

# APPENDIX G – COST ENGINEERING

## Galveston Intercoastal Waterways Coastal Resilience Study, Texas

January 2022



**US Army Corps  
of Engineers** ®  
Galveston District



Texas  
Department  
of Transportation

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# **Gulf Intracoastal Waterway, Coastal Resiliency Study, Texas**

## **Cost Appendix G**

The Coastal Resiliency Study covers a length of the Gulf Intracoastal Waterway (GIWW) along the Texas coastline. The primary focus of the study is improving the resilience of roughly 36 miles of channel.

Class 3 cost estimates were developed in MCACES (Micro-Computer Aided Cost Estimating System), also known as MII, for the final alternatives: Alternative 6 - NED and Alternative 6 - Resiliency designed by the project delivery team (PDT).

Alternative 6 - NED plan is divided into two (2) contracts and Alternative 6 - Resiliency plan is divided into three (3) contracts. Each contract is organized in accordance with a work breakdown structure. Midpoint dates for the construction contracts were developed in conjunction with the PM and the PDT for developing the fully funded costs. The estimates were prepared in accordance with ER 1110-2-1302 Civil Works Cost Engineering and EM 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS), dated 30 September 2021.

Marine fuel price is averaged, locked in at \$3.00/gallon (October 2021). Diesel fuel price is locked in at \$3.47/gallon (October 2021). There are no impacts to utilities anticipated. There are no Hazardous, Toxic, and Radioactive Wastes anticipated. The Operation and Maintenance estimate is dated October 2021, with an effective pricing date of October 2021. A formal Cost Risk Analyses is performed with the cooperation of the PDT and Cost Engineering Directory of Expertise (DX) of the Walla Walla District (October 2021). The risks were quantified, and a cost risk model developed to determine a contingency at 80% Confidence Level (CL). An ATR Certification of Cost Estimate is provided by Walla Walla District.

### **Alternative 6 - NED Plan:**

Alternative 6 - NED plan is split into two contracts.

#### **Contract 1:**

This contract covers construction in zone 12, zone 14, and zone 16. Breakwaters will be constructed in each zone. Earthen berms will be constructed in zones 14 and 16. Oyster reefs will be constructed in zone 16 and seagrass will be planted. The approximate duration is 13 months.

#### **Contract 2:**

This contract covers construction in zone 18. Construction involves breakwaters, oyster reefs, and sea grass. The approximate duration is 16 months.

## **Alternative 6 - Resilience Plan:**

Alternative 6 - Resilience plan is split into three contracts.

### Contract 1:

This contract covers construction in zone 12 and zone 13. Breakwaters will be constructed in each zone. Earthen berms and oyster reefs will be constructed in zones 13. The approximate duration is 18 months.

### Contract 2:

This contract covers construction in zone 14 and zone 16. Breakwaters will be constructed in each zone. Earthen berms will be constructed in zones 14 and 16. Oyster reefs will be constructed in zone 16 and seagrass will be planted. The approximate duration is 10 months.

### Contract 3:

This contract covers construction in zone 18. Construction involves breakwaters, oyster reefs, and sea grass. The approximate duration is 16 months.

ACCOUNT CODE 01 - LANDS AND DAMAGES: The Galveston District Real Estate Division developed costs and contingency for Lands and Damages.

ACCOUNT CODE 06 – FISH AND WILDLIFE FACILITIES: H&H Branch and Environmental Brach provided all the quantities associate with this account. The cost was based on similar work done by the district.

ACCOUNT CODE 10 – BREAKWATER AND SEAWALL: H&H Branch provided all the quantities associate with this account. It was assumed the contractor would need to dredge an access channel to place the riprap, which ultimately creates an offshore breakwater to mitigate the wave impacts along the shoreline.

ACCOUNT CODE 12 – NAVIGATION PORTS AND HARBORS: H&H Branch provided the quantities associated with this account. It was assumed that the dredge material would come from between Stations 691+500 to 883+000 on the GIWW using traditional dredging methods for the area, a 24" pipeline. The dredging cost was developed using CEDEP and based on standard operating practices for the Galveston District.

ACCOUNT CODE 30 – PLANNING, ENGINEERING AND DESIGN: The cost for this account code was developed using a percentage of the construction work and in coordination with the PM/PDT.

ACCOUNT CODE 31 - CONSTRUCTION MANAGEMENT: Costs for this account code was developed using a percentage of the construction work and in coordination with the PM/PDT.

Costs were developed by increments, so the team could combine them as they wanted to present them. The increments were as follows:

**Increment 12.3.1:** Breakwaters are constructed in Zone 12 with the intent of constricting flow through Caney Creek and reducing shoreline erosion.

**Increment 12.3.2:** Breakwaters are constructed in Zone 12 with the intent of constricting flow through Caney Creek and reducing shoreline erosion. Additionally, a section of the channel will be widened to create a sediment trap.

**Increment 13.3.1:** Breakwaters are constructed in Zone 13 to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW.

**Increment 14.3.1:** Breakwaters are constructed in Zone 14 to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW as well as reduce erosion on the barrier island next to the channel.

**Increment 16.3.1:** Breakwaters are constructed in Zone 16 to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW as well as reduce erosion on the barrier island next to the channel.

