SHORE PROTECTION PROJECT FOR

MIAMI-DADE COUNTY, FLORIDA

LIMITED REEVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT

APPENDIX B
COST ENGINEERING AND RISK ANALYSIS

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B. COST ESTIMATES

B1. GENERAL INFORMATION

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, 15 September 2008
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, as amended
- Engineer Manual (EM) 1110-2-1304 (Tables Revised 31 March 2009), Civil Works Construction Cost Index System, 31 March 2000
- CECW-CP Memorandum for Distribution, Subject: Initiatives to Improve the Accuracy of Total Project Costs in Civil Works Feasibility Studies Requiring Congressional Authorization, 19 September 2007
- CECW-CE Memorandum for Distribution, Subject: Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs, 3 July 2007
- Cost and Schedule Risk Analysis Process, March 2008

The goal of the cost estimates for the Miami-Dade County Shore Protection Project Limited Reevaluation Report are to present a Total Project Cost (Construction and non-Construction costs) for the tentatively selected plan(s) at the current price level to be used for project justification/authorization and to escalate costs for budgeting purposes. In addition, the costing efforts are intended to produce a final product (cost estimate) that is reliable and accurate, and that supports the definition of the Government's and the non-Federal sponsor's obligations.

The cost estimating effort for the study also yielded a series of alternative plan formulation cost estimates for decision making. The final set of plan formulation cost estimates used for plan selection rely on construction feature unit pricing and are prepared in Civil Works Work Breakdown Structure (CWWBS) format to the sub-feature level. The cost estimate supporting the Tentatively Selected Plan is prepared in MCACES/MII format to the CWWBS sub-feature level. This estimate is supported by the preferred labor, equipment, materials and crew/production breakdown. A Total Project Cost Summary has also been developed.

Contingencies for the plan formulation alternatives were taken from the cost and schedule risk analyses performed as part of the previous year's certified total project cost summary. While the previous total project cost summary only considered use of the offshore sand sources, the same contingencies were held for the truck haul alternatives to facilitate comparisons of all potential sand sources for individual nourishment events of varying quantities and limits. A new cost and schedule risk analysis was performed to establish the project contingency for the Tentatively Selected Plan's cost items.

B.1.1 Plan Formulation Cost Estimates

For the plan formulation cost estimates, unit prices for dredging related work were developed in CEDEP and then entered into MCACES/MII. Unit prices for truck hauling and other remaining major or variable construction elements were developed in MCACES/MII based on input from the PDT and industry. Design details, information and assumptions were provided in the Engineering Appendix. Cost Engineering provided estimates for the array of possible borrow areas for each projected renourishment event as projected in the Engineering Appendix. The contingencies developed from the previously performed cost and schedule risk analysis were used for all of the potential borrow area alternatives at each of the segments. Non-construction costs were included as lump sums for PED, real estate and construction oversight as provided by the PM.

Refer to Economics Section in the main report for final plan formulation cost tables.

B.1.2 Tentatively Selected Plan(s)

The Tentatively Selected Plan (TSP) was chosen by the Project Delivery Team (PDT) according to Cost Effectiveness/Incremental Cost Analysis procedures and resulted directly from the plan formulation described above. The Economics Appendix fully describes the plan selection. The scope of work for the TSP is found in Appendix A, Engineering. The MCACES/MII cost estimate for the TSP is based on that scope and is formatted in the CWWBS. The estimate is priced at the Fiscal Year 2015 price level (1 October 2014-30 September 2015) and wage rates are in accordance with Davis Bacon Act. For project justification purposes, the estimate costs are categorized under the appropriate CWWBS code and include both construction and non-construction costs.

The construction costs fall under the following feature codes:

- 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

B.1.3 Construction Cost

For the construction costs, unit prices for dredging related work were developed in the Cost Engineering Dredge Estimating Program (CEDEP) and then entered into MCACES/MII. Unit prices for truck haul related work was developed directly in MCACES/MII. These costs include all major project components categorized under the appropriate CWWBS to the sub-feature level. The Total Project Cost Summary (TPCS) on the TSP contains contingencies as determined by the risk analysis which is covered under another paragraph.

B.1.4 Non-Construction Cost

Non-construction costs typically include Lands and Damages (Real Estate), Planning Engineering & Design (PED) and Construction Management Costs (Supervision & Administration, S&A). These costs were provided by the PDT as a lump sum cost. Lands and Damages are provided by Real Estate and are best described in the Real Estate Appendix,

Appendix D. PED costs are for the preparation of contract plans and specifications (P&S) and include itemized costs that were provided by the PDT, as well as lump sums for Engineering During Construction (EDC) that were provided by the project manager. Construction Management costs are for the supervision and administration of a contract and include Project Management and Contract Admin costs. These costs were provided by the project manager and are included as a percentage of the total construction contract cost.

The main report details both cost allocation and cost apportionment for the Federal Government and the Non-Federal Sponsor. Also included in the main report are the Non-Federal Sponsor's obligations (items of local cooperation).

B.1.5 Construction Schedule

A construction schedule was prepared utilizing input from the PDT and reflects all project construction components. The schedule considers not only durations of individual components of construction, but also the timing of construction contracts based on projected renourishment needs of each segment and construction windows. Risks associated with funding the construction as scheduled are considered in the cost and schedule risk analysis. The construction schedule was combined with the project schedule to create an overall schedule that was used for the generation of the TPCS. The construction schedule will change as the project moves through remaining years of Federal participation. Refer to Section B4..

B.1.6 Total Project Cost Summary

The cost estimate for the TSP is prepared with an identified price level date and inflation factors are used to adjust the pricing to the project schedule. This estimate is known as the Fully Funded Cost Estimate or Total Project Cost Summary. It includes all Federal and non-Federal costs: Lands, Easements, Rights of Way and Relocations; construction features; Preconstruction Engineering and Design; Construction Management; Contingency; and Inflation.

B2. PLAN FORMULATION COST ESTIMATES

There were several alternatives the PDT evaluated during plan formulation in order to identify the TSP. All alternatives that were evaluated at various stages in the study are outlined in the Main Report.

The Final Array of Alternatives looked at constructing all of the projected events with each potential borrow source. The TSP was developed by combining the most cost effective, viable borrow area for each remaining nourishment event.

All segment limits, volumes and construction years were provided by Engineering. Average distances to borrow sites were estimated using Google Earth.

The various borrow area alternatives included two offshore areas in federal waters known as M4-R105 (roughly 80 statute miles from center of the project shoreline) and SL10-T41 (roughly 110 statute miles from center of the project shoreline). Inland sand mines in Glades County

(Ortona & Witherspoon mines) and Miami-Dade County (ACI mine) were also evaluated as sand sources (to be used via truck haul.) Additionally, the ebb shoal at Bakers Haulover Inlet is considered for use at the Bal Harbor and Surfside segments only.

All renourishments utilizing the offshore sand sources were assumed to be dredged with a large hopper dredge with pumpout through a designated pipeline corridor. The renourishment utilizing the existing Bakers Haulover ebb shoal assumes use of a pipeline dredge with placement via an established pipeline corridor. All beach fill events utilizing upland mines deposit material via established beach access points that were provided by the county.

All dredging unit costs were calculated in CEDEP and transferred to MII to determine the total construction costs for each alternative utilizing an offshore borrow area. Unit costs for use of the inland mines were developed with input from the mining and trucking industries. The Planning, Engineering and Design (PED) costs, Engineering During Construction (EDC) costs, Supervision & Administration (S&A) and real estate costs were provided as lump sum costs per construction contract cost by the Project Manager.

A contingency was applied to each alternative. The contingencies for the construction and remaining non-construction costs of the TSP were developed by performing a cost and schedule risk analysis. Contingencies were developed individually for the Sunny Isles Segment and the Main Segment. The contingencies used for the alternatives were based on the FY14 certified cost estimates for both Sunny Isles and Main Segments.

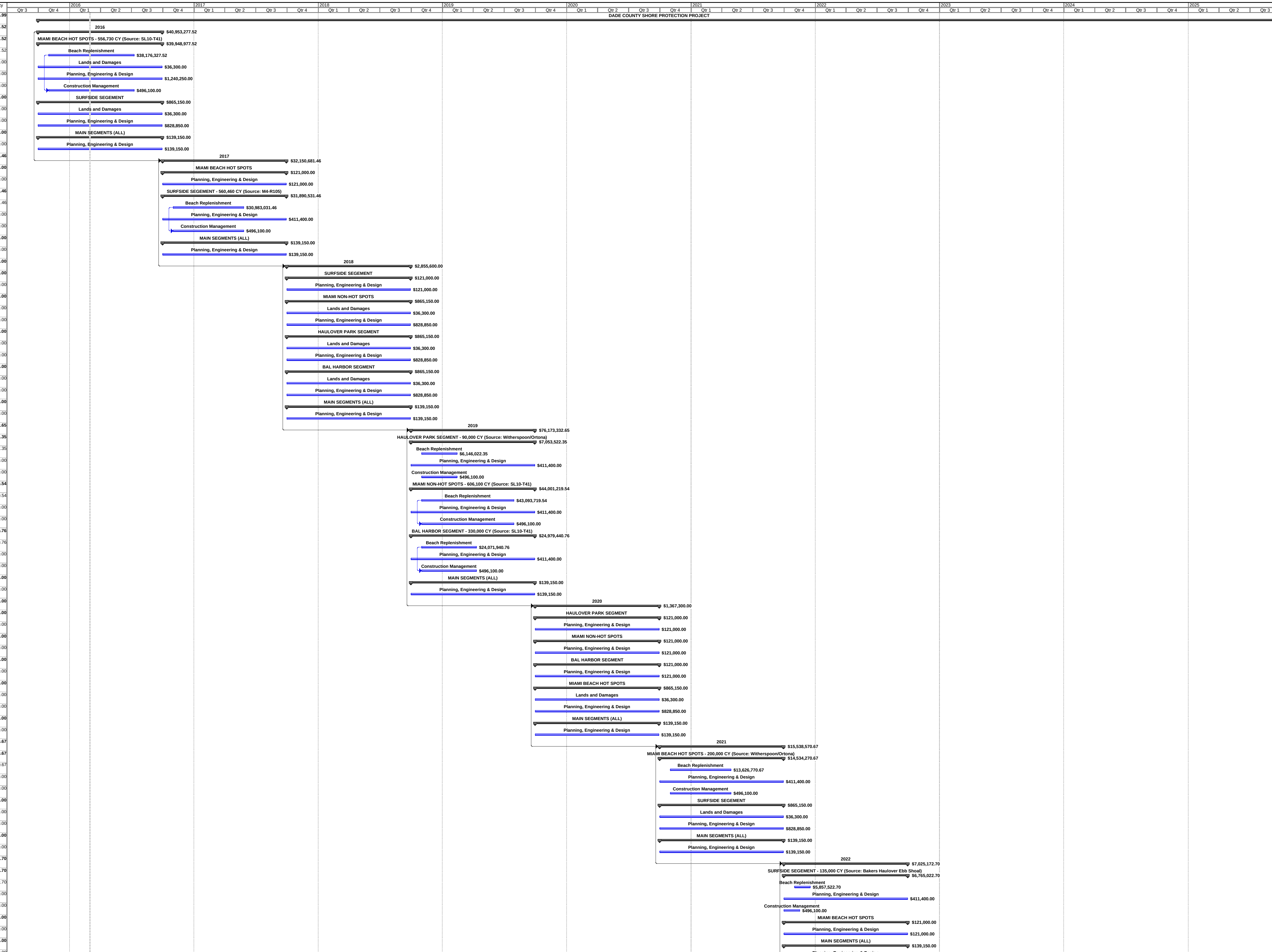
B3. TENTATIVELY SELECTED PLAN COST ESTIMATE

The TSP is prepared for the Total Project Cost and utilizes a combination of borrow areas as sources of material to provide the necessary quantities of material for the remaining life of the project. It is anticipated that five of the remaining ten renourishment events will use SL10-T41, one will use M4-R105, one event will use the existing Bakers Haulover ebb shoal and there will be three truck haul events from inland sand mines.

B4. SCHEDULE

Refer to the Schedule on the next page.

