RARITAN BAY AND SANDY HOOK BAY
UNION BEACH, NEW JERSEY

HURRICANE SANDY LIMITED REEVALUATION REPORT

Appendix C

Quantities & Costs (Cost Engineering)

U.S. Army Corps of Engineers
New York District

June 2017

Appendix C – Cost Engineering

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Introduction

This Appendix presents the detailed cost estimate and pertinent information for the recommended plan in the Hurricane Sandy Limited Reevaluation Report (HSRR) dated August 2016. The Recommended Plan, which is fully described in the Feasibility Report, can be defined according to the major construction elements and sub-elements or segments within three distinct areas of the Union Beach area. The three areas of the project are designated as the Raritan Bay shoreline, Chingarora Creek and Flat/East Creeks. The selected plan consists of a levee and floodwall alignment for the Chingarora Creek element that begins at the high ground near the intersections of Florence Avenue and Bank Street and ends at the northwestern end Shorefront element. The Shorefront element consists of a beach and dune incorporating terminal groins and revetments stretching from the Chingarora Creek levee floodwall alignment to the southeastern limit of the Dune that ties into the levee alignment near Flat Creek. The Flat/East Creeks element of the flood protection consists of a floodwall and levee alignment that begins at the southeastern limit of the Shorefront element and ties into the existing Keansburg levee at the eastern end of the project limits. The location of each of the sub-areas within the project area is shown in Section V of the Main Report.

It was determined that a change in the 2007 Authorized Plan alignment for the Chingarora Creek element was warranted between Ash Street and State Street due to this reach crossing the wetlands well within the CBRA boundary. The extent of realignment was constrained by the desire to not affect additional private real estate. The alignment change resulted in an increase in floodwall length of 6,465 LF, and a decrease in levee length of 3,998 LF. The additional wetland impact is relatively small. The other reaches along Bay Avenue and Chingarora Street, and around the Bayshore Regional Sewage Treatment Authority plant where the levee/floodwall alignment was adjacent to, along or slightly within the boundary, were not revised. Coordination was initiated with the regional office of the Fish and Wildlife Service. Further discussion on this issue is elsewhere in this study.

The anticipated phasing is as follows:

- Phase 1 will consist of the construction of shoreline protection which includes beachfill, terminal groins and revetment, and some relocation elements such as the outfall extension, dune overwalk, and dune walkways.
- Phase 2 will consist of the construction of 6,959 feet of levee and floodwall, sluice gates and drainage structures from just west of Flat Creek near the intersection of Union Avenue and Brook Avenue, then roughly parallel to Brook Avenue before turning south toward Bayview Avenue then Southwest along East Creek to just east of East Creek, tying into the west end of Phase 1. And approximately 3,388 line feet of interior levee located south of Jersey Avenue and behind the houses lining High and Harris Avenues to the intersection of High and Isabella Avenues on the west and along Harris and Willow Streets to the intersection of Willow Street and Wesley Avenue.
- Phase 3 will consist of the construction of 2,919 feet of levee and drainage structures along the Henry Hudson Trail and parallel to Jersey Avenue from just east of the bridge over East Creek, across the raising of Rose Lane, past Natco Lake to the tie-out with the Keansburg levee.
- Phase 4 will consist of the construction of 13,280 feet of levee and floodwall, and drainage structures from the high ground near the intersections of Florence Avenue and Bank Street, across Broadway, where a gated closure is required, continuing roughly parallel to Chingagora Creek and to the rear of the houses, past State Street, then turning parallel to Bay Avenue and Chingarora

Street before following the perimeter of the Regional Wastewater Treatment Plant, turning east toward Florence Avenue before following Dock Street and ending at the northwestern end of the Shorefront element.

- Phase 5 will consist of wetland mitigations.

Since prices for equipment and materials were obtained on various dates over the course of the development of the cost estimate, these costs were escalated to first quarter 2015 pricing using cost indexes obtained from the most recent version of the Civil Works Construction Cost Index System (CWCCIS). Once a single effective index date was established for all equipment and material pricing throughout the estimate, one comprehensive escalation was applied to these prices. An overall escalation of 0.9% was applied, which was obtained from the CWCCIS using indexes from first quarter 2015 to fourth quarter 2016. Indexes used were account code-specific.

Lands and Damages costs were developed for each contract reach.

The costs for the terminal groin and revetment construction in Phase 1 were developed by utilizing actual construction bid data from historical jobsites for similar work (Port Monmouth), as well as soliciting vendor quotes for major material costs, which included each of the stone classes (armor, underlayment, core/bedding stone), and geotextile. The material and delivery price for the stone was based on truck-hauling to the site from quarries in New Jersey with construction utilizing land-based equipment. Through multiple iterations of the cost estimate, equipment rates have been updated with the MII Region 1 Equipment Book most current at the time (2011 and 2014), labor rates were updated using Davis-Bacon rates from the project area, and current fuel costs were obtained from the Energy Information Administration website.

The beach fill cost was developed using a combination of a generic large hopper dredge Cost Engineering Dredge Estimating Program (CEDEP) with an average production rate of 190,000 cy per month and a pipeline CEDEP to pump sand to shore. Both CEDEP estimates were used to simulate the historical fact of a similar dredging operation for a similar project (Port Monmouth) in the vicinity, using a combination of a large hopper dredge and a pipeline dredge. For initial construction, beach fill placement is required to be coordinated with groin construction in order to prevent wasting material placement. If beach fill is placed in the seaward area of the groin before starting groin construction, the material must be first excavated out to place the stone once construction progresses that far out. Therefore, full beach sections are to be completed at the groin locations to once the groin construction is finished. The large hopper dredge is assumed to dredge the material, travel to a pump-out location, and the pipeline dredge is assumed to pump the sand to shore using a booster pump. There it will be placed and graded by a shore crew consisting of bulldozers and loaders.

The outfall extension, dune grass, and sand fence costs were developed with production rates obtained from a combination of the 2012 MII cost book, RS Means and pricing from websites, and vendor quotes for some of the line items. The dune grass and sand fence work will be completed after the beach fill work has been completed.

The Dune Overwalk and Dune Walkway were based on the cost in the 2001 Feasibility Study MCACES cost estimate and were escalated to second quarter 2014 from first quarter 2001 using Civil Works Construction Cost Index System (CWCCIS) Escalation Indices dated 31 Mar 2014 for account 02,

Relocation. These prices were escalated to first quarter 2015 using various indexes obtained from the CWCCIS.

The cost estimate for road raising, road relocations (account 02), levee construction (account 11), interior drainage work (account 15) in Phases 2, 3, 4 and 5 were developed with production rates obtained from a combination of the 2012 MII cost book, RS Means and pricing from websites, and vendor quotes for a few line items. A few items such as trash racks and aluminum stop logs under storm gate structure work item in Phase 2, 3, and 4 are based on 2001 Feasibility Study MCACES cost estimate and escalation for account 15, Floodway Control and Diversion Structure, from first quarter 2001 to second quarter 2014, using CWCCIS Escalation Indices dated 31 Mar 2014. These prices were escalated to first quarter 2015 using various indexes obtained from the CWCCIS.

