PROJECT INFORMATION REPORT

FOR THE

REHABILITATION EFFORT FOR

SEGMENT III OF THE BROWARD COUNTY SHORE PROTECTION PROJECT

BROWARD COUNTY, FLORIDA

April 2018

Contents

PART I. EXECUTIVE SUMMARY	II
PART II. BASIC REPORT	1
1. NAMEAND LOCATION	
2. PUBLIC SPONSOR	
3. POINT OF CONTACT FOR PUBLIC SPONSOR	2
4. PROJECT A UTHORIZATION	2
5. PROJECT CLASSIFICATION	4
6. DESIGN DA TA OF PROJECT	4
7. MAINTENANCE	5
8. PERIODIC NOURISHMENT	5
9. PREVIOUS P.L. 84-99 ASSISTANCE	6
10. DISASTER INCIDENT	6
11. DAMAGE DESCRIPTION	7
12. NEED FOR P.L. 84-99 REHABILITATION	
13. PROPOSED WORK	
14. COST ESTIMATE	
15. ECONOMICS	
16. EN VIRONMENTAL CONSIDERATIONS	
17. PERMITS	
18. IMPLEMENTATION SCHEDULE	
19. RECOMMENDATIONS	25
LIST OF ACRONYMS	
PART III. APPENDICES	
APPENDIX A. PUBLIC SPONSOR'S REQUEST FOR ASSISTANCE	
Appendix B. Project map(s)	
Appendix C. Project Overview	
Appendix D. Project Design Dat a	
APPENDIX E. PROJECT MAINTENANCE DATA	
Appendix F. Periodic Renourishment Data	
APPENDIX G. PREVIOUS P.L. 84-99 OR OTHER FEDERAL AGENCY ASSISTANCE	
Appendix H. Disaster Incident	
APPENDIX I. DAMAGE DESCRIPTION	
APPENDIX J. PROPOSED WORK	
Appendix K. Cost Estimate Data	
APPENDIX L. BCR DATA	
APPENDIX M. ENVIRONMENT AL CONSIDERATIONS	
Appendix N-Y.	
APPENDIX Z. PIR REVIEW CHECKLIST	

PROJECT INFORMATION REPORT REHABILITATION EFFORT FOR SEGMENT III OF THE BROWARD COUNTY SHORE PROTECTION PROJECT

PART I. EXECUTIVE SUMMARY

This report was prepared at the request of the project sponsor in a letter dated 13 September 2017. Public Law (P.L.) 84-99 authorizes the U.S. Army Corps of Engineers to provide emergency and disaster assistance that includes rehabilitation of Coastal Storm Risk Management (CSRM) Projects where the rehabilitation meets the program criteria. This report recommends Flood Control and Coastal Emergencies (FCCE) rehabilitation under the authority of P.L. 84-99.

The previously constructed Broward County Shore Protection Project (SPP) is Federally authorized and located on the southeastern coast of Florida. Segment III consists of 8.1 miles of Atlantic Ocean shoreline from Port Everglades to the south county line and includes Dr. Von D. Mizell-Eula Johnson State Park (Park), Dania, Hollywood and Hallandale. The protective berm design is 50 feet wide at a variable elevation of 8.4 to 5.4 feet NAVD88 with a 1 Vertical (V) on 15 Horizontal (H) slope to MLW and a 1V on 30H out to existing bottom. The Department of the Army and the Board of County Commissioners executed a Project Cooperation Agreement (PCA) on 29 September 2004 providing for the one-time periodic nourishment. Congress originally authorized the project in Section 301 of the River and Harbor Act of 1965 (P.L. 89-298) and Section 506 of the Water Resources Development Act of 1996 (P.L. 104-33) authorizes periodic nourishments for 50 years from the date of initial construction.

This report finds that the significant storm criteria has been met. Hurricane Irma was considered to be an extraordinary storm per Engineer Regulation (ER) 500-1-1, 5-20.f along the East Florida Coast. Hurricane Irma made landfall along the Southwest Florida coast as a major, category 3 hurricane on 10 September 2017 and traveled northward along the Florida peninsula for the next 24 hours with hurricane force winds stretching nearly from coast to coast and tropical storm force winds extending much further beyond that. The storm had devastating consequences on Federal coastal storm risk management Projects causing extensive beach and dune erosion along several hundred miles of Florida coastline. Due to the intensity and size of the storm coupled with a nor'easter in the time prior to tropical storm force wind arrival, high-energy waves and elevated water levels (storm surge and wave setup) affected areas far from the core of the storm over a duration of greater than a day. The combination of high waves and water levels over a long duration created the potential for extensive beach erosion.

This report finds that the "significant damage determination" criteria pursuant to ER 500-1-1, paragraph 5-20.e.(2) is met. The cost to restore the Project to the design level of protection is estimated at \$23,000,000 (\$9,000,000 above MHW)¹ without mobilization and demobilization costs, which is greater than \$1,000,000 and is approximately 60% (24% above MHW) of the original construction cost of \$39,473,000, which is greater than 2% of the original construction cost.

As the damages to Segment III of the Broward County SPP met the significant damage criteria under ER 500-1-1, paragraph 5-20.e.(2), two scenarios were considered in the economic analysis in order to establish the best allocation of resources and to determine if the second eligibility criteria is met for economic justification (ER 500-1-1, paragraph 5-20 (a)): (1) Alternative 1 - FCCE restoration of the design template and material necessary to maintain the restored design profile template through the next storm season and (2) Alternative 1a - FCCE of the Project above the MHW line only. In order to obtain environmental permits, extensive surveys and coordination would need to occur that would delay the completion of design and start of construction. Placing above the MHW line significantly reduces the environmental coordination and is implementable upon receiving funds. The benefits were expressed at the last approved document price level of 2004 and the costs of the emergency restoration were deflated back to this price level. The FY 18 discount rate of 2.75% was used. Alternative 1 (Full FCCE) is economically justified; the benefit-to-cost ratio (BCR) is approximately 2.69 to 1.0. Alternative 1a (FCCE above the MHW line) is economically justified; the BCR is approximately 1.05 to 1.0.

This report recommends that Alternative 1a, an FCCE-only renourishment above MHW, be completed. The estimated volume of sand to be placed under the 100% Federal FCCE nourishment is 123,200 cubic yards (cy). Table ES-1 includes a summary of cost apportionment placement of the FCCE volume only at 100% Federal cost. Per guidance in ER 500-1-1, a contingency of 15% was used for this analysis.

	\$0,705,000
Total FCCE (100% Federal)	\$9,735,000
Federal CG	\$0
Non-Federal CG	\$0
Total Cost (100% Federal)	\$9,735,000

Table ES-1: Cost Summary Table

Federal participation for Segment III expires in 2026. The sponsor has agreed to sign a Cooperation Agreement prior to construction. In addition, USACE must complete analysis to meet its obligations in accordance with the National Environmental Policy Act (NEPA) (42 U.S.C. §4321 *et seq.*) prior to advertisement. USACE completed the Broward County Segment II and Segment III SPP Environmental Impact Statement (EIS) in 2004; however, it did not analyze truck haul as a viable option, so any truck haul for Segment III will require supplemental NEPA analysis. Placement of sand on Segment III will also require coordination with U.S. Fish and Wildlife Service (USFWS) under the 2015

¹ Due to the status of the existing environmental permits, a smaller FCCE alternative which considers only placement above mean high water was evaluated.

Statewide Programmatic Biological Opinion (SPBO) for placement of sand on the beach and a Coastal Zone Management Act (CZMA) consistency determination from the Florida Department of Environmental Protection (FDEP).

PART II. BASIC REPORT

1. NAME AND LOCATION

The authorized name is Segment III of the Broward County, Florida SPP. Broward County is located on the southeastern coast of Florida. This segment of the Federal project for Broward County consists of 8.1 miles of Atlantic Ocean shoreline from Port Everglades to the south county line including the Park, Dania, Hollywood and Hallandale (**Figure 1-1**).



BROWARD COUNTY LOCATION MAP

Figure 1-1: Segment III of the Broward County SPP location.

2. PUBLIC SPONSOR

Broward County Board of County Commissioners, 115 South Andrews Avenue, Room 421, Fort Lauderdale, Florida 33301; 954-519-1270.

3. POINT OF CONTACT FOR PUBLIC SPONSOR

Nicole S. Sharp, P.E. Environmental Protection and Growth Management Department Environmental Planning and Community Resilience Division 115 South Andrews Avenue, Room 329H Fort Lauderdale, FL 33301 Phone: (954) 519-1270; Fax: (954) 517-1496

4. PROJECT AUTHORIZATION

Congress authorized the Broward County, Florida Beach Erosion Control and Navigation Project in Section 301 of the River and Harbor Act of 1965 (P.L. 89-298). The authorization included beach erosion control and periodic renourishment for 15.6 miles of the shoreline of Broward County (R-25 to R-128, Segments II and III). See **Figure 4-1**. The project provides for initial beach fill of adequate width and elevation and periodic nourishment county-wide, as needed. Each of the three segments were authorized to be constructed independently of each other as three separate usable parts. Federal participation was limited to the first 10 years of project life. The project was authorized for construction by local interests, with subsequent reimbursement of the Federal share of project costs. Section 506 of the Water Resources Development Act of 1996 (P.L. 104-33) authorizes periodic nourishments for 50 years from the date of initial construction for Segment III.

