



**US Army Corps
of Engineers®**
San Francisco District

Appendix G Cost Engineering



TABLE OF CONTENTS

1. INTRODUCTION

2. BASIS OF ESTIMATE

3. MCACES REPORT

4. PROJECT COST AND ABBREVIATED RISK ANALYSIS REPORT

DRAFT

1. INTRODUCTION

The cost estimate for the Lower Colma Flood Protection Project’s Feasibility Report was developed using the Micro-Computer Aided Cost Estimating System (MCACES), Second Generation (MII) software and the USACE established Civil Works Work Breakdown Structure (CWWBS). The estimate used quantities provided by the Civil Design Section, and was based on USACE cost estimating standards, and the cost estimating knowledge and judgment of USACE cost engineers as they apply to civil works projects.

Table 1: First Costs Table Tentatively Selected Plan

Lower Colma Creek CAP 103 Flood Protection Feasibility Study							
April 2022 Price Level							
Feasibility Report Cost Estimate Summary							
Feat. Acct.	Description	Qty	UoM	Subtotal	Cont. %	Cont \$	Total Cost
01	LANDS AND DAMAGES	1	LS	\$1,344,000	5.0%	\$67,000	\$1,411,000
06	FISH& WILDLIFE FACILITIES	1	LS	\$500,000	30.0%	\$150,000	\$650,000
11	FLOODWALLS	1	LS	\$7,135,000	35.0%	\$2,497,000	\$9,632,000
18	CULTURAL RESOURCE PRESERVATION	1	LS	\$115,000	30.0%	\$35,000	\$150,000
30	PLANNING, ENGINEERING AND DESIGN	1	LS	\$1,348,000	35.0%	\$472,000	\$1,820,000
31	CONSTRUCTION MANAGEMENT	1	LS	\$620,000	35.0%	\$217,000	\$837,000
	TOTAL			\$11,062,000	31.1%	\$3,438,000	\$14,500,000

2. BASIS OF ESTIMATE

BASIS/FACTS/ASSUMPTIONS

The basis for the estimate was the scoping documents provided by the Project Delivery Team (PDT). The unit costs for the construction features were computed by estimating the equipment, labor, material, and production rates suitable for the project.

EFFECTIVE PRICE LEVEL

The cost estimate effective price level is April 2022.

OVERTIME

The estimate assumed that the work will be done during 8-hour shifts, 5 days a week and that no overtime will be required.

ACQUISITION PLAN

The acquisition plan is unknown at this time; however, the cost estimate was developed assuming Invitation for Bid (IFB) competitive bidding, under multiple contracts with a prime contractor and subcontractors. It is assumed that construction will take four to five years to complete, and there will be a five separate contracts, one for each reach.

SITE ACCESS

There are no site access issues for the Contractor for this project, therefore no additional cost impacts have been applied to the IGE for this element.

CONSTRUCTION METHOD

No special construction technologies are required for the job.

UNUSUAL CONDITIONS

No unusual conditions are anticipated.

EQUIPMENT /LABOR AVAILABILITY AND DISTANCE TRAVELED

The project is located within San Mateo County, California. All labor and equipment are assumed available within a 100-miles radius in order to allow for fair competition.

ENVIRONMENTAL CONCERNS

No special environmental concerns beyond those stated in the construction window.

LABOR RATES

The labor rates used are from the Davis-Bacon wage rates tables for the San Francisco Bay Area, California.

EQUIPMENT RATES

Equipment rates are based upon the latest approved U.S. Army Corps of Engineers, Engineer Pamphlet (EP) 1110-1-8, Vol. 07, Construction Equipment Ownership and Operation Expense Schedule.

MATERIAL COSTS

Material prices were obtained from vendor and supplier quotes, discussions with USACE personnel and local government agencies, historical cost data from previous projects, and the MCACES Unit Price Book.