The following items are based on historical Independent Government Estimates (IGEs) of similar projects with some adjustments to fit the current project location:

- Roller Gate Closure Structure in account 15 of Phase 4, which includes items from an MII bid box estimate for Plot and Green Ridge Sections, Phase 1 – Closure Structures and MSE Wall, Scranton PA, W912DR-04-R-0003, dated Dec 19, 2003. The original roller gate estimate for Green Ridge is 36' w x 8.4' h (or 302.4 SF), which is size adjusted by linking method in MII program to arrive with the $/sf cost for the required 350 SF (the required dimension is 7'x50'). Local factor is applied at 6.14% (NJ/PA=1.21/1.14) using 2014_PAX_3.2.1 _DoDAreaCostFactors20 Mar2014.pdf, and escalation factor 1.4548 is used for account 15 escalating from 1st Quarter 2004 to 2nd Quarter 2014 based on CWCCIS dated 31 Mar 2014. These prices were escalated to first quarter 2015 using various indexes obtained from the CWCCIS.

The Pump Station cost estimates are based on the pump station cost items in the IGE Greenbrook Flood Control Project (FCP) Segment R2 20080902 of New York District of Army Corps of Engineers. Actual quoted pump costs for 37,400 GPM pumps and 14,960 GPM pumps (Chesapeakeequipment.com) replaces the 40,400 gpm New York District pump cost. After costs are repriced by 2012 Cost Book, the remainder of the pump station items gets escalated from first quarter 2012 to second quarter 2014 for account 13 using CWCCIS Escalation Calculation dated 31 March 2014. In general, the Pump Station cost estimates are developed as follows:

- The 40 cfs Pumping Plant in account 13 of Phase 4 is excluded with unnecessary items from the Greenbrook IGE such as extra A.D. gate, extra sluice gates, steel stairways, brick veneer, fixed ladder, pipe rails, 22 linear feet of Headwall, Pump Station Outlet. A quoted pump cost for 40 cfs replaces the pump cost in the Greenbrook IGE. The remaining items are repriced to second quarter 2014.
- The 250 cfs Pumping Plant in account 13 of Phase 2 includes all repriced items from the Greenbrook IGE. A quoted pump cost for 250 cfs capacity replaces the pump cost in the Greenbrook IGE.
- The 100 cfs Pumping Plant in account 13 of Phase 2 includes all repriced items from the Greenbrook IGE. A quoted pump cost for 100 cfs capacity replaces the pump cost in the Greenbrook IGE.

Most recently, these costs were escalated to first quarter 2015 using various cost indexes obtained from the CWCCIS.

The unit cost $/acre of Wetland Monitoring and Wetlands Mitigations, in Phase 5, is based on the 2001 Feasibility Study MCACES cost estimate and escalation for account 06, Fish and Wildlife, from first quarter 2001 to second quarter 2014, using CWCCIS Escalation Indices dated 31 Mar 2014. It was subsequently escalated from second quarter 2014 to fourth quarter 2016 using the most recent CWCCIS index, dated March 13 2016. Number of acreages is revised to 25 acres to fit the current layout of wetland areas. However, since Wetland Monitoring is a project cost and not construction contract costs, and since it is accounted for in the Environmental Monitoring cost, it is excluded from PED costs.

Planning Engineering and Design (PED) cost is estimated at 12.4 percent of total of construction contract cost before contingency and escalation are applied. The PED percentage is a total of all percentages for various items such as project management, planning and environmental compliance, engineering, design, reviews, life cycle updates, contracting, engineering during construction, and planning during construction, which were all estimated and concurred by each discipline point of contact in NY Districts.

Construction Management (CM) is estimated at seven percent of total construction contract cost before contingency and escalation are applied. The CM percentage was established after considering efforts to accomplish future tasks such as supervision and assurance, and project management.

The 23.6% of overall contingency for construction accounts and the 9% of contingency for account 30 and 31 are the results of an Abbreviated Risk Analysis (ARA). These contingencies are applied in the Total Project Cost Summary (TPCS) with escalation applied to each contract.

The following are assumed construction start dates and completion schedule[1] (see Construction Schedule on page 18):

- Phase 1, Shoreline Protection. Proposed construction start date is in January2018. Construction duration is approximately 450 days. Construction midpoint period is assumed to be in August 2018.
- Phase 2, Construction of 6,959 feet of Levee and Floodwall, Sluice Gates and Drainage Structures. Proposed construction start date is in January 2019. Construction duration is approximately 912 days. Construction midpoint period is assumed to be in April 2020.
- Phase 3, Construction of 2,919 feet of Levee and Drainage Structures. Proposed construction start date is in July 2019. Construction duration is approximately 365 days. Construction midpoint period is assumed to be in January 2020.
- Phase 4, Construction of 13,280 feet of Levee and Drainage Structures. Proposed construction start date is in July 2019. Construction duration is approximately 1000 days. Construction midpoint period is assumed to be in April 2021.
- Phase 5, Wetland Mitigations. Proposed construction start date is in July 2018. Construction duration is approximately 365 days. Construction midpoint period is assumed to be in January 2019.

[1] Please note that compliance with Clean Air Act in the MII reflects the previous construction sequencing and will be updated during the review period.

Table C-1 shows the initial construction costs, or 'project first costs.'

Annualized costs are based on an economic project life of 50 years and an interest rate of 3.125%. The annual charges include the annualized first costs along with periodic nourishment every nine years, emergency beach fill, major rehab costs, coastal monitoring, federal inspection, environmental, and annual maintenance costs. These costs are shown in Table C-2.

Periodic renourishment is required to protect the integrity of the design dune and beach from the effects of long-term erosion and sea level rise. Renourishment at Union Beach will occur every nine years over the project life. Because of the fill limited quantity of 21,000 cy renourishment operations will be performed by trucking fill from an upland source (such as Amboy Aggregates, which is 8 miles away). The annualized renourishment cost is estimated to be $136,550 over the period of analysis. In addition to periodic renourishment, emergency beachfill may be necessary after significant coastal storms.

Rehabilitation. Significant portions of the overall project's components such as levees, beach berm, dune and drainage facilities are subject to damage from storms exceeding the design levels. The cost of repair after various flood events was weighted by their expected probability of occurrence to determine average annual rehabilitation costs.

Major Levee and Floodwall Rehabilitation Costs. During some extreme storm events, overtopping of the line of protection may result in significant damage to the levee and associated facilities. The cost of restoring or rehabilitating the project features after such an event has been evaluated and included in the economic assessment. The primary features subject to damage during an extreme event are; the levee earthwork, drainage outlets within the levees, and electrical/mechanical equipment at the storm gate and pump stations. Damage to the levee earthwork was assumed to be 35% of the initial cost. Repairs to interior drainage outlets within the levee were estimated to be 15% of the initial construction cost or $912,000. Repairs to the 100 cfs and 250 cfs pump stations were estimated to be $3,468,000 per station, approximately twice the cost of mechanical equipment, while repair of the storm sluice gates was estimated to cost $358,000. The frequency of such repairs has been evaluated based on the expected frequency of overtopping determined from the Flood Damage Analysis (HEC-FDA) flood damage simulations. The expected frequency of overtopping, which incorporates the impact of flood stage uncertainty, was determined to be 0.45% annually for the 15-foot NGVD levee.

Coastal monitoring costs include semi-annual surveys over the 50-year project life and environmental monitoring over the first nine years of the project. Environmental monitoring costs include monitoring costs over the 50-year project life and environmental monitoring over the first nine years of the project. Both coastal monitoring and environmental monitoring costs are based on the approved Feasibility Study Monitoring scope.

