3,056,682	$182,806,143	$1,698,841	$734,402	$75,317,630	$77,327,714	$186,898,589
93	$1,262,334	$5,403,022	$180,691,400	$962,387	$1,682,158	$78,596,685	$79,906,297	$184,336,766
94	$322	$600,282	$10,640,437	$288	$1,070	$4,602,468	$4,603,538	$11,206,632
95	$1,468,963	$2,356,134	$65,775,381	$1,292,312	$2,442	$26,695,248	$27,980,245	$69,206,747
96	$3,359,518	$10,917,698	$151,621,572	$2,454,576	$4,665,965	$66,572,559	$70,288,094	$159,911,757
97	$844,410	$4,918,407	$64,636,732	$748,206	$1,526,932	$28,528,056	$30,245,652	$69,383,896
98	$875,318	$4,118,596	$115,131,422	$753,214	$1,501,849	$51,655,801	$53,390,008	$119,148,583
99	$2,520,356	$8,100,535	$84,088,693	$1,950,566	$4,678,100	$38,072,395	$41,466,101	$90,795,863
100	$288	$514,569	$105,802,633	$318	$1,506	$47,656,298	$47,657,642	$106,299,044

12.0 SENSITIVITY ANALYSIS – WORST CASE IMPACTS OF ECONOMIC DOWNTURN (2009-2010) ON PROJECT JUSTIFICATION

12.1 BACKGROUND

The economic downturn and subsequent contraction of economic activity whose full effects were measured during the years 2009 and 2010 show strong signs that a full recovery is under way. Recovery is showing up in the majority of economic activity indicators which have enjoyed a steady upwards trend but for the unemployment rates and the very low number of housing starts. This current ongoing recovery has been termed a jobless recovery. The seasonally adjusted annual unemployment rate for the Nation was 9.6 percent in 2010, 9.3 percent in 2009 and 5.8 percent in 2008. The State of Florida unemployment rate for 2009 was 12.0 percent in December of 2010, ranking 49th of 50 states and the District of Columbia. Only California and Nevada were higher with 12.5 percent and 14.5 percent respectively. Florida's historical highest unemployment rate was recorded in March of 2010 at 12.3 percent and its lowest was 3.3 percent in May of 2006.

Our analyses are performed over a 50-year time frame horizon which assumes the expansions and contractions in the economy would be smoothed out over that time and short term phenomena like the economy is experiencing now would be mostly balanced by an expansion some time later which would generally act as a canceling if not damping force. Our Planning and Guidance directs us to assume full employment in our analyses, therefore, this sensitivity analysis is to serve as an economic check to answer the question, what if this current condition, near the historical high rate of unemployment, were to continue throughout the period of analysis would the project still be economically justified?

Manufacturing has recorded six consecutive months of expansion and the stock market indices have returned to their pre-recession levels or just a few percentages points below. The national economy is moving from contraction to expansion. The state of the housing market across the nation is marked by large devaluations to residential and commercial properties created by large surpluses as a result of a heavily oversold market, this is true as well as in Walton County. Because of the impact on formulation of the NED and selected plan from changes in added dune width optimization and the subsequent impacts which were to occur if engineering design were likewise reformulated; this sensitivity analysis is performed to determine if the project continues to be justified. If so, then the recommendation will be to keep the formulation of the project engineering and design as is as formulated in the draft General Investigation (GI) Study in the pre 2009 -2010 economic downturn.

12.2 GENERAL

The proposed Walton County's Hurricane and Storm Damage Prevention project will provide National Economic Development (NED) benefits to the Nation in special accounts: Hurricane and Storm Damage Reduction to property, the berm and dune structure, prevention of land loss and emergency nourishment cost avoidance.

12.3 OBJECTIVE

This sensitivity analysis will estimate the impact to the justification of the proposed project using the post 2009 – 2010 inventory depreciated replacement costs and the updated near shore land values.

The near shore land value which is used to measure the land loss benefit has been significantly reduced. The near shore land value in some project reaches have declined by as much as 68 percent. Depreciated replacement costs (DRC) of single family residences on the beach have remained at relatively the same as they were before the 2009 – 2010 economic downturn but have increased somewhat for multi-family residences. Investors and homeowners of structures on the beach have not panicked because of the economic downturn. Relatively few structures have been sold indicating that the belief is that values are where they should be. Most of the properties do not have year round occupancy by the owner or investor. Principally they are income producing properties that are rented or leased. The DRC for walkways and dune crossovers have increased due to the rise on construction material costs the Federal discount rate has reduced to four and one-eighth percent, which is used in this sensitivity analysis. Table B-48 compares the before 2009 and 2010 near shore land values and the current estimate of near shore values as impacted by the oversold condition in the housing sector of the economy.

Project benefits are also dependent upon the prevention of emergency nourishment costs. Emergency nourishment volumes have not changed because the same historical storm sets are used in both the with and without project conditions. Fuel prices used in estimating truck haul of fill in the without project condition have held at relatively the same price level, just below three dollars per gallon used in the GI study, therefore the truck haul cost remained at $30 dollars per cy.

12.4 METHODOLOGY

The total project cost estimate was certified by the Corps' Cost Directorate of Expertise in Walla Walla, Washington. The price level of project benefits and the total project cost estimate are adjusted to comparable price levels.

TABLE B-48
UPDATED NEAR SHORE LAND VALUES

Identifier	Reach Name	Near Shore land value pre 2009//2010 per square foot	Current Estimated Near Shore land value per square foot	Difference per square foot/ % decrease
A	Miramar Beach/Scenic Gulf Drive east to Highway 98	$70.00	$30.00	-$40.00/ - 57%
B	Scenic Gulf Drive and Highway 98 east to east side of Topsail Hill Preserve State Park and Stallworth Lake	$85.00	$32.50	-$52.50/ - 62%
C	Stallworth Lake east to Highway 393	$45.00	$16.00	-$29.00/ - 64%
D	Hwy 393 east to Watercolor	$75.00	$27.50	-$47.50/ - 63%
E	West side of Watercolor to Highway 395	$112.50	$75.00	-$37.50/ - 33%
F	Highway 395 east to Eastern Lake	$67.50	$35.00	-$32.50/ - 48%
G	East side of Eastern Lake to Rosemary Beach	$35.00	$30.00	-$5.00/ - 14%
H	West side of Rosemary Beach to convergence of Highway 30A and Highway 98	$87.50	$87.50	$0.00/ - 0%
I	Highway 30A/98 Fork east to Bay County line	$77.50	$25.00	-$52.50/ - 68%
J	The west line of Bay County through Carillon Beach	$32.50	$25.00	-$7.50/ - 23%

12.5 PREVENTION OF LAND LOST BENEFITS

Average annual erosion rates are calculated in the execution of the future without project condition. With a hurricane and storm damage project properly maintained in place, land loss to erosion is prevented and valued as a benefit. Tables B-49 and B-50 show the land lost benefit for the pre 2009 – 2010 valuations and the updated reduced current valuations.

TABLE B-49
VALUE OF LAND LOST BY REACH
PRE 2009 - 2010 NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
1	R1-1	1149.8	R1P1	0.6808	$70.00	$54,794.87
2	R1-2	1101.6	R1P1	0.6435	$70.00	$49,621.57
3	R1-3	1043.6	R1P1	0.5137	$70.00	$37,526.81
4	R1-4	1001.8	R1P1	0.3958	$70.00	$27,755.87
5	R1-5	1061.8	R1P1	0.3077	$70.00	$22,870.11
6	R1-6	1044.6	R1P1	0.0926	$70.00	$6,771.10
7	R1-7	1002.7	R1P1	0.0063	$70.00	$442.19
8	R1-8	1061.4	R1P1	0.0156	$70.00	$1,159.05
9	R1-9	1013.6	R1P1	0.0284	$70.00	$2,015.04
10	R1-10	959.4	R1P1	0.0926	$70.00	$6,218.83
11	R1-11	1021.2	R1P1	0.1216	$70.00	$8,692.45
12	R1-12	1056.7	R1P1	0.0508	$70.00	$3,757.63
13	R1-13	1040.1	R1P2	-0.0008	$70.00	-$58.25
14	R1-14	1050.6	R1P2	-0.1008	$70.00	-$7,413.03
15	R1-15	997.9	R1P2	-0.1155	$70.00	-$8,068.02
16	R1-16	1024.7	R1P2	-0.1263	$85.00	-$11,000.67
17	R1-17	1113.6	R1P2	-0.1183	$85.00	-$11,197.80
18	R1-18	1133.1	R1P2	-0.1323	$85.00	-$12,742.28
19	R1-19	1058.4	R1P2	-0.0633	$85.00	-$5,694.72
20	R1-20	961	R1P1	0.1033	$85.00	$8,438.06
21	R1-21	952.1	R1P1	0.1122	$85.00	$9,080.18
22	R1-22	1028	R1P1	0.2459	$85.00	$21,486.74
23	R1-23	1085.9	R1P1	0.3952	$85.00	$36,477.55
24	R1-24	1038.7	R1P1	0.4652	$85.00	$41,072.28
25	R2-1	990	R2P1	0.3687	$85.00	$31,026.11
26	R2-2	935.5	R2P1	0.2417	$45.00	$10,174.97
27	R2-3	2160.3	R2P2	0.3044	$45.00	$29,591.79
28	R2-4	2065.5	R2P1	0.2417	$45.00	$22,465.41
29	R2-5	1001.3	R2P2	0.1844	$45.00	$8,308.79
30	R2-6	10078.2	R2P1	-0.5495	$45.00	-$249,208.69
31	R2-7	1040.4	R2P1	0.3869	$45.00	$18,113.88
32	R3-1	1147	R3P1	0.4031	$45.00	$20,806.01
33	R3-2	1037.4	R3P1	0.4283	$45.00	$19,994.33
34	R3-3	1051.6	R3P1	0.4316	$45.00	$20,424.18
35	R3-4	1026	R3P2	0.5535	$45.00	$25,555.10
36	R3-5	1120.7	R3P2	0.4180	$45.00	$21,080.37

TABLE B-49 (CONTINUED)
VALUE OF LAND LOST BY REACH
PRE 2009 - 2010 NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
37	R3-6	1184.9	R3P2	0.2885	$45.00	$15,382.96
38	R3-7	1155.8	R3P2	0.0960	$45.00	$4,993.06
39	R3-8	1102.9	R3P1	-0.2985	$45.00	-$14,814.70
40	R3-9	1057.8	R3P1	-0.3588	$45.00	-$17,079.24
41	R3-10	1068.2	R3P1	-0.4446	$45.00	-$21,371.48
42	R3-11	1044.7	R3P1	-0.5076	$45.00	-$23,863.04
43	R3-12	1006.8	R3P1	-0.4978	$75.00	-$37,588.88
44	R3-13	1004	R3P1	-0.5924	$75.00	-$44,607.72
45	R3-14	1345	R3P1	-0.7700	$75.00	-$77,673.75
46	R3-15	1061.8	R3P1	-0.8489	$75.00	-$67,602.15
47	R3-16	731.7	R3P1	-0.9596	$75.00	-$52,660.45
48	R3-17	1016.6	R3P1	-1.0926	$75.00	-$83,305.29
49	R3-18	1039.4	R3P1	-1.1151	$75.00	-$86,927.62
50	R3-19	1036	R3P1	-1.0589	$75.00	-$82,276.53
51	R3-20	1026.7	R3P1	-1.0373	$75.00	-$79,874.69
52	R3-21	1029	R3P1	-1.0106	$75.00	-$77,993.06
53	R3-22	978	R3P1	-0.9243	$75.00	-$67,797.41
54	R3-23	855.4	R3P1	-0.8319	$75.00	-$53,370.54
55	R3-24	1115	R3P2	-0.5435	$75.00	-$45,450.19
56	R3-25	1274	R3P2	-0.3414	$75.00	-$32,620.77
57	R3-26	1082.2	R4P1	-0.3292	$75.00	-$26,719.52
58	R4-1	1082	R4P1	-0.6703	$75.00	-$54,394.85
59	R4-2	1125.7	R4P1	-0.5439	$75.00	-$45,920.12
60	R4-3	981.5	R4P2	0.0509	$75.00	$3,746.88
61	R4-4	942.1	R4P2	0.1131	$75.00	$7,991.36
62	R4-5	998.1	R4P1	-0.2903	$75.00	-$21,731.13
63	R4-6	971.4	R4P2	0.0925	$75.00	$6,739.09
64	R4-7	1060.9	R4P2	-0.1046	$75.00	-$8,322.76
65	R4-8	2119.2	R4P1	-0.5521	$75.00	-$87,750.77
66	R4-9	2074.7	R4P1	-0.9889	$75.00	-$153,875.31
67	R5-1	993.1	R5P2	-0.8973	$112.50	-$100,249.72
68	R5-2	1003	R5P2	-0.6237	$112.50	-$70,376.75
69	R5-3	1039.4	R5P2	-0.3263	$112.50	-$38,155.07
70	R5-4	1303.7	R5P2	-0.0772	$112.50	-$11,322.63
71	R5-5	1009.2	R5P2	0.1001	$112.50	$11,364.85
72	R5-6	1061.5	R5P1	-0.2592	$112.50	-$30,953.34
73	R5-7	1037.5	R5P1	-0.3266	$112.50	-$38,120.34
74	R5-8	991.6	R5P1	-0.4109	$67.50	-$27,502.77
75	R5-9	1026.5	R5P2	-0.2260	$67.50	-$15,659.26
76	R5-10	1010.7	R5P2	-0.2626	$67.50	-$17,915.16
77	R5-11	1022.2	R5P2	-0.2847	$67.50	-$19,643.87

TABLE B-49 (CONTINUED)
VALUE OF LAND LOST BY REACH
PRE 2009 - 2010 NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
78	R5-12	1018	R5P2	-0.2734	$67.50	-$18,786.68
79	R5-13	1016.5	R5P2	-0.2876	$67.50	-$19,733.31
80	R5-14	1005.3	R5P2	-0.2623	$67.50	-$17,799.09
81	R5-15	1011	R5P2	-0.3549	$67.50	-$24,219.26
82	R5-16	1035.2	R5P2	-0.3543	$67.50	-$24,757.07
83	R5-17	942.6	R5P3	-0.2078	$67.50	-$13,221.38
84	R5-18	999.9	R5P2	-0.3578	$67.50	-$24,149.08
85	R5-19	1010.9	R5P3	-0.0820	$35.00	-$2,901.28
86	R5-20	1028.6	R5P2	0.0051	$35.00	$183.61
87	R5-21	1122	R5P2	-0.0141	$35.00	-$553.71
88	R5-22	1029.7	R5P3	-0.0545	$35.00	-$1,964.15
89	R5-23	1013.1	R5P3	-0.0144	$35.00	-$510.60
90	R5-24	1021.7	R5P2	-0.1929	$35.00	-$6,898.01
91	R5-25	1054.4	R5P2	-0.4140	$35.00	-$15,278.26
92	R5-26	884.4	R5P1	-0.4138	$35.00	-$12,808.77
93	R5-27	1044.2	R5P3	-0.2764	$35.00	-$10,101.59
94	R5-28	1058.5	R5P3	-0.3145	$35.00	-$11,651.44
95	R5-29	986.7	R5P2	-0.4391	$87.50	-$37,910.25
96	R5-30	1021.8	R5P2	-0.3674	$87.50	-$32,848.32
97	R5-31	1014.9	R5P2	-0.3815	$87.50	-$33,878.63
98	R5-32	984.6	R5P1	-0.7184	$87.50	-$61,891.96
99	R5-33	1025.3	R5P1	-0.6970	$87.50	-$62,530.48
100	R5-34	1037.8	R5P1	-0.5918	$87.50	-$53,739.88
101	R5-35	1002.2	R5P1	-0.6019	$87.50	-$52,782.12
102	R5-36	943.7	R5P1	-0.6839	$87.50	-$56,472.19
103	R5-37	1019.9	R5P1	-0.9037	$87.50	-$80,647.32
104	R5-38	1094.1	R5P1	-0.9874	$87.50	-$94,527.50
105	R5-39	1024.2	R5P1	-1.1019	$87.50	-$98,749.52
106	R5-40	1009.7	R5P2	-0.5617	$87.50	-$49,625.49
107	R5-41	1003.7	R5P2	-0.5106	$87.50	-$44,842.81
108	R5-42	1022.6	R5P2	-0.3367	$87.50	-$30,127.07
109	R5-43	1002.2	R5P2	-0.2136	$87.50	-$18,731.12
110	R5-44	1000.5	R5P2	-0.0640	$87.50	-$5,602.80
111	R5-45	968.6	R5P2	0.0031	$87.50	$262.73
112	R5-46	987.6	R5P2	0.0848	$87.50	$7,327.99
113	R5-47	1030.6	R5P2	0.0123	$77.50	$982.42
114	R5-48	1026.4	R5P3	0.0289	$77.50	$2,298.88
115	R5-49	1041.1	R5P3	-0.1516	$77.50	-$12,231.88
116	R5-50	1031.8	R5P3	-0.2372	$77.50	-$18,967.58
117	R5-51	1025.9	R5P3	-0.3640	$77.50	-$28,940.64

TABLE B-50
VALUE OF LAND LOST BY REACH
CURRENT UPDATED NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
1	R1-1	1149.8	R1P1	0.6808	$30.00	$23,483.52
2	R1-2	1101.6	R1P1	0.6435	$30.00	$21,266.39
3	R1-3	1043.6	R1P1	0.5137	$30.00	$16,082.92
4	R1-4	1001.8	R1P1	0.3958	$30.00	$11,895.37
5	R1-5	1061.8	R1P1	0.3077	$30.00	$9,801.48
6	R1-6	1044.6	R1P1	0.0926	$30.00	$2,901.90
7	R1-7	1002.7	R1P1	0.0063	$30.00	$189.51
8	R1-8	1061.4	R1P1	0.0156	$30.00	$496.74
9	R1-9	1013.6	R1P1	0.0284	$30.00	$863.59
10	R1-10	959.4	R1P1	0.0926	$30.00	$2,665.21
11	R1-11	1021.2	R1P1	0.1216	$30.00	$3,725.34
12	R1-12	1056.7	R1P1	0.0508	$30.00	$1,610.41
13	R1-13	1040.1	R1P2	-0.0008	$30.00	-$24.96
14	R1-14	1050.6	R1P2	-0.1008	$30.00	-$3,177.01
15	R1-15	997.9	R1P2	-0.1155	$30.00	-$3,457.72
16	R1-16	1024.7	R1P2	-0.1263	$32.50	-$4,206.14
17	R1-17	1113.6	R1P2	-0.1183	$32.50	-$4,281.51
18	R1-18	1133.1	R1P2	-0.1323	$32.50	-$4,872.05
19	R1-19	1058.4	R1P2	-0.0633	$32.50	-$2,177.39
20	R1-20	961	R1P1	0.1033	$32.50	$3,226.32
21	R1-21	952.1	R1P1	0.1122	$32.50	$3,471.83
22	R1-22	1028	R1P1	0.2459	$32.50	$8,215.52
23	R1-23	1085.9	R1P1	0.3952	$32.50	$13,947.30
24	R1-24	1038.7	R1P1	0.4652	$32.50	$15,704.11
25	R2-1	990	R2P1	0.3687	$32.50	$11,862.92
26	R2-2	935.5	R2P1	0.2417	$16.00	$3,617.77
27	R2-3	2160.3	R2P2	0.3044	$16.00	$10,521.53
28	R2-4	2065.5	R2P1	0.2417	$16.00	$7,987.70
29	R2-5	1001.3	R2P2	0.1844	$16.00	$2,954.24
30	R2-6	10078.2	R2P1	-0.5495	$16.00	-$88,607.53
31	R2-7	1040.4	R2P1	0.3869	$16.00	$6,440.49
32	R3-1	1147	R3P1	0.4031	$16.00	$7,397.69
33	R3-2	1037.4	R3P1	0.4283	$16.00	$7,109.09
34	R3-3	1051.6	R3P1	0.4316	$16.00	$7,261.93
35	R3-4	1026	R3P2	0.5535	$16.00	$9,086.26
36	R3-5	1120.7	R3P2	0.4180	$16.00	$7,495.24
37	R3-6	1184.9	R3P2	0.2885	$16.00	$5,469.50
38	R3-7	1155.8	R3P2	0.0960	$16.00	$1,775.31
39	R3-8	1102.9	R3P1	-0.2985	$16.00	-$5,267.45
40	R3-9	1057.8	R3P1	-0.3588	$16.00	-$6,072.62
41	R3-10	1068.2	R3P1	-0.4446	$16.00	-$7,598.75

TABLE B-50 (CONTINUED)
VALUE OF LAND LOST BY REACH
CURRENT UPDATED NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
42	R3-11	1044.7	R3P1	-0.5076	$16.00	-$8,484.64
43	R3-12	1006.8	R3P1	-0.4978	$27.50	-$13,782.59
44	R3-13	1004	R3P1	-0.5924	$27.50	-$16,356.16
45	R3-14	1345	R3P1	-0.7700	$27.50	-$28,480.38
46	R3-15	1061.8	R3P1	-0.8489	$27.50	-$24,787.46
47	R3-16	731.7	R3P1	-0.9596	$27.50	-$19,308.83
48	R3-17	1016.6	R3P1	-1.0926	$27.50	-$30,545.27
49	R3-18	1039.4	R3P1	-1.1151	$27.50	-$31,873.46
50	R3-19	1036	R3P1	-1.0589	$27.50	-$30,168.06
51	R3-20	1026.7	R3P1	-1.0373	$27.50	-$29,287.39
52	R3-21	1029	R3P1	-1.0106	$27.50	-$28,597.45
53	R3-22	978	R3P1	-0.9243	$27.50	-$24,859.05
54	R3-23	855.4	R3P1	-0.8319	$27.50	-$19,569.20
55	R3-24	1115	R3P2	-0.5435	$27.50	-$16,665.07
56	R3-25	1274	R3P2	-0.3414	$27.50	-$11,960.95
57	R3-26	1082.2	R4P1	-0.3292	$27.50	-$9,797.16
58	R4-1	1082	R4P1	-0.6703	$27.50	-$19,944.78
59	R4-2	1125.7	R4P1	-0.5439	$27.50	-$16,837.38
60	R4-3	981.5	R4P2	0.0509	$27.50	$1,373.85
61	R4-4	942.1	R4P2	0.1131	$27.50	$2,930.17
62	R4-5	998.1	R4P1	-0.2903	$27.50	-$7,968.08
63	R4-6	971.4	R4P2	0.0925	$27.50	$2,471.00
64	R4-7	1060.9	R4P2	-0.1046	$27.50	-$3,051.68
65	R4-8	2119.2	R4P1	-0.5521	$27.50	-$32,175.28
66	R4-9	2074.7	R4P1	-0.9889	$27.50	-$56,420.95
67	R5-1	993.1	R5P2	-0.8973	$75.00	-$66,833.15
68	R5-2	1003	R5P2	-0.6237	$75.00	-$46,917.83
69	R5-3	1039.4	R5P2	-0.3263	$75.00	-$25,436.72
70	R5-4	1303.7	R5P2	-0.0772	$75.00	-$7,548.42
71	R5-5	1009.2	R5P2	0.1001	$75.00	$7,576.57
72	R5-6	1061.5	R5P1	-0.2592	$75.00	-$20,635.56
73	R5-7	1037.5	R5P1	-0.3266	$75.00	-$25,413.56
74	R5-8	991.6	R5P1	-0.4109	$35.00	-$14,260.70
75	R5-9	1026.5	R5P2	-0.2260	$35.00	-$8,119.62
76	R5-10	1010.7	R5P2	-0.2626	$35.00	-$9,289.34
77	R5-11	1022.2	R5P2	-0.2847	$35.00	-$10,185.71
78	R5-12	1018	R5P2	-0.2734	$35.00	-$9,741.24
79	R5-13	1016.5	R5P2	-0.2876	$35.00	-$10,232.09
80	R5-14	1005.3	R5P2	-0.2623	$35.00	-$9,229.16
81	R5-15	1011	R5P2	-0.3549	$35.00	-$12,558.14
82	R5-16	1035.2	R5P2	-0.3543	$35.00	-$12,837.00

TABLE B-50 (CONTINUED)
VALUE OF LAND LOST BY REACH
CURRENT UPDATED NEAR SHORE LAND VALUES

Reach	Model Reach	Reach Length -ft	Representative Profile	Average Annual Erosion	Land Value per Sq. Ft.	Value of Land Loss -
83	R5-17	942.6	R5P3	-0.2078	$35.00	-$6,855.53
84	R5-18	999.9	R5P2	-0.3578	$35.00	-$12,521.75
85	R5-19	1010.9	R5P3	-0.0820	$30.00	-$2,486.81
86	R5-20	1028.6	R5P2	0.0051	$30.00	$157.38
87	R5-21	1122	R5P2	-0.0141	$30.00	-$474.61
88	R5-22	1029.7	R5P3	-0.0545	$30.00	-$1,683.56
89	R5-23	1013.1	R5P3	-0.0144	$30.00	-$437.66
90	R5-24	1021.7	R5P2	-0.1929	$30.00	-$5,912.58
91	R5-25	1054.4	R5P2	-0.4140	$30.00	-$13,095.65
92	R5-26	884.4	R5P1	-0.4138	$30.00	-$10,978.94
93	R5-27	1044.2	R5P3	-0.2764	$30.00	-$8,658.51
94	R5-28	1058.5	R5P3	-0.3145	$30.00	-$9,986.95
95	R5-29	986.7	R5P2	-0.4391	$87.50	-$37,910.25
96	R5-30	1021.8	R5P2	-0.3674	$87.50	-$32,848.32
97	R5-31	1014.9	R5P2	-0.3815	$87.50	-$33,878.63
98	R5-32	984.6	R5P1	-0.7184	$87.50	-$61,891.96
99	R5-33	1025.3	R5P1	-0.6970	$87.50	-$62,530.48
100	R5-34	1037.8	R5P1	-0.5918	$87.50	-$53,739.88
101	R5-35	1002.2	R5P1	-0.6019	$87.50	-$52,782.12
102	R5-36	943.7	R5P1	-0.6839	$87.50	-$56,472.19
103	R5-37	1019.9	R5P1	-0.9037	$87.50	-$80,647.32
104	R5-38	1094.1	R5P1	-0.9874	$87.50	-$94,527.50
105	R5-39	1024.2	R5P1	-1.1019	$87.50	-$98,749.52
106	R5-40	1009.7	R5P2	-0.5617	$87.50	-$49,625.49
107	R5-41	1003.7	R5P2	-0.5106	$87.50	-$44,842.81
108	R5-42	1022.6	R5P2	-0.3367	$87.50	-$30,127.07
109	R5-43	1002.2	R5P2	-0.2136	$87.50	-$18,731.12
110	R5-44	1000.5	R5P2	-0.0640	$87.50	-$5,602.80
111	R5-45	968.6	R5P2	0.0031	$87.50	$262.73
112	R5-46	987.6	R5P2	0.0848	$87.50	$7,327.99
113	R5-47	1030.6	R5P2	0.0123	$25.00	$316.91
114	R5-48	1026.4	R5P3	0.0289	$25.00	$741.57
115	R5-49	1041.1	R5P3	-0.1516	$25.00	-$3,945.77
116	R5-50	1031.8	R5P3	-0.2372	$25.00	-$6,118.57
117	R5-51	1025.9	R5P3	-0.3640	$25.00	-$9,335.69

12.6 DUNE WIDTH OPTIMIZATION FUTURE WITH PROJECT CONDITION

Sensitivity runs were performed on all of the dune optimization alternatives to determine if the project remains justified and indicate any the impacts upon formulation. The alternatives evaluated are added dune width on the previously optimized berm width alternative. Early on, while evaluating additional berm width alternatives, only the results showed that justified reaches were very small and there were wide gaps of unjustified reaches. There was maybe only one somewhat contiguous reach that could have been economically justified. Then added dune width was added as a damage reducing mechanism to protect the toe of the dune which was showing evidence of erosion from wave attack. All berm widths were evaluated with a constant 20 feet of added dune width, and it was noticed that numerous reaches were justified so added dune width protected the toe of the dune very well protecting the dunes of Walton County and gave significant protection to the project. The key to storm damage reduction in the high dune climate at Walton County was to protect the toe of the dune which helps in preventing dune sloughing. Since the majority of storm damage reduction benefits are rooted in additional dune width, those alternatives were re-evaluated for justification. The results are presented in the following tables. Added dune widths of 0, 10, 20, 30 and 40 feet were evaluated and the statistics are presented in Tables B-51 to B-56.

TABLE B-51
OPTIMIZED BERM WIDTH – NO ADDED DUNE WIDTH

Reach	Damage Reduction DW00	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW00	Summed Net Benefits DW00
R1-1	$13,790	$656	$22,628	$1,658	$2,314	$722,786	$34,369	0.067	-$32,055	
R1-2	$17,542	$834	$21,746	$760	$1,594	$690,370	$32,828	0.049	-$31,234	
R1-3	$23,522	$1,118	$16,531	$860	$1,979	$637,849	$30,330	0.065	-$28,352	
R1-4	$19,128	$910	$12,262	$947	$1,856	$652,415	$31,023	0.060	-$29,167	
R1-5	$8,308	$395	$10,066	$1,097	$1,492	$667,846	$31,757	0.047	-$30,265	
R1-6	$20,314	$966	$3,040	$1,220	$2,186	$777,559	$36,974	0.059	-$34,788	
R1-7	$33,893	$1,612	$271	$1,260	$2,871	$754,123	$35,859	0.080	-$32,988	
R1-8	$20,627	$981	$732	$1,320	$2,301	$779,792	$37,080	0.062	-$34,779	
R1-9	$38,660	$1,838	$1,125	$1,261	$3,100	$731,033	$34,761	0.089	-$31,662	
R1-10	$29,025	$1,380	$2,792	$1,128	$2,508	$639,046	$30,387	0.083	-$27,879	
R1-11	$2,111,260	$100,393	$3,707	$1,198	$101,590	$721,411	$34,304	2.961	$67,286	
R1-12	$134,057	$6,375	$1,807	$1,275	$7,650	$803,442	$38,204	0.200	-$30,555	
R1-13	$2,621,829	$124,671	-$31	$1,351	$126,052	$744,773	$35,415	3.559	$90,638	
R1-14	$2,490,545	$118,428	-$3,467	$1,641	$123,536	$810,607	$38,545	3.205	$84,991	
R1-15	$997,740	$47,444	-$4,550	$2,177	$54,171	$503,268	$23,931	2.264	$30,240	
R1-16	$1,846,130	$87,785	-$5,362	$2,224	$95,371	$539,581	$25,658	3.717	$69,713	**$312,314**
R1-17	$48,323	$2,298	-$5,465	$2,412	$10,175	$548,009	$26,058	0.390	-$15,883	
R1-18	$97,210	$4,622	-$6,187	$2,457	$13,266	$553,880	$26,338	0.504	-$13,071	
R1-19	$83,170	$3,955	-$3,233	$2,285	$9,473	$574,029	$27,296	0.347	-$17,822	
R1-20	$95,810	$4,556	$2,311	$2,005	$6,561	$137,207	$6,524	1.006	$37	
R1-21	$9,520	$453	$3,589	$1,095	$1,548	$699,267	$33,251	0.047	-$31,703	
R1-22	$34,889	$1,659	$8,653	$1,035	$2,694	$689,029	$32,764	0.082	-$30,070	
R1-23	$13,903	$661	$14,399	$1,013	$1,674	$717,604	$34,123	0.049	-$32,449	
R1-24	$142,497	$6,776	$16,204	$866	$7,641	$611,333	$29,070	0.263	-$21,428	

TABLE B-51 (CONTINUED)
OPTIMIZED BERM WIDTH – NO ADDED DUNE WIDTH

Reach	Damage Reduction DW00	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW00	Summed Net Benefits DW00
R2-1	$2,270	$0	$13,063	$598	$598	$0	$0	0.000	$0	
R2-2	$0	$0	$4,236	$0	$0	$0	$0	0.000	$0	
R2-3	$0	$0	$11,959	$0	$0	$0	$0	0.000	$0	
R2-4	$0	$0	$9,353	$0	$0	$0	$0	0.000	$0	
R2-5	$0	$0	$3,573	$0	$0	$0	$0	0.000	$0	
R2-6	$0	$0	-$83,044	$0	$83,044	$0	$0	0.000	$0	
R2-7	$0	$0	$7,141	$0	$0	$0	$0	0.000	$0	
R3-1	$199,810	$9,501	$5,891	$24,947	$34,448	$1,191,330	$56,649	0.608	-$22,201	
R3-2	$2,357,436	$112,098	$5,627	$23,658	$135,756	$1,007,056	$47,886	2.835	$87,870	
R3-3	$333,777	$15,871	$5,906	$24,046	$39,917	$947,403	$45,050	0.886	-$5,133	
R3-4	$10,947	$521	$8,487	$4,945	$5,466	$289,544	$13,768	0.397	-$8,303	
R3-5	$96,900	$4,608	$6,688	$5,603	$10,211	$380,855	$18,110	0.564	-$7,899	
R3-6	$108,389	$5,154	$4,474	$6,233	$11,387	$433,586	$20,617	0.552	-$9,230	
R3-7	$65,911	$3,134	$703	$6,395	$9,529	$433,330	$20,605	0.462	-$11,076	
R3-8	$117,844	$5,604	-$9,617	$26,457	$41,678	$1,039,621	$49,435	0.843	-$7,757	
R3-9	$596,952	$28,386	-$9,884	$25,180	$63,450	$1,046,856	$49,779	1.275	$13,670	
R3-10	$2,794,558	$132,884	-$12,203	$25,793	$170,880	$1,102,238	$52,413	3.260	$118,468	
R3-11	$860,940	$40,939	-$13,222	$25,305	$79,466	$1,066,094	$50,694	1.568	$28,772	
R3-12	$1,706,825	$81,161	-$21,956	$24,328	$127,445	$1,033,505	$49,144	2.593	$78,301	
R3-13	$1,156,401	$54,988	-$25,401	$24,456	$104,846	$1,016,554	$48,338	2.169	$56,508	
R3-14	$1,700,341	$80,853	-$44,459	$33,306	$158,618	$1,508,733	$71,742	2.211	$86,876	
R3-15	$33,003	$1,569	-$38,631	$26,434	$66,635	$1,141,150	$54,263	1.228	$12,372	
R3-16	$9,434	$449	-$30,464	$18,467	$49,380	$800,063	$38,044	1.298	$11,336	
R3-17	$161,310	$7,670	-$47,442	$25,790	$80,903	$1,153,330	$54,842	1.475	$26,061	
R3-18	$400,038	$19,022	-$49,993	$26,381	$95,396	$1,225,524	$58,275	1.637	$37,121	
R3-19	$1,513,857	$71,985	-$46,980	$26,270	$145,236	$1,163,552	$55,328	2.625	$89,908	
R3-20	$4,040,625	$192,136	-$46,022	$26,011	$264,168	$1,203,450	$57,225	4.616	$206,943	
R3-21	$1,119,176	$53,218	-$44,965	$26,018	$124,201	$1,240,216	$58,974	2.106	$65,227	
R3-22	$301,930	$14,357	-$39,078	$24,496	$77,932	$1,142,968	$54,349	1.434	$23,583	
R3-23	$276,630	$13,154	-$30,816	$21,282	$65,252	$979,392	$46,571	1.401	$18,681	**$912,297**
R3-24	$10,225	$0	-$18,581	$7,322	$0	$0	$0	0.000	$0	
R3-25	-$10,198	$0	-$13,979	$7,972	$0	$0	$0	0.000	$0	
R3-26	$0	$0	-$7,529	$0	$0	$0	$0	0.000	$0	
R4-1	$22,624	$1,076	-$22,733	$26,171	$49,980	$190,124	$9,041	5.528	$40,939	
R4-2	$82,816	$3,938	-$17,522	$26,718	$48,178	$293,418	$13,952	3.453	$34,225	$75,165
R4-3	$0	$0	$2,348	$0	$0	$142,320	$0	0.000	$0	
R4-4	$0	$0	$3,860	$0	$0	$59,895	$0	0.000	$0	
R4-5	$212,312	$10,096	-$7,878	$23,197	$41,170	$174,258	$8,286	4.969	$32,884	
R4-6	$32,526	$1,547	$2,378	$5,399	$6,946	$29,204	$1,389	5.002	$5,557	$38,441
R4-7	$0	$0	-$3,297	$5,986	$0	$0	$0	0.000	$0	
R4-8	$0	$0	-$27,507	$0	$0	$0	$0	0.000	$0	
R4-9	$0	$0	-$52,376	$0	$0	$0	$0	0.000	$0	

TABLE B-51 (CONTINUED)
OPTIMIZED BERM WIDTH – NO ADDED DUNE WIDTH

Reach	Damage Reduction DW00	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW00	Summed Net Benefits DW00
R5-1	$28,547	$1,357	-$65,843	$13,267	$80,467	$435,289	$20,698	3.888	$59,768	
R5-2	$32,644	$1,552	-$45,737	$12,035	$59,324	$380,502	$18,093	3.279	$41,231	
R5-3	$33,389	$1,588	-$23,776	$10,917	$36,281	$339,095	$16,124	2.250	$20,157	
R5-4	$28,153	$1,339	-$5,084	$12,065	$18,488	$330,158	$15,699	1.178	$2,789	
R5-5	$100,252	$4,767	$10,142	$8,641	$13,408	$260,402	$12,382	1.083	$1,026	
R5-6	$3,224,682	$153,337	-$10,350	$17,186	$180,873	$911,755	$43,355	4.172	$137,518	
R5-7	$4,372,101	$207,898	-$15,952	$17,083	$240,932	$905,590	$43,062	5.595	$197,870	
R5-8	$1,928,218	$91,689	-$10,377	$16,855	$118,921	$896,122	$42,611	2.791	$76,309	
R5-9	$49,174	$2,338	-$7,078	$10,125	$19,541	$364,118	$17,314	1.129	$2,227	
R5-10	$55,733	$2,650	-$8,738	$10,268	$21,656	$333,174	$15,843	1.367	$5,813	
R5-11	$215,229	$10,234	-$9,588	$10,496	$30,319	$368,517	$17,523	1.730	$12,795	
R5-12	$64,935	$3,088	-$9,121	$10,424	$22,633	$310,603	$14,769	1.532	$7,864	
R5-13	$130,073	$6,185	-$9,535	$10,403	$26,123	$392,444	$18,661	1.400	$7,462	
R5-14	$72,686	$3,456	-$8,691	$10,083	$22,231	$357,647	$17,006	1.307	$5,224	
R5-15	$63,395	$3,014	-$11,925	$10,730	$25,670	$371,512	$17,666	1.453	$8,004	
R5-16	$220,428	$10,482	-$11,884	$10,950	$33,316	$358,687	$17,056	1.953	$16,260	
R5-17	$26,962	$1,282	-$7,819	$2,956	$12,057	$233,169	$11,087	1.087	$969	
R5-18	$107,934	$5,132	-$11,759	$10,445	$27,336	$162,674	$7,735	3.534	$19,601	
R5-19	$147,232	$7,001	-$3,184	$3,047	$13,233	$219,156	$10,421	1.270	$2,811	
R5-20	$44,560	$2,119	$1,142	$9,036	$11,155	$271,148	$12,893	0.865	-$1,738	
R5-21	$54,067	$2,571	$202	$9,963	$12,534	$289,990	$13,789	0.909	-$1,255	**$622,705**
R5-22	$0	$0	-$1,853	$0	$0	$0	$0	0.000	$0	
R5-23	$0	$0	-$699	$0	$0	$0	$0	0.000	$0	
R5-24	$0	$0	-$4,659	$0	$0	$0	$0	0.000	$0	
R5-25	$0	$0	-$11,704	$0	$0	$0	$0	0.000	$0	
R5-26	$0	$0	-$9,313	$0	$0	$0	$0	0.000	$0	
R5-27	$0	$0	-$8,897	$0	$0	$0	$0	0.000	$0	
R5-28	$0	$0	-$10,193	$0	$0	$0	$0	0.000	$0	
R5-29	$0	$0	-$34,189	$0	$0	$0	$0	0.000	$0	
R5-30	$40,237	$1,913	-$31,024	$10,827	$43,764	$367,222	$17,462	2.506	$26,302	
R5-31	$316,946	$15,071	-$31,703	$10,722	$57,496	$385,074	$18,311	3.140	$39,185	
R5-32	$1,736,474	$82,571	-$52,553	$17,647	$152,771	$922,089	$43,846	3.484	$108,925	
R5-33	$713,989	$33,951	-$51,765	$18,446	$104,162	$933,718	$44,399	2.346	$59,763	
R5-34	$291,574	$13,865	-$41,227	$18,079	$73,170	$933,207	$44,375	1.649	$28,795	
R5-35	$426,201	$20,266	-$40,514	$17,448	$78,228	$887,506	$42,202	1.854	$36,026	
R5-36	$4,116,646	$195,751	-$45,746	$16,745	$258,241	$926,362	$44,049	5.863	$214,192	
R5-37	$313,694	$14,916	-$71,304	$19,309	$105,529	$973,843	$46,307	2.279	$59,222	
R5-38	$677,501	$32,216	-$85,107	$21,213	$138,536	$1,150,877	$54,725	2.531	$83,810	
R5-39	$133,767	$6,361	-$88,452	$20,024	$114,838	$957,806	$45,545	2.521	$69,293	
R5-40	$8,089	$385	-$47,885	$11,375	$59,645	$359,529	$17,096	3.489	$42,549	
R5-41	$23,257	$1,106	-$41,980	$11,011	$54,097	$359,413	$17,090	3.165	$37,006	
R5-42	$9,355	$445	-$28,454	$10,512	$39,411	$345,235	$16,416	2.401	$22,995	

TABLE B-51 (CONTINUED)
OPTIMIZED BERM WIDTH – NO ADDED DUNE WIDTH

Reach	Damage Reduction DW00	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW00	Summed Net Benefits DW00
R5-43	$15,851	$754	-$16,135	$9,713	$26,602	$290,822	$13,829	1.924	$12,773	
R5-44	-$5,731	-$273	-$2,976	$9,075	$11,779	$272,058	$12,937	0.910	-$1,158	
R5-45	-$25,142	-$1,196	$3,051	$8,380	$7,184	$252,172	$11,991	0.599	-$4,807	
R5-46	$183,046	$8,704	$10,715	$8,307	$17,011	$264,720	$12,588	1.351	$4,423	
R5-47	$394,981	$18,782	$1,211	$8,628	$27,410	$320,987	$15,263	1.796	$12,146	
R5-48	$3,159	$150	$334	$2,950	$3,100	$197,382	$9,386	0.330	-$6,285	
R5-49	-$7,508	-$357	-$4,633	$3,115	$7,390	$299,078	$14,221	0.520	-$6,831	
R5-50	$3,059	$145	-$6,629	$3,149	$9,923	$17,717	$842	11.779	$9,081	
R5-51	$14,052	$668	-$9,926	$3,288	$13,882	$294,107	$13,985	0.993	-$103	**$847,304**

TABLE B-52
OPTIMIZED BERM WIDTH – 10 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW10	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW10	Summed Net Benefits DW10
R1-1	$26,440	$1,257	$22,628	$1,659	$2,916	$1,093,581	$52,001	0.056	-$49,085	
R1-2	$49,159	$2,338	$21,746	$760	$3,097	$1,028,476	$48,905	0.063	-$45,808	
R1-3	$52,516	$2,497	$16,531	$861	$3,358	$954,802	$45,402	0.074	-$42,044	
R1-4	$17,581	$836	$12,262	$947	$1,783	$960,314	$45,664	0.039	-$43,881	
R1-5	$14,089	$670	$10,066	$1,097	$1,767	$999,252	$47,515	0.037	-$45,748	
R1-6	$34,475	$1,639	$3,040	$1,220	$2,859	$1,120,972	$53,303	0.054	-$50,444	
R1-7	$67,234	$3,197	$271	$1,260	$4,457	$1,092,591	$51,954	0.086	-$47,497	
R1-8	$34,319	$1,632	$732	$1,321	$2,953	$1,135,924	$54,014	0.055	-$51,062	
R1-9	$43,779	$2,082	$1,125	$1,261	$3,343	$1,067,820	$50,776	0.066	-$47,433	
R1-10	$29,995	$1,426	$2,792	$1,128	$2,555	$950,394	$45,192	0.057	-$42,638	
R1-11	$2,375,937	$112,978	$3,707	$1,198	$114,176	$1,046,053	$49,741	2.295	$64,435	
R1-12	$192,388	$9,148	$1,807	$1,275	$10,424	$1,141,243	$54,267	0.192	-$43,844	
R1-13	$2,893,878	$137,607	-$31	$1,351	$138,989	$1,074,718	$51,104	2.720	$87,885	
R1-14	$2,802,156	$133,245	-$3,467	$1,642	$138,354	$1,182,862	$56,246	2.460	$82,108	
R1-15	$2,594,956	$123,393	-$4,550	$2,177	$130,121	$823,993	$39,182	3.321	$90,939	
R1-16	$1,727,363	$82,138	-$5,362	$2,224	$89,723	$862,881	$41,031	2.187	$48,693	
R1-17	$80,973	$3,850	-$5,465	$2,412	$11,728	$893,116	$42,469	0.276	-$30,741	$330,215
R1-18	$139,801	$6,648	-$6,187	$2,458	$15,292	$908,943	$43,221	0.354	-$27,929	

TABLE B-52 (CONTINUED)
OPTIMIZED BERM WIDTH – 10 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW10	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW10	Summed Net Benefits DW10
R1-19	$102,174	$4,858	-$3,233	$2,285	$10,377	$908,084	$43,180	0.240	-$32,803	
R1-20	$115,838	$5,508	$2,311	$2,006	$7,514	$805,427	$38,299	0.196	-$30,785	
R1-21	$53,711	$2,554	$3,589	$1,095	$3,649	$1,030,529	$49,003	0.074	-$45,354	
R1-22	$63,455	$3,017	$8,653	$1,035	$4,052	$1,011,988	$48,121	0.084	-$44,069	
R1-23	$35,235	$1,675	$14,399	$1,013	$2,688	$1,074,825	$51,109	0.053	-$48,421	
R1-24	$163,796	$7,789	$16,204	$866	$8,654	$987,550	$46,959	0.184	-$38,305	
R2-1	$0	$0	$13,063	$598	$598	$0	$0	$ -	$0	
R2-2	$0	$0	$4,236	$0	$0	$0	$0	$ -	$0	
R2-3	$0	$0	$11,959	$0	$0	$0	$0	$ -	$0	
R2-4	$0	$0	$9,353	$0	$0	$0	$0	$ -	$0	
R2-5	$0	$0	$3,573	$0	$0	$0	$0	$ -	$0	
R2-6	$0	$0	-$83,044	$0	$83,044	$0	$0	$ -	$0	
R2-7	$0	$0	$7,141	$0	$0	$0	$0	$ -	$0	
R3-1	$177,922	$8,460	$5,891	$24,947	$33,408	$1,462,820	$69,559	0.480	-$36,151	
R3-2	$2,002,561	$95,224	$5,627	$23,658	$118,882	$1,242,625	$59,088	2.012	$59,794	
R3-3	$294,588	$14,008	$5,906	$24,046	$38,054	$1,181,366	$56,175	0.677	-$18,121	
R3-4	$17,007	$809	$8,487	$4,945	$5,754	$437,513	$20,804	0.277	-$15,050	
R3-5	$248,251	$11,805	$6,688	$5,603	$17,408	$553,079	$26,299	0.662	-$8,892	
R3-6	$89,741	$4,267	$4,474	$6,233	$10,501	$623,339	$29,640	0.354	-$19,140	
R3-7	$138,507	$6,586	$703	$6,395	$12,982	$627,010	$29,815	0.435	-$16,833	
R3-8	$143,276	$6,813	-$9,617	$26,457	$42,888	$1,298,951	$61,766	0.694	-$18,879	
R3-9	$617,467	$29,361	-$9,884	$25,180	$64,425	$1,292,794	$61,474	1.048	$2,952	
R3-10	$2,220,756	$105,599	-$12,203	$25,793	$143,596	$1,351,515	$64,266	2.234	$79,330	
R3-11	$761,321	$36,202	-$13,222	$25,306	$74,729	$1,307,998	$62,197	1.201	$12,532	
R3-12	$1,156,397	$54,988	-$21,956	$24,329	$101,272	$1,265,086	$60,156	1.683	$41,116	
R3-13	$1,150,851	$54,724	-$25,401	$24,457	$104,582	$1,249,851	$59,432	1.760	$45,150	
R3-14	$1,771,935	$84,257	-$44,459	$33,306	$162,022	$1,827,405	$86,895	1.865	$75,127	
R3-15	$71,684	$3,409	-$38,631	$26,435	$68,474	$1,397,560	$66,455	1.030	$2,019	
R3-16	$28,074	$1,335	-$30,464	$18,467	$50,266	$977,658	$46,489	1.081	$3,778	
R3-17	$149,792	$7,123	-$47,442	$25,790	$80,355	$1,402,687	$66,699	1.205	$13,656	
R3-18	$363,284	$17,275	-$49,993	$26,381	$93,648	$1,480,541	$70,401	1.330	$23,247	
R3-19	$1,504,492	$71,540	-$46,980	$26,271	$144,791	$1,414,296	$67,251	2.153	$77,540	
R3-20	$4,192,109	$199,339	-$46,022	$26,011	$271,372	$1,452,029	$69,045	3.930	$202,326	
R3-21	$1,095,868	$52,110	-$44,965	$26,018	$123,092	$1,487,321	$70,724	1.740	$52,369	
R3-22	$329,407	$15,664	-$39,078	$24,497	$79,239	$1,378,488	$65,548	1.209	$13,690	

TABLE B-52 (CONTINUED)
OPTIMIZED BERM WIDTH – 10 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW10	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW10	Summed Net Benefits DW10
R3-23	$252,654	$12,014	-$30,816	$21,282	$64,112	$1,184,704	$56,334	1.138	$7,778	$615,488
R3-24	$0	$0	-$18,581	$7,322	$25,904	$0	$0	$ -	$0	
R3-25	$0	$0	-$13,979	$7,973	$21,951	$0	$0	$ -	$0	
R3-26	$0	$0	-$7,529	$0	$7,529	$0	$0	$ -	$0	
R4-1	-$21,012	-$999	-$22,733	$26,171	$47,905	$245,679	$11,682	4.101	$36,223	
R4-2	-$122,806	-$5,840	-$17,522	$26,718	$38,400	$342,575	$16,290	2.357	$22,111	$58,334
R4-3	$0	$0	$2,348	$0	$0	$175,936	$8,366	-	-$8,366	
R4-4	$0	$0	$3,860	$0	$0	$91,479	$4,350	-	-$4,350	
R4-5	$1,077,211	$51,222	-$7,878	$23,197	$82,297	$209,879	$9,980	8.246	$72,317	
R4-6	$1,850,336	$87,985	$2,378	$5,399	$93,385	$41,227	$1,960	47.636	$91,424	$163,741
R4-7	$0	$0	-$3,297	$5,986	$9,283	$0	$0	$ -	$0	
R4-8	$0	$0	-$27,507	$0	$27,507	$0	$0	$ -	$0	
R4-9	$0	$0	-$52,376	$0	$52,376	$0	$0	$ -	$0	
R5-1	$84,950	$4,039	-$65,843	$13,267	$83,149	$713,056	$33,907	2.452	$49,242	
R5-2	$57,623	$2,740	-$45,737	$12,036	$60,512	$647,081	$30,769	1.967	$29,743	
R5-3	$376,455	$17,901	-$23,776	$10,917	$52,594	$603,128	$28,679	1.834	$23,915	
R5-4	$45,627	$2,170	-$5,084	$12,065	$19,319	$643,329	$30,591	0.632	-$11,272	
R5-5	$127,442	$6,060	$10,142	$8,641	$14,701	$492,487	$23,418	0.628	-$8,717	
R5-6	$3,312,541	$157,515	-$10,350	$17,186	$185,051	$1,257,820	$59,811	3.094	$125,240	
R5-7	$4,486,827	$213,353	-$15,952	$17,083	$246,388	$1,242,966	$59,104	4.169	$187,283	
R5-8	$2,009,656	$95,561	-$10,377	$16,855	$122,794	$1,219,582	$57,992	2.117	$64,801	
R5-9	$98,195	$4,669	-$7,078	$10,125	$21,872	$615,973	$29,290	0.747	-$7,418	
R5-10	$100,125	$4,761	-$8,738	$10,268	$23,767	$586,293	$27,879	0.853	-$4,112	
R5-11	$251,739	$11,970	-$9,588	$10,496	$32,055	$625,738	$29,754	1.077	$2,300	
R5-12	$123,463	$5,871	-$9,121	$10,424	$25,416	$564,827	$26,858	0.946	-$1,442	
R5-13	$408,697	$19,434	-$9,535	$10,403	$39,372	$647,180	$30,774	1.279	$8,598	
R5-14	$132,942	$6,322	-$8,691	$10,084	$25,096	$608,596	$28,939	0.867	-$3,843	
R5-15	$124,312	$5,911	-$11,925	$10,731	$28,566	$628,575	$29,889	0.956	-$1,323	
R5-16	$217,711	$10,352	-$11,884	$10,950	$33,187	$621,296	$29,543	1.123	$3,644	
R5-17	$70,512	$3,353	-$7,819	$2,956	$14,128	$344,141	$16,364	0.863	-$2,237	
R5-18	$135,727	$6,454	-$11,759	$10,445	$28,658	$595,140	$28,299	1.013	$359	
R5-19	$166,733	$7,928	-$3,184	$3,047	$14,160	$325,160	$15,462	0.916	-$1,302	

