SABINE PASS TO GALVESTON BAY, TEXAS COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESTORATION: FINAL INTEGRATED FEASIBILITY REPORT—ENVIRONMENTAL IMPACT STATEMENT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, DEPARTMENT OF DEFENSE

TRANSMITTING

THE CORPS' REPORT ON SABINE PASS TO GALVESTON BAY, TEXAS COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESTORATION: FINAL INTEGRATED FEASIBILITY REPORT—ENVIRONMENTAL IMPACT STATEMENT FOR DECEMBER 7, 2017

PART 2 OF 2

DECEMBER 19, 2018.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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U.S. GOVERNMENT PUBLISHING OFFICE

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Sabine Pass to Galveston Bay, Texas

NOTE: The costs for work breakdown Accounts 01, 30, and 31 were developed and found in the TPCS only to prevent errors. The escalation percentage is developed from the construction schedule and included in the TPCS. Contingences were developed in the Risk Analysis and were included in the TPCS. Due to the breakout of Federal and Non-Federal Sponsor costs rounding errors do occur, but they tally correctly.

(1)

Estimated by	CESWG-EC-PS
Designed by	CESWG-E
Prepared by	Jackie Lockhart
Preparation Date	12/28/2016
Effective Date of Pricing	12/28/2016
Estimated Construction Time	Days

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Description	Quantity	UOM	DirectCost	ContractCost	ProjectCost
Project Cost Summary Report			1,671,991,257	2,021,658,113	2,021,658,113
01 Orange	1.00	LS	1,025,990,908	1,203,797,828	1,203,797,828
0101 Non-Fed	1.00	LS	36,685,912	48,361,492	48,361,492
010202 Relocations	1.00	LS	36,685,912	48,361,492	48,361,492
0102 Federal	1.00	LS	989,304,996	1,155,436,336	1,155,436,336
010206 Fish and Wildlife Facilities	1.00	LS	12,494,161	15,103,859	15,103,859
010211 Levees and Floodwalls	1.00	LS	535,324,062	672,362,226	672,362,226
010213 Pumping Plant based on 9/27/16 - 13,200 cfs numbers	1.00	LS	358,272,873	358,272,873	358,272,873
010215 Floodway Control-Diversion Struc	1.00	LS	83,213,900	109,697,378	109,697,378
05 Port Arthur	1.00	LS	358,746,306	450,825,461	450,825,461
0501 Non-Fed	1.00	LS	22,150,124	29,199,574	29,199,574
050102 Relocations	1.00	LS	22,150,124	29,199,574	29,199,574
0502 Federal	1.00	LS	336,596,183	421,625,886	421,625,886
050211 Levees and Floodwalls	1.00	LS	336,596,183	421,625,886	421,625,886
10 Freeport	1.00	LS	287,254,042	367,034,825	367,034,825
1001 Non-Fed	1.00	LS	15,860,613	20,908,378	20,908,378
100102 Relocations	1.00	LS	15,860,613	20,908,378	20,908,378
1002 Federal	1.00	LS	271,393,429	346,126,447	346,126,447
010211 Levees and Floodwalls	1.00	LS	227,134,468	287,781,723	287,781,723
010213 Pumping Plant	1.00	LS	10,775,029	14,204,267	14,204,267
100215 Floodway Control-Diversion Struc	1.00	LS	33,483,933	44,140,457	44,140,457

Description	Page
Project Cost Summary Report	**1**
01 Orange	1
0101 Non-Fed	1
010202 Relocations	1
0102 Federal	1
010206 Fish and Wildlife Facilities	1
010211 Levees and Floodwalls	1
010213 Pumping Plant based on 9/27/16 - 13,200 cfs numbers	1
010215 Floodway Control-Diversion Struc	1
05 Port Arthur	1
0501 Non-Fed	1
050102 Relocations	1
0502 Federal	1
050211 Levees and Floodwalls	1
10 Freeport	1
1001 Non-Fed	1
100102 Relocations	1
1002 Federal	1
010211 Levees and Floodwalls	1
010213 Pumping Plant	1
100215 Floodway Control-Diversion Struc	1

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 375949

SWG – Sabine Pass to Galveston Bay, TX
Coastal Storm Risk Management
Feasibility Study

The Sabine Pass to Galveston Bay Feasibility Study, as presented by Galveston District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of December 30, 2016, the Cost MCX certifies the estimated total project cost:

FY17 Project First Cost: $3,248,607,000
Fully Funded Amount: $3,814,126,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management throughout the life of the project.

CALLAN.KIM.C.1231558221

Digitally signed by CALLAN.KIM.C.1231558221
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=CALLAN.KIM.C.1231558221
Date: 2017.01.03 08:27:15 -08'00'

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

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

PROJECT: Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem
PROJECT: P2 375949
LOCATION: Orange, Jefferson, and Brazoria Counties, Texas

DISTRICT: Galveston District **PREPARED:** 12/28/2016
POC: CHIEF, COST ENGINEERING, Willie Joe Honza P.E.

This Estimate reflects the scope and schedule in report; Final Integrated Feasibility Report - EIS Oct 2016

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: 10/1/2016 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
02	RELOCATIONS	$98,470	$29,850	30.3%	$128,320	0.0%	$98,470	$29,850	$128,320	$0	$128,320	12.4%	$110,751	$33,545	$144,296
06	FISH & WILDLIFE FACILITIES	$15,104	$4,380	29.0%	$19,484	0.0%	$15,104	$4,380	$19,484	$0	$19,484	10.3%	$16,657	$4,831	$21,488
11	LEVEES & FLOODWALLS	$1,381,770	$419,118	30.3%	$1,800,888	0.0%	$1,381,770	$419,118	$1,800,888	$0	$1,800,888	14.7%	$1,584,890	$480,321	$2,065,211
13	PUMPING PLANT	$372,477	$108,302	29.1%	$480,779	0.0%	$372,477	$108,302	$480,779	$0	$480,779	16.9%	$435,279	$126,551	$561,830
15	FLOODWAY CONTROL & DIVERSION STRU	$153,838	$45,496	29.6%	$199,334	0.0%	$153,838	$45,496	$199,334	$0	$199,334	15.7%	$178,035	$52,623	$230,658
	CONSTRUCTION ESTIMATE TOTALS:	$2,021,659	$607,147		$2,628,806	0.0%	$2,021,659	$607,147	$2,628,806	$0	$2,628,806	15.0%	$2,325,613	$697,870	$3,023,483
01	LANDS AND DAMAGES - Non-Fed	$43,705	$8,746	20.0%	$52,451	0.0%	$43,705	$8,746	$52,451	$0	$52,451	13.1%	$49,432	$9,892	$59,324
01	LANDS AND DAMAGES - Federal	$5,815	$1,329	22.9%	$7,144	0.0%	$5,815	$1,329	$7,144	$0	$7,144	13.8%	$6,620	$1,512	$8,133
30	PLANNING, ENGINEERING & DESIGN	$259,034	$77,723	30.0%	$336,757	0.0%	$259,034	$77,723	$336,757	$0	$336,757	27.3%	$329,773	$98,790	$428,563
31	CONSTRUCTION MANAGEMENT	$171,841	$51,607	30.0%	$223,448	0.0%	$171,841	$51,607	$223,448	$0	$223,448	31.9%	$226,662	$67,961	$294,623
	PROJECT COST TOTALS:	$2,502,054	$746,553	29.8%	$3,248,607		$2,502,054	$746,553	$3,248,607	$0	$3,248,607	17.4%	$2,938,100	$876,025	$3,814,126

CHIEF, COST ENGINEERING, Willie Joe Honza P.E.

PROJECT MANAGER,Sharon Tirpak

CHIEF, REAL ESTATE,Timothy Nelsc

ESTIMATED TOTAL PROJECT COST: **$3,814,126**

CHIEF, PLANNING, Eric Verwers

CHIEF, ENGINEERING, Joseph King R.A.

CHIEF, OPERATIONS, Joseph Hrametz, P.E.

CHIEF, CONSTRUCTION, Donald W Carelock P.E.

CHIEF, CONTRACTING, Kathrine Freeman

CHIEF, PM-G, Valerie Miller

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CHIEF, DPM, Edmond J. Russo Jr., PhD, P.E,D.CE,D.NE.

**** CONTRACT COST SUMMARY ****

PROJECT: Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration
LOCATION: Orange, Jefferson, and Brazoria Counties, Texas
This Estimate reflects the scope and schedule in report; Final Integrated Feasibility Report - EIS Oct 2016

DISTRICT: Galveston District PREPARED: 12/28/2016
POC: CHIEF, COST ENGINEERING, Willie Joe Honza P.E.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 6-Dec-16 Effective Price Level: 1-Oct-16				Program Year (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	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Orange													
02	RELOCATIONS	$48,362	$14,025	29.0%	$62,387	0.0%	$48,362	$14,025	$62,387	2024Q1	14.7%	$55,490	$16,092	$71,582
06	FISH & WILDLIFE FACILITIES	$15,104	$4,380	29.0%	$19,484	0.0%	$15,104	$4,380	$19,484	2022Q1	10.3%	$16,657	$4,831	$21,488
11	LEVEES & FLOODWALLS	$672,362	$194,985	29.0%	$867,347	0.0%	$672,362	$194,985	$867,347	2025Q1	17.0%	$786,888	$228,198	$1,015,086
13	PUMPING PLANT	$358,273	$103,899	29.0%	$462,172	0.0%	$358,273	$103,899	$462,172	2025Q1	17.0%	$419,301	$121,597	$540,899
15	FLOODWAY CONTROL & DIVERSION STRU	$109,697	$31,812	29.0%	$141,509	0.0%	$109,697	$31,812	$141,509	2025Q1	17.0%	$128,381	$37,231	$165,612
	CONSTRUCTION ESTIMATE TOTALS:	$1,203,798	$349,101	29.0%	**$1,552,899**		$1,203,798	$349,101	$1,552,899			$1,406,718	$407,948	$1,814,667
01	LANDS AND DAMAGES- Non-Fed	$27,666	$5,533	20.0%	$33,199	0.0%	$27,666	$5,533	$33,199	2024Q1	14.7%	$31,744	$6,349	$38,092
01	LANDS AND DAMAGES - Federal	$4,654	$1,052	22.6%	$5,706	0.0%	$4,654	$1,052	$5,706	2024Q1	14.7%	$5,340	$1,207	$6,547
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$6,019	$1,746	29.0%	$7,765	0.0%	$6,019	$1,746	$7,765	2024Q1	30.8%	$7,872	$2,283	$10,155
0.0%	Planning & Environmental Compliance	$2,469	$716	29.0%	$3,185	0.0%	$2,469	$716	$3,185	2024Q1	30.8%	$3,229	$936	$4,165
9.8%	Engineering & Design	$117,972	$34,212	29.0%	$152,184	0.0%	$117,972	$34,212	$152,184	2024Q1	30.8%	$154,285	$44,743	$199,028
0.7%	Reviews, ATRs, IEPRs, VE	$7,825	$2,269	29.0%	$10,094	0.0%	$7,825	$2,269	$10,094	2024Q1	30.8%	$10,234	$2,968	$13,201
0.5%	Life Cycle Updates (cost, schedule, risks)	$5,417	$1,571	29.0%	$6,988	0.0%	$5,417	$1,571	$6,988	2024Q1	30.8%	$7,084	$2,054	$9,139
0.0%	Contracting & Reprographics	$361	$105	29.0%	$466	0.0%	$361	$105	$466	2024Q1	30.8%	$472	$137	$609
1.0%	Engineering During Construction	$12,038	$3,491	29.0%	$15,529	0.0%	$12,038	$3,491	$15,529	2025Q1	36.1%	$16,389	$4,753	$21,142
0.2%	Planning During Construction	$2,408	$698	29.0%	$3,106	0.0%	$2,408	$698	$3,106	2025Q1	36.1%	$3,278	$951	$4,229
0.2%	Project Operations	$2,408	$698	29.0%	$3,106	0.0%	$2,408	$698	$3,106	2024Q1	30.8%	$3,149	$913	$4,062
31	CONSTRUCTION MANAGEMENT													
5.5%	Construction Management	$66,209	$19,201	29.0%	$85,410	0.0%	$66,209	$19,201	$85,410	2025Q1	36.1%	$90,139	$26,140	$116,280
0.5%	Project Operation:	$6,019	$1,746	29.0%	$7,765	0.0%	$6,019	$1,746	$7,765	2025Q1	36.1%	$8,194	$2,376	$10,571
2.5%	Project Management	$30,095	$8,728	29.0%	$38,823	0.0%	$30,095	$8,728	$38,823	2025Q1	36.1%	$40,972	$11,882	$52,854
	CONTRACT COST TOTALS:	$1,495,358	$430,866		$1,926,224		$1,495,358	$430,866	$1,926,224			$1,789,101	$515,641	$2,304,741

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

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

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LOCATION: Orange, Jefferson, and Brazoria Counties, Texas
This Estimate reflects the scope and schedule in report; Final Integrated Feasibility Report - EIS Oct 2016

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POC: CHIEF, COST ENGINEERING, Willie Joe Honza P.E.

PREPARED: 12/28/2016

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			6-Dec-16 / 1-Oct-16	Program Year (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	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Port Arthur													
02	RELOCATIONS	$29,200	$9,344	32.0%	$38,544	0.0%	$29,200	$9,344	$38,544	2022Q1	10.3%	$32,203	$10,305	$42,508
11	LEVEES & FLOODWALLS	$421,626	$134,920	32.0%	$556,546	0.0%	$421,626	$134,920	$556,546	2023Q1	12.5%	$474,280	$151,770	$626,050
	CONSTRUCTION ESTIMATE TOTALS:	$450,826	$144,264	32.0%	$595,090		$450,826	$144,264	$595,090			$506,483	$162,075	$668,558
01	LANDS AND DAMAGES - Non-Fed	$6,980	$1,396	20.0%	$8,376	0.0%	$6,980	$1,396	$8,376	2022Q1	10.3%	$7,698	$1,540	$9,237
01	LANDS AND DAMAGES - Federal	$760	$177	23.3%	$937	0.0%	$760	$177	$937	2022Q1	10.3%	$838	$195	$1,033
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$2,254	$721	32.0%	$2,975	0.0%	$2,254	$721	$2,975	2022Q1	20.8%	$2,723	$871	$3,595
0.0%	Planning & Environmental Compliance	$538	$172	32.0%	$710	0.0%	$538	$172	$710	2022Q1	20.8%	$650	$208	$858
9.5%	Engineering & Design	$42,828	$13,705	32.0%	$56,533	0.0%	$42,828	$13,705	$56,533	2022Q1	20.8%	$51,748	$16,559	$68,307
0.7%	Reviews, ATRs, IEPRs, VE	$2,930	$938	32.0%	$3,868	0.0%	$2,930	$938	$3,868	2022Q1	20.8%	$3,540	$1,133	$4,673
0.5%	Life Cycle Updates (cost, schedule, risks)	$2,029	$649	32.0%	$2,678	0.0%	$2,029	$649	$2,678	2022Q1	20.8%	$2,452	$785	$3,236
0.0%	Contracting & Reprographics	$135	$43	32.0%	$178	0.0%	$135	$43	$178	2022Q1	20.8%	$163	$52	$215
1.0%	Engineering During Construction	$4,508	$1,443	32.0%	$5,951	0.0%	$4,508	$1,443	$5,951	2023Q1	25.7%	$5,665	$1,813	$7,477
0.2%	Planning During Construction	$0	$0	32.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.2%	Project Operations	$902	$289	32.0%	$1,191	0.0%	$902	$289	$1,191	2022Q1	20.8%	$1,090	$349	$1,439
31	CONSTRUCTION MANAGEMENT													
5.5%	Construction Management	$24,795	$7,934	32.0%	$32,729	0.0%	$24,795	$7,934	$32,729	2023Q1	25.7%	$31,157	$9,970	$41,128
0.5%	Project Operation:	$2,254	$721	32.0%	$2,975	0.0%	$2,254	$721	$2,975	2023Q1	25.7%	$2,832	$906	$3,739
2.5%	Project Management	$11,271	$3,607	32.0%	$14,878	0.0%	$11,271	$3,607	$14,878	2023Q1	25.7%	$14,163	$4,532	$18,695
	CONTRACT COST TOTALS:	$553,010	$176,059		$729,069		$553,010	$176,059	$729,069			$631,203	$200,988	$832,191

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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
	Freeport													
02	RELOCATIONS	$20,908	$6,481	31.0%	$27,389	0.0%	$20,908	$6,481	$27,389	2022Q1	10.3%	$23,058	$7,148	$30,206
11	LEVEES & FLOODWALLS	$287,782	$89,212	31.0%	$376,994	0.0%	$287,782	$89,212	$376,994	2023Q1	12.5%	$323,721	$100,354	$424,075
13	PUMPING PLANT	$14,204	$4,403	31.0%	$18,607	0.0%	$14,204	$4,403	$18,607	2023Q1	12.5%	$15,978	$4,953	$20,931
15	FLOODWAY CONTROL & DIVERSION STRU	$44,141	$13,684	31.0%	$57,825	0.0%	$44,141	$13,684	$57,825	2023Q1	12.5%	$49,654	$15,393	$65,046
	CONSTRUCTION ESTIMATE TOTALS:	$367,035	$113,781	31.0%	$480,816		$367,035	$113,781	$480,816			$412,411	$127,847	$540,259
01	LANDS AND DAMAGES - Non-Fed	$9,059	$1,817	20.1%	$10,876	0.0%	$9,059	$1,817	$10,876	2022Q1	10.3%	$9,991	$2,004	$11,994
01	LANDS AND DAMAGES - Federal	$401	$100	24.9%	$501	0.0%	$401	$100	$501	2022Q1	10.3%	$442	$110	$553
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$1,835	$569	31.0%	$2,404	0.0%	$1,835	$569	$2,404	2022Q1	20.8%	$2,217	$687	$2,904
0.0%	Planning & Environmental Compliance	$738	$229	31.0%	$967	0.0%	$738	$229	$967	2022Q1	20.8%	$892	$276	$1,168
9.5%	Engineering & Design	$34,868	$10,809	31.0%	$45,677	0.0%	$34,868	$10,809	$45,677	2022Q1	20.8%	$42,130	$13,060	$55,190
0.7%	Reviews, ATRs, IEPRs, VE	$2,386	$740	31.0%	$3,126	0.0%	$2,386	$740	$3,126	2022Q1	20.8%	$2,883	$894	$3,777
0.5%	Life Cycle Updates (cost, schedule, risks)	$1,652	$512	31.0%	$2,164	0.0%	$1,652	$512	$2,164	2022Q1	20.8%	$1,996	$619	$2,615
0.0%	Contracting & Reprographics	$110	$34	31.0%	$144	0.0%	$110	$34	$144	2022Q1	20.8%	$133	$41	$174
1.0%	Engineering During Construction	$3,670	$1,138	31.0%	$4,808	0.0%	$3,670	$1,138	$4,808	2023Q1	25.7%	$4,612	$1,430	$6,041
0.2%	Planning During Construction	$0	$0	31.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.2%	Project Operations	$734	$228	31.0%	$962	0.0%	$734	$228	$962	2022Q1	20.8%	$887	$275	$1,162
31	CONSTRUCTION MANAGEMENT													
5.5%	Construction Management	$20,187	$6,258	31.0%	$26,445	0.0%	$20,187	$6,258	$26,445	2023Q1	25.7%	$25,367	$7,864	$33,231
0.5%	Project Operation:	$1,835	$569	31.0%	$2,404	0.0%	$1,835	$569	$2,404	2023Q1	25.7%	$2,306	$715	$3,021
2.5%	Project Management	$9,176	$2,845	31.0%	$12,021	0.0%	$9,176	$2,845	$12,021	2023Q1	25.7%	$11,531	$3,574	$15,105
	CONTRACT COST TOTALS:	$453,686	$139,627		$593,313		$453,686	$139,627	$593,313			$517,797	$159,397	**$677,193**

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Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration

Final Integrated Feasibility Report – Real Estate Plan

May 2017

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Sabine Pass to Galveston Bay, Texas Feasibility Study
Real Estate Plan

1. Purpose

This Real Estate Plan (REP) has been prepared in support of the feasibility study that describes the lands, easements, rights of way, relocation, and disposal (LERRD) required for the for the Sabine Pass to Galveston Bay, Texas, Feasibility Study. The information contained herein is tentative in nature and intended for planning purposes only.

2. Project Location

The study area consists of three distinct project areas: Orange, Jefferson, and Brazoria regions. The Orange region is located about 90 miles east of the City of Houston and shares a border with the State of Louisiana. The region is approximately 356 square miles in size and 333 square miles is land and 23 is water. A total of seven incorporated cities (Orange, Vidor, Bridge City, West Orange, Rose City, Pinehurst, and Pine Forest) are in this region. The Jefferson region is located about 90 miles east of the City of Houston. The region is approximately 1,111 square miles in size and 904 square miles is land and 207 is water. A total of nine incorporated cities (Beaumont, Port Arthur, Nederland, Port Neches, Groves, China, Nome, Bevil Oaks, and Taylor Landing) are in this region. The Brazoria region is located about 60 miles south of the City of Houston. The region is approximately 1,597 square miles in size and 1,386 square miles is land and 211 is water. A total of 20 incorporated cities (Angleton, Pearland, Lake Jackson, Brazoria, Alvin, Freeport, Clute, Rosharon, Manvel, Sweeny, West Columbia, Surfside Beach, Danbury, Richwood, Qunitana, Oyster Creek, Jones Creek, Iowa Colony, Brookside Village, and Liverpool) are in the County. The study area is identified on Exhibit A.

For the purposes of this report the Recommended Plan project areas were renamed as Orange Coastal Storm Risk Management (CSRM), Port Arthur and Vicinity CSRM, and Freeport and Vicinity CSRM. Within the project area are different reaches. Reaches of project areas are listed below and are shown on Exhibits B-D.

3. Project Authorization

Authorization for the study is derived from a resolution from the Committee on Environmental and Public Works dated June 23, 2004 entitled "Coastal Texas Protection and Restoration Study".

By resolution dated June 23, 2004 entitled "Coastal Texas Protection and Restoration Study", the Committee on Environment and Public Works, U.S. Senate has requested that in accordance with Section 110 of the Rivers and Harbors Act of 1962 the Secretary of the Army develop a comprehensive plan for severe erosion along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing

natural sediment supply to coast, restoring and preserving marshes and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area.

The study fits into the overall concept of the authorization to conduct an integrated and coordinated approach to locating and implementing opportunities for CSRM. The purpose of the study is to recommend for Congressional approval a regional CSRM project that encompasses counties of the upper Texas coast between Sabine Pass and Galveston Bay.

3. Non-Federal Sponsor

The USACE Galveston District was responsible for the overall management of the study and the report preparation. As the non-Federal sponsor (NFS), the Texas General Land Office (GLO) was actively involved throughout the study process. GLO is the NFS for the study phase only.

As the project moves towards implementation, three different entities have been identified as NFS for the three different project areas. As public entities, Velasco Drainage District (VDD) will oversee Freeport and Vicinity CSRM, Jefferson County Drainage District #7 (DD7) will oversee Port Arthur and Vicinity CSRM features and Orange County will oversee Orange CSRM.

4. Lands, Easement & Rights-of-Way

The Non-Federal Sponsor is responsible for acquiring and furnishing all lands, easements, rights-of-way, relocations (i.e., P.L. 91-646 relocations and utility/facility relocations), borrow material, and dredged or excavated material disposal areas (LERRD) for the project, if required. Lands needed for this project will be acquired in fee excluding minerals, permanent levee easements, temporary staging easements and a nonstandard estate for TPWD owned lands needed for mitigation. A review of LERRD requirements is set forth below. The real estate requirements for the Project must support construction as well as the continued operation and maintenance of the Project. The majority of the acreage affected by the project consists of residential, commercial, industrial, and vacant/undeveloped and marsh land. At the feasibility level over 600 tracts have been identified as being impacted by the project. However, each tract's ownership was not researched at the level of detail as it will be prior to construction.[1]

[1] There has been some discussion of the possibility of a revision to the levee slope design during completion of the design in PED. For purposes of this study, a 3:1 slope was utilized to determine the land requirements for the levee. If the design changes to a 6:1 slope, the project footprint would be smaller, resulting in less acreage required in the levee easements than that identified in this REP.

The real estate interests for this project are as follows. The following Corps Standard Estates are applicable:

- *Standard Estate #3 Fee Excluding Minerals - The fee simple title to the land, subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines; excepting and excluding all (coal) (oil and gas), in and under said land and all appurtenant rights for the exploration, development, production and removal of said (coal) (oil and gas), but without the right to enter upon or over the surface of said land for the for the purpose of exploration, development, production and removal therefrom of said (coal) (oil and gas).*

- *Standard Estate #9 Flood Protection Levee Easement - a perpetual and assignable right and easement in the land described to construct, maintain, repair, operate, patrol and replace a flood protection levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.*

- *Standard Estate #15 Temporary Work Area Easement - a temporary easement and right-of-way in, on, over and across the land described, for a period not to exceed ___ months, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the _____ Project, together with the right to trim, cut, fell and remove there from all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.*

Project Levee and Floodwall Alignment. Project features are shown in Exhibits A.

Orange CSRM: The recommended plan of the Orange CSRM is a levee/floodwall flood risk reduction system located on the southern half of Orange County along the Sabine River and Bessie Heights Marsh. The recommended plan indicate 15 miles of new levee and 11 miles of new floodwall will be constructed. For the levees, a perpetual easement ranging from 100 feet to 150 feet was devised, variations in such easement requirements are due to the varying nature of the elevation of the flood risk reduction system and the existing natural ground. For the floodwalls, which have a smaller footprint than the levees, a uniform 78 foot wide easement was assumed for permanent use. Two gate structures will also be constructed at Cow

and Adams bayous. In general, the alignment for the levee and/or floodwall starts near Rose City (I-10) and meanders in a southeast direction, turning north near Bridge City, to the termini near the City of Orange and adjacent to I-10.

The types of lands affected by this project consist of residential (14%), commercial (7%), industrial (14%), vacant/undeveloped (18%), and marshland (47%). 85 acres will need to be acquired for this section of the project as shown in Exhibit A. Total number of ownerships impacted by this section of the project is 168 with the number of tracts being 335. This number was determined by reviewing aerial maps of the alignment and seeing which tracts where affected. For example, an ownership was found to be impacted even if the alignment fell on a 10ft portion of the tract. The total number of structures impacted is 30. This number was determined by reviewing aerial maps of the alignment and seeing what structures were impacted. Access to the project site will be by barge or public roads. Also, the width of the area acquired in a perpetual easement is sufficient to accommodate all the construction activities for the levee and/or floodwall.

Approximately 80 acres of Texas Parks and Wildlife (TPWD) fee lands will be affected by construction of the floodwall/levee features located in the Orange reach. The impacts of these requirements have resulted in the need for environmental mitigation, discussed in detail below in paragraph 9. We expect to work out any additional impacts to TPWD lands that are revealed during the design phase, and TPWD will convey the standard permanent easement for these construction features. The local TPWD land managers have expressed support verbally to the District team for the proposed plan. The letter from the TPWD Austin office is necessarily conservative in nature now due to the work yet to be done during the design phase. It is understood that, once in the land acquisition stage, the acquisition of easements for the levee and floodwall features by the NFS over the 80 acres owned by TPWD must follow the process identified in chapter 26 of the Texas Parks and Wildlife Code. This is the only way TPWD can convey interests in land to the NFS. The land acquisition schedule will be set accordingly.

Port Arthur and Vicinity CSRM: An existing Hurricane Flood Protection Project (HFPP) protects the Port Arthur area from coastal storm surge events coming from the Gulf of Mexico. It also protects against flooding from the Sabine River. The levee system consists of 27.8 miles of earthen embankment and 6.6 miles of floodwall, including 3.5 miles of cantilever wall. The recommended plan consists of portions of the existing system of levees and floodwalls and/or closure system to be improved with resiliency features or replaced. There will also be a new levee section on the northeastern end of the system measuring 1,830 LF which will require perpetual easements. The majority of the proposed work will be within the existing HFPP right-of-way. Total number of ownerships impacted by this section of the project is 62. Total number of structures impacted is 8.

Freeport and Vicinity CSRM: The existing HFPP at Freeport consists of approximately 43 miles of levees, wave barriers and floodwalls, pump stations, multiple gates and culverts. The recommended plan for the Freeport and Vicinity CSRM Project involves construction of

floodwalls, raising of levees, replacement of vehicular closure structures, and constructing a navigable gate structure in an active barge canal. The majority of the proposed work will be within the existing HFPP right-of-way in which the NFS, VDD, holds a perpetual easement. The total number of ownerships impacted by this section of the project is 22. The total number for of structures identified impacted by this section of the project is 1 industrial structure.

5. Borrow Material

Material needed for the levee will be acquired commercially rather than obtained from a borrow area. This will be a construction cost and the NSF will not be eligible for LERRD crediting for these cost.

6. Access/Staging Area

Access to the construction areas will be over existing public roads and navigable waters throughout the project areas. Also, width of the area acquired for the easements for the levee and/or floodwall, negates the need to acquire TWE and Road Easements in those areas. For access in the Port Arthur and Freeport Vicinity areas, access will be via the existing levee Right-of- Way in which VDD and DD7, hold perpetual easements. Staging areas that will be needed for all project areas and are shown in Exhibit A.

7. Recreation Features

The proposed Project does not have any recreation features.

8. Induced Flooding

Modeling did show induced impacts that could reach to levels of 1 to 1.5 feet in areas along the Neches River and the Orange County levee. The levees on the Neches River that were causing the most adjacent impact and could induce damages in this area have since been removed from the selected plan and these impacts will not occur. Regarding Orange 3, some induced flooding was determined, the largest being along the Neches River. Again these sections of levee have been removed from the final selected plan and impacts in this area will be negligible.

9. Mitigation

All environmental impacts identified for the Recommended Plan are associated with the Orange 3 CSRM Plan and the associated land requirements will be the responsibility of Orange County. Planning for the avoidance and minimization of environmental impacts began with the initial selection of the Orange CSRM alignment. The proposed mitigation plan is to restore approximately 453 acres of emergent marsh, and preserve in perpetuity approximately 559 acres of forested wetlands. Mitigation is needed to compensate for a loss of forested wetlands and coastal wetlands. Mitigation construction consists of containment dikes, pumping dredged

material into open water areas, dewatering, marsh plantings and containment dike removal. Monitoring and adaptive management is also required, consisting of periodic inspections and any necessary corrective actions.

There are six areas identified as land to be utilized for the mitigation. These areas are identified as Mitigation Areas (MA) 28, 29, 31, 52, 11, and 161. MAs 52, 11, 161 are privately owned, total 622 acres, and the NFS will be required to acquire the land for these mitigation sites in accordance with standard Army policy, using standard fee estate three: Fee Excluding Minerals With a Restriction on Use of the Surface. For further discussion of the treatment of minerals, see Section 17 of this Appendix.

MAs 28, 29 and 31 are owned in fee by Texas Park and Wildlife Department (TPWD) and total 390 acres. The mitigation sites on TPWD fee lands are compatible with TPWD land use and mission and are not a concern with regard to TPWD's cooperation and concurrence. However, pursuant to Texas state law, TPWD cannot convey its fee interest in these lands. Army policy requires fee acquisition for mitigation lands. As a result, a non-standard estate will be necessary and HQUSACE approval will be required prior to acquisition by the NFS. Preliminary coordination has already begun with TPWD regarding a nonstandard estate for its' lands identified as proposed mitigation sites. In the event a satisfactory non-standard estate cannot be acquired and approved by HQUSACE, the District will identify additional privately owned lands for mitigation and the NFS will acquire these in fee as described above. Costs to address this additional private land requirement, if it develops, are included in project contingency funds.

Ongoing coordination with TPWD regarding the acquisition of TPWD lands for mitigation will be necessary for this project feature.

10. Federally Owned Land & Existing Federal Project

There is no existing federally-owned land within the limits of this Project. However, the recommended plan affects two existing federal projects, the Port Arthur and Port Freeport Hurricane Flood Protection Projects.

Port Arthur: The Port Arthur HFPP is owned and operated by the Jefferson County Drainage District #7, the NFS for the current Port Arthur and Vicinity CSRM features. As a part of the HFPP, the NFS owns permanent levee easement. Some of the proposed project features in this CSRM reach for replacement or resiliency improvements will be constructed within the same real property footprint as the HFPP existing project where it has been determined that the acreage and the estate are sufficient. For features that have been identified as not within existing rights, those acquisition requirements, like temporary staging areas, are included in the acreage and costs to be acquired by the NFS in this report. No LERRD credits will be given for any lands previously provided as an item of local cooperation for the HFPP. The HFPP deeds and legal descriptions will be compared with the plans and specs during the design phase to be certain all LERRD requirements are properly identified in writing prior to PPA execution and

that no LERRD credits are given for lands previously provided as an item of cooperation for the HFPP.

Port Freeport: The Freeport Hurricane Flood Protection Project is owned and operated by the Velasco Drainage District, the NFS for the Freeport and Vicinity CSRM. As a part of the HFPP, the NFS owns permanent levee easement. Some of the proposed project features in this CSRM reach for replacement or resiliency improvements will be constructed within the same real property footprint as the HFPP existing project where it has been determined that the acreage and the estate are sufficient. For features that have been identified as not within existing rights, those acquisition requirements, like temporary staging areas and permanent rights for the drainage overflow are included in the acreage and costs to be acquired by the NFS in this report. No LERRD credits will be given for any lands previously provided as an item of local cooperation for the HFPP. The HFPP deeds and legal descriptions will be compared with the plans and specs during the design phase to be certain all LERRD requirements are properly identified in writing prior to PPA execution and that no LERRD credits are given for lands previously provided as an item of cooperation for the HFPP.

11. Non-Federal Sponsor Owned Land

Orange CSRM: Orange County owns the underlying fee lands for 116 acres of the 379 acres needed for this section of the project. The majority of the 116 acres is located on the northeastern portion of the Orange CSRM in the city of Orange.

Port Arthur and Vicinity CSRM: Jefferson County Drainage District #7 owns permanent easements for the existing HFPP located in the Port Arthur and Vicinity CSRM project area. The existing system consists of 27.8 miles of earthen embankment and 6.6 miles of floodwall, including 3.5 miles of cantilever wall.

Freeport and Vicinity CSRM: Velasco Drainage owns permanent easements for the existing HFPP located in Freeport and Vicinity CSRM project area. The existing system consists of approximately 43 miles of levees, wave barriers, floodwalls, pump stations, multiple gates and culverts.

All of the NFSs understand that their existing lands will be utilized as much as possible for the recommended project features and all have expressed their willingness to make their lands available. They also understand that no LERRD credits are given for lands previously provided as an item of local cooperation for the HFPP or any other federal project. For new project features that have been identified as not within existing rights, those acquisition requirements, like temporary staging areas and permanent rights for the drainage overflow and levee easements for extensions of the existing levees are included in the REP acreage and costs to be acquired by the NFS.

12. Navigation Servitude

Portions of the project structures, specifically flood gates on Cow and Adams Bayou Channels, lie within the navigable waters of the United States. When properly exercised, the navigation servitude operates as an exception to the Fifth Amendment's Takings Clause and no compensation is required for actions that would otherwise constitute a taking. Whether the navigation servitude is available for a coastal storm damage reduction project depends on the project's relationship to navigation. For example, coastal storm damage reduction measures may be related to navigation if the measures contribute to preventing or mitigating damage caused by navigation measures, involve the placement of material dredged from navigation channels, or otherwise have an impact on navigation.

This project is a broad multi-purpose project to develop a plan to address severe erosion and storm damages along coastal Texas. The proposed project flood gates protect two commercial navigation channels that are used for interstate and foreign commerce. The floodgates will be designed to protect commercial navigation along these channels that are part of the Gulf Intracoastal Waterway (GIWW) system. The GIWW in Texas is a nationally significant channel that supports energy, chemical and agricultural industries. These flood gate project features are integrally linked to preventing storm and flood damage impacts on navigation and interstate and foreign commerce. A District Counsel legal opinion has been completed and supports application of the servitude for these flood gate features. No land acquisition has been identified as necessary by the NFS for these gates that are within the servitude.

13. Public Law 91-646 Relocation Assistance

The benefits of Title II of the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970 (P.L. 91-646), as amended, are applicable for this project. Title II requires that persons and businesses displaced by a Federal project be given advisory services and assistance in the location of replacement dwellings and businesses.

Under Title II, displaced persons are entitled to reimbursement for actual and reasonable moving of personal property, differential housing payment, and incidental costs associated with the relocation. Differential housing payment is a payment made by the Government when the compensation paid for the property being acquired is not sufficient to cover the costs of a replacement dwelling for the displaced persons. Differential payments are capped at $34,000 for homeowners and $10,200 for tenants. Commercial businesses are entitled to receive advisory services, reimbursement for actual reasonable moving costs, re-establishment costs which are capped at $10,000 and certain reasonable and necessary incidental costs associated with the relocation. For purposes of this study, the estimate of relocation for business includes all of these costs and was estimated to be approximately $100,000 per industrial business and $50,000 per commercial business. Non-Federal Sponsor will be required to perform and pay for PL 91-646 relocations which will be eligible for LERRD crediting.

There are a total of approximately 39 residential, commercial or industrial structures identified as needing to be relocated for this project.

Orange: 9 Residential
4 Commercial
17 Industrial

Port Arthur: 8 Residential

Freeport: 1 Industrial

14. Assessment of Non-Federal Sponsor Land Acquisition Capabilities

An Assessment of each Non-Federal Sponsor's Real Estate Capabilities is attached as Exhibit D.

As described previously, the Orange CSRM includes requirements on property owned by the TPWD. The NFS, Orange County, does not have the legal authority to condemn lands owned by TPWD. If a consensual land transaction approved by USACE cannot be reached between the NFS and TPWD, then other private lands will be utilized, if possible, as discussed in the mitigation paragraph above.

The Assessment of NFS's Land Acquisition Capabilities survey indicates no major issues with any NFS's ability to acquire lands for this project. However, if it is established at some point in the future that a survey was mistakenly answered, a NFS maintains the option to request Government assistance to acquire subject lands on its behalf.

Both the Orange and Port Arthur projects propose features constructed on land owned by railroad companies. DD7 has the apparent legal authority to condemn a railroad if needed. Currently it is uncertain if Orange County has legal authority to condemn a railroad. If Orange County is not able to condemn a railroad property and cannot reach amicable agreement approved by USACE, the NFS will have to request USACE to complete the land transactions on their behalf.

15. Baseline Cost Estimate for Real Estate

Refer to Exhibit B for the Baseline Cost Estimate/Chart of Accounts estimate for Orange, Port Arthur and Freeport CSRM project areas. The costs include land payments as well as administrative costs and incremental costs associated with acquiring the real estate interests. These estimates include costs of acquiring mitigation lands.
A gross appraisal was done for all project areas. The appraisal report contained estimates for acquisitions of real property interest, residential (PL-91-646), commercial and industrial relocation cost, damages/severances, condemnation, and contingencies. During the time of this report, the Galveston Real Estate Division was still coordinating with the NFS on determining certain Non-Federal Costs for the Freeport and Orange project areas. Below are the Federal and Non-Federal real estate costs for this project.

Orange
Non-Fed: $33,199,506.00
Fed: $5,706,150.00

Port Arthur
Non-Fed: $8,377,956.73
Fed: $786,910.40

Freeport
Non-Fed: $10,876,984.47
Fed: $501,250.00

16. Acquisition Schedule

An acquisition schedule has not been determined at this time. It is assumed that the project will be constructed in sections. A detailed acquisition schedule will be prepared during PED once the 95% plans and specifications are prepared for each section of the project. The NFS will be required to acquire all LERRD for the Recommended Plan CSRM features, after a PPA has been signed and prior to the advertisement for construction, such that the features can be constructed and available for use as scheduled. Additional days were added to the Milestone table to account for the number of tracts needing to be acquired. Description of acquisition milestones for the NFS are listed below.

Milestones are based on the Project Partnership Agreement being signed	
Transmittal of ROW drawings & estate(s)	90 days after PPA signed
Obtain Surveys	90 days after transmittal of ROW drawings & estate(s)
Obtain Title Evidence	180 days after obtaining surveys
Obtain Appraisals	180 days after obtaining titles
Appraisal Review (Federal Task)	180 days after obtaining appraisals
Authorization to Proceed with Offer	30 days after obtaining appraisals & reviews
Conclude Negotiations	360 days after start of negotiations
Conclude Closings	180 days after concluding negotiations

17. Minerals

The lands to be acquired in fee for the project are all in the Orange CSRM reach and are needed for mitigation of environmental impacts. These lands are privately owned and will be acquired in fee by the NFS, Orange County, using the estate described previously. Use of this estate excepts and excludes minerals from the acquisition. While the estate includes a surface restriction that will be effective against the surface owner, to the extent the surface owner

retains any mineral interests, it leaves third party mineral interests outstanding and unrestricted.

The recommendation to leave the third party mineral rights outstanding beneath the fee lands to be acquired for Mitigation Areas 11, 52 and 161 is based on a determination of low risk to the project. These three mitigation sites are estimated in size as follows: site 11 - 447 acres; site 52 - 63 acres; and, site 161 - 112.5 acres. The District viewed the risk exposure in light of the extensive administrative effort to identify the third party mineral title owners and the time and cost it would then take the NFS to acquire a subordination of all of the fractional interests needed. Condemnation of some mineral interests would be expected in order to clear title for unknown owners or for unwilling sellers.

The low risk determination is based upon a review of available mineral activity data from the Texas Railroad Commission public records. Although there are no wells directly within the project area or footprint, these records reflect that several dry wells have already been drilled within approximately one mile of Mitigation Area 161. In the vicinity of Mitigation Area 52, there are perhaps 100 wells active or plugged within 1 mile of the site. Mitigation area 11 is within a mile or less of multiple dry extraction wells. The extraction technology used in the area is directional drilling and this allows for extraction from adjacent lands, resulting in minimal onsite surface impacts. The relative small size of the mitigation areas facilitates offsite extraction. Mineral production in this vicinity is largely complete, with production rates on the decline. Any remaining extraction under the mitigation sites would likely occur through directional drilling from the existing well sites in order to avoid the federal project mitigation features. Land loss rates due to subsidence are also declining and any possible additional subsidence under the sites would take decades to occur, with expected minimal impacts to the mitigation features. The adaptive management plan already includes requirements for the NFS to monitor and mitigate to protect the project features, watching to see if natural accretion and subsidence are in balance. Any delta would be a NFS responsibility. The risk has been coordinated with the NFS, and the NFS concurs in the recommendation to not acquire third party mineral interests beneath the fee parcels. In addition, to the extent that 33 USC 408 applies, USACE, through its permission process, will have an opportunity to affect any proposed mineral extraction that would impact the federal project so as to prevent injury to the public interest or impairment to the usefulness of the project.

18. Facilities/Utilities/Pipeline Relocation & Removals

Relocation data was collected and detailed by the USACE Galveston District, Engineering and Construction Division, to a feasibility level of design.

There are several oil and natural gas pipelines (165), utilities and railroads that have been identified to be impacted by this project. These facilities are listed and discussed in detail in the Engineering Appendix. Because of the sheer number of facility/utility/ and pipeline relocations identified and the PDT's resources, Attorney Opinions of Compensability were not done at the time of this report. To adjust for this gap, all of the affected facilities were assumed to be

entitled to a substitute facility in exchange for the real estate rights needed, and the estimated costs for labor and construction have been included in Exhibit B for each. The Non-Federal Sponsors will perform these relocations as a part of their responsibility under the project partnership agreement. The Government will make a final determination of the relocations necessary for the construction, operation or maintenance of the project during the design phase and will complete Final Attorney Opinions of Compensability as required by Chapter 12 of ER 405-1-12.

19. HTRW or Other Environmental Contaminates

Database searches were performed to identify potential sites of concern in the project area. This investigation indicates no HTRW areas are within or adjacent to the proposed project areas which could impact this project. Based on findings of the searches, the potential of encountering HTRW is considered low. A more detailed description of HTRW can be found in the HTRW Appendix.

20. Landowner Opposition

During the preliminary phases of this report there was a mix of both support and opposition from landowners. Landowner concerns were due to the alignment of the levee and flood walls. It was explained that this project is only in the preliminary study phase and final design has not been determined.

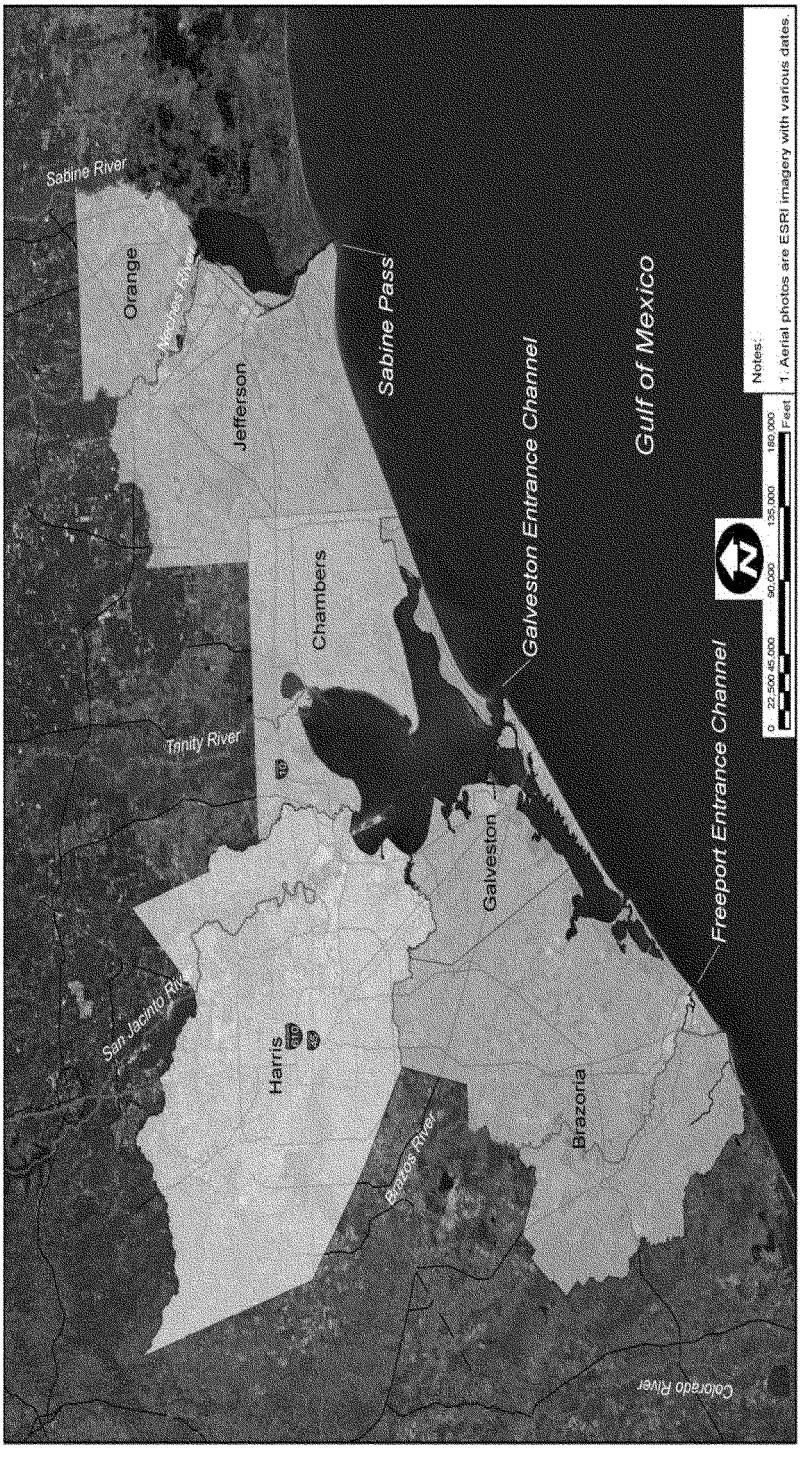
21. Zoning

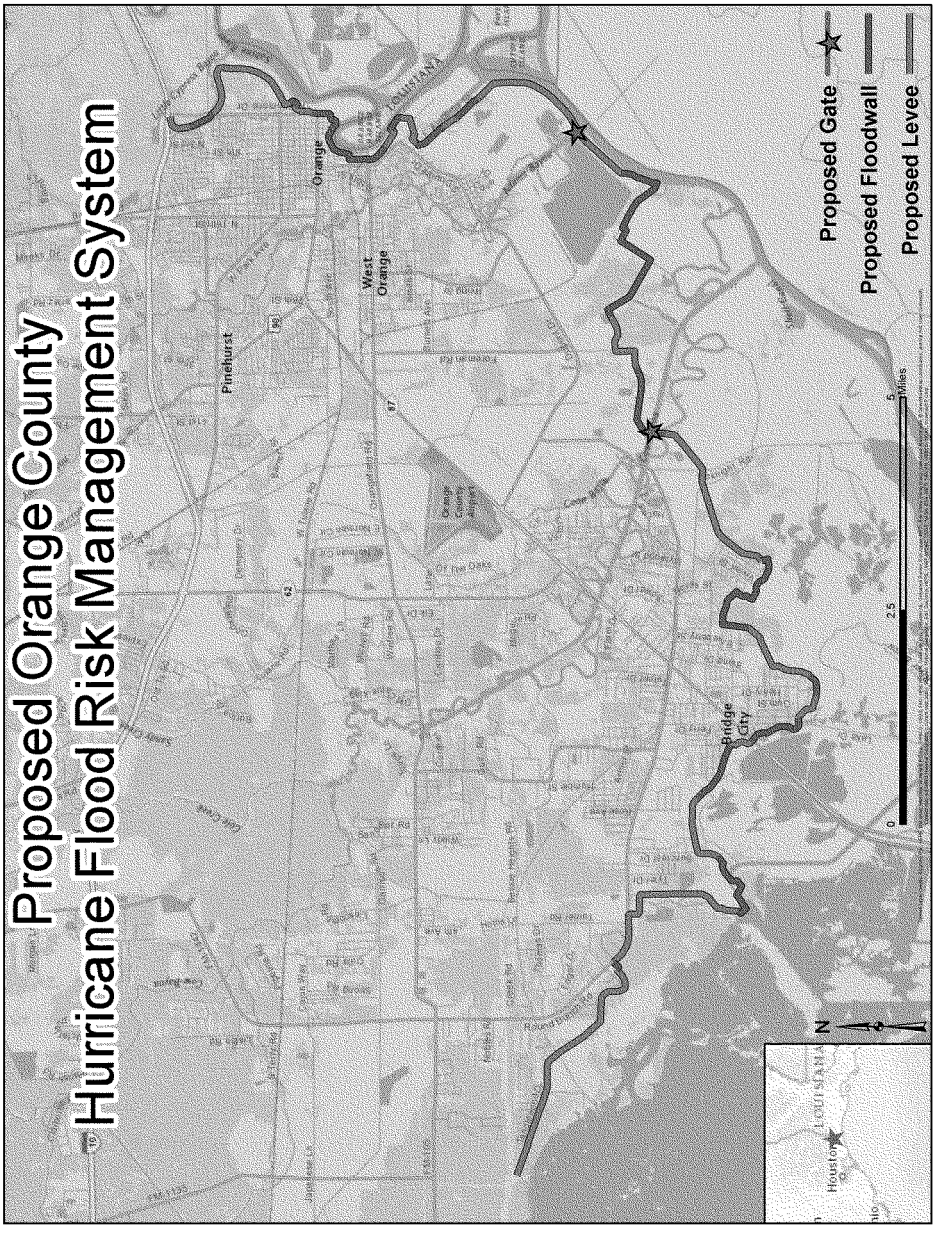
No application or enactment of zoning ordinances is proposed in connection with the Project.

EXHIBIT A

PROJECT MAPS

Study Area


Sabine River
Orange
Neches River
Jefferson
Sabine Pass
Gulf of Mexico
Galveston Entrance Channel
Chambers
Trinity River
Galveston
Freeport Entrance Channel
San Jacinto River
Harris
Brazoria
Brazos River
Colorado River
0 22,500 45,000 90,000 135,000 180,000
Feet
Notes:
1. Aerial photos are ESRI imagery with various dates.


Proposed Orange County
Hurricane Flood Risk Management System
Proposed Gate
Proposed Floodwall
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West Orange
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Bridge City
Orange County Airport
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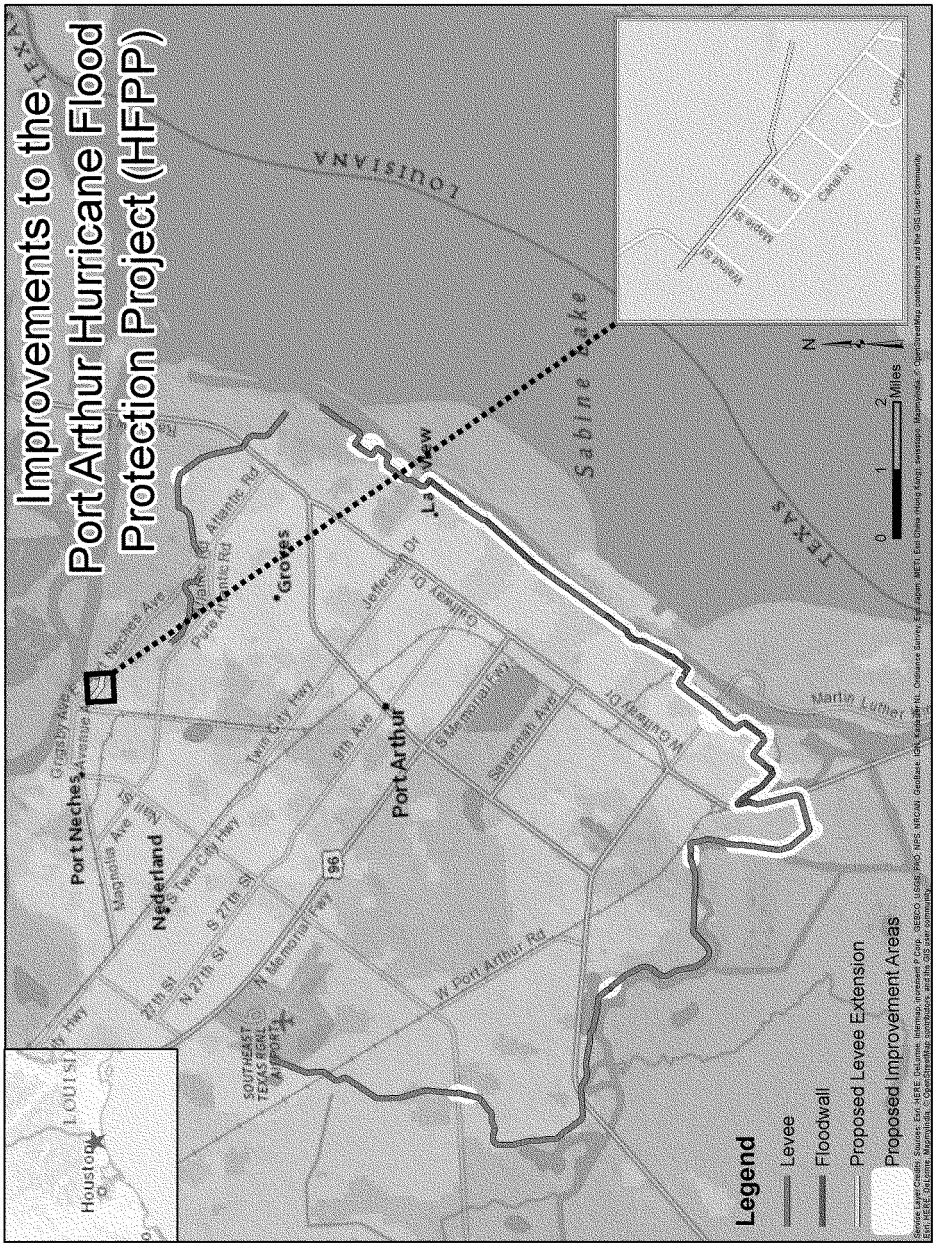
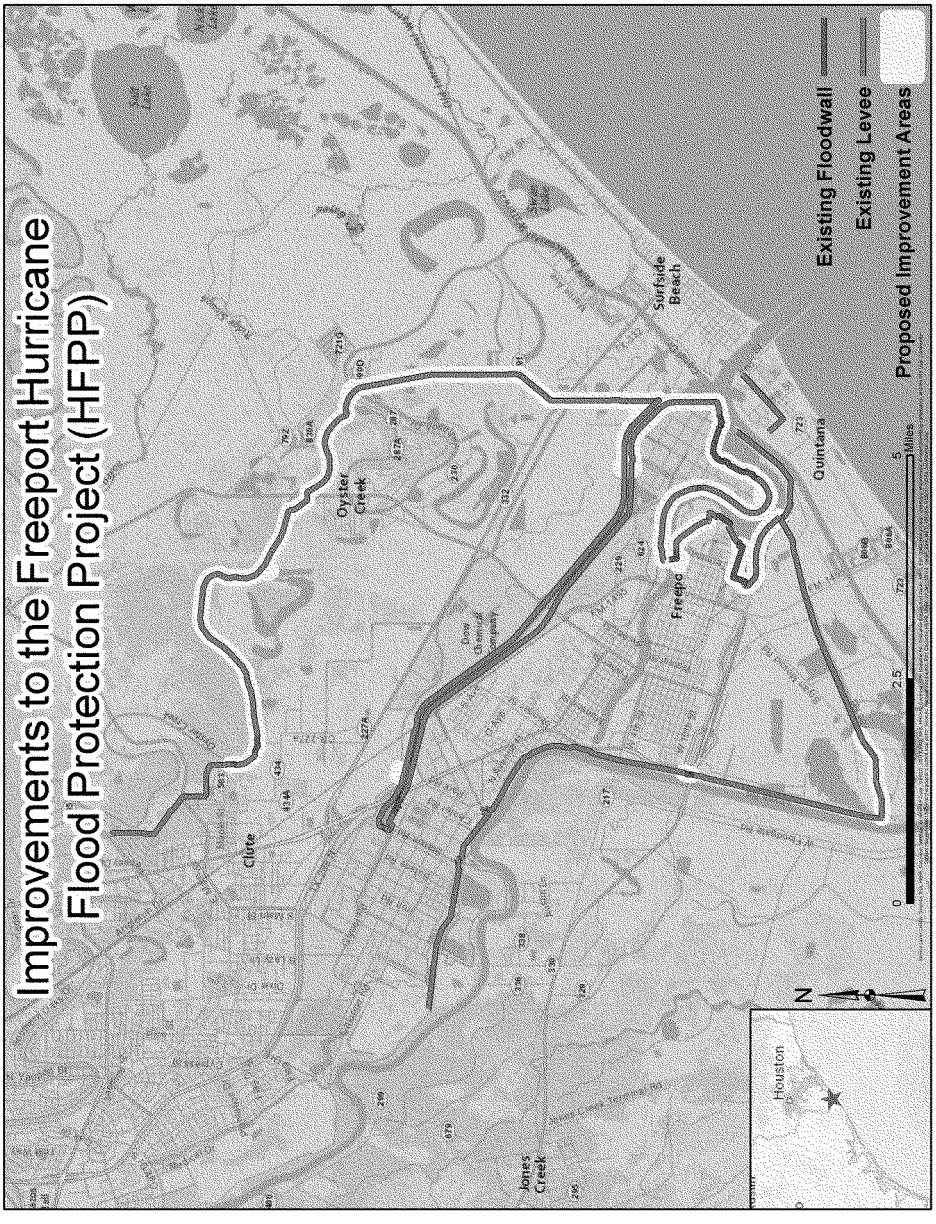

Improvements to the
Port Arthur Hurricane Flood
Protection Project (HFPP)
Legend
Levee
Floodwall
Proposed Levee Extension
Proposed Improvement Areas
Port Neches
Nederland
Groves
Port Arthur
Lake Sabine
Sabine Lake
LOUISIANA
TEXAS
Houston
Martin Luther
Miles


Improvements to the Freeport Hurricane Flood Protection Project (HFPP)
Existing Floodwall
Existing Levee
Proposed Improvement Areas
Clute
Oyster Creek
Freeport
Surfside Beach
Quintana
Jones Creek
Houston
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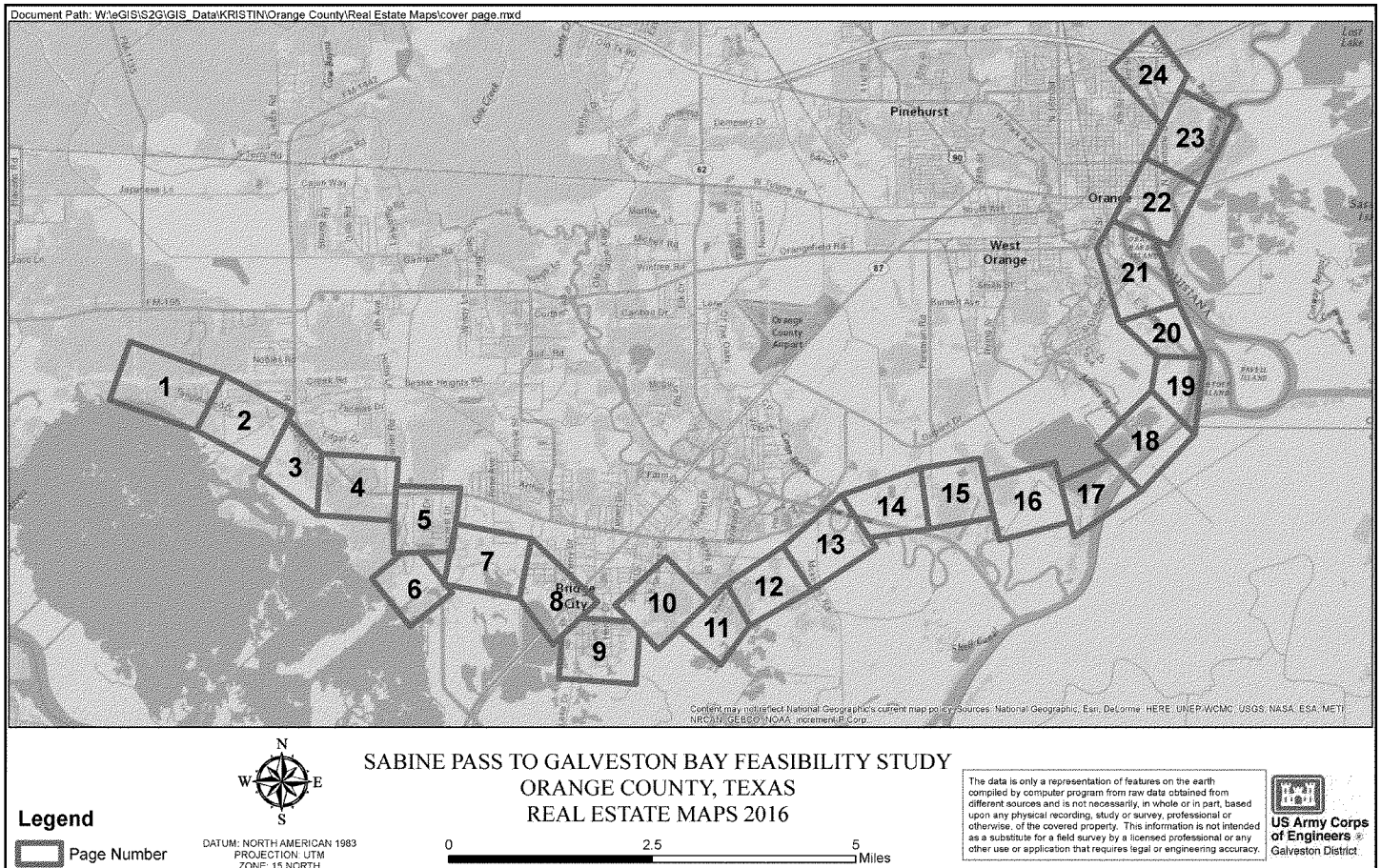
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Legend
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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
REAL ESTATE MAPS 2016
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Legend

- Orange Co. Parcels
- FPLE
- TWAE
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- Outfall Location
- Outfalls
- Levee
- Floodwall
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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
REAL ESTATE MAPS 2016

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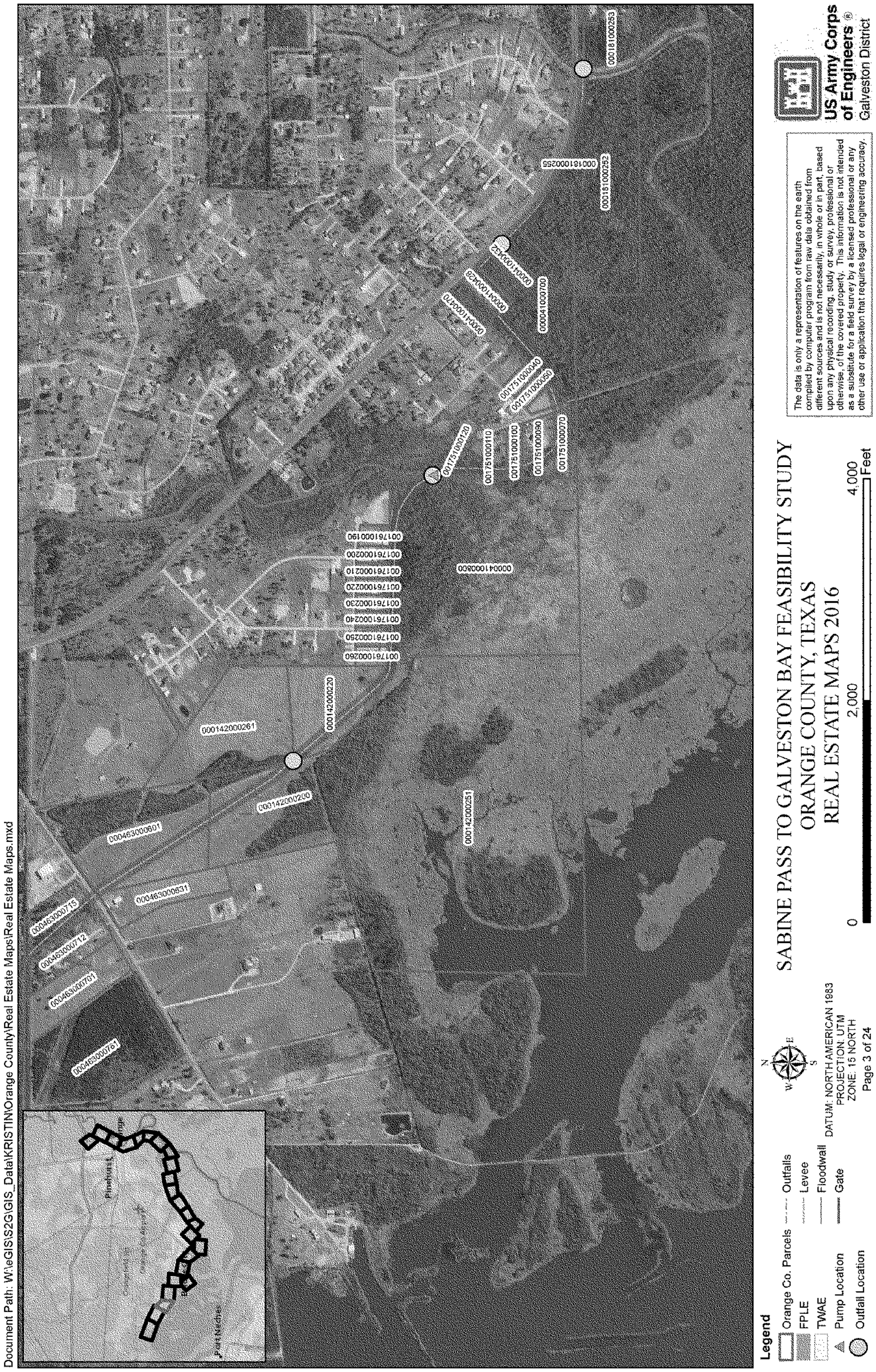
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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
REAL ESTATE MAPS 2016
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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
REAL ESTATE MAPS 2016

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
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ORANGE COUNTY, TEXAS
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ORANGE COUNTY, TEXAS
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ORANGE COUNTY, TEXAS
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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
ORANGE COUNTY, TEXAS
REAL ESTATE MAPS 2016

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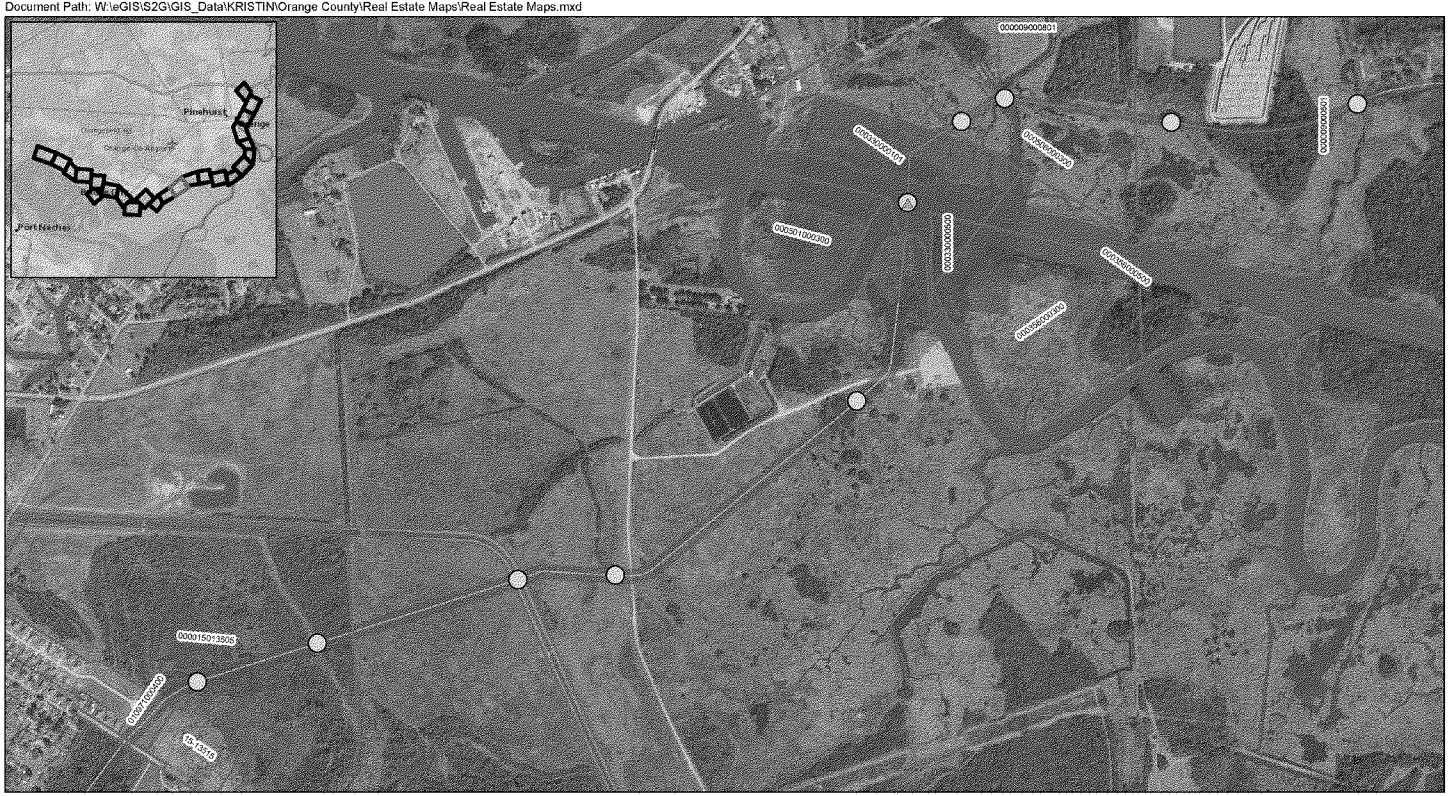

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
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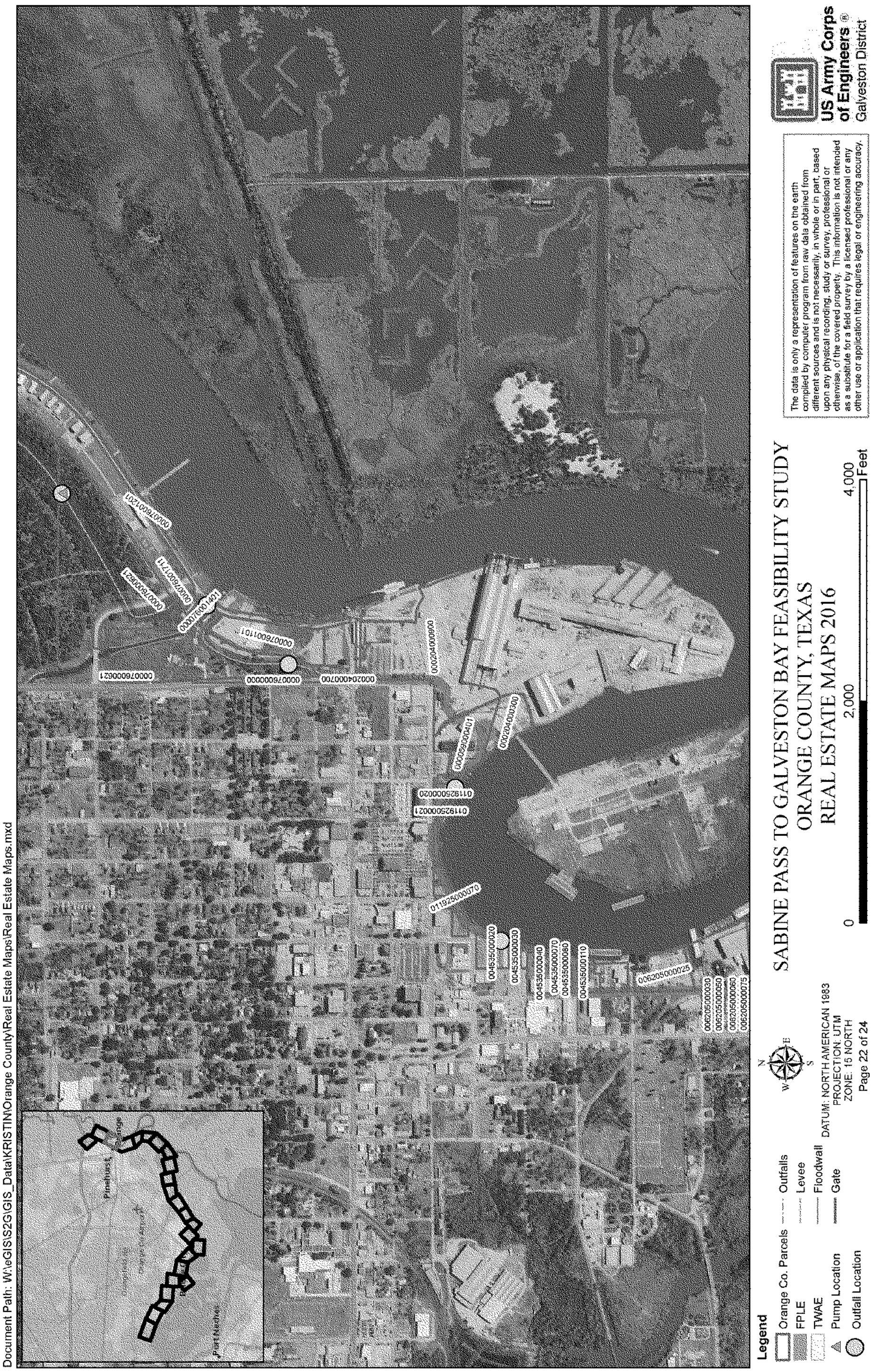
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REAL ESTATE MAPS 2016

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Galveston District

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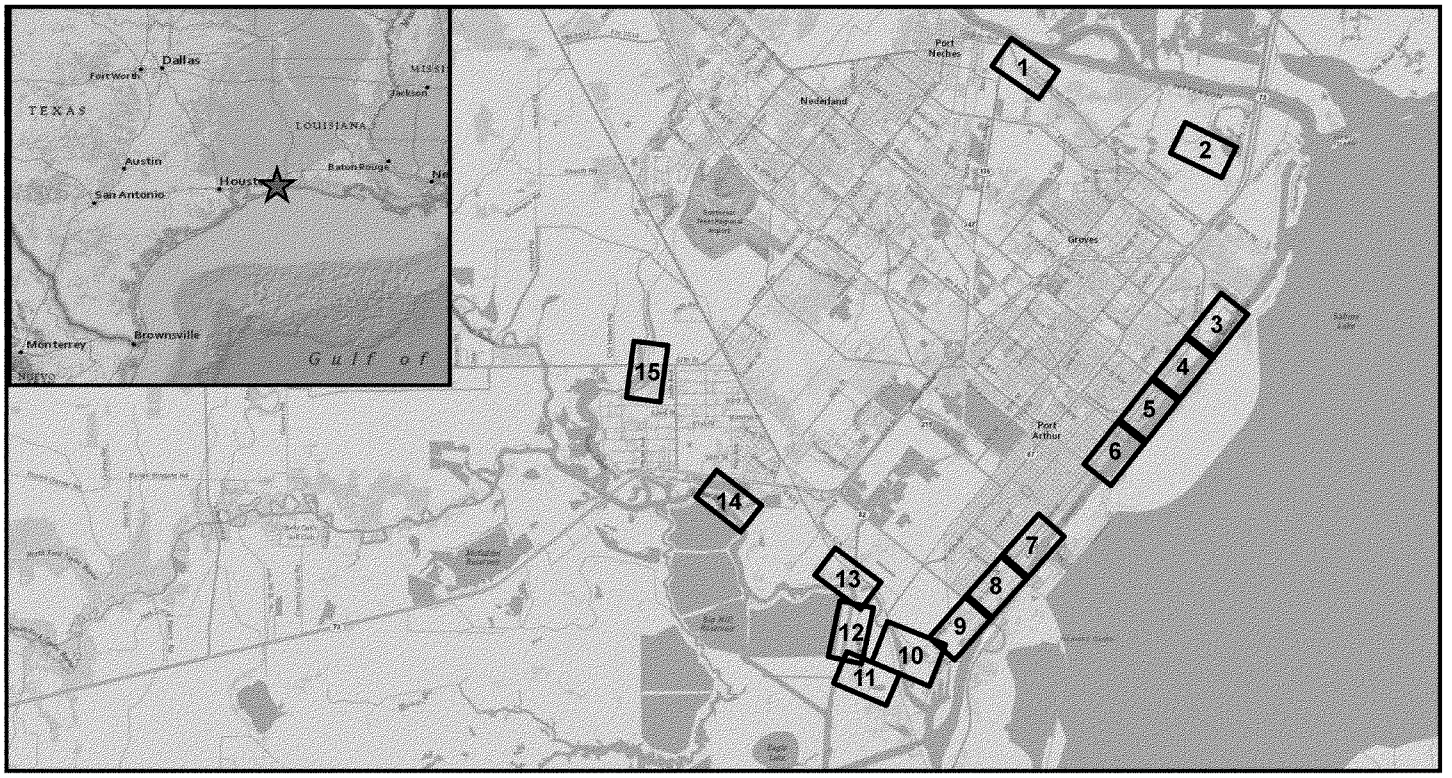

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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 1,000 2,000 Feet

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Galveston District

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Legend

- Jefferson Co. Parcels
- FPLE
- TWAE
- Levee
- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 1 of 15

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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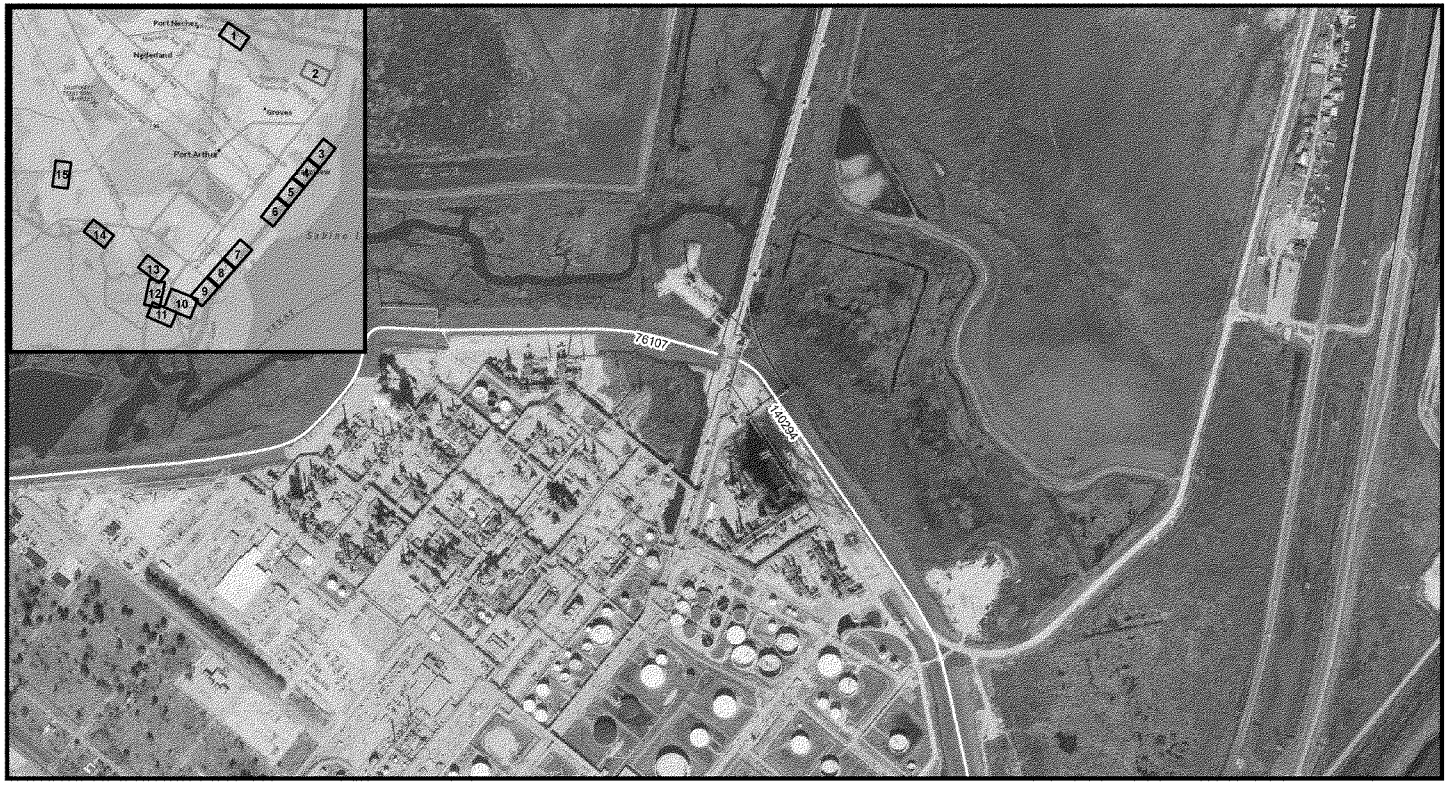

Legend

- Jefferson Co. Parcels
- FPLE
- TWAE
- Levee
- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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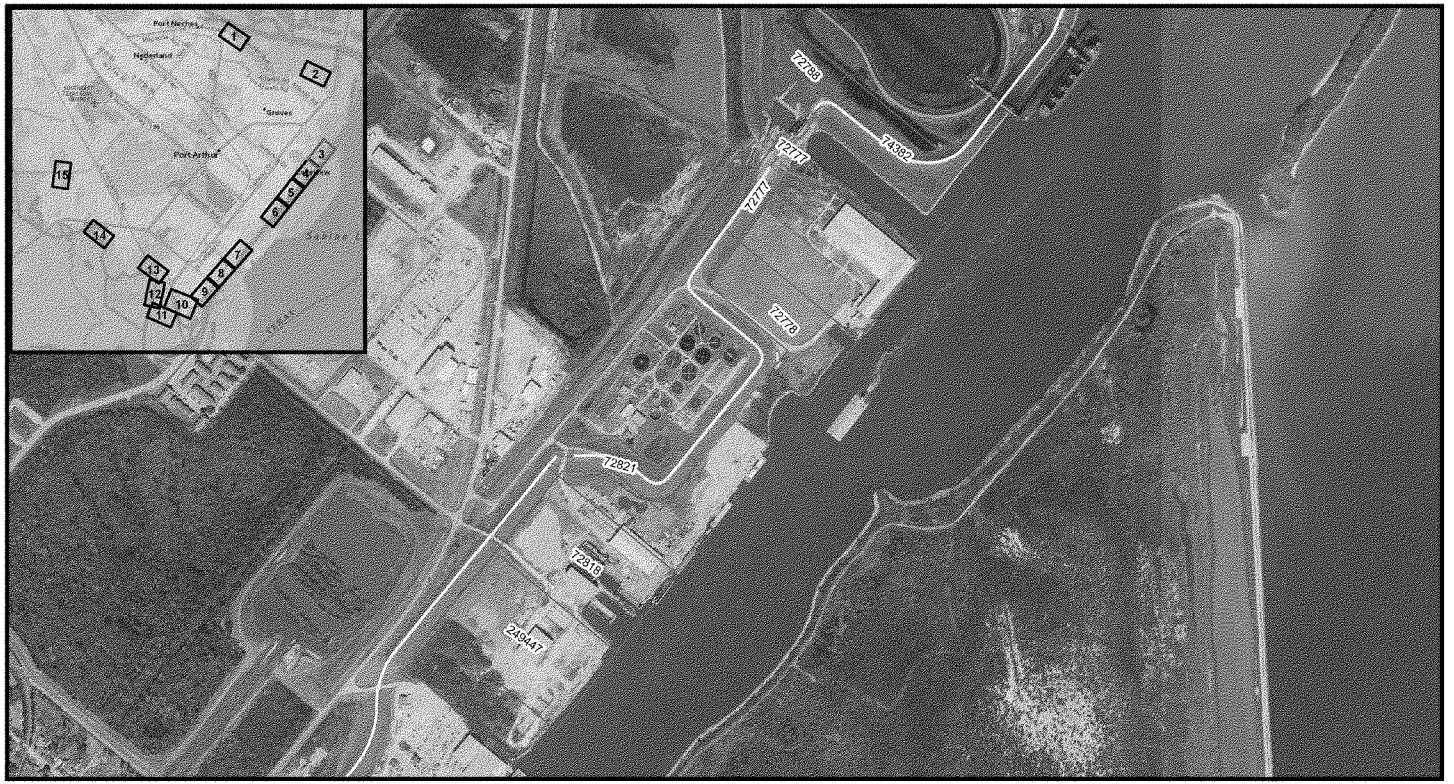

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Jefferson Co. Parcels
FPLE
TWAE
Levee
Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 3 of 15