A General Reevaluation Report (GRR) approved May 2004 modified the authorized project for the remainder of the project life for Segment III. The periodic nourishment interval period for Segment III was estimated at six years, with an estimated 780,000 cubic yards (cy). The Department of the Army and the Board of County Commissioners executed a Project Cooperation Agreement (PCA) on 29 September 2004 providing for the one-time periodic nourishment. Federal participation for Segment III expires in 2026.



Figure 4-1: Broward County Segments

5. PROJECT CLASSIFICATION

This project was designed to provide protection against historical storms experienced in the area. The berm heights are 8.4 ft (NAVD88) (from R-86 to R-94) and 5.4 ft NAVD88 (R-101 to R-128). Some coastal experts have equated the natural berm heights in Florida to a 10-year storm surge elevation. It is understood that the construction berm will erode and the beach fill will be redistributed to a more naturally shaped profile. The amount of advance nourishment placed in front of the design berm allows for six years of erosional losses before effecting the design berm, allowing the design berm to function as protection for the upland development. The berm width of beach was optimized against predicted shoreline recession and damages associated with recession frequency. The authorized project dimensions provided for a design shoreline extension of 75 foot to 125 foot at Mean High Water (MHW); however, the initial project authorization recommended a 50-foot project berm width.

6. DESIGN DATA OF PROJECT

The original Segment III's authorization limits extended from Port Everglades to the south county line for 8.1 miles (R-86 through R-128); however, as of 2006, only 6.8 miles have been constructed with fill limits extending between R-86 and R-94 and between R-101 and R-128 (see Figure 1-1). Initial construction between R-86 through R-94 occurred from late 1976 to early 1977 with the placement of 1,090,000cy of material and a total construction cost of \$68,800,000 in 2006 prices. The 2004 GRR optimized renourishment at 780,000cy every six years. The authorized project, as modified by the 2004 GRR, provides for restoration of the protective berm along 6.8 miles of shoreline starting at the Park at R-86 through R-92 and R-99 to R-128. Several modifications/reductions to beach fill amounts and widths were performed in Segment III during project development to reduce avoidable impacts to nearshore hardbottom communities. Fill placement between R-92 and R-99 in Dania Beach was eliminated from the original project design. The authorized project dimensions provided for a design shoreline extension of 75 to 125 feet at MHW; however, as recommended by the initial project report, the protective berm is 50 feet wide at an elevation of 8.4/5.4 feet NAVD88 (8.4 ft R-86 to R-92 and 5.4 ft R-99 to R-128) with a 1 Vertical (V) on 15 Horizontal (H) slope to Mean Low Water (MLW) and a 1V on 30H out to existing bottom.

7. MAINTENANCE

The non-Federal project sponsor is responsible for lands, easements, rights-of-way, relocations, and suitable borrow and/or disposal areas required for maintenance of the project. The sponsor is required to monitor the project annually to determine losses of nourishment material from the project design section and to determine impact of project construction on sea turtle nesting. The sponsor is also required to reshape the beach and dune profile using material within the project area and to maintain vegetation, public dune crossovers and other project features associated with the beach and dune. The project is in an active status in the Rehabilitation and Inspection Program (RIP). The last post-storm inspection was accomplished December 2017. The sponsor shall also provide and maintain necessary access roads, parking areas and other public use facilities open and available to all on equal terms. The non-Federal project sponsor continues to fulfill responsibility in accordance with current agreements.

8. PERIODIC NOURISHMENT

Segment III is further broken down into three portions: Park, Hollywood, and Hallandale. Initial construction of the Park portion of Segment III occurred in late 1976 and early 1977. That project extended along about 1.52 miles of shoreline between R-86 and R-94. The physical performance of the 1977 project was assessed in 1988 as part of the planning for the project's first renourishment in 1989. This project's first renourishment occurred in 1989. The Hollywood and Hallandale project reach was originally constructed in 1979. This project included about 5.25 miles of shoreline between R-101 and R-128. The 1978 General and Detailed Design Memorandum concerning Segment III altered project features for the Hollywood and Hallandale beaches from those prescribed in the Chief of Engineer's Report (House Document 91/89) to reflect changed site conditions and Federal criteria. This reach was renouished in 1991 (over 1.11 Mcy), and last in 2006. The full renourishment in 2006 was 1,540,000cy of material at a cost of \$24,431,000.

An evaluation of the 1979 project's performance and recommendations for the project dimension modifications were included in the 1990 General Design Memorandum Addendum for the Hollywood and Hallandale shorelines. The 2004 GRR confirmed the assumption that for the entire Segment III, periodic nourishments of 780,000cy were planned for every six (6) years.

9. PREVIOUS P.L. 84-99 ASSISTANCE

Previous P.L. 84-99 assistance was provided for Segment III in 2006 following tropical storm Bonnie and Hurricanes Charlie, Ivan, Frances, and Jeanne. A Project Information Report (PIR) was prepared in 2005 for this reach of shoreline that recommended P.L. 84-99 assistance to mitigate for the 2004 storm impacts. An emergency renourishment contract was awarded April 2005 that called for the placement of approximately 196,000 cubic yards of material to be placed along 6.6 miles of shoreline.

P.L. 84-99 assistance was provided in 2013 for Segment III in response to damages caused by Hurricane Sandy in 2012. The PIR was prepared in 2013 and recommended placement of 177,450cy beach fill between R-86 to R-128 using material from a borrow site located directly offshore of the project area. Although recommended, this event was not constructed.

10. DISASTER INCIDENT

Hurricane Irma made landfall along the Southwest Florida coast as a major, category 3 hurricane on 10 September 2017 and traveled northward along the Florida peninsula for the next 24 hours with hurricane force winds stretching nearly from coast to coast and tropical storm force winds extending much further beyond that. The storm had devastating consequences on Federal coastal storm risk management Projects causing extensive beach and dune erosion along several hundred miles of Florida coastline. Due to the intensity and size of the storm coupled with a nor'easter in the time prior to tropical storm force wind arrival, high-energy waves and elevated water levels (storm surge and wave setup) affected areas far from the core of the storm over a duration of greater than a day. The combination of high waves and water levels over a long duration creates the potential for extensive beach erosion.

Along the Florida East coast, the coastal NOAA gauges nearly replicated (difference of 0.01 ft at Lake Worth Pier) or exceeded (at Virginia Key, Trident Pier, and Mayport) the peak water levels recorded during the extraordinary storm, Hurricane Matthew in 2016. Only the Fernandina Beach gauge registered a significantly lower peak water level (0.56 ft lower) but the value of 6.34 ft NAVD88 still represents an approximately 75 year exceedance water level value based on NOAA data at this location while the nearby Mayport gauge exceeded the 100-year exceedance water level value (5.58 ft NAVD88 recorded versus a 100-year exceedance value of 4.72 ft NAVD88). Irma created wave heights of 22.0, 26.6, and 21.0 ft at the National Data Buoy Center's Ft. Pierce, Canaveral 20 NM, and Offshore Fernandina Beach wave gauges respectively which rank as the top 3rd, 2nd, and 1st wave heights in the Corps WIS database and are comparable to those experienced during 2016 Hurricane Matthew. Based on the observed water level, wave, and wind data, SAJ has found a preponderance of evidence to support the fact that Hurricane Irma is an extraordinary storm per ER 500-1-1, 5-20.f along the East Florida coast.

11. DAMAGE DESCRIPTION

Damage to Segment III due to Hurricane Irma consisted of erosion in the project area. **Figure 11-1** provides an example of how the Park portion of the project area looked following the storm. **Figure 11-2** provides an example of how the Hollywood/Hallandale portion of the project area looked following the storm. A site inspection conducted by SAJ staff on 14 September 2017 indicated that some erosion had occurred in the project as a direct result of Hurricane Irma, based on a visual assessment.



Figure 11-1: Post Storm view of the beach looking south along the Park portion of the project area.



Figure 11-2: Post Storm view of the beach looking south near FDEP R-Monument R-111.5 in the Hollywood/Hallandale portion of the project area.

Broward County's consultant, Olsen Associates, Inc., performed a volumetric change analysis to quantify the degree of storm damage to the project area from the hurricane. The most recent survey to use as a pre-storm survey for the Park portion of the project area (R-86 to R-94) was post Hurricane Matthew Lidar data collected in November 2016. The most recent survey to use as a pre-storm survey for the Hollywood/Hallandale portion of the project area (R-101 to R-128) was a beach profile survey conducted for the City of Hollywood by Applied Technology and Management (ATM) in July 2017, about two months before Hurricane Irma. Morgan & Eklund Inc. under contract to Olsen Associates, Inc. conducted the post-Irma beach survey for both portions of the project in October 2017. The pre- and post-storm survey profiles were compared and volumes were calculated using the average end area method.

Figure 11-3 shows a profile in the Park portion of the Segment III project and **Figure 11-4** shows a profile in the Hollywood/Hallandale portion of the Segment III project. In general, both portions of the project experienced erosion into the upper berm area with some accretion below mean low water.



Figure 11-3: Profile at R-89 in the Park Portion of the Project Area. (Olsen Associates, Inc.)



Figure 11-4: Profile at R-114 in the Hollywood/Hallandale Portion of the Project Area. (Olsen Associates, Inc.)

Table 11-1 provides a volume change summary for the Segment III project area. Overall, pre- to post-storm erosion of **209,300cy** was calculated along the entire profile. The pre- to post-storm volume loss within the Segment III authorized design template is **144,100cy**. The volume needed to restore the full design template from the post-storm survey is **488,900cy**. The volume needed to restore the full construction template from the post-storm survey is **1,015,400cy**.