TABLE B-52 (CONTINUED)
OPTIMIZED BERM WIDTH – 10 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW10	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW10	Summed Net Benefits DW10
R5-20	$104,648	$4,976	$1,142	$9,036	$14,013	$512,478	$24,369	0.575	-$10,356	
R5-21	$81,619	$3,881	$202	$9,963	$13,844	$555,388	$26,409	0.524	-$12,565	**$430,539**
R5-22	$0	$0	-$1,853	$0	$1,853	$0	$0	$ -	$0	
R5-23	$0	$0	-$699	$0	$699	$0	$0	$ -	$0	
R5-24	$0	$0	-$4,659	$0	$4,659	$0	$0	$ -	$0	
R5-25	$0	$0	-$11,704	$0	$11,704	$0	$0	$ -	$0	
R5-26	$0	$0	-$9,313	$0	$9,313	$0	$0	$ -	$0	
R5-27	$0	$0	-$8,897	$0	$8,897	$0	$0	$ -	$0	
R5-28	$0	$0	-$10,193	$0	$10,193	$0	$0	$ -	$0	
R5-29	$0	$0	-$34,189	$0	$34,189	$0	$0	$ -	$0	
R5-30	$83,019	$3,948	-$31,024	$10,827	$45,799	$627,438	$29,835	1.535	$15,963	
R5-31	$361,948	$17,211	-$31,703	$10,722	$59,636	$643,549	$30,601	1.949	$29,034	
R5-32	$1,934,825	$92,003	-$52,553	$17,647	$162,203	$1,245,685	$59,234	2.738	$102,969	
R5-33	$806,800	$38,364	-$51,765	$18,447	$108,576	$1,268,632	$60,325	1.800	$48,251	
R5-34	$327,300	$15,563	-$41,227	$18,079	$74,869	$1,271,420	$60,457	1.238	$14,412	
R5-35	$473,196	$22,501	-$40,514	$17,448	$80,463	$1,212,663	$57,663	1.395	$22,800	
R5-36	$3,941,642	$187,429	-$45,746	$16,745	$249,920	$1,233,004	$58,631	4.263	$191,289	
R5-37	$340,379	$16,185	-$71,304	$19,309	$106,798	$1,304,941	$62,051	1.721	$44,747	
R5-38	$754,159	$35,861	-$85,107	$21,213	$142,181	$1,506,116	$71,617	1.985	$70,564	
R5-39	$142,335	$6,768	-$88,452	$20,025	$115,245	$1,299,624	$61,798	1.865	$53,447	
R5-40	$13,212	$628	-$47,885	$11,376	$59,889	$623,337	$29,640	2.021	$30,249	
R5-41	$41,435	$1,970	-$41,980	$11,011	$54,961	$620,092	$29,486	1.864	$25,475	
R5-42	$16,598	$789	-$28,454	$10,513	$39,756	$604,228	$28,732	1.384	$11,024	
R5-43	$33,357	$1,586	-$16,135	$9,713	$27,434	$538,230	$25,593	1.072	$1,841	
R5-44	$157,552	$7,492	-$2,976	$9,075	$19,543	$510,440	$24,272	0.805	-$4,729	
R5-45	$756,356	$35,966	$3,051	$8,380	$44,346	$480,652	$22,855	1.940	$21,490	
R5-46	$238,025	$11,318	$10,715	$8,307	$19,625	$490,658	$23,331	0.841	-$3,706	
R5-47	-$285,593	-$13,580	$1,211	$8,628	-$4,952	$247,219	$11,756	(0.421)	-$16,708	
R5-48	$6,644	$316	$334	$2,950	$3,266	$314,980	$14,978	0.218	-$11,711	
R5-49	$178,689	$8,497	-$4,633	$3,115	$16,244	$465,180	$22,120	0.734	-$5,875	
R5-50	$8,676	$413	-$6,629	$3,149	$10,191	$551,821	$26,240	0.388	-$16,049	
R5-51	$83,695	$3,980	-$9,926	$3,288	$17,194	$450,823	$21,437	0.802	-$4,243	$620,533

TABLE B-53
OPTIMIZED BERM WIDTH – 20 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW20	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW20	Summed Net Benefits DW20
R1-1	$27,980	$1,330	$22,628	$646	$1,976	$1,417,319	$67,395	0.029	-$65,419	
R1-2	$49,220	$2,340	$21,746	$760	$3,100	$1,338,060	$63,626	0.049	-$60,526	
R1-3	$53,244	$2,532	$16,531	$861	$3,392	$1,249,540	$59,417	0.057	-$56,025	
R1-4	$17,630	$838	$12,262	$947	$1,785	$1,242,814	$59,097	0.030	-$57,312	
R1-5	$14,194	$675	$10,066	$1,097	$1,772	$1,298,303	$61,736	0.029	-$59,964	
R1-6	$34,534	$1,642	$3,040	$1,220	$2,862	$1,415,470	$67,307	0.043	-$64,445	
R1-7	$67,280	$3,199	$271	$1,260	$4,459	$1,374,242	$65,347	0.068	-$60,887	
R1-8	$34,303	$1,631	$732	$1,321	$2,952	$1,433,949	$68,186	0.043	-$65,234	
R1-9	$46,163	$2,195	$1,125	$1,261	$3,457	$1,352,355	$64,306	0.054	-$60,849	
R1-10	$31,880	$1,516	$2,792	$1,128	$2,644	$1,219,726	$57,999	0.046	-$55,355	
R1-11	$2,669,471	$126,936	$3,707	$1,198	$128,134	$1,332,714	$63,372	2.022	$64,762	
R1-12	$192,771	$9,166	$1,807	$1,275	$10,442	$1,437,794	$68,369	0.153	-$57,927	
R1-13	$2,896,636	$137,738	-$31	$1,351	$139,120	$1,366,592	$64,983	2.141	$74,137	
R1-14	$2,805,319	$133,396	-$3,467	$1,642	$138,504	$1,475,949	$70,183	1.973	$68,322	
R1-15	$3,461,218	$164,584	-$4,550	$2,177	$171,312	$1,089,928	$51,827	3.305	$119,485	
R1-16	$2,191,508	$104,208	-$5,362	$2,224	$111,794	$1,133,670	$53,907	2.074	$57,887	
R1-17	$81,805	$3,890	-$5,465	$2,412	$11,767	$1,186,113	$56,401	0.209	-$44,634	**$326,666**
R1-18	$140,865	$6,698	-$6,187	$2,458	$15,342	$1,207,197	$57,403	0.267	-$42,061	
R1-19	$104,693	$4,978	-$3,233	$2,285	$10,497	$1,186,587	$56,423	0.186	-$45,926	
R1-20	$91,942	$4,372	$2,311	$2,006	$6,378	$240,270	$11,425	0.558	-$5,048	
R1-21	$53,711	$2,554	$3,589	$1,095	$3,649	$1,294,685	$61,564	0.059	-$57,914	
R1-22	$65,519	$3,115	$8,653	$1,035	$4,150	$1,298,117	$61,727	0.067	-$57,576	
R1-23	$35,259	$1,677	$14,399	$1,013	$2,690	$1,376,251	$65,442	0.041	-$62,753	
R1-24	$164,180	$7,807	$16,204	$866	$8,673	$1,276,311	$60,690	0.143	-$52,017	
R2-1	$0	$0	$13,063	$598	$598	$0	$0	$ -	$0	
R2-2	$0	$0	$4,236	$0	$0	$0	$0	$ -	$0	
R2-3	$0	$0	$11,959	$0	$0	$0	$0	$ -	$0	
R2-4	$0	$0	$9,353	$0	$0	$0	$0	$ -	$0	
R2-5	$0	$0	$3,573	$0	$0	$0	$0	$ -	$0	
R2-6	$0	$0	-$83,044	$0	$83,044	$0	$0	$ -	$0	
R2-7	$0	$0	$7,141	$0	$0	$0	$0	$ -	$0	
R3-1	$208,887	$9,933	$5,891	$24,947	$34,880	$1,763,852	$83,873	0.416	-$48,993	
R3-2	$2,409,584	$114,578	$5,627	$23,658	$138,236	$1,505,664	$71,596	1.931	$66,640	
R3-3	$349,155	$16,603	$5,906	$24,046	$40,649	$1,453,579	$69,119	0.588	-$28,470	
R3-4	$17,353	$825	$8,487	$4,945	$5,770	$711,435	$33,829	0.171	-$28,059	
R3-5	$252,656	$12,014	$6,688	$5,603	$17,617	$852,962	$40,559	0.434	-$22,942	
R3-6	$94,574	$4,497	$4,474	$6,233	$10,730	$940,961	$44,744	0.240	-$34,013	
R3-7	$140,222	$6,668	$703	$6,395	$13,063	$941,171	$44,754	0.292	-$31,691	
R3-8	$205,512	$9,772	-$9,617	$26,457	$45,847	$1,585,621	$75,398	0.608	-$29,551	
R3-9	$758,155	$36,051	-$9,884	$25,180	$71,115	$1,571,916	$74,746	0.951	-$3,631	
R3-10	$3,481,788	$165,562	-$12,203	$25,793	$203,559	$1,631,281	$77,569	2.624	$125,990	
R3-11	$993,154	$47,225	-$13,222	$25,306	$85,753	$1,586,476	$75,439	1.137	$10,314	
R3-12	$1,921,570	$91,373	-$21,956	$24,329	$137,657	$1,532,643	$72,879	1.889	$64,778	
R3-13	$1,183,206	$56,263	-$25,401	$24,457	$106,120	$1,512,571	$71,924	1.475	$34,196	
R3-14	$1,970,212	$93,686	-$44,459	$33,306	$171,451	$2,189,298	$104,103	1.647	$67,347	
R3-15	$71,684	$3,409	-$38,631	$26,435	$68,474	$1,678,647	$79,821	0.858	-$11,347	
R3-16	$28,074	$1,335	-$30,464	$18,467	$50,266	$1,172,519	$55,754	0.902	-$5,488	

TABLE B-53 (CONTINUED)
OPTIMIZED BERM WIDTH – 20 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW20	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW20	Summed Net Benefits DW20
R3-17	$181,481	$8,630	-$47,442	$25,790	$81,862	$1,673,978	$79,599	1.028	$2,263	
R3-18	$456,492	$21,707	-$49,993	$26,381	$98,080	$1,757,530	$83,572	1.174	$14,508	
R3-19	$1,528,670	$72,690	-$46,980	$26,271	$145,940	$1,691,568	$80,436	1.814	$65,505	
R3-20	$4,643,380	$220,797	-$46,022	$26,011	$292,830	$1,728,797	$82,206	3.562	$210,624	
R3-21	$1,400,046	$66,574	-$44,965	$26,018	$137,556	$1,765,395	$83,946	1.639	$53,610	
R3-22	$417,501	$19,853	-$39,078	$24,497	$83,428	$1,642,616	$78,108	1.068	$5,320	
R3-23	$314,983	$14,978	-$30,816	$21,282	$67,076	$1,414,807	$67,275	0.997	-$200	$525,703
R3-24	$0	$0	-$18,581	$7,322	$25,904	$0	$0	$ -	$0	
R3-25	$0	$0	-$13,979	$7,973	$21,951	$0	$0	$ -	$0	
R3-26	$0	$0	-$7,529	$0	$7,529	$0	$0	$ -	$0	
R4-1	-$11,245	-$535	-$22,733	$26,171	$48,370	$312,455	$14,858	3.256	$33,512	
R4-2	-$113,998	-$5,421	-$17,522	$26,718	$38,819	$413,011	$19,639	1.977	$19,180	$52,692
R4-3	$0	$0	$2,348	$0	$0	$213,448	$10,150	-	-$10,150	
R4-4	$0	$0	$3,860	$0	$0	$126,787	$6,029	-	-$6,029	
R4-5	$1,079,036	$51,309	-$7,878	$23,197	$82,384	$266,759	$12,685	6.495	$69,699	
R4-6	$1,850,336	$87,985	$2,378	$5,399	$93,385	$64,677	$3,075	30.365	$90,309	$160,008
R4-7	$0	$0	-$3,297	$5,986	$9,283	$0	$0	$ -	$0	
R4-8	$0	$0	-$27,507	$0	$27,507	$0	$0	$ -	$0	
R4-9	$0	$0	-$52,376	$0	$52,376	$0	$0	$ -	$0	
R5-1	$89,008	$4,232	-$65,843	$13,267	$83,342	$993,899	$47,261	1.763	$36,081	
R5-2	$58,491	$2,781	-$45,737	$12,036	$60,554	$928,665	$44,159	1.371	$16,395	
R5-3	$376,433	$17,900	-$23,776	$10,917	$52,593	$893,959	$42,509	1.237	$10,085	
R5-4	$46,797	$2,225	-$5,084	$12,065	$19,375	$1,007,036	$47,886	0.405	-$28,511	
R5-5	$130,998	$6,229	$10,142	$8,641	$14,870	$774,082	$36,808	0.404	-$21,938	
R5-6	$3,380,304	$160,737	-$10,350	$17,186	$188,273	$1,593,353	$75,766	2.485	$112,507	
R5-7	$4,528,238	$215,322	-$15,952	$17,083	$248,357	$1,571,556	$74,729	3.323	$173,628	
R5-8	$2,051,984	$97,574	-$10,377	$16,855	$124,806	$1,532,547	$72,874	1.713	$51,932	
R5-9	$99,714	$4,741	-$7,078	$10,125	$21,944	$900,572	$42,823	0.512	-$20,879	
R5-10	$104,205	$4,955	-$8,738	$10,268	$23,961	$867,429	$41,247	0.581	-$17,286	
R5-11	$237,962	$11,315	-$9,588	$10,496	$31,400	$910,575	$43,299	0.725	-$11,899	
R5-12	$125,965	$5,990	-$9,121	$10,424	$25,535	$848,683	$40,356	0.633	-$14,820	
R5-13	$411,749	$19,579	-$9,535	$10,403	$39,517	$930,104	$44,227	0.893	-$4,710	
R5-14	$135,467	$6,442	-$8,691	$10,084	$25,216	$887,775	$42,215	0.597	-$16,999	
R5-15	$125,861	$5,985	-$11,925	$10,731	$28,640	$909,784	$43,261	0.662	-$14,621	
R5-16	$251,385	$11,954	-$11,884	$10,950	$34,788	$909,322	$43,239	0.805	-$8,451	
R5-17	$71,553	$3,402	-$7,819	$2,956	$14,177	$531,333	$25,265	0.561	-$11,088	
R5-18	$119,286	$5,672	-$11,759	$10,445	$27,876	$451,732	$21,480	1.298	$6,396	
R5-19	$197,669	$9,399	-$3,184	$3,047	$15,631	$519,605	$24,708	0.633	-$9,077	
R5-20	$110,187	$5,240	$1,142	$9,036	$14,276	$798,624	$37,975	0.376	-$23,699	
R5-21	$87,636	$4,167	$202	$9,963	$14,130	$866,094	$41,184	0.343	-$27,053	**$175,992**
R5-22	$0	$0	-$1,853	$0	$1,853	$0	$0	$ -	$0	
R5-23	$0	$0	-$699	$0	$699	$0	$0	$ -	$0	
R5-24	$0	$0	-$4,659	$0	$4,659	$0	$0	$ -	$0	
R5-25	$0	$0	-$11,704	$0	$11,704	$0	$0	$ -	$0	
R5-26	$0	$0	-$9,313	$0	$9,313	$0	$0	$ -	$0	
R5-27	$0	$0	-$8,897	$0	$8,897	$0	$0	$ -	$0	
R5-28	$0	$0	-$10,193	$0	$10,193	$0	$0	$ -	$0	

TABLE B-53 (CONTINUED)
OPTIMIZED BERM WIDTH – 20 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW20	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW20	Summed Net Benefits DW20
R5-29	$0	$0	-$34,189	$0	$34,189	$0	$0	$ -	$0	
R5-30	$87,314	$4,152	-$31,024	$10,827	$46,003	$911,052	$43,321	1.062	$2,681	
R5-31	$362,887	$17,256	-$31,703	$10,722	$59,680	$925,122	$43,990	1.357	$15,690	
R5-32	$2,110,678	$100,365	-$52,553	$17,647	$170,565	$1,554,802	$73,932	2.307	$96,632	
R5-33	$832,606	$39,591	-$51,765	$18,447	$109,803	$1,597,136	$75,945	1.446	$33,857	
R5-34	$336,523	$16,002	-$41,227	$18,079	$75,308	$1,604,235	$76,283	0.987	-$975	
R5-35	$490,293	$23,314	-$40,514	$17,448	$81,276	$1,534,699	$72,976	1.114	$8,300	
R5-36	$4,167,716	$198,179	-$45,746	$16,745	$260,670	$1,534,802	$72,981	3.572	$187,688	
R5-37	$348,726	$16,582	-$71,304	$19,309	$107,195	$1,632,304	$77,618	1.381	$29,577	
R5-38	$777,585	$36,975	-$85,107	$21,213	$143,295	$1,858,566	$88,377	1.621	$54,918	
R5-39	$145,910	$6,938	-$88,452	$20,025	$115,415	$1,623,051	$77,178	1.495	$38,237	
R5-40	$13,244	$630	-$47,885	$11,376	$59,890	$903,780	$42,976	1.394	$16,915	
R5-41	$41,483	$1,973	-$41,980	$11,011	$54,964	$896,665	$42,637	1.289	$12,326	
R5-42	$16,613	$790	-$28,454	$10,513	$39,756	$887,569	$42,205	0.942	-$2,448	
R5-43	$33,370	$1,587	-$16,135	$9,713	$27,435	$816,019	$38,802	0.707	-$11,368	
R5-44	$157,552	$7,492	-$2,976	$9,075	$19,543	$786,707	$37,409	0.522	-$17,866	
R5-45	$756,356	$35,966	$3,051	$8,380	$44,346	$748,279	$35,581	1.246	$8,764	
R5-46	$259,633	$12,346	$10,715	$8,307	$20,653	$764,609	$36,358	0.568	-$15,705	
R5-47	$453,840	$21,581	$1,211	$8,628	$30,209	$852,338	$40,530	0.745	-$10,321	
R5-48	$7,293	$347	$334	$2,950	$3,297	$512,971	$24,392	0.135	-$21,095	
R5-49	$178,689	$8,497	-$4,633	$3,115	$16,244	$686,751	$32,656	0.497	-$16,411	
R5-50	$7,867	$374	-$6,629	$3,149	$10,152	$775,706	$36,886	0.275	-$26,733	
R5-51	$84,237	$4,006	-$9,926	$3,288	$17,220	$675,405	$32,116	0.536	-$14,897	**$367,768**

TABLE B-54
OPTIMIZED BERM WIDTH – 30 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW30	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW30	Summed Net Benefits DW30
R1-1	$11,501	$547	$22,628	$646	$1,193	$1,522,275	$72,386	0.016	-$71,193	
R1-2	$10,254	$488	$21,746	$760	$1,247	$1,440,805	$68,512	0.018	-$67,264	
R1-3	$17,004	$809	$16,531	$861	$1,669	$1,346,456	$64,025	0.026	-$62,356	
R1-4	$17,593	$837	$12,262	$947	$1,783	$1,333,467	$63,408	0.028	-$61,624	
R1-5	$7,189	$342	$10,066	$1,097	$1,439	$1,391,941	$66,188	0.022	-$64,749	
R1-6	$16,490	$784	$3,040	$1,220	$2,004	$1,498,667	$71,263	0.028	-$69,259	
R1-7	$26,440	$1,257	$271	$1,260	$2,517	$1,450,241	$68,960	0.037	-$66,443	
R1-8	$18,457	$878	$732	$1,321	$2,198	$1,515,263	$72,052	0.031	-$69,854	
R1-9	$35,807	$1,703	$1,125	$1,261	$2,964	$1,431,202	$68,055	0.044	-$65,091	
R1-10	$22,931	$1,090	$2,792	$1,128	$2,219	$1,297,438	$61,694	0.036	-$59,476	
R1-11	$2,659,517	$126,463	$3,707	$1,198	$127,660	$1,417,532	$67,405	1.894	$60,255	
R1-12	$123,289	$5,863	$1,807	$1,275	$7,138	$1,524,599	$72,496	0.098	-$65,358	
R1-13	$2,834,338	$134,776	-$31	$1,351	$136,157	$1,451,695	$69,030	1.972	$67,128	
R1-14	$2,798,976	$133,094	-$3,467	$1,642	$138,203	$1,545,167	$73,474	1.881	$64,729	
R1-15	$3,838,772	$182,537	-$4,550	$2,177	$189,265	$1,151,418	$54,751	3.457	$134,514	
R1-16	$2,294,935	$109,126	-$5,362	$2,224	$116,712	$1,201,735	$57,144	2.042	$59,568	
R1-17	$40,409	$1,921	-$5,465	$2,412	$9,799	$1,263,497	$60,081	0.163	-$50,282	**$320,836**
R1-18	$84,027	$3,996	-$6,187	$2,458	$12,640	$1,284,458	$61,077	0.207	-$48,437	
R1-19	$71,581	$3,404	-$3,233	$2,285	$8,923	$1,257,326	$59,787	0.149	-$50,865	
R1-20	$79,631	$3,787	$2,311	$2,006	$5,792	$1,122,553	$53,378	0.109	-$47,586	
R1-21	$963	$46	$3,589	$1,095	$1,141	$1,359,991	$64,669	0.018	-$63,528	
R1-22	$28,072	$1,335	$8,653	$1,035	$2,370	$1,383,721	$65,797	0.036	-$63,427	
R1-23	$8,969	$426	$14,399	$1,013	$1,439	$1,461,055	$69,475	0.021	-$68,035	
R1-24	$135,454	$6,441	$16,204	$866	$7,307	$1,369,576	$65,125	0.112	-$57,818	
R2-1	$0	$0	$13,063	$598	$598	$0	$0	$ -	$0	
R2-2	$0	$0	$4,236	$0	$0	$0	$0	$ -	$0	
R2-3	$0	$0	$11,959	$0	$0	$0	$0	$ -	$0	
R2-4	$0	$0	$9,353	$0	$0	$0	$0	$ -	$0	
R2-5	$0	$0	$3,573	$0	$0	$0	$0	$ -	$0	
R2-6	$0	$0	-$83,044	$0	$83,044	$0	$0	$ -	$0	
R2-7	$0	$0	$7,141	$0	$0	$0	$0	$ -	$0	
R3-1	$210,031	$9,987	$5,891	$24,947	$34,934	$1,812,616	$86,192	0.405	-$51,257	
R3-2	$2,549,759	$121,244	$5,627	$23,658	$144,902	$1,569,252	$74,619	1.942	$70,282	
R3-3	$343,083	$16,314	$5,906	$24,046	$40,360	$1,525,766	$72,552	0.556	-$32,192	
R3-4	$9,270	$441	$8,487	$4,945	$5,386	$833,654	$39,641	0.136	-$34,255	

TABLE B-54 (CONTINUED)
OPTIMIZED BERM WIDTH – 30 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW30	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW30	Summed Net Benefits DW30
R3-5	$55,342	$2,632	$6,688	$5,603	$8,235	$984,495	$46,814	0.176	-$38,579	
R3-6	$62,337	$2,964	$4,474	$6,233	$9,198	$1,076,646	$51,196	0.180	-$41,998	
R3-7	$46,542	$2,213	$703	$6,395	$8,609	$1,067,547	$50,763	0.170	-$42,154	
R3-8	$169,099	$8,041	-$9,617	$26,457	$44,116	$1,654,181	$78,658	0.561	-$34,542	
R3-9	$719,242	$34,201	-$9,884	$25,180	$69,265	$1,636,120	$77,799	0.890	-$8,534	
R3-10	$4,296,347	$204,296	-$12,203	$25,793	$242,292	$1,691,388	$80,427	3.013	$161,865	
R3-11	$1,049,678	$49,913	-$13,222	$25,306	$88,441	$1,641,532	$78,056	1.133	$10,384	
R3-12	$2,430,196	$115,558	-$21,956	$24,329	$161,843	$1,586,018	$75,417	2.146	$86,426	
R3-13	$1,171,493	$55,706	-$25,401	$24,457	$105,564	$1,564,251	$74,382	1.419	$31,182	
R3-14	$1,790,465	$85,138	-$44,459	$33,306	$162,903	$2,246,256	$106,812	1.525	$56,092	
R3-15	$25,013	$1,189	-$38,631	$26,435	$66,255	$1,727,551	$82,147	0.807	-$15,892	
R3-16	$5,706	$271	-$30,464	$18,467	$49,203	$1,200,159	$57,069	0.862	-$7,866	
R3-17	$174,047	$8,276	-$47,442	$25,790	$81,508	$1,709,505	$81,289	1.003	$220	
R3-18	$436,849	$20,773	-$49,993	$26,381	$97,146	$1,794,370	$85,324	1.139	$11,822	
R3-19	$1,527,392	$72,629	-$46,980	$26,271	$145,880	$1,729,073	$82,219	1.774	$63,661	
R3-20	$4,800,326	$228,260	-$46,022	$26,011	$300,293	$1,763,809	$83,871	3.580	$216,422	
R3-21	$1,420,738	$67,558	-$44,965	$26,018	$138,540	$1,801,358	$85,656	1.617	$52,884	
R3-22	$420,524	$19,996	-$39,078	$24,497	$83,571	$1,677,869	$79,784	1.047	$3,787	
R3-23	$304,369	$14,473	-$30,816	$21,282	$66,571	$1,451,311	$69,011	0.965	-$2,440	$506,573
R3-24	$0	$0	-$18,581	$7,322	$25,904	$0	$0	$ -	$0	
R3-25	$0	$0	-$13,979	$7,973	$21,951	$0	$0	$ -	$0	
R3-26	$0	$0	-$7,529	$0	$7,529	$0	$0	$ -	$0	
R4-1			-$22,733	$26,171	$48,904					
R4-2	-$130,192	-$6,191	-$17,522	$26,718	$38,049	$440,125	$20,928	1.818	$17,121	
R4-3	$0	$0	$2,348	$0	$0	$239,742	$11,400	-	-$11,400	$5,721
R4-4	$0	$0	$3,860	$0	$0	$150,944	$7,178	-	-$7,178	
R4-5	-$18,332	-$872	-$7,878	$23,197	$30,203	$299,381	$14,236	2.122	$15,967	
R4-6	-$24,942	-$1,186	$2,378	$5,399	$4,213	$93,950	$4,467	0.943	-$254	$15,713
R4-7	$0	$0	-$3,297	$5,986	$9,283	$0	$0	$ -	$0	
R4-8	$0	$0	-$27,507	$0	$27,507	$0	$0	$ -	$0	
R4-9	$0	$0	-$52,376	$0	$52,376	$0	$0	$ -	$0	
R5-1	$65,042	$3,093	-$65,843	$13,267	$82,202	$1,110,458	$52,803	1.557	$29,399	
R5-2	$30,922	$1,470	-$45,737	$12,036	$59,243	$1,056,960	$50,260	1.179	$8,983	
R5-3	$22,336	$1,062	-$23,776	$10,917	$35,756	$1,036,890	$49,305	0.725	-$13,549	
R5-4	$26,425	$1,257	-$5,084	$12,065	$18,406	$1,196,625	$56,901	0.323	-$38,495	

TABLE B-54 (CONTINUED)
OPTIMIZED BERM WIDTH – 30 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW30	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW30	Summed Net Benefits DW30
R5-5	$96,490	$4,588	$10,142	$8,641	$13,229	$927,103	$44,085	0.300	-$30,855	
R5-6	$3,335,466	$158,605	-$10,350	$17,186	$186,141	$1,689,746	$80,349	2.317	$105,792	
R5-7	$4,458,437	$212,003	-$15,952	$17,083	$245,038	$1,666,685	$79,253	3.092	$165,785	
R5-8	$2,016,728	$95,897	-$10,377	$16,855	$123,130	$1,621,908	$77,123	1.597	$46,007	
R5-9	$40,116	$1,908	-$7,078	$10,125	$19,110	$1,043,589	$49,624	0.385	-$30,514	
R5-10	$48,751	$2,318	-$8,738	$10,268	$21,324	$1,008,641	$47,962	0.445	-$26,638	
R5-11	$154,743	$7,358	-$9,588	$10,496	$27,443	$1,051,715	$50,010	0.549	-$22,567	
R5-12	$52,644	$2,503	-$9,121	$10,424	$22,049	$989,626	$47,058	0.469	-$25,009	
R5-13	$122,049	$5,804	-$9,535	$10,403	$25,742	$1,070,559	$50,906	0.506	-$25,165	
R5-14	$60,975	$2,899	-$8,691	$10,084	$21,674	$1,027,806	$48,873	0.443	-$27,199	
R5-15	$51,966	$2,471	-$11,925	$10,731	$25,126	$1,046,479	$49,761	0.505	-$24,635	
R5-16	$228,916	$10,885	-$11,884	$10,950	$33,720	$1,050,669	$49,960	0.675	-$16,241	
R5-17	$19,614	$933	-$7,819	$2,956	$11,707	$671,888	$31,949	0.366	-$20,241	
R5-18	$114,969	$5,467	-$11,759	$10,445	$27,671	$1,010,005	$48,027	0.576	-$20,356	
R5-19	$164,885	$7,840	-$3,184	$3,047	$14,072	$672,742	$31,990	0.440	-$17,917	
R5-20	$55,043	$2,617	$1,142	$9,036	$11,654	$951,767	$45,257	0.257	-$33,604	
R5-21	$47,328	$2,250	$202	$9,963	$12,214	$1,032,518	$49,097	0.249	-$36,883	**$16,584**
R5-22	$0	$0	-$1,853	$0	$1,853	$0	$0	$ -	$0	
R5-23	$0	$0	-$699	$0	$699	$0	$0	$ -	$0	
R5-24	$0	$0	-$4,659	$0	$4,659	$0	$0	$ -	$0	
R5-25	$0	$0	-$11,704	$0	$11,704	$0	$0	$ -	$0	
R5-26	$0	$0	-$9,313	$0	$9,313	$0	$0	$ -	$0	
R5-27	$0	$0	-$8,897	$0	$8,897	$0	$0	$ -	$0	
R5-28	$0	$0	-$10,193	$0	$10,193	$0	$0	$ -	$0	
R5-29	$0	$0	-$34,189	$0	$34,189	$0	$0	$ -	$0	
R5-30	$50,301	$2,392	-$31,024	$10,827	$44,243	$1,050,897	$49,971	0.885	-$5,728	
R5-31	$307,935	$14,643	-$31,703	$10,722	$57,067	$1,063,438	$50,568	1.129	$6,500	
R5-32	$1,969,176	$93,636	-$52,553	$17,647	$163,836	$1,641,498	$78,055	2.099	$85,781	
R5-33	$748,613	$35,597	-$51,765	$18,447	$105,809	$1,681,725	$79,968	1.323	$25,841	
R5-34	$302,561	$14,387	-$41,227	$18,079	$73,693	$1,690,822	$80,400	0.917	-$6,708	
R5-35	$442,419	$21,037	-$40,514	$17,448	$78,999	$1,620,643	$77,063	1.025	$1,936	
R5-36	$4,158,831	$197,757	-$45,746	$16,745	$260,247	$1,615,725	$76,829	3.387	$183,418	
R5-37	$320,099	$15,221	-$71,304	$19,309	$105,834	$1,711,560	$81,386	1.300	$24,447	
R5-38	$699,372	$33,256	-$85,107	$21,213	$139,576	$1,946,362	$92,551	1.508	$47,025	
R5-39	$137,642	$6,545	-$88,452	$20,025	$115,022	$1,703,368	$80,997	1.420	$34,025	

TABLE B-54 (CONTINUED)
OPTIMIZED BERM WIDTH – 30 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW30	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW30	Summed Net Benefits DW30
R5-40	$7,160	$340	-$47,885	$11,376	$59,601	$1,033,144	$49,127	1.213	$10,474	
R5-41	$18,545	$882	-$41,980	$11,011	$53,873	$1,028,757	$48,918	1.101	$4,954	
R5-42	$6,844	$325	-$28,454	$10,513	$39,292	$1,026,267	$48,800	0.805	-$9,508	
R5-43	$11,178	$532	-$16,135	$9,713	$26,380	$956,378	$45,477	0.580	-$19,097	
R5-44	-$5,731	-$273	-$2,976	$9,075	$11,779	$931,602	$44,299	0.266	-$32,520	
R5-45	-$20,906	-$994	$3,051	$8,380	$7,386	$889,630	$42,303	0.175	-$34,917	
R5-46	$162,751	$7,739	$10,715	$8,307	$16,046	$910,725	$43,306	0.371	-$27,260	
R5-47	$386,800	$18,393	$1,211	$8,628	$27,021	$620,858	$29,522	0.915	-$2,502	
R5-48	$2,886	$137	$334	$2,950	$3,087	$666,610	$31,698	0.097	-$28,611	
R5-49	-$7,508	-$357	-$4,633	$3,115	$7,391	$817,214	$38,859	0.190	-$31,469	
R5-50	-$1,637	-$78	-$6,629	$3,149	$9,700	$892,448	$42,437	0.229	-$32,736	
R5-51	$15,569	$740	-$9,926	$3,288	$13,954	$810,140	$38,523	0.362	-$24,569	**$168,779**

TABLE B-55
OPTIMIZED BERM WIDTH – 40 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW40	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW40	Summed Net Benefits DW40
R1-1	$23,090	$1,098	$22,628	$1,658	$2,756	$2,060,250	$97,967	0.028	-$95,211	
R1-2	$18,067	$859	$21,746	$760	$1,619	$1,955,573	$92,989	0.017	-$91,371	
R1-3	$28,093	$1,336	$16,531	$860	$2,196	$1,834,152	$87,216	0.025	-$85,020	
R1-4	$20,442	$972	$12,262	$947	$1,919	$1,804,627	$85,812	0.022	-$83,893	
R1-5	$9,138	$435	$10,066	$1,097	$1,531	$1,893,254	$90,026	0.017	-$88,495	
R1-6	$22,998	$1,094	$3,040	$1,220	$2,314	$1,999,827	$95,094	0.024	-$92,780	
R1-7	$33,643	$1,600	$271	$1,260	$2,860	$1,935,231	$92,022	0.031	-$89,163	
R1-8	$21,576	$1,026	$732	$1,320	$2,346	$2,026,988	$96,385	0.024	-$94,039	
R1-9	$43,850	$2,085	$1,125	$1,261	$3,346	$1,918,321	$91,218	0.037	-$87,872	
R1-10	$34,650	$1,648	$2,792	$1,128	$2,776	$1,754,866	$83,446	0.033	-$80,670	
R1-11	$2,738,287	$130,208	$3,707	$1,198	$131,406	$1,902,011	$90,443	1.453	$40,963	
R1-12	$137,166	$6,522	$1,807	$1,275	$7,797	$2,027,074	$96,389	0.081	-$88,592	
R1-13	$2,820,802	$134,132	-$31	$1,351	$135,514	$1,946,909	$92,577	1.464	$42,936	
R1-14	$2,800,613	$133,172	-$3,467	$1,641	$138,280	$2,058,601	$97,889	1.413	$40,392	
R1-15	$4,062,754	$193,188	-$4,550	$2,177	$199,916	$1,552,831	$73,839	2.707	$126,077	

TABLE B-55 (CONTINUED)
OPTIMIZED BERM WIDTH – 40 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW40	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW40	Summed Net Benefits DW40
R1-16	$2,254,822	$107,219	-$5,362	$2,224	$114,804	$1,610,772	$76,594	1.499	$38,211	
R1-17	$48,473	$2,305	-$5,465	$2,412	$10,182	$1,705,260	$81,087	0.126	-$70,905	**$199,987**
R1-18	$108,630	$5,165	-$6,187	$2,457	$13,810	$1,735,040	$82,503	0.167	-$68,693	
R1-19	$93,405	$4,442	-$3,233	$2,285	$9,960	$1,677,852	$79,784	0.125	-$69,823	
R1-20	$109,855	$5,224	$2,311	$2,005	$7,229	$1,503,201	$71,479	0.101	-$64,250	
R1-21	$9,520	$453	$3,589	$1,095	$1,548	$1,817,549	$86,426	0.018	-$84,879	
R1-22	$43,736	$2,080	$8,653	$1,035	$3,114	$1,863,693	$88,620	0.035	-$85,506	
R1-23	$14,130	$672	$14,399	$1,013	$1,685	$1,969,959	$93,673	0.018	-$91,989	
R1-24	$140,276	$6,670	$16,204	$866	$7,536	$1,845,218	$87,742	0.086	-$80,206	
R2-1	$2,412	$0	$13,063	$598	$598	$0	$0	$ -	$0	
R2-2	$0	$0	$4,236	$0	$0	$0	$0	$ -	$0	
R2-3	$0	$0	$11,959	$0	$0	$0	$0	$ -	$0	
R2-4	$0	$0	$9,353	$0	$0	$0	$0	$ -	$0	
R2-5	$0	$0	$3,573	$0	$0	$0	$0	$ -	$0	
R2-6	$0	$0	-$83,044	$0	$83,044	$0	$0	$ -	$0	
R2-7	$0	$0	$7,141	$0	$0	$0	$0	$ -	$0	
R3-1	$221,465	$10,531	$5,891	$24,947	$35,478	$2,384,526	$113,387	0.313	-$77,909	
R3-2	$2,685,250	$127,686	$5,627	$23,658	$151,344	$2,071,302	$98,492	1.537	$52,852	
R3-3	$366,723	$17,438	$5,906	$24,046	$41,484	$2,023,980	$96,242	0.431	-$54,758	
R3-4	$10,968	$522	$8,487	$4,945	$5,466	$1,189,013	$56,539	0.097	-$51,072	
R3-5	$107,028	$5,089	$6,688	$5,603	$10,692	$1,375,035	$65,384	0.164	-$54,692	
R3-6	$115,225	$5,479	$4,474	$6,233	$11,712	$1,493,451	$71,015	0.165	-$59,303	
R3-7	$67,927	$3,230	$703	$6,395	$9,625	$1,479,887	$70,370	0.137	-$60,745	
R3-8	$216,008	$10,271	-$9,617	$26,457	$46,346	$2,192,530	$104,257	0.445	-$57,911	
R3-9	$779,707	$37,076	-$9,884	$25,180	$72,140	$2,152,736	$102,365	0.705	-$30,225	
R3-10	$4,878,109	$231,959	-$12,203	$25,793	$269,955	$2,216,023	$105,374	2.562	$164,581	
R3-11	$1,140,404	$54,227	-$13,222	$25,305	$92,754	$2,157,173	$102,576	0.904	-$9,821	
R3-12	$2,797,284	$133,014	-$21,956	$24,328	$179,298	$2,088,249	$99,298	1.806	$80,000	
R3-13	$1,185,068	$56,351	-$25,401	$24,456	$106,209	$2,069,751	$98,419	1.079	$7,790	
R3-14	$1,888,815	$89,815	-$44,459	$33,306	$167,580	$2,934,560	$139,541	1.201	$28,039	
R3-15	$33,043	$1,571	-$38,631	$26,434	$66,637	$2,267,701	$107,831	0.618	-$41,195	
R3-16	$9,434	$449	-$30,464	$18,467	$49,380	$1,573,874	$74,839	0.660	-$25,459	
R3-17	$189,742	$9,022	-$47,442	$25,790	$82,255	$2,233,793	$106,219	0.774	-$23,965	
R3-18	$479,216	$22,787	-$49,993	$26,381	$99,161	$2,329,256	$110,758	0.895	-$11,598	
R3-19	$1,540,627	$73,258	-$46,980	$26,270	$146,509	$2,260,325	$107,481	1.363	$39,028	

TABLE B-55 (CONTINUED)
OPTIMIZED BERM WIDTH – 40 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW40	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW40	Summed Net Benefits DW40
R3-20	$4,913,751	$233,654	-$46,022	$26,011	$305,686	$2,287,769	$108,786	2.810	$196,901	
R3-21	$1,539,747	$73,217	-$44,965	$26,018	$144,199	$2,326,458	$110,625	1.303	$33,574	
R3-22	$448,633	$21,333	-$39,078	$24,496	$84,908	$2,172,493	$103,304	0.822	-$18,396	
R3-23	$325,922	$15,498	-$30,816	$21,282	$67,596	$1,880,715	$89,430	0.756	-$21,834	$81,788
R3-24	$4,940	$235	-$18,581	$7,322	$26,138	$0	$0	$ -	$0	
R3-25	-$10,198	-$485	-$13,979	$7,972	$21,466	$0	$0	$ -	$0	
R3-26	$0	$0	-$7,529	$0	$7,529	$0	$0	$ -	$0	
R4-1	$38,627	$1,837	-$22,733	$26,171	$50,741	$478,569	$22,756	2.230	$27,984	
R4-2	$145,281	$6,908	-$17,522	$26,718	$51,148	$568,518	$27,034	1.892	$24,114	$52,099
R4-3	$0	$0	$2,348	$0	$0	$328,547	$15,623	-	-$15,623	
R4-4	$0	$0	$3,860	$0	$0	$233,262	$11,092	-	-$11,092	
R4-5	$216,661	$10,302	-$7,878	$23,197	$41,377	$397,997	$18,925	2.186	$22,452	
R4-6	$32,526	$1,547	$2,378	$5,399	$6,946	$171,987	$8,178	0.849	-$1,232	$21,219
R4-7	$0	$0	-$3,297	$5,986	$9,283	$0	$0	$ -	$0	
R4-8	$0	$0	-$27,507	$0	$27,507	$0	$0	$ -	$0	
R4-9	$0	$0	-$52,376	$0	$52,376	$0	$0	$ -	$0	
R5-1	$74,649	$3,550	-$65,843	$13,267	$82,659	$1,549,637	$73,687	1.122	$8,972	
R5-2	$37,561	$1,786	-$45,737	$12,035	$59,558	$1,490,537	$70,877	0.840	-$11,318	
R5-3	$34,275	$1,630	-$23,776	$10,917	$36,323	$1,473,678	$70,075	0.518	-$33,752	
R5-4	$32,992	$1,569	-$5,084	$12,065	$18,718	$1,734,708	$82,487	0.227	-$63,769	
R5-5	$104,462	$4,967	$10,142	$8,641	$13,608	$1,338,038	$63,625	0.214	-$50,017	
R5-6	$3,345,811	$159,097	-$10,350	$17,186	$186,633	$2,260,344	$107,482	1.736	$79,151	
R5-7	$4,471,976	$212,647	-$15,952	$17,083	$245,681	$2,228,398	$105,963	2.319	$139,719	
R5-8	$2,022,516	$96,173	-$10,377	$16,855	$123,405	$2,157,998	$102,615	1.203	$20,790	
R5-9	$50,121	$2,383	-$7,078	$10,125	$19,586	$1,471,028	$69,949	0.280	-$50,363	
R5-10	$63,281	$3,009	-$8,738	$10,268	$22,015	$1,432,063	$68,096	0.323	-$46,081	
R5-11	$169,837	$8,076	-$9,588	$10,496	$28,160	$1,481,172	$70,431	0.400	-$42,271	
R5-12	$71,415	$3,396	-$9,121	$10,424	$22,941	$1,418,258	$67,440	0.340	-$44,498	
R5-13	$128,840	$6,126	-$9,535	$10,403	$26,064	$1,498,215	$71,242	0.366	-$45,177	
R5-14	$78,276	$3,722	-$8,691	$10,083	$22,496	$1,450,069	$68,952	0.326	-$46,456	
R5-15	$65,173	$3,099	-$11,925	$10,730	$25,754	$1,473,184	$70,051	0.368	-$44,297	
R5-16	$232,425	$11,052	-$11,884	$10,950	$33,886	$1,486,229	$70,672	0.479	-$36,785	
R5-17	$35,252	$1,676	-$7,819	$2,956	$12,451	$989,022	$47,029	0.265	-$34,578	
R5-18	$136,495	$6,490	-$11,759	$10,445	$28,694	$1,429,088	$67,955	0.422	-$39,260	
R5-19	$283,773	$13,494	-$3,184	$3,047	$19,725	$1,007,426	$47,904	0.412	-$28,179	

TABLE B-55 (CONTINUED)
OPTIMIZED BERM WIDTH – 40 FEET OF ADDED DUNE WIDTH

Reach	Damage Reduction DW40	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost (Planned Nourishment Plus Crossover Work)	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits DW40	Summed Net Benefits DW40
R5-20	$72,339	$3,440	$1,142	$9,036	$12,476	$1,369,629	$65,127	0.192	-$52,651	
R5-21	$64,889	$3,086	$202	$9,963	$13,049	$1,488,267	$70,769	0.184	-$57,720	**-$478,541**
R5-22	$0	$0	-$1,853	$0	$1,853	$0	$0	$ -	$0	
R5-23	$0	$0	-$699	$0	$699	$0	$0	$ -	$0	
R5-24	$0	$0	-$4,659	$0	$4,659	$0	$0	$ -	$0	
R5-25	$0	$0	-$11,704	$0	$11,704	$0	$0	$ -	$0	
R5-26	$0	$0	-$9,313	$0	$9,313	$0	$0	$ -	$0	
R5-27	$0	$0	-$8,897	$0	$8,897	$0	$0	$ -	$0	
R5-28	$0	$0	-$10,193	$0	$10,193	$0	$0	$ -	$0	
R5-29	$0	$0	-$34,189	$0	$34,189	$0	$0	$ -	$0	
R5-30	$64,882	$3,085	-$31,024	$10,827	$44,936	$1,476,885	$70,227	0.640	-$25,291	
R5-31	$314,708	$14,965	-$31,703	$10,722	$57,389	$1,487,399	$70,727	0.811	-$13,338	
R5-32	$1,994,943	$94,862	-$52,553	$17,647	$165,061	$2,181,877	$103,750	1.591	$61,311	
R5-33	$767,311	$36,486	-$51,765	$18,446	$106,698	$2,245,575	$106,779	0.999	-$82	
R5-34	$308,874	$14,687	-$41,227	$18,079	$73,993	$2,260,091	$107,470	0.688	-$33,477	
R5-35	$457,837	$21,771	-$40,514	$17,448	$79,732	$2,166,464	$103,017	0.774	-$23,285	
R5-36	$4,289,689	$203,979	-$45,746	$16,745	$266,470	$2,131,470	$101,354	2.629	$165,116	
R5-37	$325,896	$15,497	-$71,304	$19,309	$106,109	$2,274,156	$108,138	0.981	-$2,029	
R5-38	$713,775	$33,941	-$85,107	$21,213	$140,261	$2,543,815	$120,961	1.160	$19,300	
R5-39	$139,349	$6,626	-$88,452	$20,024	$115,103	$2,271,087	$107,992	1.066	$7,111	
R5-40	$8,036	$382	-$47,885	$11,375	$59,643	$1,458,882	$69,371	0.860	-$9,729	
R5-41	$22,721	$1,080	-$41,980	$11,011	$54,071	$1,449,635	$68,932	0.784	-$14,860	
R5-42	$9,035	$430	-$28,454	$10,512	$39,396	$1,449,324	$68,917	0.572	-$29,521	
R5-43	$15,449	$735	-$16,135	$9,713	$26,583	$1,365,501	$64,931	0.409	-$38,348	
R5-44	-$5,731	-$273	-$2,976	$9,075	$11,779	$1,336,670	$63,560	0.185	-$51,781	
R5-45	-$25,142	-$1,196	$3,051	$8,380	$7,184	$1,279,403	$60,837	0.118	-$53,652	
R5-46	$179,383	$8,530	$10,715	$8,307	$16,837	$1,306,232	$62,113	0.271	-$45,276	
R5-47	$409,155	$19,456	$1,211	$8,628	$28,084	$985,240	$46,849	0.599	-$18,765	
R5-48	$3,643	$173	$334	$2,950	$3,123	$1,003,688	$47,726	0.065	-$44,603	
R5-49	-$7,508	-$357	-$4,633	$3,115	$7,390	$1,179,714	$56,097	0.132	-$48,706	
R5-50	$4,719	$224	-$6,629	$3,149	$10,002	$1,262,758	$60,045	0.167	-$50,043	
R5-51	$16,436	$782	-$9,926	$3,288	$13,995	$1,165,307	$55,411	0.253	-$41,416	**-$291,366**

12.7 FORMULATION OF CONSTRUCTION REACHES

The added dune width alternatives were formulated to first bracket the NED Plan and secondly to assist in building an optimized project. The same optimization procedure is applied at this point by comparing net benefits among the alternatives. In the next step benefits from the optimized alternatives are summed and project benefits are combined with the project's construction costs to calculate the project BCR.

Table B-56 collects and displays the net benefits alternatives with various added dune width and the optimized berm width identified in the Main Report. Each reach is evaluated to select which alternative maximized net benefits for that reach.