CONTINGENCIES

During development of the cost estimates, sufficient contingencies developed via PDT discussions during Abbreviated Risk Analysis (ARA) were applied to develop the Total Project First Cost. The breakdown of items within each account. The contingency factors used in the two alternatives are summarized in Table 1 and in the Total Project Cost Summary (TPCS).

DRAFT

North and South Floodwall Alternative includes an I-wall (sheetpile) floodwall, approximately 3 to 4.5 feet above grade at WQCP at the north side of the WQCP adjacent to the right-bank of Creek, as well as a second shorter approximately two-foot-high floodwall south of plant adjacent to San Francisco Bay. At Pump Station 4, a perimeter sheetpile floodwall, approximately 2 feet above grade, would be constructed, with stop log gate for vehicular access and early warning system so that plant operators would know when to seal the stop log gate.

DRAFT

Estimated by SPN

Designed by

Prepared by Mike Vo

Preparation Date 2/4/2022

Effective Date of Pricing 2/4/2022

Estimated Construction Time Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

Description	Quantity	UOM	ProjectCost
All Construction WBS Accounts			7,134,933.76
LOWER COLMA CREEK CONSTRUCTION COST	1.0000	JOB	7,134,933.76
TEMPORARY CONSTRUCTION FENCE	1.0000	JOB	27,173.73
TRAFFIC CONTROL	1.0000	JOB	174,713.02
MOBILIZATION AND DEMOBILIZATION	1.0000	JOB	564,193.00
STORM WATER POLLUTION PREVENTION PLAN	1.0000	JOB	202,620.89
CLEARING AND GRUBBING	1.0000	JOB	57,709.00
CONSTRUCTION TRAILER	1.0000	JOB	68,733.33
FLOOD WALL 1 NORTH (500 YEAR EVENT)	1.0000	JOB	4,180,497.78
FLOOD WALL 2 SOUTH (500 YEAR EVENT)	1.0000	JOB	1,438,578.78
PUMP STATION 4: FULL PERIMETER T-WALL (500 YEAR EVENT)	1.0000	JOB	238,153.78
PUMP STATION 4: SMALL INNER T-WALL (500 YEAR EVENT)	1.0000	JOB	182,560.43

DRAFT

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

PROJECT: Lower Colma Floodwall Feasibility Study
PROJECT NO: P2 xxxxxx
LOCATION: South San Francisco, CA

DISTRICT: SPN
POC: CHIEF, COST ENGINEERING, WARREN TAN

PREPARED: 4/17/2022

This Estimate reflects the scope and schedule in report; Lower Colma Floodwall Feasibility Study

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
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-21 (\$K) K	TOTAL FIRST COST (\$K) K	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
03	RESERVOIRS	\$0	\$0 -		\$0	-	\$0	\$0	\$0	\$0	\$0	-	\$0	\$0	\$0
04	DAMS	\$0	\$0 -		\$0	-	\$0	\$0	\$0	\$0	\$0	-	\$0	\$0	\$0
05	LOCKS	\$0	\$0 -		\$0	-	\$0	\$0	\$0	\$0	\$0	-	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$500	\$150	30.0%	\$650	0.0%	\$500	\$150	\$650	\$0	\$650	8.0%	\$540	\$162	\$702
07	POWER PLANT	\$0	\$0 -		\$0	-	\$0	\$0	\$0	\$0	\$0	-	\$0	\$0	\$0
08	ROADS, RAILROADS & BRIDGES	\$0	\$0 -		\$0	-	\$0	\$0	\$0	\$0	\$0	-	\$0	\$0	\$0
11	LEVEES & FLOODWALLS	\$7,135	\$2,497	35.0%	\$9,632	0.0%	\$7,135	\$2,497	\$9,632	\$0	\$9,632	8.0%	\$7,709	\$2,698	\$10,407
18	CULTURAL RESOURCE PRESERVATION	\$115	\$35	30.0%	\$150	0.0%	\$115	\$35	\$150	\$0	\$150	8.0%	\$124	\$37	\$162
CONSTRUCTION ESTIMATE TOTALS:		\$7,750	\$2,682		\$10,432	0.0%	\$7,750	\$2,682	\$10,432	\$0	\$10,432	8.0%	\$8,373	\$2,897	\$11,270
01	LANDS AND DAMAGES	\$1,344	\$67	5.0%	\$1,411	0.0%	\$1,344	\$67	\$1,411	\$0	\$1,411	8.0%	\$1,452	\$73	\$1,525
30	PLANNING, ENGINEERING & DESIGN	\$1,349	\$472	35.0%	\$1,820	0.0%	\$1,349	\$472	\$1,820	\$0	\$1,820	4.2%	\$1,405	\$492	\$1,897
31	CONSTRUCTION MANAGEMENT	\$620	\$217	35.0%	\$837	0.0%	\$620	\$217	\$837	\$0	\$837	6.4%	\$659	\$231	\$890
PROJECT COST TOTALS:		\$11,063	\$3,438	31.1%	\$14,500		\$11,063	\$3,438	\$14,500	\$0	\$14,500	7.5%	\$11,890	\$3,693	\$15,583

