Rahway River Basin, New Jersey
Coastal Storm Risk Management Feasibility Study

Appendix D
Cost Engineering

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INTRODUCTION

This appendix presents the detail cost estimate for Rahway Tidal (NED). Rahway Tidal project provides solution to reduce the impact of coastal flooding in the lower portions of the Rahway River Basin, which experienced damages during Hurricane Sandy. It consists of a combination of levees, floodwalls, drainages, and nonstructural treatments of properties in the flood prone areas. The Total First Cost is presented in Table 1.

Table 1 – First Cost Table

Rahway Tidal

October 2019 Price Level

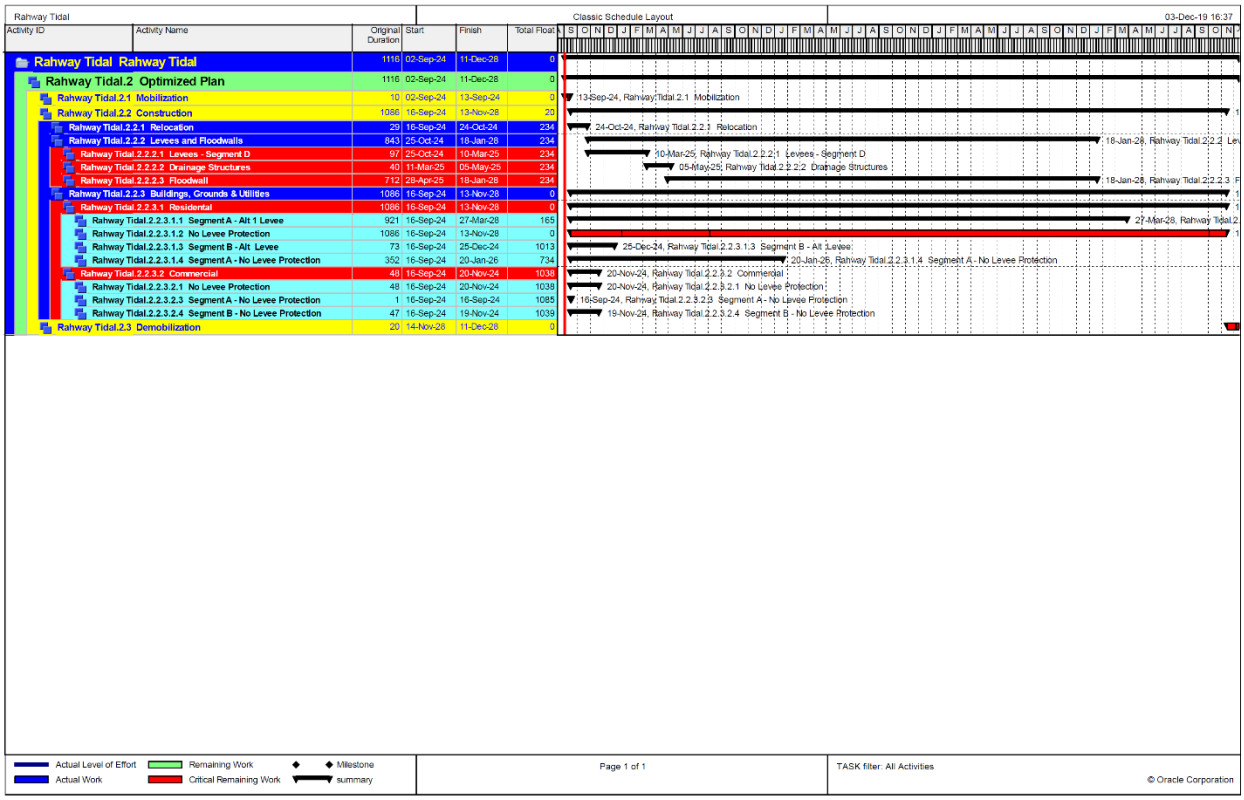
Feat. Acct.	Description	Qty	UoM	Subtotal	Cont. %	Cont $$	Total Cost
01	Lands & Damanges			$ 6,471,300	40.00%	$ 2,588,520	$ 9,059,820
	Total Lands & Damages			**$ 6,471,300**		**$ 2,588,520**	**$ 9,059,820**
02	Relocations			$ 1,373,175	35.00%	$ 480,611	$ 1,853,787
	Relocations			**$ 1,373,175**		**$ 480,611**	**$ 1,853,787**
06	Fish & Wildlife Facilities			$ 2,157,112	35.00%	$ 754,989	$ 2,912,101
	Total Fish & Wildlife Facilities			**$ 2,157,112**		**$ 754,989**	**$ 2,912,101**
11	Levees and Floodwalls			$ 17,147,714	35.00%	$ 6,001,700	$ 23,149,414
	Total Levees and Floodwalls			**$ 17,147,714**		**$ 6,001,700**	**$ 23,149,414**
18	Cultural Resource Preservation			$ 1,070,000	35.00%	$ 374,500	$ 1,444,500
	Total Cultural Resource Preservation			**$ 1,070,000**		**$ 374,500**	**$ 1,444,500**
19	Builidngs, Grounds & Utilities			$ 12,620,889	35.00%	$ 4,417,311	$ 17,038,200
	Total Buildings, Grounds & Utilities			**$ 12,620,889**		**$ 4,417,311**	**$ 17,038,200**
30	Planning, Engineering, and Design	1	LS	$ 8,592,222	35.00%	$ 3,007,278	$ 11,599,500
31	Construction Management	1	LS	$ 3,608,733	35.00%	$ 1,263,057	$ 4,871,790
	Total			**$ 53,041,145**		**$ 18,887,966**	**$ 71,929,111**