TABLE B-56

MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits -7 + -8	Average Annual Damage Reduction & Land Loss Benefits -7	Average Annual With Project Emergency Nourishment Cost Avoidance -8	Construction Reach
R1-1	-$32,055	-$49,085	-$65,419	-$71,193	-$95,211	+00	$3,972	$2,314	$1,658	
R1-2	-$31,234	-$45,808	-$60,526	-$67,264	-$91,371	+00	$2,353	$1,594	$760	
R1-3	-$28,352	-$42,044	-$56,025	-$62,356	-$85,020	+00	$2,839	$1,979	$860	
R1-4	-$29,167	-$43,881	-$57,312	-$61,624	-$83,893	+00	$2,803	$1,856	$947	
R1-5	-$30,265	-$45,748	-$59,964	-$64,749	-$88,495	+00	$2,589	$1,492	$1,097	
R1-6	-$34,788	-$50,444	-$64,445	-$69,259	-$92,780	+00	$3,406	$2,186	$1,220	
R1-7	-$32,988	-$47,497	-$60,887	-$66,443	-$89,163	+00	$4,131	$2,871	$1,260	
R1-8	-$34,779	-$51,062	-$65,234	-$69,854	-$94,039	+00	$3,622	$2,301	$1,320	
R1-9	-$31,662	-$47,433	-$60,849	-$65,091	-$87,872	+00	$4,361	$3,100	$1,261	
R1-10	-$27,879	-$42,638	-$55,355	-$59,476	-$80,670	+00	$3,636	$2,508	$1,128	
R1-11	$67,286	$64,435	$64,762	$60,255	$40,963	+00	$102,788	$101,590	$1,198	Construction Reach One
R1-12	-$30,555	-$43,844	-$57,927	-$65,358	-$88,592	+00	$8,925	$7,650	$1,275	
R1-13	$90,638	$87,885	$74,137	$67,128	$42,936	+00	$127,403	$126,052	$1,351	
R1-14	$84,991	$82,108	$68,322	$64,729	$40,392	+00	$125,178	$123,536	$1,641	
R1-15	$30,240	$90,939	$119,485	$134,514	$126,077	+30	$191,443	$189,265	$2,177	
R1-16	$69,713	$48,693	$57,887	$59,568	$38,211	+00	$97,594	$95,371	$2,224	
R1-17	-$15,883	-$30,741	-$44,634	-$50,282	-$70,905	+00	$12,587	$10,175	$2,412	
R1-18	-$13,071	-$27,929	-$42,061	-$48,437	-$68,693	+00	$15,724	$13,266	$2,457	
R1-19	-$17,822	-$32,803	-$45,926	-$50,865	-$69,823	+00	$11,759	$9,473	$2,285	
R1-20	$37	-$30,785	-$5,048	-$47,586	-$64,250	+00	$8,567	$6,561	$2,005	
R1-21	-$31,703	-$45,354	-$57,914	-$63,528	-$84,879	+00	$2,643	$1,548	$1,095	
R1-22	-$30,070	-$44,069	-$57,576	-$63,427	-$85,506	+00	$3,729	$2,694	$1,035	
R1-23	-$32,449	-$48,421	-$62,753	-$68,035	-$91,989	+00	$2,687	$1,674	$1,013	
R1-24	-$21,428	-$38,305	-$52,017	-$57,818	-$80,206	+00	$8,507	$7,641	$866	
R2-1	$0	$0	$0	$0	$0	+00	$1,195	$598	$598	
R2-2	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R2-3	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R2-4	$0	$0	$0	$0	$0	+00	$0	$0	$0	

TABLE B-56 (CONTINUED)

MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits -7 + -8	Average Annual Damage Reduction & Land Loss Benefits -7	Average Annual With Project Emergency Nourishment Cost Avoidance -8	Construction Reach
R2-5	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R2-6	$0	$0	$0	$0	$0	+00	$83,044	$83,044	$0	
R2-7	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R3-1	-$22,201	-$36,151	-$48,993	-$51,257	-$77,909	+00	$59,395	$34,448	$24,947	
R3-2	$87,870	$59,794	$66,640	$70,282	$52,852	+00	$159,414	$135,756	$23,658	Construction Reach Two
R3-3	-$5,133	-$18,121	-$28,470	-$32,192	-$54,758	+00	$63,963	$39,917	$24,046	
R3-4	-$8,303	-$15,050	-$28,059	-$34,255	-$51,072	+00	$10,410	$5,466	$4,945	
R3-5	-$7,899	-$8,892	-$22,942	-$38,579	-$54,692	+00	$15,813	$10,211	$5,603	
R3-6	-$9,230	-$19,140	-$34,013	-$41,998	-$59,303	+00	$17,620	$11,387	$6,233	
R3-7	-$11,076	-$16,833	-$31,691	-$42,154	-$60,745	+00	$15,925	$9,529	$6,395	
R3-8	-$7,757	-$18,879	-$29,551	-$34,542	-$57,911	+00	$68,135	$41,678	$26,457	
R3-9	$13,670	$2,952	-$3,631	-$8,534	-$30,225	+00	$88,629	$63,450	$25,180	
R3-10	$118,468	$79,330	$125,990	$161,865	$164,581	+40	$295,748	$269,955	$25,793	
R3-11	$28,772	$12,532	$10,314	$10,384	-$9,821	+00	$104,771	$79,466	$25,305	
R3-12	$78,301	$41,116	$64,778	$86,426	$80,000	+30	$186,171	$161,843	$24,328	
R3-13	$56,508	$45,150	$34,196	$31,182	$7,790	+00	$129,302	$104,846	$24,456	
R3-14	$86,876	$75,127	$67,347	$56,092	$28,039	+00	$191,923	$158,618	$33,306	
R3-15	$12,372	$2,019	-$11,347	-$15,892	-$41,195	+00	$93,069	$66,635	$26,434	
R3-16	$11,336	$3,778	-$5,488	-$7,866	-$25,459	+00	$67,847	$49,380	$18,467	
R3-17	$26,061	$13,656	$2,263	$220	-$23,965	+00	$106,692	$80,903	$25,790	
R3-18	$37,121	$23,247	$14,508	$11,822	-$11,598	+00	$121,776	$95,396	$26,381	
R3-19	$89,908	$77,540	$65,505	$63,661	$39,028	+00	$171,506	$145,236	$26,270	
R3-20	$206,943	$202,326	$210,624	$216,422	$196,901	+30	$326,304	$300,293	$26,011	
R3-21	$65,227	$52,369	$53,610	$52,884	$33,574	+00	$150,218	$124,201	$26,018	
R3-22	$23,583	$13,690	$5,320	$3,787	-$18,396	+00	$102,428	$77,932	$24,496	
R3-23	$18,681	$7,778	-$200	-$2,440	-$21,834	+00	$86,534	$65,252	$21,282	
R3-24	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R3-25	$0	$0	$0	$0	$0	+00	$0	$0	$0	

TABLE B-56 (CONTINUED)

MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits -7 + -8	Average Annual Damage Reduction & Land Loss Benefits -7	Average Annual With Project Emergency Nourishment Cost Avoidance -8	Construction Reach
R3-26	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R4-1	$40,939	$36,223	$33,512	$0	$27,984	+00	$76,151	$49,980	$26,171	Construction Reach Three
R4-2	$34,225	$22,111	$19,180	$17,121	$24,114	+00	$74,896	$48,178	$26,718	
R4-3	$0	-$8,366	-$10,150	-$11,400	-$15,623	+00	$0	$0	$0	
R4-4	$0	-$4,350	-$6,029	-$7,178	-$11,092	+00	$0	$0	$0	
R4-5	$32,884	$72,317	$69,699	$15,967	$22,452	+10	$105,494	$82,297	$23,197	
R4-6	$5,557	$91,424	$90,309	-$254	-$1,232	+10	$98,784	$93,385	$5,399	
R4-7	$0	$0	$0	$0	$0	+00	$5,986	$0	$5,986	
R4-8	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R4-9	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-1	$59,768	$49,242	$36,081	$29,399	$8,972	+00	$93,733	$80,467	$13,267	Construction Reach Four
R5-2	$41,231	$29,743	$16,395	$8,983	-$11,318	+00	$71,360	$59,324	$12,035	
R5-3	$20,157	$23,915	$10,085	-$13,549	-$33,752	+10	$63,512	$52,594	$10,917	
R5-4	$2,789	-$11,272	-$28,511	-$38,495	-$63,769	+00	$30,553	$18,488	$12,065	
R5-5	$1,026	-$8,717	-$21,938	-$30,855	-$50,017	+00	$22,049	$13,408	$8,641	
R5-6	$137,518	$125,240	$112,507	$105,792	$79,151	+00	$198,059	$180,873	$17,186	
R5-7	$197,870	$187,283	$173,628	$165,785	$139,719	+00	$258,015	$240,932	$17,083	
R5-8	$76,309	$64,801	$51,932	$46,007	$20,790	+00	$135,776	$118,921	$16,855	
R5-9	$2,227	-$7,418	-$20,879	-$30,514	-$50,363	+00	$29,665	$19,541	$10,125	
R5-10	$5,813	-$4,112	-$17,286	-$26,638	-$46,081	+00	$31,924	$21,656	$10,268	
R5-11	$12,795	$2,300	-$11,899	-$22,567	-$42,271	+00	$40,815	$30,319	$10,496	
R5-12	$7,864	-$1,442	-$14,820	-$25,009	-$44,498	+00	$33,057	$22,633	$10,424	
R5-13	$7,462	$8,598	-$4,710	-$25,165	-$45,177	+10	$49,775	$39,372	$10,403	
R5-14	$5,224	-$3,843	-$16,999	-$27,199	-$46,456	+00	$32,314	$22,231	$10,083	
R5-15	$8,004	-$1,323	-$14,621	-$24,635	-$44,297	+00	$36,400	$25,670	$10,730	
R5-16	$16,260	$3,644	-$8,451	-$16,241	-$36,785	+00	$44,266	$33,316	$10,950	
R5-17	$969	-$2,237	-$11,088	-$20,241	-$34,578	+00	$15,013	$12,057	$2,956	
R5-18	$19,601	$359	$6,396	-$20,356	-$39,260	+00	$37,781	$27,336	$10,445	

TABLE B-56 (CONTINUED)

MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits -7 + -8	Average Annual Damage Reduction & Land Loss Benefits -7	Average Annual With Project Emergency Nourishment Cost Avoidance -8	Construction Reach
R5-19	$2,811	-$1,302	-$9,077	-$17,917	-$28,179	+00	$16,280	$13,233	$3,047	
R5-20	-$1,738	-$10,356	-$23,699	-$33,604	-$52,651	+00	$20,191	$11,155	$9,036	
R5-21	-$1,255	-$12,565	-$27,053	-$36,883	-$57,720	+00	$22,497	$12,534	$9,963	
R5-22	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-23	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-24	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-25	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-26	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-27	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-28	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-29	$0	$0	$0	$0	$0	+00	$0	$0	$0	
R5-30	$26,302	$15,963	$2,681	-$5,728	-$25,291	+00	$54,591	$43,764	$10,827	Construction Reach Five
R5-31	$39,185	$29,034	$15,690	$6,500	-$13,338	+00	$68,218	$57,496	$10,722	
R5-32	$108,925	$102,969	$96,632	$85,781	$61,311	+00	$170,418	$152,771	$17,647	
R5-33	$59,763	$48,251	$33,857	$25,841	-$82	+00	$122,609	$104,162	$18,446	
R5-34	$28,795	$14,412	-$975	-$6,708	-$33,477	+00	$91,249	$73,170	$18,079	
R5-35	$36,026	$22,800	$8,300	$1,936	-$23,285	+00	$95,676	$78,228	$17,448	
R5-36	$214,192	$191,289	$187,688	$183,418	$165,116	+00	$274,986	$258,241	$16,745	
R5-37	$59,222	$44,747	$29,577	$24,447	-$2,029	+00	$124,838	$105,529	$19,309	
R5-38	$83,810	$70,564	$54,918	$47,025	$19,300	+00	$159,748	$138,536	$21,213	
R5-39	$69,293	$53,447	$38,237	$34,025	$7,111	+00	$134,862	$114,838	$20,024	
R5-40	$42,549	$30,249	$16,915	$10,474	-$9,729	+00	$71,021	$59,645	$11,375	
R5-41	$37,006	$25,475	$12,326	$4,954	-$14,860	+00	$65,108	$54,097	$11,011	
R5-42	$22,995	$11,024	-$2,448	-$9,508	-$29,521	+00	$49,924	$39,411	$10,512	
R5-43	$12,773	$1,841	-$11,368	-$19,097	-$38,348	+00	$36,314	$26,602	$9,713	
R5-44	-$1,158	-$4,729	-$17,866	-$32,520	-$51,781	+00	$20,853	$11,779	$9,075	
R5-45	-$4,807	$21,490	$8,764	-$34,917	-$53,652	+10	$52,726	$44,346	$8,380	
R5-46	$4,423	-$3,706	-$15,705	-$27,260	-$45,276	+00	$25,317	$17,011	$8,307	

TABLE B-56 (CONTINUED)

MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits -7 + -8	Average Annual Damage Reduction & Land Loss Benefits -7	Average Annual With Project Emergency Nourishment Cost Avoidance -8	Construction Reach
R5-47	$12,146	-$16,708	-$10,321	-$2,502	-$18,765	+00	$36,038	$27,410	$8,628	
R5-48	-$6,285	-$11,711	-$21,095	-$28,611	-$44,603	+00	$6,050	$3,100	$2,950	
R5-49	-$6,831	-$5,875	-$16,411	-$31,469	-$48,706	+10	$19,359	$16,244	$3,115	
R5-50	$9,081	-$16,049	-$26,733	-$32,736	-$50,043	+00	$13,072	$9,923	$3,149	
R5-51	-$103	-$4,243	-$14,897	-$24,569	-$41,416	+00	$17,170	$13,882	$3,288	

12.8 GEOMORPHIC OPTIMIZATION

The economic optimization of added dune width suggests construction of disparate added dune widths within the construction reaches. A final optimization needs to be applied using geomorphic and engineering construction limitations to recommend a robust beach fill design. Long contiguous same sized beach fill perturbations perform best according to observed and established geomorphic science. Each construction reach must be evaluated and adjusted to yield that robustness.

The reformulated construction reaches based on maximized benefits and geomorphic considerations is presented in Table B-57.

TABLE B-57
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R1-1	-$32,055	-$49,085	-$65,419	-$71,193	-$95,211	+00	$3,972	$2,314	$1,658			
R1-2	-$31,234	-$45,808	-$60,526	-$67,264	-$91,371	+00	$2,353	$1,594	$760			
R1-3	-$28,352	-$42,044	-$56,025	-$62,356	-$85,020	+00	$2,839	$1,979	$860			
R1-4	-$29,167	-$43,881	-$57,312	-$61,624	-$83,893	+00	$2,803	$1,856	$947			
R1-5	-$30,265	-$45,748	-$59,964	-$64,749	-$88,495	+00	$2,589	$1,492	$1,097			
R1-6	-$34,788	-$50,444	-$64,445	-$69,259	-$92,780	+00	$3,406	$2,186	$1,220			
R1-7	-$32,988	-$47,497	-$60,887	-$66,443	-$89,163	+00	$4,131	$2,871	$1,260			
R1-8	-$34,779	-$51,062	-$65,234	-$69,854	-$94,039	+00	$3,622	$2,301	$1,320			
R1-9	-$31,662	-$47,433	-$60,849	-$65,091	-$87,872	+00	$4,361	$3,100	$1,261			
R1-10	-$27,879	-$42,638	-$55,355	-$59,476	-$80,670	+00	$3,636	$2,508	$1,128			
R1-11	$67,286	$64,435	$64,762	$60,255	$40,963	+00	$102,788	$101,590	$1,198	NED Construction Reach One		
R1-12	-$30,555	-$43,844	-$57,927	-$65,358	-$88,592	+00	$8,925	$7,650	$1,275			
R1-13	$90,638	$87,885	$74,137	$67,128	$42,936	+00	$127,403	$126,052	$1,351			
R1-14	$84,991	$82,108	$68,322	$64,729	$40,392	+00	$125,178	$123,536	$1,641			
R1-15	$30,240	$90,939	$119,485	$134,514	$126,077	+00	$56,348	$54,171	$2,177			
R1-16	$69,713	$48,693	$57,887	$59,568	$38,211	+00	$97,594	$95,371	$2,224		$518,236	
R1-17	-$15,883	-$30,741	-$44,634	-$50,282	-$70,905	+00	$12,587	$10,175	$2,412			
R1-18	-$13,071	-$27,929	-$42,061	-$48,437	-$68,693	+00	$15,724	$13,266	$2,457			
R1-19	-$17,822	-$32,803	-$45,926	-$50,865	-$69,823	+00	$11,759	$9,473	$2,285			
R1-20	$37	-$30,785	-$5,048	-$47,586	-$64,250	+00	$8,567	$6,561	$2,005			
R1-21	-$31,703	-$45,354	-$57,914	-$63,528	-$84,879	+00	$2,643	$1,548	$1,095			
R1-22	-$30,070	-$44,069	-$57,576	-$63,427	-$85,506	+00	$3,729	$2,694	$1,035			
R1-23	-$32,449	-$48,421	-$62,753	-$68,035	-$91,989	+00	$2,687	$1,674	$1,013			
R1-24	-$21,428	-$38,305	-$52,017	-$57,818	-$80,206	+00	$8,507	$7,641	$866			$619,345

TABLE B-57 (CONTINUED)
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R2-1	$0	$0	$0	$0	$0	+00	$1,195	$598	$598			
R2-2	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R2-3	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R2-4	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R2-5	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R2-6	$0	$0	$0	$0	$0	+00	$83,044	$83,044	$0			
R2-7	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R3-1	-$22,201	-$36,151	-$48,993	-$51,257	-$77,909	+00	$59,395	$34,448	$24,947			
R3-2	$87,870	$59,794	$66,640	$70,282	$52,852	+00	$159,414	$135,756	$23,658	Construction Reach Two		
R3-3	-$5,133	-$18,121	-$28,470	-$32,192	-$54,758	+00	$63,963	$39,917	$24,046			
R3-4	-$8,303	-$15,050	-$28,059	-$34,255	-$51,072	+00	$10,410	$5,466	$4,945			
R3-5	-$7,899	-$8,892	-$22,942	-$38,579	-$54,692	+00	$15,813	$10,211	$5,603			
R3-6	-$9,230	-$19,140	-$34,013	-$41,998	-$59,303	+00	$17,620	$11,387	$6,233			
R3-7	-$11,076	-$16,833	-$31,691	-$42,154	-$60,745	+00	$15,925	$9,529	$6,395			
R3-8	-$7,757	-$18,879	-$29,551	-$34,542	-$57,911	+00	$68,135	$41,678	$26,457			
R3-9	$13,670	$2,952	-$3,631	-$8,534	-$30,225	+00	$88,629	$63,450	$25,180			
R3-10	$118,468	$79,330	$125,990	$161,865	$164,581	+00	$196,673	$170,880	$25,793			
R3-11	$28,772	$12,532	$10,314	$10,384	-$9,821	+00	$104,771	$79,466	$25,305			
R3-12	$78,301	$41,116	$64,778	$86,426	$80,000	+00	$151,774	$127,445	$24,328			
R3-13	$56,508	$45,150	$34,196	$31,182	$7,790	+00	$129,302	$104,846	$24,456			
R3-14	$86,876	$75,127	$67,347	$56,092	$28,039	+00	$191,923	$158,618	$33,306			
R3-15	$12,372	$2,019	-$11,347	-$15,892	-$41,195	+00	$93,069	$66,635	$26,434			
R3-16	$11,336	$3,778	-$5,488	-$7,866	-$25,459	+00	$67,847	$49,380	$18,467			
R3-17	$26,061	$13,656	$2,263	$220	-$23,965	+00	$106,692	$80,903	$25,790		$2,404,605	$2,404,605

TABLE B-57 (CONTINUED)
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R3-18	$37,121	$23,247	$14,508	$11,822	-$11,598	+00	$121,776	$95,396	$26,381			
R3-19	$89,908	$77,540	$65,505	$63,661	$39,028	+00	$171,506	$145,236	$26,270			
R3-20	$206,943	$202,326	$210,624	$216,422	$196,901	+00	$290,179	$264,168	$26,011			
R3-21	$65,227	$52,369	$53,610	$52,884	$33,574	+00	$150,218	$124,201	$26,018			
R3-22	$23,583	$13,690	$5,320	$3,787	-$18,396	+00	$102,428	$77,932	$24,496			
R3-23	$18,681	$7,778	-$200	-$2,440	-$21,834	+00	$86,534	$65,252	$21,282			
R3-24	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R3-25	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R3-26	$0	$0	$0	$0	$0	+00	$0	$0	$0			

TABLE B-57 (CONTINUED)
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R4-1	$40,939	$36,223	$33,512	$0	$27,984	+10	$74,076	$47,905	$26,171	Construction Reach Three		
R4-2	$34,225	$22,111	$19,180	$17,121	$24,114	+10	$65,119	$38,400	$26,718			
R4-3	$0	-$8,366	-$10,150	-$11,400	-$15,623	+10	$0	$0	$0			
R4-4	$0	-$4,350	-$6,029	-$7,178	-$11,092	+10	$0	$0	$0			
R4-5	$32,884	$72,317	$69,699	$15,967	$22,452	+10	$105,494	$82,297	$23,197			
R4-6	$5,557	$91,424	$90,309	-$254	-$1,232	+10	$98,784	$93,385	$5,399		$343,473	$261,987
R4-7	$0	$0	$0	$0	$0	+00	$5,986	$0	$5,986			
R4-8	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R4-9	$0	$0	$0	$0	$0	+00	$0	$0	$0			
R5-1	$59,768	$49,242	$36,081	$29,399	$8,972	+10	$96,415	$83,149	$13,267	Construction Reach Four		
R5-2	$41,231	$29,743	$16,395	$8,983	-$11,318	+10	$72,548	$60,512	$12,035			
R5-3	$20,157	$23,915	$10,085	-$13,549	-$33,752	+10	$63,512	$52,594	$10,917			
R5-4	$2,789	-$11,272	-$28,511	-$38,495	-$63,769	+10	$31,384	$19,319	$12,065			
R5-5	$1,026	-$8,717	-$21,938	-$30,855	-$50,017	+10	$23,342	$14,701	$8,641			
R5-6	$137,518	$125,240	$112,507	$105,792	$79,151	+10	$202,237	$185,051	$17,186			
R5-7	$197,870	$187,283	$173,628	$165,785	$139,719	+10	$263,471	$246,388	$17,083			
R5-8	$76,309	$64,801	$51,932	$46,007	$20,790	+10	$139,649	$122,794	$16,855			
R5-9	$2,227	-$7,418	-$20,879	-$30,514	-$50,363	+10	$31,997	$21,872	$10,125			
R5-10	$5,813	-$4,112	-$17,286	-$26,638	-$46,081	+10	$34,035	$23,767	$10,268			
R5-11	$12,795	$2,300	-$11,899	-$22,567	-$42,271	+10	$42,551	$32,055	$10,496			
R5-12	$7,864	-$1,442	-$14,820	-$25,009	-$44,498	+10	$35,840	$25,416	$10,424			
R5-13	$7,462	$8,598	-$4,710	-$25,165	-$45,177	+10	$49,775	$39,372	$10,403			
R5-14	$5,224	-$3,843	-$16,999	-$27,199	-$46,456	+10	$35,179	$25,096	$10,083			
R5-15	$8,004	-$1,323	-$14,621	-$24,635	-$44,297	+10	$39,297	$28,566	$10,730		$1,325,619	$1,325,619

TABLE B-57 (CONTINUED)
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R5-16	$16,260	$3,644	-$8,451	-$16,241	-$36,785	+10	$44,137	$33,187	$10,950			
R5-17	$969	-$2,237	-$11,088	-$20,241	-$34,578	+10	$17,084	$14,128	$2,956			
R5-18	$19,601	$359	$6,396	-$20,356	-$39,260	+10	$39,103	$28,658	$10,445			
R5-19	$2,811	-$1,302	-$9,077	-$17,917	-$28,179	+10	$17,207	$14,160	$3,047			
R5-20	-$1,738	-$10,356	-$23,699	-$33,604	-$52,651	+10	$23,049	$14,013	$9,036			
R5-21	-$1,255	-$12,565	-$27,053	-$36,883	-$57,720	+10	$23,807	$13,844	$9,963			
R5-22	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-23	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-24	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-25	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-26	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-27	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-28	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-29	**$0**	**$0**	**$0**	**$0**	**$0**	**+00**	**$0**	**$0**	**$0**			
R5-30	**$26,302**	**$15,963**	**$2,681**	**-$5,728**	**-$25,291**	**+10**	**$56,625**	**$45,799**	**$10,827**	**Construction Reach Five**		
R5-31	**$39,185**	**$29,034**	**$15,690**	**$6,500**	**-$13,338**	**+10**	**$70,358**	**$59,636**	**$10,722**			
R5-32	**$108,925**	**$102,969**	**$96,632**	**$85,781**	**$61,311**	**+10**	**$179,849**	**$162,203**	**$17,647**			
R5-33	**$59,763**	**$48,251**	**$33,857**	**$25,841**	**-$82**	**+10**	**$127,022**	**$108,576**	**$18,446**			
R5-34	**$28,795**	**$14,412**	**-$975**	**-$6,708**	**-$33,477**	**+10**	**$92,948**	**$74,869**	**$18,079**			
R5-35	**$36,026**	**$22,800**	**$8,300**	**$1,936**	**-$23,285**	**+10**	**$97,911**	**$80,463**	**$17,448**			
R5-36	**$214,192**	**$191,289**	**$187,688**	**$183,418**	**$165,116**	**+10**	**$266,664**	**$249,920**	**$16,745**			
R5-37	**$59,222**	**$44,747**	**$29,577**	**$24,447**	**-$2,029**	**+10**	**$126,107**	**$106,798**	**$19,309**			
R5-38	**$83,810**	**$70,564**	**$54,918**	**$47,025**	**$19,300**	**+10**	**$163,394**	**$142,181**	**$21,213**			
R5-39	**$69,293**	**$53,447**	**$38,237**	**$34,025**	**$7,111**	**+10**	**$135,270**	**$115,245**	**$20,024**		**$1,713,147**	**$1,713,147**

TABLE B-57 (CONTINUED)
MAXIMIZED DUNE WIDTH BY CONSTRUCTION REACH

Reach	ZERO ADDED DUNE WIDTH Net Benefits DW00 -1	10 FEET ADDED DUNE WIDTH Net Benefits DW10 -2	20 FEET ADDED DUNE WIDTH Net Benefits DW20 -3	30 FEET ADDED DUNE WIDTH Net Benefits DW30 -4	40 FEET ADDED DUNE WIDTH Net Benefits DW40 -5	ADDED DUNE WIDTH Maximized Net Benefits by Model Reach MAX-1,2,3,4	Total Benefits - 7 + -8	Average Annual Damage Reduction & Land Loss Benefits - 7	Average Annual With Project Emergency Nourishment Cost Avoidance - 8	Construction Reach	NED Benefits - per Construction Reach	LPP Benefits - per Construction Reach
R5-40	**$42,549**	**$30,249**	**$16,915**	**$10,474**	**-$9,729**	**+10**	**$71,264**	**$59,889**	**$11,375**			
R5-41	**$37,006**	**$25,475**	**$12,326**	**$4,954**	**-$14,860**	**+10**	**$65,972**	**$54,961**	**$11,011**			
R5-42	**$22,995**	**$11,024**	**-$2,448**	**-$9,508**	**-$29,521**	**+10**	**$50,268**	**$39,756**	**$10,512**			
R5-43	**$12,773**	**$1,841**	**-$11,368**	**-$19,097**	**-$38,348**	**+10**	**$37,147**	**$27,434**	**$9,713**			
R5-44	**-$1,158**	**-$4,729**	**-$17,866**	**-$32,520**	**-$51,781**	**+10**	**$28,618**	**$19,543**	**$9,075**			
R5-45	**-$4,807**	**$21,490**	**$8,764**	**-$34,917**	**-$53,652**	**+10**	**$52,726**	**$44,346**	**$8,380**			
R5-46	**$4,423**	**-$3,706**	**-$15,705**	**-$27,260**	**-$45,276**	**+10**	**$27,932**	**$19,625**	**$8,307**			
R5-47	**$12,146**	**-$16,708**	**-$10,321**	**-$2,502**	**-$18,765**	**+10**	**$3,676**	**-$4,952**	**$8,628**			
R5-48	**-$6,285**	**-$11,711**	**-$21,095**	**-$28,611**	**-$44,603**	**+10**	**$6,216**	**$3,266**	**$2,950**			
R5-49	**-$6,831**	**-$5,875**	**-$16,411**	**-$31,469**	**-$48,706**	**+10**	**$19,359**	**$16,244**	**$3,115**			
R5-50	**$9,081**	**-$16,049**	**-$26,733**	**-$32,736**	**-$50,043**	**+10**	**$13,339**	**$10,191**	**$3,149**			
R5-51	**-$103**	**-$4,243**	**-$14,897**	**-$24,569**	**-$41,416**	**+10**	**$20,482**	**$17,194**	**$3,288**			
Total Project Benefits NED / LPP											**$6,305,080**	**$6,324,703**

12.9 UPDATED ECONOMIC JUSTIFICATION OF NED PLAN AND LPP

Note (December 2012): As this report was being drafted in 2011, concern was expressed that a sensitivity analysis should be conducted for the plans being developed to assure economic justification because of reduced values resulting from an economic downturn that began in 2008. The cost and benefits for the NED and LPP noted in this and the next two sections are those that were under consideration at the time of the analysis. They have not been updated for the Final Report as the assumption that the downturn was a temporary phenomenon was valid as local values have stabilized and have even begun to rise. An update of the values at this time would continue to demonstrate economic justification for the NED and LPP.

Two final runs were made to determine if the NED Plan and the LPP as formulated are still justified when considering the changed cost estimate, adjustments to the structure inventory and near shore land values. If the NED Plan and the LPP continue to be justified then the recommendation will be to keep the formulation and the selected plan as is, realizing that the current economic down turn and its impacts are a temporary phenomena which will not remain at these levels for the 50-year period of analysis.

Tables B-58 and B-59 show that HSDR benefits are $5,704,945 for the NED Plan and $5,833,482 for the LPP.

TABLE B-58
NED PLAN UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction NED	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits NED	NED Summed Benefits	Profile
R1-1	$9,620	$457	$23,484	$1,658	$2,116	$53,151	$2,527	0.837	-$412		R1P1
R1-2	$8,387	$399	$21,266	$760	$1,158	$44,293	$2,106	0.550	-$948		R1P1
R1-3	$14,359	$683	$16,083	$860	$1,543	$17,717	$842	1.832	$701		R1P1
R1-4	$8,307	$395	$11,895	$947	$1,342	$44,293	$2,106	0.637	-$764		R1P1
R1-5	$6,086	$289	$9,801	$1,097	$1,386	$8,859	$421	3.291	$965		R1P1
R1-6	$12,885	$613	$2,902	$1,220	$1,833	$79,727	$3,791	0.483	-$1,958		R1P1
R1-7	$25,236	$1,200	$190	$1,260	$2,460	$62,010	$2,949	0.834	-$489		R1P1
R1-8	$14,769	$702	$497	$1,320	$2,023	$53,151	$2,527	0.800	-$505		R1P1
R1-9	$30,853	$1,467	$864	$1,261	$2,728	$44,293	$2,106	1.295	$622		R1P1
R1-10	$23,201	$1,103	$2,665	$1,128	$2,231	$8,859	$421	5.297	$1,810		R1P1
R1-11	$2,415,519	$114,860	$3,725	$1,198	$116,058	$2,219,920	$105,559	1.099	$10,499	CONSTRUCTION REACH ONE	R1P1
R1-12	$137,766	$6,551	$1,610	$1,275	$7,826	$2,097,534	$99,740	0.078	-$91,914		R1P1
R1-13	$3,203,676	$152,338	-$25	$1,351	$153,713	$1,942,066	$92,347	1.665	$61,366		R1P1
R1-14	$3,085,015	$146,696	-$3,177	$1,641	$151,514	$2,097,129	$99,721	1.519	$51,793		R1P1
R1-15	$3,964,781	$188,529	-$3,458	$2,177	$194,164	$2,359,005	$112,173	1.731	$81,991		R1P2
R1-16	$2,554,768	$121,482	-$4,206	$2,224	$127,912	$1,310,098	$62,296	2.053	$65,615	$ 807,937	R1P2
R1-17	$31,014	$1,475	-$4,282	$2,412	$8,169	$53,151	$2,527	3.232	$5,641		R1P2
R1-18	$77,316	$3,676	-$4,872	$2,457	$11,006	$44,293	$2,106	5.226	$8,900		R1P2
R1-19	$56,388	$2,681	-$2,177	$2,285	$7,144	$97,444	$4,634	1.542	$2,510		R1P2
R1-20	$61,402	$2,920	$3,226	$2,005	$4,925	$70,868	$3,370	1.462	$1,555		R1P2
R1-21	$9,166	$436	$3,472	$1,095	$1,531	$26,576	$1,264	1.211	$267		R1P1
R1-22	$17,545	$834	$8,216	$1,035	$1,869	$44,293	$2,106	0.887	-$237		R1P1

TABLE B-58 (CONTINUED)
NED PLAN UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction NED	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits NED	NED Summed Benefits	Profile
R1-23	$7,600	$361	$13,947	$1,013	$1,374	$17,717	$842	1.631	$532		R1P1
R1-24	$22,024	$1,047	$15,704	$866	$1,913	$0	$0	$ -	$1,913		R1P1
R2-1	$0	$0	$11,863	$0	$0	$0	$0	$ -	$0		R2P1
R2-2	$0	$0	$3,618	$0	$0	$0	$0	$ -	$0		R2P1
R2-3	$0	$0	$10,522	$0	$0	$0	$0	$ -	$0		R2P2
R2-4	$0	$0	$7,988	$0	$0	$0	$0	$ -	$0		R2P1
R2-5	$0	$0	$2,954	$0	$0	$0	$0	$ -	$0		R2P2
R2-6	$0	$0	-$88,608	$0	$0	$0	$0	$ -	$0		R2P1
R2-7	$0	$0	$6,440	$0	$0	$0	$0	$ -	$0		R2P1
R3-1	-$97,784	-$4,650	$7,398	$24,947	$20,297	$0	$0	$ -	$20,297		R3P1
R3-2	$2,485,270	$118,177	$7,109	$23,658	$141,835	$1,126,056	$53,545	2.649	$88,290	CONSTRUCTION REACH TWO	R3P1
R3-3	$319,955	$15,214	$7,262	$24,046	$39,260	$1,124,852	$53,488	0.734	-$14,228		R3P1
R3-4	$11,415	$543	$9,086	$4,945	$5,488	$418,842	$19,916	0.276	-$14,429		R3P2
R3-5	$98,291	$4,674	$7,495	$5,603	$10,277	$501,307	$23,838	0.431	-$13,561		R3P2
R3-6	$121,728	$5,788	$5,469	$6,233	$12,021	$519,290	$24,693	0.487	-$12,671		R3P2
R3-7	$65,939	$3,135	$1,775	$6,395	$9,531	$479,041	$22,779	0.418	-$13,248		R3P2
R3-8	$138,425	$6,582	-$5,267	$26,457	$38,307	$2,500,452	$118,899	0.322	-$80,592		R3P1
R3-9	$761,061	$36,189	-$6,073	$25,180	$67,442	$2,696,168	$128,205	0.526	-$60,764		R3P1
R3-10	$5,150,797	$244,925	-$7,599	$25,793	$278,317	$2,436,378	$115,852	2.402	$162,465		R3P1
R3-11	$1,171,549	$55,708	-$8,485	$25,305	$89,498	$2,187,485	$104,017	0.860	-$14,519		R3P1
R3-12	$3,044,179	$144,754	-$14,284	$24,328	$183,366	$2,024,457	$96,265	1.905	$87,101		R3P1
R3-13	$1,493,055	$70,996	-$16,951	$24,456	$112,404	$1,961,846	$93,288	1.205	$19,116		R3P1
R3-14	$1,994,340	$94,833	-$29,516	$33,306	$157,655	$2,762,244	$131,347	1.200	$26,307		R3P1

TABLE B-58 (CONTINUED)
NED PLAN UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction NED	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits NED	NED Summed Benefits	Profile
R3-15	$33,043	$1,571	-$25,689	$26,434	$53,694	$2,131,967	$101,377	0.530	-$47,683		R3P1
R3-16	$9,434	$449	-$20,011	$18,467	$38,927	$1,484,287	$70,579	0.552	-$31,653		R3P1
R3-17	$189,234	$8,998	-$31,656	$25,790	$66,444	$2,125,876	$101,088	0.657	-$34,643		R3P1
R3-18	$478,323	$22,745	-$33,032	$26,381	$82,158	$2,259,579	$107,445	0.765	-$25,287		R3P1
R3-19	$1,678,176	$79,799	-$31,265	$26,270	$137,334	$2,280,429	$108,437	1.266	$28,898		R3P1
R3-20	$5,327,669	$253,336	-$30,352	$26,011	$309,699	$2,507,067	$119,214	2.598	$190,486		R3P1
R3-21	$1,512,469	$71,919	-$29,637	$26,018	$127,575	$2,884,265	$137,150	0.930	-$9,575		R3P1
R3-22	$433,629	$20,619	-$25,763	$24,496	$70,879	$3,169,557	$150,716	0.470	-$79,837		R3P1
R3-23	$328,938	$15,641	-$20,281	$21,282	$57,204	$1,779,034	$84,595	0.676	-$27,391	$ 2,089,314	R3P1
R3-24	$10,281	$0	-$17,271	$7,322	$0	$0	$0	$ -	$0		R3P2
R3-25	-$10,198	$0	-$12,396	$7,972	$0	$0	$0	$ -	$0		R3P2
R3-26	$0	$0	-$10,153	$0	$0	$0	$0	$ -	$0		R4P1
R4-1	$16,652	$792	-$20,670	$26,171	$47,633	$197,031	$9,369	5.084	$38,264	CONSTRUCTION REACH THREE	R4P1
R4-2	$79,725	$3,791	-$17,450	$26,718	$47,959	$317,117	$15,079	3.180	$32,880		R4P1
R4-3	$0	$0	$1,424	$0	$0	$174,722	$0	$ -	$0		R4P2
R4-4	$0	$0	$3,037	$0	$0	$91,574	$0	$ -	$0		R4P2
R4-5	$241,255	$11,472	-$8,258	$23,197	$42,927	$201,632	$9,588	4.477	$33,339		R4P1
R4-6	$35,284	$1,678	$2,561	$5,399	$7,077	$35,480	$1,687	4.195	$5,390	$ 145,596	R4P2
R4-7	$0	$0	-$3,163	$5,986	$0	$0	$0	$ -	$0		R4P2
R4-8	$0	$0	-$33,345	$0	$0	$0	$0	$ -	$0		R4P1
R4-9	$0	$0	-$58,473	$0	$0	$0	$0	$ -	$0		R4P1
R5-1	$50,054	$2,380	-$66,833	$13,267	$82,480	$1,750,822	$83,253	0.991	-$773	CONSTRUCTION REACH FOUR	R5P2
R5-2	$34,073	$1,620	-$46,918	$12,035	$60,573	$1,395,810	$66,372	0.913	-$5,799		R5P2

TABLE B-58 (CONTINUED)
NED PLAN UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction NED	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits NED	NED Summed Benefits	Profile
R5-3	$33,924	$1,613	-$25,437	$10,917	$37,967	$1,015,440	$48,285	0.786	-$10,318		R5P2
R5-4	$29,812	$1,418	-$7,548	$12,065	$21,031	$881,157	$41,900	0.502	-$20,869		R5P2
R5-5	$105,362	$5,010	$7,577	$8,641	$13,651	$590,797	$28,093	0.486	-$14,442		R5P2
R5-6	$3,602,197	$171,288	-$20,636	$17,186	$209,110	$1,326,375	$63,070	3.315	$146,039		R5P1
R5-7	$4,865,320	$231,351	-$25,414	$17,083	$273,847	$1,300,624	$61,846	4.428	$212,001		R5P1
R5-8	$2,179,789	$103,651	-$14,261	$16,855	$134,767	$1,269,820	$60,381	2.232	$74,386		R5P1
R5-9	$48,619	$2,312	-$8,120	$10,125	$20,556	$670,787	$31,897	0.644	-$11,340		R5P2
R5-10	$54,486	$2,591	-$9,289	$10,268	$22,148	$641,153	$30,487	0.726	-$8,339		R5P2
R5-11	$218,207	$10,376	-$10,186	$10,496	$31,058	$680,573	$32,362	0.960	-$1,304		R5P2
R5-12	$67,097	$3,191	-$9,741	$10,424	$23,356	$618,727	$29,421	0.794	-$6,065		R5P2
R5-13	$138,895	$6,605	-$10,232	$10,403	$27,240	$700,896	$33,328	0.817	-$6,089		R5P2
R5-14	$72,992	$3,471	-$9,229	$10,083	$22,783	$663,490	$31,550	0.722	-$8,766		R5P2
R5-15	$63,158	$3,003	-$12,558	$10,730	$26,292	$692,853	$32,946	0.798	-$6,654		R5P2
R5-16	$223,961	$10,650	-$12,837	$10,950	$34,437	$721,798	$34,322	1.003	$115		R5P2
R5-17	$29,325	$1,394	-$6,856	$2,956	$11,206	$454,596	$21,616	0.518	-$10,411		R5P3
R5-18	$110,804	$5,269	-$12,522	$10,445	$28,236	$934,693	$44,446	0.635	-$16,210		R5P2
R5-19	$216,156	$10,278	-$2,487	$3,047	$15,812	$810,062	$38,519	0.411	-$22,707		R5P3
R5-20	$53,301	$2,535	$157	$9,036	$11,571	$1,485,337	$70,629	0.164	-$59,058		R5P2
R5-21	$52,645	$2,503	-$475	$9,963	$12,941	$471,610	$22,426	0.577	-$9,484	$ 1,121,062	R5P2
R5-22	$0	$0	-$1,684	$0	$0	$0	$0	$ -	$0		R5P3
R5-23	$0	$0	-$438	$0	$0	$0	$0	$ -	$0		R5P3
R5-24	$0	$0	-$5,913	$0	$0	$0	$0	$ -	$0		R5P2
R5-25	$0	$0	-$13,096	$0	$0	$0	$0	$ -	$0		R5P2
R5-26	$0	$0	-$10,979	$0	$0	$0	$0	$ -	$0		R5P1
R5-27	$0	$0	-$8,659	$0	$0	$0	$0	$ -	$0		R5P3

TABLE B-58 (CONTINUED)
NED PLAN UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction NED	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits NED	NED Summed Benefits	Profile
R5-28	$0	$0	-$9,987	$0	$0	$0	$0	$ -	$0		R5P3
R5-29	$0	$0	-$37,910	$0	$0	$0	$0	$ -	$0		R5P2
R5-30	$47,602	$2,264	-$32,848	$10,827	$45,938	$1,604,072	$76,275	0.602	-$30,337	CONSTRUCTION REACH FIVE	R5P2
R5-31	$345,353	$16,422	-$33,879	$10,722	$61,022	$1,359,284	$64,635	0.944	-$3,613		R5P2
R5-32	$1,933,757	$91,952	-$61,892	$17,647	$171,491	$1,709,931	$81,309	2.109	$90,182		R5P1
R5-33	$751,701	$35,744	-$62,530	$18,446	$116,721	$1,519,045	$72,232	1.616	$44,489		R5P1
R5-34	$307,967	$14,644	-$53,740	$18,079	$86,463	$1,393,904	$66,281	1.304	$20,181		R5P1
R5-35	$445,780	$21,197	-$52,782	$17,448	$91,427	$1,287,290	$61,212	1.494	$30,215		R5P1
R5-36	$4,569,570	$217,288	-$56,472	$16,745	$290,504	$1,289,036	$61,295	4.739	$229,209		R5P1
R5-37	$325,474	$15,477	-$80,647	$19,309	$115,433	$1,364,144	$64,866	1.780	$50,566		R5P1
R5-38	$711,049	$33,811	-$94,528	$21,213	$149,551	$1,567,523	$74,537	2.006	$75,014		R5P1
R5-39	$139,002	$6,610	-$98,750	$20,024	$125,384	$1,355,066	$64,435	1.946	$60,949		R5P1
R5-40	$8,174	$389	-$49,625	$11,375	$61,390	$676,365	$32,162	1.909	$29,228		R5P2
R5-41	$23,301	$1,108	-$44,843	$11,011	$56,962	$671,353	$31,923	1.784	$25,038		R5P2
R5-42	$9,385	$446	-$30,127	$10,512	$41,086	$657,037	$31,243	1.315	$9,843		R5P2
R5-43	$15,873	$755	-$18,731	$9,713	$29,199	$590,384	$28,073	1.040	$1,125		R5P2
R5-44	-$5,731	-$273	-$5,603	$9,075	$14,405	$565,175	$26,875	0.536	-$12,470		R5P2
R5-45	-$25,142	-$1,196	$263	$8,380	$7,184	$537,137	$25,541	0.281	-$18,357		R5P2
R5-46	$181,668	$8,639	$7,328	$8,307	$16,945	$565,047	$26,869	0.631	-$9,923		R5P2
R5-47	$390,378	$18,563	$317	$8,628	$27,191	$686,496	$32,644	0.833	-$5,453		R5P2
R5-48	$3,752	$178	$742	$2,950	$3,129	$473,867	$22,533	0.139	-$19,404		R5P3
R5-49	-$7,508	-$357	-$3,946	$3,115	$6,703	$782,524	$37,210	0.180	-$30,506		R5P3
R5-50	$6,151	$292	-$6,119	$3,149	$9,560	$1,169,915	$55,631	0.172	-$46,071		R5P3
R5-51	$15,225	$724	-$9,336	$3,288	$13,348	$340,821	$16,206	0.824	-$2,858	$ 1,541,035	R5P3
NED SUMMED BENEFITS--------------------->										$5,704,945	

TABLE B-59
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R1-1	$13,149	$625	$23,484	$1,658	$2,284	$959,993	$45,649	0.050	-$43,365	CONSTRUCTION REACH ONE	R1P1
R1-2	$17,556	$835	$21,266	$760	$1,594	$902,116	$42,896	0.037	-$41,302		R1P1
R1-3	$23,567	$1,121	$16,083	$860	$1,981	$834,489	$39,681	0.050	-$37,700		R1P1
R1-4	$19,327	$919	$11,895	$947	$1,866	$842,705	$40,071	0.047	-$38,206		R1P1
R1-5	$8,704	$414	$9,801	$1,097	$1,511	$872,093	$41,469	0.036	-$39,958		R1P1
R1-6	$20,390	$970	$2,902	$1,220	$2,190	$987,277	$46,946	0.047	-$44,756		R1P1
R1-7	$33,916	$1,613	$190	$1,260	$2,872	$960,262	$45,661	0.063	-$42,789		R1P1
R1-8	$20,689	$984	$497	$1,320	$2,304	$996,894	$47,403	0.049	-$45,099		R1P1
R1-9	$37,640	$1,790	$864	$1,261	$3,051	$936,399	$44,527	0.069	-$41,476		R1P1
R1-10	$27,897	$1,327	$2,665	$1,128	$2,455	$829,503	$39,444	0.062	-$36,989		R1P1
R1-11	$3,040,594	$144,583	$3,725	$1,198	$145,781	$919,706	$43,733	3.333	$102,048		R1P1
R1-12	$137,993	$6,562	$1,610	$1,275	$7,837	$1,009,498	$48,003	0.163	-$40,166		R1P1
R1-13	$3,212,573	$152,761	-$25	$1,351	$154,137	$944,689	$44,921	3.431	$109,216		R1P1
R1-14	$3,137,802	$149,206	-$3,177	$1,641	$154,024	$1,035,520	$49,240	3.128	$104,784		R1P1
R1-15	$4,822,253	$229,303	-$3,458	$2,177	$234,938	$721,578	$34,312	6.847	$200,626		R1P2
R1-16	$2,728,699	$129,752	-$4,206	$2,224	$136,182	$761,163	$36,194	3.763	$99,988		R1P2
R1-17	$49,610	$2,359	-$4,282	$2,412	$9,053	$785,242	$37,339	0.242	-$28,286		R1P2
R1-18	$117,512	$5,588	-$4,872	$2,457	$12,917	$797,897	$37,941	0.340	-$25,024		R1P2
R1-19	$91,895	$4,370	-$2,177	$2,285	$8,832	$803,973	$38,230	0.231	-$29,397		R1P2
R1-20	$71,126	$3,382	$3,226	$2,005	$5,388	$711,085	$33,813	0.159	-$28,425		R1P2
R1-21	$9,520	$453	$3,472	$1,095	$1,548	$901,612	$42,873	0.036	-$41,325		R1P1
R1-22	$34,341	$1,633	$8,216	$1,035	$2,668	$887,741	$42,213	0.063	-$39,545		R1P1

TABLE B-59 (CONTINUED)
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R1-23	$13,768	$655	$13,947	$1,013	$1,667	$939,091	$44,655	0.037	-$42,987		R1P1
R1-24	$161,596	$7,684	$15,704	$866	$8,550	$869,858	$41,363	0.207	-$32,813	$ 905,628	R1P1
R2-1	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P1
R2-2	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P1
R2-3	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P2
R2-4	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P1
R2-5	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P2
R2-6	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P1
R2-7	$0	$0	$0	$0	$0	$0	$0	0	$0		R2P1
R3-1	-$59,050	-$2,808	$7,398	$24,947	$22,139	$1,277,161	$60,730	0.365	-$38,591		R3P1
R3-2	$2,384,316	$113,377	$7,109	$23,658	$137,034	$1,092,091	$51,930	2.639	$85,104	CONSTRUCTION REACH TWO	R3P1
R3-3	$296,817	$14,114	$7,262	$24,046	$38,160	$1,039,846	$49,446	0.772	-$11,286		R3P1
R3-4	$10,856	$516	$9,086	$4,945	$5,461	$383,597	$18,240	0.299	-$12,779		R3P2
R3-5	$93,019	$4,423	$7,495	$5,603	$10,026	$492,286	$23,409	0.428	-$13,383		R3P2
R3-6	$122,608	$5,830	$5,469	$6,233	$12,063	$555,796	$26,429	0.456	-$14,365		R3P2
R3-7	$63,720	$3,030	$1,775	$6,395	$9,425	$555,580	$26,418	0.357	-$16,993		R3P2
R3-8	$159,817	$7,599	-$5,267	$26,457	$39,324	$1,137,770	$54,102	0.727	-$14,778		R3P1
R3-9	$774,468	$36,827	-$6,073	$25,180	$68,079	$1,138,093	$54,117	1.258	$13,962		R3P1
R3-10	$5,585,285	$265,586	-$7,599	$25,793	$298,978	$1,191,546	$56,659	5.277	$242,318		R3P1
R3-11	$1,202,340	$57,172	-$8,485	$25,305	$90,963	$1,150,204	$54,693	1.663	$36,269		R3P1
R3-12	$3,280,288	$155,981	-$14,284	$24,328	$194,593	$1,112,806	$52,915	3.677	$141,678		R3P1
R3-13	$1,492,409	$70,966	-$16,951	$24,456	$112,373	$1,093,836	$52,013	2.160	$60,360		R3P1

TABLE B-59 (CONTINUED)
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R3-14	$1,993,234	$94,780	-$29,516	$33,306	$157,602	$1,609,707	$76,543	2.059	$81,059		R3P1
R3-15	$33,043	$1,571	-$25,689	$26,434	$53,694	$1,221,427	$58,080	0.924	-$4,386		R3P1
R3-16	$9,434	$449	-$20,011	$18,467	$38,927	$853,193	$40,570	0.959	-$1,644		R3P1
R3-17	$188,572	$8,967	-$31,656	$25,790	$66,413	$1,224,753	$58,238	1.140	$8,174		R3P1
R3-18	$476,567	$22,661	-$33,032	$26,381	$82,075	$1,297,156	$61,681	1.331	$20,394		R3P1
R3-19	$1,676,841	$79,735	-$31,265	$26,270	$137,271	$1,234,871	$58,719	2.338	$78,552		R3P1
R3-20	$5,393,166	$256,450	-$30,352	$26,011	$312,813	$1,274,585	$60,608	5.161	$252,206		R3P1
R3-21	$1,511,988	$71,897	-$29,637	$26,018	$127,552	$1,311,034	$62,341	2.046	$65,211		R3P1
R3-22	$436,987	$20,779	-$25,763	$24,496	$71,039	$1,213,908	$57,723	1.231	$13,316		R3P1
R3-23	$329,306	$15,659	-$20,281	$21,282	$57,222	$1,043,882	$49,638	1.153	$7,584	$ 2,121,086	R3P1
R3-24	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R3P2
R3-25	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R3P2
R3-26	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R4P1
R4-1	-$28,753	-$1,367	-$20,670	$26,171	$45,474	$217,520	$10,343	4.396	$35,131		R4P1
R4-2	-$66,325	-$3,154	-$17,450	$26,718	$41,014	$315,625	$15,008	2.733	$26,006		R4P1
R4-3	$0	$0	$1,424	$0	$0	$166,991	$7,941	-	-$7,941	CONSTRUCTION REACH THREE	R4P2
R4-4	$0	$0	$3,037	$0	$0	$83,142	$3,953	-	-$3,953		R4P2
R4-5	$296,627	$14,105	-$8,258	$23,197	$45,560	$188,599	$8,968	5.080	$36,592		R4P1
R4-6	$93,818	$4,461	$2,561	$5,399	$9,860	$37,068	$1,763	5.594	$8,098	$ 141,908	R4P2
R4-7	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R4P2
R4-8	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R4P1
R4-9	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R4P1

TABLE B-59 (CONTINUED)
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R5-1	$50,088	$2,382	-$66,833	$13,267	$82,481	$622,597	$29,605	2.786	$52,876	CONSTRUCTION REACH FOUR	R5P2
R5-2	$33,465	$1,591	-$46,918	$12,035	$60,545	$566,239	$26,925	2.249	$33,619		R5P2
R5-3	$33,823	$1,608	-$25,437	$10,917	$37,962	$530,213	$25,212	1.506	$12,750		R5P2
R5-4	$29,982	$1,426	-$7,548	$12,065	$21,039	$562,980	$26,770	0.786	-$5,731		R5P2
R5-5	$108,820	$5,174	$7,577	$8,641	$13,815	$436,065	$20,735	0.666	-$6,920		R5P2
R5-6	$3,638,134	$172,997	-$20,636	$17,186	$210,819	$1,108,799	$52,725	3.998	$158,094		R5P1
R5-7	$4,901,507	$233,072	-$25,414	$17,083	$275,568	$1,095,852	$52,109	5.288	$223,459		R5P1
R5-8	$2,206,097	$104,902	-$14,261	$16,855	$136,018	$1,076,607	$51,194	2.657	$84,824		R5P1
R5-9	$48,622	$2,312	-$8,120	$10,125	$20,556	$548,236	$26,069	0.789	-$5,513		R5P2
R5-10	$54,465	$2,590	-$9,289	$10,268	$22,147	$517,816	$24,623	0.899	-$2,475		R5P2
R5-11	$222,152	$10,564	-$10,186	$10,496	$31,245	$555,609	$26,420	1.183	$4,826		R5P2
R5-12	$67,076	$3,190	-$9,741	$10,424	$23,355	$495,694	$23,571	0.991	-$216		R5P2
R5-13	$141,831	$6,744	-$10,232	$10,403	$27,379	$577,709	$27,471	0.997	-$91		R5P2
R5-14	$72,962	$3,469	-$9,229	$10,083	$22,782	$540,668	$25,709	0.886	-$2,927		R5P2
R5-15	$63,142	$3,002	-$12,558	$10,730	$26,291	$556,942	$26,483	0.993	-$192		R5P2
R5-16	$240,746	$11,448	-$12,837	$10,950	$35,235	$548,322	$26,073	1.351	$9,162		R5P2
R5-17	$29,445	$1,400	-$6,856	$2,956	$11,211	$311,306	$14,803	0.757	-$3,591		R5P3
R5-18	$111,682	$5,311	-$12,522	$10,445	$28,277	$524,388	$24,935	1.134	$3,342		R5P2
R5-19	$213,591	$10,156	-$2,487	$3,047	$15,690	$293,626	$13,962	1.124	$1,728		R5P3
R5-20	$50,575	$2,405	$157	$9,036	$11,441	$452,349	$21,510	0.532	-$10,068		R5P2
R5-21	$52,584	$2,500	-$475	$9,963	$12,938	$488,609	$23,234	0.557	-$10,296	$ 1,126,797	R5P2
R5-22	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P3

TABLE B-59 (CONTINUED)
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R5-23	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P3
R5-24	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P2
R5-25	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P2
R5-26	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P1
R5-27	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P3
R5-28	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P3
R5-29	$0	$0	$0	$0	$0	$0	$0	$ -	$0		R5P2
R5-30	$44,493	$2,116	-$32,848	$10,827	$45,790	$554,812	$26,382	1.736	$19,409	CONSTRUCTION REACH FIVE	R5P2
R5-31	$345,328	$16,421	-$33,879	$10,722	$61,021	$571,129	$27,158	2.247	$33,863		R5P2
R5-32	$2,022,512	$96,172	-$61,892	$17,647	$175,711	$1,097,078	$52,167	3.368	$123,544		R5P1
R5-33	$748,163	$35,576	-$62,530	$18,446	$116,553	$1,114,803	$53,010	2.199	$63,543		R5P1
R5-34	$307,009	$14,599	-$53,740	$18,079	$86,417	$1,118,372	$53,180	1.625	$33,238		R5P1
R5-35	$444,499	$21,136	-$52,782	$17,448	$91,366	$1,064,885	$50,636	1.804	$40,730		R5P1
R5-36	$4,660,489	$221,611	-$56,472	$16,745	$294,828	$1,091,714	$51,912	5.679	$242,916		R5P1
R5-37	$323,556	$15,385	-$80,647	$19,309	$115,341	$1,146,445	$54,515	2.116	$60,827		R5P1
R5-38	$704,787	$33,513	-$94,528	$21,213	$149,253	$1,334,296	$63,447	2.352	$85,806		R5P1
R5-39	$138,667	$6,594	-$98,750	$20,024	$125,368	$1,136,118	$54,024	2.321	$71,344		R5P1
R5-40	$8,174	$389	-$49,625	$11,375	$61,390	$544,407	$25,887	2.371	$35,503		R5P2
R5-41	$23,301	$1,108	-$44,843	$11,011	$56,962	$543,856	$25,861	2.203	$31,101		R5P2
R5-42	$9,385	$446	-$30,127	$10,512	$41,086	$532,308	$25,312	1.623	$15,774		R5P2
R5-43	$15,871	$755	-$18,731	$9,713	$29,198	$472,514	$22,468	1.300	$6,730		R5P2
R5-44	-$5,731	-$273	-$5,603	$9,075	$14,405	$449,433	$21,371	0.674	-$6,966		R5P2

TABLE B-59 (CONTINUED)
LPP UPDATED BENEFITS BY CONSTRUCTION REACH

Reach	Damage Reduction LPP	Average Annual Damage Reduction	Average Annual Erosion Benefits	Average Annual Emergency Nourishment Cost Avoidance	Average Annual Benefits	Additional Cost -Planned Nourishment Plus Crossover Work	Average Annual Cost	Benefit-to-Cost Ratio	Net Benefits LPP	LPP Summed Benefits	Profile
R5-45	-$25,142	-$1,196	$263	$8,380	$7,184	$423,472	$20,136	0.357	-$12,952		R5P2
R5-46	$195,538	$9,298	$7,328	$8,307	$17,605	$434,469	$20,659	0.852	-$3,055		R5P2
R5-47	$432,393	$20,561	$317	$8,628	$29,189	$224,561	$10,678	2.734	$18,511		R5P2
R5-48	$3,828	$182	$742	$2,950	$3,132	$279,061	$13,270	0.236	-$10,137		R5P3
R5-49	-$7,508	-$357	-$3,946	$3,115	$6,703	$407,677	$19,385	0.346	-$12,682		R5P3
R5-50	$6,144	$292	-$6,119	$3,149	$9,559	$483,178	$22,976	0.416	-$13,416		R5P3
										$ 1,538,063	
LPP SUMMED BENEFITS--------->										$5,833,482	

12.10 CONSTRUCTION COSTS

The following tables display the FY 2014 construction costs for the NED Plan and the LPP from the total project cost summary.