Segment	R-Monuments	Pre- to Post- Storm Volume Change (cy)	Post-Storm Volume to Fill Authorized Design Template (cy)	Post-Storm Volume Needed to Fill Construction Template (cy)
Park	R-86 to R-94	-61,200	153,100	449,000
Hollyw ood/ Hallandale	R-101 to R-128	-148,100	335,800	566,400
Total	R-86 to R-94 & R-101 to R-128	-209,300	488,900	1,015,400

Table 11-1: Volume Summary

With minimal environmental consultation for the placement of sand below MHW, sand could still be truck hauled and placed above MHW in the project area that would provide a benefit to the project before the next full renourishment which is currently planned for 2020. In order to obtain environmental permits for placement of material below MHW, extensive surveys and coordination would need to occur that would delay the completion of design and start of construction. Placing sand only above the MHW line significantly reduces the environmental coordination and is implementable upon receiving funds. Placement above MHW was done under FCCE for the Broward County Segment II project in 2013 following Hurricane Sandy. This placement helped to stabilize the project until a full renourishment was completed in 2016. The volume of material that could be placed above MHW in the Park portion of the project and 89,200cy that could be placed above MHW in the Hollywood/Hallandale portion of the project.

Overall, Segment III experienced erosion during Hurricane Irma based on the pre- and post-storm survey data available. Portions of the project have experienced erosion into the authorized design berm. The eroded profile leaves portions of the project more vulnerable to future erosional events and coastal storm damage.

12. NEED FOR P.L. 84-99 REHABILITATION

Hurricane Irma produced conditions at Segment III that can be classified as extraordinary.

Per the PIR Review Checklist (Appendix Z), CSRM Rehabilitation Assistance, item 6 criteria (per ER 500-1-1 (30 September 2001), 5-20.e.(2) to verify "significant amounts of damage" and updated in the 30 May 2017 CECW-HS memo):

- 1. The cost of the construction effort to effect repair of the CSRM (*exclusive of dredge mob/demob costs*) (a) exceeds \$1 million and (b) is greater than 2 percent of the original project construction costs (expressed in current day dollars.); or,
 - The cost of construction to repair the design template (a) is \$23,000,000 (\$9,000,000 above MHW) excluding mob and demob which does exceed \$1 million and (b) is 60% (24% above MHW) of the original construction cost which is greater than 2%

- 2. The cost of the construction effort to effect repair of the CSRM (*exclusive of dredge mob/demob costs*) exceeds \$6 million; or,
 - The cost, exclusive of mob and demob, to repair the design template, is **does** exceed \$6 million
- 3. More than one-third of the planned or historically placed sand for renourishment was lost.
 - Approximately 166,600cy was lost between the pre-storm to post-storm template which equates to 21%, which **does not exceed** the criteria of 33% of the historically placed sand for renourishment (780,000cy)
- 4. Only hard features are involved.
 - This does not apply, as the features are sand

As is shown from the above evaluation, the project meets two of the requirements from the PIR Review Checklist. Therefore, the next step is to determine cost estimates and determine economic justification for each of the alternatives listed below:

Alternative 1 – FCCE Alternative = Restoring to the design level of protection

The volume of material necessary to maintain the restored design profile template, immediately following physical completion through the next storm season is estimated at 683,900cy.

Alternative 1a – FCCE Alternative above MHW = Restoring above MHW

The volume of material to restore the Project above MHW is estimated at 123,200cy.

The Risk Test

The shoreline along Segment III protects a densely developed barrier island which contains a combination of hotel/motel complexes and single family residential, commercial, and recreational developments. These barrier islands are mandatory evacuation areas for major storm events, so little potential for loss of life should exist if evacuation orders are followed. However, the protective value of the beaches along the previously constructed area of Segment III are reduced due to the impacts from Hurricane Irma. This has resulted in an increased damage potential through both direct wave attack and increased flooding risk to structures and roads. According to the 2004 GRR, the Segment III beaches protect a total value of shorefront infrastructure of \$542,765,000.

13. PROPOSED WORK

Under the provisions of the Memorandum from CECW-HS (30 May 2017), rehabilitation assistance under P.L. 84-99 for a CSRM Project damaged by an extraordinary storm includes all repairs to hard structures and the replenishment of soft features (dune and beach fill). The quantity of soft feature restoration may be calculated as the amount of

material necessary to maintain the restored design profile template, immediately following physical completion through the next storm season or to the next assumed periodic nourishment cycle, whichever is less. The volume to restore and maintain the design template is approximately 683,900cy. Due to the status of the environmental permits for the Project, the full FCCE alternative is not constructible at this time; therefore, an above MHW FCCE alternative is considered. The FCCE above MHW alternative consists of approximately 123,200cy.

Alternative 1 (FCCE alternatives) is explored in the sections below.

14. COST ESTIMATE

The amount of sand above MHW needed to rebuild the Project, per the CECW-HS May 2017 memo, is estimated at 123,200cy. The total estimated cost to rehabilitate the Project is \$9,735,000. This estimate includes mobilization, contingency, preconstruction, engineering and design (PED), and supervision and administration (S&A) in accordance with EP 500-1-1 and ER 500-1-1. The estimated cost presented in this report (**Table 14-1**) are at FY18 price level. These costs were generated from the volumetric quantities required for the alternative mentioned above. Cost estimate details are included in **Appendix K.**

		Alt 1 - FCCE Restore
		and Maintain the
WBS		Design Level of
Code	Project Feature	Protection
	Mobilization and	
17	Demobilization	\$373,000
17	Beach Replenishment	\$8,101,000
17	Associated General Items	\$417,000
1	Lands and Damages	\$60,000
30	Engineering and Design	\$300,000
	Construction	
31	Management	\$484,000
TOTAL	COST:	\$9,735,000

Table 14-1: Cost Allocation for Alternative 1.²

Cost Allocation

All work associated with the FCCE funds would be 100% Federal.

¹ Total project costs contain contingencies that are in accordance with ER 500-1-1 which set a maximum contingency for dredging projects at 15% on the construction costs only. All cost estimates are at FY18 Price Levels.

Cost Apportionment

Table 14-2 provides the breakdown on costs; these are the cost estimates for constructing the FCCE work.

Table 14-2: Cost Apportionment

COST APPORTIONMENT OF THE BROWARD COUNTY SEGMENT III SHORE PROTECTION PROJECT						
Project Feature	Project Cost	Federal Share	Federal Cost	Non-Federal Share	Non-Federal Cost	
Mobilization and Demobilization	\$373,000					
FCCE* (100% Federal Cost)	\$373,000	100.00%	\$373,000	0.00%	\$0	
Beach Replenishment	\$8,101,000					
FCCE* (100% Federal Cost)	\$8,101,000	100.00%	\$8,101,000	0.00%	\$0	
Associated General Items	\$417,000					
FCCE* (100% Federal Cost)	\$417,000	100.00%	\$417,000	0.00%	\$0	
Lands and Damages	\$60,000					
FCCE* (100% Federal Cost)	\$60,000	100.00%	\$60,000	0.00%	\$0	
Engineering and Design	\$300,000					
FCCE* (100% Federal Cost)	\$300,000	100.00%	\$300,000	0.00%	\$0	
Construction Management	\$484,000					
FCCE* (100% Federal Cost)	\$484,000	100.00%	\$484,000	0.00%	\$0	
Total Cost	\$9,735,000					
FCCE* (100% Federal Cost)	\$9,735,000	100.00%	\$9,735,000	0.00%	\$0	

Table 14-3: Cost Apportionment Summary Table

Total FCCE (100% Federal)	\$9,735,000
Federal CG	\$0
Non-Federal CG	\$0
Total Cost (100% Federal FCCE)	\$9,735,000

15. ECONOMICS

OVERVIEW

This economic analysis for FCCE has been conducted in accordance with EP 500-1-1 (2001), Appendix D, and was developed to compare the economic benefits versus the economic costs of emergency restoration and nourishment activities for Segment III. Emergency restoration and nourishment is defined by P.L. 84-99 (as amended by WRDA 2014) as the placement of material on the beach of the subject project in order to repair and restore the project to the design level of protection (i.e. design template). There are two quantities of sand used for benefit determination for P.L. 84-99 Rehabilitation Assistance in this economic analysis. The first will be the amount of sand necessary to restore this profile and maintain the profile into the next storm season, hereafter referred to as FCCE quantity. A second quantity is necessary in the analysis since there is uncertainty whether or not environmental permitting will be obtained prior to construction. In the event permitting is not obtained placement will only occur above MHW, and this quantity will hereafter be referred to as MHW quantity.³ The primary objective of this analysis is to determine whether or not emergency restoration is economically justified (i.e. has a benefit-cost-ratio greater than 1.0). Normally, a secondary objective would be to see if placement to the full construction template would be economically justifiable and then compare the net-benefits to the FCCE above MHW quantity. However, Segment III does not have any authorized nourishments remaining and therefore this report will be an analysis of strictly emergency rehabilitation.

Two scenarios were considered in the economic analysis in order to establish economic justification: (1) restoration using FCCE quantity or (2) above MHW quantity only (hereafter referred to as Alternative 1 and Alternative 1a respectively). It is important to note that the analysis for all alternatives is strictly a comparison of remaining costs and remaining benefits. Any indication of a BCR in the following paragraphs and appendices should be treated not as a "Total BCR" but as a remaining-benefit-remaining-cost ratio.