CHIEF, COST ENGINEERING, WARREN TAN

ESTIMATED TOTAL PROJECT COST: \$15,583

PROJECT MANAGER, ROBERT GRIMES

CHIEF, REAL ESTATE, CESP-D-SPK

CHIEF, PLANNING, TOM KENDALL

CHIEF, ENGINEERING, SON HA

CHIEF, OPERATIONS, NICK MALASAVAGE

CHIEF, CONSTRUCTION, JERE HARPER

CHIEF, CONTRACTING, MARY FRONCK

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxxx

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

**** CONTRACT COST SUMMARY ****

PROJECT: Lower Colma Floodwall Feasibility Study
 LOCATION: South San Francisco, CA
 This Estimate reflects the scope and schedule in report; Lower Colma Floodwall Feasibility Study

DISTRICT: SPN
 POC: CHIEF, COST ENGINEERING, WARREN TAN
 PREPARED: 4/17/2022

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 17-Apr-22		Effective Price Level: 1-Oct-21		Program Year (Budget EC): 2022		Effective Price Level Date: 1 OCT 21						
		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														
03	RESERVOIRS	\$0	\$0	0.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
04	DAMS	\$0	\$0	0.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
05	LOCKS	\$0	\$0	0.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$500	\$150	30.0%	\$650	0.0%	\$500	\$150	\$650	2024Q3	8.0%	\$540	\$162	\$702
07	POWER PLANT	\$0	\$0	0.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
08	ROADS, RAILROADS & BRIDGES	\$0	\$0	0.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
11	LEVEES & FLOODWALLS	\$7,135	\$2,497	35.0%	\$9,632	0.0%	\$7,135	\$2,497	\$9,632	2024Q3	8.0%	\$7,709	\$2,698	\$10,407
18	CULTURAL RESOURCE PRESERVATION	\$115	\$35	30.0%	\$150	0.0%	\$115	\$35	\$150	2024Q3	8.0%	\$124	\$37	\$162
CONSTRUCTION ESTIMATE TOTALS:		\$7,750	\$2,682	34.6%	\$10,432		\$7,750	\$2,682	\$10,432			\$8,373	\$2,897	\$11,270
01	LANDS AND DAMAGES	\$1,344	\$67	5.0%	\$1,411	0.0%	\$1,344	\$67	\$1,411	2024Q3	8.0%	\$1,452	\$73	\$1,525
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
1.0%	Planning & Environmental Compliance	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
7.0%	Engineering & Design	\$543	\$190	35.0%	\$732	0.0%	\$543	\$190	\$732	2023Q3	3.8%	\$563	\$197	\$760
1.4%	Reviews, ATRs, IEPs, VE	\$109	\$38	35.0%	\$146	0.0%	\$109	\$38	\$146	2023Q3	3.8%	\$113	\$39	\$152
1.0%	Life Cycle Updates (cost, schedule, risks)	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
1.0%	Contracting & Reprographics	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
1.0%	Engineering During Construction	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2024Q3	6.4%	\$82	\$29	\$111
2.0%	Planning During Construction	\$155	\$54	35.0%	\$209	0.0%	\$155	\$54	\$209	2024Q3	6.4%	\$165	\$58	\$223
1.0%	Adaptive Management & Monitoring	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
1.0%	Project Operations	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2023Q3	3.8%	\$80	\$28	\$109
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$543	\$190	35.0%	\$732	0.0%	\$543	\$190	\$732	2024Q3	6.4%	\$577	\$202	\$779
0.0%	Project Operation:	\$0	\$0	35.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
1.0%	Project Management	\$78	\$27	35.0%	\$105	0.0%	\$78	\$27	\$105	2024Q3	6.4%	\$82	\$29	\$111
CONTRACT COST TOTALS:		\$11,063	\$3,438		\$14,500		\$11,063	\$3,438	\$14,500			\$11,890	\$3,693	\$15,583