Operation & Maintenance and Replacements

Charges attributed to the operation and maintenance (O&M) of the flood control project consist of annualized replacement costs, repair, anticipated energy charges, and labor charges for the care and cleaning of project facilities. Project components requiring routine care include; the storm gate, levees and floodwalls, interior drainage closure and manhole structures, road closure gate, pump stations, beach dune grass and sand fence.

The major mechanical equipment within the storm gate and the interior drainage pump stations have anticipated life expectancies of 20-25 years. The cost of periodic equipment replacement has been estimated, annualized over the 50-year period of analysis and incorporated into the O&M charge. In addition, electric power requirements based on the anticipated frequency of pump station and storm gate operation have been added to the project' annual operation charge.

The O&M cost is based on the Green Brook FCP O&M crew rates with crew hours and annual frequencies modified to fit the current project at Union Beach, NJ. The Dune Maintenance cost is based on the assumption that two (2) equipment operators with 2 rental 140 hp dozers would take about one (1) eight-hour work day to move sand around in an event assuming six (6) events or six times a year. Labor rate and equipment rental rates are from RS Means Construction Building Data 2014 for Long Branch, NJ. Finally, the O&M costs for 250 cfs, 100 cfs, and 40 cfs pump stations are based on O&M cost model from the Deal project in NJ.

2001 vs. 2016 Cost Explanation and Comparison

Table C-3 shows a cost table with explanation and comparison between 2001 and 2016 estimates. In general, the cost increases in construction accounts 02, 10, 11, 13, 15, and 17 are due to phasing factors, markup differences, higher contingencies, material cost increases, and regulations that resulted in a major design change to the floodwall portion of construction. Phasing a high risk project presents design and construction issues that may result in cost increases as discussed in the abbreviated risk analysis. The 2001 estimate assumes a prime contractor with 13% markups, as well as performing most construction of the construction, whereas in today’s market condition a majority of the work would be subbed out. The 2016 estimate assumes subcontractors will be doing most of the construction which results in a layer of 21% markups in addition to 30% Prime markups. The subprime contractor work assignment and higher markups in 2016 estimate result in higher costs for most construction accounts. In 2016, an Abbreviated Risk Analysis (ARA) was completed in order to develop a contingency for the project cost based on risks, likelihood of risks, and their cost impacts. The resulting 23.6% averaged contingency was produced from the ARA boosted the overall construction cost. In 2001, 15% contingency was determined by an A/E firm based on their best judgments for most construction accounts (only account 15 Floodway Control-Diversion Structures got the highest contingency of 18%). In the 2016 estimate, material costs were updated with higher costs and reflect more recent historic costs than in the 2001 estimate. Finally, realignment changes to the Coastal Barrier Resources System (CBRS) boundary and updated engineering regulations which require T-walls with deep foundation in place of I-walls resulted in significant increases of footprint, mitigation requirements, and required heavy duty construction materials.

Table C-1. Project First Cost

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)							TOTAL PROJECT COST (FULLY FUNDED)			
							Program Year (Budget EC):			2017							
							Effective Price Level Date:			1 OCT 16							
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: 10/1/2015 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS		$1,746	$412	24%	$2,158	1.4%	$1,770	$417	$2,187	$0	$2,187	3.0%	$1,822	$430	$2,252
06	FISH & WILDLIFE FACILITIES		$10,680	$2,517	24%	$13,198	1.4%	$10,825	$2,551	$13,376	$0	$13,376	3.9%	$11,249	$2,651	$13,901
10	BREAKWATER & SEAWALLS		$10,547	$2,486	24%	$13,033	1.4%	$10,690	$2,520	$13,210	$0	$13,210	2.9%	$10,999	$2,592	$13,591
11	LEVEES & FLOODWALLS		$96,113	$22,654	24%	$118,767	1.4%	$97,415	$22,961	$120,375	$0	$120,375	7.4%	$104,652	$24,667	$129,319
13	PUMPING PLANT		$15,641	$3,687	24%	$19,328	1.4%	$15,853	$3,736	$19,589	$0	$19,589	7.3%	$17,009	$4,009	$21,018
15	FLOODWAY CONTROL & DIVERSION STRUCTURE		$12,526	$2,952	24%	$15,479	1.4%	$12,696	$2,992	$15,688	$0	$15,688	7.7%	$13,675	$3,223	$16,898
17	BEACH REPLENISHMENT		$26,433	$6,230	24%	$32,664	1.4%	$26,791	$6,315	$33,106	$0	$33,106	2.9%	$27,564	$6,497	$34,061
18	CULTURAL RESOURCE PRESERVATION		$623	$147	24%	$770	1.4%	$631	$149	$780	$0	$780	5.9%	$669	$158	$826
	CONSTRUCTION ESTIMATE TOTALS:		$174,311	$41,085		$215,396	1.4%	$176,671	$41,641	$218,312	$0	$218,312	6.2%	$187,639	$44,227	$231,866
01	LANDS AND DAMAGES		$13,730	$2,746	20%	$16,476	1.4%	$13,916	$2,783	$16,699	$0	$16,699	2.4%	$14,253	$2,851	$17,103
30	PLANNING, ENGINEERING & DESIGN		$21,615	$2,032	9%	$23,647	2.7%	$22,199	$2,087	$24,285	$0	$24,285	2.3%	$22,717	$2,135	$24,852
31	CONSTRUCTION MANAGEMENT		$12,201	$1,147	9%	$13,348	2.7%	$12,530	$1,178	$13,708	$0	$13,708	12.5%	$14,098	$1,325	$15,424
	PROJECT COST TOTALS:		$221,857	$47,010	21%	$268,866		$225,316	$47,689	**$273,005**	$0	**$273,005**	5.9%	$238,707	$50,538	**$289,245**
17	BEACH REPLENISHMENT	renourishments	$14,110	$2,540	18%	$16,650	1.4%	$14,302	$2,574	$16,876	$0			$24,038	$4,327	$28,364
	RENOURISHMENT ESTIMATE TOTALS:		$14,110	$2,540		$16,650	1.4%	$14,302	$2,574	$16,876	$0			$24,038	$4,327	$28,364
30	PLANNING, ENGINEERING & DESIGN	renourishments	$764	$72	9%	$835	2.7%	$784	$74	$858	$0			$2,925	$275	$3,200
31	CONSTRUCTION MANAGEMENT	renourishments	$790	$74	9%	$864	2.7%	$811	$76	$888	$0			$3,219	$303	$3,522
	PROJECT COST TOTALS:		$15,664	$2,686	17%	$18,350		$15,897	$2,724	**$18,621**	$0			$30,182	$4,904	**$35,086**

Table C-2. Annualized Costs

Project First Cost	$	273,005,000
Interest During Construction	$	20,402,000
Total Investment Cost:	$	293,407,000
Annual Costs		
Annualized Investment Cost (a)	$	11,675,500
Annualized Scheduled Renourishment (b)	$	136,600
Annualized Emergency Beach Fill Cost (c)	$	50,700
Annual Coastal Monitoring Cost	$	79,400
Annual Federal Inspection Cost	$	52,800
Annual Rehabilitation Cost	$	46,000
Annual Environmental Monitoring Cost	$	85,400
Subtotal	$	12,126,400
Annual Dune Maintenance Cost (d)	$	18,200
Annual Outfall Maintenance Cost (e)	$	54,100
Annual Groin and Revetment Maintenance (f)	$	52,400
Annual Levee and Floodwall Maintenance (g)	$	86,600
Annual Interior Drainage O&M (g)	$	120,900
Annual Roller Gate O&M (g)	$	23,000
Annual Chingarora 40 cfs Pump Station O&M (i)	$	120,000
Annual East Creek 100 cfs Pump Station O&M (i)	$	160,000
Annual Flat Creek 250 cfs Pump Station O&M (i)	$	250,000
Subtotal O&M	$	885,200
Total Annual Cost*	**$**	**13,011,600**

*October 2016 Price Level

(a) I = 3.125% n = 50 yrs

(b) Based on 20,680 CY at $57/CY to truck from an upland source, 33% contingency, E&D, and S&A.