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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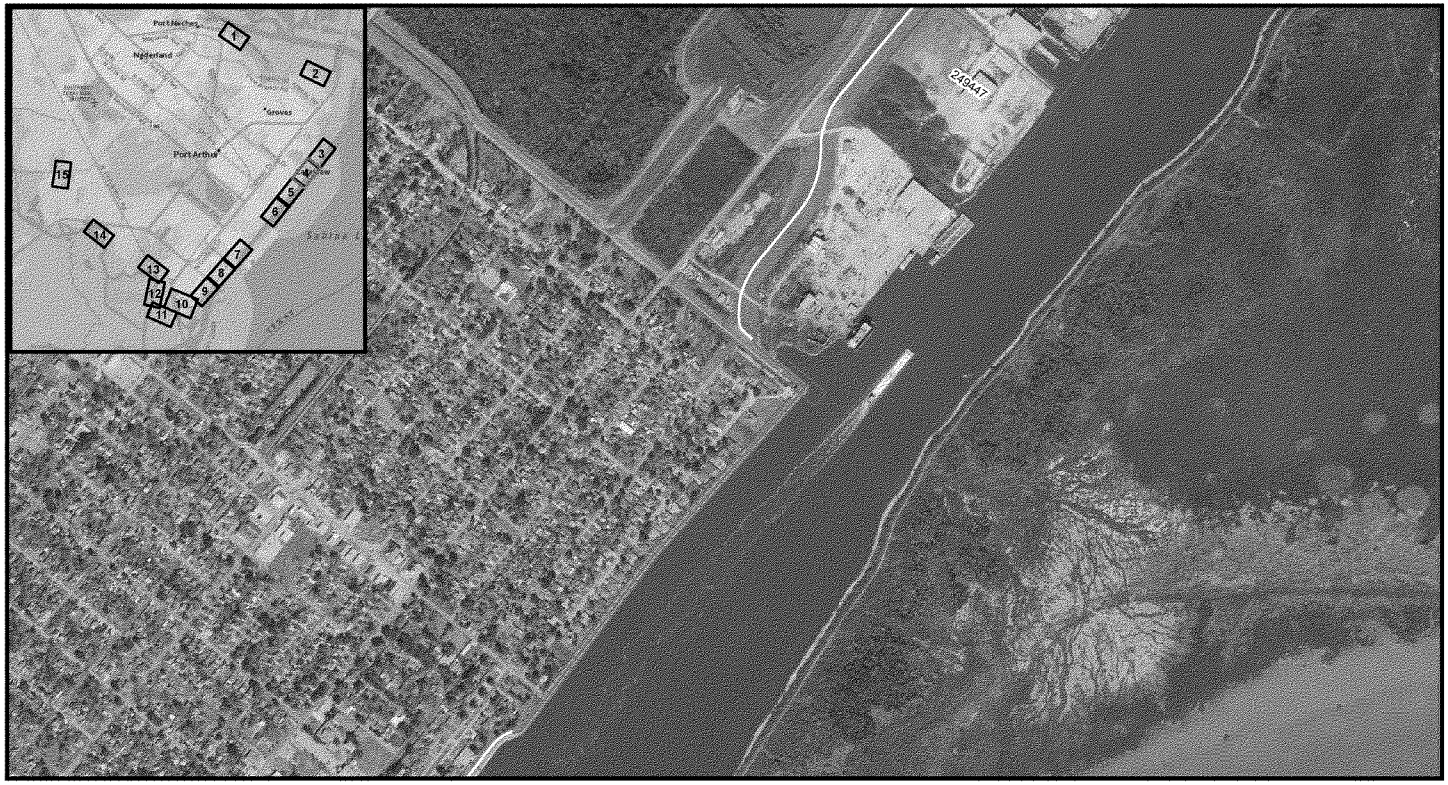

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- Jefferson Co. Parcels
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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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DATUM: NORTH AMERICAN 1983
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PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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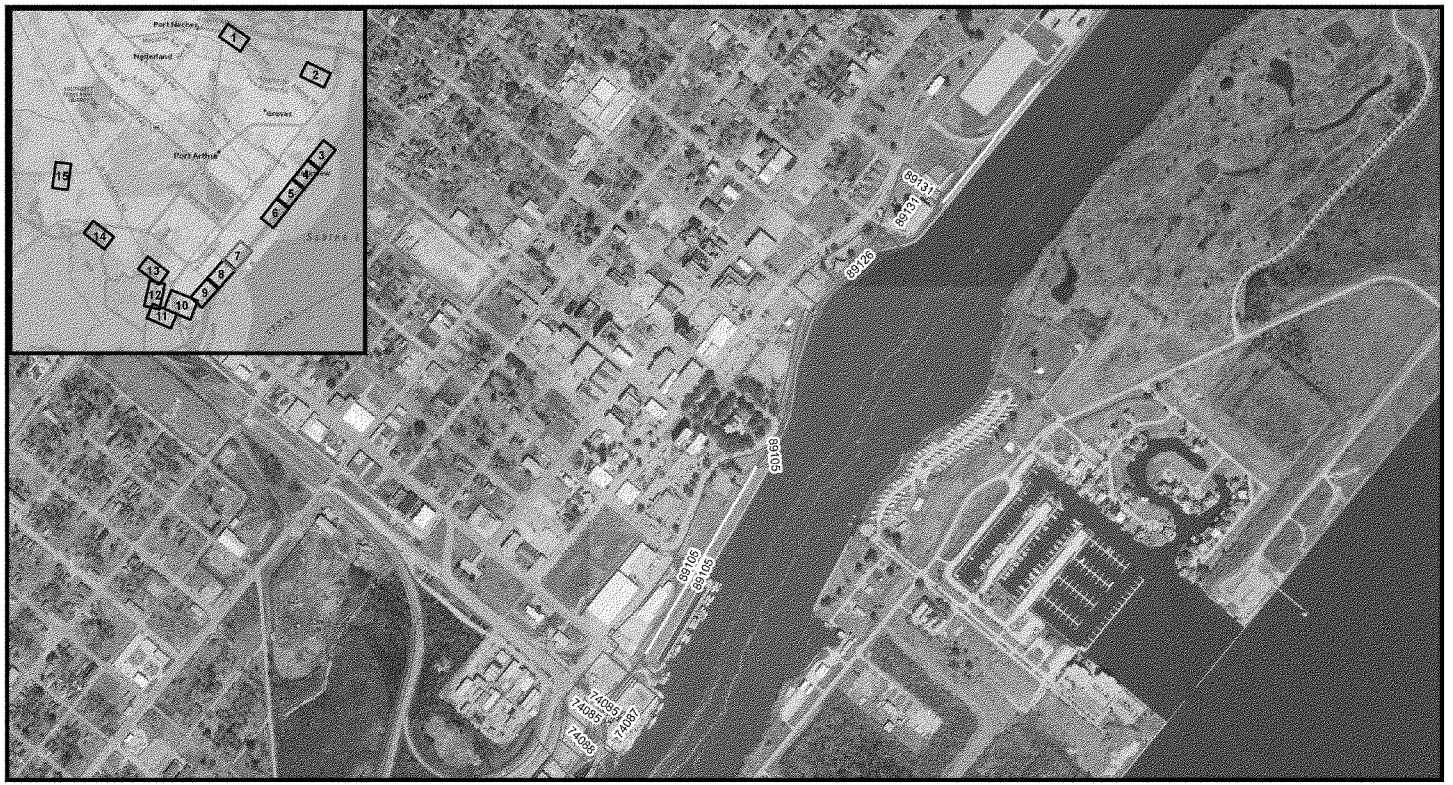

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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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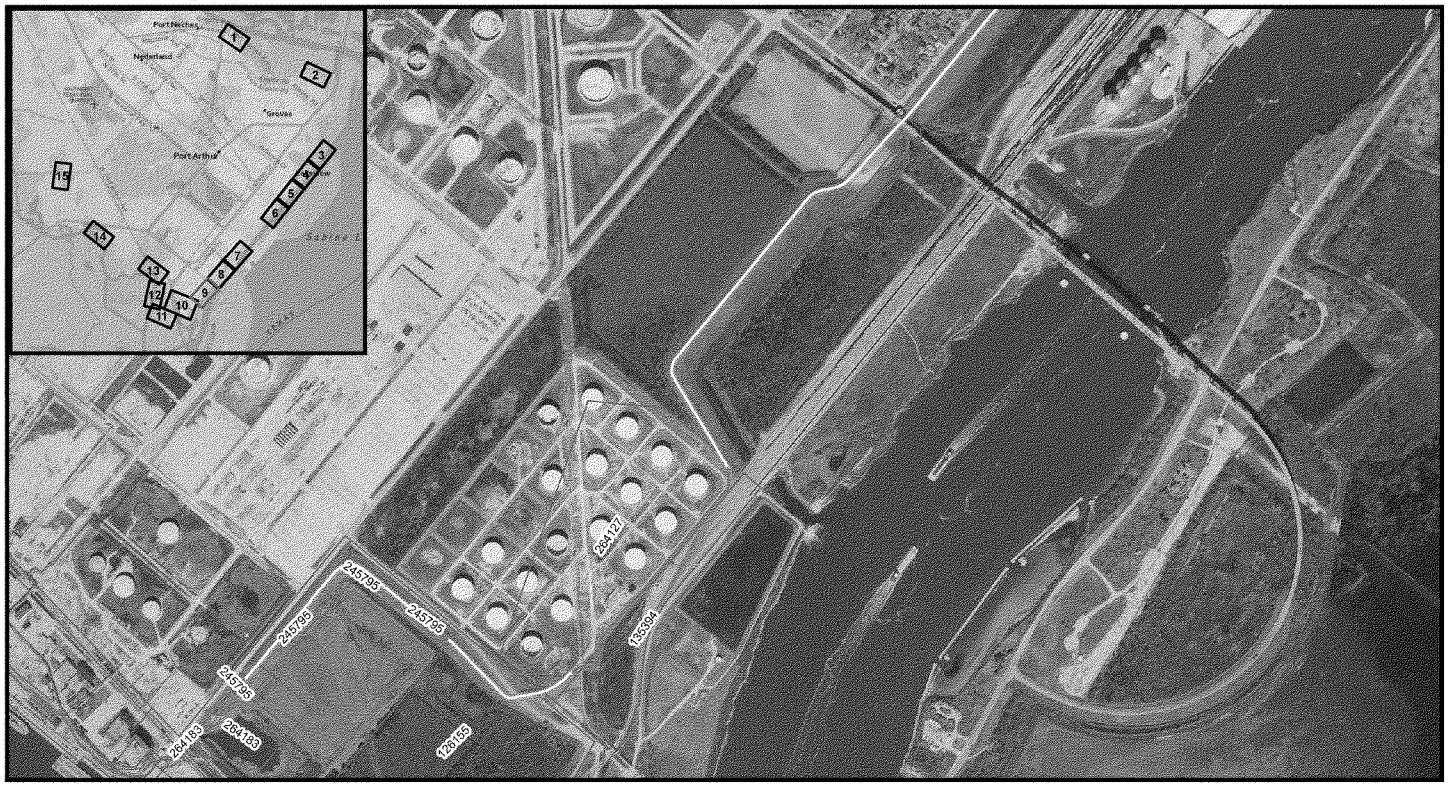

Legend

- Jefferson Co. Parcels
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- TWAE
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- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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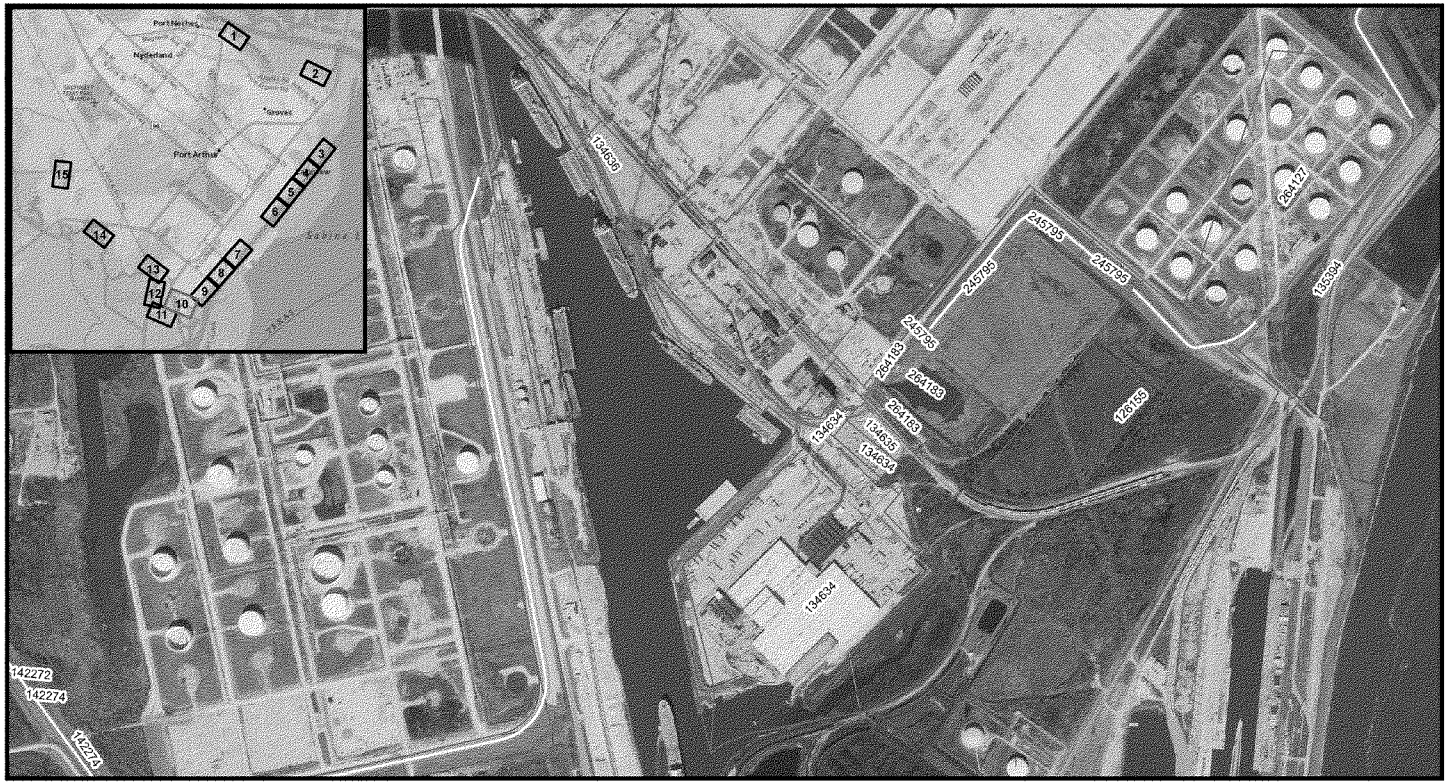

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- Jefferson Co. Parcels
- FPLE
- TWAE
- Levee
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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

Page 10 of 15

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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Galveston District

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Jefferson Co. Parcels
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TWAE
Levee
Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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Jefferson Co. Parcels
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N W E S
DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 12 of 15

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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DATUM: NORTH AMERICAN 1983
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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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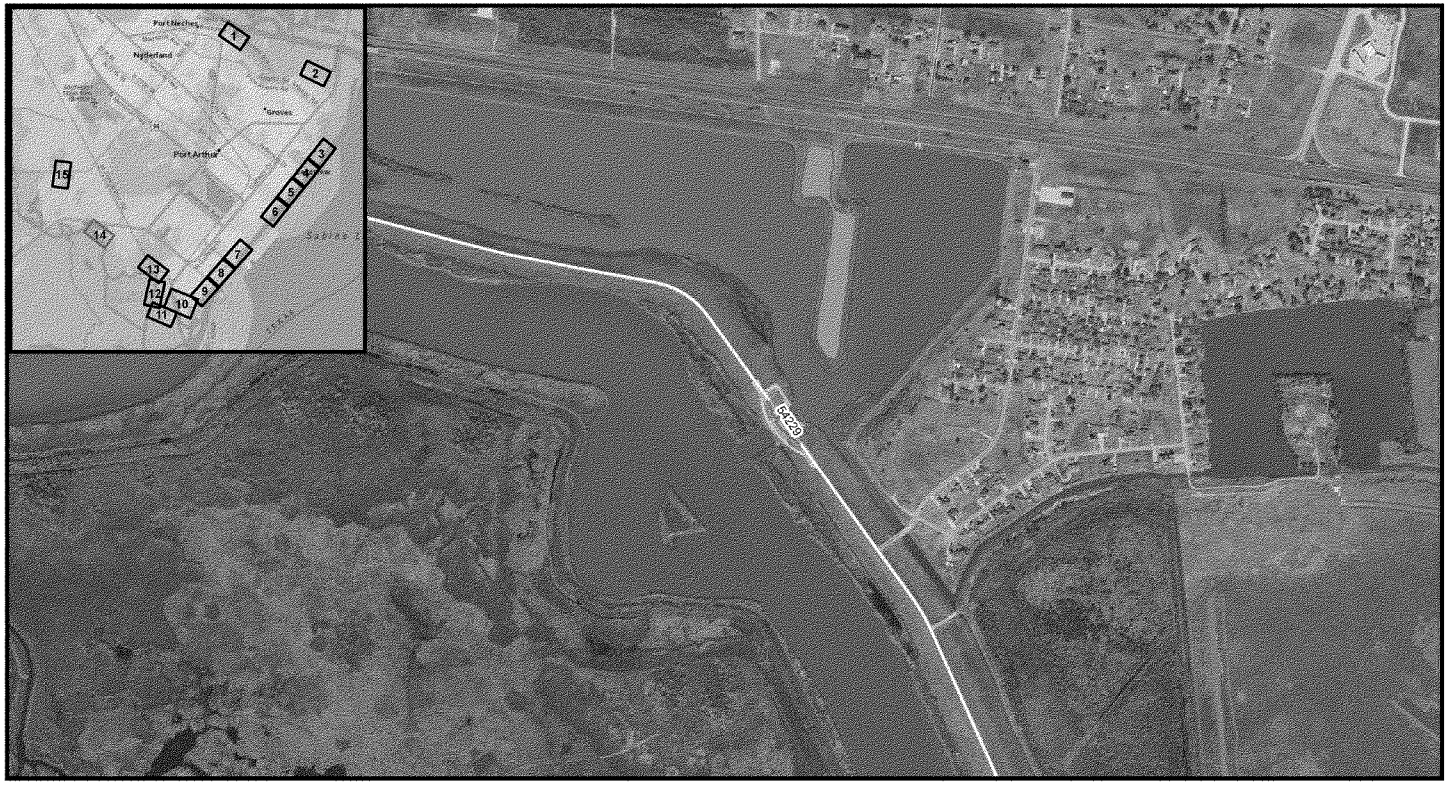

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- Jefferson Co. Parcels
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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

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SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

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- Jefferson Co. Parcels
- FPLE
- TWAE
- Levee
- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 15 of 15

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
PORT ARTHUR, TEXAS
REAL ESTATE MAPS 2016

0 750 1,500 Feet

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Page Numbers

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

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Legend

- Freeport Parcels
- TWAE
- Staging Area
- Gate
- Levee
- Floodwall

N W E S

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 2 of 17

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

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Galveston District

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Legend

- Freeport Parcels
- TWAE
- Staging Area
- Gate
- Levee
- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 3 of 17

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

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Galveston District

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- Freeport Parcels
- TWAE
- Staging Area
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DATUM: NORTH AMERICAN 1983
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ZONE: 15 NORTH

Page 4 of 17

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FREEPORT CSRM
REAL ESTATE MAPS 2016

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- TWAE
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DATUM: NORTH AMERICAN 1983
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DATUM: NORTH AMERICAN 1983
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Galveston District

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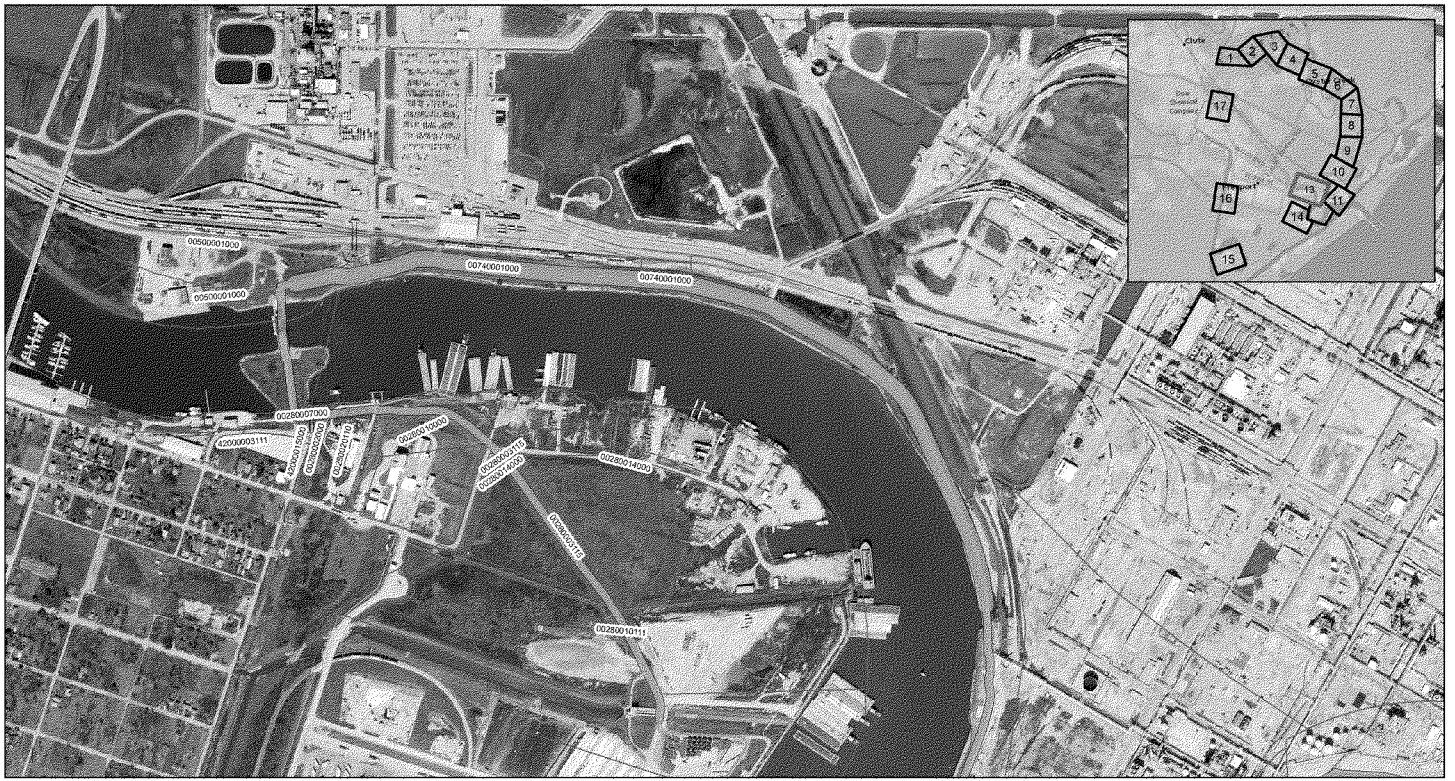
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Legend

- Freeport Parcels
- TWAE
- Staging Area
- Gate
- Levee
- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 14 of 17

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

0 1,000 2,000 Feet

The data is only a representation of features on the earth compiled by computer program from raw data obtained from different sources and is not necessarily, in whole or in part, based upon any physical recording, study or survey, professional or otherwise, of the covered property. This information is not intended as a substitute for a field survey by a licensed professional or any other use or application that requires legal or engineering accuracy.

US Army Corps of Engineers ®
Galveston District

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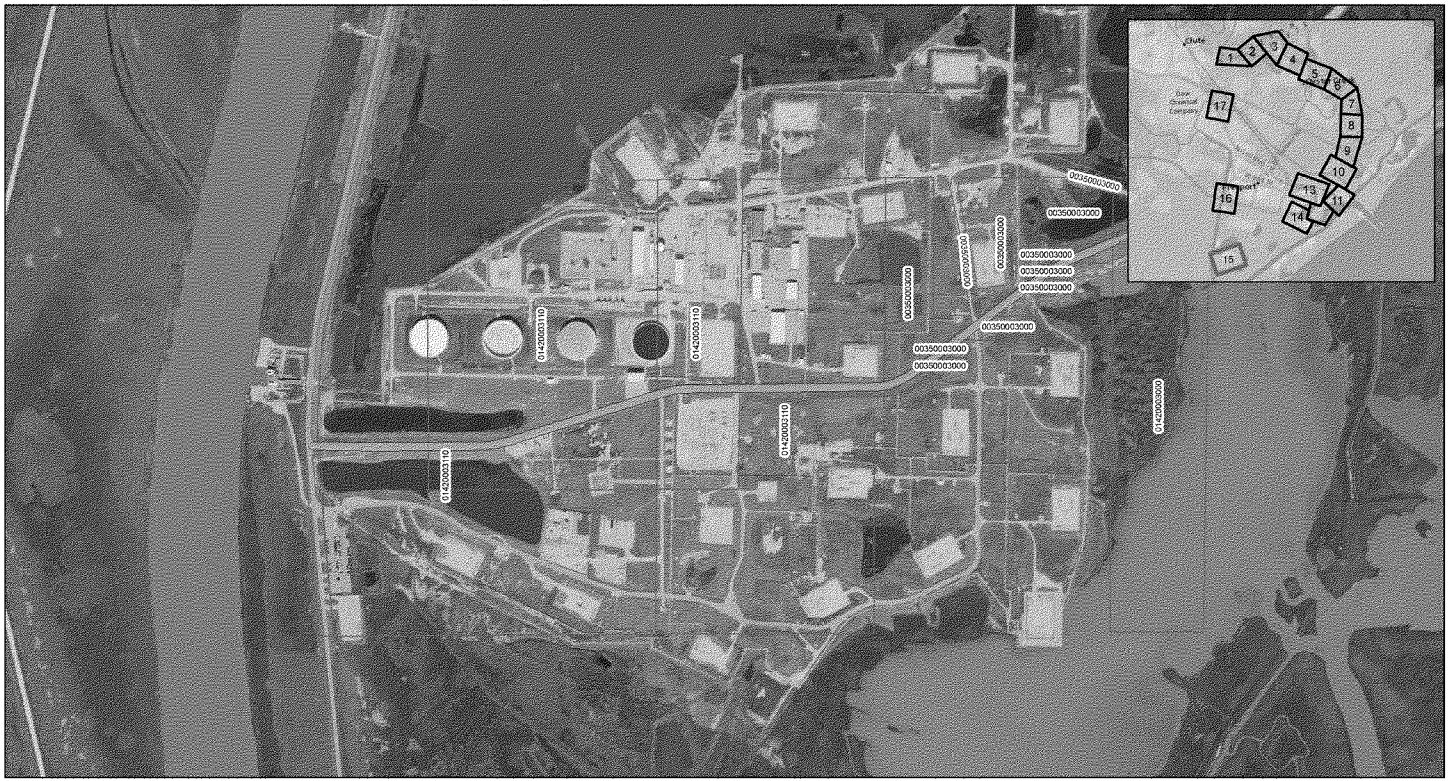
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- Freeport Parcels
- TWAE
- Staging Area
- Gate
- Levee
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DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 16 of 17

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

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Galveston District

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Legend

- Freeport Parcels
- TWAE
- Staging Area
- Gate
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- Floodwall

DATUM: NORTH AMERICAN 1983
PROJECTION: UTM
ZONE: 15 NORTH
Page 17 of 17

SABINE PASS TO GALVESTON BAY FEASIBILITY STUDY
FREEPORT CSRM
REAL ESTATE MAPS 2016

0 1,000 2,000 Feet

The data is only a representation of features on the earth compiled by computer program from raw data obtained from different sources and is not necessarily, in whole or in part, based upon any physical recording, study or survey, professional or otherwise, of the covered property. This information is not intended as a substitute for a field survey by a licensed professional or any other use or application that requires legal or engineering accuracy.

US Army Corps of Engineers ®
Galveston District

EXHIBIT B

BASELINE COST ESTIMATES

ORANGE COUNTY AND VICINITY -NON-FEDERAL COSTS

01 Lands and Damages

		Amount	Contingency
01B20	Acquisitions (335 tracts x $8,000)	$2,680,000.00	$53,600.00
01C20	Condemnations (3)	$270,000.00	$8,370.00
01E30	Appraisals (335 tracts x $1,000)	$335,000.00	$10,050.00
107	Staging Area (4 tracts)	$280,313.00	$8,409.39
113	Pipeline Removal Administration (95 unitsx $5,000)	$475,000.00	$14,250.00
	Rail Road Relocation (4 units X $25,000)	$100,000.00	$3,000.00
01R1B	Land Payments	$21,578,278.00	$625,770.06
	Mitigation Site 28	$50,000.00	$4,000.00
	Mitigation Site 29	$60,450.00	$4,231.50
	Mitigation Site 31	$161,820.00	$11,327.40
	Mitigation Site 52	$89,010.00	$7,120.80
	Mitigation Site 11	$660,150.00	$26,406.00
	Mitigation Site 161	$124,375.00	$4,975.00
01F20	PL 91-646 Assistance Payments (9 Residential)	$306,000.00	$9,180.00
	Commercial Relocation Assistance (4)	$200,000.00	$6,000.00
	Industrial Relocation Assistance (17)	$1,700,000.00	$51,000.00
11503	Damage Payments	$2,185,859.00	$65,575.77
01T	LERRD Crediting Package	$1,000,000.00	$30,000.00
	Sub Total	$32,256,255.00	$943,265.92
	Total	**$33,199,520.92**	

02 Relocations

02	Relocations (Construction Cost)	$48,962,000.00	$14,198,980.00
		$63,160,980.00	

ORANGE COUNTY AND VICINITY -FEDERAL COSTS

01 Lands and Damages

		Amount	Contingency
01B40	Acquisitions Review of NFS work (335 tracts @ $5,000)	$1,675,000.00	$418,750.00
01C40	Condemnations Review of NFS Work (3 unit @ $20,000)	$60,000.00	$15,000.00
01E50	Appraisals Reviews of NSF Work (10 tract @ $5,000)	$50,000.00	$12,500.00
107	Staging Area 4 tracts@ $3,000 Review of NFS Work	$12,000.00	$3,000.00
112	Project Related Administration	$20,000.00	$5,000.00
113	Pipeline Removal Administration	$0.00	$0.00
113	Pipelines (95 units) $4,000	$380,000.00	$95,000.00
113	RR Crossing (4) $20,000	$80,000.00	$20,000.00
114	Withdrawals (Public Domain Land)	$0.00	$0.00
	PL 91-646 Assistance/Commercial/Industrial Review of NFS		
01F40	Work (30 units) $5,000 per	$150,000.00	$37,500.00
	LERRD Crediting ($3,000 per tract assuming 335 tracts/4		
	Staging Areas)($3,000 per Appraisal 335); ($2,000 per		
01T20	Pipelines 95) ($5,000 per RR)	$2,227,000.00	$445,400.00
	Sub Total	$4,654,000.00	$1,052,150.00
	Total	**$5,706,150.00**	

PORT ARTHUR AND VICINITY -NON-FEDERAL COSTS
01 Lands and Damages

		Amount	Contingency
01B20	Acquisitions (10 tracts @ $10,000)	$100,000.00	$10,000.00
01C20	Condemnations (1 unit)	$90,000.00	$9,900.00
01E30	Appraisals (10 tracts x $1,000 per)	$10,000.00	$1,100.00
107	Staging Area (14)	$2,003,937.00	$120,236.22
112	Project Related Administration	$10,000.00	$1,100.00
113	Pipeline Removal Administration		
	Pipelines (46 units @ $8,000)	$368,000.00	$29,440.00
	RR Crossing (2 @ $30,000)	$60,000.00	$6,000.00
01R1B	Land Payments	$3,997,921.00	$199,896.05
01F20	PL 91-646 Assistance Payments (8 Residential)	$288,000.00	$28,800.00
11503	Damage Payments	$600,186.00	$66,020.46
	LERRD Crediting ($10,000 per tract assuming 10 tracts);		
01T	($3,000 per apprasial 10); ($4,000 per pipelines 46); ($10,000	$334,000.00	$43,420.00
	Sub Total	$7,862,044.00	$515,912.73
	Total	**$8,377,956.73**	

PORT ARTHUR AND VICINITY -FEDERAL COSTS
01 Lands and Damages

		Amount	Contingency
01B40	Acquisitions Review of NFS work (10 tract @ $5,000)	$50,000.00	$10,000.00
01C40	Condemnations Review of NFS Work (1 unit @ $20,000)	$20,000.00	$5,000.00
01E50	Appraisals Reviews of NSF Work (10 tract @ $5,000)	$50,000.00	$12,500.00
107	Staging Area 14@ $3,000 Review of NFS Work	$42,000.00	$10,500.00
112	Project Related Administration	$10,000.00	$2,000.00
113	Pipeline Removal Administration		$0.00
113	Pipelines (46 units) $4,000 per	$184,000.00	$46,000.00
113	RR Crossing (2) $20,000 per	$40,000.00	$10,000.00
01F40	PL 91-646 Assistance Review of NFS Work (8 units) $5,000 p	$40,000.00	$10,000.00
	LERRD Crediting ($6,000 per tract assuming 10 tracts/14		
	Staging Areas)($5,000 per Apprasial 10); ($2,000 per		
01T20	Pipelines 46) ($5,000 per RR)	$204,092.00	$40,818.40
	Sub Total	$640,092.00	$146,818.40
	Total	**$786,910.40**	

FREEPORT AND VICINITY -NON-FEDERAL COSTS
01 Lands and Damages

		Amount	Contingency
01B20	Acquisitions Cost (10 tracts)	$25,000.00	$5,750.00
01C20	Condemnations (1 unit)	$90,000.00	$19,800.00
01E30	Appraisals (10 x $1,000 per)	$10,000.00	$2,500.00
107	Staging Area (8)	$544,841.00	$119,865.02
112	Project Related Administration	$5,000.00	$1,100.00
113	Pipeline Removal Administration	$2,300.00	$575.00
	Pipeline Relocation (23)	$5,000.00	$1,250.00
	Industrial Structure Relocation (1)	$400,000.00	$92,000.00
01R1B	Land Payments	$7,120,651.00	$1,424,130.20
11503	Damage Payments	$766,549.00	$191,637.25
11504	Other	$20,000.00	$5,000.00
01T	LERRD Crediting Package	$20,000.00	$4,000.00
	Sub Total	$9,009,341.00	$1,867,607.47
	Total	**$10,876,948.47**	

FREEPORT AND VICINITY -FEDERAL COSTS
01 Lands and Damages

		Amount	Contingency
01B40	Acquisitions Review of NFS Work(10 tracts @ $5,000)	$50,000.00	$12,500.00
01C40	Condemnations Review of NFS Work (1 unit @ $20,000)	$20,000.00	$5,000.00
01E50	Appraisals Reviews of NFS Work ($5,000 per trac assuming 10 tracts)	$50,000.00	$12,500.00
107	Staging Area (8 @ $3,000 per) Review of NFS Work	$24,000.00	$6,000.00
112	Project Related Administration	$10,000.00	$2,500.00
113	Pipeline Removal Administration	$0.00	$0.00
	Pipeline Relocation (23) $4,000 per	$92,000.00	$23,000.00
	Industrial Structure Relocation (1) $20,000 per	$20,000.00	$5,000.00
114	Withdrawals (Public Domain Land)	$0.00	$0.00
01F40	PL 91-646 Assistance Payments	$0.00	$0.00
01T20	LERRD Crediting ($3,000 per tract assuming 10 tracts/8 Staging Areas)($3,000 per Apprasial 10); ($2,000 per Pipelines 23) ($5,000 per Industral Relo)	$135,000.00	$33,750.00
	Sub Total	$401,000.00	$100,250.00
	Total	**$501,250.00**	

EXHIBIT C

RISK LETTER

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

Real Estate Division

George L. Kidwell
Chairman of the Board of Directors
Velasco Drainage District
P.O. Box 7
Clute, TX 77531

Dear Mr. Kidwell:

It is our understanding that you may or have begun acquiring rights-of-way in connection with the Sabine to Galveston Project prior to execution of a Project Partnership Agreement (PPA) with the Federal Government. We appreciate your support for this proposed project, but our regulations require us to inform you that **IF FOR ANY REASON, THE PPA NEVER GETS SIGNED OR IF CONGRESS FAILS TO AUTHORIZE OR FUND THE PROJECT, ANY LAND YOU ACQUIRED OR ANY MONEY YOU SPEND IN YOUR EFFORTS TO ACQUIRE LAND WILL BE AT THE SOLE RISK OF VELASCO DRAINAGE DISTRICT.** Furthermore, for any property that qualifies for Federal participation in the project, your acquisition efforts must be in compliance with all of the provisions of P.L. 91-646, the Federal Relocation Assistance Law.

Please ensure that records are kept regarding purchase price and real estate administrative expenses such as title evidence, surveys and appraisal fees. This will be necessary for you to receive credit in the event of Federal Authorization. Please be advised our regulations dictate that credit will not be given for real estate administrative costs for any properties acquired five or more years prior to execution of a PPA.

If you have any questions, please contact Mr. Kenny Pablo at (409) 766-3816 or Kenneth.Pablo@usace.army.mil.

Sincerely,

Timothy J. Nelson
Chief, Real Estate Division
Galveston District
U.S. Army Corps of Engineers

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

Real Estate Division

Judge Stephen Carlton
County Judge
Orange County
123 South 6th Street
Orange, TX 77630

Dear Judge Carlton:

It is our understanding, that you may or have begun acquiring rights-of-way in connection with the Sabine to Galveston Project prior to execution of a Project Partnership Agreement (PPA) with the Federal Government. We appreciate your support for this proposed project, but our regulations require us to inform you that **IF FOR ANY REASON, THE AMENDED LCA NEVER GETS SIGNED OR IF CONGRESS FAILS TO AUTHORIZE OR FUND THE PROJECT, ANY LAND YOU ACQUIRED OR ANY MONEY YOU SPEND IN YOUR EFFORTS TO ACQUIRE LAND WILL BE AT THE SOLE RISK OF ORANGE COUNTY.** Furthermore, for any property that qualifies for Federal participation in the project, your acquisition efforts must be in compliance with all of the provisions of P.L. 91-646, the Federal Relocation Assistance Law.

Please ensure that records are kept regarding purchase price and real estate administrative expenses such as title evidence, surveys and appraisal fees. This will be necessary for you to receive credit in the event of Federal Authorization. Be advised that regulations dictate that credit will not be given for real estate administrative costs for properties acquired five years' prior to execution of a PPA.

If you have any questions, please contact Mr. Kenny Pablo at (409) 766-3816 or Kenneth.Pablo@usace.army.mil.

Sincerely,

Timothy J. Nelson
Chief, Real Estate Division
Galveston District
U.S. Army Corps of Engineers

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

Real Estate Division

Mr. Phil Kelley
Manager
Jefferson County Drainage District No. 7
P.O. Box 3244 4401 Ninth Avenue
Port Arthur, TX 77642

Dear Mr. Kelley:

It is our understanding, that you may or have begun acquiring rights-of-way in connection with the Sabine to Galveston Project prior to execution of a Project Partnership Agreement (PPA) with the Federal Government. We appreciate your support for this proposed project, but our regulations require us to inform you that **IF FOR ANY REASON, THE AMENDED LCA NEVER GETS SIGNED OR IF CONGRESS FAILS TO AUTHORIZE OR FUND THE PROJECT, ANY LAND YOU ACQUIRED OR ANY MONEY YOU SPEND IN YOUR EFFORTS TO ACQUIRE LAND WILL BE AT THE SOLE RISK OF JEFFERSON COUNTY DRAINAGE DISTRICT NO.7.** Furthermore, for any property that qualifies for Federal participation in the project, your acquisition efforts must be in compliance with all of the provisions of P.L. 91-646, the Federal Relocation Assistance Law.

Please ensure that records are kept regarding purchase price and real estate administrative expenses such as title evidence, surveys and appraisal fees. This will be necessary for you to receive credit in the event of Federal Authorization. Be advised that regulations dictate that credit will not be given for real estate administrative costs for properties acquired five years' prior to execution of a PPA.

If you have any questions, please contact Mr. Kenny Pablo at (409) 766-3816 or Kenneth.Pablo@usace.army.mil.

Sincerely,

Timothy J. Nelson
Chief, Real Estate Division
Galveston District
U.S. Army Corps of Engineers

EXHIBIT D

ASSESSMENT OF NON-FEDERAL ACQUISTION CAPABILITY

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

Jefferson County Drainage District No. 7
Jefferson County, Texas

SABINE PASS TO GALVESTON BAY, TEXAS FEASIBILITY STUDY

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes?
(yes/no)

b. Does the sponsor have the power of eminent domain for this project?
(yes/no)

c. Does the sponsor have "quick-take" authority for this project? (yes/no)

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? (yes/no)

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/no)

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? (yes/no)

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (yes/no)

d. If the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? (yes/no)

e. Can the sponsor obtain contractor support, if required in a timely fashion? (yes/no)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/no) (If "yes", provide description)

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? (yes/no)

b. Has the sponsor approved the project/real estate schedule/milestones? (yes/no) Will be provided prior to PED

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? (yes/no)

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable. (If sponsor is believed to be "insufficiently capable," provide explanation)

V. Coordination

a. Has this assessment been coordinated with the sponsor? (yes/no)

b. Does the sponsor concur with this assessment? (yes/no) (If "no," provide explanation)

Prepared by:

4/19/17

Kenny Pablo — Date
Realty Specialist
Galveston District
U.S. Army Corp of Engineers

Reviewed by:

4/18/17

Phil Kelley — Date
Manager
Jefferson County Drainage District No.7

Approved by:

4/19/17

Timothy J. Nelson — Date
Chief, Real Estate Division
Galveston District
U.S. Army Corp of Engineers

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

Orange County
Orange County, Texas

SABINE PASS TO GALVESTON BAY, TEXAS FEASIBILITY STUDY

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (yes/no)

b. Does the sponsor have the power of eminent domain for this project? (yes/no)

c. Does the sponsor have "quick-take" authority for this project? (yes/no)

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? (yes/no)

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/no)

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? (yes/no)

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (yes/no)

d. If the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? (yes/no)

e. Can the sponsor obtain contractor support, if required in a timely fashion? (yes/no)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/no) (If "yes", provide description) General assistance in ensuring all federal guidelines are met.

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? (yes/no)

b. Has the sponsor approved the project/real estate schedule/milestones? (yes/no) Will be provided prior to PED

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? (yes/no)

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable. (If sponsor is believed to be "insufficiently capable," provide explanation)

V. Coordination

a. Has this assessment been coordinated with the sponsor? (yes/no)

b. Does the sponsor concur with this assessment? (yes/no) (If "no," provide explanation)

Prepared by:

4/19/17

Kenny Pablo — Date
Realty Specialist
Galveston District
U.S. Army Corp of Engineers

Reviewed by:

Stephen B. Carlton
County Judge
Orange County, Texas

Approved by:

4/19/17

Timothy J. Nelson — Date
Chief, Real Estate Division
Galveston District
U.S. Army Corp of Engineers

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

Velasco Drainage District
Brazoria County, Texas

SABINE PASS TO GALVESTON BAY, TEXAS FEASIBILITY STUDY

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (yes/no)

b. Does the sponsor have the power of eminent domain for this project? (yes/no)

c. Does the sponsor have "quick-take" authority for this project? (yes/no) UNKNOWN AK

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? (yes/no)

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (yes/no)

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? (yes/no)

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? (yes/no)

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? (yes/no)

d. If the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? (yes/no)

e. Can the sponsor obtain contractor support, if required in a timely fashion? (yes/no)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/no) (If "yes", provide description)

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? (yes/no)

b. Has the sponsor approved the project/real estate schedule/milestones? (yes/no)

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? (yes/no)

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable. (If sponsor is believed to be "insufficiently capable," provide explanation)

V. Coordination

a. Has this assessment been coordinated with the sponsor? (yes/no)

b. Does the sponsor concur with this assessment? (yes/no) (If "no," provide explanation)

Prepared by:

5/8/17

Kenny Pablo Date
Realty Specialist
Galveston District
U.S. Army Corp of Engineers

Reviewed by:

George L. Kidwell 4-25-17

George L. Kidwell Date
Chairman of the Board of Directors
Velasco Drainage District

Approved by:

5/8/17

Timothy J. Nelson Date
Chief, Real Estate Division
Galveston District
U.S. Army Corp of Engineers

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

APPENDIX F

PUBLIC COORDINATION

May 2017

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2. Summary of Notice of Intent Comments 1
3. Comments on the DIFR-EIS 3

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Part I - Scoping

1. Public Scoping Workshops Invitation
2. Notice of Intent dated November 24, 2014
3. Comments During Notice of Intent Period

Part II – Draft Integrated Feasibility Report/Environmental Impact Statement

4. Public Notice of Availability
5. Beaumont Public Meeting Transcript
6. Freeport Public Meeting Transcript
7. Public Comments on DIFR-EIS

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Reduction and Ecosystem Restoration
Final Integrated Feasibility Report-Environmental Impact Statement
Public Scoping and Comment Summary

1. Public Involvement Activities

Extensive public scoping, stakeholder communication, and resource agency coordination were maintained throughout development of the Recommended Plan. Four scoping meetings were held in early 2012, which resulted in the identification of over 250 ideas addressing Coastal Storm Risk Reduction (CSRM) problems and Ecosystem Restoration (ER) opportunities in the six-county study area. The February 6, 2012, invitation to participate in meetings held in Beaumont, Seabrook, Galveston and Freeport, Texas, was published on the USACE-Galveston District website and sent to an extensive mail list (Attachment 1).

Two stakeholder briefings were held in the spring of 2014 that focused primarily on communicating the goals and progress of the study with local governments and agencies. Continuous contact has been maintained with outside organizations that have been working to address the same problems as those addressed by this study. In particular, close communication has been maintained with the team at Texas A&M Galveston, which has been working to develop the Ike Dike proposal, the Severe Storm Prediction, Education and Evacuation from Disasters Center (a consortium of several universities headquartered at Rice University in Houston), which has been assessing a number of other CSRM, ER, and recreation initiatives for the Galveston Bay region, and the Gulf Coast Community Protection and Restoration District, which is preparing a report evaluating CSRM opportunities in the six-county study area.

2. Summary of Notice of Intent Comments

USACE published the Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) in the Federal Register on November 24, 2014. Written comments were accepted for a 30-day period following that notice. In total, about 20 written comments were received following the public meetings and NOI. The NOI and comments are presented in Attachments 2 and 3, respectively. Comments made at the public meetings and in the written comments are summarized below.

The majority of the original public and agency comments received pertained to the Galveston Bay Region and to ER opportunities in general. The Audubon Society expressed concerns regarding

Colonial Waterbird rookeries and piping plover critical habitat areas. Several rookery and critical habitat areas are within the project area, which provide nesting and feeding habitat, and are currently subject to erosion from storm damage, ship traffic and sand mining activities. The Port of Houston Authority (PHA) advised that solutions will need to reflect industry participation or sponsorship of projects, considering that public and private interests coexist along the coast. The feasibility of structural solutions on the Houston Ship Channel (HSC) need to be considered prior to implementation, as most of the current transportation systems that serve the HSC cannot appropriately accommodate proposed flood control structures without causing a disruption in the transportation of commerce. The City of Galveston and the general public also expressed interest in public and private partnerships, which can reduce the financial burden on taxpayers. The City of Galveston recommended that a sediment management plan be considered that encourages beneficial use of dredge materials for public and private projects such as beach preservation, beach nourishment, and establishment of a natural sand dune defense system. Local citizens and municipalities would also like to see conservation and enhancement of wetlands, in combination with responsible development, to prevent and mitigate impacts from severe weather and flood damage, specifically on Bolivar Peninsula and west end of Galveston Island. Multiple comments referenced flood control projects, greenspace, and conservation areas as practicable and effective examples.

In the Sabine region, Orange County expressed strong support for an evaluation of surge protection for that county, including protection for Chemical Row and the Entergy Power Plant. USACE was urged to evaluate levee and surge gate alternatives, and to utilize the Orange County Study, which evaluated several potential alternatives. Industrial facilities and the general public emphasized the need to protect petro-chemical facilities in the area, one of which is the largest refinery in the U.S. The general public was also concerned about maintaining or improving evacuation routes during storm emergencies. Jefferson County and Ducks Unlimited supported shoreline erosion control for the GIWW; this would prevent the loss of interior marshes that serve as storm buffers for inland communities. Comments from resource agencies focused on the need for marsh restoration on the lower Neches River and marshes near Sabine Pass, and dune and shoreline restoration of the Jefferson county shoreline, again as a means for buffering surge impacts. GIWW erosion, marsh, dune, and shoreline restoration will be addressed as part of the new USACE Jefferson County ER Feasibility Study being conducted in conjunction with Jefferson County and the Sabine-Neches Navigation District.

In the Brazoria region, the local sponsor of the Freeport Hurricane Flood Protection Project (HFPP) supported evaluation of storm surge impacts on the existing system. This would strengthen existing protection of the dense petrochemical and residential development within the Freeport HFPP. Maintaining or improving evacuation routes were important to local citizens. Local interest groups and the general public expressed concern with maintaining a tidal connection with

the Gulf at the San Bernard River, and the effect of altered circulation created by the GIWW intersection with the Brazos River Diversion Channel. Local citizens also expressed concern regarding the effect of the Brazos River Diversion Channel on sediment delivery to the Surfside area. Beach restoration in the Surfside area would protect nearby residences and help attenuate storm surge. Resource agencies recommended restoration of Follets Island, a barrier peninsula, as a means of buffering storm surge impacts on the Freeport mainland. Tidal circulation, sediment supply, and beach and marsh restoration will be addressed as part of the ongoing USACE Coastal Texas CSRM and ER Feasibility study, in conjunction with the Texas GLO

The Sierra Club provided comprehensive comments, which applied to the six-county study area. In general, they urged restoring natural coastal shoreline system features and urged restraint in the construction of structural systems that would encourage more development. They supported structural measures that are limited in size and focused on vulnerable, developed areas, and recommended targeted buyouts rather than structural alternatives in areas such as Surfside in the Brazoria Region. They urged working with nature and natural processes, as well as protecting shoreline features that provide natural erosion protection.

3. Comments on the DIFR-EIS

The DIFR-EIS was released for public review and comment on September 11, 2015. The Notice of Availability is Attachment 4. All comments were due on October 26, 2015. Public meetings on the DIFR-EIS were held on October 6 and 8, 2015, in Beaumont and Freeport, Texas, respectively. The meetings were announced on the USACE S2G webpage and in Orange, Port Arthur and Freeport newspapers. Transcripts of these meetings and all comments received during the public comment period and USACE responses are provided in Attachments 5 and 6, respectively. The comments are summarized below.

Summary of Public Comments

Comments were received from one city, two local governmental agencies, three companies, the Houston Sierra Club, and seven individuals from Bridge City and Freeport. Several individuals and one company asked for close-up maps, which were added to the Galveston District website during the public comment period. While supportive of the project, individuals and companies expressed concerns over impacts to their properties or operations during construction, or maintaining access through the structures after construction. The City of Port Neches asked that the Orange-Jefferson CSRM Plan be revised to exclude city recreational properties along the Neches River waterfront from the risk reduction plan. Port Freeport identified concerns with how the Freeport and Vicinity CSRM Plan design would impact one of their docks. Badische Anilin-

& Sodafabrik (BASF) expressed concerns that the construction and operation of the Dow Barge Canal gate would interrupt their daily operations. The Velasco Drainage District (VDD) and the Sierra Club provided the most extensive comments, which are summarized below.

The VDD suggested that SWG revisit and improve our public notification process. Written notices were sent but not received by some entities; press releases were made but the local press did not respond. The VDD does not concur with USACE's requirement for steady state seepage evaluation and risk assessment of the levees in their system. They maintain that there is insufficient time during a coastal storm to reach a steady state sufficient to cause breeching. Other comments requested clarification for specific sections of the DIFR-EIS, additional information on specific engineering methodologies, and further explanation of specific plan recommendations.

The Sierra Club objected to our denial of their request for a time extension of the public comment period. The comment period opened on 11 Sep 2015 and their request for the extension was made on 21 Sep 2015. We denied their request at that time, but advised that we would reevaluate the need for an extension as the comment period progressed. No other public requests for an extension were received and the comment period was not formally extended. The Sierra Club also expressed concern that the final recommended plan and mitigation were not presented in the DIFR-EIS, and in general, requested that much more information and analyses be presented. Sierra Club comments requested further clarification on numerous topics that were covered in detail in the appendices, such as the programmatic overview of the six counties, unintended consequence, hydrologic impacts of the new levee system and surge gates, historic property impacts, the economic analysis, and the WVA ecological modeling. The comments requested additional explanation regarding screening of structural and non-structural alternatives, cumulative impacts, O&M, and relative sea-level rise.

PART I

SCOPING COMMENTS

ATTACHMENT 1
SCOPING WORKSHOP ANNOUNCEMENT

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

February 6, 2012

INVITATION TO PARTICIPATE IN PUBLIC WORKSHOP AND NEPA SCOPING MEETING FOR

IDENTIFICATION OF STORM DAMAGE REDUCTION, ECOSYSTEM RESTORATION, AND FLOOD RISK MANAGEMENT OPPORTUNITIES IN ORANGE, JEFFERSON, CHAMBERS, HARRIS, GALVESTON, BRAZORIA COUNTIES

The U.S. Army Corps of Engineers, Galveston District and the Texas General Land Office along with their Regional County partners, are seeking individuals, groups or organizations interested in participating in public workshops for the purpose of gathering ideas for hurricane / tropical storm damage reduction, ecosystem restoration, and flood risk management opportunities in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria Counties. This outreach effort is being conducted in conjunction with the Sabine Pass to Galveston Bay, Texas Study. The meeting will also serve as a scoping meeting for the purposes of identifying significant issues to be addressed in accordance with requirements of the National Environmental Policy Act (NEPA).

The workshops will take place at the following locations:

February 28, 6:30 to 8:30 PM - Seabrook Community House, 1210 Anders Ave, Seabrook, TX

February 29, 6:30 to 8:30 PM - Jefferson County Agri-Life Auditorium, 1225 Pearl Street, Beaumont, TX (Enter on Franklin St., north side of bldg.)

March 6, 6:30 to 8:30 PM - Freeport Riverplace, 420 N. Brazosport Blvd., Freeport, TX

March 7, 6:30 to 8:30 PM - Galveston County Courthouse, 722 Moody Ave., Galveston, TX

If you would like to receive information or submit comments please notify us in writing at: SabinePassToGalvestonBay@usace.army.mil or at the following address:

U.S. ARMY ENGINEER DISTRICT, GALVESTON
ATTENTION: Sabine Pass to Galveston Bay, TX, Study
CESWG-PE-PL
P.O. BOX 1229
GALVESTON, TEXAS 77553-1229

For additional information please visit the project website at:
http://www.swg.usace.army.mil/sabinepasstogalvestonbay/

ATTACHMENT 2
NOTICE OF INTENT TO FILE AN EIS

to the location listed (see **ADDRESSES**). In order to be considered, each application must include:

1. The name of the applicant and the primary stakeholder interest category that person is qualified to represent;

2. A written statement describing the applicant's area of expertise and why the applicant believes he or she should be appointed to represent that area of expertise on the MRRIC;

3. A written statement describing how the applicant's participation as a Stakeholder Representative will fulfill the roles and responsibilities of MRRIC;

4. A written description of the applicant's past experience(s) working collaboratively with a group of individuals representing varied interests towards achieving a mutual goal, and the outcome of the effort(s);

5. A written description of the communication network that the applicant plans to use to inform his or her constituents and to gather their feedback, and

6. A written endorsement letter from an organization, local government body, or formal constituency, which demonstrates that the applicant represents an interest group(s) in the Missouri River basin.

To be considered, the application must be complete and received by the close of business on December 29, 2014, at the location indicated (see **ADDRESSES**). Applications must include an endorsement letter to be considered complete. Full consideration will be given to all complete applications received by the specified due date.

Application Review Process. Committee stakeholder applications will be forwarded to the current members of the MRRIC. The MRRIC will provide membership recommendations to the Corps as described in Attachment A of the *Process for Filling MRRIC Stakeholder Vacancies* document (*www.MRRIC.org*). The Corps is responsible for appointing stakeholder members. The Corps will consider applications using the following criteria:

- Ability to commit the time required.
- Commitment to make a good faith (as defined in the Charter) effort to seek balanced solutions that address multiple interests and concerns.
- Agreement to support and adhere to the approved MRRIC Charter and Operating Procedures.
- Demonstration of a formal designation or endorsement by an organization, local government, or constituency as its preferred representative.
- Demonstration of an established communication network to keep constituents informed and efficiently seek their input when needed.
- Agreement to participate in collaboration training as a condition of membership.

All applicants will be notified in writing as to the final decision about their application.

Certification. I hereby certify that the establishment of the MRRIC is necessary and in the public interest in connection with the performance of duties imposed on the Corps by the Endangered Species Act and other statutes.

Dated: November 13, 2014.

Brad Thompson,

Chief of Planning, Omaha District.

[FR Doc. 2014–27718 Filed 11–21–14; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Army; Corps of Engineers

Intent To Prepare a Draft Environmental Impact Statement for the Sabine Pass to Galveston Bay, TX, Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of Intent.

SUMMARY: The Sabine Pass to Galveston Bay, Texas, study area encompasses six coastal counties on the upper Texas Gulf coast—Orange, Jefferson, Chambers, Harris, Galveston and Brazoria. The Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR–EIS) will evaluate structural and non-structural alternatives which address coastal storm risk management (CSRM) and ecosystem restoration (ER) impacts in the study area. The environmental impact study will focus on environmental and social conditions currently present and those likely to be affected by potential future impacts of storm surge and ecosystem restoration opportunities. Several major historical surge events have occurred in the study area in the past 120 years. The most notable is perhaps the 1900 Storm, which inundated most of the island city of Galveston, TX, and adjacent areas on the mainland. The storm was responsible for over eight thousand deaths and up to $30 million in property damage. Hurricane Rita in 2005 resulted in storm surge of 9.2 feet in Port Arthur, TX, and just over 8 feet in Sabine Pass. Most recently, Hurricane Ike in 2008 produced storm surges of 14 feet near Sabine Pass and 11 to 12 feet across Sabine Lake. The City of Port Arthur was spared from the impacts of storm surge thanks to its existing 14- to 17-foot hurricane flood protection system. However, the remaining southern half of Jefferson County was inundated, with estimated high water marks reaching 18 to19 feet to the south and east of High Island. The City of Galveston was protected from Hurricane Ike's high energy surge impacts by the Galveston Seawall, but much of the City of Galveston was later flooded by about 6 to 10 feet of surge coming from the bay. The City of Texas City was protected from Ike's surge impacts by its existing hurricane flood protection system. At risk within the study area are approximately 2.26 million people living within the storm-surge inundation zone, three of the nine largest oil refineries in the world, 40 percent of the nation's petrochemical industry, 25 percent of the nation's petroleum-refining capacity, and three of the ten largest U.S. seaports.

DATES: Comments on proposed DIFR–EIS will be accepted through December 24, 2014.

ADDRESSES: U.S. Army Corps of Engineers, Galveston District, P.O. Box 1229, Galveston, TX 77553–1229. Emails may be sent to *Janelle.S.Stokes@usace.army.mil.*

FOR FURTHER INFORMATION CONTACT: Ms. Sheridan Willey, (409) 766–3917, Planning Lead, Plan Formulation Section, Regional Planning and Environmental Center; or Ms. Janelle Stokes, (409) 766–3039, Environmental Lead, NEPA/Cultural Resources Section, Regional Planning and Environmental Center.

SUPPLEMENTARY INFORMATION:

(1) *Background.* In 2011, the Corps of Engineers and non-Federal sponsor, the Texas General Land Office, agreed to rescope an earlier study to evaluate plans to develop CSRM and ER features over the entire six-county region covering the upper Texas coast. The study is authorized under Section 4091, Water Resources Development Act of 2007 Public Law 110–114.

(2) *Alternatives.* Structural alternatives that will be evaluated are: (1) A new surge protection system in Orange and Jefferson Counties, including small, navigable surge gates on Cow and Adams Bayous; (2) a large navigable surge gate in the Neches River near the Rainbow Bridge; and (3) reevaluation of the existing Port Arthur and Freeport Hurricane Flood Protection Systems. Non-structural measures such as targeted buy-outs, will also be evaluated. Structural and non-structural alternatives to address storm

surge impacts in the Galveston Bay system, as well as ER measures throughout the six-county study area will be evaluated programmatically, with recommendations being made for future detailed analyses of feasible alternatives.

(3) *Scoping.* In February and March of 2012, four scoping meetings were held in the cities of Beaumont, Seabrook, Galveston and Freeport, TX. The scoping process involved Federal, State and local agencies, Federally-recognized Indian tribes, and other interested persons and organizations. Comments were received for 30 days following each scoping meeting. A total of 285 ideas were collected and these were collated and screened into a detailed list of structural and non-structural CSRM and ER measures that are being considered during this study. At this time, there are no plans for an additional scoping meeting. However, input from affected Federal, state and local agencies, affected Indian tribes, and other interested private organizations and parties is being solicited with this notice.

(4) *Coordination.* Further coordination with environmental agencies will be conducted under the National Environmental Policy Act, the Fish and Wildlife Coordination Act, the Endangered Species Act, the Clean Water Act, the Clean Air Act, the National Historic Preservation Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Coastal Zone Management Act under the Texas Coastal Management Program.

(5) *DIFR–EIS Preparation.* It is estimated that the DIFR–EIS will be available to the public for review and comment in August, 2015.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 2014–27723 Filed 11–21–14; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF ENERGY

Commission To Review the Effectiveness of the National Energy Laboratories

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: This notice announces an open meeting of the Commission to Review the Effectiveness of the National Energy Laboratories (Commission). The Commission was created pursuant section 319 of the Consolidated Appropriations Act, 2014, Public Law 113–76, and in accordance with the provisions of the Federal Advisory Committee Act (FACA), as amended, 5 U.S.C. App. 2. This notice is provided in accordance with the Act.

DATES: Monday, December 15, 2014, 10:00 a.m.–3:30 p.m.

ADDRESSES: Institute for Defense Analyses, 4850 Mark Center Drive, Room 1301, Alexandria, VA 22311.

FOR FURTHER INFORMATION CONTACT: Karen Gibson, Designated Federal Officer, U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585; telephone (202) 586–3787; email *crenel@hq.doe.gov.*

SUPPLEMENTARY INFORMATION:

Background: The Commission was established to provide advice to the Secretary on the Department's national laboratories. The Commission will review the DOE national laboratories for alignment with the Department's strategic priorities, clear and balanced missions, unique capabilities to meet current energy and national security challenges, appropriate size to meet the Department's energy and national security missions, and support of other Federal agencies. The Commission will also look for opportunities to more effectively and efficiently use the capabilities of the national laboratories and review the use of laboratory directed research and development (LDRD) to meet the Department's science, energy, and national security goals.

Purpose of the Meeting: This meeting is the fourth meeting of the Commission.

Tentative Agenda: The meeting will start at 10:00 a.m. on December 15. The tentative meeting agenda includes discussion on how the DOE Labs impact the national science and technology enterprise and further discussions on their relationship with industry. Key presenters will address and discuss these topics with comments from the public. The meeting will conclude at 3:30 p.m. The agenda will be posted when finalized and in advance of the meeting on the Lab Commission Web site: (*http://energy.gov/labcommission/commission-review-effectiveness-national-energy-laboratories*).

Public Participation: The meeting is open to the public. Individuals who would like to attend must RSVP to Karen Gibson no later than 5:00 p.m. on Wednesday, December 10, 2014 at email *crenel@hq.doe.gov.* Please provide your name, organization, citizenship, and contact information. Anyone attending the meeting will be required to present government issued identification. Individuals and representatives of organizations who would like to offer comments and suggestions may do so at the end of the meeting. Approximately 30 minutes will be reserved for public comments. Time allotted per speaker will depend on the number who wish to speak but will not exceed 5 minutes. The Designated Federal Officer is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Those wishing to speak should register to do so beginning at 10:00 a.m. on December 15.

Those not able to attend the meeting or who have insufficient time to address the committee are invited to send a written statement to Karen Gibson, U.S. Department of Energy, 1000 Independence Avenue SW., Washington DC 20585, or to email: *crenel@hq.doe.gov.*

Minutes: The minutes of the meeting will be available on the Commission Web site at: *http://energy.gov/labcommission.*

Issued in Washington, DC, on November 18, 2014.

LaTanya R. Butler,

Deputy Committee Management Officer.

[FR Doc. 2014–27742 Filed 11–21–14; 8:45 am]

BILLING CODE 6450–01–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–9919–53–OAR]

California State Nonroad Engine Pollution Control Standards; Diesel Engines on Commercial Harbor Craft; Request for Within-the-Scope and Full Authorization; Opportunity for Public Hearing and Comment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The California Air Resources Board (CARB) has notified the Environmental Protection Agency (EPA) that it has adopted amendments to its Commercial Harbor Craft regulation (CHC amendments). By letter dated May 28, 2014, CARB asked that EPA authorize these amendments pursuant to section 209(e) of the Clean Air Act (CAA or Act). CARB seeks confirmation that certain of the amendments are within the scope of a prior authorization issued by EPA, and that certain of the amendments require and merit a full authorization. This notice announces that EPA has tentatively scheduled a public hearing to consider California's request for authorization of the CHC amendments, and that EPA is now

ATTACHMENT 3
COMMENTS RECEIVED DURING NOI COMMENT PERIOD

901 S. Mopac, Bldg 2, #410
Austin, TX 78746
Tel: 512-306-0225
Fax: 512-306-0235
www.audubon.org
ipena@audubon.org

March 16, 2012

Colonel Christopher W. Sallese
District Engineer, Galveston District
U.S. Army Corps of Engineers
CESWG-PE-PL
P.O. Box 1229
Galveston, TX 77553-1229

RE: Sabine Pass to Galveston Bay, TX Study

Dear Colonel Sallese:

The eastern coast of Texas is vital habitat for a number of bird species, both resident and migratory. Audubon Texas has a long history of coastal stewardship and avian research in the region and would like to act as one of the regional contacts during the re-scoping effort stakeholder meetings.

Audubon owns, leases, and manages several islands within the proposed study area. These islands are critical to nesting colonial waterbirds including egrets, herons, spoonbills, skimmers, gulls and terns. Many of our islands are shrinking due to erosion caused by storm damage, subsidence and local ship traffic thus reducing the amount of available habitat for these and other waterbird species. We would be very interested in working with the USACE to find a solution to the degradation of several islands we oversee in West, East, and Galveston Bay as well as the Smith Point area. We would also like to avoid the problems of the past. A previous USACE project on Smith Point Island was completed but ineffective due to poor project oversight and miscommunication by contractors.

We are also very interested in the potential sand mining for beach nourishment from the west end of Galveston Island and dredging of San Luis Pass. The west end of Galveston Island supports a rich variety of habitat for both wintering and breeding shorebirds. The flats to the northeast of San Luis Pass offer foraging habitat for a number of herons, egrets, and gull species, as well as the endangered piping plover. Many of these birds depend on foraging areas on the Texas coast to replenish their fat reserves during migrations from wintering areas in South America to breeding habitat in Canada and the Artic. If major dredging work in San Luis Pass alters the hydrology and sediment behavior of these flats, many species would lose a vital patch of habitat. Wintering piping plover are also using the beaches along the southwestern coast of Galveston Island for foraging and need to be considered during any beach nourishment or armoring that may occur in these areas.

Please feel free to contact Iliana Pena, Director of Conservation or Bob Benson, Executive Director for Audubon Texas for additional information.

Sincerely,

Iliana A. Peña
Director of Conservation
Audubon Texas

From: Leslie Barras
To: Stokes, Janelle S SWG
Subject: [EXTERNAL] DEIS for the Sabine Pass to Galveston Bay, TX, Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study
Date: Saturday, November 22, 2014 6:36:49 PM

Dear Ms. Stokes:

Please include me in the email list regarding the DEIS and FEIS for the above-referenced study. I understand, from Monday's Federal Register notice, that the DEIS may be issued in Aug. 2015.

Also, I am interested in the Section 106 consultation on the proposed undertaking and major federal action. When would you anticipate beginning the process of involving consulting parties?

Thank you,
Ms. Leslie Barras
912 W. Cypress Avenue
Orange, TX 7630

PUBLIC WORKSHOP
AND NEPA SCOPING MEETING FOR
IDENTIFICATION OF
STORM DAMAGE REDUCTION, ECOSYSTEM RESTORATION,
AND FLOOD RISK MANAGEMENT OPPORTUNITIES
IN
ORANGE, JEFFERSON, CHAMBERS, HARRIS,
GALVESTON, BRAZORIA COUNTIES

Comment Form

This form is provided for your comments regarding the U. S. Army Corps of Engineers, Galveston District Sabine Pass to Galveston Bay, Texas Study Project. Please use the space below, attaching additional pages if necessary. The form may be deposited in the comment box, mailed to the address provided below, or emailed to SabinePassToGalvestonBay@usace.army.mil. Future information will be posted to our website. http://www.swg.usace.army.mil/sabinepasstogalvestonbay/

We appreciate your interest in and contributions towards this project.

Comments:

Thank you for the opportunity to comment on this issue.

We've lived on Robinson Bayou for 25 years. We see wonderful wildlife and destructive flooding.

I believe that conservation and enhancement of wetlands combined with responsible development and drainage can mitigate the effects of severe storms on those of us in inland tidal areas. We get slammed doubly:

- by storm surge pushing "upstream"
- by runoff pushing "downstream" (in surge-swollen bayous). We have seen larger waterways become dikes that block the flow of smaller ones.

My suggestions:

a) Conservation- I support your interest in protecting estuaries. I would like you to also consider parkways. They are narrow parks along waterways that are prone to flooding. They accommodate flood waters, support wildlife, and are popular with the public. They may have trails, recreation facilities, gardens, fish hatcheries, etc. Sometimes the land is donated by utilities. Maintenance may be supported by community groups.

b) Development- Neighborhoods, private and public buildings, sports fields, roads-- they are all on high ground that was not there 100 years ago. The volume and speed of runoff is more than waterways can hold. Some communities are trying to slow the volume of runoff but we also need some wider/deeper spots in the waterways that will slow the velocity of the water.

Comments due by March 16, 2012 to:

District Engineer, Galveston District
U.S. Army Corps of Engineers
Attn: Sabine Pass to Galveston Bay, TX Study
CESWG-PE-PL
P.O. Box 1229
Galveston, Texas 77553-1229

Please Print:

Your Name Kathleen Barth
Your Company/Org. _____
Address 2211 Bayou Drive
League City, TX 77573
email: Katy.Barth@hotmail.com

From: Boyers, Amy [mailto:Amy.Boyers@h-gac.com]
Sent: Wednesday, March 14, 2012 1:38 PM
To: SabinePassToGalvestonBay
Subject: Comments on the Sabine Pass to Galveston Bay Project

Thanks to the USACE and GLO for taking on the Sabine Pass to Galveston Bay Project. We appreciate the opportunity to provide comments. H-GAC urges the USACE and GLO to fully explore all structural and non-structural options and also to determine an equitable cost-benefit analysis for coastal wetlands and barrier island dune systems (non-structural) to include not only environmental benefits but also economic benefits.

Thank you,

Amy

Amy Boyers

Resiliency Coordinator

From: Michael W. Kovacs [mailto:KovacsMic@cityofgalveston.org]
Sent: Friday, March 16, 2012 8:26 AM
To: SabinePassToGalvestonBay
Cc: Kelly De Schaun
Subject: Comments on Galveston Area Study Project

Thank you for the opportunity to comment on the Corps of Engineer's study of the Storm Damage Reduction, ecosystem restoration, and flood risk management opportunities for the upper Texas coast. I would encourage the scoping plan to focus on more detailed reviews of the following:

Top Priority:

Comprehensive sediment management plan that encourages partnerships on the beneficial use of dredge materials wherever possible, and the maintenance of not only inlets and harbors, which is done very well as part of the current mission, but also including mitigating impacts of those activities and existing hard structures (jetties for example) by planning to address beach preservation, periodic beach nourishment, and a natural dune defensive system. A plan that acknowledges the responsibility of federal, state, and local governments in the management of passes, beaches, and dunes and seeks to form partnerships for addressing the missing pieces of natural beach and dune protection of shorelines on Galveston Island is critical.

Secondary Priorities:

Surge protection plan reviews of costs/benefits of concepts including a ring levee on the back of Galveston Island and the Ike Dike are of significant interest to our citizens and businesses.

Thanks again. Good luck in your endeavors to improve the upper Texas Coast. We are interested in being a major partner with you.

Michael W. Kovacs

City Manager

City of Galveston

From: Garrett Dolan [mailto:garrettdolan@earthlink.net]
Sent: Saturday, March 03, 2012 2:01 PM
To: SabinePassToGalvestonBay
Cc: bedient@rice.edu
Subject: Comments for the Sabine to Galveston Bay

Dear USACE/GLO.

Please find below my comments regarding the Sabine Pass to Galveston Bay, Texas re-scoping process that will result in a new Feasibility Cost Sharing Agreement.

Most of my comments are targeted at how and why decisions should be made for protecting the coast. There are two articles attached that will provide insight into my comments. I offer them as resources to help the management team. Thank you.

Recommendations:
• Understand the true natural process at work
Approach any analysis with the understanding that coastlines are dynamic environments that are in a constant state of flux. Further, coastal erosion, floods, hurricanes, etc…. are natural processes that have occurred for thousands of years and will continue to occur into the next century. Public health problems and property destruction occur when humans try to impose their will over these natural processes. Sustainability requires human involvement and interventions that align with nature's natural process.

• Make decisions based on science
The upper Texas coast is geologically, meteorologically, and hydrologically in a dynamic state of flux. All four of the major natural processes shaping the coast—subsidence, sediment supply and transport, global sea level rise, and tropical cyclones—are pro¬jected to continue transforming the shore¬line. Structural mitigation efforts that try to prevent these natural processes from occurring are a sure-fire way to create an extremely expensive program dependent upon constant infusions of taxpayer money. Further, it has been scientifically proven that structural mitigation efforts can in fact, speed up the change process. Please read the attached article "A Foundation for Developing a Coastal Sustainability Program in the Houston-Galveston Region" for a short synopsis the natural processes shaping the coast.

• Correct public policy "moral hazards" before any infrastructure is built
Along the Upper Texas coast, public policy intended to protect and make life more viable is actually creating "moral hazards" and escalating the financial burdens on government. There are several public policies at the local, state and federal levels of government that are working at cross purposes by allowing risky investment decisions that put people's livelihoods in jeopardy. If not addressed first, these policies will negate any benefit added by USACE mitigation efforts. The attached article "Policy and management hazards along the Upper Texas coast" explains the hazards in detail.

• Only use tax payer money to protect structures of national interest and security

The use of taxpayer money for the development of mitigation interventions should be exclusively reserved for those projects that are of national interest (i.e. Houston Ship Channel). Using federal money to protect the lifestyles of a very small minority of people is inequitable, unsustainable and ultimately, increases the number of people vulnerable to the adverse consequences of severe storms.

• Create a hierarchy of coastal protection measures
Conduct an analysis of coastal protection measures that prioritizes the prevention, reduction and hardening options available. Prevention measures are those actions that remove people and their structures from potential harm (i.e. buyouts). Reduction measures are those actions and public policies that seek to minimize the scope and scale of harm (i.e. changing National Flood Insurance Program). Finally, hardening, are capital improvement projects that seek to defend against harm (i.e. levee).

- Leverage financial resources of the project by financially supporting the modeling and impact analyses already underway by the SSPEED Center.

Thank you.

Garrett Dolan, Ph.D.
2106 Amber Glen Lane
Katy, TX 77494
281-395-2158
garrettdolan@earthlink.net

From: Nick Fratila [mailto:nfratila@brazoriainet.com]
Sent: Sunday, March 11, 2012 9:13 PM
To: SabinePassToGalvestonBay
Cc: ttaylor@computer.org; 'Mike Goodson'; linda@yellowstoneboat.com; 'Marie Breakiron'
Subject: San Bernard River

I attended the March 6 public COE/GLO meeting in Freeport as the co-chairman of the River Mouth Committee of the Friends of the River San Bernard non-profit organization.

For a long term solution for the San Bernard River water flow, I had suggested building a jetty at the mouth. Today, I received a very interesting photo of the intersection of the river and the Intracoastal Waterway (ICW) taken this month. Due to a strong current from Brazos River, the San Bernard flow looks like it is going into the ICW moving toward Sargent. Taking a good look at this intersection, doesn't it show that this is happening because some of the land is extending too far into the river? Wouldn’t this cause another problem in the water flow to the mouth? I am not sure who is the owner of that land, but a correction of the river banks may improve the river flow to the Gulf. I attached also a photo with my suggested correction of the river banks.

Best Regards,

Nick Fratila, P.E.
1126 County Road 432
Brazoria, TX 77422
(979) 964-4549
(409) 284-7862 Cell
nfratila@brazoriainet.com <mailto:nfratila@brazoriainet.com>

PUBLIC WORKSHOP
AND NEPA SCOPING MEETING FOR
IDENTIFICATION OF
STORM DAMAGE REDUCTION, ECOSYSTEM RESTORATION,
AND FLOOD RISK MANAGEMENT OPPORTUNITIES
IN
ORANGE, JEFFERSON, CHAMBERS, HARRIS,
GALVESTON, BRAZORIA COUNTIES

Comment Form

This form is provided for your comments regarding the U. S. Army Corps of Engineers, Galveston District Sabine Pass to Galveston Bay, Texas Study Project. Please use the space below, attaching additional pages if necessary. The form may be deposited in the comment box, mailed to the address provided below, or emailed to SabinePassToGalvestonBay@usace.army.mil. Future information will be posted to our website. http://www.swg.usace.army.mil/sabinepasstogalvestonbay/

We appreciate your interesting and contributions towards this project.

Comments:

Thank you for coming to Beaumont and taking our input.

We believe the construction of rock breakwaters along the Gulf Intracoastal Waterway in Jefferson County should have a high priority, since it is an economical solution to day-to-day silting, as well as storm surge erosion of the banks, which threatens precious wetlands and marsh ecosystems.

Hurricane Ike caused 30 feet of erosion along the banks of the G.I.W.W., which could have been prevented by rock breakwaters.

Included herein are aerial photographs taken to 1-ft resolution by the Jefferson County Appraisal District before and after Hurricane Ike. These photographs prove the effectiveness of these breakwaters, which not only prevent erosion, but encourage ground and vegetation buildup between the breakwaters and the shoreline. These breakwaters cost $130 per linear foot.

Such severe erosion has occurred along the G.I.W.W. in Jefferson County, that the placement of these breakwaters in no way restricts navigation. Construction of the rock breakwaters is easily permitted through the COE's regulatory branch.

Examples and details of the breakwaters are included herein.

Comments due by March 16, 2012 to:
District Engineer, Galveston District
U.S. Army Corps of Engineers
Attn: Sabine Pass to Galveston Bay, TX Study
CESWG-PE-PL
P.O. Box 1229
Galveston, Texas 77553-1229

Please Print:
Your Name **Doug S. Canant, P.E., R.P.L.S., C.F.M.**
Your Company/Org. **Jefferson County Drainage District No. 6**
Address **6550 Walden Road**
Beaumont, Texas 77707
email: **dscanant@dd6.org**

The following six aerial photographs illustrate the erosion of the shoreline along the Gulf Intracoastal Waterway, primarily during Hurricane Ike.

Hurricane Ike occurred in September of 2008, and included record breaking storm surge levels covering the coast in Jefferson County and 22 miles inland. The storm surge reached elevation 21' above sea level near the coast. Most of the ground along the G.I.W.W. in Jefferson County is at elevation 5' above sea level or lower.

Aerial photos were taken to a 1-ft resolution in 2006 and in 2009. We traced the shoreline in three locations on the 2006 aerials. One of these locations had rock breakwater in place during Hurricane Ike. We then superimposed the shoreline on the 2009 aerial to show the amount of shore that was lost in each instance. The areas with no breakwater protection in place during the hurricanes showed significant shoreline erosion; that is 12 to 30 feet. The areas with rock breakwater in place showed no erosion, and actually showed a gain of ground between the shoreline and the breakwater, as well as signification vegetation growth.

From: William Kiene [mailto:william.kiene@noaa.gov]
Sent: Tuesday, April 09, 2013 4:40 PM
To: SabinePassToGalvestonBay
Subject: Status of Sabine Pass to Galveston Bay Study

As someone who participated in the public workshops regarding this study, I am wondering what has happened to this effort by the ACOE to study the options for protecting the region from storm-surge flooding. I strongly believe that all options should be investigated to ensure that an effective, affordable and practical solution is found. The only option that seems to so far be under investigation (not by the ACOE) is the Ike Dike proposal. Has the ACOE study been completed or was it terminated?

Regards,

William E. Kiene, Ph.D.
NOAA's Office of National Marine Sanctuaries
Southeast, Gulf of Mexico and Caribbean Region
4700 Avenue U, Building 216
Galveston, Texas 77551
Tel: (409) 621-5151 x109
Fax: (409) 621-1316
Mobile: (409) 550-6214

William.Kiene@noaa.gov

Statement for Delivery
At Corps of Engineers Scoping Meeting
March 6, 2012

My name is Craig Sherlock and I am representing LaBelle General, Inc, LaBelle Properties LLC and the Broussard family. We own approximately 6,000 acres, consisting primarily of wetlands, in the Salt Bayou Basin in southern Jefferson County near Sabine Pass.

During recent years, we have become aware of the conversion of a substantial surface acreage of our property to open water as a result of substrate erosion, subsidence, mortality of native vegetation, increases in water salinity, and acceleration of beach erosion. The loss of surface acreage is ongoing.

We believe that these proximate causes are associated with or result from a number of government-implemented actions which collectively resulted in the conversion of at least the lower portion of the Salt Bayou Basin from a historic freshwater wetland to a much more saline condition. These actions include, but may not be limited to the construction of the Gulf Intracoastal Waterway, the Sabine Pass Jetty, and the Keith Lake Fish Pass.

Construction of the Intracoastal Waterway isolated the existing Salt Bayou drainage basin from approximately 60 percent of its historic freshwater watershed, and served as a source for introduction of more saline water to the Salt Bayou basin. The construction of the Sabine Jetty system interrupted longshore flow of materials which historically nourished the beaches west of Sabine Pass, contributing to the erosion of the beach ridge and increasing the frequency of salt water overwash from the Gulf of Mexico into the middle portion of the Salt Bayou Basin. The construction of the Keith Lake Fish Pass has resulted in a dramatic increase in tidal exchange between the Salt Bayou Basin and the Sabine Neches Waterway.

Collectively, these projects have decreased the amount of freshwater entering the Salt Bayou Basin, increased tidal exchange, introduced large volumes of saline water, and caused mortality of freshwater wetlands vegetation and erosion of surface features. The resulting conditions effectively result in the change in the character of and loss of surface features on our property, diminishing and ultimately depriving us of the beneficial use of our property and effectively taking our land. Additionally, the conversion of emergent wetlands to open water compromises the ability of the wetlands in the Salt Bayou Basin to attenuate storm surge, increasing the likelihood of flooding in residential and industrial areas lying to the north.

We understand that the Corps of Engineers has developed a plan to mitigate these adverse impacts on the Salt Bayou basin. The plan reportedly includes beach renourishment to attenuate breaching of the beach ridge by high-tides and storm events in the Gulf, reduction in the capacity of the Fish Pass to deliver saline water

to the system, and reconnection of the system to that portion of the portion of the watershed lying north of the Intracoastal Waterway through construction of a system of inverted siphons. Collectively, these actions would minimize the ongoing taking of our land and its beneficial use, restore the Salt Bayou Basin to a less saline condition, restore a measure of the Salt Bayou Basin's traditional ecological function, improve wildlife habitat and improve the capacity of the Salt Bayou wetlands to attenuate storm surge damage to residential and industrial lands lying to the north.

We respectfully request your priority implementation of these measures. Thank you for your consideration.

Sincerely,

Craig J. Sherlock

From: Susan [mailto:dolphints@erfw.net]
Sent: Tuesday, March 06, 2012 3:15 PM
To: SabinePassToGalvestonBay
Subject: Freeport Meeting Tonight - Question

Thank you for hosting these type of events. I did not know these informational events occurred until last night and just received the letter of announcement which indicates questions may be submitted. I plan to attend this evening and hope I am not too late to ask a question?

Background: There is a 500 acre tract of land located along County Road (CR) 792, just off of FM 523 near the City of Oyster Creek. The property is not located in the jurisdiction of any municipality but is under Brazoria County's jurisdiction. This tract of land backs up to the Brazoria National Wildlife Refuge. There is over 300 acres of wetland on this property. It is my understanding the the owner intends to elevate 22 acres 16 feet above natural grade, and construct a retention pond of 22 acres with elevated berms/sides. I also understand that 80 acres will be used for equipment and supplies. The 16 foot change in natural grade appears like it would have a significant impact on the lands natural drainage not only to the refuge but the remaining wetlands acreage. Question: What impact will a Hurricane Ike type storm surge have not only to the wetlands but to the surrounding properties in your knowledgeable opinion?

Thank you for your time.

Susan Luycx
1557 Blue Water Drive
Freeport, Texas 77541

From: McAlister, Gay [mailto:gmcalist@mail.smu.edu]
Sent: Wednesday, February 29, 2012 4:35 PM
To: SabinePassToGalvestonBay
Subject: Storm Damage Reduction, Environmental Restoration, and Flood Risk in Galveston County

I own property in Galveston County (995 Alicia, Gilchrist 77617 and 1044 Waco, Gilchrist, 77617) on Bolivar Peninsula and I strongly request consideration of a beach renourishment project on Bolivar Peninsula. Highway 87 runs the length of the peninsula and the only land access to the peninsula. This land transportation route needs to be protected, as well as serious erosion that occurred as a result of Hurricane Ike 9/13/2008. Please give this request strong consideration as I believe it merits approval as service to the permanent home owners on the peninsula as well as the thousands of summer tourists.
Thank you,
Gay McAlister

Gay McAlister, Ph.D., LPC-S
Associate Director of Supervision
Southern Methodist University
5228 Tennyson, Ste. 102G
Plano, Texas 75024
972-473-3452 (Office)
972-473-3490 (Fax)

From: Tyler Ortego [mailto:tyler@oratechnologies.com]
Sent: Tuesday, April 24, 2012 9:49 AM
To: SabinePassToGalvestonBay
Subject: OysterBreak Shoreline Protection

Dear project team,

We developed the OysterBreak Shoreline Protection system for the purpose of delivering engineered shoreline protection while enhancing the health of our estuaries. I think you will find the OysterBreak an interesting alternative that is consistent with the comprehensive approach planned for the Sabine Pass to Galveston study.

The OysterBreak Shoreline Protection System uses the gregarious nature of oysters to create engineered shoreline protection structures. The OysterBreak design consists of interlocking concrete armor units that can be configured in any number of ways. The individual armor units are made of OysterKrete, a proprietary concrete developed specifically for growing oysters. Key benefits of the OysterBreak over rock structures are the ecological enhancements, low bearing pressure and ease of construction. We designed the OysterBreak as an engineered alternative to rock breakwaters, so you can use it in similar applications. More information can be found at http://www.wayfarertech.com/oysterbreak or at www.oratechnologies.com.

Would you recommend a point of contact, either at the Galveston District or with your consultants?

Thank you,

Tyler Ortego, PE
ORA Engineering, LLC
www.ora-eng.com
ORA Technologies, LLC
www.Oratechnologies.com <http://www.oratechnologies.com/>
Mobile: (225) 229-2539
http://www.linkedin.com/in/tylerortego
Twitter: @TylerOrtego

From: Mark Vincent [mailto:mvincent@poha.com]
Sent: Wednesday, March 14, 2012 3:08 PM
To: SabinePassToGalvestonBay
Cc: James Jackson
Subject: Sabine Pass to Galveston Bay, Tx Regional Risk Reduction Study

The Port of Houston Authority offers the following general comments, as the District prepares the rescoped project:

1. Public and private interests are intermingled along the coast. Proposed solutions need to consider industry participation or sponsorship of various projects during project execution phases.

2. The national significance of certain industries along the Houston Ship Channel needs to be appropriately weighted in project prioritization.

3. Structural solutions need to carefully consider impacts on transportation systems that serve industry along the channel, particularly rail. Many of the industries rely on railroad access, which cannot easily accommodate levees, flood gates, or other protective features.

4. Structural solutions that involve gates within the water system itself have the potential to significantly impact commerce, through use (closures), or indirectly through increased silitation or siltation patterns—both of which can disrupt maritime commerce for extended periods.

5. The potential scope of the project (including geographic extent) may tax the ability of the Corps to produce a viable and defendable plan under limited time and cost (3 years, $3 mil). Subdivision of the scope into smaller, mutually supported projects should be considered.

The scoping meeting presentation includes the comment, "USCG estimates that a one month closure of a major port like Houston would cost the national economy $60 billion". If possible, PHA respectfully requests that the study managers informally share the source of that comment, so PHA can better support funding priorities for channel maintenance and operation, region wide.

Sincerely,

Mark Vincent, P.E.