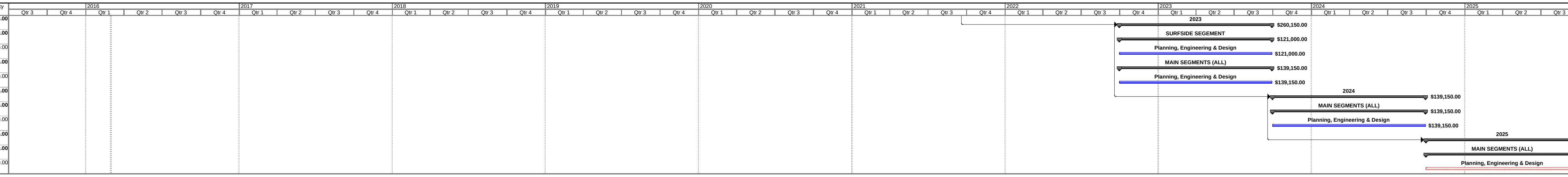
ID	Task Name	Duration	Start	Finish	Cost	w/Contingency
1	**DADE COUNTY SHORE PROTECTION PROJECT**	**3652 days**	**Thu 10/1/15**	**Tue 9/30/25**	**$145,952,384.29**	**$176,602,384.99**
2	**2016**	**365 days**	**Thu 10/1/15**	**Fri 9/30/16**	**$33,845,683.90**	**$40,953,277.52**
3	**MIAMI BEACH HOT SPOTS - 556,730 CY (Source: SL10-T41)**	**365 days**	**Thu 10/1/15**	**Fri 9/30/16**	**$33,015,683.90**	**$39,948,977.52**
4	Beach Replenishment	252 days	Sun 11/1/15	Sun 7/10/16	$31,550,683.90	$38,176,327.52
5	Lands and Damages	365 days	Thu 10/1/15	Fri 9/30/16	$30,000.00	$36,300.00
6	Planning, Engineering & Design	365 days	Thu 10/1/15	Fri 9/30/16	$1,025,000.00	$1,240,250.00
7	Construction Management	252 days	Sun 11/1/15	Sun 7/10/16	$410,000.00	$496,100.00
8	**SURFSIDE SEGEMENT**	**365 days**	**Thu 10/1/15**	**Fri 9/30/16**	**$715,000.00**	**$865,150.00**
9	Lands and Damages	365 days	Thu 10/1/15	Fri 9/30/16	$30,000.00	$36,300.00
10	Planning, Engineering & Design	365 days	Thu 10/1/15	Fri 9/30/16	$685,000.00	$828,850.00
11	**MAIN SEGMENTS (ALL)**	**365 days**	**Thu 10/1/15**	**Fri 9/30/16**	**$115,000.00**	**$139,150.00**
12	Planning, Engineering & Design	365 days	Thu 10/1/15	Fri 9/30/16	$115,000.00	$139,150.00
13	**2017**	**364 days**	**Sat 10/1/16**	**Sat 9/30/17**	**$26,570,811.12**	**$32,150,681.46**
14	**MIAMI BEACH HOT SPOTS**	**364 days**	**Sat 10/1/16**	**Sat 9/30/17**	**$100,000.00**	**$121,000.00**
15	Planning, Engineering & Design	364 days	Sat 10/1/16	Sat 9/30/17	$100,000.00	$121,000.00
16	**SURFSIDE SEGEMENT - 560,460 CY (Source: M4-R105)**	**364 days**	**Sat 10/1/16**	**Sat 9/30/17**	**$26,355,811.12**	**$31,890,531.46**
17	Beach Replenishment	208 days	Tue 11/1/16	Sun 5/28/17	$25,605,811.12	$30,983,031.46
18	Planning, Engineering & Design	364 days	Sat 10/1/16	Sat 9/30/17	$340,000.00	$411,400.00
19	Construction Management	208 days	Tue 11/1/16	Sun 5/28/17	$410,000.00	$496,100.00
20	**MAIN SEGMENTS (ALL)**	**364 days**	**Sat 10/1/16**	**Sat 9/30/17**	**$115,000.00**	**$139,150.00**
21	Planning, Engineering & Design	364 days	Sat 10/1/16	Sat 9/30/17	$115,000.00	$139,150.00
22	**2018**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$2,360,000.00**	**$2,855,600.00**
23	**SURFSIDE SEGEMENT**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$100,000.00**	**$121,000.00**
24	Planning, Engineering & Design	364 days	Sun 10/1/17	Sun 9/30/18	$100,000.00	$121,000.00
25	**MIAMI NON-HOT SPOTS**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$715,000.00**	**$865,150.00**
26	Lands and Damages	364 days	Sun 10/1/17	Sun 9/30/18	$30,000.00	$36,300.00
27	Planning, Engineering & Design	364 days	Sun 10/1/17	Sun 9/30/18	$685,000.00	$828,850.00
28	**HAULOVER PARK SEGMENT**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$715,000.00**	**$865,150.00**
29	Lands and Damages	364 days	Sun 10/1/17	Sun 9/30/18	$30,000.00	$36,300.00
30	Planning, Engineering & Design	364 days	Sun 10/1/17	Sun 9/30/18	$685,000.00	$828,850.00
31	**BAL HARBOR SEGMENT**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$715,000.00**	**$865,150.00**
32	Lands and Damages	364 days	Sun 10/1/17	Sun 9/30/18	$30,000.00	$36,300.00
33	Planning, Engineering & Design	364 days	Sun 10/1/17	Sun 9/30/18	$685,000.00	$828,850.00
34	**MAIN SEGMENTS (ALL)**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$115,000.00**	**$139,150.00**
35	Planning, Engineering & Design	364 days	Sun 10/1/17	Sun 9/30/18	$115,000.00	$139,150.00
36	**2019**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$62,953,167.48**	**$76,173,332.65**
37	**HAULOVER PARK SEGMENT - 90,000 CY (Source: Witherspoon/Ortona)**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$5,829,357.31**	**$7,053,522.35**
38	Beach Replenishment	105 days	Thu 11/1/18	Thu 2/14/19	$5,079,357.31	$6,146,022.35
39	Planning, Engineering & Design	364 days	Mon 10/1/18	Mon 9/30/19	$340,000.00	$411,400.00
40	Construction Management	105 days	Thu 11/1/18	Thu 2/14/19	$410,000.00	$496,100.00
41	**MIAMI NON-HOT SPOTS - 606,100 CY (Source: SL10-T41)**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$36,364,644.25**	**$44,001,219.54**
42	Beach Replenishment	272 days	Thu 11/1/18	Wed 7/31/19	$35,614,644.25	$43,093,719.54
43	Planning, Engineering & Design	364 days	Mon 10/1/18	Mon 9/30/19	$340,000.00	$411,400.00
44	Construction Management	272 days	Thu 11/1/18	Wed 7/31/19	$410,000.00	$496,100.00
45	**BAL HARBOR SEGMENT - 330,000 CY (Source: SL10-T41)**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$20,644,165.92**	**$24,979,440.76**
46	Beach Replenishment	162 days	Thu 11/1/18	Fri 4/12/19	$19,894,165.92	$24,071,940.76
47	Planning, Engineering & Design	364 days	Mon 10/1/18	Mon 9/30/19	$340,000.00	$411,400.00
48	Construction Management	162 days	Thu 11/1/18	Fri 4/12/19	$410,000.00	$496,100.00
49	**MAIN SEGMENTS (ALL)**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$115,000.00**	**$139,150.00**
50	Planning, Engineering & Design	364 days	Mon 10/1/18	Mon 9/30/19	$115,000.00	$139,150.00
51	**2020**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$1,130,000.00**	**$1,367,300.00**
52	**HAULOVER PARK SEGMENT**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$100,000.00**	**$121,000.00**
53	Planning, Engineering & Design	365 days	Tue 10/1/19	Wed 9/30/20	$100,000.00	$121,000.00
54	**MIAMI NON-HOT SPOTS**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$100,000.00**	**$121,000.00**
55	Planning, Engineering & Design	365 days	Tue 10/1/19	Wed 9/30/20	$100,000.00	$121,000.00
56	**BAL HARBOR SEGMENT**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$100,000.00**	**$121,000.00**
57	Planning, Engineering & Design	365 days	Tue 10/1/19	Wed 9/30/20	$100,000.00	$121,000.00
58	**MIAMI BEACH HOT SPOTS**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$715,000.00**	**$865,150.00**
59	Lands and Damages	365 days	Tue 10/1/19	Wed 9/30/20	$30,000.00	$36,300.00
60	Planning, Engineering & Design	365 days	Tue 10/1/19	Wed 9/30/20	$685,000.00	$828,850.00
61	**MAIN SEGMENTS (ALL)**	**364 days**	**Tue 10/1/19**	**Tue 9/29/20**	**$115,000.00**	**$139,150.00**
62	Planning, Engineering & Design	364 days	Tue 10/1/19	Tue 9/29/20	$115,000.00	$139,150.00
63	**2021**	**364 days**	**Thu 10/1/20**	**Thu 9/30/21**	**$12,841,793.94**	**$15,538,570.67**
64	**MIAMI BEACH HOT SPOTS - 200,000 CY (Source: Witherspoon/Ortona)**	**364 days**	**Thu 10/1/20**	**Thu 9/30/21**	**$12,011,793.94**	**$14,534,270.67**
65	Beach Replenishment	179 days	Sun 11/1/20	Thu 4/29/21	$11,261,793.94	$13,626,770.67
66	Planning, Engineering & Design	364 days	Thu 10/1/20	Thu 9/30/21	$340,000.00	$411,400.00
67	Construction Management	179 days	Sun 11/1/20	Thu 4/29/21	$410,000.00	$496,100.00
68	**SURFSIDE SEGEMENT**	**364 days**	**Thu 10/1/20**	**Thu 9/30/21**	**$715,000.00**	**$865,150.00**
69	Lands and Damages	364 days	Thu 10/1/20	Thu 9/30/21	$30,000.00	$36,300.00
70	Planning, Engineering & Design	364 days	Thu 10/1/20	Thu 9/30/21	$685,000.00	$828,850.00
71	**MAIN SEGMENTS (ALL)**	**364 days**	**Thu 10/1/20**	**Thu 9/30/21**	**$115,000.00**	**$139,150.00**
72	Planning, Engineering & Design	364 days	Thu 10/1/20	Thu 9/30/21	$115,000.00	$139,150.00
73	**2022**	**364 days**	**Fri 10/1/21**	**Fri 9/30/22**	**$5,805,927.85**	**$7,025,172.70**
74	**SURFSIDE SEGEMENT - 135,000 CY (Source: Bakers Haulover Ebb Shoal)**	**364 days**	**Fri 10/1/21**	**Fri 9/30/22**	**$5,590,927.85**	**$6,765,022.70**
75	Beach Replenishment	47 days	Mon 11/1/21	Sat 12/18/21	$4,840,927.85	$5,857,522.70
76	Planning, Engineering & Design	364 days	Fri 10/1/21	Fri 9/30/22	$340,000.00	$411,400.00
77	Construction Management	47 days	Fri 10/1/21	Wed 11/17/21	$410,000.00	$496,100.00
78	**MIAMI BEACH HOT SPOTS**	**364 days**	**Fri 10/1/21**	**Fri 9/30/22**	**$100,000.00**	**$121,000.00**
79	Planning, Engineering & Design	364 days	Fri 10/1/21	Fri 9/30/22	$100,000.00	$121,000.00
80	**MAIN SEGMENTS (ALL)**	**364 days**	**Fri 10/1/21**	**Fri 9/30/22**	**$115,000.00**	**$139,150.00**
81	Planning, Engineering & Design	364 days	Fri 10/1/21	Fri 9/30/22	$115,000.00	$139,150.00



Project: DADE CO SPP REMAINING P
Date: Mon 2/29/16

Critical | Critical Split | Critical Progress | Task | Split | Task Progress | Baseline | Baseline Split | Baseline Milestone | Milestone | Summary Progress | Summary | Project Summary | External Tasks | External Milestone | Deadline

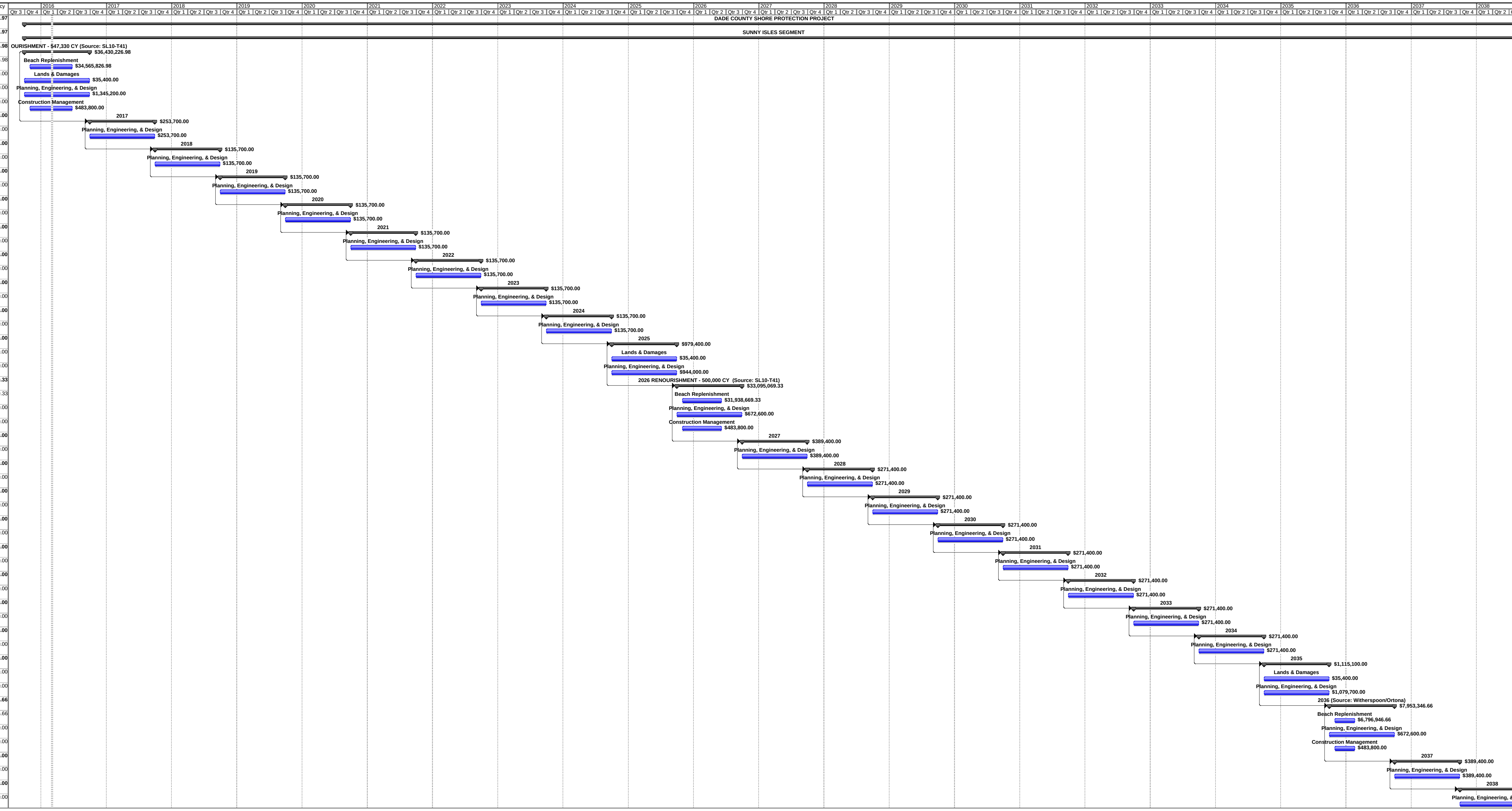
ID	Task Name	Duration	Start	Finish	Cost	w/Contingency
82	**2023**	**364 days**	**Sat 10/1/22**	**Sat 9/30/23**	**$215,000.00**	**$260,150.00**
83	**SURFSIDE SEGEMENT**	**364 days**	**Sat 10/1/22**	**Sat 9/30/23**	**$100,000.00**	**$121,000.00**
84	Planning, Engineering & Design	364 days	Sat 10/1/22	Sat 9/30/23	$100,000.00	$121,000.00
85	**MAIN SEGMENTS (ALL)**	**364 days**	**Sat 10/1/22**	**Sat 9/30/23**	**$115,000.00**	**$139,150.00**
86	Planning, Engineering & Design	364 days	Sat 10/1/22	Sat 9/30/23	$115,000.00	$139,150.00
87	**2024**	**365 days**	**Sun 10/1/23**	**Mon 9/30/24**	**$115,000.00**	**$139,150.00**
88	**MAIN SEGMENTS (ALL)**	**365 days**	**Sun 10/1/23**	**Mon 9/30/24**	**$115,000.00**	**$139,150.00**
89	Planning, Engineering & Design	365 days	Sun 10/1/23	Mon 9/30/24	$115,000.00	$139,150.00
90	**2025**	**364 days**	**Tue 10/1/24**	**Tue 9/30/25**	**$115,000.00**	**$139,150.00**
91	**MAIN SEGMENTS (ALL)**	**364 days**	**Tue 10/1/24**	**Tue 9/30/25**	**$115,000.00**	**$139,150.00**
92	Planning, Engineering & Design	364 days	Tue 10/1/24	Tue 9/30/25	$115,000.00	$139,150.00



Project: DADE CO SPP REMAINING P
Date: Mon 2/29/16

Critical	Critical Split	Critical Progress	Task	Split	Task Progress	Baseline	Baseline Split	Baseline Milestone	Milestone	Summary Progress	Summary	Project Summary	External Tasks	External Milestone	Deadline