Abbreviated Risk Analysis

Project (less than \$40M): **Lower Colma Creek CAP 103**
 Project Development Stage/Alternative: **Feasibility (Recommended Plan)**
 Risk Category: **Low Risk: Typical Construction, Simple**

Alternative: Alt A

Meeting Date: 3/10/2022

Total Estimated Construction Contract Cost = \$ **3,232,602**

	CWWBS	Feature of Work	Estimated Cost	% Contingency	\$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	\$ -	0%	\$ -	\$ -
1		Alternative 1: North Floodwall + PS4+ early warni	\$ 5,528,000	35%	\$ 1,921,608	\$ 7,449,608
2		Alternative 2: N&S Floodwalls + PS4 + early warni	\$ 7,135,000	35%	\$ 2,480,223	\$ 9,615,223
3		Alternative 3: Nonstructural Plan- raising electric:	\$ 72,041,000	107%	\$ 77,039,458	\$ 149,080,458
4				0%	\$ -	\$ -
5				0%	\$ -	\$ -
6				0%	\$ -	\$ -
7				0%	\$ -	\$ -
8			\$ -	0%	\$ -	\$ -
9			\$ -	0%	\$ -	\$ -
10			\$ -	0%	\$ -	\$ -
11			\$ -	0%	\$ -	\$ -
12	All Other	Remaining Construction Items	\$ (81,471,398)	0.0%	\$ (9,850,934)	\$ (91,322,332)
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ -	0%	\$ -	\$ -
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ -	0%	\$ -	\$ -
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)				\$ -	\$ -

Totals						
	Real Estate	\$ -	0%	\$ -	\$ -	\$ -
	Total Construction Estimate	\$ 3,232,602	2215%	\$ 71,590,355	\$ 74,822,957	\$ 74,822,957
	Total Planning, Engineering & Design	\$ -	0%	\$ -	\$ -	\$ -
	Total Construction Management	\$ -	0%	\$ -	\$ -	\$ -
	Total Excluding Real Estate	\$ 3,232,602	2215%	\$ 71,590,355	\$ 74,822,957	\$ 74,822,957
		Base		50%	80%	
Confidence Level Range Estimate (\$000's)		\$3,233k	\$46,187k	\$74,823k		

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.)