**Increment 18.3.1:** Breakwaters are constructed in Zone 18 (along the bayside of the barrier island) to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW as well as reduce erosion on the barrier island next to the channel.

**Increment 18.3.2:** Breakwaters are constructed in Zone 18 (along the bayside and the channel side of the barrier island) to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW as well as reduce erosion on the barrier island next to the channel.

**Increment 18.3.3:** Breakwaters are constructed in Zone 18 (along the bayside and the channel side of the barrier island along with on the landward side of the GIWW) to 5ft above NAVD to reduce sediment transfer between the bay and the GIWW as well as reduce erosion on the barrier island next to the channel.

**Increment 13.6.1:** Breakwaters are constructed in Zone 13 to 3ft above NAVD to reduce sediment transfer between the bay and the GIWW. Dredge material will be placed inside the area protected by the breakwaters to rebuild the eroded barrier island.

**Increment 14.6.1:** Breakwaters are constructed in Zone 14 to 3ft above NAVD to reduce sediment transfer between the bay and the GIWW. Dredge material will be placed inside the area protected by the breakwaters to rebuild the eroded barrier island.

**Increment 16.6.1:** Breakwaters are constructed in Zone 16 to 3ft above NAVD to reduce sediment transfer between the bay and the GIWW. Dredge material will be placed inside the area protected by the breakwaters to rebuild the eroded barrier island.

**Increment 18.6.1:** Breakwaters are constructed in Zone 18 (along the bayside and the channel side of the barrier island) to 3ft above NAVD to reduce sediment transfer between the bay and the GIWW. Dredge material will be placed inside the area protected by the breakwaters to rebuild the eroded barrier island.

**Increment 18.6.2:** Breakwaters are constructed in Zone 18 (along the bayside and the channel side of the barrier island along with on the landward side of the GIWW) to 3ft above NAVD to reduce sediment transfer between the bay and the GIWW. Dredge material will be placed inside the area protected by the breakwaters to rebuild the eroded barrier island.

**Combined Increments 12.3.1, 13.3.1, 14.3.1, 16.3.1:** These increments were modeled together so that benefits related to construction in multiple zones could be captured.

**Combined Increments 12.3.1, 13.6.1, 14.6.1, 16.6.1:** These increments were modeled together so that benefits related to construction in multiple zones could be captured.

**Combined Increments 12.3.1, 13.3.1, 14.3.1, 16.3.1, 18.3.3:** These increments were modeled together so that benefits related to construction in multiple zones could be captured.

**Combined Increments 12.3.1, 13.6.1, 14.6.1, 16.6.1, 18.6.2:** These increments were modeled together so that benefits related to construction in multiple zones could be captured.

**Baseline:** A comprehensive Operations and Maintenance (O&M) plan was developed for the Future Without Project.

**Table 1: Summary of Preliminary Cost by Code of Account, October 2021 Price Level, First Cost**

Code of Accounts	FWOP	12.3.1	12.3.2	13.3.1	14.3.1
<b>Non-Federal Costs</b>					
01 Lands and Damages	\$ -	\$ 58,367	\$ 58,367	\$ -	\$ -
<b>Total Non-Federal Costs</b>	\$ -	\$ 58,367	\$ 58,367	\$ -	\$ -
<b>Federal Costs</b>					
01 Lands and Damages	\$ -	\$ 16,875	\$ 16,875	\$ 2,700	\$ 2,700
06 Fish & Wildlife Facilities	\$ -			\$ 1,425,882	\$ 1,902,935
10 Breakwaters and Seawalls	\$ -	\$ 10,480,802	\$ 10,480,813	\$ 32,891,809	\$ 15,625,105
12 Navigation Ports & Harbors	\$ -		\$ 4,972,642		
30 Planning, E&D	\$ -	\$ 838,464	\$ 1,242,672	\$ 2,745,415	\$ 1,402,243
31 Construction Management	\$ -	\$ 628,848	\$ 932,004	\$ 2,059,061	\$ 1,051,682
<b>Total Federal Costs</b>	\$ -	\$ 11,964,989	\$ 17,645,005	\$ 39,124,868	\$ 19,984,666
<b>Total Project Cost</b>	\$ -	\$ 12,023,356	\$ 17,703,372	\$ 39,124,868	\$ 19,984,666
<b>Total Proj Cst (Rounded)</b>	\$ -	\$ 12,023,000	\$ 17,703,000	\$ 39,125,000	\$ 19,985,000
<b>Total O&amp;M (Rounded)</b>	\$ 689,187,000	\$ 674,532,100	\$ 683,834,900	\$ 677,674,300	\$ 677,348,500