BASIS OF COST

The construction cost estimate was developed in MCACES, Second Generation (MII) using the appropriate Work Breakdown Structure (WBS) and based on current estimated quantities provided by the Hydraulics & Hydrology Engineers. The cost estimate was developed from these quantities using cost resources such as RSMeans, historical data from similar construction features, and MII Cost Libraries. The contingencies were developed based on input to the Cost Schedule Risk Analysis (CSRA) (template provided by the Cost Mandatory Center of Expertise, MCX, Walla Walla District). These contingencies were applied to the construction cost estimates to develop the Total Project First Cost. The overall construction duration was

estimated at 52 months as shown in Figure 1. The construction schedule was developed based on the crew outputs referenced from RSMeans with assumptions that multiple crews would work simultaneously.

Figure 1 – Construction Schedule



CONTINGENCIES

As stated in ER 1110-2-1302, the goal in contingency development is to identify the uncertainty associated with an item of work or task to an acceptable degree of confidence. Consideration must be given to the detail available at each stage of planning, design, or construction for which a cost estimate is being prepared. Contingency may vary throughout the cost estimate and could constitute a significant portion of the overall costs when data or design details are unavailable. Final contingency development and assessment of the potential for cost growth is included in this cost estimate. To develop the Total Project First Cost, contingencies developed in the CSRA were applied. The construction cost contingency developed per CSRA for Rahway Tidal is shown in Table 2 on the following page.

Table 2 – Contingencies

Element	Contingency Factor
Relocation	35%
Fish and Wildlife Facilities	35%
Levees and Floodwalls	35%
Cultural Resource Preservation	35%
Buildings, Grounds & Utilities	35%
Total Construction Contingency	**35%**
Lands & Damages	40%
Planning, Engineering, and Design	35%
Construction Management	35%

PLANNING, ENGINNERING, AND DESIGN

The costs were developed for all activities associated with the planning, engineering and design effort. The cost for this account includes the preparation of Design Documentation Reports and plans and specifications for each construction contract and engineering support during construction through project completion. It includes all the in-house labor based upon work-hour requirements, material and facility costs, travel and overhead.

CONSTRUCTION MANAGEMENT

The costs were developed for all construction management activities from pre-award requirements through final contract closeout. These costs include the in-house labor based upon work-hour requirements, materials, facility costs, support contracts, travel and overhead. Costs were developed based on the input from the construction division in accordance with the CWBS and include but are not limited to anticipated items such as the salaries of the resident engineer and staff, surveyors, inspectors, draftsmen, clerical, and custodial personnel; operation, maintenance and fixed charges for transportation and for other field equipment; field supplies; construction management, general construction supervision; project office administration, distributive cost of area office and general overhead charged to the project. The work items and activities would include, but not be limited to: the salaries of all supervisory, engineering (including resident geologist and geological staff), office and safety field personnel; all on site expenses.