Channel Development Director
Port of Houston Authority
111 East Loop North
Houston, Texas 77029
(713) 670-2605 Office
(713) 670-2427 Fax
mvincent@poha.com <mailto:ajames@poha.com>
www.poha.com <http://www.poha.com/>

From: Terren & Karen [mailto:tkroark@earthlink.net]
Sent: Friday, March 16, 2012 11:05 AM
To: SabinePassToGalvestonBay
Subject: Comments to the Sabine Pass to Galveston Bay project

I attended the public meeting that was held Wednesday, March 7, 2012 in Galveston. I would like to suggest that a long term solution be addressed. With the prospect of 9 million people populating the area in the next 50 years; something needs to be done to protect the land, erosion and life. I heard things like using things that were done in Louisiana. Why? They had a heavy rainstorm just this past week and 2 parishes were flooded. You need to start thinking outside the box. Look at the dike system in Holland. I lived in Europe for over 3 years and I have been to Holland. Europe spends money on protecting their land. Why? Because land is precious to them since the population of many of those countries exceeds the amount of land available to them so they protect it. Holland is a little country; yet they knew the value of their land was worth protecting and put in a large dike system. Europe has been around a long time and the people there have learned a lot from their years of habitation. Whereas the United States, who is young in relation to Europe, seems to think that "we" can only have the good ideas. I have lived there. Europe actually has some very good ideas and we need to really embrace their knowledge and history. They learned what happens when you take things for granted which is what we do especially here in Texas. Protect our seashores. I spent many a summer vacation on the beaches in Texas. That was all my family could afford. If we don't take care of them now, there won't be anything left for future generations. We need to think outside the usual box. Some of those ideas are only good for a short period of time. Do something that will be lasting. Use our tax money, both state and national, for something that is going to preserve our seashore and life itself. The millions of dollars that are lost every time a hurricane comes our way, will be reduced greatly if we spend the money on something that will protect us for many, many years to come. Don't use Louisiana as a model-please! Go somewhere that they know how to protect their precious land and people. Think outside the box-please!

Thank you,

Karen Roark

2214 Merrill Hills Circle

Katy, TX 77450

Own property on the West End of Galveston

tkroark@earthlink.net

PUBLIC WORKSHOP
AND NEPA SCOPING MEETING FOR
IDENTIFICATION OF
STORM DAMAGE REDUCTION, ECOSYSTEM RESTORATION,
AND FLOOD RISK MANAGEMENT OPPORTUNITIES
IN
ORANGE, JEFFERSON, CHAMBERS, HARRIS,
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Comment Form

This form is provided for your comments regarding the U. S. Army Corps of Engineers, Galveston District Sabine Pass to Galveston Bay, Texas Study Project. Please use the space below, attaching additional pages if necessary. The form may be deposited in the comment box, mailed to the address provided below, or emailedtoSabinePassToGalvestonBay@usace.army.mil. Future information will be posted to our website. http://www.swg.usace.army.mil/sabinepasstogalvestonbay/

We appreciate your interest in and contributions towards this project.

Comments:

After attending your 2/28 Meeting, it was quite obvious that you are preparing to tackle a big problem. Although I suffered significant damage from IKE, my damages were minimal compared to those of many of my neighbors here in Nassau Bay. Since IKE, I have attended several meetings @ Rice & other venues where different solutions were discussed. Some of this effort was made possible by grants from private organizations like Houston Endowment.
Although not as grand as the "IKE DIKE", the solutions offered in the SSPEED Study certainly look like they should be looked at closely by your workshop. It seemed like you gave the SSPEED effort only a cursory mention in your presentation. In this time of deficits and excess spending, it would be terrible not to take full advantage of the excellent works already completed. The SSPEED study had input from at least 6 major Universities. I was especially impressed with the hydraulic modeling and computer work done at The University of Texas. This modeling showed that had IKE come ashore @ San Luis Pass, I probably wouldn't be sitting here @ my desk writing this note
Certainly there is a lot of Engineering work left; but, please assure me that we are going to take full advantage of the good works that have already been completed. Too many times it seems like our Government Projects waste a lot of time and tax money.
Good luck
Joseph Wayne Roberts
18530 Barbuda Ln
Houston, TX 77058
waynerob@comcast.net

Comments **due by March 16, 2012** to:

District Engineer, Galveston District
U.S. Army Corps of Engineers
Attn: Sabine Pass to Galveston Bay, TX Study
CESWG-PE-PL
P.O. Box 1229
Galveston, Texas 77553-1229

Please Print:

Your Name _____

YourCompany/O~. _____

Address _____

_____

_____

email: _____

SIERRA CLUB
FOUNDED 1892

Houston Regional Group
P. O. Box 3021
Houston, Texas 77253-3021
713-895-9309
http://texas.sierraclub.org/houston/

February 28, 2012

Colonel Christopher W. Sallese
District Commander
U.S. Army Engineer District
Galveston
Attention: Sabine Pass to Galveston Bay, Texas, Study
CESWG-PE-PL
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Sallese,

Enclosed are the scoping comments of the Houston Regional Group of the Sierra Club (Sierra Club) for the U.S. Army Corps of Engineers (Corps) National Environmental Policy Act (NEPA) process for the "Identification of Storm Damage Reduction, Ecosystem Restoration, and Flood Risk Management Opportunities in Orange, Jefferson, Chambers, Harris, Galveston, and Brazoria Counties Study," also known as the "Sabine Pass to Galveston Bay, Texas Study (SPGBTS)."

1) The Corps should ensure that an environmental impact statement (EIS) accompany the SPGBT so that a programmatic landscape-scale picture is provided to citizens and decision-makers about the environmental impacts of the study recommendations. The public needs this information so that it can review, comment on, and understand the full environmental impacts of the study and any proposals and projects that are considered and result from the study.

2) To guide the Sierra Club with regard to this issue the Lone Star Chapter of the Sierra Club Executive Committee passed on July 18, 2009 the following resolution:

Resolution on Upper Texas Coast Protection

Whereas, the Upper Texas Coast (including Galveston Island and Bolivar Peninsula) provides important historic, recreational, ecologic, economic, scenic, other values and benefits, and places for people to live;

Whereas, 95% of marine organisms in the Gulf of Mexico, at some point in their life cycle, depend upon access to healthy bays and estuaries;

Whereas, the Upper Texas Coast has longtime natural shoreline erosion and accretion, exacerbated by human causes;

Whereas, the Upper Texas Coast has many important natural areas including shallow water areas; shallow water mud and sand bottoms; beaches; sand dunes; coastal

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prairie; freshwater marsh; brackish water marsh; salt water marsh; mud flats; coves, bays, and estuaries; riparian or bottomland hardwood forested wetlands; and other important habitats;

Whereas, the beaches of Galveston County are now providing habitat for recovering endangered species, specifically the head-started Kemp's Ridley Sea Turtle and the Piping Plover;

Whereas, climate change is exacerbating existing flooding, subsidence, and rising sea level, thus increasing the potential for hurricane and storm damage problems on the Upper Texas Coast;

Whereas, it is important to recognize the goals of removing people and structures from harm's way, since hurricanes and flooding threaten our coast, while protecting natural ecosystems and functioning ecological processes on the Upper Texas Coast;

Be it therefore resolved, that the Sierra Club supports careful consideration of the protection of the Upper Texas coast and communities on Galveston Island and Bolivar Peninsula using the following principles:

1. The protection of Galveston Island and Bolivar Peninsula should be part of an Upper Texas Coast Erosion and Accretion Regional Plan (UTCEARP) which addresses coastal erosion and accretion; restoration and protection of natural coastal erosion and accretion processes so that they function naturally or more naturally than currently; protection of natural ecosystems; steers development away from more vulnerable natural coastal areas and those areas that are more vulnerable to hurricane and storm damage; and is implemented from Sabine Lake to Matagorda Bay.

2. The UTCEARP should focus any hard erosion solutions, considered compatible with the UTCEARP, on developed areas near the seawall in the City of Galveston proper, and allow no artificial structures that would impede the natural currents and salinity of Galveston Bay, or impede access to the bay of those marine organisms that depend upon it.

3. The UTCEARP must protect shoreline features that provide natural erosion protection like beaches, sand dunes, offshore sand replenishment areas, freshwater inflows that provide new sediment to the coastal shoreline system, and habitat for endangered species.

4. The UTCEARP must restore natural coastal shoreline system features like current sediment movement processes and remove obstacles to sediment movement and transport along the Upper Texas Coast.

5. The UTCEARP must ensure that adjacent and nearby areas do not have their shoreline erosion and accretion negatively impacted or their risk increased by implementation of the UTCEARP.

6. The UTCEARP must ensure that the Texas Open Beaches Act public "rolling easement" and access for public recreation, protection of existing public lands, and other purposes is not diminished.

7. The UTCEARP must assess and determine the environmental impacts and mitigation of these impacts due to any encouragement of additional development in flood and storm prone areas along the Upper Texas Coast caused by the implementation of the UTCEARP.

8. The UTCEARP must protect the scenic beauty of Galveston Island, Bolivar Peninsula, and the Upper Texas Coast.

9. Any UTCEARP must not encourage further development on more vulnerable natural coastal areas and areas that are more flood and storm prone (like West Galveston Island) and thus put more people; property; and sensitive areas in danger.

The principles embedded in this resolution guide these comments and the Sierra Club requests that the Corps consider this resolution when conducting the SPGBTS.

3) These Sierra Club scoping comments use the term "large structures" to describe any single storm damage reduction structural measure or system of storm damage reduction structural measures like dikes, gates, seawalls, and similar hard structural measures.

4) The Corps should, via the SPGBTS, make land acquisition one of the priority strategies to provide restoration for the Upper Texas Gulf Coast (UTGC) in the EIS. Land acquisition is permanent (fee title acquisition and conservation easements in perpetuity). Fee title acquisition allows restoration without other owners to modify or impede restoration.

The Sierra Club favors on the UTGC, from the Texas – Louisiana border to the end of Matagorda County, acquisition of areas (priority ecosystems) to be restored and added to existing public or land trust lands. Some of these priority ecosystem areas include:

1. The Katy Prairie, in western Harris County and eastern Waller County, particularly additions to and adjoining to existing conservation lands that have been protected by the Katy Prairie Conservancy. This includes coastal prairies and prairie wetlands like prairie pothole wetlands, pimple mounds, and gilgai.

2. The Eastern Chenier Plain, from Interstate (I) 45 east to the Texas – Louisiana border which includes coastal prairies and marshes in Anahuac National Wildlife Refuge, McFaddin National Wildlife Refuge, J.D. Murphree Wildlife Management Area, Candy Cain Abshier Wildlife Management Area, Nature Conservancy Texas City Prairie Preserve, Texas Point National Wildlife Refuge, Sea Rim State Park, and Scenic Galveston lands on Galveston Bay.

3. The Western Chenier Plain, from I-45 west to the end of Matagorda County and includes coastal prairies, marshes, and the important Columbia Bottomlands habitat in Brazoria National Wildlife Refuge, San Bernard National Wildlife Refuge, Big Boggy National Wildlife Refuge, Brazos Bend State Park, Stephen F. Austin State Park, Nannie M. Stringfellow Wildlife Management Area, Christmas Bay Preserve, Galveston Island State Park, and Scenic Galveston lands on Galveston Bay.

4. The Trinity River Floodplain and Delta, which includes bottomland hardwood forested wetlands in the Trinity River National Wildlife Refuge and U.S. Army Corps of Engineers Wallisville Lake Project.

5. Farther inland, but still mostly in or near the coastal zone, Sam Houston National Forest and Big Thicket National Preserve which include upland, slope, and bottomland hardwood forests, wetlands, and aquifer recharge areas.

5) The Corps should, via the SPGBTS, make climate change an issue in the EIS. The SPGBTS must analyze climate change and its impacts on the coast and any alternatives for shoreline protection. With current climate change, we can expect a sea level rise of three feet over the next hundred years.

Climate change will alter existing ecosystems and human inhabited areas and make it more difficult for plants/animals and humans to adapt successfully to these changed ecosystems. The Corps must address questions like:

1. How will the UTGC be affected by climate change?

2. What can be done to create more resilient and resistant habitats/ecosystems?

3. What can the Corps do to reduce carbon dioxide (CO2) or other greenhouse gas emissions on the UTGC?

4. What can be done to assist plants/animals and humans so they can adapt to climate change?

The Corps should prepare and include in the draft EIS, a climate change ecological resilience and resistance plan (CCERRP). The CCERRP will assess the biological and ecological elements in the UTGC and the effects that climate change has had and will have on them. The CCERRP will assist plants, animals, and ecosystems in adapting to climate change and would require monitoring of changes and mitigation measure effectiveness. The CCERRP would be based on:

1. Protection of the existing ecosystems functions on the UTGC.
2. Reduction of stressors on the ecosystems on the UTGC.

3. Restoration of natural functioning ecological processes on the UTGC.

4. Use natural recovery on the UTGC, in most instances.

5. Acquisition of buffers/corridors to expand and ensure connectivity of ecosystems on the UTGC.

6. Intervention to manipulate (manage) ecosystems on the UTGC only as a last resort.

7. Reduction of greenhouse gas emissions on the UTGC.

6) The Corps should, via the SPGBTS, make restoration that is done via habitat mitigation and is maintained in perpetuity an issue in the EIS.

7) The Corps should, via the SPGBTS, make the restoration of adequate freshwater inflows and instream flows for bays and estuaries on the UTGC an issue in the EIS. This action supports this natural mechanism that delivers sediments to the coast for shoreline accretion and stability.

8) The Corps should, via the SPGBTS, make the perpetual monitoring of restoration work done an issue in the EIS to ensure that the restoration is maintained and continues to provide the natural functioning ecological processes, values, and benefits that were envisioned it would.

9) The Corps should, via the SPGBTS, work with the Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service, and the National Marine Fisheries Service via an agreement to ensure that a more focused Section 404 process provides mitigation for priority ecosystems. This should be an issue in the EIS. In addition, existing public lands or private lands that are already protected should be used as the foundation for building a natural coastal protection system.

10) The Corps should, via the SPGBTS, make a buy-out program with a perpetually ready to use fund an issue in the EIS. Such a fund would be established so that when natural or human disasters occur, impacted properties can be bought immediately and the land turned back into natural functioning ecosystems, allow retreat from the coast, and provide natural buffers for the protection of land and people.

11) The Corps should, via the SPGBTS, make the level of enforcement and compliance for coastal protection an issue in the EIS. Currently, the level of enforcement and compliance for coastal protection is not sufficient to ensure long-term and maintenance of natural ecological processes, values, and benefits. More resources are needed (money, people, equipment) for enforcement and compliance for the long-term. A fund that provides money for long-term enforcement, monitoring, and compliance would help provide protection in perpetuity.

12) The Corps should, via the SPGBTS, make prevention of the widening of the Gulf Intracoastal Waterway (GIWW) due to boat wake erosion an issue in the EIS. The

GIWW should be restored to its approved width and damages that have occurred to natural lands should be mitigated. Not only does the widening cause loss of coastal prairie and marshes but it cuts off freshwater flows across the land and changes the type of marsh, based on salinity, so the actual natural wetlands community changes or is extinguished.

13) The Corps should, via the SPGBTS, within Brazoria County, have an alternative that buys out as many residences/businesses as possible along County Road (CR) 257 (Blue Water Highway, a 10 mile stretch of coastal road) in the EIS. Such a program would ensure that people are permanently protected and out of harm's way.

Follets Island is one of the most vulnerable barrier islands (really a barrier peninsula like Bolivar Peninsula) on the Texas Coast. This is due to its narrowness, low elevation, and the number of storm overwashes or breaches that have occurred across Follets Island or beyond the road on the existing right-of-way (ROW).

Part of CR 257 would remain on Follets Island and allow fishers, hunters, and birders access. However, with a buyout people and their property would not be at risk to erosion, flooding, or storm surge because structures and the land they are on would be bought up wherever there are willing sellers. This is a low maintenance alternative that could rely on gravel and other relatively low cost materials to keep part of CR 257 open. This is an attractive alternative since Brazoria County does not have the funds to maintain CR 257 when it is damaged by erosion, flooding, or storms.

The Sierra Club is concerned that storm surge from a significant hurricane will undermine the revetment structure along CR 257 and daily tidal erosion will reduce the energy absorbing soil that is placed over the revetment.

The construction costs of the revetment were estimated to be $29 million. Because beach re-nourishment (a part of the proposal), once started will have to be continued in perpetuity and because beach grade sand is in short supply in the Galveston Bay area this will result in additional costs. Even if the revetment withstands storms and every day tidal erosion (which averages 10 feet of beach loss/year on Follets Island according to the Bureau of Economic Geology) only 3.5 miles of the 10 mile stretch have had the revetment installed. This means additional breaches will occur which will require revetment or other structural solutions to save the road. It therefore is not outrageous to estimate that construction costs and environmental impacts of shoreline protection for CR 257 may be $100 million or more.

Even this may underestimate the costs and environmental impacts of protection of CR 257 since offshore berms may also be needed to catch enough sand for beach re-nourishment. Due to the minimal sand in the system (the sandy shore-face is only a few 100 feet wide before mud and a steep drop-off are encountered) most of which is within the long-shore transport system (refer to Rice University sediment core studies from the summer of 2007) the result would be robbing current shorelines to acquire sand where CR 257 exists, if there is enough sand in the system to make a difference.

The Sierra Club has similar concerns about Bolivar Peninsula. A buy-out program for willing sellers there also should be considered in the SPGBTS.

14) The Corps should, via the SPGBTS, make the effect that shoreline protection projects have on erosion an issue in the EIS. Shoreline protection projects must not make erosion worse somewhere else or reduce long-shore current sediment loads downstream from project locations.

15) The Corps should, via the SPGBTS, make Highway 87 and other projects that destroy or alter beaches, dunes, and wetlands an issue in the EIS. Highway 87 cannot be justified in the location it is currently in. Any movement inward will destroy significant wetlands and alter wetland hydrology for a non-water dependent action.

16) The Corps should, via the SPGBTS, make hard structures like seawalls, extensive rock groins, jetties, or similar projects an issue in the EIS. These projects often cause further losses of shoreline and beaches and require even more shoreline erosion control.

17) The Corps should, via the SPGBTS, make the use of natural or soft erosion control methods like marsh planting, **some** beach re-nourishment, and the offshore insertion of flexible materials that assist in sediment dropout an issue in the EIS. These projects can have environmental impacts if not located properly or if sources of beach re-nourishment sand are in biologically important areas.

18) The Corps should, via the SPGBTS, make the impacts that trapping of sediments in inland reservoirs an issue in the EIS. The trapping of sediments in inland reservoirs have impacts on shoreline erosion and the EIS should analyze how these trapped sediments could be released in an environmentally safe manner and returned to the coast.

19) The Corps should, via the SPGBTS, make impacts that trapping of sediments by port projects and waterway improvements have an issue in the EIS. These projects have impacts on shoreline erosion and the EIS should analyze how these trapped sediments can be released in an environmentally safe manner and be returned to the coast.

20) The Corps should, via the SPGBTS, make the free operation of natural shoreline erosion process an issue in the EIS.

21) The Corps should, via the SPGBTS, make the protection of existing natural sand dunes an issue in the EIS.

22) The Corps should, via the SPGBTS, make continued building in 100-year floodplains, the hurricane zones, dunes, beaches, and marshes an issue in the EIS.

The Corps must ensure that this study does not encourage shoreline erosion producing developments.

23) The Corps should, via the SPGBTS, make the protection of existing riparian wetlands, freshwater wetlands, and all non-jurisdictional wetlands which naturally assist in control of shoreline erosion, an issue in the EIS.

24) The Corps should, via the SPGBTS, make the proposed bridge from Galveston to Bolivar an issue in the EIS. This bridge would exacerbate shoreline erosion directly, by its design and operation, and particularly indirectly due its impetus for development in coastal prairie, rangeland, wetlands, and marshes on Bolivar Peninsula. This new development will result in the loss of an important way of life and destroy natural erosion control features like beaches, dunes, marshes, prairies, wetlands, and vegetated areas.

25) The Corps should, via the SPGBTS, make resort/second homes and commercial properties for persons who have built in hurricane and flood prone areas an issue in the EIS. The risk of living near the Gulf of Mexico is well-known. Public works projects that protect the few, many of who can afford to protect themselves or move elsewhere, and require that the many pay for irresponsible lifestyles are not in the public interest. These actions ensure further destruction of the natural flood protection and erosion control features of the land including beaches, marshes, prairies, dunes, wetlands, riparian zones, and other vegetated areas.

26) **Technical Questions and Concerns About Large Structures**

The Corps should, via the SPGBTS, make large structures an issue in the EIS. Some of the questions/concerns about large structures and their associated facilities for storm surge protection and erosion control include:

1. **For Large Structures at Bolivar Roads**

a. Will this alter Galveston Bay salinity by adversely impacting marine spawning productivity (shrimp, oysters, fish species) if the width of Bolivar Roads is reduced from 10,000 feet to a lesser width (as narrow as 1,000 feet)?

b. Will this block the ingress/egress of marine organisms using flapper/guillotine gates and fill islands to provide an anchored framework?

c. Will scouring at Bolivar Roads lead to increased erosion at or near gates?

d. Could construction of large structures lead to the dredging of the Houston Ship Channel to 65-75 feet? If so would this be cost prohibitive since the Gulf of Mexico is shallow for about 20 miles out from the proposed gates at Bolivar Roads?

e. Will dredge material deposited in Galveston Bay means the loss of bay bottom and other habitats?

2. **For Large Structures Built Along All of Bolivar Peninsula, Galveston Island, and Other Areas**

a. Will this result in the loss of open beaches/dunes?

b. Will this result in the loss of federally endangered Kemp's Ridley sea turtle nesting habitat?

c. Will this result in the loss of federally endangered piping plover resting/feeding habitats or the resting/feeding habitats of other shorebirds and other birds?

d. Will this result in the loss of other land/marine organisms' feeding/nesting/shelter habitats?

e. Is there too little sand available to re-nourish beaches and is most of that sand economically prohibitive to dredge/use?

f. What will the maintenance costs, including beach re-nourishment, of large structures be?

g. Will this result in the loss of wetlands because sand will no longer be pushed across the barrier island to its backside to nourish wetland creation?

h. What will the air quality (carbon monoxide, CO2, nitrogen oxides, particulate matter, volatile organic compounds, sulfur dioxide, ozone, and air toxics) impacts be due to the construction, maintenance, repair, and operation (diesel trucks, dredge boats, etc) of large structures?

i. Will this result in the loss of all or a large portion of Houston Audubon Society's sanctuaries and other protected areas on Bolivar Peninsula or Galveston Island?

j. How much private/public property must be acquired for construction of large structures?

k. Will the beneficial effects and functions of hurricanes be reduced (flushing and deposition of sediments and nutrients) due to the use of large structures?

l. What will be the total costs, over 30 years, to finance, construct, maintain, repair, and operate large structures?

m. Will Bolivar Peninsula and other areas still be subject to large inside-the-bay storm surges after large structures are constructed?

n. Will the construction of large structures result in a false sense of security and encourage development to increase due to perceived protection provided by large

structures? Will more wetlands and other habitats be destroyed and more people and property put at risk due to this new development?

o. Will large structures encourage the ricochet of internal storm surge in Galveston Bay that occurs when a hurricane passes over?

p. Will large structures obscure or mar the natural ocean view of the wild Texas coast?

q. Will taxpayer dollars be used to benefit and subsidize private interests in a way that the public cannot afford?

r. Will Bolivar Peninsula, unless massive dredging is conducted (with its own environmental impacts) to raise portions of the Peninsula where people live, still be subject to large within the bay storm surges?

3. **For Side Dikes/Gates/ and Other Large Structures**

a. What will the erosion and habitat loss impacts be for San Luis Pass from the construction, maintenance, repair, and operation of a dike?

b. Will this interfere with the passage of water/salinity/marine organisms into and out of bays?

c. Will this interfere with currents, accretion/deposition patterns, and sand budgets?

d. Will sensitive habitats, like Christmas Bay, be harmed?

e. For those areas of the coast that are outside where large structures have been constructed, during storms and hurricanes, will there will be increased water, wave, and erosion effects? Will this result in areas without large structures subsidizing areas with large structures and paying a higher price in environmental, social, and economic costs?

27) The Corps should, via the SPGBTS, make protection of communities and beaches, sand dunes, bays, and wetlands an issue in the EIS. This includes:

1. The protection of Galveston Island and Bolivar Peninsula should be part of a coastal erosion and accretion plan (Plan). This Plan would address coastal erosion and accretion; restoration and protection of natural coastal erosion and accretion processes so that they function naturally or more naturally than currently; protection of natural ecosystems; steer development away from more vulnerable natural coastal areas and those areas that are more vulnerable to hurricane and storm damage.

2. The Plan should focus any compatible, hard structure solutions in developed areas near the seawall in the City of Galveston proper, and allow no artificial structures to

impede the natural currents, sediments, and salinities of Galveston Bay, or access to the bay of marine organisms that depend upon these features.

3. The Plan must protect shoreline features that provide natural erosion protection like beaches, sand dunes, offshore sand replenishment areas, wetlands, freshwater inflows that bring new sediment, and habitat for endangered species (like Kemp's Ridley Sea Turtles and Piping Plovers).

4. The Plan must restore natural coastal shoreline features and remove obstacles to sediment movement and transport along our coast.

5. The Plan must ensure that adjacent and nearby areas do not have their shoreline negatively impacted by the Plan.

6. The Plan must ensure that the public's Texas Open Beaches Act "rolling easement," access for public recreation, and protection of existing public lands are not diminished.

7. The Plan must assess and determine the environmental impacts and mitigation of these impacts due to any encouraged additional development in flood and storm prone areas along the coast caused by the implementation of the Plan.

8. The Plan must protect the scenic beauty of the UTGC.

9. The Plan must not encourage further development on more vulnerable natural coastal areas that are more flood and storm prone (like West Galveston Island) which puts more people; property; and sensitive areas in danger.

28) The Corps should, via the SPGBTS, make the concentration of development where residents live and work an issue in the EIS. Currently, much development has occurred or is planned for West Galveston Island and Bolivar Peninsula. Unfortunately, these areas are the most vulnerable to hurricane and storm effects. It makes sense to step back and look for a new way.

Concentrating development on East Galveston Island, where existing seawall, harbor, and city infrastructure exists makes good economic, environmental, and safety sense. Completing the sea wall around the City of Galveston; in some way protecting the Houston Ship Channel; and concentrating development in this area will do much to protect most residents of Galveston Island. Some sensitive areas, like wave buffering wetlands need protection on East Galveston Island. This can be accomplished with much less damage to Galveston's important beaches, dunes, coastal prairie, wetlands, and bays than allowing development on West Galveston Island.

29) The Corps should, via the SPGBTS, make working with existing natural features that protect the UTGC an issue in the EIS. The first line of defense against the power of hurricanes and storms are the natural features that already protect the UTGC. These natural features include beaches, dunes, wetlands, and coastal prairie ridges. Beaches

and dunes absorb tremendous amounts of wave energy during storms. They actually move shoreward as sands and sediment are pushed across coastal ridges to the back bays. This natural sand transport system feeds the maintenance of wave protecting wetlands, beaches, and dunes. Large structures destroy beaches and dunes and interrupt this natural sand transport system. Beach re-nourishment, if adequate sands can be found close by, enhances this natural sand transport system.

30) The Corps should, via the SPGBTS, make the protection of natural amenities an issue in the EIS. People visit the UTGC for the beaches, open vistas, and wildlife and sea life. People love walking the beach, watching birds, fishing, and just hanging out in the wind, sun, and water. Who doesn't like to see a porpoise cruise or a mullet jump in the Gulf of Mexico? The rare Kemp's Ridley Sea Turtle and Piping Plover nest or visit our beaches. By protecting these natural amenities the people of Galveston, Bolivar, and other coastal communities ensure their quality of life. Any solution must conserve, protect, and preserve these natural amenities or surely the UPGC will suffer over the short and long-term. Destroying beaches to protect houses means coastal communities would not be themselves.

31) The Corps should, via the SPGBTS, make the implementation of solutions in a sustainable and economic manner an issue in the EIS. Long-term protection of Galveston Island, Bolivar Peninsula, and other parts of the UTGC requires sustainable and economic solutions. Working with Nature, and not against it surely is the best way to go. For example, San Luis Pass is one of the few natural passes left that is able to function with the existing sediment supplies on the coast. Interrupting this natural system so that replenishing sand it reduced or sent elsewhere will create a further erosion problem and degrade the incredible marsh, mudflat, and shallow water areas that make this place so irresistible to beach combers, fishers, and boaters.

32) The Corps should, via the SPGBTS, make it clear that the SPGBTS is a plan for the future in the EIS. What is needed is a Coastal Protection Plan. This Plan would give everyone from Sabine Pass to Matagorda County a way to provide a vision for the future. All interested people could participate and at the end of the process all would be united going in the same direction for funding and implementation.

33) The Corps should, via the SPGBTS, ensure that the SPGBTS is the where people work together to determine how they can effectively reduce the impacts of hurricanes on humans and the environment in the EIS. The SPGBTS must make things safer and not continue to increase the risk to lives, property, and ways of life. It's our choice to make. Some of the policies that could be implemented right now by local, state, and federal governments to better protect people and the environment include:

1. All levels of government adopt the foundation policy that we all must work with Our Mother Nature, and not against her.

2. All levels of local government adopt the policy which maximally protects wetlands, which store and filter water during rain and storm events. All levels of government will

intercede in the wetlands dredge/fill permit process on behalf wetlands protection and the avoidance, minimization, and mitigation of all wetlands losses.

3. All levels of government adopt the policy of moving from an insurance and disaster relief process, in the 100-year floodplain or storm zone, to a buyout and environmental protection process.

4. All levels of government adopt the policy which requires immediate clean-up of existing hazardous waste and superfund sites or requires the owner of the waste site to build levees that will not be breached by a Category 5 Hurricane.

5. All levels of government adopt the policy which removes all governmental incentives to develop in the 100-year floodplain or storm zone.

6. All levels of government adopt the policy to support protection and expansion of existing and additional natural areas along our coasts and floodplains.

34) The Corps should, via the SPGBTS, ensure that:

1. The SPGBTS must learn from past mistakes. Years ago there was a proposal to build a ring levee all the way around the City of Galveston. Only the seawall was built. We know what happened to the City of Galveston in Hurricane Ike. A ring levee makes sense for very developed and densely populated areas like the built-up portion of the City of Galveston because storm surge does not just come from the Gulf of Mexico. Winds generate storm surges on both Galveston Bay and the Gulf of Mexico. A large structure on the Gulf of Mexico coast will not protect the City of Galveston from any storm surge that comes from Galveston Bay. We have to learn from our mistakes!

2. The SPBGTS must embrace local solutions that require local responsibility. Since the focus is on local shoreline protection for the UTGC the economic, social, and environmental responsibility to solve these problems must come from and be paid for by local sources. Our local governments and developers did not heed the call that we should not develop in vulnerable floodplains and hurricane surge areas. We must take responsibility for having encouraged development in harm's way. This misguided policy requires vast public subsidies so that people and their private property are kept somewhat safe in these vulnerable areas.

Therefore land development, where it is appropriate, must be done in a more sensible manner including set-backs, stronger building codes, reduction in public subsidized hurricane related insurance, storm surge easements, and other local solutions that make good economic, social, and environmental sense. But first we must take responsibility for the actions that got us into this mess.

3. The SPGBTS must work with Nature. The more humans oppose Nature and take a "we shall conquer" attitude the more we endanger ourselves and those we love. Much of the UTGC is not densely populated. Examples include parts of Bolivar Peninsula, the

coast between Sabine Pass and Winnie, the northern shoreline of West Galveston Bay, and Follets Island near Freeport. In these areas, it makes sense to keep people out of harm's way by protection and restoration of natural landscapes and ecosystems including beaches, sand dunes, coastal prairies, and marshes. National wildlife refuges, a national seashore, and state wildlife management areas make the most sense for these areas.

4. The SPGBTS must address the issue in the EIS that those who benefit must pay. Yes, the Houston Ship Channel is important and needs to be protected. The responsibility for that lies with channel companies who are publicly traded and privately-owned. These companies are supposed to spend **their money** to protect **their investments.** Should public money be privatized to subsidize channel companies' risk and responsibility? Channel companies, either separately or together, can afford to build new levees or strengthen existing ones. It may make more sense to construct a gate at the entrance of the Houston Ship Channel to Galveston Bay near Morgans Point. We should use the Port of Houston as the sponsor and channel companies should pay much of the cost.

35) The Corps should, via the SPGBTS, make the analysis of all types of alternatives an issue in the EIS. For instance, varied alternatives that should be analyzed include:

1. Ring levee around all of Galveston Island's East End.

2. Higher levees around Houston Ship Channel industries.

3. Levees around some job centers, like National Aeronautic and Space Administration (NASA) and University of Texas Medical Branch at Galveston (UTMBG).

4. Retreat from the coast in certain areas.

5. Buyouts on the coast and in floodplains in repetitive flood loss areas.

6. Expand existing national wildlife refuges.

7. Create a national seashore on Bolivar Peninsula and other coastal areas.

8. Increase structure elevation for new and old buildings.

9. Enforce stricter building codes and implement Federal Emergency Management Agency (FEMA) advisories.

10. Pay landowners for the use of their land as flood easements.

36) The Corps should, via the SPGBTS, emphasize natural protection and make this an issue in the EIS. Nature is a great protector against hurricane damage. Many natural areas were hard hit by Hurricane Ike, but nature is designed to take this stress. Certain

habitats are meant to take the brunt of severe storms to protect habitats inland. Nature has been able to fine tune its own protection system for a long time, and we should use what it already provides to us – dunes, beaches, and wetlands.

The beach and dunes act as a buffer between the mainland and the worst of a storm's energy. These habitats absorb the energy of storm surge by allowing waves to crash onto them and decrease the force of waves' impact on structures. The edge of dunes creates a line in front of which we should not build any manmade structures. If we build in front of, or on top of, dunes there will be nothing standing between these structures and the storm's force. A lack of dunes means that if we develop on the coastline, there will be no natural defense between us and the storm. Dunes keep smaller storm surges at bay because they function as a small natural hill between the water and the land.

What beaches and dunes are to the energy of a storm, wetlands are to storm surge. Wetlands can be immensely helpful in diverting floodwaters away from developed areas. On average an acre of wetland can hold 3 acre feet, or 1 million gallons, of water (http://www.epa.gov/owow/wetlands/pdf/Flooding.pdf).

There are currently about 120,000 acres of wetlands in Galveston Bay. Since the 1950's over 20% of natural wetland areas in Galveston have been lost (http://74.125.47.132/search?q=cache:Y4YEnlgbOvoJ:www.betterbay.org/html/media/WetlandsOfGalvestonBay.DOC+galveston+wetlands+acres&cd=5&hl=en&ct=clnk&gl=us).

37) The Corps should, via the SPGBTS, make analysis of community development an issue in the EIS. One of the best ways to protect people and property from hurricanes is to carefully select areas where development occurs. Hurricane Ike showed which areas will be hard hit by a storm and which areas remain relatively unharmed. By using Hurricane Ike as an example, the SPGBTS can analyze if development should be concentrated in areas that are more naturally protected from storms. For example, people could be encouraged to build behind the existing sea wall on the east end of Galveston Island.

Places harder hit by Hurricane Ike are good places to turn into natural areas. Properties that were destroyed or severely damaged can be bought and turned into wild areas. Preventing rebuilding in hard hit areas would decrease the risk of property damage and increase the number of natural areas that protect us from the storms.

The amount of concrete that is used in construction contributes to flood problems. When it rains some of the water is absorbed in the ground. Large concrete slabs (parking lots, roads, building foundations) do not absorb water. Water concentrates and causes flooding or water is flushed at a faster rate which floods those who live downstream.

38) The Corps should, via the SPGBTS, make analysis of the environmental impacts of large structures an issue in the EIS. The aesthetics of large structures can cause unanticipated problems. Many people, tourists and residents alike, are drawn to

Galveston for its natural beauty. Beaches and natural areas create a haven for people to get away and relax. However, large structures destroy the natural ecosystems in the area directly and indirectly.

Another problem with large structures is the time that it takes to build them and their cost. It is estimated that a large structure system could take ten to thirty years to construct. Another hurricane could hit the coast while construction is in progress. A storm could wipe out the unfinished construction. The SPGBTS should determine how to protect large structures that are being constructed from hurricanes and what this would cost.

Directly, the dune system and beaches will disappear due to the presence of large structures. Beaches will have to be re-nourished using expensive and hard to come by sand. The ecosystems around the bay area will change with the presence of large structures which could change water flow and salinity. By providing a false sense of security large structures encourage further development in more sensitive areas, like wetlands, around Galveston Bay. All of these problems combined should be analyzed in the SPGBTS. If much of the natural beauty of coastal areas is destroyed how many people will still be interested in visiting and spending their money?

39) The Corps should, via the SPGBTS, make the analysis of the false sense of security that the construction of large structures engender and make this an issue in the EIS. For example, construction of large structures along the Texas coast may create a false sense of security for people who live in the area, and could cause them to think that the seawall will prevent ALL storm damage from hurricanes.

While large structures could theoretically prevent some of the storm surge from hitting the coast, there are several other factors that contribute to hurricane damage - the two most prominent being wind and localized flooding due to rainfall. Many places that are far inland have been severely flooded as a result of downpours that occur with hurricanes. Wind can also cause significant damage. For example, much damage is caused by high winds or tornados spawned by hurricanes. If the storm surge exceeds large structures capabilities areas could end up under water. Inland floodwaters, unless released, will be trapped by large structures and exacerbate flooding behind them. In addition, the storm surge behind large structures in Galveston Bay cannot be eliminated.

This false sense of security would also contribute to a greater increase in development on the coast because of the 'protection' provided by larges structures. Should we encourage greater development of coastal areas? We must not forget that barrier islands are Nature's 'seawall' for the mainland. These islands take the worst of a storm's force, and allow less damage to occur on the mainland. When people moved to Galveston Island they built on top of the natural seawall. It makes more sense that we encourage people to move away from threatened areas in order to protect fragile ecosystems, human lives, and property from storms.

40) The Corps should, via the SPGBTS, make geo-hazard maps for the UTGC and their implementation for human safety and environmental protection an issue in the EIS.

41) The Corps should, via the SPGBTS, should prepare a set of questions in the EIS that will be answered about any alternatives that utilize large structures. Some of these questions include:

1. **Political Questions**

a. Are regulations/rules going to be implemented to keep development out of flood-prone areas?

b. What is the goal of larges structures; can that goal be accomplished; and what social, economic, financial, and environmental studies are required to determine if the goal can be accomplished?

c. What will be the process for studying the feasibility and environmental, social, and financial impacts of larges structures?

d. How will the decision be made to build or not build and who will make the decision to build/not build large structures?

e. Which entities will be involved and where will the public input occur during the study and approval/disapproval process to build/not build larges structures?

f. Will the construction of large structures lead to the dredging of the Houston Ship Channel to 60-75 feet?

g. Will there be a vote to determine whether larges structures or some other systems are implemented?

2. **Financial and Economic Questions**

a. Who is willing to finance, construct, maintain, repair, and operate a large structure system?

b. What is the full cost of large structures and any associated facilities or activities including its financing, construction, maintenance, repair, and operation?

c. Who benefits and who takes the losses financially if a large structure system is constructed?

3. **Design Questions**

a. What are alternatives to large structures?

b. How long would large structures be effective given sea level rise?

c. How long will it take to construct large structures?

d. Where will the sand come from for re-nourishment of beaches as part of a large structure proposal?

e. Where exactly will large structures be constructed and what will be the total size (footprint)?

f. If large structures are built near State Highway (SH) 3005 how will they impact the houses that are located seaward of the large structures on Galveston Island and Bolivar Peninsula?

g. Will large structures be built and used on existing roads and infrastructure or in new areas?

g. What level of protection, in hurricane category, height of storm surge, and flood or storm protection will large structures provide?

4. **Environmental Questions**

a. When will the environmental impact statement (EIS) be available?

b. What will be the environmental effect of new development caused/assisted by large structures?

c. Will more wetlands/other habitats be destroyed and more people/property put at risk due to new development?

d. Which beach organisms will be affected and how will they be affected; how will nesting sea turtles, migrating sea turtles, and the continued growth of the sea turtle population be affected; how will shorebirds be affected; and what type and how much wetlands and other wildlife habitat will be required for mitigation for large structures?

e. What monitoring of environmental affects will be conducted; who will conduct the environmental monitoring; how long will the environmental monitoring last; how much will environmental monitoring cost; and who will pay for the environmental monitoring for large structures?

f. What environmental effects will large structures have on areas that are outside of large structures but adjacent or nearby?

g. How will the natural migration of Galveston Island, as a barrier island, be affected by larges structures and will large structures prevent Galveston Island from migrating?

h. Will large structures increase subsidence of wetlands behind it by reducing sand migration and deposition?

i. Will large structures cause or enhance the storm surge ricochet that occurs within Galveston Bay during a hurricane?

j. What mitigation will be required for perpetual environmental losses from large structures?

5. **Social Questions**

a. Will large structures make it safe for people to remain on the UTGC during hurricanes?

b. What coastal mitigation alternatives are needed, other than larges structures, to protect citizens' health and welfare from hurricanes and storms?

c. Will large structures obscure/mar the natural ocean view of our wild UTGC?

d. Will taxpayer dollars be used to benefit and subsidize private interests?

e. Will large structures result in a false sense of security and encourage increased development due to the perceived protection?

f. Can people be protected from inside-the-bay storm surges?

g. What is the sustainability of the City of Galveston and Bolivar Peninsula due to their vulnerability to hurricanes and sea level rise?

42) The Corps should, via the SPGBTS, make invasive species an issue for the EIS.

43) The Corps should, via the SPGBTS, make non-point water pollution an issue in the EIS. We must ensure that large structures, roads, and associated areas (parking lots) are required to control and reduce their effluent. Roads cause much of the sediment, herbicide, and toxic pollutants that are in non-point source pollution run-off from urban areas which enter bays and estuaries.

44) The Corps should, via the SPGBTS, make the impacts of any alternatives on the Galveston Bay Estuary Program and Coastal Barrier Resources Act an issue in the EIS.

45) The Corps should, via the SPGBTS, make "public-private partnerships" an issue in the EIS. The Sierra Club is concerned that often "public-private partnerships" result in the commercialization and privatization of public resources. We must keep public resources public and managed by professionals that work for the "people" and not other interests that have other goals, like the "maximization of profit" by using public resources.

46) The Corps should, via the SPGBTS, make "political will" an issue in the EIS. The real crux of the matter is "political will." If we are not going to be serious about regulating what can and cannot happen in the coastal zone and how and how much cannot occur then all else means nothing. We will have a slow, or not so slow, decline into degradation and destruction via cumulative impacts of all actions.

We need sometimes to "just say no" to what happens in the coastal zone. Otherwise we may not have a coastal zone at all someday. We need to take responsibility now or our children will not understand why we did not. We are less in need of "innovative ideas" than "political will".

47) The Corps should, via the SPGBTS, make economic impacts that this proposal has in relation to environmental impacts an issue in the EIS. This includes the qualitative and quantitative impacts due to nature tourism and existing recreational pursuits in the area. NEPA requires such analysis as follows:

1. **Section 101(a)** of the NEPA states, "The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances ... to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

2. **Section 101(b)(5)** of the NEPA states, "achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities".

3. **Section 102(1)(B)** of the NEPA states, "... which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations".

4. **Section 102(1)(C)** of the NEPA states, "... major Federal actions significantly affecting the quality of the human environment". (what is economics but a part of the human environment)

5. **Section 201(2)** of the NEPA states, "current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation".

6. **Section 201(3)** of the NEPA states, "the adequacy of available natural resources for fulfilling human and economic requirements of the National in the light of expected population pressures".

7. **Section 202** of the NEPA states, "to be conscious of and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation".

8. **Section 204(4)** of the NEPA states, "to develop and recommend to the president national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation".

9. **Section 1501.2(b)** of CEQ NEPA regulations states, "Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses."

10. **Section 1508.8(b)** of CEQ NEPA regulations states, "... Effects includes ecological ... aesthetic, historic, cultural, economic, social or health, whether direct, indirect, or cumulative".

11. **Section 1508.14** of CEQ NEPA regulations states, "... This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment".

Without a full accounting of the economic and environmental costs the Corps will not be integrating all costs of storm damage reduction, ecosystem restoration, and flood risk management and providing that information to the public for its review and comment about all costs and benefits of the proposal.

48) The Corps should, via the SPGBTS, use public interest review factors including flood hazards, land use, fish and wildlife values, wetlands, aesthetics, economics, conservation, shore erosion and accretion, safety, water quality, and general environmental concerns in preparing the EIS.

49) The Corps should, via the SPGBTS, make long-term protection of mitigation areas and whether created habitat will be appropriately done an issue for the EIS. Some of the questions that must be answered include:

1. What agency will be responsible for monitoring and enforcement of mitigation areas?

2. What resources does this agency have to conduct unannounced inspections? What is that agency's track record?

3. How often will that agency monitor the mitigation for this proposal?

4. What criteria will be used to determine if the mitigation is functioning as required by the permit?

5. How will this be determined and or measured?

50) The Corps should, via the SPGBTS, examine all cumulative impacts and make this an issue in the EIS. The cumulative impacts of all past, present, and future foreseeable actions must be identified and their impacts must be assessed, analyzed, and evaluated. The cumulative impacts analysis in the EIS must comply with the Council on Environmental Quality (CEQ) NEPA implementing regulations, 40 CFR 1502.16, 1508.7, 1508.8, 1508.25, and 1508.27.

The CEQ has extensively described the minimum requirements for analysis and mitigation of cumulative impacts on environmental quality. At minimum, an adequate cumulative effects analysis must:

1. Identify the past, present, and reasonably foreseeable actions of the Corps and other parties affecting each particular aspect of the affected environment

2. Must provide quantitative information regarding past changes in habitat quality and quantity, water quality, resource values, and other aspects of the affected environment that are likely to be altered by Corps actions

3. Must estimate incremental changes in these conditions that will result from Corps actions in combination with actions of other parties, including synergistic effects

4. Must identify any critical thresholds of environmental concern that may be exceeded by Corps actions in combination with actions of other parties

5. Must identify specific mitigation measures that will be implemented to reduce or eliminate such effects

The Corps must use the CEQ's January 1997 document, "Considering Cumulative Effects Under the National Environmental Policy Act" for determining cumulative impacts and carrying out its analysis, assessment, and evaluation. It is clear that the Corps has an affirmative duty, a statutory duty, and a regulatory duty to carry out cumulative impacts assessment.

Some of the especially important quotes from the CEQ document include:

a. On page v, "Only by reevaluating and modifying alternatives in light of the projected cumulative effects can adverse consequences be effectively avoided or minimized. Considering cumulative effects in also essential to developing appropriate mitigation and monitoring its effectiveness."

b. On page v, "By evaluating resource impact zones and the life cycle of effects rather than projects, the analyst can properly bound the cumulative effects analysis. Scoping can also facilitate the interagency cooperation needed to identify agency plans and other actions whose effects might overlap those of the proposed action."

c. On page vi, "When the analyst describes the affected environment, he or she is setting the environmental baseline and thresholds of environmental change that are important for analyzing cumulative effects. Recently developed indicators of ecological integrity. (e.g., index of biotic integrity for fish) and landscape conditions (e.g., fragmentation of habitat patches) can be used as benchmarks of accumulated change over time ... GIS technologies provide improved means to analyze historical change in indicators of the condition of resources, ecosystems, and human communities, as well as the relevant stress factors.

d. On page vi, "Most often, the historical context surrounding the resource is critical to developing these baselines and thresholds and to supporting both imminent and future decision-making."

e. On page ... the consequences of human activities will vary from those that were predicted and mitigated ... therefore, monitoring the accuracy of predictions and the success of mitigation measures is critical.

f. On page vi, "Special methods are also available to address the unique aspects of cumulative effects, including carrying capacity analysis, ecosystem analysis, economic impacts analysis, and social impact analysis.

g. On page vii, Table E-1, "CEA Principles ... Cumulative effects analysis ...Address additive, countervailing, and synergistic effects ... Look beyond the life of the action.

h. On page 1, "The range of actions that must be considered includes not only the projects proposal but all connected and similar actions that could contribute to cumulative effects.

i. On page 3, "The purpose of cumulative effects analysis, therefore is to ensure that federal decisions consider the full range of consequences of actions ... If cumulative effects become apparent as agency programs are being planned or as larger strategies and policies are developed then potential cumulative effects should be analyzed at that times.

j. On page 3, Cumulative effects analysis necessarily involves assumptions and uncertainties, but useful information can be put on the decision-making table now ... Important research and monitoring programs can be identified that will improve analyses in the future, but their absence should not be used as a reason for not analyzing cumulative effects to the extent possible now ... adaptive management provisions for flexible project implementation can be incorporated into the selected alternative."

k. On page 4, "The Federal Highway Administration and state transportation agencies frequently make decisions on highway projects that may not have significant direct environmental effects, but that may induce indirect and cumulative effects by permitting other development activities that have significant effects on air and water resources at a regional or national scale, The highway and other development activities can reasonably be foreseen as "connected actions.

l. On page 7, "Increasingly, decision makers are recognizing the importance of looking at their projects in the context of other development in the community or region (i.e., of analyzing the cumulative effects) ... Without a definitive threshold, the NEPA practitioner should compare the cumulative effects of multiple actions with appropriate national, regional, state, or community goals to determine whether the total effect is significant ... Cumulative effects results from spatial (geographic) and temporal (time) crowding of environmental perturbations. The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effect of the first perturbation."

m. On page 8, Table 1-2, lists 8 principles of cumulative effects analysis. See copy enclosed.

n. On page 19, "The first step in identifying future actions is to investigate the plans of the proponent agency and other agencies in the area. Commonly, analysts only include those plans for actions which are funded or for which other NEPA analysis is being prepared. This approach does not meet the letter or intent of CEQ's regulations ... The analyst should develop guidelines as to what constitutes "reasonably foreseeable future actions" based on planning process within each agency ... In many cases, local government planning agencies can provide useful information on the likely future development of the region, such as master plans. Local zoning requirements, water supply plans, economic development plans, and various permitting records will help in identifying reasonably foreseeable private actions ... These plans can be considered in the analysis, but it is important to indicate in the NEPA analysis whether these plans were presented by the private party responsible for originating the action. Whenever speculative projections of future development are used, the analyst should provide an explicit description of the assumptions involved ... NEPA litigation ... has made it clear that "reasonable forecasting" is implicit in NEPA and that it is the responsibility of federal agencies to predict the environmental effects of proposed actions before they are fully known.

o. On page 23, "Characterizing the affected environment in a NEPA analysis that addresses cumulative effects requires special attention to defining baseline conditions. These baseline conditions provide the context for evaluating environmental consequences and should include historical cumulative effects to the extent feasible.

p. On page 29, "Lastly, trends analysis of change in the extent and magnitude of stresses in critical for projecting the future cumulative effects.

q. On page 29, "Government regulations and administrative standards ... often influence developmental activity and the resultant cumulative stress on resources, ecosystems, and human communities.

r. On page 31, "Cumulative effects occur through the accumulation of effects over varying periods of time. For this reason, an understanding of the historical context of effects is critical to assessing the direct, indirect, and cumulative effects of proposed actions. Trends data can be used ... to establish the baseline for the affected environment more accurately (i.e., by incorporating variation over time) ... to evaluate the significance of effects relative to historical degradation (i.e., by helping to estimate how close the resource is to a threshold of degradation) ... to predict the effects of the actions (i.e., by using the model of cause and effects established by past actions)."

s. On pages 38-40, "Using information gathered to describe the affected environment, the factors that affect resources (i.e., the causes in the cause-and-effect relationships) can be identified and a conceptual model of cause and effect developed ... The cause-and-effect model can aid in the identification of past, present, and future actions that should be considered in the analysis ... The cause-and effect relationships for each resource are used to determine the magnitude of the cumulative effect resulting from all actions included in the analysis ... one of the most useful approaches for determining the likely response of the resource ... to environmental change is to evaluate the historical effects of activities similar to those under consideration.

t. On page 41, "The analyst's primary goal is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions ... The critical element in this conceptual model is defining an appropriate baseline or threshold condition of the resource.

u. On page 43, "Situations can arise where an incremental effect that exceeds the threshold of concern for cumulative effects results, not from the proposed action, but the reasonably foreseeable but still uncertain future actions.

v. On page 45, "The significance of effects should be determined based on context and intensity ... Intensity refers to the severity of effect ... As discussed above, the magnitude of an effect reflects relative size or amount of an effect. Geographic extent considers how widespread the effect might be. Duration and frequency refers to whether the effect is a one-time event, intermittent, or chronic.

w. On page 45, "Determinations of significance ... are the focus of analysis because they lead to additional (more costly) analysis or to inclusion of additional mitigation (or a detailed justification for not implementing mitigation) ... the project proponent should avoid, minimize, or mitigate adverse effects by modifying alternatives ... in most cases, however, avoidance or minimization are more effective than remediating unwanted effects."

y. On page 51, "different resource effects that cumulatively affect interconnected systems must be addressed in combination."

51) The Corps should, via the SPGBTS, make the inclusion of important information an issue in the EIS. If this is not done then important information will be hidden from the public and decision-makers about the magnitude and significance of storm damage reduction, ecosystem restoration, and flood risk management alternatives. The need for this information in an EIS is documented by the following:

1. **CEQ NEPA Regulation, 1500.1(b),** "NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA."

2. **CEQ NEPA Regulation, 1500.1(c),** "The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences."

3. **CEQ NEPA Regulation, 1500.2(b),** "Implement procedures to make the NEPA process more useful to decision-makers and the public."

4. **CEQ NEPA Regulation, 1500.2(d),** "Encourage and facilitate public involvement in decisions which affect the quality of the human environment."

5. **CEQ NEPA Regulation, 1500.4(b),** "Preparing analytic rather than encyclopedic environmental impact statements."

6. **CEQ NEPA Regulation, 1500.4(f),** "Emphasizing the portions of the EIS that are useful to decision-makers and the public."

7. **CEQ NEPA Regulation, 1501.2(b),** "Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses."

8. **CEQ NEPA Regulation, 1502.2,** "EISs shall be analytic rather than encyclopedic."

9. **CEQ NEPA Regulation, 1502.4(a),** "Agencies shall make sure the proposal which is the subject of an EIS is properly defined."

10. **CEQ NEPA Regulation 1502.16,** "This section forms the scientific and analytic basis for the comparisons ... environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and irreversible or irretrievable commitments of resources."

11. **CEQ NEPA Regulation, 1502.21,** "No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment."

12. **CEQ NEPA Regulation, 1502.24,** "Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in EISs. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement."

13. **CEQ NEPA Regulation, 1506.6(a),** "Agencies shall make diligent efforts to involve the public in preparing and implementing their NEPA procedures."

14. **CEQ NEPA Regulation, 1508.3,** "Affecting means will or may have an effect on."

15. **CEQ NEPA Regulation, 1508.14,** "Human Environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment ... When an EIS is prepared and economic or social and natural or physical environmental effects are interrelated then the EIS will discuss all of these effects on the human environment."

16. **CEQ NEPA Regulation, 1508.18,** "Major Federal action includes actions with effects that may be major and which are potentially subject to Federal control and responsibility. Major reinforces but does not have a meaning independent of significantly ... Actions include new and continuing activities, including projects ... approval of specific projects, such as construction or management activities located in a defined geographic area."

17. **CEQ NEPA Regulation, 1508.27,** "Significantly as used in NEPA requires considerations of both context and intensity ... Context means that the significance of an action must be analyzed in several contexts ... For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as whole ... Intensity refers to the severity of impact ... impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believe that on balance the effect will be beneficial ... Unique characteristics of the geographic area ... The degree to which the effects on the quality of the human environment are likely to be highly controversial ... The degree to which the possible effects ... are highly uncertain or involve unique or unknown risks ... Whether the action is related to other actions with individually insignificant but cumulatively significant impacts ... Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment."

52) The Corps should, via the SPGBTS, ensure that dictionary usage of words or phrases do not suffice to provide the public with a clear picture of what the intensity, significance, and context of environmental impacts are in the EIS. An all qualitative assessment, analysis, and evaluation of environmental impacts is not sufficient to deal

with the clearly articulated CEQ requirements in **Section 1502.14,** that the EIS "should present the environmental impacts of the proposal and the alternatives in comparative form, thus **sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public".**

1. Quantitative assessment, analysis, and evaluation are necessary to ensure that alternatives and environmental impacts are clearly defined and shown in the EIS. As stated in the CEQ NEPA implementing regulations, **Section 1500.1(b),** Purpose, "NEPA procedures must insure that environmental information is available to public officials and citizens ... The information must be of high quality. Accurate scientific analysis ... are essential to implementing NEPA".

2. As stated in **Section 1501.2(b),** "Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses."

3. As stated in **Section 1502.8,** "which will be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts."

4. As stated in **Section 1502.18(b),** about the Appendix, "Normally consist of material which substantiates any analysis fundamental to the impact statement".

5. As stated in **Section 1502.24,** "Agencies shall insure the professional integrity, of the discussions and analyses ... They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement."

The analysis that the Corps must conduct for this EIS is much more than **"best professional judgment". "Best professional judgment"** is where a group of people, using their experience, decide what is important. This level of assessment, analyses, and evaluation for environmental impacts and alternatives is an insufficient foundation upon which to base an EIS.

The Corps should, via the SPGBTS, define what phrases and words mean so that the public can review, comment on, and understand what the Corps refers to in the EIS. Decision-makers must know this information.

The qualitative description of phrases used to describe environmental impacts or the protectiveness of an alternative does not provide the public with the degree of comparison required by the CEQ's mandatory NEPA implementing regulations. These regulations state, in **Section 1502.14, Alternatives including the proposed action,** that, "This section is the heart of the EIS ... it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public ... Devote substantial treatment to each alternative in detail ... so that reviewers may evaluate their comparative merits."

The CEQ also states, in **Section 1502.16 and (d), Environmental consequences,** that, "This section forms the scientific and analytic basis for the comparisons ... The environmental effects of alternatives including the proposed action the comparisons under **Section 1502.14** will be based on this discussion."

It is key that the Corps clearly compare and make apparent the distinctiveness of each alternative and its impacts or protectiveness. This is not accomplished when phrases are used qualitatively instead of quantitatively with more detailed and clear descriptions of qualitative information. **The Sierra Club requests that the Corps clarify and detail clearly the comparative differences between each alternative and define clearly what the words or phrases used mean.**

The Sierra Club appreciates this opportunity to comment. Thank you.

Sincerely,

Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096
713-664-5962
brandtshnfbt@juno.com

From: Ray Taft [mailto:raybacliff@verizon.net]
Sent: Thursday, March 01, 2012 5:02 PM
To: SabinePassToGalvestonBay
Subject: Comment concerning USACE Galveston NEPA and flood control meetings.

Hello,

I think the starting point for storm damage reduction, flood risk management and ecosystem restoration should be with maintaining the current storm drain systems.

As you all probably know, the storm drain inlets, pipes and ditches all need periodic cleaning. Without cleaning, debris and trash can choke up a drain system resulting in reduced efficiency.

According to the EPA, pollution prevention depends upon good housekeeping. Pollutants, in the form of undesirable debris and trash, in a drain system can be washed into the waterways if not removed.

This all adds up to the need to clean storm drain systems on a regular basis. The municipal organizations responsible for maintaining our current systems should be performing storm drain system cleaning on a periodic schedule.

Drain systems may also need periodical engineering reviews. Sediment build-up or erosion in ditches can cause a system to fail to operate as originally designed. Increased drain inputs from added development can overload a drain system if the system was not designed for expansion.

Let’s ensure the local municipalities can demonstrate they are maintaining the current systems properly before spending taxpayer money on new systems and new projects.

I urge the group to first institute a program that will educate local municipalities on the need to maintain current storm drain systems and if needed to provide training on how to maintain storm drain systems according to accepted practices.

Regards,
Ray Taft
Bacliff, TX

From: Winston Denton [mailto:Winston.Denton@tpwd.state.tx.us]
Sent: Wednesday, March 14, 2012 5:01 PM
To: SabinePassToGalvestonBay
Cc: Michael Rezsutek; Cherie OBrien
Subject: Sabine Pass to Galveston Bay Risk Reduction

Comments provided by Texas Parks and Wildlife Department Upper Coast Region for the Wildlife Division J. D. Murphree Wildlife Management Area (WMA) and the Coastal Fisheries Division Ecosystem Resources Program. Contact information regarding specific projects are provided below.

Please let me know if you have any questions

Sincerely,

Winston Denton
Ecosystem Resources Program
Coastal Fisheries Division
Texas Parks and Wildlife Department
1502 FM 517 E
Dickinson, TX 77539
281-534-0138
winston.denton@tpwd.state.tx.us

1. Inverted Siphons Under the Gulf Intracoastal Waterway and the Keith Lake Fish Pass Cross Section Reduction

Construct two sets of inverted siphons under the GIWW to move excess freshwater from the marshes north of the GIWW to salt-stressed marshes south of the GIWW. This portion of the project will: 1) Reduce the salinity within the marshes around the discharge points lessening the level of sulfide stress in the plants. 2) Create a head of freshwater against the salt water entering through the Keith Lake Fish Pass. 3) Re-establish salinities gradients from Willow and Barnett Lakes on McFaddin National Wildlife Refuge (NWR) to the Keith Lake Fish Pass.

Reduce the cross section of Keith Lake Fish Pass from its current size to the original cross section. This project has been studied by USACOE under a CAP 1135.

Project Contacts:

Richard LeBlanc, Jr., General Manager of Drainage District 6 at 409-842-1818. (Siphon Project)

Mike Rezsutek at 409-736-2551, michael.rezsutek@tpwd.state.tx.us <mailto:michael.rezsutek@tpwd.state.tx.us> (Siphon and Keith Lake Fish Pass Projects)

The feasibility of the siphons is supported by a Texas Water Development Board study completed in 2009. The complete citation is: Dharhas Pothina and Carla G. Guthrie, Ph.D. 2009. Evaluating inverted siphons as a means of mitigating

salinity intrusion in the Keith Lake/Salt Bayou System, Jefferson County, Texas. A report submitted to US Environmental Protection Agency Gulf of Mexico Program. Grant Number MX-96401704."

2. Beneficial Use of Dredged Material to Restore Marshes in the Keith Lake Watershed

Expand the beneficial use of dredged maintenance material from Golden Pass LNG and other dredging projects to restore elevations and marsh communities on the J. D. Murphree WMA Salt Bayou Unit, the McFaddin NWR and private property within the Keith Lake watershed. Coordination with multiple landowners and the USACOE would result in a larger and cost effective project. The restoration of a healthy marsh community will reduce the impacts of storm surges.

Project Contact:

Mike Rezsutek at 409-736-2551, michael.rezsutek@tpwd.state.tx.us <mailto:michael.rezsutek@tpwd.state.tx.us>

3. Stabilization and Erosion Protection of the Banks and Adjacent Habitats Along the GIWW

Continue the placement of rock breakwaters in front of the banks along the GIWW. This technique reduces erosion of the bank, provides protection to the adjacent freshwater and intermediate marshes, and traps sediment behind the breakwaters creating a narrow fringe of salt marsh habitat. This is a well established method of preventing erosion that is practiced in Louisiana and Texas.

4. Infrastructure Development for the Continued Use of Dredge Material in the Nelda Stark Unit, Lower Neches WMA

Complete the necessary magnetometer and bathymetric surveys and design and construct a system of containment levees/terraces for future placement of dredge material. The completion of this phase would allow for Restoration of Nelda Stark Unit as material becomes available from local industries along the Sabine Neches Waterway. The area would be suitable for the beneficial use of maintenance and new work dredged material.

Project Contact:

Mike Rezsutek at 409-736-2551, michael.rezsutek@tpwd.state.tx.us <mailto:michael.rezsutek@tpwd.state.tx.us>

5. Restoration of the Beach Ridge from McFaddin NWR to High Island

Restore the beach ridge from McFaddin NWR to High Island. The primary intent of the project is to prevent frequent infusions of salt water from the Gulf of Mexico into the freshwater and intermediate marshes between the existing beach ridge remnants and the GIWW.

Project Contacts:

Patrick Walther and Tim Cooper at the Texas Chenier Plain Refuge Complex

6. Re-evaluation of the Current Use of Maintenance Dredged Material Under existing EA's and EIS's

Regionally (Sabine Pass to San Luis Pass) evaluate and amend/improve existing EA's and EIS's associated with dredging projects, mainly projects whose maintenance is under the authority of the Corps' Operations [and Maintenance] Division. The emphasis of the evaluation should be to revise the projects' Placement Areas (PA's) incorporating newer ideas, science, and techniques such as beneficial use of dredge material to mitigate, and protect against shoreline erosion (beach and bay), loss of wetlands and other natural resources (undeveloped costal prairie, bird rookery islands), and destruction to private and commercial property and to restore shorelines (beach and bay), wetlands, and other natural resources (bird rookery island).

Project Contact:

Cherie O'Brien at 281-534-0132, cherie.obrien@tpwd.state.tx.us <mailto:cherie.obrien@tpwd.state.tx.us>

7. Projects Promoting Sand Migration at Shipping Channels

Design and evaluate alternative techniques that would allow/promote the migration of sand to by-pass ship channels. The project should include the construction of a pilot project.

Project Contact:

Cherie O'Brien at 281-534-0132, cherie.obrien@tpwd.state.tx.us <mailto:cherie.obrien@tpwd.state.tx.us>

PART II

COMMENTS
ON
DRAFT INTEGRATED FEASIBILITY REPORT/ ENVIRONMENTAL IMPACT STATEMENT

ATTACHMENT 4
DIFR-EIS NOTICE OF AVAILABILITY

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OAR–2015–0202; FRL–9933–72–OEI]

Information Collection Request Submitted to OMB for Review and Approval; Comment Request; Recordkeeping and Reporting Related to E15

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Environmental Protection Agency has submitted an information collection request (ICR), "Recordkeeping and Reporting Related to E15" (EPA ICR No. 2408.04, OMB Control No. 2060–0675) to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). Public comments were previously requested via the **Federal Register** (80 FR 15595) on March 24, 2015 during a 60-day comment period. This notice allows for an additional 30 days for public comments. A fuller description of the ICR is given below, including its estimated burden and cost to the public. An Agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number.

DATES: Additional comments may be submitted on or before October 13, 2015.

ADDRESSES: Submit your comments, referencing Docket ID Number EPA–HQ–OAR–2015–0202, to (1) EPA online using *www.regulations.gov* (our preferred method), by email to *a-and-r-Docket@epa.gov*, or by mail to: EPA Docket Center, Environmental Protection Agency, Mail Code 28221T, 1200 Pennsylvania Ave. NW., Washington, DC 20460, and (2) OMB via email to *oira_submission@omb.eop.gov*. Address comments to OMB Desk Officer for EPA.

EPA's policy is that all comments received will be included in the public docket without change including any personal information provided, unless the comment includes profanity, threats, information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute.

FOR FURTHER INFORMATION CONTACT: Geanetta Heard, Fuel Compliance Center, 6406J, Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460; telephone number: 202–343–9017 fax number: 202–565–2085 email address: *heard.geanetta@epa.gov*.

SUPPLEMENTARY INFORMATION: Supporting documents, which explain in detail the information that the EPA will be collecting, are available in the public docket for this ICR. The docket can be viewed online at *www.regulations.gov* or in person at the EPA Docket Center, EPA West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The telephone number for the Docket Center is 202–566–1744. For additional information about EPA's public docket, visit *http://www.epa.gov/dockets*.

Abstract: Under the Clean Air Act (CAA), EPA granted partial waivers that allow gasoline containing greater than 10 volume percent (vol%) ethanol up to 15 vol% ethanol (E15) to be introduced into commerce for use in model year (MY) 2001 and newer light-duty motor vehicles, subject to certain conditions. EPA issued final rule establishing several measures to mitigate misfueling of other vehicles, engines and equipment with E15 and the potential emissions consequences of misfueling. The rule prohibits the use of gasoline containing more than 10 vol% ethanol in vehicles, engines and equipment that are not covered by the partial waiver decisions. The rule also requires all E15 gasoline fuel dispensers to have a specific label when a retail station or wholesale-purchaser consumer chooses to sell E15. In addition, the rule requires that product transfer documents (PTDs) specifying ethanol content and Reid Vapor Pressure (RVP) accompany the transfer of gasoline blended with ethanol, and a survey of retail stations to ensure compliance with these requirements. The rule also modifies the Reformulated Gasoline (RFG) program by updating the Complex Model to allow fuel manufacturers to certify batches of gasoline containing up to 15 vol% ethanol. This ICR supporting statement addresses associated recordkeeping and reporting items.

Respondent's obligation to respond: Mandatory (40 CFR part 80).

Estimated number of respondents: 2,103 (total).

Estimated number of responses: 44,000,103.

Frequency of response: On occasion.

Total estimated burden: 13,270 hours (per year). Burden is defined at 5 CFR 1320.03(b).

Total estimated cost: $ 1,340,292, which includes no annualized capital or operation & maintenance costs.

Changes in Estimates: We expect there will be a decrease in the total estimated respondents, responses and cost to the industry compared to the ICR currently approved by OMB. This change in burden is due to no longer requiring the programing of product transfer codes in this collection. The respondent universe decreased from 6,211 to 2,103, a difference of 4,108 members. The number of responses declined from 44,010,211 to 44,000,103, a difference of 10,108 reports. This reduced the industry burden hours from 37,350 to 13,270.

Courtney Kerwin,

Acting Director, Collection Strategies Division.

[FR Doc. 2015–22900 Filed 9–10–15; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–9022–8]

Environmental Impact Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7146 or *http://www2.epa.gov/nepa*.

Weekly receipt of Environmental Impact Statements (EISs).

Filed 08/31/2015 Through 09/04/2015.

Pursuant to 40 CFR 1506.9.

Notice

Section 309(a) of the Clean Air Act requires that EPA make public its comments on EISs issued by other Federal agencies. EPA's comment letters on EISs are available at: *http://www.cdxnodengn.epa.gov/cdx-enepa-public/action/eis/search*.

EIS No. 20150253, Draft, USACE, PR, Caño Martín Peña Ecosystem Restoration Project, Comment Period Ends: 10/26/2015, Contact: Jim Suggs 904–232–1018.

EIS No. 20150254, Draft, FRA, AZ, Arizona Passenger Rail Corridor: Tucson to Phoenix, Comment Period Ends: 10/30/2015, Contact: Andrea Martin 202–493–6201.

EIS No. 20150255, Draft, USACE, TX, Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Reduction and Ecosystem Restoration, Comment Period Ends: 10/26/2015, Contact: Janelle Stokes 409–766–3039.

EIS No. 20150256, Draft, FERC, FL, Southeast Market Pipeline Project, Comment Period Ends: 10/26/2015, Contact: John Peconom 202–502–6352.

EIS No. 20150257, Final, USDA, PRO, Programmatic—Asian Longhorned Beetle Eradication Program, Review Period Ends: 10/12/2015, Contact: Jim E. Warren 202–316–3216.

EIS No. 20150258, Draft, USACE, CA, Panoche Valley Solar Facility, Comment Period Ends: 10/26/2015, Contact: Lisa M. Gibson 916–557–5288.

Amended Notices

EIS No. 20150210, Draft, USFS, WY, Teton to Snake Fuels Management, Comment Period Ends: 10/05/2015, Contact: Steve Markason 307–739–5431 Revision to FR Notice Published 08/07/2015; Extending Comment Period from 09/21/2015 to 10/05/2015.

Dated: September 8, 2015.

Karin Leff,

Acting Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 2015–22932 Filed 9–10–15; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OECA–2014–0089; FRL–9933–40–OEI]

Information Collection Request Submitted to OMB for Review and Approval; Comment Request; NESHAP for Semiconductor Manufacturing (Renewal)

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Environmental Protection Agency has submitted an information collection request (ICR), "NESHAP for Semiconductor Manufacturing (40 CFR part 63, subpart BBBBB) (Renewal)" (EPA ICR No. 2042.06, OMB Control No. 2060–0519), to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). This is a proposed extension of the ICR, which is currently approved through September 30, 2015. Public comments were previously requested via the **Federal Register** (79 FR 30117) on May 27, 2014 during a 60-day comment period. This notice allows for an additional 30 days for public comments. A fuller description of the ICR is given below, including its estimated burden and cost to the public. An Agency may neither conduct nor sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

DATES: Additional comments may be submitted on or before October 13, 2015.

ADDRESSES: Submit your comments, referencing Docket ID Number EPA–HQ–OECA–2014–0089, to: (1) EPA online using *www.regulations.gov* (our preferred method); or by email to *docket.oeca@epa.gov,* or by mail to: EPA Docket Center, Environmental Protection Agency, Mail Code 28221T, 1200 Pennsylvania Ave. NW., Washington, DC 20460; and (2) OMB via email to *oira_submission@omb.eop.gov.* Address comments to OMB Desk Officer for EPA.

EPA's policy is that all comments received will be included in the public docket without change including any personal information provided, unless the comment includes profanity, threats, information claimed to be Confidential Business Information (CBI), or other information whose disclosure is restricted by statute.

FOR FURTHER INFORMATION CONTACT: Patrick Yellin, Monitoring, Assistance, and Media Programs Division, Office of Compliance, Mail Code 2227A, Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460; telephone number: (202) 564–2970; fax number: (202) 564–0050; email address: *yellin.patrick@epa.gov.*

SUPPLEMENTARY INFORMATION: Supporting documents which explain in detail the information that the EPA will be collecting are available in the public docket for this ICR. The docket can be viewed online at *www.regulations.gov* or in person at the EPA Docket Center, WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The telephone number for the Docket Center is 202–566–1744. For additional information about EPA's public docket, visit: *http://www.epa.gov/dockets.*

Abstract: The affected entities are subject to the General Provisions of the NESHAP (40 CFR part 63, subpart A), and any changes, or additions to the Provisions specified at 40 CFR part 63, subpart BBBBB. Owners or operators of the affected facilities must submit an initial notification report, performance tests, and periodic reports and results. Owners or operators are also required to maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility, or any period during which the monitoring system is inoperative. Reports, at a minimum, are required semiannually.

Form Numbers: None.

Respondents/affected entities: Semiconductor manufacturing facilities.

Respondent's obligation to respond: Mandatory (40 CFR part 63, subpart BBBBB).

Estimated number of respondents: 1 (total).

Frequency of response: Initially, occasionally and semiannually.

Total estimated burden: 41 hours (per year). Burden is defined at 5 CFR 1320.3(b).

Total estimated cost: $4,710 (per year), including $550 in either annualized capital/start-up and/or operation & maintenance costs.

Changes in the Estimates: There is a small increase in the respondent burden from the most- recently approved ICR due to an update in assumption and an adjustment in labor rates. In this ICR, we assume the existing major source will read and re-familiar with the rule requirement annually. We have also updated all burden calculations using the latest labor rates from the Bureau of Labor Statistics.

Courtney Kerwin,

Acting Director, Collection Strategies Division.

[FR Doc. 2015–22896 Filed 9–10–15; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OECA–2014–0031; FRL–9933–85–OEI]

Information Collection Request Submitted to OMB for Review and Approval; Comment Request; NSPS for Petroleum Dry Cleaners (Renewal)

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Environmental Protection Agency has submitted an information collection request (ICR), "NSPS for Petroleum Dry Cleaners (40 CFR part 60, subpart JJJ) (Renewal)" (EPA ICR No. 0997.11, OMB Control No. 2060–0079), to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). This is a proposed extension of the ICR, which is currently approved through September 30, 2015. Public comments were previously requested via the **Federal Register** (79 FR 30117) on May 27, 2014 during a 60-day comment period. This notice allows for an additional 30 days for public comments. A fuller description of the ICR is given below, including its estimated burden and cost to the public. An Agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

ATTACHMENT 5
TRANSCRIPT OF BEAUMONT, TEXAS, PUBLIC MEETING

NOTICE OF PUBLIC MEETING
SABINE PASS TO GALVESTON BAY, TEXAS
COASTAL STORM RISK REDUCTION AND ECOSYSTEM RESTORATION
DRAFT INTEGRATED FEASIBILITY REPORT -
ENVIRONMENTAL IMPACT STATEMENT

Interested parties are hereby notified of and invited to attend an open house and public meeting to be conducted by the U.S. Army Corps of Engineers and the Texas General Land Office on:

OCTOBER 6, 2015
OPEN HOUSE 6:00-7:00 PM
PUBLIC MEETING 7:00-8:30 PM

PRICE AUDITORIUM
THE JOHN GRAY CENTER AT LAMAR UNIVERSITY
855 JIM GILLIGAN WAY, BEAUMONT, TEXAS 77710

The meeting will provide an opportunity for all persons to comment on the Draft Integrated Feasibility Report - Environmental Impact Statement. A map showing the meeting location is attached. Written comments must be postmarked by October 26, 2015. The draft document is available at:

http://www.swg.usace.army.mil/BusinessWithUs/PlanningEnvironmentalBranch/DocumentsforPublicReview.aspx

Comments may be mailed or emailed to:

Galveston District, Corps of Engineers
Attn: Ms. Janelle Stokes
P.O. Box 1229
Galveston, Texas 77553
or
Janelle.S.Stokes@usace.army.mil

U.S. ARMY CORPS OF ENGINEERS PUBLIC MEETING

October 6, 2015

7:00 p.m.

Price Auditorium
John Gray Center at Lamar University
855 Jim Gilligan Way
Beaumont, Texas

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Appearances:

Lieutenant colonel Jared Erickson

Mr. Ray Newby

Mr. Fred Jackson

Mr. James Wolfe

Dr. Edmond Russo

Ms. Sharon Tirpak

Ms. Sherry Willie

Ms. Lauren Kruse

Ms. Janelle Stokes

Mr. Winston Denton

Court Reporter:

TAMARA CASTILLE DEROUEN, CSR
Nell McCallum & Associates, Inc.
Firm Registration No. 143
2615 Calder Avenue, Suite 111
Beaumont, Texas 77702

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NMA
ORIGINAL

P R O C E E D I N G S

LIEUTENANT COLONEL ERICKSON: Good morning, ladies and gentlemen. I'm pleased to be here tonight on behalf Colonel Richard Pannell, the risk manager of the Galveston District, U.S. Army Corps of Engineers. I'm Lieutenant colonel Jared Erickson. I'm the deputy commander of the Galveston District. I welcome you to tonight's public meeting concerning the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Study. For the record, let me state that this public meeting is being convened at 7:00 p.m. on October 6th, 2015, at the John Gray Center, Lamar University, in Beaumont, Texas.

Specifically we are presenting a commission and accepting public comments on the draft, the greater Feasibility Report, and Environmental Impact Statement for this study that was released for public review on September 11th, 2015. The court reporter is here to transcribe these proceedings and all public comments.

The Corps of Engineers and the Texas General Land Office have been conducting a study analyzing potential coastal storm risk management measures that will reduce the risk of tropical storm surge impact to the lives and property in the Golden Triangle and the Freeport area of the upper Texas Gulf Coast.

Seven years ago the region experienced a near-miss from Hurricane Ike that disrupted many lives and resulted in extensive damages in the Sabine and Galveston regions. The Nation came within one foot of an economic depression when the storm surge nearly overtopped existing hurricane flood protection projects in Port Arthur and in Texas City. Had the areas protected by these systems had been flooded, the Nation would have been experience significant disruptions in gasoline and other petrochemical supplies that we all depend upon. A cost effective plan has been identified that we believe would significantly reduce the risk of storm surge impact in the Sabine and Brazoria regions. This plan, which we refer to as the Tentatively Selected Plan, or the TSP, will be described later in this meeting.

I hope that all of you had an opportunity to read the notice of availability either on the Galveston District's website or on the announcements that were mailed to individuals and organizations that may have interest in these proceedings. It contains a summary of the Tentatively Selected Plan and its environmental impact.

Before we go any further, I would like to introduce a representative of the Texas General Land

Office, our study's nonfederal sponsor, Mr. Ray Newby, coastal geologist with the G.L.O.'s coastal resources program. Thank you for being here.

MR. NEWBY: Thank you.

LIEUTENANT COLONEL ERICKSON: At this time would you like to make any statements, Mr. Newby?

MR. NEWBY: I guess I could stand here. I'd just like to say on behalf of Commissioner Bush, we're proud to be partners with the Corps of Engineers on this important project. And, Colonel, you mentioned we've dodged a couple of bullets; but this area has taken on the chance several times and it's just a matter of time before it happens again. So, Commissioner Bush has made it one of his priorities to protect the economic and environmental resources of the Texas Coast, the jewel that it is. Thank you.

LIEUTENANT COLONEL ERICKSON: Thank you.

I would also like to recognize the public officials who are attending tonight: Mr. Fred Jackson, representing Jefferson County; and Mr. James Wolfe representing the city of Orange. Additionally, I would like to introduce those that are here with me from the Corps of Engineers: Dr. Edmond Russo, Galveston District, deputy district engineer for programs and project management; Ms. Sharon Tirpak, Galveston District

project manager for this study; Ms. Sherry Willie, Regional Planning Center. She's with the planning section; Ms. Lauren Kruse, Regional Planning Center, planning lead; and Ms. Janelle Stokes, Regional Planning Center, environmental lead.

Now I'll describe the ground rules and format for tonight's meeting. I hope everyone completed a comment form when they entered the meeting. A comment form is used to provide us your contact information so we can keep you updated on the status of the study. It can also be used to submit a written comment. If you would like to make your comment orally tonight, please make sure that you have indicated your intent on the sign-in sheet at the door. Those wishing to make a comment will be given an opportunity to do so after the presentation. If you prefer not to speak tonight, you may submit your comments in writing by dropping them in the box provided, which you see up there on that divider, or send them to us by mail or e-mail.

Following these opening remarks, Ms. Sharon Tirpak, project manager, will present an overview of this feasibility study. After her presentation, I'll open the floor for public comments. We don't have any federal or state officials here; but had they been here, they would have been requested to make a statement to be recognized

first other than Mr. Newby.

MS. TIRPAK: We have Winston Denton from the Parks & Wildlife.

MR. DENTON: Texas Parks & Wildlife.

LIEUTENANT COLONEL ERICKSON: I'm sorry, sir.

Next, representatives from federal and state resource agencies wishing to make a statement will be called upon. Then I'll recognize each individual as indicated if they wish to make a comment.

At this time I don't think we've established a limit for comments given the size of the audience, but we do have the room until 8:30. So, that will be the driving force behind that.

I would like to emphasize that this will not be a question-and-answer session. This meeting is to provide everyone with an opportunity to publicly comment on the plan. Please give all speakers the courtesy of not making any comments during their presentation. Turn off your cell phones and hold all applause or other reactions so that we can have an orderly meeting and be respectful of everyone's time. All individuals have an equal right to be heard.

Now, I would like to present Ms. Sharon Tirpak to make our presentation.

MS. TIRPAK: Thanks, everyone, for coming out tonight. We're going to talk about the Sabine Pass to Galveston Bay study for coastal storm risk management and ecosystem restoration.

(SLIDE PRESENTATION)

MS. TIRPAK: Next slide.

We're here to present the Tentatively Selected Plan -- or you'll hear me refer to it as the TSP in the presentation -- and to gather your comments on the plan and its environmental impacts. This is a Tentatively Selected Plan based on a preliminary engineering design and tentative alignment. The TSP is being reviewed concurrently by the public, internal Corps of Engineers, and independent technical reviewers, and Corps headquarters. The plan may change in response to these comments and technical issues identified during the final feasibility analysis.

Since 1854, 61 tropical storms have hit the upper Texas coast. Certainly the most recently -- recent one is the 2008 Hurricane Ike. It was the third most destructive in U.S. history with 112 deaths, thousands of homes destroyed, and 29 billion in losses.

In this area, also especially Hurricane Rita, in 2005, 111 deaths mainly attributed to incidents during the mass of evacuation, and 10 billion in losses.

And then there was Tropical Storm Allison, which was in the Houston area.

And certainly one of most historic storms in the Texas Coast, and even in the country, the 1900 storm was 6,000 deaths and 20 million in losses.

So, a congressional study background, a congressional resolution gives the Corps the authority to study and recommend projects to reduce the risk of surge damages in this region. And our mission and authorities do not allow us to address wind-related impacts.

The study is being conducted by the Corps in conjunction with our non-federal study sponsor, the Texas General Land Office. The purpose of the study is to evaluate vulnerability to storm surge impacts in the upper six counties in the Texas Gulf Coast and to develop projects that reduce the risk of storm surge impacts to people, infrastructure, the economy, and the environment.

For this study the scope was ultimately reduced to focus on CSRM and projects in the Sabine and Brazoria regions. So, as originally scoped, the study covered all six counties and recommended projects for three regions shown here: The Sabine, the Galveston, and the Brazoria region.

Let me turn this off.

The Sabine region, the Galveston region, and

Brazoria region.

However, the level of effort and associated risk for the large and complex regional study was determined to be too high. And it was agreed that this study would focus on recommending CSRM solutions for the Sabine and Brazoria regions only.

The coastal service management solutions for the large and extremely complex Galveston Bay region and ER opportunities throughout the six-county area are included in the ongoing and separate coastal Texas feasibility study and the Jefferson County ecosystem restoration study.

So, the revised study scope includes a programmatic discussion on the entire six-county area and a focus study effort on the Sabine and Brazoria region. The cost of the study is $4.4 million. And the time frame to complete it is 3.9 years.

The coastal storm risk management problems have been evaluated and a TSP developed for the Sabine region, which is the Orange and Jefferson counties and the Brazoria region, which is the Freeport area.

This is Hurricane Ike surge impact in the Orange and Jefferson counties. After Hurricane Ike a study was commissioned by Orange County to evaluate potential solutions for surge impacts like those caused by

Hurricane Ike. The study found that the surge generated by the storm caused widespread flooding in industrial, commercial, and residential areas of Orange County. The cities of Orange, Bridge City, West Orange, Pinehurst, Vidor, and Rose City, as well as unincorporated areas, suffered extreme damages. Approximately one-third of the city of Orange was flooded, primarily the downtown and commercial districts of the city. Rose City also suffered major damages from the surge that traveled up the Neches River.

Virtually 100 percent of Bridge City was flooded, including most residential and commercial property. The Chemical Row area of Orange County also received major damage, and production stopped -- production stoppage because of Ike's storm surge flooding. Estimates of damages and production losses exceed 500 million.

There were fewer impacts in Jefferson County, due in large part to the higher based ground elevations; and minor damages occurred to the ExxonMobil refinery on the Neches River just south of the city of Beaumont. The Sabine Neches Navigation District reported considerable damages along Taylor's Bayou.

Extensive in Jefferson County, the existing Port Arthur and vicinity, Hurricane Flood Protection

Project really helped this area during Hurricane Ike. Extensive damages would have occurred except for the protection provided by the levee system.

While the existing system performed well, it came close to being overtopped by the surge. The picture on the right was taken -- this one here was taken at Highway 365 after the storm when waters were still very close to the top of the flood wall in that area.

Areas not protected by the existing project were heavily impacted. The image at the bottom is of a barge lying across Highway 73 near Taylor's Bayou.

The Freeport area, on the extreme margin of this storm's effects, experienced tidal flooding up to 6 to 8 feet in areas not protected by the existing Hurricane Flood Protection Project.

Next slide.

The Port Arthur, Texas City, and Freeport Hurricane Flood Protection Projects were built as a result of storm surge damages from Hurricane Carla in 1961. Although it came ashore in Port O'Connor, some of the most dangerous impacts were felt in the Freeport area. Carla was a Category 4 storm when it came ashore with storm surges up to 22 feet. The black and white picture shows the post-storm impact.

In these existing hurricane protection levees,

all of them performed pretty well during the most recent hurricane.

So, within our study process, we have to evaluate a set of alternative plans. Several phases of alternative analysis were conducted during the study.

Shown here is the final array of alternatives that were evaluated to determine the Tentatively Selected Plan.

For the Sabine region, CSRM alternatives developed by the Orange County study were evaluated and plans -- plans which would protected nearly all of Orange County and northern Jefferson County were advanced for further screening.

Structural alternatives included construction of a new levee system in Orange and northeast Jefferson County and improving the existing Port Arthur Hurricane Flood Protection Project. One alternative included construction of a large surge gate in the Neches River with the levee system connecting to the new levee system in Orange County and the existing levee -- the Port Arthur hurricane levee system.

In Brazoria County, improvements to the existing Freeport Hurricane Flood Protection Project were advanced for further screening.

Non-structural alternatives were also

considered, and those which are within the Corps' authority to implement were advanced for further screening.

Next slide.

The Neches River surge gate alternative, I want to talk a little bit about that. It included three components: A new levee and flood wall system along the Sabine River and Sabine Lake, and a large surge gate in the Neches River with levees connecting to the Orange and Port Arthur systems. So, this would be a new levee. There would be a gate here that would connect to the existing flood protection system.

The Neches River surge gate would need to be large enough to accommodate large oceangoing tankers and other vessels which use the river to access numerous petrochemical facilities in the Port of Beaumont. The channel is currently 40 feet deep, and deepening the channel to 48 feet is authorized.