**Table 2: Summary of Preliminary Cost by Code of Account, October 2021  
Price Level, First Cost**

<b>Code of Accounts</b>	<b>16.3.1</b>	<b>18.3.1</b>	<b>18.3.2</b>	<b>18.3.3</b>	<b>13.6.1</b>
<b>Non-Federal Costs</b>					
01 Lands and Damages	\$ 19,452	\$ -	\$ 38,924	\$ 58,371	\$ -
<b>Total Non-Federal Costs</b>	\$ 19,452	\$ -	\$ 38,924	\$ 58,371	\$ -
<b>Federal Costs</b>					
01 Lands and Damages	\$ 7,425	\$ 2,700	\$ 12,150	\$ 16,875	\$ 2,700
06 Fish & Wildlife Facilities	\$ 2,138,823	\$ 10,940,556	\$ 14,505,261	\$ 14,505,261	\$ 6,441,792
10 Breakwaters and Seawalls	\$ 37,123,563	\$ 61,142,038	\$ 143,389,738	\$ 182,339,585	\$ 43,084,473
12 Navigation Ports & Harbors					\$ 3,898,819
30 Planning, E&D	\$ 3,140,991	\$ 5,766,607	\$ 12,631,600	\$ 15,747,588	\$ 4,274,007
31 Construction Management	\$ 2,355,743	\$ 4,324,956	\$ 9,473,700	\$ 11,810,691	\$ 3,205,505
<b>Total Federal Costs</b>	\$ 44,766,545	\$ 82,176,857	\$ 180,012,449	\$ 224,419,999	\$ 60,907,295
<b>Total Project Cost</b>	\$ 44,785,997	\$ 82,176,857	\$ 180,051,373	\$ 224,478,370	\$ 60,907,295
<b>Total Proj Cst (Rounded)</b>	\$ 44,786,000	\$ 82,177,000	\$ 180,051,000	\$ 224,478,000	\$ 60,907,000
<b>Total O&amp;M (Rounded)</b>	\$ 671,461,000	\$ 599,004,300	\$ 606,027,700	\$ 599,703,700	\$ 678,008,900

**Table 3: Summary of Preliminary Cost by Code of Account, October 2021  
Price Level, First Cost**

Code of Accounts	14.6.1	16.6.1	18.6.1	18.6.2
<b>Non-Federal Costs</b>				
01 Lands and Damages	\$ -	\$ 19,819	\$ 19,586	\$ 39,317
<b>Total Non-Federal Costs</b>	\$ -	\$ 19,819	\$ 19,586	\$ 39,317
<b>Federal Costs</b>				
01 Lands and Damages	\$ 2,700	\$ 7,425	\$ 7,425	\$ 12,150
06 Fish & Wildlife Facilities	\$ 2,154,047	\$ 2,936,775	\$ 20,591,939	\$ 24,209,399
10 Breakwaters and Seawalls	\$ 9,667,606	\$ 23,535,593	\$ 89,102,594	\$ 129,559,122
12 Navigation Ports & Harbors	\$ 1,988,608	\$ 1,870,230		
30 Planning, E&D	\$ 1,104,821	\$ 2,267,408	\$ 8,775,563	\$ 12,301,482
31 Construction Management	\$ 828,616	\$ 1,700,556	\$ 6,581,672	\$ 9,226,111
<b>Total Federal Costs</b>	\$ 15,746,397	\$ 32,317,987	\$ 125,059,193	\$ 175,308,264
<b>Total Project Cost</b>	\$ 15,746,397	\$ 32,337,806	\$ 125,078,779	\$ 175,347,581
<b>Total Proj Cst (Rounded)</b>	\$ 15,746,000	\$ 32,338,000	\$ 125,079,000	\$ 175,348,000
<b>Total O&amp;M (Rounded)</b>	\$ 655,450,800	\$ 648,902,900	\$ 480,366,400	\$ 528,259,300

**Table 4: Summary of Preliminary Cost by Code of Account, October 2021  
Price Level, First Cost**

Code of Accounts	12.3.1, 13.3.1, 14.3.1, 16.3.1	12.3.1, 13.6.1, 14.6.1, 16.6.1	12.3.1, 13.3.1, 14.3.1, 16.3.1, 18.3.3	12.3.1, 13.6.1, 14.6.1, 16.6.1, 18.6.2
<b>Non-Federal Costs</b>				
01 Lands and Damages	\$ 77,818	\$ 78,186	\$ 136,189	\$ 117,503
<b>Total Non-Federal Costs</b>	\$ 77,818	\$ 78,186	\$ 136,189	\$ 117,503
<b>Federal Costs</b>				
01 Lands and Damages	\$ 29,700	\$ 29,700	\$ 46,575	\$ 41,850
06 Fish & Wildlife Facilities	\$ 5,467,640	\$ 11,532,613	\$ 19,972,901	\$ 35,742,012
10 Breakwaters and Seawalls	\$ 96,121,279	\$ 86,768,474	\$ 278,460,864	\$ 216,327,596
12 Navigation Ports & Harbors		\$ 7,757,657		\$ 7,757,657
30 Planning, E&D	\$ 8,127,114	\$ 8,484,700	\$ 23,874,701	\$ 20,786,181
31 Construction Management	\$ 6,095,335	\$ 6,363,525	\$ 17,906,026	\$ 15,589,636
<b>Total Federal Costs</b>	\$ 115,841,068	\$ 120,936,669	\$ 340,261,067	\$ 296,244,933
<b>Total Project Cost</b>	\$ 115,918,886	\$ 121,014,855	\$ 340,397,256	\$ 296,362,436
<b>Total Proj Cst (Rounded)</b>	\$ 115,919,000	\$ 121,015,000	\$ 340,397,000	\$ 296,362,000
<b>Total O&amp;M (Rounded)</b>	\$ 568,775,800	\$ 545,307,600	\$ 522,705,000	\$ 432,974,500

With these Increments the PDT developed ten alternatives shown in Table 5 and Table 6 below.

Alternative 1: No Action

Alternative 3 - Most Efficient: The plan consists of Increment 12.3.1.