(c) From based on experience at Ocean City, MD and verbal price quote from Amboy Aggregates, Sales Department, (908)-227-7103

(d) Assumed 2 equipment operators to move sand around 6 times a year with 2 140 hp dozers.

(e) Based 5% of initial outfall extensions in for total outfall costs with contingency.

(f) Based 0.5% of initial new groin, groin extension and groin rehabilitation costs from First Cost table on TPCS.

(g) Based on Annual O&M Table of the Green Brook Federal Flood Damage Reduction Project

(h) Based on discussions with personel at Troy Lock & Dam

(i) Based on discussions with personel at Keansburg, NJ.

Table C-3. Union Beach 2001 vs. 2016 Cost Comparison and Explanation

Union Beach Cost Change Information						
Account Code	**Description**	**2001 Costs**	**2016 Indexed Costs***	**2016 MII Costs**	**% Change in MII**	**Explananation of Change/Increase**
General themes to note that have affected the increase in costs in accounts 2,10,11,13,15,and 17: **Phasing:** We have updated the phasing to reflect current funding climate. We are assuming 5 contracts with a total construction duration of 6 years 2015- 2021. **Markups:** assumed a Prime contractor self performs for most work in 2001 costs but in reality we'll have subprimes and resulting additional markups. **Contingencies:** When the Feasibility Report was completed, contingencies were determined by an A/E to be 15% for most construction accounts (only account 15 Floodway Control-Diversion Structures got the highest percentage 18%). Since that time, USACE has adopted a risk based process (ARA, CSRA) to develop contingencies that is based on risk, likelihood of that risk occurring, and effects of that risk. The PDT has now developed the ARA that results in an average contingency of 33% for all construction accounts. **Materials:** costs were updated and reflect more recent historic costs. **Updated Regulations:** Updated Engineering Regulations require T-walls in place of I-walls which results in significant increases of footprint, mitigation requirements, and required construction materials.						
		Total	**Total**	**Total**		
01	TOTAL LANDS & DAMAGES	$3,215,000	$5,191,000	$16,476,000	412%	Land Value increased. Increase easement footprint for vegetation management (15 by 8 ft coridor equired allows for O&M of levees, requirements increased since Katrina), and I wall transition to T wall increases the footprint and subsequent real estate requirements (more acreage).
02	TOTAL RELOCATIONS	$1,165,000	$1,903,000	$2,158,000	85%	Outfall Extension was recalculated, road raising and resurfacing was costed out to reflect more current historic pricing. Prime Contractor was assumed to self perform in 2001; subcontractor markups have now been added and subcontractors are assumed to perform most of the work. Current Prime Contractor's Markups are 28% with 28% Prime on Subs Markups. 2003 Prime markup was 13%. Subcontractor marksups, which have now been introduced to the project account for an additional 20% markup.
06	FISH AND WILDLIFE FACILITIES	$5,801,400	$9,443,000	$13,198,000	127%	We are impacting more wetlands with the increased Twall footprint (all I walls became T walls) which means an increase acreage for mitigation. 2001 $/acre unit cost was escalated using CWCCIS ESCALATION CALCULATION dated 31-Mar-14. More acres are now applied in the 2016 estimate. No contractor's markups were applied.
10	BREAKWATERS AND SEAWALLS	$5,821,900	$9,158,000	$13,033,000	124%	Material costs have been updated (e.g. 2001 armor stone installed cost was 70/ton; now we have an estimated installed cost of about 157/ton to reflect the current market price). Prime Contractor was assumed to self perform in 2001; subcontractor markups have now been added and subcontractors are assumed to perform most of the work. Current Prime Contractor's Markups are 28% with 28% Prime on Subs Markups. 2003 Prime markup was 13%. Subcontractor marksups, which have now been introduced to the project account for an additional 20% markup. Project Phasing and resulting interest losses also impact the cost.
11	TOTAL LEVEES & FLOODWALLS	$34,111,900	$55,271,000	$118,767,000	248%	Prime Contractor was assumed to self perform in 2001; subcontractor markups have now been added and subcontractors are assumed to perform most of the work. Current Prime Contractor's Markups are 28% with 28% Prime on Subs Markups. 2003 Prime markup was 13%. Subcontractor marksups, which have now been introduced to the project account for an additional 20% markup. In addition, all I-walls (less costs) became T walls with steel pile foundation (higher costs). Materials costs have increased (riprap, concrete, steel). Our steel pile base now is more heavy duty (H steel pile HP16x88 at $91/lf (ER requirement) vs. in 2001 design of 12" dia concrete filled pipe piles at $43/lf). A floodwall increase of about 6465 LFand a levee decrease of about 3998 LF accounts for the CBRA change.
13	TOTAL PUMPING PLANT	$3,506,000	$5,837,000	$19,328,000	451%	Prime Contractor was assumed to self perform in 2001; subcontractor markups have now been added and subcontractors are assumed to perform most of the work. Current Prime Contractor's Markups are 28% with 28% Prime on Subs Markups. 2003 Prime markup was 13%. Subcontractor marksups, which have now been introduced to the project account for an additional 20% markup. In 2001 estimate, it was noted that a pump cost curve was used to calculate the cost for pump stations. In 2016, we also used a pump cfs vs cost curve but with more recent historical costs (from Greenbrook in 2008 and Seabrings Mills Rd in 2010) to make it more relevant to our necessary pumping plants (250, 100, 40CFS: station sizes remain the same)
15	TOTAL FLOOD CONTROL DIVERSION STRUCTURE	$18,293,200	$29,775,000	$15,479,000	-15%	Prime Contractor was assumed to self perform in 2001; subcontractor markups have now been added and subcontractors are assumed to perform most of the work. Current Prime Contractor's Markups are 28% with 28% Prime on Subs Markups. 2003 Prime markup was 13%. Subcontractor marksups, which have now been introduced to the project account for an additional 20% markup. We used more recent (4th Qtr 2011) historic cost model for a sector gate in New Orleans District, size adjusted to 35' project gate size by extrapolation, localized it to our project area using area cost factor of 10.11%, escalated it to 2016 cost using CWCCIS ESCALATION CALCULATION dated 31-Mar-16, and took out nonrelevant components/costs that will not apply to Union Beach (same process as Port Monmouth).
17	TOTAL BEACH REPLENISHMENT	$6,537,300	$10,635,000	$32,664,000	400%	We based our dredging cost on a 2014 bid from Keansburg ($34/CY) but anticipated that Union Beach will be more difficult than Keansburg. 2003 cost used an estimated $8/CY unit price.
18	CULTURAL RESOURCES	$0	$0	$770,000	n/a	Added to 2016 estimate
30	PLANNING, ENGINEERING, & DESIGN	$8,200,000	$8,535,000	$23,647,000	188%	It was noted that 10% was used in 2001. In 2016, the 12.4% of total construction cost before escalation and contingency was used.
31	CONSTRUCTION MANAGEMENT	$4,750,000	$4,944,000	$13,348,000	181%	2001 estimate used 6%. In 20146, 7% of construction cost before escalation and contingency was used.
	TOTAL PROJECT FIRST COST	**$91,401,700**	**$140,692,000**	**$268,868,000**	**194%**	