ID		Task Name	Duration	Start	Finish	Cost	w/Contingency
1		**DADE COUNTY SHORE PROTECTION PROJECT**	**8400 days**	**Thu 10/1/15**	**Thu 9/30/38**	**$70,954,866.92**	**$83,726,742.97**
2		**SUNNY ISLES SEGMENT**	**8400 days**	**Thu 10/1/15**	**Thu 9/30/38**	**$70,954,866.92**	**$83,726,742.97**
3		**2016 RENOURISHMENT - 547,330 CY (Source: SL10-T41)**	**365 days**	**Thu 10/1/15**	**Fri 9/30/16**	**$30,873,073.71**	**$36,430,226.98**
4		Beach Replenishment	237 days	Sun 11/1/15	Sat 6/25/16	$29,293,073.71	$34,565,826.98
5		Lands & Damages	365 days	Thu 10/1/15	Fri 9/30/16	$30,000.00	$35,400.00
6		Planning, Engineering, & Design	365 days	Thu 10/1/15	Fri 9/30/16	$1,140,000.00	$1,345,200.00
7		Construction Management	237 days	Sun 11/1/15	Sat 6/25/16	$410,000.00	$483,800.00
8		**2017**	**364 days**	**Sat 10/1/16**	**Sat 9/30/17**	**$215,000.00**	**$253,700.00**
9		Planning, Engineering, & Design	364 days	Sat 10/1/16	Sat 9/30/17	$215,000.00	$253,700.00
10		**2018**	**364 days**	**Sun 10/1/17**	**Sun 9/30/18**	**$115,000.00**	**$135,700.00**
11		Planning, Engineering, & Design	364 days	Sun 10/1/17	Sun 9/30/18	$115,000.00	$135,700.00
12		**2019**	**364 days**	**Mon 10/1/18**	**Mon 9/30/19**	**$115,000.00**	**$135,700.00**
13		Planning, Engineering, & Design	364 days	Mon 10/1/18	Mon 9/30/19	$115,000.00	$135,700.00
14		**2020**	**365 days**	**Tue 10/1/19**	**Wed 9/30/20**	**$115,000.00**	**$135,700.00**
15		Planning, Engineering, & Design	365 days	Tue 10/1/19	Wed 9/30/20	$115,000.00	$135,700.00
16		**2021**	**364 days**	**Thu 10/1/20**	**Thu 9/30/21**	**$115,000.00**	**$135,700.00**
17		Planning, Engineering, & Design	364 days	Thu 10/1/20	Thu 9/30/21	$115,000.00	$135,700.00
18		**2022**	**364 days**	**Fri 10/1/21**	**Fri 9/30/22**	**$115,000.00**	**$135,700.00**
19		Planning, Engineering, & Design	364 days	Fri 10/1/21	Fri 9/30/22	$115,000.00	$135,700.00
20		**2023**	**364 days**	**Sat 10/1/22**	**Sat 9/30/23**	**$115,000.00**	**$135,700.00**
21		Planning, Engineering, & Design	364 days	Sat 10/1/22	Sat 9/30/23	$115,000.00	$135,700.00
22		**2024**	**365 days**	**Sun 10/1/23**	**Mon 9/30/24**	**$115,000.00**	**$135,700.00**
23		Planning, Engineering, & Design	365 days	Sun 10/1/23	Mon 9/30/24	$115,000.00	$135,700.00
24		**2025**	**364 days**	**Tue 10/1/24**	**Tue 9/30/25**	**$830,000.00**	**$979,400.00**
25		Lands & Damages	364 days	Tue 10/1/24	Tue 9/30/25	$30,000.00	$35,400.00
26		Planning, Engineering, & Design	364 days	Tue 10/1/24	Tue 9/30/25	$800,000.00	$944,000.00
27		**2026 RENOURISHMENT - 500,000 CY (Source: SL10-T41)**	**364 days**	**Wed 10/1/25**	**Wed 9/30/26**	**$28,046,668.92**	**$33,095,069.33**
28		Beach Replenishment	219 days	Sat 11/1/25	Mon 6/8/26	$27,066,668.92	$31,938,669.33
29		Planning, Engineering, & Design	364 days	Wed 10/1/25	Wed 9/30/26	$570,000.00	$672,600.00
30		Construction Management	219 days	Sat 11/1/25	Mon 6/8/26	$410,000.00	$483,800.00
31		**2027**	**364 days**	**Thu 10/1/26**	**Thu 9/30/27**	**$330,000.00**	**$389,400.00**
32		Planning, Engineering, & Design	364 days	Thu 10/1/26	Thu 9/30/27	$330,000.00	$389,400.00
33		**2028**	**365 days**	**Fri 10/1/27**	**Sat 9/30/28**	**$230,000.00**	**$271,400.00**
34		Planning, Engineering, & Design	365 days	Fri 10/1/27	Sat 9/30/28	$230,000.00	$271,400.00
35		**2029**	**364 days**	**Sun 10/1/28**	**Sun 9/30/29**	**$230,000.00**	**$271,400.00**
36		Planning, Engineering, & Design	364 days	Sun 10/1/28	Sun 9/30/29	$230,000.00	$271,400.00
37		**2030**	**364 days**	**Mon 10/1/29**	**Mon 9/30/30**	**$230,000.00**	**$271,400.00**
38		Planning, Engineering, & Design	364 days	Mon 10/1/29	Mon 9/30/30	$230,000.00	$271,400.00
39		**2031**	**364 days**	**Tue 10/1/30**	**Tue 9/30/31**	**$230,000.00**	**$271,400.00**
40		Planning, Engineering, & Design	364 days	Tue 10/1/30	Tue 9/30/31	$230,000.00	$271,400.00
41		**2032**	**365 days**	**Wed 10/1/31**	**Thu 9/30/32**	**$230,000.00**	**$271,400.00**
42		Planning, Engineering, & Design	365 days	Wed 10/1/31	Thu 9/30/32	$230,000.00	$271,400.00
43		**2033**	**364 days**	**Fri 10/1/32**	**Fri 9/30/33**	**$230,000.00**	**$271,400.00**
44		Planning, Engineering, & Design	364 days	Fri 10/1/32	Fri 9/30/33	$230,000.00	$271,400.00
45		**2034**	**364 days**	**Sat 10/1/33**	**Sat 9/30/34**	**$230,000.00**	**$271,400.00**
46		Planning, Engineering, & Design	364 days	Sat 10/1/33	Sat 9/30/34	$230,000.00	$271,400.00
47		**2035**	**364 days**	**Sun 10/1/34**	**Sun 9/30/35**	**$945,000.00**	**$1,115,100.00**
48		Lands & Damages	364 days	Sun 10/1/34	Sun 9/30/35	$30,000.00	$35,400.00
49		Planning, Engineering, & Design	364 days	Sun 10/1/34	Sun 9/30/35	$915,000.00	$1,079,700.00
50		**2036 (Source: Witherspoon/Ortona)**	**365 days**	**Mon 10/1/35**	**Tue 9/30/36**	**$6,740,124.29**	**$7,953,346.66**
51		Beach Replenishment	112 days	Thu 11/1/35	Thu 2/21/36	$5,760,124.29	$6,796,946.66
52		Planning, Engineering, & Design	365 days	Mon 10/1/35	Tue 9/30/36	$570,000.00	$672,600.00
53		Construction Management	112 days	Thu 11/1/35	Thu 2/21/36	$410,000.00	$483,800.00
54		**2037**	**364 days**	**Wed 10/1/36**	**Wed 9/30/37**	**$330,000.00**	**$389,400.00**
55		Planning, Engineering, & Design	364 days	Wed 10/1/36	Wed 9/30/37	$330,000.00	$389,400.00
56		**2038**	**364 days**	**Thu 10/1/37**	**Thu 9/30/38**	**$230,000.00**	**$271,400.00**
57		Planning, Engineering, & Design	364 days	Thu 10/1/37	Thu 9/30/38	$230,000.00	$271,400.00



B5. RISK AND UNCERTAINTY ANALYSIS

A Cost and Schedule Risk Analysis was conducted according to the procedures outlined in 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.

B.5.1 Risk Analysis Methods

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. Initially, the estimates included the contingencies developed during the Total Project Cost Summary certification from the previous years. Once the borrow areas were determined for the individual events and the TSP established, the PDT convened to reassess the existing Risk Register in order to take the specifically identified sand sources for each event into consideration.

The entire PDT participated in a risk analysis brainstorming session to identify risks associated with the tentatively selected plan. The risks were listed in the risk register, which is a tool commonly used in project planning and risk analysis, and evaluated by the PDT. The actual Risk Register is provided in Attachment A. Assumptions were made as to the likelihood and impact of each risk item, as well as the probability of occurrence and magnitude of the impact if it were to occur. A risk model was then developed in order to establish contingencies to apply to the project cost. Risks were evaluated for the following features of work:

- 17 Beach Replenishment
  - Mob, Demob & Preparatory Work
  - Dredging
  - Beach Fill (via Truck Haul)
- 30 Planning, Engineering and Design
- 31 Construction Management
- 01 Lands and Damages

After the model was run, the results were reviewed and all parameters were re-evaluated by the PDT as a sanity check of assumptions and inputs. Adjustments were made to the analysis accordingly and the final contingency was established. The contingency was applied to the tentatively selected plan estimate in the Total Project Cost Summary in order to obtain the Fully Funded Cost.

B.5.2 Risk Analysis Results

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.

Based on the risks that were assessed for the project, the resultant contingencies were 21% for the Main Segments and 18% for Sunny Isles Segment. The complete breakdown of results can be viewed in the Cost and Schedule Risk Analysis report provided in Attachment A.

B6. TOTAL PROJECT COST SUMMARY

The Total Project Cost Summary (TPCS) addresses inflation through project completion (accomplished by escalation to mid-point of construction per ER 1110-2-1302, Appendix C, Page C-2). It is based on the scope of the Tentatively Selected Plan and the official project schedule. The TPCS includes Federal and non-Federal costs for Lands and Damages, all construction features, PED, S&A, along with the appropriate contingencies and escalation associated with each of these activities. The TPCS is formatted according to the CWWBS and uses Civil Works Construction Cost Indexing System (CWCCIS) factors for escalation (EM 1110-2-1304) of construction costs and Office of Management and Budget (EC 11-2-18X, 20 Feb 2008) factors for escalation of PED and S&A costs.

The Total Project Cost Summary was prepared using the MCACES/MII cost estimate on the Tentatively Selected Plan, as well as the contingencies set by the risk analysis and the official project schedule.

B.6.1 Total Project Cost Summary Spreadsheet

Refer to the Total Project Cost Summary Spreadsheet on the next page.

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

PROJECT: **Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment**
PROJECT NO: P2 113082
LOCATION: Miami-Dade County, Florida

DISTRICT: SAJ Jacksonville District TPCS PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC): 2016									
						Effective Price Level Date: 1 OCT 15									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **10/1/2014** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
10	BREAKWATER & SEAWALLS	$0	$0	-	$0	-	$0	$0	$0	$3,608	$3,608	-	$0	$0	$3,608
17	BEACH REPLENISHMENT	$133,847	$28,108	21%	$161,955	1.9%	$136,349	$28,633	$164,982	$109,267	$274,249	4.9%	$143,075	$30,046	$282,388
	CONSTRUCTION ESTIMATE TOTALS:	$133,847	$28,108		$161,955	1.9%	$136,349	$28,633	$164,982	$112,875	$277,857	4.9%	$143,075	$30,046	$285,996
01	LANDS AND DAMAGES	$210	$44	21%	$254	1.9%	$214	$45	$259	$1,842	$2,101	5.3%	$225	$47	$2,114
30	PLANNING, ENGINEERING & DESIGN	$9,025	$1,895	21%	$10,920	3.4%	$9,335	$1,960	$11,295	$13,666	$24,961	12.4%	$10,488	$2,203	$26,357
31	CONSTRUCTION MANAGEMENT	$2,870	$603	21%	$3,473	3.4%	$2,969	$623	$3,592	$5,810	$9,402	13.3%	$3,363	$706	$9,879
	PROJECT COST TOTALS:	$145,952	$30,650	21%	$176,602		$148,866	$31,262	**$180,128**	$134,193	**$314,321**	5.6%	$157,152	$33,002	$324,347

ESTIMATED FEDERAL COST:	**56.1%**	**$181,959**
ESTIMATED NON-FEDERAL COST:	**43.9%**	**$142,388**
ESTIMATED TOTAL PROJECT COST:		**$324,347**

______________________ CHIEF, COST ENGINEERING, Matthew Cunningham

______________________ PROJECT MANAGER, Jason Harrah

______________________ CHIEF, REAL ESTATE, Audrey Ormerod

______________________ CHIEF, PLANNING, Eric Bush

______________________ CHIEF, ENGINEERING, Laureen Borochaner

______________________ CHIEF, OPERATIONS, Jim Jeffords

______________________ CHIEF, CONSTRUCTION, Stephen Duba

______________________ CHIEF, CONTRACTING, Carlos Clark

______________________ CHIEF, PM-PB, Daniel Haubner

______________________ CHIEF, DPM, David Hobbie

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			16-Nov-14	Program Year (Budget EC):			2016					
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
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*
	Miami Beach Segments (ALL)													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	BEACH FILL	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	ASSOCIATED GENERAL ITEMS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$0	$0	0%	**$0**		$0	$0	$0			$0	$0	$0
01	LANDS AND DAMAGES	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$900	$189	21%	$1,089	3.4%	$931	$195	$1,126	2020Q2	17.7%	$1,096	$230	$1,326
	Planning & Environmental Compliance	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Engineering & Design	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$250	$53	21%	$303	3.4%	$259	$54	$313	2020Q2	17.7%	$304	$64	$368
	Contracting & Reprographics	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Engineering During Construction	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Physical Monitoring	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Environmental Monitoring	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$1,150	$242		$1,392		$1,189	$250	$1,439			$1,401	$294	$1,695

Filename: DadeCoSPP_MainSegment_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham
PREPARED: 11/18/2014

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016					
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
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*
	Miami Beach "Hot Spot" Segments 2016													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,690	$775	21%	$4,464	1.9%	$3,759	$789	$4,548	2016Q2	0.5%	$3,777	$793	$4,570
17	BEACH FILL	$27,296	$5,732	21%	$33,028	1.9%	$27,806	$5,839	$33,645	2016Q2	0.5%	$27,939	$5,867	$33,806
17	ASSOCIATED GENERAL ITEMS	$565	$119	21%	$684	1.9%	$576	$121	$697	2016Q2	0.5%	$579	$121	$700
	CONSTRUCTION ESTIMATE TOTALS:	$31,551	$6,626	21%	**$38,176**		$32,140	$6,749	$38,890			$32,294	$6,782	$39,076
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2016Q1	0.0%	$31	$6	$37
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2016Q1	0.0%	$103	$22	$125
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2016Q1	0.0%	$559	$117	$676
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2016Q1	0.0%	$47	$10	$56
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2016Q2	1.0%	$355	$75	$430
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2017Q2	1.0%	$52	$11	$63
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2017Q2	0.0%	$52	$11	$63
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2016Q2	1.0%	$428	$90	$518
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$33,116	$6,954		$40,070		$33,759	$7,089	$40,848			$33,920	$7,123	$41,043

Filename: DadeCoSPP_MainSegment_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham
PREPARED: 11/18/2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016					
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
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***
	Surfside Segment 2017													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,478	$730	21%	$4,209	1.9%	$3,543	$744	$4,287	2017Q2	2.5%	$3,631	$762	$4,393
17	BEACH FILL	$21,680	$4,553	21%	$26,233	1.9%	$22,085	$4,638	$26,723	2017Q2	2.5%	$22,632	$4,753	$27,384
17	ASSOCIATED GENERAL ITEMS	$448	$94	21%	$541	1.9%	$456	$96	$552	2017Q2	2.5%	$467	$98	$565
	CONSTRUCTION ESTIMATE TOTALS:	$25,606	$5,377	21%	**$30,983**		$26,084	$5,478	$31,562			$26,730	$5,613	$32,343
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2016Q3	1.0%	$31	$6	$37
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2016Q3	1.9%	$105	$22	$128
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2016Q3	1.9%	$569	$120	$689
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2016Q3	1.9%	$47	$10	$57
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2017Q2	4.9%	$369	$77	$446
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2018Q2	4.9%	$54	$11	$66
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2018Q2	1.9%	$53	$11	$64
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2017Q2	4.9%	$445	$93	$538
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$27,171	$5,706		**$32,877**		$27,703	$5,818	$33,520			$28,403	$5,965	**$34,368**

Filename: DadeCoSPP_MainSegment_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham
PREPARED: 11/18/2014

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016	FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Haulover Park Segment 2019													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$203	$43	21%	$246	1.9%	$207	$43	$250	2019Q1	6.1%	$220	$46	$266
17	BEACH FILL	$4,741	$996	21%	$5,736	1.9%	$4,829	$1,014	$5,844	2019Q1	6.1%	$5,123	$1,076	$6,199
17	ASSOCIATED GENERAL ITEMS	$135	$28	21%	$164	1.9%	$138	$29	$167	2019Q1	6.1%	$146	$31	$177
	CONSTRUCTION ESTIMATE TOTALS:	$5,079	$1,067	21%	**$6,146**		$5,174	$1,087	$6,261			$5,489	$1,153	$6,642
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2018Q3	5.0%	$32	$7	$39
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2018Q3	10.0%	$114	$24	$138
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2018Q3	10.0%	$615	$129	$744
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2018Q3	10.0%	$51	$11	$62
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2019Q1	12.2%	$395	$83	$477
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	12.2%	$58	$12	$70
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	10.0%	$57	$12	$69
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2019Q1	12.2%	$476	$100	$576
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$6,644	$1,395		**$8,040**		$6,793	$1,426	$8,219			$7,286	$1,530	**$8,816**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016	FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
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***
	Miami Beach Non-Hot Spots 2019													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$5,224	$1,097	21%	$6,321	1.9%	$5,322	$1,118	$6,439	2019Q2	6.6%	$5,674	$1,191	$6,865
17	BEACH FILL	$29,784	$6,255	21%	$36,038	1.9%	$30,340	$6,371	$36,712	2019Q2	6.6%	$32,347	$6,793	$39,140
17	ASSOCIATED GENERAL ITEMS	$607	$127	21%	$734	1.9%	$618	$130	$748	2019Q2	6.6%	$659	$138	$798
	CONSTRUCTION ESTIMATE TOTALS:	$35,615	$7,479	21%	**$43,094**		$36,280	$7,619	$43,899			$38,680	$8,123	$46,803
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2018Q3	5.0%	$32	$7	$39
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2018Q3	10.0%	$114	$24	$138
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2018Q3	10.0%	$615	$129	$744
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2018Q3	10.0%	$51	$11	$62
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2019Q2	13.3%	$398	$84	$482
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	13.3%	$59	$12	$71
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	10.0%	$57	$12	$69
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2019Q2	13.3%	$480	$101	$581
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$37,180	$7,808		**$44,987**		$37,898	$7,959	$45,857			$40,486	$8,502	**$48,988**