INTEREST DURING CONSTRUCTION

Interest during construction (IDC) is the cost of construction money invested before the beginning of the period of economic analysis and before the accumulation of benefits by the project. IDC costs have been added to the project cost to determine investment costs. Average annual costs were determined based on investment costs which include IDC. The pre-base year costs were estimated using the Federal interest rate of 2.75 percent (FY20).

OPERATION AND MAINTENANCE

The Operation and Maintenance (O&M) costs were estimated to represent the anticipated annual costs necessary to maintain the project at full operating efficiency throughout the project life. Following

completion of the project, operation and maintenance of project facilities would be performed by the local cooperating agency in accordance with federal regulations and operations manual.

ESTIMATED ANNUAL CHARGES

Annualized costs are based on an economic project life of 50 years and an interest rate of 2.75%. The annual charges include the annualized investment costs along with annual operation and maintenance costs. A detailed breakdown of annual costs is presented in Table 3.

Table 3 – Annualized Cost

Rahway Tidal

First Cost		$ 71,929,111
Investment Cost		
Interest During Construction (a)		$ 2,424,017
	Total Investment Cost:	$ 74,353,128
Annual Costs		
Annualized Investment Cost (b)		$ 2,754,108
Annualized Operation & Maintenance Cost (c)		$ 231,990
Total Annual Cost*		**$ 2,986,098**

October 2019 PL

(a) Based on 52 months of construction @ 2.75% (IDC, E&D and RE costs calculated separately and included in this total)

(b) Annualized investment cost only includes the remaining features. I = 2.75% and n = 50 yrs

(c) Assume 0.5% of total Construction Cost based on historical data.

COST SUMMARY

The Total Fully Funded Project cost is $88,130,000.

Figure 2 – Total Project Cost Summary

PROJECT: **Rahway Tidal**
PROJECT NO: P2 # 403353
LOCATION: Rahway , NJ

DISTRICT: NAN **PREPARED: 11/21/2019**
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	**TOTAL ($K)** J	Spent Thru: **1-Oct-19** ($K)	**TOTAL FIRST COST** ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS	$1,373	$481	35.0%	$1,854	0.0%	$1,373	$481	$1,854	$0	$1,854	23.2%	$1,692	$592	$2,284
06	FISH & WILDLIFE FACILITIES	$2,157	$755	35.0%	$2,912	0.0%	$2,157	$755	$2,912	$0	$2,912	23.2%	$2,658	$930	$3,589
11	LEVEES & FLOODWALLS	$17,148	$6,002	35.0%	$23,149	0.0%	$17,148	$6,002	$23,149	$0	$23,149	23.2%	$21,131	$7,396	$28,527
18	CULTURAL RESOURCE PRESERVATION	$1,070	$375	35.0%	$1,445	0.0%	$1,070	$375	$1,445	$0	$1,445	23.2%	$1,319	$461	$1,780
19	BUILDINGS, GROUNDS & UTILITIES	$12,621	$4,417	35.0%	$17,038	0.0%	$12,621	$4,417	$17,038	$0	$17,038	23.2%	$15,553	$5,443	$20,996
	CONSTRUCTION ESTIMATE TOTALS:	$34,369	$12,029		$46,398	0.0%	$34,369	$12,029	$46,398	$0	$46,398	23.2%	$42,353	$14,824	$57,177
01	LANDS AND DAMAGES	$6,471	$2,589	40.0%	$9,060	0.0%	$6,471	$2,589	$9,060	$0	$9,060	15.3%	$7,464	$2,986	$10,450
30	PLANNING, ENGINEERING & DESIGN	$8,592	$3,007	35.0%	$11,600	0.0%	$8,592	$3,007	$11,600	$0	$11,600	22.1%	$10,492	$3,672	$14,165
31	CONSTRUCTION MANAGEMENT	$3,609	$1,263	35.0%	$4,872	0.0%	$3,609	$1,263	$4,872	$0	$4,872	30.1%	$4,695	$1,643	$6,339
	PROJECT COST TOTALS:	$53,041	$18,888	35.6%	$71,929		$53,041	$18,888	**$71,929**	$0	**$71,929**	22.5%	$65,005	$23,125	$88,130

_____ **CHIEF, COST ENGINEERING, Mukesh Kumar**

ESTIMATED TOTAL PROJECT COST: **$88,130**

_____ **PROJECT MANAGER, Rifat Salim**

_____ **CHIEF, REAL ESTATE, Lydia William**

PROJECT: Rahway Tidal
LOCATION: Rahway , NJ
This Estimate reflects the scope and schedule in report; 0