*costs are indexed using the CWCCIS qtrly values

Total Project Cost Summary

(Part 1 – summary of all phases)

PROJECT: Union Beach HSRR
PROJECT NC TBD
LOCATION: Raritan Bay and Sandy Hook Bay, NJ

DISTRICT: NAD North Atlantic Division PREPARED: 9/27/2016
POC: CHIEF, COST ENGINEERING

This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
							Program Year (Budget EC): 2017									
							Effective Price Level Date: 1 OCT 16									
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: 10/1/2015 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS		$1,746	$412	24%	$2,158	1.4%	$1,770	$417	$2,187	$0	$2,187	3.0%	$1,822	$430	$2,252
06	FISH & WILDLIFE FACILITIES		$10,680	$2,517	24%	$13,198	1.4%	$10,825	$2,551	$13,376	$0	$13,376	3.9%	$11,249	$2,651	$13,901
10	BREAKWATER & SEAWALLS		$10,547	$2,486	24%	$13,033	1.4%	$10,690	$2,520	$13,210	$0	$13,210	2.9%	$10,999	$2,592	$13,591
11	LEVEES & FLOODWALLS		$96,113	$22,654	24%	$118,767	1.4%	$97,415	$22,961	$120,375	$0	$120,375	7.4%	$104,652	$24,667	$129,319
13	PUMPING PLANT		$15,641	$3,687	24%	$19,328	1.4%	$15,853	$3,736	$19,589	$0	$19,589	7.3%	$17,009	$4,009	$21,018
15	FLOODWAY CONTROL & DIVERSION STRUCTURE		$12,526	$2,952	24%	$15,479	1.4%	$12,696	$2,992	$15,688	$0	$15,688	7.7%	$13,675	$3,223	$16,898
17	BEACH REPLENISHMENT		$26,433	$6,230	24%	$32,664	1.4%	$26,791	$6,315	$33,106	$0	$33,106	2.9%	$27,564	$6,497	$34,061
18	CULTURAL RESOURCE PRESERVATION		$623	$147	24%	$770	1.4%	$631	$149	$780	$0	$780	5.9%	$669	$158	$826
	CONSTRUCTION ESTIMATE TOTALS:		$174,311	$41,085		$215,396	1.4%	$176,671	$41,641	$218,312	$0	$218,312	6.2%	$187,639	$44,227	$231,866
01	LANDS AND DAMAGES		$13,730	$2,746	20%	$16,476	1.4%	$13,916	$2,783	$16,699	$0	$16,699	2.4%	$14,253	$2,851	$17,103
30	PLANNING, ENGINEERING & DESIGN		$21,615	$2,032	9%	$23,647	2.7%	$22,199	$2,087	$24,285	$0	$24,285	2.3%	$22,717	$2,135	$24,852
31	CONSTRUCTION MANAGEMENT		$12,201	$1,147	9%	$13,348	2.7%	$12,530	$1,178	$13,708	$0	$13,708	12.5%	$14,098	$1,325	$15,424
	PROJECT COST TOTALS:		$221,857	$47,010	21%	$268,866		$225,316	$47,689	**$273,005**	$0	**$273,005**	5.9%	$238,707	$50,538	**$289,245**
17	BEACH REPLENISHMENT	renourishments	$14,110	$2,540	18%	$16,650	1.4%	$14,302	$2,574	$16,876	$0			$24,038	$4,327	$28,364
	RENOURISHMENT ESTIMATE TOTALS:		$14,110	$2,540		$16,650	1.4%	$14,302	$2,574	$16,876	$0			$24,038	$4,327	$28,364
30	PLANNING, ENGINEERING & DESIGN	renourishments	$764	$72	9%	$835	2.7%	$784	$74	$858	$0			$2,925	$275	$3,200
31	CONSTRUCTION MANAGEMENT	renourishments	$790	$74	9%	$864	2.7%	$811	$76	$888	$0			$3,219	$303	$3,522
	PROJECT COST TOTALS:		$15,664	$2,686	17%	$18,350		$15,897	$2,724	**$18,621**	$0			$30,182	$4,904	**$35,086**

CHIEF, COST ENGINEERING, Mukesh Kumar

PROJECT MANAGER, Jenifer E. Thalhauser

CHIEF, REAL ESTATE, Noreen D. Dresser

ESTIMATED FEDERAL COST:	**65%**	**$188,009**
ESTIMATED NON-FEDERAL COST:	**35%**	**$101,236**
ESTIMATED TOTAL PROJECT COST:		**$289,245**

ESTIMATED FEDERAL COST:	**65%**	**$ 22,806**
ESTIMATED NON-FEDERAL COST:	**35%**	**$ 12,280**

ESTIMATED RENOURISHMENT TOTAL PROJECT COST: $35,086

Total Project Cost Summary (continued - phase 1)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 9/27/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/27/2016 Effective Price Level: 10/1/2015				(Budget EC): 2017 Effective Price Level Date: 1 OCT 16								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1 - Beach Nourishment													
02	RELOCATIONS	$1,431	$337	24%	$1,769	1.4%	$1,451	$342	$1,793	2018Q2	2.4%	$1,486	$350	$1,836
10	BREAKWATER & SEAWALLS	$10,547	$2,486	24%	$13,033	1.4%	$10,690	$2,520	$13,210	2018Q3	2.9%	$10,999	$2,592	$13,591
17	BEACH REPLENISHMENT	$26,433	$6,230	24%	$32,664	1.4%	$26,791	$6,315	$33,106	2018Q3	2.9%	$27,564	$6,497	$34,061
18	CULTURAL RESOURCE PRESERVATION	$156	$37	24%	$192	1.4%	$158	$37	$195	2019Q1	3.9%	$164	$39	$203
	CONSTRUCTION ESTIMATE TOTALS:	$38,568	$9,090	24%	**$47,658**		$39,090	$9,214	$48,304			$40,213	$9,478	$49,691
01	LANDS AND DAMAGES	$1,386	$277	20%	$1,663	1.4%	$1,405	$281	$1,686	2018Q2	2.4%	$1,439	$288	$1,726
30	PLANNING, ENGINEERING & DESIGN													
0.8%	Project Management	$289	$27	9%	$316	2.7%	$297	$28	$325	2017Q2	0.7%	$299	$28	$327
1.0%	Planning & Environmental Compliance	$386	$36	9%	$422	2.7%	$396	$37	$434	2017Q2	0.7%	$399	$38	$437
8.0%	Engineering & Design	$3,085	$290	9%	$3,375	2.7%	$3,168	$298	$3,466	2017Q2	0.7%	$3,189	$300	$3,489
0.6%	Reviews, ATRs, IEPRs, VE	$231	$22	9%	$253	2.7%	$237	$22	$260	2017Q2	0.7%	$239	$22	$261
0.2%	Life Cycle Updates (cost, schedule, risks)	$58	$5	9%	$63	2.7%	$60	$6	$65	2017Q2	0.7%	$60	$6	$66
0.2%	Contracting & Reprographics	$58	$5	9%	$63	2.7%	$60	$6	$65	2017Q2	0.7%	$60	$6	$66
1.0%	Engineering During Construction	$386	$36	9%	$422	2.7%	$396	$37	$434	2018Q3	5.6%	$419	$39	$458
0.8%	Planning During Construction	$289	$27	9%	$316	2.7%	$297	$28	$325	2018Q3	5.6%	$313	$29	$343
0.0%	Project Operations	-	-	9%	-	-	-	-	-	-	-			
12.40%														
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$2,507	$236	9%	$2,743	2.7%	$2,575	$242	$2,817	2018Q3	5.6%	$2,719	$256	$2,975
0.0%	Project Operation:	-	-	9%	-	-	-	-	-	-	-	-	-	-
0.5%	Project Management	$193	$18	9%	$211	2.7%	$198	$19	$217	2018Q3	5.6%	$209	$20	$229
	CONTRACT COST TOTALS:	$47,436	$10,071		**$57,507**		$48,179	$10,217	$58,396			$49,558	$10,509	**$60,067**