Filename: DadeCoSPP_MainSegment_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

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

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:			16-Nov-14 01-Oct-14	Program Year (Budget EC): 2016 Effective Price Level Date: 1 OCT 15				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Bal Harbor Segment 2019													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,478	$730	21%	$4,209	1.9%	$3,543	$744	$4,287	2019Q2	6.6%	$3,778	$793	$4,571
17	BEACH FILL	$16,070	$3,375	21%	$19,445	1.9%	$16,371	$3,438	$19,809	2019Q2	6.6%	$17,453	$3,665	$21,119
17	ASSOCIATED GENERAL ITEMS	$346	$73	21%	$418	1.9%	$352	$74	$426	2019Q2	6.6%	$375	$79	$454
	CONSTRUCTION ESTIMATE TOTALS:	$19,894	$4,178	21%	**$24,072**		$20,266	$4,256	$24,522			$21,606	$4,537	$26,144
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2018Q3	5.0%	$32	$7	$39
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2018Q3	10.0%	$114	$24	$138
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2018Q3	10.0%	$615	$129	$744
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2018Q3	10.0%	$51	$11	$62
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2019Q2	13.3%	$398	$84	$482
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	13.3%	$59	$12	$71
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2020Q3	10.0%	$57	$12	$69
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2019Q2	13.3%	$480	$101	$581
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$21,459	$4,506		**$25,966**		$21,884	$4,596	$26,480			$23,412	$4,917	**$28,329**

Filename: DadeCoSPP_MainSegment_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham
PREPARED: 11/18/2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			16-Nov-14 / 01-Oct-14	Program Year (Budget EC): 2016 / Effective Price Level Date: 1 OCT 15				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	ESC (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	Miami Beach "Hot Spot" Segments 2021													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$493	$104	21%	$597	1.9%	$502	$105	$608	2021Q2	10.9%	$557	$117	$674
17	BEACH FILL	$10,527	$2,211	21%	$12,737	1.9%	$10,723	$2,252	$12,975	2021Q2	10.9%	$11,894	$2,498	$14,392
17	ASSOCIATED GENERAL ITEMS	$242	$51	21%	$293	1.9%	$247	$52	$299	2021Q2	10.9%	$274	$57	$331
	CONSTRUCTION ESTIMATE TOTALS:	$11,262	$2,365	21%	**$13,627**		$11,472	$2,409	$13,881			$12,725	$2,672	$15,398
01	LANDS AND DAMAGES	$30	$6	21%	$36	1.9%	$31	$6	$37	2020Q3	9.3%	$33	$7	$40
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21%	$121	3.4%	$103	$22	$125	2020Q3	18.9%	$123	$26	$149
	Engineering & Design	$540	$113	21%	$653	3.4%	$559	$117	$676	2020Q3	18.9%	$664	$139	$804
	Reviews, ATRs, IEPRs, VE	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21%	$54	3.4%	$47	$10	$56	2020Q3	18.9%	$55	$12	$67
	Engineering During Construction	$340	$71	21%	$411	3.4%	$352	$74	$426	2021Q2	22.4%	$431	$90	$521
	Physical Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2022Q3	22.4%	$63	$13	$77
	Environmental Monitoring	$50	$11	21%	$61	3.4%	$52	$11	$63	2022Q3	18.9%	$61	$13	$74
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21%	$496	3.4%	$424	$89	$513	2021Q2	22.4%	$519	$109	$628
	Project Operation:	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$12,827	$2,694		**$15,520**		$13,091	$2,749	$15,840			$14,676	$3,082	**$17,758**

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Main Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham
PREPARED: 11/18/2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016	FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level:			01-Oct-14	Effective Price Level Date:			1 OCT 15					
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***
	Surfside Segment 2022													
10	BREAKWATER & SEAWALLS	$0	$0	21%	$ -	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,060	$643	21%	$ 3,702	1.9%	$3,117	$655	$3,772	2022Q1	12.6%	$3,509	$737	$4,246
17	BEACH FILL	$1,699	$357	21%	$ 2,056	1.9%	$1,731	$364	$2,095	2022Q1	12.6%	$1,949	$409	$2,358
17	ASSOCIATED GENERAL ITEMS	$82	$17	21%	$ 99	1.9%	$83	$17	$101	2022Q1	12.6%	$94	$20	$113
	CONSTRUCTION ESTIMATE TOTALS:	$4,841	$1,017	21%	**5,858**		$4,931	$1,036	$5,967			$5,551	$1,166	$6,717
01	LANDS AND DAMAGES	$30	$6	21%	$ 36	1.9%	$31	$6	$37	2021Q3	11.5%	$34	$7	$41
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$0	$0	21.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning & Environmental Compliance	$100	$21	21.0%	121	3.4%	$103	$22	$125	2021Q3	23.7%	$128	$27	$155
	Engineering & Design	$540	$113	21.0%	653	3.4%	$559	$117	$676	2021Q3	23.7%	$691	$145	$836
	Reviews, ATRs, IEPRs, VE	$0	$0	21.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	21.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Contracting & Reprographics	$45	$9	21.0%	54	3.4%	$47	$10	$56	2021Q3	23.7%	$58	$12	$70
	Engineering During Construction	$340	$71	21.0%	411	3.4%	$352	$74	$426	2022Q1	26.1%	$443	$93	$537
	Physical Monitoring	$50	$11	21.0%	61	3.4%	$52	$11	$63	2023Q3	26.1%	$65	$14	$79
	Environmental Monitoring	$50	$11	21.0%	61	3.4%	$52	$11	$63	2023Q3	23.7%	$64	$13	$77
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$86	21.0%	496	3.4%	$424	$89	$513	2022Q1	26.1%	$535	$112	$647
	Project Operation:	$0	$0	21.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	21.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$6,406	$1,345		**7,751**		$6,550	$1,375	$7,925			$7,569	$1,590	**$9,159**

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

PROJECT: **Dade County Beach Erosion Control and Hurricane Protection Project, Sunny Isles Segment**
PROJECT NO: P2 113082
LOCATION: Miami-Dade County, Florida

DISTRICT: SAJ Jacksonville District TPCS PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC): 2016									
						Effective Price Level Date: 1 OCT 15									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: **10/1/2014** ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***				***M***	***N***	***O***
10	BREAKWATER & SEAWALLS	$0	$0	-	$0	-	$0	$0	$0	$1,647	$1,647	-	$0	$0	$1,647
17	BEACH REPLENISHMENT	$62,120	$11,182	18%	$73,301	1.9%	$63,281	$11,391	$74,671	$31,325	$105,996	14.5%	$72,466	$13,044	$116,835
	CONSTRUCTION ESTIMATE TOTALS:	$62,120	$11,182		$73,301	1.9%	$63,281	$11,391	$74,671	$32,972	$107,643	14.5%	$72,466	$13,044	$118,482
01	LANDS AND DAMAGES	$90	$16	18%	$106	1.9%	$92	$17	$108	$373	$481	22.5%	$112	$20	$505
30	PLANNING, ENGINEERING & DESIGN	$7,515	$1,353	18%	$8,868	3.4%	$7,773	$1,399	$9,172	$683	$9,855	59.7%	$12,412	$2,234	$15,329
31	CONSTRUCTION MANAGEMENT	$1,230	$221	18%	$1,451	3.4%	$1,272	$229	$1,501	$941	$2,442	62.0%	$2,061	$371	$3,373
	PROJECT COST TOTALS:	$70,955	$12,772	18%	$83,727		$72,418	$13,035	**$85,453**	$34,969	**$120,422**	20.2%	$87,051	$15,669	$137,690

______________________ CHIEF, COST ENGINEERING, Matthew Cunningham

______________________ PROJECT MANAGER, Jason Harrah

______________________ CHIEF, REAL ESTATE, Audrey Ormerod

______________________ CHIEF, PLANNING, Eric Bush

______________________ CHIEF, ENGINEERING, Laureen Borochaner

______________________ CHIEF, OPERATIONS, Jim Jeffords

______________________ CHIEF, CONSTRUCTION, Stephen Duba

______________________ CHIEF, CONTRACTING, Carlos Clark

______________________ CHIEF, PM-PB, Daniel Haubner

CHIEF, DPM, David Hobbie

ESTIMATED FEDERAL COST:	**62.7%**	**$86,331**
ESTIMATED NON-FEDERAL COST:	**37.3%**	**$51,358**
ESTIMATED TOTAL PROJECT COST:		**$137,690**

Filename: DadeCoSPP_SunnyIsles_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Sunny Isles Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			16-Nov-14	Program Year (Budget EC):			2016					
		Effective Price Level:			1-Oct-14	Effective Price Level Date:			1 OCT 15					
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*
	Sunny Isles Segment													
10	BREAKWATER & SEAWALLS	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	BEACH FILL	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	ASSOCIATED GENERAL ITEMS	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$0	$0	0%	**$0**		$0	$0	$0			$0	$0	$0
01	LANDS AND DAMAGES	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$2,790	$502	18%	$3,292	3.4%	$2,886	$519	$3,405	2027Q3	58.1%	$4,564	$821	$5,385
	Planning & Environmental Compliance	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Engineering & Design	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Reviews, ATRs, IEPRs, VE	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$775	$140	18%	$915	3.4%	$802	$144	$946	2027Q3	58.1%	$1,268	$228	$1,496
	Contracting & Reprographics	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Engineering During Construction	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Planning During Construction	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Operations	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Operation:	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$3,565	$642		$4,207		$3,687	$664	$4,351			$5,832	$1,050	$6,881

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Sunny Isles Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District
PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016					
		Effective Price Level:			1-Oct-14	Effective Price Level Date:			1 OCT 15					
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***
	Sunny Isles Segment 2016													
10	BREAKWATER & SEAWALLS	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,473	$625	18%	$4,099	1.9%	$3,538	$637	$4,175	2016Q2	0.5%	$3,555	$640	$4,195
17	BEACH FILL	$25,292	$4,552	18%	$29,844	1.9%	$25,764	$4,638	$30,402	2016Q2	0.5%	$25,887	$4,660	$30,547
17	ASSOCIATED GENERAL ITEMS	$528	$95	18%	$623	1.9%	$538	$97	$635	2016Q2	0.5%	$541	$97	$638
	CONSTRUCTION ESTIMATE TOTALS:	$29,293	$5,273	18%	**$34,566**		$29,840	$5,371	$35,212			$29,983	$5,397	$35,380
01	LANDS AND DAMAGES	$30	$5	18%	$35	1.9%	$31	$6	$36	2015Q4	-0.4%	$30	$5	$36
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$90	$16	18%	$106	3.4%	$93	$17	$110	2016Q1	0.0%	$93	$17	$110
	Planning & Environmental Compliance	$100	$18	18%	$118	3.4%	$103	$19	$122	2016Q2	0.0%	$103	$19	$122
	Engineering & Design	$540	$97	18%	$637	3.4%	$559	$101	$659	2016Q1	0.0%	$559	$101	$659
	Reviews, ATRs, IEPRs, VE	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$25	$5	18%	$30	3.4%	$26	$5	$31	2016Q2	0.0%	$26	$5	$31
	Contracting & Reprographics	$45	$8	18%	$53	3.4%	$47	$8	$55	2016Q1	0.0%	$47	$8	$55
	Engineering During Construction	$340	$61	18%	$401	3.4%	$352	$63	$415	2016Q2	1.0%	$355	$64	$419
	Physical Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2017Q3	1.0%	$52	$9	$62
	Environmental Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2017Q3	0.0%	$52	$9	$61
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$74	18%	$484	3.4%	$424	$76	$500	2016Q2	1.0%	$428	$77	$505
	Project Operation:	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$30,973	$5,575		$36,548		$31,578	$5,684	$37,262			$31,728	$5,711	$37,439

Filename: DadeCoSPP_SunnyIsles_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Sunny Isles Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:			**16-Nov-14** 1-Oct-14	Program Year (Budget EC): Effective Price Level Date:			2016 1 OCT 15					
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***
	Sunny Isles Segment 2026													
10	BREAKWATER & SEAWALLS	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$3,473	$625	18%	$4,099	1.9%	$3,538	$637	$4,175	2026Q2	22.5%	$4,333	$780	$5,113
17	BEACH FILL	$23,105	$4,159	18%	$27,263	1.9%	$23,536	$4,237	$27,773	2026Q2	22.5%	$28,824	$5,188	$34,012
17	ASSOCIATED GENERAL ITEMS	$489	$88	18%	$577	1.9%	$498	$90	$588	2026Q2	22.5%	$610	$110	$720
	CONSTRUCTION ESTIMATE TOTALS:	$27,067	$4,872	18%	**$31,939**		$27,572	$4,963	$32,536			$33,767	$6,078	$39,845
01	LANDS AND DAMAGES	$30	$5	18%	$35	1.9%	$31	$6	$36	2025Q3	20.7%	$37	$7	$44
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$180	$32	18%	$212	3.4%	$186	$34	$220	2025Q3	45.3%	$270	$49	$319
	Planning & Environmental Compliance	$100	$18	18%	$118	3.4%	$103	$19	$122	2026Q2	45.3%	$150	$27	$177
	Engineering & Design	$540	$97	18%	$637	3.4%	$559	$101	$659	2025Q3	45.3%	$811	$146	$957
	Reviews, ATRs, IEPRs, VE	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$50	$9	18%	$59	3.4%	$52	$9	$61	2026Q2	45.3%	$75	$14	$89
	Contracting & Reprographics	$45	$8	18%	$53	3.4%	$47	$8	$55	2025Q3	45.3%	$68	$12	$80
	Engineering During Construction	$340	$61	18%	$401	3.4%	$352	$63	$415	2026Q2	49.9%	$527	$95	$622
	Physical Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2027Q3	49.9%	$78	$14	$91
	Environmental Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2027Q3	45.3%	$75	$14	$89
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$74	18%	$484	3.4%	$424	$76	$500	2026Q2	49.9%	$636	$114	$750
	Project Operation:	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$28,862	$5,195		**$34,057**		$29,429	$5,297	$34,726			$36,494	$6,569	**$43,063**

Filename: DadeCoSPP_SunnyIsles_TPCS Sep 2014 r1_061015.xlsx
TPCS

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

**** CONTRACT COST SUMMARY ****

PROJECT: Dade County Beach Erosion Control and Hurricane Protection Project, Sunny Isles Segment
LOCATION: Miami-Dade County, Florida
This Estimate reflects the scope and schedule in report; Draft Limited Reevaluation Report and Environmental Assessment

DISTRICT: SAJ Jacksonville District PREPARED: 11/18/2014
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared:			**16-Nov-14**	Program Year (Budget EC):			2016	FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level:			1-Oct-14	Effective Price Level Date:			1 OCT 15					
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***
	Sunny Isles Segment 2036													
10	BREAKWATER & SEAWALLS	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
17	MOB/DEMOB	$299	$54	18%	$353	1.9%	$305	$55	$360	2036Q1	48.5%	$453	$81	$534
17	BEACH FILL	$5,305	$955	18%	$6,260	1.9%	$5,404	$973	$6,377	2036Q1	48.5%	$8,027	$1,445	$9,472
17	ASSOCIATED GENERAL ITEMS	$156	$28	18%	$184	1.9%	$159	$29	$188	2036Q1	48.5%	$236	$43	$279
	CONSTRUCTION ESTIMATE TOTALS:	$5,760	$1,037	18%	**$6,797**		$5,868	$1,056	$6,924			$8,716	$1,569	$10,285
01	LANDS AND DAMAGES	$30	$5	18%	$35	1.9%	$31	$6	$36	2035Q3	47.1%	$45	$8	$53
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$180	$32	18%	$212	3.4%	$186	$34	$220	2035Q3	129.5%	$427	$77	$504
	Planning & Environmental Compliance	$100	$18	18%	$118	3.4%	$103	$19	$122	2036Q1	129.5%	$237	$43	$280
	Engineering & Design	$540	$97	18%	$637	3.4%	$559	$101	$659	2035Q3	129.5%	$1,282	$231	$1,512
	Reviews, ATRs, IEPRs, VE	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$50	$9	18%	$59	3.4%	$52	$9	$61	2036Q1	129.5%	$119	$21	$140
	Contracting & Reprographics	$45	$8	18%	$53	3.4%	$47	$8	$55	2035Q3	129.5%	$107	$19	$126
	Engineering During Construction	$340	$61	18%	$401	3.4%	$352	$63	$415	2036Q1	135.2%	$827	$149	$976
	Physical Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2037Q3	135.2%	$122	$22	$144
	Environmental Monitoring	$50	$9	18%	$59	3.4%	$52	$9	$61	2037Q3	129.5%	$119	$21	$140
31	CONSTRUCTION MANAGEMENT													
	Construction Management	$410	$74	18%	$484	3.4%	$424	$76	$500	2036Q1	135.2%	$998	$180	$1,177
	Project Operation:	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	18%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$7,555	$1,360		**$8,915**		$7,724	$1,390	$9,114			$12,998	$2,340	**$15,337**

B7. COST DX TPCS CERTIFICATION

The Tentatively Selected Plan estimate, as well as a full Cost and Schedule Risk Analysis and Total Project Cost Summary has undergone Cost Review and Certification by the Walla Walla Mandatory Center of Expertise, prior to submittal of the Final Report.