This alternative was compared to a levee system which protected the same areas to where no surge gate would be needed in the Neches River. The construction cost of the gate was estimated to be about 865 million more than all the levee -- than the all-levee approach. The gate would need to be very large across the Neches River. And large pump stations would also be needed to

prevent upstream flooding while the gate is closed.

In addition, considerable operations and maintenance costs would be needed to maintain and operate the gate into the foreseeable future. For these reasons, the gate was determined not to be cost effective and was eliminated from further screening.

So, on this slide, this shows the final array of alternatives that we have moved past the initial screening; and we have looked at these as we were working toward at the Tentatively Selected Plan.

And, as always in a Corps process, you always address the no action or future without project condition. In the Sabine region we have the new levees, flood walls in Orange and Jefferson counties, and, also, improvements to the existing Port Arthur Hurricane Flood Protection System. And, of course, we always look at non-structural alternatives.

For the Brazoria region alternatives we have the improvements to the Freeport existing Hurricane Flood Protection System and then non-structural alternatives.

So, in Orange and Jefferson counties the CSRM alternative reaches that we evaluated: Costs, economic benefits, and environmental impact of each of the Orange, Jefferson CSRM reaches were compared.

Orange Reaches 1 and 2, which are up here

(indicating). And Beaumont Reach B and C were eliminated from the proposed -- proposed levee system because costs to protect these areas would exceed the economic benefits.

For Orange Reach 1, there was an estimated average annual benefits of 275,000 with an average annual cost of over 2 million. If it were expressed in a benefits to cost ratio, it would be a 0.13. And generally in the Corps process we need at least a 1.0 to retain in the plan. So, the benefits to cost has to at least be unity.

Orange Reach 2 had an average annual benefit of 42,000 and an average annual cost of 1.8 million, with a BCR of 0.02. So, that also fell out.

These were compared to Orange Reach 3, which had and an average annual benefit of 24.7 million and an average annual cost of 14.9, or a BCR of 1.65. And that was Orange Reach 3, which is this entire -- entire reach.

So, the proposed TSP for the Orange, Jefferson Coastal Storm Risk Management is a 27.2 mile long levee and flood wall system that would be constructed from Interstate 10 at the Sabine River, down the west bank of the river, across the north bank of Sabine Lake, up the east bank of the Neches River to the vicinity of the junction of Orangefield Road and Highway 1135. So,

basically that's this area here that I just talked about (indicating).

Surge gates on Adams Bayou and Cow Bayou would need to be constructed where the levee system crosses these bayous. Existing navigation would be maintained during and after construction.

In addition, an 11-mile long levee and flood wall system would be constructed in northern Jefferson County to connect with high ground near the existing Port Arthur Hurricane Flood Protection Project. Protection northwest of this section is not needed because shoreline elevations are sufficiently high. So, this is the proposed levee system in Jefferson County, which would tie into the existing Hurricane Protection System.

The levee flood wall systems would be constructed to a minimum elevation of 11 feet. And elevations during final feasible analysis may result in higher heights of those levees. The alignment as laid out now is tentative, and there's a high likelihood that it will change as a result of public comments and technical reviews. Some residents and structures would likely be impacted by construction of the new system. In the event the project acquires property and displaces residences or businesses, the property would be purchased

at the current fair market value and assistance with moving cost would be provided. Relocations of pipelines and utilities would also probably be required. Relocation costs are a non-federal responsibility.

And here's just a -- for the Port Arthur Hurricane Protection System, here's a listing of the proposed improvements under the Tentatively Selected Plan moving from north to south.

Replacing and raising of railroad and vehicle closure structure and raising 2.3 miles of levee by 1 foot at the north end of the Sabine-Neches Canal. So, that's -- that's in this area (indicating).

Reinforcing the existing I-wall and raising about 1.3 miles of adjacent levee by 1 foot near a tank farm at the south end of the Sabine-Neches Canal.

Reinforcing the existing the I-wall near Valero and raising about a half mile of levee by 1 foot in the Taylor Bayou Basin.

And reinforcing the 8 to 10 foot I-wall and raising about one-third of a mile of levee by 1 foot west of Taylor's Bayou.

Most of the construction activities would occur within the existing project right-of-way.

And, again, this is a tentatively -- a tentative plan. It could change as a result of the ongoing public

and technical reviews. At this time we believe the plan may impact some existing structures.

For the Freeport vicinity area, the proposed TSP from north to south is raising about 2 1/2 miles of levee along North Oyster Creek by 1 to 3 feet. That would be in here (indicating).

Raising about 2 1/2 miles of the east storm levee by 1 foot and constructing a new surge gate and pump station at the mouth of the DOW Barge Canal. Navigation would maintained during the construction. That would be in here (indicating).

Raising about a half mile of levee at the DOW Thumb by 1 foot and installing erosion control and scour protection features on about 3 miles of the levee in this area.

We would also reconstruct about 700 feet of the Tide Gate I-wall, raising it by 1 foot and raising about 4/10 of a mile of adjacent levee by a foot.

And we would reconstruct about a half mile of the Freeport dock floodwall.

Most of the construction activities would occur within the existing project right-of-way. And, again, this is a tentative plan. It could change as a result of the ongoing public and technical reviews. However, at this point, the plan does not impact any existing

structures.

For the environmental impact, based on the Tentatively Selective Plan, the Port Arthur, Freeport plans have negligible environmental impacts that would require no mitigation. The Orange, Jefferson CSRM plan avoids and minimizes wetland impacts to the greatest extent possible. Trade-offs have been necessary to balance environmental impacts against impacts to homes and businesses.

Construction would directly impact about 300 acres of wetlands, marshes, and wetland forests. Indirect fisheries access impacts would occur to about 2,200 hundred acres of marsh in Adams and Cow Bayou floodplains with installation of flood gates at Adams and Cow Bayou.

The value of direct and indirect wetlands impact would have be determined with the Wetlands Value Assessment Model in coordination with resource agencies.

No known hazardous or toxic waste releases, violations, or sites of concern would be affected by the construction.

No significant impacts to cultural resource -- resources are anticipated and no endangered species impacts are expected.

We have developed a Conceptual Mitigation Plan.

An adverse impact on ecological resources resulting from construction of the TSP have been avoided or minimized to the extent practicable.

Further refinements to the plan will occur during final feasible analysis, and efforts will be made to further avoid and reduce these impacts.

Remaining unavoidable impacts will be fully mitigated as required by law.

The wetlands value assessment modeling will be conducted to quantify the benefits of mitigation measures. Selection of potential mitigation sites and modeling of benefits will be conducted in coordination with the resource agencies.

We anticipate that the recommended plan will include impacts to Texas Parks & Wildlife property. We plan to work with Texas Parks & Wildlife so that those impacts will be mitigated on Parks & Wildlife property.

The final mitigation plan will be developed and presented in the final Integrated Feasibility Report and EIS.

So, we have identified some areas where marsh restoration could occur. And that would -- the marsh restoration evaluation areas have been identified in Bessie Heights and Old River Cove vicinities.

Areas targeted for evaluation exclude areas

already identified for beneficial use or mitigation in conjunction with other projects.

Sediments from regular maintenance dredging of the adjacent Sabine-Neches could be used to restore marsh in areas of open water.

For forested wetlands: Areas on the Neches and Sabine Rivers north of Interstate 10 contain large, undeveloped tracts of forested wetlands, including cypress-tupelo swamps and bottomland hardwood -- forest.

We will evaluate the acquisition of long-term conservation of forested wetland areas to mitigate impacts of this project. Additional benefits could be earned by making improvements to the forested wetlands conservation areas, such as improving tidal flows in impounded areas or the removing and controlling invasive species such as Chinese tallow.

So, what does all this cost? These are preliminary cost estimates. Construction would be cost shared 65 percent federal and 35 percent non-federal.

We currently have indications from Orange County and Jefferson County that they would be our non-federal sponsors for the construction of the Orange and Jefferson CSRM plan. And Jefferson County Drainage District No. 7 could also be the sponsor for the Port Arthur vicinity coastal storm risk management.

In Freeport, Velasco Drainage District has indicated an interest in sponsoring improvements to the Freeport vicinity CSRM plan.

And, again, these are preliminary costs. And as we further develop the working up to the recommended plan, these costs will be refined.

So, what are our next steps? The final feasibility analysis, after all of the comments are received from all the concurrent reviews, there could be potential changes in the levee alignment location.

Development of feasibility level engineering design will occur. An analysis of effects of relative sea-level rise could result in increases to the recommended height and width of new Orange, Jefferson CSRM plan, and the Port Arthur and Freeport plans.

The analysis of potential changes in the environmental impact could occur in development of the environmental mitigation and monitoring plan will be finalized.

Now, we wanted to talk a little bit about the relative sea-level change. This table presents a range of estimated increases in sea level by the year 2080 in the Sabine and Brazoria regions. The low, intermediate, and high estimates are based on a landmark National Resource Council study from 1987. The high rate is

within the range predicted by current studies.

In the Sabine region the relative sea-level rise could range from about 1 foot to about 3 and a quarter feet. And in Brazoria, it can range from about three-quarters of a foot to about 3 feet by 2080.

These future projections will be taken into account when developing the levee and floodwall heights for the final recommended plan.

So, our schedule for the study completion is in front of you. This is -- to complete the study, we anticipate releasing the final Integrated Feasibility Report and EIS for State and Agency Review in August of next year. However, we want to say if the public and technical reviews that are ongoing right now result in significant changes to the TSP, another public comment may be warranted. The potential additional comment period is not included in the schedule that you see here. It would delay the completion of the report.

When the final Feasibility Report is completed, notices will be mailed to everyone who has expressed an interest or is an affected landowner, and copies of the final report will be available on the Galveston District website.

We are currently collecting comments. Comments must be submitted by October 26th. And we have an

address where you can submit your comments to; or if you have comments, you can write them down. We have comment forms and a comment box at the back of the room, or you can come up after I'm done and say your comment tonight if you have -- if you have any.

And I believe that's the end of the presentation. Now we'll start the public comment period.

UNIDENTIFIED SPEAKER: Can you leave Slide 26 up.

MS. TIRPAK: Yeah, we can leave Slide 26 up.

LIEUTENANT COLONEL ERICKSON: Okay. For the record, I'm told that no one has indicated on the sign-in sheet that they would like to speak. I would like to offer the opportunity to the representative from the Texas Department. Sir, do you wish to --

MR. DENTON: I didn't bring any prepared comments.

LIEUTENANT COLONEL ERICKSON: Okay. Mr. Jackson?

MR. JACKSON: No. We've made our comments many times.

LIEUTENANT COLONEL ERICKSON: And Mr. Wolfe?

MR. WOLFE: The only concern I would

have -- and I don't know the intimate details about where the study has been thus far. So, it may have been addressed. But we have numerous storm sewer pipes. They're old pipes. They are pipes that were put in by the Navy back during the second World War along the Sabine River. And we can't account for all of them. And occasionally I'll find -- I'll stumble across an old map and see evidence of where one might be. But over the years there's -- there's quite a few storm sewer pipes that connect the storm sewer systems within the city of Orange to the Sabine River and in some cases even Adams Bayou.

Since about 1950 the city of Orange and over three or four drainage studies that I'm aware of -- and I've only been with the city about 17 years. So, some of it is just digging around through old manuals and books and studies. But where they knew that they had these storm sewer pipes that connected to either Adams Bayou or the Sabine River, they provided for a stop log gap of some kind or a flat gate or a closed gate mechanism. So, I would -- I would ask that that be taken into consideration.

And the information I have I'll be happy to share it with anybody. This would be most applicable along -- immediately south of I-10 as you work down

the -- that east bank of the Sabine River -- the west bank -- excuse me -- all the way down into that shipyard. And years ago -- I have an old photograph that years ago that Navy shipyard had its own retaining wall in there for -- for some degree of flood protection.

Thank you.

MS. STOKES: It still shows up on the topo map.

LIEUTENANT COLONEL ERICKSON: Okay. Thank you.

I'd like to offer any members of the general public who wish to make a statement.

(NO RESPONSE)

LIEUTENANT COLONEL ERICKSON: Okay. In conclusion, written comments on the draft of the Integrated Feasibility Report and Environmental Impact Statement must be received on or before October 26th of 2015, the conclusion of the 45-day comment period that began on September 11, 2015.

I'd like to thank the Texas General Land office for their efforts and assistance in preparing for and holding this meeting. I thank you for your attendance and the interest that all of you have shown tonight.

This meeting is adjourned.

(MEETING ADJOURNED AT 7:36 P.M.)

THE STATE OF TEXAS XX
COUNTY OF JEFFERSON XX

I, TAMARA CASTILLE DEROUEN, a Certified Shorthand Reporter, hereby certify that I reported the U.S. Army Corps of Engineers Public Meeting, and that the foregoing 26 pages contain and constitute a true and correct transcript of my shorthand notes taken on October 6, 2015.

To which I certify on this the 23rd day of October, 2015.

TAMARA CASTILLE DEROUEN, Texas CSR No. 3700
Expiration Date: December 31, 2016
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ATTACHMENT 6
TRANSCRIPT OF FREEPORT, TEXAS, PUBLIC MEETING

NOTICE OF PUBLIC MEETING
SABINE PASS TO GALVESTON BAY, TEXAS
COASTAL STORM RISK REDUCTION AND ECOSYSTEM RESTORATION
DRAFT INTEGRATED FEASIBILITY REPORT -
ENVIRONMENTAL IMPACT STATEMENT

Interested parties are hereby notified of and invited to attend an open house and public meeting to be conducted by the U.S. Army Corps of Engineers and the Texas General Land Office on:

OCTOBER 8, 2015
OPEN HOUSE 6:00-7:00 PM
PUBLIC MEETING 7:00-8:30 PM

FREEPORT COMMUNITY HOUSE
1300 WEST SECOND STREET, FREEPORT, TEXAS 77541

The meeting will provide an opportunity for all persons to comment on the Draft Integrated Feasibility Report - Environmental Impact Statement. A map showing the meeting location is attached. Written comments must be postmarked by October 26, 2015. The draft document is available at:

http://www.swg.usace.army.mil/BusinessWithUs/PlanningEnvironmentalBranch/DocumentsforPublicReview.aspx

Comments may be mailed or emailed to:

Galveston District, Corps of Engineers
Attn: Ms. Janelle Stokes
P.O. Box 1229
Galveston, Texas 77553
or
Janelle.S.Stokes@usace.army.mil

SABINE PASS TO GALVESTON BAY, TEXAS, COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESTORATION STUDY

Public Comment Meeting

October 8, 2015

Freeport, Texas

(Meeting commenced at 7:00 p.m.)

COLONEL RICHARD PANNELL: Good evening, everyone. I appreciate y'all coming out tonight for this public meeting. I'm Colonel Richard Pannell, commander of the Galveston District of the United States Army Corps of Engineers; and we welcome you tonight to today's public meeting concerning the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Study.

For the record, let me state that this public meeting is being convened at 7:00 p.m. on October 8, 2015, at the Freeport Community House in Freeport, Texas. This evening we're presenting information and accepting public comment on the draft integrated feasibility report and environmental impact statement that was released for public review on September 11, 2015. A court reporter is here to transcribe these proceedings and all public comments.

The Corps of Engineers and the General Land Office have been conducting a study analyzing potential coastal storm risk

management measures that would reduce the risk of tropical storm surge impacts to lives and property in the Golden Triangle and Freeport areas of the upper Texas Gulf Coast.

Seven years ago, the region experienced a near miss from Hurricane Ike that disrupted many lives and resulted in extensive damages in the Sabine and Galveston region. The nation was within a foot of an economic depression when the storm surge nearly overtopped existing hurricane flood protection systems in Port Arthur and Texas City. If the areas protected by these systems had been flooded, the nation would have experienced significant disruptions in gasoline and other petrochemical supplies that we all depend on.

For this study, a cost-effective plan has been identified that we believe would significantly reduce the risk of storm surge impacts in the Sabine and Brazoria regions. This plan, which we refer to as the Tentatively Selected Plan or the TSP, will be described later in the meeting.

I hope that you've all had an opportunity to read the notice of availability, which we

handed out at the table in the back; and you can also get that on our district's website. We have also mailed out announcements to individuals and organizations as well that had a copy of this. It contains a summary of the Tentatively Selected Plan and its environmental impacts.

Before we go any further, I'd like to introduce a representative of the Texas General Land office, our study's nonfederal sponsor, Mr. Ray Newby, Coastal Geologist, with GLO's Coastal Resources Program.

MR. RAY NEWBY: Thank you, Colonel. Thank you very much. I appreciate you folks coming out tonight. On behalf of Commissioner Bush, I'd just like to say we're very supportive of the Corps' efforts and willingness to partner with the land office on these important projects.

The study tonight is just one of many steps that are being taken amongst the General Land Office and the Corps of Engineers to comprehensively address the whole Texas coast to basically look at protecting the economic assets and environmental resources that make

the Texas coast what it is. Thank you very much.

COLONEL RICHARD PANNELL: Thank you, Mr. Newby.

Before we get started here, I do want to recognize the public officials who are attending tonight. We've got Mr. George Tidwell, Chairman of the Board of Supervisors of the Velasco Drainage District. We also have Mr. John Hoss, Commissioner of the Port of Freeport. Good to see you, sir. And we have Jason Hull, Port Engineer, from Port of Freeport; and Colonel Retired, Chris Solis of the Gulf Coast Community Protection and Recovery District. Good to have you here as well. From resource agencies, we have Colleen Roco from Texas Parks and Wildlife. Thank you very much for attending today.

Additionally, I'd like to introduce our team from the Corps of Engineers and I'll start with our chief of project management, Mr. Rob Thomas to my left; and we have Ms. Sharon Tirpak, our project manager for this study. Also in the audience, we've got Mr. Tim Nelson, our chief of real estate. We've got

Mr. Don Carelock, our chief of construction; and we've got Mr. Joe Hrametz, our chief of operations in the back. We also have Ms. Sheri Willey in the far back, our planner, chief of planning section; Ms. Lauren Kruse from our regional planning center or planning league; and Ms. Janelle Stokes, our environmental lead in the regional planning center.

Okay. Let me just talk a little bit about the ground rules here. I'll describe the ground rules and the formats for tonight's meeting. I hope you've had a chance to complete a comment form when you entered the meeting. The comment form is used to provide us your contact information so we can keep you updated on the status of the study. It can also be used to submit a written comment, if you'd like.

And if you'd like to make your comment orally, please make sure that you have indicated your intent on the sign-in sheet at the door. Those wishing to make a comment will be given an opportunity to do so after the presentation. If you prefer not to speak

tonight, you may submit you comments in writing by dropping them in the box provided or you can send them to us by mail or e-mail and that's all located on the joint notice of availability.

Following my remarks, Sharon Tirpak, our Project Manager, was going to present an overview of the feasibility study; and after her presentation, I'll open the floor for public comments. Federal and state officials that have requested to make a statement will be recognized first. Next, representatives from the federal and state resource agencies wishing to make a statement will be called upon; and then I will recognize each individual that has indicated that they wish to make a comment.

I think we'll be good on time tonight, so I'm not overly concerned; but if I get a number for how many folks we have -- do you know how many we have so far?

MS. JANELLE STOKES: About 20 all together.

COLONEL RICHARD PANNELL: 20 comments?

MS. JANELLE STOKES: Oh, no, the number of people to comment, three.

COLONEL RICHARD PANNELL: Okay. So I think we're good on time. So you can, you know, bend our ear as long as you'd like on that; and the meeting will be adjourned at 8:30. So whatever time frame we need between now and 8:30.

Also, we'd like to emphasize that this will not be a question-and-answer session. The meeting is to provide you an opportunity to comment on our project.

Now, I'd like to turn it over to Ms. Sharon Tirpak to make our presentation.

MS. SHARON TIRPAK: Thank you. Good evening. Thank you for joining us. We can go past this title slide.

So the purpose of the public meeting this evening, we're here to present the Tentatively Selected Plan or the TSP and to gather your comments on the plan and its environmental impacts. This is a tentatively selected plan, and it's based on preliminary engineering design and tentative alignment.

The TSP is being reviewed concurrently by the public, internal Corps of Engineers and independent technical reviewers and Corps

headquarters. The plan may change in response to these comments and technical issues identified during the final feasibility analysis.

Since 1854, 61 tropical storms have hit the upper Texas coast and some of the more devastating storms are listed here. Certainly, the one most recent is Hurricane Ike. Hurricane Rita also in this area. Houston with tropical storm Allison; and then we also have the most historic storm of all, the 1900 Storm. And you can see some statistics there on these storms.

A congressional resolution gives the Corps the authority to study and recommend projects to reduce the risk of surge damages in this region. Our mission and authorities do not allow us to address wind-related impacts. The study is being conducted by the Corps of Engineers in conjunction with our nonfederal study sponsor, the General Land Office. The purpose of the study is to evaluate vulnerabilities to storm surge impacts in the upper six counties on the Texas Gulf Coast and to develop projects that reduce the risk of

storm surge impacts to people, infrastructure, the economy and the environment. For this study, the scope was ultimately reduced to focus on CSRM, or Coastal Storm Risk Management, in the Sabine and Brazoria regions.

As originally scoped, the study covered all six counties and recommended projects for the three regions shown here. The Sabine region, which is up here (indicating), the Brazoria region and the Houston-Galveston region. However, the level of effort and associated risk for the large and complex regional study was determined to be too high; and it was agreed that this study would focus on recommending Coastal Storm Risk Management solutions for the Sabine and Brazoria regions only.

The CSRM solutions for the large and extremely complex Galveston Bay region and ecosystem restoration opportunities throughout the six-county area are included in the ongoing and separate coastal Texas feasibility studies as well as Jefferson County ecosystem restoration feasibility study.

The revised site scope includes a

programmatic discussion on the entire six-county area and a focused study effort on the Sabine and Brazoria regions. The cost of the study is $4.4 million, and it will take 3.9 years to complete. The CSRM problems have been evaluated and a Tentatively Selected Plan developed for the Sabine region, which is Orange and Jefferson Counties and the Brazoria region, which is the Freeport area.

Now, after Hurricane Ike, a study was commissioned by Orange County to evaluate potential solutions for storm surge impacts like those caused by Hurricane Ike. This study found that the surge generated by the storm caused widespread flooding in industrial, commercial and residential areas of Orange County. The cities of Orange, Bridge City, West Orange, Pinehurst, Vidor and Rose City, as well as unincorporated areas, suffered extreme damages.

Approximately one-third of the city of Orange was flooded, primarily the downtown and commercial districts of the city. Rose City also suffered major damages from the surge that traveled up the Neches River. Virtually 100

percent of Bridge City was flooded, including most residential and commercial properties. The "Chemical Row" area of Orange County also received major damage and production stoppage because of Ike's storm surge flooding. Estimates of damages and production losses exceed $500 million.

There were fewer impacts in Jefferson County due in large part to higher base ground elevations. Minor damages occurred to the ExxonMobil refinery on the Neches River just south of the city of Beaumont. The Sabine-Neches Navigation District reported considerable damages along Taylors Bayou.

For the existing Port Arthur and vicinity, extensive damages would have occurred to Port Arthur but for the protection provided by the existing Port Arthur and Vicinity Hurricane Flood Protection Project. While the existing system performed well, it came close to being overtopped by the surge.

The picture on the right, this one right here (indicating), was taken at Highway 365 after the storm when waters were still very close to the top of the flood wall in that

area. Areas not protected by the existing project were heavily impacted. The image at the bottom is of a barge lying across Highway 73 near Taylors Bayou.

In Brazoria County, the Freeport area on the extreme margin of this storm's effects experienced tidal flooding up to 6 to 8 feet in areas not protected by the existing Hurricane Flood Protection Project. If you can't see it, the red is the highest inundation. This color here is 2 to 4 feet, and it goes on up (indicating).

The existing Freeport and Vicinity Hurricane Flood Protection Project, Port Arthur, Texas City and Freeport projects were built as a result of storm surge damages from Hurricane Carla in 1961. Although it came ashore near Port O'Connor, dangerous impacts were felt in the Freeport area. Carla was a Category 4 storm with storm surges of up to 22 feet. The black and white pictures show post-storm impacts.

Several phases of alternative analysis were conducted during the study. Shown here is a final array of alternatives that were

evaluated to determine the Tentatively Selected Plan. For the Sabine region, the CSRM alternatives developed by the Orange County study were evaluated and plans which would protect nearly all of Orange County and northern Jefferson County were advanced for further screening.

Structural alternatives included constructing a new levee system in Orange and northeast Jefferson County and improving the existing Port Arthur Hurricane Flood Protection Project. One alternative included construction of a large surge gate in the Neches River with a levee system connecting to the new levee system in Orange County and the existing Port Arthur Hurricane Flood Protection Project.

In Brazoria County, improvements to the existing Freeport Hurricane Flood Protection Project were advanced for further screening. Nonstructural alternatives were also considered and those which are within the Corps' authority to implement were advanced for further screening.

The Neches River gate alternative included three components: New levee/flood wall system

along the Sabine River and Sabine Lake. And that would be up in here (indicating); a surge gate in the Neches River with levees connecting to the Orange and Port Arthur systems; and improvements to the Port Arthur Hurricane Flood Protection Project, which is this blue line (indicating).

The Neches River surge gate would need to be large enough to accommodate large oceangoing tankers and other vessels which use the river to access numerous petrochemical facilities in the Port of Beaumont. The channel is currently 40 feet deep, and deepening of the channel to 48 feet is authorized. This alternative was compared to a levee system, which protected the same areas; and no surge gate would be needed in the Neches River. The construction cost of the gate was estimated to be about $865 million more than the all-levee approach.

Again, the gate would need to be very large to cross the Neches River and the deep navigation channel. Large pump stations would also be needed to prevent upstream flooding while the gate is closed. In addition, considerable operations and maintenance costs

would be needed to maintain and operate the gate into the foreseeable future. For these reasons, the gate was determined not to be cost effective and was eliminated from further screening.

So the final array of alternatives; and what I mean by "final array," these are the alternatives that we looked at to determine what we wanted to be the Tentatively Selected Plan. The No Action Alternative is always an alternative that we look at, and for Brazoria region, we have the Freeport and Vicinity Coastal Storm Risk Management, which includes the improvements to the existing Freeport Hurricane Flood Protection Project; and we will also look at nonstructural alternatives.

In the Sabine region, we have new levees and flood walls in Orange and Jefferson Counties, improvements to the existing Port Arthur Flood Protection Project and then again, nonstructural alternatives.

So the proposed Tentatively Selected Plan for Freeport and vicinity include -- and let me see if I can step through this because there's a bunch of segments here -- the raising of

about two-and-a-half miles of levee along north Oyster Creek by one to 3 feet. So that's up in this area (indicating). Raising two-and-a-half miles of the east storm levee by one foot. Constructing a new surge gate and pump station at the mouth of the DOW Barge Canal. Navigation would be maintained during and after construction. That's down in there (indicating). And raising about a half mile of levee at the DOW Thumb by one foot and installing erosion control and scour protection features on about three miles of levee in this area and that would be down in here (indicating).

Reconstruct about 700 feet of the Tide Gate I-Wall, raising it by one foot and raising about four tenths of a mile of adjacent levee by one foot. And I think that's right in here (indicating). And reconstructing about a half a mile of the Freeport Dock Flood Wall and that's at Port of Freeport.

Most of the construction activities would occur within the existing project right-of-way. And again, this is a tentative plan; it could change as a result of the ongoing public and

technical reviews. However, at this point, the plan does not impact existing structures.

For the Orange and Jefferson CSRM alternatives, costs, economic benefits, environmental impacts of the Orange-Jefferson reaches were compared. Orange Reaches 1 and 2 and Beaumont Reach B and C were eliminated from the proposed CSRM levee system because costs to protect these areas would exceed the economic benefits. And we're talking about this area Orange 1 and Orange 2 and Beaumont B and C (indicating).

Orange Reach 1 had an estimated average annual benefits of $275,000 and average annual costs of over $2 million. If it were expressed in a benefit-to-cost ratio, it would be a 0.13. Generally, a BCR of at least one is needed to retain in a plan. Orange Reach 2 had average annual benefits of $42,000 and an average annual cost of $1.8 million or BCR of 0.02.

These were compared to Orange Reach 3, which have average annual benefits of $24.7 million and average annual costs of $14.9 million or BCR of 1.65. And that's this reach here for Orange Reach 3 (indicating).

So the proposed TSP for Orange and Jefferson includes a 27.2-mile-long new levee flood wall system, which would be constructed from Interstate 10 at the Sabine River down the west bank of the river, across the north bank of the Sabine Lake and up the east bank of the Neches River to the vicinity of the junction of Orangefield Road and Highway 1135. So basically, we're talking -- this is the 27.2-mile-long levee (indicating).

And surge gates on Adams and Cow Bayous would need to be constructed where the levee system crosses these bayous. Existing navigation on the bayous would be maintained during and after construction. So there's two smaller gated structures that are needed on those two bayous. In addition, an 11-mile long flood wall system would be constructed in northern Jefferson County to connect with high ground near the existing Port Arthur Hurricane Flood Protection Project. Protection northwest of this section is not needed because shoreline elevations are sufficiently high.

So Jefferson County, you have 11 miles of new levee system here that would tie into the

existing Port Arthur hurricane system (indicating).

Lastly, one 3.6 mile-long system in the vicinity of the ExxonMobil plant is currently included in the TSP, and we plan to continue to evaluate the facility's existing protection system to determine if additional protection is warranted. The levee/flood wall systems would be constructed to a minimum elevation of 11 feet. Elevations during final feasibility analysis may result in higher final elevations.

The alignment, as laid out now, is tentative. There is a high likelihood that it will change as a result of public comments and technical reviews. Some residences and structures would likely be impacted by construction of this new system. In the event the project acquires property that displaces residents or business, the property would be purchased at the current fair market value and assistance with moving costs would be provided. Relocations of pipelines and utilities will also probably be required. Relocation costs are a nonfederal responsibility.

The proposed TSP improvements for the Port

Arthur protection project, replacing and raising a railroad and vehicle closure structures and raising 2.3 miles of levee by one foot at the north end of the Sabine-Neches Canal. Reinforcing the I-Wall and raising about 1.3 miles of adjacent levee by one foot near a tank farm at the south end of the Sabine-Neches Canal. Here's the tank farm and here's the other reach (indicating).

Reinforcing the existing I-Wall near Valero and raising about one-half mile of levee by one foot in the Taylor Bayou basin area. We would also reinforce the 8- to ten-foot I-Wall and raising about one-third of a mile of levee by one foot west of the Taylor Bayou basin. Most of the construction activities would occur within the existing project right-of-way.

Again, this is a tentative plan; it could change as a result of ongoing public and technical reviews. At this time, we believe the plan may impact some existing structures.

The environmental impacts of the Tentatively Selected Plan, Port Arthur and Freeport CSRM plans have negligible environmental impacts that would require no

mitigation. The Orange-Jefferson CSRM plan avoids and minimizes wetland impacts to greatest extent possible and trade-offs have been necessary to balance environmental impacts against impacts to homes and businesses.

Construction would directly impact about 300 acres of wetlands, including marshes and wetland forests. Indirect fisheries access impacts would occur to about 2200 acres of marsh in Adams and Cow Bayou floodplains with installation of the surge gates at Adams and Cow Bayous. The value of direct and indirect wetland impacts has been determined with the Wetlands Value Assessment Model in coordination with the resource agencies.

No known hazardous or toxic waste releases, violations or sites of concern would be affected by construction. No significant impacts to cultural resources are anticipated. No endangered species impacts are expected.

For, at this point in time, our mitigation plan, adverse impacts on ecological resources resulting from the construction of the TSP have been avoided or minimized to the extent practicable. Further refinements to the plan

will occur during final feasibility analysis, and efforts will be made to further avoid and reduce impacts.

Remaining unavoidable impacts will be fully mitigated, as required by law. The wetlands value assessment modeling will be conducted to quantify the benefits of mitigation measures. Selection of potential mitigation sites and modeling of benefits will be conducted in coordination with resource agencies. We anticipate that the recommended plan will include impacts to Texas Parks and Wildlife property.

We plan to work with Texas Parks and Wildlife so that those impacts will be mitigated on Texas Parks and Wildlife property. The final mitigation plan will be developed and presented in the final integrated feasibility report and EIS.

We have identified some marsh restoration evaluation areas in the Bessie Heights and Old River Cove areas. Areas targeted for evaluation exclude areas already identified for beneficial use or mitigation in conjunction with other projects. Sediments from regular

maintenance dredging of the adjacent Sabine-Neches could be used to restore marsh in areas of open water.

For forested wetlands mitigation, areas on the Neches and Sabine Rivers north of Interstate 10 contain large undeveloped tracts of forested wetlands, including cypress-tupelo swamps and bottomland forest. We will evaluate the acquisition and long-term conservation of forested wetland areas to mitigate impacts of this project.

Additional benefits could be earned by making improvements to the forested wetland conservation areas such as improving tidal flows in impounded areas or removing and controlling invasive species, such as Chinese tallow.

So for preliminary project costs, construction would be cost shared at 65 percent Federal and 35 percent non-Federal. We currently have indications from Orange County and Jefferson County that they would be our non-Federal sponsors for construction of the Orange-Jefferson CSRM plan. Jefferson County Drainage District No. 7 may be the sponsor for

the Port Arthur and Vicinity CSRM plan. Velasco Drainage District has indicated an interest in sponsoring improvements to the Freeport and Vicinity CSRM plan.

The next steps are the final feasibility analysis, and that would include the items listed here. There's potential changes in the levee alignment location based on the comments that we served during the public and technical reviews. So we will go ahead and develop the final feasibility level of engineering. Also, we will do an analysis of effects of relative sea level rise that could result in increases to the recommended height and width of the new Orange and Jefferson plan and the Port Arthur and Freeport plans. Analysis of potential changes and environmental impacts will occur and development of environmental mitigation and monitoring plan.

We did want to cover relative sea level change, and this table presents a range of estimated increases in sea level by the year 2080 in the Sabine and Brazoria regions. The low, intermediate and high estimates are based on a landmark National Research Council study

from 1987. The high rate is within the range predicted by the current studies.

In the Sabine region, relative sea level rise could range from about one- to about three-and-a-quarter feet. In the Brazoria region, it could range from about three-quarters of a foot to about 3 feet by 2080. These future projections will be taken into account in developing the levee flood wall heights for the final recommended plan.

So the schedule for the study completion, we anticipate releasing the Final Integrated Feasibility Report and EIS for state and agency review in August of next year. You can see the concurrent review is ongoing through September, October and November. We should have our recommended plan by January 2016 and the final Chief's report in September of 2016.

If the public and technical reviews result in significant changes to the TSP, another public comment period may be warranted; and the potential additional comment period is not included in this schedule you see here. It would delay completion of the report.

When final feasibility report is completed, notices will be mailed to everyone who has expressed an interest or is an affected landowner; and copies of the final report will be available on the Galveston district website.

So for updates on this study, please visit the Galveston district website at the address shown here; and a copy of this presentation and transcript of today's meeting will be posted on our website. Written comments on the Draft Integrated Feasibility Report and the Environmental Impact Statement can be submitted to us here at the meeting or sent to us by mail or e-mail. All comments need to be submitted by October 26th, and that's the end of the presentation.

COLONEL RICHARD PANNELL: Okay. We'll go ahead and move into the comment period. What I'd ask is: Please give all speakers the courtesy of being quiet during their presentation.

Please turn off your cell phones, hold applause or other reactions so that we can have an orderly meeting; and be respectful of everyone's time. All individuals have an equal

right to be heard.

What we're going to do is: We'll start off with our elected officials, resource agency representatives who wish to make a statement. I currently have a list, so I'll go down the list here.

Our first speaker that I call forward is Mr. George Tidwell from the Velasco Drainage District.

MR. GEORGE TIDWELL: The only thing I think that I'd like to do publicly, we have -- as you know -- as a local sponsor, have dealt with you for several years concerning this because we're one of the bookends of the feasibility study as Velasco Drainage District being a local sponsor.

And as I've commented to almost everybody involved with the Corps in this study, Velasco Drainage District has some concerns about the study; and we would prefer to work with the Corps as we work through those. I will -- Velasco Drainage District will make some public comments in writing. The time is sort of short. 18 days, it's not long to get that all together and read that umpteen-page report, but

we'll do what we can.

But I'd like just to make some general comments that I think y'all can take back. It's nothing that you haven't heard, I think; but our basic primary concern is -- is that the Corps is intransigent in taking the position that a coastal levee be treated like a riverine levee and it just makes common sense to us in the coastal region that as you consider risk analysis, risk assessment, that you treat a coastal levee the same as riverine levee if it's the same. But if the conditions are different, then you treat them different and evaluate it as a coastal.

And y'all know the reason is that a coastal levee has a flood condition that's limited by time. We all know the storm comes in and leaves in a short period of time. It doesn't stay. The flood condition doesn't stay up for six weeks or four weeks or something; it's up in hours.

And so our concern is that the Corps takes the position that it stays in a steady condition, and we disagree with that. We'll continue to work with you to try to resolve

that.

The second comment is -- is that in that same light, we would like the Corps to be more amenable to looking at data that we've used to evaluate our levees and give that a fair evaluation and I'm primarily talking about fragility analysis on the flood slopes of the barge canal. I'm talking about groundwater movement on a sand layer underneath the levee for underseepage; and those, we think, have validity. They're used in the community, and we think that the Corps needs to take a serious look at that and help us evaluate because it does go to risk-based analysis.

And the other final comment I think I'll make is: I think you need to take a very hard look at how you communicate and advertise your public hearings. For instance, I don't see anybody from our local newspaper here -- there may be one that I don't know about, but I don't think so. And it is important that the local community -- the taxpayers -- get the opportunity to hear all of this because they're the one that's paying the bill.

If we end up being a sponsor -- a

partnership -- in this endeavor, then they're going to be footing that bill; and they need to be able to have some comments and make some decisions about whether they want to spend the money to do that based on the assumptions you have made in the study on still water elevation, wave runup, all those kind of things that, to me, based on what I've been told, are rather arbitrary.

So with that, I'll write some public written comments; but we will continue, as a local sponsor, to work diligently with the Corps in trying to resolve these. We're glad that those are tentative recommendations rather than final recommendations, and we look forward to meeting with you and discussing all these in a more technical-type atmosphere. Thank you.

COLONEL RICHARD PANNELL: Thank you, Mr. Tidwell. Next, I call up Mr. Jason Hull from the Port of Freeport.

MR. JASON HULL: I'll try to talk a lot slower than I normally do. I know the stenographer is hard at work over there.

Again, Jason Hull, H-U-L-L, director of engineering in Port of Freeport. 200 West 2nd

Street, 3rd floor, Freeport, Texas 77541. (979)233-2667.

As Sharon mentioned, the flood wall was built shortly after Hurricane Ike, which was September 13th, 2008. The Corps' design had built the flood wall design in 2009 and completed it in 2010 at record speed. The Port, then, objected to the 3-foot-high flood wall under the precedence the dock was built in 1954, one was built in 1957, in 1986 and a piece in 2001.

The section that was built in 2001 is an open-faced-pile-supported dock, and our friends at the Velasco Drainage District commissioned a -- their district engineer did a study that said that the open-faced dock would lift off or in a storm surge, would be raised and come apart, basically.

We are supportive of a design that incorporates some sort of closure like sheet pile driven in front of the dock to close that off with some sort of access panels that we could get in and inspect if we need to so that a wave could not lift that off, as made reference to.

Also, the 4-foot-high wall that is proposed -- currently at 3-foot-high -- I think the proposal is to go another foot higher. We're asking for more removable sections of wall, something that would not impede the loading and unloading of cargo.

Currently, when a linesman has to tie up a ship, he leans over a 3-foot-high wall and has to tie up between eight, 12, ten lines; and it's a whole lot safer on them if there's a removable section that could be quickly, easily deployed in advance of an oncoming storm and then removed when there's no danger of a storm coming, like most of the time.

Also, when you do your final feasibility study, incorporate, please, in the design the cost associated with contract working around ships; our schedules cannot be delayed. It's very important that the ship have priority so that the cargo is unloaded timely and when it leaves, then the contractor can come in and -- just like the wall in 2010 was built that way.

So please consider that in the cost to the contractor premium, standby time. That's all I have. Thank you.

COLONEL RICHARD PANNELL: Thank you, Mr. Hull. Okay. At this point in time, I'm going to start calling on members of the general public. I'd ask when you come up to speak into the microphone and make sure that you identify yourself by your full name and the organization that you represent.

The first member of the public I'd like to call is Mr. James Saccomanno.

MR. JAMES SACCOMANNO: Good evening. Thank you. My name's James Saccomanno. I'm a retired engineer from BASF, and I live in Freeport, 1507 West 10th Street.

And my comment is that the proposal or the plan to raise the levees by one foot seems like a nominal, almost token amount. It's not possible to -- I don't think it's possible to accurately project storm surges. It's essentially making a weather forecast and so it'd seem to me more reasonable to mobilize and spend all that much money to raise the levees to raise them two feet or maybe even higher.

And I know there's reasons why you referred to the one foot, but that just seems like an awful nominal amount for the amount of

investment that's around this area. Anyway, that's my comment. Thank you very much.

COLONEL RICHARD PANNELL: Thank you very much, sir. Okay. Is there anyone else who would like to make a comment? Okay. Since we haven't heard any comments from anyone else, we'll go ahead and conclude this meeting.

Written comments on the Draft Integrated Feasibility Report and Environmental Impact Statement must be received on or before October 26th, 2015, the conclusion of the 45-day comment period that began on September 11th, 2015.

I'd like to thank the General Land Office for their efforts and assistance in preparing for and holding this meeting, and I thank you for your attendance this evening and the interest that you've shown in the project tonight.

This meeting is adjourned.

(Public comment meeting concluded at 7:43 p.m.)

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ATTACHMENT 7
COMMENTS RECEIVED DURING NOI COMMENT PERIOD

From: Nelson, Charles
To: Stokes, Janelle S SWF @SWG
Cc: Williams, Kiley; Wolfe, Adam B
Subject: [EXTERNAL] Texas Gulf Coast Storm Risk Management Project
Date: Tuesday, September 15, 2015 12:18:21 PM
Attachments: ACOE Texas Coastal Storm Risk Managment Project.pdf

Mrs. Stokes,

I am in receipt of the USACE's letter of notice for the above referenced project.

Colonial Pipeline Company owns and operates two large diameter refined product pipelines through the general area of the proposed project and will likely be impacted by the "Jefferson Main New Levee" works and possible the "Orange 3 New Levee". Could your office provide me with a higher detailed map or drawings depicting the locations of these proposed work? Also, an approximate timeline for the start of construction would be helpful to Colonial. Please also share any date(s) for the Public meeting(s). 1 2 3

Thanks,

Charles Nelson

District Right of Way Manager,

Colonial Pipeline Co.

O – 225-570-3011

C – 225-921-1844

F – 770-754-8075

Description: Blockedhttp://www.811marking.com/Images/811_logo_for_sidebar.jpg

Charles Nelson
District Right of Way Manager
Colonial Pipeline Co.

RESPONSE TO COMMENTS

Comment No.	Response
1	More detailed maps were added to the USACE S2G study webpage as requested
2	Construction could not start until the study is completed and approved by USACE (estimated date August 2017), the project is authorized by the U.S. Congress and funding is appropriated. An estimated construction start date cannot be provided at this time.
3	Public meetings were announced on the S2G webpage and published in local newspapers. They were held on October 6, 2015 in Beaumont, Texas and on October 8 in Freeport, Texas.

BASF

The Chemical Company

October 12, 2015
To: USACE Galveston District
Attn: Janelle Stokes

To whom it may concern:

This letter is in reference to the surge gate structure and pump station potentially to be constructed at the mouth of the DOW barge canal in the Port of Freeport. BASF Freeport's barge dock is located in the turning basin, at the very end of this barge canal as it heads northwest. Our dock is used on a daily basis, and consists of two sections; east and west. The east end is primarily used for bringing in two key raw materials that are used for our production units while the west end is used for transferring finished products in and out of our complex.

Basis this, we want to express our concern that there will be little or no interruption with our daily barge traffic and operations at the time this structure is being constructed as well as once it is placed in service. We would like to kindly request further clarification and confirmation that this gate would remain open, and would only be closed in the event of a flooding situation or tidal surge caused by tropical disturbance or a hurricane in this region. We also want to confirm that this surge gate will not create any further dimension restrictions such as the current water depth, air draft, and width of the canal itself will not be compromised that could inhibit our existing draft and beam restrictions. Additionally, in the duration of construction, we would like to make sure that interruption of barge traffic through the canal is kept at a minimum as well as that we receive a timely notice and thorough communication of when traffic would be halted so we can plan accordingly. Another factor would be for planning purposes, we would like to find out how much notice would be given to BASF in the event of this surge gate being closed for a duration of time in the event of a tidal surge or tropical disturbance. 1

We at BASF feel that placing this structure at the mouth of the canal will be a tremendous asset to our community for better protection to all of us, and we greatly appreciate the USACE's involvement with this conception. At the same time we also want to be sure that our marine traffic through the DOW barge canal will not be interrupted or restricted, and we thank you for taking our concerns into consideration.

Kindest Regards,

Morgan T. Campbell
Logistics Coord Sr / Marine Vetting
Phone: +1 979 415-6882 Mobile: +1-979-201-0907 Fax: +1 979 415-6319
Email: morgan.campbell@basf.com
BASF Corporation
602 Copper Road
Freeport, Texas 77541, USA
150 years
BASF - We create chemistry

Morgan T. Campbell
Logistics Coordinator Sr/ Marine Vetting
BASF Corporation
602 Copper Road
Freeport, Texas 77541

RESPONSE TO COMMENTS

Comment No.	Response
1	Every effort will be undertaken by the USACE during construction of the surge gate structure, as much as possible, to not limit or inhibit daily barge traffic through the DOW Barge Canal. The gate will remain open other than possible closure for maintenance practices or for an approaching storm event. Each of these possible closure activities would entail notification to all parties which utilize the DOW Barge Canal. Each of the closure activities will be conveyed from the current local sponsor for the Freeport and Vicinity Hurricane Flood Protection system, Velasco Drainage District. The surge gate will not inhibit usage by any size vessel which currently utilizes the canal. There will not be any draft, air-draft or vessel width restrictions for any existing vessel using the canal. Local industry will be properly notified in order to make proper preparations in the event of the surge gate closure. The amount of notice that would be given to local entities in the event of closure of the surge gate on the DOW Barge Canal is still yet to be determined but can be conveyed to BASF in the future, when this has been defined.

PORT NECHES
TEXAS

1005 Merriman Street Port Neches, Texas 77651
P.O. Box 758 Port Neches, Texas 77651
office 409.727.2182 fax 409.719.4302
www.ci.port-neches.tx.us

October 15, 2015

Department of the Army
Corps of Engineers
Galveston District
Attn: Janelle Stokes
P.O. Box 1229
Galveston, TX 77553-1229

RE: Draft Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement

Dear Ms. Stokes:

The City of Port Neches (City) has reviewed the above referenced document relative to potential impacts on properties owned by the City. Specifically, the City maintains ownership of two (2) tracts abutting the Neches River, Port Neches Riverfront Park and an area of currently undeveloped land (see Attachment I), which, when combined, includes approximately 3,600 feet of shoreline. In reading the Draft Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement (Report), it appears that construction of a levee and/or floodwall has been proposed for the entire length of the City's shoreline. While recognizing the potential need of such a project, the City believes that the contemplated design would be extremely detrimental to both properties. In terms of the Port Neches Riverfront Park, a levee/floodwall would minimize direct public access to the Neches River, require the closure of two (2) public access boat ramps, and eliminate the most aesthetic component of this property. As you may be aware, Port Neches Riverfront Park is the only facility that allows for public access to the Neches River for many miles, both up river and down river. With respect to the City's other property, the proposed levee/floodwall would negate currently on-going revitalization efforts which include a mixture of economic development activities and additional public access to the Neches River. The amount of land necessary for the levee/floodwall would negatively impact the site both in terms of development opportunities and aesthetic appeal. This tract previously included on abandoned refinery and a barge/industrial facility; the City acquired the property and environmentally remediated the area at a cost of approximately $7 million. It has long been the City's intent to redevelop this site with a mixture of commercial, residential, and public improvements. 1

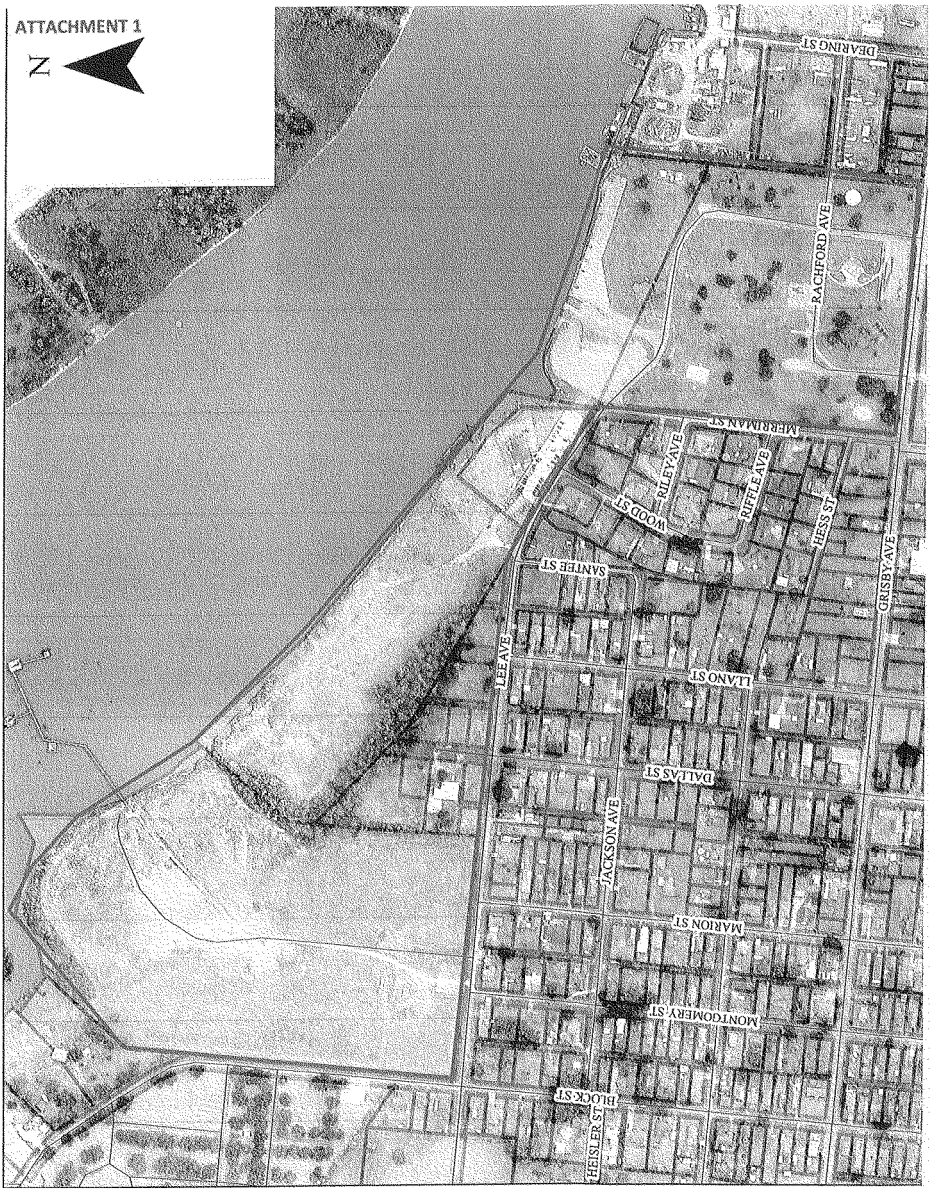
As an alternative to the system/structure included in the Report, the City would respectively propose that the use of existing topographic features be considered. Relative to Port Neches Riverfront Park (see Attachment 2), an existing bluff, located approximately 300 feet from the shoreline, rises to an elevation of 15 feet. It is the City's belief, that the height of this bluff would satisfy the Report's desire criteria in terms storm water protection. Consequently, the City would submit that there is no need for the construction of a levee/floodwall in Port Neches Riverfront Park.

In terms of the City's currently undeveloped tract, again, the City would request that the natural elevation of the existing bluff be utilized. The elevation along Lee Street (see Attachment 3) would appear to satisfy the desired storm surge protection criteria. Please note that the City does recognize that a short segment, approximately 700 feet, along Lee Street would require additional elevation. In conjunction with this proposal, the City would require that any structures built in the area between Lee Street and the Neches River shoreline be elevated to the appropriate height. As such, the City would suggest that a vastly less costly option exists that would achieve the Report's goals while also allowing the planned developed of this area.

The City respectively submits the above comments in response to the Report. The City is certainly available to meet with representatives of the Corps of Engineers to further discuss this matter. In the interim, should you have any questions or need additional information, please contact Andre' Wimer, City Manager, at (409) 727-2182.

Sincerely,

Glenn Johnson
Mayor


ATTACHMENT 1
N
DEARING ST
RACHFORD AVE
MERRIMAN ST
RILEY AVE
RIFFLE AVE
WOOD ST
HESS ST
GRISBY AVE
SANTEE ST
LEE AVE
LLANO ST
DALLAS ST
JACKSON AVE
MARION ST
MONTGOMERY ST
HEISLER ST
BLOCK ST

ATTACHMENT 2

ATTACHMENT 3

Glen Johnson
Mayor
City of Port Neches
1005 Merriman Street
Port Neches, Texas 77651

RESPONSE TO COMMENTS

Comment No.	Response
1	The final feasibility analysis determined that the proposed levee system within the City of Port Neches was not needed when elevation data was revised in some sections and local preferences for no levee system were taken into account.

G. L. KIDWELL
Chairman
Area 1
Lake Jackson, Texas

L. H. JONES
Vice Chairman
Area 3
Freeport, Texas

F. R. Hamlet
Secretary
Area 2
Clute, Texas

Velasco Drainage District

Phone (979) 265-4251 Fax (979) 265-7602
E-mail: vdd@velascodrainagedistrict.com

October 21, 2015

U. S. Army Corps of Engineers, Galveston District
Attn: Janelle Stokes, Environmental Section
P. O. Box 1229
Galveston, Texas 77553

Xc: Colonel Richard Pannell, Commander, Southwest District, Galveston; Sharon Tirpak, SWG, Project Lead, Sabine to Galveston Feasibility Study; Scott Leimer, Levee Safety Manager, SWG; Ray Newby, GLO Representative

Subject: Written Comments on Draft Integrated Sabine Pass to Galveston Bay Feasibility Report

Dear Sirs:

The Board of Supervisors of the Velasco Drainage District, Local Sponsor of the Freeport and Vicinity Hurricane Protection System, is submitting the following comments pursuant to the information received at the Public Hearing on Oct 8th in Freeport, TX and subsequent reading of the Draft Report and Appendices.

The first comment is in the form of a suggestion. We would suggest that SWG evaluate and review the Public Hearing notification/distribution procedure. The District became aware of the Public Hearing accidently at a weekly Business Roundtable Breakfast. The breakdown in the notification process subsequently prevented our primary industrial stakeholders and local newspaper from attending the Public Hearing. The District followed up with SWG and local newspaper and is available and welcomes a discussion with SWG Public Affairs to improve the process. It's also our understanding that Jefferson County Drainage District also had some notification issues.

The second comment is to express the District's disappointment, frustration and inability to understand the basis for USACE's intransigence on requiring steady state seepage in evaluation and risk assessment of Coastal Levees. It is an established fact that flood side loading during a Coastal Storm is significantly different than dam and riverine loading scenarios. The SQRA on the Freeport System compiled existing data from the hurricanes making landfall on the Texas coast and determined that flood side loading averaged between 14-18 hrs above 8 ft elevation. Loading at peak of surge averaged between 2-4 hrs. Since the Coastal Levee is not at steady state saturation above the tidal influence, roughly 1-2 ft, the Districts opinion is there is insufficient time during a Coastal Storm to reach steady state and initiate piping sufficient to cause breeching. The District is aware of papers by Shewbridge/Shaeffer, VandenBerge et al 2015, and a recent paper issued by ASCE Journal of Geotechnical and Environmental Engineering, and agree, if the dam/river levee are at or can reach steady state during a flood event, then steady state conditions should be considered. Our position is that a Coastal Levee above the tidal influence is not in steady state when Coastal Storm flood is initiated. In sand layers under the levees

Mail Address
Post Office Box 7
Clute, Texas 77531

Freight and Express
Drainage District Warehouse
915 Stratton Ridge Road
Clute, Texas 77531

that are in steady state, underseepage can be evaluated with established, widely used and accepted USGS models using SEEPW as inputs. These results can be evaluated against USACE Design Guidance for Levee Underseepage ETL 1110-2-569.

A statement was made in the report indicating that several storms, including Ike "nearly overtopped" the Freeport Hurricane Protection System. That is an incorrect statement. The Freeport System has had three major storm events that resulted in flood side loading on the levees, Carla (1961) 10-11 ft; Faye 8 ft; Ike 7 ft., none of which came close to overtopping the levees.

Due to the fact that the Public Hearing was not done in a question and answer format, the District is submitting a series of questions and is requesting responses or answers.

1. Why was there a Public Hearing prior to ATR, IEPR & HQ review since that is normal protocol and most likely would result in changes? 1
2. What methodology was used to determine SWE and Wave Runup? 2
3. What methodology and how was it used to determine changes recommending the raising levee elevations? 3
4. Was there any consideration for changing the line of protection inside Port Freeport? 4
5. Page 5-16; Please explain the "updated Hydraulic modeling" that justifies raising OC levee, specifically what were the changes to model inputs that caused differences from the 2011 FEMA ADCIRC data? 5
6. Pg 5-17; Why is it necessary to replace the 6 gravity structures on OC levee? 6
7. Pg 5-17; Why is it necessary to raise South Levee if dredge disposal sites are higher than levee? The District questions this statement since on site inspection and on Google map, the area between ICWW and South Levee is not dredge disposal areas and is natural ground until it reaches the South Wave Barrier near the Phillips 66 Dock area. Dredge disposal areas are South of ICWW. 7
8. Pg 5-18 --- Old river North – What is justification or basis for A-801 replacement, flood wall replacing levee, etc. Explain how backside scour protection reduces likelihood of brittle failure. What is "brittle failure"? 8
9. Pg 5-20; South Storm Levee was screened from further consideration due to lack of net positive benefits. Why, on Pg 5-17, do you include a recommended levee rise of 1 ft and 2 ft, respectively? These seem contradictory. 9
10. Table .5-9, pg 5-21 "TSP Height 26ft Dow Barge Canal". 5.5 ft higher than Frontal Levee???. Please explain? 10
11. Table 5-10; $114M for gate/pump station. Later in report it is stated this estimate came from a Baker & Lawson 2011 report. Due to that report being a very early preliminary assessment of our levee system, did USACE check or do an independent cost estimate on the gate/pump station structure? If not, why not? Did USACE evaluate any other "gate" alternatives? 11
12. Pg 5-25 Section 5.4.5 Why is it unlikely there will be a LPP? 12
13. On East Storm Levee, Dock Floodwall, Dow Thumb, Tide wall, What is justification for adding all the HFPP on protected side? Is there justification for it from the modeling data? What is the calculated overtopping number and what SWE and Wave Height was used? 13
14. Pg 6-12, 6.2.3 Storm Surge --- "... designers will have to apply current engineering design requirements to....." 14

Does this imply that the "Storm Surge" level for these TSP's and subsequent recommendations has not been determined?

VDD protests the usage of the "high" value of RSLC in these recommendations. As stated in your first paragraph, "... uncertainty and values vary considerably amongst the worldwide community."

15. Pg 6-17 Hydrodynamics and Storm Surge ---- Did you re-run ADCIRC? What inputs were used? Did you use STWAVE for the wave simulations all the way to toe of levee? If so, why did USACE not use shallow wave (Boussinesq, short wave period) models such as COULWAVE or FUNWAVE? The District questions the validity of STWAVE results in water depths less than 10 meters. 15

16. Pg 6-17 6.7.1.2 Bullet 5. "Assumed structure heights based on SWE only." How can you make a TSP without wave runup data. RSLC is just an arbitrary number you add on and overtopping is a result a calculation using SWE and Wave Runup. Did you do that? 16

17. Pg 7.1; Here you state you are using the intermediate RSLC which contradicts your statement under 6.2.3 Storm Surge. Which is correct? 17

18. Pg 7-32, 7.10.3.1 The naming of three different Dow sites needs to be edited. If you would contact Local sponsor, we would help name them correctly. Not sure what you mean by DOW Chemical Shipping. I also believe VDD has a map of the 48 inch pipeline from DOE to Texas City crossing our levee system. Also not sure the intent or meaning of last sentence reading "..., but impacts can occur with storms of great magnitude or when storms spin-up quickly and come ashore with little advance warning." 18

19. In App N --- Your map overlay includes BASF, which is included in the Dow Chemical Company identifying area, and BASF is not listed in your hazardous materials assessment. 19

20. We have not had time to read all the appendices carefully; however, in a cursory reading there did not appear to be any factual backup data as to how these recommendations were determined or justified. Perhaps with a better understanding of how these recommendations were determined, the District could possibly become more comfortable. 20

Respectfully submitted,

George L. Kidwell

George L. Kidwell
Chairman
Velasco Drainage District

George Kidwell
Chairman
Velasco Drainage District
P.O. Box 7
Clute, Texas 77531

RESPONSE TO COMMENTS

Comment No.	Response
1	The new SMART Planning process requires concurrent ATR, IEPR, policy and public review. Changes made in response to comments will be reflected in the Final Feasibility Report. The final report will be released for State and Agency review.
2	ADCIRC and STWAVE were used.
3	See response for comment 2
4	For purposes of this study, this was not taken into consideration.
5	See response for comment 2.
6	The plan has had considerable changes since the TSP. The recommended plan includes replacement of 3 drainage structures due to the recommended raise through one section of the Oyster Creek levee. It is assumed that the drainage structures cannot accommodate this raise and would require replacement
7	This statement will be revised in the report.
8	The recommended plan includes placing a new floodwall in front of the A-801 structure. The structure itself would not be replaced. The wording of this statement will be revised.
9	These statements have been corrected. The recommended plan includes raising a short portion of the South storm levee.
10	This information has since been revised. The section of the DOW Barge Canal which is referenced in this part of the report refers to the far southern end of the DOW Barge Canal South levee, which is at the entrance of the Freeport Navigation channel.
11	This statement has been revised since the TSP. The USACE has since completed an independent cost estimate for this feature.
12	An LPP was not identified for the Recommended Plan. It could be pursued after completion of this feasibility report if a non-Federal sponsor demonstrates interest.
13	The report and plan have since been revised.
14	The report has since been revised. The study uses the intermediate level of RSLC for all features.
15	See response for comment 2.
16	See response for comment 2.

17	The report has since been revised. The study uses the intermediate level of RSLC for all features.
18	Storms can increase in wind speed and strength very quickly in the nearshore environment.
19	The presence of BASF in the project area has been included in our evaluation.
20	The report and appendices have since been revised.

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October 13, 2015

U.S. Army Corps of Engineers, SWG
P.O. Box 1229
Galveston, TX 77553-1229
Attn: Ms. Janelle Stokes

RE: Sabine to Galveston CSRM DIFR-EIS

Ms. Stokes:

This is in response to your invitation to comment on the Sabine to Galveston Coastal Storm Risk Management project DIFR-EIS. My comments are limited to the section inside the boundary of Port Freeport. 1

In 2010, the COE built a 3-foot high floodwall along the precipice of our existing docks. These docks were never designed or intended to be incorporated into a flood protection system. The current design calls for an existing 3-foot high floodwall to be raised by 1-foot for a total wall height of 4 feet. Be aware that a portion of the existing wall was built on top of an open-face, pile supported dock. As I have said, this Dock #5 was never intended to be incorporated into a flood protection system. The Velasco Drainage District has studied and concluded that our Dock 5 will be lifted off of the piles in a 100-year storm and there will be a resulting breach in the flood protection system if corrections to the existing condition are not included in this protect.

The exiting floodwall is also burdensome to port operations. In its present configuration, the wall limits and restricts the types of, and locations that cargo can be handled. The restricted cargo operations has detracted from the benefit of the port to the economy. The wall has also turned out to be less safe for the workers that tie-up the ships as they must now reach over the wall to access the cleats.

In order for the Port to support the 1-foot high floodwall raise, the Port will require that the design incorporate the following elements.

First, a sheet pile system that will close off the open-face portion of Dock 5 to incoming waves, but also is accessible to inspection and maintenance of the structure is needed.

Next, the majority of the wall's construction shall be lightweight, removable, and easily deployable segmented wall sections that can be installed only when storm landfall is imminent.

PORT COMMISSION

RAVI SINGHANIA, CHAIRMAN; BILL TERRY, VICE CHAIRMAN; PAUL KRESTA, SECRETARY; RUDY SANTOS, ASST. SECRETARY;
SHANE PIRTLE, COMMISSIONER; JOHN HOSS, COMMISSIONER; GLENN A. CARLSON, EXECUTIVE PORT DIRECTOR/CEO

Lastly, as was done in the construction of the 3-foot high project, the construction operations of this project shall not interfere with port operations and handling of cargo. No construction will be allowed while vessel operations are ongoing.

Sincerely,

Glenn A. Carlson
Executive Port Director/CEO
Port Freeport

/mab
cc: Jason Hull, Director of Engineering

Glenn A. Carlson
Executive Port Director/CEO
Port Freeport
200 W. Second St.
Freeport, Texas 77541

RESPONSE TO COMMENTS

Comment No.	Response
1	The Recommended Plan design will address the stated concerns. Industry use of the dock area will not be limited by construction activities for this project.

From: Jennie@exp.net
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] Sabine pass to Galveston Bay, Texas Coastal Storm Risk Management
Date: Monday, September 28, 2015 2:56:00 PM

Janelle,

As to Orange county, we think this is a good project. However, from view the available proposed alignment sheet we do have questions and potential problems as the levee appears it will cut through a piece of our property crossing two access roads. How would this be handled? 1

R.E. Odom

Jennie Scalfano

Jennie Scalfano
Manager
409-883-8550 Ext. 7001
jennie@exp.net <mailto:jennie@exp.net>
P.O. Box 458
Orange, TX 77631-0458

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Jennie Scalfano
Manager
R.E. Odom
P.O. Box 458
Orange, TX 77631-0458

RESPONSE TO COMMENTS

Comment No.	Response
1	The Recommended Plan would provide access through the levee/floodwall system for facilities or parts of facilities located outside of the system. Where the new levee/floodwall cuts off existing access roads, the road would either be raised to go across the levee or a gated closure structure would be installed to maintain access through a floodwall. Additional information can be found in the Engineering Appendix.

From: Lynda Bonsall
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] DIFR-EIS questions
Date: Tuesday, October 06, 2015 6:40:09 AM

Dear Ms, Stokes,
First let me say I am so glad that a study has been done toward putting a levee system around our area to protect against storm surge. The sooner this comes to fruition, the better. My home is located on Jasmine street in Bridge City. We were the first hit during Ike and received 8 ft. 9 in. of water in my first level of my home. Therefore, you can see why my husband and I are very interested in the construction of a levee system. That being said, here is a list of questions I have for you:

Why only 12 ft. in height? If we get another storm the strength of Ike, it will breach the proposed height. My garage is 8 ft. above sea level. If you do the math it will easily top this height. 1
The water drains south of highway 87 in Bridge City toward the marsh, my back yard. If a levee is there without effective pumping it will become a lake again threatening my house. According to the map the levee will cross less than 100 yards from my back door. Even during a normal rainfall it will be a problem. Where will the pumps be located in Bridge City and how many? Also, what conditions apply toward turning these pumps on? 2
The cost for this system? It seems a mighty low number for 200 miles of construction. I would have thought it to be closer to three or four times that amount. If your going to do this, do it right the first time. Why such a wig wag around Bridge City? What material will be used in the construction of this levee system? 3 4
We depend on the wind from Lake Sabine to keep the mosquitos from us. At the position proposed, the levee will block that flow with no leeway. The mosquitos will get on the leeward side of the levee, my back yard. Could something be done about this position?
We have numerous pipelines running directly behind our home. A plane flies over regularly checking for leaks. Will they support this extra weight, and what about leaks? Would it still be detectable? We have both liquid and gas pipelines. According to the map, the levee will be sitting right on top of them. 5

Please do not take my questions to be in opposition to the levee system. We are for this construction but I do have a number of questions that need to be addressed.

Thanks, Lynda & Jim Bonsall

Lynda and Jim Bonsall
Bridge City, Texas

RESPONSE TO COMMENTS

Comment No.	Response
1	The DIFR-EIS did not present a final plan for the proposed levee/floodwall system; it was a tentative alignment and height that were further during final feasibility analysis. The final proposed levee/floodwall system elevations range from 12.0 to 17.5 feet NAVD88 and include additional height to accommodate predicted relative sea level rise and wave run-up. More specific information can be found in the Engineering Appendix.
2	A plan to provide pumps, culverts and appropriately sized interior drainage has been developed and included in the Recommended Plan. More details can be found in the Engineering Appendix.
3	The cost developed for the FIFR-EIS is based on more information and the Recommended Plan; it is much higher than that estimated in the DIFR-EIS. The cost can be found in the FIFR-EIS Main Report and in the Cost Engineering Section of the Engineering Appendix.
4	The Recommended Plan alignment was sited to avoid impacts to the floodplain and wetlands while also avoiding impacts to homes, industry, pipelines and other development as much as possible.
5	Coordination with pipeline companies will be conducted during the Pre-construction Engineering and Design phase to ensure that the new levee/floodwall system is designed and constructed so as not to adversely impact pipelines.

From: Karen Reese
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Project
Date: Wednesday, September 16, 2015 1:22:36 PM

Hello Ms. Stokes;

My question to the USACE is :

Can you email either an AutoCad 11 file, or a .jpeg or a .pdf version of the following Maps (they were included in the report) our community would like to see a closer view of exactly were the 11'-0" levee will be installed along our borders and we can not clearly identify any landmarks with what was provided in the report. 1

Figure 5-1: Location of Optimization Alternatives in the Orange-Jefferson CSRM Project
Figure 5-4: Orange County Critical Infrastructure
Figure 7-1: Sabine Regions Sub-basins and Drainage's

Thank you for your time and attention to this matter.

Regards,
Karen Reese
karen.reese@basf.com
karen.reese5@gmail.com
(409) 782-4691

Karen Reese
Karen.Reese@basf.com
Karen.Reese@gmail.com

RESPONSE TO COMMENTS

Comment No.	Response
1	More detailed maps were added to the USACE S2G study webpage as requested

From: Tom Harvey
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] DIFR-EIS
Date: Tuesday, September 29, 2015 9:03:03 PM

I just wanted to take a few minutes to voice my support behind the feasibility of building a levee system to help guard against coastal flooding of areas so devastated by Hurricane Ike. I know such an endeavor is a huge undertaking but could have a monumental return on investment in the event that such a storm struck the location again. I appreciate the fact that authorities are looking into ways to help prevent loss of life and property due to natural disasters. Once again, I wholeheartedly support the project. 1

I appreciate your time.

Tom Harvey
309 Sabine Dr
Bridge City, TX 77611

Tom Harvey
309 Sabine Drive
Bridge City, TX 77611

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank-you for taking the time to provide your position on the proposed project.

From: James Saccomanno
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] Coastal Storm Risk Management and Ecosystem Restoration Project
Date: Friday, September 11, 2015 1:45:51 PM

Janelle,

The project is a great one ! Press on ASAP. I would like to know what the overall schedule for completion is. 1

Thank You For the Information ! we appreciate your work!

James Saccomanno
1507 W 10th
Freeport Tx 77541

James Saccomanno
1507 W. 10th
Freeport, TX 77541

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank-you for taking the time to provide your position on the proposed project.

From: James Sligar
To: Stokes, Janelle S SWF @SWG
Cc: Jim Sligar
Subject: [EXTERNAL] Request for Information - Bridge City, Texas
Date: Wednesday, September 16, 2015 1:09:34 PM

AGENCY: Department of the Army; Corps of Engineers and Texas Commission on Environmental Quality

Joint Notice of Availability for the Draft Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement

Janelle, I have seen a copy of a September 11, 2015 correspondence provided by your office regarding the above matter. Could you please send me the information? 1

Thanks very much.

Jim Sligar cell 404-316-3769

Jim Sligar
Bridge City, Texas 77611

RESPONSE TO COMMENTS

Comment No.	Response
1	Mr. Sligar was provided the link to the USACE S2G webpage where the DIFR-EIS could be viewed or downloaded.

PM

9-19-15

To Whom It May Concern,

I have been a resident of Bridge City, TX (Orange County) for 35 years.
The damage done by storm surge from Hurricane Ike inundated our city. 1
What an experience!
A levee system for our town, our community and many other towns would be welcomed tremedously!

Sincerely,

Lorna Wade
385 Holiday St.
Bridge City, TX. 77611
email: ldoone17@att.net

Lorna Wade
385 Holiday Street
Bridge City, TX 77611

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank-you for taking the time to provide your position on the proposed project.

From: wwinstead@gt.rr.com
To: Stokes, Janelle S SWF @SWG
Subject: [EXTERNAL] FIGURE 1 AND FIG 2 CSRM MAPS
Date: Wednesday, September 16, 2015 1:34:49 PM

I LIVE IN ORANGE COUNTY ON THE MARSH NEAR NECHES RIVER. WOULD LIKE TO SEE CLOSER UP OF MAP DRAFT.
THANKS MRS WINSTEAD
1100 HARDY ST
BRIDGE CITY 77611

Mr. Winstead
1100 Hardy Street
Bridge City, Texas 77611

RESPONSE TO COMMENTS

Comment No.	Response
1	More detailed maps were added to the USACE S2G study webpage as requested.

From:	brandtshnfbt@juno.com
To:	Stokes, Janelle S SWF @SWG
Cc:	brandtshnfbt@juno.com; page.williams@gmail.com; oldham_melanie@yahoo.com; art.brownig@gmail.com; elmerz@hal-pc.org; frankblake@juno.com; kenwkramer@aol.com; margot.sierraclub@austin.rr.com; cyrus.reed@sierraclub.org; eva.hernandez@sierraclub.org; baytime@mac.com; sjones@galvbay.org; sharronlstewart@gmail.com
Subject:	[EXTERNAL] Draft Integrated Feasibility Report and Environmental Impact Statement for the Tentatively Select Plan of the Sabine Pass to Galveston Bay C oastal Storm Risk Management and Ecosystem Restoration Project
Date:	Friday, September 11, 2015 8:24:50 AM

Dear Janelle,

Would you please send to me on behalf of the Houston Sierra Club (address below) one CD copy of the Draft Integrated Feasibility Report and Environmental Impact Statement for the Tentatively Select Plan of the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Project? Thank you. If you have any questions please contact me at the email or phone number below.

Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096
713-664-5962
brandtshnfbt@juno.com

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Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank-you for your interest in the study. A CD was mailed to Mr. Mannchen on September 11 and the link to the USACE S2G study webpage was also provided.

From:	brandtshnfbt@juno.com
To:	Stokes, Janelle S SWF @SWG
Cc:	brandtshnfbt@juno.com; page.williams@gmail.com; art.browning@gmail.com; elmerz@hal-pc.org; frankblake@juno.com; kenwkramer@aol.com; margot.sierraclub@austin.rr.com; cyrus.reed@sierraclub.org; eva.hernandez@sierraclub.org
Subject:	[EXTERNAL] Request by Houston Sierra Club to Extend Comment Period for Sabine Pas s to Galveston Bay Feasibility Study and EIS
Date:	Monday, September 21, 2015 12:10:47 PM

Dear Janelle,

On behalf of the Houston Regional Group of the Sierra Club (Sierra Club) I request from the U.S. Army Corps of Engineers an extension of the public comment period for the Draft Integrated Feasibility Report and Environmental Impact Statement for the Tentative Select Plan for the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Project. I request a comment extension of 20 days, from October 27, 2015 to November 15, 2015. 1

The Sierra Club needs this additional time to read this extremely large report, appendices, and EIS, make our analyses, assessments, and evaluations, and prepare comments.

The Sierra Club appreciates your consideration of this important issue. Thank you.

Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096
713-664-5962
brandtshnfbt@juno.com

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Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096

RESPONSE TO COMMENTS

Comment No.	Response
1	Thank-you for your interest in the study. USACE considered your request for a time extension, but do not see the need for an extension of comment period at that time.

From:	brandtshnfbt@juno.com
To:	Stokes, Janelle S SWF @SWG
Cc:	brandtshnfbt@juno.com; art.browning@gmail.com; elmerz@hal-pc.org; frankblake@juno.com; kenwkramer@aol.com; margot.sierraclub@austin.rr.com; cyrus.reed@sierraclub.org; eva.hernandez@sierraclub.org; Murphy, Carolyn E SWF @SWG; Tirpak, Sharon M SWG; Willey, Sheridan S SWF @SWG
Subject:	[EXTERNAL] Request by Houston Sierra Club to Extend Comment Period for Sabine Pas s to Galveston Bay Feasibility Study and EIS (UNCLASSIFIED)
Date:	Monday, September 21, 2015 3:18:54 PM

Dear Janelle,

Please tell me why specifically that the Corps has rejected my request on behalf of the Houston Regional Group of the Sierra Club (Sierra Club) for an extension of the public comment period. The email you sent me did not have this information and in fact gave no reason for the rejection of the request for more public comment time for the Sabine to Galveston Report/Appendices/EIS. Failure to provide a specific reason why a public comment extension request has been rejected is not transparent with the public for whom the Corps serves. 1

I just got through printing out over 600 pages of the report/appendices/EIS that is at the heart of this request. This is a lot of very technical information to absorb for a volunteer at the Sierra Club (which is an all volunteer run organization) who is not a professional engineer or coastal scientist. The 45 days, while the minimum that NEPA requires (CEQ regulation) can be extended by the Corps. In the past the Corps and other agencies have extended the public comment period for the Sierra Club for EISs for various projects. If the 20 day period requested by the Sierra Club appears to the Corps to be too much then the Sierra Club would accept a lesser amount of time.

I do not understand why the Corps has turned down the Sierra Club's reasonable request for additional time for the public comment period. I request an explanation.

Brandt Mannchen
Houston Regional Group of the Sierra Club
713-664-5962
brandtshnfbt@juno.com

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Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096

RESPONSE TO COMMENTS

Comment No.	Response
1	USACE determined that the request for an extension would not be granted because of schedule constraints faced in completing the report. USACE, as part of efforts to reduce the time it takes to complete studies, has required the use of SMART Planning Guidelines in developing study schedules. These requirements, which were codified in law by the Water Resources Reform and Development Act of 2014 (P.L. 113-121, June 10, 2014) were used in establishing a schedule for the completion of this study. USACE also endeavored to reduce the length of the report, while adequately addressing all potential significant impacts of the proposed projects. USACE advised Mr, Mannchen that his request would be kept in mind as the review period progressed and the need to extend the comment period would be reevaluated.

From:	brandtshnfbt@juno.com
To:	Stokes, Janelle S SWF @SWG
Cc:	brandtshnfbt@juno.com; elmerz@hal-pc.org; frankblake@juno.com; kenwkramer@aol.com; margot.sierraclub@austin.rr.com; cyrus.reed@sierraclub.org; eva.hernandez@sierraclub.org; Murphy, Carolyn E SWF @SWG; Tirpak, Sharon M SWG; Willey, Sheridan S SWF @SWG
Subject:	[EXTERNAL] Request by Houston Sierra Club to Extend Comment Period for Sabine Pas s to Galveston Bay Feasibility Study and EIS
Date:	Wednesday, September 23, 2015 4:01:12 PM

Dear Janelle,

Thank you for explaining why the Corps has not granted the Houston Sierra Club's request for an extension of the public comment time period for the Sabine Pass to Galveston Bay Feasibility Study and EIS. In the future, it would be transparent and helpful to the public to know that going into the NEPA process that the Corps has ruled out any extension of the public comment time period. Then the public would know what rules are being applied to its actions and know the reason for the action. 1

Brandt Mannchen
Houston Regional Group of the Sierra Club
713-664-5962
brandtshnfbt@juno.com

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Brandt Mannchen
Conservation Committee
Houston Regional Group of the Sierra Club
5431 Carew
Houston, Texas 77096

RESPONSE TO COMMENTS

Comment No.	Response
1	USACE considers requests for extensions of the public comment time period for Environmental Impact Statements based on the CEQ regulations 40 CFR Part 1501.8.

October 23, 2015

Ms. Janelle Stokes
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Ms. Stokes,

Enclosed are the comments of the Houston Regional Group of the Sierra Club (Sierra Club) for the U.S. Army Corps of Engineers (Corps) Draft Integrated Feasibility Report (FR) and Environmental Impact Statement (EIS) for the Tentatively Selected Plan of the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Project.

The Sierra Club, for the record, protests that the Corps turned down its September 21, 2015 request (see enclosure) to extend the October 26, 2015 public comment period for 20 days. The Sierra Club request was based upon the length of the document (over 700 pages for the Feasibility Report, Environmental Impact Statement, and Appendices). Even a 7 day extension of the comment period would have been helpful and much appreciated.

However, the Corps initially (see enclosure) turned down the Sierra Club and provided no reason for the rejection ("... but do not see the need for an extension of comment period at this time." See enclosure.). After the Sierra Club sent an email and demanded a reason for the rejection of its request for an extension of the public comment period (see enclosure) the Corps provided a reason ("... because of schedule constraints we face in completing the report." See enclosure.).

Because the Corps rejected the Sierra Club's request for an extension of the public comment period the Sierra Club was not able to read, review, analyze, assess, evaluate, and comment on Appendices F, G, H, J, L, M, N, R, S, and T.

The Sierra Club states for the record that the Corps has not demonstrated that it wants to assist the public in a transparent manner and encourage public participation and comments in the National Environmental Policy Act (NEPA) process as required or encouraged by the Council on Environmental Quality (CEQ) in Sections 1500.1(b); 1500.2(b); 1500.4(f); 1501.2(d)1.; 1501.4(b); 1502.1; 1502.8; 1502.12; 1502.14;Section

1502.19(c); 1503.1(a)4.; 1504.1(c); 1505.1(e); 1505.3(d); 1506.6(a); 1506.6(d); and 1506.6(f). This is a very sad situation.

1) **Page ES-1, Executive Summary (ES), Study Description,** the FR/EIS states a "recommended plan" will be developed for the Final EIS. This means that the public will have no ability to comment, then have the Corps respond to its comments as required by the draft EIS, and then have those comments published so the public can see how the Corps responded with regard to the final "recommended plan". 1

This removes from the public its ability to review and comment on a "recommended plan". This is not a transparent process to follow and the Sierra Club requests that the Corps put the "recommended plan" out for public review and comment; give at least a minimum of 45 days to review the "recommended plan"; then provide a response to comments for the "recommended plan"; and then publish these responses so the public an see how the Corps responded to public comments.

2) **Page ES-1, ES, Study Purpose and Scope, Pages 1-2 and 1-3, 1.3 Study Purpose and Scope, Page 4-1, 4.1 Problems and Opportunities, Page 7-1, Environmental Consequences, Pages 7-39 and 7-40, 7.13.2 EO 11988 Eight-Step Analysis, All Pages, Draft Appendix A, Measure Information Sheets, Pages 1 and 2, 1.3 Final Array of Alternatives, Draft Appendix C, Economic Analysis, and Pages 1-1 and 2-1 through 2-5,** it is not clear what the Corps means when it says "Because of cost and complexity, the decision was made to include only a programmatic assessment of potential projects in the Galveston region (Galveston, Harris, and Chambers Counties) and potential ER projects throughout the entire six-county study area." The Corps should explain in what sense a "programmatic assessment of potential projects" and "potential ER projects throughout the entire six-county study area" effects NEPA analysis and requirements. 2

The so-called "programmatic assessment of potential projects" and "potential ER projects" in **Draft Appendix A, Measure Information Sheets,** does not include "all reasonable alternatives" as required by NEPA. The purpose and need statement is so constricted that there is only one alternative, other than No Action, that the Corps analyzes. For instance, there is no alternative that looks at:

a. Have each large industrial facility either improve its existing levee (see **Page 2-19, 2.3.11 Hazardous, Toxic, and Radioactive Waste Concerns,** which refers to above ground tanks, like tank farms) and or construct a levee to protect its property (many companies have excess land where a levee can be built); looks at all of these companies joining together to do this; and or having these companies protect their property using their own money.

b. Have local, state, and federal officials put companies on notice that their fiduciary responsibility to stockholders and their responsibility to the nearby community to be a "good neighbor", not a nuisance", requires that they protect their assets from storm surge and if they do not do this during a storm then it is not an "Act of God" when damage occurs and they will be sued.

c. Certain parts of the coast should have significant buyouts as the best way to go (Bridge City, Gilchrist, Bolivar Peninsula, West Galveston Island, Shoreacres, LaPorte, etc.). There is no alternative that requires that particularly vulnerable areas (mentioned above) protect their public or move them back a safe distance from the Gulf of Mexico or Galveston Bay and that this should be a first step for any storm surge protection plan.

d. The implementation of zoning or protection of the shoreline, within Gulf of Mexico, Galveston Bay, and or other bays to keep these areas undeveloped. There is no alternative that puts protection of the natural shoreline, beach, dune, marshes, and San Luis Pass first rather than looking at these areas after an alternative has been proposed.

e. There is no alternative that results in the creation of a local and or state fund, similar to FEMA's federal floodplain buyout program, that would be available to people before or immediately after a storm so that vulnerable properties could be bought-out at market value when people voluntarily decide that they want to move out of harm's way.

f. There are no alternatives that combine alternatives (structural and or non-structural) in feasible ways to provide for stronger, broader, and more comprehensive results for alternative(s).

g. There are no alternatives that remove all or most subsidies from development of vulnerable areas along the coast so there is not a governmental incentive to build and put people in harm's way.

The Corps has not presented "all reasonable alternatives" as required by NEPA in its "programmatic assessment of potential projects" and "potential ER projects". Instead the Corps proposes for Galveston Bay, "Ike Dike" and significant parts of "Ike Dike" (elevated highways are the major portion of "Ike Dike") and other projects in a slightly different, but essentially the same as Ike Dike. The Corps has not done its job. In particular the Sierra Club does not support:

a. **Measure 1, Ike Dike,** the Corps gives an incomplete explanation of environmental impacts including the disturbance of one of the last natural passes on the Upper Texas Coast, San Luis Pass, loss of beach, dune, and marsh habitat in front of the dike, interruption of the sediment movement mechanisms for Galveston Island and Bolivar Peninsula, requirement for perpetual beach re-nourishment, and others.

b. **Measures 3-1, 3-2, and 3-3, Port Arthur, Texas City and Freeport Texas Hurricane Flood Protection,** there is a lack of detailed information about the proposals and mitigation that is required.

c. **Measures 3-4, 3-5, 3-6, 3-7, and 3.8, County-Wide Protection System in Orange and Jefferson Counties,** which would implement huge storm surge protection structures where it is more appropriate to buyout exposed and vulnerable residential and commercial structures.

d. **Measures 3-9, 3-10.1, 3-10.2, 3-10.3, 3-10.4, 3-10.5, and 3-10.6, local surge protection,** for various communities in the Houston Area.

e. **Measures 4-1, 4-2.1, 4-2.2, and 4-2.3, Measure 4-1 and 4-2.2,** are the Ike Dike by another name, and Measures 4-2.1 and 4-2.3, are the Ike Dike extended to Jefferson, Chambers, and Brazoria Counties.

f. **Measure 5-1, Chenier Ridge Restoration,** in Jefferson County this would not work due to climate change and the use of Bermuda Grass would make this a desert for wildlife and native plants.

g. **Measure 5-2, Beneficial Use of Dredged Material for Shoreline Nourishment at Texas Point, Jefferson County,** because there is not enough information about this alternative.

h. **Measures 5-3, 5-6, 5-7, 5-8, 5-11, 5-12, and 5-13, Dune and Beach Restoration at various places,** some of these locations may make sense but there is not enough information about the location and amount of sand available to restore all of these areas in perpetuity. Long-term restoration is in danger due to rising sea level.

i. **Measures 5-5, 5-9, and 5-15, construction of breakwaters at various places,** breakwaters make distribution of sediment via longshore current impossible and San Luis Pass, one of the last natural passes on the Upper Texas Coast, would be modified and disturbed by this proposal.

j. **Measure 5-16, Groin at SH 332, Brazoria County,** this will interfere with longshore current sediment transport.

k. **Measures 6-1.1, 6-2, 6-4.1, 6-5.1, 6-6.1, 6-6.2, breakwaters in various locations,** which would interrupt sediment transport.

l. **Measures 7-1 and 7-2, Shoreline Protection breakwaters for East Bay and Bastrop Bay,** the breakwaters typically interrupt sediment transport.