KEY ASSUMPTIONS

Initial construction of Segment III was completed in 1977. As of October 2017 (FY18), the remaining period of Federal participation is nine years, concluding in 2026 with no future authorized nourishments. The period of analysis (POA) for Alternatives 1 and 1a is assumed to be six years. A future-with project (FWP) condition, which is the FCCE placement, will be compared to a future-without project (FWOP) condition (i.e. no action), in which annual erosion continues unabated for six years, in order to establish the average annual benefits of FCCE placement. Per FCCE policy, recreation benefits are not a part

³ Despite the nomenclature, this quantity would still be considered emergency placement applicable for PL 84-99 rehabilitation assistance since it falls within the design template.

of the analysis even though Segment III has approved recreation benefits of \$12,984,100. Benefits will be expressed at the price level in the last approved report, the 2004 GRR, and the costs of the emergency restoration will be deflated back to this price level (3QFY04).

Economic Evaluation of FCCE Restoration to Design Template (Alternative 1 and 1a)

BENEFITS

The authorizing document design profile estimate of coastal flood damage reduction benefits has been applied as the initial assessment point. Engineering has provided the incremental loss in cubic-yardage of sand from the design profile. This lost quantity is to be subtracted from the total cubic-yardage of 768,000cy utilized to initially construct the authorized project design profile in order to establish the starting condition of the design template in the FWOP. The starting point in the FWP for Alternative 1 is the full design template plus the estimated advanced nourishment required to provide protection into the next storm season, calculated by engineering as 683,900cy. The FWP starting point for Alternative 1a is the current condition of the design template (approximately 279,100cy) plus the quantity that can be placed in the absence of permitting, which is 123,200cy, for a total of 402,300cy. To estimate benefits in both the FWOP and FWP, the proportion of volume in the design template that remains after the annual erosion of 128,667cy has been factored in to serve as a proxy for benefits. For example, if 98% of the design template remains in any given year then the benefits for that year would be calculated as 98% of the authorized benefits. The proportion remains linear throughout. Therefore, the calculation for total annual benefits of FCCE action is the summation of the FWP proportion of benefits minus the FWOP proportion of benefits discounted and annualized across all six years. This net result is an approximation of the storm damage protective capability to be provided by the restoration of the project from the end of construction until the next periodic nourishment.

The benefits are expressed at the last approved document price level of May 2004 (3QFY04). The structure inventory on which benefits are based has not significantly changed since the last approved document and, therefore, are assumed to still be valid. Average annual expected benefits for the authorizing document design profile is \$13,496,400. The following tables (Table 15-1 and Table 15-2) capture the calculation of benefits from FCCE action for both Alternative 1 and Alternative 1a:

Condition of De		Condition of Design Berm (% of Annual Benefits)		ion of erm (% nual fits)	Annual Benefits Maintained (\$)					
Year	FWOP	FWP	FWOP	FWP	FWOP	FWP	FCCE Benefits	PV Factor	PV FC	CE Benefits
0	279,100	963,000	36%	100%	\$ 4,904,746	\$ 13,496,400	\$ 8,591,654	1.0000	\$	8,591,654
1	150 <i>,</i> 433	834,333	20%	100%	\$ 2,643,625	\$ 13,496,400	\$ 10,852,775	0.9732	\$	10,562,312
2	21,766	705,666	3%	92%	\$ 382,503	\$ 12,400,977	\$ 12,018,474	0.9472	\$	11,383,758
3	-	576,999	0%	75%	\$ -	\$ 10,139,856	\$ 10,139,856	0.9218	\$	9,347,302
4	-	448,332	0%	58%	\$ -	\$ 7,878,734	\$ 7,878,734	0.8972	\$	7,068,531
5	-	319,665	0%	42%	\$ -	\$ 5,617,613	\$ 5,617,613	0.8732	\$	4,905,041
								Total PV	\$	51,858,597
								AAEQ Benefit	\$	9,493,796

Table 15-1: Alternative 1 FCCE Benefits

Table 15-2: Alternative 1a (above MHW) FCCE Benefits

	Condition of De	esign Berm (CY)	Condit Design (% of A Bene	ion of Berm nnual fits)	An	inual Benefi	ts Ma	aintained (\$)					
Year	FWOP	FWP	FWOP	FWP	FV	VOP	FW	/P	FCC	E Benefits	PV Factor	PV F	CCE Benefits
0	279,100	402,300	36%	52%	\$	4,904,746	\$	7,069,794	\$	2,165,048	1.0000	\$	2,165,048
1	150 <i>/</i> 433	273,633	20%	36%	\$	2,643,625	\$	4,808,672	\$	2,165,048	0.9732	\$	2,107,102
2	21,766	144,966	3%	19%	\$	382,503	\$	2,547,551	\$	2,165,048	0.9472	\$	2,050,708
3	-	16,299	0%	2%	\$	-	\$	286 <i>,</i> 429	\$	286 <i>4</i> 29	0.9218	\$	264,041
4	-	-	0%	0%	\$	-	\$	-	\$	-	0.8972	\$	-
5	-	-	0%	0%	\$	-	\$	-	\$	-	0.8732	\$	-
											Total PV	\$	6,586,899
											AAEQ Benefit	\$	1,205,869

COSTS

Costs of the emergency restoration have been deflated back to the authorizing document price level by applying the CWCCIS, EM 1110-2-1304 quarterly cost index tables (current version, 30 September 2017). This cost adjustment is necessary to place costs and benefits on a comparable price-level basis.

The cost at the FY18 price level for the project's emergency placement as a standalone project for both alternatives are presented in the Cost of Alternatives table below. The cost has also been deflated and then annualized over the period of analysis (six years), by applying the FY18 discount rate of 2.75%. More information on how costs were calculated can be found in the economics appendix. The average annual cost of the emergency placement of material for restoration to the design profile for Alternative 1 is equivalent to \$3,527,852, and for Alternative 1a is \$1,150,271.

	Alternative 1	Alternative 1a				
FY18 Cost	\$ 29,857,000	\$ 9,735,000				
Deflated Cost	\$ 19,270,420	\$ 6,283,201				
Average Annual Cost (n=6 i=2.75%)	\$ 3,527,852	\$ 1,150,271				

Table 15-3: Cost of Alternatives

BENEFIT-COST RATIO

The BCR for Alternative 1 (\$9,493,796 v. \$3,527,852) is 2.69-to-1, with net-benefits of \$5,965,945. The BCR for Alternative 1a (\$1,205,869 v. \$1,150,271) is 1.05-to-1, with net-benefits of \$55,598.

CONCLUSION

The benefits exceed the cost for Alternative 1 and Alternative 1a and the FCCE action is economically justified. Net-benefits could be maximized between the two alternatives if environmental permitting was established and the full FCCE amount was able to be placed. It is important to highlight the fact that there is a considerable amount of risk to infrastructure with both the no action alternative and Alternative 1a. Table 2 above highlights this fact documenting that years three, four, and five of the analysis achieve 2%, 0% and 0% of benefits respectively. An increased amount of placement would mean an increased amount of benefits in those years. It is also worthy to note that it is estimated that the entire design template will be gone by year three in the absence of action and the estimated annual benefits of \$13,496,400 will be lost, each year, until action occurs.

16. ENVIRONMENTAL CONSIDERATIONS

A) Proposed Activity.

The proposed action includes the restoration of Segment III above MHW. Restoration above MHW would occur on the 6.8 miles segment from the Park between DEP monuments R-86 and R-92 and the Hollywood/Hallendale shoreline between DEP monuments R-101 and R-128 (see **Figure 1-1**), requiring approximately 123,200cy of sand. Sand placement material will be delivered by truck haul from two proposed commercial upland sand source mines, Ortona Mine and Witherspoon Mine. These two mines are the same mines approved for use on the Broward Segment II project footprint in the 2013 FCCE Environmental Assessment (EA).

B) Impacts, Beach Nourishment.

The purpose of renourishing the previously nourished beach is to restore and maintain the hurricane protection and storm damage reduction benefits of the project. Shore protection projects are typically designed to provide a minimum level of protection plus additional nourishment to optimize the renourishment interval (typically enough sand to achieve a renourishment interval of three to seven years). . To reduce impacts, the sand used for renourishment is required to be similar to the "natural" or "existing" beach, the level of "fines" (material passing through a #230 sieve) must not exceed 10%, the beach is tilled if compaction exceeds 500 psi, scarps are removed just prior to sea turtle nesting season, and renourishment occurs outside the sea turtle nesting window or sea turtle nests are relocated to a "safe hatchery" as required by the 2015 Statewide Programmatic Biological Opinion (SPBO) from the U.S. Fish and Wildlife Service (USFWS) that covers the project methods of delivery for sand placement, as well as the project specific ESA consultation conducted as part of the 2004 FEIS. Monitoring for escarpments and compaction is typically conducted on an annual basis just prior to sea turtle nesting season and for three years following construction by the local sponsor.

Specific impacts of sand placement on Segment III were discussed in detail in Section 4.1 of the 2004 EIS. In general, the beneficial placement of sand benefits sea turtles and shorebirds through creation or restoration of nesting and/or foraging habitat. Negative effects to sea turtles can include possible destruction of nests deposited within the boundaries of the project, harassment in the form of disturbing or interfering with females attempting to nesting within the construction area or on adjacent beaches, disorientation or hatchings due to project lighting, and behavior modification of nesting females due to escarpment formation within the project area. As a result of the quality and color of the sand, longer term effects may include changes to the ability of female turtles to nest, the suitability of the nest incubation environment and the ability of hatchings to emerge from the sand. Attempts are made as part of the project specifications to avoid and minimize these effects to the maximum extent practicable. Temporary effects of the project may include decreased aesthetics due to the presence of construction equipment, particularly within the State park boundaries where the beach is in a more natural state as compared to other areas in the County and portions of the beach may be closed during sand placement operations to ensure public safety.