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

SAJ - PN 113082
Dade County Beach Erosion Control and Protection Project
Miami-Dade County, FL

The Dade County Florida Shore Protection Project, as presented by the Jacksonville District, has undergone a successful Cost Agency Technical Review (Cost ATR) of remaining costs, 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 cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of March 6, 2015, the Cost MCX certifies the estimated total project cost:

Main Segment

FY2016 Remaining Costs:	$ 180,128,000 (Cost ATR Certified)
FY2014 Spent Costs:	$ 134,193,000 (From SAJ Programs & PM)
Fully Funded Costs:	$ 324,347,000 including Spent Costs

Sunny Isles Segment

FY2016 Remaining Costs:	$ 85,453,000 (Cost ATR Certified)
FY2014 Spent Costs:	$ 34,969,000 (From SAJ Programs & PM)
Fully Funded Costs:	$ 137,690,000 including Spent Costs

Note: Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. 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.

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Date: 2015.03.06 10:55:42 -08'00'

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

ATTACHMENT A
COST AND SCHEDULE RISK ANALYSIS

US Army Corps
of Engineers®

Dade County – Main Segment, Florida
Periodic Beach Renourishment

Project Cost and Schedule Risk Analysis Report

Prepared by:

U.S. Army Corps of Engineers,
Jacksonville District

February 2015

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LIST OF FIGURES

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EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Jacksonville District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the Dade County Main Segment, Florida project. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

The project is an ongoing effort consisting of nourishing several segments of Dade County beaches through the application of dredging offshore material and pumping onto the beaches for land-based construction, as well as mining sand from an upland sand mine and hauling it to the beach for land-based construction. Most of the future work proposes to utilize the St. Lucie and Martin County offshore borrow areas, as well as upland sand mines as the sand source; although not approved borrow sources for this project, they have been identified as the best potential source at this time since all of Dade County's authorized borrow areas have been depleted with the exception of Bakers Haulover Inlet Ebb Shoal and Lummus Park. Work also includes beach tilling, turbidity monitoring, turtle nest monitoring, endangered species monitoring and construction/vibration controls and monitoring.

The project has nearly 50% construction complete ($137M of an estimated $320M). The estimated project base cost for the remaining work approximates $146M in 2015 dollars and excludes any contingency or escalation.

This CSRA study focused on the remaining construction, design and construction management costs. The comparatively minor Lands and Damages cost of $210,000 does little to affect the risks and outcome. Based on the results of the analysis and the added real estate contingency, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) recommends a contingency value near $31M or approximately 21% of base project cost at an 80% confidence level of successful execution.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency per cent values will be reported, cost values rounded.

Table ES-1. Construction Contingency Results

Remaining Costs (Construction, Design and Management)			
Confidence Level	**Base Cost**	**Contingency $**	**Contingency (%)**
5%	$145,952,000	$6,056,420	4%
50%	$145,952,000	$22,202,997	15%
80%	$145,952,000	**$31,057,071**	**21%**
90%	$145,952,000	$36,689,746	25%

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The PDT worked through the risk register in December 2014, focusing on the construction, design and construction management risks, real estate risks excluded. Noting that approximately 50% of the construction has been completed, many of the risks have either been realized or now well understood. The study outcome identified key cost and schedule risks resulting in an approximate 21% contingency of the costs studied.

Cost Risks: From the CSRA, the key or greater identified Cost Risks include:

- Fuel Price: Estimates indicate that volatile fuel prices can have a strong influence in dredging costs, mobilization as well as during actual equipment use. While prices have become more stable in the recent past, this project could well go into year 2025. The out-year pricing is much less predictable. In addition, this project has long hauls to and from the identified borrow sources, making fuel a much larger cost factor compared to other similar type projects.

- Bidding Climate: This is one of the few beach renourishment projects along Florida's east coast that does not have a strict environmental window. However, if the work overlaps the busy season for hopper dredges and other beach renourishment projects, there could be an impact to contractor's bids.

- Mods and Claims: There is an inherent risk for contract mods and claims. A number of possible risks for modifications have been modeled under other risk items (i.e. quantities, material characterisitics, etc.), but this risk option is in place to cover any other possible risk for a contract modification.

- Acquisition Strategy: This is tied largely to the funding stream. Due to the expense of the long haul and the duration required for hauling larger quantities, there may be multiple contracts in order to accomplish the work, which would ultimately increase the project costs due to the multiple mobilizations.

- Availability of Borrow Areas: There are two offshore borrow areas that have been identified. One only has about 500,000 CY of material and can only supply one of the remaining renourishments. The other offshore borrow area has 4.6 million CY available, which is enough to supply the entire project. The upland sand sources that have been identified have an abundant supply of sand. However, depending on the quantity of material, they can be a more expensive option. If the larger quantity renourishments have to be completed using upland sources, there may be a cost increase.

Schedule Risks: Schedule risks indicate a duration uncertainty which can also be translated into cost impacts. Since the renourishment cycles are based on assumed annual cycles which are contingent upon approvals and funding availability, schedule risks are dampened, each annual event less reliant on previous annual cycles. The greatest identified schedule risks include:

- Funding Stream: Funding stream affects each scheduled annual event. Delayed funding pushes needed renourishments farther into the future.

- Review and Authorization Delays: Approval of the new borrow areas would delay the start of the renourishment events.

- Haul/Pumping Distance: There are some options to reduce the haul distance (especially for the upland sources), which would decrease the contract duration.

Recommendations: Further iterative project and risk study is important throughout the remaining years of Federal participation in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the PDT control, while certain risks can be managed to lessen impact in cost and time. The more critical items that warrant attention are:

- Work to identify and procure quality borrow sources close to the project location. This brings dividends related to haul time and productivity. Closer borrow sources are key in decreasing the cost and risk impacts to this project.

MAIN REPORT

1.0 PURPOSE

Following the requirements of the US Army Corps of Engineers (USACE) risk analysis processes, the Jacksonville District identifies and presents recommended strategies for efficiently managing the total project cost and schedule for the remaining work on Dade County Main Segment renourishments.

2.0 BACKGROUND

The project is an ongoing effort consisting of nourishing several segments of Dade County beaches through the application of dredging offshore material and pumping onto the beaches for land-based construction, as well as mining sand from an upland sand mine and hauling it to the beach for land-based construction. Most of the future work proposes to utilize the St. Lucie and Martin County offshore borrow areas, as well as upland sand mines as the sand source; although not approved borrow sources for this project, they have been identified as the best potential source at this time since all of Dade County's authorized borrow areas have been depleted with the exception of Bakers Haulover Inlet Ebb Shoal and Lummus Park. Work also includes beach tilling, turbidity monitoring, turtle nest monitoring, endangered species monitoring and construction/vibration controls and monitoring.

The project has nearly 50% construction complete ($137M of an estimated $320M). The estimated project base cost for the remaining work approximates $146M in 2015 dollars and excludes any contingency or escalation.

As a part of this effort, Jacksonville 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 the Tentatively Selected Plan. That tasking also included providing a risk analysis study to establish the resulting cost and schedule contingencies.

3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for 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 construction features, design and construction management. The small Lands and Damages costs have little bearing on the risks.

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 Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project 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, schedules and risk register were developed and provided by the Jacksonville District for risk study. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of concerns, 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 Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local District staff to provide expertise and information gathering. The District PDT conducted a November 2014 risk identification meeting, completing a draft risk register in support of a risk analysis study and modeling. Participants in the risk identification meetings included:

EN-TC	USACE - Jacksonville District	Cost Engineer
PM-WN	USACE - Jacksonville District	Project Manager
PD-EC	USACE - Jacksonville District	Permitting
PD-E	USACE - Jacksonville District	NEPA
EN-WC	USACE - Jacksonville District	Coastal Engineer
EN-DW	USACE - Jacksonville District	Engineering Technical Lead
EN-GG	USACE - Jacksonville District	Geologist
PD-PN	USACE - Jacksonville District	Planning Technical Lead
PD-ES	USACE - Jacksonville District	Cultural Resources
PD-D	USACE - Jacksonville District	Economics

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. There may be inherent characteristics or conditions of the project or external influences, events, or conditions such as funding stream, weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Formal PDT meeting were held with the District office for the purposes of identifying and assessing risk factors. The meetings included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, biology, environmental, structural, contracting, 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. 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. The discussions were captured in a draft risk register, refined following quantitative study.

4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) 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 Appendix A for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions 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 project.

a. The District provided current MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The MII and Current Working Estimate files served as the basis for the initial cost and schedule risk analyses.

b. The risk analysis considers that approximately 50% of the project construction is now complete and a culmination of lessons is included in the estimate and considerations made within the risk analysis.

c. Schedules are analyzed for impact to the project cost in terms of delayed funding, uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.

d. The Cost Engineering 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.

e. Greater focus was placed on high and moderate risk level impacts, as identified in the risk register and 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 remaining years of Federal participation. 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 P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

Cost contingency for the Construction risks, design and construction management (including schedule impacts converted to dollars) was quantified as approximately $30 million at the P80 confidence level (20% of the baseline cost estimate for those features).

Table 1. Construction Cost Contingency Summary

Remaining Costs (Construction, Design and Management)			
Confidence Level	**Base Cost**	**Contingency $**	**Contingency (%)**
5%	$145,952,000	$5,983,249	4%
50%	$145,952,000	$21,316,498	12%
80%	$145,952,000	**$29,685,981**	**20%**
90%	$145,952,000	$35,135,613	24%

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.

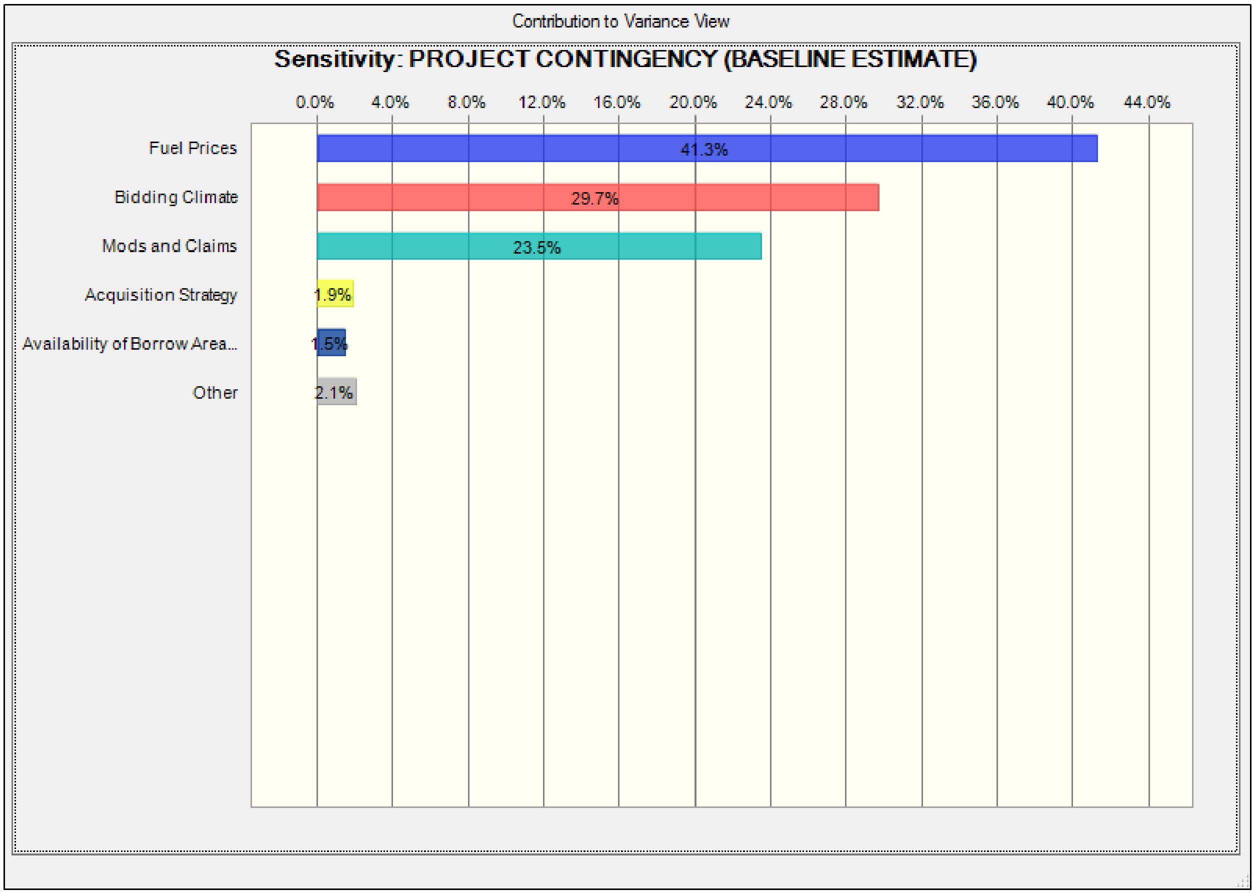
Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the remaining years of Federal participation. Together with the risk register, sensitivity analysis 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 and the respective value variance 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



6.3 Schedule and Contingency Risk Analysis

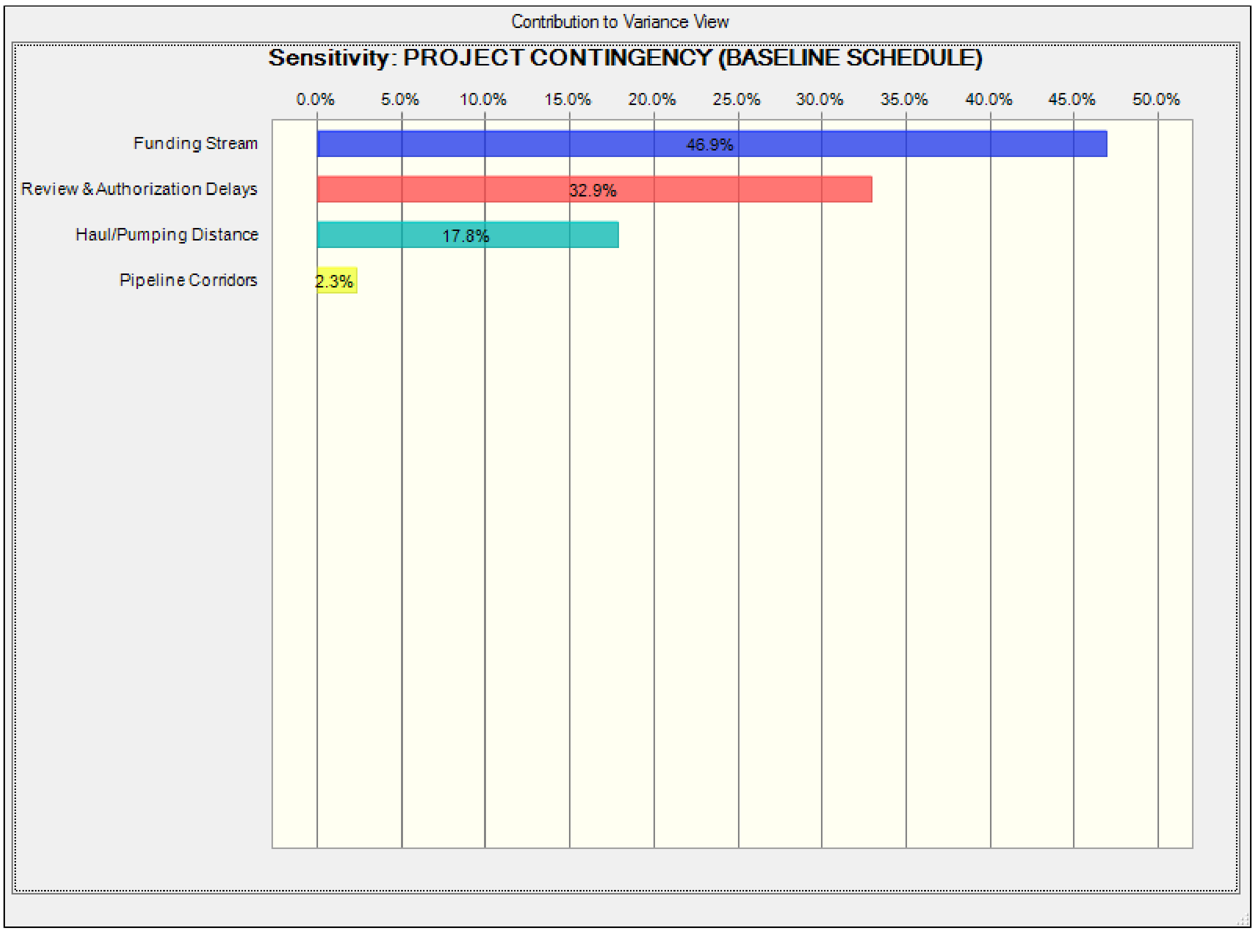
The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the recommended 13 months with a P80 confidence level. The schedule duration contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency.