Total Project Cost Summary (continued - phase 2)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 9/27/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			9/27/2016		(Budget EC):		2017					
		Effective Price Level:			10/1/2015		Effective Price Level Date:		1 OCT 16	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 2 - Flat to East Levee and Floodwall													
02	RELOCATIONS	$42	$10	24%	$51	1.4%	$42	$10	$52	2019Q2	4.4%	$44	$10	$54
11	LEVEES & FLOODWALLS	$19,931	$4,698	24%	$24,629	1.4%	$20,201	$4,761	$24,963	2019Q3	5.0%	$21,205	$4,998	$26,203
13	PUMPING PLANT	$13,434	$3,167	24%	$16,601	1.4%	$13,616	$3,209	$16,826	2020Q3	7.1%	$14,579	$3,436	$18,015
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$4,667	$1,100	24%	$5,767	1.4%	$4,730	$1,115	$5,845	2020Q4	7.6%	$5,090	$1,200	$6,289
18	CULTURAL RESOURCE PRESERVATION	$156	$37	24%	$192	1.4%	$158	$37	$195	2019Q2	4.4%	$165	$39	$204
	CONSTRUCTION ESTIMATE TOTALS:	$38,230	$9,011	24%	**$47,241**		$38,747	$9,133	$47,880			$41,082	$9,683	$50,766
01	LANDS AND DAMAGES	$2,582	$516	20%	$3,098	1.4%	$2,617	$523	$3,140	2018Q2	2.4%	$2,680	$536	$3,216
30	PLANNING, ENGINEERING & DESIGN													
0.8%	Project Management	$287	$27	9%	$314	2.7%	$295	$28	$322	2017Q2	0.7%	$297	$28	$325
1.0%	Planning & Environmental Compliance	$382	$36	9%	$418	2.7%	$392	$37	$429	2017Q2	0.7%	$395	$37	$432
8.0%	Engineering & Design	$3,058	$287	9%	$3,345	2.7%	$3,141	$295	$3,436	2017Q2	0.7%	$3,161	$297	$3,459
0.6%	Reviews, ATRs, IEPRs, VE	$229	$22	9%	$251	2.7%	$235	$22	$257	2017Q2	0.7%	$237	$22	$259
0.2%	Life Cycle Updates (cost, schedule, risks)	$57	$5	9%	$62	2.7%	$59	$6	$64	2017Q2	0.7%	$59	$6	$64
0.2%	Contracting & Reprographics	$57	$5	9%	$62	2.7%	$59	$6	$64	2017Q2	0.7%	$59	$6	$64
1.0%	Engineering During Construction	$382	$36	9%	$418	2.7%	$392	$37	$429	2020Q2	12.9%	$443	$42	$485
0.8%	Planning During Construction	$287	$27	9%	$314	2.7%	$295	$28	$322	2020Q2	12.9%	$333	$31	$364
0.0%	Project Operations	-	-	9%	-	-	-	-	-	-	-			
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$2,485	$234	9%	$2,719	2.7%	$2,552	$240	$2,792	2020Q2	12.9%	$2,881	$271	$3,152
0.0%	Project Operation:	-	-	9%	-	-	-	-	-	-	-	-	-	-
0.5%	Project Management	$191	$18	9%	$209	2.7%	$196	$18	$215	2020Q2	12.9%	$221	$21	$242
	CONTRACT COST TOTALS:	$48,227	$10,224		**$58,451**		$48,980	$10,372	$59,352			$51,849	$10,979	**$62,828**

Total Project Cost Summary (continued - phase 3)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division PREPARED: 9/27/2016
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			9/27/2016 / 10/1/2015	(Budget EC): / Effective Price Level Date:			2017 / 1 OCT 16					
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*
	PHASE 3 - East Creek Levee													
02	RELOCATIONS	$273	$64	24%	$338	1.4%	$277	$65	$342	2019Q4	5.5%	$292	$69	$361
11	LEVEES & FLOODWALLS	$2,285	$539	24%	$2,824	1.4%	$2,316	$546	$2,862	2020Q2	6.5%	$2,468	$582	$3,049
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$2,568	$605	24%	$3,173	1.4%	$2,602	$613	$3,216	2020Q3	7.1%	$2,786	$657	$3,443
18	CULTURAL RESOURCE PRESERVATION	$156	$37	24%	$192	1.4%	$158	$37	$195	2020Q3	7.1%	$169	$40	$209
	CONSTRUCTION ESTIMATE TOTALS:	$5,282	$1,245	24%	**$6,527**		$5,354	$1,262	$6,616			$5,715	$1,347	$7,062
01	LANDS AND DAMAGES	$235	$47	20%	$282	1.4%	$238	$48	$286	2018Q2	2.4%	$244	$49	$293
30	PLANNING, ENGINEERING & DESIGN													
0.8%	Project Management	$40	$4	9%	$44	2.7%	$41	$4	$45	2017Q2	0.7%	$41	$4	$45
1.0%	Planning & Environmental Compliance	$53	$5	9%	$58	2.7%	$54	$5	$60	2017Q2	0.7%	$55	$5	$60
8.0%	Engineering & Design	$423	$40	9%	$463	2.7%	$434	$41	$475	2017Q2	0.7%	$437	$41	$478
0.6%	Reviews, ATRs, IEPRs, VE	$32	$3	9%	$35	2.7%	$33	$3	$36	2017Q2	0.7%	$33	$3	$36
0.2%	Life Cycle Updates (cost, schedule, risks)	$8	$1	9%	$9	2.7%	$8	$1	$9	2017Q2	0.7%	$8	$1	$9
0.2%	Contracting & Reprographics	$8	$1	9%	$9	2.7%	$8	$1	$9	2017Q2	0.7%	$8	$1	$9
1.0%	Engineering During Construction	$53	$5	9%	$58	2.7%	$54	$5	$60	2020Q2	12.9%	$61	$6	$67
0.8%	Planning During Construction	$40	$4	9%	$44	2.7%	$41	$4	$45	2020Q2	12.9%	$46	$4	$51
0.0%	Project Operations	-	-	9%	-	-	-	-	-	-	-			
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$343	$32	9%	$375	2.7%	$352	$33	$385	2020Q2	12.9%	$398	$37	$435
0.0%	Project Operation:	-	-	9%	-	-	-	-	-	-	-	-	-	-
0.5%	Project Management	$26	$2	9%	$28	2.7%	$27	$3	$29	2020Q2	12.9%	$30	$3	$33
	CONTRACT COST TOTALS:	$6,543	$1,388		**$7,932**		$6,646	$1,409	$8,054			$7,078	$1,501	**$8,579**