Lower Colma Creek CAP 103 Alt A

Feasibility (Recommended Plan)
Abbreviated Risk Analysis

Meeting Dates: 10-Mar-22
17-Mar-22

Risk Level					
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Moderate	Significant	Critical

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth						40%
PS-1	Alternative 1: North Floodwall + PS4+ early warning	Refined alignment to be determined	Bedrock is not very shallow and should be ok based on proposed alignment. If unknown underground utilities are discovered, they may need to be relocated, or the alignment may need to be pushed further into the adjacent marsh, which could increase environmental mitigation cost. Sheetpile driving that meets hard material could slow construction. Subsurface sampling showed no hard material at the intended embedment depth, but sampling is limited, so there is a possibility of encountering.	Moderate	Unlikely	1
PS-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	Refined alignment to be determined	Bedrock is not very shallow and should be ok based on proposed alignment. If unknown underground utilities are discovered, they may need to be relocated, or the alignment may need to be pushed further into the adjacent marsh, which could increase environmental mitigation cost. Sheetpile driving that meets hard material could slow construction. Subsurface sampling showed no hard material at the intended embedment depth, but sampling is limited, so there is a possibility of encountering.	Moderate	Unlikely	1
PS-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	Costs are conceptual and parametric but refinement would not change plan selection and would likely only increase the cost.	Floodproofing costs were obtained from the North Atlantic Coastal Comprehensive Study and are parametric costs, which may not apply sufficiently to a wastewater treatment facility. Uncertainty is high and further refinement would likely increase the cost. For electrical raising, this cost was provided by the non-federal-sponsor based on similar constructed projects and is a conceptual cost, which is likely to rise based on further refinement. This is not the tentatively selected plan and is outside of the scope of the CAP cost limit. The cost to raise exits and walkways out of the flood depths has not been included and would only raise the cost further. Early warning system costs has also been excluded, as it is negligible compared to overall cost.	Significant	Very LIKELY	5

PS-4	0			Negligible	Unlikely	0
PS-5	0			Negligible	Unlikely	0
PS-6	0			Negligible	Unlikely	0
PS-7	0			Negligible	Unlikely	0
PS-8	0			Negligible	Unlikely	0
PS-9	0			Negligible	Unlikely	0
PS-10	0			Negligible	Unlikely	0
PS-11	0			Negligible	Unlikely	0
PS-12	Remaining Construction Items	Possible mitigation	There is a rough order of magnitude cost included for mitigation. This has a 30% contingency added to it based on it being a rough cost estimate. There is a small possibility that actual mitigation could exceed this cost estimate.	Marginal	Possible	1
PS-13	Planning, Engineering, & Design	No concerns	A standard percentage cost estimate was applied initially of 35%. This is a simple project and design. After the Abbreviated CSRA, this estimate will decrease. The project was justified even with the higher estimate.	Negligible	Unlikely	0
PS-14	Construction Management	No concerns	A standard percentage cost estimate was applied initially of 35%. This is a simple project and design. After the Abbreviated CSRA, this estimate will decrease. The project was justified even with the higher estimate.	Negligible	Unlikely	0

Acquisition Strategy				Maximum Project Growth		30%
AS-1	Alternative 1: North Floodwall + PS4+ early warning	One parcel of real estate will need to be acquired from the State.	Part of the WQCP footprint near Colma Creek on the north side of the bank is owned by the State of California. If the City of South San Francisco does not already have a sufficient existing easement, they will need to acquire a permanent easement for this tract. There is a unlikely possibility that real estate will not be able to be attained, or will take prolonged coordination to attain which will cause delays and added project management costs.	Significant	Unlikely	2
AS-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	One parcel of real estate will need to be acquired from the State.	Part of the WQCP footprint near Colma Creek on the north side of the bank is owned by the State of California. If the City of South San Francisco does not already have a sufficient existing easement, they will need to acquire a permanent easement for this tract. There is a unlikely possibility that real estate will not be able to be attained, or will take prolonged coordination to attain which will cause delays and added project management costs.	Significant	Unlikely	2
AS-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system			Negligible	Unlikely	0