TABLE B-60
NED CONSTRUCTION COSTS

Account	NED	Initial Nourishment ($K) (2014)	Renourishment ($K) (2024, 2034, 2044, 2054)
01	Lands & Damages	762	
17	Initial Beach Nourishment	50,720	22416
22	Environmental	186	101
30	Planning Engineering &Design	1526	678
31	Construction Management	1018	453
	Total NED Cost	**53,765**	**23,649**

TABLE B-61
LPP CONSTRUCTION COSTS

Account	LPP	Initial Nourishment ($K) (2014)	Renourishment ($K) (2024, 2034, 2044, 2054)
01	Lands & Damages	762	
17	Initial Beach Nourishment	59585	25,281
22	Environmental	188	102
30	Planning Engineering &Design	1,807	767
31	Construction Management	1,205	512
	Total LPP Cost	**63,548**	**26,662**

Table B-62 shows the economic justification for the NED Plan and LPP from the Draft Final Report compared to the results of this sensitivity. The average annual benefits for the NED Plan reduce by $1,632,000, the BCR drops from 1.66 to 1.29 and net benefits decrease from $2,924,000 to $1,292,000. The average annual benefits for the LPP reduce by $1,684,000, the BCR falls from 1.46 to 1.13 and the net benefits decrease from $2,374,000 to $690,000.

TABLE B-62
SUMMARY BENEFITS COMPARISONS – FEASIBILITY AND SENSITIVITY

	NED - Feasibility	NED - Sensitivity
Total First Cost	$91,252,000	$91,252,000
Interest During Construction	$1,204,100	$1,204,100
Total Project First Cost	$92,456,100	$92,456,100
Average Annual First Cost	$4,303,850	$4,303,850.0
Annual OMRR&R	$124,500	$124,500
Total Average Annual Cost	$4,428,350	$4,428,350
Average Annual HSDR Benefits	$7,337,000	$5,705,000
Average Annual Recreation Benefits	$16,000	$16,000
Total Average Annual Benefits	$7,353,000	$5,721,000
Benefit-to-Cost Ratio	1.66	1.29
Net Benefits	$2,924,700	$1,292,650
	LPP - Feasibility	LPP - Sensitivity
Total First Cost	$105,811,342	$105,811,342
Interest During Construction	$1,396,200	$1,396,200
Total Project First Cost	$107,207,542	$107,207,542
Average Annual First Cost	$4,990,533	$4,990,533
Annual OMRR&R	$168,000	$168,000
Total Average Annual Cost	$5,158,533	$5,158,533
Average Annual HSDR Benefits	$7,517,000	$5,833,000
Average Annual Recreation Benefits	$16,000	$16,000
Total Average Annual Benefits	$7,533,000	$5,849,000
Benefit-to-Cost Ratio	1.46	1.13
Net Benefits	$2,374,467	$690,467

12.11 CONCLUSION

The NED Plan and the LPP (the selected plan) remain justified even considering the effects of the economic downturn throughout the full period of analysis. Therefore the formulation in the feasibility study should remain and go forward for recommendation.

ATTACHMENT I

RECREATION ANALYSIS

BACKGROUND

Walton County Beaches are ranked among the top 20 destinations in the world by Frommers.

FROMMERS TOP 20 DESTINATIONS 2010
Florida Panhandle Beaches, United States

”Northwest Florida contains some of the most diverse recreation choices along Florida's drastically under-appreciated Gulf Coast, and some of the best options for visitors seeking an affordable family vacation. From Destin to the west, where you can hire fishing or sailing charter, to the smattering of National Seashores as you move east, there's really something for everyone. Seaside's planned community is so "perfect" it was the setting for the *Truman Show*, yet you'll also find old-school Florida towns with funky shops, tiny hotels, pristine beaches, and the perfect cottage to rent. ("Stunning beaches, nature trails, great restaurants, and a cozy, yet quirky, sense of community." -- Lesley Abravanel, author *Frommer's Florida)*

SOURCE:
http://www.frommers.com/trip_ideas/arts_and_culture/article.cfm?ideaID=ARTCULTURE&articleID=6469&t=Frommer%27s%20Top%20Destinations%202010

RECREATIONAL FACILITIES

Recreation at Walton County Beaches occurs along the entire length of the beach which extends for the 26 miles. In addition to the beach, there are a variety of recreation facilities.

STATE PARKS

There are three State Parks in the Walton County Study area. They feature great diversity and natural beauty.

Grayton Beach State Park

Grayton Beach State Park is located south of U.S. Highway 98 approximately halfway between Panama City Beach and Destin. Grayton Beach State Park offers a wide variety of activities for the visitor. Along with the beaches, there are two trails in the 2,228-acre coastal park. There are also 35 campsites with camping and cabin rentals with an additional 22 campsites to be provided in a renovation project that also includes a new ranger station and enhanced American Disabilities Act accessibility and boardwalks.

Topsail Hill Preserve State Park

Topsail Hill Preserve State Park features one of the most diverse natural ecosystems in the state, with wet prairies, scrub, pine flatwoods, marshes and cypress domes. The park has more than three miles of beaches and five dune lakes. The lakes total more than 170 acres within the 1,637-acre park. In addition to the beaches, this recreation area provides opportunities for bicycling, camping, fishing, nature trails, picnicking, scuba, and swimming. The park has a 2.5-mile long maritime nature trail which traverses ancient dunes and scrub communities. The park has Recreational Vehicle (RV) accommodations, with 156 sites and 16 rental cabins. Topsail Hill Preserve State Park is located in Santa Rosa Beach about 10 miles east of Destin, Florida.

Deer Lake State Park

The Deer Lake State Park on County Highway 30A, just west of Watersound, offers park goers a look at intact ancient sand dunes and vast ecosystems. The park has an area of approximately 2,000 acres, the majority of which lies on the north side of the park across County Highway 30A. A walking trail approximately one mile long is located in the wooded area in the northern portion of the park. The recreation area has recently completed a remodeling project on the walkway to the beach providing ADA accessibility.

RECREATION BENEFITS

In order to determine the recreation benefits of the selected plan an economic value must be placed on the recreation experience at the Walton County Beaches. This value can then be applied to the increase in visitation which results from the project to determine the National Economic Development (NED) recreation benefits. For this report, general unit day values (UDV) are used to determine the economic value of recreation at Walton County Beaches. UDV are administratively determined values which represent the NED recreation values for typical types of recreation. Guidance for their use is provided by Engineering Regulation (ER) 1105-2-100.

The UDV are determined using a point system that takes into account the following factors: recreation experience, availability of opportunity, carrying capacity, accessibility, and environmental (esthetics) quality. A good deal of judgment is required in the assessment of point values. A group of planning professionals with knowledge of the study area made independent judgments of the UDV values which were averaged. The UDV point totals convert to a recreation value of $5.07 for the without project condition and $5.16 for the with project condition. There values were applied to the increase in visitation over the study period. The difference between the without and with project value of recreation determines the NED and LPP recreation benefits. The source of the value of recreation is obtained from Economic Guidance Memorandum, 12-03, Unit Day Values for Recreation, Fiscal Year 2010.

Current Visitation

The Walton County Beaches area had 2,300,000 beach visitors in 2004. This estimate is based on data provided by the Beaches of South Walton. In 2009, the peak day estimate was July 4, 2009 weekend when an estimated 13,537 visits occurred. The peak recreation season is from 15 May thru 8 September each year (a total of 15 weeks). Recreational visitation reaches a peak four times during the year. These times are Spring Break, Memorial Day, Independence Day, and Labor Day.

TABLE B-1-1
2004 BEACH VISITATION SUMMARY

According to 2004 Census		
Month	Average Monthly Visitation	Average Daily Visitation
January	34000	1097
February	34000	1172
March	50000	1613
Peak Day	Spring Break	10830
April	40000	1333
May	300000	9677
Peak Day	Memorial Day	13537
June	520000	17333
July	540000	17419
Peak Day	4th of July	13537
August	520000	16774
September	160000	5333
Peak Day	Labor Day	13537
October	34000	1097
November	34000	1133
December	34000	1097
Yearly Total	2,300,000	

SOURCE: Beaches of Walton County

PARKING

Lack of parking may constitute a restriction on public access and use. Therefore, eligibility for Federal participation is precluded in areas where there is a lack of sufficient parking facilities provided for the general public (including non-resident users) reasonably near and accessible to the project beaches according to the ER 1105-2-100.

Access

According to the ER 1105-2-100, reasonable access is approximately every one-half mile or less. Provision of reasonable public access rights-of-way, consistent with attendance used in benefit evaluation is a condition of Corps participation.

Capacity Constraints

The actual capacity of the beach is limited by several types of constraints. These include public access to the beach, availability of parking, and the size of the beach area. Thus the unconstrained visitation forecast must be limited by these capacity considerations. There are a total of 73 access points along the beach. There are over 10,000 public and private parking spaces within the beach. Assuming an average of 4.5 persons per automobile and a turnover rate of 1.5 cars per parking space per day, these 10,000 spaces will support visitation of over 67,000 persons per day.

TABLE B-1-2
ACCESS POINTS AND PARKING

Construction Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
1	R1-3	2375 Scenic Gulf Drive	170	1,148
1	R1-12	735 Scenic Gulf Drive	0	0
1	R1-14	132 Norwood Drive	0	0
1	R1-15	Open Gulf Street	0	0
1	R1-16	~ 90 Beach Drive	6	41
1	R1-17	253 Sand Trap Road	3	20
1	R1-18	End of Tango De Mer	0	0
1	R1-22	San Destin Day Use Area	110	743
1	R2-1	719 Top Sail Hill Road	0	0
2	R3-4	363 Highland Avenue	5	34
2	R3-4	127 Highland Avenue	0	0
2	R3-5	Dune Allen 5753 W. Co Hwy 30A	75	506
2	R3-9	5605 Co Hwy 30A	0	0
2	R3-9	5173 Co Hwy 30A	15	101
2	R3-9	4991 W. Co Hwy 30A	0	0
2	R3-10	4850 W. Co Hwy 30A	5	34
2	R3-11	Gulf Place West Access Point	13	88
2	R3-12	Gulf Place Middle Access Point	13	88
2	R3-13	Gulf Place East Access Point	14	95
2	R3-11	4447 W Co Hwy 30A	42	284
2	R3-13	92 South Spooky Lane	0	0
2	R3-14	4201 Co. Hwy 30A	0	0
2	R3-14	186 Gulf View Heights Street	30	203
2	R3-21	2365 S. Co Hwy 83	22	149
2	R3-21	446 Blue Mountain Road	5	34
2	R3-21	590 Blue Mountain Road	5	34
2	R3-21	726 Blue Mountain Road	5	34
3	R4-5	125 Sandy Lane	12	81
3	R4-6	288 Garfield St.	41	277
3	R4-6	199 Banfill Street	41	277
3	R4-6	208 Holtz Avenue	0	0
3	R4-7	91 Boat Ramp Road	0	0
3	R4-6	913 Main Park Road	0	0
4	R5-2	Water Color Park Garage and Access	100	675
4	R5-3	1931 E. Co Hwy 30A Van Ness Butler Beach Access	101	682

TABLE B-1-2 (CONTINUED)
ACCESS POINTS AND PARKING

Construction Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
4	R5-5	2560 Co Hwy 30A	0	0
4	R5-6	2624 Co Hwy 30A	2	14
4	R5-6	2680 Co Hwy 30A	0	0
4	R5-6	~ 2750 Co Hwy 30A	0	0
4	R5-6	2790 Co Hwy 30A	30	203
4	R5-7	2845 Co Hwy 30A	0	0
4	R5-7	2920 Co Hwy 30A	0	0
4	R5-8	3020 Co Hwy 30A	4	27
4	R5-9	118 Montgomery Street	0	0
4	R5-9	52 S Andalusia St	0	0
4	R5-9	South end of Dothan Avenue on Montgomery Street	0	0
4	R5-10	3458 E. Co Hwy 30A - San Juan Neighborhood B A	20	135
4	R5-10	3512 E. Co. Hwy 30A	0	0
4	R5-10	3576 E. Co Hwy 30A - Pelaya Neighborhood B A	0	0
4	R5-12	3694 E. Co Hwy 30 A - Campbell Street Neighborhood	75	506
4	R5-12	3874 E. Co Hwy 30A	20	135
4	R5-13	57 Seagrove Place	9	61
4	R5-18	679 Eastern Lake Road	6	41
4	R5-18	491 Eastern Lake Road #33 - Eastern Lake N B A	0	0
4	R5-18	188 San Roy Road - neighborhood come out to helio	0	0
4	R5-19	11 Beachside Dune - Sugar Dune	16	108
4	R5-20	258 Beachfront Trail - Walton Dune	10	68
4	R5-22	308 Beachfront Trail	10	68
4	R5-22	Beachside Drive	16	108
5	R5-22	Deer Lake State Park	1	7
5	R5-32	8040 E. Co Hwy 30A - Gulf Lakes Neighborhood B A	0	0
5	R5-34	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	10	68
5	R5-35	Saint Lucia Lane	100	675
5	R5-35	Rosemary Avenue	0	0
5	R5-35	8520 E. Co Hwy 30A - Seacrest Drive Neighborhood B A	0	0
5	R5-46	East Water Street	50	338
5	R5-46	East Water Street	50	338

TABLE B-1-2 (CONTINUED)
ACCESS POINTS AND PARKING

Construction Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
5	R5-46	188 Winston Lane Beach Access	5	34
5	R5-47	264 South Wall Street - Wall Street Neighborhood	9	61
5	R5-47	435 West Park Place Ave.	67	452
5	R5-48	139 South Orange Street	67	452
5	R5-49	118 West Park Place Avenue FL #20	67	452
5	R5-50	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101
TOTALS		73 Access Points	1,492	10,071

BEACH AREA AND CAPACITY

Beach area acts as a constraint on the number of visitors that will visit the Walton County beaches during peak days. Measurements of the beach were taken using 2007 aerial photographs. These measurements indicated that there were over 14.6 million square feet of beach. In this report, it is assumed that visitors will each require 100 square feet of beach per day. Because some visitors spend only part of the day at the beach, a turnover rate of 1.5 visitors per 100 square feet of beach is used as an adjustment. Thus, in 2004, the Walton County beaches were capable of supporting 219,967 visitors per day. Beach area and visitation capacity for 2004 are displayed in Table B-1-3.

TABLE B-1-3
WALTON COUNTY BEACHES BEACH AREA AND VISITATION CAPACITY YEAR 2010

Sub-Reach	Beach Area 2010 (sq. ft.)	2010 Beach Visitation Capacity
1	144,647	2,170
2	193,884	2,908
3	118,450	1,777
4	143,759	2,156
5	151,095	2,266
6	81,688	1,225
7	144,038	2,161
8	150,241	2,254
9	98,015	1,470
10	142,423	2,136
11	102,325	1,535
12	138,375	2,076
13	108,430	1,626
14	145,981	2,190
15	132,471	1,987
16	118,250	1,774
17	120,825	1,812
18	186,678	2,800
19	99,066	1,486
20	117,002	1,755
21	117,680	1,765
22	126,239	1,894
23	146,109	2,192
24	138,097	2,071
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	196,081	2,941
33	94,405	1,416
34	104,320	1,565
35	106,244	1,594
36	148,886	2,233
37	169,797	2,547
38	160,194	2,403
39	123,744	1,856
40	129,262	1,939
41	111,145	1,667
42	132,414	1,986
43	139,742	2,096
44	105,268	1,579
45	168,190	2,523

TABLE B-1-3 (CONTINUED)
WALTON COUNTY BEACHES BEACH AREA AND VISITATION CAPACITY YEAR 2010

Sub-Reach	Beach Area 2010 (sq. ft.)	2010 Beach Visitation Capacity
46	181,141	2,717
47	119,447	1,792
48	144,862	2,173
49	162,923	2,444
50	146,073	2,191
51	151,948	2,279
52	176,213	2,643
53	160,927	2,414
54	133,953	2,009
55	-	-
56	-	-
57	-	-
58	152,398	2,286
59	147,409	2,211
60	147,225	2,208
61	141,315	2,120
62	153,307	2,300
63	204,820	3,072
64	-	-
65	-	-
66	-	-
67	159,837	2,398
68	139,515	2,093
69	151,024	2,265
70	235,318	3,530
71	180,143	2,702
72	197,863	2,968
73	192,040	2,881
74	152,606	2,289
75	171,220	2,568
76	169,494	2,542
77	177,249	2,659
78	197,338	2,960
79	187,086	2,806
80	159,641	2,395
81	181,271	2,719
82	186,231	2,793
83	164,059	2,461
84	198,929	2,984
85	172,004	2,580
86	178,565	2,678
87	220,361	3,305
88	-	-
89	-	-
90	-	-

TABLE B-1-3 (CONTINUED)
WALTON COUNTY BEACHES BEACH AREA AND VISITATION CAPACITY YEAR 2010

Sub-Reach	Beach Area 2010 (sq. ft.)	2010 Beach Visitation Capacity
91	-	-
92	-	-
93	-	-
94	-	-
95	-	-
96	173,143	2,597
97	169,589	2,544
98	163,392	2,451
99	178,913	2,684
100	180,108	2,702
101	165,461	2,482
102	153,915	2,309
103	163,946	2,459
104	173,029	2,595
105	181,690	2,725
106	177,504	2,663
107	157,027	2,355
108	149,656	2,245
109	141,009	2,115
110	136,468	2,047
111	123,157	1,847
112	131,154	1,967
113	140,728	2,111
114	137,897	2,068
115	157,622	2,364
116	174,941	2,624
117	182,917	2,744
TOTALS	14,664,482	219,967

WITHOUT AND WITH PROJECT VALUES

In order to determine the recreation benefits of the selected plan an economic value must be placed on the recreation experience at the Walton County beaches. This value can then be applied to the increase in beach area which results from the project to determine the NED recreation benefits. For this report, unit day values (UDV) are used to determine the economic value of recreation at Walton County beaches. UDV are administratively determined values which represent the NED recreation values for typical types of recreation. They should not be confused with regional economic impact values, which are not appropriate measures of economic benefits for use in a study of this type. UDV were originally set by the U.S. Water Resources Council based on studies of recreation value. Guidance for their use is provided by ER 1105-2-100.

Point System

UDV are determined using a point system that takes into account the following factors: recreation experience, availability of opportunity, carrying capacity, accessibility, and environmental (esthetics) quality. A good deal of judgment is required in the assessment of point values. A group of planning professionals with knowledge of the study area made independent judgments of the UDV values. These values varied somewhat within categories, but were remarkably similar over all. They were averaged for the use in this study.

Recreation Experience. Under the without project condition, Walton County beaches has several general recreation activities including swimming, boating, picnicking, and sunbathing, providing a recreation experience equivalent to 10 points out of 30.

Availability of Opportunity. Availability of opportunity is considered high because there are several similar beaches within 30 minutes to one hour driving time. Because of the large number of competing recreation opportunities, this category was limited to 3 points out of a total of 18.

Carrying Capacity. The carrying capacity of the facilities is considered adequate to conduct recreation during peak demand days, although facilities can certainly be strained at those times. This equates to 7 points out of a total of 14. Note that carrying capacity in the future with project condition is characterized by added dune width. The added dune width is gained at the expense of berm width resulting in less beach in which to recreate.

Accessibility. The project is considered very accessible, with high quality roads to the site and 73 access points within the site. This equates to 15 points out of a total of 18.

Environment. The area has exceptional esthetic value due to the beautiful white sand and clear, warm water of the Gulf of Mexico. Some reduction was made in this category due to the close proximity of commercial development. A rating of 13 out of a total of 16 points was awarded. Under the width project condition, it was felt that the additional 50-foot beach width would result in a slight increase esthetic value during peak days, so one additional point was awarded, for a total of 14 points.

The UDV point totals convert to a recreation value of $5.07 for the without project condition and $5.16 for the with project condition per Economics Guidance Memorandum, 10-03, Unit Day Values for Recreation, Fiscal Year 2010.

TABLE B-1-4
WALTON COUNTY BEACHES WITHOUT AND WITH PROJECT UNIT DAY VALUES

Criteria	W/O Project Points	W/ Project Points
Recreation Experience	10	10
Availability of Opportunity	3	3
Carrying Capacity	8	7
Accessibility	15	15
Environment (Esthetics)	13	14
Total Points	49	49
General Recreation Value	$5.07	$5.16

Future Visitation

Visitation to the Walton County Beach study area has increased rapidly, and this trend is expected to continue as the population of the tributary area increases. For this study, an unconstrained visitation growth forecast was developed for both annual visitation and peak day visitation by applying three percent annual historic increases in visitation. The unconstrained forecast identifies the maximum potential recreation demand for the study area. Limiting factor such as availability of parking and beach area are not considered under this unconstrained forecast.

TABLE B-1-5
WALTON COUNTY BEACHES PROJECTED UNCONSTRAINED VISITATION
2004-2063

Year	Unconstrained Total Annual Visitation	Unconstrained Peak Day Visitation Per Day
2004	2,300,000	13,537
2010	2,746,320	16,164
2014	3,091,008	18,193
2020	3,690,825	21,723
2030	4,960,160	29,194
2040	6,666,040	39,234
2050	8,958,601	52,727
2060	12,039,610	70,861
2063	13,156,007	77,432

Erosion and Accretion

Because the beach is eroding in some areas and accreting in others, total beach area will vary over time in the without project condition.

TABLE B-1-6
WITHOUT PROJECT CONDITION - BEACH AREA STATION (2010 - 2063)

Sub-Reach	Model Reach	2010 (sq. ft)	2020 (sq. ft.)	2030 (sq. ft)	2040 (sq. ft)	2050 (sq. ft)	2060 (sq. ft)	2063 (sq. ft)
1	R1-1	144,647	144,654	144,660	144,667	144,674	144,681	144,688
2	R1-2	193,884	193,890	193,896	193,903	193,909	193,916	193,922
3	R1-3	118,450	118,455	118,460	118,466	118,471	118,476	118,481
4	R1-4	143,759	143,763	143,767	143,771	143,775	143,779	143,783
5	R1-5	151,095	151,098	151,101	151,104	151,107	151,110	151,114
6	R1-6	81,688	81,689	81,690	81,691	81,692	81,693	81,694
7	R1-7	144,038	144,038	144,038	144,038	144,038	144,038	144,038
8	R1-8	150,241	150,241	150,242	150,242	150,242	150,242	150,242
9	R1-9	98,015	98,015	98,016	98,016	98,016	98,017	98,017
10	R1-10	142,423	142,424	142,425	142,426	142,427	142,428	142,429
11	R1-11	102,325	102,326	102,327	102,328	102,329	102,331	102,332
12	R1-12	138,375	138,376	138,376	138,377	138,377	138,378	138,378

TABLE B-1-6 WITHOUT PROJECT CONDITION - BEACH AREA STATION (2010 - 2063)								
Sub-Reach	Model Reach	2010 (sq. ft)	2020 (sq. ft.)	2030 (sq. ft)	2040 (sq. ft)	2050 (sq. ft)	2060 (sq. ft)	2063 (sq. ft)
13	R1-13	108,430	108,430	108,430	108,430	108,430	108,430	108,430
14	R1-14	145,981	145,980	145,979	145,978	145,977	145,976	145,975
15	R1-15	132,471	132,470	132,469	132,467	132,466	132,465	132,464
16	R1-16	118,250	118,249	118,247	118,246	118,245	118,244	118,242
17	R1-17	120,825	120,824	120,823	120,822	120,821	120,819	120,818
18	R1-18	186,678	186,677	186,675	186,674	186,673	186,671	186,670
19	R1-19	99,066	99,065	99,065	99,064	99,064	99,063	99,062
20	R1-20	117,002	117,003	117,004	117,005	117,006	117,007	117,008
21	R1-21	117,680	117,681	117,682	117,683	117,684	117,686	117,687
22	R1-22	126,239	126,242	126,244	126,247	126,249	126,251	126,254
23	R1-23	146,109	146,113	146,117	146,121	146,125	146,129	146,133
24	R1-24	138,097	138,101	138,106	138,111	138,115	138,120	138,124
25	R2-1	-	-	-	-	-	-	-
26	R2-2	-	-	-	-	-	-	-
27	R2-3	-	-	-	-	-	-	-
28	R2-4	-	-	-	-	-	-	-
29	R2-5	-	-	-	-	-	-	-
30	R2-6	-	-	-	-	-	-	-
31	R2-7	-	-	-	-	-	-	-
32	R3-1	196,081	196,085	196,089	196,093	196,097	196,101	196,105
33	R3-2	94,405	94,409	94,413	94,418	94,422	94,426	94,430
34	R3-3	104,320	104,324	104,329	104,333	104,337	104,342	104,346
35	R3-4	106,244	106,249	106,255	106,261	106,266	106,272	106,277
36	R3-5	148,886	148,890	148,895	148,899	148,903	148,907	148,911
37	R3-6	169,797	169,800	169,803	169,806	169,809	169,811	169,814
38	R3-7	160,194	160,195	160,196	160,197	160,198	160,199	160,200
39	R3-8	123,744	123,741	123,739	123,736	123,733	123,730	123,727
40	R3-9	129,262	129,258	129,255	129,251	129,248	129,244	129,241
41	R3-10	111,145	111,140	111,136	111,132	111,127	111,123	111,118
42	R3-11	132,414	132,409	132,404	132,399	132,394	132,389	132,384
43	R3-12	139,742	139,737	139,732	139,727	139,722	139,717	139,712
44	R3-13	105,268	105,262	105,256	105,250	105,244	105,238	105,232
45	R3-14	168,190	168,182	168,175	168,167	168,159	168,151	168,144
46	R3-15	181,141	181,132	181,124	181,115	181,107	181,098	181,090
47	R3-16	119,447	119,438	119,428	119,418	119,409	119,399	119,390
48	R3-17	144,862	144,851	144,840	144,829	144,819	144,808	144,797
49	R3-18	162,923	162,911	162,900	162,889	162,878	162,867	162,856
50	R3-19	146,073	146,062	146,052	146,041	146,030	146,020	146,009
51	R3-20	151,948	151,938	151,928	151,917	151,907	151,897	151,886
52	R3-21	176,213	176,203	176,193	176,183	176,173	176,163	176,153
53	R3-22	160,927	160,918	160,909	160,899	160,890	160,881	160,872
54	R3-23	133,953	133,945	133,937	133,928	133,920	133,912	133,903
55	R3-24	-	-	-	-	-	-	-
56	R3-25	-	-	-	-	-	-	-

TABLE B-1-6 WITHOUT PROJECT CONDITION - BEACH AREA STATION (2010 - 2063)								
Sub-Reach	Model Reach	2010 (sq. ft)	2020 (sq. ft.)	2030 (sq. ft)	2040 (sq. ft)	2050 (sq. ft)	2060 (sq. ft)	2063 (sq. ft)
57	R3-26	-	-	-	-	-	-	-
58	R4-1	152,398	152,391	152,384	152,378	152,371	152,364	152,357
59	R4-2	147,409	147,403	147,398	147,392	147,387	147,382	147,376
60	R4-3	147,225	147,226	147,226	147,227	147,227	147,228	147,228
61	R4-4	141,315	141,316	141,318	141,319	141,320	141,321	141,322
62	R4-5	153,307	153,304	153,301	153,299	153,296	153,293	153,290
63	R4-6	204,820	204,821	204,822	204,823	204,824	204,825	204,826
64	R4-7	-	-	-	-	-	-	-
65	R4-8	-	-	-	-	-	-	-
66	R4-9	-	-	-	-	-	-	-
67	R5-1	159,837	159,828	159,819	159,810	159,801	159,792	159,783
68	R5-2	139,515	139,509	139,503	139,497	139,490	139,484	139,478
69	R5-3	151,024	151,021	151,017	151,014	151,011	151,008	151,004
70	R5-4	235,318	235,317	235,316	235,315	235,315	235,314	235,313
71	R5-5	180,143	180,144	180,145	180,146	180,147	180,148	180,149
72	R5-6	197,863	197,860	197,858	197,855	197,852	197,850	197,847
73	R5-7	192,040	192,037	192,034	192,030	192,027	192,024	192,021
74	R5-8	152,606	152,602	152,598	152,594	152,590	152,585	152,581
75	R5-9	171,220	171,217	171,215	171,213	171,210	171,208	171,206
76	R5-10	169,494	169,491	169,488	169,486	169,483	169,480	169,478
77	R5-11	177,249	177,246	177,243	177,240	177,237	177,234	177,232
78	R5-12	197,338	197,336	197,333	197,330	197,328	197,325	197,322
79	R5-13	187,086	187,083	187,080	187,077	187,074	187,072	187,069
80	R5-14	159,641	159,638	159,636	159,633	159,630	159,628	159,625
81	R5-15	181,271	181,268	181,264	181,261	181,257	181,253	181,250
82	R5-16	186,231	186,228	186,224	186,221	186,217	186,214	186,210
83	R5-17	164,059	164,057	164,055	164,053	164,051	164,049	164,046
84	R5-18	198,929	198,925	198,922	198,918	198,915	198,911	198,908
85	R5-19	172,004	172,004	172,003	172,002	172,001	172,000	171,999
86	R5-20	178,565	178,565	178,565	178,565	178,565	178,565	178,565
87	R5-21	220,361	220,361	220,360	220,360	220,360	220,360	220,360
88	R5-22	-	-	-	-	-	-	-
89	R5-23	-	-	-	-	-	-	-
90	R5-24	-	-	-	-	-	-	-
91	R5-25	-	-	-	-	-	-	-
92	R5-26	-	-	-	-	-	-	-
93	R5-27	-	-	-	-	-	-	-
94	R5-28	-	-	-	-	-	-	-
95	R5-29	-	-	-	-	-	-	-
96	R5-30	173,143	173,139	173,136	173,132	173,128	173,125	173,121
97	R5-31	169,589	169,585	169,581	169,577	169,573	169,570	169,566
98	R5-32	163,392	163,385	163,378	163,371	163,363	163,356	163,349
99	R5-33	178,913	178,906	178,899	178,892	178,885	178,878	178,871
100	R5-34	180,108	180,102	180,097	180,091	180,085	180,079	180,073

TABLE B-1-6 WITHOUT PROJECT CONDITION - BEACH AREA STATION (2010 - 2063)								
Sub-Reach	Model Reach	2010 (sq. ft)	2020 (sq. ft.)	2030 (sq. ft)	2040 (sq. ft)	2050 (sq. ft)	2060 (sq. ft)	2063 (sq. ft)
101	R5-35	165,461	165,455	165,449	165,443	165,437	165,431	165,425
102	R5-36	153,915	153,909	153,902	153,895	153,888	153,881	153,874
103	R5-37	163,946	163,937	163,928	163,919	163,910	163,901	163,892
104	R5-38	173,029	173,019	173,009	172,999	172,989	172,980	172,970
105	R5-39	181,690	181,679	181,668	181,657	181,646	181,635	181,624
106	R5-40	177,504	177,498	177,492	177,487	177,481	177,475	177,470
107	R5-41	157,027	157,022	157,017	157,012	157,007	157,002	156,997
108	R5-42	149,656	149,653	149,650	149,646	149,643	149,640	149,636
109	R5-43	141,009	141,007	141,005	141,002	141,000	140,998	140,996
110	R5-44	136,468	136,467	136,467	136,466	136,465	136,465	136,464
111	R5-45	123,157	123,158	123,158	123,158	123,158	123,158	123,158
112	R5-46	131,154	131,154	131,155	131,156	131,157	131,158	131,159
113	R5-47	140,728	140,729	140,729	140,729	140,729	140,729	140,729
114	R5-48	137,897	137,897	137,898	137,898	137,898	137,898	137,899
115	R5-49	157,622	157,621	157,619	157,618	157,616	157,615	157,613
116	R5-50	174,941	174,939	174,936	174,934	174,931	174,929	174,927
117	R5-51	182,917	182,913	182,910	182,906	182,902	182,899	182,895
TOTALS		14,664,482	14,664,257	14,664,033	14,663,808	14,663,583	14,663,358	14,663,133

Visitation Constraints

Because beach visitation can be affected not only by demand, but also by access constraints, parking constraints, and beach area, all factors are considered in determining actual visitation. Note that parking is a critical constraint when using a beach capacity methodology. The peak user day methodology will be employed to determine the adequacy of parking for the project.

TABLE B-1-7 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2010							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2010 Beach Capacity	Daily Visits For 2010	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,908	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,156	68	$342	Parking
5	R1-5	16	72	2,266	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking

TABLE B-1-7 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2010							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2010 Beach Capacity	Daily Visits For 2010	Daily Value @ $5.07	Critical Constraint
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,071	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,233	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,579	167	$844	Parking
45	R3-14	30	203	2,523	203	$1,027	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,792	0	$0	Parking
48	R3-17	0	0	2,173	0	$0	Parking
49	R3-18	24	108	2,444	108	$548	Parking
50	R3-19	111	500	2,191	500	$2,532	Parking
51	R3-20	23	104	2,279	104	$525	Parking
52	R3-21	37	250	2,643	250	$1,266	Parking
53	R3-22	0	0	2,414	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking

TABLE B-1-7 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2010							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2010 Beach Capacity	Daily Visits For 2010	Daily Value @ $5.07	Critical Constraint
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,300	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,398	0	$0	Parking
68	R5-2	111	725	2,093	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,881	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,659	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,395	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,451	0	$0	Parking
99	R5-33	13	59	2,684	59	$297	Parking

TABLE B-1-7 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2010							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2010 Beach Capacity	Daily Visits For 2010	Daily Value @ $5.07	Critical Constraint
100	R5-34	14	86	2,702	86	$433	Parking
101	R5-35	106	702	2,482	702	$3,559	Parking
102	R5-36	0	0	2,309	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,663	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,967	17,712	$89,800	

2020

TABLE B-1-8 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2020							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2020 Beach Capacity	Daily Visits For 2020	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,908	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,156	68	$342	Parking
5	R1-5	16	72	2,266	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking

TABLE B-1-8 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2020							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2020 Beach Capacity	Daily Visits For 2020	Daily Value @ $5.07	Critical Constraint
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,233	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,579	167	$844	Parking
45	R3-14	30	203	2,523	203	$1,027	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,792	0	$0	Parking
48	R3-17	0	0	2,173	0	$0	Parking
49	R3-18	24	108	2,444	108	$548	Parking
50	R3-19	111	500	2,191	500	$2,532	Parking
51	R3-20	23	104	2,279	104	$525	Parking
52	R3-21	37	250	2,643	250	$1,266	Parking
53	R3-22	0	0	2,414	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking

TABLE B-1-8 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2020							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2020 Beach Capacity	Daily Visits For 2020	Daily Value @ $5.07	Critical Constraint
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,300	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	111	725	2,093	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,881	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,659	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,395	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,451	0	$0	Parking
99	R5-33	13	59	2,684	59	$297	Parking
100	R5-34	14	86	2,702	86	$433	Parking
101	R5-35	106	702	2,482	702	$3,559	Parking
102	R5-36	0	0	2,309	0	$0	Parking

TABLE B-1-8 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2020							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2020 Beach Capacity	Daily Visits For 2020	Daily Value @ $5.07	Critical Constraint
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,964	17,712	$89,800	

2030

TABLE B-1-9 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2030							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2030 Beach Capacity	Daily Visits For 2030	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,908	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,157	68	$342	Parking
5	R1-5	16	72	2,267	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,233	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking

TABLE B-1-9 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2030							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2030 Beach Capacity	Daily Visits For 2030	Daily Value @ $5.07	Critical Constraint
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,579	167	$844	Parking
45	R3-14	30	203	2,523	203	$1,027	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,791	0	$0	Parking
48	R3-17	0	0	2,173	0	$0	Parking
49	R3-18	24	108	2,444	108	$548	Parking
50	R3-19	111	500	2,191	500	$2,532	Parking
51	R3-20	23	104	2,279	104	$525	Parking
52	R3-21	37	250	2,643	250	$1,266	Parking
53	R3-22	0	0	2,414	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,300	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	111	725	2,093	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,881	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,659	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,395	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking

TABLE B-1-9 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2030							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2030 Beach Capacity	Daily Visits For 2030	Daily Value @ $5.07	Critical Constraint
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,451	0	$0	Parking
99	R5-33	13	59	2,683	59	$297	Parking
100	R5-34	14	86	2,701	86	$433	Parking
101	R5-35	106	702	2,482	702	$3,559	Parking
102	R5-36	0	0	2,309	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,960	17,712	$89,800	

2040

TABLE B-1-10 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2040							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2040 Beach Capacity	Daily Visits For 2040	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	0	0	2,909	0	$0	Parking
3	R1-3	170	1,148	1,777	1,148	$5,818	Parking
4	R1-4	0	0	2,157	0	$0	Parking
5	R1-5	0	0	2,267	0	$0	Parking
6	R1-6	0	0	1,225	0	$0	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	0	0	2,254	0	$0	Parking
9	R1-9	0	0	1,470	0	$0	Parking
10	R1-10	0	0	2,136	0	$0	Parking
11	R1-11	0	0	1,535	0	$0	Parking
12	R1-12	0	0	2,076	0	$0	Parking
13	R1-13	0	0	1,626	0	$0	Parking
14	R1-14	0	0	2,190	0	$0	Parking
15	R1-15	0	0	1,987	0	$0	Parking
16	R1-16	6	41	1,774	41	$205	Parking
17	R1-17	3	20	1,812	20	$103	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	0	0	1,486	0	$0	Parking
20	R1-20	0	0	1,755	0	$0	Parking
21	R1-21	0	0	1,765	0	$0	Parking
22	R1-22	110	743	1,894	743	$3,764	Parking
23	R1-23	0	0	2,192	0	$0	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	0	0	1,565	0	$0	Parking
35	R3-4	5	34	1,594	34	$171	Parking
36	R3-5	75	506	2,233	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	0	0	1,856	0	$0	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	55	371	1,986	371	$1,882	Parking

TABLE B-1-10 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2040							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2040 Beach Capacity	Daily Visits For 2040	Daily Value @ $5.07	Critical Constraint
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	14	95	1,579	95	$479	Parking
45	R3-14	30	203	2,523	203	$1,027	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,791	0	$0	Parking
48	R3-17	0	0	2,172	0	$0	Parking
49	R3-18	0	0	2,443	0	$0	Parking
50	R3-19	0	0	2,191	0	$0	Parking
51	R3-20	0	0	2,279	0	$0	Parking
52	R3-21	37	250	2,643	250	$1,266	Parking
53	R3-22	0	0	2,413	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,299	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	100	675	2,092	675	$3,422	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,880	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	0	0	2,659	0	$0	Parking
78	R5-12	95	641	2,960	641	$3,251	Parking
79	R5-13	9	61	2,806	61	$308	Parking
80	R5-14	0	0	2,394	0	$0	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	0	0	2,793	0	$0	Parking
83	R5-17	0	0	2,461	0	$0	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	10	68	2,678	68	$342	Parking

TABLE B-1-10 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2040							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2040 Beach Capacity	Daily Visits For 2040	Daily Value @ $5.07	Critical Constraint
87	R5-21	0	0	3,305	0	$0	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,451	0	$0	Parking
99	R5-33	0	0	2,683	0	$0	Parking
100	R5-34	10	68	2,701	68	$342	Parking
101	R5-35	100	675	2,482	675	$3,422	Parking
102	R5-36	0	0	2,308	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	0	0	2,245	0	$0	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,957	10,071	$51,060	

2050

TABLE B-1-11 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2050							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2050 Beach Capacity	Daily Visits For 2050	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,909	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,157	68	$342	Parking
5	R1-5	16	72	2,267	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,234	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking

TABLE B-1-11 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2050							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2050 Beach Capacity	Daily Visits For 2050	Daily Value @ $5.07	Critical Constraint
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,579	167	$844	Parking
45	R3-14	30	203	2,522	203	$1,027	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,791	0	$0	Parking
48	R3-17	0	0	2,172	0	$0	Parking
49	R3-18	24	108	2,443	108	$548	Parking
50	R3-19	111	500	2,190	500	$2,532	Parking
51	R3-20	23	104	2,279	104	$525	Parking
52	R3-21	37	250	2,643	250	$1,266	Parking
53	R3-22	0	0	2,413	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,299	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	111	725	2,092	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,880	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,659	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,394	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking

TABLE B-1-11 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2050							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2050 Beach Capacity	Daily Visits For 2050	Daily Value @ $5.07	Critical Constraint
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,450	0	$0	Parking
99	R5-33	13	59	2,683	59	$297	Parking
100	R5-34	14	86	2,701	86	$433	Parking
101	R5-35	106	702	2,482	702	$3,559	Parking
102	R5-36	0	0	2,308	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,954	17,712	$89,800	

2060

TABLE B-1-12 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2060							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2060 Beach Capacity	Daily Visits For 2060	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,909	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,157	68	$342	Parking
5	R1-5	16	72	2,267	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,942	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,234	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking

TABLE B-1-12 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2060							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2060 Beach Capacity	Daily Visits For 2060	Daily Value @ $5.07	Critical Constraint
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,579	167	$844	Parking
45	R3-14	30	203	2,522	203	$1,027	Parking
46	R3-15	0	0	2,716	0	$0	Parking
47	R3-16	0	0	1,791	0	$0	Parking
48	R3-17	0	0	2,172	0	$0	Parking
49	R3-18	24	108	2,443	108	$548	Parking
50	R3-19	111	500	2,190	500	$2,532	Parking
51	R3-20	23	104	2,278	104	$525	Parking
52	R3-21	37	250	2,642	250	$1,266	Parking
53	R3-22	0	0	2,413	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,285	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,299	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	111	725	2,092	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,880	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,659	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,394	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking

TABLE B-1-12 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2060							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2060 Beach Capacity	Daily Visits For 2060	Daily Value @ $5.07	Critical Constraint
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,450	0	$0	Parking
99	R5-33	13	59	2,683	59	$297	Parking
100	R5-34	14	86	2,701	86	$433	Parking
101	R5-35	106	702	2,481	702	$3,559	Parking
102	R5-36	0	0	2,308	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,743	0	$0	Parking
TOTAL		3,190	17,712	219,950	17,712	$89,800	

2063

TABLE B-1-13 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2063							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2063 Beach Capacity	Daily Visits For 2063	Daily Value @ $5.07	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,909	99	$502	Parking
3	R1-3	198	1,274	1,777	1,274	$6,457	Parking
4	R1-4	15	68	2,157	68	$342	Parking
5	R1-5	16	72	2,267	72	$365	Parking
6	R1-6	18	81	1,225	81	$411	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$228	Parking
9	R1-9	3	14	1,470	14	$68	Parking
10	R1-10	33	149	2,136	149	$753	Parking
11	R1-11	16	72	1,535	72	$365	Parking
12	R1-12	31	140	2,076	140	$707	Parking
13	R1-13	76	342	1,626	342	$1,734	Parking
14	R1-14	33	149	2,190	149	$753	Parking
15	R1-15	77	347	1,987	347	$1,757	Parking
16	R1-16	109	504	1,774	504	$2,555	Parking
17	R1-17	7	38	1,812	38	$194	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,255	Parking
20	R1-20	81	365	1,755	365	$1,848	Parking
21	R1-21	146	657	1,765	657	$3,331	Parking
22	R1-22	202	1,157	1,894	1,157	$5,863	Parking
23	R1-23	155	698	2,192	698	$3,536	Parking
24	R1-24	0	0	2,072	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,942	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$114	Parking
35	R3-4	12	65	1,594	65	$331	Parking
36	R3-5	75	506	2,234	506	$2,567	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$274	Parking
40	R3-9	15	101	1,939	101	$513	Parking
41	R3-10	5	34	1,667	34	$171	Parking
42	R3-11	68	430	1,986	430	$2,179	Parking

TABLE B-1-13 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2063							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2063 Beach Capacity	Daily Visits For 2063	Daily Value @ $5.07	Critical Constraint
43	R3-12	13	88	2,096	88	$445	Parking
44	R3-13	30	167	1,578	167	$844	Parking
45	R3-14	30	203	2,522	203	$1,027	Parking
46	R3-15	0	0	2,716	0	$0	Parking
47	R3-16	0	0	1,791	0	$0	Parking
48	R3-17	0	0	2,172	0	$0	Parking
49	R3-18	24	108	2,443	108	$548	Parking
50	R3-19	111	500	2,190	500	$2,532	Parking
51	R3-20	23	104	2,278	104	$525	Parking
52	R3-21	37	250	2,642	250	$1,266	Parking
53	R3-22	0	0	2,413	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,285	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,299	81	$411	Parking
63	R4-6	82	554	3,072	554	$2,806	Parking
64	R4-7	0	0	-	0	$0	Parking
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,397	0	$0	Parking
68	R5-2	111	725	2,092	725	$3,673	Parking
69	R5-3	101	682	2,265	682	$3,456	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,095	Parking
73	R5-7	0	0	2,880	0	$0	Parking
74	R5-8	4	27	2,289	27	$137	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$684	Parking
77	R5-11	71	320	2,658	320	$1,620	Parking
78	R5-12	145	866	2,960	866	$4,392	Parking
79	R5-13	79	376	2,806	376	$1,905	Parking
80	R5-14	137	617	2,394	617	$3,126	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$821	Parking
84	R5-18	6	41	2,984	41	$205	Parking
85	R5-19	16	108	2,580	108	$548	Parking
86	R5-20	61	297	2,678	297	$1,506	Parking

TABLE B-1-13 HISTORIC PEAK DAY CONSTRAINED VISITATION CAPACITY - 2063							
Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	2063 Beach Capacity	Daily Visits For 2063	Daily Value @ $5.07	Critical Constraint
87	R5-21	9	41	3,305	41	$205	Parking
88	R5-22	27	182	-	182	$924	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,543	0	$0	Parking
98	R5-32	0	0	2,450	0	$0	Parking
99	R5-33	13	59	2,683	59	$297	Parking
100	R5-34	14	86	2,701	86	$433	Parking
101	R5-35	106	702	2,481	702	$3,559	Parking
102	R5-36	0	0	2,308	0	$0	Parking
103	R5-37	0	0	2,458	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,724	0	$0	Parking
106	R5-40	0	0	2,662	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking
108	R5-42	13	59	2,245	59	$297	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,593	Parking
113	R5-47	76	513	2,111	513	$2,601	Parking
114	R5-48	67	452	2,068	452	$2,293	Parking
115	R5-49	67	452	2,364	452	$2,293	Parking
116	R5-50	15	101	2,624	101	$513	Parking
117	R5-51	0	0	2,743	0	$0	Parking
TOTAL		3,190	17,712	219,947	17,712	$89,800	

Table B-1-14 presents a summary data for visitation capacity by year for the without project condition.

TABLE B-1-14
WITHOUT PROJECT CONDITION SUMMARY VISITATION CAPACITY BY YEAR

Year	Maximum Peak Day Visits	Daily Parking Capacity	Daily Beach Capacity	Daily Constrained Visits		Daily Parking Capacity
2010	16,164	17,712	219,967	17,712		17,712
2020	18,193	17,712	219,964	17,712		17,712
2030	21,723	17,712	219,960	17,712		17,712
2040	29,194	17,712	219,957	17,712		17,712
2050	39,234	17,712	219,954	17,712		17,712
2060	52,727	17,712	219,950	17,712		17,712
2063	70,861	17,712	219,947	17,712		17,712

Table B-1-15 presents a summary of peak day recreation value by reach and year for the without project condition.

TABLE B-1-15
WITHOUT PROJECT PEAK DAY VISITATION VALUE BY REACH AND YEAR

Sub-Reach	Model Reach	2020	2030	2040	2050	2060	2063
1	R1-1	$0	$0	$0	$0	$0	$0
2	R1-2	$502	$502	$502	$502	$502	$502
3	R1-3	$6,457	$6,457	$6,457	$6,457	$6,457	$6,457
4	R1-4	$342	$342	$342	$342	$342	$342
5	R1-5	$365	$365	$365	$365	$365	$365
6	R1-6	$411	$411	$411	$411	$411	$411
7	R1-7	$0	$0	$0	$0	$0	$0
8	R1-8	$228	$228	$228	$228	$228	$228
9	R1-9	$68	$68	$68	$68	$68	$68
10	R1-10	$753	$753	$753	$753	$753	$753
11	R1-11	$365	$365	$365	$365	$365	$365
12	R1-12	$707	$707	$707	$707	$707	$707
13	R1-13	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734
14	R1-14	$753	$753	$753	$753	$753	$753
15	R1-15	$1,757	$1,757	$1,757	$1,757	$1,757	$1,757
16	R1-16	$2,555	$2,555	$2,555	$2,555	$2,555	$2,555
17	R1-17	$194	$194	$194	$194	$194	$194
18	R1-18	$0	$0	$0	$0	$0	$0
19	R1-19	$1,255	$1,255	$1,255	$1,255	$1,255	$1,255

TABLE B-1-15 (CONTINUED)
WITHOUT PROJECT PEAK DAY VISITATION VALUE BY REACH AND YEAR

Sub-Reach	Model Reach	2020	2030	2040	2050	2060	2063
20	R1-20	$1,848	$1,848	$1,848	$1,848	$1,848	$1,848
21	R1-21	$3,331	$3,331	$3,331	$3,331	$3,331	$3,331
22	R1-22	$5,863	$5,863	$5,863	$5,863	$5,863	$5,863
23	R1-23	$3,536	$3,536	$3,536	$3,536	$3,536	$3,536
24	R1-24	$0	$0	$0	$0	$0	$0
25	R2-1	$0	$0	$0	$0	$0	$0
26	R2-2	$0	$0	$0	$0	$0	$0
27	R2-3	$0	$0	$0	$0	$0	$0
28	R2-4	$0	$0	$0	$0	$0	$0
29	R2-5	$0	$0	$0	$0	$0	$0
30	R2-6	$0	$0	$0	$0	$0	$0
31	R2-7	$0	$0	$0	$0	$0	$0
32	R3-1	$0	$0	$0	$0	$0	$0
33	R3-2	$0	$0	$0	$0	$0	$0
34	R3-3	$114	$114	$114	$114	$114	$114
35	R3-4	$331	$331	$331	$331	$331	$331
36	R3-5	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567
37	R3-6	$0	$0	$0	$0	$0	$0
38	R3-7	$0	$0	$0	$0	$0	$0
39	R3-8	$274	$274	$274	$274	$274	$274
40	R3-9	$513	$513	$513	$513	$513	$513
41	R3-10	$171	$171	$171	$171	$171	$171
42	R3-11	$2,179	$2,179	$2,179	$2,179	$2,179	$2,179
43	R3-12	$445	$445	$445	$445	$445	$445
44	R3-13	$844	$844	$844	$844	$844	$844
45	R3-14	$1,027	$1,027	$1,027	$1,027	$1,027	$1,027
46	R3-15	$0	$0	$0	$0	$0	$0
47	R3-16	$0	$0	$0	$0	$0	$0
48	R3-17	$0	$0	$0	$0	$0	$0
49	R3-18	$548	$548	$548	$548	$548	$548
50	R3-19	$2,532	$2,532	$2,532	$2,532	$2,532	$2,532
51	R3-20	$525	$525	$525	$525	$525	$525
52	R3-21	$1,266	$1,266	$1,266	$1,266	$1,266	$1,266
53	R3-22	$0	$0	$0	$0	$0	$0
54	R3-23	$0	$0	$0	$0	$0	$0
55	R3-24	$0	$0	$0	$0	$0	$0
56	R3-25	$0	$0	$0	$0	$0	$0
57	R3-26	$0	$0	$0	$0	$0	$0
58	R4-1	$0	$0	$0	$0	$0	$0
59	R4-2	$0	$0	$0	$0	$0	$0
60	R4-3	$0	$0	$0	$0	$0	$0
61	R4-4	$0	$0	$0	$0	$0	$0
62	R4-5	$411	$411	$411	$411	$411	$411
63	R4-6	$2,806	$2,806	$2,806	$2,806	$2,806	$2,806

TABLE B-1-15 (CONTINUED)
WITHOUT PROJECT PEAK DAY VISITATION VALUE BY REACH AND YEAR

Sub-Reach	Model Reach	2020	2030	2040	2050	2060	2063
64	R4-7	$0	$0	$0	$0	$0	$0
65	R4-8	$0	$0	$0	$0	$0	$0
66	R4-9	$0	$0	$0	$0	$0	$0
67	R5-1	$0	$0	$0	$0	$0	$0
68	R5-2	$3,673	$3,673	$3,673	$3,673	$3,673	$3,673
69	R5-3	$3,456	$3,456	$3,456	$3,456	$3,456	$3,456
70	R5-4	$0	$0	$0	$0	$0	$0
71	R5-5	$0	$0	$0	$0	$0	$0
72	R5-6	$1,095	$1,095	$1,095	$1,095	$1,095	$1,095
73	R5-7	$0	$0	$0	$0	$0	$0
74	R5-8	$137	$137	$137	$137	$137	$137
75	R5-9	$0	$0	$0	$0	$0	$0
76	R5-10	$684	$684	$684	$684	$684	$684
77	R5-11	$1,620	$1,620	$1,620	$1,620	$1,620	$1,620
78	R5-12	$4,392	$4,392	$4,392	$4,392	$4,392	$4,392
79	R5-13	$1,905	$1,905	$1,905	$1,905	$1,905	$1,905
80	R5-14	$3,126	$3,126	$3,126	$3,126	$3,126	$3,126
81	R5-15	$0	$0	$0	$0	$0	$0
82	R5-16	$46	$46	$46	$46	$46	$46
83	R5-17	$821	$821	$821	$821	$821	$821
84	R5-18	$205	$205	$205	$205	$205	$205
85	R5-19	$548	$548	$548	$548	$548	$548
86	R5-20	$1,506	$1,506	$1,506	$1,506	$1,506	$1,506
87	R5-21	$205	$205	$205	$205	$205	$205
88	R5-22	$924	$924	$924	$924	$924	$924
89	R5-23	$0	$0	$0	$0	$0	$0
90	R5-24	$0	$0	$0	$0	$0	$0
91	R5-25	$0	$0	$0	$0	$0	$0
92	R5-26	$0	$0	$0	$0	$0	$0
93	R5-27	$0	$0	$0	$0	$0	$0
94	R5-28	$0	$0	$0	$0	$0	$0
95	R5-29	$0	$0	$0	$0	$0	$0
96	R5-30	$0	$0	$0	$0	$0	$0
97	R5-31	$0	$0	$0	$0	$0	$0
98	R5-32	$0	$0	$0	$0	$0	$0
99	R5-33	$297	$297	$297	$297	$297	$297
100	R5-34	$433	$433	$433	$433	$433	$433
101	R5-35	$3,559	$3,559	$3,559	$3,559	$3,559	$3,559
102	R5-36	$0	$0	$0	$0	$0	$0
103	R5-37	$0	$0	$0	$0	$0	$0
104	R5-38	$0	$0	$0	$0	$0	$0
105	R5-39	$0	$0	$0	$0	$0	$0
106	R5-40	$0	$0	$0	$0	$0	$0
107	R5-41	$0	$0	$0	$0	$0	$0

TABLE B-1-15 (CONTINUED)
WITHOUT PROJECT PEAK DAY VISITATION VALUE BY REACH AND YEAR

Sub-Reach	Model Reach	2020	2030	2040	2050	2060	2063
108	R5-42	$297	$297	$297	$297	$297	$297
109	R5-43	$0	$0	$0	$0	$0	$0
110	R5-44	$0	$0	$0	$0	$0	$0
111	R5-45	$0	$0	$0	$0	$0	$0
112	R5-46	$3,593	$3,593	$3,593	$3,593	$3,593	$3,593
113	R5-47	$2,601	$2,601	$2,601	$2,601	$2,601	$2,601
114	R5-48	$2,293	$2,293	$2,293	$2,293	$2,293	$2,293
115	R5-49	$2,293	$2,293	$2,293	$2,293	$2,293	$2,293
116	R5-50	$513	$513	$513	$513	$513	$513
117	R5-51	$0	$0	$0	$0	$0	$0
TOTAL		$89,800	$89,800	$89,800	$89,800	$89,800	$89,800

SELECTED PLAN

Only one alternative, the selected plan, is evaluated under the with project condition.