Alternative 3 – Channel Modification: The plan consists of increment 12.3.2.

Alternative 3 – Barrier Restoration for Zone 13: The plan consists of Increment 13.3.1.

Alternative 6 – Zone 13: The plan consists of Increment 13.6.1.

Alternative 6 - NED: The plan consists of Increments 12.3.1, 14.6.1, 16.6.1, and 18.6.1.

Alternative 6 - Resilience: The plan consists of Increments 12.3.2, 13.6.1, 14.6.1, 16.6.1, and 18.6.1.

Alternative 6 - NED Minus Zone 18: The plan consists of Increments 12.3.2, 14.6.1, and 16.6.1.

Alternative 6 - Most Cost-Effective: The plan consists of Increment 18.6.1.

Alternative 6 - Resilience Minus Zone 18: The plan consists of Increments 12.3.2, 13.6.1, 14.6.1, and 16.6.1.

**Table 5: Cost for Alternative Plans (rounded), October 2021 Price Level, First Cost**

Code of Accounts	No Action	Most Efficient Combination	Channel Modification	Barrier Restoration for Zone 13	Resilience for Zone 13
<b>Non-Federal Costs</b>					
01 Lands and Damages	\$ -	\$ 58,367	\$ 58,367	\$ -	\$ -
<b>Total Non-Federal Costs</b>	\$ -	\$ 58,367	\$ 58,367	\$ -	\$ -
<b>Federal Costs</b>					
01 Lands and Damages	\$ -	\$ 16,875	\$ 16,875	\$ 2,700	\$ 2,700
06 Fish & Wildlife Facilities	\$ -	\$ -	\$ -	\$ 1,425,882	\$ 6,441,792
10 Breakwaters and Seawalls	\$ -	\$ 10,480,802	\$ 10,480,813	\$ 32,891,809	\$ 43,084,473
12 Navigation Ports & Harbors	\$ -	\$ -	\$ 4,972,642	\$ -	\$ 3,898,819
30 Planning, E&D	\$ -	\$ 838,464	\$ 1,242,672	\$ 2,745,415	\$ 4,274,007
31 Construction Management	\$ -	\$ 628,848	\$ 932,004	\$ 2,059,061	\$ 3,205,505
<b>Total Federal Costs</b>	\$ -	\$ 11,964,989	\$ 17,645,005	\$ 39,124,868	\$ 60,907,295
<b>Total Project Cost</b>	\$ -	\$ 12,023,356	\$ 17,703,372	\$ 39,124,868	\$ 60,907,295
<b>Total Proj Cst (Rounded)</b>	\$ -	\$ 12,023,000	\$ 17,703,000	\$ 39,125,000	\$ 60,907,000

**Table 6: Cost for Alternative Plans (rounded), October 2021 Price Level, First Cost**

Code of Accounts	NED	Resilience	NED Minus Zone 18	Most Cost-Effective Increment	Resilience Minus Zone 18
<b>Non-Federal Costs</b>					
01 Lands and Damages	\$ 97,772	\$ 97,772	\$ 78,186	\$ 19,586	\$ 78,186
<b>Total Non-Federal Costs</b>	\$ 97,772	\$ 97,772	\$ 78,186	\$ 19,586	\$ 78,186
<b>Federal Costs</b>					
01 Lands and Damages	\$ 34,425	\$ 37,125	\$ 27,000	\$ 7,425	\$ 29,700
06 Fish & Wildlife Facilities	\$ 25,682,760	\$ 32,124,552	\$ 5,090,821	\$ 20,591,939	\$ 11,532,613
10 Breakwaters and Seawalls	\$132,786,596	\$175,871,080	\$ 43,684,001	\$ 89,102,594	\$ 86,768,485
12 Navigation Ports & Harbors	\$ 3,858,838	\$ 12,730,299	\$ 3,858,838	\$ -	\$ 12,730,299
30 Planning, E&D	\$ 12,986,256	\$ 17,664,470	\$ 4,210,693	\$ 8,775,563	\$ 8,888,907
31 Construction Management	\$ 9,739,692	\$ 13,248,352	\$ 3,158,020	\$ 6,581,672	\$ 6,666,680
<b>Total Federal Costs</b>	\$185,088,567	\$251,675,878	\$ 60,029,374	\$ 125,059,193	\$ 126,616,685
<b>Total Project Cost</b>	\$185,186,338	\$251,773,649	\$ 60,107,559	\$ 125,078,779	\$ 126,694,871
<b>Total Proj Cst (Rounded)</b>	\$185,186,000	\$251,774,000	\$ 60,108,000	\$ 125,079,000	\$ 126,695,000

## Abbreviated Risk Analysis

### 471987-GIWW Coastal Resiliency Study (CRS) Feasibility (Alternatives)

Meeting Date: 16-Jun-21

#### PDT Members

Note: PDT involvement is commensurate with project size and involvement.