Table 2. Schedule Duration Contingency Summary

CSRA Forecast (Confidence Level)	Base Schedule (mo)	Contingency (mo)	Contingency %
5%	120	1	1%
50%	120	9	7%
80%	120	13	11%
90%	120	15	13%

Figure 2. Schedule Sensitivity Analysis



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 and schedule comparison summaries are provided in Table 3 and Table 4 respectively. Additional major findings and observations of the risk analysis are listed below.

The PDT worked through the risk register in November 2014. The key risk drivers identified through sensitivity analysis suggest a cost contingency of $31M and schedule risks adding another 13 months, both at an 80% confidence level.

Cost Risks: From the CSRA, the key or greater identified Cost Risks include:

- Fuel Price: Estimates indicate that volatile fuel prices can have a strong influence in dredging costs, mobilization as well as during actual equipment use. While prices have become more stable in the recent past, this project could well go into year 2025. The out-year pricing is much less predictable. In addition, this project has long hauls to and from the identified borrow sources, making fuel a much larger cost factor compared to other similar type projects.

- Bidding Climate: This is one of the few beach renourishment projects along Florida’s east coast that does not have a strict environmental window. However, if the work overlaps the busy season for hopper dredges and other beach renourishment projects, there could be an impact to contractor’s bids.

- Mods and Claims: There is an inherent risk for contract mods and claims. A number of possible risks for modifications have been modeled under other risk items (i.e. quantities, material characterisitics, etc.), but this risk option is in place to cover any other possible risk for a contract modification.

- Acquisition Strategy: This is tied largely to the funding stream. Due to the expense of the long haul and the duration required for hauling larger quantities, there may be multiple contracts in order to accomplish the work, which would ultimately increase the project costs due to the multiple mobilizations.

- Availability of Borrow Areas: There are two offshore borrow areas that have been identified. One only has about 500,000 CY of material and can only supply one of the remaining renourishments. The other offshore borrow area has 4.6 million CY available, which is enough to supply the entire project. The upland sand sources that have been identified have an abundant supply of sand. However, depending on the quantity of material, they can be a more expensive option. If the larger quantity renourishments have to be completed using upland sources, there may be a cost increase.

Schedule Risks: Schedule risks indicate a duration uncertainty which can also be translated into cost impacts. The greatest identified schedule risks include:

- Funding Stream: Funding stream affects each scheduled annual event. Delayed funding pushes needed renourishments farther into the future.

- Review and Authorization Delays: Approval of the new borrow areas would delay the start of the renourishment events.

- Haul/Pumping Distance: There are some options to reduce the haul distance (especially for the upland sources), which would decrease the contract duration.

Table 3. Construction Cost Comparison Summary (Uncertainty Analysis)

Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
5%	$145,952,000	$5,983,248.52	$151,935,249	4.10%
10%	$145,952,000	$9,048,731.45	$155,000,731	6.20%
15%	$145,952,000	$10,808,827.31	$156,760,827	7.41%
20%	$145,952,000	$12,627,749.40	$158,579,749	8.65%
25%	$145,952,000	$14,198,620.77	$160,150,621	9.73%
30%	$145,952,000	$15,788,887.84	$161,740,888	10.82%
35%	$145,952,000	$17,180,424.44	$163,132,424	11.77%
40%	$145,952,000	$18,907,153.57	$164,859,154	12.95%
45%	$145,952,000	$20,183,157.26	$166,135,157	13.83%
50%	$145,952,000	$21,316,497.99	$167,268,498	14.61%
55%	$145,952,000	$22,731,794.39	$168,683,794	15.57%
60%	$145,952,000	$24,154,754.68	$170,106,755	16.55%
65%	$145,952,000	$25,473,706.46	$171,425,706	17.45%
70%	$145,952,000	$26,703,927.94	$172,655,928	18.30%
75%	$145,952,000	$28,176,091.36	$174,128,091	19.31%
80%	**$145,952,000**	**$29,685,981.36**	**$175,637,981**	**20.34%**
85%	$145,952,000	$31,756,895.81	$177,708,896	21.76%
90%	$145,952,000	$35,135,613.01	$181,087,613	24.07%
95%	$145,952,000	$38,439,274.15	$184,391,274	26.34%

Table 4. Construction Schedule Comparison Summary (Uncertainty Analysis)

Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
5%	120.0 Months	0.7 Months	120.8 Months	0.59%
10%	120.0 Months	2.4 Months	122.5 Months	2.02%
15%	120.0 Months	3.4 Months	123.4 Months	2.81%
20%	120.0 Months	4.3 Months	124.4 Months	3.61%
25%	120.0 Months	5.0 Months	125.0 Months	4.16%
30%	120.0 Months	5.7 Months	125.8 Months	4.77%
35%	120.0 Months	6.3 Months	126.4 Months	5.29%
40%	120.0 Months	7.2 Months	127.2 Months	5.96%
45%	120.0 Months	7.9 Months	127.9 Months	6.55%
50%	120.0 Months	8.6 Months	128.6 Months	7.15%
55%	120.0 Months	9.2 Months	129.3 Months	7.69%
60%	120.0 Months	10.0 Months	130.0 Months	8.30%
65%	120.0 Months	10.7 Months	130.7 Months	8.90%
70%	120.0 Months	11.5 Months	131.5 Months	9.56%
75%	120.0 Months	12.2 Months	132.3 Months	10.20%
80%	**120.0 Months**	**13.3 Months**	**133.3 Months**	**11.05%**
85%	120.0 Months	14.0 Months	134.1 Months	11.69%
90%	120.0 Months	15.0 Months	135.1 Months	12.53%
95%	120.0 Months	16.9 Months	137.0 Months	14.11%

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.

The CSRA study serves as a "road map" towards project improvements and reduced risks over time. The PDT should include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the remaining years of Federal participation is important in support of remaining within an approved budget and appropriation.

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.

Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the remaining years of Federal participation. 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).

Specific Risks: Further iterative project and risk study is important throughout the remaining years of Federal participation in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the PDT control such as severe weather and sufficient and timely funding to complete. There are other risks that can be managed at the PDT level such as:

- Work to identify and procure quality borrow sources close to the project location. This brings dividends related to haul time and productivity. Closer borrow sources are key in decreasing the cost and risk impacts to this project.

- Identify and resolve the mitigation requirements and concerns in order to gain a better understanding of cost implications.

APPENDIX A

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
PROJECT & PROGRAM MGMT					
PPM-1	Scope Definition	Poorly defined scope could lead to higher costs and impacts to the schedule	Original project borrow sources were depleted; Current scope from an LRR that is under review includes offshore borrow area options as well as upland sand mines	LOW	LOW
PPM-2	Funding Stream	Receipt of funding in a timely manner could affect the cost and schedule	Should be good on the Fed side, but may see some issues with funding from the LS end (higher cost with borrow area further away- county may have difficulty with their share); this has an effect on when the renourishments are completed and could result in not all of the renourishments being completed prior to expiration of the federal participation.	MODERATE	HIGH
PPM-3	PPA Issues	Delay in an agreement could delay the project	PPA in place so no risk	LOW	LOW
PPM-4	Review & Authorization Delays	Delayed reviews and authorization would impact the schedule	Authorization in place, just need a new borrow area approved	LOW	HIGH
CONTRACT ACQUISITION RISKS					
CT-1	Acquisition Strategy	Multiple contracts possible which could increase cost	Based on funding limitations and the expense of a long haul, some segments may need to be completed under two separate contracts	MODERATE	LOW
CT-2	Acquisition Plan	Multiple CT methods available (MATOC, IFB, RFP, IDIQ, 8A), which represents uncertainty in contract cost and schedule. Impacts effort in award; some contract vehicles more conducive to lower cost	Most likely MATOC, but possibly IFB if MATOC not available	LOW	LOW
CT-3	Acquisition Delays	Bid opening could be delayed due to amendments, permit receipt, etc. which could affect schedule	Likely to occur, especially if using MATOC, but not a big schedule impact	LOW	LOW

Risk No.					
T-1	Volume Variations	Erosion rates may vary throughout the remaining years of Federal participation as monitoring information is collected and shorelines stabilize	Erosion rates have remained pretty stable over the life of the project; new surveys were used for volume calculations		
T-2	Renourishment Interval	Renourishment intervals could change based on storm events and funding	Project should have a steady renourishment interval once a new borrow source is identified; if funding is not available then renourishments get delayed		
T-3	Availability of Borrow Area/Sand	Could be a shortage in the amount of borrow material available for the life of the project	The Martin Co offshore borrow area only has 500,000 CY avail; St. Lucie has 4.6 mil CY; Upland sand sources have infinite quantity; the existing Bakers Haulover Ebb Shoal only has 300,000 CY available every 10 years; Based on the Alternative estimates for the borrow sources, using upland sand sources is roughly $3,700,000 more for Surfside Segment. Based on the Alternative estimates, using truck haul for the larger quantity jobs vs going offshore to St. Lucie Co. would be a savings of roughly $4,300,000 for all the events.		
T-4	Character of Materials	Lack of geotech investigations or presence of rock leads to uncertainity regarding the yield of suitable material from the borrow site	There is a lack of geotech investigation at this time as far as the number of borings in the offshore areas; presence of rock and dark color would be a large risk until after initial use of the borrow area; Very low risk involved with the upland sources		

T-5	Trucking Quantity	Logistics of hauling larger quantities of sand	There is a risk involved in hauling larger quantities of sand; increased truck traffic thru Miami-Dade Co. could be an issue, as well as the duration required for trucking and placing large quantities.	LOW	LOW

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
LANDS AND DAMAGES RISKS					
RE-1	Site Access	Availability of access areas	Access available for offshore and truck haul; minor cost risk involved with utilizing the truck haul access points	LOW	LOW
RE-2	Staging Areas	Availability of staging areas	Staging available on the beach; may need a staging area for the trucks as a waiting area	LOW	LOW
RE-3	Easements	Need to obtain perpetual easements	Easements in place	LOW	LOW
REGULATORY AND ENVIRONMENTAL RISKS					
ENV-1	Environmental Impacts & Mitigation	Could be impacts to hardbottoms, reefs and cultural resources at the project site or borrow area which would require additional investigation, coordination and permitting	Mitigation has already been completed for this project; however, there is potential for impacts within the pipeline corridors and will be on a per event basis; estimated to be 80-100 sqyd per corridor; potential for resources in the operational areas and new borrow area	LOW	LOW
ENV-2	Environmental Monitoring	Monitoring requirements as a result of hardbottom or reef impacts could impact cost and schedule	Shouldn't be any additonal monitoring requirements; have a list of 5 new corals; may need to do additional mapping	LOW	LOW
ENV-3	Environmental Restrictions	Required dredging windows and environmental restrictions could impact project cost and schedule	Already know all environmental restrictions and permit requirements; pipeline collars to anchor pipeline within corridors already accounted for within estimate;	LOW	LOW

ENV-4	Environmental Delays	Turtle takes and other wildlife impacts could delay the contract	There's not a large risk of turtle takes; there are requirements for turtle nest relocation during nesting season, but rarely causes cost impacts or delays	LOW	LOW
ENV-5	Permit Delays	Permit coordination	Any permit delays would only delay the contract which would be a small cost impact, not a total project schedule	LOW	LOW
ENV-6	NEPA	Project changes could require changes to NEPA document	NEPA required for new borrow area; usually have a good heads up that new NEPA required and don't see too many delays	LOW	LOW

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
CONSTRUCTION RISKS					
CO-1	Mods and Claims	Could be modifications and claims that impact cost and schedule	Always possible risk to a project; most mods on beach projects for VEQ (Quantity Estimates) or DSC	HIGH	LOW
CO-2	Staging Areas	Accessibility and location of staging areas could pose a risk to contractor	No risk to contractor; staging areas nearby and very accessible	LOW	LOW
CO-3	Safety Issues	Certain project requirements and existing features could pose a safety risk	If contractor is working during the winter and seas are rough, there could be safety issues for contractor; could be standby costs associated	LOW	LOW
ESTIMATE AND SCHEDULE RISKS					
ES-1	Production Estimates	Actual production can vary from what was assumed	Project has been constructed numerous times by the Corps, so actual historic data is availableto estimate pumpout rates; risk for fluctuation in dredging and hauling assumptions due to new borrow area; may be issues with hopper dredging to 60+ ft which affects production; truck haul production based on nearby Broward Co. SPP truck haul project	LOW	LOW
ES-2	Pipeline Corridors	Use of corridors could affect project cost	Estimate assumes one corridor to be used per event, but the hot spot and non-hot spot segments could use multiple corridors which would add interim mob costs	LOW	MODERATE
ES-3	Contract Markups	Actual contractor markups can vary from what was estimated	Typical historic big business markup percentages have been used in the estimate, but they can vary from markups contractor actually uses	LOW	LOW

ES-4	Subcontracting Plan	Subcontracting plan can vary	It is assumed the Contractor would sub all env and vibration monitoring work. Other associated general work could be sub'd, but sub-markups on other AG work would result in very negligible cost increase. Contractor could sub additional environmental monitoring	LOW	LOW
ES-5	Dredge Size/Type	Actual dredge size/type could vary from what was assumed	Estimate assumes a large hopper which would be most practical due to long haul distance and borrow area depths	LOW	LOW
ES-6	Haul/Pumping Distance	Could be some variation in hauling and pumping distance that may affect the cost and schedule	Current estimate for truck haul assumes use of the Ortona/Witherspoon mines due to material pricing; howveer, ACI is closer and has a cheaper hauling cost, but more expensive material cost based on quotes. The Martin Co. offshore borrow area was more cost effective, but does not have enough material to sustain project; estimate already assumes St. Lucie (more expensive) for all segments over 200,000 CY and the further of the two mines. Therefore variations would be more likely to result in cost decreases (ie negligible impact)	LOW	MODERATE

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
OTHER RISKS					
Programmatic Risks		(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)			
EXT-1	Bidding Climate	Severe economic swings can increase / decrease number of potential bidders.	Project doesn't have an environmental window, but could see issues if project completed during busy season	HIGH	LOW
EXT-2	Bid Protests	There is inherent risk of protests from the industry	Low risk	LOW	LOW
EXT-3	Court Injunctions	Could cause schedule delays	Low risk	LOW	LOW
EXT-4	Political Support/Opposition	Delays due to political ramifications are possible and could delay the work.	Dade county supports getting sand for the beach; counties have been consulted on use of their sand sources	LOW	LOW

EXT-5	Fuel Prices	Fluctuation in fuel costs could impact the contract cost	Fuel is always fluctuating and is a big factor in dredging projects, but has not been seen as a high risk on dredging projects	HIGH	LOW
EXT-6	Labor Availability	Labor Prices are fixed by Davis Bacon wage rates. Labor availability is subject to bidding climate.	Never been a risk on this project	LOW	LOW
EXT-7	Equipment Availability	Industry demand can have an effect on the available equipment; Dredge may have to come from further away, increasing mobilization costs; size/type of equipment available may vary	There is an inherent risk that a hopper will not be available to perform the work in the specified timeframe (due to the long haul which increases the project duration); could see impact costs affecting mobilization in contractor's proposals. While a 20% mob cost increase due to "impact fees" would result in marginal impacts, it is unlikely overall to incur these costs (overall low risk);	LOW	LOW
EXT-8	Weather	Severe weather causing damage to project during construction could cause schedule delays	Weather can be an issue, especially during the winter months. However, weather impacts are already captured in the historical production set used for the estimate. Additional impacts beyond what is captured in the historical analysis is unlikely.	LOW	LOW
EXT-9	Sea Level Rise	Sea Level Rise could impact the scope and schedule	Not expected to be a factor during the remaining years of Federal participation	LOW	LOW

US Army Corps of Engineers®

Dade County – Sunny Isles, Florida
Periodic Beach Renourishment

Project Cost and Schedule Risk Analysis Report

Prepared by:

U.S. Army Corps of Engineers,
Jacksonville District

February 2015

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EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Jacksonville District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the Dade County Sunny Isles, Florida project. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

The project is an ongoing effort consisting of nourishing several segments of Dade County beaches through the application of dredging offshore material and pumping onto the beaches for land-based construction, as well as mining sand from an upland sand mine and hauling it to the beach for land-based construction. Most of the future work proposes to utilize the St. Lucie and Martin County offshore borrow areas, as well as upland sand mines as the sand source; although not approved borrow sources for this project, they have been identified as the best potential source at this time since all of Dade County's authorized borrow areas have been depleted with the exception of Bakers Haulover Inlet Ebb Shoal and Lummus Park. Work also includes beach tilling, turbidity monitoring, turtle nest monitoring, endangered species monitoring and construction/vibration controls and monitoring.