AS-4	0			Negligible	Unlikely	0	
AS-5	0			Negligible	Unlikely	0	
AS-6	0			Negligible	Unlikely	0	
AS-7	0			Negligible	Unlikely	0	
AS-8	0			Negligible	Unlikely	0	
AS-9	0			Negligible	Unlikely	0	
AS-10	0			Negligible	Unlikely	0	
AS-11	0			Negligible	Unlikely	0	
AS-12	Remaining Construction Items			Negligible	Unlikely	0	
AS-13	Planning, Engineering, & Design			Negligible	Unlikely	0	
AS-14	Construction Management			Negligible	Unlikely	0	
Construction Elements						Maximum Project Growth	15%
CON-1	Alternative 1: North Floodwall + PS4+ early warning	There may be a need for utility relocations.	There is a 4' by 4' utility box and a 2' by 2' electrical power unit that may need to be relocated prior to floodwall construction.	Significant	Possible	3	
CE-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	There may be a need for utility relocations.	There is a 4' by 4' utility box and a 2' by 2' electrical power unit that may need to be relocated prior to floodwall construction.	Significant	Possible	3	
CE-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	This alternative includes complicated electrical raising.	The risk of this increasing the cost to implement this measure is already captured in risk element PS-3 and SC-3.	Negligible	Unlikely	0	
CE-4	0			Negligible	Unlikely	0	
CE-5	0			Negligible	Unlikely	0	
CE-6	0			Negligible	Unlikely	0	
CE-7	0			Negligible	Unlikely	0	
CE-8	0			Negligible	Unlikely	0	

CE-9	0			Negligible	Unlikely	0
CE-10	0			Negligible	Unlikely	0
CE-11	0			Negligible	Unlikely	0
CE-12	Remaining Construction Items			Negligible	Unlikely	0
CE-13	Planning, Engineering, & Design			Negligible	Unlikely	0
CE-14	Construction Management			Negligible	Unlikely	0
Specialty Construction or Fabrication				Maximum Project Growth		50%
SC-1	Alternative 1: North Floodwall + PS4+ early warning	N/A	Subsurface testing for buried cultural artifacts could reveal artifacts, which would need to be excavated and reburied or documented. This would add to the cost. If listed species are identified prior to or during construction, a monitor or more stringent construction windows could increase the cost.	Moderate	Possible	2
SC-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	N/A	Subsurface testing for buried cultural artifacts could reveal artifacts, which would need to be excavated and reburied or documented. This would add to the cost. If listed species are identified prior to or during construction, a monitor or more stringent construction windows could increase the cost.	Moderate	Possible	2
SC-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	Alternative 3 includes specialty construction, which could cause the cost estimate to increase. It is not the TSP, so there is no risk this would change the selected plan.	Raising the electrical system is highly specialized work. Floodproofing this type of infrastructure could also be considered specialty construction and may require custom fabrication, which could increase the cost estimate.	Significant	Very LIKELY	5
SC-4	0			Negligible	Unlikely	0
SC-5	0			Negligible	Unlikely	0
SC-6	0			Negligible	Unlikely	0
SC-7	0			Negligible	Unlikely	0
SC-8	0			Negligible	Unlikely	0
SC-9	0			Negligible	Unlikely	0
SC-10	0			Negligible	Unlikely	0

SC-11	0			Negligible	Unlikely	0
SC-12	Remaining Construction Items			Negligible	Unlikely	0
SC-13	Planning, Engineering, & Design			Negligible	Unlikely	0
SC-14	Construction Management			Negligible	Unlikely	0

Technical Design & Quantities				Maximum Project Growth		20%
--	--	--	--	-------------------------------	--	------------

T-1	Alternative 1: North Floodwall + PS4+ early warning	No concerns		Negligible	Unlikely	0
T-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	No concerns		Negligible	Unlikely	0
T-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	No concerns		Negligible	Unlikely	0
T-4	0			Negligible	Unlikely	0
T-5	0			Negligible	Unlikely	0
T-6	0			Negligible	Unlikely	0
T-7	0			Negligible	Unlikely	0
T-8	0			Negligible	Unlikely	0
T-9	0			Negligible	Unlikely	0
T-10	0			Negligible	Unlikely	0
T-11	0			Negligible	Unlikely	0
T-12	Remaining Construction Items			Negligible	Unlikely	0
T-13	Planning, Engineering, & Design			Negligible	Unlikely	0
T-14	Construction Management			Negligible	Unlikely	0