3) **Page ES-3, Problems and Opportunities and Pages 2-8 and 2-9, 2.3.2 Storm Surge Effects on the Study Area,** the FR/EIS states "Both hurricanes resulted in significant impacts on ... forested wetlands" and "as well as downed trees from surge and winds". These impacts should be presented and discussed. If tree blow down is one of the impacts the Corps should remember that snags (standing dead trees) and downed trees are "biological residuals" that help a forest recover from a "natural disturbance". They are not inherently bad and in fact are part of the "ecological functions" that the Corps talks about restoring in wetlands. So their presence and function (organic and nutrient sources, erosion control structures, wildlife shelter and food, etc.) and the ecological succession that occurs afterwards are natural and desirable and not bad (impacts). 3

4

4) **Page ES-3, Problems and Opportunities and Page 2-8, 2.3.2 Storm Sure Effects on the Study Area,** the FR/EIS fails to state that hurricane storm surge of high salinity water killed, injured, and reduced in number non-native invasive plants like Chinese Tallow. This is a positive effect of storms. Other positive effects are the provision of sites for new vegetation, ecosystem succession, removal or redistribution of excess sediments and organic wastes and nutrients, etc., should be enumerated so the public understands that hurricanes and other storms are "agents of change" which bring both good and bad (in human terms) changes to ecosystems on the coast. 4

The FR/EIS fails to state that San Luis Pass in one of the last natural passes left on the Upper Texas Coast (see its importance for Piping Plovers mentioned on **Page 2-18, 2.3.8 Threatened and Endangered Species**) and thus it is very important not to alter its current functions via the proposal. The long-term impacts of storms on the environment should be discussed very clearly.

5) **Pages ES-3 and ES-4, Planning Objectives and Page 5-8, 5.4.1 Final Screening Criteria and Page 7-2, 7.1.2 Final Screening Criteria, Draft Appendix B, Plan Formulation,** the only objective that uses the phrase "where feasible" is Objective 3, which deals with coastal habitat. Every other alternative does not have this weakening phrase so that the implementation of Objectives 1, 2, 4, 5, and 6 are not qualified by a phrase that makes implementation less likely. This shows bias by the Corps and less of a commitment to environmental protection, maintenance, and restoration than to economic and human focused financial objectives. Protection of the environment should not be optional in this FR/EIS. 5

6) **Page ES-4, Planning Objectives,** the FR/EIS states that "reducing life-safety risk is a primary objective of the study". However, the Corps does not conduct a study to determine how much the proposal will induce population growth and increased development in the areas to be armored. A document is used which refers to other states and parts of the United States instead of our area. This is specious reasoning that is not supported by past events.

6

Page 1.3, 1.5 Study Area, Page 4-1, 4.1.1 Problem Statements Page 4, 1.5.1 Project Need, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis, the FR/EIS states that there are five million people that reside in the study area and that 2.26 million of those people, or 45.2%, "live within storm-surge inundation zones". Then the FR/EIS states that in the future there will be nine million people in the next 50 years that will live in the study area. Just using the present 45.2% figure of people that live in the study area (assuming no increase in percent of people that live in the storm-surge portion of the study area) and multiplying this number by nine million means that in 50 years 4,068,000 people will live in the storm-surge portion of the study area (an increase of 1,808,000). More people will be in harm's way and it can no longer be assumed that levees or other structural measures will not fail, since we saw this happen in 2005 in New Orleans with Hurricane Katrina. Using the alternative recommended in the FR/EIS will put more people in harm's way in 50 years and not less. This is in opposition to Objective 2 which calls for a reduction in risk to human life. This proposal does not keep people out of harm's way.

7) **Page ES-4 through ES-6, Formulation of Alternative Plans,** the FR/EIS reports that the Corps cleverly decides that all alternatives, except the one it supports, are not appropriate for some reason(s). This is even though, as mentioned above, that all reasonable alternatives are not considered. This is a sad reflection on the procedure and process used to determine all reasonable alternatives. 7

8) **Pages ES-6 and ES-7, Future Without Project Condition and Page 3-1, Future Without Project Conditions,** this analysis is not realistic ("... it is assumed that no project would be implemented by the Federal government or by local interests to achieve the planning objective") and is biased since the Corps knows that people will do something to protect their property and lives even if the chosen alternative is not implemented. The Corps should have determined the most likely measures that will be implemented in the next 50 years to address sea level rise, shoreline erosion, and hurricane and storm surge if the chosen alternative is not implemented and then state what these measures are (for instance, zoning and buyouts) and how they affect the objectives. People do not sit idly by and allow themselves and their property to be destroyed. People will either construct some protective measures or implement procedures or will leave the endangered area. **The Corps assumption here is not realistic and should be changed.** 8

9) **Pages ES-7 and ES-8, Finally Array Evaluation Results and Recommended Plan and Pages 1-4 and 1-5, 1.6 Project Area,** the FR/EIS fails to analyze, assess, and evaluate the impacts of the one alternative (NEPA requires all reasonable alternatives and the Corps is not in compliance with NEPA by evaluating only one alternative other than "No Action" which is required for analysis by NEPA) chosen on nearby areas or parts of this one alternative. For example, all of the human created levees, channels, and other structures in the Freeport area have already caused additional erosion of soil and shoreline and sedimentation in the area (up-coast and down-coast), silting of the San Bernard River outflow to the Gulf of Mexico, loss of soil at state-owned Bryan Beach, and other impacts. When hurricanes or other storms affect the Freeport area storm surge waves will not be able to move inland and dissipate their energy on the beach, marshes, dunes, and other features of the coast because the levees and other structures contemplated or already in place will be in the way. **The impacts on other parts of the Freeport area from further armoring are not discussed or stated. This is a significant deficiency in the FR/EIS.** 9

10) **Pages ES-8 and ES-9, Public Coordination and Pages 9-1 through 9-3, 9.1 Public Involvement Activities,** the public scoping, etc. was not extensive for the general public. Other than the four scoping meetings the general public, including the Sierra Club, were not invited to "stakeholder briefings" or "resource agency meetings" or had "close communications" with those who want the "Ike Dike" or "SSPEED Center" alternatives. It is particularly inappropriate to include these communications since the Galveston area is not included in this FR/EIS. Another FR/EIS will cover the Galveston area in the future. The Sierra Club considers itself a "stakeholder" but was not invited to briefings. It is not appropriate for the Corps to keep some organizations out of the loop 10

with regard to information while favoring others. The Corps in summing up what the general public wants said very little about what the Sierra Club comments stated.

11) **Page ES-10, Areas of Controversy and Unresolved Issues,** the Sierra Club disagrees with the Corps that "There are no other controversies or unresolved issues with the study results at this time." These Sierra Club comments state clearly that there are controversies and unresolved issues. 11

12) **Page 1-1, 1.2.1 General Authority and Page 4, 3 Project Authorization, Draft Appendix E, Real Estate,** the Sierra Club does not see any specific "water quality" improvements in this FR/EIS proposed for implementation. 12

13) **Page 1-2, 1.3 Study Purpose and Scope,** the reason this study was expanded and hurried up was due to the response to Hurricane Ike. 13

14) **Page 1-7, 1.10.1 Existing Coastal Storm Risk Management Projects,** it is not clear how long each part of each portion of the one alternative (Orange, Beaumont, Port Arthur, and Freeport areas), will take to construct. In one place in the FR/EIS "three years" is stated but more than three years will be needed to construct all of these projects. The Corps should state clearly how long each project will take to complete in the main body of the FR/EIS so the public knows how much time will elapse between approval and when construction is completed. 14

15) **Page 2.7, 2.3.1 Description of the Ecological Region,** the reference for number of different types of geese is from 1964 (Buller). This reference is 51 years old and many changes have occurred to goose populations and where they reside on the Upper Texas Coast. A newer source of information is needed for this population estimate. 15

16) **Page 2-8 and 2-9, 2.3.2 Storm Sure Effects on the Study Area,** the FR/EIS lacks recent data or documentation for Pre-Ike and Pre-Rita ecological information. 16

17) **Page 2-10, 2.3.3 Attenuation of Storm Surge Impacts by Coastal Wetlands,** the FR/EIS states that "... the model results show that the surge probably increased in height by 1 foot per 8.7 miles of inland penetration because the surge piled up against the levee." The FR/EIS should discuss this scenario and its likelihood with regard to the one alternative that is analyzed that has massive levee and floodwall construction in three locations on the Upper Texas Coast (not to mention Galveston Bay that will have similar proposals in a separate document). 17

18) **Pages 2.10 and 2-11, 2.3.4.1 Sabine Region,** the FR/EIS states that "Remnant dune/beach systems exist along the coastline, although much has been lost through erosion and shoreline retreat, leaving only a low-lying washover terrace." The FR/EIS should also include "sea level rise" as a factor that causes erosion and shoreline retreat. 18

19) **Page 2-13, 2.3.4.2 Galveston Region,** the name of the Scenic Galveston preserve is the "John O'Quinn I-45 Estuarial Corridor" not the "O-Quinn Preserve". The FR/EIS 19

says that "Virginia Point Peninsula Preserve is owned by the GLO". This is incorrect. Scenic Galveston owns the Virginia Point Peninsula Preserve.

20) **Page 2-20, 2.3.13 Energy and Mineral Resources,** the FR/EIS fails to include fully the costs for moving pipelines, etc., because "In-depth research and surveys would be needed to identify pipelines for detailed pre-construction planning and design". This means that the costs are underestimated and that the public does not know what the costs of the proposed alternative truly are. **20**

21) **Pages 2-21 and 2-22, 2.3.14 Socioeconomic Considerations,** the FR/EIS verges on "scare-mongering" by reporting how many homes were left standing after stroms. If these areas are that vulnerable then the people should be bought-out so that they are no longer in harm's way. **21**

22) **Pages 3-4 through 3-7, Port Arthur and Vicinity CSRM Project Area and Freeport and Vicinity CSRM Project Area,** local sponsors should fix the deficiencies of their storm surge protection systems. The FR/EIS must state clearly how big a hurricane or storm that each portion of the one alternative (other than No Action) that it analyzes can withstand over the 50 year period. The FR/EIS does not state how many of these storms (strength) each portion of the one alternative it analyzes can withstand. **If the "local sponsor has no current plans to address the risk drivers" then the Corps should not feel obliged to accept this risk and build a project. The local decision-makers have spoken.**

22

The Corps mentions a 130 year event but does not state here how much protection it wants this one alternative to have that it analyzes. If the sponsor has no current plans to address the "structural risk drivers" then the local decision-makers have spoken and the Corps should not feel compelled to bail them out because they are willing to accept the risk by not paying the operation and maintenance costs for protection. If these sponsors cannot guarantee operation and maintenance of the current system of storm protection how will they be able to do so with a more complex and larger system? It is worth noting that the 130 year event system protective capacity that already exists is better than the 100 year event protective capacity that the **Page 3.7, 3.2.1 Initial and Evaluation Array of Alternatives,** is modeled for.

23) **Page 3.9, Orange-Jefferson CSRM,** certain communities could be abandoned (bought-out) but the FR/EIS does not use this alternative as part of the one alternative that is analyzed by the Corps. **23**

24) **Page 3-7 through 3-13, Economic Conditions,** the FR/EIS assumes that all values are estimated correctly and then property will be protected if storm surge is prevented or reduced. This is not accurate since wind causes damage (downed trees, power-lines, damaged roofs that cause rain damage to internal contents of houses, etc.) even if storm surge is prevented or reduced. **24**

25) **Page 3-13 and 3-14, 3.3 Environmental Conditions,** the FR/EIS errs in saying that "tropical storm events, hurricanes ... has increased ecosystem vulnerability on the upper Texas coast." Storms are part of the natural system of disturbance that helps create change in ecosystems, ecological succession, and rejuvenation of ecosystems. Just talking about damage and vulnerability is not ecologically correct. Levees and walls don't help ecosystems. They fragment and alter connectivity between ecosystems and interrupt natural change in ecosystems. **25**

26) **Pages 3-14 through 3-16, 3.4 Life Safety,** it is significant that the FR/EIS does not define "the population at risk and the depth of flooding is evaluated in a risk assessment, which was not performed in this study." So in reality the public does not know from the FR/EIS what the actual risk is that the proposed alternative is supposed to protect people from. This makes no sense. **26**

27) **Page 3-15, 3.4 Life Safety, Page 44, 2.5.2 Life Safety Considerations, and Page 7-19, 8.1.6 Life Safety, Draft Appendix B Plan Formulation,** the FR/EIS states "Southeast Texas Altering Network". The Sierra Club assumes the Corps means "Alerting" and not "Altering". **27**

28) **Pages 3-16 through 3-18, 3.5 Critical Infrastructure, Pages 45-69 2.5.3 Critical Infrastructure, Draft Appendix C, Economic Analysis, and Pages 7-19 through 7-22, 7.1.7 Critical Infrastructure,** it is not clear if the FR/EIS double counts some of the chemical manufacturers and petroleum refineries since Jefferson County is mentioned under two different CSRM's. **28**

The Sierra Club argues that, on a local level, a chemical manufacturing facility and petroleum refinery are not critical infrastructure like roads, schools, hospitals, water treatment plants, waste-water treatment plants, fire departments, and police departments. The FR/EIS should distinguish between what is needed to get people going again locally and what is needed on a larger scale.

29) **Pages 3-18 and 3-19, 3.6 Relative Sea Level Change and Page 5-22, 5.4.3 Comparison of Alternative Plans, Page 7-3, 7.1.1 Final Screening Criteria and Page 7-23, 7.1.8 Relative Sea Level Change, Draft Appendix B, Plan Formulation,** at a minimum the 20, 50, and 100 year sea level rise costs/impacts, which include construction, operation, maintenance, repair, replacement, and financing costs that sea level rise creates, must be covered by the FR/EIS. **29**

30) **Page 4-1, 4.1 Problems and Opportunities and Pages 5-4 and 5-5, 5.3.1 Initial Array of Alternatives,** the FR/EIS states the "Problem and opportunity statements ... were initially developed in collaboration with ... the affected public." The Sierra Club was not invited to collaborate with the Corps to develop problem and opportunity statements.

The FR/EIS is confusing because it states that "The following in-depth alternative analyses and recommendations do not include CSRM projects in the Galveston Region **30**

or ER projects throughout the six-county study area" but then goes on to prepare Problem Statements, Opportunity Statements, Planning Goals and Objectives, Planning Constraints, and Evaluation Array Alternatives for the Galveston Region and ER projects for the six-county area. This information for the Galveston Region and ER projects should be placed in their respective documents that will be prepared for those proposals and not in this FR/EIS.

31) **Page 4-2, 4.1.1 Problem Statements,** the FR/EIS states that "If the ridges and marshes disappear, saltwater inundation will result ... eliminating the protective buffer." The FR/EIS should state clearly if this process is inevitable. **31**

If the area is a "geologically sand-starved system" then it is important not to prepare ER or other alternatives that require beach re-nourishment every few years which will be very expensive and temporary in nature and not in perpetuity. The FR/EIS should determine whether it is worth fighting nature on the inevitable.

A storm track that was 30 miles away is not "slightly to the south". The FR/EIS should define what it means by "slightly" so the public knows how this term is defined and measured.

32) **Pages 4-2 and 4-3, 4.1.2 Opportunity Statements,** the FR/EIS should tell the public what the risks are to "commercial and residential property, real estate, and infrastructure" and how much these risks will be reduced with the proposed alternative. The FR/EIS should also state how "ecotourism and recreation opportunities" will be enhanced. The FR/EIS should state what the risks are for "evacuation routes" and how much they will be reduced. The FR/EIS should state how much environmental damage will be reduced with regard to refinery infrastructure. The FR/EIS should state how communities will be more resilient. Building walls and levees does not make communities more resilient. Building better housing, utilities, emergency services, etc., are examples of more resilient activities. **32**

33) **Page 4-3, 4.2.2 Public Concerns,** the FR/EIS should do a better job of enumerating public concerns. The ones mentioned are not fully descriptive of what the Sierra Club and others submitted. The Corps should attach the scoping comments of the public so that people know who submitted comments and what these comments said. **33**

34) **Page 4-4 4.2.3 Planning Objectives and Page 4-5, Table 4-1 Sabine Pass to Galveston Bay, Texas Planning Objectives and Measurements and Page7-3, 7.1.3 FWOP Conditions Updates for the Final Array of Alternatives,** the NED and RED appear to cover some of the same economic factors and during the analysis process will double count economic importance and under count environmental importance. There appears to be no requirement that all costs which include construction, operation, maintenance, repair, replacement, and financing costs will all be calculated and revealed completely. Environmental quality appears to be given less consideration than **34**

economic factors. The present risk is not given and how much it will be reduced with the proposed alternative.

The FR/EIS states that "The location of the new levee alignment and the design of the culvert system minimized impacts on wetlands and floodplains, both inside and outside the system, to the greatest extent practicable." It would be helpful for the public to see schematics that document the natural flow of water to wetlands and floodplains and then show how the culvert system will duplicate or mimic this system in areal extent, duration, and magnitude.

35) **Page 4-7, 4.3 Related Project Documents and Page 46, 2.6.2 Sabine Region, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS fails to include the 1979 U.S. Army Corps of Engineers study, **"Feasibility Report, Texas Coast Hurricane Study, Volume I, Main Report, and Volume II, Bay Area Report, Galveston Bay Study Segment," and "Sabine Lake Study Area".** This study covers the entire Texas Coast and should be considered and documented in this FR/EIS as being an important source of information for alternatives. 35

36) **Page 5-1, 5.1 Plan Formulation Rationale,** the "Acceptability" criteria leaves a lot of room for subjectivity and arbitrariness to bias alternative analysis, evaluation, and assessment. The FR/EIS states that "lines of communication were opened with ... the affected public." The Sierra Club was not included in stakeholder briefings that the Corps held. This is not good public outreach. 36

37) **Pages 5-2 and 5-3, 5.2 Management Measures,** nonstructural measures should also include buying lands in the floodplain and surge area that do not have structures on them so that those lands can never be developed and people will not be put in harm's way.

The Charette does not fully cover criteria that should be used when the evaluation of initial array of alternatives was done. Implementation costs (which is not defined so the public does not know what costs this covers), damages reduced, and environmental benefits are criteria chosen for this evaluation. **However, environmental damages caused by an alternative and financing costs of an alternative are not used as criteria. These two criteria should be added to the evaluation of alternatives process.** 37

38) **Pages 5-4 through 5-9, 5.3.1 Initial Array of Alternatives, 5.3.2 Evaluation Array of Alternatives, 5.3.3 Scoping of Study under 3x3x3 Guidelines, Final Array of Alternatives, 5.4 Comparison of Final Array of Alternative Plans and Decision Criteria, 5.4.1 Final Screening Criteria, and 7 Environmental Consequences,** the FR/EIS so constricts alternatives that it effectively screens out all but the one alternative that is proposed. This means that "all reasonable alternatives" are not evaluated (or compared) in the FR/EIS and that only one alternative, plus the No Action alternative, is analyzed, assessed, and evaluated in the FR/EIS. This does not meet the spirit and letter of NEPA and Council on Environmental Quality (CEQ) regulation/rules.

CEQ regulation/rules, **Section 1502.14 Alternatives including the proposed action,** state that "This section is the heart of the environmental impact statement ... it should present the environmental impacts of the proposal and the alternatives **in comparative form,** thus sharply defining the issues and providing a clear basis for **choice among options** ... (a) Rigorously explore and objectively evaluate **all reasonable alternatives** ... (b) **Devote substantial treatment to each alternative** ... so that reviewers may **evaluate their comparative merits** ... (c) **Include reasonable alternatives not within the jurisdiction of the lead agency".**

Choosing one alternative to analyze (other than the baseline No Action Alternative) emasculates NEPA and is a false choice because there is not only one alternative that meets the **Page 1-2, 1.3 Study Purpose and Scope.** The actual purpose and scope is not given on **Page 1-2, 1.3 Study Purpose and Scope,** since the FR/EIS simply refers to the "Coastal Texas Protection and Restoration Study" authority and says that CSMR projects are the focus. The purpose is not to look at projects but to respond to need(s) like surge protection. The FR/EIS must do a better job of stating clearly what the purpose and need for the projects are. NEPA and CEQ regulation/rules expect more than one alternative so that the **"comparative merits"** of alternatives are provided to the public. The FR/EIS does not do this and is not in compliance with NEPA and CEQ regulation/rules. **38A**

Page 5-5, Table 5-2 Criteria for Screening Initial Array of Alternatives, "sensitive habitat" is not a broad enough criteria to cover the losses that wildlife will incur. "Wildlife habitat" should be used as the criteria. Operation and maintenance impacts should be considered in addition to construction impacts. **38B**

Page 5-5 5.3.2 Evaluation Array of Alternatives, the FR/EIS does not use environmental quality costs to separate alternatives. Therefore, economic factors, "the primary determining factor was cost" are used to the exclusion of environmental costs of alternatives. This is biased analysis. What further biases the analysis is that the public is not given documentation that can be used to compare all alternatives that were dropped with the alternative that was chosen. This action hides from the public what the "comparative merits" are of all reasonable alternatives and ensures that the FR/EIS is not in compliance with NEPA and CEQ regulation/rules. **38C**

Page 5-9, 5.4.1 Final Screening Criteria, the acronym EAD is not found in the "List of Acronyms" at the beginning of the FS/EIS. This must be changed. It is not appropriate that the 20, 50, and 100 year sea level rise scenarios were not used for the EADs. If the RED and OSE objectives, Objectives 4 and 2, are qualitatively discussed there is no way that economic impacts of petrochemical supply related interruptions and reduced risk to human life can be calculated. However, figures on **Page 4-2, 4.1.1 Problem Statements,** of "$60 billion economic loss due to closure of the Houston Ship Channel" are used which biases this FR/EIS. These statements must be removed because they are supposed to be "qualitative" and not "quantitative". **38D**

39) **Page 5-11, 5.4.2.2 Orange-Jefferson CSRM Project Area, Economic Evaluation,** the FR/EIS states that "Fish and wildlife mitigation costs were included in the economic evaluation." The Corps should state what the costs are and what mitigation will be conducted. In other parts of the FR/EIS, mitigation of wetlands is not documented and will be provided at a later time. The FR/EIS should state whether this is true for this alternative. **39**

40) **Page 5-15, 5.4.2.3 Port Arthur and Vicinity CSRM, Economic Evaluation,** the FR/EIS states "Environmental impacts and associated mitigation cost were not needed in the comparison." The Corps should not be arbitrary and capricious about costs. If there are costs they should be reflected in every alternative and each part of an alternative. The public must have this information so that it can review and comment about the adequacy and appropriateness of environmental costs and mitigation for those costs. **40**

41) **Page 5-15, Dow Barge Canal Protection,** the FR/EIS should contain costs for keeping the dead-end barge canal supplied with sufficient dissolved oxygen (D.O.) so that fish kills or suppression of aquatic habitat and organisms does not occur. There is no such mitigation mentioned in the FR/EIS to address this problem. **41**

42) **Page 5-19, 5.4.2.4 Freeport and Vicinity CSRM, Economic Evaluation,** the FR/EIS states "Environmental impacts and associated mitigation cost were not needed in the comparison." The Corps should not be arbitrary and capricious about costs. If there are costs they should be reflected in every alternative and or part of an alternative. The public must have this information so that it can review and comment about the adequacy and appropriateness of environmental costs and mitigation for those costs. **42**

43) **Pages 5-19 and 5-20, 5.4.2.5 Brazoria and Sabine Nonstructural and Page 7-36, 7.1.15 Sabine and Brazoria Nonstructural Buyouts,** the FR/EIS states that "Buyout opportunities in Brazoria are virtually non-existent and very limited in both Orange and Jefferson Counties ... The analysis showed the nonstructural buyouts had negative net benefits and any potential buyouts were screened from the analysis." These statements are misleading and biased. There are many structures that could be bought out to reduce storm surge risk in Brazoria, Jefferson, and Orange Counties. **43**

Page 2-21 of the FR/EIS states when referring to damage caused by Hurricane Ike that "Entire cities were inundated with the mud and debris that accompanied the surge. In the small town of Bridge City, only 14 of 3,400 homes were habitable after the storm". Certainly, a buyout of 3,400 homes would not be insubstantial and it would have positive benefits because any buyouts later, after rebuilding occurs, will be more expensive. The Corps should not bias buyout options in this FR/EIS.

44) **Page 5-20, 5.4.3 Comparison of Alternative Plans, Page 7-34, 7.1.13 Freeport and Vicinity CSRM, South Storm Levee, and Page 19, South Storm Levee Raise, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis**, the FR/EIS states "In the Freeport and Vicinity CSRM project area, all Alternative

Reaches had positive net benefits except the South Storm Levee." If the South Storm Levee reach will be dropped the FR/EIS does not address what happens if this levee fails because it was not strengthened. 44

Page 5-17, South Storm Levee, states "The south storm levee is a frontal levee that has potential for direct wave impact from the Gulf of Mexico during storm loading." The Corps never discusses what happens if the South Storm Levee fails. The FR/EIS must state what effect this will have on the Freeport and Vicinity CSRM project. Although the Corps states that south of the South Storm Levee there are disposal areas that are as high or higher than the South Storm Levee there is no proposal to consolidate these disposal areas to ensure that they withstand storm impacts. Their failure or erosion could lead to the breach of the South Storm Levee. The FR/EIS must give a complete picture of what happens to the proposal if other structures in the area fail. The impacts must be thorough discussed and mitigated. Just because a levee is tall does not mean that it cannot have weakened areas and cannot fail. Are the disposal areas and South Storm Levee safe?

45) **Page 5-22, 5.4.3 Comparison of Alternative Plans,** no ER projects and their costs were considered important because they were removed from this study as the FR/EIS states, "Objective 3 **(Page ES-3, Objective 3: Maintain and or restore coastal habitat that contributes to storm surge attenuation where feasible for the 50-year period of analysis)** was removed from consideration in this planning study from an ER implementation standpoint. Opportunities to meet these objectives **could be** pursued under different study authorizations."

The Corps admits that there is no guarantee that ER will be pursued merely that it "could be" under some other process. The FR/EIS further states that "The ER objective achieved in this study through avoiding, minimizing ... impacts on existing habitats." This is not the same (mitigation) as ER and the Corps is aware of this. Why it would state it in this manner is of great concern. The FR/EIS does not consider the impacts that ER projects can have on protection of people and does not include regular mitigation costs in the project proposals. It is like the "environment" does not exist to the Corps. How shameful and illegal to use NEPA where it does not consider mitigation, costs, and ER. The public must have this information so that it can review and comment on the adequacy and appropriateness of this proposal. The Sierra Club believes this direction for the study is bankrupt, ignores environmental impacts, and mitigation should be in sync with project alternatives. 45

46) **Page 5-27, 5.4.5 Selection of the Recommended Plan,** the FR/EIS fails to consider non-structural alternatives that move people out of an area (evacuate) if they are elderly, disabled, or lack transportation, move people out of an area who are in good health quicker, etc. These types of non-structural alternatives are much cheaper with a higher benefit-cost ratio than building huge levees and walls.

The reality of the FR/EIS is finally stated here when the FR/EIS says "Most importantly, increased protection would also avoid disruption of significant industrial and manufacturing facilities located in the project area". The FR/EIS never addresses why

these multi-billion dollar corporations cannot and will not protect their assets themselves as required so that stock-holder's interests are protected. The FR/EIS does not address why public money is used for private subsidy, liability, and economic gain. This type of action is crucial to the acceptance of more debt for federal, state, and local governments that have millions, billions, and trillions of dollars of debt. The Corps should ask and answer why is a public subsidy needed when these corporations are able to pay to protect themselves. Failure to invest in protection of assets and safety of the community (the good neighbor policy) makes these corporations unqualified to get public subsidies. The FR/EIS never states why a one foot raise in a levee cannot and should not be paid for by these huge corporations. **46**

47) **Page 5-30, 5.4.5 Selection of the Recommended Plan,** the FR/EIS states "In addition, the current TSP could result in larger future project modifications to account for RSLC in the Orange-Jefferson CSRM project area". This means that this entire FR/EIS is pointless since the public is told that a 1 foot increase is needed but may be required to pay for a 3 foot increase. The public does not know what proposal it should review and comment on. This is arbitrary and capricious since the Corps should decide now what proposal it supports. The FR/EIS states "This expense would be minimal compared to the significant expense of project replacement in the future." This can be said for many projects and makes no sense. Any costs are not "minimal" for taxpayers either locally or federally. **47**

48) **Pages 5-31 through 5-39, 5.4.6.1 WVA Modeling of Alternatives, 5.4.6.2 Orange-Jefferson CSRM Project Area, Table 5-14: Direct and Indirect Wetland Impacts of Orange 1, 2, and 3 Alternatives, 5.4.6.3 Port Arthur and Vicinity CSRM Project Area, and 5.4.6.4 Freeport and Vicinity CSRM Project Area,** the FR/EIS apparently cannot provide impact assessment for all the areas identified as vulnerable to RSLC since it states that it can do this only for "most of the areas". This is not acceptable. The public needs a comprehensive assessment of environmental impacts not an approximation. **48A**

Page 5-33, the FR/EIS does not show what its **flow maintenance plan** is with respect to installation of culverts versus what flows through tributaries right now. The FR/EIS should state what if any tributaries and overflow areas will not be reconnected with culverts, where this happens, and why this happens both inside and outside the levee system. The FR/EIS should state clearly if any freshwater flows and the extent of flows (the area covered) would shrink due to this proposal. **48B**

Pages 5-31 through 5-39, the FR/EIS fails to include cumulative impacts that are due to greater population growth (from 5 million people to 9 million people in 50 years) and greater development that includes more waste-water, hazardous waste, bacteria pollution, air pollution, from just finished and presently expanding refineries and chemical plants and future growth from these facilities and associated businesses. This will occur due to the "false sense of security" that more levees, taller levees, levees covering more area, and other structures will provide. All the Corps has to do is look at when the existing levees were built and what construction occurred after they were built.

Wetlands losses will also be higher due to this increase in population and development but this is not shown on **Table 5-14.** **48C**

Page 5-33, higher tidal inundation does not necessarily improve fisheries since the levees and walls create more fragmentation, less connectivity, the loss of wetlands, the reduction of sediments, organic matter, nutrients, and freshwater in certain areas. Such overly broad and biased statements have no business in an objective FR/EIS. **48D**

Page 5-35, the loss of essential fish habitat (ESH) bottom habitat cannot be mitigated by structures which provide hard bottom habitat in the same area. These are two different habitats and the Corps assumes that it is okay to mitigate "out-of-kind" habitat when this is not the case. Soft bottoms and hard bottoms provide totally different habitat for marine, brackish water, and freshwater organisms. The FR/EIS fails to state that hard bottom habitats may make it easier for invasive species like Zebra Mussels to spread and effect native ecosystems. This is a negative environmental impact that should be acknowledged and analyzed in this FR/EIS. **48E**

Page 5-35, the FR/EIS fails to address light and noise pollution for these alternatives as it should and ignores the cumulative impacts of increased population and development from construction equipment for projects that occur due to the increased population (more air pollution, water pollution, noise pollution, light pollution, etc.).

Page 5-36, the FR/EIS should state plainly how many years it will take (an estimate is fine), from signing the Record of Decision, to build each part of this alternative. The public must know how long they will have to endure impacts (noise, light, air pollution, water pollution, etc.) from the construction of this alternative and what will occur if a storm hits the area before construction is complete. **48F**

49) **Page 6-3, 6.1.1.1 Orange 3 New Levee (11-Foot), Page 6-4, Jefferson Main New Levee (11-Foot), and Page 6-17, Relative Sea Level Change,** the FR/EIS states there is "no provision for future sea level rise, waves on top of the surge level, and additional minimum freeboard for wave overtopping in project design or cost" and "This approach provides information about adjacent impacts but does not include calculation of still water level overtopping." This makes no sense. Such protection should be built into the alternative and cost and environmental estimates should be provided for this level of protection since a proposal without this level of protection would not be safe and appropriate. **49**

50) **Page 6-4, 6.1.1.1 Orange 3 New Levee (11-Foot),** the FR/EIS states "... there are going to be several challenges in implementing this reach of the project that will add considerably to its construction cost." All construction costs, including pipeline and other re-locations, must be part of the estimated cost so the public can see how many tax dollars are required. **50**

51) **Page 6-4, Beaumont A New Levee (12-Foot),** since this proposal will protect ExxonMobil the Corps should ensure that this private, multi-billion dollar corporation **51**

pays for its own protection. There is no need for tax-payer subsidies for additional protection. Exxon/Mobil can take care of itself.

52) **Page 6-5, 8-10-Foot I-Wall Raise (1-Foot) and Page 6-7, Old River Levee Raise at DOW Thumb (1-Foot) and Pages 14, 15, 16, 20, 21, 32, and 33, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS for Port Arthur and Vicinity CSRM Project Area refers to a "brittle failure". The FR/EIS should explain what this is so the public understands what is discussed. 52

53) **Page 6-6, DOW Barge Canal Protection,** the FR/EIS states about the Freeport and Vicinity CSRM Project Area that "Additional tidal circulation would be provided". The Corps should require, as mitigation for this dead-end canal, additional oxygen be placed in the water to reduce the possibility of fish kills in the in-river aquatic ecosystem. 53

54) **Page 6-7, DOW Barge Canal Protection,** the FR/EIS fails to provide the cumulative impacts of population growth and development due to implementation of the Freeport Harbor Channel Improvement Project. Cumulative actions with impacts include the widening of State Highway (SH) 36 up to and beyond Waller County (Prairie Parkway). This is a connected and cumulative action with environmental impacts that should be assessed with this FR/EIS. 54

55) **Pages 6-7 through 6-9, 6.1.3.1 Summary of Environmental Impacts,** in the FR/EIS, for Fish and Wildlife Mitigation, the Corps fails to include cumulative impacts on wetlands and other environmental issues due to other past, present, and future foreseeable actions like the Freeport Harbor Channel Improvement Project, widening of SH 36, and the proposed Prairie Parkway. 55

56) **Pages 6-9 and 6-10, 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan and Page 6-12, 6.3 Real Estate Considerations,** the FR/EIS should explain what "to the extent practicable", "to the greatest extent practicable", and "to the extent possible" mean with regard to mitigation and or real estate. **The fact that the mitigation plan is not complete means the public will not be able to comment on it, get a Corps response back as is required by CEQ NEPA regulation/rules, and be able to review and respond to the Corps response**. This means the public cannot easily make its concerns known and get any feedback from the Corps. **Section 1502.14 Alternatives including the proposed action (f),** requires that the Corps "Include appropriate mitigation measures not already included in the proposed action or alternatives" and **Section 1502.16 Environmental consequences (h),** requires the Corps to provide "Means to mitigate adverse environmental impacts (if not fully covered under Section 1502.14(f)". 56

57) **Page 6-10, 6.1.4 Historic Properties Mitigation,** the FR/EIS fails to provide a mitigation plan which means the public will never get to review and comment on the mitigation plan and see how the Corps responds back to public comments. This leaves the public out of the process and is not what CEQ requires under **Section 1502.14 Alternatives including the proposed action (f),** that the Corps "Include appropriate

mitigation measures not already included in the proposed action or alternatives and **Section 1502.16 Environmental consequences (h),** requires the Corps to provide "Means to mitigate adverse environmental impacts (if not fully covered under Section 1502.14(f)"; 57

58) **Page 6-12, 6.3 Real Estate Considerations,** the FR/EIS does not state what the environmental impacts are of borrow areas and excavated material disposal areas and how these impacts will be mitigated. 58

59) **Page 6-13, 6.3.2 Facility Removals/Utility Re-locations,** the FR/EIS does not include "relocation and modification costs in plan formulation costs". Therefore the public does not know the total cost of the proposal. Even if the Corps does not know the precise costs an estimate can be made and added to other costs so the public has a better idea of how many taxpayer dollars are required for this proposal. Transparency is crucial when using taxpayer dollars and for NEPA. 59

60) **Page 6-14, 6.4 Operations and Maintenance Considerations,** the FR/EIS states "Operation and Maintenance (O&M) of these facilities would be extensive. The TSP will be a complex system constructed in a marine environment." This is why it is critical to give the public the best estimate possible of how much money it will take to operate and maintain these facilities. Transparency is crucial when using taxpayer dollars and for NEPA. 60

61) **Page 6-15, 6.6.2 Environmental Quality,** the FR/EIS ignores many cumulative actions and impacts of other projects like deepening of the Freeport channel, expansion of SH 36, construction of the Prairie Parkway as well as the overall population growth and residential, commercial, and industrial development that will occur due to normal growth and due to the "appearance of safety" that this proposal provides for people living in the area. 61

62) **Page 6-15, 6.6.3 Regional Economic Development Benefits (RED),** it is of concern that the FR/EIS fails to use a quantitative model to determine secondary impacts (benefits other than direct damages) since "This information would be used to support a decision to increase the levee height in any of the project areas in support for RED". This means the public is kept in the dark about how benefits are calculated and how the Corps justifies a bigger project. This information should be provided to the public now so that it can review and comment on its adequacy and appropriateness. 62

63) **Page 6-15, 6.6.4 Other Social Effects (OSE),** the FR/EIS fails to take into account how the proposal will negatively affect life safety risk by giving people a "false sense of security" about their ability to live in a dangerous area. The the Corps should discuss induced development due to the construction of this proposal and not avoid it and say it does not exist. Large corporations would not invest in or would invest less in refineries and petrochemical plants if they could not get protection from storm surge and other storm impacts. 63

64) **Pages 6-17 and 6-18, 6.7.1.2 Other Engineering Risk and Uncertainty and 6.7.3 Project Cost and schedule Risk Analysis,** the FR/EIS admits that it has not calculated risk which may lead to additional changes and the raising of the height of the project since "the TSP ... will be designed as an entire system to perform at a uniform level". Risk deals with probability and the Corps has not provided any probability information about this proposal in this section. **64A**

The Corps admits that there is "no on-the-ground physical survey data" which means that there could be important considerations that have not been discovered about this proposal The Corps admits that there have been "very limited geotechnical investigations"; that "Decisions are yet to made regarding how high the structures will be raised after factoring in relative sea-level rise, wave run-up, and wave overtopping, and evaluating an LPP could result in a substantial increase in hydraulic loading on the structures and will increase the seepage potential, either of which could significantly change the designs of the levee embankments and flood wall as concerned in developing the TSP"; and that "A Cost and Schedule Risk Analysis will be performed on the plan carried forward for feasibility-level design following the concurrent public review." This means that the public will not have transparency and an opportunity to review and comment on the true costs of the proposal. This is not good public administration. **64B**

LLP is not found in the "List of Acronyms" at the beginning of the FR/EIS. The public must know what acronyms mean that are used in the FR/EIS.

65) **Page 6-20 and 6-21, 6.8.1 Clean Air Act and Pages i through Page 11, Draft Appendix I, Clean Air Act Emissions Modeling, September 2015,** the FR/EIS fails to state how many tons of volatile organic compounds (VOC), nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO2), particulate matter (PM 2.5 and PM 10), lead (Pb), air toxics (like benzene, toluene, xylene, 1,3-butadiene, ethylbenzene, etc.), and carbon dioxide (CO2) and other greenhouse gases that this proposal will emit (air pollution) during construction, operation, maintenance, repair, and replacement activities. This air pollution information can easily be calculated using either emission factors or other appropriate air pollution emissions information. The public must have this information so that it can review and comment on it.

The FR/EIS also does not provide air pollution information (tons/year) for the cumulative actions that will have cumulative air pollution impacts for the air pollutants mentioned above or the population growth and residential, commercial, and industrial development that has occurred in the past and present and that will occur in the foreseeable future for 50 years. Many large corporations with refineries and petrochemical plants affected by this proposal (the proposal will provide protection for these facilities) have recently expanded, are in the process of expanding their production units or other facilities, or plan to expand their facilities. The public must have this information so that it can review and comment on cumulative actions and impacts due to air pollution. **65**

66) **Page 6-21, 6.8.2 Clean Water Act,** the FR/EIS does not have any information about the types of water pollutants and the amount of each individual water pollutant that will be discharged due to this proposal. The public must have this information so that it can review and comment on this issue. Certainly, bacteria, D.O., total suspended solids, total dissolved solids, and other water pollution parameters will be affected or discharged due to this proposal. There is no non-point source water pollution plan outlined in the FR/EIS. The Corps should explain what "to the greatest extent practicable" means in relation to water pollution discharged from this proposal. There is no quantification of water pollution so the public cannot determine the magnitude of the problem. **66**

67) **Page 6-22, 6.8.5 Coastal Zone Management Act,** the FR/EIS does not explain to the public what "maximum extent practicable" means with relation to the proposal and the Coast Zone Management Act. The public must have this information so that it can understand how this proposal is consistent with the Coastal Zone Management Act. **67**

68) **Page 6-23, 6.8.9 Federal Water Project Recreation Act,** there is no analysis provided about how it was determined that the "TSP is not expected to have any long-term effects on outdoor recreation opportunities in the area." This seems like an incorrect statement because the proposal will affect where and when people can canoe, kayak, hike, bird, fish, hunt, etc. safely. The public must have this information so that it can review and comment on the FR/EIS statement of "no long-term effects" on outdoor recreation. **68**

69) **Pages 6-23 and 6-24, 6.8.10 Farmland Protection Policy Act of 1981 and the CEQ Memorandum Price and Unique Farmlands,** the FR/EIS fails to tell the public what "to the greatest extent possible" means with respect to the protection of farmland. The FR/EIS fails to look at cumulative impacts on farmland due to cumulative actions like port, road (widening SH 36 and the Prairie Parkway), and other projects and increased population growth and residential, commercial, and industrial development that occurs for all past, present, and future foreseeable actions and the induced development that this proposal will cause for the next 50 years. **69**

70) **Page 6-24, 6.8.11 Executive Order 11988, Floodplain Management,** the FR/EIS states that "The TSP does not support direct or indirect floodplain development within the base floodplain." That is exactly what this proposal does. This proposal gives the appearance that it is safer to live in the project area so that people will develop and live on properties because there is a huge wall/levee around those properties that is supposed to reduce the possibility of storm surge. Cumulative actions will also affect this proposal by an increase in population growth (from 5 million to 9 million) and increased development (more industrial and other development, which is occurring right now and is planned for the future). **70**

71) **Page 6-24, 6.8.12 Executive Order 11990, Protection of Wetlands and Page 9, 5.8 Mitigation, Draft Appendix E, Real Estate and Page 7-24, 7.1.10 Economic Evaluation,** FR/EIS states that the Orange-Jefferson CSRM Plan would convert 400

acres of wetlands to a levee system. The damage is much greater than 400 acres. **Page 6-8, Table 6-1: Direct and Indirect Impact (Intermediate RSLC) – Orange-Jefferson CSRM Plan,** says that total impacts are 2,509.3 acres including 124.8 acres of forested wetlands and 2,384.5 acres of coastal marsh that will be destroyed. The Corps must reveal all wetland impacts in this section so that the public knows what they are and can review and comment on them. **71A**

The FR/EIS does not afford "... the public an opportunity for review" because the complete mitigation plan (only a conceptual one) has not been completed. This means the public does not know what mitigation for wetlands loss will ultimately be proposed. This means the public cannot review and comment on the adequacy and appropriateness of the mitigation plan and get a response back from the Corps because the mitigation plan is not finished and has not been presented to the public in the draft FR/EIS. A complete mitigation plan is needed now for the public to review and comment on. **71B**

72) **Page 6-25, 6.8.15 Executive Order, 13186, Responsibilities of Federal Agencies to Protect Migratory Birds and the Migratory Bird Treaty Act,** the FR/EIS states "The effect of the TSP on migratory bird species has been assessed, and no impacts are expected on migratory birds or their habitat in the project area." **This statement is false. The bottomland hardwood forested wetlands and cypress-tupelo swamps that will be destroyed are important areas that birds use to feed and rest when migrating to Mexico, Central, and South America and back to the United States. The marshes that will be destroyed are important habitats for wading birds, shorebirds, ducks, raptors, etc. The Corps should remove this statement and provide a real analysis that looks at all migratory birds, the habitats they use, and how they will be affected by this proposal.** **72**

73) **Pages 7-1 and 7-2, Protected Lands, 7.1.1 Orange-Jefferson CSRM Plan, 7.1.2 Port Arthur and Vicinity CSRM Plan, and 7.1.3 Freeport and Vicinity CSRM Plan,** it is not clear from the description of the alternative whether Texas Parks and Wildlife (TPWD) Wildlife Management Areas (WMA's) will be effected by this proposal. The FR/EIS should state clearly how this proposal will affect TPWD WMA's. This is especially important with respect to connectivity and fragmentation issues. **73A**

Page 7-2, Table 7-1: Impacts on TPWD Property, the column that is labeled "Other" and the row that is labeled "Total" have 8.8 acres as the impact. However, for the Lower Neches River WMA alone there will be 13 acres of losses and for the Tony Houseman WMA there will be an additional 2.3 acres of loss which is 15.3 acres of total losses for these two WMAs. This summation must be changed. The FR/EIS should state if there will be any connectivity or fragmentation issues caused by the Port Arthur and Vicinity CSRM Plan on TPWD lands. The same is true for the Freeport and Vicinity CSRM Plan especially since the Brazoria National Wildlife Refuge (NWR) and Justin Hurst WMA are located just east and west of the boundaries of the exiting Freeport levee system. **It would appear that connectivity and fragmentation issues already exist due to the existing system and will be worse for wildlife and plants with the new proposal.** **73B**

This is a key point. What happens at the end of each structure with regard to water and energy deflection. For Orange-Jefferson, Port Arthur, and Freeport there are natural lands and developed lands just to the east and west of all of these proposed projects. The FR/EIS fails to state what impacts these areas near the levees/flood walls (shorelines, national wildlife refuges, wildlife management areas, residential areas, etc.) will endure as water is deflected back or in another direction toward these areas. The amount of erosion, the location of erosion, the level of storm surge flood water, the location of storm surge flood water should be clearly analyzed so that environmental impacts at the periphery of these three structural projects will be determined and provided to the public for its review and comment. **73C**

74) **Pages 7.3 and 7-4, 7.2.1 Orange-Jefferson CSRM Plan,** the FR/EIS states that "Deepening the channel would allow the saltwater wedge in the deep draft navigation channel to reach further inland and increase salinity in the Lower Neches and Sabine River channels, as well as Sabine Lake." The Big Thicket National Preserve (BTNP), Beaumont Unit, which was expanded south of the original Beaumont Unit, is below the Lower Neches Valley saltwater barrier and already has been exposed to higher salinity levels in 2011 in cypress swamps. In addition, the storm surge could be directed and more focused due to its deflection from levees/walls on this upstream area of BTNP and other properties which could have additional impacts. Modeling of storm surge conditions and their effects on BTNP, Beaumont Unit, should be conducted by the Corps. The FR/EIS is silent about impacts to the BTNP and how the Corps will address these impacts. This is not acceptable. **74**

Pages 7-4, the FR/EIS states that "The relatively high difference in elevation between the floodplain and the uplands will protect most of the developed upland areas from the effects of RSLC for the period of analysis." However, connectivity and fragmentation will exert further pressure on wildlife and plant migration. The FR/EIS must address this issue. **Page 7-5,** the Corps must state what "to the greatest extent possible" means with regard to minimizing flow impacts.

75) **Pages 7.5 through 7-7, 7.2.1.1 Design Accommodations to Minimize Impacts,** the FR/EIS it is not clear how many of the existing tributaries, drainages, and sheet flow areas (overland flow) will be connected using culverts or other mechanisms. The FR/EIS should state specifically how many of these areas there are, how many will be connected via the proposal, and what surface area drainage will be maintained by the proposal. Culverts must be installed so they are at ground level otherwise during low flow times fish and aquatic organisms will be unable to migrate.

When the FR/EIS states that "Hydrologic flows in the FWP conditions would thus be very similar to FWOP flows in location, duration, and magnitude, both inside and outside of the levee system" it should be specific and state how it defines "similar" and describe what "similar" means for each of these conditions (location, duration, and magnitude).

It is not clear what type of erosion and sedimentation the levee and other parts of the proposal will have on waterways and wetlands. This should be clearly described in the FR/EIS which also should state how often "periodic monitoring" will be done to determine the extent and quality of wetlands and freshwater flows. Constriction of the inlet the FR/EIS states will have "minimal impacts on water surface elevation and salinity within the bayous" but there is no discussion about the organic matter, nutrients, and sediment loads and how these will be affected by the construction of inlets or any other part of the proposal. This should be clearly stated in the FR/EIS. The Sierra Club does not believe that a 50% constriction will have beneficial or neutral effects on any waterway that will be affected by such a proposal. It is particularly unfortunate that there is no "operating plan for the gates" **(Page 7-7)** and therefore the public cannot review and comment on its adequacy and appropriateness. **75**

76) **Pages 7-7 and 7-8, 7.2.1.2 Unavoidable Indirect Impacts,** the FR/EIS states "A few localized indirect hydrologic impacts ... identified small areas that would be impounded between the new levee and terrace bluff ... would indirectly affect a few areas". It would be helpful to the public if the FR/EIS would state how many areas would be affected, show their locations, tell how many acres at each location will be lost or impacted, and state how the proposal affects adjoining areas. **76**

77) **Page 7-8, 7.2.2 Port Arthur and Vicinity CSRM Plan,** the FR/EIS states "with a few isolated wetland areas ... such that improvements would have negligible impacts". It would be helpful to the public if the FR/EIS would state how many areas will be affected, show their locations, tell how many acres at each location will be lost or impacted, and state how the proposal affects adjoining areas. The FR/EIS should state clearly what "negligible impacts" equates to with regard to actual impacts so the public can review and comment on the adequacy and appropriateness of the Corps assessment. **77**

78) **Pages 7-8 and 7-9, 7.2.3 Freeport and Vicinity CSRM Plan,** the FR/EIS states "FWOP forecasts of salinity, marsh loss, and related impacts on plant and animal communities in the study area are important in establishing the baseline condition against which FWP impacts are measured". If this is so then the FR/EIS should state in this section what the forecasts are for salinity, marsh loss, and related impacts in the study area and not just refer to them. The FR/EIS ignores the impacts on terrestrial animals and the impacts on aquatic organisms and ecosystems due to poor circulation and low D.O. levels in the DOW Barge Canal. The "some degree of flow constriction" should be stated in percent so the public knows what level of impact is referred to. **78**

79) **Pages 7-10 and 7-11, 7.4.1 Orange-Jefferson CSRM Plan and Pages 7-12 and 7-13, 7.5.1 Orange-Jefferson CSRM Plan,** the FR/EIS should not focus on the intermediate RSLC scenario but should focus on the high RSLC scenario because predictions of sea-level rise have been going up steadily and the melting of glaciers, Greenland Ice Sheet, and Antarctic have occurred much faster than originally thought. **79**

80) **Page 7-11, 7.4.2 Port Arthur and Vicinity CSRM Plan,** the FR/EIS states that "TSP improvements from the Port Arthur CSRM Plan would result in no impacts on

coastal marsh." This statement ignores uplands that the levee will enclose so that marshes cannot retreat landward. 80

81) **Pages 7-12 and 7-13, 7.4.1 Orange-Jefferson CSRM Plan, 7-13, 7.5.2 Port Arthur and Vicinity, and 7.5.3 Freeport and vicinity CSRM Plan,** the FR/EIS fails to estimate the wetlands and other ecosystem losses (in acres) due to the Section 10/404 program and where their approximate locations will be (which can be done by looking at past permit applications) so that this form of cumulative action and impacts along with population growth and increased development (residential, commercial, and industrial) from past, present, and foreseeable future actions (50 years) and impacts will all be assessed, evaluated, and analyzed so all environmental impacts are truly revealed in the FR/EIS. 81

82) **Pages 7-14 through 7-17, 7.6.1 Fish and Wildlife Impacts, 7.6.1.1 Sabine Region CSRM Plans, and Page 137, 5.6 Maintenance of Ecological Continuity With the Surrounding Area and Within the Region, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "This is a small fraction of the tens of thousands of acres of fish and wildlife habitat present in the study area". This statement does not relate to environmental impacts. It does not give respect to those 200.5 acres of natural fish and wildlife habitat, 128.5 acres of forest wetlands and marsh, and 2,384.5 acres of coastal marsh that will be destroyed by this proposal.

This is not a small number of wetlands and fish and wildlife habitat that will be lost. The Corps should not try to diminish the impacts that will occur but must own up to them and simply state the facts. To suggest that "fish and wildlife would be able to move out of construction corridors into adjacent habitat and avoid harm" is not ecologically and biologically feasible since most habitats are probably already at their carrying capacities and added numbers of animals will usually result in death for those animals whose habitat has been destroyed and whose territory no longer exists. 82

The FR/EIS should explain what "when practicable" means in relation to the avoidance of nesting of birds. The assumption that "Terrestrial wildlife would be able to cross earthen levee segments to access remaining habitat on either side" ignores that many species of wildlife including insects, annelids, crustaceans, reptiles, amphibians, small mammals, etc., will be exposed to more predation, desiccation, and other impacts if they try to cross 10-13 foot tall levees. For many wildlife species, crossing these levees will be impossible, their habitat will be permanently fragmented, and connectivity will cease. This is how real biological and ecological processes work and the Corps should state this instead of attempting to make excuses about environmental impacts and losses.

The loss of or impact on 7.7 stream miles of Cow Bayou and 4.4 stream miles of Adams Bayou is a tremendous loss of habitat and the Corps should propose at least an equal number of linear feet for stream mitigation. This means that 40,679.1 linear feet of stream mitigation for Cow Bayou and 23,245.2 linear feet for Adams Bayou is needed. The Corps should hold itself to the same or greater mitigation that it requires for Section

404 permit applicants especially since the Corps is a leader and by example should show how a government takes responsibility for its negative environmental actions.

Page 7-17, the FR/EIS should state how "greatest extent possible" will be implemented for fisheries damage. The FR/EIS should state what the specific impacts are on the 7.7 miles of Cow Bayou and 4.4 miles of Adams Bayou that must be mitigated via "National Marine Fisheries Service (NMFS) design recommendations" and give some idea of what these recommendations will be. The public must have this information so that it can review and comment about the adequacy and appropriateness of the description of impacts and mitigation proposed. The Sierra Club does not believe that a 50% reduction in cross-sectional area of a bayou will not have a significant impact. The Corps must mitigate for this impact.

83) **Pages 7-17 and 7-18, 7.6.1.2 Freeport and Vicinity CSRM Plan and Page 7-19, 7.6.2.1 Sabine Region CSRM Plans,** the FR/EIS suggests that "fish and wildlife would be able to move out of construction corridors into adjacent habitat and avoid harm" and "displacement of finfish and shrimp species ... during levee system construction would be temporary and individuals should move back into these specific areas once the project is complete" is not ecologically and biologically feasible since most habitats are probably already at their carrying capacities and added numbers of animals will usually result in death for those who habitat has been destroyed and whose territory no longer exists.

83

The assumption that "Wildlife access is unobstructed across the levees along these levee segments ... Terrestrial wildlife would be able to cross earthen levee segments to access remaining habitat on either side" ignores and does not acknowledge that many species of wildlife, including insects, annelids, crustaceans, reptiles, amphibians, small mammals, etc., will be exposed to more predation, desiccation, and other impacts if they try to cross 10-13 foot tall levees. For many wildlife species this will be impossible to successfully accomplish and their habitat will be permanently fragmented and connectivity will cease. This is how real biological and ecological processes work and the Corps should state this instead of attempting to make excuses for environmental impacts and losses.

84) **Pages 7-18 and 7-19, 7.6.2 Essential Fish Habitat Impacts, 7.6.2.1 Sabine Region CSRM Plans and Pages 7-19 and 7-20, 7.6.2.2 Freeport and Vicinity CSRM Plan,** the loss of ESH bottom habitat (soft bottom) cannot be mitigated by structures which provide hard bottom habitat in the same area. These are two different habitats and the Corps assumes that it is okay to mitigate "out-of-kind" habitat when this is not the case. Soft bottoms and hard bottoms provide totally different habitat for marine, brackish water, and freshwater organisms. The FR/EIS fails to state that hard bottom habitats may make it easier for invasive species like Zebra Mussels to spread and effect native ecosystems. This is a negative environmental impact that should be acknowledged and analyzed in this EIS.

84

The functional loss of marsh systems should be known now so that the public can review and comment on its adequacy and appropriateness and get a Corps response

back. If this information is in the Final FR/EIS then there will be a 30 day period where comments could be provided by the public (15 days less than for the draft FR/EIS) and there is no requirement in CEQ NEPA regulation/rules that the Corps respond to public comments and publish those responses. Thus, transparency of Corps actions suffers and the public loses a chance to learn.

85) **Pages 7-20 and 7-21, 7.7 Water and Sediment Quality Impacts, 7.7.1 No Action Alternative for All CSRM Plans,** the FR/EIS fails to address possible low D.O. levels in the Dow Barge Canal. The FR/EIS states that "Little Cypress Bayou also exhibits water toxicity" but does not explain what this means. The public must have this information so that it understands all the impacts of this proposal and background information. **85**

86) **Page 7-23, 7.7.3 FWP Alternative for Brazoria Region and Page 7-31, 7.1.13 Freeport and Vicinity CSRM, Dow Barge Canal Protection,** the FR/EIS states that "Effects of the proposed surge gate on the DOW Barge Canal are expected to be minimal" but does not say why that is the case. The Corps should state what the D.O. and other water quality levels are. Certainly, mitigation to increase circulation and D.O. makes sense for this proposal. **86**

87) **Pages 7-23 through 7.25, 7.8.2 FWP Alternative – All CSRM Plans, 7.8.2.1 Air Emission Impacts and 7.8.2.2 Greenhouse Gas Impacts,** it is amazing that the Corps does not include equipment lists and proposed operations in an appendix and does not have a summation of them in the FR/EIS. This does not make sense and with-holds from the public information that it should have. The FR/EIS also ignores population growth and increases in residential, commercial, and industrial development air pollution (including past, present, and future foreseeable air pollution for 50 years) like the massive future just completed, currently constructed, and soon implemented refinery and petrochemical expansions. This oversight is not appropriate.

Greenhouse gas air pollution is a responsibility of the Corps and its supposed helplessness "there are no implementing regulations to direct development of these analyses for Federal projects" makes no sense especially since the CEQ December 18, 2014 guidance gives a considered direction and method that the Corps can use to determine greenhouse gas emissions and their mitigation.

The Sierra Club strongly recommends that the Corps implement in the FR/EIS climate change mitigation. The Corps should prepare and include in the FR/EIS a climate change ecological resilience and resistance plan (CCERRP) for the proposal. The CCERRP would assess the biological and ecological elements in the project area and the effects that climate change has had and will have on them. The CCERRP would also assist plants, animals, and ecosystems in their adaptation to climate change and would require monitoring of changes and mitigation measure effectiveness. The CCERRP would also determine how climate change emissions can be reduced in this proposal. The CCERRP would be based on:

a. Protection of existing functioning ecosystems in the project area. **87**

b. Reduction of stressors on ecosystems in the project area.

c. Restoration of natural functioning ecological processes in the project area.

d. Use of natural recovery in the project area, in most instances.

e. Acquisition of buffers and corridors to expand and ensure connectivity of ecosystems in the project area.

f. Intervention to manipulate (manage) ecosystems in the project area only as a last resort.

g. Reduction of climate change emissions (carbon footprint) due to the proposal or mitigation for the CO2 and methane that is released via carbon sequestration.

88) **Page 7-35, 7.11.2 FWP Alternatives – All CSRM Plans,** the FR/EIS states that "recommends intensive cultural resources investigations" but this should be done now so that the results are reported to the public in the FR/EIS and the public can then review and comment on the adequacy and appropriateness of the surveys and mitigation for cultural resources. **88**

89) **Page 7-36, 7.12 Prime and Unique Farmlands, 7.12.1 Orange-Jefferson CSRM Plan, 7.12.1.1 No Action Alternative,** the FR/EIS states "Impacts on prime farmland during the FWOP condition would occur primarily from industrial, commercial, and or residential development, and continue according to expected trends of population growth and development in each area." The Corps should state clearly what the "expected trends of population growth and development" are for each area which are, in part, the cumulative actions and impacts. The public must have this information so that it can review and comment on the adequacy and appropriateness of this information, its environmental impacts, and mitigation for those impacts. **89**

90) **Pages 7-40 through 7-42, 7.13.2 EO 11988 Eight-Step Analysis,** the FR/EIS states that "The proposed Action would not induce development in the base floodplain." There is no documentation provided which supports this assertion or that cumulative impacts will not occur in non-floodplain area. After all, floodplains change over time particularly due to urbanization. All indications are that after construction of new or improvement of existing levees that people will want to build and live in more residential, commercial, and industrial developments. This has already happened with the federal flood insurance program which subsidized rebuilding in the floodplain after Hurricanes Rita and Ike and since 1968. If the town of Bridgeport had almost no houses that were not damaged (14 of 3,400) but now is built back then it is obvious that subsidies play a role in whether people go or remain in harm's way. In fact the Proposed Action is an example of a federal subsidy and does support direct or indirect floodplain development within the base floodplain.

The FR/EIS states that there are five million people that reside in the study area and that 2.26 million of those people, or 45.2%, "live within storm-surge inundation zones". Then the FR/EIS states that in the future there will be nine million people in the next 50 years that will live in the study area. Just using the present 45.2% figure of people that live in the study area (assuming no increase in percent of people that live in the storm-surge portion of the study area) and multiplying this number by nine million means that in 50 years 4,068,000 people will live in the storm-surge portion of the study area (an increase of 1,808,000). 90

More people will be in harm's way and we can no longer assume that levees or other structural measures will not fail, since we saw this happen in 2005 in New Orleans with Hurricane Katrina. The alternative recommended in the FR/EIS will put more people in harm's way in 50 years and not less people in harm's way. This is in opposition to Objective 2 which calls for a reduction in risk to human life. It does not appear that this proposal keeps people out of harm's way.

91) **Page 7-43, 7.15.2 FWP Alternatives – All CSRM Plans,** the proposal does in fact lure new people in and existing people continue to live in harm's way, in the floodplain and storm surge zone which will increase the risk of harm if over-topping or failure of a levee/wall occurs. The Corps already earlier in the FR/EIS **(Pages 3-1 through 3-7)** stated that local entities have not maintained current levees and other flood control and storm surge structures to appropriate standards. With more people at risk because of population growth and increased development, both normal and induced, this risk due to local entity inaction will increase. This is not where we want to put people's lives and property. 91

92) **Page 7-47, 7.16.1.3 Sabine Region Resource Impact Evaluation,** the FR/EIS states that "Impacts of the TSP in the Sabine Region would not be sufficient, when combined with past, present, and reasonably foreseeable future impacts to lead to significant degradation of the region"s environment ... would result in negligible environmental impacts." This makes no sense when the FR/EIS states on **Pages 7-3 and 7-4** that "Deepening the channel would allow the saltwater wedge in the deep draft navigation channel to reach further inland and increase salinity in the Lower Neches and Sabine River channels, as well as Sabine Lake." Already the Big Thicket National Preserve (BTNP), Beaumont Unit, which was expanded south of the original Beaumont Unit where the Lower Neches Valley saltwater barrier is has been exposed to higher salinity levels in 2011 in cypress swamps.

In addition, the storm surge could be directed and more focused due to its deflection off of the levees/walls on upstream areas where there is BTNP and could have additional impacts. Modeling of storm surge conditions and their effects on BTNP, Beaumont Unit, should be conducted by the Corps. The FR/EIS is silent about impacts to the BTNP and how the Corps will address these impacts. This is not acceptable. The FR/EIS is silent about impacts to the BTNP and how the Corps intends on address these impacts. This is not acceptable. **Degradation of a National Park System unit is not acceptable. This is a significant environmental impact that this proposal and all cumulative** 92

actions with environmental impacts has and analysis with mitigation must be done.

93) **Pages 7-48 through 7-51, 7.16.2.1 Brazoria Region Past or Present Actions,** the FR/EIS fails to describe the widening of the Gulf Intracoastal Waterway from 125 feet to over 200 feet in many places along the Texas Coast, from Sabine Lake to Freeport. This is a massive environmental impact that has destroyed coastal wetlands, prairie, and other habitats. However, the FR/EIS ignores these impacts. The FR/EIS also ignores the impacts of past residential, commercial, and industrial development and does not provide any quantification of the destruction that has occurred (number of acres or square miles covered by development, number of wetlands destroyed, etc.). This is an incomplete analysis for cumulative actions and impacts and is not sufficient for NEPA analysis. There is no quantification of the tons of air pollutants that are released annually and over the past, present, and foreseeable future time periods. The analysis does not discuss the change in the in-river estuary on the Brazos River from brackish to marine and the sedimentation and other impacts that have occurred by moving the entrance of the Brazos River and the impacts this has had on the San Bernard River and other shoreline locations. **93**

94) **Page 7-51, 7.17 Any Adverse Environmental Impacts That Cannot Be Avoided Should the TSP Be Implemented,** the FR/EIS low-rates the environmental impacts by using the figures of 359 acres of marshes and forested wetlands. **Page 7-41** of the FR/EIS states that the figures are 140 acres of forested wetlands and 2,411 acres of coastal marsh that would be impacted. The Corps must reveal the true and complete environmental impacts at the appropriate places in this FR/EIS. **94**

95) **Page 7-52, 7.20 Energy and Natural or Depletable Resource Requirements and Conservation Potential of Various Alternatives and Mitigation Measures,** the FR/EIS fails to mention the additional energy that will be used to operate, maintain, repair, and replace the proposal. This is a massive amount of energy that will be used for 50 years if not in perpetuity to keep these structures in good condition. **95**

96) **Pages 8-4, 8.2 Cost for the Recommended Plan and Page 8-5, 8.5.1 USACE Campaign Plan,** the FR/EIS fails to provide a full cost accounting for the proposal. The financing costs, operation costs, maintenance cost, repair costs, and replacement costs are not fully provided. In fact, on **Page 8-5** the Corps admits that "The cost estimate for the TSP has not been developed at this point in the study." The public must have this information now to determine if it wants to use taxpayer monies. **96**

97) **Pages 8-5 and 8-6, 8.5.2 Environmental Operating Principles and Page 4-3, 4.3 Methodology to Analyze Environmental Criteria,** the FR/EIS states that "Sustainability was an integral consideration in the development of flood risk reduction recommendations." However, no flood risk has been calculated with a probability number and provided to the public in this section. This proposal is not sustainable because it puts more people in harm's way in an environment where sea level is rising

and where constant attention in perpetuity will have to be paid to the erosion around the levees/walls as the water levels rise. 97

The FR/EIS states "A thorough NEPA and engineering analysis has ensured that we will meet our corporate responsibility". **The Corps is not a corporation. The Corps is a part of the United States Government. The Corps must understand that it must be responsible and accountable to the public and not "corporate responsibility".**

98) **Page 3-1, 3.1.1 Initial Screening of Measures Criteria and page 4-1, 4 Basis for Choice, Draft Appendix B, Plan Formulation,** the initial screening criteria should have a fourth criteria, damage, degradation, or destruction of acres of ecosystems. The environment as a "wounded entity" must be recognized and alternatives that minimize these wounds chosen. Focusing on so-called "environmental benefits" ignores the costs to the environment due to the existence of the alternative and its construction, operation, maintenance, repair, and replacement. 98

99) **Pages 3-1 and 3-2, 3.1.2 Initial Screening of Measures Prior to Alternative Formulation, Table 3-2 Measures Eliminated from Further Consideration, Draft Appendix B, Plan Formulation,** the FR/EIS states that "If a measure could not meet at least one objective, the measure was dropped from further consideration in plan formulation". The Corps failed to adhere to this requirement because Measure 3-4, Measure 3-8, Measure 3-10.1,and several other measures in Table 3-2 do meet at least one objective. 99

100) **Page 4-2, 4.2 Methodology to Analyze Economic Criteria,Draft Appendix B, Plan Formulation,** the FR/EIS refers to "projects exceed project costs" and "alternative that most reasonably maximizes net economic benefits" but as the FR/EIS has shown all the "project costs", like pipeline relocations and complete mitigation plans, are not factored into the "project costs" in many of the sections/chapters/tables that are represented. The Corps must state what "most reasonably maximizes" means in relation to economic and environmental costs and damages. In the last paragraph the Corps leaves out "repair costs" as part of "total annual costs". This is not appropriate and should be changed. 100

101) **Page 4-3, 4.3 Methodology to Analyze Environmental Criteria, Draft Appendix B, Plan Formulation,** the FR/EIS fails to state clearly what "sustainability" means with regard to Corps policy and this project. This must be addressed. 101

102) **Page 4-3, 4.5 Key Uncertainties, Draft Appendix B, Plan Formulation,** the FR/EIS uses data for sea level rise that is 28 years old (NRC, 1987), and 8 years old (IPCC, 2007). There should be newer data on sea level rise including a new IPCC report from 2014. The Corps must use the latest scientific data for this FR/EIS. 102

103) **Pages 5-1 through 5-4, 5.2.2 Galveston Region, Table 5-2 Galveston Region, Initial Array of Alternative Plans, Draft Appendix B, Plan Formulation,** the Sierra Club does not support Ike Dike, Ike Dike derived alternatives, or alternatives with parts 103

of Ike Dike in them including G1, G2, and G3 due to their costs, negative environmental impacts, and ability to place people into harm's way.

104) **Page 5-5, 5.3 Initial Screening Criteria, Table 5-4 Criteria for Screening Initial Array, Draft Appendix B, Plan Formulation,** the initial array screening criteria should have a fourth criteria, damage, degradation, or destruction of acres of ecosystems. The environment as a "wounded entity" must be recognized and alternatives that minimize these wounds chosen. Focusing on so-called "environmental benefits" ignores the costs to the environment due to the existence of the alternative and its construction, operation, maintenance, repair, and replacement. **104**

105) **Page 5-5, 5.3.2 Environmental Benefit Criterion, Draft Appendix B, Plan Formulation,** the FR/EIS states "It was assumed that environmental benefits would be equal to the acres protected from storm surge damages". The acres protected may degrade due to levee/wall impacts. The assumption that storm surge, which is a natural disturbance, should be treated the same way as human destruction is antithetical to natural ecosystem restoration and planning. Storm surge, is a natural disturbance, reorders ecosystems, creates new ecosystems, removes other ecosystems, creates successional areas for replenishment and rejuvenation, moves and redistributes sediments within and out of ecosystems, frees organic matter and nutrients for additional incorporation into ecosystems, etc.

Storm surge is not the problem. It is the failure of the Corps and others to prevent human created environmental destruction that makes natural ecosystems more vulnerable to storm surge effects. The focus should be on stopping or reducing significantly the human created environmental destruction that makes ecosystems more vulnerable than normal to storm surge effects. These projects or proposals do the opposite and create conditions for further environmental degradation. **Natural ecosystems do not need protection from natural storm surge but need protection from human created environmental destruction and built environments. In other words, the Corps assumes that it has to "protect Nature, from Nature" a ridiculous concept that will not work.** **105**

The Corps relies on the National Wetlands Inventory information without telling the public about its flaws and correcting for those flaws so that wetlands information will be as accurate as possible. The U.S. Fish and Wildlife Service has admitted that the National Wetlands Inventory underestimates wetlands in some areas.

106) **Page 5-6, 5.3.3 Implementation Costs Criterion, Draft Appendix B, Plan Formulation,** the FR/EIS states that "Rough order of magnitude costs were refined". As used in other parts of the FR/EIS this means a 10 times costs figure (ten times higher or ten times lower costs). This is not a "rough order of magnitude". The Corps should explain how it can use costs that may be 10 times higher or lower than the figure calculated as acceptable. The public must have accurate cost figures so that it can determine whether the costs of a proposal are worth the public tax dollars to be spent. **106**

107) **Page 5-6, 5.3.4 Environmental Impacts Criterion, Draft Appendix B, Plan Formulation,** the FR/EIS should use environmental flows, both inflows into bays and estuaries and instream flows, as a criterion for judging the environmental impacts of proposals. 107

108) **Pages 5-6 through 5-20, 5.4 Initial Screening of Alternatives, Draft Appendix B, Plan Formulation,** the FR/EIS admits that "Additional study is needed, as described below, to determine if the environmental effects of these surge barriers will be positive or negative." The Corps is choosing alternatives based in part on environmental benefits and impacts but admits that it does not know if surge protection alternatives have positive or negative impacts on the environment. If this is not known then these alternatives should not be chosen during the screening process. These alternatives are not ready for screening because their impacts cannot be determined. For instance, it appears logical to assume that the natural San Luis Pass will be negatively affected by the Ike Dike or similar alternatives because this pass will have huge structures placed within it that will alter flows, amounts of flows, direction of flows, and sediment, organic matter, and nutrient existence, distribution, and deposition. But the advocates of Ike Dike have ignored this real possibility in public right up to the release of the FR/EIS.

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It is also logical to assume that the Ike Dike or similar alternatives will eventually result in the loss of beach, dune, and marsh habitats seaward of FM 3005/SH 87 even with attempts to create dunes because of storm and high tide energy impacts on a solid structure. But the advocates of Ike Dike have ignored this real possibility in public right up to the release of the FR/EIS. An Ike Dike or similar project or proposal will not reduce salinity but will interfere with flow of waters, organic matter, sediment, and nutrients.

109) **Pages 5-21 through 5-25, 5.5 Evaluation Array of Alternative Plans Carried Forward, Table 5-11 Qualitative Analysis of Environmental Impacts Sabine Region and Galveston Region, Draft Appendix B, Plan Formulation,** the FR/EIS fails to recognize the alteration of sediment transport that many of these alternatives will have. 109
Also "expanded right-of-way" (ROW) issues are not discussed. The Corps should state how much additional ROW is needed for each alternative. San Luis Pass environmental impacts are ignored. Operation, maintenance, repair, and replacement impacts are ignored. These tables need to be totally redone to accurate reflect potential environmental impacts and their costs.

110) **Page 5-27, Table 5-15, Summary of Screening of Galveston Region Alternatives for Evaluation Array, Draft Appendix B, Plan Formulation,** the FR/EIS for the G6 Alternative, states that it was eliminated "due to extremely high implementation costs". The FR/EIS should discuss what this means with regard to ER measures and why G2 is not also eliminated because they appear to have many of the same costs. 110

111) **Page 6-5, 6.2.2 Hydraulic and Hydrology (H&H) Analysis, Draft Appendix B, Plan Formulation,**the FR/EIS states that "There would be some storage volume in the 111

Neches River basin behind the gate". The FR/EIS should state what this volume is so the public understands the magnitude.

112) **Page 6-13, 6.2.5 Wetlands and Hydrology, Draft Appendix B, Plan Formulation,** it is of great concern that the FR/EIS admits that "there is no line item cost for environmental mitigation in cost comparison presented below ... Therefore, it is not possible to determine with this preliminary analysis which alternative would require the most mitigation". On the one hand this statement does not make sense. The Corps states in the FR/EIS that it assumes that 50% reduction in the width (instream flow interference) is acceptable for Adams and Cow Bayous. Therefore it should be able to compute costs based on this absurd allowance of environmental impacts. But it does not. This is another way that the environment gets short-shrift in this analysis of damages and costs. The public must have environmental costs, both damages and the mitigation costs, that it will take to somewhat offset the environmental damages. The public cannot review and comment on the acceptability of these damages and costs if they are not calculated and presented. **112**

113) **Page 6-14, 6.2.6 HTRW, Draft Appendix B, Plan Formulation,** the FR/EIS assumes that each alternative "is likely to affect roughly the same number of archaeological sites". This is not true. For instance, in the same paragraph where this statement is made, **Cultural Resources,** the Corps states that the No-Gate Alternative has 11 archaeological sites, 1 National Register District, 4 cemeteries and 2 historic markers" while the Gate Alternative has "9 archaeological sites, the Navy Park Historic District, the Hollywood Community cemetery, and 1 historic marker". **As the Corps knows the value of the site depends on its richness in archaeological artifacts and historical record. These sites cannot be assumed to be equivalent and have the same mitigation costs.** **113**

114) **Page 5-15, 6.2.8 Economic Analysis, Draft Appendix B, Plan Formulation,** it does not make sense for the FR/EIS to make the No-Gate Alternative configured to provide the same level of protection as the Gate Alternative since the entire purpose for the Gate Alternative is to provide more protection. This negates the Gate Alternative's reason for its greater costs. **114**

115) **Page 7-1, Final Array of Alternatives, Draft Appendix B, Plan Formulation,** the FR/EIS states "The Lone Star-like conservation plan non-structural alternative was also screened out, as it was not implementable by USACE." This statement is in violation of the NEPA CEQ regulation/rules which states in **Section 1502.14 Alternatives including the proposed action**, "In this section ... (c) Include reasonable alternatives not within the jurisdiction of the lead agency." **The Corps cannot simply throw-out the Lone Star conservation plan non-structural alternative because it cannot be implemented by the Corps. The Corps must put this alternative back in and conduct the appropriate environmental and economic cost analysis.** **115**

116) **Page 7-6, 7.1.4 Existing Hurricane Flood Protection Facilities and Page 7-16, Freeport and Vicinity CSRM, Draft Appendix B, Plan Formulation and Page 12, 1.8.2 Port Arthur and Vicinity CSRM, Draft Appendix D, Engineering Design, Cost**

Estimates, and Cost Risk Analysis, the FR/EIS states that "The sponsor is in the process of correcting these items. The potential failure issues addressed in this study are not considered an O&M responsibility ... the local sponsor has no current plans to address the risk drivers for the engineering concerns in the FWOP conditions. It is assumed in the FWOMP conditions, no other actions to reduce the risk will take place by others."

The Corps should state clearly how the sponsor's failure to address "potential failure issues" that are O&M will affect the proposal if the sponsor does not fix the O&M issues. The proposed alternative is even more complex and larger than the present one. How will the sponsors be able to maintain a new and bigger project? The statement that it is assumed that no other actions will occur to reduce the risk if the proposal is not implemented does not make sense. If the proposal is not approved then people will address flood and storm surge issues in some other ways. **116**

117) **Page 7-11, 7.1.5 Economic Evaluation, Draft Appendix B, Plan Formulation,** the FR/EIS does not consider wave run-up and overtopping but instead uses still water levels to compute economic efficiency. If one of the problems is storm surge damage and breaching of levees/flood walls, then it does not make sense to ignore wave run-up, overtoppping, tides, and other phenomena that will make storm surge worse and increase the risk of damage to levees/flood walls. **117**

118) **Page 7-19, 7.1.6 Life Safety and Page 7-22, 7.1.7 Critical Infrastructure, Draft Appendix B, Plan Formulation,** the FR/EIS states "This does not include transportation routes for population evacuation or those at work in commercial or industrial areas." The cost of improved evacuation should be considered as a non-structural method to reduce deaths and injuries. **118**

119) **Pages 7-42 and 7-43, 7.1.18 Selection of the Recommended Plan, Draft Appendix B, Plan Formulation,** the FR/EIS fails to consider evacuation which would reduce both deaths, injuries, and minor property damage. **119**

120) **Page 7-53, 7.1.21 Separable Elements, Draft Appendix B, Plan Formulation,** the FR/EIS fails to examine how the entire Upper Texas Coast will be impacted (shoreline erosion, natural ecosystems, wildlife, etc.), if all the proposals for Orange and Jefferson Counties, Beaumont, Freeport, and Galveston Bay are constructed, operated, maintained, repaired, replaced, and financed, four million more people move into the area, and the additional residential, commercial, and industrial growth occurs in the next 50 years. These are foreseeable cumulative actions with impacts that should be assessed, analyzed and evaluated in this FR/EIS but are not. **120**

121) **Page 2, 1.4.2 Port Arthur and Vicinity CSRM, Draft Appendix C, Economic Analysis,** the FR/EIS states that a plan formulation was not conducted for Port Arthur. The Semi-Quantitative Risk Assessment (SQRA) is not final." The FR/EIS should explain how this risk assessment is "semi-quantitative" and why it is not "quantitative". The public must have this information and in a final form so that it can review and **121**

comment on its adequacy and appropriateness. The Corps should finalize the SQRA and then release it to the public for review and comment.

122) **Page 5, 1.4.3 Freeport and Vicinity CSRM, Draft Appendix C, Economic Analysis,** the FR/EIS states "Other performance issues ... were the result of deferred local sponsor maintenance or alterations that local industrial stakeholders have constructed over time". The FR/EIS should clearly show how these "performance issues" will be resolved so that any new construction is not endangered by these actions. **The FR/EIS must clearly document that if local sponsors are not able to keep up with maintenance of the existing system how they will be able to maintain appropriately a more complex and larger system.** 122

123) **Page 9, 2.1.2 Fragility Curves, Draft Appendix C, Economic Analysis,** the FR/EIS relies on "average still water levels for damage estimates". This makes no sense. It is the overtopping, waves, tidal influences, and other factors that make the damage more severe or that will lead to system failure. By only looking at "average still water levels" the Corps underestimates damages and the fragility of alternatives. 123

124) **Page 21, 2.2.4 Depth-Damage Functions, Draft Appendix C, Economic Analysis,** it is of concern that the FR/EIS does not use depth-damage functions from the Texas Coast but relies on those from Louisiana. There is no documentation that shows that such data from Louisiana is appropriate for Texas. 124

125) **Page 23, 2.4.1 Orange-Jefferson CSRM, 2.4 Alternative Analysis, Page 32, 2.4.2 Port Arthur and Vicinity CSRM, and Page 33, 2.4.3 Freeport and Vicinity CSRM, Draft Appendix C, Economic Analysis,** it is of concern that a "rough order of magnitude costs" was used to identify benefits. This means that the costs could be 10 times higher or lower. This is not an accurate figure to use in calculating benefits due to reduction of damages. 125

126) **Pages 23 and 31, 2.4.1 Orange-Jefferson CSRM, 2.4 Alternative Analysis, Draft Appendix C, Economic Analysis,** the FR/EIS states that "Operation, Maintenance, Repair, Replacement and Rehabilitation (with the exception of mitigation) was not taken into account". This makes no sense. The use of proportionality breaks down because some alternatives or parts of alternatives are larger in scale or more complex than others. In addition, the total costs are of importance and of concern to taxpayers who want to determine whether they support such an expensive proposal. 126

127) **Pages 34 through 36, Tables 2-10, 2011, and 2-12, 2.4.3 Freeport and Vicinity CSRM, Draft Appendix C, Economic Analysis,** it is not clear what the pay-off time-frame is. The FR/EIS should clearly state how many years will it take to pay-off each project in the proposal. 127

128) **Page 37, 2.4.3 Freeport and Vicinity CSRM, Draft Appendix C, Economic Analysis,** the FR/EIS states "at the East Storm Levee, $1.3 to $3.8". The Sierra Club assumes the Corps meant $1.3 million to $3.8 million. 128

129) **Page 37, 2.4.4 Brazoria and Sabine Non-Structural, Draft Appendix C, Economic Analysis and Pages 2-4 through 2-6, 2 Management Measures, Table 2-1 Sabine Pass to Galveston Bay, Texas Structural Measures, and 2.1 Non structural Measures, and 2.2 Structural Measures, Draft Appendix B, Plan Formulation,** the Corps does not give nonstructural alternatives a chance to work. What makes sense is to see which residences, commercial properties, and industrial properties could be bought out first before construction of levees/walls. By buying out first this ensures that if there is a structural alternative that it is as small as possible (smaller footprint) and thus will cost as little as possible. **129**

If the structural alternative fails during a storm then all of these properties could flood which means that not only would there be a cost for fixing the structural alternative but also a cost for all the properties damaged inside of it. With a buy-out the residence, etc., is gone forever and there is no danger of further costs due to damage, destruction, loss of life, or injury because the people are gone. Buy-outs are the cheapest thing to do first to reduce risk and eliminate possible damage, death, and injury. After buy-outs then you can look at other more structural alternatives. A combination alternative like this, that is several tiered or layered makes sense to reduce the liability of the government and reduce damage, death, and injury to people and their properties.

130) **Page 1, 1.2 Scope of Effort, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should explain what "maximum extent possible" means with regard to acquiring information to develop plans and designs for the project. **130**

131) **Pages 2 and 3, 1.4 Project Areas, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** if the FR/EIS truly wants to cover nonstructural buyouts it should consider these first before any engineering project is contemplated and then see how the buyout program affects the engineering alternatives. **131**

132) **Page 6, 1.6.1 Design Considerations, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS refers to a "balanced approach in planning". The Sierra Club perceives that this "balanced approach" has not worked for this project because non-structural methods have not been chosen, used, or even given much consideration and any balance with the environment was lost a long time ago when development and economic activities destroyed and degraded so much of natural ecosystems. **132**

133) **Page 7, 1.6.1 Design Considerations, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should inform the public how the Corps "reasonably maximizes" the expected net benefits with regard to "the explicit trade-off between risks and costs" and the environment. **133**

134) **Page 7, 1.6.1 Design Considerations, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "As the project features are further developed, they likely will be raised to accommodate future sea-level rise, wave run-up, and overtopping to the extent practicable". This means in **134**

essence that these are cumulative impacts from future foreseeable actions and should be addressed in the FR/EIS.

135) **Page 8, 1.6.2 Relative Sea-Level Change and Pages 30, 1.10.1.1 Orange 3 Reach, and 31, 1.10.1.2 Jefferson Main Reach, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states "it was assumed that the applied range of future SLC would be the same across the system; therefore, there was no need to include or incorporate this criterion in the screening process ... SLC is not accommodated in the TSP concept designs as of yet, but is a consideration the PDT recognizes needs to be addressed in the project. This will be done when the TSP is further developed." These statements are not acceptable. This is another way that the Corps underestimates the costs of the alternative so the public, which pays with taxpayer dollars, does not know the cost. This is not a transparent process for the public. **135**

Pages 8 and 9, the FR/EIS states that "Adaptive strategies could be employed to address higher change potential for sea-level rise over the project's service life, which is assumed to extend well beyond the 50-year period assumed for the economic analysis." If this is so then the Corps should give an estimate of how much longer the project will last beyond 50 years and consider this as a cumulative action whose impacts should be considered in the FR/EIS.

136) **Page 10, 1.8.1 Orange-Jefferson CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** if ExxonMobil has already constructed a levee then let them pay for any further construction. Certainly, this company can afford to do its own storm surge protection plan especially since the Corps stated that little damage occurred due to storm surges from Hurricanes Ike and Rita. See **Page 93, 2.15.4 Consideration of Storm Surge Damages in Port/City of Beaumont,** where it says that 87% of the damage claims were debris removal and there was minimal damage to infrastructure or facilities. **136**

137) **Page 12, 1.8.2 Port Arthur and Vicinity CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "This is a fairly frequent event for still water overtopping". The Corps should define what "fairly frequent" means. **137**

138) **Page 13, 1.8.2 Port Arthur and Vicinity CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the Corps should define what it means by "catastrophic failure" so that the public understands this phrase.

Pages 13 and 18, If there is "additional project scoping" the public should have the opportunity to review and comment on any changes proposed. **138**

Page 13, it is disconcerting that the "Port Arthur SQRA has not yet been done". The public should be provided this information so that it can review and comment on it.