TABLE B-1-16
WITH PROJECT PEAK DAY VISITATION CAPACITY AND VALUE - 2010

Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	With Project Beach Capacity	Daily Visits With Project	Daily Value @ $5.16	Critical Constraint
1	R1-1	0	0	2,170	0	$0	Parking
2	R1-2	22	99	2,908	99	$511	Parking
3	R1-3	198	1,274	1,777	1,274	$6,571	Parking
4	R1-4	15	68	2,156	68	$348	Parking
5	R1-5	16	72	2,266	72	$372	Parking
6	R1-6	18	81	1,225	81	$418	Parking
7	R1-7	0	0	2,161	0	$0	Parking
8	R1-8	10	45	2,254	45	$232	Parking
9	R1-9	3	14	1,470	14	$70	Parking
10	R1-10	33	149	2,136	149	$766	Parking
11	R1-11	16	72	1,535	72	$372	Parking
12	R1-12	31	140	2,076	140	$720	Parking
13	R1-13	76	342	1,626	342	$1,765	Parking
14	R1-14	33	149	2,190	149	$766	Parking
15	R1-15	77	347	1,987	347	$1,788	Parking
16	R1-16	109	504	1,774	504	$2,601	Parking
17	R1-17	7	38	1,812	38	$197	Parking
18	R1-18	0	0	2,800	0	$0	Parking
19	R1-19	55	248	1,486	248	$1,277	Parking
20	R1-20	81	365	1,755	365	$1,881	Parking
21	R1-21	146	657	1,765	657	$3,390	Parking

TABLE B-1-16 (CONTINUED)
WITH PROJECT PEAK DAY VISITATION CAPACITY AND VALUE - 2010

Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	With Project Beach Capacity	Daily Visits With Project	Daily Value @ $5.16	Critical Constraint
22	R1-22	202	1,157	1,894	1,157	$5,968	Parking
23	R1-23	155	698	2,192	698	$3,599	Parking
24	R1-24	0	0	2,071	0	$0	Parking
25	R2-1	0	0	-	0	$0	Parking
26	R2-2	0	0	-	0	$0	Parking
27	R2-3	0	0	-	0	$0	Parking
28	R2-4	0	0	-	0	$0	Parking
29	R2-5	0	0	-	0	$0	Parking
30	R2-6	0	0	-	0	$0	Parking
31	R2-7	0	0	-	0	$0	Parking
32	R3-1	0	0	2,941	0	$0	Parking
33	R3-2	0	0	1,416	0	$0	Parking
34	R3-3	5	23	1,565	23	$116	Parking
35	R3-4	12	65	1,594	65	$337	Parking
36	R3-5	75	506	2,233	506	$2,612	Parking
37	R3-6	0	0	2,547	0	$0	Parking
38	R3-7	0	0	2,403	0	$0	Parking
39	R3-8	12	54	1,856	54	$279	Parking
40	R3-9	15	101	1,939	101	$522	Parking
41	R3-10	5	34	1,667	34	$174	Parking
42	R3-11	68	430	1,986	430	$2,218	Parking
43	R3-12	13	88	2,096	88	$453	Parking
44	R3-13	30	167	1,579	167	$859	Parking
45	R3-14	30	203	2,523	203	$1,045	Parking
46	R3-15	0	0	2,717	0	$0	Parking
47	R3-16	0	0	1,792	0	$0	Parking
48	R3-17	0	0	2,173	0	$0	Parking
49	R3-18	24	108	2,444	108	$557	Parking
50	R3-19	111	500	2,191	500	$2,577	Parking
51	R3-20	23	104	2,279	104	$534	Parking
52	R3-21	37	250	2,643	250	$1,289	Parking
53	R3-22	0	0	2,414	0	$0	Parking
54	R3-23	0	0	2,009	0	$0	Parking
55	R3-24	0	0	-	0	$0	Parking
56	R3-25	0	0	-	0	$0	Parking
57	R3-26	0	0	-	0	$0	Parking
58	R4-1	0	0	2,286	0	$0	Parking
59	R4-2	0	0	2,211	0	$0	Parking
60	R4-3	0	0	2,208	0	$0	Parking
61	R4-4	0	0	2,120	0	$0	Parking
62	R4-5	12	81	2,300	81	$418	Parking
63	R4-6	82	554	3,072	554	$2,856	Parking
64	R4-7	0	0	-	0	$0	Parking

TABLE B-1-16 (CONTINUED)
WITH PROJECT PEAK DAY VISITATION CAPACITY AND VALUE - 2010

Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	With Project Beach Capacity	Daily Visits With Project	Daily Value @ $5.16	Critical Constraint
65	R4-8	0	0	-	0	$0	Parking
66	R4-9	0	0	-	0	$0	Parking
67	R5-1	0	0	2,398	0	$0	Parking
68	R5-2	111	725	2,093	725	$3,738	Parking
69	R5-3	101	682	2,265	682	$3,518	Parking
70	R5-4	0	0	3,530	0	$0	Parking
71	R5-5	0	0	2,702	0	$0	Parking
72	R5-6	32	216	2,968	216	$1,115	Parking
73	R5-7	0	0	2,881	0	$0	Parking
74	R5-8	4	27	2,289	27	$139	Parking
75	R5-9	0	0	2,568	0	$0	Parking
76	R5-10	20	135	2,542	135	$697	Parking
77	R5-11	71	320	2,659	320	$1,649	Parking
78	R5-12	145	866	2,960	866	$4,470	Parking
79	R5-13	79	376	2,806	376	$1,939	Parking
80	R5-14	137	617	2,395	617	$3,181	Parking
81	R5-15	0	0	2,719	0	$0	Parking
82	R5-16	2	9	2,793	9	$46	Parking
83	R5-17	36	162	2,461	162	$836	Parking
84	R5-18	6	41	2,984	41	$209	Parking
85	R5-19	16	108	2,580	108	$557	Parking
86	R5-20	61	297	2,678	297	$1,533	Parking
87	R5-21	9	41	3,305	41	$209	Parking
88	R5-22	27	182	-	182	$940	Parking
89	R5-23	0	0	-	0	$0	Parking
90	R5-24	0	0	-	0	$0	Parking
91	R5-25	0	0	-	0	$0	Parking
92	R5-26	0	0	-	0	$0	Parking
93	R5-27	0	0	-	0	$0	Parking
94	R5-28	0	0	-	0	$0	Parking
95	R5-29	0	0	-	0	$0	Parking
96	R5-30	0	0	2,597	0	$0	Parking
97	R5-31	0	0	2,544	0	$0	Parking
98	R5-32	0	0	2,451	0	$0	Parking
99	R5-33	13	59	2,684	59	$302	Parking
100	R5-34	14	86	2,702	86	$441	Parking
101	R5-35	106	702	2,482	702	$3,622	Parking
102	R5-36	0	0	2,309	0	$0	Parking
103	R5-37	0	0	2,459	0	$0	Parking
104	R5-38	0	0	2,595	0	$0	Parking
105	R5-39	0	0	2,725	0	$0	Parking
106	R5-40	0	0	2,663	0	$0	Parking
107	R5-41	0	0	2,355	0	$0	Parking

TABLE B-1-16 (CONTINUED)
WITH PROJECT PEAK DAY VISITATION CAPACITY AND VALUE - 2010

Sub-Reach	Model Reach	Parking Spaces	Daily Parking Capacity	With Project Beach Capacity	Daily Visits With Project	Daily Value @ $5.16	Critical Constraint
108	R5-42	13	59	2,245	59	$302	Parking
109	R5-43	0	0	2,115	0	$0	Parking
110	R5-44	0	0	2,047	0	$0	Parking
111	R5-45	0	0	1,847	0	$0	Parking
112	R5-46	105	709	1,967	709	$3,657	Parking
113	R5-47	76	513	2,111	513	$2,647	Parking
114	R5-48	67	452	2,068	452	$2,334	Parking
115	R5-49	67	452	2,364	452	$2,334	Parking
116	R5-50	15	101	2,624	101	$522	Parking
117	R5-51	0	0	2,744	0	$0	Parking
TOTAL		3,190	17,712	219,967	17,712	$91,394	

Benefit Evaluation

The net increase in visitation experience between the without and with project conditions is the basis for determining recreation benefits for the selected plan. Information related to net increases in peak day recreation is provided in Table B-1-17.

TABLE B-1-17
NET INCREASE IN PEAK DAY VISITATION SELECTED PLAN

Year	Without Project Peak Day Visits	With Project Peak Day Visits	Net Peak Day Increased
2010	17,712	17,712	0
2020	17,712	17,712	0
2030	17,712	17,712	0
2040	17,712	17,712	0
2050	17,712	17,712	0
2060	17,712	17,712	0
2063	17,712	17,712	0

Assuming a project life of 50 years and an interest rate of four and three-eight percent, average annual benefits for recreation total approximately $15,800. Average annual recreation value information is presented by reach in Table B-1-18 These benefits are included as incidental benefits in the total benefit accounting, but they are not included in the formulation of the project with respect to size and scope.

TABLE B-1-18 AVERAGE ANNUAL PEAK DAY RECREATION BENEFITS BY REACH				
Sub-Reach	W/O Project Peak Day Benefits	W/ Project Peak Day Benefits	Incremental Peak Day Benefits	Total Annual Benefits
1	$0	$0	$0	$0
2	$502	$511	$9	$89
3	$6,457	$6,571	$115	$1,146
4	$342	$348	$6	$61
5	$365	$372	$6	$65
6	$411	$418	$7	$73
7	$0	$0	$0	$0
8	$228	$232	$4	$40
9	$68	$70	$1	$12
10	$753	$766	$13	$134
11	$365	$372	$6	$65
12	$707	$720	$13	$126
13	$1,734	$1,765	$31	$308
14	$753	$766	$13	$134
15	$1,757	$1,788	$31	$312
16	$2,555	$2,601	$45	$454
17	$194	$197	$3	$34
18	$0	$0	$0	$0
19	$1,255	$1,277	$22	$223
20	$1,848	$1,881	$33	$328
21	$3,331	$3,390	$59	$591
22	$5,863	$5,968	$104	$1,041
23	$3,536	$3,599	$63	$628
24	$0	$0	$0	$0
25	-	-	-	-
26	-	-	-	-
27	-	-	-	-
28	-	-	-	-
29	-	-	-	-
30	-	-	-	-
31	-	-	-	-
32	$0	$0	$0	$0
33	$0	$0	$0	$0
34	$114	$116	$2	$20
35	$331	$337	$6	$59
36	$2,567	$2,612	$46	$456
37	$0	$0	$0	$0
38	$0	$0	$0	$0
39	$274	$279	$5	$49
40	$513	$522	$9	$91
41	$171	$174	$3	$30
42	$2,179	$2,218	$39	$387
43	$445	$453	$8	$79
44	$844	$859	$15	$150

TABLE B-1-18 (CONTINUED) AVERAGE ANNUAL PEAK DAY RECREATION BENEFITS BY REACH				
Sub-Reach	W/O Project Peak Day Benefits	W/ Project Peak Day Benefits	Incremental Peak Day Benefits	Total Annual Benefits
45	$1,027	$1,045	$18	$182
46	$0	$0	$0	$0
47	$0	$0	$0	$0
48	$0	$0	$0	$0
49	$548	$557	$10	$97
50	$2,532	$2,577	$45	$450
51	$525	$534	$9	$93
52	$1,266	$1,289	$22	$225
53	$0	$0	$0	$0
54	$0	$0	$0	$0
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
58	$0	$0	$0	$0
59	$0	$0	$0	$0
60	$0	$0	$0	$0
61	$0	$0	$0	$0
62	$411	$418	$7	$73
63	$2,806	$2,856	$50	$498
64	-	-	-	-
65	-	-	-	-
66	-	-	-	-
67	$0	$0	$0	$0
68	$3,673	$3,738	$65	$652
69	$3,456	$3,518	$61	$614
70	$0	$0	$0	$0
71	$0	$0	$0	$0
72	$1,095	$1,115	$19	$194
73	$0	$0	$0	$0
74	$137	$139	$2	$24
75	$0	$0	$0	$0
76	$684	$697	$12	$122
77	$1,620	$1,649	$29	$288
78	$4,392	$4,470	$78	$780
79	$1,905	$1,939	$34	$338
80	$3,126	$3,181	$55	$555
81	$0	$0	$0	$0
82	$46	$46	$1	$8
83	$821	$836	$15	$146
84	$205	$209	$4	$36
85	$548	$557	$10	$97
86	$1,506	$1,533	$27	$267
87	$205	$209	$4	$36

TABLE B-1-18 (CONTINUED) AVERAGE ANNUAL PEAK DAY RECREATION BENEFITS BY REACH				
Sub-Reach	W/O Project Peak Day Benefits	W/ Project Peak Day Benefits	Incremental Peak Day Benefits	Total Annual Benefits
88	-	-	-	-
89	-	-	-	-
90	-	-	-	-
91	-	-	-	-
92	-	-	-	-
93	-	-	-	-
94	-	-	-	-
95	-	-	-	-
96	$0	$0	$0	$0
97	$0	$0	$0	$0
98	$0	$0	$0	$0
99	$297	$302	$5	$53
100	$433	$441	$8	$77
101	$3,559	$3,622	$63	$632
102	$0	$0	$0	$0
103	$0	$0	$0	$0
104	$0	$0	$0	$0
105	$0	$0	$0	$0
106	$0	$0	$0	$0
107	$0	$0	$0	$0
108	$297	$302	$5	$53
109	$0	$0	$0	$0
110	$0	$0	$0	$0
111	$0	$0	$0	$0
112	$3,593	$3,657	$64	$638
113	$2,601	$2,647	$46	$462
114	$2,293	$2,334	$41	$407
115	$2,293	$2,334	$41	$407
116	$513	$522	$9	$91
117	$0	$0	$0	$0
TOTALS	$88,876	$90,454	$1,578	$15,777

- Non-Benefiting Reaches

ATTACHMENT II

COASTAL STORM DAMAGE RELATIONSHIPS BASED ON EXPERT OPINION ELICITATION

Institute for Water Resources, U.S. Army Corps of Engineers
Version1 dated July 31, 2009

Coastal Storm Damage Relationships Based on Expert Opinion Elicitation

(DRAFT)

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Abstract

This report documents the results of the Coastal Storm Damage Workshop on June 5, 6, 2002 in Alexandria, Virginia where expert-opinion was elicited for economic consequence assessment of coastal storm damage. The objectives of this workshop were to discuss and recommend damage relationships needed for predicting structural damage from coastal storms as functions of hazard intensity levels, with associated uncertainties, resulting from erosion, waves, inundation, and their combined effects. Because information on the relationship between residential structural damage and storm parameters is limited, this workshop used expert-opinion as a means of gaining information on these relationships (see Ayyub 2001). This report describes the results of the workshop both in terms of damage relationships and future information needs identified by the experts at the workshop.

This workshop is part of longer-term research effort whose objective is to develop a peer-reviewed, step-by-step methodology for estimating coastal storm damages. The methodology will be incorporated as part of the inputs to a new hurricane and storm damage reduction estimation model being developed by IWR. The methodology will be able to stand alone for use in Corps' districts or by other national or local agencies including potential incorporation as an option in FEMA's HAZUS model.

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1. Introduction

1.1. Program Overview

The objective of this research is to develop a peer-reviewed, step-by-step methodology for estimating damages from coastal storms to property and improvements. The methodology will also be incorporated as part of the inputs to a new hurricane and storm damage reduction estimation model being developed by the Institute for Water Resources (IWR). The methodology will be able to stand alone for use in Corps' districts or by other national or local agencies including potential incorporation as an option in FEMA's HAZUS model.

The objective will be achieved using a two-stage process to elicit opinions from experts to develop damage functions to estimate storm damages. The first stage of this process consisted of developing framework to quantitatively describe the damage done to a structure from storm hazards such as inundation, waves, erosion, and wind. Preliminary damage relationships (curves) were also developed. As a starting point for the first stage, the project core team from IWR proposed a “strawman” framework to be modified by a small group of experts. Inputs for this first stage included the models presently in use by Corps' offices (e.g. Wilmington and Jacksonville) and other agencies around the country, as well as a framework that is being developed for this purpose for the Corps’ Wilmington District. Experts were chosen from within the Corps’, from contractors and academics with experience in coastal storm damage, and from the Federal Emergency Management Authority. Although a focus was on the hurricane-prone southeastern U.S., the workshop also included expertise from the North Atlantic and California.

The second stage will involve additional data collection through a full review of the initial framework and relationships by a review team, by Corps' offices, and by the professional community at-large, and from damage data collected in post-storm surveys. Experts will then be convened in a formal expert elicitation to use this additional information to modify the preliminary depth-damage relationships and develop final estimates of likely economic damages from a coastal storm.

1.2. Needs and Existing Storm Damage Information

This study was prompted by a widely-perceived need for better information on coastal storm damage relationships. A December 2000 letter from the Assistant Secretary of the Army to the Wilmington District requested a “Corps-wide-survey of damage functions used for all types of structures and the rationale for using them, for hurricane and storm damage reduction projects”. The expectation was that “better guidance can be provided to field offices on the conduct of economic analysis if we have the benefit of … better tools to evaluate hurricane and storm damage projects". This research seeks to provide these better tools.

In investigating storm damage relationships, available sources of information can be divided into two general categories: 1) data on storm damages and on existing structures, and 2) models of the relationships between storm parameters and damage. Whereas the relationships between storm parameters and damage is the ultimate purpose of this investigation, the relationships need to be grounded in the data on actual storm damages. As background for the research and in preparation for the workshop, the project core team from IWR reviewed coastal damage methodologies from various sources including: Corps Districts in Jacksonville, Wilmington, New Orleans, Mobile, New York, Philadelphia; the HAZUS model - a natural hazard loss estimation methodology developed by the Federal Emergency Management Agency in partnership with the National Institute of Building Sciences; FEMA building performance studies; Federal Insurance claims data; USACE reports on Hurricane Fran and on Shoreline Protection and Beach Erosion Control; state data from HurricaneOpal (FL); the Heinz Center's Evaluation of Erosion Hazards, and various articles from the open literature (i.e. Bodge 1991, King et al. 1991, Urlich et al. 1994, Kato and Torii 2002, Thomalla et al. 2002).

1.3. Use of Expert Opinions

The primary reason for using expert opinions is provide "data" where little or no data exists about an issue or problem. It can also deal with uncertainty in selected technical issues related to a system of interest. Issues with significant uncertainty, issues that are controversial and/or contentious, issues that are complex, and/or issues that can have a significant effect on risk are most suited for expert-opinion elicitation. Here we used an informal, consensus-based elicitation process to promote creative thinking about potential frameworks and problem definition. The value of any expert-opinion elicitation comes from its initial intended uses as a heuristic tool, not a scientific tool, for exploring vague and unknowable issues that are otherwise inaccessible. It is not a substitute to scientific, rigorous research.

The identification of the need for the information developed during the elicitation process and its communication to experts are essential for the success of the elicitation. The need identification and communication should include the definition of the goal of the study and relevance of issues to this goal. Establishing this relevance would make the experts stakeholders and thereby increase their attention and sincerity levels. Relevance of each issue and/or question to the study needs to be established. This question-to-study relevance is essential to enhancing the reliability of collected data from the experts. Each question or issue needs to be relevant to each expert especially when dealing with subjects with diverse views.

The expert-opinion elicitation process can be defined as a formal, heuristic process of obtaining information or answers to specific questions about certain quantities, called issues, such as failure rates, unsatisfactory-performance consequences and expected service life. This process should not be used in lieu of rigorous reliability and risk analytical methods, but should be used to supplement them and to prepare for them. It should be preferably performed during a face-to-face meeting of members of an expert panel that is developed specifically for the issues under consideration. The meeting of the expert panel should be conducted after communicating to the experts in advance to the meeting background information, objectives, list of issues, and anticipated outcome from the meeting. The different components of the expert-opinion elicitation process are described in Ayyub (2001).

1.4. Recent USACE Expert-Opinion Elicitation Studies

Expert-opinion elicitation is a technique for using a panel of individuals with various areas of specialized knowledge for estimating parameters or addressing issues of interest based on their expertise. The March 2002 expert elicitation conducted by IWR on the Economic Consequence Assessment of Residential Flood Damage is a recent example of use of the technique. Expert-opinion elicitation has also been recently applied by the New Orleans District's study of the Lower Atchafalaya Basin and reevaluation of the Morganza to the Gulf of Mexico feasibility studies, by Vicksburg District's Pearl River study, and by the Sacramento District's Feather River flood damage study. Building contractors, insurance adjusters, home decorators, and other individuals with knowledge of construction, prices, and typical home furnishings were used to estimate depth-damage and content-to-structure value ratios. Details on some of these studies are provided in Ayyub (1999 and 2001).

1.5. Residential Damage Due to Coastal Storms

The scope of this study consists of structural damage to single-family homes from coastal storms. These economic consequences can be described by mathematical functions that relate storm parameters such as wave crest height or the depth of still water flooding to the percent of damage that occurs to structures. The percent damage to structure refers to the percent of the depreciated replacement costs of the structure that is damaged. Coastal storms damage structures through wave action, still water flooding, wave run-up, erosion, and wind. These hazard types are described briefly below

Waves: Most of the energy delivered to the shore by the ocean originates from the wind acting on the ocean to produce waves. Wave characteristics are determined by the wind direction, wind speed, wind duration, how far the wind blows over water, and how far the wave travels before reaching land. Wave action can cause significant damage to coastal structures. Conventional wisdom is that if breaking waves strike at or above a building's first floor elevation, that structure will be severely damaged. This is the rationale for the National Flood Insurance Program's (NFIP) characterization of a highly vulnerable zone (V-zone) for damage from wave action. The ability to prevent wave damage is considered a major benefit of Corps' shore protection measures. Although FEMA demarks the V-zone as an area subject to breaking waves at least 3 feet high, recent, FEMA-sponsored tests indicate that 1.5-foot waves can break away walls. This research suggests that the V-zone might more appropriately extended to all areas subject to 1.5-foot high breaking waves.

Stillwater flooding: Storms can cause inundation of structures with still water either through overtopping of a dunes system (coastal flooding) or through flood waters coming from the bay side of a coastal island (bay-side flooding). Coastal flooding implies still-water level flooding of structures because of overtopping of a dune system or storm surge breaking through from the coastal side and inundating beach areas. A major benefit of Corps' shore protection measures may be reduced coastal flooding damages. Bayside flooding implies still water level flooding of structures, with flooding coming from the bayside. Natural or man-made structures may have prevented flooding from storm surge on the coastal side of an island, but high seas inundated structures from the bay or backside of an island. Structures on the bayside of islands are frequently constructed with a lower level of flood protection than structures across the island on the oceanfront. For example bayside houses may be built lower to the ground whereas oceanfront houses might be raised on piles. Damage from bayside flooding is generally not reduced through shore protection measures.

Erosion: On average, the nation's shorelines are receding at an annual rate of slightly more than one foot per year, although rates vary significantly across regions and across shoreline types. In addition to long-term erosion, erosion during a storm may destroy a dune and undermine shorefront structures. The extent of damage will depend on the amount of storm-induced erosion at the structure and structural characteristics such as foundation and piling embedment. Damages from storm-induced erosion can be significant, regardless of the long-term erosion rate or whether natural processes rebuild the dune in the months following a storm. Corps shore protection measures can provide significant reduction in damages attributable to erosion. Because erosion causes beaches to narrow over time, it is a major factor to consider in conducting a life cycle analysis of project benefits and costs.

Wave Run-up: Wave run-up is the upper level reached by a wave on a beach or coastal structure, relative to still-water level (Coastal Engineering Manual, 2002). Wave run-up applies pressure on a structure in both a vertical and horizontal direction and is a function of the water depth and the square of the water velocity. Wave run-up ceases to be a damage factor when breaking waves attack a structure.

Wind Damages: High winds associated with storms can cause significant damages to structures both on the coast and much further inland. High winds and associated flying projectiles can damage doors, windows or roofs. This damage to the integrity of the structure may combine with high winds to cause severe damage or structural failure. Such breaching also allows rainwater damage to the structure. Most of the damages from Hurricanes Andrew, Iniki, and Hugo were caused by wind and wind-related rainwater as opposed to waves, flooding, wave run-up, or erosion. Because Corps' projects do not significantly affect the wind speed of storms, wind damage is not reduced through shore protection measures. Nonetheless, wind damage plays a significant role in life cycle cost analysis for Corps' storm damage reduction projects.

2. Participants

2.1. Requirements

The IWR project core team has the lead responsibility for achieving the project objectives, but relied on input from a larger, working group of experts to develop appropriate damage relationships. The working group represented Corps' Districts that had been active in shoreline protection projects and represented different geographic regions. In addition, it included outside experts from the Federal Emergency Management Agency, universities, and the private sector who had expertise in coastal storm damage assessment.

2.2. Participants

A list of the IWR project core team and working group for the workshop is below.

PROJECT CORE TEAM

Affiliation	Name	Role
IWR	Stuart Davis	Project Leader
IWR	Hal Cardwell	Project Leader
IWR	David Moser	IWR Program Manager
USACE-HQ	Lillian Almodovar	HQ Program Manager
BMA Engr/Un. of MD	Bilal Ayyub	Facilitator

WORKING GROUP

Affiliation	Name	Role
USACE/Wilmington	Bob Finch	In-house Technical Advisor (S.Atlantic)
USACE/Wilmington	Mike Wutkowski	In-house Technical Advisor (S.Atlantic)
USACE/Jacksonville	Dan Peck	In-house Technical Advisor (S.Atlantic)
USACE/Jacksonville	Tom Smith	In-house Technical Advisor (S.Atlantic)
USACE/SAD	Gerald Melton	In-house Technical Advisor (S.Atlantic)
USACE/New Orleans	Brian Maestri	In-house Technical Advisor (Gulf)
USACE/Los Angeles	Dan Sulzer	In-house Technical Advisor (W.Coast)
USACE/Los Angeles	Susie Ming	In-house Technical Advisor (W.Coast)
USACE-HQ	Harry Shoudy	In-house Technical Advisor
USACE-HQ	Charlie Chesnutt	In-house Technical Advisor
USACE-HQ	Jay Warren	In-house Technical Advisor
URS	Bill Coulbourne	Outside Technical Advisor (N.Atlantic)
URS	Mike Cannon	Outside Technical Advisor (N.Atlantic)
Consultant	Chris Jones	Outside Technical Advisor (S.Atlantic)
NC SeaGrant	Spencer Rogers	Outside Technical Advisor (S.Atlantic)
FEMA	Paul Tertell	Outside Technical Advisor

3. Workshop Results

3.1. Strawman Coastal Storm Damage Framework

The starting point for discussions of coastal storm damage processes was a "strawman framework" for structural damage estimation that was put forth by the IWR project core team. The strawman framework assumes as known, the physical parameters of the area and of the storm. These parameters include surface water elevation, ground elevation, shoreline type, wave heights, storm-induced erosion depth. Also assumed known are structural characteristics such as location, foundation type, height of lowest supporting beam of structures including their location. Long-term erosion is considered by progressively moving the shoreline landward, therefore increasing the storm-induced erosion and inundation potential from subsequent storms. Economic losses (damages) due to land lost are outside the scope. Wind damages are estimated outside of this framework; this estimate will be used to modify damage to structures from coastal flooding and erosion as appropriate. We also assume the surface water elevation accounts for bay-side flooding and dune breaches.

> *Inundation:* Damage to both contents and structures from wave run-up, breaking waves, and still water flooding is assumed to be captured through the use of FIMA[1] V-zone curves for all areas that experience breaking waves of 1.5 ft above the lowest structural horizontal member of the structure. For areas that experience less than 1.5 feet of flooding, FIMA A-zone curves will be used for structure damage.
>
> *Storm-induced erosion:* A curve relating damage to the depth of vertical erosion at the center of building will be developed for various foundation types. This curve will be applied for sandy beaches with small dunes (as defined by FEMA). An additional relationship for high dunes and sandy bluff shoreline types will describe storm-induced damages from near-vertical erosion scarps.

Combined Damage vectors: The total damage to a structure will be the sum of the inundation damages and the storm-induced erosion damages, with the total not to exceed the value of the structure.

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[1] The Federal Insurance and Mitigation Administration (FIMA – formerly the Federal Insurance Administration - FIA) developed and uses depth-damage curves to estimate actuarial premiums for flood insurance. FIMA has two sets of curves, A-zone curves for riverine and coastal areas without high wave velocity, and V-zone curves for coastal areas that are expected to experience wave action. FIMA defines the V-zone as those coastal areas expected to experience a 3-foot high breaking wave.

3.2. Revised Framework

Discussion at the workshop produced consensus on a revised framework for structural damage estimation. Once the damage hazards were identified, the experts focused on determining the appropriate storm variable that would relate to damage for each hazard type. For example, depth of water above the walking surface for the lowest main floor was selected as the best variable to relate to still water flooding damages. This is the X-axis in a depth (or other variable) versus damage curve. The experts then agreed on the number of relationships that would have to be developed to properly predict damages to different foundation types (e.g. slab on grade or pile) or materials (wood, concrete, masonry) were appropriate for each damage hazard. Discussion then moved to different ways to combine the damages across hazards, and how to account for regional differences in shorelines, with a focus on estimating damages to bluffs. We describe the discussions and decisions in this section. Appendix A contains results in the form of quantified relationships (curves) for storm damages.

3.2.1. Inundation Damage

For damages from still water inundation the workshop determined that the appropriate storm variable to use was the "Depth of water above the walking surface of the lowest main floor". Although damages to the floors of a structure occur before the water depth reaches the walking surface, using the depth of water surface is an easier variable to use for data collection. **Structural damages that occur from inundation of the floors at slightly lower depths can be included by assigning positive values to damages when depth of water above the walking surface is negative.**

The workshop determined that damages from inundation also depend on the foundation type, on material, number of floors, and, for structures on piles, on the existence of ground-level enclosures. Separate relationship (although using the same X-axis) would need to be developed for each of the following cases:

- Wood frame with piles (with & without enclosures – small medium and full)
- Wood frame without piles
- Concrete & masonry with piles (with & without enclosure – small medium and full)
- Concrete & masonry without piles
- Number of floors (1, 1.5 and 2)

The workshop considered various existing data sources to quantify the relationships for inundation. These data sources included FIMA coastal A-zone curves, curves from New Orleans District for structures on piles and on piers, and curves issued by the Corps in 2000 based on post-flood surveys of actual damages in various parts of the United States.

3.2.2. Waves Damage

For damages due to breaking waves the workshop determined that the appropriate storm variable to use was the "difference between the top of wave (crest) and the bottom of the lowest horizontal member". The workshop considered using the walking floor elevation as the datum for comparison with the top of the wave height for consistency with the measure suggested for inundation. However the workshop decided that the framework would be clearer and more rigorous if it used the bottom of the lowest horizontal member as the reference point because it is at this point that waves can start to damage the structure. If practical considerations preclude measurements of the bottom of the lowest horizontal member, this value can be estimated based on the elevation of the walking surface.

The workshop determined that damages from inundation also depended on the foundation type for structures on piles and on the existence of ground-level enclosures. Separate relationships (although using the same X-axis) would need to be developed for each of the following cases:

- Structures on piles (with & without enclosures – small medium and full)
- Structures not on piles

3.2.3. Wave Run-up Damage

The workshop concluded that damages from wave run-up were attributable to the "Difference between the top of water and the bottom of the lowest horizontal member, and its velocity at the seaward face of the structure". The force applied by wave run-up could be described as directly dependent on the depth of the water and the square of the velocity. Forces would likely act in both a horizontal and vertical direction and be measured in lbs/linear foot. However the workshop participants did not feel that the there was enough known about the damage from wave run-up to determine an appropriate storm variable to use, and opted to delay development of a damage relationship as a long-term need.

3.2.4. Erosion Damage

For damages from storm-induced erosion, the workshop determined that the appropriate storm variable to use both for structures with shallow foundations and ones on piers was the "percent of footprint compromised." Shallow foundation structures were defined as structures that are on slabs or on piers. Houses on bluffs that experience erosion can be considered as structures with shallow foundations. When a shallow foundation experiences vertical erosion such that it loses support from the ground, the foundation is compromised. Six inches of vertical erosion or undermining has been conventionally considered to cause a loss of support. Whereas the workshop participants felt that this definition was relatively straightforward for shallow foundations, the selection of a variable for deep or pile-supported foundations was more contentious.

The distinction was made between a structure that was undermined by erosion and one that had its foundation "compromised". Whereas for structures on shallow foundations undermining (six vertical inches of erosion) is equivalent to compromised, pile structures can be extensively undermined with little or no damage. In these cases the entire footprint could experience vertical erosion of six inches yet no damage would occur because, although undermined, the erosion does not compromise the ability of the foundation to support the structure. Conversely, a compromised pile can be defined as one whose remaining embedment depth renders it ineffective against lateral forces such as wind and waves. Using, as the independent variable (X-axis) the "percent of footprint compromised" would allow correct categorization of damages done to a pile-support house that, because of erosion, might have its entire footprint in the surf zone (and hence undermined), but yet had minimal damage because its foundation was not compromised. The workshop noted that relating storm parameters to the percent of footprint compromised would be difficult and likely be regionally and structurally specific. Comment: This percent of footprint compromised is pretty useless to predict damage from a storm unless this can be predicted from the extent of vertical erosion at the structure. I don't think there will be any model that keeps track of all piles of a pile-founded structure. We will have to make assumptions about where piles are located and the extent of embedment.

Because the appropriate storm variable was defined so broadly, the workshop only called for two separate relationships to be developed for erosion damages: one for shallow foundation and one for deep foundations (piles). More relationships may need to be developed as definitions of "footprint compromised" are developed for specific regions and projects.

3.2.5. Combining Damages

Because a structure may be damaged by more than one of the four storm damage hazards identified by the workshop, a methodology must be developed for how to combine the damages. The Strawman Framework proposed a simple additive combination with a constraint that the total damages to a structure could not exceed its value. The can be expressed as %A + %B. A more commonly used rule for combining damages is to simply use the maximum percent damage from any hazard, or Max [%A, %B]. Whereas the first rule assumes that there is no common damage caused by different hazards, the latter rule assumes the other extreme - that no damage occurs that is not covered by the most damaging hazard. A third rule to consider would be the sum of the hazard percentages minus their product: %A + %B -%A%B. This framework was used in the Portland District and is akin to the probability of occurrence at least one of two independent events A and B.

The workshop concluded that the combination rule must be dependent on the types of hazard that cause damages. If both waves and inundation cause damage the workshop suggested the rule be to only use the damages caused by waves (this is consistent with FIMA's V-zone definition). If both erosion and inundation cause damage the proposed rule is to use the sum of the damages minus their product. Similarly, if both erosion and run-up cause damage the rule is to use the sum of the damages minus their product. For the case where both run-up and erosion cause damages, the workshop proposed two definitions, one for shallow foundation structures, where the rule is to use the maximum of the two damages, and one for pile foundation structures where the rule is to use the sum of the damages minus their product. We summarize these relationships below for the various cases of combination

Case 1 – Inundation + Waves	%W
Case 2 – Run-up + Waves	%W
Case 3 – Inundation + Run-up	will not occur
Case 4 – Inundation + Erosion	%I + %E - %I*%E
Case 5 – Run-up + Erosion	%R + %E - %R*%E
Case 6 – Waves + Erosion	Max %W, %E (shallow foundation)
	%W + %E - %W*%E (pile foundation)

These cases cover all likely combinations of hazards because a structure would not be subject to both moving water (run-up) at the same time as still-water inundation, and waves damages would subsume run-up as it does inundation damages. The workshop noted as a long term need, better information as to when to “switch” from the inundation damage curve to the wave damage curve. Similarly this could be one area of investigation when determining the run-up damage relationships.

Discussion at the workshop included concerns on how to calibrate damage relationships from multiple sources, and noted that the structure should permit direct data collection for the calibration

3.2.6. Coastlines with of Bluffs

Storm damages on coastlines with bluffs differ from those on a beach and dune coastline. Inundation is not an issue for bluffs, and neither are waves or run-up except as they promote erosion. Also, all foundations on bluffs can be treated as shallow foundations or slabs, because erosion from a bluff will undermine a deep pile foundation in the same way as a shallow foundation. Failure of a bluff can be from top to bottom, or from bottom to top.

3.2.7. Long-term and Short-term Needs / Next Steps

The following table summarizes the long-term and short-term needs and future steps in this area:

Priority	Long-term and Short-term Needs / Next Steps
High	Methodology (including authority) for post storm data collection to determine flood conditions during event and erosion conditions at the end of an event.
High	Define/issue guidance for “Compromised” regional Differences
High	Beach profile translation
High	Contents
High	Land Loss/estimated value
High	Post storm data – wave crest water level elevations, lower limit (elevation) of wave damage.
High	Pre-storm building inventory
High	Collection of Existing loss information (including analysis of data from Fran)
Medium	Wave damage height threshold (1.5 ft vs 3 ft) – When do we abandon the inundation curve? How far inland is wave damage an issue?
Medium	RUN-UP RELATIONSHIPS - HOW TO QUANTIFY (WEST COAST)
Medium/Low	Sedimentation damage during inundation
Medium/Low	Duration of inundation
Low	Bluff Erosion processes
Low	Curves/response of engineered buildings, and other non residential structures
Low	Salt versus fresh water inundation damage

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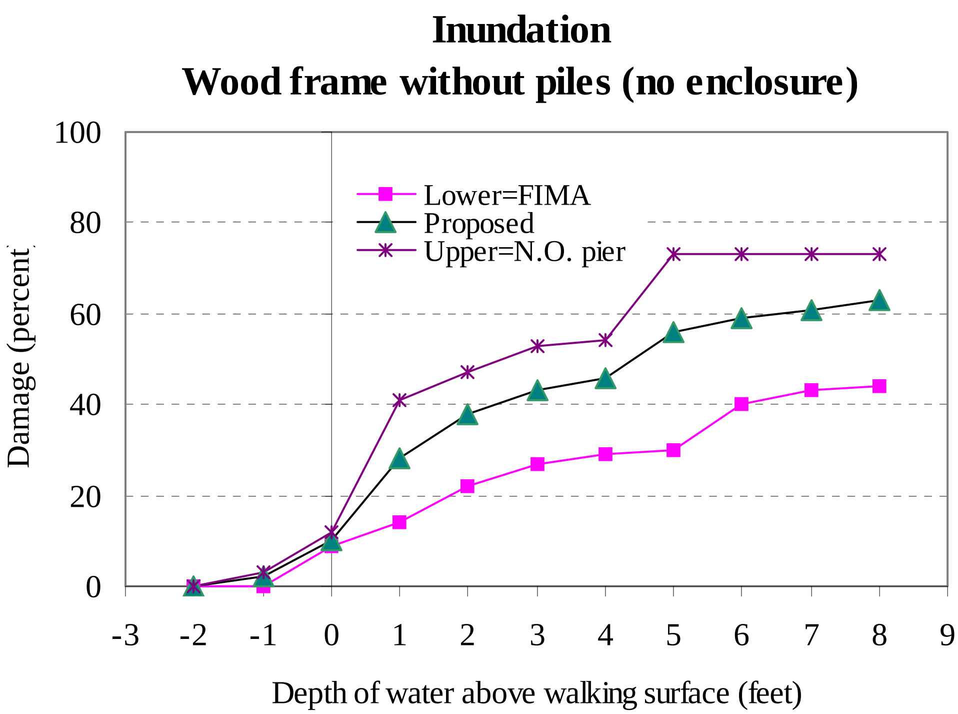
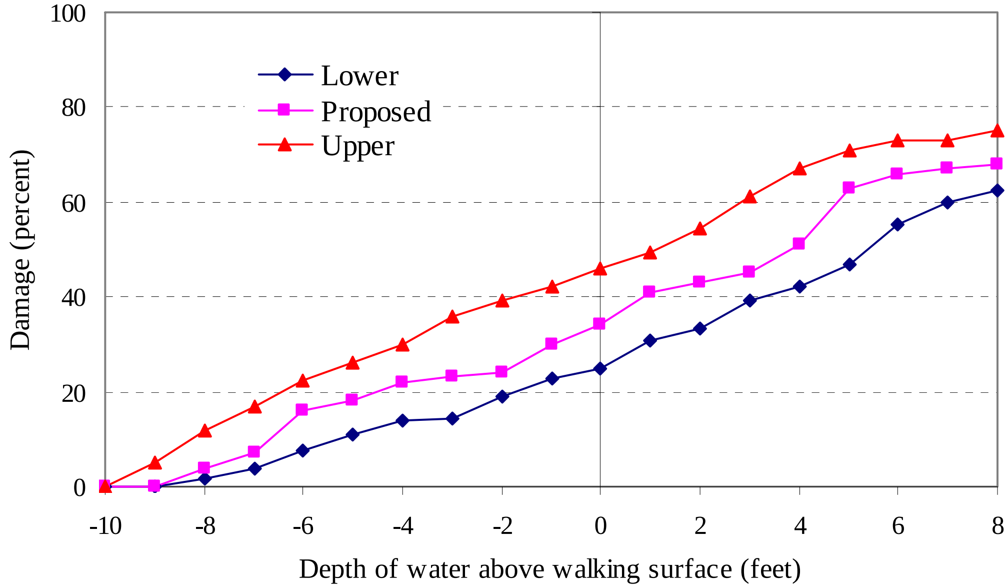
Appendix A. Damage Relationship Details

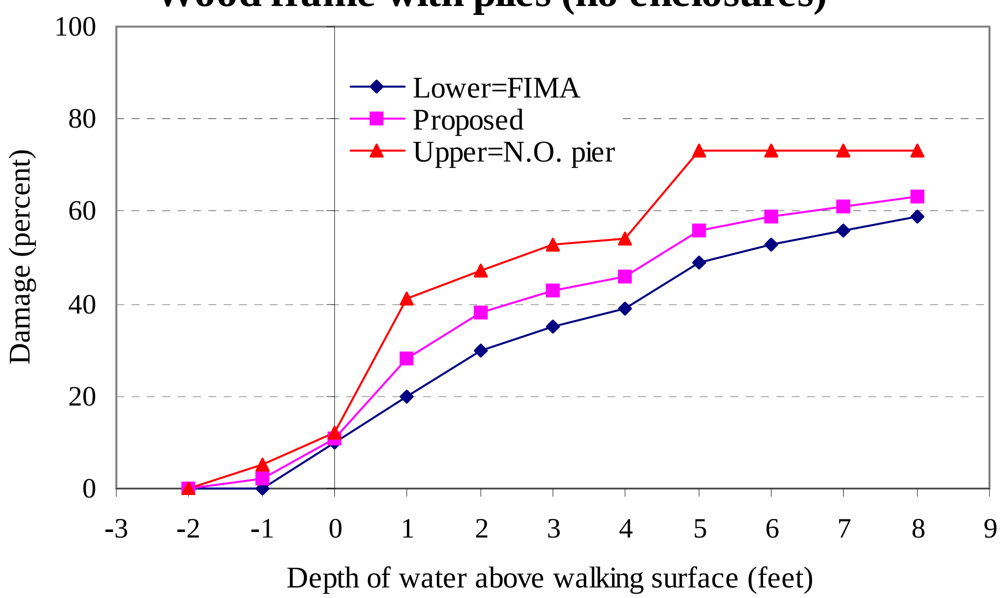
The following figures contain the details of the damage relationships developed in the workshop. The “Proposed” curve represents the experts’ median estimate of damages, whereas the upper and lower represent estimates of the range of the damages. Here, 75 percent of the time damages will be less than the “Upper” curve and 25 percent of the time damages will be lower than the “Lower” curve. For the inundation curves, the upper and lower bounds were set equivalent to the estimates used by New Orleans district for structures on piers (N.O. pier), and by the FIMA coastal A-zone curves, respectively. For damages from inundation, the workshop only developed curves for the selected cases noted below. The workshop assumed that estimates for inundation damages in structures with partial enclosures would flow from the curves developed here. Likewise all curves apply for single story houses.