Represents	Name
Project Management:	Gretchen Brown
Planner:	Solomon Kang/Christopher King
Economist:	Bob Needham
Contracting:	
Real Estate:	Micaela Kinsey
Relocations:	
Sponsor:	Matt Mahoney
Engineering & Design:	
Technical Lead:	Rachael Patrick
Geotech:	Brandon Crawford
H&H	Patrick Kerr
Civil:	
Structural:	
Mechanical:	NA
Electrical:	NA
Cost Engineering:	Ryan Harbour/Martin Regner
Construction:	Jantzen Miller
Operations:	Belynda Kinman
Environmental:	C. Brandon Ford
VE	Jacob Walsdorf
Archeologist	Chris Davies
Office of Counsel	Stakely McConnell

**Abbreviated Risk Analysis**

Project (less than \$40M): **471987-GIWW Coastal Resiliency Study (CRS)**  
 Project Development Stage/Alternative: **Feasibility (Alternatives)**  
 Risk Category: **Low Risk: Typical Construction, Simple**

Alternative: **All**

Meeting Date: **6/16/2021**

Total Estimated Construction Contract Cost = \$ **40,000**

CWWBS	Feature of Work	Estimated Cost	% Contingency	\$ Contingency	Total
01 LANDS AND DAMAGES	Real Estate	\$ -	10%	\$ -	\$ -
1 06 FISH AND WILDLIFE FACILITIES	Mitigation (Marsh, Oyster Reef)	\$ 10,000	38%	\$ 3,752	\$ 13,752
2 10 BREAKWATERS AND SEAWALLS	Breakwaters	\$ 10,000	34%	\$ 3,380	\$ 13,380
3 12 NAVIGATION, PORTS AND HARBORS	Earthwork	\$ 10,000	36%	\$ 3,584	\$ 13,584
4 12 NAVIGATION, PORTS AND HARBORS	Dredging	\$ 10,000	33%	\$ 3,350	\$ 13,350
5		\$ -	0%	\$ -	\$ -
6		\$ -	0%	\$ -	\$ -
7		\$ -	0%	\$ -	\$ -
8		\$ -	0%	\$ -	\$ -
9		\$ -	0%	\$ -	\$ -
10		\$ -	0%	\$ -	\$ -
11		\$ -	0%	\$ -	\$ -
12 All Other	Remaining Construction Items	\$ -	0.0%	\$ -	\$ -
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	\$ 40,000	35%	\$ 14,065	\$ 54,065
	Total Planning, Engineering & Design	\$ -	0%	\$ -	\$ -
	Total Construction Management	\$ -	0%	\$ -	\$ -
	<b>Total Excluding Real Estate</b>	<b>\$ 40,000</b>	<b>35%</b>	<b>\$ 14,065</b>	<b>\$ 54,065</b>

Confidence Level Range Estimate (\$000's)	Base	50%	80%
		\$40k	\$48k

\* 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.)

471987-GIWW Coastal Resiliency Study (CRS) All

Feasibility (Alternatives)  
Abbreviated Risk Analysis  
Meeting Date: 16-Jun-21

		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

35%

Use/View	Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level	Line Item Magnitude (\$000)
<b>Project Management &amp; Scope Growth</b>							Maximum Project Growth	40%
Yes	PS-1	Mitigation (Marsh, Oyster Reef)			Negligible	Unlikely	0	\$10k
Yes	PS-2	Breakwaters			Negligible	Unlikely	0	\$10k
Yes	PS-3	Earthwork			Negligible	Unlikely	0	\$10k
Yes	PS-4	Dredging	* potential for channel deepening or widening to act as sediment trap	* PED will include further analysis on sediment traps to limit shoaling.	Moderate	Possible	2	\$10k
<b>Acquisition Strategy</b>							Maximum Project Growth	30%
Yes	AS-1	Mitigation (Marsh, Oyster Reef)	* 8a or small business likely? * market conditions and competing projects may impact bid competition	* Contracting plan not firmly established. Current assumption is large business, but small business may be required/possible; the impact would be marginal, i.e. small prime managing large sub. * Dredges are limited in quantity and there is a significant amount of OM and New Work at the District. It is unknown how competitive the market will be at time of award.	Marginal	Likely	2	\$10k
Yes	AS-2	Breakwaters	* 8a or small business likely? * market conditions and competing projects may impact bid competition	* Contracting plan not firmly established. Current assumption is large business, but small business may be required/possible; the impact would be marginal, i.e. small prime managing large sub. * Dredges are limited in quantity and there is a significant amount of OM and New Work at the District. It is unknown how competitive the market will be at time of award.	Marginal	Likely	2	\$10k
Yes	AS-3	Earthwork	* 8a or small business likely? * market conditions and competing projects may impact bid competition	* Contracting plan not firmly established. Current assumption is large business, but small business may be required/possible; the impact would be marginal, i.e. small prime managing large sub. * Dredges are limited in quantity and there is a significant amount of OM and New Work at the District. It is unknown how competitive the market will be at time of award.	Marginal	Likely	2	\$10k
Yes	AS-4	Dredging	* 8a or small business likely? * market conditions and competing projects may impact bid competition	* Contracting plan not firmly established. Current assumption is large business, but small business may be required/possible; the impact would be marginal, i.e. small prime managing large sub. * Dredges are limited in quantity and there is a significant amount of OM and New Work at the District. It is unknown how competitive the market will be at time of award.	Marginal	Likely	2	\$10k