Cost Estimate Assumptions				Maximum Project Growth		25%
----------------------------------	--	--	--	-------------------------------	--	------------

EST-1	Alternative 1: North Floodwall + PS4+ early warning	Prime and Subcontractor markup could be greater than estimated	this would increase the cost of construction	Moderate	Possible	2
EST-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	Prime and Subcontractor markup could be greater than estimated	this would increase the cost of construction	Moderate	Possible	2
EST-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	Prime and Subcontractor markup could be greater than estimated	this would increase the cost of construction	Moderate	Possible	2
EST-4	0			Negligible	Unlikely	0
EST-5	0			Negligible	Unlikely	0
EST-6	0			Negligible	Unlikely	0
EST-7	0			Negligible	Unlikely	0
EST-8	0			Negligible	Unlikely	0
EST-9	0			Negligible	Unlikely	0
EST-10	0			Negligible	Unlikely	0
EST-11	0			Negligible	Unlikely	0
EST-12	Remaining Construction Items			Negligible	Unlikely	0
EST-13	Planning, Engineering, & Design			Negligible	Unlikely	0
EST-14	Construction Management			Negligible	Unlikely	0
External Project Risks				Maximum Project Growth		20%
EX-1	Alternative 1: North Floodwall + PS4+ early warning	Weather, funding constraints, inflation, supply chain issues, material costs, or workforce availability and other outside factors could impact construction schedule and productivity, increasing cost of construction.	Rain or storms or wet ground could impact the construction schedule. Generally for CAP, the funding can be dropped in full, or by FY. The recent infrastructure bill greatly increased the CAP funding from previous years by orders of magnitude. This decreases the likelihood of funding not becoming available to construct. Workforce availability, supply chain issues, increased material costs, and inflation are more likely to occur than these other outside factors.	Moderate	Possible	2

EX-2	Alternative 2: N&S Floodwalls + PS4 + early warning system	Weather, funding constraints, inflation, supply chain issues, material costs, or workforce availability and other outside factors could impact construction schedule and productivity, increasing cost of construction.	Rain or storms or wet ground could impact the construction schedule. Generally for CAP, the funding can be dropped in full, or by FY. The recent infrastructure bill greatly increased the CAP funding from previous years by orders of magnitude. This decreases the likelihood of funding not becoming available to construct. Workforce availability, supply chain issues, increased material costs, and inflation are more likely to occur than these other outside factors.	Moderate	Possible	2
EX-3	Alternative 3: Nonstructural Plan- raising electrical, floodproofing, elevated exits/walkways, early warning system	Weather, funding constraints, inflation, supply chain issues, material costs, or workforce availability and other outside factors could impact construction schedule and productivity, increasing cost of construction.	Rain or storms or wet ground could impact the construction schedule. Generally for CAP, the funding can be dropped in full, or by FY. The recent infrastructure bill greatly increased the CAP funding from previous years by orders of magnitude. This decreases the likelihood of funding not becoming available to construct. Workforce availability, supply chain issues, increased material costs, and inflation are more likely to occur than these other outside factors.	Moderate	Possible	2
EX-4	0			Negligible	Unlikely	0
EX-5	0			Negligible	Unlikely	0
EX-6	0			Negligible	Unlikely	0
EX-7	0			Negligible	Unlikely	0
EX-8	0			Negligible	Unlikely	0
EX-9	0			Negligible	Unlikely	0
EX-10	0			Negligible	Unlikely	0
EX-11	0			Negligible	Unlikely	0
EX-12	Remaining Construction Items			Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design			Negligible	Unlikely	0
EX-14	Construction Management			Negligible	Unlikely	0