Figure 16-1: Typical Beach Profile

C) Impacts, Borrow Areas.

The primary source of sand for the emergency action is two upland commercial sand mines: the Ortona Mine and the Witherspoon Mine. Both mines hold State of Florida permits for sand mining operations and are in compliance with those permits. However, these sand minds are not approved for use on the Broward Segment III project and will require additional analysis to satisfy NEPA requirements. Additionally, the project requires a coastal zone consistency determination from the State of Florida as there are no active permits.

D) NEPA (42 U.S.C. §4321 et. seq.).

USACE will complete environmental planning in accordance with NEPA for sand placement activities involving hauling sand from a mine via truck. As discussed above, the nourishment of Segment III has been analyzed under NEPA in the 2004 EIS. Additional NEPA analysis is scheduled to be complete by July/August 2018 to maintain the construction schedule, pending appropriation.

E) Threatened and Endangered Species (Endangered Species Act, 16 U.S.C. §1531 *et. seq.*).

<u>Borrow Areas</u> – No offshore borrow areas are proposed for this emergency nourishment event. Both the Ortona and Witherspoon sand mines are proposed to be used for Broward Segment III. The mines are commercial mines with permits issued by USACE and FDEP and ESA consultations on the development of the mines with the USFWS were conducted by USACE prior to issuance of the permits. Those consultations are incorporated by reference. No ESA consultations with NMFS are required as the mines are upland areas.

<u>Beach Placement</u> – Broward County has been documented as common nesting habitat for green, loggerhead, leatherback with no recorded nesting of either Kemp's ridley or hawksbill sea turtles. Section 3.3.1 of the 2004 EIS provides a detailed history of nesting in Broward County from 1995-2000 and annual sea turtle nesting surveys have been continued to be conducted by the County since 2000 and sea turtles continue to nest in Broward County in high numbers. The USFWS issued the SPBO in 2015 which covers all beach nourishment projects for impacts to nesting sea turtles as well as protection for manatees in Florida and supersedes any project specific Biological Opinions. As such, USACE concluded that the SPBO covers this project and will seek USFWS's concurrence on this determination. Protection measures for nesting sea turtles shall be incorporated into the project plans and specifications in order to comply with the terms and conditions of the SPBO.

The project is also covered by the Programmatic Piping Plover Biological Opinion (P3BO). Piping plovers may occasionally utilize the beach placement area. The closest designated critical habitat for wintering piping plover to the project area is Unit FL-33, located on the north shore of St. Lucie Inlet in Martin County, approximately 60 miles to the north of Palm Beach County (USFWS, 2013). Broward County is not considered optimal habitat for the piping plover by the USFWS and USACE believes that placement of sand on Segment III "may affect, but it not likely to adversely affect" the piping plover. USACE will consult with the USFWS under the P3BO and request concurrence with this determination. This consultation must be completed prior to construction.

The rufa red knot was federally listed subsequent to the issuance of these opinions and may occasionally occur in the project area. The USACE has determined that the project "may affect but is not likely to adversely affect" the rufa red knot. All consultation shall be completed prior to initiation of work and protection measures shall also be implemented consistent with that consultation. Because the project completed ESA consultation with USFWS in 2002 as part of the original EIS, and the affects of beach placement above MHW are the same as those consulted on in 2002, it is expected that the project will be found to be compliant with the SPBO.

Consultation with NMFS under Section 7 of the ESA (16 U.S.C. §1538) is not required as placement of mined sand will be above MHW and will not affect species under NMFS jurisdiction.

F) Archeological and Cultural Resources.

Cultural resources that exist near the project area include archaeological sites or historic structures located in or near the project placement area (occurring between FDEP Monuments 86 to 92 and 101 to 128) or within the potential upland sand sources. Therefore, it is necessary to determine if any cultural resources exist within the project area and if they are eligible for listing on the National Register of Historic Places. The federal statutes associated with these actions include Section 106 of the National Historic Preservation Act (54 U.S.C. §300101 *et. seq.*) and its implementing regulations (36 CFR Part 800); the Archaeological Resources Protection Act (16 U.S.C. §§ 470aa–470mm); the Archaeological and Historic Preservation Act (54 U.S.C. §§ 1996 and 1996a); the American Indian Religious Freedom Act of 1978 (42 U.S.C. §§ 1996 and 1996a); and the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. §3001 *et. seq.*).

Based on archival research of the Florida Master Site File, no archaeological sites are recorded within the beach placement area; however, several historic structures (8BD03841, 8BD03836, 8BD03835, 8BD03804, 8BD03802, 8BD03815, 8BD03800, 8BD00322, 8BD05203, 8BD03427, 8BD03769, 8BD03337, 8BD03309, 8BD3300, and 8BD03299) are located within 200 feet of the placement activities. The last full renourishment of the beach occurred in 2006. USACE has determined that the project will have no adverse effect on archaeological sites; however, monitoring or avoidance buffering may be required in the vicinity of these sites to ensure protection of resources that may be associated with them. Consultation regarding the beach placement activities for Segment III is ongoing with SHPO and the appropriate federally-recognized Tribes, and will be completed prior to project implementation.

The primary commercial upland sand sources identified for the Segment III Project include the Ortona Sand Mine and the Witherspoon Sand Mine. Over the years, a number of cultural resource surveys have been conducted for the Ortona Sand Mine (Department of Historical Resources DHR Survey Nos. 6689, 4847, 3021, 17005, and 16862). Several prehistoric archaeological sites associated with the Ortona Mound complex have been identified and recorded within the mine property including Ortona Canal East (8GL4a), Quarry Mound (8GL81), Lance's Mound (8GL419), Sawpalmetto Haven Mound (8GL420), and Tallant Mound (8GL00083). Florida Master Site File records indicate that the Ortona Canal East (8GL4a) and Quarry Mound (8GL81) have been mitigated. Cultural resources investigations for the adjacent Witherspoon sand mine have been completed (DHR Survey No. 4602). Two archaeological sites (8GL378 T.C. Cabbage Palm Mound and 8GL379 Fox Hammock Midden) were identified as eligible for inclusion in the National Register of Historic Places. These sites will not be impacted by the sand mining activities. Any upland sand mines employed for this project are subject to the requirement of proving compliance with the State of Florida's statutory requirements in Chapter 267 for protection of historical resources in the sand source footprints before the Corps will approve utilizing the source. Consultation under Section 106 of National Historic Preservation Act (54 U.S.C. §306108) with Florida SHPO and appropriate Federally-recognized tribes will be maintained for any unforeseen issues that may arise with respect to cultural resources.

Based on this information, USACE has determined that the use of the potential upland sand sources will have no effect on historic properties.

G) Section 404(b) Clean Water Act (33 U.S.C. §1344(b)).

USACE conducted a Section 404(b) evaluation for the 2004 EIS which covers beach nourishment up to the design template in Segment III. No changes have occurred to the project that would result in the need to update the Section 404(b) analysis. The 404(b) analysis is located in Appendix A of the EIS.

H) Coastal Zone Consistency/Coastal Zone Management Act (CZMA) (16 U.S.C. §1451 *et. seq.*).

USACE has not completed coordination with the State of Florida to seek a consistency determination as required by the CZMA for sand placement above MHW and will complete that coordination prior to project implementation. Coordination with FDEP under CZMA shall be completed prior to issuance of a contract for placement of mined sand above MHW.

I) Coastal Barrier Resources Act (CBRA) (16 U.S.C. §3501 et. seq.).

USFWS completed a CBRA determination for Segment III, dated 30 April 2003, which was included in the 2004 EIS. There is one CBRA unit (North Beach P-14A) and there are two "otherwise protected areas" (OPAs) (Birch Park FL-19P and Lloyd Beach FL-20P) within the footprint of the project. The USFWS determined that since the proposed beach restoration does not include the construction of structures that would require Federal Flood Insurance, Federal expenditures for the proposed project are not restricted in the FL-19P and FL-20P OPAs. The USFWS determined that the beach restoration activities proposed in the CBRA unit PA-14A are consistent with the intent of the Act and are exempt pursuant to 16 U.S.C. §3505(a)(6)(G) which authorizes "nonstructural projects for shoreline stabilization that is designed to mimic, enhance, or restore a natural stabilization system." The coordination letter documenting CBRA coordination with USFWS is included the appendices.

J) Essential Fish Habitat. The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §801 *et. seq.*) requires the Federal Agency to prepare an Essential Fish Habitat (EFH) Assessment for the NMFS. Placement of sand above MHW will have no impact on EFH and consultation on the action is not required.

EO 11988. Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The purpose of the proposed project is to reduce damage to infrastructure through coastal storm damage reduction. Relocation of the proposed project outside the flood plain would not be responsive to the purpose of the project and was not considered further. The project shoreline is already

completely developed and further development is not possible, except for the State park that will prevent development within those boundaries.

K) Storm Drains. There are no storm drains located within the project footprint. Therefore, no storm drains will be affected by the proposed work.

17. PERMITS

Section 401, Clean Water Act, Water Quality Certification (33 U.S.C. §1341).

Placement of sand above the MHW line does not require a water quality certification (WQC).