Construction Elements					Maximum Project Growth		15%	
Yes	CON-1	Mitigation (Marsh, Oyster Reef)	* site accessibility, transportation delays, congestion	* Project could experience boat traffic along GMMW as construction is underway. Construction contractors could be delayed while boat traffic passes.	Marginal	Possible	1	\$10k
Yes	CE-2	Breakwaters	* site accessibility, transportation delays, congestion	* Project could experience boat traffic along GMMW as construction is underway. Construction contractors could be delayed while boat traffic passes.	Negligible	Very LIKELY	2	\$10k
Yes	CE-3	Earthwork	* site accessibility, transportation delays, congestion	* Project could experience boat traffic along GMMW as construction is underway. Construction contractors could be delayed while boat traffic passes.	Marginal	Possible	1	\$10k
Yes	CE-4	Dredging	* site accessibility, transportation delays, congestion	* Project could experience boat traffic along GMMW as construction is underway. Construction contractors could be delayed while boat traffic passes.	Negligible	Possible	0	\$10k
Specialty Construction or Fabrication					Maximum Project Growth		50%	
Yes	SC-1	Mitigation (Marsh, Oyster Reef)	NA	NA	Negligible	Unlikely	0	\$10k
Yes	SC-2	Breakwaters	NA	NA	Negligible	Unlikely	0	\$10k
Yes	SC-3	Earthwork	NA	NA	Negligible	Unlikely	0	\$10k
Yes	SC-4	Dredging	NA	NA	Negligible	Unlikely	0	\$10k
Technical Design & Quantities					Maximum Project Growth		20%	
Yes	T-1	Mitigation (Marsh, Oyster Reef)	<ul style="list-style-type: none"> <li>* limited surveys</li> <li>* unknown water depth and amount of material to be placed at mitigation sites</li> <li>* wildlife windows and/or species protection</li> <li>* BU Site or Marsh Creation. Currently placing max 1FD/Cycle for BU Site/ Marsh Creation.</li> <li>* Mitigation costs are considered best-case.</li> <li>* Sediment availability for berms.</li> </ul>	<ul style="list-style-type: none"> <li>* Surveys (topography, bathymetry, geotechnical and laboratory surveys) are required during FED. Results could change foundation requirements.</li> <li>* Quantities are subject to increases or decreases due to unknown water depth. However, team feels this is a very low risk. Negligible. Also placement captured in T-4.</li> <li>* Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, e.g. nesting piping plover, Whooping crane, etc. or turtle windows, which may delay project schedule. In addition, costs may increase to account for environmental oversight.</li> <li>* Need further refinement to define target elevation for marsh creation with varying heights through cell sites. Could reach marsh elevation with one cycle. SLR could impact O&amp;M of BU Marsh creation.</li> <li>* Because they are considered best-case, a price increase is likely.</li> <li>* Feel we have existing material available, mechanical dredge, sidecast for berms.</li> </ul>	Significant	Likely	4	\$10k

Yes	T-2	Breakwaters	<ul style="list-style-type: none"> <li>* limited surveys, design height</li> <li>* quantities for breakwaters</li> <li>* wildlife windows and/or species protection</li> <li>* Anytime a structure on GWW, barges could pull up on it. Or storm event moves the structure into the channel.</li> </ul>	<ul style="list-style-type: none"> <li>* Surveys (topography, bathymetry, geotechnical and laboratory surveys) are required during PED. Results could change foundation requirements, elevations (sea level rise), alignment from CL of channel, alignment along backside of barriers. Also potential for depth to change alignment and/or increase quantities.</li> <li>* Assumed depth for reefballs and fish passage widths. Vertical team could ask PDT to reduce quantities as we proceed forward to drop overall costs. Consider comparison of reef ball vs. riprap. Assume some settlement but negl increase in quantities at this time. Possible benefits for oyster reef, ALTS, outside zones 14, 16, 18, not oyster castles in traffic zones/channel.</li> <li>* Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, e.g. nesting piping plover, Whooping crane, etc. or turtle windows, which may delay project schedule. In addition, costs may increase to account for environmental oversight.</li> <li>* Barge could hit reef balls or pull up on breakwater, which could impact long-term maintenance of proposed structures. Movement of structure could be low? More likely to be hit by barge than fall into channel.</li> </ul>	Moderate	Likely	3	\$10k
Yes	T-3	Earthwork	<ul style="list-style-type: none"> <li>* limited surveys</li> <li>* quantity uncertainly driven by final dimensions</li> <li>* quality of adjacent borrow material</li> <li>* wildlife windows and/or species protection</li> </ul>	<ul style="list-style-type: none"> <li>* Surveys (topography, bathymetry, geotechnical and laboratory surveys) are required during PED. Results could change foundation requirements.</li> <li>* Slopes/elevations, crest width, to be adjusted during PED. Will need life cycle analysis for nourishment cycles to optimize dimensions.</li> <li>* Unknown material characteristic: adjacent to proposed 100' x 8' islands</li> <li>* Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, e.g. nesting piping plover, Whooping crane, etc. or turtle windows, which may delay project schedule. In addition, costs may increase to account for environmental oversight.</li> </ul>	Moderate	Likely	3	\$10k
Yes	T-4	Dredging	<ul style="list-style-type: none"> <li>* possibility for changes in quantities, no fluff in quantities</li> <li>* wildlife windows and/or species protection</li> <li>* no concern with soil characteristics in authorized channel, maintenance material to be used with historical data available</li> <li>* material concerns with sides of channel and potential sediment trap/identifying, have not swung out that wide with dredge before</li> </ul>	<ul style="list-style-type: none"> <li>* Quantities do not include contingencies, i.e. quantities are netline. Densities are assumed. Additional shoaling analysis to be performed (e.g. open water effects), which could increase (or decrease) quantities for current scope. Amount of maintenance material available?</li> <li>* Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, e.g. nesting piping plover, Whooping crane, etc. or turtle windows, which may delay project schedule. In addition, costs may increase to account for environmental oversight.</li> <li>* NA.</li> <li>* uncertain what type of virgin material we will run into, e.g. clays, debris, etc.</li> </ul>	Moderate	Likely	3	\$10k