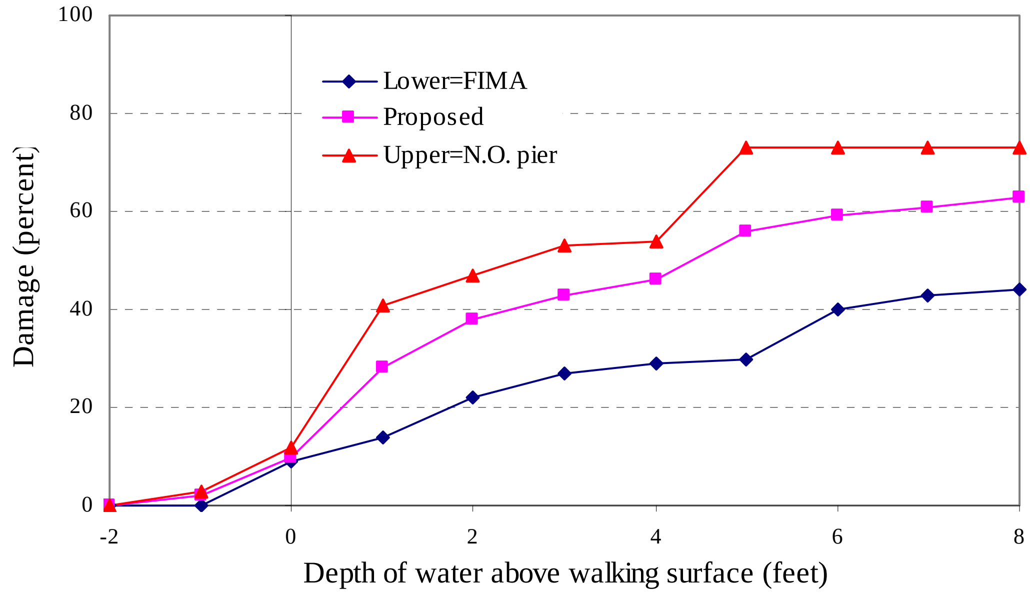
Inundation
Wood frame with piles (full enclosures)



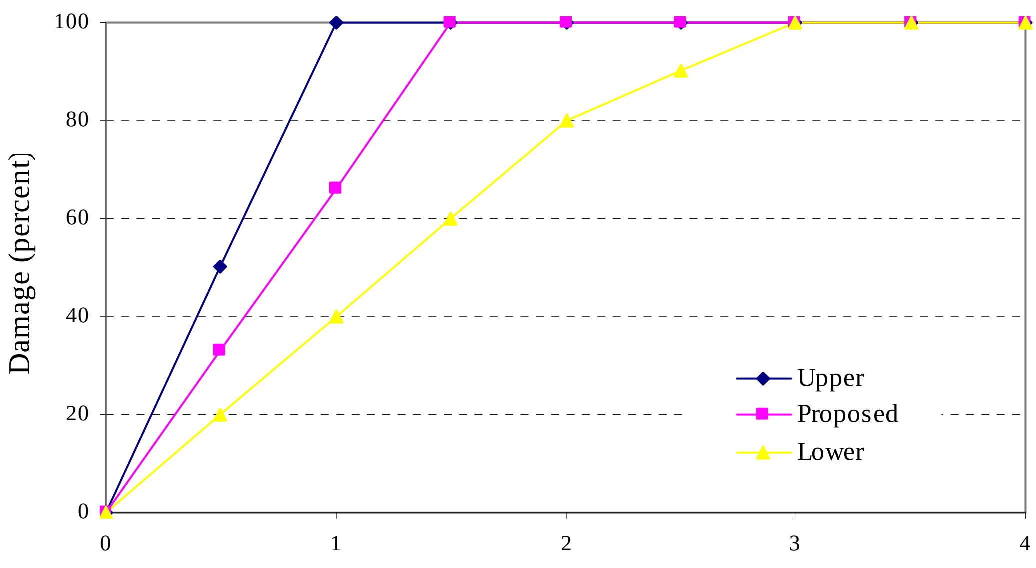
Inundation
Wood frame with piles (no enclosures)

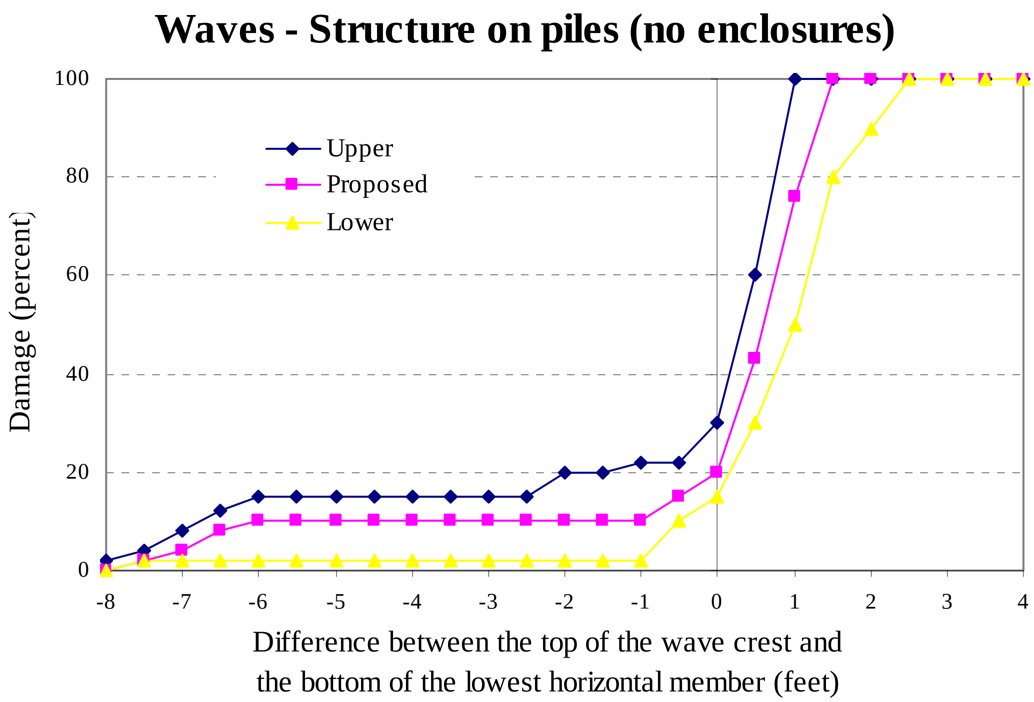


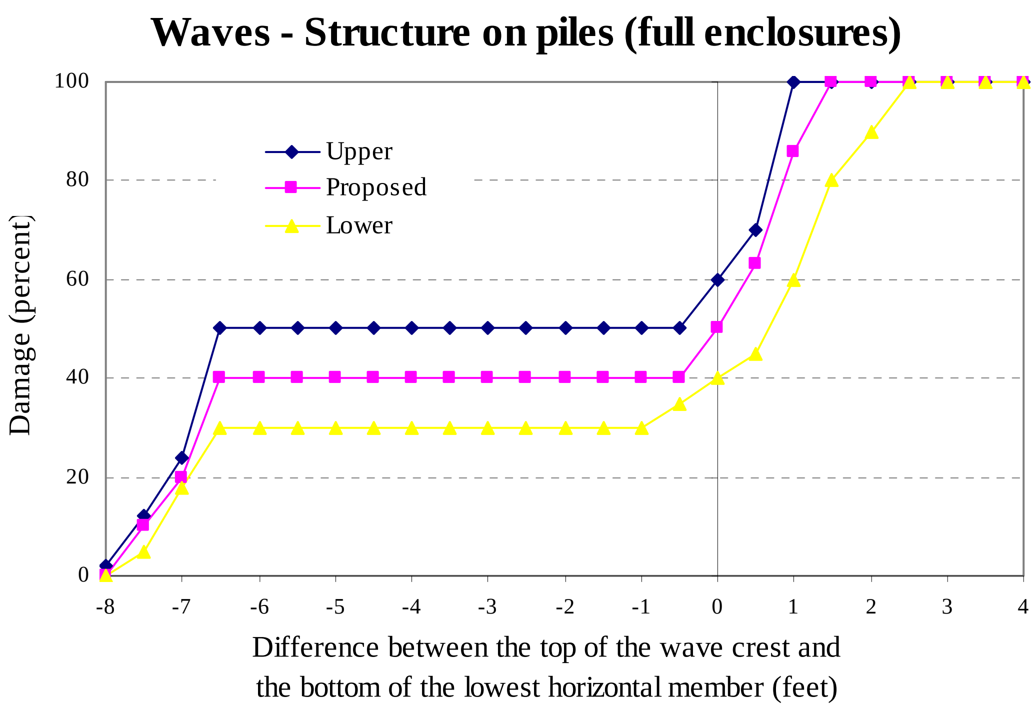
Inundation
Concrete and masonry without piles

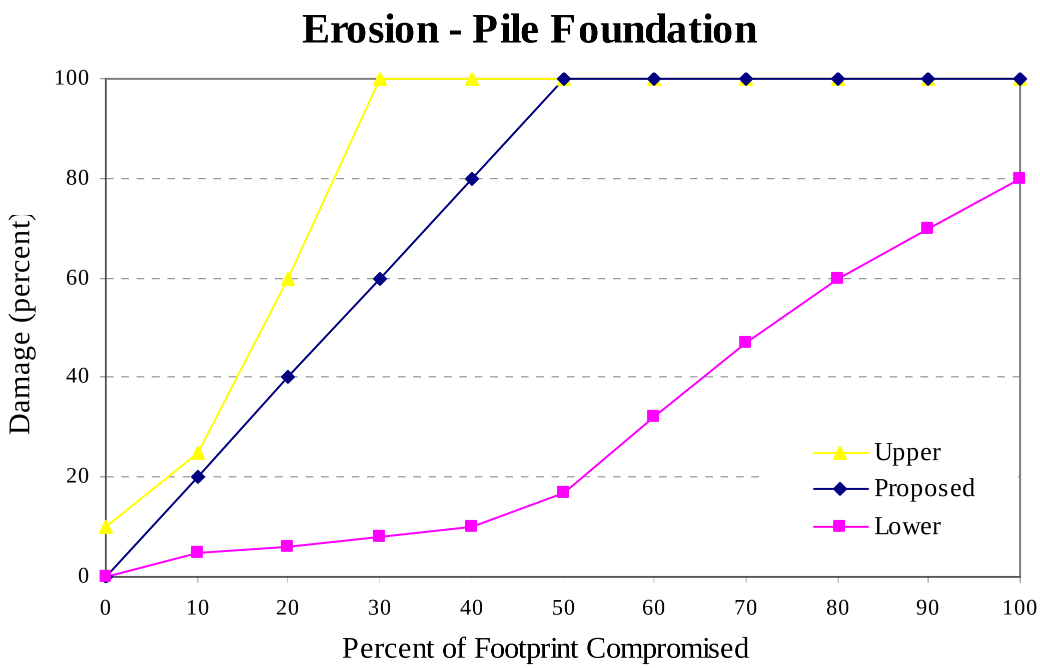


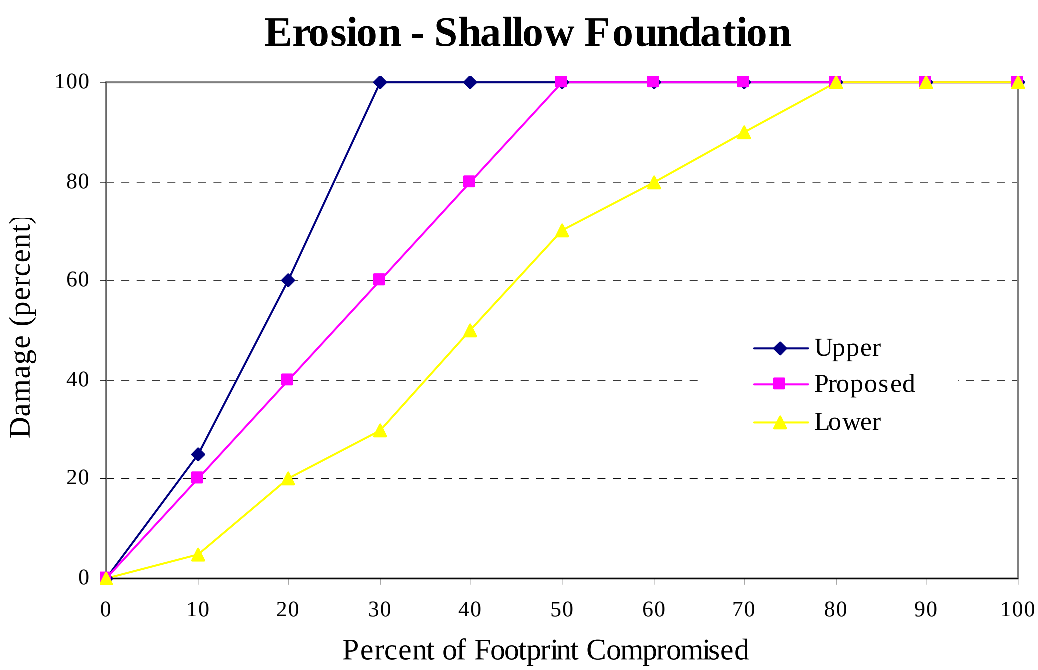
Waves - Structure not on piles




Waves - Structure on piles (no enclosures)
Upper
Proposed
Lower
Damage (percent)
100
80
60
40
20
0
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
Difference between the top of the wave crest and
the bottom of the lowest horizontal member (feet)


Waves - Structure on piles (full enclosures)
Upper
Proposed
Lower
Damage (percent)
100
80
60
40
20
0
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
Difference between the top of the wave crest and
the bottom of the lowest horizontal member (feet)


Erosion - Pile Foundation
Damage (percent)
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Footprint Compromised
Upper
Proposed
Lower


Erosion - Shallow Foundation
Damage (percent)
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Footprint Compromised
Upper
Proposed
Lower

ATTACHMENT III

Damage Functions (Structure Value Degradation) Multi-Storied Buildings

Notes to accompany scour depth computations/curves:

The accompanying spread sheets and curves depicting predictions of structure value degradation with increasing foundation scour were variously based on the following assumptions:

1. Scour was assumed to be nonthreatening as far as immediate stability and integrity of the structure is concerned; i.e. depth and extent of scour not sufficient to jeopardize stability of the overall structure, and not having induced any signs of structure settlement or structural member deformation or distress.

2. Depth of scour was assumed to be 5' at the landward edge, increasing at a rate of 1% from the innermost extent to the Gulf side edge of the structure (roughly consistent with patterns observed in photographs for all types and sizes of buildings).

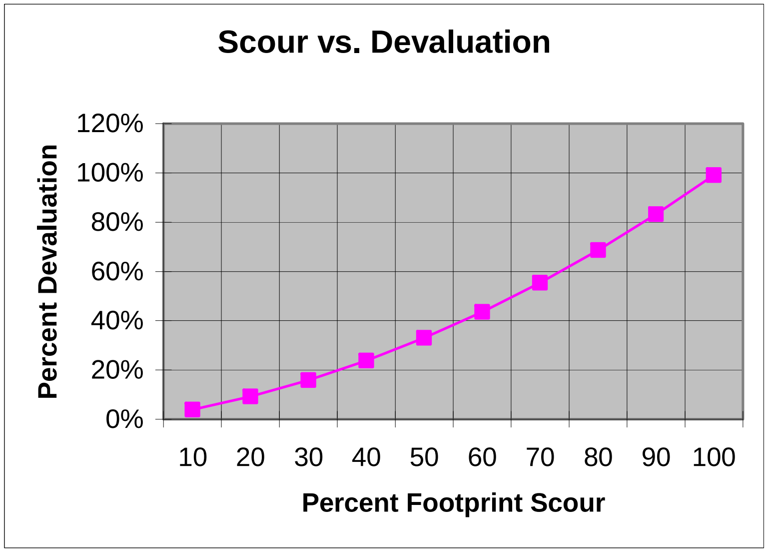
3. Dollar costs of buildings of various sizes and types were taken from Table 1. Square Foot Construction Costs, Building Groups R-1, R-2 and R-3, **Building Safety Journal**, October 2004, with each cost adjusted upward by 10% to account for the specific locality.

4. The rehabilitation cost was based on the cost of re-establishing foundation grade beneath the structure to original conditions and presupposes that this is physically possible and that materials so deposited will re-establish the lateral stability of the entire structure pile foundation. The Cubic Yard cost of restoration of the foundation was derived in coordination with EN Cost Estimating personnel, and was based on experience and judgment.

Derivation of Pecentage Devaluations for Commercial Beach Front Properties onDeep Pile Foundations caused by Foundation Undercutting

Buildings of 10 stories and above (Computed on 10 story)

Footprint X	Y	Footprint Area S.F.	Total Building Area (10 Sty.)	Estimated New Building Value	% Scour (Based on Footprint)	Scour Area S.F.	Average Depth Scour	Volume C.Y.	$ per C.Y.	Estimated Rehabilitation $$$	% Building First Cost
200	400	80,000	800,000	$112,200,000	10	800,000	6.00	177,778	$25.00	$4,400,000	4%
					20	1,600,000	7.00	414,815		10,400,000	9%
					30	2,400,000	8.00	711,111		17,800,000	16%
					40	3,200,000	9.00	1,066,667		26,700,000	24%
					50	4,000,000	10.00	1,481,481		37,000,000	33%
					60	4,800,000	11.00	1,955,556		48,900,000	44%
					70	5,600,000	12.00	2,488,889		62,200,000	55%
					80	6,400,000	13.00	3,081,481		77,000,000	69%
					90	7,200,000	14.00	3,733,333		93,300,000	83%
					100	8,000,000	15.00	4,444,444		111,100,000	99%
150	300	45,000	450,000	$63,112,500	10	450,000	5.75	95,833	$25.00	$2,400,000	4%
					20	900,000	6.50	216,667		5,400,000	9%
					30	1,350,000	7.25	362,500		9,100,000	14%
					40	1,800,000	8.00	533,333		13,300,000	21%
					50	2,250,000	8.75	729,167		18,200,000	29%
					60	2,700,000	9.50	950,000		23,800,000	38%
					70	3,150,000	10.25	1,195,833		29,900,000	47%
					80	3,600,000	11.00	1,466,667		36,700,000	58%
					90	4,050,000	11.75	1,762,500		44,100,000	70%
					100	4,500,000	12.50	2,083,333		52,100,000	83%
100	200	20,000	200,000	$28,050,000	10	200,000	5.50	40,741	$25.00	$1,000,000	4%
					20	400,000	6.00	88,889		2,200,000	8%
					30	600,000	6.50	144,444		3,600,000	13%
					40	800,000	7.00	207,407		5,200,000	19%
					50	1,000,000	7.50	277,778		6,900,000	25%
					60	1,200,000	8.00	355,556		8,900,000	32%
					70	1,400,000	8.50	440,741		11,000,000	39%
					80	1,600,000	9.00	533,333		13,300,000	47%
					90	1,800,000	9.50	633,333		15,800,000	56%
					100	2,000,000	10.00	740,741		18,500,000	66%



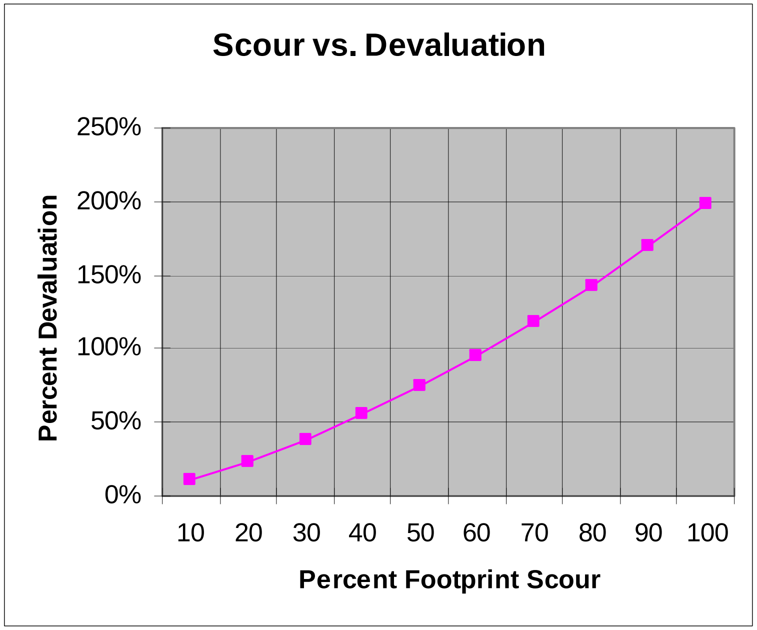
Scour vs. Devaluation
Percent Devaluation
120%
100%
80%
60%
40%
20%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour

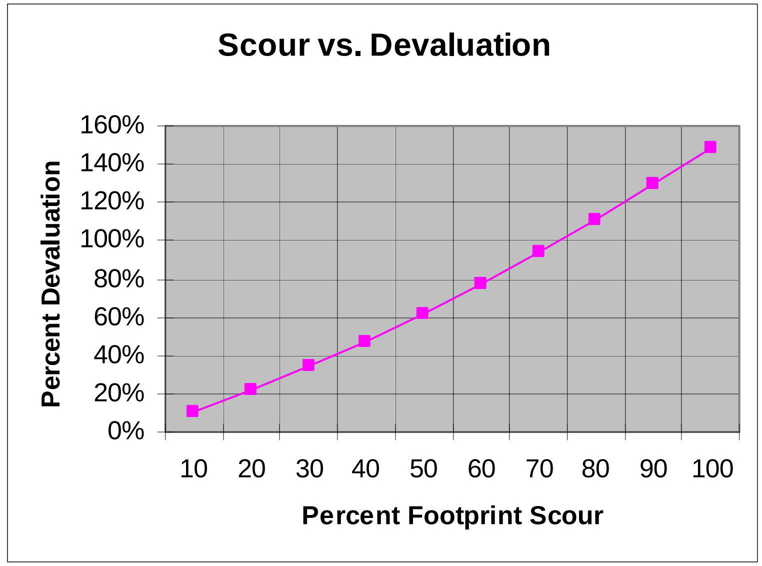
Derivation of Pecentage Devaluations for Commercial Beach Front Properties onDeep Pile Foundations caused by Foundation Undercutting

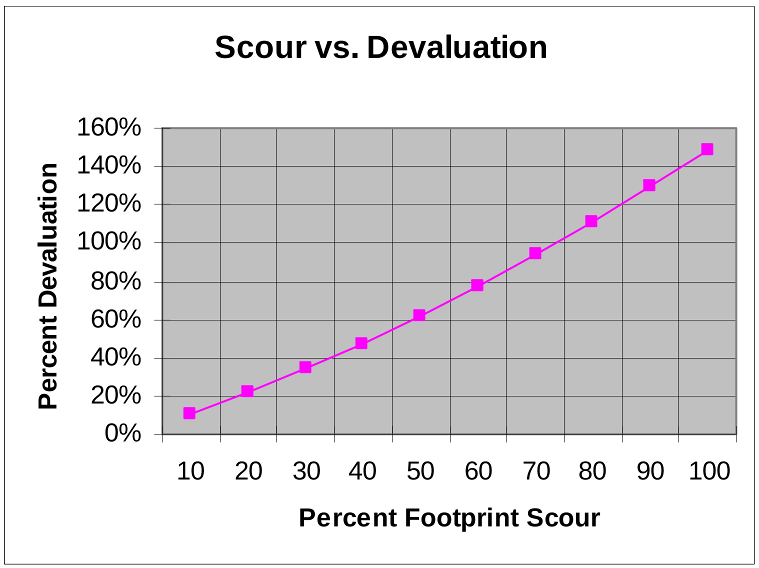
<u>Buildings from 4 to 10 stories</u> (Computed on 4 story)

Footprint X ft	Footprint Y ft	Footprint Area S.F.	Total Building Area (4 Sty.)	Estimated New Building Value	% Scour (Based on Footprint)	Scour Area S.F.	Average Depth Scour (assumed)	Volume C.Y.	*$ per C.Y.	Estimated Rehabilitation $$$	% Building First Cost
100	200	20,000	80,000	$9,348,240	10	200,000	5.50	40,741	$25.00	$ 1,019,000	11%
					20	400,000	6.00	88,889		$ 2,222,000	24%
					30	600,000	6.50	144,444		$ 3,611,000	39%
					40	800,000	7.00	207,407		$ 5,185,000	55%
					50	1,000,000	7.50	277,778		$ 6,944,000	74%
					60	1,200,000	8.00	355,556		$ 8,889,000	95%
					70	1,400,000	8.50	440,741		$ 11,019,000	118%
					80	1,600,000	9.00	533,333		$ 13,333,000	143%
					90	1,800,000	9.50	633,333		$ 15,833,000	169%
					100	2,000,000	10.00	740,741		$ 18,519,000	198%
75	150	11,250	45,000	$5,258,385	10	112,500	5.38	22,396	$25.00	$ 560,000	11%
					20	225,000	5.75	47,917		$ 1,198,000	23%
					30	337,500	6.13	76,563		$ 1,914,000	36%
					40	450,000	6.50	108,333		$ 2,708,000	51%
					50	562,500	6.88	143,229		$ 3,581,000	68%
					60	675,000	7.25	181,250		$ 4,531,000	86%
					70	787,500	7.63	222,396		$ 5,560,000	106%
					80	900,000	8.00	266,667		$ 6,667,000	127%
					90	1,012,500	8.38	314,063		$ 7,852,000	149%
					100	1,125,000	8.75	364,583		$ 9,115,000	173%
50	100	5,000	20,000	$2,337,060	10	50,000	5.25	9,722	$25.00	$ 243,000	10%
					20	100,000	5.50	20,370		$ 509,000	22%
					30	150,000	5.75	31,944		$ 799,000	34%
					40	200,000	6.00	44,444		$ 1,111,000	48%
					50	250,000	6.25	57,870		$ 1,447,000	62%
					60	300,000	6.50	72,222		$ 1,806,000	77%
					70	350,000	6.75	87,500		$ 2,188,000	94%
					80	400,000	7.00	103,704		$ 2,593,000	111%
					90	450,000	7.25	120,833		$ 3,021,000	129%
					100	500,000	7.50	138,889		$ 3,472,000	149%

* Assumes extraordinary measures (e.g. hydro-slurry injection) must be used to place foundation material beneath structure and around foundation piling.


Scour vs. Devaluation
Percent Devaluation
250%
200%
150%
100%
50%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour


Scour vs. Devaluation
Percent Devaluation
160%
140%
120%
100%
80%
60%
40%
20%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour

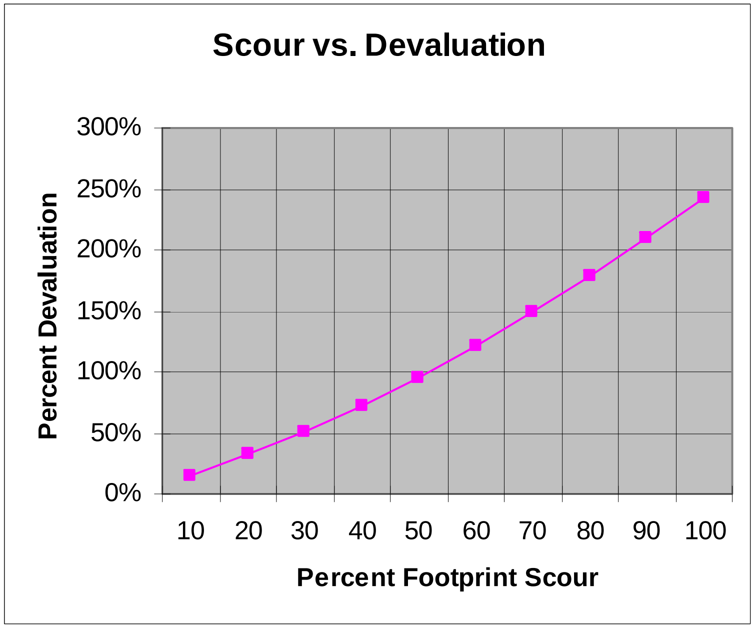

Scour vs. Devaluation
Percent Devaluation
160%
140%
120%
100%
80%
60%
40%
20%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour

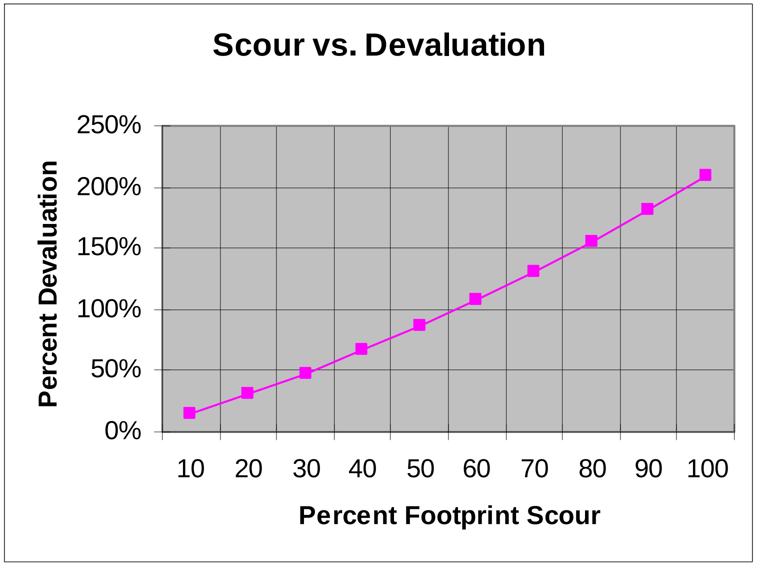
Derivation of Pecentage Devaluations for Commercial Beach Front Properties onDeep Pile Foundations caused by Foundation Undercutting

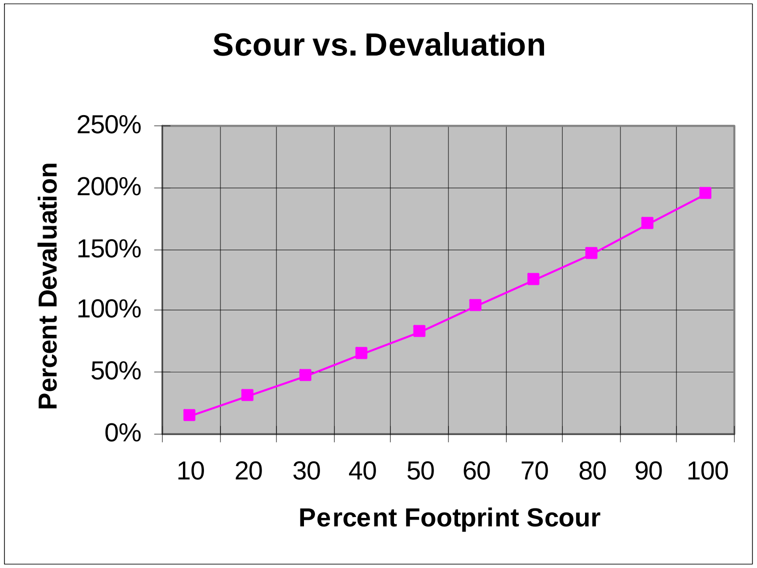
Buildings 3 stories or less (Computed on 3 story)

Footprint X ft	Footprint Y ft	Footprint Area S.F.	Total Building Area (10 Sty.)	Estimated New Building Value	% Scour (Based on Footprint)	Scour Area S.F.	Average Depth Scour	Volume C.Y.	*$ per C.Y.	Estimated Rehabilitation $$$	% Building First Cost
75	150	11,250	33,750	$3,745,913	10	112,500	5.38	22,396	$25.00	$ 560,000	15%
					20	225,000	5.75	47,917		$ 1,198,000	32%
					30	337,500	6.13	76,563		$ 1,914,000	51%
					40	450,000	6.50	108,333		$ 2,708,000	72%
					50	562,500	6.88	143,229		$ 3,581,000	96%
					60	675,000	7.25	181,250		$ 4,531,000	121%
					70	787,500	7.63	222,396		$ 5,560,000	148%
					80	900,000	8.00	266,667		$ 6,667,000	178%
					90	1,012,500	8.38	314,063		$ 7,852,000	210%
					100	1,125,000	8.75	364,583		$ 9,115,000	243%
50	100	5,000	15,000	$1,664,850	10	50,000	5.25	9,722	$25.00	$ 243,000	15%
					20	100,000	5.50	20,370		$ 509,000	31%
					30	150,000	5.75	31,944		$ 799,000	48%
					40	200,000	6.00	44,444		$ 1,111,000	67%
					50	250,000	6.25	57,870		$ 1,447,000	87%
					60	300,000	6.50	72,222		$ 1,806,000	108%
					70	350,000	6.75	87,500		$ 2,188,000	131%
					80	400,000	7.00	103,704		$ 2,593,000	156%
					90	450,000	7.25	120,833		$ 3,021,000	181%
					100	500,000	7.50	138,889		$ 3,472,000	209%
40	80	3,200	9,600	$1,065,504	10	32,000	5.20	6,163	$25.00	$ 154,000	14%
					20	64,000	5.40	12,800		$ 320,000	30%
					30	96,000	5.60	19,911		$ 498,000	47%
					40	128,000	5.80	27,496		$ 687,000	64%
					50	160,000	6.00	35,556		$ 889,000	83%
					60	192,000	6.20	44,089		$ 1,102,000	103%
					70	224,000	6.40	53,096		$ 1,327,000	125%
					80	256,000	6.60	62,578		$ 1,564,000	147%
					90	288,000	6.80	72,533		$ 1,813,000	170%
					100	320,000	7.00	82,963		$ 2,074,000	195%

* Assumes extraordinary measures (e.g. hydro-slurry injection) must be used to place foundation material beneath structure and around foundation piling.


Scour vs. Devaluation
Percent Devaluation
300%
250%
200%
150%
100%
50%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour


Scour vs. Devaluation
Percent Devaluation
250%
200%
150%
100%
50%
0%
10
20
30
40
50
60
70
80
90
100
Percent Footprint Scour


Scour vs. Devaluation
Percent Devaluation
250%
200%
150%
100%
50%
0%
10
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30
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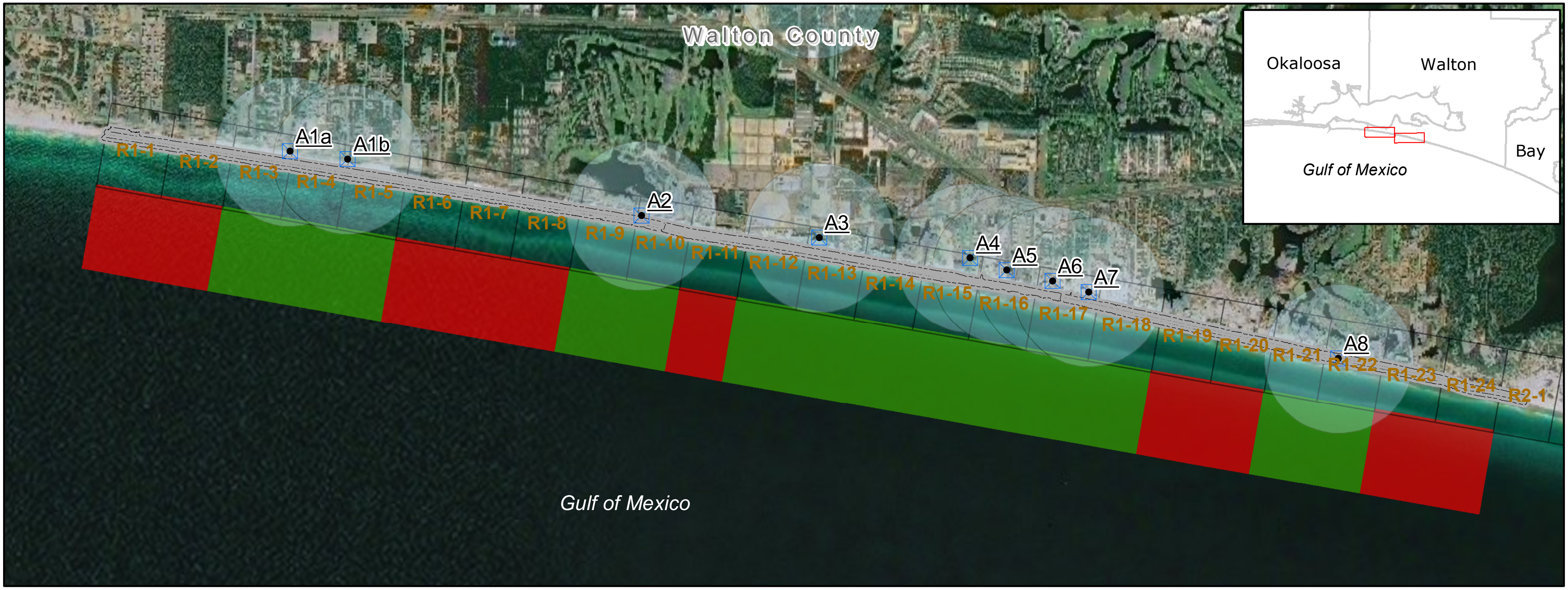
70
80
90
100
Percent Footprint Scour

ATTACHMENT IV

ACCESS POINTS AND PARKING


Walton County
Okaloosa
Walton
Bay
Gulf of Mexico
A1a
A1b
A2
A3
A4
A5
A6
A7
A8
R1-1
R1-2
R1-3
R1-4
R1-5
R1-6
R1-7
R1-8
R1-9
R1-10
R1-11
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R1-16
R1-17
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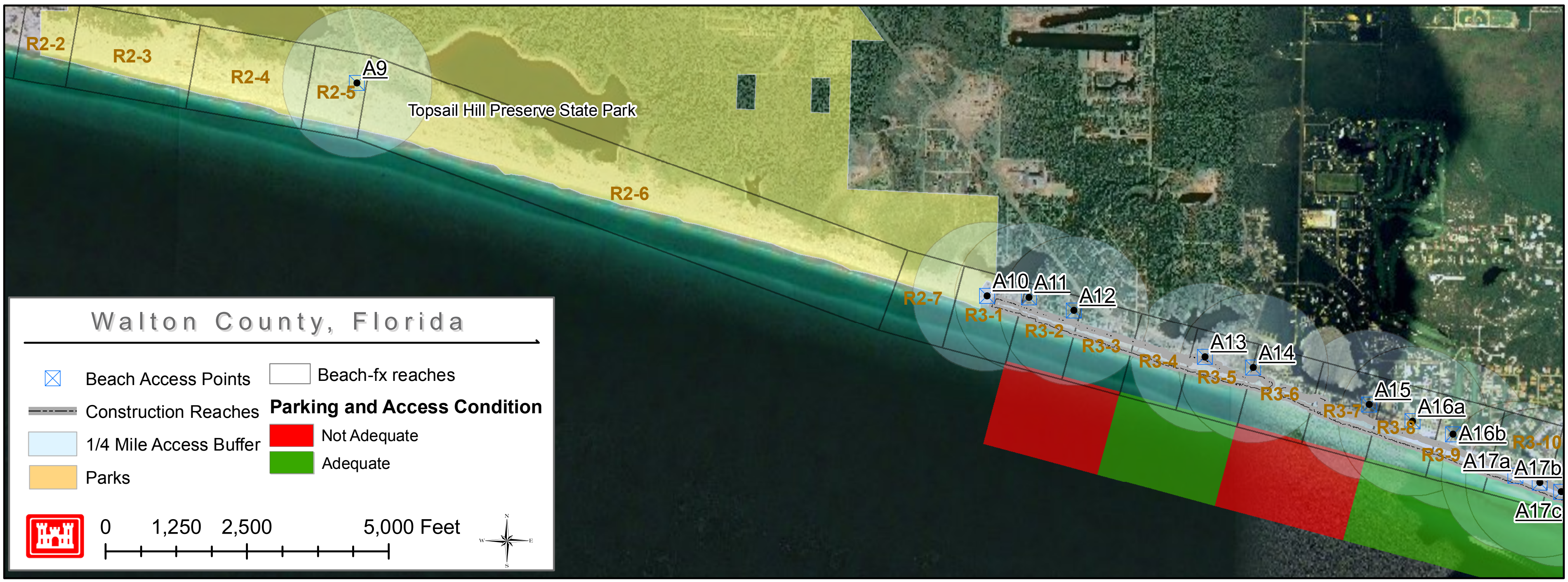
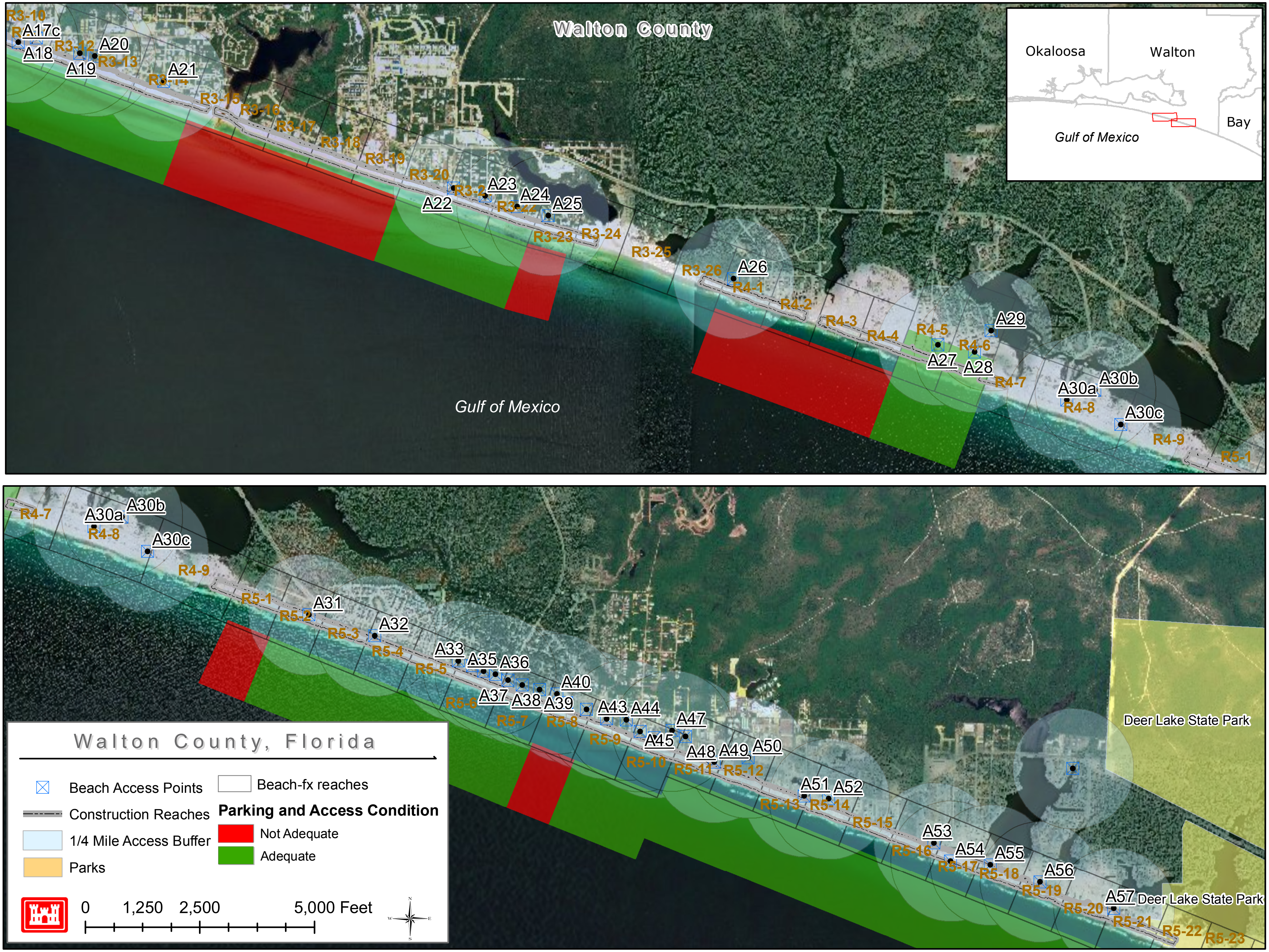
R1-21
R1-22
R1-23
R1-24
R2-1
Gulf of Mexico


R2-2
R2-3
R2-4
R2-5
A9
Topsail Hill Preserve State Park
R2-6
R2-7
A10
A11
A12
R3-1
R3-2
R3-3
R3-4
R3-5
A13
A14
R3-6
R3-7
A15
A16a
R3-8
A16b
R3-9
R3-10
A17a
A17b
A17c
Walton County, Florida
Beach Access Points
Construction Reaches
1/4 Mile Access Buffer
Parks
Beach-fx reaches
Parking and Access Condition
Not Adequate
Adequate
0
1,250
2,500
5,000 Feet


Walton County
Okaloosa
Walton
Bay
Gulf of Mexico
Gulf of Mexico
Deer Lake State Park
Deer Lake State Park
Walton County, Florida
Beach Access Points
Construction Reaches
1/4 Mile Access Buffer
Parks
Beach-fx reaches
Parking and Access Condition
Not Adequate
Adequate
0
1,250
2,500
5,000 Feet
A17c
A18
A19
A20
A21
A22
A23
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A30a
A30b
A30c
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R3-19
R3-20
R3-23
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R4-6
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R4-8
R4-9
R5-1
R5-3
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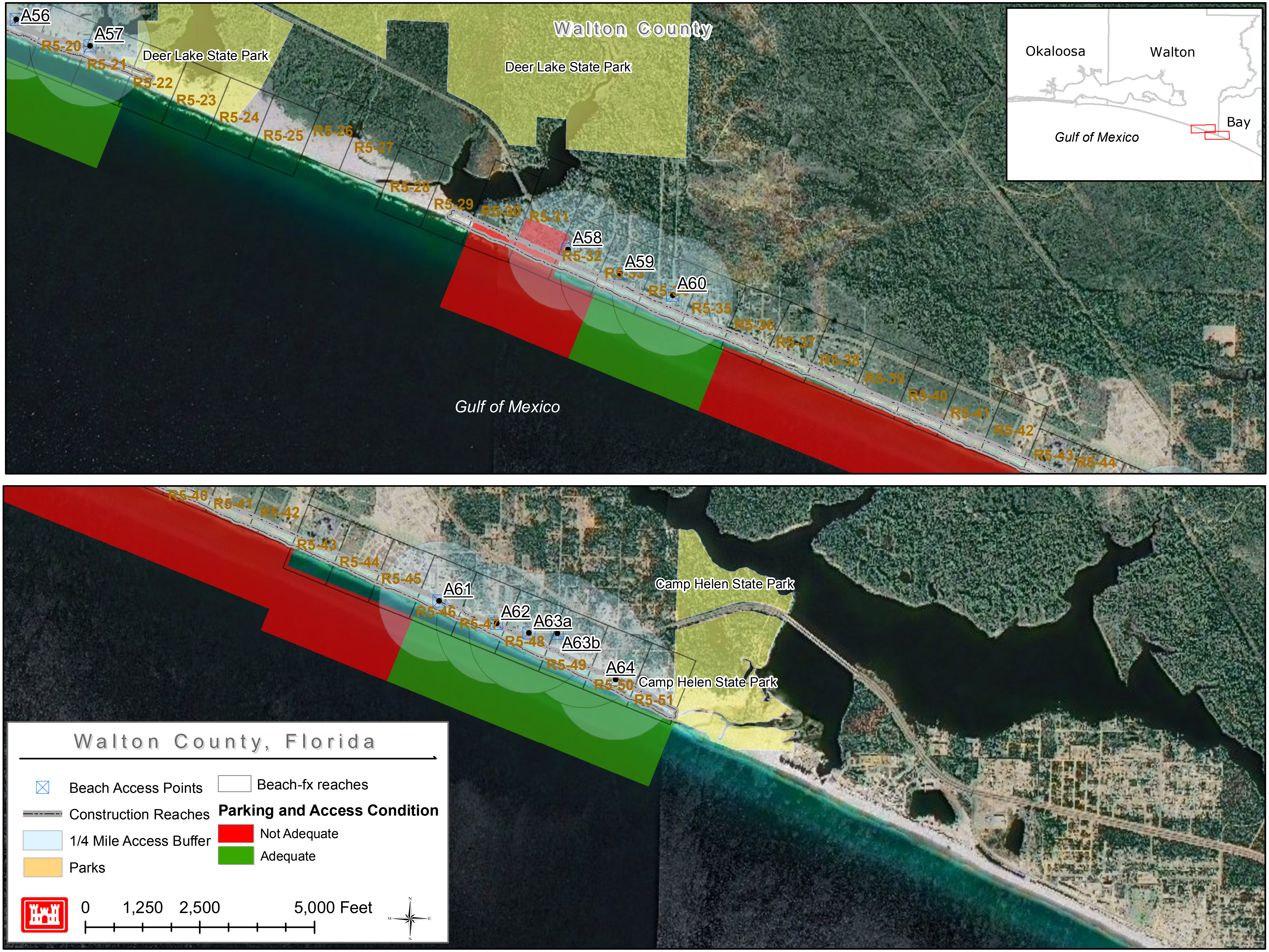
R5-22
R5-23



Walton County
Deer Lake State Park
Deer Lake State Park
Okaloosa
Walton
Bay
Gulf of Mexico
Gulf of Mexico
A56
A57
A58
A59
A60
A61
A62
A63a
A63b
A64
R5-20
R5-21
R5-22
R5-23
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R5-45
R5-46
R5-47
R5-48
R5-49
R5-50
R5-51
Camp Helen State Park
Camp Helen State Park
Walton County, Florida
Beach Access Points
Construction Reaches
1/4 Mile Access Buffer
Parks
Beach-fx reaches
Parking and Access Condition
Not Adequate
Adequate
0
1,250
2,500
5,000 Feet

WALTON COUNTY ACCESS AND PARKING

Construction Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
1	R1-3	Miramar Beach Regional Access West	85	574
1	R1-4	Miramar Beach Regional Access East	85	574
1	R1-10	Scenic Gulf Drive	100	675
1	R1-12	735 Scenic Gulf Drive	0	0
1	R1-14	132 Norwood Drive	0	0
1	R1-15	Open Gulf Street	0	0
1	R1-16	~ 90 Beach Drive	6	41
1	R1-17	253 Sand Trap Road	3	20
1	R1-18	End of Tango De Mer	0	0
1	R1-22	San Destin Day Use Area	110	743
1	R2-1	719 Top Sail Hill Road	0	0
2	R3-4	363 Highland Avenue	5	34
2	R3-4	127 Highland Avenue	0	0
2	R3-5	Dune Allen 5753 W. Co Hwy 30A	75	506
2	R3-9	5605 Co Hwy 30A	0	0
2	R3-9	5173 Co Hwy 30A	15	101
2	R3-9	4991 W. Co Hwy 30A	0	0
2	R3-10	4850 W. Co Hwy 30A	5	34
2	R3-11	Gulf Place West Access Point	13	88
2	R3-12	Gulf Place Middle Access Point	13	88
2	R3-13	Gulf Place East Access Point	14	95
2	R3-11	4447 W Co Hwy 30A	42	284
2	R3-13	92 South Spooky Lane	0	0
2	R3-14	4201 Co. Hwy 30A	0	0
2	R3-14	186 Gulf View Heights Street	30	203
2	R3-21	2365 S. Co Hwy 83	22	149
2	R3-21	446 Blue Mountain Road	5	34
2	R3-21	590 Blue Mountain Road	5	34
2	R3-21	726 Blue Mountain Road	5	34
3	R4-5	125 Sandy Lane	12	81
3	R4-6	288 Garfield St.	41	277
3	R4-6	199 Banfill Street	41	277
3	R4-6	208 Holtz Avenue	0	0
3	R4-7	91 Boat Ramp Road	0	0

)

WALTON COUNTY ACCESS AND PARKING

Sub- Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
3	R4-6	913 Main Park Road	0	0
4	R5-2	Van Ness Butler Jr. Beach Access and parking and Watercolor Parking Garage and access	100	675
4	R5-4	Seaside (Access & Parking)	60	405
4	R5-5	2560 Co Hwy 30A	0	0
4	R5-6	2624 Co Hwy 30A	2	14
4	R5-6	2680 Co Hwy 30A	0	0
4	R5-6	~ 2750 Co Hwy 30A	0	0
4	R5-6	2790 Co Hwy 30A	32	203
4	R5-7	2845 Co Hwy 30A	0	0
4	R5-7	2920 Co Hwy 30A	0	0
4	R5-8	3020 Co Hwy 30A	4	27
4	R5-9	118 Montgomery Street	0	0
4	R5-9	52 S Andalusia St	0	0
4	R5-9	South end of Dothan Avenue on Montgomery Street	0	0
4	R5-10	3458 E. Co Hwy 30A - San Juan Neighborhood B A	20	135
4	R5-10	3512 E. Co. Hwy 30A	0	0
4	R5-10	3576 E. Co Hwy 30A - Pelaya Neighborhood B A	0	0
4	R5-12	3694 E. Co Hwy 30 A - Campbell Street Neighborhood	75	506
4	R5-12	3874 E. Co Hwy 30A	20	135
4	R5-13	57 Seagrove Place	9	61
4	R5-18	679 Eastern Lake Road	6	41
4	R5-18	491 Eastern Lake Road #33 - Eastern Lake N B A	0	0
4	R5-18	188 San Roy Road - neighborhood come out to helio	0	0
4	R5-19	11 Beachside Dune - Sugar Dune	16	108
4	R5-20	258 Beachfront Trail - Walton Dune	10	68
4	R5-22	308 Beachfront Trail	10	68
4	R5-22	Beachside Drive	16	108
5	R5-22	Deer Lake State Park	1	7
5	R5-32	8040 E. Co Hwy 30A - Gulf Lakes Neighborhood B A	0	0

WALTON COUNTY ACCESS AND PARKING

Sub- Reach	Model Reach	Access Points	Parking Spaces	Visits Parking Will Support
5	R5-34	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	10	68
5	R5-35	Saint Lucia Lane	100	675
5	R5-35	Rosemary Avenue	0	0
5	R5-35	8520 E. Co Hwy 30A - Seacrest Drive Neighborhood B A	0	0
5	R5-46	East Water Street	50	338
5	R5-46	East Water Street	50	338
5	R5-46	188 Winston Lane Beach Access	5	34
5	R5-47	264 South Wall Street - Wall Street Neighborhood	9	61
5	R5-47	435 West Park Place Ave.	67	452
5	R5-48	139 South Orange Street	67	452
5	R5-49	118 West Park Place Avenue FL #20	67	452
5	R5-50	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101
TOTALS		73 Access Points	1,553	10,478

Parking - Access - Cost Sharing Qualifying															
Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
1	R1-1					0	0	55	0	0 0		Not Adequate		Not Adequate	No ***
2	R1-2					0	0	55	22	99 99		Not Adequate		Adequate	No ***
3	R1-3	A1a	Miramar Beach Regional Access W (Parking/Access)	2375 Scenic Gulf Drive	2375 Scenic Gulf Drive	85	574	574	28	126	700	Adequate		Adequate	No ***
4	R1-4	A1b	Miramar Beach Regional Access E (Parking/Access)	2375 Scenic Gulf Drive		85	574	55	15	68	641	Adequate		Adequate	No ***
5	R1-5					0	0	55	16	72	72	Adequate		Adequate	No ***
6	R1-6					0	0	55	18	81	0	Not Adequate		Not Adequate	No ***
7	R1-7					0	0	55	0	0 0		Not Adequate		Not Adequate	No ***
8	R1-8					0	0	55	10	45	0	Not Adequate		Not Adequate	No ***
9	R1-9					0	0	55	3	14	14	Adequate	R1-10	Adequate	No ***
10	R1-10	A2	Scenic Gulf Drive Access ROW (Parking/Access)	Scenic Gulf Drive		100	675	55	33	149	824	Adequate		Adequate	No ***
11	R1-11					0	0	55	16	72	0	Not Adequate		Not Adequate	No
12	R1-12					0	0	55	31	140	140	Adequate		Adequate	Yes
13	R1-13	A3	Gerinimo Street (Access)	735 Scenic Gulf Drive	735 Scenic Gulf Drive	0	0	55	76	342	342	Adequate		Adequate	Yes
14	R1-14					0	0	55	33	149	149	Adequate		Adequate	Yes
15	R1-15	A4	Norwood Drive (Access)	132 Norwood Dirve	132 Norwood Dirve	0	0	55	77	347	347	Adequate		Adequate	Yes

Parking - Access - Cost Sharing Qualifying																
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
16	R1-16	A5	Open Gulf (Access)	213 Open Gulf St.	Open Gulf Street	6	41	55	103	464	504	Adequate		Adequate	Yes
17	R1-17	A6, A7	Sand Trap & Tango De Mer (Parking & Access)	253 Sand Trap Rd & End of Tango De Mer	253 Sand Trap Road	3	20	55	4	18	38	Adequate	R1-16	Adequate	No ***
18	R1-18		Acess at End of Tango De Mer	Acess at End of Tango De Mer	End of Tango De Mer	0	0	55	0	0 0		Adequate	R1-19	Adequate	No ***
19	R1-19					0	0	55	55	248	0	Not Adequate		Not Adequate	No ***
20	R1-20					0	0	55	81	365	0	Not Adequate		Not Adequate	No ***
21	R1-21					0	0	55	146	657	657	Adequate		Adequate	No ***
22	R1-22	A8	Sand Destin Day Use Area (Parking & Access)		San Destin Day Use Area	110	743	743	92	414	1,157	Adequate		Adequate	No ***
23	R1-23					0	0	55	155	698	698	Adequate		Not Adequate	No ***
24	R1-24					0	0	55	0	0 0		Adequate	R1-23	Not Adequate	No ***
25	R2-1					0	0	55	0	0	0				
26	R2-2					0	0	55	0	0	0				
27	R2-3					0	0	55	0	0	0				
28	R2-4					0	0	55	0	0	0				
29	R2-5		State Park (Parking & Access)	719 Top Sail Hill Road		0	0	55	0	0	0				
30	R2-6					0	0	55	0	0	0				
31	R2-7					0	0	55	0	0	0				
32	R3-1	A10	Stallworth Preserve North (Access)	140 Stallworth Blvd.		5	34	55	0	0	34				

Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
33	R3-2	A11, A12	Beach Highland & Bullard Beach Neighborhood Access (Parking & Access)	127 & 363 Highland Avenue	127 & 363 Highland Avenue	3	20	55	0	0	20	Not Adequate		Adequate	No
34	R3-3					0	0	55	5	23	23	Not Adequate		Adequate	No
35	R3-4					5	34	55	7	32	65	Adequate		Adequate	Yes
36	R3-5	A13	Dune Allen (Parking & Access)	5753 W. Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A	75	506	506	0	0	506	Adequate		Adequate	Yes
37	R3-6	A14	West Allen (Access)	5605 Co. Hwy 30-A		0	0	55	0	0	55	Not Adequate	R3-5	Adequate	Yes
38	R3-7	A15	Palms Ave W (Parking & Access)	4850 w. Co Hwy 30A		0	0	55	0	0 0		Not Adequate		Adequate	No
39	R3-8	A16a	Palms Ave E (Parking & Access)	4850 w. Co Hwy 30A		0	0	55	12	54 54		Adequate	R3-9	Adequate	Yes
40	R3-9	A16b	Lake Causeway (Access)	5173 Co Hwy 30A	4850 & 4991 & 5605 Co Hwy 30A	15	101	55	0	0	101	Adequate		Adequate	Yes
41	R3-10	A17a, A17b	Gulf Place West and Middle (Access)		4850 w. Co Hwy 30A	5	34	55	0	0	34	Adequate	R3-9	Adequate	Yes
42	R3-11	A17c, A18	Gulf Place East & Ed Walline Regional Beach Access (Parking & Access)	4447 W Co Hwy 30A	4447 W Co Hwy 30A & Gulf Place West Access Point	55	371	55	13	59	430	Adequate		Adequate	Yes
43	R3-12	A19	Spooky lane & Shellseekers (Access and Parking)	92 South Spooky Lane & 4201 W. Co. Rd. Hwy 30-A	92 South Spooky Lane & Gulf Place East Access Point	13	88	55	0	0	88	Adequate		Adequate	Yes

Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
44	R3-13	A20				14	95	55	16	72	167	Adequate		Adequate	Yes
45	R3-14	A21	Gulfview Heights (Parking & Access)	186 Gulfview Heights St	4201 Co. Hwy 30A & 186 Gulf View Heights Street	30	203	55	0	0	203	Adequate		Adequate	Yes
46	R3-15					0	0	55	0	0 0		Adequate	R3-14	Not Adequate	No
47	R3-16					0	0	55	0	0 0		Not Adequate		Not Adequate	No
48	R3-17					0	0	55	0	0 0		Not Adequate		Not Adequate	No
49	R3-18					0	0	55	24	108	0	Not Adequate		Not Adequate	No
50	R3-19					0	0	55	111	500	0	Not Adequate		Not Adequate	No
51	R3-20					0	0	55	23	104	104	Adequate		Adequate	Yes
52	R3-21	A22, A23	Blue Mountain and Gulf Point (Parking & Access)	2365 S Co Hwy 83 & 446 Blue Mountain Road	2365 S. Co Hwy 83 & 446, 590 and 726 Blue Mountain Road	37	250	55	0	0	250	Adequate		Adequate	Yes
53	R3-22	A24	Seagrade Road Neighborhood Access (Access)	590 Blue Mountain Road		0	0	55	0	0 0		Adequate	R3-21	Adequate	Yes
54	R3-23	A25	Blue Lake (Access)	726 Blue Mountain Road		0	0	55	0	0 0		Not Adequate		Adequate	No
55	R3-24					0	0	55	0	0	0				
56	R3-25					0	0	55	0	0	0				
57	R3-26					0	0	55	0	0	0				
58	R4-1	A26	Grayton State Park (Acess & Parking)			0	0	55	0	0 0		Not Adequate		Adequate	No
59	R4-2					0	0	55	0	0 0		Not Adequate		Not Adequate	No

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
60	R4-3					0	0	55	0	0 0		Not Adequate		Not Adequate	No
61	R4-4					0	0	55	0	0 0		Not Adequate	R4-5	Not Adequate	No
62	R4-5	A27	Ray's Multi-Moutain (Access)	125 Sandy Lane	125 Sandy Lane	12	81	55	0	0	81	Adequate		Adequate	Yes
63	R4-6	A28, A29	Grayton Dunes and Weston (Parking & Access)	288 Garfield St & 208 Holtz Ave	288 Garfield St. & 199 Banfill St.& 208 Holtz Avenue & 913 Main Park Road	82	554	554	0	0	554	Adequate		Adequate	Yes
64	R4-7				91 Boat Ramp Road	0	0	55	0	0	0		R4-6		
65	R4-8	A301, A30B, A30C	Grayton State Park (Acess & Parking)			0	0	55	0	0	0				
66	R4-9					0	0	55	0	0	0				
67	R5-1					0	0	55	0	0 0		Not Adequate		Not Adequate	No
68	R5-2	A31	Van Ness Butler (Parking and Access)	1931 E Co Hwy 30A	Dune Allen 5753 W. Co Hwy 30A & Water Color Park Gargae and Access	100	675	675	11	50	725	Adequate		Adequate	Yes
69	R5-3					0	0	0	0	0 0		Adequate	R5-4	Adequate	Yes
70	R5-4	A32	Seaside (Access and Parking)			60	405	55	0	0	405	Adequate		Adequate	No
71	R5-5	A33	Dogwood/Thyme (Access)	2560 E. Co Hwy 30A	2560 Co Hwy 30A	0	0	55	0	0	0	Adequate	R5-6	Adequate	Yes

Parking - Access - Cost Sharing Qualifying

Sub Reach	Model Reach	MAP ID	GIS -Database Access Name	GIS - Database Address	Large Day Use Public Areas and Access Points	Day Use Parking Spaces	Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)	Peak Day Parking Demand*	Rental Parking Spaces	Visits Rental Parking Will Support (4.5 persons per Vehicle)	Total Parking	Parking Adequate or Not Adequate	Neighboring Reaches Requisite Parking Provided From	Access Adequate or Not Adequate	Qualify for Cost Sharing Yes/No
72	R5-6	A34, A35, A36	Nightcap, Live Oak, Hickory (Access)	30A at End of Nightcap Street, 2680 E. Co Hwy 30A, 2624 E. Co Hwy 30A	2624, 2680, ~2750 and 2790 Co Hwy 30 A	32	216	55	0	0	216	Adequate		Adequate	Yes
73	R5-7	A37, A38, A39	Hollywood, Azela, Hwy 395 (Access)	2790, 2845, 2920 E. Co. Hwy 30-A	2845 and 2920 Co Hwy 30A	0	0	55	0	0 0		Adequate	R5-6	Adequate	Yes
74	R5-8	A40, A41, A42	Headland, Greenwood, Gardenia (Access)	3020 Co Hwy 30A, 30 & 118 Montgomery	3020 Co Hwy 30A	4	27	55	0	0	27	Not Adequate		Adequate	No
75	R5-9	A43, A44	Dothan and Andalusia (Access)	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	52 South Andalusia St and South End of Dothan Ave on Montgomery St.	0	0	55	0	0	0	Adequate	R5-9	Adequate	Yes
76	R5-10	A45, A46, A47	Santa Clara, Santa Juan, Pelayo & Montego (Parking & Access)	3458, 3512, 3468, & 3576 E. Co Hwy 30A	3458, 3512 and 3576 E. Co Hwy 30A - San Juan & Pelaya Neighborhood G A	20	135	55	0	0	135	Adequate		Adequate	Yes
77	R5-11	A48, A49	Campbell	3694 E Co Hwy 30A		0	0	55	71	320	320	Adequate		Adequate	Yes
78	R5-12	A50	Beachwood villas (Access)	3874 E. Co Hwy 30A	3694 and 3874 E. Co Hwy 30 A - (Campbell Street)	95	641	641	50	225	866	Adequate		Adequate	Yes
79	R5-13	A51	One Seagrove (Access)		57 Seagrove Place	9	61	55	70	315	376	Adequate		Adequate	Yes
80	R5-14	A52	Sugar Cliffs (Access)			0	0	55	137	617	617	Adequate		Adequate	Yes

Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
81	R5-15					0	0	55	0	0 0		Adequate	R5-14	Adequate	Yes
82	R5-16	A53	Ramsgate (Access)	679 Eastern Lake Rd	679 and 491 Eastern Lake Road	0	0	55	2	9	9	Adequate	R5-17	Adequate	Yes
83	R5-17	A54	Eastern Lake (Parking & Access)	28 Lakewood Dr		0	0	55	36	162	162	Adequate		Adequate	Yes
84	R5-18	A55	Port Property (Access)	188 San Roy Rd	188 San Roy Road	6	41	55	0	0	41	Adequate	R5-17, R5-19	Adequate	Yes
85	R5-19	A56	Sugar Dunes (Access)	11 Beachside Drive	11 Beachside Dune - Sugar Dune	16	108	55	0	0	108	Adequate		Adequate	Yes
86	R5-20					10	68	55	51	230	297	Adequate		Adequate	Yes
87	R5-21	A57	Walton Dunes (Access)	258 Beachfront Taril - Walton Dune	258 Beachfront Taril - Walton Dune - Beachside Drive & Deer Lake State Park	0	0	55	9	41	41	Adequate	R5-20, R5-22	Adequate	Yes
88	R5-22					27	182	55	0	0	182				
89	R5-23					0	0	55	0	0	0				
90	R5-24					0	0	55	0	0	0				
91	R5-25					0	0	55	0	0	0				
92	R5-26					0	0	55	0	0	0				
93	R5-27					0	0	55	0	0	0				
94	R5-28					0	0	55	0	0	0				
95	R5-29					0	0	55	0	0	0				
96	R5-30					0	0	55	0	0 0		Not Adequate		Not Adequate	No
97	R5-31					0	0	55	0	0 0		Not Adequate		Adequate	No

Parking - Access - Cost Sharing Qualifying																
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
98	R5-32	A58	Gulf Lake (Access)	8040 E. Co Highway 30A	8040 E Co Hwy 30A - Gulf Lakes Neighborhood	0	0	55	0	0 0		Not Adequate		Adequate	No
99	R5-33	A59	Sea Breeze (Access)	8286 E. Co Hwy 30A	8286 E. Co. Hwy 30A - Seabreeze Neighborhood B A	0	0	55	13	59 59		Adequate		Adequate	Yes
100	R5-34		Seacrest (Access)	8520 E Co Hwy 30A	Saint Lucia Lane & Rosemary Avenue & 8520 E Co Hwy30A - Seacrest Dr.	10	68	55	4	18	86	Adequate		Adequate	Yes
101	R5-35					100	675	675	6	27	702	Adequate		Adequate	Yes
102	R5-36					0	0	55	0	0 0		Not Adequate		Not Adequate	No
103	R5-37					0	0	55	0	0 0		Not Adequate		Not Adequate	No
104	R5-38					0	0	55	0	0 0		Not Adequate		Not Adequate	No
105	R5-39					0	0	55	0	0 0		Not Adequate		Not Adequate	No
106	R5-40					0	0	55	0	0 0		Not Adequate		Not Adequate	No
107	R5-41					0	0	55	0	0 0		Not Adequate		Not Adequate	No
108	R5-42					0	0	55	13	59	0	Not Adequate		Not Adequate	No
109	R5-43					0	0	55	0	0 0		Not Adequate		Not Adequate	No
110	R5-44					0	0	55	0	0 0		Not Adequate		Not Adequate	No
111	R5-45					0	0	55	0	0 0		Not Adequate		Not Adequate	No

Parking - Access - Cost Sharing Qualifying															
Sub Reach	**Model Reach**	**MAP ID**	**GIS -Database Access Name**	**GIS - Database Address**	**Large Day Use Public Areas and Access Points**	**Day Use Parking Spaces**	**Visits Parking Will Support (4.5 persons per Vehicle times 1.5 Turnover Rate)**	**Peak Day Parking Demand***	**Rental Parking Spaces**	**Visits Rental Parking Will Support (4.5 persons per Vehicle)**	**Total Parking**	**Parking Adequate or Not Adequate**	**Neighboring Reaches Requisite Parking Provided From**	**Access Adequate or Not Adequate**	**Qualify for Cost Sharing Yes/No**
112	R5-46	A61	Inlet beach Neighborhood (Access)	188 Winston Lane	188 Winstor lane	105	709	709	0	0	709	Adequate		Adequate	Yes
113	R5-47	A62	Wall Street (Access)	264 South Wall Street	435 West Park Place Ave. & 264 South Wall Street	76	513	513	0	0	513	Adequate		Adequate	Yes
114	R5-48	A63A	Inlet Beach Regional Access West (Parking & Access)	438 South Orange Street Center	438 South Orange Street	67	452	452	0	0	452	Adequate		Adequate	Yes
115	R5-49	A63B	Inlet Beach Regional Access Middle & East (Parking and Access)	438 South Orange Street Center	118 West Park Place Avenue FL #20	67	452	452	0	0	452	Adequate		Adequate	Yes
116	R5-50	A64	Philips Inlet (Access)	202 South Walton Lakeshore Drive	202 South Walton Lakeshore Drive Phillips Inlet Access	15	101	55	0	0	101	Adequate		Adequate	Yes
117	R5-51					0	0	55	0	0 0		Adequate	R5-49, R5-50	Adequate	Yes
TOTALS						1,559	10,523	13537**	1,698	7,641	16,743				

* Assuming Large Public Day Use Area Parking is fully utilized and remainder of parking demand is distributed uniformly throughout the study area

** Peak Day Demand (July 4th)

*** LPP Reaches not economically justified, not eligible for cost sharing

Rental Parking disqualified - No Public Access Available

LPP Construction Reaches

APPENDIX C

REAL ESTATE PLAN

WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

APPENDIX C – REAL ESTATE PLAN

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WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION
GENERAL INVESTIGATIONS STUDY

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WALTON COUNTY, FLORIDA
HURRICANE AND STORM DAMAGE REDUCTION

GENERAL INVESTIGATIONS STUDY

APPENDIX C – REAL ESTATE PLAN

1. PURPOSE OF THE REAL ESTATE PLAN

This Real Estate Plan (REP) identifies the real estate requirements for the proposed construction of the various project components for a Federal shore protection project in Walton County, Florida. These real estate requirements are based on a project need to reduce the damaging effects of hurricanes and severe storms to real property along the coast and stabilize or restore the shoreline by eliminating long-term erosion. This REP is tentative in nature for planning purposes only and both the final real property acquisition lines and estimates of value are subject to change even after approval of this report. The REP is written to support the Walton County Hurricane and Storm Damage Reduction Project General Investigations Study and is written to the same level of detail as the Feasibility Report. The author of this report has inspected the project area. The non-Federal sponsor is the Walton County Board of Commissioners, represented by the Director of Beach Management for the Walton County Tourist Development Council (TDC). This REP was last updated on 28 September 2012.

2. PROJECT AUTHORIZATION

This study was authorized both within the United States Senate and the U.S. House of Representatives. In the Senate, the Committee on Environment and Public Works adopted a committee resolution (unnumbered) on July 25, 2002, which reads as follows:

> *"Resolved by the Committee on Environment and Public Works of the United States Senate, That in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army is requested to review the feasibility of providing beach nourishment, shore protection and related improvements in Walton County, Florida, in the interest of protecting and restoring the environmental resources on and behind the beach, including the feasibility of providing shoreline and erosion protection and related improvements consistent with the unique characteristics of the existing beach sand, and with consideration of the need to develop a comprehensive body of knowledge, information, and data on coastal area changes and processes as well as impacts from Federally constructed projects in the vicinity of Walton County, Florida.*

In the House, the Committee on Transportation and Infrastructure adopted a resolution, Docket 2690, dated July 24, 2002, which reads as follows:

"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That in accordance with Section 110 of the Rivers and Harbors Act of 1962, the Secretary of the Army is requested to review the feasibility of providing beach nourishment, shore protection and environmental restoration and protection in the vicinity of Walton County, Florida.

3. PROJECT LOCATION AND DESCRIPTION

The project location is located in Walton County, Florida along the coast of the Gulf of Mexico in the northwest Florida panhandle. Walton County is situated approximately 103 miles east of Pensacola, Florida and 98 miles west of Tallahassee, Florida. Walton County beaches extend from Destin, Florida in Okaloosa County, on the west, to Philips Inlet in Bay County, Florida on the east. A vicinity map of Walton County, Florida project limits is shown below as Figure C-1.

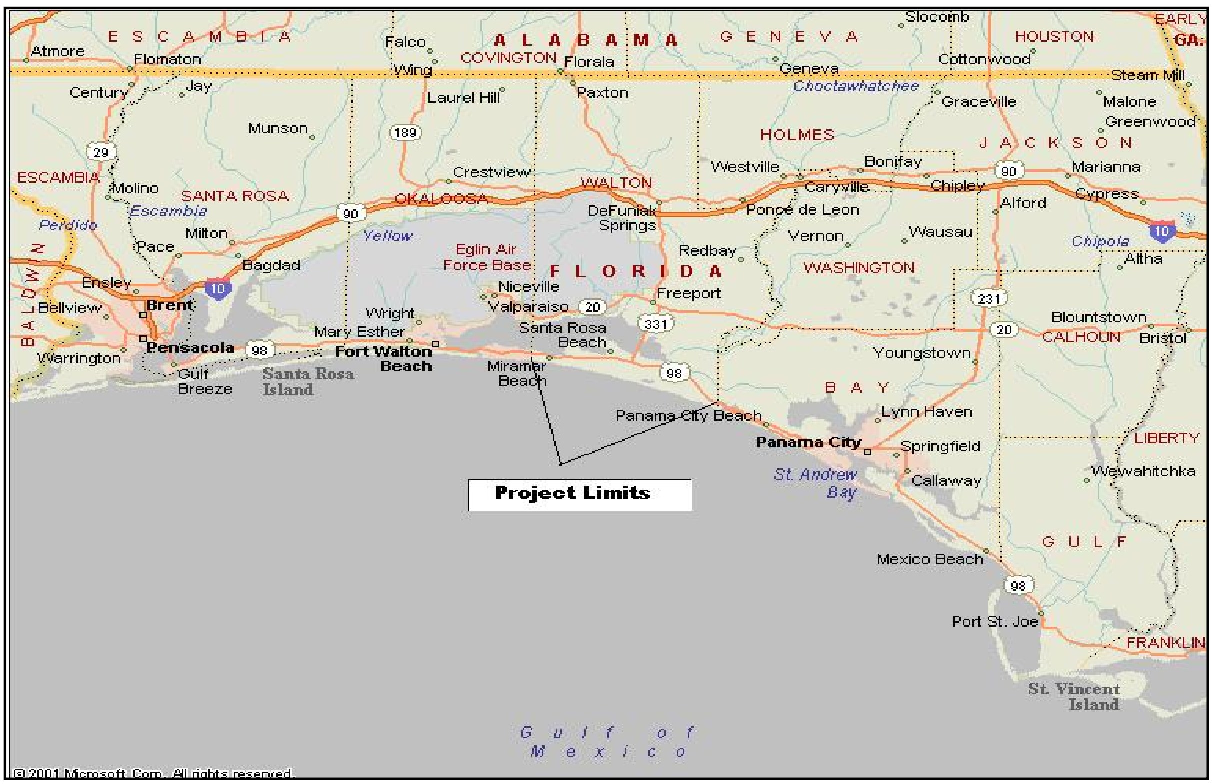


Figure C-1. Walton County, Florida Vicinity Map

In April of 2003, Taylor Engineering, Inc. of Jacksonville, Florida conducted a Beach Management Feasibility Study for Walton County, Florida. The results of this coastal processes analysis indicate that the beaches of Walton County have the natural ability to recover from storm events given sufficient time; however, successive storms from 1995 to 1998 have severely eroded the beach and hindered natural recovery process by transporting large volumes of sediment out of the littoral system both onshore and offshore. Furthermore, this study found that the beaches of Walton County have eroded an average of seven feet per year from 1993 to 2003. The beach width, beach elevation, and dune heights and widths have become critically eroded to the point that the beach no longer provides protection to upland structures from the ravages of hurricane driven surges. Without beach restoration, it is estimated that 85 percent of the upland structures will be damaged by a Category 2 or 3 hurricane.

Walton County, Florida encompasses 26 miles of shoreline which includes six miles of State parks. A coastal peninsula extending west from the mainland characterizes the western two-thirds of the coastline, and a mainland beach characterizes the eastern third. Choctawhatchee Bay lies north of the peninsula. Behind the dune system, upland drainage feeds several freshwater lakes that intermittently breach the dune system at seven different intervals throughout the project (See Table C-6). These lake outfalls discharge directly into the Gulf of Mexico. Primary dune elevations range from 11.5 to 44.5 feet North American Vertical Datum 88 (NAVD88) and average 25.5 feet National Geodetic Vertical Datum (NGVD).

An array of plans has been formulated and considered for this project. This REP will focus on the Locally Preferred Plan (LPP) which provides for shore protection measures in the interest of reducing hurricane and storm damages within the aforementioned project location. The LPP varies slightly from the proposed National Economic Development (NED) Plan by extending the berm and dune system horizontally which envelops a diminutive amount of additional coastline within reaches R1-1 – R1-10 and R1-17 – R2-1. In concept, the project will consist of the construction and maintenance of a berm and dune system that will tie into the existing dunes and vegetation line. The LPP is a beach-fill plan with a 30-foot wide dune at elevation 15 feet NGVD, fronted by a 50-foot wide berm at elevation 5.5 feet NGVD. A typical cross section is shown in Exhibit “A”. The project begins in Reach R1-1 and runs eastwardly approximately 137,280 feet or 26 miles to Reach R5-51. Due to breaches in the construction limits caused by dune lake outfalls and State park preserves, the actual dune and berm system constructed will be approximately 77,944 feet in length. The frequency of maintenance is estimated to be every 10 years or four cycles during the 50-year project life. The constructed berm will serve two primary purposes: as a stockpile of sand on the beach to serve as sacrificial material to reduce the erosion of the high ground beach during storm events and to provide storm damage protection to beachfront structures by moving the point of erosion seaward.

4. DESCRIPTION OF LANDS, EASEMENTS, RIGHTS-OF-WAY AND RELOCATIONS, AND DISPOSAL/BORROW AREAS (LERRDS)

The requirements for lands, easements, rights-of-way, relocations, and disposal/borrow areas (LERRDs) include the right to construct a dune and berm system along the shoreline of Walton County from R1-1 to R5-51. Included within these project reaches are single family residential units, multi family and condominium units, and a very limited amount of commercial properties. According to the project maps and site examinations, no dwellings will be impacted by the project. In addition, there are no public or private piers within the existing project limits. The following subsections a – e and accompanying tables detail the LERRDs requirements for the proposed project:

a. **Lands and Easements:** Tables C-1 – C-5 depict the number of parcels which will be impacted by easement acquisition within each reach and the associated average acreage per reach. It is estimated that a total of 179.16 acres will be required in Perpetual Storm Damage Reduction Easements. All estimates are based on the average distance from the landward toe of the proposed dune to the Mean High Water Line (MHWL) which is equivalent to the engineering baseline located at 1.037 NGVD. Refer to Exhibit "A" for a typical cross section of the proposed construction limits. The MHWL normally corresponds with the Erosion Control Line (ECL) and is an estimate of where the ECL will be set. For planning purposes, an average easement width of 80 feet is projected between the MHWL and the landward toe based on typical sections. Refer to Exhibit "B" for an aerial depiction of the typical easement limits. All coordinates are founded on 2007 survey information provided by the non-Federal sponsor.

   The MHWL is used for estimate purposes for this project since an ECL has not been identified and recorded for the entire Walton County coastline; however, recordation of the ECL will be required prior to construction. An ECL does currently exist between Reaches R1-1 and R1-24 of the westernmost portion of the project area. The existing ECL coordinates commence at Northing 506,530.825 feet and Easting 1,369,639.083 feet and runs eastwardly to coordinate N 502,059.76 feet E 1,393,555.83 feet as referenced to the Florida State Plane Coordinate System, North Zone, North American Datum of 1983, 1990 Adjustment.

   As shown in Table C-1, the estimated number of impacted parcels within the proposed project is 960 of which 37 of these are deemed to be publicly-owned. Based on these calculations, 923 Perpetual Storm Damage Reduction Easements will be required on private lands and 37 Perpetual Storm Damage Reduction Easements required for publicly-held lands. All easements will be located landward of the MHWL or the ECL once the ECL is surveyed and recorded. The ECL is expected to be set by the FL Department of Environmental Protection (FDEP) during the Preconstruction, Engineering, and Design (PED) phase of the project.

   Material placed upon public lands seaward of the MHWL or proposed ECL will require a Consent of Use from the State of Florida. The Consent of Use grants the rights to place material on state-owned submerged lands in accordance with the beach nourishment plans submitted with the application for an ECL.

   Based on a ground examination, it appears that there will be no adverse impact to the upland portion of ownership. The only improvements noted in the proposed easement area are access structures, such as walkways and dune crossovers. Damage to any existing structures is not compensable as this would be covered under the easement estate that is acquired by the non-Federal sponsor. Furthermore, this damage is not creditable unless an approved appraisal shows compensation due because of the structure damage. It should be noted that the Perpetual Beach Storm Damage Reduction Easement provided herein allows for landowners to "construct dune over walk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project."

b. **Appraisal:** The proposed shore protection project has been reviewed by Mobile District appraiser. The appraiser has determined that the value of the lands needed for easement purposes are assessed at zero based on the off-setting benefits appraisal method. The proposed project is deemed to be within the purview of EC 405-1-04, Section V, paragraph 4-44(b) which states "Hurricane protection and shore protection projects will generally be treated in a manner as to not allow credit for LERRDs when the project provides direct (off-setting) benefits such as prevention of erosion or re-establishment of beaches, i.e., those lands subject to shore erosion that are required for the project." Although credit is not allowed for LERRDs due to the off-setting benefits valuation, the administrative acquisition expenses incurred by the non-Federal sponsor are allowed for credit purposes.

   It is noted that Florida appraisal laws do not conform completely to the Federal off-setting benefits appraisal methodology described above. Under Florida law, off-setting benefits can be used for damages, but this method cannot be applied to the part taken. While the non-Federal sponsor can issue waivers of payment to the landowners along with the easement document that would specify that the land transaction is a voluntarily made donation for the public project, Federal appraisal rules dictate that no credit will be allowed.

   If in fact the non-Federal sponsor chooses to make land payments for the part taken, then this would be considered a non-creditable item and is strictly the responsibility of the non-Federal sponsor. Further guidance regarding this type of appraisal situation and waiver template is provided for in EC 405-1-04-4-33 and 4-43, dated 30 Dec 2003 which includes Appendix 4-F – USACE Suggested Format for Informal Value Estimates.

In 2007, in support of the economic benefit evaluation of near shore / land loss valuations as previously defined, USACE-SAM-RE-P estimated near shore values of parcels that were sufficiently removed from the shore to lose any direct water frontage value. This valuation estimate, dated 27 February 2007, was performed under jurisdictional exception, 2001 edition of the Uniform Standards of Professional Appraisal Practice and designed for the internal use of USACE and conforms to USACE regulations.

In 2010, in support of the Economic Sensitivity Analysis (Economic Appendix B, Section 12.0) concerning project justification, USACE-SAM-RE-P updated near shore / land loss values which showed a significant reduction in estimated square footage value ranges. All factors used for updating this valuation remained constant. This valuation estimate, effective 8 December 2010, presented a range of values by price per square foot for near shore properties.

On 7 August 2012, market values were again evaluated for properties in South Walton County (i.e. all lands south of Choctawhatchee Bay) from 2008 to 2012 in support of the Economic Sensitivity Analyses and to further gauge market condition trends. In 2008, a noticeable value decline occurred at 5.7% from the previous year. This decline peaked in 2010 at approximately 18%. As of 2nd quarter 2012, a slight increase of 1/10% has occurred showing a leveling off of falling values in this locale. This data is strictly noted for the Economic Analyses since off-setting benefits will be applied and no compensation is deemed necessary for the easement acquisition portion of this project. For further information concerning the inclusion of these valuation estimates and its relation to the formulation of the Economic and Sensitivity Analyses, refer to Appendix B – Economic Investigations.

c. **Borrow Areas:** Only one offshore borrow area has been identified as a source of sand for this project. If required for future renourishment cycles, this site may be expanded further south to accommodate this need. This borrow area is located within State waters which by definition are limited to three nautical miles offshore. A more detailed discussion on the borrow area is found in the Geotechnical Analysis and in the Sand Compatibility Analysis. Permits and/or consent agreements for sand removal from borrow areas will be from appropriate State and/or Federal agencies.

d. **Public Access:** In order to participate in cost sharing with the Federal Government, the non-Federal sponsor must meet certain requirements for public access. Otherwise, the non-Federal sponsor is responsible for 100% of the project cost for that reach where no public access exists. Public access must be available every one-half mile, and parking must be within one-quarter mile. Engineer Regulation 1165-2-130 sets forth the requirements for public access. While Walton County has approximately 50 public access points dispersed across the coastline, the County does not fully meet aforementioned access and parking requirements. If the non-Federal sponsor chooses to acquire additional access points and parking areas, as a pre-requisite for meeting Federal cost-share requirements, then all access and parking sites should be acquired in either fee simple or perpetual easement. Acquisition of public beach access points that are necessary for compliance in cost sharing is strictly a non-Federal sponsor responsibility. Accordingly, any cost incurred with the acquisition of public access points and parking areas cannot be considered a creditable item of cost share. The aforementioned access and parking locations are shown under Exhibit “G” attached hereto.

e. **Construction Access:** Proposed construction access to the project will be via public roads and existing rights-of-way. There are sufficient access corridors along the Walton County coastline located at the ends of public streets and at public access areas for contractors to move pipe and construction equipment onto the beach. Table C-6 lists all known publicly-owned lands within the project area that could be used for such access and Exhibit “G” provides additional mapping of these public access points that could be suitable for construction access purposes.

f. **Staging Areas:** All staging areas for the placement of construction equipment are expected to be within public rights-of-way, public access corridors, seaward of the ECL, and/or within acquired easement limits. If it is later determined that a temporary off-site staging area is required for project purposes, the NFS, in conjunction with the contractor, will secure a temporary work area easement (See Section 21 b. for estate language) that is suitable for project construction. This site will be appraised by the NFS in order to determine a fair market value which will be later reviewed by USACE for crediting purposes.

Table C-1. Reach 1

Project Reaches	Parcels	Estimated Acreage	Project Reaches	Parcels	Estimated Acreage
R1-1 = 549'	6	1.01	**R1-13=1040'**	5	1.91
R1-2 = 920'	16	1.69	**R1-14=1054'**	9	1.93
R1-3 = 1182'	3	2.17	**R1-15=990'**	7	1.82
R1-4 = 975'	1	1.79	**R1-16=1027'**	11	1.88
R1-5 =1140'	22	2.09	**R1-17=1115'**	15	2.05
R1-6 = 1035'	37	1.9	**R1-18=1135'**	11	2.08
R1-7 = 1045'	17	1.92	**R1-19=1075'**	8	1.97
R1-8 = 1032'	31	1.89	**R1-20=960'**	9	1.76
R1-9 = 1005'	6	1.84	**R1-21=956'**	6	1.75
R1-10 = 960'	4	1.76	**R1-22=1027'**	4	1.88
R1-11 = 1025'	19	1.88	**R1-23=1087'**	4	2
R1-12 = 1057'	14	1.94	**R1-24=1040'**	8	1.91
Sub-total:		21.88	**Total:**		44.82

Table C-2. Reach 2

Project Reaches	Parcels	Estimated Acreage
R2-1=503'	4	0.92
R2-2	0	0
R2-3	0	0
R2-4	0	0
R2-5	0	0
R2-6	0	0
R2-7	0	0
Total:		0.92

Table C-3. Reach 3

Project Reaches	Parcels	Estimated Acreage	Project Reaches	Parcels	Estimated Acreage
R3-1=478'	10	0.87	**R3-14=1348'**	17	2.48
R3-2=1040'	11	1.91	**R3-15=932'**	2	1.71
R3-3=1065'	8	1.95	**R3-16=732'**	5	1.34
R3-4=1035'	11	1.9	**R3-17=1020'**	15	1.87
R3-5=1125'	12	2.07	**R3-18=1040'**	15	1.91
R3-6=1002'	17	1.84	**R3-19=1037'**	5	1.9
R3-7=1163'	21	2.13	**R3-20=1029'**	11	1.89
R3-8=1105'	3	2.03	**R3-21=1032'**	11	1.89
R3-9=1061'	14	1.95	**R3-22=978'**	12	1.79
R3-10=1072'	15	1.97	**R3-23=940'**	8	1.72
R3-11=950'	9	1.74	**R3-24=485'**	1	0.89
R3-12=1007'	15	1.85	**R3-25=0'**	0	0
R3-13=1007'	6	1.85	**R3-26=470'**	1	0.86
Sub-total:		24.06	**Total:**		44.31

Table C-4. Reach 4

Project Reaches	Parcels	Estimated Acreage
R4-1=1084'	13	1.99
R4-2=854'	16	1.57
R4-3=961'	3	1.76
R4-4=945'	2	1.73
R4-5=1000'	10	1.84
R4-6=628'	3	1.15
R4-7=479'	2	0.88
R4-8=0'	0	0
R4-9=490'	1	0.9
Total:		11.82

Table C-5. Reach 5

Project Reaches	Parcels	Estimated Acreage	Project Reaches	Parcels	Estimated Acreage
R5-1=1035'	3	1.9	**R5-26=0**	0	0
R5-2=1005'	8	1.84	**R5-27=0'**	0	0
R5-3=1040'	26	1.91	**R5-28=0'**	0	0
R5-4=1035'	12	1.9	**R5-29=496'**	2	0.91
R5-5=1007'	13	1.85	**R5-30=1068'**	15	1.96
R5-6=1064'	1	1.95	**R5-31=969'**	7	1.78
R5-7=1037'	0	0	**R5-32=985'**	14	1.81
R5-8=997'	1	0.79	**R5-33=1028'**	12	1.89
R5-9=1026'	1	0.16	**R5-34=1040'**	21	1.91
R5-10=1015'	16	1.86	**R5-35=1000'**	11	1.84
R5-11=1025'	11	1.88	**R5-36=960'**	24	1.76
R5-12=1018'	8	1.87	**R5-37=1003'**	11	1.84
R5-13=1018'	13	1.87	**R5-38=1094'**	22	2.01
R5-14=1007'	15	1.85	**R5-39=1025'**	4	1.88
R5-15=1007'	18	1.85	**R5-40=1013'**	3	1.86
R5-16=1037'	14	1.9	**R5-41=1001'**	16	1.84
R5-17=900'	13	1.65	**R5-42=1020'**	16	1.87
R5-18=916'	14	1.68	**R5-43=1001'**	12	1.84
R5-19=1010'	10	1.85	**R5-44=1000'**	6	1.84
R5-20=1030'	13	1.89	**R5-45=970'**	3	1.78
R5-21=1125'	12	2.07	**R5-46=990'**	8	1.82
R5-22=469'	2	0.86	**R5-47=1031'**	17	1.89
R5-23=0'	0	0	**R5-48=1027'**	7	1.88
R5-24=0'	0	0	**R5-49=1040'**	3	1.91
R5-25=0'	0	0	**R5-50=1035'**	20	1.9
			R5-51=1030'	7	1.89
			Total:		77.29

Table C-6. Walton County, Florida Parcel Data

Project Reaches		General Reach Description	
R1		Miramar Beach, Sandestin, and Four Mile Village	
R2		Topsail Hill Preserve State Park	
R3		Beach Highlands, Dune Allen, Santa Rosa Beach, Blue Mountain and Gulf Trace	
R4		Grayton Beach State Park, Grayton Beach	
R5		Watercolor, Seaside, Seagrove, Watersound, Seacrest, Rosemary, and Inlet Beach	
Project Sheet #	**Project Reach**	**Publicly-owned Lands w/in Project Area (Public Beach, Access & Parking Areas)**	**Total # of Impacted Parcels**
F-101	R1-1 - R1-7	1)PIDN:30-2S-21-42290-000-1200	101
		Walton County Board of Commissioners	
F-102	R1-8 - R1-16	None Identified	104
F-103	R1-17 - R2-1	1)East of PIDN:34-2S-21-42000-019-0011	53
		Walton County-owned Access Rd. (R1-17)	
		2)East of PIDN:34-2S-21-42080-007-0300	
		Walton County-owned Access Rd. (R1-19)	
F-104	R2-1 - R2-6	1)Topsail State Park (R2-2 thru R2-6)	0
		Florida Board of Trustees of the Internal Improvement Trust Fund (TIITF)/State of FL Forestry Dept. of Ag.&Con.	
		**Breach in Construction limits from R2-1 thru R3-1.*	
F-105	R2-6 - R3-1	1)Topsail State Park (R2-6 thru R3-1)(4 separate parcels)	0
F-106	R3-1 - R3-9	1)PIDN:05-3S-20-34000-001-0010	98
		Walton County-owned parcel (R3-1)	
		(Note: Above parcel marks the end of Topsail State Park and the recommencement of project construction limits.)	
		2)Beach Highlands w/ access (R3-2 thru R3-3) (no PIDN)	
		3)PIDN:04-3S-20-34110-000-0021	
		Walton County-owned parcel in R3-5 (south of Ft.Panic Rd)	
		4)PIDN:04-3S-20-34140-000-0370	
		Dune Allen Regional Beach Access & Parking Area(R3-5)	
		5)Public beach parcel (R3-5 - R3-6) (no PIDN)	
		Walton County-owned(access south of Allen Loop Drive)	
		**Breach in Construction limits in R3-6*	
		6)Public beach access parcel (R3-8) (no PIDN)	
		Walton County-owned parcel	

Table C-6 (Continued). Walton County, Florida Parcel Data

Project Reaches		General Reach Description	
F-107	R3-9 - R3-18	1)PIDN:02-3S-20-34160-000-0680	83
		Ed Walline Regional Beach Access & Parking Area(R3-11)	
		2)PIDN:11-3S-20-34000-003-0000	
		Gulfview Heights Regional Beach Access & Parking(R3-14)	
		3)PIDN:11-3S-20-34000-002-0000	
		TIITF/State of FL Public Lands (R3-12 thru R3-13)	
		**Breach in Construction limits for Draper Lake Outfall(R3-15)*	
F-108	R3-18 - R3-26	1)PIDN:12-3S-20-34000-001-0061	53
		Blue Mountain Regional Beach Access & Parking (R3-20)	
		2)Public beach access parcel w/ parking (R3-21)	
		Walton County-owned - Co. Rd.83 r/w (no PIDN)	
		3) 3 Beach Access parcels (R3-21 thru R3-23) (no PIDN)	
		Located in Blue Mountain Beach Sub. PB2-41	
		4)PIDN:07-3S-19-25000-003-0000	
		Grayton Beach State Park (R3-26)	
		TIITF/St. of FL Dept.Rec&Parks	
		**Breach in Construction limits for Big Redfish Lake Outfall (R3-24 - R3-26)*	
F-109	R3-26 - R4-8	1)PIDN:08-3S-19-25000-017-0000	42
		TIITF/DNR (Rec&Parks Div.)(Abutting SFR/Alligator Lake)	
		**Breach in Construction limits for Alligator Lake Outfall (R4-2 - R4-3)*	
		2)PIDN:08-3S-19-25000-017-0000	
		TIITF/State of FL Public Lands (R4-3 thru R4-5)	
		3)PIDN:17-3S-19-25000-017-0010	
		Walton County-owned access parcel (R4-5)	
		4)PIDN:17-3S-19-25000-016-0000	
		Grayton Dunes Regional Beach Access/Parking/Rec Area	
		TIITF/DNR (Rec&Parks Div.) (R4-5 thru R4-6)	
		5)PIDN:17-3S-19-25040-000-0091	
		Walton County-owned access parcel (R4-6)	
		6)PIDN:17-3S-19-25040-000-0010	
		Grayton Dunes Regional Beach Access/Rec Area	
		TIITF/DNR (Rec&Parks Div.) (R4-6)	
		**Breach in Construction limits due to Western Lake outfall (R4-6)*	
		7)PIDN:17-3S-19-25000-016-0020	
		Grayton Dunes Regional Beach Access/Rec Area	
		TIITF/DNR (Rec&Parks Div.) (R4-6 thru R4-7)	
		8)PIDN:16-3S-19-25000-001-0000	
		Grayton Beach State Park	
		TIITF/DNR (Rec&Parks Div.) (R4-7 thru R4-8)	
		**Breach in Construction limits due to State Park Land (R4-7 - R4-9)*	

Table C-6 (Continued). Walton County, Florida Parcel Data

Project Reaches		General Reach Description	
F-110	R4-8 - R5-7	1)Van Ness Butler, Jr. Regional Beach Access/Rec Area	53
		(No PIDN or Parcel Ownership Information Available)	
		Located in Sec.15-3S-19W	
F-111	R5-7 - R5-16	1)PIDN:23-3S-19-25100-000-00A0	79
		Santa Clara Regional Beach Access/Parking/Rec Area	
		Walton Co. Board of Commissioners (R5-10)	
		2)PIDN:24-3S-19-25120-000-0240	
		Federally-owned by DOI/BLM (1.022 acres)	
		(Accessed via Seagrove Pl.) (R5-13) (Sec.24-3S-19)	
F-112	R5-16 - R5-25	**Breach in Construction limits due to Eastern Lake Outfall (R5-17 - R5-18)*	67
		1)PIDN:19-3S-18-16320-000-00A1(Beachfront Trail r/w)	
		Walton County-owned access r/w w/ parking located @ sw cor of Beachfront Trail & Lakewood Dr. (R5-20)	
		2)PIDN:19-3S-18-16080-000-0340	
		Walton County-owned beach parcel (R5-20 thru R5-21)	
		Public Beach Park w/ access via Beachfront Trail above	
		3)PIDN:19-3S-18-16080-000-0370	
		TIITF/DNR (Rec&Parks Div.) (R5-21 thru R5-22)	
		4)PIDN:20-3S-18-160000-001-0020	
		TIITF/Forestry Dept. of Ag&Con. (R5-22 thru R5-23)	
		**Breach in Construction limits due to Deer Lake Outfall (R5-22 - R5-29)*	
F-113	R5-25 - R5-34	None Identified	41
F-114	R5-34 - R5-43	None Identified	116
F-115	R5-43 - R5-51	1)PIDN:36-3S-18-16100-000-1890	70
		Inlet Beach Regional Beach Access/Parking/Rec Area	
		Walton County-owned beach parcel (R5-47 thru R5-48)	
		2)PIDN:36-3S-18-16100-000-1930	
		Inlet Beach Regional Beach Access/Parking/Rec Area	
		Walton County-owned beach parcel (R5-48 thru R5-49)	
		(Access provided via West Park Place Ave.)	
		Total # of Publicly-owned parcels: 37	
	Total # of Reaches: 117	**Overall Total # of Impacted Parcels:** **Total # of Privately-owned Impacted Parcels:** **Total # of Publicly-owned Impacted Parcels:**	**960** **923** **37**

5. LERRDS OWNED BY NON-FEDERAL SPONSOR

The lands, easements, and rights-of-way that are owned by the non-Federal sponsor are described in Table C-6. An approximate total of 37 parcels have been identified within the project area. This includes both County and State owned lands. Walton County owns numerous regional beach areas, street ends which will be used for access, and parking areas that can be used for staging areas during construction.

State-owned lands within the project area consist of Topsail Hill Preserve State Park, just east of Miramar Beach, Grayton Beach State Park, adjacent to Grayton Beach, and Deer Lake State Park located east of Grayton Beach State Park. In addition, there are numerous other parcels containing dune lake outfalls that are owned and managed by the Florida Board of Trustees of the Internal Improvement Trust Fund (TIITF) and the State of Florida Forestry Department of Agriculture and Conservation. For those areas where the project construction limits transition onto State-owned lands, a Consent of Use or Temporary Work Area Easement will be required from the appropriate State agency.

6. ANY EXISTING FEDERAL PROJECT THAT LIES FULLY OR PARTIALLY WITHIN THE LERRDs REQUIRED FOR THE PROJECT

There are no existing Federal projects that lie fully or partially within the LERRDs required for this project.

7. FEDERALLY OWNED LAND

A Federally-owned parcel was identified and located in Reach 5-13. This parcel is vested in the United States of America as public domain land and currently exempt from State property levy. This parcel is assessed as Parcel Identification Number (PIDN): 24-3S-19-25120-000-0240 containing 1.022 acres and is located in Section 24, 3 South, 19 West. The political subdivision by which this parcel of land is being managed is the United States Department of the Interior, Bureau of Land Management (BLM) and subject land is recognized by BLM as One Seagrove Place beach tract as noted on that Dependent Re-Survey and Subdivision of Section 24, Township 3 South, Range 19 West, of the Tallahassee Meridian, Florida (BLM Plat 9885 Sheet 1), memorandum notes dated July 17, 1947. The surrounding parcels were conveyed by patent by the United States while this particular parcel was never conveyed by patent and left as a remainder under the aforementioned re-survey.

Based on recent correspondence with BLM and the non-Federal Sponsor, this public domain land is currently under a 25-year lease to the Walton County Board of Commissioners under the Recreation and Public Purposes Act (R&PP) (68 Statute 173; 43 United States Code 869 et. seq.) which authorizes the sale or lease of public lands for recreational or public purposes to State and local governments. The subject land is actively managed by the South Walton County Tourism Development Council (SWTDC) which is a legal division under the Walton County Board of Commissioners. At present, BLM is processing Walton County's patent application whereby the subject land would be conveyed in fee to Walton County so long as the land remains accessible to the public for recreational and other public purposes. This conveyance is to be issued by the end of Fiscal Year 2013. The non-Federal Sponsor would not be entitled to credit under this scenario as a patent conveyance for recreation and public purposes is issued without monetary consideration.

8. LERRD THAT LIES BELOW THE ORDINARY HIGH WATER MARK

Under Florida law**,** the boundary between private riparian or littoral property and the State's sovereign land is the Ordinary High Water Mark (also known as the Mean High Water Line which represents the intersection of the land with the water surface at the elevation of mean high water), which migrates over time as sand is added or removed by natural forces.

The State of Florida owns all submerged lands that lie seaward of the Ordinary High Water Mark or the Erosion Control Line (ECL) depending on whether an ECL has been established. According to Florida Statute, submerged lands are defined as: "State lands lying below the ordinary high water line of fresh waters and below the mean high water line of salt waters and any other lands defined as submerged lands in Florida Statute (F.S.) § 253.03. Florida law also requires that an ECL be fixed before a restoration project can proceed. Furthermore, the Federal Government's ability to exercise navigational servitude is not available as the determination has been made that no nexus exists between the proposed project and commercial navigation.

9. MAPS / EXHIBITS / TABLES

- **g.** Refer to Figure 1 for vicinity map of Walton County, Florida.
- **h.** Table C-1 through C-5 details the number of impacted parcels and estimated acreage required for acquisition within Reaches 1 – 5.
- **i.** Table C-6 provides a general description of each reach as well as publicly-owned lands within each reach of the overall project area.
- **j.** Table C-7 – Real Estate Cost Estimate.
- **k.** Table C-8 - Chart of Accounts.
- **l.** Refer to Exhibit "A" for typical cross sections A and B (Proposed Government Template).
- **m.** Refer to Exhibit "B" for an aerial depiction of typical easement limits.
- **n.** Refer to Exhibit "C" for overview map of Reaches 1 – 5.
- **o.** Refer to Exhibit "D" for Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability.
- **p.** Refer to Exhibit "E" for Formal Risk Notification to Non-Federal Sponsor.
- **q.** Refer to Exhibit "F-1 through F-6" for photographs of various locations across the project area.

r. Refer to Exhibit “G” for Master Beach Access Improvement Plan depicting access points and USACE GIS aerial maps depicting beach access/parking
s. Refer to Exhibit “H” for Authorization for Entry for Construction.
t. Refer to Exhibit “I” for Appraisal Waiver Template

10. INDUCED FLOODING

No induced flooding is expected as a result of the proposed storm damage reduction and beach erosion control project.

11. BASELINE COST ESTIMATE FOR REAL ESTATE (BCERE)

The following real estate cost estimate was closely coordinated between Mobile District Real Estate Division and the non-Federal sponsor. It was agreed that the non-Federal sponsor would provide a realistic cost estimate since the non-Federal sponsor will be tasked with all acquisition activities. The non-Federal sponsor estimate included the cost for acquisition of land, relocation costs, and non-Federal administrative costs.

For this particular project, the non-Federal sponsor administrative costs are those costs incurred for verifying ownership of lands, certification of those lands required for project purposes, legal opinions, title insurance, appraisals, condemnations, property analysis and/or other requirements to secure the land interests that will be necessary during the Preconstruction, Engineering and Design (PED) Phase. According to EC 405-1-04, Section V, paragraph 4-44(b), this real estate cost estimate is based on the determination that the value of project lands needed for beach restoration easement purposes are assessed at zero dollars due to the off-setting benefits appraisal methodology. The remaining expense is contained in Federal and non-Federal administrative costs associated with acquisition of approximately 960 perpetual beach restoration easements. Table C-7 is an itemized breakdown of the projected real estate costs.

Table C-7. Baseline Cost Estimate for Real Estate

CATEGORY	COST
A. Lands:	
I. Lands	$0.00
II. Improvements	$0.00
III. Severance Damages	$0.00
IV. Minerals	$0.00
V. Total Lands & Damages	$0.00
B. ADMINISTRATIVE COSTS	
I. Federal Review of Non-Federal Sponsor – Reviews include Cadastral/Appraisal/Title/Acquisition/Condemnation/Crediting	
1. $175.00 x 923 (private lands)	$161,500.00
2. $175.00 x 37 (public lands)	$6,500.00
3. Sub-Total:	$168,000.00
4. Contingency (25%)	$42,000.00
5. Sub-Total:	**$210,000.00**
II. Non-Federal Sponsor Acquisition Costs Estimates based on a total of 960 easement acquisitions	
1. ECL Survey/Mapping/Legal Descriptions	$35,000.00
2. Ownership Verification & Title Insurance (960 x $125.00)	$120,000.00
3. County Atty. Review of Title (960 x $100.00)	$96,000.00
4. Contingency for items 1-3 (25% rounded)	$63,000.00
5. Appraisal Reports (assuming 5% of landowners)	$25,000.00
6. Appraisal Waivers (assuming 95% of landowners)	$5,000.00
7. Contingency for items 5 & 6 (25% rounded)	$8,000.00
8. Condemnation/Quick-Take Process (assuming 1%)	$100,000.00
9. Miscellaneous non-Federal Sponsor Administrative Costs	$40,000.00
10. Contingency (25%)	$35,000.00
11. Sub-Total:	**$527,000.00**
III. Public Law 91-646 Relocation Costs	$0.00
IV. **Total RE Cost Estimate:**	**$737,000.00**

12. RELOCATION ASSISTANCE BENEFITS (P.L. 91-646)

Based on the proposed project construction limits/project alignment and site examinations, no persons or businesses will require relocation assistance benefits as required under Public Law 91-64, Title II.

13. MINERAL ACTIVITY

There are no known mineral activities within the scope of the proposed project.

14. ASSESSMENT OF NON-FEDERAL SPONSOR AND PROJECT SPONSOR RESPONSIBILITIES

The Walton County Board of Commissioners, represented by the Director of Beach Management for the Walton County Tourist Development Council (TDC) is the non-Federal sponsor for this proposed project. The non-Federal sponsor has the responsibility to acquire all real estate interests required for the project. The non-Federal sponsor shall accomplish all alterations and relocations of facilities, structures and improvements (if applicable) determined by the Government to be necessary for construction of the project. Furthermore, the non-Federal sponsor will have operation and maintenance responsibility for the project after construction is completed.

Title to any acquired real estate will be retained by the non-Federal sponsor and will not be conveyed to the United States of America. Prior to advertisement of any construction contracts, the non-Federal sponsor shall furnish to the Government an Authorization for Entry for Construction (See Exhibit “H” attached hereto) to all lands, easements, and rights-of-way, as necessary. The non-Federal sponsor will also furnish to the Government evidence supporting their legal authority to grant rights-of-way to such lands.

The non-Federal sponsor shall comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved 2 January 1971, and amended by Title IV of the Surface Transportation Uniform Relocation Assistance Act of 1987, Public Law 100-17, effective 2 April 1989, in acquiring real estate interests for the proposed project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act(s).

Mobile District, Real Estate Division has officially inquired into the non-Federal sponsor’s capability to adequately acquire all necessary LERRDs. The non-Federal sponsor has documented this understanding in the Assessment of the Non-Federal Sponsor’s Real Estate Acquisition Capability and has also confirmed said real property acquisition tasks and associated estimate of costs in that letter dated 14 May 2009 attached hereto as Exhibit “D”.

The NFS is not entitled to receive credits against its share of project costs for the value of lands it provides due to the aforementioned Federal rules of offsetting benefits. Documented incidental costs of acquiring land interests, as determined by the Government to be reasonable can be a creditable item. Credit for sponsor owned lands that may have been acquired more than 5 years from the effective date of the Project Partnership Agreement (PPA) cannot include incidental costs and will not be creditable for this particular project. For further information regarding acquisition/relocation and crediting requirements, the sponsor should review the *NFS Guide to Land Acquisition* located at http://www.sam.usace.army.mil/RE/default.htm

15. APPLICATION OF ZONING ORDINANCES

No application or enactment of zoning ordinances is proposed in lieu of, or to facilitate acquisition in connection with this project.

16. LAND ACQUISITION MILESTONES

Commencement of land acquisition hinges on a number of overall project milestones. Specifically, the projected fiscal budget appropriations, anticipated approval of the Chief's Report by the Assistant Secretary of the Army (ASA) Civil Works, and ultimately, the finalization of a Project Partnership Agreement (PPA). That being said, the non-Federal sponsor has made proposals to begin acquisition at the time of feasibility approval and prior to the final execution of PPA. The non-Federal sponsor has been notified of the risks involved as provided for in Exhibit "E" – Formal Risk Notification Letter. However, the land acquisition schedule ultimately centers on the placement and recordation of an ECL which is anticipated for the vast majority of the Walton County coastline. Due to the large number of impacted lands, a minimum of 24 to 36 months for the acquisition process is estimated for this project. It is recommended that the project be constructed in phases to mirror the acquisition timeline. The non-Federal sponsor, USACE Project Manager, and Real Estate Technical Manager will further formulate the milestone schedule upon project approval to allow adequate time to complete real estate acquisition phase in order to meet the advertisement for construction date(s).

It is critical to note some general elements that have an impact on acquisition schedules are landowner attitudes, funding concerns, manpower resources, and title issues. Depending on the nature of some title defects, significant time and efforts should be expected to impact acquisition milestones. In some cases, curative efforts may require condemnation to identify and provide legal notice to all affected landowners. Where negotiations fail and condemnation is required, the non-Federal sponsor should use their quick-take authority in order to expedite the condemnation process and allow for possession of the property for project purposes. The non-Federal sponsor has documented in Exhibit "D" attached hereto that quick-take authority is available for this project.

17. FACILITY OR UTILITY RELOCATIONS

There are no known facilities or utility relocations within the scope of the proposed project.

18. KNOWN CONTAMINANTS

There is no known or suspected presence of Hazardous, Toxic, and Radiological Waste (HTRW) located in, on, under, or adjacent to the LERRDs required for the construction or operation and maintenance of the proposed project.