18. IMPLEMENTATION SCHEDULE

Segment III of the Broward County SPP Schedule						
	Start Date	Finish Date				
Plans & Specs	2-Apr-18	1-Jun-18				
P&S Final ATR and BCOE Certification	1-Jun-18	16-Jul-18				
Construction Contract Advertised	16-Jul-18	15-Aug-18				
Construction Contract Awarded	15-Aug-18	29-Sep-18				
Design Template Work complete*	1-Nov-17	1-Mar-18				
Full Construction Template Work Complete	1-Nov-17	15-Apr-18				
*NTP constrained to meet turtle window						

19. RECOMMENDATIONS

Based on study findings, Hurricane Irma meets the criteria in ER 500-1-1 for extraordinary storm event, significant amounts of damage, and provides a benefit-to-cost ratio greater than 1.0 to 1 for rehabilitation and restoration of Segment III. I recommend that emergency rehabilitation of the Project, as described herein, be performed under the authority of Public Law 84-99 once USACE has fulfilled all environmental requirements. The recommended plan includes FCCE restoration of 123,200cy. The recommended plan is justified with a CBR ratio of 1.05 and average annual net benefits of \$55,598.

TIMIKA M. WILSON

TÍMIKA M. WILSON LTC, EN Commanding

LIST OF ACRONYMS

ASA(CW) - Assistant Secretary of the Army for Civil Works BCR - Benefit-to-Cost Ratio CA – Cooperation Agreement CG - Construction General Corps - U.S. Army Corps of Engineers CSRM – Coastal Storm Risk Management Project CWCCIS - Civil Works Construction Cost Index System CY – cubic vards EA - Environmental Assessment EFH - Essential Fish Habitat EIS - Environmental Impact Statement EM - Engineering Manual **ER – Engineer Regulation** ESA - Endangered Species Act FCCE - Flood Control and Coastal Emergency FY - Fiscal year HSDR - Hurricane and Storm Damage Reduction HSPP - Hurricane/Shore Protection Project MCACES - Micro-Computer Aided Cost Estimating System MHHW - Mean Higher High Water MLW - Mean Low Water MLLW - Mean Lower Low Water MSL - Mean Sea Level NAVD88 - North American Vertical Datum of 1988 NEPA - National Environmental Policy Act NDBC - National Data Buoy Center NGVD - National Geodetic Vertical Datum NMFS- National Marine Fisheries Service NOAA - National Oceanic and Atmospheric Administration NOS - National Ocean Service PCA - Project Cooperation Agreement PED – Preconstruction, Engineering and Design P.L. 84-99 - Public Law 84-99 **RBO - Regional Biological Opinion** RBRCR - Remaining benefit to remaining cost ratio **RIP** - Rehabilitation and Inspection Program SEI - Storm Erosion Index SHPO - State Historic Preservation Office SPBO - Statewide Programmatic Biological Opinion **SPP** - Shore Protection Project TS - Tropical Storm UTC - Coordinated Universal Time WIS - Wave Information Study

PART III. APPENDICES

Appendix A. Public sponsor's request for assistance



ENVIRONMENTAL PROTECTION AND GROWTH MANAGEMENT DEPARTMENT ENVIRONMENTAL PLANNING AND COMMUNITY RESILIENCE DIVISION 115 S. Andrews Avenue, Room 329H • Fort Lauderdale, Florida 33301 • 954-519-1270 • FAX 954-519-1496

September 13, 2017

U.S. Army Corps of Engineers, Jacksonville District Attn: CESAJ-OD-E 701 San Marco Boulevard Jacksonville, Florida 32207

Subject: Request for Hurricane Irma USACE Rehabilitation Assistance for the Broward County Federal Shore Protection Project

Dear Colonel Kirk:

The Broward County Federal Shore Protection Project has received damage from Hurricane Irma. We respectfully request that the U.S. Army Corps of Engineers evaluate and repair the damage to this project. Currently we are in the process of documenting the impacts through physical data collection and photographs as advised and will be forwarded the results of this more in depth assessment under separate cover as soon as possible.

On behalf of Broward County, I am grateful for all the effort put forth in maintaining the Broward County Federal Shore Protection Project and look forward to continued collaborative efforts with the U.S. Army Corps of Engineers moving forward.

Sincerely,

Nicole S. Sharp, P.E. Natural Resources Administrator

CC: Lacy S. Pfaff, USACE Berth Henry, County Administrator Henry Sniezek, Director EPGMD Jennifer Jurado, Ph. D., Director EPCRD

Broward County Board of County Commissioners Mark Bogen • Beam Furr • Steve Geller • Dale V.C. Holness • Chip LaMarca • Nan H. Rich • Tim Ryan • Barbara Sharief • Michael Udine www.broward.org

Appendix B. Project map(s)

See Figure 1-1 in the main report.

Appendix C. Project Overview

See Sections 1 through 5 in the main report.

Appendix D. Project Design Data

See Section 6 in the main report.

Appendix E. Project Maintenance Data

See Section 7 in the main report.

Appendix F. Periodic Renourishment Data

See Section 8 in the main report.

Appendix G. Previous P.L. 84-99 or Other Federal Agency Assistance

See Section 9 in the main report.

Appendix H. Disaster Incident

See Section 10 in the main report.

Appendix I. Damage Description

See Section 11 in the main report.

Appendix J. Proposed Work

See Section 13 in the main report.

Appendix K. Cost Estimate Data

BROWARD COUNTY, FLORIDA

Segment III

PROJECT INFORMATION REPORT FOR REHABILIATION ASSISTANCE

APPENDIX K Cost Engineering

APRIL 2018



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TABLE OF CONTENTS

K. COST ESTIMATES		i,
K.1 General Information	1	L
K.1.1 Rehabilitation Plan		
K.1.2 Construction Cost		2
K.1.3 Non-Construction Cost		;
K.2 PIR Cost Estimates		;
K.2.1 Design Template Cost Estin	nate3	5
K.2.2 Pre to Post Storm Cost Esti	mate4	ŀ
K.2.3 Full Construction Template	Cost Estimate	,
K.2.4 Restore Above MHW (Truc	k Haul)6	;

K. COST ESTIMATES

K.1 GENERAL INFORMATION

US Army Corps of Engineers' cost estimates for planning purposes are prepared in accordance with the following guidance:

- Engineer Technical Letter (ETL) 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 September 2008
- Engineer Regulation (ER) 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993
- ER 1110-2-1302, Civil Works Cost Engineering, 30 June 2016
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- Engineer Manual (EM) 1110-2-1304 (Tables Revised 31 September 2016), Civil Works Construction Cost Index System, 31 March 2017
- ER 500-1-1, Emergency Employment of Army and Other Resources, Civil Emergency Management Program - Procedures, 30 September 2001
- EP 500-1-1 Emergency Employment of Army and Other Resources, Civil Emergency Management Program – Procedures, 30 September 2001
- Implementation Guidance WRRDA 2014 Section 3029a , 04 April 2016
- Public Law 84-99, Section 5 Flood Control Act of 1941 (PL 84-99)

The cost estimates for the rehabilitation of the shore protection project at Broward County, Segment III are based on dredging material from an offshore borrow area and placing that material on areas damaged by the recent storm event. This material will be placed as beach fill and then shaped into a protective berm for protection against storm damage. PL 84-99 provides for restoration of the project to the design level of protection at 100% Federal cost. The non-Federal sponsor, Broward County, at their option, may request project rehabilitation to full project dimensions which would be cost shared.

These estimates have undergone a Discipline Quality Check and Review in accordance with 02611-SAJ, 02612-SAJ, 02613-SAJ, and 02614-SAJ and have been prepared in accordance with ER 1110-2-1302, ER 500-1-1, and EP 500-1-1. These estimates are based upon the FY18 Budget Submission estimates for Broward County Segment III. A Cost ATR review was performed by the Cost MCX as part of this process with a certification for the Budget Submission products received in May 2016.

The MCACES/MII cost estimates are based on the approved project scopes and are formatted in the CWWBS. This MII estimate is based upon the budget submission MII baseline estimate which was certified in FY16 for the FY18 Budget Submission. Since the previous estimate was updated within 2 years (2 years or less) no update of labor, equipment, and materials is necessary. The estimate has used CWCCIS escalation to bring the cost from FY16 to FY18 price levels. The costs for this project have been developed in CEDEP based upon historic project contract production. Prices from CEDEP for dredging and mobilization/demobilization work were transferred into MII where the remaining cost development was completed.

Contingency of 15% has been applied to dredge mobilization/demobilization costs, beach fill costs, and other associated construction costs. Contingency in these amounts has been included based on EP 500-1-1 (30 Sep 01), Section 5-18, page 5-37 and ER 500-1-1 (30 Sep 01), Section 5, page 5-5.

A lump sum 30 Account Planning, Engineering, and Design and 31 Account Construction Management has been calculated by applying six percent of the construction cost. Reference ER 500-1-1 (30 Sep 01), Section 5, page 5-5.

K.1.1 Rehabilitation Plan

The rehabilitation of a shore protection project within the requirements of PL 84-99 requires the calculation of two separate cost estimates. The first cost estimate for consideration is the cost to restore the project from the post storm condition back to the design template plus one and a half years of renourishment material. This estimate includes all labor, equipment and material to return the protective features to the full design template. The funding for this estimate is 100% Federal with no Sponsor funds required. The second estimate for consideration is to restore the project from the post storm condition to the Full Construction Template including material for an advanced maintenance berm. The cost of this option that exceeds the estimate for returning the project to the Design Template is cost shared in accordance with the existing cost share agreement between the Federal government and the project Sponsor. The project Sponsor has the option of choosing to pursue the Full Construction Template project. The MCACES/MII cost estimates are based on the scopes and are formatted in the CWWBS. The notes provided in the body of the estimate detail the estimate parameters and assumptions. These include pricing at the Fiscal Year 2018 price level (1 October 2017-30 September 2018).