Cost Estimate Assumptions				Maximum Project Growth		25%		
Yes	EST-1	Mitigation (Marsh, Oyster Reef)	<ul style="list-style-type: none"> <li>* unknown water depth and amount of material to be placed at mitigation sites</li> <li>* challenging site access, in-water work</li> </ul>	<ul style="list-style-type: none"> <li>* Costs currently assume planting the entire area, though we may not be able to plant the entire area based on water depth. Marsh plantings unlikely to increase in costs. Negligible.</li> <li>* Mitigation work requires daily mobilization and demobilizations. Estimate does not account for daily mob/demob at this time.</li> </ul>	Marginal	Likely	2	\$10k
Yes	EST-2	Breakwaters	<ul style="list-style-type: none"> <li>* challenging site access, in-water work</li> <li>* cost for reefballs appear high, source of suppliers</li> </ul>	<ul style="list-style-type: none"> <li>* Riprap, Reefballs require daily mobilization and demobilizations. Estimate does not account for daily mob/demob at this time.</li> <li>* Costs for reefballs are currently higher than TxDOT historical data. (\$1M/1000LF for riprap, installed, ARRWBU B) Riprap R300/granite potential sourcing. Consider alternative designs, e.g. reefball vs. breakwater.</li> </ul>	Marginal	Likely	2	\$10k
Yes	EST-3	Earthwork	<ul style="list-style-type: none"> <li>* challenging site access, in-water work</li> <li>*additional construction potentially required for temporary site access</li> </ul>	<ul style="list-style-type: none"> <li>* Work requires daily mobilization and demobilizations. Estimate does not account for daily mob/demob at this time.</li> <li>*potential for additional costs due to site access difficulties, not considered at this time</li> </ul>	Moderate	Likely	3	\$10k
Yes	EST-4	Dredging	<ul style="list-style-type: none"> <li>* fuel fluctuations can impact dredging costs</li> </ul>	<ul style="list-style-type: none"> <li>On dredging projects, fuel is a major cost driver. An average of \$3.00/gallon was used, which is the three-year average. Currently fuel rate is about \$2.30/gallon.</li> </ul>	Marginal	Possible	1	\$10k
External Project Risks				Maximum Project Growth		20%		
Yes	EX-1	Mitigation (Marsh, Oyster Reef)	<ul style="list-style-type: none"> <li>* potential for severe adverse weather</li> <li>* funding for PED is uncertain post feasibility; funding for construction is uncertain, e.g. funding is incremental per FY and can be impacted by budget delays such as continuing resolutions</li> <li>* assumes Coastal Texas to be in place</li> </ul>	<ul style="list-style-type: none"> <li>* There is potential for weather damages and delays, e.g. tropical depressions or hurricanes, should project construction occur during hurricane seasons, which is anticipated. Team to strategize during PED construction methodology to reduce erosion risks as construction is underway.</li> <li>* It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner.</li> <li>* If CT is not in place, could impact project/delay schedule. If CT does not get authorized -- and current project was to look at Brazoria and Matagorda and we only looked at Matagorda -- and we assumed CT would look at Brazoria, would we get in trouble for not looking at Brazoria. Would we not fulfill our obligation?</li> </ul>	Marginal	Likely	2	\$10k
Yes	EX-2	Breakwaters	<ul style="list-style-type: none"> <li>* potential for severe adverse weather</li> <li>* funding for PED is uncertain post feasibility; funding for construction is uncertain, e.g. funding is incremental per FY and can be impacted by budget delays such as continuing resolutions</li> <li>* assumes Coastal Texas to be in place</li> </ul>	<ul style="list-style-type: none"> <li>* There is potential for weather damages and delays, e.g. tropical depressions or hurricanes, should project construction occur during hurricane seasons, which is anticipated. Team to strategize during PED construction methodology to reduce erosion risks as construction is underway.</li> <li>* It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner.</li> <li>* If CT is not in place, could impact project/delay schedule. If CT does not get authorized -- and current project was to look at Brazoria and Matagorda and we only looked at Matagorda -- and we assumed CT would look at Brazoria, would we get in trouble for not looking at Brazoria. Would we not fulfill our obligation?</li> </ul>	Marginal	Likely	2	\$10k