139) **Page 17, 1.8.3 Freeport and Vicinity CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** "LSAC" is not in the list of acronyms at the beginning of the FR/EIS. 139

140) **Page 18, 1.8.3 Freeport and Vicinity CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should use a final report of the SQRA for Freeport and not just a draft. The FR/EIS never discusses how it will ensure that a larger and more complex levee system will be maintained when the local sponsors have had problems with maintenance of the present less complex and smaller levee system. 140

141) **Page 20, Old River at Dow Thumb, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** "FOS" is not found in the list of acronyms at the beginning of the FR/EIS. 141

142) **Page 43, 2.3.4 Tropical Cyclones and Floods of Record, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** Hurricane Carla occurred in 1961 and not 1962. 142

143) **Page 44, 2.5 Analysis of Hydraulic Loading for Flood Protection Systems, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,**the overtopping analysis is done at the 100 year level when a number of the levees provide protection at the 130 year protection level. The Corps should explain the reason for this difference. 143

144) **Page 59, 2.9.3 Wave Overtopping Analysis Methods and Page 64, 2.12 TSP/NED Plans Compared to Recommended FEMA Certification and USACE Accreditation Heights, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "various methods for calculating overtopping are not consistently conservative". This is of concern because then you cannot build additional strength into a design. The Corps should state how it will compensate for this fact. The public should be told how this will be handled. This is very important since only the 50% level of assurance is applied for the feasibility study when at least a 90% level is needed. 144

145) **Page 60, 2.10.1 General Process, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS weakens designs for climate change impacts by using the low sea level rise estimate for earthen levees and the intermediate sea level rise rate for flood walls. The high sea-level rise rate should be used because the indications are that sea level is rising much faster than anticipated and to ensure that additional strength will be built into structural alternatives. 145

146) **Page 64, 2.11 Adjacent Impacts, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should state what the cost will be for "minor surge protection features" so the public knows this. 146

147) **Page 76, 2.13.5 Predicted Future Rates of RSLC – 100-year Sea-Level Change, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** it is of concern that "detailed modeling has not occurred yet". There is no reason to wait to model how sea level rise will affect the Upper Texas Coast and this proposal. 147

148) **Page 83, 2.13.7 Additional Climate Change Considerations, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should be corrected here. The statement that "many of the water shortages occur in the drier east part of Texas" is incorrect and should be changed to "drier west part of Texas". 148

149) **Page 85, 2.13.8 Conclusions and Recommendations Regarding RSLC, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the Sierra Club prefers an anticipatory/conservative approach especially with buyouts so that people are permanently kept out of harm's way. 149

150) **Page 88, 2.14 Interior Drainage, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should state clearly how it will ensure that "known deficiencies of interior drainage structures" are addressed. The FR/EIS should state what these specific "deficiencies" are and what is the schedule to fix them. 150

151) **Page 103, 2.15.10 Pumps and Page 117, 2.17.7 Pumps, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the Sierra Club has not seen in the FR/EIS any mention of the need for back-up pumps in case the main pump fails. The Corps should indicate whether back-up pumps will be installed and what is the cost for back-up pumps. 151

152) **Page 110, 2.17.2 Cow Bayou Analysis, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "Inlet constricts the outflow such that there is some increase in both the magnitude and duration of the stormwater flooding in the marsh." The Corps should state clearly what "some increase" means with respect to magnitude and duration. 152

153) **Page 110, 2.17.3 Adams Bayou Analysis, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should state clearly what "very near" means (distance) with regard to the location of the proposed structure on Adams Bayou near the Sabine River. 153

154) **Pages 113 and 114, 2.17.5 Discussion and Conclusions of Cow and Adams Proposed Gate Structures, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should state clearly how much water back-up will occur due to these structures. In addition, "significant impacts" should be defined quantitatively and the criteria used to make this statement revealed. The FR/EIS should define what "significant constriction" is and what "minimal impacts on water surface elevation and salinity" are. The Corps should also state quantitatively what "additional impoundment" of stormwater will occur behind the structures. 154

155) **Page 117, 2.17.7 Pumps, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "Smaller features ... and other features for wildlife will be included". The Corps should state what these "features" are, what their purpose is, and where they will be installed. **155**

156) **Pages 135, 137, and 139, 5.2 Design of Positive Environmental Attributes into the Project, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the use of native grasses is mentioned for levees. **The Corps should provide a list of native grasses it will choose from. Of course, Bermuda grass is not a native grass.** **156**

157) **Page 135, 5.2 Design of Positive Environmental Attributes into the Project, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS refers to the use of reinforcement mats for levees. The Corps should state what is the life span of these mats, how they will be replaced when their life span is reached, and if they will not be replaced how much of the strength of the levee is compromised when their life span is reached. **157**

158) **Page 136, 5.4 Beneficial Uses of Spoil or Other Project Refuse During Construction and Operation, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should state what the environmental impacts are of spoil, where the spoil will be deposited, and how the environmental impacts of spoil will be mitigated. **158**

159) **Page 137, 5.6 Maintenance of Ecological Continuity With the Surrounding Area and Within the Region, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS should explain "maximum extent possible" with regard to "resiliency elements". **159**

160) **Page 143, 6.1.2.1 Orange-Jefferson County HFPP, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FR/EIS states that "The proposed Orange County reach alignment will cut through several forested areas ... In deriving the TSP cost and NED Plan costs, the acreage of forests within the preliminary construction easements was not estimated." The Corps should provide an estimate of forest loss for the public. In addition, the Corps should demonstrate what mitigation will take place due to the loss of these forests. Part of the mitigation should be fore the fragmentation and loss of connectivity that the levee will cause. The public must have this information so that it can review and comment on this "significant" environmental impact. The cost of this mitigation should be revealed now to the public. **160**

161) **Page 1, 1 Purpose and Page 15, 11 Facilities/Utilities/Pipeline Relocation and Removals, Draft Appendix E, Real Estate,** although the **Purpose** refers to rights-of-way, in other places in the FR/EIS the Corps states that pipeline estimates have not been made. The actual field conditions should already have been examined and a preliminary estimate provided to the public about pipeline removals and costs. Thus the current real estate costs are vastly underestimated, are inaccurate, and provide very **161**

little useful information for the public. The public must have this information so that it can review and comment on the costs of the proposal.

162) **Draft Appendix K, Coordination Act Report, Draft Appendix P, Mitigation Plan and Incremental Analysis and Monitoring Plan, and Draft Appendix Q, Wetlands Value Assessment Sensitivity Analysis,** all three of these documents should be available now so that the public can review and comment on their adequacy and appropriateness and then see what the Corps response is to their comments in the Final FR/EIS. By failing to have these documents available now, the Corps avoids having to respond to any public comments (during a short 30-day comment period) in writing and still will be in compliance with NEPA and CEQ regulation/rules. The Corps should practice transparency and give the public 45 days for public comments when these currently unavailable documents are complete and then should respond to public comments and provide the Corps responses to the public in writing so that the public can see how the agency addressed its concerns and issues. **162**

163) **Page 13, 4.5 Emergent Marsh Loss, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS gives annual percent change of sea level rise from low to intermediate scenarios and low to high sea level scenarios but fails to give the annual percent change for intermediate to high scenarios. The public must have this information so that it can see the full range of sea level change for each of the different scenarios. **163**

164) **Page 15, 5 WVA Modeling Methodology, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS fails to conduct sensitivity analyses on the modeling method (WVA) that calculates impacts and leads to mitigation. This is not transparent for the public because this information will not be available until the Final FR/EIS when public comments are not required to be reviewed and a response given by the Corps in writing. The public is unable to determine what the actual impacts are and how the Corps proposes to mitigate them. The Corps should put out the sensitivity analysis and have a public review and comment period and then publish its response to each comment so the public knows what is being done and why. **164**

It is of concern that the habitat variable habitat suitability relationships within the WVA models have not been verified by field experiments or validated via a "rigorous" scientific process. It is also of concern that a number of the variables are defined by the Coastal Wetlands Planning, Protection, and Restoration Act and not by local conditions on the Upper Texas Coast that are related to coastal marshes and bottomland hardwood forested wetlands. **The Corps should use a different model that is verified and validated via field experiments or a "rigorous" scientific process. The public needs a model that can be trusted to give accurate and precise results. The public does not need the WVA which is being worked on so that results can be determined with the appropriate accuracy and precision.**

165) **Pages 16 and 17, 5.2 Wetland Vegetation Mapping, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS uses out-of-date National Wetland

Inventory and 2015 Google Earth imagery information. What is needed is ground-truthing of wetlands locations, acres, and types. Without this the Corps is simply guessing what is or is not a wetlands. Both the National Wetland Inventory and Google Earth are not 100% accurate and miss wetlands. The public must have an accurate and thus ground-truthed accounting of wetlands that exist, that will be damaged or destroyed, and a complete mitigation plan for those wetlands that will be destroyed or degraded. 165

The marshes that are aggregated by type do not include salt marsh (include fresh, intermediate, and brackish). Salt marsh also must be aggregated by type and acres.

166) **Page 24, 5.4 Data Collection/Groundtruthing, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS states that groundtruthing was based upon field investigations and "previous observations". The Corps must state clearly what this means with regard to how field investigations are different than previous observations. 166

The use of August 24 and 25, 2004 and October 21, 2004 data means that this information is at least 11 years old. Many changes to wetland acres could have occurred in 11 years due to human and natural activities. This data is too old to use and more recent data should be collected and used so that the wetlands information is accurate and precise.

167) **Page 26, 6 FWP Analysis of Direct Impacts and Pages 43 through 45, 6.4 Summary of Direct Impacts-Intermediate RSLE Scenario, Draft Appendix O, Wetland Value Assessment Modeling and Pages 7 through 9, 1.6.1 Design Considerations, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the high sea level change scenario should be used because updates on sea level change are showing higher change quicker and to be conservative about wetland losses and mitigation needed for those losses. **See Pages 9 and 10, 1.8.1 Orange-Jefferson CSRM, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** which states that "Noteworthy of the areas is that they are highly susceptible to rising sea level, with studies suggesting that region relative sea-level rise rates ... have been significantly higher than presumed eustatic rise rates." 167

168) **Page 26, 6.1.1 V1 Emergent Marsh, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS states that "100 percent shallow water is assumed to have minimal habitat suitability ... optimal vegetative coverage is assumed to be 100 percent ... This assumption diverges from the general biological understanding that optimum cover falls in the 60 to 80 percent range. Selection of 100 percent marsh cover as the optimal habitat conditions is based upon several factors.".

The FR/EIS should state clearly what factors override the biological understanding that 60-80% marsh coverage is optimal. Currently, the Corps provides no documentation for its assumption that 100% is optimal for vegetative marsh coverage.

The assumption that "100 percent shallow water is assumed to have minimal habitat suitability" is contradicted on **Page 27, 6.1.2 V2 Percent Submerged Aquatic**

Vegetation, which refers to SAV, a type of wetland that needs shallow water and therefore documents that not all shallow water has "minimal habitat suitability". In addition, on **Page 29, 6.1.3 V3 Interspersion,** the FR/EIS states "The marsh/open-water edge provides cover for postlarval and juvenile organisms. Smaller, isolated ponds are less turbid and contain more aquatic vegetation, thereby providing more suitable waterfowl habitat" which contradicts the assumption that shallow water has "minimal habitat suitability". Finally, **Page 30, 6.1.4 V4 Percent Open Water less than 1.5 feet**, the FR/EIS states "Deeper water is assumed to be less biologically productive than shallow water because sunlight, oxygen, and temperature are reduced as depth increases. Shallow water also provides better bottom access for waterfowl, better foraging habitat for wading birds, and more-favorable conditions for the growth of aquatic vegetation ... Optimal shallow-water conditions in fresh/intermediate marsh are assumed when 80 to 90 percent of the open water is equal to or less than 1.5 feet deep." **168**

Page 27, the FR/EIS states that "It was assumed that the emergent marsh that is lost is converted to water, and therefore the acres lost from the marsh are added to the water acres." This assumption is faulty. The loss could be due to emergent marsh that was legally or illegally filled or dredged for development.

169) **Page 31, 6.1.5 V5 Salinity, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS should not use salinity as a double count for vegetation and fish and wildlife. Salinity impacts on both are very variable depending on the wildlife species of interest. Salinity should be used once for vegetation only. **169**

170) **Page 33, 6.2.1 V1 Stand Structure Draft Appendix O, Wetland Value Assessment Modeling,** for swamp modeling, the FR/EIS states that tree species composition is not considered a limiting factor. There is no documentation to support this assertion. Some trees have a different decomposition rate for leaves, different nutrient content, different rate of decay and cavity formation, etc. The Corps should document its assertion here. **170**

171) **Pages 34 and 35, 6.2.2 V2 Stand Maturity and Page 39, 6.3.2 V2 Stand Maturity, Draft Appendix O, Wetland Value Assessment Modeling,**, the FR/EIS uses 16 inches for bald-cypress and 12 inches for water tupelo as older canopy-dominant and co-dominant trees. These diameters are very small and larger trees, in general, are more attractive to wildlife due to cavity formation which is due to decay rates and probability. The most important item for wildlife in swamps for trees is that they be mature or even better old-growth in size and age. Optimum growth conditions on managed lands should not be used for rate of tree growth for natural areas because they assume a higher rate of growth than occurs naturally. **171**

172) **Page 36, 6.2.3 Water Regime, Draft Appendix O, Wetland Value Assessment Modeling,** the use of existing water surface elevations in the Sabine and Neches Rivers is based upon data that is 14 years old. Changes may have occurred in water surface elevations. The Corps should re-verify the data to ensure it reflects current conditions for water surface elevations. **172**

173) **Page 37, 6.3.1 V1 Tree Species Composition, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS assumes that "more production of mast and other edible seeds is better than less, and that hard mast is more critical than soft mast because it is available during late fall and winter and has high energy content." This assumption does not take into account that different leaves and mast may have different microbes or different decomposition rates which affects the lower part of the food chain/web which ultimately affects food and wildlife populations. More than what the model presents must be taken into account for bottomland hardwood forested wetlands. **173**

174) **Pages 41 and 42, 6.3.6 V6 Surrounding Land Use, Draft Appendix O, Wetland Value Assessment Modeling and Page 18, Draft Appendix D, Engineering Design, Cost Estimates, and Cost Risk Analysis,** the FS/EIS states that "The review group had no specific information regarding future land use or development changes in the areas surrounding the construction right-of-way." It would not be difficult to ask local entities, like cities and counties, what future growth they have permitted or that they envision in their local plans. In addition, the group could get information from the Corps about legal and illegal Section 10/404 permits in the past and extrapolate that out to the future. Finally, Google Earth could be used to look at rate of loss of wetlands for swamps and bottomland hardwood forested wetlands and use this as an approximate figure for future growth. Since the group knows that 4 million additional people will be in the project area in the next 50 years the amount of land space needed for that increased population could be determined and could then be distributed according to past growth patterns. There are estimates by U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department about losses of certain kinds of wetlands over a certain year period or estimated as loss/year. **There is no excuse for not preparing or getting information that tells you what land and wetlands losses may occur in the future.** **174**

The assumption on **Page 42** that "changes in surrounding land use would occur with or without the project" is a false assumption when looking at how roads and other developments from the past have provided access and a "sense of protection" which induced growth.

175) **Pages 42 and 43, 6.3.7 V7 Disturbance, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS fails to analyze the impacts that disturbance will have with regard to non-native invasive plant species and feral hog spread. **This should be done since one of the most important problems is how fragmentation and a lack of connectivity allow non-native species to invade and or take over natural habitats. This proposal will create more disturbance and stress for habitats both within the outside the levees/flood walls.** **175**

176) **Page 46, 7 FWP Analysis of Indirect Impacts of Orange-Jefferson CSRM Plan, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS ignores most cumulative impacts that population growth of 4 million additional people will have (or the proportionate share for Orange-Jefferson Counties) and residential, commercial, and industrial development will have.

This makes no sense when the FR/EIS states on **Pages 7-3 and 7-4** that "Deepening the channel would allow the saltwater wedge in the deep draft navigation channel to reach further inland and increase salinity in the Lower Neches and Sabine River channels, as well as Sabine Lake." Already the Big Thicket National Preserve (BTNP), Beaumont Unit, which was expanded south of the original Beaumont Unit and south of the Lower Neches Valley saltwater barrier, has been exposed to higher salinity levels in 2011 in cypress swamps. **176**

In addition, storm surge could be directed and more focused due to its deflection off of the levees/walls on upstream areas like BTNP property and could have additional impacts. Modeling of storm surge conditions and their effects on BTNP, Beaumont Unit, should be conducted by the Corps. The FR/EIS is silent about impacts to the BTNP and how the Corps will address these impacts. This is not acceptable. The FR/EIS is silent about impacts to the BTNP and how the Corps intends on address these impacts. This is not acceptable. Degradation of a National Park System unit is not acceptable. This is a significant environmental impact that this proposal and all cumulative actions with environmental impacts has and analysis with mitigation must be done. The FR/EIS fails to quantify the impacts so that the public knows how many areas, both inside and outside the levee/flood wall system, will be impacted and how they will be impacted.

177) **Pages 51 through 55, 7.1.3 WVA Coastal Marsh Modeling of Indirect Impacts, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS refers on **Pages 51 and 52** to "Lumping all polygons of one marsh type for the WVA modeling ... The total amount of the classified water in each basin ... is included in the V1 water acres". This may obscure where the losses occur and what level of impacts occur in what geographic area for open water and marshes. The model may dilute impacts on better areas and increase impacts on poorer areas. It is a concern that the model may average out or oversimplify what occurs during a model run. **177**

Page 54, the FS/EIS states "Impact to fisheries access (V6) were assessed based on limited, preliminary information". The Corps should state when the information will not be limited or preliminary and will be made available to the public for review and comment and Corps response.

Page 55, the Crops must do more than "final design **will attempt** to minimize impacts". The final design "must" minimize" impacts.

178) **Page 56, 7.1.4 Intermediate and High RSLE Scenarios and Page 69, 7.2.2.3 FWP Condition, Draft Appendix O, Wetland Value Assessment Modeling,** the FS/EIS states that "indirect fisheries impacts were not modeled for the intermediate and high RSLR scenarios". This is not good. This many underestimate impacts due to sea level rise.

178

When the FR/EIS states that "Higher tidal inundation would improve fisheries access even with the structures in place" this does not necessarily relate to better fishing. The key is the condition of the habitat.

179) **Pages 56 through 63, 7.2.1.2 FWP Condition, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS should state clearly how much flow is needed for flap gates and other culverts to open and allow flow. **Page 57,** the FR/EIS should state what the "greatest extent possible" means when dealing with impacts on the floodplain. **179A**

Page 58, the FR/EIS states that "Hydrologic flows in the FWP condition would thus be very similar to FWOP flows and in location, duration and magnitude, both inside and outside of the levee system." The Corps should quantitatively show what "very similar" means. **179B**

Page 58, the FR/EIS should determine how it will monitor if "Groundwater flow from shallow aquifers may be affected by compaction ... due to the weight of the overlying levee, or by construction of seepage barriers beneath the levee". **179C**

Page 58, the monitoring and adaptive management plan should be available now so that the public can review and comment on its adequacy and appropriateness. **179D**

Page 59, the Sierra Club believes that the statement that "no direct impacts were identified on most of the marshes, bottomland hardwoods and swamps located inside and outside the levee system" is overly broad and does not tell the public how many, where, and how many acres of marshes bottomland hardwoods and swamps located inside and outside the levee have indirect impacts. **179E**

Page 59, use of 20 year old data for "pattern and growth of development" that appears to be from another part of the United States is not sufficient for this analysis. We need something that is local and is up-to-date. **179F**

Page 59, the FR/EIS fails to tell how many areas, acres, and types of wetlands are caught between the new levee and bluff and would be cutoff from daily tidal inundation or have disrupted hydrology and impounded rainwater, and eventually die. **179G**

Page 59, if construction zone impacts would block the flow of small channels feeding adjacent marsh or swamp then as mitigation a connection to these areas for water should be provided if at all possible. **179H**

Page 63, the FR/EIS should commit to levee realignment and not say "may be recommended" and may be possible".

180) **Page 67, 7.2.2.3 FWP Condition, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS states that "Daily flooding of natural areas and wetland creation would occur as they would have under the FWOP condition ... in the FWOP condition with only minimal differences ... It is assumed that this development would continue in the FWOP condition, and therefore the alternative would cause no impacts related to induced development ".

No matter how the proposal attempts to mimic the natural flooding of wetland areas there will be a difference because some wetlands will be destroyed, some wetlands will be degraded, and some of the floodplain will be developed due to the levees/flood walls. The Corps should quantify the "minimal differences" so that the public can understand what this term means. Of course there will be induced development since protection and more access to the property with levees and flood walls will occur. To suggest otherwise ignores past development history. The quantification of this induced development must be presented in the FR/EIS so the public will have an opportunity to review and comment on this environmental impact. Some type of mitigation should be required for this induced development since more land will be paved (impervious surface) and there will be more non-point source water pollution runoff and more wetlands will be degraded or destroyed. **180**

181) **Page 70, 8.1 Summary of TSP Impacts and Mitigation Needs, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS calls mitigation costs small but the actual mitigation plan and cost are not known to the public. The Corps must be transparent and not release a FR/EIS that is incomplete and does not have important information that the public should have available for review and comments and then a Corps response to comments. This is a transparency issue where the Corps does not show the public what mitigation will cost and there is no complete mitigation plan. **181**

182) **Pages 70 through 74, 8.2 Description of Potential Mitigation Sties and Conceptual Mitigation Plans, Draft Appendix O, Wetland Value Assessment Modeling,** the FR/EIS should state clearly what "to the extent practicable" means with regard to avoided or minimized adverse impacts on ecological resources. The public deserves to know what this truly means from the Corps perspective.

Page 71, the fact that the FR/EIS states that "Selection of potential mitigation sites and modeling of benefits will be conducted in coordination with resource agencies," just means that the public does not get to have meaningful input about these mitigation sites and the mitigation plan which has not been completed .

Page 71, the FR/EIS states that there could be "possible improvements to the forested wetland areas targeted for conservation." The Corps should be transparent and state what these "possible improvements" are. The public should know so that it can review and comment on their adequacy and appropriateness. **182**

Page 73, the FR/EIS should state clearly what it means when it says "Other benefits could b earned by making improvements". Earned by whom, for what, and for how long? Will this mitigation be done in perpetuity?

Page 74, the FR/EIS states that "during final feasibility planning, fully-realized mitigation plans will be developed in consultation with the resource agencies and presented in the FIFR-EIS". This means the public has taken away from it the opportunity to review and comment on these mitigation plans (fully-realized) and then have the Corps respond to

its comments in writing. It is not in the spirit of NEPA to reduce transparency by conducting important analysis and planning for the final EIS and not for the draft EIS. Shame on the Corps for steering important analysis and planning to a part of the NEPA process where the public has less input and less transparency about what the Corps thinks about the public's comments.

183) **Attachment C, WVA Model Output of Direct Impacts, Draft Appendix O, Wetland Value Assessment Modeling,** there are incorrect calculations on many of the 13 sheets. For instance:

1. a. Sheet 1, BH2, Net (FWP-FWOP), is listed as -2.18 and it should be -2.19

b. Sheet 2, BH12, Net (FWP-FWOP), is listed as -0.30 and it should be -0.31

c. Sheet 3, S3, Net (FWP-FWOP), is listed as -3.12 and it should be -3.11

d. Sheet 4, S9, Net (FWP-FWOP), is listed as -14.43 and it should be -14.44

e. Sheet 7, F-5, Net (FWP-FWOP), is listed as -1.01 and it should be -1.02

f. Sheet 8, F-7, Net (FWP-FWOP), is listed as -0.60 and it should be -0.59

g. Sheet 8, F-8, Net (FWP-FWOP), is listed as -3.12 and it should be -3.11 **183**

h. Sheet 9, F-9, Net (FWP-FWOP), is listed as -9.00 and it should be -9.01

i. Sheet 4, I-1, Net (FWP-FWOP), is listed as -1.78 and it should be -1.77

j. Sheet 4, B-3, Net (FWP-FWOP), is listed as -4.42 and it should be -4.43

2. The "Net Impacts" figures, shown on sheets 5 through 13, do not have a formula for how they are derived so that the public knows what this phrase is and means, how these figures were derived, and thus the public cannot check these figures for accuracy.

184) **Attachment D, WVA Model Output of Indirect Impacts, Draft Appendix O, Wetland Value Assessment Modeling,** there are incorrect calculations on many of these 15 sheets. For instance:

1. a. Sheet 1, BH Indirect-1, Net (FWP-FWOP), is listed as -0.29 and it should be -0.30

b. Sheet 2, S Indirect-2, Net (FWP-FWOP), is listed as -0.77 and it should be -0.78

c. Sheet 3, F Indirect-2, Net (FWP-FWOP), is listed as -5.18 and it should be -5.17

d. Sheet 4, F Indirect-3, Net (FWP-FWOP), is listed as -5.76 and it should be -5.75; and Open Water is listed as -24.32 and it should be -24.31

e. Sheet 7, B Indirect-3, Net (FWP-FWOP), is listed as -3.57 and it should be -3.56

f. Sheet 8, B Indirect-5, Net (FWP-FWOP), is listed as -25.27 and it should be -25.26 **184**

g. Sheet 10, B indirect 3, Net (FWP-FWOP), is listed as -2.78 and it should be -2.77

2. The "Net Impacts" figures, shown on sheets 3 through 15, do not have a formula for how they are derived so that the public knows what this phrase is and means, how these figures were derived, and thus the public cannot check these figures for accuracy.

The Sierra Club appreciates this opportunity to comment. Thank you.

Sincerely,

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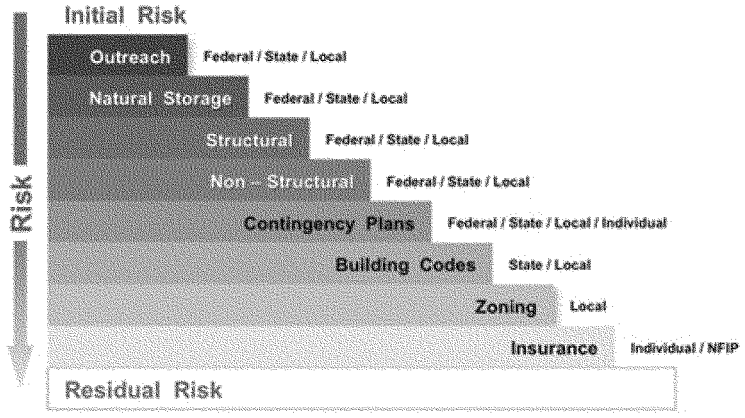
RESPONSE TO COMMENTS

Comment No.	Response
1	The DIFR-EIS described and compared impacts of all alternatives in the final array. In addition, direct impacts have been developed using a conservatively-wide construction right-of-way. This was done to ensure that impacts of the Recommended Plan have been disclosed. If changes to the TSP result in a Recommended Plan with significantly different impacts from those disclosed in the EIS, then a supplemental report will be provided for public review.
2	This feasibility report presents a programmatic overview of CSRM problems and opportunities in the central Galveston region (Galveston, Harris, and Chambers Counties) and a programmatic assessment of ER opportunities for the entire six-county study area. The programmatic assessment is a listing and screening of measures identified as having high potential to demonstrate Federal interest and result in successful CSRM and ER projects. The list of measures is provided in Appendix A. The only measures and alternatives fully evaluated by this feasibility study, with the intent of recommending a plan for Congressional review and authorization, are those associated with a new storm surge risk reduction system for the Orange-Northeast Jefferson County area, and improvements to the existing Port Arthur and Freeport Hurricane Flood Protection projects. No recommendations regarding the feasibility or impacts of the remaining measures are included in this feasibility report; thus detailed analysis of their impacts in this NEPA document is not required. These measures could be fully analyzed in future, separate feasibility studies.
3	Comment noted.
4	Section 2.3.2 of the Main Report summarizes both long-term positive and negative effects of storm surge on the region. An exhaustive list of effects is not needed to comply with the purpose of NEPA.
5	Protection of the environment is not optional and has not been considered so in development of the Recommended Plan.
6	Repairs and reconstruction of homes, industry and infrastructure damaged by Hurricane Ike occurred in the absence of a coastal storm risk management project. The three study areas developed and will continued to grow because of multiple benefits present in the area which are unrelated to the proposed coastal storm risk reduction project. The proposed project would reduce the risk of storm surge damages and loss of life in currently developed areas of Orange County; it would not reduce surge risks to undeveloped areas. Other non-structural measures, such as evacuation plans, would also be utilized to reduce residual risks. Proposed improvements in Jefferson and Brazoria Counties would affect areas which are already behind existing levee projects.
7	There is no ironclad rule governing the scope of the alternatives to be included rather the development of alternatives should be guided by the rule of reason. The "rule of reason" requires the planning process to set forth only those alternatives necessary to permit a reasoned choice. The study is not required to report on every conceivable alternative in the

	study area, rather the USACE only should consider a reasonable range of potential feasible alternatives to satisfy the planning objectives. We fully understand that other conceivable alternatives may exists, but the responsibility for flood risk management in the United States is a shared responsibility between multiple Federal, state, and local government agencies with a complex set of programs and authorities. For example, other flood risk management measures may still exist but they could be addressed under local and state programs. The figure below provides a general overview of the concept of shared responsibility for addressing flood risk management.



8	Historically, stainability or growth of populations in the study area is highly dependent upon the major employment sectors, not necessarily impacts from episodic storm events. Due to the close proximity to waterways and intermodal transportation connections we would not expect to see large scale relocations of population densities even under the future without scenario. Measures implemented outside of the federal action under the FWOP conditions would be highly speculative and would not allow for a baseline assessment of the proposed federal action. Analysis shows that estimates for expected annual damages under the current conditions are largely consistent with the historical post-flood response by the affected population, and that while there remains uncertainty with respect to possible future post-flood responses as flood risk increases over time, the range of scenarios considered does not change relative to the actions of others nor is the economic justification of the project compromised.
9	The Port Arthur and Freeport CSRM Plans consist of modifications to existing levee systems. The report clearly states that no new levee segments are proposed as part of these modifications. Thus, there would be no impacts associated with new levees or levee extensions.
10	The comments of all parties are summarized for the draft and final reports. Contrary to the assertion, the Sierra Club was not specifically excluded from scoping efforts.
11	This section has been revised in the FIFR-EIS.
12	The project authorization includes broadly applicable language to facilitate plan formulation. Study objectives and project purposes are refined during plan formulation.

13	Comment noted.
14	Detailed plans and construction periods were developed during final feasibility analysis and presented in the FIFR-EIS. This cost estimate includes costs for pipeline and other relocations, and mitigations costs. Cost estimates presented in the DIFR-EIS were developed based on costs from similar recent projects, which included pipeline and relocation costs. Estimated mitigation costs for the Orange-Jefferson CSRM Plan were included in the total project costs presented in the DIFR-EIS.
15	The referenced information is not critical for plan formulation or selection. It will be removed from the FIFR-EIS.
16	The FIFR-EIS contains general information on the existing conditions sufficient for development of the future without-project condition and evaluation of project impacts.
17	The Engineering Appendix (Sections 2.5 through 2.13) describes the hydrology and hydraulics analysis and results regarding storm surge impact areas and water elevations, wave run-up, induced damages to adjacent areas, relative sea level rise, and implications for levee heights. No significant impacts from induced damages were identified for the Recommended Plan.
18	Relative sea level rise will be added to factors causing erosion and shoreline retreat.
19	The names will be corrected in the final report.
20	See Response 14
21	The DIFR-EIS is merely attempting to accurately portray historic disruptions that have occurred after a large storm event such as Hurricane Ike. During the formulation of alternatives, buyouts was analyzed for those areas that would not be protected by structural alternatives but were not found to be economically justified per Corps policy. While life safety is a concern when formulating potential alternatives, an incremental component such as this would have to be economically justified. Outlying properties such as these may be candidates for participation in other programs that local jurisdictions can pursue such as FEMA's Hazard Mitigation program and can be carried out in conjunction with ongoing studies.
22	The local sponsor is responsible for maintenance of any existing system and is responsible for any deficiencies that may arise due to a lack maintenance. Alternatives for the two existing CSRMs were developed to provide a uniform level of protection. The IFR-EIS describes the level of risk reduction for the recommended alternative at each of the existing CSRMs.
23	See Response 22
24	Damage estimates discussed in the report are associated with storm surge impacts, only.
25	Comment noted; the text references other viewpoints.
26	See Response 22
27	The text will be revised.
28	The areas protected by the Jefferson component of the Orange-Jefferson and the Port Arthur CSRM are roughly the same therefore the listing of critical infrastructure in Jefferson County will be identical. Damage estimates were however modeled as independent events therefore no double-counting (relative to potential damages) exists. Since the Jefferson component has been dropped from the recommended plan, the critical infrastructure associated with the Orange-Jefferson CSRM in Jefferson County needs to be removed. We argue that refining and petrochemical manufacturing are critical infrastructure since they comprise a significant portion of the economic activity in the region and a significant

	portion of the refining and petrochemical manufacturing capacity of the nation as a whole. A significant storm event would potentially have far-reaching economic and societal consequences should these facilities become incapacitated including sharp rises in gasoline prices and/or gasoline shortages. Also, without these facilities, much of the other types of critical infrastructure, particularly those involving water, public safety, health, and education would not exist in the area.
29	Construction cost associated with sea level rise has been included in the overall cost for the final recommendation. Details related to future sea level and potential impacts the O&M plan, will be further developed under PED and future O&M manuals. The current recommendation uses an average annual O&M cost based on the selected sea level rise rate.
30	The final report will be revised to say "Problem and opportunity statements …were initially developed after scoping comments were received from...,and the affected public." In addition, the Congressional authorization for this study required that all six counties be addressed in the report; therefore, potential CSRM and ER measures for the whole study are discussed and measures are described in Appendix A. An alternatives evaluation and environmental impact analysis of CSRM measures for the Galveston region and ER projects may be conducted under a separate feasibility study.
31	Problem statements will be reworded to use less definitive verbs.
32	Specific risk to the commercial and residential property, real estate, and infrastructure has been included in the Economics appendix. As stated under comment #7 buying down flood risk is a shared responsibility between multiple Federal, state, and local government agencies with a complex set of programs and authorities. The USACE will continue to engage local sponsors to further reduce communities risk through program such as the Silver Jacks Program http://silverjackets.nfrmp.us/. Program such as this allows the USACE to improve and increase flood risk communication and present a unified interagency message. The opportunities were only used to develop the planning objectives for the study and guide in selection of the TSP. The fundamental purpose of the final recommendation for addressing Coastal Storm Risk Management. "Ecotourism and recreation opportunities" is beyond the scope of the water resource study, but this information will be passed along to the appropriate agencies and the USACE will continue to look to partner with others to develop ecotourism and recreation opportunities under the PED phase, but the cost for these features would have to independent of the final recommendation.
33	Sierra Club scoping comments, dated February 28, 2012, are included in Appendix F, pdf document page 32.
34	Appendix D (Engineering) Sections 2.15-2.17 provides a detailed analysis of the interior drainage analysis. It explains how flows would be maintained at FWOP levels. Main Report Section 7.2.1.1, Design Accommodations to Minimize Impacts, Figure 7-1, Sabine Regions Sub-basins and Drainages, and Engineering Appendix 2.15.5 describe the interior drainage analysis and design/location recommendations for the culvert system.
35	Section 5.2 of the Main Report will be revised to acknowledge that this reference was utilized in developing alternatives.
36	The Sierra Club was included on the mailing list for scoping comments and public comment on the draft report.
37	Environmental benefits were only used to screen the initial array of measures; environmental impacts were used as criteria in all subsequent screenings of alternatives.
38A	The study evaluated more than one alternative in sections 5.2, 5.3 and 5.4 of the DIFR-EIS.

38B	Sensitive habitat is a broad term which includes wildlife habitat. Operation and maintenance impacts were not an appropriate criteria for this early screening.
38C	Refer to Response 37. In addition, based on the results of the preliminary comparison of CSRM alternatives called the Gate and No Gate alternatives, the Neches River Gate alternative was eliminated from further consideration. Referenced statements have been taken out of context, and do not include explanatory material both before and between the quoted fragments. The screening was based primarily on cost since both the Gate and No Gate alternatives reduced the risk of storm surge to the same upland areas. A total cost was developed for the Gate and No Gate alternatives based on a previous Orange County engineering report. These costs did include environmental mitigation, although environmental mitigation was not called out as a specific line item in the cost comparison. Since mitigation costs developed by Orange County included only direct construction impacts, they could not be used to accurately compare alternatives when one of them, the Gate Alternative, would have more widespread impacts on the river system's hydrology, floodplain wetlands and fishery access. The section concluded that costs for mitigation of indirect impacts for either alternative would be dwarfed by construction costs, and therefore, environmental mitigation costs would not affect plan selection. Similarly, costs for cultural resource mitigation would be very small in comparison to construction costs, and also would not affect plan selection.
38D	The acronym for Expected Annual Damages (EAD) will be added to the FIFR-EIS. The DIFR-EIS clearly stated that levee system heights might be increased when RSLC was incorporated into the final design. Additional analyses in the final feasibility phase have resulted in the inclusion of the appropriate still water levels, RSLC and wave run-up components in the design of levee system heights for the Recommended Plan.
39	The DIFR-EIS identified a "Tentatively Selected Plan" (TSP) and a "Conceptual Mitigation Plan". Impacts of the TSP were clearly and thoroughly identified and disclosed. The types of mitigation anticipated at that time were discussed in the Main Report Section 6.1.3.2 and in Appendix O, section 8.0, and thus provided an opportunity for the public to review and comment on proposed mitigation in compliance with 40 CFR Section 1502.14 and 1502.16. Costs of the conceptual mitigation were considered in comparing alternatives presented in the DIFR-EIS. The report clearly stated that a final mitigation plan would be developed in compliance with Federal law. A final mitigation plan and the costs of that plan are presented in the FIFR-EIS.
40	Refer to Response 14
41	The DOW barge canal is a dead-end, artificial canal leading into the heart of the Freeport industrial zone. It has very little habitat value and therefore environmental impacts are negligible.
42	The sentence will be revised to clarify that no environmental impacts have been identified for the Freeport CSRM Plan, and therefore no mitigation costs, were included in the net benefit comparison table.
43	Refer to Response 21.
44	The type, purpose and condition of the other levees in the Freeport area have been taken into account in evaluating alternatives. Impacts associated with the proposed Freeport and Vicinity CSRM Plan are described in the FIFR-EIS. Refer to Response 21.
45	Refer to Response 39.
46	Refer to Response 21.

47	Refer to Response 1.
48A	We agree that the whole affected area needs to be assessed for impacts, and the environmental analysis in the DIFR-EIS and FIFR-EIS did just that. The report states that "No FWP impacts were identified for most of the areas vulnerable to RSLC in the FWOP condition." In other words, no RSLC impacts were identified for most of the affected area, but a few low lying areas would be inundated. The report includes descriptions of the areas that would be inundated.
48B	Refer to Response 34.
48C	The types of impacts described here are future without-project (FWOP) impacts. The impacts shown in Table 5-14 are net future with-project impacts; these are the direct and indirect impacts estimated to occur with project construction and relative sea-level rise. Cumulative impacts are addressed separately in Section 7.16.
48D	The report referenced the specific impacts of the proposed surge gates in the Cow and Adams Bayous. In this specific locale, higher tidal inundation would improve fisheries access, even with the structures in place. This is due to the particular configuration of the floodplains and structure locations. The statement was not overly broad or biased as asserted by the commenter. The environmental impact of the structures was acknowledged in the DIFR-EIS and the FIFR-EIS. Regarding estuarine soft bottom impacts from installation of the Adams and Cow Bayou surge gates, this water area has been included in the WVA impact analysis, and the loss will be fully compensated by shallow water restoration in association with marsh mitigation.
48E	Noise impacts have been addressed in the Main Report (Section 7.9). No light impacts are anticipated during construction as work would be restricted to day light hours. Both are temporary impacts and therefore do not affect cumulative impacts.
48F	It is not possible to estimate the time lapse between signing the Record of Decision and the start of construction. This is dependent upon approval from the Office of Management and Budget, Congressional authorization and Construction would take place in sequential phases over a series of years, and therefore, construction would be occurring in any one area for a much shorter duration of time.
49	Refer to Response 38D.
50	The costs utilized in the DIFR-EIS were conservatively high to ensure that inefficient plans were eliminated from consideration. Final estimated construction costs, which include pipeline and other relocations, have been presented in the FIFR-EIS
51	Further evaluation of the Beaumont A Alternative has resulted in it being eliminated from the Recommended Plan.
52	Rapid break.
53	Refer to Response 41.
54	Proposed improvements to the existing Port Arthur and Freeport HFPs do not increase the area of protection and thus have limited potential for increasing cumulative impacts. Projects referenced in the comment are not associated with the improvements proposed by this study and are part of the future without-project condition.
55	Impact analysis has determined that impacts are not sufficient to create a tipping point for affected resources (wetlands); the mitigation plan addresses incremental impacts of the recommended plan, not all impacts occurring in the future without the project.
56	Refer to Response 39. In addition, the term "to the extent practicable" is utilized by many regulations. It is not defined by the regulations because its meaning is commonly understood.

57	Compliance with the National Historic Preservation Act, including potential mitigation of historic property impacts, will be achieved with execution of the Programmatic Agreement that was provided for public review and comment in Appendix L of the DIFR-EIS. The PA includes a stipulation (Stipulation I, Section 3, Paragraph a, Subsection (2)) regarding the need to provide opportunities for public comment.
58	The referenced section refers to standard USACE Real Estate requirements language. Other sections of the report state that the plan assumes that borrow material will be obtained from commercial sources (Main Report Sections 7.4.1, 7.7.2; Appendix D, Section 5.1). If new borrow areas are identified during final feasibility planning or prior to construction, these areas will be evaluated for impacts in coordination with the resource agencies and the appropriate NEPA document will be prepared. Staging areas needed to support construction would be located in previously disturbed or non-wetland upland areas.
59	Appendix D, Section 9.2, states that alternative costs "...were developed using a Class 4 parametric approach using both historical and unit costs." Historical costs were based on total costs from a recent engineering evaluation of essentially the same project, and include all costs, including relocation costs.
60	Operations and maintenance costs will be developed for the Recommended Plan and provided in the FIFR-EIS.
61	The cumulative impacts section includes a discussion of potential FWOP impacts to wetlands from other past, present and reasonably foreseeable projects in the study area (including the authorized Freeport Harbor Channel deepening project, the authorized Sabine-Neches Waterway deepening project and others. Wetland impacts are the only significant environmental impacts that have been identified for the TSP. Only negligible impacts have been identified for the Freeport and Port Arthur CSRM Plans. NEPA documents, per 40 CFR 1500.1 must concentrate on issues that are truly significant to the action in question, rather than amassing needless detail. A lengthy recitation of all possible developments in the project area is not significant to the action in question
62	While RED is one of the accounts to be considered when developing project alternatives, the determination of a recommended plan rests in the identification of the NED per Corps policy. Since RED was determined to be relatively proportional to NED across all alternatives, RED itself would not change the overall ranking of alternatives. While RED benefits can help tell the story of a recommended plan, the current Corps model for assessing RED benefits was of little use due to the configuration of the study.
63	Refer to Response 6.
64A	Refer to Response 38D
64B	Refer to Response 1. In addition, the acronym will be added to the Main Report Acronym List.
65	Section 6.8 (Consistency with Other State and Federal Laws) of the Main Report provides a summary of the status of compliance with applicable laws and regulations. Impacts analyses, such as those referenced here, are presented in Section 7.8 (Environmental Consequences) of the Main Report and in many cases, additional supporting analyses are presented in appendices. In this case, Section 7.8 and Appendix I, Chapter 2 report the air quality impacts of the TSP in tons/year of air pollutants that would be released by equipment to be used in constructing the projects and evaluate the overall air emissions impacts for the Sabine and Brazoria regions.
66	Refer to Responses 56 and 65. In addition, Section 7.7 and Appendix H report the TSP water and sediment quality impacts for the Sabine and Brazoria regions.
67	Refer to Response 56.

68	The Federal Water Project Recreation Act focuses on providing opportunities for fish and wildlife enhancement and recreation in conjunction with Federal water development projects if non-Federal sponsors agree to share construction costs and be responsible for operations and maintenance. No opportunities for enhancement were identified and thus no impacts to outdoor recreation in the area in anticipated.
69	Refer to response 56. In addition, as reported in Section 7.12.1 of the Main Report, prime farmland impacts in Orange and Jefferson counties represent about 0.3 percent and 0.005 percent, respectively, of the total farmland in each county. Clearly, this represents a negligible cumulative impact. The Port Arthur and Freeport CSRM plans have no prime farmland impacts.
70	See Section 7.13 of the Main Report for an evaluation of floodplain impacts.
71	The comment that over 2,000 acres of wetlands will be destroyed is incorrect. As stated in Section 7.6.2.1, indirect functional losses would occur to a total of 2,137 acres of marsh. Total direct and indirect impacts of the Recommended Plan would result in the actual loss of about 272.5 acres of marsh and forested wetlands. In addition, refer to Response 39.
72	Refer to Response 65. In addition, Section 7.6.1 of the Main Report presents an analysis of connectivity/fragmentation impacts. The Orange CSRM Plan is the only part of the Recommended Plan that involves construction of a new levee system. The alignment for this plan has been placed along the upland-floodplain transition. The upland area consists of urban, residential and industrial areas, and thus therefore the levee systems does not fragment natural habitat. Impacts resulting from the impoundment of small areas of the floodplain by the alignment would be fully compensated by the mitigation plan.
73A	Section 7.1.1 of the Main Report clearly states that the Recommended Plan would impact the Tony Houseman and Lower Neches River Wildlife Management Areas.
73B	The subtotals and totals in Table 7-1 of the Main Report have been checked and are correct. As stated in the report, the Freeport CRSM plan include no new levee segments and thus does result in fragmentation/connectivity impacts
73C	Refer to Response 17.
74	Refer to Responses 17 and 72.
75	Refer to Response 34. In addition, Operating Plans are always developed after completion of the feasibility report. They are based on issues and concerns that have been presented in the draft report and subject to public review and comment. The Operating Plan would be developed in consultation with resource agencies during the Pre-Construction Engineering and Design (PED) Phase.
76	Areas of indirect hydrologic impacts are described in Appendix O, Section 7.1.
77	No environmental impacts have been identified for the Port Arthur CSRM Plan. The term "negligible" was used to be conservative in the impact assessment.
78	Refer to Response 41.
79	The report discusses a range (from low to high) of potential relative sea level change (RSLC). This range is prescribed by USACE guidance.
80	Refer to Response 9.
81	Refer to Response 61.
82	Refer to Responses 71 and 72. In addition, the impacts to Cow and Adams Bayou are functional impacts, not direct impacts. The amount of impact and the appropriate compensation will be determined with the WVA model.
83	Refer to Response 72.

84	Refer to Responses 39 and 48D.
85	Response 41. In addition, the Recommended Plan will have no impacts in the Little Cypress Bayou area.
86	Refer to Response 41.
87	Air emissions modeling and a summary of impacts are reported in Appendix I. The Recommended Plan does not cause climate change. Project impacts are being addressed within the context of future without-project conditions that are affected by climate change. Only impacts that result from project construction or operation will be addressed by the mitigation plan.
88	Refer to Response 57.
89	Refer to Response 69.
90	Refer to Response 6.
91	Refer to Response 6.
92	Refer to Response 17. In addition, the Recommended Plan would not impact the Big Thicket National Preserve
93	Section 7.16.2.3 discusses the cumulative impacts of the multiple USACE projects that have been constructed in the Brazoria region, including the GIWW, the Brazos River Diversion Channel, and the Freeport Harbor Channel 45-foot project.
94	Refer to Response 71.
95	Section 7.20 of the Main report will be revised to acknowledge energy needed to operate and maintain the new levee system.
96	Refer to Response 14.
97	Refer to Response 6. In addition, "corporate" has more than one acceptable definition. In this case, the term is defined as a group of people authorized to act as a single entity and recognized as such in law.
98	Refer to Response 37.
99	Refer to Response 2.
100	"Most reasonably maximizes" is a USACE policy requirement; it is interpreted according to the specifics of each individual project.
101	The meaning of the word or phrase in question is commonly understood.
102	The study utilized the RSLC methodology required by USACE and the recent IPCC reports. The IPCC citation in Appendix B will be revised to 2014.
103	Refer to Response 2.
104	Refer to Response 37
105	The positive and negative effects of storm surge on the coastal environment were presented in Section 2.3.2 of the main report. Environmental benefits were only used to screen the initial array of measures, as a quick measure of the size of area over which environmental impacts of storm surge, such as scour and saltwater intrusion, would occur in the absence of the measure. Environmental impacts were used as criteria in all subsequent screenings of alternatives.
106	These estimates were for plan comparison purposes only. They were conservatively high to ensure that inefficient plans were identified and eliminated. The actual cost of the recommended plan will be presented in the FIFR-EIS.
107	The referenced initial screening criteria included "system-wide hydrologic impacts" as noted in Table 5-4.

108	Refer to Response 2.
109	Refer to Response 2.
110	Refer to Response 2.
111	Refer to Response 40.
112	Refer to Response 40.
113	Refer to Response 40.
114	Refer to Response 40.
115	An additional assessment is being conducted to reinforce the determination that non-structural alternatives were not appropriate for this study. The only area where non-structural alternatives may be applicable is at the Jefferson-Orange CSRM where there is no existing system. Nonstructural alternatives (particularly permanent evacuations) make sense in areas with wide variations in topography and considerable numbers of structures being damaged at frequent events. Orange County is the antithesis of this. The topography is flat and a significant number of structures do not begin to get damaged until the 20-year event. For this event, over 3,000 single- and multi-family houses would need to be evacuated in order to have a reasonable impact on reducing storm damages. Taking out this many structures would have a detrimental impact on area's tax base and therefore would more than likely not be supported by an implementing sponsor. The Lone Star conservation plan would likewise not be appropriate for this area, as it would require acquisition of large areas of private property from willing sellers and conversion of suburban communities to fish and wildlife conservation areas. This would likewise have an adverse effect on the area's tax base and the social fabric of this community.
116	The potential failure issues associated with this language of the report concern the overtopping failure probability of the Freeport and Port Arthur levee systems. The potential failure issues associated with this project are currently not an operations and maintenance concern borne solely by the sponsor. The current status of the O&M issues to be addressed will not affect the recommended plan of this project. The recommended plan for both Freeport and Port Arthur are relatively the same size and scope of what the sponsor's currently maintain and in one case, there is possibility for less maintenance with this project. The recommended plan for the Orange county area will have a different sponsor than the Port Arthur or Freeport levee systems. This report makes the assumption that if this project is not implemented then both the Freeport and Port Arthur systems would have no avenue to address overtopping of the levee system due to RSLC. There might be things that could happen, but at this time, the assumption made by the USACE will remain as stated.
117	Refer to Response 38D.
118	Refer to Response 115.
119	Refer to Response 115.
120	Refer to Response 2.
121	Due to the Port Arthur SQRA being in a draft status at the time of this report submittal, some of the results from the finalized Freeport SQRA were utilized in determining the path forward for the system. The SQRA is currently not a document that goes through the public commenting process. It is finalized through extensive reviews within the USACE

	and then released to the public. The public can then provide concerns, but the USACE will not change the findings of the SQRA.
122	The maintenance concerns of the system are not due to an issue with the local sponsor 'not being able to keep up' with the maintenance issues. These concerns are present due to more stringent USACE guidance and policy concerning operations and maintenance of levee systems. The sponsor currently has a plan in place to address these maintenance issues and is continually working to resolve the issues.
123	Refer to Response 38D.
124	Depth-damage functions that had previously been used in previous studies for the Texas coast were deemed to be inappropriate because they did not account for saltwater effects of short durations. Due to this being one of the first studies in the Southwestern Division to be conducted under the Corps' Planning Modernization where time and funds are limited, this particular study did not have the time nor the funding to develop Texas Coast-specific depth-damage functions. The use of the New Orleans functions was vetted and approved through the Corps' vertical team early on in the study.
125	Refer to Response 124.
126	Refer to Response 124.
127	Refer to Response 124.
128	Refer to Response 124.
129	Refer to Response 115.
130	Refer to Response 101.
131	Refer to Response 115.
132	Refer to Response 115.
133	Refer to Response 37.
134	Refer to Response 61.
135	Refer to Response 38D. The USACE, as part of efforts to reduce the time and tax dollars that it takes to complete studies, has required the use of SMART Planning guidelines in preparing new feasibility reports such as this one. These requirements, which were codified in law by the Water Resources Reform and Development Act of 2014 (P.L. 113-121, June 10, 2014), specify the level of detailed analysis to be performed in developing the Tentatively Selected Plan (TSP) and relegate detailed design effort to the final feasibility analysis. The guidelines also set much shorter time frames for the completion of feasibility reports. These changes are intended to reduce the length of the report in compliance with 40 CFR 1500.4, while adequately addressing all potential significant impacts of the proposed project.
136	Refer to Response 51.
137	"Fairly frequent" has now been computed and is estimated on an annual basis at two-thirds of a percent chance (0.67%/yr).
138	Refer to Responses 1, and 115. "Catastrophic failure" means that it is breached.
139	LSAC will be added to the Acronym List in the Main Report.
140	Refer to Response 115.
141	FOS will be added to the Acronym List in the Main Report.

142	The year in which Hurricane Carla occurred will be corrected in Appendix D.
143	There are no 130-year overtopping projections. We have computed 1yr, 2yr, 5yr, 10yr, 20yr, 50yr, 100yr, 500yr.
144	In subsequent phases of the project, more detailed analyses will be conducted and will possibly lead to utilization of a higher level of assurance.
145	Since the submittal of the report the USACE has changed what RSLC scenario it will use for the project. The project currently will utilize the intermediate level for all features. Currently all features on the project have the capability to be adaptable to higher RSLC scenarios, if found to be necessary in the future.
146	Since submittal of this draft report, the adjacent impacts were calculated and are considered negligible. The language stated above has been removed from the report.
147	Modeling has been completed for the project. During subsequent phases of the project, a more extensive analysis will be completed. The report states "More detailed engineering analyses will be conducted during the PED phase."
148	The referenced statement in Section 2.13.8 of Appendix D will be corrected as suggested.
149	Comment noted.
150	Refer to Response 34.
151	Refer to Response 34.
152	The estimated increases are shown in the tables in the same section (2.17.3) of Appendix D.
153	The distance can be estimated by looking at the figure in the report.
154	Sensitivity analyses, conducted to investigate the impacts of differently-sized constrictions, determined that water surface elevation and salinity impacts described in this section, are robust.
155	This level of detail will not be determined until pre-construction engineering and design phase.
156	Refer to Response 155.
157	Refer to Response 155.
158	Excavated material generated as a by-product of construction will be used in the construction of the levee system. Thus, environmental impacts have already been identified in the direct impact analysis.
159	Refer to Response 101.
160	Environmental impacts associated with loss of forested wetlands are described in detail in Sections 7.5 and 7.6 of the Main Report, and in Appendix O.
161	Pipeline relocation costs were embedded in the unit costs used to prepare the estimate. The report will be revised to report the correct information and for consistency.
162	Refer to Responses 39 and 135.
163	The information provided supported the analysis presented. The percent change from intermediate to high is between those already provided and can easily be interpolated by the reader.
164	Refer to Response 39. In addition, the WVA models were developed for habitats like those found in the project area. Independent review of the model has confirmed that it is applicable and appropriate for determining impacts and quantifying mitigation in the project area.
165	As explained in Appendix O, marsh vegetation mapping is based on a USGS 2010 classification; forested wetland acreages utilized the 1992 National Wetland Inventory but

	were also updated using current imagery, and spot checked by groundtruthing. Groundtruthing of 100 percent of a project area of this size is simply not possible. The marsh classification determined that while salt marsh is present to the south, there is none in the project area.
166	Spot checking confirmed that the reference areas had not changed to any significant degree and therefore the data was applicable.
167	Refer to Response 38D.
168	As explained in Appendix O, some aspects of the WVA Coastal Marsh Model concerning variables 1, 2, and 3 were found to have been defined primarily by policy and/or functional considerations of Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA). These concerns are being evaluated with a sensitivity analysis to be presented in Appendix Q. As directed by HQUSACE, plan formulation for this study will be based on V 1.0 of the WVA model. The WVA model has undergone an independent technical review to ensure that it is a technically and theoretically sound and functional tool that can be applied to planning studies. This review (Final Model Review Report for the Wetland Value Assessment Models, dated 31 August 2010, Battelle Memorial Institute) determined that the model and its accompanying documentation are theoretically appropriate and technically sound. Furthermore, an agency technical review determined that the WVA model has been correctly applied to the S2G study. The WVA Model is a quantitative, habitat-based assessment methodology initially developed for use along the Louisiana coast but it has been confirmed that it is appropriate for application through the Galveston Bay region of the upper Texas Gulf coast. The same types of coastal habitat (Chenier Plain, emergent coastal marsh, bottomland hardwoods, and cypress-tupelo swamp) are present throughout the Sabine-Neches coastal watershed in both Texas and Louisiana, and in fact are a continuation of the same system. In addition, the areas contain the same fish and wildlife communities and similar soils and topography.
169	Refer to Response 168.
170	Refer to Response 168.
171	Data from optimum growth conditions results in a conservatively high impact estimate.
172	Based on current RSLR rates, the change in water surface over that time period would be around 3 inches, which is well within the range of error for any of the calculations and estimates used for this modeling effort.
173	Refer to Response 168.
174	Refer to Response 168.
175	Refer to Response 168.
176	Refer to Response 192.
177	Refer to Response 1. In addition, models are intended to be a simplification of reality and average conditions are typically utilized. Where possible, conservative assumptions were used that over-predict impacts so that impacts are not understated.
178	Refer to Response 168.
179A	Specifics regarding culverts and flap gates will be determined with final design. The reference on page 57 will be revised to state that the impacts will be minimized such that remaining impacts are negligible.
179B	Details on the interior drainage analysis is presented in Appendix D, Sections 14 – 17.

179C	As stated in the report, the location and extent of ground water flows will be determined during final design.
179D	The monitoring and adaptive management plan must be developed for the final mitigation plan, which cannot be finalized until the recommended plan is finalized.
179E	The referenced report studied general human behavior that is not geographically dependent.
179G	Details on indirect impacts are presented in Appendix O, section 7.2.2.3.
179H	Refer to Response 179G.
180	The Recommended Plan protects areas that have already been developed; it is not unreasonable to assume that developed areas will continue to be developed as they have in the past. This is not a project-related impact and therefore mitigation would not be required.
181	Refer to Response 39.
182	Refer to Responses 39 and 56.
183	These differences are the result of rounding and do not affect the results. Revisions are not appropriate. Formulas used in the WVA models are provided in the USFWS references for these models which are cited in the References section.
184	Refer to Response 183.

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

APPENDIX G

AGENCY AND TRIBAL COORDINATION

May 2017

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PART I
RESOURCE AGENCY COORDINATION

Resource Agency Cooperating Agency Requests

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 17300
FORT WORTH, TEXAS 76102-0300
November 19, 2014

REPLY TO ATTENTION OF

NEPA/Cultural Resources Section

Edith Erfling
Field Supervisor
Clear Lake Ecological Services Field Office
17629 El Camino Real, Suite 211
Houston, Texas 77058

Dear Ms. Erfling:

The Galveston District, Corps of Engineers, and the non-federal sponsor, the Texas General Land Office, would like to invite your agency to participate as a cooperating agency in the development of an Environmental Impact Statement (EIS) for the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study. The Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) will evaluate structural and non-structural alternatives which address coastal storm risk management (CSRM) impacts and ecosystem restoration (ER) opportunities in Orange, Jefferson, Chambers, Harris, Galveston and Brazoria Counties. The Draft IFR-EIS is currently scheduled to be released for public review and comment in August 2015.

Structural alternatives that will be evaluated are: (1) new surge protection levees and small, navigable surge gates on Cow and Adams Bayous in Orange and Jefferson Counties; (2) a large navigable surge gate in the Neches River near the Rainbow Bridge (eliminated); and (3) reevaluation of the existing Port Arthur and Freeport Hurricane Flood Protection (HFP) systems in Jefferson and Brazoria Counties, respectively. Maps showing the location of the existing HPFs and the structural alternatives are enclosed. Non-structural measures such as targeted buy-outs will also be evaluated. Structural and non-structural alternatives to address storm surge impacts in the Galveston Bay system, as well as ER measures throughout the six-county study area will be evaluated programmatically, with recommendations being made for detailed analyses of feasible alternatives in future studies.

We are inviting your participation as a cooperating agency pursuant to Council on Environmental Quality (CEQ) Regulations for Implementing the National Environmental Policy Act (NEPA) (40 CFR Part 1501.6). Furthermore, we would like to coordinate with you our schedule for study completion so that all reviews and approvals will, to the maximum extent practicable, be conducted concurrently. This concurrent coordination is required by Section 2045 of the Water Resources Development Act of 2007. The following review periods for the Biological Opinion (if needed) and the IFR-EIS have been established in accordance with the current project schedule:

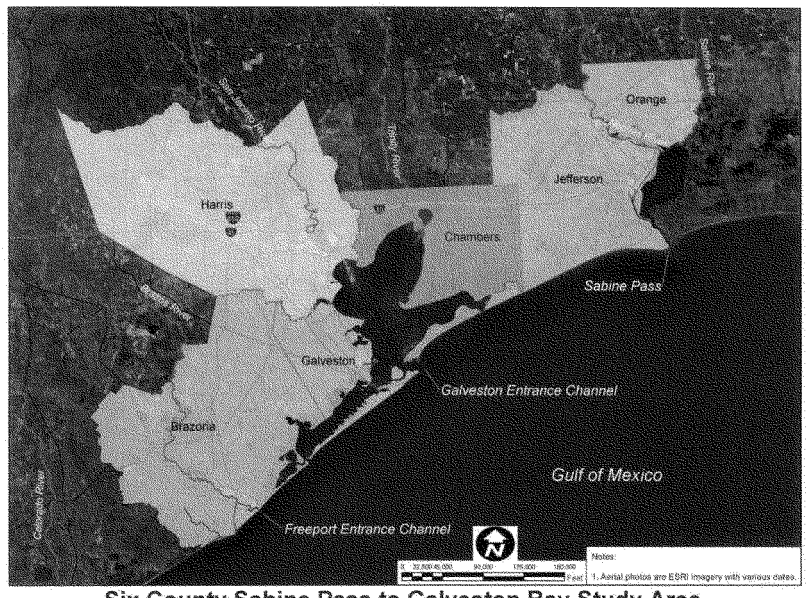
Draft Biological Opinion – 120-day preparation period (January 5 through May 7, 2015)
Final Biological Opinion – 45-day review period (May 26 through July 13, 2015)
Draft Coordination Act Report – due March 31, 2015
Final Coordination Act Report – due April 17, 2015
Review of Draft IFR-EIS –45-day review period (August 29 through October 12, 2015)
State and Agency Review of Final IFR-EIS – 30-day review (July 15 through August 14, 2016)

We appreciate this opportunity to invite your agency's participation as a cooperating agency and request that you advise us as to whether the review periods are acceptable to your agency. If you should have any questions regarding this request, please contact Janelle Stokes of my staff at (409) 766-3039.

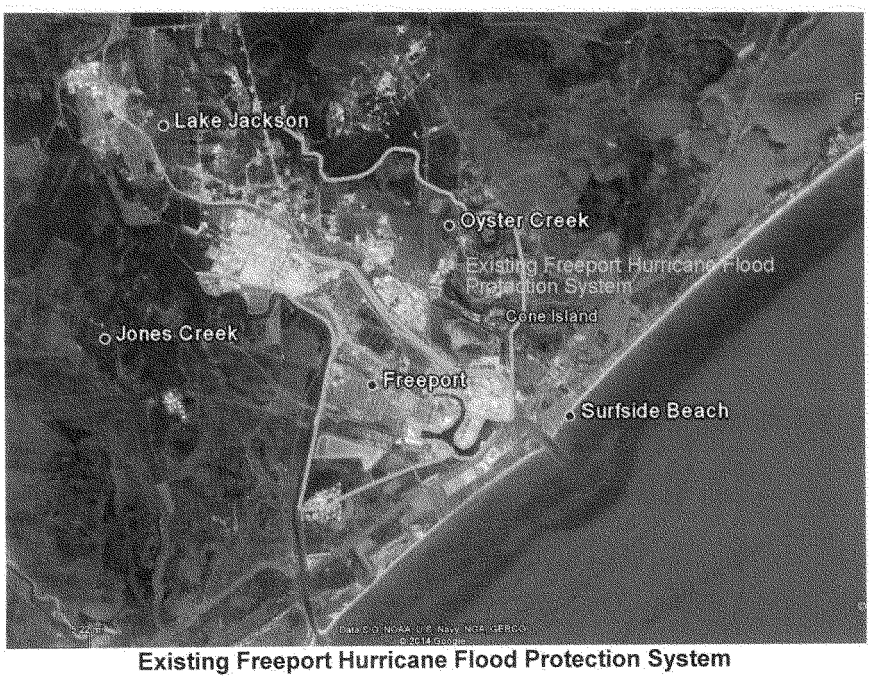
Sincerely,

Carolyn Murphy
Chief, Unit A, NEPA/Cultural
Resources Section

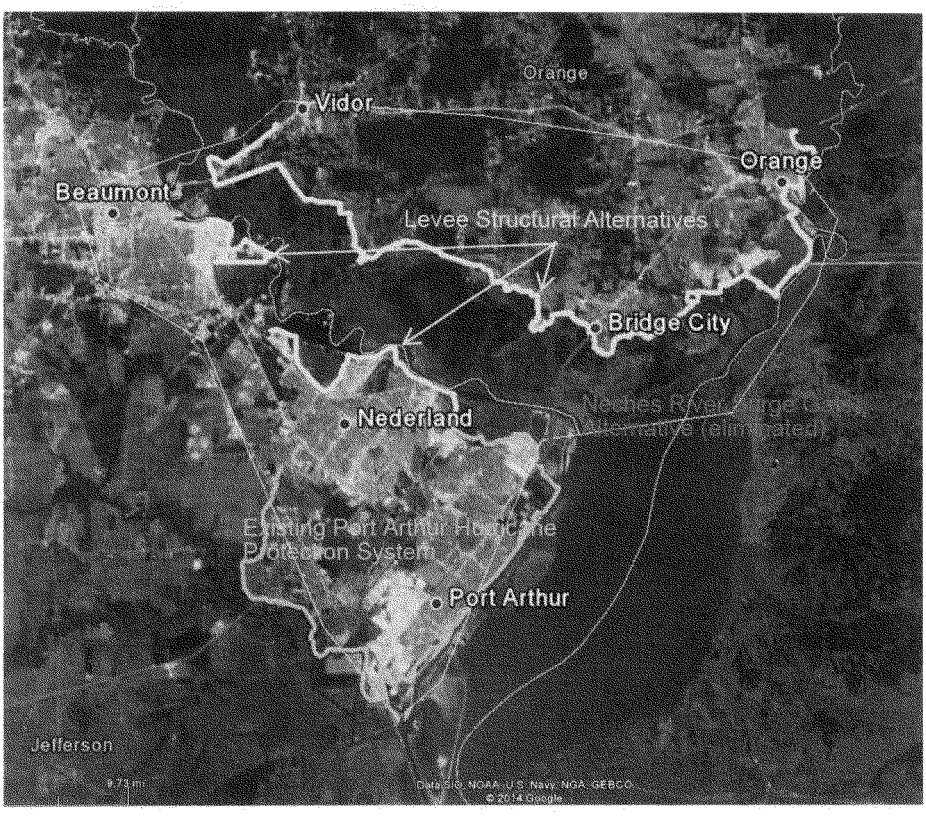
Enclosures



Six County Sabine Pass to Galveston Bay Study Area



Existing Freeport Hurricane Flood Protection System



Existing Port Arthur Hurricane Flood Protection System, Levee Structural Alternatives and Neches River Surge Gate Alternative

Identical Cooperating Agency Letters Also Sent To:

Rusty Swafford
National Marine Fisheries Service
4700 Avenue U
Galveston, Texas 77551

Rebecca Hensley
Ecosystem Resources Program Regional Director
Texas Parks and Wildlife Department
1502 FM 517 East
Dickinson, Texas 77539

Greg Easley
Texas Commission on Environmental Quality
P.O. Box 13087, MC-150
Austin, Texas 78711-3087

Matthew Mahoney
Waterways Program Coordinator
Texas Department of Transportation
Maritime Division
118 E. Riverside Drive
Austin, Texas 78704

Ray Newby
Coastal Resources Division
Texas General Land Office
P.O. Box 12873
Austin, Texas 78711-2873

Phil Kelley
Manager
Jefferson County Drainage District No. 7
P.O. Box 3244
Port Arthur, Texas 77643

Brent Peveto
Director-At-Large
Orange County Drainage District
8081 Old Highway 90
Orange, Texas 77630

George Kidwell
Chairman
Velasco Drainage District
915 Stratton Ridge Road
Clute, Texas 77531

One agency (NOAA-NMFS) responded with an acceptance of this request. No agencies declined.

November 25, 2014 F/SER46: HY

Ms. Carolyn Murphy
Chief, Unit A, NEPA/Cultural Resources Section
Galveston District
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Ms. Murphy:

The NOAA's National Marine Fisheries Service Habitat Conservation Division (NMFS HCD) has received your letter dated November 19, 2014, inviting NMFS HCD to participate as a cooperating agency in the development of an Environmental Impact Statement (EIS) for the Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study. The EIS and Integrated Feasibility Report to be prepared by the U.S. Army Corps of Engineers Galveston District and the non-federal sponsor, the Texas General Land Office, will evaluate structural and non-structural alternatives which address coastal storm risk management impacts and ecosystem restoration opportunities in Orange, Jefferson, Chambers, Harris, Galveston and Brazoria Counties.

The NMFS HCD will accept your invitation to be a cooperating agency for the preparation of the EIS. However due to our very limited staff resources and a heavy regulatory review workload, we will have to restrict our participation to activities such as: (1) review of relevant sections of draft documents, (2) participation in meetings and teleconferences, and (3) occasional field inspections to portions of the project that may adversely affect Essential Fish Habitat.

We appreciate your invitation to participate in this study and look forward to working with the Galveston District. If we may be of further assistance, please contact Ms. Heather Young of our Galveston Facility at (409) 766-3699.

Sincerely,

Virginia M. Fay

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc:
USACE, Galveston, Stokes
F/SER4, Dale, Rolfes

U.S. Environmental Protection Agency Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

Mr. Michael Jansky
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Mail Code 6 ENXP
Dallas, Texas 75202-2733

Dear Mr. Jansky:

Enclosed please find five compact disks of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement. This draft report is provided for your review in conformance with the National Environmental Policy Act.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosure

CF w/o encl:
Tirpak, CWSWG-PM-J

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

October 21, 2015

Carolyn Murphy
Acting Chief
Plan Formulation Section
U.S. Army Corps of Engineers
Galveston District
P.O. Box 1229
Galveston, TX 77553-1229

RE: Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report (DIFR)-Draft Environmental Impact Statement (DEIS)

Dear Ms. Murphy:

Pursuant to National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations (40 CFR Parts 1500-1508) and the Section 309 of the Clean Clear Act, and Section 404 of the Clean Water Act (CWA), the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas, is reviewing the proposed Galveston District, U.S. Army Corps of Engineers Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report (FIFR)-Draft Environmental Impact Statement (DEIS).

We understand that the DEIS review and comment period ends on Monday, October 26, 2015. However, due to the complexity of the project, and the associated environment impacts; EPA does not have sufficient time to develop a complete, thorough, and coordinated review within the time constraints allowed. Additional review time is needed to assure EPA's concerns are fully identified and coordinated for consistency within our Agency. As we discussed with Janelle Stokes of your staff, on October 20th, the additional time is warranted to facilitate additional discussion and coordination with your agency, if needed. EPA is seeking a fourteen (14) consecutive day extension of the *EPA's review and comment period* ending on Monday, November 09, 2015. We plan to have our comments to you on or before this date.

We hope this additional time has not inconvenienced you; however, this extension is necessary to assure that EPA's concerns are complete and consistent for the EIS being developed. If you have any questions, please contact me at 214-665-7451 or by e-mail at jansky.michael@epa.gov respectively, for assistance.

Sincerely,

Michael Jansky (6ENXP)
Regional EIS Coordinator/R6
Office of Planning and Coordination

ITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

October 30, 2015

Carolyn Murphy
Acting Chief
Plan Formulation Section
U.S. Army Corps of Engineers
Galveston District
P.O. Box 1229
Galveston, TX 77553-1229

RE: Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report (DIFR) and Draft Environmental Impact Statement (DEIS)

Dear Ms. Murphy:

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulations for implementing NEPA, the U.S. Environmental Protection Agency (EPA) Region 6 office, Dallas, Texas has completed its review of the proposed Sabine Pass to Galveston Bay, Texas, Coastal Strom Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report (DIFR) and Draft Environmental Impact Statement (DEIS) prepared by the Galveston District, U.S. Army Corps of Engineers (COE) and Texas General Land Office.

The DIFR and DEIS examines coastal storm risk management (CSRM) and ecosystem restoration (ER) opportunities within six counties of the upper Texas coast (Orange, Jefferson, Chambers, Harris, Galveston, and Brazoria Counties). Currently, the study has identified and screened alternatives to address CSRM and ER, and is presenting a Tentatively Selected Plan (TSP). This DIFR and DEIS will undergo public review, policy review, Agency Technical Review (ATR), and Independent External Peer Review (IEPR). The COE study team will respond to review comments, then present a recommended plan and develop a Final Integrated Feasibility Report and Final Environmental Impact Statement.

EPA has rated the DEIS as **EC-2**, i.e.; (**Environmental Concerns and Request Additional Information**). The EPA's Rating System Criteria can be found at http://www.epa.gov/compliance/nepa/comments/ratings.html. We have enclosed detailed comments that identify our concerns and recommendations for additional analysis in the Final EIS (FEIS).

EPA appreciates the opportunity to review the DIFR and DEIS. Please note that a copy of this letter will be published on our website, http://www.epa.gov/compliance/nepa/eisdata.html, in order to fulfill our responsibility under Section 309 of the CAA to inform the public of our views on the proposed Federal action. Please send our office one copy of the FEIS when it is filed using our *e-NEPA Electronic Filing System* at http://www.epa.gov/compliance/nepa/submiteis/index.html. If you have any questions or concerns, please contact me at (214) 665-7451or jansky.michael@epa.gov for assistance.

Sincerely,

Michael Jansky, P.E, Acting Chief
Office of Planning and Coordination (6ENXP)
Compliance Assurance and Enforcement Division

Enclosure

DETAILED COMMENTS
ON THE
U.S. ARMY CORPS OF ENGINEERS (COE)
AND
TEXAS GENERAL LAND OFFICE (TGLO)
DRAFT INTERGRATED FEASIBILITY REPORT AND
DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE
SABINE PASS TO GALVESTON BAY, TEXAS,
COASTAL STORM RISK MANAGEMENT (CSRM) AND
ECOSYSTEM RESTORATION (ER) PROJECT

Background

General Authority

Authorization for the this study is derived from a resolution from the United States Congressional Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study".

By resolution dated June 23, 2004 entitled "Coastal Texas Protection and Restoration Study", the Committee on Environment and Public Works, U.S. Senate has requested that in accordance with Section 110 of the Rivers and Harbors Act of 1962 the Secretary of the Army develop a comprehensive plan for severe erosion along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply to coast, restoring and preserving marshes and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area.

The study fits into the overall concept of the authorization to conduct an integrated and coordinated approach to locating and implementing opportunities for CSRM and ER. The purpose of the study is to recommend for Congressional approval a regional CSRM and ER project that encompasses the six coastal counties of the upper Texas coast between Sabine Pass and Galveston Bay.

Study Purpose and Scope

The purpose of this report and DEIS is to present the findings of the feasibility investigations and analyses conducted to determine if there is a Federal interest in potential CSRM and ER projects within the coastal areas of the six-county study area. This study is an interim response to the "Coastal Texas Protection and Restoration Study," authority. Originally, the study was intended to develop recommendations for regional CSRM and ER projects for Congressional approval across a study area encompassing six counties along the upper Texas coast between Sabine Pass and Galveston Bay. Because of a 3x3x3 Rule exemption approved February 25, 2014, the study scope was revised to focus full feasibility planning efforts on CSMR projects in the northern (Orange and Jefferson) and southern (Brazoria County) parts of the study area. Accordingly, the feasibility study effort described here has focused on CSRM

recommendations for the Sabine Region (Orange and Jefferson Counties) and the Brazoria Region (the Freeport metropolitan area in southern Brazoria County). It was agreed that this report would present a programmatic overview of CSRM problems and opportunities in the central Galveston region (Galveston, Harris, and Chambers Counties) and a programmatic assessment of ER opportunities for the entire six-county study area.

The DEIS describes and illustrates measures that were evaluated, combined into potential alternatives, and screened. The alternatives evaluated include an extensive list of CSRM alternatives for Galveston Bay and ER alternatives for the entire six-county area. Reducing life-safety risk is a primary objective of the study; however, careful evaluation of alternatives is required to ensure that structural plans do not increase risk.

Study Area

The study area encompasses six coastal counties of the upper Texas coast (Figure 1-1). Over five million people reside in the six counties, which includes the fourth largest U.S. city (Houston), and three other metropolitan areas (Beaumont/Port Arthur/Orange, Galveston/Texas City, and Freeport/Surfside). Approximately 2.26 million people across the study area live within storm-surge inundation zones, and estimates for a one-month closure of the Houston Ship Channel (HSC) alone are upwards of $60 billion in damages to the national economy.

Non-Federal Sponsor

The Galveston District COE is responsible for the overall management of the study and the report preparation. As the non-Federal sponsor of the study, the TGLO was actively involved throughout the study process. The existing Port Arthur and the Freeport HFPPs local sponsors have expressed interest in cost sharing for the Tentatively Selected Plan (TSP) identified for the Port Arthur and Vicinity CSRM and the Freeport and Vicinity CSRM. The local sponsors responsible for operation and maintenance are the Jefferson Country Drainage District No. 7 and the Velasco Drainage District (VDD), respectively. The local sponsor for Orange-Jefferson CSRM would be Orange and Jefferson Counties. They have also expressed interest in cost share for construction.

COMMENTS

The following comments are offered for COE and TGLO consideration in preparation of the FIFR and FEIS:

Wetlands/Section 404 CWA/Mitigation

The Clean Water Act (CWA) Section 404 regulates the discharge of dredged or fill material into waters of the United States (WOUS), including wetlands and other *special aquatic sites*. Due to the nature of the proposed project, Section 404 will apply for the required dredging and construction of the CSRM alternatives for Galveston Bay and ER alternatives for the entire six-county area, and therefore the project sponsors and/or applicant should coordinate with the

COE.

EPA has developed comments and has identified environmental concerns regarding dredge and fill construction activities and their related impacts to aquatic resources for this project. The EPA Region 6 Section 404/Wetland Section (6WQ) staff developed a list of **General Comments** and **Specific Comments** for your consideration. EPA requests that the information, recommendations, and requested clarifications be incorporated and addressed within the FEIS. 1

These comments and concerns are included as **ATTACHMENT 1** to the Detailed Comments enclosed with our comment letter. Should you have any specific questions with regard to this attachment, please contact me or Ken Teague of the Region 6 Wetlands Section at 214-665-7451 or 214-665-6687, respectively, for assistance.

Air Quality

PM_{10} Emissions and Fugitive Dust Control:

The EPA appreciates the air quality assessment and analysis, including the estimation of emissions from non-road and on-road equipment using MOVES 2014, that was included in Appendix I of the DEIS. However, given that the scale and geographic scope of the Tentatively Selected Plan (TSP) area is quite large (Sabine Pass to Galveston Bay), EPA believes it is especially important that mitigation measures include the use of best management practices for PM_{10} and fugitive dust control (e.g., gravel roads, soil wetting practices, limiting access, traffic and speed reduction). In order to further reduce potential air quality impacts, the responsible parties should develop a more detailed Construction Emissions Mitigation Plan (Plan) – or modify Appendix I of the DEIS accordingly. 2

EPA recommends that, in addition to all applicable local, state, or federal requirements, the following mitigation measures be included (**as applicable and practicable**) in the Plan in order to reduce air quality impacts associated with emissions of NOx, CO, CO_2, PM, SO_2, and other pollutants from construction-related activities, any planned structural and non-structural activities (e.g., new levees, surge gates, pump stations, I-walls, railroad track closure structures), and possible future modifications to the roadway system:

Recommendations:

- *Construction Emissions Mitigation Plan* – we recommend the following control measures be included (**as applicable and practicable**) in the Construction Emissions Mitigation Plan in order to reduce impacts associated with emissions of particulate matter and other pollutants from construction-related activities:
    - Fugitive Dust Source Controls: We recommend that the plan include these general commitments:

- Stabilize heavily used unpaved construction roads with a non-toxic soil stabilizer or soil weighting agent that will not result in loss of vegetation, or increase other environmental impacts.
- During grading, use water, as necessary, on disturbed areas in construction sites to control visible plumes.
- Vehicle Speed
    - Limit speeds to 25 miles per hour on stabilized unpaved roads as long as such speeds do not create visible dust emissions.
    - Limit speeds to 10 miles per hour or less on unpaved areas within construction sites on un-stabilized (and unpaved) roads.
    - Post visible speed limit signs at construction site entrances.
- Inspect and wash construction equipment vehicle tires, as necessary, so they are free of dirt before entering paved roadways, if applicable.
- Provide gravel ramps of at least 20 feet in length at tire washing/cleaning stations, and ensure construction vehicles exit construction sites through treated entrance roadways, unless an alternative route has been approved by appropriate lead agencies, if applicable.
- Use sandbags or equivalent effective measures to prevent run-off to roadways in construction areas adjacent to paved roadways. Ensure consistency with the project's Storm Water Pollution Prevention Plan, if such a plan is required for the project.
- Sweep the first 500 feet of paved roads exiting construction sites, other unpaved roads en route from the construction site, or construction staging areas whenever dirt or runoff from construction activity is visible on paved roads, or at least twice daily (less during periods of precipitation).
- Stabilize disturbed soils (after active construction activities are completed) with a non-toxic soil stabilizer, soil weighting agent, or other approved soil stabilizing method.
- Cover or treat soil storage piles with appropriate dust suppressant compounds and disturbed areas that remain inactive for longer than 10 days. Provide vehicles (used to transport solid bulk material on public roadways and that have potential to cause visible emissions) with covers. Alternatively, sufficiently wet and load materials onto the trucks in a manner to provide at least one foot of freeboard.
- Use wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) where soils are disturbed in construction, access and maintenance routes, and materials stock pile areas. Keep related windbreaks in place until the soil is stabilized or permanently covered with vegetation.

- Mobile and Stationary Source Controls:
    - Plan construction scheduling to minimize vehicle trips.

- Limit idling of heavy equipment to less than 5 minutes and verify through unscheduled inspections.

o Administrative controls:
  - Develop a construction traffic and parking management plan that maintains traffic flow and plan construction to minimize vehicle trips.
  - Identify any sensitive receptors in the project area, such as children, elderly, and the infirm, and specify the means by which impacts to these populations will be minimized (e.g. locate construction equipment and staging zones away from sensitive receptors and building air intakes).
  - Include provisions for monitoring fugitive dust in the fugitive dust control plan and initiate increased mitigation measures to abate any visible dust

Climate Change

The DEIS mentions Council on Environmental Quality's (CEQ) guidance entitled "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions". It is unclear in the DEIS how the guidance was applied to the proposed project. Because any such emission contribute to climate change impacts in the U.S., it is appropriate to consider and disclose them in the EIS due to their reasonably close causal relationship to the project. 3

Recommendations:

EPA recommends that the FEIS describes measures to reduce GHG emissions associated with the project, including practicable mitigation opportunities and disclose the estimated GHG reductions associated with such measures. EPA further recommends that COE commit to implementation of reasonable mitigation measures that would reduce or eliminate project-related GHG emissions.

Environmental Justice

The DEIS states that based on the findings of an environmental justice review, presented earlier in the report, the Sabine and Brazoria TSPs would not significantly disproportionately affect low-income or minority populations. Data were compiled to help assess the potential impacts on minority and low-income populations within the study area. This information indicates that 10 of the 39 2010 Census tracts in the Brazoria County study area, 20 of the 33 tracts in the Jefferson County study area, and 7 of the 40 tracts in the Orange County study area have minority populations higher than 50 percent.

The potential for impacts from the TSP on protected populations exists primarily at the Orange-Jefferson CSRM since it encompasses the construction of new levees and floodwalls.

For the purposes of making a determination on the potential for impacts on potentially protected populations, the racial makeup of the Census block groups that intersect the footprint of the proposed features of the Orange-Jefferson portion of the TSP were examined. Of the eleven Census block groups, only one displayed a population where more than 50 percent of the population was non-white. Census block 202.1 has a white population of 44.1 percent with the remaining belonging to historically identified minority groups. There is no indication that populations may be protected on the basis of existing income among these Census block groups.

Census block 202.1, however, resides at the very end of the Orange 3 reach of the proposed TSP in Orange County where impacts would not be expected to be as great as the potential impacts in other areas. Public involvement will need to continue to ensure no disproportionate impacts occur for these residents.

Tribal Analysis:

The DEIS states that based on the current information for the proposed levee construction and improvements, there is a potential to affect historic properties and cemeteries. These effects consist of direct impacts from earth moving and excavation activities related to construction and potential indirect effects on historic structures such as diminished view shed from the raising of levees and floodwalls. The COE recommends intensive cultural resources investigations to identify and evaluate any historic properties within proposed construction areas. The scope of these investigations will be determined in concert with the Texas State Historic Preservation Officer (SHPO) and Native American Tribes and in accordance with the Programmatic Agreement for this project.

Prior to the initiation of construction, the DEIS indicates that the COE will make a reasonable and good faith effort to identify historic properties located within the Area of Potential Effects (APE). These steps may include, but are not limited to, background research, consultation, oral history interviews, sample field investigations, and field survey. The level of effort for these activities shall be determined in consultation with the SHPO and any Native American Indian Tribe or Tribes (Tribes) that attach religious and cultural significance to identified properties.

Tribal Cooperating Agency Request Letters were sent to invite tribes to participate as cooperating agencies in the development of the EIS. The letters offered tribes the opportunity to consult regarding any concerns they may have with potential project impacts or review periods. Tribes that were sent letters include the following.

Alabama-Coushatta Tribe of Texas
Comanche Nation of Oklahoma
Coushatta Tribe of Louisiana
Kiowa Indian Tribe of Oklahoma
Mescalero Apache Tribe (NM)
Tonkawa Tribe of Oklahoma.

7

It is unclear what the referenced "environmental justice review" consisted of and where the findings are summarized in the report. However, the Demographic Analysis in Appendix R provides data on minority and low-income populations within the study area. Assessment of project impacts on minority and low-income populations should involve coordination with those affected populations in some form. Additional outreach should be conducted beyond general public meetings, publication of the Notice of Intent in the Federal Register, and mailing of the notice of availability. The FEIS should describe the outreach conducted to minority and low-income populations.

Recommendation:

EPA believes expanded outreach to Native American Indian Tribes may need to be completed. It is unclear whether the six tribes that were invited to participate as cooperating agencies are the only tribes that attach religious and cultural significance to the Area of Potential Effects. The FEIS should provide a clear explanation of the effort to identify all Tribes, tribal citizens, and tribal resources that may potentially be interested or affected. There is also no information regarding whether any Tribes responded to the cooperating agency request letters or whether tribal consultation was conducted. Outreach and coordination with the appropriate environmental justice populations and Native American Indian Tribes should continue throughout all phases of the project. Collaboration with other federal agencies who work with environmental justice issues and groups is recommended. 4

ATTACHMENT 1

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Draft Integrated Feasibility Report –Environmental Impact Statement
General and Specific Section 404 CWA Comments

GENERAL COMMENTS

Comment: The DEIS states that Authorization for the study is derived from a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study". However, the proposed project, as described in this DEIS, does not appear to be consistent with the Senate resolution.

Recommendation: We recommend that the COE verify in the FEIS the actual authority for the proposed project. 1-1

Comment: The purpose of the project does not seem to have been clearly conveyed by the report. In a number of locations, and in a number of ways, the report seems unclear of whether or not it is actually the purpose of the proposed project to conduct ecosystem restoration activities. The title of the project itself is a source of the confusion. If ecosystem restoration is not actually a purpose of the proposed project, this raises questions regarding whether the project is consistent with the Senate resolution that is cited as a key driver of the project.

Recommendation: Please clarify whether ecosystem restoration is a purpose of the project, or not and revise the title of the project and at numerous locations within the report, accordingly. 1-2

Comment: The Draft EIS is not clear whether part of the purpose of the project is to provide additional coastal storm risk management in the Galveston Bay system. This is clearly discussed in the document, but then seems to have been deferred into the future, or some other program.

Recommendation: Please clarify whether part of this project's purpose is to provide additional coastal storm risk management in the Galveston Bay system and clarify whether there will be opportunities in the future to review and comment on storm risk management features for the Galveston Bay system in the future. 1-3

Comment: It appears that the COE did not use "environmental impacts" or "environmental benefits" as criteria in their elaborate alternatives analysis.

Recommendation: We suggest revision of the alternatives analysis to include "environmental impacts" as an explicit criterion. 1-4

Comment: With regard to wetland impacts, we noted that efforts to avoid and minimize impacts to aquatic resources are only generally described.