The construction costs fall under the following feature code:

17 Beach Replenishment

The non-construction costs fall under the following feature codes:

- 01 Lands and Damages
- 30 Planning, Engineering and Design
- 31 Construction Management

K.1.2 Construction Cost

Construction costs were developed in MCACES/MII and include all major project components categorized under the appropriate CWWBS to the sub- feature level. The construction costs for dredging operations were developed using the Cost Engineering Dredge Estimating Program (CEDEP) and then transferred into the MCACES/MII estimates. Total Project Costs on each plan contain contingencies that were in accordance with the requirements of ER 500-1-1 which set a maximum contingency for dredging projects at 15%.

K.1.3 Non-Construction Cost

Non-construction costs typically include Lands and Damages (Real Estate), Engineering & Design (E&D) and Construction Management Costs (Supervision & Administration, S&A). These costs were previously provided by the Project Manager and appropriate PDT members as a lump sum cost and have been reviewed for this PIR effort. The lump sum amounts for 30 account E&D and 31 account S&A are estimated at the maximum of 6% of the construction contract costs as specified in ER 500-1-1 Section 5. Lands and Damages cover the real estate administration costs necessary for verifying easements prior to award of the construction contract. This allows the contractor to access the beach and use as an equipment laydown area. Engineering and Design (E&D) costs accounts for preparation of contract plans and specifications (P&S). Construction Management (S&A) costs are for the supervision and administration of the contract required to perform the various aspects of construction required for this project and includes Project Management, Construction Quality Assurance and Contract Administration costs.

K.2 PIR COST ESTIMATES

Cost estimates for the alternative plans were generated based on quantities derived from the post-storm surveys taken after the significant storm event and comparing these surveys to pre-storm conditions, the design template, and the full construction template for the protective beach system including advanced maintenance which is the periodic renourishment quantity. These quantities were used to derive cost estimates that reflect as best as possible the conditions expected in each of the alternatives of this project.

K.2.1. Design Template Cost Estimate

The following table provides a cost estimate for placing 683,900 CY of sand on the damaged areas of the beach by utilizing a dredge plant and associated equipment with borrow material. This is the quantity required to return the project to the design template for the protective berm. The cost includes mobilization/demobilization of the dredge plant and associated equipment, dredging of material, placement on the beach, environmental monitoring, beach tilling, vibration monitoring, surveys, etc. Additionally, non-construction costs include real estate costs, design costs and construction management costs. The MII estimate for this alternative is contained on the following pages.

WBS Code	Project Feature	Restore to Design Template
17	Mobilization and Demobilization	\$ 6,059,000
17	Beach Replenishment	\$ 20,163,000
17	Associated General Items	\$ 879,000
1	Lands and Damages	\$ 60,000
30	Engineering and Design	\$ 1,348,000
31	Construction Management	\$ 1,348,000
	Total Cost	\$29,857,000

K.2.2. Pre to Post Storm Cost Estimate

The following table provides a cost estimate for placing 166,600 CY of sand on the damaged areas of the beach by utilizing a dredge plant and associated equipment with borrow material. This is the quantity required to return the project to the pre-storm conditions. The cost includes mobilization/demobilization of the dredge plant and associated equipment, dredging of material, placement on the beach, environmental monitoring, beach tilling, vibration monitoring, surveys, etc. Additionally, non-construction costs include real estate costs, design costs and construction management costs. The MII estimate for this alternative is contained on the following pages.

WBS Code	Project Feature	Restore to Pre Storm Conditions
17	Mobilization and Demobilization	\$ 6,059,000
17	Beach Replenishment	\$ 7,447,000
17	Associated General Items	\$ 533,000
1	Lands and Damages	\$ 60,000
30	Engineering and Design	\$ 698,000
31	Construction Management	\$ 698,000
	Total Cost	\$15,495,000

K.2.3. Full Construction Template Cost Estimate

The following table provides a cost estimate for placing 1,015,400 CY of sand along the entire project limits with borrow material. This is the quantity required to return the project to the full construction template for the protective berm and includes advanced maintenance which is the periodic renourishment quantity. The cost includes mobilization/demobilization of the dredge plant and associated equipment, dredging of material, placement on the beach, environmental monitoring, beach tilling, vibration monitoring, surveys, etc. Additionally, non-construction costs include real estate costs, design costs and construction management costs. The MII estimate for this alternative is contained on the following pages.

WBS Code	Project Feature	Restore to Full Construction Template
17	Mobilization and Demobilization	\$ 6,282,000
17	Beach Replenishment	\$ 27,746,000
17	Associated General Items	\$ 2,647,000
1	Lands and Damages	\$ 60,000
30	Engineering and Design	\$ 1,824,000
31	Construction Management	\$ 1,824,000
	Total Cost	\$40,383,000

K.2.4. Restore above MHW (Truck Haul)

The following table provides a cost estimate for placing 123,200 CY of sand above the mean high water-level with material from an upland sand source. This source is undetermined at this time. Acceptable sand sources are thought to be within a reasonable hauling distance. This alternative is being considered assuming environmental coordination (for placement seaward of the MHW) is not complete prior to advertisement. The cost includes mobilization/demobilization of equipment, purchase and hauling of sand, placement on the beach, environmental monitoring, beach tilling, surveys, etc. Additionally, non-construction costs include real estate costs, design costs and construction management costs. The MII estimate for this alternative is contained on the following pages.

WBS Code	Project Feature	Restore Above MHW (Truck Haul)				
17	Mobilization and Demobilization	\$373,000				
17	Beach Replenishment	\$8,101,000				
17	Associated General Items	\$417,000				
1	Lands and Damages	\$60,000				
30	Engineering and Design	\$300,000				
31	Construction Management	\$484,000				
	Total Cost	\$9,735,000				

Appendix L. BCR Data

Alternative 1 and 1a Data and Assumptions Table displays the input that was required for the calculation of benefits as described in the body of the report.

Project Specs		Project Financi	als	
Initial Construction Design Template (CY)	768,000	Discount Rate		2.750%
Post-Storm Loss to Design (CY)	488,900	Period of Analysis (Years)		6
		CRF		0.1831
Estimated FCCE Placement Quantity (CY)	683,900	Current Q CWCCI	1Q1	8
		Benefit Price Level	3Q0	3
Advanced Fill (CY)	195,000	Current Cost (\$)	\$	29,857,000
		Deflated Cost (\$)	\$	19,270,420
Annual Rate of Erosion (CY)	128,667	Approved Annual Benefits (\$)	\$	13,496,400

Alternative 1 Data and Assumption Table

Alternative 1a Data and Assumptions Table

Project Specs		Project Financi	ials	
Initial Construction Design Template (CY)	768,000	Discount Rate		2.750%
Post-Storm Loss to Design (CY)	488,900	Period of Analysis (Years)		6
		CRF		0.1831
Estimated FCCE Placement Quantity (CY)	123,200	Current Q CWCCI	1Q1	.8
		Benefit Price Level	3Q0)3
Advanced Fill (CY)	-	Current Cost (\$)	\$	9,735,000
		Deflated Cost (\$)	\$	6,283,201
Annual Rate of Erosion (CY)	128,667	Approved Annual Benefits (\$)	\$	13,496,400

Alternative 1 and Alternative 1a BCR Table demonstrates how benefits were calculated and shows cost information used to determine BCR.

	Condition Design Ber of Annu Condition of Design Berm (CY) Benefit		Condition of Design Berm (% of Annual Benefits) Annual Benefits Maintained (\$)								
Year	FWOP	FWP	FWOP	FWP	FWOP	FWP	FCC	E Benefits	PV Factor	PVH	LCE Benefits
0	279,100	963,000	36%	100%	\$ 4,904,746	\$ 13,496,400	\$	8,591,654	1.0000	\$	8,591,654
1	150,433	834,333	20%	100%	\$ 2,643,625	\$ 13,496,400	\$	10,852,775	0.9732	\$	10,562,312
2	21,766	705,666	3%	92%	\$ 382,503	\$ 12,400,977	\$	12,018,474	0.9472	\$	11,383,758
3	-	576,999	0%	75%	\$ -	\$ 10,139,856	\$	10,139,856	0.9218	\$	9,347,302
4	-	448,332	0%	58%	\$ -	\$ 7,878,734	\$	7,878,734	0.8972	\$	7,068531
5	-	319,665	0%	42%	\$ -	\$ 5,617,613	Ş	5,617,613	0.8732	\$	4,905,041
									Total PV	\$	51,858,597
									AAEQ Benefit	\$	9,493,796
									AAEQ Cost	Ş	3,527,852
									Net Benefits	Ş	5,965,945
									BCR		2.69

Alternative 1 BCR Table

Alternative 1a BCR Table

	Condition of De	sign Berm (CY)	Conditi Design (% of A Bene	on of Berm nnual fits)	Annual Benefits Maintained (\$)												
Year	FWOP	FWP	FWOP	FWP	FWOP		FWOP		FWOP FWP		FWOP FWP		FCCE	Benefits	PV Factor	PV F	CCE Benefits
0	279,100	402,300	36%	52%	\$	4,904,746	\$	7,069,794	\$	2,165,048	1.0000	\$	2,165,048				
1	150 <i>/</i> 433	273,633	20%	36%	\$	2,643,625	\$	4,808,672	\$	2,165,048	0.9732	\$	2,107,102				
2	21,766	144,966	3%	19%	\$	382,503	\$	2,547,551	\$	2,165,048	0.9472	\$	2,050,708				
3	-	16,299	0%	2%	\$	-	\$	286 <i>,</i> 429	\$	286,429	0.9218	\$	264,041				
4	-	-	0%	0%	\$	-	\$	-	\$	-	0.8972	\$	-				
5	_	-	0%	0%	\$	-	\$	-	Ş	-	0.8732	\$	-				
											Total PV	\$	6,586,899				
											AAEQ Benefit	\$	1,205,869				
											AAEQ Cost	Ś	1.150271				
											Net Benefits	Ś	55,598				
											BCR		1.05				

Appendix M. Environmental Considerations

The PIR Format in EP 500-1-1 Figure 5-8 requires that specific statements for tabs M-1 to M-6 be provided in Appendix M.