19. SUPPORT OR OPPOSITION TO THE PROJECT

Based on past meetings with the non-Federal sponsor, it appears the majority of landowners within the project area are supportive of the proposed hurricane and storm damage reduction project since this project will provide much needed protection to upland structures and real property.

However, in 2004, a small group of landowners challenged the establishment of a Walton County Erosion Control Line (applied under the Beach and Shore Preservation Act) claiming that this acquisition affected an unconstitutional taking of their property without just compensation. The importance of citing this case is to point out the possible procedural effects on real estate acquisition for this proposed project. A brief synopsis of this case is as follows:

> Save Our Beaches v. City of Destin, Walton County
> Case No. SC06-1449
> Florida Supreme Court

Walton County, along with the Florida Department of Environmental Protection, the Internal Improvement Trust Fund and the City of Destin, have appealed a decision of the First District Court of Appeal (DCA) finding that the application of Section 161.141, Florida Statutes, and the establishment and recordation of an Erosion Control Line ("ECL"), to the properties of the members of Stop the Beach Renourishment, Inc. ("STBR"), constitutes an unconstitutional taking of private property. Although the DCA decision is couched in terms an "as-applied" constitutional challenge, neither the court nor STBR established how the members of STBR are situated any differently than any other owner of beach front property in the State.

The practical effect of the decision, therefore, is a determination of the facial invalidity of the statute. The decision would then apply to all existing and proposed beach renourishment projects in the State, as each project requires the establishment and recordation of an ECL. The effect of such a decision, therefore, is the requirement that the State and/or the local project sponsor acquire, through eminent domain, all riparian rights to the upland properties included within a project area prior to the issuance of a permit by the Department of Environmental Protection (the "Department").

On 29 September, 2008, the Florida Supreme Court issued an Opinion holding that the Beach and Shore Preservation Act achieves a reasonable balance between public and private interests. Further, the Act, on its face, does not unconstitutionally deprive upland owners of property rights without just compensation when the State is restoring beaches under the aforementioned Act.

After the Florida Supreme Court decision was issued, this case was further elevated to the Supreme Court of the United States (No. 08-1151), argued December 2, 2009 and decided June 17, 2010. The Certiorari affirmed the lower court's decision as stated in the following excerpt:

Florida owns in trust for the public the land permanently submerged beneath navigable waters and the foreshore. The mean high-water line is the ordinary boundary between private beachfront, or littoral property, and state-owned land. Littoral owners have, inter alia, rights to have access to the water, to use the water for certain purposes, to have an unobstructed view of the water, and to receive accretions and relictions (collectively, accretions) to the littoral property. An accretion occurs gradually and imperceptibly, while a sudden change is an avulsion. The littoral owner automatically takes title to dry land added to his property by accretion. With avulsion, however, the seaward boundary of littoral property remains what it was: the mean high-water line before the event. Thus, when an avulsion has added new land, the littoral owner has no right to subsequent accretions, because the property abutting the water belongs to the owner of the seabed (ordinarily the State).

Florida's Beach and Shore Preservation Act establishes procedures for depositing sand on eroded beaches (restoration) and maintaining the deposited sand (nourishment). When such a project is undertaken, the State entity that holds title to the seabed sets a fixed "erosion control line" to replace the fluctuating mean high-water line as the boundary between littoral and state property. Once the new line is recorded, the common law ceases to apply. Thereafter, when accretion moves the mean high-water line seaward, the littoral property remains bounded by the permanent erosion-control line.

Respondents, the city of Destin and Walton County, sought permits to restore 6.9 miles of beach eroded by several hurricanes, adding about 75 feet of dry sand seaward of the mean high-water line (to be denominated the erosion-control line). Petitioner, a nonprofit corporation formed by owners of beachfront property bordering the project (hereinafter Members) brought an unsuccessful administrative challenge. Respondent *the Florida Department of Environmental Protection approved the permits, and this suit followed. The State Court of Appeal concluded that the Department's order had eliminated the Members' littoral rights (1) to receive accretions to their property and (2) to have their property's contact with the water remain intact. Concluding that this would be an unconstitutional taking and would require an additional administrative requirement to be met, it set aside the order, remanded the proceeding, and certified to the Florida Supreme Court the question whether the Act unconstitutionally deprived the Members of littoral rights without just compensation. The State Supreme Court answered "no" and quashed the remand, concluding that the Members did not own the property supposedly taken. Petitioner sought rehearing on the ground that the Florida Supreme Court's decision effected a taking of the Members' littoral rights contrary to the Fifth and Fourteenth Amendments; rehearing was denied.* ***Held: The judgment is affirmed.***

20. STATEMENT THAT NON-FEDERAL SPONSOR HAS BEEN NOTIFIED IN WRITING ABOUT THE RISKS ASSOCIATED WITH ACQUIRING LAND

The non-Federal sponsor has been notified of the risks involved upon acquiring lands required for the project prior to execution of the PPA. Should the non-Federal sponsor proceed with acquisition of lands prior to execution of the PPA, it is at the risk of not receiving credit or reimbursement for any costs incurred in the connection with the acquisition process should the PPA not be signed. There is also risk in acquiring lands either not needed for the project or not acquired in compliance with requirements for crediting purposes in accordance with 49 CFR Part 24, dated March 2, 1989.

The non-Federal sponsor has been notified via email and supplied with a formal notification of the risks involved in acquiring land for the proposed prior to the execution of the PPA and the Government's formal notice to proceed with acquisition. The non-Federal sponsor's formal acknowledgment of these risks as provided for in ER 405-1-12-31 is attached hereto as Exhibit "E".

21. ESTATES TO BE ACQUIRED

It is recommended that the non-Federal sponsor acquire the standard perpetual beach storm damage reduction easement, as is described under item a. below.

a. Perpetual Beach Storm Damage Reduction Easement:

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts No. ___), for use by the Project Sponsor, its representatives, agents, contractors and assigns, to construct; preserve; patrol; operate; maintain; repair; rehabilitate; and replace; a public beach, a dune system, and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land; to construct berms and dunes; to nourish and renourish periodically; to move, store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the Walton County Hurricane and Storm Damage Reduction Project, together with the right of public use and access; to plant vegetation on said dunes and berms; to erect, maintain and remove silt screens and snow fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas; to trim, cut, fell, and remove from said land all trees, underbrush, debris, obstructions, and any other vegetation, structures and obstacles within the limits of the easement (except _________); (reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns, the right to construct dune over walk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the Florida Department of Environmental Protection (FDEP) and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project; and further reserving to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

b. Temporary Work Area Easement:

In the event that the non-Federal sponsor encounters difficulties with construction access and staging, it is recommended that the non-Federal sponsor acquire a temporary work area easement. Said temporary easement term should be required for 24 – 36 months in order to provide enough time for the project to be fully constructed unless it is determined later that the easement term can be minimized to reflect construction phases.

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____), for a period not to exceed____________________, beginning with date possession of the land is granted to the Project Sponsor, for use by the Project Sponsor, its representatives, agents, and contractors as a work area, including the right to deposit backfill, move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Walton County Hurricane and Storm Damage Reduction Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

c. Consent of Use

(1) There is no estate which the sponsors acquire from the State to place material seaward of the ECL, however, the State issues a permit type document known as a "Consent of Use". This consent is issued when the initial Water Quality Certificate is approved by the Florida Department of Environmental Regulation and the ECL is approved by the Governor and Cabinet.

(2) The consent of use basically grants the rights to place sand on state-owned submerged land in accordance with the beach nourishment plans submitted with the application for an ECL. This document must be renewed with the renewal of the Water Quality Certificate.

22. NAVIGATIONAL SERVITUDE

The Federal Navigational Servitude doctrine arises from two related components: navigation power which is derived from the commerce clause of the U.S. Constitution giving Congress regulatory power over navigable waters; and navigation servitude which provides that certain private property may be taken, without compensation to the landowner, if the taking is necessary to exercise the navigation power. Private ownership of land below navigable or tidal waters is acquired and held subject to the dominant public right of navigation. This dominant public right may be exercised by Congress without giving rise to a compensable taking. The Federal Government's ability to exercise navigational servitude is not available for this project as the determination has been made that no nexus exists between the proposed project and commercial navigation.

23. CHART OF ACCOUNTS

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

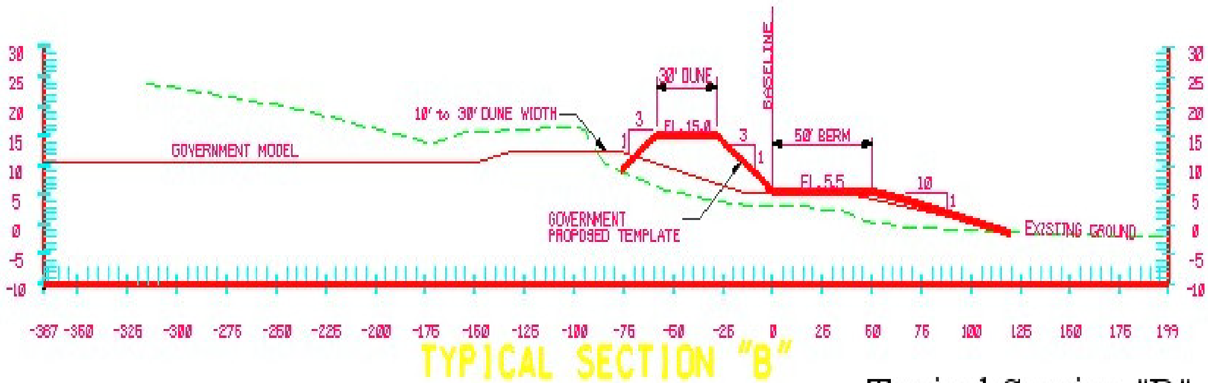
Table C-8. Chart of Accounts

Chart of Accounts				
01A	**PROJECT PLANNING**	**FEDERAL**	**NON-FEDERAL**	**TOTALS**
	Other			
	Project Partnership Agreement (OC)	$ -	$ -	$ -
01AX	Contingencies (25%)	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -
01B	**LANDS AND DAMAGES**			
01B20	Acquisition by non-Federal sponsor	$ -	$421,000.00	$421,000.00
01B40	Acq/Review of non-Federal sponsor	$168,000.00	$ -	$168,000.00
01BX	Contingencies (25% Rounded)	$ 42,000.00	$106,000.00	$148,000.00
01R	**RE PAYMENTS**	**FEDERAL**	**NON-FEDERAL**	**TOTALS**
01R1	LAND PAYMENTS	$ -	$ -	$ -
01R1A	By Government	$ -	$ -	$ -
01R1B	By non-Federal sponsor	$ -	$ -	$ -
01R1C	By Government on behalf of non-Federal sponsor	$ -	$ -	$ -
01R1D	Review of non-Federal sponsor	$ -	$ -	$ -
01RX	Contingencies (25%)	$ -	$ -	$ -
01R2	**PL 91-646 Assistance Payments**			
01R2A	By Government	$ -	$ -	$ -
01R2B	By non-Federal sponsor	$ -	$ -	$ -
01R2C	By Government on behalf of non-Federal sponsor	$ -	$ -	$ -
01R2D	Review of non-Federal sponsor	$ -	$ -	$ -
	TOTALS	**$210,000.00**	**$527,000.00**	**$737,000.00**

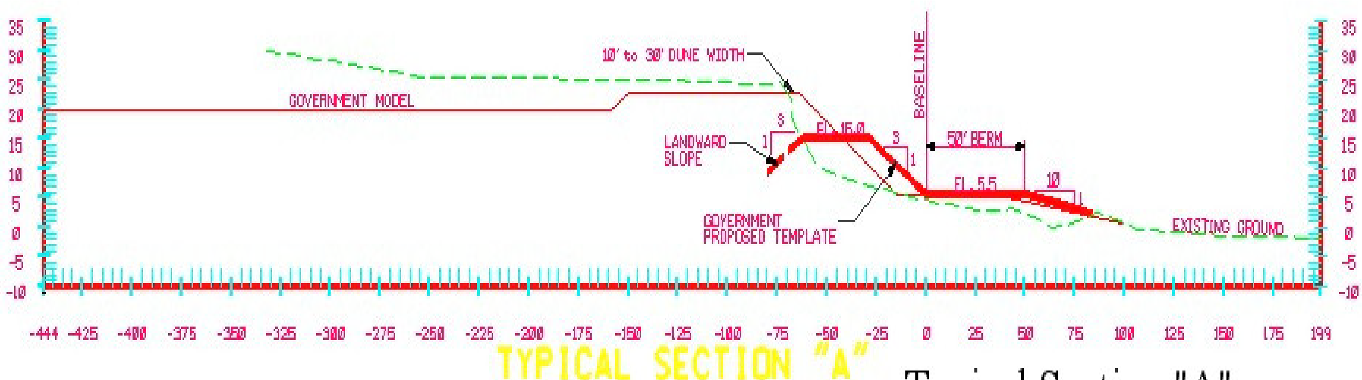
24. OTHER REAL ESTATE ISSUES

No other pertinent real estate issues have been identified for the proposed project.

<u>EXHIBIT "A"</u>

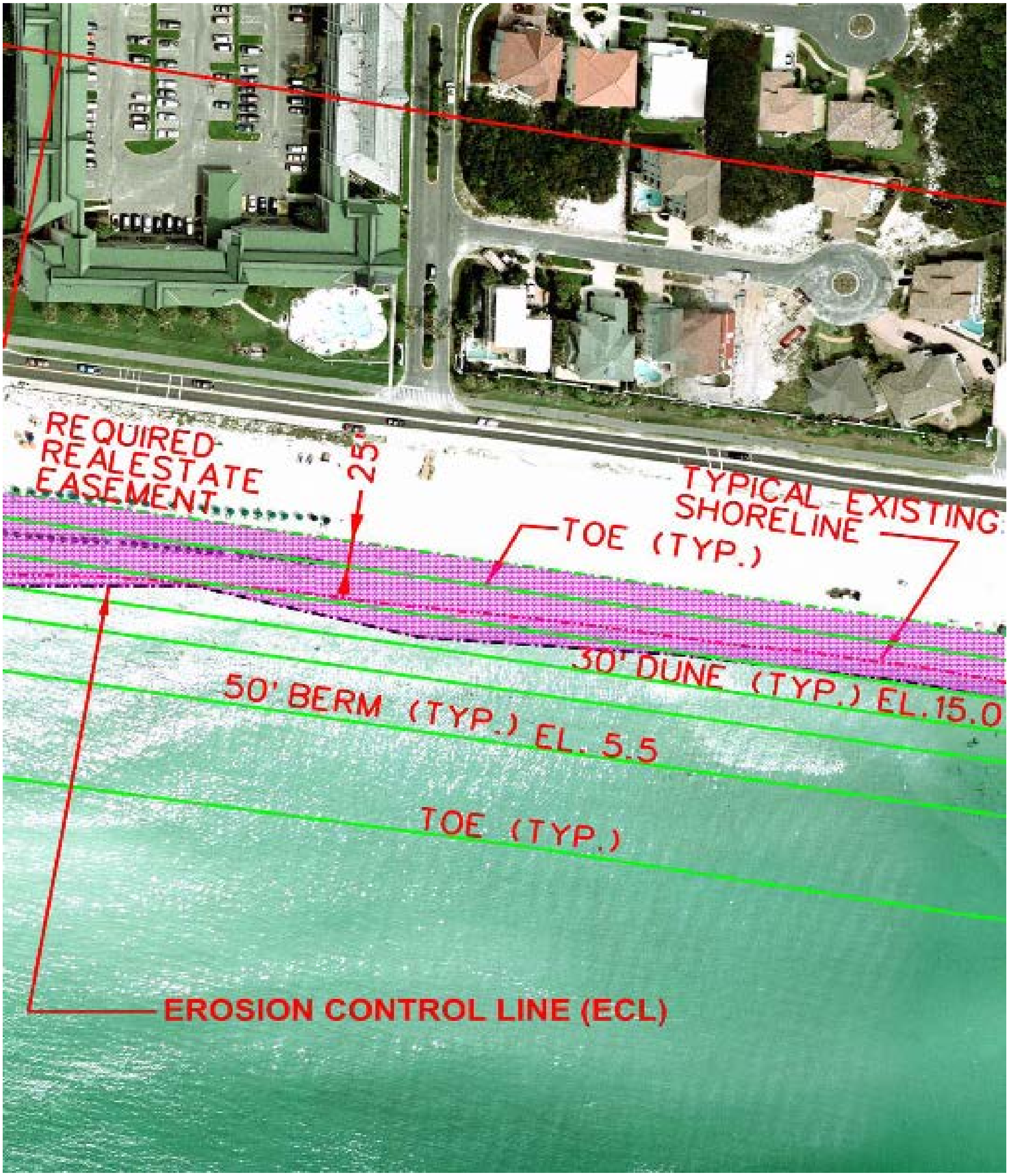


Typical Section "B"



Typical Section "A"

EXHIBIT "B"



REQUIRED REALESTATE EASEMENT
25'
TYPICAL EXISTING SHORELINE
TOE (TYP.)
30' DUNE (TYP.) EL.15.0
50' BERM (TYP.) EL. 5.5
TOE (TYP.)
EROSION CONTROL LINE (ECL)

EXHIBIT “C”

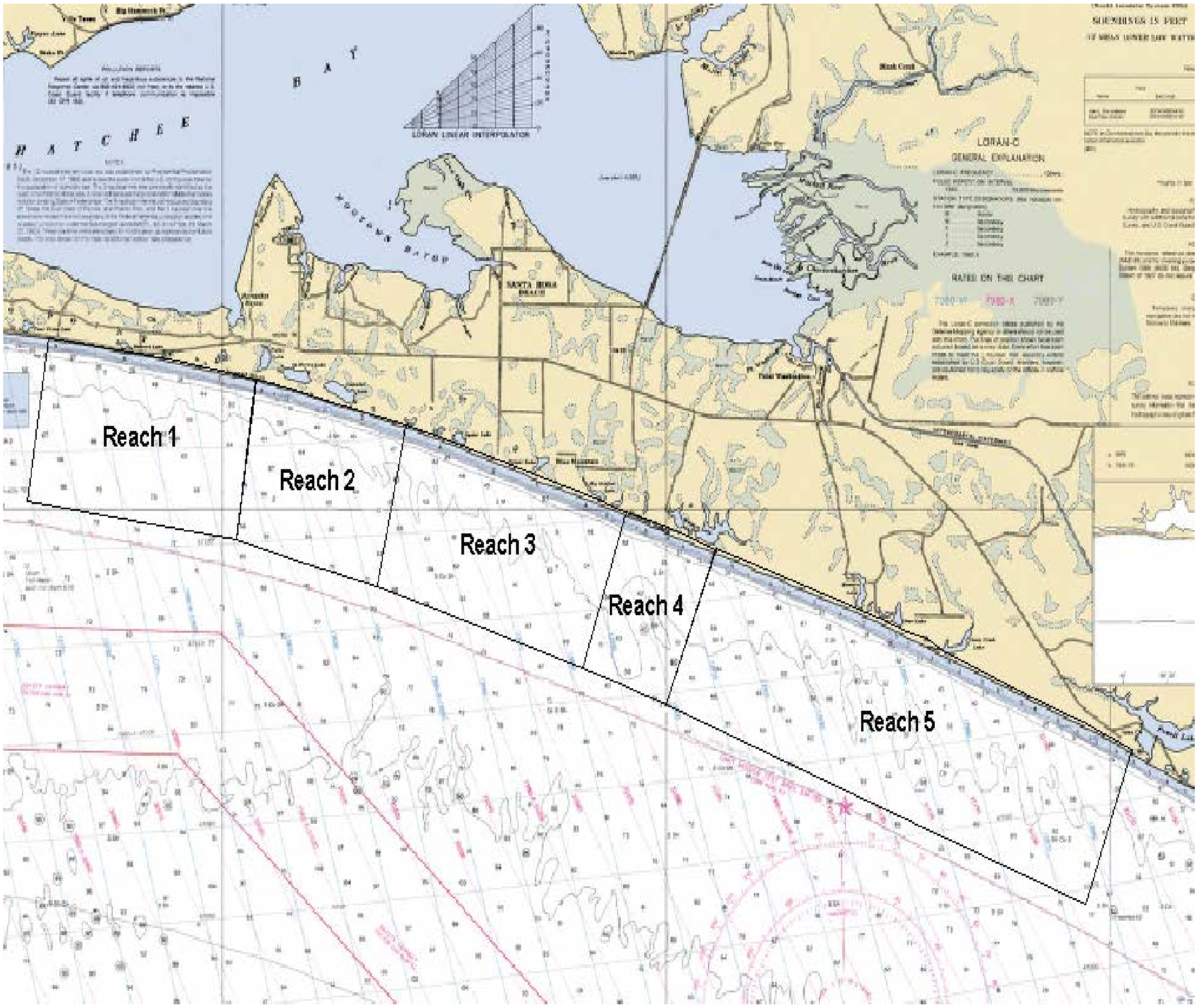


EXHIBIT "D"

WALTON COUNTY, FLORIDA
STORM DAMAGE REDUCTION AND
BEACH EROSION CONTROL PROJECT

WALTON COUNTY BOARD OF COMMISSIONERS – NON FEDERAL SPONSOR

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

1. **LEGAL AUTHORITY:**

   a. **Does the sponsor have legal authority to acquire and hold title to real property for project purposes? Yes**

   b. **Does the sponsor have the power of eminent domain for this project? Yes**

   c. **Does the sponsor have "quick-take" authority for this project? Yes**

   d. **Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? No**

   e. **Any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn?**
      i. **Private Property: Yes**
      ii. **State-Owned Property: No**

2. **HUMAN RESOURCE REQUIREMENTS:**

   a. **Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? No**

   b. **If the answer to 2(a) is "yes", has a reasonable plan been developed to provide such training? N/A**

   c. **Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? Yes**

   d. **Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule? Yes**

e. Can the sponsor obtain contractor support, if required, in a timely fashion? Yes

f. Will the sponsor likely request USACE assistance in acquiring real estate? (If "yes", provide description). No, USACE will provide guidance and oversight functions only.

3. <u>OTHER PROJECT VARIABLES:</u>

a. Will the sponsor's staff be located within reasonable proximity to the project site? Yes

b. Has the sponsor approved the project/real estate schedule milestones? The project/real estate schedule milestones have not yet been explicitly defined.

4. OVERALL ASSESSMENT:

a. Has the sponsor performed satisfactorily on other USACE projects? Yes

b. With regard to this project, the sponsor is anticipated to be: <u>Highly capable</u>; Fully capable; Moderately capable; Marginally capable; Insufficiently capable. (If sponsor is believed to be insufficiently capable, please provide explanation).

5. COORDINATION:

a. Has this assessment been coordinated with the sponsor? Yes

b. Does the sponsor concur with this assessment? Yes

Accepted by Non-Federal Sponsor:

Donny Mares **(Signature)**

EXECUTIVE DIRECTOR **(Title)**
WALTON COUNTY TOURIST
DEVELOPMENT COUNCIL

Prepared by:

_______________ **(Signature)**
RUSSELL W. BLOUNT III
PLANNING SECTION
REAL ESTATE DIVISION

Reviewed and Approved by:

_______________ **(Signature)**
FREDERICK D. DAWSON
ACTING CHIEF
REAL ESTATE DIVISION
U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

BEACHES OF SOUTH WALTON
Northwest Florida's Gulf Coast

May 14, 2009

Russell W. Blount III
U.S. Army Corps of Engineers
Mobile District, Real Estate Division
109 St. Joseph Street
Mobile, AL 36602

Re: Walton County, Florida's Plan regarding Real Estate Acquisition for the Walton County Hurricane and Storm Damage Reduction Project

Mr. Blount,

As you are aware, Walton County has been working with the Mobile District of the U.S Army Corps of Engineers since 2003 with the goal of identifying a federally justified Hurricane and Storm Damage Reduction Protection project for the Walton County shoreline. In this letter, Walton County is proposing how we would approach the real estate acquisition portion of the project based on previous conversations with Mobile team members.

It is our understanding that prior to the initiation of any real estate activities; Walton County will survey and record an Erosion Control Line (ECL) for the entire length of the project. Additional real estate acquisition activities will include identifying the parcels that are within the project area, identifying the ownership of those parcels, securing easements for those parcels that meet or exceed the need of the federal government to construct the federal shore protection project, and obtaining appraisal waivers and appraisal reports (an appraisal report will be required if Walton County is forced to use their quick-take authority due to failed landowner negotiations). Based on previous discussions with Mobile District Real Estate Division, they have identified roughly 960 parcels within the proposed project area. This leaves an explanation of how we would identify ownership of those parcels and securing easements as the remaining two items that we must account for costs and activities. Walton County's proposed plan for those two activities is outlined in the following two sections.

Identification of parcel ownership within the project area

Walton County is in the process of identifying the ownership of the parcels within the project area. Mike Burke, Walton County Attorney, has contacted Fidelity National Title Insurance Company, a major title insurance company in the United States, to obtain a cost estimate for their effort to identify the owners and producing a report for each parcel. The cost for this effort is estimated by Fidelity to be $125 per parcel. In addition to this cost, the County Attorney anticipates a cost of $100 per parcel to review each report from Fidelity to insure accuracy and prepare information to be included for individual easement documents. Based on these estimates, we calculate the local sponsors cost for ownership identification portion of the real estate acquisition program to be $216,000. In addition to the parcel ownership identification process, Walton County has received an estimate of $35,000 for the Erosion Control Line Survey from Morgan & Eklund a registered surveying company in the State of Florida. Assuming a 25% contingency (approximately $63,000), the cost for this activity would be estimated at approximately $314,000.

Beaches of South Walton Tourist Development Council
25777 U.S. Hwy. 331 South • Santa Rosa Beach, FL 32459
800-822-6877 • 850-267-1216 • Fax 850-267-3943
www.beachesofsouthwalton.com

Blue Wave Certified

SEASCAPE | MIRAMAR | SANDESTIN | DUNE ALLEN | SANTA ROSA | BLUE MOUNTAIN | GRAYTON | WATERCOLOR | SEASIDE | SEAGROVE | WATERSOUND | SEACREST | ALYS BEACH | ROSEMARY BEACH | INLET

Securing easements for parcels located within the project area

In conversations with Mobile, Walton County has expressed an interest in moving quickly to begin securing easements for the project area. Walton County has been informed of the risks in moving forward prior to the project being authorized and those risks were noted and accepted in a formal risk notification letter dated July 3, 2008. It is our intention to work closely with Mobile to insure that our easement includes the necessary language to meet or exceed the needs of the project.

The approach by Walton County in this task will be to draft an easement for review by Mobile District Real Estate Division and receive acceptance that the language is sufficient for supporting the needs of the project. Additionally, it is the intention of Walton County to include language within the easement document regarding offsetting benefits in order to alleviate the need of an appraisal for takings claims. In addition, Walton County and Mobile District will draft an appraisal waiver detailing that the easement was voluntarily provided by the landowner for the proposed project and that monetary compensation for said easement will be waived. If the need arises for an appraiser, Walton County will identify an appraiser and submit the necessary documentation to Mobile for review. The appraiser will then be tasked with assisting Walton County through the acquisition process.

Walton County staff will be responsible for formulating, mailing, and recording of easements in the Walton County, FL Clerk of Courts. Moreover, Walton County, through the Tourist Development Council, will conduct an educational campaign to assist the dissemination of information regarding the project and specifically the easement process. Walton County has notified the Mobile District Real Estate Division that the County is highly capable of implementing this acquisition project as noted in that real estate assessment letter dated July 16, 2008. The estimated cost to the non-federal sponsor for administrative duties regarding securing easements for parcels located within the project area is $40,000 plus a 25% contingency for a total administrative cost of $50,000.

Summary

It is our understanding that the current estimate for non-federal sponsor administrative costs related to this project exceeds $3,500,000 including the 25% contingency. Our estimate for the non-federal sponsor administrative cost is $527,000. Therefore, we expect a cost savings of almost $3 million on this item. Refer to the attached itemized chart for the newly proposed real estate cost estimate. We appreciate the opportunity to submit this information in regards to the Walton County, FL Hurricane and Storm Damage Reduction Project.

Sincerely,

Sonny Mares

Sonny Mares
Executive Director

Itemized exhibit referenced in above Sponsor letter dated May 14, 2009

CATEGORY	COST
A. Lands:	
I. Lands	$0.00
II. Improvements	$0.00
III. Severance Damages	$0.00
IV. Minerals	$0.00
V. Total Lands & Damages	$0.00
B. ADMINISTRATIVE COSTS	
I. Federal Review of Non-Federal Sponsor – Reviews include Cadastral/Appraisal/Title/Acquisition/Condemnation/Crediting	
1. $175.00 x 923 (private lands)	$161,500.00
2. $175.00 x 37 (public lands)	$6,500.00
3. Sub-Total:	$168,000.00
4. Contingency (25%)	$42,000.00
5. Sub-Total:	**$210,000.00**
II. Non-Federal Sponsor Acquisition Costs Estimates based on a total of 960 easement acquisitions	
1. ECL Survey/Mapping/Legal Descriptions	$35,000.00
2. Ownership Verification & Title Insurance (960 x $125.00)	$120,000.00
3. County Atty. Review of Title (960 x $100.00)	$96,000.00
4. Contingency for items 1-3 (25% rounded)	$63,000.00
5. Appraisal Reports (assuming 5% of landowners)	$25,000.00
6. Appraisal Waivers (assuming 95% of landowners)	$5,000.00
7. Contingency for items 5 & 6 (25% rounded)	$8,000.00
8. Condemnation/Quick-Take Process (assuming 1%)	$100,000.00
9. Miscellaneous non-Federal Sponsor Administrative Costs	$40,000.00
10. Contingency (25%)	$35,000.00
11. Sub-Total:	**$527,000.00**
III. Public Law 91-646 Relocation Costs	$0.00
IV. **Total RE Cost Estimate:**	**$737,000.00**

EXHIBIT "E"

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

Real Estate Division
Planning Section

South Walton Tourist Development Council
Attn: Sonny Mares, Executive Director
P.O. Box 1248
Santa Rosa Beach, FL 32459

Re: Walton County, FL Storm Damage Reduction and Beach Erosion Control Project; Formal Risk Notification to Non-Federal Sponsor

Dear Mr. Mares,

The intent of this letter is to formally advise Walton County, as potential Non-Federal Sponsor for a proposed project, of the risks associated with land acquisition prior to the execution of a Project Partnership Agreement (PPA) or prior to the Government's formal notice to proceed with acquisition. If a Non-Federal Sponsor deems it necessary to commence acquisition prior to an executed PPA for whatever reason, the Non-Federal Sponsor assumes full and sole responsibility for any and all costs, responsibility, or liability arising out of the acquisition effort.

Generally, these risks include, but may be not be limited to, the following:

(1) Congress may not appropriate funds to construct the proposed project;

(2) The proposed project may otherwise not be funded or approved for construction;

(3) A PPA mutually agreeable to the non-Federal sponsor and the Government may not be executed and implemented;

(4) The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA, as amended;

(5) The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project;

(6) The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could

1

have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of LERRD;

(7) The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD in advance of the executed PPA and the Government's notice to proceed which may not be creditable under the provisions of Public Law 99-662 or the PCA. **(Reference: ER 405-1-12 (Change 31; 1 May 98) Section 12-31. Acquisition Prior to PCA Execution.)**

Please acknowledge that the Non-Federal Sponsor for the proposed project accepts these terms and conditions.

Accepted on behalf of the Non-Federal Sponsor:

Donny Mauer (Signature)

EXECUTIVE DIRECTOR (Title)

Prepared by:

Russell W. Blount III
Planning Section
Real Estate Division
U.S. Army Corps of Engineers

EXHIBIT “F-1”

Facing west at the Miramar Beach Regional Access – This public access is located on the very western end of Walton County, Florida.

EXHIBIT “F-2”

Facing east at the Miramar Beach Regional Access.

EXHIBIT “F-3”

Just south of the intersection of Highland Avenue and Bullard Road. Topsail Hill Preserve State Park is directly to the west and Dune Allen Regional Beach Access is directly to the east.

EXHIBIT “F-4”

Facing northeast at the Ed Walline Regional Beach Access corridor located near the intersection of Walton County Hwy. 393 and Walton County Hwy. 30A.

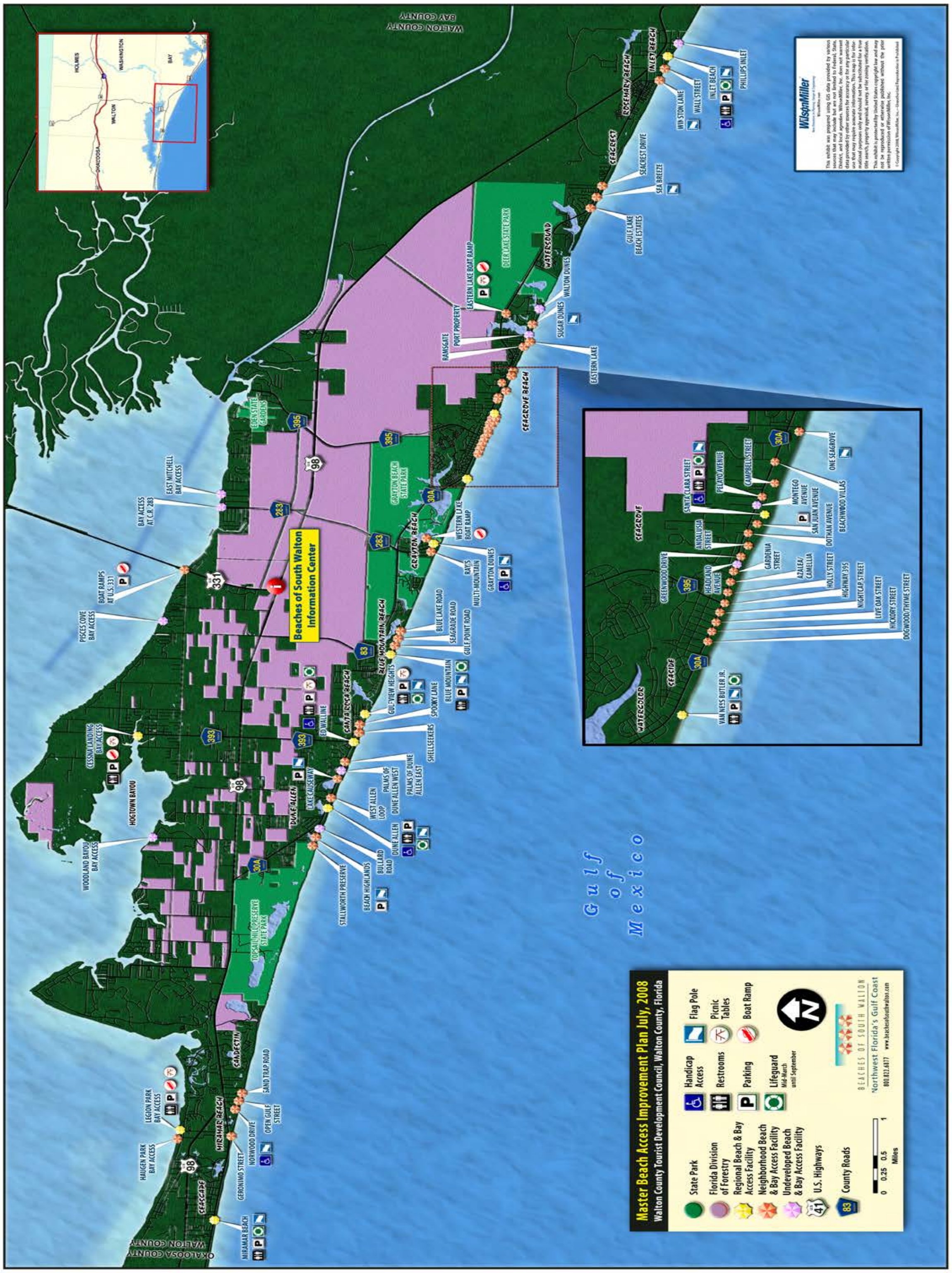
EXHIBIT "F-5"

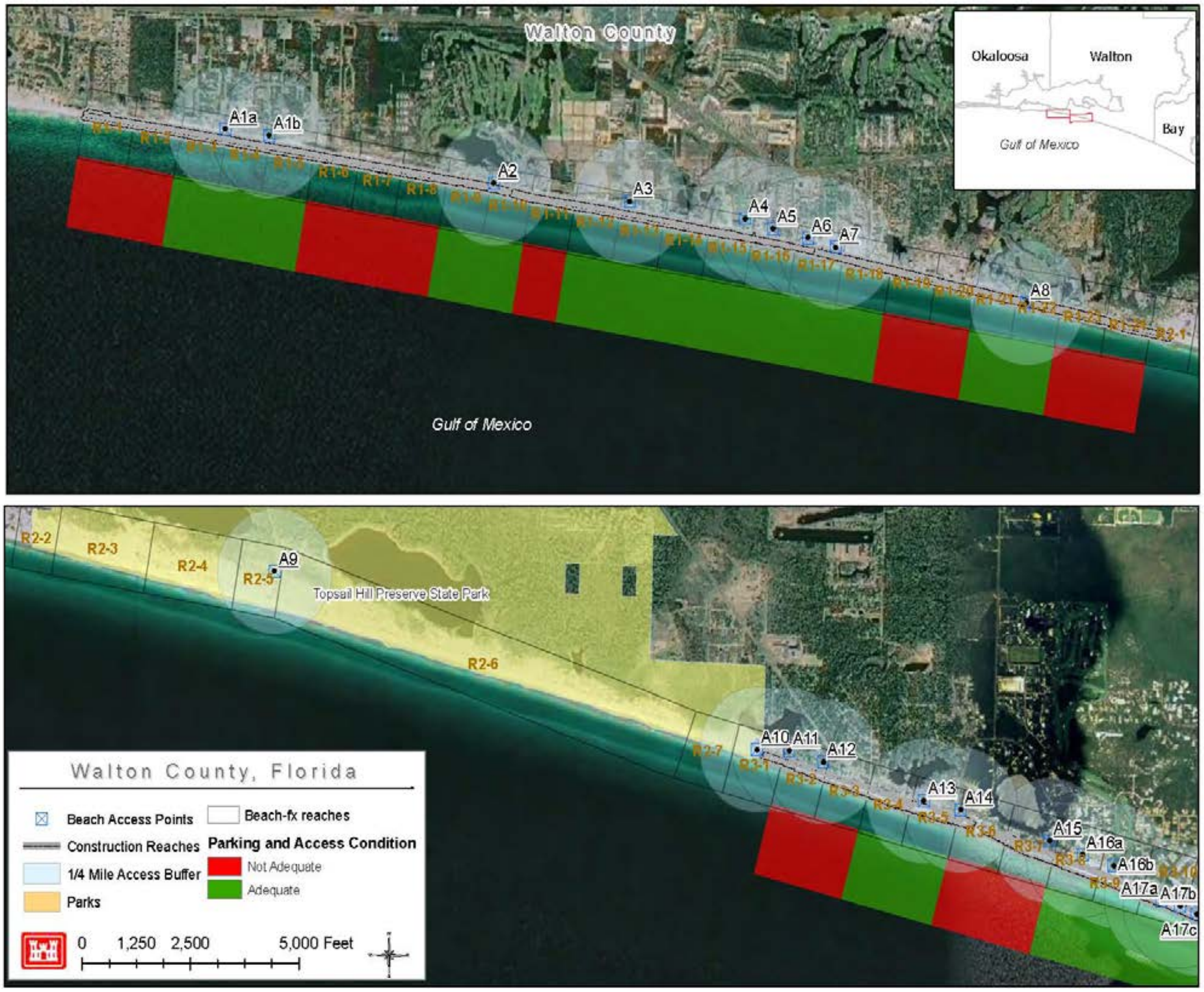
Facing north at Blue Mountain Regional Beach Access (Note: Construction is privately funded effort to shore up private lands that were critically eroded by Hurricane Ivan.)

EXHIBIT "F-6"

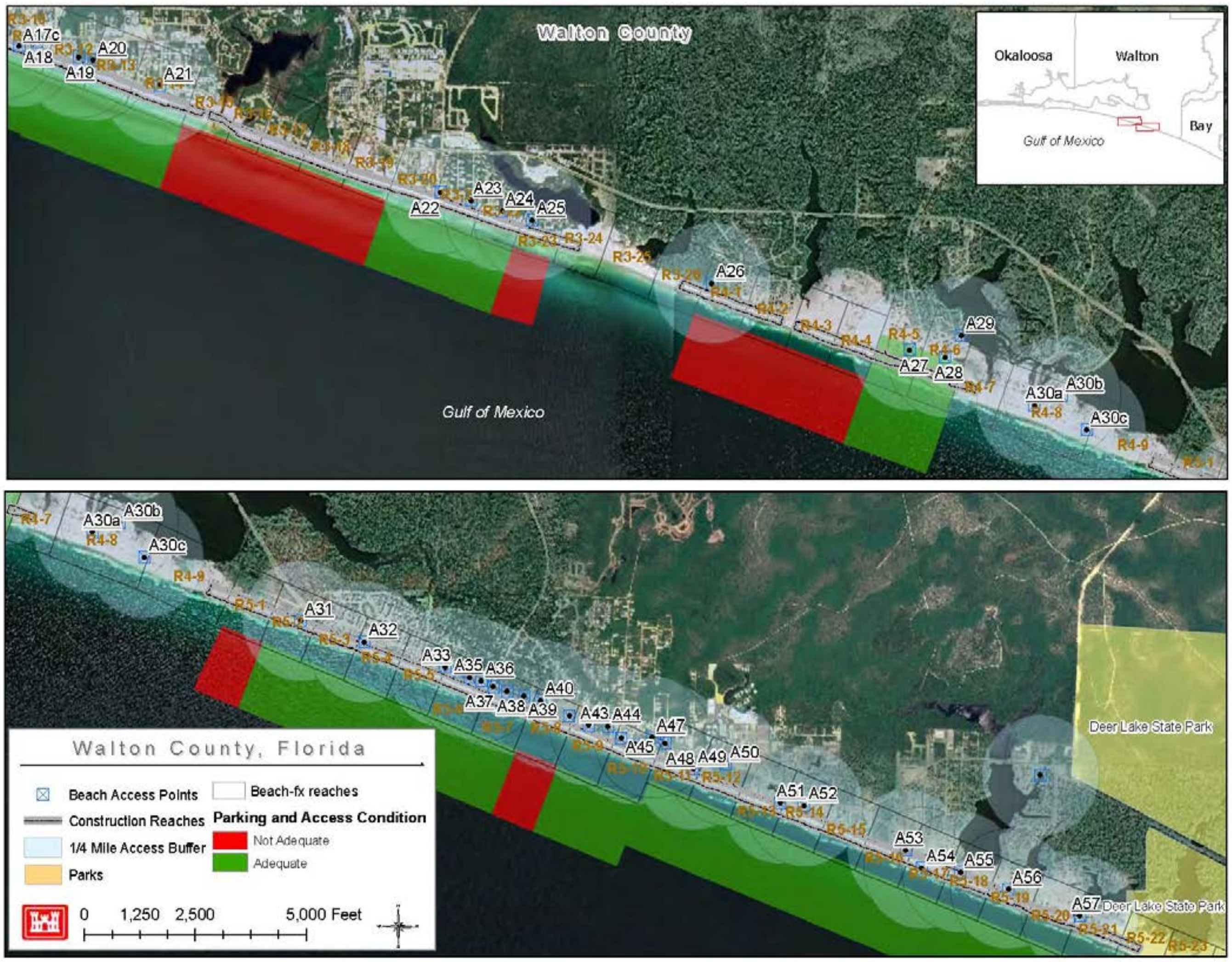
Facing east at Blue Mountain Regional Beach Access located near the intersection of Walton County Hwy. 30A and State Route 83.

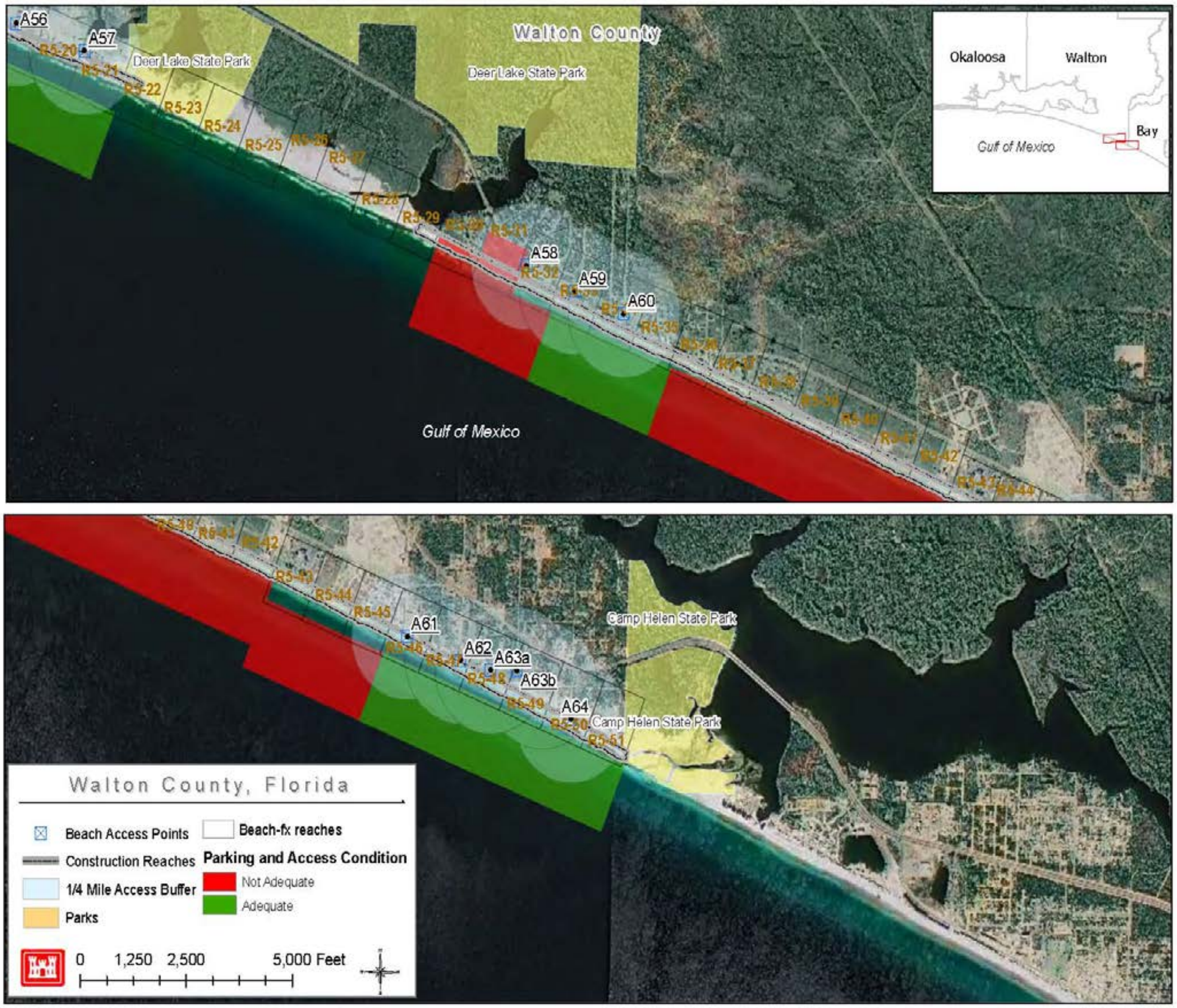
EXHIBIT "G"


Master Beach Access Improvement Plan July, 2008
Walton County Tourist Development Council, Walton County, Florida
State Park
Florida Division of Forestry
Regional Beach & Bay Access Facility
Neighborhood Beach & Bay Access Facility
Undeveloped Beach & Bay Access Facility
U.S. Highways
County Roads
Handicap Access
Restrooms
Parking
Lifeguard
Flag Pole
Picnic Tables
Boat Ramp
Miles
Gulf of Mexico
Beaches of South Walton Information Center
WALTON COUNTY
BAY COUNTY
OKALOOSA COUNTY
SEAGROVE BEACH
GRAYTON BEACH
SANTA ROSA BEACH
BLUE MOUNTAIN BEACH
DUNE ALLEN
MIRAMAR BEACH
SEACREST
ROSEMARY BEACH
INLET BEACH
WATERSOUND
HOGTOWN BAYOU
Northwest Florida's Gulf Coast



Walton County
Okaloosa
Walton
Bay
Gulf of Mexico
A1a
A1b
A2
A3
A4
A5
A6
A7
A8
A9
Topsail Hill Preserve State Park
R2-2
R2-3
R2-4
R2-5
R2-6
R2-7
A10
A11
A12
A13
A14
A15
A16a
A16b
A17a
A17b
A17c
Walton County, Florida
Beach Access Points
Construction Reaches
1/4 Mile Access Buffer
Parks
Beach-fx reaches
Parking and Access Condition
Not Adequate
Adequate
0 1,250 2,500 5,000 Feet


Walton County
Okaloosa
Walton
Bay
Gulf of Mexico
Gulf of Mexico
Deer Lake State Park
Deer Lake State Park
Walton County, Florida
Beach Access Points
Beach-fx reaches
Construction Reaches
Parking and Access Condition
1/4 Mile Access Buffer
Not Adequate
Adequate
Parks
0 1,250 2,500 5,000 Feet


Walton County
Deer Lake State Park
Deer Lake State Park
Okaloosa
Walton
Bay
Gulf of Mexico
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R5-23
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R5-31
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R5-32
A59
A60
R5-35
Gulf of Mexico
R5-42
R5-43
R5-44
R5-45
A61
A62
A63a
A63b
A64
R5-51
Camp Helen State Park
Camp Helen State Park
Walton County, Florida
Beach Access Points
Construction Reaches
1/4 Mile Access Buffer
Parks
Beach-fx reaches
Parking and Access Condition
Not Adequate
Adequate
0
1,250
2,500
5,000 Feet

EXHIBIT "H"

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I ___________________________________, _____________________________ for the
(Name of accountable official) (Title)

Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners, do hereby certify that the Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners has acquired the real property interest required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction for Walton County, FL Hurricane and Storm Damage Reduction Project. Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon _________________________
(Identify tracts)

to construct Walton County, FL Hurricane and Storm Damage Reduction Project as set forth in the plans and specifications held in the U. S. Army Corps of Engineers', Mobile District, Mobile, AL.

WITNESS my signature as _____________________________________ for the
(Title)

Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners this ______ day of ____________________, 20___________.

BY: _____________________________________
(Name)

____
(Title)

ATTORNEY'S CERTIFICATE OF AUTHORITY

I,____________________________, ____________________________________ for the
(Name) (Title of legal officer)

Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners, certify that ___________________________________ has
(Name of accountable official)

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

WITNESS my signature as _____________________________ for the
(Title)

Walton County Tourist Development Council acting by and through the Walton County Board of Commissioners, this____________day of________________, 20_____.

BY: ______________________________ (Name)

______________________________ (Title)

APPENDIX D

NON-FEDERAL COORDINATION

WALTON COUNTY, FLORIDA
Board of County Commissioners

Scott A. Brannon, District 1, *Chair*

Kenneth Pridgen, District 2, *Vice-Chair*

Larry D. Jones, District 3,

Sara Comander, District 4

Cecilia Jones, District 5

P.O. Box 1355
DeFuniak Springs, FL 32435

Phone: (850) 892-8155
(850) 892-8156
Fax: (850) 892-8454

July 16, 2012

Curtis M. Flakes
U.S. Army Corps of Engineers
CESAM-PD
109 St Joseph Street
Mobile, AL 36602

RE: Walton County, Florida Hurricane and Storm Damage Reduction Project

Dear Mr. Flakes,

This letter is to advise you that the Walton County Board of Commissioners intends to act as a non-Federal sponsor for the above referenced Hurricane and Storm Damage Reduction Project proposed for Walton County, Florida. The proposed project is to be executed by the U.S. Army Corps of Engineers under the authorization of Section 110 of the Rivers and Harbors Act of 1962. This Letter of Intent is provided as evidence of our continuing support of the project based upon information presented to Walton County Board of Commissioners regarding the General Investigations Study (GIS).

We understand that non-Federal cost sharing will be required for project construction. We are also aware that both the Corps and our responsibilities will be delineated in a Project Partnership Agreement (PPA) which both parties will execute before the design and construction phase commences. Furthermore, we understand that the Walton County Board of Commissioners is in no way obligated to fulfill any of the requirements of the non-Federal sponsor until the PPA is executed.

We understand that upon execution of the PPA, we will be responsible for providing a proportionate share of the project cost as determined by the GIS. We understand that the non-Federal share can be provided in cash and/or in-kind contributions with up to 100 percent of the non-Federal share in in-kind contributions. This share also includes provision of all lands, easements, rights-of-way, necessary relocations and disposal areas that may be required for project implementation. We also understand that the project must be maintained and operated by the local authority after completion without cost to the United States in accordance with regulations prescribed by the Secretary of the Army.

Sincerely,

Scott a. Brannon

Scott Brannon, Chair

NON-FEDERAL SPONSOR'S
SELF-CERTIFICATION OF FINANCIAL CAPABILITY
FOR DECISION DOCUMENTS

I, Wanda J. Quimby, do hereby certify that I am the Interim Financial Director of the Walton County Board of County Commissioners (the "Non-Federal Sponsor"); that I am aware of the financial obligations of the Non-Federal Sponsor for the Walton County, Florida Hurricane and Storm Damage Reduction Project; and that the Non-Federal Sponsor will have the financial capability to satisfy the Non-Federal Sponsor's obligations for that project. I understand that the Government's acceptance of this self-certification shall not be construed as obligating either the Government or the Non-Federal Sponsor to implement a project.

IN WITNESS WHEREOF, I have made and executed this certification this 16th day of October, 2012.

BY: Wanda J. Quimby

TITLE: Interim Finance Director

DATE: October 16, 2012