> ***Recommendation***: The FEIS should describe efforts taken to avoid and minimize impacts to aquatic resources in detail. Please provide maps showing details of alternative levee segments that were revised to avoid and minimize impacts to aquatic resources. 1-5

Comment: While there is some discussion of the potential negative secondary impacts of the proposed gates on fisheries functions of tidal wetlands "inside" the proposed gates, there is no discussion regarding the potential for similar effects to other ecological functions of these wetlands. For example, what impacts would the gates have on the exchanges of sediment, nutrients, and organic matter between wetlands "inside" the gates and wetlands and estuaries "outside" the gates? The report explains that modeling indicates that the gates should not change the patterns of water exchange, so this might answer our question. However, there is no mention of this potential concern at all. Under the circumstances, the potential for such an effect must be acknowledged, and the results of a preliminary assessment of the risk of effects should be presented. We acknowledge that if water exchanges are not affected, that it is possible that exchanges of sediment, nutrients, and organic matter may not be affected either. If that is the case though, the report should also explain why there is a legitimate concern for fisheries access. Note that the WVA "Fish Access" variable is deemed to include not just fish access, but also effects on the exchanges of sediment, nutrients, and organic matter, so if there is a need to quantify effects of gates on the latter, the WVA analysis should already address this.

> ***Recommendation:*** Please include in the FEIS an analysis and discussion of the potential impacts of the gates on the exchange of sediment, nutrients, and organic matter, between wetlands "inside" the gates, and wetlands and estuaries "outside" the gates. 1-6

Comment: Similar to the comment above, there is little discussion of the potential for impacts to ecological functions of wetlands "inside", as well as "outside" the levees, due to the physical effects of the levees and culverts. Because of the spatial scale and locations of the proposed levees, there would appear to be potential effects of the levees on wetlands "inside" and "outside." The levees would seem to restrict or block water flow in either direction, altering wetland and coastal stream hydrology, and thus wetland and stream ecology, as well as other ecological functions related to connectivity with adjacent ecosystems, including fish access and sediment, nutrient, and organic matter exchanges. By committing to install culverts to facilitate continued channelized flows between wetlands and streams "inside" the levees, and wetlands, streams, and estuaries "outside" the levees, the COE may have reduced or eliminated these concerns. However, discussion of these issues, and presentation of evidence in support of a finding of no effect, is lacking.

> ***Recommendation:*** Please expand the discussion of these concerns and explain in detail why levees will not have these impacts. The FEIS should explain why the proposed culverts will be sufficient to maintain existing hydrology and ecological functions. 1-7

Please provided modeling results to support a conclusion of "no effect". The arguments to the contrary should be correspondingly robust. Provide a clear, enforceable commitment to keeping the gates open when they do not need to be closed to control storm surge. Provide a similar commitment to maintain flow through the many culverts that will be required through the levee to maintain drainage and ecological connectivity.

Comment: A draft wetland mitigation plan has not been provided for review and comment. The COE has apparently had discussions with some of the other agencies regarding potential mitigation, but discussions with EPA regarding mitigation have been limited. EPA is aware that the COE is considering mitigating for unavoidable project impacts by a combination of marsh creation and "preservation only" of forested wetlands. EPA generally does not support mitigation through "preservation only." While "preservation" is listed in the mitigation rule as an option, it is the lowest priority, and thus the least desirable option. Finally, while marsh creation may be an acceptable approach to providing required compensatory mitigation, there are a number of important issues associated with it, including:

- the source of the sediment
- the quality of the sediment
- land loss rates at the proposed mitigation site and at the impact sites
- marsh design criteria including target elevation, settlement rate, and containment

Recommendation: EPA asks that the COE provide opportunities for agencies, including EPA, to discuss potential mitigation. Following such discussions, we recommend the COE draft a mitigation plan and provide it for review and comment by EPA and other agencies, prior to release of a FEIS. 1-8

Comment: Due to the location of the proposed project, and its scale, the risk for the project to disturb contaminated soils may be greater than acknowledged in the DEIS.

Recommendation: The COE should provide in the FEIS a more detailed assessment of the risk of the proposed project to disturb contaminated soils, and provide the draft report to agencies for review and comment. 1-9

SPECIFIC COMMENTS

Executive Summary

p. ES-3; Planning Objectives; 1st bullet:
Comment: This planning objective was "to reduce economic damages to business, residents, and infrastructure for the Sabine and Brazoria region for the 50-year period of analysis". It doesn't limit consideration to economic damages due to storm surge.

Recommendation: EPA suggest the COE revise the planning objective to specify that it is limited to reducing economic damages due to storm surge 1-10

p. ES-4; Planning Objectives; 2nd to last paragraph; 1st sentence:
Comment: According to the DEIS, environmental policies require that fish and wildlife resource conservation be given equal consideration with other study purposes in the formulation and evaluation of alternative plans. However, it is not clear what environmental policies this refers to; nor is it clear that they explicitly require that fish and wildlife resource conservation be given equal consideration. Is the term "fish and wildlife resource conservation" explicitly used in these policies? "Fish and wildlife resource conservation" is a subset of more general environmental protection. Note also that neither "fish and wildlife resource conservation" or "environmental impacts" (see comment above) were apparently included as criteria in the alternatives analysis.

Recommendation: Please clarify what policies the DEIS refers to and whether the policies explicitly state "fish and wildlife resource conservation". The FEIS should clarify whether or not "fish and wildlife resource conservation" was a criterion in the alternatives analysis. 1-11

p. ES-4; Planning Objectives; 2nd to last paragraph; 2nd sentence:
Comment: The statement doesn't indicate what risks to what valued resources the EIS is referring to.

Recommendation: Please clarify what resources are of concern. Human infrastructure? Wetlands? 1-12

p. ES-4; Planning Objectives; 2nd to last paragraph; 3rd sentence:
Comment: EPA has not seen a mitigation plan nor have we been consulted with on mitigation.

Recommendation: See previous related general comment. If a draft mitigation plan exists, as stated, please provide EPA an opportunity to review and comment prior to the release of the FEIS. 1-13

p. ES-4; Planning Objectives; 2nd to last paragraph; 4th sentence:
Comment: No mitigation cost estimate has been provided. If mitigation plans are not yet available it would be difficult to estimate their cost. Mitigation cost could be a significant factor in the project cost estimate, and therefore, in the project decision.

Recommendation: Please provide the mitigation cost estimate that was used in the project cost estimate, and provide a detailed explanation of the basis for it. 1-14

p. ES-4; Formulation of Alternative Plans; 1st paragraph; 2nd sentence:
Comment: What is meant by the reference to "conservation areas"? What are these in relation to this proposed project?

Recommendation: Please clarify what is meant by "conservation areas" in this statement. 1-15

p. ES-5; Formulation of Alternative Plans; 2nd complete paragraph; 3rd sentence:
Comment: Why was the criterion "environmental impacts" only used qualitatively? The lack of detailed description of how this criterion was used, and what its effects were, makes it difficult to tell if environmental impacts were fully considered as part of the alternatives analysis.

Recommendation: Please explain why the criterion was only used qualitatively. Describe in detail how the criterion was used and what its effects where on the alternatives analysis. 1-16

p. ES-5; Formulation of Alternative Plans; 3rd complete paragraph; 2nd sentence:
Comment: It is unclear how the "Gate" and "No Gate" alternatives in the Sabine Region did not provide different degrees of environmental impacts. Intuitively, it would seem obvious that the "Gate" alternative would produce more environmental impacts than the "No Gate" alternative. Other than this paragraph, we did not find detailed discussion of this question.

Recommendation: We recommend the COE discuss in detail the environmental effects of the "Gate" alternative, and compare them to those of the "No Gate" alternative. As part of this, the specific details of what "the gate" would consist of, and where it would be located, should be provided. 1-17

p. ES-7; Final Array Evaluation Results; 1st paragraph; 2nd to last sentence:
Comment: The COE states that the only criterion used in the final selection of the tentatively selected plan (TSP) is economics. We assume that means cost. So, environmental impacts are not a criterion in the selection? How does this allow compliance with the 404(b)(1) Guidelines? How is avoidance and minimization of impacts to wetlands assured? How does this approach ensure that unavoidable impacts to wetlands are fully compensated?

Recommendation: Discuss the process used to select the TSP in greater detail in the FEIS. Address the questions and comments above, particularly the possibility that this approach may not be consistent with the 404(b)(1) Guidelines. 1-18

p. ES-8; Final Array Evaluation Results; 1st incomplete paragraph; last sentence:
Comment: Does the Fish and Wildlife Coordination Act require coordination with EPA? Doesn't NEPA require it? Will coordination be limited to fish and wildlife agencies?

Recommendation: Please revise this statement based on answers to the above questions. 1-19

p. 1-1; 1.2.1 General Authority:
Comment: The DEIS states that Authorization for the study is derived from a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas

Protection and Restoration Study". However, the proposed project, as described in this DEIS, does not appear consistent with the Senate resolution.

Recommendation: We recommend that the COE cite the actual authority for the proposed project. 1-20

p.1-2; 1.3 Study Purpose and Scope; 2nd paragraph:
Comment: The DEIS states that in the exemption approval, it was agreed that this report would present a programmatic overview of coastal storm risk management problems and opportunities and a programmatic assessment of ecosystem restoration opportunities for the entire six county study area.

Recommendation: Please clarify in the FEIS the actual authorities and approvals that support and guided this project. 1-21

p.1-3, 1-4, 1-5; 1.5 Study Area & 1.6 Project Area:
Comment: Similar to the situation with the project purpose, the DEIS describes "study area" and "project area" in a confusing manner. The explanation given is extremely difficult to follow. First, the document should be very clear regarding the difference between "study area" and "project area." Similar to project purpose, apparently the project has evolved from one that applied in a six county area, to one that applies to only a three county area. The reasons that three counties were eliminated is not clear. So, the project evolved from one that addressed both storm impacts and ecosystem restoration in a six county area, to one that addresses only storm impacts in a three county area. The exact alternative evaluation process that resulted in this needs to be clearly explained.

Recommendation: Please explain the difference between study area and project area. Simplify and clarify that the project really only addresses three counties. Explain in detail clearly how the project evolved from one that addresses six counties, to one that addresses three counties. 1-22

p. 1-5; 1.8 Major Historical Surge Events in the Study Area; 3rd paragraph; 1st sentence:
Comment: We are not aware of a Morgan City, Texas.

Recommendation: Please confirm this is not an error. 1-23

p. 1-8, 1-9; 1.10.2 Navigation Projects in the Study Area:
Comment: Given the likely relationship between the navigation channels and storm surge, it would seem to be necessary to discuss this.

Recommendation: Please explain the impacts of the enlargements in the geometry of the connection between Sabine Lake and the Gulf of Mexico and the storm surge. 1-24

p. 2-1; Physical Description of the Existing Area:

Comment: Is the "existing area" the "study area", or the "project area" or both? 1-25

Recommendation: Please change the title to be consistent with the EIS's other uses of the terms "study area" and "project area".

p. 2-1; Table 2-1:
Comment: Rather than "tide ranges" do you mean "water surface elevation ranges"? Changes in water surface elevation along the Gulf coast are not all due to tides.

Recommendation: Please revise the title of the table to clarify what it represents. 1-26

p. 2-1; last paragraph:
Comment: See above comment. This discussion appears to use various forms of the term "tide" when discussing variations in water level.

Recommendation: Please revise this paragraph to clarify the discussion is about "water surface elevation" or "water level" rather than "tide" explicitly. 1-27

p. 2-5; 2.2.2 Currents and Circulation; 1st sentence:
Comment: This statement appears to be inaccurate. There are two estuaries in this project area: Sabine Lake and Galveston Bay. The Sabine and Neches Rivers discharge into Sabine Lake. The Trinity and San Jacinto Rivers discharge into Galveston Bay. The Brazos River discharges directly to the Gulf of Mexico near Freeport.

Recommendation: Please edit the statement similar to clarify. 1-28

p. 2-5; 2.2.1 Sabine Lake System; 1st paragraph; 1st sentence:
Comment: This section is entitled "Sabine Lake System," but the first thing that is stated is something about "the Sabine Region". "Sabine Lake System" seems more appropriate than "Sabine Region," but "Sabine Lake Estuary" would be more accurate.

Recommendation: Please change the section title to "Sabine Lake Estuary". Change 1st sentence to refer to "Sabine Lake Estuary". 1-29

p. 2-5; 2.2.2.2 The Galveston Bay System:
Comment: Similar to above, the term "Galveston Bay Estuary" would seem to be a more precise term.

Recommendation: Please change the section title to "Galveston Bay Estuary". 1-30

p. 2-5; 2.2.2.2 The Galveston Bay System; 1st paragraph; 1st sentence:
Comment: The San Jacinto actually runs from its headwaters in Montgomery, Grimes, Waller, Harris, and Liberty Counties, to Lake Conroe, then to Lake Houston, and from Lake Houston to Galveston Bay.

Recommendation: Revise the statement to acknowledge that the San Jacinto River begins upstream of Lake Houston. 1-31

p. 2-6; 2nd paragraph; last sentence:
Comment: It isn't clear why this statement was provided.

Recommendation: We suggest you either remove the statement or explain in the EIS, why it is included. 1-32

p. 2-6; 2.2.3 Brazos River System; 2nd sentence:
Comment: While this statement may be technically correct, depending on which statistic you use to define "the river with the greatest discharge", on the face of it, it doesn't appear to be correct. The Sabine River has the highest median discharge of any river in Texas. Based on median discharge, the Brazos River has the third largest discharge of all Texas rivers.

Recommendation: Please clarify the comparison being made among Texas rivers. Specify which flow statistic the statement is based on. Intuitively, we would not tend to agree that the Brazos River has the greatest discharge of any river in Texas. 1-33

p. 2-6; 2.2.2.4 GIWW:
Comment: Using this acronym as a title does not seem like the best approach. In addition, the GIWW is significant to this project, so this section should have much more information about it.

Recommendation: Spell out the acronym in the title. Add more basic information regarding the GIWW to this section. What are the dimensions of the channel? How much water moves through it? Note also that the GIWW intercepts some of the freshwater flow and runoff from uplands towards the coast, leaving wetlands and estuaries on the seaward side of the GIWW cut off from freshwater input. Comment on the potential for the GIWW to convey storm surge. 1-34

p. 2-7; 2.3.1 Description of the Ecological Region:
Comment: This section needs more discussion of the ecological differences between the Sabine Lake ecosystem and the Brazos River Delta ecosystem. For starters, there should be a mention that the coastal ecosystem from Bolivar to Sabine Pass is part of the Chenier Plain, and there needs to be a discussion of what the Chenier Plain is. There needs to be a discussion of how these ecosystems have been changed already by man- especially the effects of the removal of the bar at Sabine Pass (oyster reef?) and the rerouting of the Brazos River, which was a huge change to the Brazos River Delta area.

Recommendation: Please revise this section to address the above comments. 1-35

p. 2-7; 2.3.1 Description of the Ecological Region; 1st paragraph; 1st sentence:
Comment: This appears to be based on an older ecological landscape classification.

Recommendation: Use a more modern classification. EPA suggests the classification in Griffith et al. 2004 which is the classification that is used by Galveston District Interagency Review Team (IRT). The appropriate ecoregion for this area based on that classification is Western Gulf Coastal Plain. 1-36

p. 2-7; 2.3.1 Description of the Ecological Region; 1st paragraph; 2nd sentence:
Comment: This discussion of coastal wetlands needs some revision:1) tidal and fresh are not mutually exclusive; 2) tidal influence here is small, and diminishes inland; 3) we recommend not classifying Texas wetlands based on tide; 4) we recommend classifying wetlands based on marsh type: salt marsh, brackish marsh, intermediate marsh, fresh marsh, cypress-tupelo swamp, etc. "Forest riparian" may not be the best term to use in this case. We question the appropriateness of the term "woodlot" as an ecological term in the project area.

***Recommendation*:** Please revise this section to address comments above. Consider changing "forest riparian" to "riparian forest". Change "woodlot" to an ecologically appropriate term. 1-37

p. 2-7; 2.3.1 Description of the Ecological Region; 1st paragraph; 3rd sentence:
Comment: This is not the only function of these wetlands, nor even necessarily the most important. Why was this function singled out for discussion?

Recommendation: Please discuss other functions of these wetlands including flood storage, water quality maintenance, other wildlife, and fisheries benefits. 1-38

p. 2-7; 2.3.1 Description of the Ecological Region; 2nd paragraph; 1st sentence:
Comment: While this rainfall amount may be possible for a small area very near Sabine Lake, it does not seem accurate for most of the study area. The office of state climatologist recently published a precipitation map showing precipitation ranging from >54 in/yr near Beaumont-Port Arthur to 46-50 near Freeport.

Recommendation: Please revise the statement to be consistent with the data. 1-39

p. 2-7; 2.3.1 Description of the Ecological Region; 3rd paragraph; 1st sentence:
Comment: The Brazos Delta region is not defined.

***Recommendation*:** Please define and describe what is being referred to as the "Brazos delta region". 1-40

p. 2-7; 2.3.1 Description of the Ecological Region; 3rd paragraph; 2nd sentence:
Comment: What are the "rice prairies?" Is this an ecological term that has been used before?

***Recommendation*:** It would seem more appropriate to refer to them as agricultural croplands that were converted from the coastal prairie ecosystem. It would probably be 1-41

appropriate to mention that rice is cultivated on them, and that rice fields are a type of artificial wetlands that are attractive to waterfowl.

p. 2-7; 2.3.1 Description of the Ecological Region; 3rd paragraph; 4th sentence:
Comment: What area does this refer to? The entire Texas coast? The project area?

Recommendation: Please clarify the area referred to. 1-42

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 1st paragraph; 6th sentence:
Comment: Is there a reference or other support for this conclusion?

Recommendation: Provide a reference or other evidence in support of this conclusion. 1-43

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 2nd paragraph; 1st sentence:
Comment: Has consideration been given to whether this could be attributed to wetland impoundments trapping saltwater?

Recommendation: Please consider the question and revise the FEIS accordingly. 1-44

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 2nd paragraph; 4th sentence:
Comment: Is there data to support this?

Recommendation: Please provide elevation data to support the conclusion that these marshes are concave in shape. 1-45

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 2nd paragraph; 5th sentence:
Comment: In addition to this list of drainage impairments, was there consideration to the likely effects of intentional and accidental marsh impoundments in slowing drainage of saline water after hurricanes?

Recommendation: Add impoundments to the list of drainage impairments. 1-46

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 2nd paragraph; 6th sentence:
Comment: See above comment. This observation may well be due at least in part, to the existence of large wetland impoundments.

Recommendation: Revise the report to acknowledge the possible role of impoundments in slowing drainage of saltwater after hurricanes. 1-47

p. 2-8; 2.3.2 Storm surge effects on the Study Area; 2nd paragraph; last sentence:
Comment: Were studies documenting these effects actually conducted, or are these hypotheses? Admittedly, these would seem to be plausible potential effects of extended exposure of brackish or less saline wetlands to high salinity water. It would seem important to note however, that the

extended exposure seems likely to be due to drainage impairments, such as impoundments, rather than the hurricane per se.

Recommendations: Please address the above questions and comments in the FEIS. 1-48

p. 2-9; 2.3.3 Attenuation of Storm Surge Impacts by Coastal Wetlands:
Comment: Although the conclusion may seem plausible the discussion is reliant on just two papers.

Recommendation: Use the findings of additional papers to support the argument. There are several other significant papers on the subject: Costanza et al. 2008, Wamsley et al. 2010, Gedan et al. 2011, Barbier et al. 2013. 1-49

Comment: Subsidence is the reason for the loss of these wetlands White et al. (1987). Saltwater intrusion was really not a problem until after the wetland system had been highly degraded.

Recommendation: Use the description regarding wetland loss in this area from White et al. (1987): Submerged Lands of Texas, Beaumont-Port Arthur Area: Sediments, Geochemistry, Benthic Macroinvertebrates, and Associated Wetlands, by W. A. White, T. R. Calnan, R. A. Morton, R. S. Kimble, T. G. Littleton, J. H. McGowen, H. S. Nance, and others. 110 p., 67 figs., 16 tables, 6 oversize color plates, 3 appendices, 1987. Historic wetland loss here has been attributed primarily to factors other than saltwater intrusion. 1-50

p. 2-11; 4th complete paragraph; 2nd sentence:
Comment: It is not clear what the significance of the boardwalk is to this DEIS.

Recommendation: Please clarify the intent or remove the comment regarding the boardwalk. 1-51

p. 2-14; 2.3.5 Physical and Hydrological Characteristics of the Study Area:
Comment: There is a similar section with a similar title earlier in the report.

Recommendation: Please review the organization of the document and ensure there is not redundant sections. 1-52

p. 2-14; 2.3.5 Physical and Hydrological Characteristics of the Study Area; 1st paragraph; 1st sentence:
Comment: This appears to be based on an older ecological landscape classification.

Recommendation: Use a more modern classification. We suggest Griffith et al. 2004. This is the classification that is used by the Galveston IRT. The appropriate ecoregion for this area based on that classification is Western Gulf Coastal Plain. 1-53

p. 2-15; 1st incomplete paragraph; last sentence:
Comment: These coastal streams are not tributaries to the water bodies discussed immediately prior to this. They are tributaries to the bay however.

Recommendation: Please clarify what these streams are tributaries to. 1-54

p. 2-15; 3rd paragraph; 1st sentence:
Comment: This sentence refers to the "intercontinental shelf." We assume it should refer to the "continental shelf".

Recommendation: Please change "intercontinental" to "continental". 1-55

p. 2-15; 2.3.6 Biological Communities in the Study Area:
Comment: Was it actually intended to specifically refer to the "study area," rather than the "project area"? See earlier comment on this subject. This section is in need of maps to show where the communities discussed are located.

Recommendation: Please review the title of this section to ensure that "study area" is actually intended rather than "project area." Add maps to the section. 1-56

p. 2-16; 2.3.6.2; Coastal Marshes; 1st sentence:
Comment: Clarify what is meant by "Gulf shoreline." Few, if any locations along the actual Gulf shoreline on the upper Texas coast are vegetated. These shorelines typically include a beach and small dunes, with brackish marsh behind them.

Recommendation: Please clarify, or correct this statement. 1-57

p. 2-16; 2.3.6.2; Coastal Marshes; 6th sentence:
Comment: Intermediate marsh optimum salinity is 0.5-2.5 parts per thousand (ppt), so if these marshes are actually experiencing these salinities they are stressed. What is the basis for this statement? Is the COE sure these are intermediate marshes rather than brackish?

Recommendation: Please clarify whether these wetlands are actually intermediate marsh and whether the stated salinities are based on actual data. After this, if the statements are deemed to be correct, one must conclude that these marshes are experiencing significant salt stress. 1-58

p. 2-17; 1st complete paragraph:
Comment: Is the term "woodlot" an ecologically appropriate term? Isn't there some more correct ecological term for these habitats?

Recommendation: Confirm that "woodlot" is an ecologically appropriate term for the habitats it is used to identify. If not, replace the term with an appropriate term. 1-59

p. 2-17; 2.3.6.4 Aquatic Habitats:
Comment: Wetlands are aquatic habitats. So is open water and so are beaches and tidal flats and submerged aquatic vegetation (SAV). If the intent was to talk about open water here, why did it include beaches and tidal flats? We recommend the discussion of each aquatic habitat type separately, and make this section about open water habitat only. Alternately, this could be referred to "Other aquatic habitats" and add SAVs to the discussion.

Recommendation: Please revise the FEIS to address the above comment. 1-60

p. 2-17; 2.3.6.4 Aquatic Habitats; 1st paragraph; 2nd sentence:
Comment: While not insignificant, we would not consider these areas "large estuarine aquatic habitats".

Recommendation: Remove the reference to Chocolate Bayou and the San Bernard River Delta from this statement. A separate statement could be included that more accurately characterizes the limited extent of estuarine ecosystems associated with these two streams. 1-61

p. 2-19; 2.3.9 Water and Sediment Quality:
Comment: EPA does not agree with the overall characterization of water and sediment quality in the project area. The discussion is also overly brief.

Recommendation: We believe revisions to this section are needed. Include all 303(d) listings. There are numerous segments in the study area that are not meeting water quality standards. Fifty-five segments in the project area are listed on the draft 2014 303(d) list as not meeting water quality standards. There are several Superfund sites, a number of fish consumption advisories, etc. The National Estuary Program Coastal Condition Report (2007) considered Galveston Bay water and sediment quality to be fair to poor. Acknowledge that some dredged material testing and other sediment testing, has shown that some sediment contains significant contamination. 1-62

p. 3-7; 3.2 Economic Conditions; 3rd sentence:
Comment: Where are these ecosystem restoration measures?

Recommendation: Please revise the EIS so that it isn't so difficult to locate information about the ecosystem restoration measures. It doesn't appear that there is any ecosystem restoration. If that is the case, explain that clearly and revise the document, including the title to make that clear. 1-63

p. 3-13, 3-14; Environmental Conditions; 1st – 2nd paragraph;
Comment: Although EPA is in agreement on the general point being made we do disagree with some of the specifics of the argument. First, Williams et al. (2009) state that "salt stress from interference with freshwater flows has put in jeopardy the process by which marsh sediment accretion and land accumulation occurs". While upstream reservoirs have undoubtedly reduced

sediment input into Sabine Lake and Galveston Bay, and to some of their wetlands, the amount of freshwater input has not declined. The seasonality of freshwater inflows has been shifted by reservoir operations, however.

While the reduced sediment supply is clearly a concern for wetlands, we would argue that alteration of freshwater inflows has not caused any increases in salinity in *these* systems *yet*, except perhaps seasonal shifts. On the other hand, the Sabine-Neches Waterway has had a major effect on salinity in the Sabine Lake system, and the Houston Ship Channel has had a major effect on salinity in Galveston Bay. Salinity increases due to these channels may have affected accretion by decreasing plant production of organic matter.

However, we feel that factors other than salinity increases, have also been important as causes of loss of wetlands in these estuaries in the past. Some of the wetland loss here has clearly been explained as perhaps having been due to subsidence and faulting due to subsurface fluid withdrawal. It is also highly likely that impoundment of coastal wetlands has been a more important factor in reducing sediment inputs to these wetlands, than has the decrease in sediment input to Sabine Lake due to reservoir effects. Impoundment of wetlands severely reduces opportunities for external sediment input to the wetlands. It also reduces nutrient inputs, which affects plant growth and organic matter production, which may in turn reduce accretion. Wetland impoundments may also serve to trap high salinity water on the marshes after hurricanes, for longer periods of time than would be the case without impoundment. This may result in extended periods of marsh exposure to high salinity water, decreased vegetative productivity, and in some cases, death of marsh plants.

> ***Recommendation:*** Please revise this section to either reduce the impact of Williams et al. (2009), or better put their conclusions and recommendations into context. Please eliminate suggestions that altered freshwater inflow has, as of yet, been a major factor in wetland changes, loss, or reduced productivity. There should be acknowledgement of the role that the Sabine-Neches Waterway and the Houston Ship Channel, have played in increasing salinity in Sabine Lake and Galveston Bay, and acknowledgement that these changes have affected the types of wetlands in the Sabine Lake area, and possibly the Galveston Bay area as well, and that these changes probably have reduced plant productivity in the Sabine Lake area, and possibly Galveston Bay as well. Acknowledgement should also be made to the likelihood that wetland impoundment has probably had on marsh accretion than has altered freshwater inflow, at least so far. And finally, acknowledge the role of subsurface fluid withdrawal-specifically oil and gas and groundwater have had on wetland losses in the Sabine Lake and Galveston Bay area. 1-64

p. 3-14; Environmental Conditions; last paragraph:
Comment: Where is "along the Gulf shoreline?" If what is meant is directly on the Gulf, they are mostly being lost due to erosion, which is normally a natural process. In this area though it is expected that it is mostly due to sand deprivation due to the effects of the Sabine jetties. Subsidence and sea level rise play roles generally, and in specific hot spots, but on the Gulf shore wetland loss is mainly due to erosion. Saltwater did not come "from the beach." It came from

the Gulf of Mexico. The wetlands that were, and are, affected by Hurricane Ike along the Gulf shoreline are probably not freshwater marshes. Some are salt marsh, most are brackish. Those behind them may be affected too though, these are intermediate. Fresh marsh was historically found landward of the GIWW, but much of this has probably converted to brackish marsh. The pathway for saltwater intrusion on the landward side of the GIWW, may not be directly from the gulf however.

Recommendation: Please revise statements on Bessie Heights to acknowledge that the actual future wetland losses here are limited due to the fact that there are few wetlands left. Also clarify the comments about wetlands "along the Gulf shoreline." Describe the process of marsh loss here more accurately, and acknowledge the major role played by the Sabine jetties. Clarify that saltwater didn't come from the beach. Clarify that it wasn't freshwater marshes that were impacted by the impacts of Ike on the beach. 1-65

p. 3-14, 3-15; 3.4 Life Safety; 5th sentence:
Comment: Why wasn't a risk assessment done? It appears that threats posed by storm surge due to tropical storms, to human life and safety, are one of the two primary purposes for proposing this project.

Recommendation: Perform the risk assessment, or explain in detail why it isn't necessary, keeping in mind that these risks are a primary reason for this project. 1-66

p. 4-1; 4.1 Problems and Opportunities; 3rd paragraph:
Comment: This paragraph attempts to explain the most confusing aspect of this project, i.e., why no ecosystem restoration is discussed, and why Galveston Bay is not discussed. However, it is still unclear why this is the case. Section 1.3 does not explain this well either.

Recommendation: The source of authority for the project is still unclear. The fact that there is no ecosystem restoration is unclear. The fact that Galveston Bay was part of it, and then was not, also is unclear. 1-67

p. 4-2; P3:
Comment: It is not clear how the proposed project would address this. 1-68

Recommendation: Please explain how the proposed project might help with this risk.

p. 4-2; P4; last sentence:
Comment: This appears to be circular reasoning: If the…marshes disappear, saltwater inundation will result in the death of marsh vegetation and the conversion of marsh to open water, eliminating the protective buffer.

Recommendation: Please clarify or delete this statement. 1-69

p. 4-2; P6:
Comment: Human modifications have affected the sand supply, including construction of jetties at the passes, deep navigation channels that become sand traps, and reservoirs in the watersheds.

Recommendation: There appears to be the need to acknowledge that the sand deficit is partly due to human modifications, specifically jetties, navigation channels, and reservoirs (Anderson 2007). 1-70

p. 4-2; 4.1.2 Opportunity Statements:
Comment: The only environmental protection or restoration statements are:

- Enhance or restore endangered species habitat;
- Reduce environmental damage associated with storm damage to refinery infrastructure;
- Avoid or mitigate adverse natural resource impacts;

Part of the purpose of the project is to include environmental restoration.

Recommendation: If it is part of the purpose of the project to include environmental restoration, we would recommend consideration of the following opportunity statements (or replace the 3rd one above): 1-71

- Restore wetlands
- Restore barrier shoreline habitats (beach, dune, subpratidal)

Restore cheniers (ridges)

p. 4-4; 2nd paragraph; 1st sentence:
Comment: What environmental policies require this? Do they specifically require "fish and wildlife resource conservation" or are the requirements for more broadly environmental?

Recommendation: Please revise the DEIS accordingly. 1-72

p. 4-4; 2nd paragraph; 4th sentence:
Comment: What were the potential ER projects, where were they, and why were they eliminated?

Recommendation: Address the above questions in the FEIS. 1-73

p. 5-2; 5.2 Management Measures; 2nd paragraph; 1st sentence:
Comment: This list doesn't address the problem of interruption of longshore transport of sediment by jetties and navigation channels. What specifically does "sediment management mean"?

Recommendation: We would recommend adding to this list: "Bypassing sediment around jetties and navigation channels." Define "sediment management". 1-74

p. 5-2; 5.2 Management Measures; 2nd paragraph; 4th sentence:
Comment: Why was such a small area of this shoreline identified? Virtually the entire shoreline from Sabine Pass to the western tip of the Bolivar Peninsula, would be expected to be in need of Gulf shoreline restoration.

Recommendation: If there is no opportunity to do this work, then please explain why a larger shoreline restoration wasn't contemplated. If there is an opportunity to do this work, then add a much larger shoreline restoration project for consideration. 1-75

p. 5-2; 5.2 Management Measures; 2nd paragraph; 5th sentence:
Comment: We thought that a sediment management plan for Galveston Bay already existed.

Recommendation: If a plan already exists, acknowledge that in the FEIS. If so, is there a need to update it? If a plan doesn't exist, please respond accordingly. 1-76

p. 5-2; 5.2 Management Measures; 2nd paragraph; 7th sentence:
Comment: This list doesn't include anything to try to address the problem of interruption of longshore transport of sediment by jetties and navigation channels.

Recommendation: We would recommend adding to this list: "Bypassing sediment around jetties and navigation channels." 1-77

p. 5-3; 1st complete paragraph; 6th sentence:
Comment: It is not clear that any of these measures have been carried forward, but note that we have significant concerns for many uses of water control structures in coastal wetlands and estuaries. Specific proposed projects need to be evaluated on a case-by-case basis, but in general we are unclear of their benefits and have concerns regarding possible negative impacts.

Recommendation: Clarify whether these measures were carried forward. If they were, acknowledge the expressed concerns and provide detailed information and evaluation of any such projects, for our review and comment. 1-78

p. 5-4; 5.3.1 Initial Array of Alternatives; 1st paragraph; 1st sentence:
Comment: EPA has not seen any comprehensive alternative plans for ecosystem restoration.

Recommendation: Please provide these comprehensive alternative plans for review and comment. 1-79

p. 5-4; 5.3.1 Initial Array of Alternatives; last paragraph; 2nd sentence:
Comment: It is not clear what is meant by "coastal barrier".

Recommendation:
Define what is meant by "coastal barrier".

1-80

p. 5-5; Table 5.2 Criteria for Screening Initial Array of Alternatives:
Comment: EPA would like to see the environmental benefits for the various alternatives.

Recommendation: Please provide EPA with this information, and provide us an opportunity to review and comment. 1-81

p. 5-4; 5.3.1 Initial Array of Alternatives; 2nd paragraph; 3rd sentence:
Comment: Why weren't environmental impacts considered? If they were only considered as costs, based on mitigation cost, this would not seem to be compliant with the 404(b)(1) Guidelines, since avoidance and minimization of impacts to wetlands would not appear to have been taken into consideration.

Recommendation: Consider the comment and respond, including modification of the FEIS. 1-82

p. 5-6; Table 5-3: Evaluation Array of Alternatives; S8:
Comment: In the development of alternatives, why was the Sabine gate alternative the only one combined with ecosystem restoration? Why wasn't an alternative included that combined the inland barrier with ecosystem restoration?

Recommendation: Please reply to the questions in the FEIS. 1-83

p. 5-6; Table 5-3: Evaluation Array of Alternatives; S11:
Comment: What is a lone star type conservation plan?

Recommendation: Please explain in the FEIS what a lone star type conservation plan is. 1-84

p. 5-11; Economic Evaluation; 2nd, 4th sentences:
Comment: Mitigation requirements seem to have been limited to fish and wildlife mitigation only? What about other wetland functions? How were these costs estimated? What was the estimate? What were the conceptual mitigation plans? Note that EPA considers "preservation only" to be the least desirable form of mitigation. EPA has not reviewed any mitigation plans, including conceptual.

1-85

Recommendation: Please address the questions/comments by revising the FEIS, and by providing EPA a draft mitigation plan for review and comment prior to issuance of a FEIS.

p. 5-15; Economic Evaluation; 1st paragraph; 2nd sentence:
Comment: Why weren't environmental impacts and associated mitigation costs needed?

Recommendation: Please address the question in the FEIS. 1-86

p. 5-19; Economic Evaluation; 1st paragraph; 2nd sentence:
Comment: See comment immediately above.

Recommendation: See recommendation immediately above. 1-87

p. 5-19, 5-20; 5.4.2.5 Brazoria and Sabine Nonstructural:
Comment: This provided little detail regarding the argument that there are few buyout opportunities available. Expand on this argument. What is that conclusion based on?

Recommendation: Address the comment question in the FEIS. 1-88

p. 5-22; 2nd paragraph 4th sentence:
Comment: What is planning objective 3? Why was it eliminated? It is unclear why all ecosystem restoration was eliminated when the basis for authorization for the study is primarily about ecosystem restoration. How is this elimination consistent with arguments presented elsewhere in the document that environmental benefits must be considered? Note that avoidance, minimization and mitigation don't produce net environmental benefits.

Recommendation: Please respond to the questions and comments by revising the FEIS. 1-89

p. 5-25; 5.4.5 Selection of the Recommended Plan; 2nd paragraph; 1st sentence:
Comment: We recommend that this review include one or more expert, independent coastal geologists, wetland ecologists, estuarine ecologists, and an ecological economist.

Recommendation: Provide EPA with the findings of the external independent peer review. 1-90

p. 5-26; 1st complete paragraph; 1st sentence:
Comment: These don't appear to be net benefits because the analysis does not appear to include consideration of environmental costs, except as possibly identified through mitigation cost. EPA has not seen a mitigation cost estimate, nor a mitigation plan.

Recommendation: Please clarify whether this analysis includes consideration of environmental costs, if so, their basis. EPA would appreciate a draft mitigation plan for review and comment prior to issuance of the FEIS. 1-91

p. 5-27; 1st paragraph; last sentence:
Comment: Why didn't the cost/benefit analysis and the alternatives analysis identify this compelling argument then? This is an important point. If the argument is so compelling, the cost/benefit analysis and the alternatives analysis should have identified these as part of the preferred alternative. Please explain, in detail, why that is not the case in the FEIS.

***Recommendation*:** Please address the question by FEIS. 1-92

p. 5-27; 2nd paragraph; last sentence:
Comment: See above.

Recommendation: See above. 1-93

p. 5-30; 5.4.5.1 Selection of the Recommended Plan Summary:
Comment: Environmental impacts are not included.

Recommendation: Please discuss in this section the environmental impacts and what role they played in selection of the recommended plan. 1-94

p. 6-7; 4th sentence:
Comment: Indirect impacts are not limited to impacts to fish access. These impacts may also include impacts to other ecological functions related to ecological connectivity, including sediment, nutrient, and organic matter exchanges between wetlands inside the levee, and waters and wetlands outside the levee. The WVA variable that addresses fish access is described as accounting for all of these potential concerns.

Recommendation: Please clarify as per the above comment. Add a discussion of the other connectivity issues mentioned above. 1-95

p. 6-9; 3rd complete sentence:
Comment: We agree that there is reason to be concerned for potential risks of disturbance of contaminated soil. It is not clear that the draft HTRW report is sufficient to ensure that these risks are insignificant. EPA remains concerned that these risks have not been estimated with sufficient rigor to match the apparent potential risk. In at least one location, EPA is aware that risks have not been accurately identified: Star Lake Canal Superfund Site straddles the hurricane levee in Port Neches, TX. There is contamination in the Jefferson Canal adjacent to and south of the levee at the water control structure. EPA does acknowledge however, that the proposed protection would reduce the risk of hazardous spills from industrial and other facilities during and after storm surge events.

1-96

Recommendation: We recommend these risks be re-evaluated using a more robust approach, prior to the FEIS. The FEIS should acknowledge the existence of at least this one problem area, and commit to take the necessary steps to avoid disturbing it, or if unavoidable, propose acceptable means of dealing with it.

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan:
Comment: Is this just a "fish and wildlife mitigation plan," or is it a conceptual draft plan for mitigation of unavoidable wetlands functional losses? Note that wetlands functional losses include considerably more than just fish and wildlife functions. If it is just a fish and wildlife mitigation plan, where is the wetlands mitigation plan?

Recommendation: Change the title and all language from "fish and wildlife mitigation plan" to "compensatory wetland mitigation plan." Ensure that all aspects of the required compensatory wetland mitigation plan reflect the need to compensate for lost wetland functions, rather than fish and wildlife only. 1-97

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 1st paragraph; last sentence:
Comment: Where in the report are the discussions of avoidance and minimization measures?

1-98

Recommendation: Please ensure that there is actually a robust discussion of efforts undertaken to avoid and minimize impacts to wetlands.

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 2nd paragraph; 1st sentence:
Comment: The forested wetlands that would be impacted are likely coastal forested wetlands. The other wetlands that would be impacted are coastal wetlands, but so are the forested wetlands. In addition, these other wetlands are "marsh," but EPA would not support aggregating them under this classification either. We recommend separating the impacts to cypress-tupelo swamp forest, bottomland hardwood swamp forest, brackish marsh, intermediate marsh, and fresh marsh, if any. Mitigation should be in-kind. Mitigation of one habitat type cannot compensate for loss of another.

1-99

Recommendation: The approach to classifying wetland impacts and wetland mitigation needs to maintain the distinctions between the various habitat types as mentioned above. Please revise the FEIS accordingly.

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 2nd paragraph; 2nd sentence:
Comment: As previously mentioned, there doesn't appear to be any discussion of the efforts that were made to avoid and minimize impacts to wetlands.

Recommendation: Please add a discussion of efforts made to avoid and minimize impacts to wetlands. 1-100

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 2nd paragraph; 8th sentence:
Comment: As previously mentioned, EPA does not support aggregating all marsh impacts under the classification of "coastal marsh." Impacts should be described by marsh type, and mitigation should be in-kind. As per the mitigation rule, acquisition and long term conservation are considered the lowest priority for mitigation. Thus, EPA does not support this approach to wetland mitigation except in rare cases, and as the rule mentions, then only with large ratio multipliers.

Recommendation: Please clarify the actual types of marsh that are impacted and to be mitigated for. The general proposal to mitigate via acquisition and long term conservation needs to be revisited. Please provide EPA a draft mitigation plan for review and comment prior to issuance of a FEIS. 1-101

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 2nd paragraph; 9th, 10th sentences:
Comment: When will these mitigation discussion occur? EPA requests that they occur as soon as possible, and prior to issuance of the FEIS.

Recommendation: Begin mitigation discussions with the agencies, including EPA, soon. We request that the Corps not issue the FEIS until this coordination occurs, and until EPA has been provided a draft mitigation plan for review and comment. 1-102

p. 6-9; 6.1.3.2 Summary of Conceptual Fish and Wildlife Mitigation Plan; 2nd paragraph; last sentence:
Comment: Elsewhere in the document it says that a mitigation cost estimate had already been developed, although it is not clear what it would be based on.

Recommendation: Clarify whether a mitigation cost estimate already exists and was used in the cost/benefit analysis. If one doesn't exist explain how the cost/benefit analysis was conducted without it. If one does exist, explain why this sentence calls for one to be developed. 1-103

p. 6-10; 1st sentence:
Comment: Since it will likely take this project time to be implemented, it would seem to be desirable to maintain a future possibility of mitigating using mitigation banks, should any appropriate new banks become available prior to completion of the project.

Recommendation: EPA recommends that the mitigation bank option not be eliminated until much later in the project design/construction process. 1-104

p. 6-15 6.6.2 Environmental Quality (EQ):
Comment: It is not clear that the work done to assess the potential risk of disturbance of contaminated soils or hazardous materials, was sufficient, given the apparent potential risk.

Recommendation: We recommend these risks be re-evaluated using a more robust approach, prior to the issuance of the FEIS. 1-105

p. 6-19; 6.7.4 Environmental Data and Analyses; 1st paragraph; 2nd sentence:
Comment: While this may be a technically correct statement, it could be misleading in the Wetland Value Assessment "modeling" is a very simplistic wetland assessment "tool." The modeling is not simulation modeling. It is not based on much data. Further, it does not simulate

ecological processes. However, it does derive a "score".

Recommendation: Please replace the term "ecological modeling" with Wetland Value Assessment. 1-106

p. 6-19; 6.7.4 Environmental Data and Analyses; 1st paragraph; last sentence:
Comment: This should be discussed in some detail.

Recommendation: Please add a discussion of how engineering models were used to support part of the ecological analysis. 1-107

p. 6-19; 6.7.4 Environmental Data and Analyses; 2nd paragraph; last sentence:
Comment: Will there be an opportunity at that point to change designs (avoidance, minimization) or increase mitigation? Will other agencies have the opportunity to review?

Recommendation: Please address the above questions/comments in the FEIS. 1-108

p. 6-19; 6.7.4 Environmental Data and Analyses; 3rd paragraph; 2nd sentence:
Comment: It is not clear that the work done to assess the potential risk of disturbance of contaminated soils or hazardous materials, was sufficient, given the apparent potential risk. In at least one location, it appears that risks have not been accurately identified: Star Lake Canal Superfund Site straddles the hurricane levee in Port Neches, TX. EPA is aware that there is contamination in the Jefferson Canal adjacent to and south of the levee at the water control structure.

Recommendation: We recommend these risks be re-evaluated using a more robust approach, prior to the FEIS. The FEIS should acknowledge the existence of at least this one problem area, and commit to take the necessary steps to avoid disturbing it, or if unavoidable, propose acceptable means of dealing with it. 1-109

p. 6-21; 6.8.2 Clean Water Act; 2nd sentence:
Comment: EPA would like to review the details of the Corps' determination.

Recommendation: Provide the Corps' determination that the proposed project would not result in water quality standards being violated, for review and comment. 1-110

p. 6-21; 6.8.2 Clean Water Act; 3rd sentence:
Comment: We recommend the details of how impacts to wetlands were avoided and minimized, be discussed in the FEIS.

Recommendation: Please revise the DEIS to include discussion of efforts undertaken to avoid and minimize impacts to wetlands. 1-111

p. 6-21; 6.8.2 Clean Water Act; 4th sentence:

Comment: The 404(b)(1) Guidelines do not limit the requirement for mitigation to those that are deemed by the project sponsor to be "significant."

Recommendation: Please remove the term "significant." Please provide to the EPA a draft mitigation plan for review and comment. 1-112

p. 6-21; 6.8.2 Clean Water Act; 2nd to last sentence:
Comment: While the least environmentally damaging practicable alternative may be identified, compliance with the 404(b)(1) Guidelines cannot yet be determined, since a draft mitigation plan has not been provided.

***Recommendation*:** Provide a draft mitigation plan for review and comment prior to issuance of the FEIS. 1-113

p. 6-24; 6.8.12 Executive Order 11990, Protection of Wetlands; 3rd sentence:
Comment: As previously mentioned, the DEIS should include discussion of efforts made to avoid and minimize impacts to wetlands.

Recommendation: Please add a discussion of efforts made to avoid and minimize impacts to wetlands. 1-114

p. 7-5; 7.2.1.1 Design Accommodations to Minimize Impacts; 1st paragraph; last sentence:
Comment: How is the COE sure that this incorporates all the needs without altering hydrology? In Figure 7-1, there appear to be far more than 13 culverts indicated, and this is just one part of the system.

Recommendation: Please add additional explanation for the conclusion that only 13 culverts are needed to protect existing drainage, as well as associated coastal streams and wetlands, across the proposed levee system. Alternatively, propose additional culverts to more fully avoid impacts to drainage, coastal streams, and wetlands. 1-115

p. 7-5; 7.2.1.1 Design Accommodations to Minimize Impacts; 2nd paragraph; 1st sentence:
Comment: This design criterion does not seem to be particularly protective, either of drainage, or environmental functions.

Recommendation: We recommend that a similar degree of conservatism be assumed in the design of these culverts, as is assumed for other aspects of the proposed project. 1-116

p. 7-5; 7.2.1.1 Design Accommodations to Minimize Impacts; 2nd paragraph; 3rd sentence:
Comment: Have environmental impacts been acknowledged and accounted for, for the effects of one-way flapgates? These will of course, impact fishery access, as well as impact any import of sediment to wetlands on the "inside" of the levee/flapgate.

Recommendation: Please review the DEIS to determine whether these impacts were accounted for. If not, revise the WVA to account for it. 1-117

p. 7-5; 7.2.1.1 Design Accommodations to Minimize Impacts; 3rd paragraph:
Comment: The proposal to create an artificial drainage system that fully replicates environmental functions, is interesting. EPA cannot determine whether this is realistic or not since no details have been provided.

Recommendation: Please provide details of this proposed artificial drainage network. At this stage of planning, even a conceptual diagram/explanation, would be useful. Please also provide opportunity for agency review/comment. 1-118

p. 7-6; 1st paragraph; last sentence:
Comment: In addition to monitoring wetland "extent and quality", wetland flooding duration and frequency should be monitored. In addition, the proposal to monitor wetland "extent and quality" is vague.

Recommendation: Please identify what indicators would be measured to monitor wetland "extent and quality." Add wetland hydrologic monitoring. Consult with the agencies, including EPA, regarding recommended monitoring. Develop a draft monitoring plan and provide opportunity for agency review and comment. 1-119

p. 7-6; 2nd paragraph; last sentence;
Comment: For this to be the case, wouldn't velocities have to increase? If so, wouldn't this affect fishery access?

Recommendation: Please clarify. Assuming that current velocities would increase, evaluate the potential impacts to fishery organisms that use these marshes. 1-120

p. 7-7; 7.2.1.2 Unavoidable Indirect Impacts; 1st paragraph; 1st sentence:
Comment: These efforts undertaken to minimize impacts need to be described in detail.

Recommendation: Describe, in detail, efforts to avoid and minimize impacts to wetlands. 1-121

p. 7-7; 7.2.1.2 Unavoidable Indirect Impacts; 2nd paragraph; 3rd sentence:
Comment: Does the anticipated lack of effect of the proposed project on water surface elevation, include no effect on variations in water surface elevation? In other words, is the determination just that the average water surface elevation won't change, or is it that there should be no differences with versus without the project, taking into account the full scope of water surface elevation variability? In addition to potential affects to vegetation, and since the document acknowledges some potential impacts to fish access, was any consideration given to potential effects on exchanges of sediment, nutrients, and organic matter? Presumably, if the

volumes of water that are expected to pass by the gates, and their directions, have not changed, then neither would the exchanges of sediment, nutrients, and organic matter.

Recommendation: Please address the above comments in the FEIS. 1-122

p. 7-7, 7-8; last incomplete paragraph on p. 7-7, 1st incomplete paragraph on p. 7-8:
Comment: Why couldn't minor adjustments of the proposed levee alignment be accomplished in order to avoid these losses?

Recommendation: Address the above question in the FEIS. Include a map showing these areas in the FEIS. 1-123

p. 7-8; 1st complete sentence:
Comment: EPA would like to see what areas these are.

Recommendation: Include a map in the FEIS that shows these areas. Explain why these impacts are not avoidable. 1-124

p. 7-8; 2nd complete sentence:
Comment: EPA would like to see what area this is. EPA would also like to review a more detailed explanation of why these impacts are unavoidable.

Recommendation: Include a map in the FEIS that shows these areas. Explain why these impacts are not avoidable. 1-125

p. 7-9; 1st complete paragraph; last sentence:
Comment: Why didn't the analysis use rates of relative sea level change from Freeport or vicinity?

Recommendation: Explain in the FEIS, why rates of relative sea level change for Freeport weren't used. 1-126

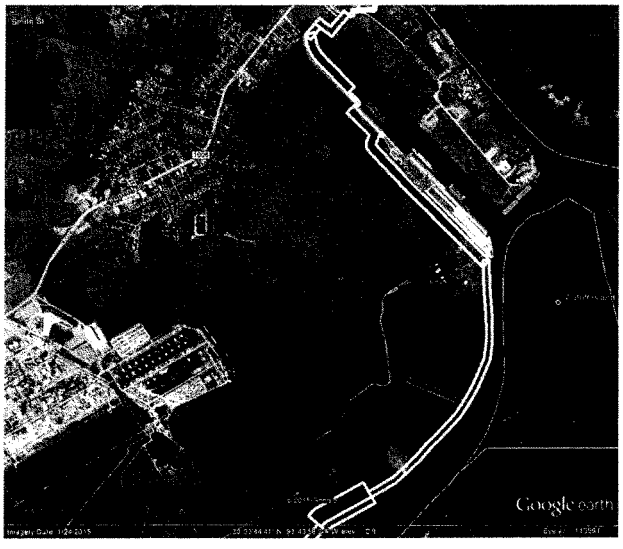
p. 7-10; 7.4.1 Orange-Jefferson CSRM Plan; 1st paragraph; 2nd sentence:
Comment: This seems not to acknowledge that losses in this area are now very low, since most of the wetlands have already been impacted. Subsidence and faulting may still be affecting the few remaining wetlands, and they may affect any created wetlands here in the future.

Recommendation: Include the above considerations in the discussion in the DEIS. 1-127

p. 7-10, 7-11; 7.4.1 Orange-Jefferson CSRM Plan:
Comment: While in general, the preferred alternative avoids and minimizes impacts to wetlands, there is one location where additional avoidance and minimization appears to be possible and desirable (see map below). This marsh is currently largely impounded by the existing dredged material placement area, a levee, a road, and upland/development. However, there is at least one

significant connection to the adjacent water via a canal on the northeast side where the road crosses over a bridge. It is not clear, but it appears the plans do not include provisions for a gate at this location. This would have the effect of impounding the northeast half of this marsh, in combination with existing internal spoil banks. The half of the marsh to the southwest of the internal spoil banks would appear to remain open to the channelized lower reach of Adams Bayou, which is proposed to be gated. Since the gate is proposed to remain open most of the time, this section of the marsh should not actually be impounded by the proposed project. However, there low spoil banks along the marsh's shoreline on Adams Bayou, which may serve to partly impound this section of the marsh. In addition to the "external" impounding features, the entire marsh appears to be internally impounded by a low levee. There is also a rectangular, open water impoundment in the center, and a road and other features associated with historic oil and gas activity. While this marsh is clearly degraded, it still has significant ecological value, and could be enhanced/restored.

Recommendation: Consider revisions to the proposed project features surrounding this marsh, as well as potential ecological enhancement/restoration, which would offset some of the project's required compensatory mitigation. 1-128



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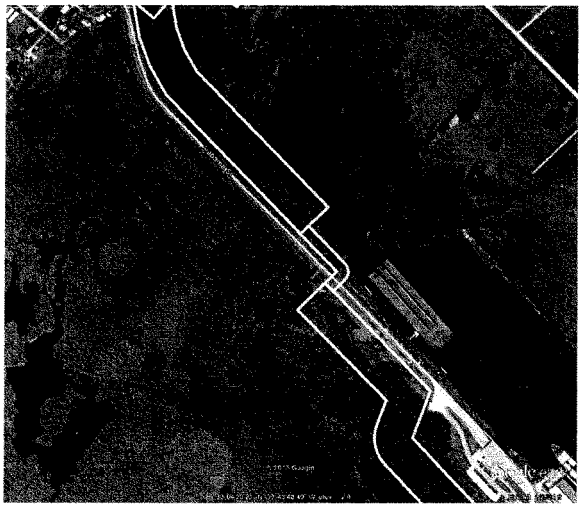

p. 7-12; 7.5.1 Orange-Jefferson CSRM Plan; 1st paragraph; last two sentences:
Comment: If the document is going to use this as an argument, provide specific examples and specific arguments. The argument presented is too general to base decisions on.

1-129

Recommendation: We suggest that you either delete the discussion about unregulated losses, or provide a much more detailed discussion, including an evaluation of the actual potential for such unregulated losses in these areas.

p. 7-12; 7.5.1 Orange-Jefferson CSRM Plan; 3rd paragraph; 2nd sentence:
Comment: Why couldn't minor adjustments of the proposed levee alignment be accomplished in order to avoid these losses?

1-130

Recommendation: Please address the above question in the FEIS. Include a map showing these areas in the FEIS.

p. 7-15; 1st complete paragraph; 3rd sentence:
Comment: EPA is not in agreement with this argument. This is true for most wetland losses and proposed development projects. Cumulative impacts often result in significant losses of wetlands.

Recommendation: While the statement is accurate, the apparent implication is that the impacts are not significant, is not. Please add a statement that acknowledges that just 1-131

because the impacts are a small percentage of the total wetland area, does not indicate that the impacts are not significant.

p. 7-15; 1st complete paragraph; 4th sentence:
Comment: While it is correct that wildlife may be able to try to move into adjacent habitats, it is not a given that they will be able to do so. It is likely that adjacent habitats are already utilized by wildlife. Additional competition for the remaining habitat may result in a reduction in wildlife productivity. In addition, disturbance caused by project construction may reduce wildlife productivity temporarily.

1-132

Recommendation: The statement needs to recognize the potential impacts.

p. 7-15; 1st complete paragraph; 7th sentence:
Comment: Are bald eagles known to use these areas? In addition to the construction right of way, additional protective buffers surrounding it should be surveyed.

1-133

Recommendation: Address the above question in the FEIS. Commit to surveying, at a minimum, the additional buffer required by U.S. Fish and Wildlife Service, in addition to the construction right of way.

p. 7-15; 1st complete paragraph; last sentence:
Comment: This EIS acknowledges that fisheries access will be negatively impacted in some locations. See below. This statement should be consistent with the acknowledgments below. This statement is not consistent with the project's impacts on fisheries access. While these impacts are limited, they are not zero.

1-134

Recommendation: Ensure that the FEIS is consistent with respect to its acknowledgement of project impacts on fisheries access.

p. 7-15; 2nd complete paragraph; 1st sentence:
Comment: In addition to fisheries access, these gates might potentially impact the exchange of sediment, nutrients, and organic matter, with streams, wetlands, and estuaries "outside" the levees/gates. See other related comments on this subject.

Recommendation: Consider the above. Discuss analysis and conclusions of addressing this question, in appropriate locations in the FEIS. 1-135

p. 7-17; 1st paragraph:
Comment: A similar discussion is needed on the question of whether or not the proposed levee/gates may affect exchanges of sediment, nutrients, and organic matter. See above.

Recommendation: Add a discussion of these potential impacts to the FEIS, in appropriate locations. 1-136

30

p. 7-17; 7.6.1.2 Freeport and Vicinity CSRM Plan; 1st paragraph; 2nd sentence:
Comment: These terms usually don't apply to fish.

Recommendation: Please delete the word "fish" from this sentence. 1-137

p. 7-18; 7.6.2.1 Sabine Region CSRM Plans; 3rd paragraph; last sentence:
Comment: What is "CE/ICA Incremental Analysis"?

Recommendation: Please explain in the text what the above is. 1-138

p. 7-18; 7.6.2.1 Sabine Region CSRM Plans; 4th paragraph:
Comment: While it is the responsibility of NMFS to determine whether the COE's argument is valid, this does not appear to be a valid argument. First, how large is the area of hard bottom habitat? We would guess it is small. So, there's probably 8-10 ac of loss. Shouldn't this be mitigated? Note also that the COE is suggesting that hard-bottom habitat can replace soft-bottom habitat functions. EPA would not agree with that either. Finally, EPA is not sure that hard-bottom habitat is natural at this location.

Recommendation: Please delete the argument that hard-bottom habitat is a valid replacement for lost soft-bottom habitat. 1-139

p. 7-19; 1st complete paragraph; 3rd sentence:
Comment: Will the fish access loss specifically be fully replaced? This may require more acres of restored wetland than it takes just to produce the required number of AAHUs in general.

Recommendation: Please provide a draft mitigation plan for review and comment prior to issuance of a FEIS. Consider mitigation required to fully mitigate for the lost fish access function specifically, which may require more mitigation than if based solely on AAHUs in general. 1-140

p. 7-20; 7.6.3 Threatened and Endangered Species Impacts; 3rd paragraph; 1st sentence:
Comment: While it is the responsibility of the U.S. Fish and Wildlife Service, EPA ask that the COE accurately estimate the potential impact of the proposed project on the West Indian manatee.

Recommendation: Please consult with U.S. Fish and Wildlife Service and document this effort in the FEIS. 1-141

p. 7-21; 2nd complete paragraph; 1st sentence:
Comment: EPA would probably not agree that sediments in the "Sabine and Brazoria regions" are of good quality. While sediments from Sabine Lake generally are not as contaminated as one might expect based on the degree of industrialization there, they are contaminated to some extent. Generally though, these sediments do not exceed contaminant concentrations, i.e., benchmarks that are used to flag possible problems. That said however, there are some locations

where moderately or highly contaminated sediments have been found. In the "Brazoria Region" the quality of sediments are not well known. The potential for contaminated sediments would appear to be significant, given the degree of industrialization here, and the limited water volume for dilution. Little sediment data is available for this area. Also note that the mouth of the San Bernard River is outside the study area.

Recommendation: Aggregate all relevant sediment data and analyze data to determine: 1-142

- Whether or not any of the sediment is contaminated;
- If sediments are contaminated:
- What are the contaminants?
- What are the concentrations? What benchmarks do they exceed?
- What percentage of the data indicate contamination above benchmarks?
- Remove the reference to data from the mouth of the San Bernard River.

p. 7-21; 2nd complete paragraph; 6th sentence:
Comment: EPA does not agree that this argument justifies the conclusion that there is a low risk of encountering contaminated sediments in the Freeport area.

Recommendation: EPA recommends deleting this statement. EPA recommends assembling all available sediment data and analyzing it for contaminant concentrations and exceedances of benchmarks used to flag possible problems. In addition, due to the extensive industry in the area, EPA recommends sampling and analysis of sediments likely to be disturbed by the proposed project. Results should be provided to the agencies for review and comment, prior to construction. 1-143

p. 7-22; 7.7.2 FWP Alternatives for Sabine Region CSRM Plans; 1st paragraph; 5th sentence:
Comment: As repeatedly mentioned elsewhere in these comments, the DEIS includes little documentation of efforts taken to avoid and minimize impacts to wetlands.

Recommendation: As repeatedly recommended elsewhere in these comments, document efforts taken to avoid and minimize impacts to wetlands, in detail, somewhere in the FEIS. 1-144

P. 7-30; 7.10.1.1 No Action Alternative; 3rd paragraph; 3rd sentence:
Comment: As mentioned elsewhere in these comments, Star Lake Canal Superfund Site straddles the hurricane levee in Port Neches, TX. There is contamination in the Jefferson Canal adjacent to and south of the levee at the water control structure.

Recommendation: The FEIS should acknowledge the existence of at least this one problem area, and commit to take the necessary steps to avoid disturbing it, or if unavoidable, propose acceptable means of dealing with it. 1-145

p. 7-31; 7.10.1.2 FWP Alternative; 1st sentence:
Comment: EPA may not agree with this conclusion. Given the known concerns associated with the Star Lake Canal Superfund Site, as well as the apparent risks due to the intensive and extensive use of the landscape by the petrochemical industry, the risk of this project potentially disturbing contaminated soils would seem to be higher than this.

1-146

Recommendation: Undertake a more robust assessment of the risks of potentially disturbing contaminated sediment or make more conservative assumptions.

p. 7-32; 7.10.2.2 FWP Alternative; 3rd sentence:
Comment: Again, EPA may not agree with this conclusion. Given the known concerns associated with the Star Lake Canal Superfund Site, as well as the apparent risks due to the intensive and extensive use of the landscape by the petrochemical industry, the risk of this project potentially disturbing contaminated soils would seem to be higher than this.

1-147

Recommendation: Please undertake a more robust assessment of the risks of potentially disturbing contaminated sediment or make more conservative assumptions.

p. 7-33; 7.10.3.2 FWP Alternative; 1st sentence:
Comment: Again, EPA may not agree with this conclusion. Given the known concerns associated with the Star Lake Canal Superfund Site, as well as the apparent risks due to the intensive and extensive use of the landscape by the petrochemical industry, the risk of this project potentially disturbing contaminated soils would seem to be higher than this.

Recommendation: Undertake a more robust assessment of the risks of potentially disturbing contaminated sediment or make more conservative assumptions. 1-148

p. 7-41; #6:
Comment: Regarding the following statement: There are no remaining unmitigated adverse effects on natural and beneficial floodplain due to implementation of the Proposed Action.

Recommendation: Since EPA has not yet seen a draft mitigation plan, we cannot verify the above statement as accurate. EPA asks that a draft mitigation plan be included in the FEIS and be provided for review and comment prior to issuance of a FEIS. 1-149

p. 7-46; 7.16.1.3 Sabine Region Resource Impact Evaluation; 3rd paragraph; 1st sentence:
Comment: How has the navigation channel affected salinity through its effects on density currents?

Recommendation: Please discuss the role of the navigation channel in increasing the importance of density currents in Sabine Lake. 1-150

p. 7-46; 7.16.1.3 Sabine Region Resource Impact Evaluation; 3rd paragraph; 2nd sentence:
Comment: Subsidence is not responsible for just lost of forested wetlands, but for loss of marshes as well. Access canals may cause wetland loss not only by increasing saltwater intrusion but by also altering wetland hydrology.

Recommendation: We suggest you acknowledge that subsidence has caused loss of marsh in addition to loss of forested wetlands. 1-151

p. 7-46, 7-47; 1st incomplete sentence:
Comment: The term "freshwater recharge" is probably not appropriate in this context. The term recharge is usually used in the context of groundwater. In this case the document is discussing the likely effects of confined disposal facilities on wetland hydrology. The confined disposal facilities are serving to partially impound the wetlands behind them, and restricting flooding from the adjacent water body, in this case, probably Sabine Lake and the Neches River.

Recommendation: We suggest you replace the term "freshwater recharge" with a more accurate discussion of the likely effects of the confined disposal areas on adjacent wetland hydrology. 1-152

p. 7-46, 7-47; 2nd complete paragraph; 1st sentence:
Comment: The Sabine Lake estuary/wetland system is degraded, and the proposed project would further impact the system, albeit not as much as one might think such a large project would.

Recommendation: Please revise the statement to acknowledge that the ecosystem has been degraded and the proposed project would further impact it by some increment. 1-153

p. 7-46, 7-47; 2nd complete paragraph; 3rd sentence:
Comment: EPA has not seen a draft mitigation plan.

Recommendation: Please provide a draft mitigation plan for review and comment prior to issuance of the FEIS. 1-154

p. 7-46, 7-47; 2nd complete paragraph; 4th sentence:
Comment: As previously mentioned, this has not been demonstrated in the DEIS. Maps in the EIS seem to suggest that the number of culverts may not be adequate to maintain drainage and connectivity.

Recommendation: Please demonstrate that levee and culvert design would maintain future tidal connectivity, resulting in negligible impacts on floodplains both inside and 1-155

outside of the levee system. Please explain why culverts are not proposed for all existing coastal streams located along the proposed levee.

p. 7-50; 7.16.2.3 Brazoria Region Resource Impact Evaluation; 2nd paragraph; last sentence:
Comment: It is not clear this is an accurate statement since limited water quality sampling and analysis have been conducted in this area.

Recommendation: We suggest the COE aggregate the available water quality data and review. Discuss data limitations including number of samples, analyses, etc. and discuss conclusions. Specifically comment on analysis for contaminants. 1-156

p. 7-51; 7.17 ANY ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED SHOULD THE TSP BE IMPLEMENTED; 3rd sentence:
Comment: It appears that this estimate may not be consistent with others provided elsewhere in the document.

Recommendation: Please review the FEIS to ensure that wetland acreage impacts are reported consistently throughout the document. 1-157

p. 7-52; 7.18 ANY IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED IN THE IMPLEMENTATION OF THE TSP; 2nd sentence:
Comment: It appears that this estimate may not be consistent with others provided elsewhere in the document.

Recommendation: Please review the FEIS to ensure that wetland acreage impacts are reported consistently throughout the document. 1-158

p. 7-52; 7.19 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY; 1st sentence:
Comment: It appears that this estimate may not be consistent with others provided elsewhere in the document.

Recommendation: Please review the FEIS to ensure that wetland acreage impacts are reported consistently throughout the document. 1-159

p. 7-52; 7.19 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY; 2nd sentence:
Comment: EPA has not seen a draft mitigation plan.

Recommendation: Please provide a draft mitigation plan for review and comment prior to issuance of the FEIS. 1-160

p. 8-4; 8.2 COST FOR THE RECOMMENDED PLAN;
Comment: EPA has not seen mitigation costs here.

Recommendation: Please add compensatory wetland mitigation costs, revise the analysis, and discuss the conclusions in the FEIS. 1-161

p. 8-5; 8.5.2 Environmental Operating Principles; 1st sentence:
Comment: The DEIS does not include much detail regarding efforts taken to avoid and minimize impacts to aquatic resources. A draft mitigation plan has not been provided to EPA for review and comment.

Recommendation: Please revise the FEIS to document efforts taken to avoid and minimize impacts to aquatic resources, in detail. Provide the agencies, including EPA, a draft compensatory wetland mitigation plan for review and comment prior to issuance of a FEIS. 1-162

p. 8-5; 8.5.2 Environmental Operating Principles; 2nd sentence:
Comment: Sustainability is not defined.

Recommendation: Define sustainability in the FEIS and specify what it is being applied to. 1-163

p. 9-2; 1st complete paragraph; last sentence:
Comment: It is not clear what study is referred to here.

Recommendation: Please clarify what study is referred to. Provide enough detail that the reader has an idea what it is. Discuss when it will be available. EPA would appreciate the opportunity for early involvement. 1-164

p. 9-3; 1st complete sentence:
Comment: What study is the Texas Coastal Study? Is it already underway? Will EPA be provided an opportunity to provide input?

Recommendations: Please explain what this study is and when it will be conducted and completed. Will EPA have an opportunity for input? 1-165

p. 1-8; 1.10.1.3Freeport HFPP, Texas; 3rd sentence:
Comment: "planes" should be "plains". 1-166

p. 7-22; 7.7.2 FWP Alternatives for Sabine Region CSRM Plans; 3rd paragraph; last sentence:
Comment: Please change Total Daily Maximum Loads to Total Maximum Daily Loads. 1-167

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RESPONSE TO COMMENTS

Comment No.	Response
1	**Wetland/Section 404 CWA/Mitigation**. Comments are provided as Attachment 1 – General and Specific Comments. These are addressed individually below, denoted by numbers beginning with "1-#".

2	**Air Quality – PM_{10} Emissions and Fugitive Dust Control.**
	The following text has been added to Section 6.8.1, paragraph 1: In order to reduce impacts associated with emissions or particulate matter and other pollutants, the control measures specified in Section 7.8.2.1 would be implemented.
	
	The following text has been added to Section 7.8.2.1 of the Final Integrated Feasibility Report-Environmental Impact Statement (FIFR-EIS):
	
	In order to reduce impacts associated with emissions of particulate matter and other pollutants, the following control measures would be included in construction contracts, as applicable and practicable.
	
	Fugitive Dust Source Controls:
	• Stabilize heavily used unpaved construction roads with a non-toxic soil stabilizer or soil weighting agent. This agent cannot result in the loss of vegetation or increase other environmental impacts.
	• During grading, use water as necessary on disturbed areas in construction sites to control visible plumes.
	• Vehicle Speed
	  ○ Limit speeds to 25 miles per hour on stabilized unpaved roads as long as such speeds do not create visible dust emissions.
	  ○ Limit speeds to 10 miles per hour or less on unpaved areas within construction sites on un-stabilized (and unpaved) roads.
	  ○ Post visible speed limit signs at construction site entrances
	• Inspect and wash construction equipment vehicle tires, as necessary, so they are free of dirt before entering paved roadways, if applicable.
	• Provide gravel ramps of at least 20 feet in length at tire washing/cleaning stations, and ensure construction vehicles exit construction sites through treated entrance roadways, unless an alternative route has been approved by appropriate lead agencies, if applicable.
	• Use sandbags or equivalent effective measures to prevent run-off to roadways in construction areas adjacent to paved roadways. For those contracts in which one is required, ensure consistency with the Storm Water Pollution Prevention Plan.

- Sweep the first 500 feet of paved roads exiting construction sites, other unpaved roads en route from the construction site, or construction staging areas whenever dirt or runoff from construction activity is visible on paved roads, or at least twice daily or less during period of precipitation.
- Stabilize disturbed soils after active construction activities are completed with a non-toxic soil stabilizer, soil weighting agent, or other approved soil stabilizing method.
- Cover or treat soil storage piles with appropriate dust suppressant compounds and disturbed areas that remain inactive for longer than 10 days. Provide vehicles, which are used to transport solid bulk material on public roadways and that have potential to cause visible emissions, with covers. Alternatively, sufficiently wet and load materials onto the trucks in a manner to provide at least one foot of freeboard.
- Use wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) where soils are disturbed in construction, access and maintenance routes, and materials stock pile areas. Keep related windbreaks in place until the soil is stabilized or permanently covered with vegetation.

Mobile and Stationary Source Controls

- Plan construction scheduling to minimize vehicle trips.
- Limit idling of heavy equipment to less than 5 minutes and verify through unscheduled inspections.

Administrative Controls

- Develop a construction traffic and parking management plan that maintains traffic flow and plan construction to minimize vehicle trips.
- Identify any sensitive receptors in the project area, such as children, elderly, and the infirm, and locate construction equipment and staging zones away from sensitive receptors and building air intakes.

Climate Change

The following text has been added to Section 6.8.1, paragraph 2: In order to reduce GHG emissions, emission reduction methods described in 7.8.2.2 would be implemented.

The following text has been added to Section 7.8.2.2 of the Final Integrated Feasibility Report-Environmental Impact Statement (FIFR-EIS):

Although GHG emissions were not estimated for the S2G projects, GHG emission levels are expected to be well below the 25,000 metric ton/year (27,557 tons/year) threshold for significance. Based on comparison to a similar waterfront construction project,
3 temporary GHG emissions from construction and commuting vehicles are expected to vary between 4,500 and 14,000 tons of CO^2 and CO^2 equivalents per year in the Sabine airshed and approximately 3,200 tons of CO^2 and CO^2 equivalent per year in the Brazoria airshed. Although these emissions do not approach the significance threshold, emissions reduction practices could be implemented.

Non-road diesel and gasoline engines can contribute significantly to many pollutant loads, including GHGs. In recent years, EPA has set standards for engines used in most new construction equipment. However, because construction equipment can last 25-30 years, it will take many years before existing equipment is fully replaced by newer, cleaner-burning equipment. With this in mind, EPA developed the Clean Construction USA

program to assist operators of heavy non-road, diesel-powered equipment to reduce emissions from older engines that are in operation today. Emission reduction methods include:

- Idle-reduction practices that save money, reduce emissions, add fuel savings, extend engine life, and provide a safer and better work environment for equipment operators;
- Switching to ultra-low-sulfur fuel, which in addition to reducing sulfur (non-GHG) emissions, improves engine efficiency by reducing wear, deposits, and oil degradation;
- Retrofitting equipment to reduce emissions; and
- Installing catalysts and filters verified by EPA to ensure emissions reduction and durability of retrofit technologies. Engine upgrade kits are also available and can be installed during routinely scheduled engine rebuilds.

To support these reduction initiatives, the USACE can request that newer Tier 2 or Tier 3 engines be prioritized for use, and can place that stipulation in construction proposals.

Roughly one-third of the temporary annual GHG emission impacts are estimated to come from delivery vehicles and worker commuter vehicles. As an additional mitigation measure, construction contractors, the USACE can encourage alternate transportation means. The encouragement of alternative transportation methods, including carpooling, public transportation, and use of local labor could potentially reduce these GHG emissions by as much as 40 percent. Incentives for these initiatives can include preferred parking for carpoolers.

With implementation of these reduction measures, total GHG emissions may reasonably be reduced by up to 25 percent over the lifespan of the projects, resulting in emission rates as low as between 3,375 and 10,500 tons of CO^2 and CO^2 equivalents per year in the Sabine airshed and approximately 2,400 tons of CO^2 and CO^2 equivalent per year in the Brazoria airshed.

Environmental Justice

4 Public meetings on the DIFR-EIS were held on October 6 and 8, 2015, in Beaumont at Lamar University and Freeport, Texas at the Freeport Community Center. Prior to these public meeting four scoping meetings were held in early 2012 aiding in the development of over 250 ideas addressing coastal storm risk problems and ecosystem restoration opportunities in the initial six-county study area. Comments from the public, stakeholders, and agencies are currently being addressed. Coordination will continue for those potentially protected populations should changes arise in the design of the project that may change the impacts or that could potentially impact other populations not yet identified as potentially experiencing impacts from the project. This will be addressed prior to signing the Record of Decision.

Tribal Analysis

5 In accordance with the USACE Tribal Policy Principles, Presidential Memorandum (April 29, 1994) Government to Government Relations with Native American Tribal Governments, Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments (November 06, 2000), and President Obama's Memorandum of November 5, 2009 – Tribal Consultation, USACE has contacted and coordinated with Federally-recognized Indian Tribes throughout the study to obtain their views and assess the impact of the proposed CSRM plans on tribal lands, resources and concerns. The Alabama

	Coushatta Tribe of Texas, the Comanche Nation of Oklahoma, the Coushatta Tribe of Louisiana, the Kiowa Indian Tribe of Oklahoma, the Mescalero Apache Tribe, and the Tonkawa Tribe of Oklahoma were contacted by letter in November, 2014, to inform them of the upcoming S2G study, invite them to participate as a cooperating agency, coordinate the study schedule, and initiate consultation regarding any concerns the tribes may have regarding potential project impacts to sites, areas or resources of religious, cultural or other tribal interest. No responses were received from the tribes and no concerns or potential impacts were identified. The DIFR-EIS was provided to the same tribes in September 2015, and the tribes were notified that USACE intended to execute a Programmatic Agreement to govern the scope of cultural resource investigations, to be determined in concert with the Texas SHPO and Indian tribes. No comments on the DIFR-EIS or the Draft Programmatic Agreement were received from the tribes. These tribes were contacted by telephone in August, 2016, to inquire if they would like any additional information on the study, provide details of the Recommended Plan, and identify any tribal concerns with the proposed CSRM plans. No tribal concerns with the Recommended Plan were identified. The FIFR-EIS will be provided to the tribes during State and Agency Review.
	Wetland/Section 404 CWA/Mitigation Attachment 1 Responses:
1-1	The project is consistent with the authorization. The cited authorization is correct. This feasibility report presents a programmatic overview of CSRM problems and opportunities in the central Galveston region (Galveston, Harris, and Chambers Counties) and a programmatic assessment of ER opportunities for the entire six-county study area. The programmatic assessment is a listing and screening of measures identified as having high potential to demonstrate Federal interest and result in successful CSRM and ER projects. The list of measures is provided in Appendix A. The only measures and alternatives fully evaluated by this feasibility study, with the intent of recommending a plan for Congressional review and authorization, are those associated with a new storm surge risk reduction system for the Orange-Northeast Jefferson County area, and improvements to the existing Port Arthur and Freeport Hurricane Flood Protection projects. No recommendations regarding the feasibility or impacts of the remaining measures are included in this feasibility report; thus detailed analysis of their impacts in this NEPA document is not required. These measures could be fully analyzed in future, separate feasibility studies.
1-2	Refer to Response 1-1.
1-3	Refer to Response 1-1.
1-4	Environmental benefits were used to screen the initial array of measures; environmental impacts were used as criteria in all subsequent screenings of alternatives. These screenings are described in Appendix B of FIFR-EIS. The detailed screening is not presented in the Main Report because of length constraints established by SMART Planning Guidelines.
1-5	Efforts to avoid and minimize impacts to aquatic resources were undertaken in all study phases. Documentation of these efforts in detail would be extensive. These efforts were presented to and discussed in detail with all resource agencies, including USEPA during multiple meetings on project impacts and mitigation modeling. The alignment changed between the early screening and the TSP presented in the Draft Integrated Feasibility Report, and was optimized again to minimize wetland impacts in the Recommended Plan presented in the FIFR-EIS. Maps of alignments for each of these phases are shown in Appendix O, Section 2.0 of the FIFR-EIS.
1-6	A discussion of the significance of marsh landforms, organics and nutrients to aquatic species is presented in Appendix O, Section 7.1.3. Further discussion on the potential

	impact of the gates on the exchange of sediment, nutrients and organic matter between wetlands upstream of the gates and wetlands/estuary downstream of the gate has been added to Appendix O, Section 7.2.
1-7	Section 7.2 of Appendix O provides a detailed discussion of the potential for the levee system to affect wetlands upstream and downstream of the system. An extensive culvert system is planned to minimize wetland effects. The FIFR-EIS includes a commitment to keep the culverts open and operable, except when closed to prevent storm surge.
1-8	Six USACE/resource agency meetings and a two-day field trip were held to develop a mitigation plan for the Recommended Plan. This mitigation plan was coordinated with the agencies in a meeting on June 15, 2016, where modeling assumptions and results were presented in tables and discussed, and the proposed mitigation plan was presented in maps and tables. Subsequent to these meetings and prior to completion of the final report, the draft WVA modeling appendix was provided to the resource agencies for review.
1-9	Additional discussion of the potential to disturb contaminated soils has been added to the FIFR-EIS Main Report, and the HTRW appendix. The FIFR-EIS will be provided to the agencies for State and Agency Review.
1-10	The planning objective is written broadly; however, the Table 4-1 of the main report specifies the benefits result from Coastal Storm Surge damage reduction.
1-11	The Federal objective, as established by Section 2031 of the Water Resources Development Act of 2007, specifies that Federal water resources investments shall reflect national priorities, encourage economic development, and protect the environment by: 1) seeking to maximize sustainable economic development; 2) seeking to avoid unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and 3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems. Alternative plans were formulated to reduce the risk of damages from coastal storms, minimize impacts to floodplains, and avoid environmentally significant resources. Where impacts could not be avoided, environmental impacts were quantified and a mitigation plan was formulated.
1-12	See response to 1-11.
1-13	The final mitigation plan was developed in coordination with EPA and other resource agencies. The mitigation plan was provided to EPA for review and comment prior to release of the FIFR-EIS.
1-14	Preliminary estimates of mitigation costs were included with the mitigation plan that was provided to EPA for review.
1-15	The term "conservation plans" referred to plans similar to the Lone Star Coastal National Recreation Area that has been proposed by the SSPEED Center.
1-16	The Initial Array of Alternatives was the evaluated during the first screening. Quantitative environmental impacts evaluations are not conducted this early in the planning process. The qualitative impact analysis identified whether the plans had a low, medium or high risk of significant impacts to wetlands, endangered species, and hydrology.
1-17	A description and location of the Neches River gate and its potential environmental impacts is provided in Appendix B, Section 6.2.1 through 6.2.9.
1-18	This section of the FIFR-EIS has been revised. The decision criteria for selecting a TSP were based on building a plan for each project area that reasonably maximized net benefits consistent with the Federal objective of protecting the Nation's environment.
1-19	The FIFR-EIS Environmental Compliance Section of the Executive Summary has been revised to indicate that coordination with Federal and state resource agencies will continue throughout the study process as required by the NEPA and Fish and Wildlife Coordination Act.

1-20	Refer to Response 1-1.
1-21	The actual authority for this study is the same as that stated in the DIFR-EIS. Refer to Response 1-1.
1-22	Section 1.9 provides an explanation of how the study evolved to the current scope. Section 3.1 provides a definition of "project area." Study area refers to the general area under study.
1-23	Morgan City has been corrected to Morgan Point in the FIFR-EIS.
1-24	SMART Planning requires a brief main report that includes only information required to make this planning decision. Supporting information is provided in appendices. The storm surge analysis for the Sabine Region is presented in the Engineering Appendix Section 2.0.
1-25	The referenced section states the "existing area" described in this chapter covers the entire six county area, and then explains that the "study" scope is limited to the three counties of Orange, Jefferson and Brazoria.
1-26	This table refers to Diurnal Tide Ranges as specified in the title.
1-27	The FIFR-EIS text has been revised as requested.
1-28	This sentence has been revised to refer to two major estuarine systems (Sabine Lake and Galveston Bay) and the Brazos River system.
1-29	The FIFR-EIS section heading has been revised as requested.
1-30	The FIFR-EIS section heading has been revised as requested.
1-31	The FIFR-EIS text has been revised as requested.
1-32	The FIFR-EIS text has been revised as requested.
1-33	The FIFR-EIS text has been revised as requested.
1-34	The additional information requested has not been added. The FIFR-EIS has an adequate level of detail required by law and regulation, but the level of detail, data collection and modeling is only that necessary to confirm the final recommended plan and complete the study. This results in documents with less detail than have been produced in the past. In addition, the SMART Planning emphasis on limiting the length of main report means that much of the supporting analysis is presented in appendices and information is presented once, rather than being repeated in numerous sections as was often done in the past.
1-35	Refer to response 1-34. Information requested is provided in the cumulative impacts analysis of the main report, and in Appendix O.
1-36	The FIFR-EIS text has been revised as requested.
1-37	The FIFR-EIS text has been revised as requested.
1-38	The FIFR-EIS text has been revised as requested.
1-39	The FIFR-EIS text has been revised as requested.
1-40	The FIFR-EIS text has been revised as requested.
1-41	The FIFR-EIS text has been revised as requested.
1-42	The referenced sentence has been deleted.
1-43	The requested citation is presented later in the same paragraph.
1-44	The effects of impoundments are discussed later in the same paragraph.
1-45	This information was provided by TPWD biologists as reported in FEMA's (2008) Hurricane Ike Impact Report.
1-46	The FIFR-EIS text has been revised as requested.

1-47	The FIFR-EIS text has been revised as requested.
1-48	This information was provided by TPWD biologists as reported in FEMA's (2008) Hurricane Ike Impact Report.
1-49	The citations were added as suggested.
1-50	Revised to reverse the order of subsidence and saltwater intrusion.
1-51	This is merely a description of the WMA; the boardwalk is a significant public education feature. No revision was made.
1-52	These sections were provided for different purposes. No revision was made.
1-53	The FIFR-EIS text has been revised as requested.
1-54	The bayous are tributaries to the referenced watersheds. No revision was made.
1-55	The FIFR-EIS text has been revised as requested.
1-56	Refer to response 1-34. The title refers to the study areas in the Sabine and Brazoria Regions. No maps have been added to the main report.
1-57	The FIFR-EIS text has been revised as requested.
1-58	The FIFR-EIS text has been revised. TPWD salinity data in the Sabine Region support the 4 ppt upper range.
1-59	Woodlot is a term used frequently by TPWD and USFWS. No revision was made.
1-60	The FIFR-EIS section heading has been revised as requested.
1-61	The FIFR-EIS text has been revised as requested.
1-62	This section is intended to be a brief, general summary. More detailed water quality information is provided in Section 7.7. Revisions have been made to address some of the comments.
1-63	ER measures are presented in Appendix A of the DIFR-EIS, as stated as Section 1.3
1-64	The FIFR-EIS text has been revised as requested.
1-65	The FIFR-EIS text has been revised as requested.
1-66	The scope of the life-safety risk assessment was determined in coordination with the USACE vertical team, which determined the level of analysis provided in the report.
1-67	Refer to Response 1-1
1-68	Section 4.1 explains that the Problem Statements were developed for the entire six-county area, but this study will result in project recommendations for the Sabine and Brazoria regions, only.
1-69	The FIFR-EIS text has been revised as requested.
1-70	The FIFR-EIS text has been revised as requested.
1-71	Op 11 – establish more resilient communities is a broad opportunity that includes ecosystem restoration. Restoring wetlands, barrier islands, etc. are considered measures which could be used to develop alternatives to address opportunities.
1-72	The FIFR-EIS text has been revised as requested.
1-73	Refer to Responses 1-9 and 1-63.
1-74	Sediment management is an inclusive term that includes all measures that facilitate beneficial use of dredged material.
1-75	This paragraph is not intended to include all potential measures. It is a brief summary of the measures that are presented in Appendix A and discussed in Appendix B.