Yes	EX-3	Earthwork	<p>* potential for severe adverse weather</p> <p>* funding for PED is uncertain post feasibility; funding for construction is uncertain, e.g. funding is incremental per FY and can be impacted by budget delays such as continuing resolutions</p> <p>* assumes Coastal Texas to be in place</p>	<p>* There is potential for weather damages and delays, e.g. tropical depressions or hurricanes, should project construction occur during hurricane seasons, which is anticipated. Team to strategize during PED construction methodology to reduce erosion risks as construction is underway.</p> <p>* It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner.</p> <p>* If CT is not in place, could impact project/delay schedule. If CT does not get authorized -- and current project was to look at Brazoria and Matagorda and we only looked at Matagorda -- and we assumed CT would look at Brazoria, would we get in trouble for not looking at Brazoria. Would we not fulfill our obligation?</p>	Marginal	Likely	2	\$10k
Yes	EX-4	Dredging	<p>* potential for severe adverse weather</p> <p>* funding for PED is uncertain post feasibility; funding for construction is uncertain, e.g. funding is incremental per FY and can be impacted by budget delays such as continuing resolutions</p> <p>* assumes Coastal Texas to be in place</p> <p>* GWW OM dredging impacted by breakwaters with floating pipelines</p>	<p>* There is potential for weather damages and delays, e.g. tropical depressions or hurricanes, should project construction occur during hurricane seasons, which is anticipated. Team to strategize during PED construction methodology to reduce erosion risks as construction is underway.</p> <p>* It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner.</p> <p>* If CT is not in place, could impact project/delay schedule. If CT does not get authorized -- and current project was to look at Brazoria and Matagorda and we only looked at Matagorda -- and we assumed CT would look at Brazoria, would we get in trouble for not looking at Brazoria. Would we not fulfill our obligation?</p> <p>* Does a new breakwater impact (cost increase) to OM projects pipeline management; dredges may need to bring cranes in to lift pipelines over breakwaters</p>	Marginal	Likely	2	\$10k

--- NEW WORK ---  
P2-471987 - GIWW, COASTAL RESILIENCY STUDY - NED PLAN  
FEASIBILITY STUDY  
OCTOBER 2021 PRICE LEVELS  
VISUAL CALENDAR

NO.	DESCRIPTION	DURATION	FY 2027 - YEAR 1												FY 2028 - YEAR 2											
			OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CONT 1	Zone 12, 14, & 16																									
	Dredging/Berm	4.30	DR			DR	BE			DR	DR	BE														
	Breakwaters	8.00		BW	BW		BW	BW			BW	BW	BW	BW	BW											
	Oyster Reefs	2.40	OR	OR	OR																					
	Sea Grass	0.01				SG																				
CONT 2	Zone 18																									
	Dredging	0.70	DR																							
	Breakwaters	14.60		BW	BW	BW	BW																			
	Oyster Reefs	2.00	OR	OR																						
	Sea Grass	1.90				SG	SG																			

1/12/2022

--- NEW WORK ---  
P2-471987 - GIWW, COASTAL RESILIENCY STUDY - NED PLAN  
FEASIBILITY STUDY  
OCTOBER 2021 PRICE LEVELS  
CONTRACT CALENDAR

CONTRACT	DESCRIPTION	DURATION (month)	DESIGN MIDPOINT	START DATE	MIDPOINT	END DATE
1	Zone 12, 14, & 16	13	Apr-24 (2024Q3)	Oct-26 (2027Q1)	Apr-27 (2027Q2)	Oct-27 (2028Q1)
3	Zone 18	16	Apr-24 (2024Q3)	Oct-26 (2027Q1)	May-27 (2027Q2)	Jan-28 (2028Q2)

-- NEW WORK --  
 P2-471987 - GIWW, COASTAL RESILIENCY STUDY - RESILIENCY PLAN  
 FEASIBILITY STUDY  
 OCTOBER 2021 PRICE LEVELS  
 VISUAL CALENDAR

NO.	DESCRIPTION	DURATION	FY 2027 - YEAR 1												FY 2028 - YEAR 2											
			OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CONT 1	Zone 12 & 13	11.74	DR	DR			DR					DR	DR	DR	DR	DR	DR	DR	BE	BE						
	Breakwaters	6.40			BW	BW			BW	BW	BW	BW							BW							
	Oyster Reefs	1.50	OR	OR																						
CONT 2	Zone 14 & 16	4.10	DR	BE			DR	DR	BE																	
	Breakwaters	6.10		BW	BW				BW	BW	BW	BW	BW													
	Oyster Reefs	1.40	OR	OR																						
	Sea Grass	0.01			SG																					
CONT 3	Zone 18	0.70	DR																							
	Breakwaters	14.60		BW	BW	BW	BW																			
	Oyster Reefs	2.00	OR	OR																						
	Sea Grass	1.90			SG	SG																				

1/12/2022

-- NEW WORK --  
 P2-471987 - GIWW, COASTAL RESILIENCY STUDY - RESILIENCY PLAN  
 FEASIBILITY STUDY  
 OCTOBER 2021 PRICE LEVELS  
 CONTRACT CALENDAR

CONTRACT	DESCRIPTION	DURATION (month)	DESIGN MIDPOINT	START DATE	MIDPOINT	END DATE
1	Zone 12 & 13	18	Apr-24 (2024Q3)	Oct-26 (2027Q1)	Jun-27 (2027Q3)	Mar-28 (2028Q2)
2	Zone 14 & 16	10	Apr-24 (2024Q3)	Oct-26 (2027Q1)	Feb-27 (2027Q2)	Jul-27 (2027Q4)
3	Zone 18	16	Apr-24 (2024Q3)	Oct-26 (2027Q1)	May-27 (2027Q3)	Jan-28 (2028Q2)