The project has nearly 27% construction complete ($32M of an estimated $117M). The estimated project base cost for the remaining work approximates $71M in 2015 dollars and excludes any contingency or escalation.

This CSRA study focused on the remaining construction, design and construction management costs. The comparatively minor Lands and Damages cost of $90,000 does little to affect the risks and outcome. Based on the results of the analysis and the added real estate contingency, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) recommends a contingency value near $13M or approximately 18% of base project cost at an 80% confidence level of successful execution.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency per cent values will be reported, cost values rounded.

Table ES-1. Construction Contingency Results

Remaining Costs (Construction, Design and Management)			
Confidence Level	**Base Cost**	**Contingency $**	**Contingency (%)**
5%	$70,955,000	$2,693,657	4%
50%	$70,955,000	$8,749,449	12%
80%	**$70,955,000**	**$12,558,992**	**18%**
90%	$70,955,000	$14,417,935	20%

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The PDT worked through the risk register in December 2014, focusing on the construction, design and construction management risks, real estate risks excluded. Noting that approximately 25% of the construction has been completed, many of the risks have either been realized or now well understood. The study outcome identified key cost and schedule risks resulting in an approximate 18% contingency of the costs studied.

Cost Risks: From the CSRA, the key or greater identified Cost Risks include:

- Fuel Price: Estimates indicate that volatile fuel prices can have a strong influence in dredging costs, mobilization as well as during actual equipment use. While prices have become more stable in the recent past, the out-year pricing is much less predictable. In addition, this project has long hauls to and from the identified borrow sources, making fuel a much larger cost factor compared to other similar type projects.

- Bidding Climate: This is one of the few beach renourishment projects along Florida's east coast that does not have a strict environmental window. However, if the work overlaps the busy season for hopper dredges and other beach renourishment projects, there could be an impact to contractor's bids.

- Mods and Claims: There is a possibility for mods and claims on any project. Most mods on a beach project are for Variation in Estimated Quantities (VEQ) or a Differing Site Condition (DSC).

- Production Estimates: Since this is the longest haul seen for an east coast Florida beach project, possible production is a best estimate. Also, current estimate assumptions only include one dredge performing the work for the offshore borrow sources. Hauling rates are based on a nearby project, but may vary due to different conditions in the haul route.

- Availability of Borrow Areas: There are two offshore borrow areas that have been identified. One only has about 500,000 CY of material and can only supply one of the remaining renourishments. The other offshore borrow area has 4.6 million CY available, which is enough to supply the entire project. The upland sand sources that have been identified have an abundant supply of sand. However, depending on the quantity of material, they can be a more expensive option. If the larger quantity renourishments have to be completed using upland sources, there may be a cost increase.

Schedule Risks: Schedule risks indicate a duration uncertainty which can also be translated into cost impacts. Since the renourishment cycles are based on assumed annual cycles which are contingent upon approvals and funding availability, schedule risks are dampened, each annual event less reliant on previous annual cycles. The greatest identified schedule risks include:

- Funding Stream: Funding stream affects each scheduled annual event. Delayed funding pushes needed renourishments farther into the future.

- Review and Authorization Delays: Approval of the new borrow areas would delay the start of the renourishment events.

- Haul/Pumping Distance: There are some options to reduce the haul distance (especially for the upland sources), which would decrease the contract duration.

Recommendations: Further iterative project and risk study is important throughout the remaining years of Federal participation in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the PDT control, while certain risks can be managed to lessen impact in cost and time. The more critical items that warrant attention are:

- Work to identify and procure quality borrow sources close to the project location. This brings dividends related to haul time and productivity. Closer borrow sources are key in decreasing the cost and risk impacts to this project.

MAIN REPORT

1.0 PURPOSE

Following the requirements of the US Army Corps of Engineers (USACE) risk analysis processes, the Jacksonville District identifies and presents recommended strategies for efficiently managing the total project cost and schedule for the remaining work on Dade County Miami Beach renourishments.

2.0 BACKGROUND

The project is an ongoing effort consisting of nourishing several segments of Dade County beaches through the application of dredging offshore material and pumping onto the beaches for land-based construction, as well as mining sand from an upland sand mine and hauling it to the beach for land-based construction. Most of the future work proposes to utilize the St. Lucie and Martin County offshore borrow areas, as well as upland sand mines as the sand source; although not approved borrow sources for this project, they have been identified as the best potential source at this time since all of Dade County's authorized borrow areas have been depleted with the exception of Bakers Haulover Inlet Ebb Shoal and Lummus Park. Work also includes beach tilling, turbidity monitoring, turtle nest monitoring, endangered species monitoring and construction/vibration controls and monitoring.

The project has nearly 25% construction complete ($32M of an estimated $118M). The estimated project base cost for the remaining work approximates $71M in 2015 dollars and excludes any contingency or escalation.

As a part of this effort, Jacksonville 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 the Tentatively Selected Plan. That tasking also included providing a risk analysis study to establish the resulting cost and schedule contingencies.

3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for 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 construction features, design and construction management. The small Lands and Damages costs have little bearing on the risks.

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 Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project 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, schedules and risk register were developed and provided by the Jacksonville District for risk study. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of concerns, 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 Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local District staff to provide expertise and information gathering. The District PDT conducted a November 2014 risk identification meeting, completing a draft risk register in support of a risk analysis study and modeling. Participants in the risk identification meetings included:

EN-TC	USACE - Jacksonville District	Cost Engineer
PM-WN	USACE - Jacksonville District	Project Manager
PD-EC	USACE - Jacksonville District	Permitting
PD-E	USACE - Jacksonville District	NEPA
EN-WC	USACE - Jacksonville District	Coastal Engineer
EN-DW	USACE - Jacksonville District	Engineering Technical Lead
EN-GG	USACE - Jacksonville District	Geologist
PD-PN	USACE - Jacksonville District	Planning Technical Lead
PD-ES	USACE - Jacksonville District	Cultural Resources
PD-D	USACE - Jacksonville District	Economics

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. There may be inherent characteristics or conditions of the project or external influences, events, or conditions such as funding stream, weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Formal PDT meeting were held with the District office for the purposes of identifying and assessing risk factors. The meetings included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, biology, environmental, structural, contracting, 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. 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. The discussions were captured in a draft risk register, refined following quantitative study.

4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) 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 Appendix A for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions 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 project.

a. The District provided current MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The MII and Current Working Estimate files served as the basis for the initial cost and schedule risk analyses.

b. The risk analysis considers that approximately 25% of the project construction is now complete and a culmination of lessons is included in the estimate and considerations made within the risk analysis.

c. Schedules are analyzed for impact to the project cost in terms of delayed funding, uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.

d. The Cost Engineering 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.

e. Greater focus was placed on high and moderate risk level impacts, as identified in the risk register and 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 remaining years of Federal participation. 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 P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

Cost contingency for the Construction risks, design and construction management (including schedule impacts converted to dollars) was quantified as approximately $13 million at the P80 confidence level (18% of the baseline cost estimate for those features).

Table 1. Construction Cost Contingency Summary

Remaining Costs (Construction, Design and Management)			
Confidence Level	**Base Cost**	**Contingency $**	**Contingency (%)**
5%	$70,955,000	$2,658,955	4%
50%	$70,955,000	$8,550,966	12%
80%	**$70,955,000**	**$12,273,942**	**17%**
90%	$70,955,000	$14,079,190	20%

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.

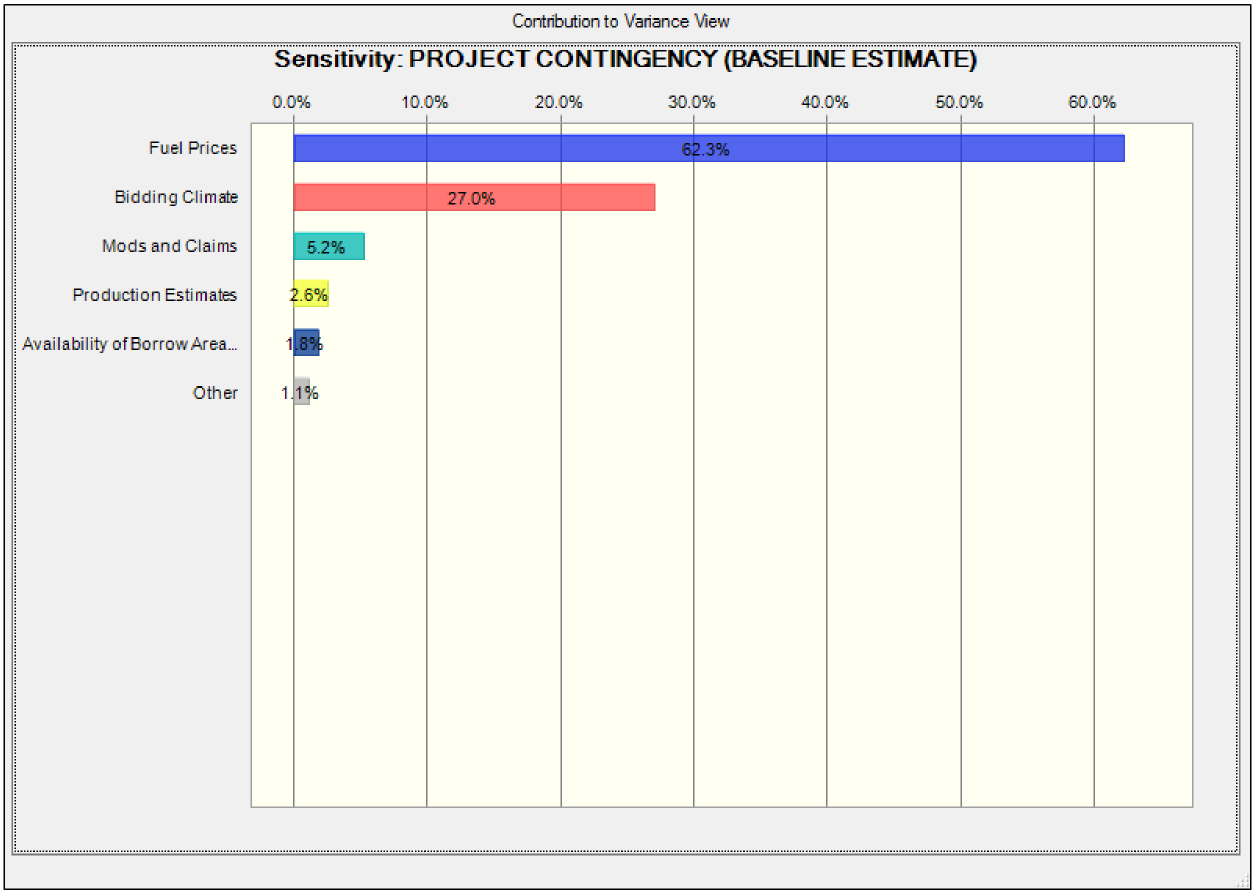
Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the remaining years of Federal participation. Together with the risk register, sensitivity analysis 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 and the respective value variance 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



6.3 Schedule and Contingency Risk Analysis

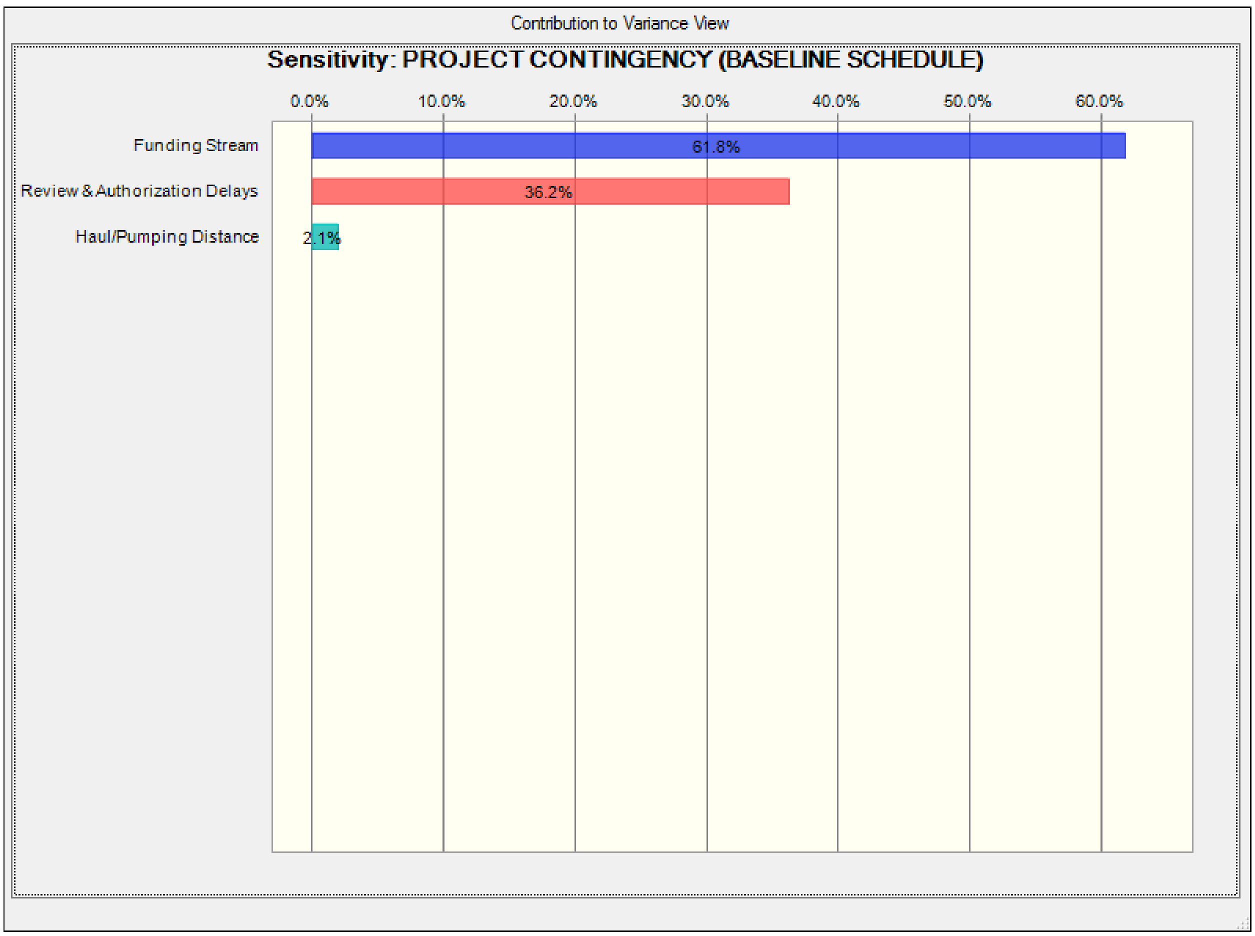
The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the recommended 13 months with a P80 confidence level. The schedule duration contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency.