Total Project Cost Summary (continued - phase 4)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 9/27/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9/27/2016 Effective Price Level: 10/1/2015				(Budget EC): 2017 Effective Price Level Date: 1 OCT 16								
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
	PHASE 4 - Chingarora Levee/Floodwall													
11	LEVEES & FLOODWALLS	$73,897	$17,417	24%	$91,314	1.4%	$74,897	$17,653	$92,551	2021Q1	8.1%	$80,979	$19,087	$100,066
13	PUMPING PLANT	$2,206	$520	24%	$2,727	1.4%	$2,236	$527	$2,763	2021Q2	8.7%	$2,430	$573	$3,003
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	$5,292	$1,247	24%	$6,539	1.4%	$5,363	$1,264	$6,628	2021Q1	8.1%	$5,799	$1,367	$7,166
18	CULTURAL RESOURCE PRESERVATION	$156	$37	24%	$192	1.4%	$158	$37	$195	2021Q1	8.1%	$171	$40	$211
	CONSTRUCTION ESTIMATE TOTALS:	$81,551	$19,222	24%	**$100,772**		$82,655	$19,482	$102,137			$89,379	$21,067	$110,446
01	LANDS AND DAMAGES	$4,910	$982	20%	$5,892	1.4%	$4,977	$995	$5,972	2018Q2	2.4%	$5,097	$1,019	$6,117
30	PLANNING, ENGINEERING & DESIGN													
0.8%	Project Management	$612	$58	9%	$670	2.7%	$629	$59	$688	2017Q2	0.7%	$633	$59	$692
1.0%	Planning & Environmental Compliance	$816	$77	9%	$893	2.7%	$838	$79	$917	2017Q2	0.7%	$844	$79	$923
8.0%	Engineering & Design	$6,524	$613	9%	$7,137	2.7%	$6,700	$630	$7,330	2017Q2	0.7%	$6,744	$634	$7,378
0.6%	Reviews, ATRs, IEPRs, VE	$489	$46	9%	$535	2.7%	$502	$47	$549	2017Q2	0.7%	$506	$48	$553
0.2%	Life Cycle Updates (cost, schedule, risks)	$122	$11	9%	$133	2.7%	$125	$12	$137	2017Q2	0.7%	$126	$12	$138
0.2%	Contracting & Reprographics	$122	$11	9%	$133	2.7%	$125	$12	$137	2017Q2	0.7%	$126	$12	$138
1.0%	Engineering During Construction	$816	$77	9%	$893	2.7%	$838	$79	$917	2021Q1	16.2%	$974	$92	$1,065
0.8%	Planning During Construction	$612	$58	9%	$670	2.7%	$629	$59	$688	2021Q1	16.2%	$730	$69	$799
0.0%	Project Operations	-	-	9%	-	-	-	-	-	-	-			
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$5,301	$498	9%	$5,799	2.7%	$5,444	$512	$5,956	2021Q1	16.2%	$6,326	$595	$6,921
0.0%	Project Operation:	-	-	9%	-	-	-	-	-	-	-	-	-	-
0.5%	Project Management	$408	$38	9%	$446	2.7%	$419	$39	$458	2021Q1	16.2%	$487	$46	$533
	CONTRACT COST TOTALS:	$102,283	$21,691		**$123,974**		$103,881	$22,005	$125,885			$111,973	$23,731	**$135,703**

Total Project Cost Summary (continued - phase 5)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 9/27/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			9/27/2016		(Budget EC):		2017					
		Effective Price Level:			10/1/2015		Effective Price Level Date:		1 OCT 16	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 5													
06	FISH & WILDLIFE FACILITIES	$10,680	$2,517	24%	$13,198	1.4%	$10,825	$2,551	$13,376	2019Q1	3.9%	$11,249	$2,651	$13,901
	CONSTRUCTION ESTIMATE TOTALS:	$10,680	$2,517	24%	**$13,198**		$10,825	$2,551	$13,376			$11,249	$2,651	$13,901
01	LANDS AND DAMAGES	$4,616	$923	20%	$5,540	1.4%	$4,679	$936	$5,615	2018Q2	2.4%	$4,792	$958	$5,751
30	PLANNING, ENGINEERING & DESIGN													
0.8%	Project Management	$80	$8	9%	$88	2.7%	$82	$8	$90	2017Q2	0.7%	$83	$8	$90
1.0%	Planning & Environmental Compliance	$107	$10	9%	$117	2.7%	$110	$10	$120	2017Q2	0.7%	$111	$10	$121
8.0%	Engineering & Design	$854	$80	9%	$934	2.7%	$877	$82	$960	2017Q2	0.7%	$883	$83	$966
0.6%	Reviews, ATRs, IEPRs, VE	$64	$6	9%	$70	2.7%	$66	$6	$72	2017Q2	0.7%	$66	$6	$72
0.2%	Life Cycle Updates (cost, schedule, risks)	$16	$2	9%	$18	2.7%	$16	$2	$18	2017Q2	0.7%	$17	$2	$18
0.2%	Contracting & Reprographics	$16	$2	9%	$18	2.7%	$16	$2	$18	2017Q2	0.7%	$17	$2	$18
1.0%	Engineering During Construction	$107	$10	9%	$117	2.7%	$110	$10	$120	2019Q1	7.6%	$118	$11	$129
0.8%	Planning During Construction	$80	$8	9%	$88	2.7%	$82	$8	$90	2019Q1	7.6%	$88	$8	$97
0.0%	Project Operations	-	-	9%	-	-	-	-	-	-	-			
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$694	$65	9%	$759	2.7%	$713	$67	$780	2019Q1	7.6%	$767	$72	$839
0.0%	Project Operation:	-	-	9%	-	-	-	-	-	-	-	-	-	-
0.5%	Project Management	$53	$5	9%	$58	2.7%	$54	$5	$60	2019Q1	7.6%	$59	$6	$64
	CONTRACT COST TOTALS:	$17,368	$3,635		**$21,003**		$17,631	$3,687	$21,318			$18,250	$3,818	**$22,067**

Total Project Cost Summary (continued – Beach Replenishment)

PROJECT: Union Beach HSRR
LOCATION: Raritan Bay and Sandy Hook Bay, NJ
This Estimate reflects the scope and schedule in report; Union Beach Feasibility Study Report September 2003