Tab M-1. A statement on the effect of proposed work on the environment. - See section 16, paragraphs a and b.

Tab M-2. The 2004 GRR and Final EIS for the Broward County Shore Protection Project includes all of the Segment III FCCE areas and includes all appropriate environmental compliance documentation therein. The SAD Commander signed the Record of Decision on May 11, 2004. The NEPA documents can be accessed using the following link:

http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/

Tab M-3. Considerations under Section 7 of the Endangered Species Act of 1973 (PL 93-205).

- Tab M-3 includes three documents; 1. SPBO; 2. BO Sand Placement; 3. BO for Broward SPP, this Tab is provided as an attachment to this PIR.

Tab M-4. Archeological Investigations.

- See section 16, paragraph f.

Tab M-5. Section 404(b) evaluations.

- See section 16, paragraph g.

Tab M-6. A statement on the applicability of EO 11988.

- The proposed Project is in the base flood plain and has been evaluated in accordance with Executive Order 11988. The Project is in full compliance.

Tab M-7. Coastal Barrier Resource Act



James Duck U.S. Army Corps of Engineers Planning Division 701 San Marco Boulevard, Room 372 Jacksonville, Florida 32207-8175

> Service Log No.: 4-1-99-I-506 Project: Broward County Shore Protection Project, Coastal Barrier Resources Act Determination Applicant: Broward County Department of Planning and Environmental Protection County: Broward

Dear Mr. Duck:

The following describes the history and the applicability of the Coastal Barrier Resources Act (CBRA) of 1982 and the Coastal Barrier Resources Improvement Act (CBRIA) of 1990 to the Broward County Shore Protection Project located in Broward County, Florida. The proposed project will over-lap the boundaries of two "otherwise protected areas" (OPAB) (Birch Park, FL-19P and Lloyd Beach, FL-20P) and one CBRA unit (North Beach, P-14A).

Historically, some Federal expenditures (c.g., Federal flood insurance and other Federal financial assistance) had the effect of encouraging development in fragile, high-risk coastal barrier systems (e.g., barrier islands, sand spits, and mangrove forests). The CBRA and CBRIA limit federally-subsidized development within a defined Coastal Barrier Resources Unit. Three important goals of these acts are to: (1) minimize loss of human life by discouraging development in high-risk areas; (2) reduce wasteful expenditure of Federal resources; and (3) protect the natural resources associated with coastal barriers. In addition, CBRIA also provided development goals for undeveloped coastal property held in public ownership, such as wildlife refuges, parks, or other lands set aside for conservation, which are identified as OPAs. The only restriction applied to an OPA prohibits the expenditure of Federal Flood Insurance to new construction of structures (buildings) in an OPA, as stated in Section 9, Prohibitions of Flood Insurance Coverage In Certain Coastal Barriers. There are no other restrictions placed on Federal expenditures in an OPA.

James Duck April 30, 2003 Page 2

Federal monies can be spent within the Coastal Barrier Resource System for certain activities, which are exempted under Section 6, Exceptions To Limitations On Expenditures. These activities include: (1) projects for the study, management, protection, and enhancement of fish and wildlife resources and habitats; (2) establishment of navigation aids; (3) projects funded under the Land and Water Conservation Fund Act of 1965; (4) scientific research; (5) assistance for emergency actions essential to saving lives and the protection of property and the public health and safety, if prefetred pursuant to the Disaster Relief, Emergency Assistance Act, and National Flood Insurance Act and are necessary to alleviate the emergency; (6) maintenance, repair, reconstruction, or repair, but not expansion of publically owned or publically operated roads, structures, or facilities; (7) nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore a natural stabilization system; (8) any use or facility necessary for the exploration, extraction, or transportation of energy resources; (9) maintenance or construction of improvements of existing Federal navigation channels, including the disposal of dredge materials related to such projects; and (10) military activities essential to national security.

Since the proposed Broward County Shore Protection Project does not include the construction of structures that would require Federal Flood Insurance, then Federal expenditures for the proposed project are not restricted in the FL-19P, Birch Park and Fl-20P, Lloyd Beach OPAs. The Service has determined that the construction activities proposed within CBRA Unit, P-14A. North Beach are consistent with the intent of the Act and are exempt pursuant to section 6(a)(G) which authorizes "nonstructural projects for shoreline stabilization that is designed to mimic, enhance, or restore a natural stabilization system."

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this determination, please contact Allen Webb at 772-562-3909, extension 246.

Sincerely yours,

fllen V. Weblaco

Linda S. Ferrell Assistant Field Supervisor South Florida Ecological Services Office

CC:

Broward County Department of Planning and Environmental Protection, Ft. Lauderdale, Florida (Stephene Higgins) Tab M-8. Essential Fish Habitat - See section 16, paragraph j.

Tab M-9. Water Quality Certificate - See section 17.

Appendix N-Y.

Not applicable.

Appendix Z. PIR Review Checklist

	YES	NO	N/A	
1.	X		1.07.1	The project is a Federally authorized and constructed coastal storm risk management project (CSRM). [ER, 5-20.a.]
2.	Х			The Project is Active in the RIP {ER, 5-2.a.]. Last inspection date: December 2017
3.	Х			The Public Sponsor has requested CSRMRehabilitation Assistance in writing. [EP, 5-18.b.]
4.	Х			The FCCE-funded CSRMRehabilitation Assistance is necessary to restore the project to its design level of protection.
5.	Х			There is sufficient evidence in the PIR to support a finding that the CSRM was damaged by an extraordinary storm. [ER, 5-20.e.]
6.	Х			There are "significant amounts of damage" to the CSRM. [ER, 5-20.e.(2)] The criterion used to make this determination is:
				Yes the cost of the construction effort to effect repair of the CSRM (exclusive of dredge mob/demob costs) (a) exceeds \$1 million and (b) is greater than 2 percent of the original project construction costs (expressed in current day dollars.); or,
				Yes the cost of the construction effort to effect repair of the CSRM (exclusive of dredge mob/demob costs) exceeds \$6 million; or,
				<u>No</u> more than one-third of the planned or historically placed sand for renourishment was lost.
				No only hard features are involved.
7.	Х			The public sponsor has agreed to sign the Cooperation Agreement which will occur before USACE begins rehabilitation work. [EP, 5-18.1]
8.	Х			The rehabilitation Project has a favorable benefit cost ratio of greater than 1.0:1 [ER, 5-20.a.].
9.	Х			The public sponsor has access to sufficient funds to meet its required cost contributions. [EP, 5-18.h.]
10.	Х			The cost estimate in the PIR itemizes the work and identifies the Public Sponsor's cost responsibility for items such as deferred and deficient maintenance. [ER, 5-2.g.]
11.	Х			The cost estimate in the PIR allocates costs between what may be paid for under PL84-99 Rehabilitation Assistance, and what is cost shared between the Corps (using CG funds) and the public sponsor under periodic renourishment terms of the PCA. [EP, 5-18.d.].
12.	Х			Dredge mobilization/demobilization costs are borne proportionally among contributing sources of funds for sand renourishment. [ER, 5-20.i.]
13.	Х			Contingency funds for the FCCE-funded portion of the Project are limited to 15 percent for dredging-related costs, and 10 percent for all other costs. [ER, 5-2.v.]

14.	YES X	NO	N/A	The repair option selected is the option that is the least cost to the Federal government. [ER, 5-2.h.]
15.	Х			The benefit cost ratio calculation excludes all recreation benefits. [ER, 5-20.a.]
16.	Х			Betterments are paid by the Public Sponsor. [ER, 5-20.o.]
17.	Х			Cost for betterments are identified separately in the cost estimate. [ER, 5-2.0.]
18.	Х			Based on the Projected schedule, Project history, anticipated degree of contention of undertaking the Project, and similar items, the Rehabilitation Assistance will be finished prior to the onset of the next storm season, or within one year of the date of occurrence of the damage, whichever is less. [ER, 5-20.j.]
19.	Х			The proposed work will not modify the CSRM to increase the degree of protection or capacity, or provide protection to a larger area. [ER, 5-2.n.]
20.	Х			An assessment of environmental requirements was completed. [ER, 5-13.e.]
21.	Х			The Endangered Species Act was appropriately considered. Dredging will not be adversely impacted. [ER, 5-13.e.]
22.	Х			The Archeological and Historical Preservation Act was appropriately considered. [ER, 5-13.h.]
23.	Х			EO 11988 was appropriately considered. [ER,5-13.f.]
24.	Х			Other permitting and evaluations were appropriately considered and result in no impediment to the Rehabilitation Assistance effort. [ER, 5-13.a.]
25.	Х			The cover letter forwarding the PIR to the MSC will contain the Projected schedule for completing the Rehabilitation Assistance. [EP, 5-18.f.(2)]
26.	Х			The completed PIR has been reviewed and the PIR checklist has been reviewed and signed by the Emergency Management Office. [EP, 5-18.f.(1)]
27.	Х			The completed PIR meets all policy, procedural, content, and formatting requirements of ER 500-1-1 and EP 500-1-1. [ER, 2-3.b.]