DISTRICT: NAN
POC: CHIEF, COST ENGINEERING, Mukesh Kumar
PREPARED: 11/21/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 21-Nov-19 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
				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	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 1 or CONTRACT 1													
02	RELOCATIONS	$1,373	$481	35.0%	$1,854	0.0%	$1,373	$481	$1,854	2027Q1	23.2%	$1,692	$592	$2,284
06	FISH & WILDLIFE FACILITIES	$2,157	$755	35.0%	$2,912	0.0%	$2,157	$755	$2,912	2027Q1	23.2%	$2,658	$930	$3,589
11	LEVEES & FLOODWALLS	$17,148	$6,002	35.0%	$23,149	0.0%	$17,148	$6,002	$23,149	2027Q1	23.2%	$21,131	$7,396	$28,527
18	CULTURAL RESOURCE PRESERVATION	$1,070	$375	35.0%	$1,445	0.0%	$1,070	$375	$1,445	2027Q1	23.2%	$1,319	$461	$1,780
19	BUILDINGS, GROUNDS & UTILITIES	$12,621	$4,417	35.0%	$17,038	0.0%	$12,621	$4,417	$17,038	2027Q1	23.2%	$15,553	$5,443	$20,996
	CONSTRUCTION ESTIMATE TOTALS:	$34,369	$12,029	35.0%	**$46,398**		$34,369	$12,029	$46,398			$42,353	$14,824	$57,177
01	LANDS AND DAMAGES	$6,471	$2,589	40.0%	$9,060	0.0%	$6,471	$2,589	$9,060	2024Q4	15.3%	$7,464	$2,986	$10,450
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$859	$301	35.0%	$1,160	0.0%	$859	$301	$1,160	2024Q4	19.6%	$1,028	$360	$1,387
1.0%	Planning & Environmental Compliance	$344	$120	35.0%	$464	0.0%	$344	$120	$464	2024Q4	19.6%	$411	$144	$555
12.5%	Engineering & Design	$4,296	$1,504	35.0%	$5,800	0.0%	$4,296	$1,504	$5,800	2024Q4	19.6%	$5,138	$1,798	$6,936
1.0%	Reviews, ATRs, IEPRs, VE	$344	$120	35.0%	$464	0.0%	$344	$120	$464	2024Q4	19.6%	$411	$144	$555
1.0%	Life Cycle Updates (cost, schedule, risks)	$344	$120	35.0%	$464	0.0%	$344	$120	$464	2024Q4	19.6%	$411	$144	$555
1.0%	Contracting & Reprographics	$344	$120	35.0%	$464	0.0%	$344	$120	$464	2024Q4	19.6%	$411	$144	$555
3.0%	Engineering During Construction	$1,031	$361	35.0%	$1,392	0.0%	$1,031	$361	$1,392	2027Q1	30.1%	$1,342	$470	$1,811
2.0%	Planning During Construction	$687	$241	35.0%	$928	0.0%	$687	$241	$928	2027Q1	30.1%	$894	$313	$1,207
1.0%	Adaptive Management & Monitoring	$344	$120	35.0%	$464	0.0%	$344	$120	$464	2027Q1	30.1%	$447	$157	$604
0.0%	Project Operations	$0	$0	35.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
10.5%	Construction Management	$3,609	$1,263	35.0%	$4,872	0.0%	$3,609	$1,263	$4,872	2027Q1	30.1%	$4,695	$1,643	$6,339
0.0%	Project Operation:	$0	$0	35.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Management	$0	$0	35.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$53,041	$18,888		$71,929		$53,041	$18,888	**$71,929**			$65,005	$23,125	**$88,130**

MII

Description	UOM	Quantity	ProjectCost
Summary			**34,378,528.50**
Optimized Plan	**LS**	**1.0000**	**34,378,528.50**
02 Relocation	**LS**	**1.0000**	**1,373,175.25**
06 Fish & Wildlife	**LS**	**1.0000**	**2,157,111.59**
11 Levees and Floodwalls	**LS**	**1.0000**	**17,157,353.03**
18 Cultural Resource Preservation	**LS**	**1.0000**	**1,070,000.00**
19 Buildings, Grounds, & Utilities	**LS**	**1.0000**	**12,620,888.62**

Labor ID: New Jersey EQ ID: EP16R01 Currency in US dollars TRACES MII Version 4.2