Table 2. Schedule Duration Contingency Summary

CSRA Forecast (Confidence Level)	Base Schedule (mo)	Contingency (mo)	Contingency %
5%	276	2	1%
50%	276	9	3%
80%	276	13	5%
90%	276	16	6%

Figure 2. Schedule Sensitivity Analysis



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 and schedule comparison summaries are provided in Table 3 and Table 4 respectively. Additional major findings and observations of the risk analysis are listed below.

The PDT worked through the risk register in November 2014. The key risk drivers identified through sensitivity analysis suggest a cost contingency of $10.4M and schedule risks adding another 13 months, both at an 80% confidence level.

Cost Risks: From the CSRA, the key or greater identified Cost Risks include:

- Fuel Price: Estimates indicate that volatile fuel prices can have a strong influence in dredging costs, mobilization as well as during actual equipment use. While prices have become more stable in the recent past, the out-year pricing is much less predictable. In addition, this project has long hauls to and from the identified borrow sources, making fuel a much larger cost factor compared to other similar type projects.

- Bidding Climate: This is one of the few beach renourishment projects along Florida’s east coast that does not have a strict environmental window. However, if the work overlaps the busy season for hopper dredges and other beach renourishment projects, there could be an impact to contractor’s bids.

- Mods and Claims: There is a possibility for mods and claims on any project. Most mods on a beach project are for Variation in Estimated Quantities (VEQ) or a Differing Site Condition (DSC).

- Production Estimates: Since this is the longest haul seen for an east coast Florida beach project, possible production is a best estimate. Also, current estimate assumptions only include one dredge performing the work for the offshore borrow sources. Hauling rates are based on a nearby project, but may vary due to different conditions in the haul route.

- Availability of Borrow Areas: There are two offshore borrow areas that have been identified. One only has about 500,000 CY of material and can only supply one of the remaining renourishments. The other offshore borrow area has 4.6 million CY available, which is enough to supply the entire project. The upland sand sources that have been identified have an abundant supply of sand. However, depending on the quantity of material, they can be a more expensive option. If the larger quantity renourishments have to be completed using upland sources, there may be a cost increase.

Schedule Risks: Schedule risks indicate a duration uncertainty which can also be translated into cost impacts. The greatest identified schedule risks include:

- Funding Stream: Funding stream affects each scheduled annual event. Delayed funding pushes needed renourishments farther into the future.

- Review and Authorization Delays: Approval of the new borrow areas would delay the start of the renourishment events.

- Haul/Pumping Distance: There are some options to reduce the haul distance (especially for the upland sources), which would decrease the contract duration.

Table 3. Construction Cost Comparison Summary (Uncertainty Analysis)

Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
5%	$70,955,000	$2,658,955.18	$73,613,955	3.75%
10%	$70,955,000	$3,611,259.98	$74,566,260	5.09%
15%	$70,955,000	$4,407,734.28	$75,362,734	6.21%
20%	$70,955,000	$5,170,352.91	$76,125,353	7.29%
25%	$70,955,000	$5,796,513.26	$76,751,513	8.17%
30%	$70,955,000	$6,347,340.48	$77,302,340	8.95%
35%	$70,955,000	$6,925,043.47	$77,880,043	9.76%
40%	$70,955,000	$7,541,143.39	$78,496,143	10.63%
45%	$70,955,000	$8,077,809.38	$79,032,809	11.38%
50%	$70,955,000	$8,550,965.62	$79,505,966	12.05%
55%	$70,955,000	$9,167,646.12	$80,122,646	12.92%
60%	$70,955,000	$9,590,043.48	$80,545,043	13.52%
65%	$70,955,000	$10,099,973.10	$81,054,973	14.23%
70%	$70,955,000	$10,740,931.48	$81,695,931	15.14%
75%	$70,955,000	$11,525,412.46	$82,480,412	16.24%
80%	**$70,955,000**	**$12,273,941.54**	**$83,228,942**	**17.30%**
85%	$70,955,000	$13,249,826.43	$84,204,826	18.67%
90%	$70,955,000	$14,079,190.21	$85,034,190	19.84%
95%	$70,955,000	$15,575,502.75	$86,530,503	21.95%

Table 4. Construction Schedule Comparison Summary (Uncertainty Analysis)

Percentile	Baseline TPC	Contingency Amount	Baseline w/ Contingency	Contingency %
5%	276.0 Months	1.6 Months	277.7 Months	0.58%
10%	276.0 Months	3.1 Months	279.3 Months	1.13%
15%	276.0 Months	4.2 Months	280.3 Months	1.52%
20%	276.0 Months	5.1 Months	281.2 Months	1.84%
25%	276.0 Months	5.8 Months	282.0 Months	2.11%
30%	276.0 Months	6.3 Months	282.5 Months	2.30%
35%	276.0 Months	7.1 Months	283.2 Months	2.56%
40%	276.0 Months	7.8 Months	283.9 Months	2.82%
45%	276.0 Months	8.4 Months	284.5 Months	3.04%
50%	276.0 Months	9.1 Months	285.2 Months	3.29%
55%	276.0 Months	9.7 Months	285.8 Months	3.52%
60%	276.0 Months	10.3 Months	286.5 Months	3.74%
65%	276.0 Months	10.9 Months	287.1 Months	3.95%
70%	276.0 Months	11.6 Months	287.7 Months	4.19%
75%	276.0 Months	12.3 Months	288.4 Months	4.44%
80%	**276.0 Months**	**13.1 Months**	**289.2 Months**	**4.73%**
85%	276.0 Months	14.4 Months	290.5 Months	5.20%
90%	276.0 Months	15.5 Months	291.6 Months	5.62%
95%	276.0 Months	17.0 Months	293.1 Months	6.14%

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.

The CSRA study serves as a "road map" towards project improvements and reduced risks over time. The PDT should include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the remaining years of Federal participation is important in support of remaining within an approved budget and appropriation.

<u>Risk Management</u>: 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.

<u>Risk Analysis Updates</u>: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the remaining years of Federal participation. 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).

Specific Risks: Further iterative project and risk study is important throughout the remaining years of Federal participation in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the PDT control such as severe weather and sufficient and timely funding to complete. There are other risks that can be managed at the PDT level such as:

- Work to identify and procure quality borrow sources close to the project location. This brings dividends related to haul time and productivity. Closer borrow sources are key in decreasing the cost and risk impacts to this project.

- Identify and resolve the mitigation requirements and concerns in order to gain a better understanding of cost implications.

APPENDIX A

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
PROJECT & PROGRAM MGMT					
PPM-1	Scope Definition	Poorly defined scope could lead to higher costs and impacts to the schedule	Scope has been determined to include offshore borrow area options as well as upland sand mines	LOW	LOW
PPM-2	Funding Stream	Receipt of funding in a timely manner could affect the cost and schedule	Should be good on the Federal side, but may see some issues with funding from the LS end (higher cost with borrow area further away- county may have difficulty with Non-Fed)	MODERATE	HIGH
PPM-3	PPA Issues	Delay in an agreement could delay the project	PPA in place so no risk	LOW	LOW
PPM-4	Review & Authorization Delays	Delayed reviews and authorization would impact the schedule	Authorization in place, just need a new borrow area approved	LOW	HIGH
CONTRACT ACQUISITION RISKS					
CT-1	Acquisition Strategy	Multiple contracts possible which could increase cost	Based on funding limitations and the expense of a long haul, some segments will need to be completed under two separate contracts	LOW	LOW
CT-2	Acquisition Plan	Multiple CT methods available (MATOC, IFB, RFP, IDIQ, 8A), which represents uncertainty in contract cost and schedule. Impacts effort in award; some contract vehicles more conducive to lower cost	Most likely MATOC, but possibly IFB if MATOC not available	LOW	LOW
CT-3	Acquisition Delays	Bid opening could be delayed due to amendments, permit receipt, etc. which could affect schedule	Likely to occur, especially if using MATOC, but not a big schedule impact	LOW	LOW

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost	Project Schedule
				Risk Level*	Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
TECHNICAL RISKS					
T-1	Volume Variations	Erosion rates may vary throughout the remaining years of Federal participation as monitoring information is collected and shorelines stabilize	Erosion rates have remained pretty stable over the life of the project; new surveys were used for volume calculations	LOW	LOW
T-2	Renourishment Interval	Renourishment intervals could change based on storm events and funding	Project should have a steady renourishment interval once a new borrow source is identified; if funding is not available then renourishments get delayed	LOW	LOW
T-3	Availability of Borrow Area/Sand	Could be a shortage in the amount of borrow material available for the life of the project	The Martin Co offshore borrow area only has 500,000 CY avail; St. Lucie has 4.6 mil CY; Upland sand sources have infinite quantity; since truck haul is just slightly more expensive, could see a cost increase if upland sources are the only thing available	MODERATE	LOW
T-4	Character of Materials	Lack of geotech investigations or presence of rock leads to uncertainity regarding the yield of suitable material from the borrow site	There is a lack of geotech investigation at this time as far as the number of borings in the offshore areas; presence of rock and dark color would be a large risk until after initial use of the borrow area; Very low risk involved with the upland sources	LOW	LOW
T-5	Trucking Quantity	Logistics of hauling larger quantities of sand	There is a risk involved in hauling larger quantities of sand; increased truck traffic thru Miami-Dade Co. could be an issue, as well as the duration required for trucking and placing large quantities.	LOW	LOW

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost	Project Schedule
				Risk Level*	Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
LANDS AND DAMAGES RISKS					
RE-1	Site Access	Availability of access areas	Access available for offshore and truck haul; minor cost risk involved with utilizing the truck haul access points	LOW	LOW
RE-2	Staging Areas	Availability of staging areas	Staging available on the beach; may need a staging area for the trucks as a waiting area	LOW	LOW
RE-3	Easements	Need to obtain perpetual easements	Easements in place	LOW	LOW
REGULATORY AND ENVIRONMENTAL RISKS					
ENV-1	Environmental Impacts & Mitigation	Could be impacts to hardbottoms, reefs and cultural resources at the project site or borrow area which would require additional investigation, coordination and permitting	Mitigation will be on a per event basis and is estimated to be 80-100 sqyd per corridor; potential for resources in the operational areas and new borrow area	LOW	LOW
ENV-2	Environmental Monitoring	Monitoring requirements as a result of hardbottom or reef impacts could impact cost and schedule	Shouldn't be any additonal monitoring requirements; have a list of 5 new corals; may need to do additional mapping	LOW	LOW
ENV-3	Environmental Restrictions	Required dredging windows and environmental restrictions could impact project cost and schedule	Already know all environmental restrictions and permit requirements; pipeline collars to anchor pipeline within corridors already accounted for within estimate;	LOW	LOW
ENV-4	Environmental Delays	Turtle takes and other wildlife impacts could delay the contract	There's not a large risk of turtle takes; there are requirements for turtle nest relocation during nesting season, but rarely causes cost impacts or delays	LOW	LOW
ENV-5	Permit Delays	Permit coordination	Any permit delays would only delay the contract which would be a small cost impact, not a total project schedule	LOW	LOW
ENV-6	NEPA	Project changes could require changes to NEPA document	NEPA required for new borrow area; usually have a good heads up that new NEPA required and don't see too many delays	LOW	LOW

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost	Project Schedule
				Risk Level*	Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
CONSTRUCTION RISKS					
CO-1	Mods and Claims	Could be modifications and claims that impact cost and schedule	Always possible risk to a project; most mods on beach projects for VEQ (Quantity Estimates) or DSC	MODERATE	LOW
CO-2	Staging Areas	Accessibility and location of staging areas could pose a risk to contractor	No risk to contractor; staging areas nearby and very accessible	LOW	LOW
CO-3	Safety Issues	Certain project requirements and existing features could pose a safety risk	If contractor is working during the winter and seas are rough, there could be safety issues for contractor; could be standby costs associated	LOW	LOW
ESTIMATE AND SCHEDULE RISKS					
ES-1	Production Estimates	Actual production can vary from what was assumed	Project has been constructed numerous times by the Corps, so actual historic data is availableto estimate pumpout rates; risk for fluctuation in dredging and hauling assumptions due to new borrow area; may be issues with hopper dredging to 60+ ft which affects production; truck haul production based on nearby Broward Co. SPP truck haul project	MODERATE	LOW
ES-2	Pipeline Corridors	Use of corridors could affect project cost	Estimate assumes the same corridor as has been used in the past	LOW	LOW
ES-3	Contract Markups	Actual contractor markups can vary from what was estimated	Typical historic big business markup percentages have been used in the estimate, but they can vary from markups contractor actually uses	LOW	LOW
ES-4	Subcontracting Plan	Subcontracting plan can vary	Contractor could sub additional environmental monitoring	LOW	LOW
ES-5	Dredge Size/Type	Actual dredge size/type could vary from what was assumed	Estimate assumes a large hopper which would be most practical due to long haul distance and borrow area depths	LOW	LOW
ES-6	Haul/Pumping Distance	Could be some variation in hauling and pumping distance that may affect the cost and schedule	Current estimate for truck haul assumes use of the Ortona/Witherspoon mines due to material pricing; howvever, ACI is closer and has a cheaper hauling cost, but more expensive material cost based on quotes. The Martin Co. offshore orrow area was more cost effective, but does not have enough material to sustain project; estimate already assumes St. Lucie for all segments over 200,000 CY	MODERATE	MODERATE

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	Project Cost Risk Level*	Project Schedule Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)					
OTHER RISKS					
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)					
EXT-1	Bidding Climate	Severe economic swings can increase / decrease number of potential bidders.	Project doesn't have an environmental window, but could see issues if project completed during busy season	HIGH	LOW
EXT-2	Bid Protests	There is inherent risk of protests from the industry	Low risk	LOW	LOW
EXT-3	Court Injunctions	Could cause schedule delays	Low risk	LOW	LOW
EXT-4	Political Support/Opposition	Delays due to political ramifications are possible and could delay the work.	Dade county supports getting sand for the beach; counties have been consulted on use of their sand sources	LOW	LOW
EXT-5	Fuel Prices	Fluctuation in fuel costs could impact the contract cost	Fuel is always fluctuating and is a big factor in dredging projects, but has not been seen as a high risk on dredging projects	HIGH	LOW
EXT-6	Labor Availability	Labor Prices are fixed by Davis Bacon wage rates. Labor availability is subject to bidding climate.	Never been a risk on this project	LOW	LOW
EXT-7	Equipment Availability	Industry demand can have an effect on the available equipment; Dredge may have to come from further away, increasing mobilization costs; size/type of equipment available may vary	There is an inherent risk that a hopper will not be available to perform the work in the specified timeframe (due to the long haul which increases the project duration); could see impact costs affecting mobilization in contractor's proposals. While a 20% mob cost increase due to "impact fees" would result in marginal impacts, it is unlikely overall to incur these costs (overall low risk);	LOW	LOW
EXT-8	Weather	Severe weather causing damage to project during construction could cause schedule delays	Weather can be an issue, especially during the winter months. However, weather impacts are already captured in the historical production set used for the estimate. Additional impacts beyond what is capture in the historical analysis is unlikely.	LOW	LOW
EXT-9	Sea Level Rise	Sea Level Rise could impact the scope and schedule	Not expected to be a factor during the remaining years of Federal participation	LOW	LOW