DISTRICT: NAD North Atlantic Division PREPARED: 9/27/2016
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
			Estimate Prepared: 9/27/2016 Effective Price Level: 10/1/2015				Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16				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
17	BEACH REPLENISHMENT	Year 9	$3,862	$695	18%	$4,558	1.4%	$3,915	$705	$4,619	2025Q2	17.6%	$4,605	$829	$5,433
17	BEACH REPLENISHMENT	Year 18	$2,601	$468	18%	$3,070	1.4%	$2,637	$475	$3,111	2034Q2	40.6%	$3,706	$667	$4,374
17	BEACH REPLENISHMENT	Year 27	$2,573	$463	18%	$3,037	1.4%	$2,608	$469	$3,078	2043Q2	68.0%	$4,382	$789	$5,170
17	BEACH REPLENISHMENT	Year 36	$2,500	$450	18%	$2,950	1.4%	$2,534	$456	$2,990	2052Q2	100.8%	$5,087	$916	$6,003
17	BEACH REPLENISHMENT	Year 45	$2,573	$463	18%	$3,037	1.4%	$2,608	$469	$3,078	2061Q2	139.9%	$6,258	$1,126	$7,385
	CONSTRUCTION ESTIMATE TOTALS:		$14,110	$2,540	18%	**$16,650**		$14,302	$2,574	$16,876			$24,038	$4,327	$28,364
30	PLANNING, ENGINEERING & DESIGN	Year 9	$153	$14	9%	$167	2.7%	$157	$15	$172	2024Q1	30.8%	$205	$19	$224
30	PLANNING, ENGINEERING & DESIGN	Year 18	$153	$14	9%	$167	2.7%	$157	$15	$172	2033Q1	93.7%	$304	$29	$332
30	PLANNING, ENGINEERING & DESIGN	Year 27	$153	$14	9%	$167	2.7%	$157	$15	$172	2042Q1	203.9%	$477	$45	$521
30	PLANNING, ENGINEERING & DESIGN	Year 36	$153	$14	9%	$167	2.7%	$157	$15	$172	2051Q1	379.6%	$752	$71	$823
30	PLANNING, ENGINEERING & DESIGN	Year 45	$153	$14	9%	$167	2.7%	$157	$15	$172	2060Q1	656.8%	$1,187	$112	$1,299
	PLANNING, ENGINEERING & DESIGN TOTALS:		$764	$72	9%	**$835**		$784	$74	$858			$2,925	$275	$3,200
31	CONSTRUCTION MANAGEMENT	Year 9	$158	$15	9%	$173	2.7%	$162	$15	$178	2025Q2	37.5%	$223	$21	$244
31	CONSTRUCTION MANAGEMENT	Year 18	$158	$15	9%	$173	2.7%	$162	$15	$178	2034Q2	105.7%	$334	$31	$365
31	CONSTRUCTION MANAGEMENT	Year 27	$158	$15	9%	$173	2.7%	$162	$15	$178	2043Q2	223.7%	$525	$49	$575
31	CONSTRUCTION MANAGEMENT	Year 36	$158	$15	9%	$173	2.7%	$162	$15	$178	2052Q2	410.8%	$829	$78	$907
31	CONSTRUCTION MANAGEMENT	Year 45	$158	$15	9%	$173	2.7%	$162	$15	$178	2061Q2	706.2%	$1,308	$123	$1,431
	CONSTRUCTION MANAGEMENT TOTALS:		$790	$74	9%	**$864**		$811	$76	$888			$3,219	$303	$3,522
	CONTRACT COST TOTALS:		$15,664	$2,686		**$18,350**		$15,897	$2,724	$18,621			$30,182	$4,904	**$35,086**

Abbreviated Risk Analysis (ARA) Results

Project (less than $40M): **Union Beach HSRR**
Project Development Stage: **Feasibility (Recommended Plan)**
Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **$ 135,781,351**

	CWWBS	Feature of Work	Contract Cost		% Contingenc	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 7,733,635		20.00%	$ 1,546,727	$ 9,280,362.00
1	02 RELOCATIONS	Utility Relocations	$ 643,232		7.37%	$ 47,415	$ 690,647.29
2	02 RELOCATIONS	Outfall Extension	$ 1,082,319		13.40%	$ 145,058	$ 1,227,377.57
3	06 FISH AND WILDLIFE FACILITIES	Wetland Mitigations	$ 11,855,952		13.32%	$ 1,579,148	$ 13,435,099.83
4	10 BREAKWATERS AND SEAWALLS	Terminal Groins & Revetment	$ 10,477,085		17.93%	$ 1,878,868	$ 12,355,952.62
5	11 01 LEVEES	Site Work	$ 13,897,306		26.08%	$ 3,624,627	$ 17,521,933.54
6	11 02 FLOODWALLS	Floodwalls	$ 43,179,932		31.68%	$ 13,681,264	$ 56,861,196.57
7	13 PUMPING PLANT	Pumping Plant	$ 15,432,041		22.78%	$ 3,516,103	$ 18,948,144.52
8	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Interior Drainage	$ 6,083,001		6.82%	$ 414,895	$ 6,497,895.53
9	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Storm Gate Structure	$ 6,720,476		37.14%	$ 2,495,695	$ 9,216,170.18
10	17 BEACH REPLENISHMENT	Hopper Dredging	$ 26,410,007		17.51%	$ 4,623,144	$ 31,033,151.85
11					0.00%	$ -	$ -
12		**Remaining Construction Items**	$ **(0)**	*0.0%*	0.00%	$ (0)	$ (0.01)
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 16,836,888		9.41%	$ 1,583,948	$ 18,420,835.98
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 9,504,695		9.41%	$ 894,164	$ 10,398,859.02

Totals				
Real Estate	$ 7,733,635	20.00%	$ 1,546,727	$ 9,280,362.00
Total Construction Estimate	$ 135,781,351	23.57%	$ 32,006,219	$ 167,787,569
Total Planning, Engineering & Design	$ 16,836,888	9.41%	$ 1,583,948	$ 18,420,836
Total Construction Management	$ 9,504,695	9.41%	$ 894,164	$ 10,398,859
Total	$ 169,856,568		$ 36,031,059	$ 205,887,626

Construction Schedule

ID	Task Name	Duration	Start	Finish
1	**PHASE 1 - Beachfront Renourishment and Groin**	**315 days**	**Mon 1/15/18**	**Sat 3/30/19**
2	Relocation	150 edays	Mon 1/15/18	Thu 6/14/18
3	Seawall and Revetment	270 edays	Mon 1/15/18	Fri 10/12/18
4	Beach Replenishment	180 edays	Mon 10/1/18	Sat 3/30/19
5				
6	**PHASE 2 - Flat to East Levee & Floodwall and Interior Levee**	**649 days**	**Tue 1/15/19**	**Sun 7/11/21**
7	Relocation	60 edays	Tue 1/15/19	Sat 3/16/19
8	Levees	270 edays	Tue 1/15/19	Sat 10/12/19
9	Floodwall	540 edays	Tue 1/15/19	Wed 7/8/20
10	Pumping Plant	540 edays	Sun 7/14/19	Mon 1/4/21
11	Floodway Control - Diversion Structures	758 edays	Fri 6/14/19	Sun 7/11/21
12				
13	**PHASE 3 - East Creek Levee East of East Creek Only**	**261 days**	**Fri 7/19/19**	**Sat 7/18/20**
14	Relocation	120 edays	Fri 7/19/19	Sat 11/16/19
15	Levees	365 edays	Fri 7/19/19	Sat 7/18/20
16	Floodway Control - Diversion Structures	120 edays	Wed 1/15/20	Thu 5/14/20
17				
18	**PHASE 4 - Chingarora Levee and Floodwall**	**714 days**	**Fri 7/19/19**	**Thu 4/14/22**
19	Levees	364 edays	Fri 7/19/19	Fri 7/17/20
20	Floodwall	1000 edays	Fri 7/19/19	Thu 4/14/22
21	Pumping Plant	180 edays	Mon 11/30/20	Sat 5/29/21
22	Floodway Control - Diversion Structures	1000 edays	Fri 7/19/19	Thu 4/14/22
23				
24	**PHASE 5 - Wetland Mitigation**	**261 days**	**Mon 6/18/18**	**Tue 6/18/19**
25	Wetland Mitigation	365 edays	Mon 6/18/18	Tue 6/18/19