1-76	The reference to the Galveston Bay regional sediment plan has been removed.
1-77	Refer to Response 1-75.
1-78	The results of the screening process are presented in Appendix B. Those that were carried forward for full feasibility analysis are presented and analyzed in this feasibility report. The DIFR-EIS was provided to EPA for review and comment.
1-79	Refer to Response 1-1.
1-80	The term "coastal barrier" is explained in Appendices A and B; it was not addressed by this study.
1-81	As noted in Section 5.3.1, a detailed description of the alternatives and the screening criteria is presented in Appendix B.
1-82	Assume this comment actually refers to Section 5.3.2. Environmental impacts were considered and displayed in Appendix B. This discussion is a simplified explanation of the screening process.
1-83	For a full understanding of the alternatives, refer to Appendix B. The surge barrier referenced for Sabine ER (S8) was specifically included to block surge from extending north of Interstate 10 into the Sabine Island WMA.
1-84	Refer to Response 1-15.
1-85	Refer to Response 1-13.
1-86	The text was revised to state: "No environmental impacts were identified for this element and therefore no mitigation costs were included in the cost estimate."
1-87	Refer to Response 1-86.
1-88	Refer to Response 1-34.
1-89	Planning Objective 3 is presented in Table 4-1: *Maintain and/or restore coastal habitat that contributes to storm surge attenuation where feasible for the 50-year period of analysis.* Even under a scenario with the greatest potential beneficial effects on surge heights, it is estimated that maximum inland attenuation rates would range from 1 foot per 2.1 miles to 1 foot per 3.6 miles of inland penetration with intact marshes. In order to provide a significant reduction in the risk of storm surge impacts, the Recommended Plan includes levee/floodwall system elevations of 15-17 feet NAVD88, far exceeding the small amount of attenuation that might be provided by the existing or restored marsh systems. Therefore, marsh or other wetland restoration alternatives were not practicable alternatives for significantly reducing the risk of storm surge impacts. Refer to Response 1-1 for the reason ER was eliminated from full feasibility analysis in this study.
1-90	The Independent External Peer Review comments and USACE responses are available on the Galveston District website.
1-91	Net benefits were developed in accordance with USACE policy. A mitigation plan has been provided to EPA – refer to Response 1-13.
1-92	This analysis was included in the DIFR-EIS to support selection of a higher level of storm surge risk reduction for the Recommended Plan if it was determined to reasonably maximize net benefits in conformance with USACE policy.
1-93	Refer to response 1-93.
1-94	The FIFR-EIS text has been revised as requested. Because it is generally the lowest height of all action alternatives that were evaluated, the Recommended Plan would result in the narrowest footprint and the fewest environmental impacts, while reasonably maximizing coastal storm risk reduction to the affected communities. The No Action Alternative would provide no coastal storm risk reduction to the vulnerable populations and infrastructure of the study area

1-95	The FIFR-EIS text has been revised as requested.
1-96	Section 7.10 has been revised to commit to conducting Phase I HTRW investigations during the Preconstruction, Engineering and Design (PED) Phase for areas of the Recommended Plan alignments located in or adjacent to industrial areas which may have a higher risk of encountering previously unknown contaminated soils or groundwater during construction. The Recommended Plan does not propose any levee system construction in the vicinity of Star Lake Canal.
1-97	USACE policy utilizes the phrase "fish and wildlife mitigation" to refer to mitigation for impacts to all significant ecological resources, including wetlands, from Federal projects.
1-98	The discussion of avoidance and minimization of environmental impacts is in Section 8 of the Appendix O.
1-99	The final mitigation plan fully compensates for impacts to coastal wetland types "in-kind."
1-100	Refer to Response 1-98.
1-101	Refer to Responses 1-13 and 1-99. Proposed "preservation only" mitigation plans for forested wetlands do provide high ratios of compensation.
1-102	Extensive coordination on the mitigation plan was conducted with EPA and other Federal and state resource agencies. Refer to Response 1-13.
1-103	A screening-level mitigation cost estimate was developed based on the conceptual mitigation to support selection of the TSP. The cost estimate referenced here is the preliminary cost estimate that was developed to select the mitigation plan and support selection of the Recommended Plan. The mitigation cost estimate for the selected mitigation plan was further refined for the final Total Project Cost Estimate and presented in the FIFR-EIS.
1-104	Changes to the mitigation can be made during PED, if coordinated with and approved by Federal and state resource agencies.
1-105	Refer to Response 1-96
1-106	The Wetland Value Assessment is an ecological model.
1-107	Refer to Response 1-34
1-108	Yes, coordination with resource agencies would continue in the PED and Construction phases. If impacts increase, mitigation could be increased. This information is presented in Section 6.1.3.1 of the Main Report.
1-109	Refer to Response 1-96.
1-110	The FIFR-EIS will include the State Water Quality Coordination. When completed and approved by HQUSACE, the FIFR-EIS will be provided to all resource agencies during State and Agency Review.
1-111	Refer to Response 1-98.
1-112	The project sponsor does not determine whether impacts are significant. Refer to Response 1-13.
1-113	Refer to Response 1-13.
1-114	Refer to Response 1-98.
1-115	The first sentence of Section 7.2.1.1 states that gated culverts would be placed everywhere drainages (shown in Figure 7.1) intersect the alignment. Thirteen additional culverts will be incorporated into the design based upon a further analysis that checked for smaller, secondary drainages where culverts would be needed.
1-116	The engineering analysis was conducted with the same degree of conservatism that was assumed for the environmental analysis.

1-117	All gated structures will remain open except during surge events. Given that the entire Recommended Plan alignment is located in the tidally affected coastal zone, use of flapgates gates at any location is unlikely.
1-118	Refer to Response 1-34. Designs would be developed during the PED phase. Coordination with resource agencies would continue in the PED and Construction phases.
1-119	A mitigation monitoring and adaptive management plan has been included in the FIFR-EIS as Attachment P.
1-120	The DOWSMM modeling determined that velocity would increase temporarily with high water flows during large storm or surge events in the vicinity of the structure. Impacts to fishery access has already been addressed with the WVA modeling.
1-121	Refer to Response 1-98.
1-122	Revisions to this effect have been made to Sections 6.1.3.1 and 7.2.1 of the FIFR-EIS.
1-123	Maps showing the locations where forested wetlands are impounded between are presented in Appendix O. The project impacts have been minimized as described in Response 1-98.
1-124	Refer to Response 1-123.
1-125	Refer to Response 1-123.
1-126	Rates of relative sea level change for the Freeport Region are reported in the FIFR-IES (Tables 3-5 through 3-7); the rates for each region were used in the analyses for each region. Salinities in the vicinity of the Freeport CSRM plan are already essentially equivalent to the Gulf of Mexico. RSLC would therefore have no effect on salinity; this is explained in the FIFR-EIS.
1-127	Future rates of land loss calculated by USGS for the WVA modeling of impacts include the effects of subsidence associated with any cause. This has been considered in the analysis presented in Appendix O.
1-128	This area is discussed in detail in Section 7.1.3 of Appendix O. Primary access is provided by Adams Bayou on its southwestern side, although up to an estimated 40 percent of the flows enter the area near its northernmost point through a bridge-culvert under the road leading into the Port of Orange. A large culvert is planned for this location for the Orange CSRM Plan. TPWD reports than an old levee, which bisects the area from northwest to southeast, is degraded in many areas, allowing flows to pass unencumbered to both sides of the levee. TPWD is very familiar with this area and agreed that no impediments to access are known.
1-129	This argument is supported by an analysis presented in Appendix O (Section 8.3.1) of the FIFR-EIS.
1-130	Refer to Response 1-123.
1-131	The referenced sentence has been removed from the FIFR-EIS.
1-132	The FIFR-EIS text has been revised as requested.
1-133	The FIFR-EIS text has been revised as requested.
1-134	The FIFR-EIS text has been revised as requested.
1-135	The FIFR-EIS text has been revised as requested.
1-136	The referenced discussion has been added in other areas where appropriate. This section is limited to fisheries access impacts.
1-137	The FIFR-EIS text has been revised as requested.
1-138	CE/ICA Incremental Analysis is described in Appendix O, Section 8.4.2.
1-139	The FIFR-EIS text has been revised as requested. P

1-140	Refer to Response 1-13. NMFS and USACE have concluded Essential Fish Habitat consultation, and NMFS has concurred that the proposed mitigation appropriately compensates for all EFH impacts.
1-141	Consultation with the USFWS regarding potential impacts of the S2G project to threatened and endangered impacts has been concluded. The Biological Assessment and USFWS correspondence is provided in Appendix J of the FIFR-EIS.
1-142	The referenced sentence has been revised in the FIFR-EIS to reference shoaled sediments. The sediment analysis requested by this comment was performed for and presented in the each of cited public documents. It is not necessary to repeat that information in this report
1-143	Refer to Response 1-96.
1-144	Refer to Response 1-98.
1-145	Section 7.10.2 of the FIFR-EIS has been revised to report the Star Canal NPS site. No CSRM Plan construction activities are proposed for the alignment in the vicinity of this NPL site.
1-146	Section 7.10 has been revised to commit to conducting Phase I HTRW investigations during the Preconstruction, Engineering and Design (PED) Phase for areas of the Recommended Plan alignments located in or adjacent to industrial areas which may have a higher risk of encountering previously unknown contaminated soils or groundwater during construction.
1-147	Refer to Response 1-96.
1-148	Refer to Response 1-146.
1-149	Refer to Response 1-13.
1-150	Refer to Response 1-34.
1-151	The FIFR-EIS text has been revised as requested.
1-152	The FIFR-EIS text has been revised as requested.
1-153	Degradation of the Sabine Region has been acknowledged in prior paragraphs, and this report and this paragraph acknowledge that the proposed project would impact the area.
1-154	Refer to Response 1-13.
1-155	Refer to Response 1-115.
1-156	Refer to Response 1-142.
1-157	Wetland impact acreages have been reviewed for consistency throughout the FIFR-EIS.
1-158	Refer to Response 1-157.
1-159	Refer to Response 1-157.
1-160	Refer to Response 1-13.
1-161	Refer to Response 1-103.
1-162	Refer to Responses 1-13 and 1-98.
1-163	The meaning of the word in question can be found in the dictionary.
1-164	The Jefferson County Ecosystem Restoration Study was initiated in August, 2016. This study will be coordinated with Federal and state agencies in accordance with USACE policy and Galveston District practice. The FIFR-EIS text has been revised as requested.
1-165	The Coastal Texas Coastal Storm Risk Management and Ecosystem Restoration Feasibility Study is underway at this time. This study is being coordinated with Federal and state agencies in accordance with USACE policy and Galveston District practice. The FIFR-EIS text has been revised as requested.

1-166	The FIFR-EIS text has been revised as requested.
1-167	The FIFR-EIS text has been revised as requested.

U.S. Fish and Wildlife Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

David Hoth
Acting Field Supervisor
U.S. Fish and Wildlife Service
Texas Coastal Ecological Services Field Office
17629 El Camino Real, Suite 211
Houston, Texas 77058

Dear Mr. Hoth:

Enclosed please find a compact disk of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement . This draft report is provided for your review pursuant to the Fish and Wildlife Coordination Act (16 USC §§661-666c), requiring coordination with USFWS and TPWD to prevent loss of and damage to wildlife resources.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@ usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosure

CF w/o encls:
Tirpak, CWSWG-PM-J

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER 15/0508
File 9043.1

October 26, 2015

Janelle Stokes
U. S. Army Corps of Engineers
Galveston District
P.O. Box 1229
Galveston, TX 77553-1229

Dear Ms. Stokes:

The U.S. Department of the Interior has reviewed the Draft Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement. In this regard, we have no comment.

Thank you for the opportunity to review this document.

Sincerely,

Stephen R. Spencer, Ph.D.
Regional Environmental Officer

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

August 26, 2015

Regional Planning and Environmental Center
Unit A

David Hoth
Acting Field Supervisor
U.S. Fish and Wildlife Service
Texas Coastal Ecological Services Field Office
17629 El Camino Real, Suite 211
Houston, Texas 77058

Dear Mr. Hoth:

This letter is in regard to a proposed Federal action for a coastal storm risk management project in Orange, Jefferson, and Brazoria Counties, Texas. The proposed action was identified during the Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Study. The Galveston District is currently preparing a Draft Integrated Feasibility Report and Environmental Impact Statement which recommends improvements to the existing Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) and the Freeport and Vicinity HFPP, and construction of new Orange-Jefferson Coastal Storm Risk Management project (CSRM). The Tentatively Selected Plan (TSP) proposes: a new CSRM levee/floodwall system for Orange and Northeast Jefferson County (including navigable surge gates on Cow and Adams Bayous), and upgrades to the levee/floodwall systems of the existing Port Arthur and Vicinity and Freeport and Vicinity HFPPs. A description of the TSP, as well as the USACE assessment of effects on listed species as required under Section 7(a)(2) of the ESA, is provided in the attached Biological Assessment (BA).

We have prepared a BA for the proposed project as listed species could potentially occur within the affected area. The TSP would have no effect on the federally-listed piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), whooping crane (*Grus Americana*), West Indian manatee (*Trichechus manatus*), any of the four whale species [fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), and sperm (*Physeter macrocephalus*)] or the five sea turtle species [green (*Chelonia midas*), Hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*) leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*)] listed as possibly occurring in the area. The TSP would also have no effect on any of the four coral species (lobed star *Orbicella annularis*, mountainous star *Orbicella faveolata*, boulder star *Orbicella franksi* and elkhorn *Acropera palmata*) that occur in offshore waters of the region. We have also concluded that the project would have no effect on candidate species, consisting of wintering Sprague's pipits (*Anthus spragueii*) or freshwater mussels (smooth pimpleback, *Quadrula houstonensis*, and Texas fawnsfoot, *Truncilla macrodon*). Designated Critical Habitat does not exist in the project areas.

We are hereby requesting your written concurrence, pursuant to the informal consultation procedures prescribed in 50 CFR 402.13, that the proposed action would have no effect on federally-listed species or designated critical habitat under your agency's jurisdiction. We appreciate your continued cooperation in allowing us to fulfill our responsibilities under the Endangered Species Act. Should you require any additional information during review of the enclosed BA, please call Ms. Janelle Stokes at 409-766-3039.

Sincerely,

Carolyn Murphy
Acting Chief, Plan Formulation Section

Enclosure

JAN 1 1 2016

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Office
17629 El Camino Real, Suite 211
Houston, Texas 77058
281-286-8282

January 6, 2016

Colonel Richard P. Pannell
Galveston District, Corps of Engineers
Attn: Janelle Stokes
PO Box 1229
Galveston, Texas 77553-1229

Consultation Number: 02ETTXX0-2016-I-0301

Dear Colonel Pannell:

Thank you for your letter of August 26, 2015 regarding the Biological Assessment (BA) prepared for the proposed Sabine Pass to Galveston Coastal Storm Risk Management and Ecosystem Restoration Study located in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria counties, Texas. The U.S. Army Corps of Engineers (Corps) is requesting concurrence from the U.S. Fish and Wildlife Service (Service) that the proposed project would have "no effect" on the federally listed piping plover (*Charadrius melodus*), Rufa red knot (*Calidris canatus rufa*), West Indian manatee (*Trichechus manatus*), whooping crane (*Grus americana*), five sea turtle species, including; Kemp's ridley sea turtle (*Lepidochelys kempii*), hawksbill sea turtle (*Eretmochyles imbricata*), leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), and loggerhead sea turtle (*Caretta caretta*). All of these species have been listed pursuant to the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). The Corps also determined that the project would have "no effect" on several candidate species; two freshwater mussels, the smooth pimpleback (Quadrula houstonensis) and the Texas fawnsfoot (*Truncilla macrodon*), and wintering Sprague's pipet (*Anthus spragueii*). There is no designated critical habitat within the project areas. In addition, all consultation procedures regarding the four whale species listed in your letter are the responsibility of the National Marine Fisheries Service and will not be addressed in this consultation.

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that the actions authorized, funded, or carried out by such agencies do not jeopardize the continued existence of any threatened or endangered species or adversely modify or destroy designated critical habitat of such species. The Service's comments are provided in accordance with the Endangered Species Act, the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) and the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661-667(e)).

The proposed project was identified during the Coastal Storm Risk Management and Ecosystem Restoration Study. The study was initiated by the Galveston District Corps to address storm risk

problems in the Galveston Region and ecological restoration opportunities for the entire six county study area. The study recommended improvements to the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) and the Freeport and Vicinity HFPP, and construction of a new Orange-Jefferson Coastal Storm Risk Management project. The tentatively selected plan would include a new CSRM levee/floodwall system for Orange and North Jefferson County, including navigable surge gates at Cow and Adams Bayous, and upgrades to the existing levee/floodwall systems of the Port Arthur and Vicinity and the Freeport and Vicinity HFPPs.

Based on the information provided in the BA regarding the location of the project and its proximity to suitable habitat, the aforementioned listed species would not be affected by the project actions. Therefore, the Service concurs with the Corps "no effect" determinations. No further endangered species consultation would be required for this project unless: 1) the identified action is subsequently modified in a manner that causes an effect on listed species or designated critical habitat; 2) new information reveals the identified action may affect federally protected species or designated critical habitat in a manner or to an extent not previously considered; or 3) a new species is listed or critical habitat is designated under the Act that may be affected by the identified action. Additional information on the projects potential effects on other Service trust resources and mitigation actions to compensate for lost ecological function will be provided at a later date in the Service's FWCA report.

Thank you for the opportunity to review and provide comments on this project. We appreciate your efforts to conserve these sensitive species. If you have any questions or comments, please contact Donna Anderson at 281-286-8282 (ext. 225).

Sincerely,

David Hoth
Acting Field Supervisor

National Marine Fisheries Service Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

August 26, 2015

Regional Planning and Environmental Center
Unit A

David Bernhart
Assistant Regional Administrator
National Marine Fisheries Service
Southeast Regional Office
Protected Resources Division
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Dear Mr. Bernhart:

This letter is in regard to a proposed Federal action for a coastal storm risk management project in Orange, Jefferson, and Brazoria Counties, Texas. The proposed action was identified during the Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Study. The Galveston District is currently preparing a Draft Integrated Feasibility Report and Environmental Impact Statement which recommends both improvements to existing and construction of new hurricane flood protection (HFP) systems. The Tentatively Selected Plan (TSP) proposes: a new levee/floodwall system for Orange and Northeast Jefferson County (including navigable surge gates on Cow and Adams Bayous); upgrades to the levee/floodwall systems of the existing Port Arthur and Vicinity HFP project; and upgrades to the levee/floodwall system in the Freeport and Vicinity HFP project. A description of the TSP is provided in the attached Biological Assessment (BA).

We have prepared a BA for the proposed project as listed species could potentially occur within the affected area. The TSP would have no effect on the federally-listed piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), whooping crane (*Grus Americana*), West Indian manatee (*Trichechus manatus*), any of the four whale species [fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), and sperm (*Physeter macrocephalus*)] or the five sea turtle species [green (*Chelonia midas*), Hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*) leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*)] listed as possibly occurring in the area. The TSP would also have no effect on any of the four coral species (lobed star *Orbicella annularis*, mountainous star *Orbicella faveolata*, boulder star *Orbicella franksi* and elkhorn *Acropera palmata*) that occur in offshore waters of the region. We have also concluded that the project would have no effect on candidate species, consisting of wintering Sprague's pipits (*Anthus spragueii*) or freshwater mussels (smooth pimpleback, *Quadrula houstonensis*, and Texas fawnsfoot, *Truncilla macrodon*). Designated Critical Habitat does not exist in the project areas.

We are hereby requesting your written concurrence, pursuant to the informal consultation procedures prescribed in 50 CFR 402.13, that the proposed action will have no effect on federally-listed species or designated critical habitat under your agency's jurisdiction. We appreciate your continued cooperation in allowing us to fulfill our responsibilities under the Endangered Species Act. Should you require any additional information during review of the enclosed BA, please call Ms. Janelle Stokes at 409-766-3039.

Sincerely,

Carolyn Murphy

Carolyn Murphy
Acting Chief, Plan Formulation Section

Enclosure

From: Teletha Mincey - NOAA Federal
To: Stokes, Janelle S SWF @SWG
Cc: Kelly Shotts - NOAA Federal; Rachel Sweeney - NOAA Federal
Subject: [EXTERNAL] Sabine Pass to Galveston Bay, Texas, Biological Assessment Coordination
Date: Wednesday, September 09, 2015 8:44:44 AM

Pursuant to section 7(a)(2) of the Endangered Species Act (ESA), the Protected Resources Division (PRD) of NOAA's National Marine Fisheries Service (NMFS) has reviewed your letter dated August 26, 2015, concerning the above-mentioned subject.

USACE concludes that the proposed action will have "no-effect" on listed species or critical habitat designated under the ESA under NMFS's purview. Given this, that concludes ESA Section 7 consultation responsibilities. USACE does not need to seek NMFS's comments or concurrence on their "no-effect" determination(s). It is our policy not to respond to "no effect" determinations.

Thank you.

--

Teletha Mincey
Program Analyst
NOAA Fisheries
Southeast Region
263 13th Ave S
St. Petersburg, FL 33701-5505
(727) 824-5312 - Main Line
(727) 551-5772 - Direct Line
(727) 824-5309 - Fax
Blockedhttp://sero.nmfs.noaa.gov/pr/pr.htm

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 10, 2015

Regional Planning and Environmental Center
Unit A

Heather Young
NOAA National Marine Fisheries Service
Habitat Conservation Division, Southeast Region
4700 Avenue U
Galveston, Texas 77551

Dear Ms. Young:

This letter is in regard to a proposed Federal action developed for the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Study. The Galveston District has prepared a Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) which recommends improvements to existing Hurricane Flood Protection Projects (HFPPs) and construction of a new coastal storm risk management (CSRM) system. The Tentatively Selected Plan (TSP) proposes: a new levee/floodwall system for Orange and Northeast Jefferson County (including navigable surge gates on Cow and Adams Bayous), called the Orange-Jefferson CSRM Plan; improvements to the existing levee/floodwall system of the Port Arthur and Vicinity HFPP; and improvements to the existing levee/floodwall system in the Freeport and Vicinity HFPP. Detailed descriptions and maps of these plans are provided in the DIFR-EIS. We would like to coordinate essential fish habitat (EFH) impacts of this project with your agency in accordance with requirements of the Magnuson-Stevens Reauthorization Act of 1996 (MSRA). Information regarding the proposed project and potential EFH impacts are provided below. A compact disk with the DIFR-EIS is enclosed for your review.

We have reviewed the proposed project for impacts to categories of EFH and managed species. The categories of EFH that occur within the study area include estuarine emergent marsh, estuarine submerged aquatic vegetation (SAV), estuarine hard bottom, and estuarine mud/soft bottoms. The study area contains EFH for larval, juvenile and adult brown and white shrimp (*Penaeus aztecus* and *Penaeus setiferus*); juvenile king mackerel (*Scomberomorus cavalla*), vermillion snapper (*Rhomboplites aurorubens*), Warsaw grouper (*Epinephelus nigritus*), and Wenchman snapper (*Pristipomoides aquilonaris)*; juvenile and adult red drum (*Sciaenops ocellatus*), Almaco jack (*Seriola rivoliana*), and gray triggerfish (*Balistes capriscus*); adult gag grouper (*Mycteroperca microlepis*) and gray snapper (*Lutjanus griseus*); larval, juvenile and adult red snapper (*Lutjanus campechanus*), lane snapper (*Lutjanus synagris*), greater amberjack (*Seriola dumerili*), and cobia (*Rachycentron canadum*).

No EFH or managed species impacts are anticipated with construction of improvements to the Port Arthur and Vicinity and Freeport and Vicinity CSRM Plans. For the Port Arthur and

Vicinity CSRM Plan, construction impacts would be confined primarily to the existing project rights-of-way, and work would be conducted from barges in the adjacent waterways. Small areas where additional rights-of-way may be required are located within industrial upland areas. Similarly, construction of the Freeport and Vicinity CSRM Plan would be confined primarily to existing project rights-of-way. A small area of additional right-of-way in the Oyster Creek area would impact an upland area only. Construction of a new surge gate at the mouth of the existing DOW Barge Canal would permanently affect up to 3 acres of soft bottom. There are no other types of EFH in this industrial canal; tidal energy and flushing is low, and the canal provides little benefit to shell or finfish that may enter it. Therefore, impacts on EFH with this loss of soft bottom would be negligible. The displacement of finfish and shrimp species that might enter it during gate construction would be temporary and individuals should move back into these specific areas once the project is completed. Tidal flow around the gate construction zone would be maintained at all times. The potential harm of some individual finfish and shellfish from temporary turbidity-related impacts would be minimal and would not reduce any populations of federally managed species or their prey.

Direct and indirect impacts associated with construction of the Orange-Jefferson CSRM Plan would result in the loss of about 274.4 acres of estuarine emergent marsh over the period of analysis. Marsh acres include water within the marsh and small drainages; some SAV in the estuarine marsh areas would also be lost. This number includes the loss of marsh due to the direct impacts of construction (173.3 acres) and the loss of marsh due to indirect impacts of the new levee system such as impoundment and disruptions in hydrologic flow (101.1 acres). Losses of 86.9 average annual habitat units (AAHUs) and 44 AAHUs, respectively, have been calculated with the Wetlands Value Assessment (WVA) model. Remaining indirect impacts to 2,137 acres would be associated with fisheries access impacts of the proposed Cow and Adams Bayou surge gate structures. All of these impacts are described in detail in Appendix O of the DIFR-EIS.

Construction of the Cow and Adams Bayou surge gates would result in the loss of approximately 11 acres of estuarine soft bottom EFH in the bayous themselves. This is the area estimated for the footings of the gate structures. The structures themselves would provide artificial hard bottom habitat in the same area, increasing the diversity of EFH bottom types in the area. Shellfish such as oyster or rangia would utilize the new vertical hard-bottom habitat provided by the concrete and steel structures, and finfish could utilize the structures as cover. The net long-term loss to EFH bottom habitat from the Cow and Adams gate structures would therefore be negligible. Construction would result in the temporary burial of benthic organisms and temporary increases in water column turbidity in the vicinity of the surge gates. Recovery of benthic macroinvertebrates is expected to be rapid with no long-term effects expected. The displacement of finfish and shrimp species (including estuarine dependent organisms that serve as prey for federally managed species) during surge gate construction would be temporary and individuals should move back into these specific areas once the project is completed. Tidal flow around the gate construction zones would be maintained at all times. Once in place, the Cow and Adam Bayous surge gate structures would constrict flows in these bayous while in their normal open condition. This would result in fisheries access impacts to a total of about 2,137 acres (approximately 1,235 and 902 acres, respectively for Cow and Adams Bayous) of estuarine emergent marsh in the bayou floodplains upstream of the gated structures. A loss of 50.5 AAHUs

as a result of fisheries access impacts over the period of analysis has been calculated with the WVA Model.

All EFH impacts identified for the TSP are associated with the Orange-Jefferson CSRM Plan. A total of approximately 2,411.4 acres of estuarine emergent marsh EFH would be impacted, resulting in a loss of 181.7 AAHUs; 274.4 acres would be lost due to direct and indirect impacts of the new levee system; the functionality of 2,137 acres would be reduced as a result of fisheries access impacts of the Cow and Adams Bayou surge gates. USACE recognizes the need to conserve EFH and its associated fisheries resources. Planning for the alignment of the TSP minimized impacts to the greatest extent possible by locating the new levee/floodwall system as close to the upland-wetland margin as possible. Mitigation would be needed to compensate for remaining unavoidable impacts to 181.7 AAHUs.

Conceptual mitigation plans to compensate for impacts to estuarine emergent marsh are presented in Appendix O of the DIFR-EIS. It is anticipated that mitigation would consist of marsh restoration in the lower Neches River and Old River marsh areas. A final mitigation plan will be developed during preparation of final feasibility report. Direct and indirect impacts will be fully compensated with the restoration of estuarine emergent marsh and shallow water in the amount determined using the WVA model and Cost-Effectiveness-Incremental Cost Analysis (CE/ICA). Selection of potential mitigation sites and modeling of mitigation measures will be conducted in coordination with your agency and others. All impacts will be fully compensated.

We would appreciate your evaluation of the EFH assessment, presented here and in the DIFR-EIS. The public comment period for the DIFR-EIS closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@ usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosure

CF w/o encl:
Tirpak, SWG-PM-J

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

October 26, 2015 F/SER46: HY/RS

Ms. Janelle Stokes
Galveston District
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Ms. Stokes:

The NOAA's National Marine Fisheries Service Habitat Conservation Division (NMFS HCD) has received the Draft Integrated Feasibility Report and Environmental Impact Statement dated September 2015 for the Sabine Pass to Galveston Bay, Texas (S2G) Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study. The U.S. Army Corps of Engineers (USACE) Regional Planning and Environmental Center also provided a letter dated September 10, 2015. This letter and the Draft Integrated Feasibility Report and Environmental Impact Statement are intended to formally initiate Essential Fish Habitat (EFH) consultation with the NMFS HCD and include an assessment of the impacts of the proposed tentatively selected plan (TSP) on EFH.

The S2G feasibility study examines CSRM and ER problems and opportunities within six counties of the upper Texas coast (Orange, Jefferson, Chambers, Harris, Galveston, and Brazoria Counties). Due to study costs, complexity, and schedule requirements, the USACE decided to include only a programmatic assessment of potential CSRM projects in the Galveston region (Galveston, Harris, and Chambers Counties) and potential ER projects throughout the six county study area. Future studies will focus on CSRM for the Galveston region and ER opportunities for all six counties. This refocused S2G feasibility study proposes a TSP for the Sabine and Brazoria regions that includes: (1) the Orange-Jefferson CSRM Plan, which is a new levee/floodwall system for Orange and Northeast Jefferson Counties that includes navigable surge gates on Cow and Adams Bayous, (2) improvements to the existing levee/floodwall system of the Port Arthur and Vicinity Hurricane Flood Protection Project, and (3) improvements to the existing levee/floodwall system in the Freeport and Vicinity Hurricane Flood Protection Project.

As described in the Draft Integrated Feasibility Report and Environmental Impact Statement, the TSP would result in adverse impacts to EFH through both direct and indirect impacts associated with construction of the Orange-Jefferson CSRM Plan. These impacts would include the loss of about 274.4 acres of estuarine emergent marsh over the 50 year period of analysis. This number includes the loss of marsh due to the direct impacts of levee and gate construction (173.3 acres) and the loss of marsh due to indirect impacts of the new levee system, such as impoundment and disruptions in hydrologic flow (101.1 acres). Losses of 86.9 average annual habitat units (AAHUs) and 44 AAHUs, respectively, have been calculated with the Wetlands Value Assessment (WVA) model. An additional 2,137 acres of indirect EFH impacts would result

from reduced/altered fisheries access as a result of the proposed Cow and Adams Bayou surge gate structures. A loss of 50.5 AAHUs due to fisheries access impacts over the period of analysis has also been calculated with the WVA Model.

The NMFS HCD believes the USACE has adequately described the majority of the anticipated adverse EFH impacts given the incomplete and preliminary design information currently available at this stage of early feasibility planning. We offer the following comments and recommendations regarding three primary issues: (1) uncertainties of the impacts (direct, indirect, and cumulative) to EFH and federally managed fisheries, (2) incomplete mitigation plans, and (3) identification of Gulf Council managed species with EFH present within the project area.

Uncertainty of Impacts to EFH and Federally Managed Fish Species

A feasibility-level engineering design for the TSP is not complete at this time. In the Executive Summary and in various sections throughout the Draft Integrated Feasibility Report and Environmental Impact Statement, the USACE acknowledges this risk and states the TSP may require revisions and additional subsequent environmental analysis because of technical, policy, and public comments. The EFH assessment sections of the Final Integrated Feasibility Report and Environmental Impact Statement would benefit from a comprehensive list of the assumptions underlying the USACE's analysis of the TSP's proposed direct and indirect effects on EFH.

The operational plans for the gates and water control structures have not been developed. It is NMFS HCD's understanding these operational plans will be developed by the USACE during preliminary engineering design. The current WVA analysis assumes a worst case scenario closure time of five to seven days, every ten to fifteen years based on predicted storm surge return intervals high enough to threaten areas targeted for protection. Therefore, the USACE concluded closure of the surge gates, sluice gates, and culverts would cause only minor and temporary impacts to fish access and coastal marsh, requiring no additional mitigation to offset operational impacts. The NMFS HCD requests the EFH assessment sections of the Final Integrated Feasibility Report and Environmental Impact Statement clearly articulate the USACE's anticipated closure criteria for all proposed structures within the Orange-Jefferson CSRM Plan. The EFH assessment should also clearly state that if more frequent closure of these structures occur as a result of unanticipated sea level rise or by requests of the local sponsor, EFH impacts and mitigation requirements will need to be reassessed.

Mitigation

The Draft Integrated Feasibility Report and Environmental Impact Statement currently does not include a complete EFH mitigation plan. Draft Appendix O includes a description of potential mitigation evaluation areas within the lower Neches River and Old River Cove marsh complexes. The USACE's draft EFH assessment states direct and indirect EFH impacts will be fully compensated for with the restoration of emergent marsh and shallow water habitat in an amount determined using the WVA model and cost-effective incremental cost analysis. It is anticipated mitigation would include in-kind marsh restoration within the lower Neches River

and Old River Cove areas, possibly through utilization of sediments from regular maintenance dredging of the Sabine-Neches Waterway.

The NMFS HCD is supportive of this mitigation concept and these two potential mitigation areas. We strongly recommend the Final Integrated Feasibility Report and Environmental Impact Statement include a complete detailed mitigation plan to compensate for all direct and indirect habitat impacts. This plan should be developed in close coordination with the NMFS HCD and the other state and federal natural resource agencies prior to release of the Final Integrated Feasibility Report and Environmental Impact Statement and should include specifics on all 12 required components of a complete mitigation plan consistent with the USACE's 2008 final mitigation rule. Of the twelve components, we specifically request the mitigation plan in the Final Integrated Feasibility Report and Environmental Impact Statement include detailed work plans and locations, mitigation performance standards, monitoring requirements, long-term management plans, site protection instruments and financial assurances committed to by the USACE for all mitigation sites.

Timely implementation of mitigation is recommended, because potential delays from the time levee impacts occur until functional mitigation is attained could cause substantial temporal loss of EFH functions. The Final Integrated Feasibility Report and Environmental Impact Statement should specify the mitigation plan will be implemented concurrently with project construction. The NMFS HCD recommends initial construction of the mitigation for each leave reach be completed (intertidal tidal elevation established and mitigation areas planted) no later than 18 months from the initiation of levee construction for that reach.

Identification of Gulf Council Managed Species with EFH Present Within the Project Area

The USACE's EFH consultation initiation letter dated September 10, 2015 identifies categories of EFH occurring within the study area to include estuarine emergent marsh, submerged aquatic vegetation (SAV), hard bottom, mud/soft bottoms. We are not aware of any estuarine hard bottom habitat within the project area. Therefore, we recommend hard bottom be removed from the list of EFH categories affected by the project. The USACE's letter also lists federally managed fish species and their life stages with EFH present in the study area. This list includes several species of reef fish not commonly found in estuarine marsh, SAV, or soft mud bottom habitats in this ecoregion. To assist the USACE in more accurately identifying EFH and federally managed fish species commonly found in the project area, we have provided a table as an enclosure to this letter.

Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation recommendations for any federal action or permit which may result in adverse impacts to EFH. Therefore, the NMFS HCD recommends the following to ensure the conservation of EFH and associated marine fishery resources:

EFH Conservation Recommendations

1. A complete mitigation plan to compensate for direct and indirect EFH impacts should be developed in consultation with the NMFS HCD and other state and federal natural resource agencies and presented in the Final Integrated Feasibility Report and

Environmental Impact Statement. This plan should include specifics on all 12 required components of a complete mitigation plan consistent with the USACE's 2008 final mitigation rule.

2. To minimize temporal EFH losses, the Final Integrated Feasibility Report and Environmental Impact Statement should specify initial construction of the mitigation for each leave reach will be completed (intertidal tidal elevations established and mitigation areas planted) no later than 18 months from the initiation of levee construction for that reach.

3. If the final surge gate designs reduce the cross sections of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis should be performed in consultation with NMFS HCD to characterize potential hydrologic and fish passage impacts and determine potential additional EFH mitigation requirements.

4. Flood protection surge gates, sluice gates, culverts, and any other water control structures should remain completely open except during storm events. Operational, maintenance, and management plans for structures should be developed in coordination with NMFS HCD and the other state and federal resource agencies.

5. If gates or water control structures are to be closed more frequently than the assumed worst case scenario (once every ten to fifteen years for a duration not to exceed two weeks), then additional hydrologic and fish passage modeling may be warranted to more quantitatively assess EFH impacts, and additional compensatory EFH mitigation may be necessary.

6. Fill material used during the construction of the levees and its associated features should come from approved upland borrow sources.

Please be advised that Section 305(b)(4)(B) of the Magnuson-Stevens Act and NMFS's implementing regulation at 50 CFR Section 600.920(k) require the USACE to provide a written response to all EFH recommendations within 30 days of receipt. The USACE's response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If this response is inconsistent with our EFH conservation recommendations, the USACE must provide a substantive discussion justifying the reasons for not implementing our recommendations. If it is not possible to provide a substantive response within 30 days, the USACE should provide an interim response to NMFS, to be followed by the detailed response at least 10 days prior to final approval of the action.

We appreciate the USACE's extensive coordination while performing the WVA used to quantify the TSP's proposed EFH impacts during preparation of the Draft Integrated Feasibility Report and Environmental Impact Statement. Continued coordination with the NMFS HCD will be necessary during preparation of the Final Integrated Feasibility Report and Environmental Impact Statement, preliminary engineering design, development of operational plan, and implementation to satisfy the consultation requirements of the Magnuson-Stevens Act and the

Fish and Wildlife Coordination Act. Please continue to work with Ms. Heather Young of our Galveston Facility at (409) 766-3699.

Sincerely,

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

cc:
EPA, Dallas, Teague
FWS, Clear Lake, Anderson, Hoth
TPWD, Dickinson, Denton, Morgan
USDA, Alford
F/SER4, Dale, Rolfes
PPI, Krasna

Enclosure 1. Estuarine EFH for Gulf Council Managed Species Present Within S2G Project Area (● indicates habitat type designated as EFH for species' life stage)

Estuarine Emergent Marsh						
Species Common Name	Eggs	Larvae	Post Larvae	Early Juvenile	Late Juvenile	Adult
Red Drum			●	●		●
Gray Snapper						●
Brown Shrimp				●		
White Shrimp				●		
Estuarine Submerged Aquatic Vegetation						
Species Common Name	Eggs	Larvae	Post Larvae	Early Juvenile	Late Juvenile	Adult
Red Drum		●	●		●	●
Lane Snapper			●	●	●	
Brown Shrimp				●		
Estuarine Mud/Soft Bottom						
Species Common Name	Eggs	Larvae	Post Larvae	Early Juvenile	Late Juvenile	Adult
Red Drum		●	●	●		●
Gray Snapper						●
Lane Snapper				●	●	
Brown Shrimp				●		
White Shrimp				●		

Regional Planning and Environmental Center

Ms. Virginia M. Fay
Assistant Regional Administrator
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Reference: F/SER46: HY/RS

Dear Ms. Fay,

Reference is made to your letter dated October 26, 2015 providing comments on the Draft Integrated Feasibility Report and Environmental Impact Assessment (DIFR-EIS) for the Sabine Pass to Galveston Bay, Texas (S2G) Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study. We have reviewed your comments and Essential Fish Habitat (EFH) Conservation Recommendations and offer the following response.

The Galveston District, Corps of Engineers (USACE) is currently reviewing all resource agency, technical, policy and public reviews on the Tentatively Selected Plan (TSP) presented in the DIFR-EIS. The TSP is being revised in response to these comments, and it is probable that the impacts analysis will need to be revised to reflect changes to the direct impacts from the Orange-Jefferson CSRM Plan component.

USACE plans to revise the impact analysis in coordination with your agency and others. The revised construction right-of-way alignment, located at the upland//floodplain transition, will avoid and minimize impacts to the greatest extent possible. In some areas, however, this will not be possible because a sinuous alignment would increase storm surge impacts by focusing and increasing the height of the surge. In others, the alignment must avoid existing infrastructure, such as pipeline corridors, industrial facilities, and existing residential or commercial developments.

In order to ensure the conservation of EFH and associated marine fishery resources, USACE concurs with the conservation recommendations to the degree that is possible at this time, as explained below.

Conservation Recommendations

1) A complete mitigation plan to compensate for direct and indirect EFH impacts should be developed in consultation with the National Marine Fisheries Service (NMFS) Habitat Conservation Division (HCD) and other state and federal natural resource agencies and presented in the Final Integrated Feasibility Report and Environmental Impact Statement

(FIFR-EIS). This plan should include specifics on all 12 required components of a complete mitigation plan consistent with the USACE's 2008 final mitigation rule.

USACE response: A detailed mitigation plan will be developed in consultation with your agency and others that compensates for direct and indirect EFH impacts. This plan will be presented in the FIFR-EIS. The mitigation plan will conform to requirements of Section 906 of the Water Resources Development Act (WRDA) of 1986 (33 USC 2283), as amended by Section 2036 of WRDA 2007 and Section 1040 of the Water Resources Reform and Development Act of 2014, the Council on Environmental Quality's National Environmental Policy Act regulations (40 CFR Sections 1502.14(f), 1502.16(h), and 1508.20), and Section C-3 of Engineer Regulation 1105-2-100. The S2G project would be a Congressionally-authorized Federal project and thus, the USACE 2008 final mitigation rule developed for the USACE Regulatory program referenced in your recommendation would not apply.

While your agency has indicated support for the conceptual mitigation plan and proposed mitigation locations identified in the DIFR-EIS, more specific details on measures to avoid, mitigate, or offset the adverse impacts of this project cannot be identified at this time. The mitigation plan will be developed and coordinated with your office prior to completion of the FIFR-EIS. USACE will ensure that damages to all significant ecological resources have been avoided and minimized to the extent practicable, and that any remaining unavoidable damages have been compensated to the extent possible. The mitigation plan will include 1) a detailed mitigation plan and location(s) of mitigation areas; 2) mitigation performance standards and criteria; 3) a monitoring and adaptive management plan to determine and assure success of the mitigation efforts; and 4) identification of non-Federal implementation sponsors and their responsibilities for monitoring, acquisition and management of the mitigation areas.

2) To minimize temporal EFH losses, the FIFR-EIS should specify initial construction of the mitigation for each leave reach will be completed (intertidal tidal elevations established and mitigation areas planted) no later than 18 months from the initiation of levee construction for that reach.

USACE response: Generally, USACE regulations require that the construction of mitigation measures be completed concurrent with or prior to construction of other project features. The construction contract schedule will be developed during the final feasibility analysis. Timing of the mitigation construction contracts will be evaluated at that time to determine if it will be possible to complete dredged material placement, settlement, and planting within the stipulated timeframe.

3) If the final surge gate designs reduce the cross sections of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis should be performed in consultation with NMFS HCD to characterize potential hydrologic and fish passage impacts and determine potential additional EFH mitigation requirements.

USACE response: Concur. If the final surge gate designs reduce the cross sections of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis will be performed in consultation with NMFS HCD to characterize potential hydrologic and fish passage impacts and determine potential additional EFH mitigation requirements.

4) Flood protection surge gates, sluice gates, culverts, and any other water control structures should remain completely open except during storm events. Operational, maintenance, and management plans for structures should be developed in coordination with NMFS HCD and the other state and Federal resource agencies.

USACE response: Concur. Operations Plans will be developed after project authorization during the Pre-construction, Engineering and Design (PED) phase. The Operations Plans will be developed in coordination with NMFS HCD and the other state and federal resource agencies.

5) If gates or water control structures are to be closed more frequently than the assumed worst case scenario (once every ten to fifteen years for a duration not to exceed two weeks), then additional hydrologic and fish passage modeling may be warranted to more quantitatively assess EFH impacts, and additional compensatory EFH mitigation may be necessary.

USACE response: Concur. At this time, it is assumed that gates or water control structures would not be closed more frequently than the assumed worst case scenario (once every ten to fifteen years for a duration not to exceed two weeks). The details and schedule of these closures will be determined during preparation of the Operations Plan. The Operation Plan will be developed in coordination with NMFS HCD and the other state and federal resource agencies.

6) Fill material used during the construction of the levees and its associated features should come from approved upland borrow sources.

USACE response: Concur. At this time, it is assumed that fill material for construction of the levee system and associated features will be obtained from upland, commercial borrow sources. If plans change to include identification and excavation of new borrow areas, consultation with NMFS HCD and the other state and Federal resource agencies would be initiated, and a separate NEPA review document would be prepared.

Since it is not possible to provide a complete response to your recommended conservation measures at this time, please consider this an interim response, which will be followed by a detailed final response "at least 10 days prior to final approval of the action." According to the current study schedule, the FIFR-EIS will be completed in September 2016. If you have any additional questions or concerns, please contact Janelle Stokes at 409/766-3039 or at janelle.s.stokes@usace.army.mil for assistance.

Sincerely,

Carolyn Murphy
Chief, Unit A, NEPA & Cultural Resources Section

CF:

Ms. Heather Young
National Marine Fisheries Service
Habitat Conservation Division
4700 Avenue U, Bldg 307
Galveston, Texas 77551

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
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AUG 05 2016

Regional Planning and Environmental Center
Environmental Compliance Branch, Coastal Section

Ms. Virginia M. Fay
Assistant Regional Administrator
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Reference: F/SER46: HY/RS

Dear Ms. Fay,

Reference is made to your letter dated October 26, 2015 formally initiating Essential Fish Habitat (EFH) consultation and providing comments on the Draft Integrated Feasibility Report and Environmental Impact Assessment (DIFR-EIS) for the Sabine Pass to Galveston Bay, Texas (S2G) Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study. The US Army Corps of Engineers, Galveston District (District) reviewed your comments and EFH Conservation Recommendations and provided an interim response dated November 24, 2015, noting that revisions to the impact analysis might be necessary as the final Recommended Plan was developed.

The District is in the process of preparing a Final Integrated Feasibility Report – Environmental Impact Statement (FIFR-EIS) for the study. During the final feasibility phase, revisions were made to the Tentatively Selected Plan (TSP) which resulted in a significant reduction in wetland impacts associated with the new levee system proposed for Orange County. The Recommended Plan now consists only of the Orange 3 CSRM Plan. The Beaumont A and the Jefferson Main elements are not included in the Recommended Plan. One short levee reach (approximately 1,900 feet) in the Jefferson Main area is still recommended, but it can now be combined with the Port Arthur CSRM Plan since it is located within the jurisdiction of the non-Federal sponsor for the existing Port Arthur and Vicinity Hurricane Flood Protection (HFP) project. The locations of these features and a summary of the Recommended Plan are presented in the preliminary final Wetlands Value Assessment (WVA) Modeling Report (Appendix O of FIFR-EIS) which has been provided to your agency as part of our ongoing resource agency coordination of this study.

Revisions have also been made to proposed Port Arthur and Freeport CSRM elements of the Recommended Plan. No wetland impacts have been identified for proposed improvements of either plan, as modifications would be constructed largely within the existing project rights-of-way. The final construction and permanent rights-of-way for both elements were coordinated with your agency under separate cover.

The Recommended Orange CSRM Plan is generally the same plan referenced as Orange 3 in the DIFR-EIS. A final elevation of about 15-17 feet NAVD88 is proposed for the Recommended Plan's levee system. The length of the system remains approximately 27 miles in total, the same length as the TSP. The overall percentage of floodwalls has increased from about 20 percent of the overall system to about 40 percent. This was necessary to avoid impacts to residences and pipelines, and to minimize impacts to wetlands. The alignment has been relocated in several short segments, but overall remains similar to that presented in the DIFR-EIS.

Direct wetland impacts modeled for the TSP assumed a conservatively wide construction right-of-way which would have resulted in the loss of about 274.4 acres of estuarine emergent marsh, and indirect, functional fisheries access impacts to an additional 2,137 acres of estuarine marsh. The final construction and permanent rights-of-way for the Recommended Plan levee system are much narrower in most areas, resulting in a significant reduction in direct impacts. Direct and indirect impacts would result in the loss of about 203.0 acres of estuarine emergent marsh over the 50-year period of analysis. This includes the loss of marsh due to direct impacts of levee and surge gate construction (105.3 acres), and the loss of marsh due to indirect impacts of the new levee system, such as impoundment and disruptions in hydrologic flow (97.7 acres). An additional 2,137 acres of indirect EFH impacts would result from reduced or altered fisheries access as a result of the proposed Cow and Adam Bayou surge gate structures. These indirect, functional impacts are the same as those described in the DIFR-EIS.

The WVA modeling was revised to evaluate the Recommended Plan's direct and indirect impacts, which were determined to total a loss of -186.0 AAHUs over the period of analysis. A comprehensive list of assumptions underlying our analysis of the Recommended Plan's direct and indirect effects on EFH will be provided in the FIFR-EIS. These assumptions include:

- Impact assessment is dependent upon the exact location of the levee system features; changes in the footprint of the levee system, or identification of new access routes/work areas/system features during the PED and Construction Phases could increase project impacts and trigger additional agency consultation.
- Fill material for levee system construction is assumed to come from approved commercial borrow sources.
- Assessment of indirect EFH fisheries access impacts assumed that the proposed surge gates in Cow and Adams Bayous would constrict flow in the waterways by no more than 50 percent.
- Construction of culverts and the Cow and Adams Bayou surge gates would follow NMFS 2008 Fisheries Friendly Design and Operation Considerations for Hurricane Flood Protection Water Control Structures (provided by the Baton Rouge field office) to the greatest extent practicable.
- Construction of mitigation areas is assumed to start concurrently with new levee system construction.

- The Operation Plan for the new Orange system would require that culverts/gates remain open during normal operations, closing for no longer than two weeks at a time during surge and maintenance events.
- Coordination with resource agencies would continue through the PED, Construction and Operations Phases to ensure appropriate consideration of project changes, implementation of mitigation, and completion of the monitoring/adaptive management plan.

A detailed mitigation plan was developed in consultation with your resource agency that compensates for all impacts that could not be avoided or minimized by Recommended Plan. The mitigation plan would restore 452.8 acres of emergent marsh, providing 194.2 AAHUs to fully compensate for losses of -143.3 AAHUs resulting from EFH impacts. This plan was developed in coordination with resource agencies; details of the plan are included in the preliminary final WVA Modeling Report provided under separate cover.

The Recommended Plan's impact analysis and mitigation plan will be fully described in the FIFR-EIS. In preparing this document, the District has considered, and incorporated additional information as needed to respond to the six Conservation Recommendations provided by your agency's letter dated October 26, 2015. USACE fully concurs with the Conservation Recommendations with the exception of some aspects of Recommendations 2 and 5, as explained fully in the enclosure.

The District is moving forward with preparation of the FIFR-EIS, which is currently scheduled for release for State and Agency Review in May 2017. We would like to conclude EFH consultation prior to HQUSACE review which is scheduled for the January – April 2017 timeframe. We are available at any time for discussion or to provide additional information as needed. If you have any questions or concerns, please contact Janelle Stokes at 409/766-3039 or at janelle.s.stokes@usace.army.mil for assistance.

Sincerely,

Kelly Burks-Copes
Acting Chief, Environmental Compliance Branch
Coastal Section

CF with encl:
Mr. Rusty Swafford
National Marine Fisheries Service
Habitat Conservation Division
4700 Avenue U, Bldg 307
Galveston, Texas 77551

USACE-Galveston District Responses
To National Marine Fisheries Service Recommendations dated October 26, 2015.

In preparing the Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS) for the Sabine Pass to Galveston Bay Feasibility Study, Galveston District has considered and incorporated additional information as needed to respond to the six Conservation Recommendations provided by your agency's letter dated October 26, 2015. USACE fully concurs with the conservation recommendations with the exception of two (Recommendations 2 and 5), as explained further below.

Conservation Recommendations:

1) A complete mitigation plan to compensate for direct and indirect EFH impacts should be developed in consultation with the National Marine Fisheries Service (NMFS) Habitat Conservation Division (HCD) and other state and federal natural resource agencies and presented in the Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS). This plan should include specifics on all 12 required components of a complete mitigation plan consistent with the USACE's 2008 final mitigation rule.

USACE response: A detailed mitigation plan has been developed in consultation with your agency and others that compensates for all direct and indirect EFH impacts. The preliminary final Appendix O (Wetlands Value Assessment Modeling Report) and Appendix P (Mitigation Monitoring and Adaptive Management Plan) have been coordinated with your agency under separate cover. The mitigation plan conforms to requirements of Section 906 of the Water Resources Development Act (WRDA) of 1986 (33 USC 2283), as amended by Section 2036 of WRDA 2007 and Section 1040 of the Water Resources Reform and Development Act of 2014, the Council on Environmental Quality's National Environmental Policy Act regulations (40 CFR Sections 1502.14(f), 1502.16(h), and 1508.20), and Section C-3 of Engineer Regulation 1105-2-100.

USACE has determined that Civil Works guidance on mitigation planning is consistent with the standards and policies of the Corps Regulatory Program for wetlands mitigation, including USACE's 2008 Final Mitigation Rule. Specifically, USACE guidance for Civil Works projects requires that any report submitted to Congress for authorization not select a project alternative unless the report contains a specific plan to mitigate fish and wildlife losses, compensating for lost non-negligible resources through in-kind mitigation to the extent incrementally justified. The plan detailed in Appendices O and P includes: 1) a detailed mitigation plan and locations of proposed mitigation areas; 2) mitigation performance standards and criteria; 3) a monitoring and adaptive management plan to determine and assure success of the mitigation efforts; and 4) identification of non-Federal implementation sponsors and their responsibilities for monitoring, acquisition and management of the mitigation areas.

2) To minimize temporal EFH losses, the FIFR-EIS should specify initial construction of the mitigation for each leave reach will be completed (intertidal tidal elevations established and mitigation areas planted) no later than 18 months from the initiation of levee construction for that reach.

USACE response: Due the scale of the mitigation features and use of dredged material from the adjacent Sabine-Neches Waterway (SNWW), it would not be possible to establish tidal elevations and plant wetland vegetation within 18 months of the initiation of levee construction. Four marsh mitigation areas are proposed that would restore approximately 452.8 acres of emergent marsh, shallow ponds and channels using shoaled material from the SNWW. Construction of the mitigation areas would begin as soon as possible after levee system construction is initiated. Construction would need to proceed on several areas concurrently because it is estimated that the total construction period for each area, from initiation through establishment of marsh vegetation and removal of invasive species would be 8 years. Initial construction of each area is estimated to take 2 years; settlement and consolidation of the material would take up to 3 years; and channels and ponds would be created in within 4-5 years of beginning construction. Marsh vegetation would be planted in years six and seven, and invasive and nuisance vegetation would be removed the year following vegetation plantings. These timing assumptions were developed in consultation with resource agencies during WVA modeling of the mitigation areas.

3) If the final surge gate designs reduce the cross sections of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis should be performed in consultation with NMFS HCD to characterize potential hydrologic and fish passage impacts and determine potential additional EFH mitigation requirements.

USACE response: If the final surge gate designs reduce the cross sections of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis would be performed in consultation with NMFS HCD to characterize potential hydrologic and fish passage impacts and determine potential additional EFH mitigation requirements. The final design of these gates would be developed during the Pre-Construction and Design Phase (PED).

4) Flood protection surge gates, sluice gates, culverts, and any other water control structures should remain completely open except during storm events. Operational, maintenance, and management plans for structures should be developed in coordination with NMFS HCD and the other state and Federal resource agencies.

USACE response: The Operation Plan would be developed after project authorization during the PED phase, in coordination with NMFS HCD and the other state and federal resource agencies. It is intended that the culverts and gates would remain completely open except during storm events and maintenance activities.

5) If gates or water control structures are to be closed more frequently than the assumed worst case scenario (once every ten to fifteen years for a duration not to exceed two weeks), then additional hydrologic and fish passage modeling may be warranted to more quantitatively assess EFH impacts, and additional compensatory EFH mitigation may be necessary.

USACE response: At this time, it is assumed that the return interval for storm surges high enough to threaten the project area would be 10 to 15 years. Gates or water control structures would need to be closed for large storm events, even if the storms occur more frequently than this predicted return period. The operating plan for the gates has not yet been developed, but an estimated closure time (one week for each storm event closure or up to two weeks for periodic maintenance) would result in only minor and temporary impacts to fisheries access. The details and schedule of these

closures would be determined during preparation of the Operation Plan. The Operation Plan would be developed in coordination with NMFS HCD and the other state and federal resource agencies.

6) Fill material used during the construction of the levees and its associated features should come from approved upland borrow sources.

USACE response: At this time, it is assumed that fill material for construction of the levee system and associated features would be obtained from approved upland, commercial borrow sources. If plans change to include identification and excavation of new borrow areas, consultation with NMFS HCD and the other state and Federal resource agencies would be initiated, and a separate NEPA review document would be prepared if required.

August 10, 2016 F/SER46: AC/RS

Colonel Lars N. Zetterstrom
District Engineer, Galveston District
Department of the Army, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Colonel Zetterstrom:

The NOAA's National Marine Fisheries Service Habitat Conservation Division (NMFS HCD) has reviewed the August 5, 2016 USACE response to Essential Fish Habitat Conservation Recommendations (EFH CRs) for the Sabine Pass to Galveston Bay, Texas (S2G) Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study. This response letter addresses the EFH CRs submitted by NMFS HCD on October 26, 2015 in reference to the Draft Integrated Feasibility Report and Environmental Impact Statement dated September 2015. We consider our EFH CRs satisfactorily addressed and no further EFH consultation is required. The NMFS HCD looks forward to working with the USACE as the project further develops during the Preliminary Engineering and Design phase.

If we may be of further assistance, please contact Mr. Aaron Chastain of our Galveston Facility at (409) 766-3699.

Sincerely,

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

Natural Resource Conservation Service Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 10, 2015

Regional Planning and Environmental Center
Unit A

Salvador Salinas
State Conservationist
Natural Resources Conservation Service
101 S. Main
Temple, Texas 76501

Dear Mr. Salinas:

This letter is in regard to a proposed Federal action developed for the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Study. The Galveston District has prepared a Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) which recommends improvements to existing Hurricane Flood Protection Projects (HFPPs) and construction of a new coastal storm risk management (CSRM) system. The Tentatively Selected Plan (TSP) proposes: a new levee/floodwall system for Orange and Northeast Jefferson County, Texas called the Orange-Jefferson CSRM Plan; improvements to the existing levee/floodwall system of the Port Arthur and Vicinity HFPP in Jefferson County, Texas, called the Port Arthur and Vicinity CSRM Plan; and improvements to the existing levee/floodwall system in the Freeport and Vicinity HFPP in Brazoria County, Texas, called the Freeport and Vicinity CSRM Plan. Detailed descriptions and maps of the TSP are provided in the DIFR-EIS; a compact disk copy of the DIFR-EIS is enclosed.

We would like to coordinate potential prime farmland impacts of the proposed new Orange-Jefferson CSRM Plan in accordance with the Farmland Protection Policy Act. The Port Arthur and Vicinity and Freeport and Vicinity CSRM Plans are located in urban areas and would result in no farmland impacts. However, the TSP alignment of the Orange-Jefferson CSRM Plan contains soils units mapped as prime farmland by the Natural Resource Conservation Service (NRCS) Web Soil Survey. Segments of this proposed levee corridor in Orange and Jefferson Counties, Texas, that are so designated as prime farmland, are shown on the maps provided as Enclosures 1 and 2. The total project area is too large to allow generation of a custom soil resource report using the NRCS web-based system.

We have completed Form CPA 106 for the corridor segments in Orange and Jefferson Counties; one form for each county is provided as Enclosures 3 and 4, respectively. Approximately 380 acres of the alignment in Orange County are currently classified as prime farmland by the 2015 NRCS Web Soil Survey. Recent aerial photographs of the area were reviewed to determine the current status of mapped units, and more than half were found to be developed or in use as residential backyards, dredged material placement areas, and pipeline rights-of-way. Approximately 160 acres of the prime farmland acres remain undeveloped and would be converted to a non-agricultural use. This represents about 0.3 percent of the total "land in farms" reported by the Orange County 2012 agriculture census. The undeveloped prime farmland areas that would be impacted are fragmented, surrounded by development, and not

currently used for agriculture. Almost all of the lands north of the alignment are developed urban, suburban, and industrial areas. Almost all of the lands south of the alignment are bottomland wetlands, which are not farmed; other areas are industrial cooling ponds or placement areas. The westernmost 2.3 miles of the alignment extends inland away from the upland/wetland margin, with a few tracts south of the alignment which appear to be used for pasture. Only one small area of the construction right-of-way itself (about 6 acres in size) appears to have been farmed recently; levees for rice farming are present in that area. USACE evaluation of the prime farmland in the Orange County project area in Part VI "Corridor Assessment" of Form CPA 106 yielded a score of 20 points.

Approximately 113 acres of the alignment in Jefferson County are currently classified as prime farmland by the 2015 NRCS Web Soil Survey. Recent aerial photographs of the area were reviewed to determine the current status of mapped units, all but about 18 acres are currently developed and thus would be exempt from consideration. This represents about 0.005 percent of the total "land in farms" reported by the Jefferson County 2012 agriculture census. On the north, the alignment would be bordered primarily by the Neches River, but industrial ponds or dredged material placement areas occur in some areas. The vast majority of the area south of the levee system is dense urban and industrial development. None of the area within or adjacent to the alignment appears to be used for crop agriculture; use as pasture is possible in a few small areas. USACE evaluation of the prime farmland in the Jefferson County project area in Part VI "Corridor Assessment" of Form CPA 106 yielded a score of 2 points.

The proposed alignment in both counties has been designed to follow the upland/wetland margin to the greatest extent possible. Construction of the Orange-Jefferson CSRM Plan would not make areas outside of the alignment unfarmable; interior drainage patterns would be maintained at future without-project conditions and ready access across the levee system would be maintained. Any areas compatible with agricultural use that occur in the vicinity of the proposed alignment would remain fully compatible with agricultural use after project construction. Impacts on prime and otherwise important farmlands have been minimized to the greatest extent practicable.

We request your evaluation of the Orange-Jefferson CSRM's effect on prime farmland based on the information presented here and in the DIFR-EIS. Should you require any additional information during this review, please call Ms. Janelle Stokes at 409-766-3039.

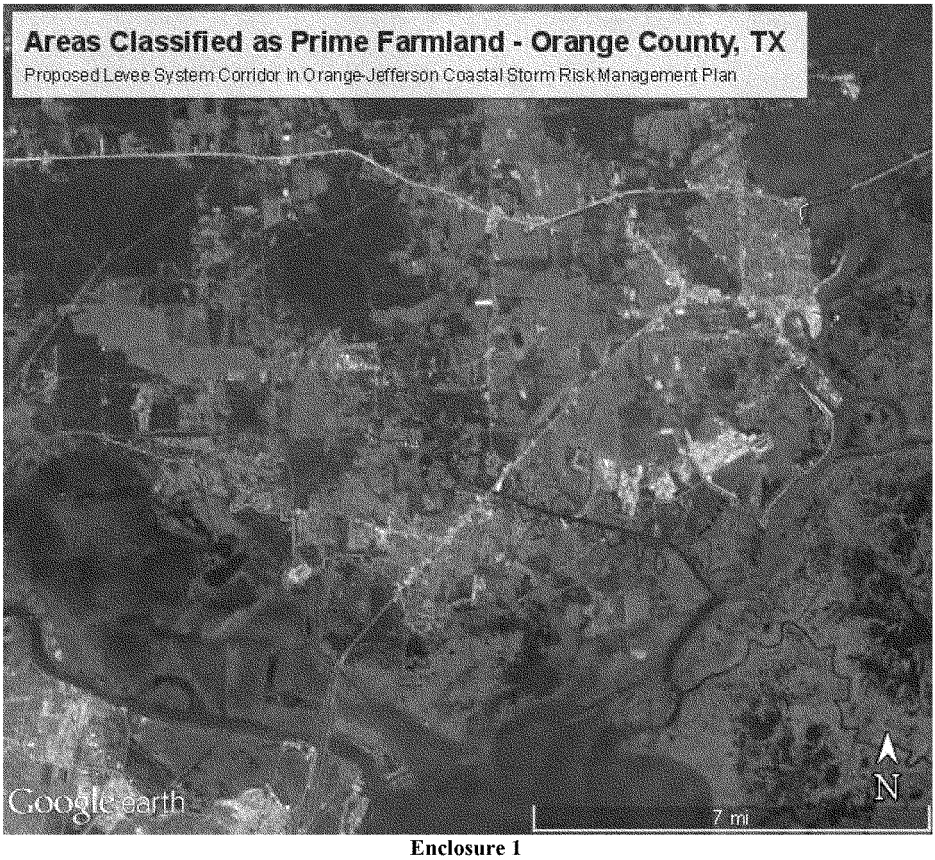
Sincerely,

Carolyn Murphy

Carolyn Murphy
Acting Chief, Plan Formulation Section

Enclosures

CF w/o encls:
Tirpak, CESWG-PM-J


Areas Classified as Prime Farmland - Orange County, TX
Proposed Levee System Corridor in Orange-Jefferson Coastal Storm Risk Management Plan
Google earth
7 mi
N

Enclosure 1

Areas Classified as Prime Farmland - Jefferson County, TX
Proposed Levee System Corridor in Orange-Jefferson Coastal Storm Risk Management Plan
Google earth
3 mi
N

Enclosure 2

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*	3. Date of Land Evaluation Request 9/10/15	4. Sheet 1 of 1
1. Name of Project **Sabine Pass to Galveston Bay, Texas**	5. Federal Agency Involved **US Army Corps of Engineers**	
2. Type of Project **Coastal Storm Risk Management Levee System**	6. County and State **Orange, Texas**	

PART II *(To be completed by NRCS)*	1. Date Request Received by NRCS	2. Person Completing Form
3. Does the corridor contain prime, unique statewide or local important farmland? (If no, the FPPA does not apply - Do not complete additional parts of this form) YES ☐ NO ☐		4. Acres Irrigated / Average Farm Size
5. Major Crop(s)	6. Farmable Land in Government Jurisdiction Acres: %	7. Amount of Farmland As Defined in FPPA Acres: %
8. Name Of Land Evaluation System Used	9. Name of Local Site Assessment System	10. Date Land Evaluation Returned by NRCS

PART III *(To be completed by Federal Agency)*	Maximum Points	Alternative Corridor For Segment: Corridor A	Corridor B	Corridor C	Corridor D
A. Total Acres To Be Converted Directly		160			
B. Total Acres To Be Converted Indirectly, Or To Receive Services		0			
C. Total Acres In Corridor		160			
PART IV *(To be completed by NRCS) Land Evaluation Information*					
A. Total Acres Prime And Unique Farmland		160			
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*					
PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.6(c))*					
1. Area in Nonurban Use	15	7			
2. Perimeter in Nonurban Use	10	5			
3. Percent Of Corridor Being Farmed	20	1			
4. Protection Provided By State And Local Government	20	0			
5. Size of Present Farm Unit Compared To Average	10	3			
6. Creation Of Nonfarmable Farmland	25	0			
7. Availablility Of Farm Support Services	5	2			
8. On-Farm Investments	20	2			
9. Effects Of Conversion On Farm Support Services	25	0			
10. Compatibility With Existing Agricultural Use	10	0			
TOTAL CORRIDOR ASSESSMENT POINTS	160	20	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland (From Part V)	100	0	0	0	0
Total Corridor Assessment (From Part VI above or a local site assessment)	160	20	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	20	0	0	0

1. Corridor Selected:	2. Total Acres of Farmlands to be Converted by Project:	3. Date Of Selection:	4. Was A Local Site Assessment Used?
Corridor A	**160 acres**	**9/10/15**	YES ☐ NO ☑

5. Reason For Selection:

Impacts on prime and important farmlands have been minimized to the greatest extent possible by locating the proposed alignment along the upland-floodplain transition. The undeveloped prime farmland areas that will be impacted are fragmented, surrounded by development, and not currently used for agriculture. Almost all of the lands north of the alignment are developed urban, suburban and industrial areas. Existing drainage patterns would be maintained, and surrounding land uses would remain compatible with agriculture in so much as they are today.

Signature of Person Completing this Part: DATE **9/9/15**

NOTE: Complete a form for each segment with more than one Alternate Corridor

Clear Form

NRCS-CPA-106 *(Reverse)*

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor - type site or design alternative for protection as farmland along with the land evaluation information.

(1) How much land is in nonurban use within a radius of 1.0 mile from where the project is intended?
More than 90 percent - 15 points
90 to 20 percent - 14 to 1 point(s)
Less than 20 percent - 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?
More than 90 percent - 10 points
90 to 20 percent - 9 to 1 point(s)
Less than 20 percent - 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?
More than 90 percent - 20 points
90 to 20 percent - 19 to 1 point(s)
Less than 20 percent - 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?
Site is protected - 20 points
Site is not protected - 0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County ? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage or Farm Units in Operation with $1,000 or more in sales.)
As large or larger - 10 points
Below average - deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average - 9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?
Acreage equal to more than 25 percent of acres directly converted by the project - 25 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project - 1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project - 0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?
All required services are available - 5 points
Some required services are available - 4 to 1 point(s)
No required services are available - 0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?
High amount of on-farm investment - 20 points
Moderate amount of on-farm investment - 19 to 1 point(s)
No on-farm investment - 0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?
Substantial reduction in demand for support services if the site is converted - 25 points
Some reduction in demand for support services if the site is converted - 1 to 24 point(s)
No significant reduction in demand for support services if the site is converted - 0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?
Proposed project is incompatible to existing agricultural use of surrounding farmland - 10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland - 9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland - 0 points

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*	3. Date of Land Evaluation Request 9/10/15	4. Sheet 1 of 1
1. Name of Project **Sabine Pass to Galveston Bay, Texas**	5. Federal Agency Involved **US Army Corps of Engineers**	
2. Type of Project **Coastal Storm Risk Management Levee System**	6. County and State **Orange, Texas**	
PART II *(To be completed by NRCS)*	1. Date Request Received by NRCS	2. Person Completing Form
3. Does the corridor contain prime, unique statewide or local important farmland? (If no, the FPPA does not apply - Do not complete additional parts of this form) YES ☐ NO ☐		4. Acres Irrigated / Average Farm Size
5. Major Crop(s)	6. Farmable Land in Government Jurisdiction Acres: %	7. Amount of Farmland As Defined in FPPA Acres: %
8. Name Of Land Evaluation System Used	9. Name of Local Site Assessment System	10. Date Land Evaluation Returned by NRCS

PART III *(To be completed by Federal Agency)*	Alternative Corridor For Segment			
	Corridor A	Corridor B	Corridor C	Corridor D
A. Total Acres To Be Converted Directly	160			
B. Total Acres To Be Converted Indirectly, Or To Receive Services	0			
C. Total Acres In Corridor	160			
PART IV *(To be completed by NRCS) Land Evaluation Information*				
A. Total Acres Prime And Unique Farmland	160			
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value				
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*				
PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.5(c))* — Maximum Points				
1. Area in Nonurban Use — 15	7			
2. Perimeter in Nonurban Use — 10	5			
3. Percent Of Corridor Being Farmed — 20	1			
4. Protection Provided By State And Local Government — 20	0			
5. Size of Present Farm Unit Compared To Average — 10	3			
6. Creation Of Nonfarmable Farmland — 25	0			
7. Availablility Of Farm Support Services — 5	2			
8. On-Farm Investments — 20	2			
9. Effects Of Conversion On Farm Support Services — 25	0			
10. Compatibility With Existing Agricultural Use — 10	0			
TOTAL CORRIDOR ASSESSMENT POINTS — 160	20	0	0	0
PART VII *(To be completed by Federal Agency)*				
Relative Value Of Farmland (From Part V) — 100	0	0	0	0
Total Corridor Assessment (From Part VI above or a local site assessment) — 160	20	0	0	0
TOTAL POINTS *(Total of above 2 lines)* — 260	20	0	0	0

1. Corridor Selected:	2. Total Acres of Farmlands to be Converted by Project:	3. Date Of Selection:	4. Was A Local Site Assessment Used?
Corridor A	**160 acres**	**9/10/15**	YES ☐ NO ☑

5. Reason For Selection:

Impacts on prime and important farmlands have been minimized to the greatest extent possible by locating the proposed alignment along the upland-floodplain transition. The undeveloped prime farmland areas that will be impacted are fragmented, surrounded by development, and not currently used for agriculture. Almost all of the lands north of the alignment are developed urban, suburban and industrial areas. Existing drainage patterns would be maintained, and surrounding land uses would remain compatible with agriculture in so much as they are today.

Signature of Person Completing this Part: | DATE **9/9/15**

NOTE: Complete a form for each segment with more than one Alternate Corridor

Clear Form

NRCS-CPA-106 *(Reverse)*

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor - type site or design alternative for protection as farmland along with the land evaluation information.

(1) How much land is in nonurban use within a radius of 1.0 mile from where the project is intended?
More than 90 percent - 15 points
90 to 20 percent - 14 to 1 point(s)
Less than 20 percent - 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?
More than 90 percent - 10 points
90 to 20 percent - 9 to 1 point(s)
Less than 20 percent - 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?
More than 90 percent - 20 points
90 to 20 percent - 19 to 1 point(s)
Less than 20 percent - 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?
Site is protected - 20 points
Site is not protected - 0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County ? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage or Farm Units in Operation with $1,000 or more in sales.)
As large or larger - 10 points
Below average - deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average - 9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?
Acreage equal to more than 25 percent of acres directly converted by the project - 25 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project - 1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project - 0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?
All required services are available - 5 points
Some required services are available - 4 to 1 point(s)
No required services are available - 0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?
High amount of on-farm investment - 20 points
Moderate amount of on-farm investment - 19 to 1 point(s)
No on-farm investment - 0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?
Substantial reduction in demand for support services if the site is converted - 25 points
Some reduction in demand for support services if the site is converted - 1 to 24 point(s)
No significant reduction in demand for support services if the site is converted - 0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?
Proposed project is incompatible to existing agricultural use of surrounding farmland - 10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland - 9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland - 0 points

USDA

Natural Resources
Conservation Service

State Office

101 S. Main Street
Temple, TX 76501
Voice 254.742.9800
Fax 254.742.9819

October 7, 2015

Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attention: Carolyn Murphy

Subject: LNU-Farmland Protection
Proposed New Levee/Floodwall System
Orange and Jefferson Counties, Texas

We have reviewed the information provided in your correspondence dated September 10, 2015 concerning the proposed new levee/floodwall system in Orange and Jefferson Counties, Texas. This review is part of the National Environmental Policy Act (NEPA) evaluation for the Corps of Engineers. We have evaluated the proposed site as required by the Farmland Protection Policy Act (FPPA).

The proposed project does contain soils that are classified as Prime Farmland. FPPA guidelines state, " Sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated", 7CFR Part 658.4 (c) 2. We know of no adverse environmental impact from this project.

I have attached the completed Farmland Conversion Impact Rating for Corridor Type Projects (Form CPA-106) notating the site score is less than 160.

If you have any questions, please contact me at (254) 742-9826 or by email at micki.yoder@tx.usda.gov.

Sincerely,

JO YODER Digitally signed by JO YODER
DN: cn=US, o=U.S. Government, ou=Department of Agriculture, cn=JO YODER, 0.9.2342.19200300.100.1.1=12001000351761
Date: 2015.10.07 10:18:37 -05'00'

Micki Yoder
NRCS Soil Conservationist

Attachment

An Equal Opportunity Provider and Employer

719,547

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*		3. Date of Land Evaluation Request 9/10/15	4. Sheet 1 of 1
1. Name of Project	Sabine Pass to Galveston Bay, Texas	5. Federal Agency Involved	US Army Corps of Engineers
2. Type of Project	Coastal Storm Risk Management Levee System	6. County and State	Orange, Texas
PART II *(To be completed by NRCS)*		1. Date Request Received by NRCS 9/18/2015	2. Person Completing Form Micky Usher
3. Does the corridor contain prime, unique statewide or local important farmland? (If no, the FPPA does not apply - Do not complete additional parts of this form).		YES ☑ NO ☐	4. Acres Irrigated / Average Farm Size 388 / 79
5. Major Crop(s)	rice	6. Farmable Land in Government Jurisdiction Acres: 120,158 % 17	7. Amount of Farmland As Defined in FPPA Acres: 120,158 % 17
8. Name Of Land Evaluation System Used	LESA	9. Name of Local Site Assessment System	10. Date Land Evaluation Returned by NRCS October 7, 2015

PART III *(To be completed by Federal Agency)*	Alternative Corridor For Segment			
	Corridor A	Corridor B	Corridor C	Corridor D
A. Total Acres To Be Converted Directly	160			
B. Total Acres To Be Converted Indirectly, Or To Receive Services	0			
C. Total Acres In Corridor	160			
PART IV *(To be completed by NRCS) Land Evaluation Information*				
A. Total Acres Prime And Unique Farmland	160			
B. Total Acres Statewide And Local Important Farmland	0			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.03			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	10%			
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*	80			
PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.5(c))*	Maximum Points			
1. Area in Nonurban Use	15	7		
2. Perimeter in Nonurban Use	10	5		
3. Percent Of Corridor Being Farmed	20	1		
4. Protection Provided By State And Local Government	20	0		
5. Size of Present Farm Unit Compared To Average	10	3		
6. Creation Of Nonfarmable Farmland	25	0		
7. Availability Of Farm Support Services	5	2		
8. On-Farm Investments	20	2		
9. Effects Of Conversion On Farm Support Services	25	0		
10. Compatibility With Existing Agricultural Use	10	0		
TOTAL CORRIDOR ASSESSMENT POINTS	160	20	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland (From Part V)	100	80	0	0	0
Total Corridor Assessment (From Part VI above or a local site assessment)	160	20	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	20/100	0	0	0

1. Corridor Selected:	2. Total Acres of Farmlands to be Converted by Project:	3. Date Of Selection:	4. Was A Local Site Assessment Used?
Corridor A	160 acres	9/10/15	YES ☐ NO ☑

5. Reason For Selection:

Impacts on prime and important farmlands have been minimized to the greatest extent possible by locating the proposed alignment along the upland-floodplain transition. The undeveloped prime farmland areas that will be impacted are fragmented, surrounded by development, and not currently used for agriculture. Almost all of the lands north of the alignment are developed urban, suburban and industrial areas. Existing drainage patterns would be maintained, and surrounding land uses would remain compatible with agriculture in so much as they are today.

Signature of Person Completing this Part: STOKES.JANELLE.S.1230710593 Digitally signed by STOKES.JANELLE.S.1230710593 DN: cn=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=STOKES.JANELLE.S.1230710593 Date: 2015.09.09 17:54:42 -05'00' DATE 9/9/15

NOTE: Complete a form for each segment with more than one Alternate Corridor

Encl 3

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*	3. Date of Land Evaluation Request 9/10/15	4. Sheet 1 of 1
1. Name of Project **Sabine Pass to Galveston Bay Study**	5. Federal Agency Involved **US Army Corps of Engineers**	
2. Type of Project **Storm Surge Protection Levee System**	6. County and State **Jefferson, Texas**	

PART II *(To be completed by NRCS)*	1. Date Request Received by NRCS 9/18/2015	2. Person Completing Form Micki Yoder
3. Does the corridor contain prime, unique statewide or local important farmland? (If no, the FPPA does not apply - Do not complete additional parts of this form). YES ☒ NO ☐		4. Acres Irrigated 22,387 Average Farm Size 463
5. Major Crop(s) rice	6. Farmable Land in Government Jurisdiction Acres: 288,198 45%	7. Amount of Farmland As Defined in FPPA Acres: 274,746 43%
8. Name Of Land Evaluation System Used ~~NRCS~~ LESA	9. Name of Local Site Assessment System NA	10. Date Land Evaluation Returned by NRCS October 7, 2015

PART III *(To be completed by Federal Agency)*	Alternative Corridor For Segment			
	Corridor A	Corridor B	Corridor C	Corridor D
A. Total Acres To Be Converted Directly	18			
B. Total Acres To Be Converted Indirectly, Or To Receive Services	0			
C. Total Acres In Corridor	18			
PART IV *(To be completed by NRCS) Land Evaluation Information*				
A. Total Acres Prime And Unique Farmland	18			
B. Total Acres Statewide And Local Important Farmland	0			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0081%			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	11%			
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*	80			

PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.5(c))*	Maximum Points				
1. Area in Nonurban Use	15	1			
2. Perimeter in Nonurban Use	10	1			
3. Percent Of Corridor Being Farmed	20	0			
4. Protection Provided By State And Local Government	20	0			
5. Size of Present Farm Unit Compared To Average	10	0			
6. Creation Of Nonfarmable Farmland	25	0			
7. Availability Of Farm Support Services	5	0			
8. On-Farm Investments	20	0			
9. Effects Of Conversion On Farm Support Services	25	0			
10. Compatibility With Existing Agricultural Use	10	0			
TOTAL CORRIDOR ASSESSMENT POINTS	160	2	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland (From Part V)	100	80	0	0	0
Total Corridor Assessment (From Part VI above or a local site assessment)	160	2	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	82	0	0	0

1. Corridor Selected:	2. Total Acres of Farmlands to be Converted by Project:	3. Date Of Selection:	4. Was A Local Site Assessment Used?
Corridor A	18	9/10/15	YES ☐ NO ☑

5. Reason For Selection:

Impacts on prime and important farmlands have been minimized to the greatest extent possible by locating the proposed alignment along the upland-floodplain transition. The undeveloped prime farmland areas that will be impacted are fragmented, surrounded by development, and not recently used for agriculture. All of the lands south of the alignment are developed urban, suburban and industrial areas; land north of the alignment is used for placement of dredged material. None of the area is has been farmed for 5 of the last 10 years.

Signature of Person Completing this Part:	DATE
STOKES.JANELLE.S.1230710593 Digitally signed by STOKES.JANELLE.S.1230710593 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=STOKES.JANELLE.S.1230710593 Date: 2015.09.09 12:03:26 -05'00'	9/9/15

NOTE: Complete a form for each segment with more than one Alternate Corridor

Encl 4

Federal Aviation Administration Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

November 1, 2016

Regional Planning and Environmental Center
Environmental Compliance Branch, Coastal Section

Mr. Kelvin L. Solco
Southwest Region Regional Administrator
Federal Aviation Administration
Southwest Region
10101 Hillwood Parkway
Fort Worth, TX 76177-1524

Dear Mr. Solco:

The US Army Corps of Engineers, Galveston District, and the Texas General Land Office (non-Federal sponsor) are conducting the Sabine Pass to Galveston Bay (S2G), Texas, Ecosystem Restoration and Coastal Storm Risk Management (CSRM) Feasibility Study. The Recommended Plan in the Sabine Region includes a new CSRM levee system in Orange County and CSRM improvements to the existing Port Arthur Hurricane Flood Protection Project in Jefferson County Texas. A vicinity map of the proposed improvements relative to nearby airports is provided in Figure 1. Mitigation for unavoidable project impacts includes marsh restoration in three existing degraded marsh areas and preservation of one existing bottomland hardwood area south of the Bridge City area.

In accordance with Federal Aviation Administration (FAA) AC 150/5200-33, we have mapped the locations of two local public use airports (the Southeast Texas Regional Airport and the Orange County Airport) in the study area to determine if project features meet or conflict with minimum separation criteria for potentially hazardous land use practices. Figures 2 and 3 show the 5,000-foot, 10,000-foot, and the 5-mile range perimeters around the Southeast Texas Regional Airport and the Orange County Airport, respectively. Based on this analysis, we have determined that none of the Recommended Plan mitigation areas are located within the largest separation perimeter (Perimeter C – 5 mile radius) of the Southeast Texas Regional Airport. However, two of the proposed marsh restoration mitigation areas are located within the 5-mile Perimeter C radius of the Orange County Airport.

We have evaluated the proposed mitigation areas to determine if restoration of these marshes would increase wildlife hazards onto, into or across the airport's approach or departure airspace. The lands proposed for Mitigation Areas 28 and 29 are located at the margin of the 5-mile Perimeter C. Almost all of the area is existing marsh and shallow water that is owned by Texas Parks and Wildlife and managed for fish and wildlife habitat. A small strip of land along the northern edge of Mitigation Area 29 is privately-owned, but it too is comprised of submerged lands and emergent estuarine marsh that also serve as fish and wildlife habitat. Marsh restoration in these areas would not change the land use of this area, and therefore land-use after construction would be compatible with airport operations.

Based upon the information presented above, we request your review and concurrence that marsh restoration at proposed Mitigation Areas 28 and 29 in conjunction with the proposed Orange CSRM plan would not constitute a change in land-use, and is compatible with operation of the Orange County Airport. In addition, we request your concurrence that the proposed Port Arthur CSRM plan would have no impacts on operation of the Southeast Texas Regional Airport. If you have any questions regarding the project, please contact Janelle Stokes at (409) 766-3039.

Sincerely,

BURKS-COPES.KELLY.A.1231450927

Digitally signed by BURKS-COPES.KELLY.A.1231450927
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=BURKS-COPES.KELLY.A.1231450927
Date: 2016.10.31 15:56:23 -05'00'

Kelly Burks-Copes
Chief, Coastal Section

Enclosures

CF with encls: Sharon Tirpak, PM-J

Figure 1: Vicinity Map for Airports in Sabine Region

Figure 2: Southeast Texas Regional Airport Separation Perimeters

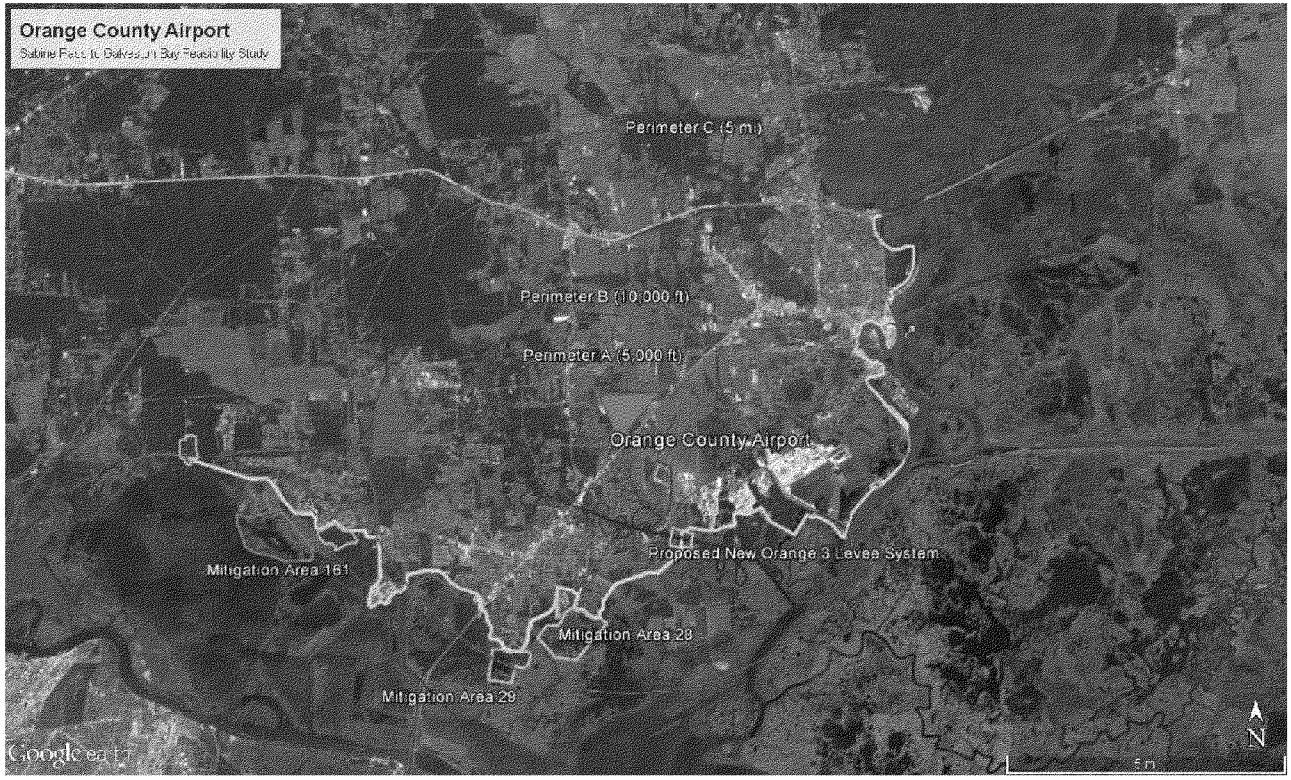


Figure 3: Orange County Airport Separation Perimeters

Texas Department of Transportation

AVIATION DIVISION
125 E. 11TH STREET • AUSTIN, TEXAS 78701-2483 • 512/416-4500 • FAX 512/416-4510

November 15, 2016

Kelly Burks-Copes
Chief, Coastal Section
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553-1229

Ms. Burks-Copes:

The Texas Department of Transportation (TxDOT) Aviation Division (AVN) has reviewed a request from the Federal Aviation Administration (FAA), Southwest Region, to respond to your letter of November 1, 2016, to Mr. Kelvin L. Solco, Southwest Region Regional Administrator, regarding the Sabine Pass to Galveston Bay, Texas, Ecosystem Restoration and Coastal Storm Risk Management Feasibility Study. FAA made this request because evaluation of potential environmental impacts to the Orange County, Texas, airport is the responsibility of TxDOT AVN under terms of the FAA State Block Grant Program.

TxDOT AVN finds that marsh restoration at proposed Mitigation Areas 28 and 29 in conjunction with the proposed Orange CSRM plan would not constitute a change in land use, and is compatible with operation of the Orange County airport. Moreover, FAA has concurred in your finding that the proposed Port Arthur CSRM plan would have no impact on operation of Jack Brooks Regional airport (formerly Southeast Texas Regional airport). You will not be receiving a separate concurrence letter from FAA regarding this issue.

Regards,

Robert W. Jackson

Robert W. Jackson, PhD, AICP, C.M.
Environmental Specialist
TxDOT Aviation Division
512-416-4511

Texas Parks and Wildlife Department Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

Rebecca Hensley
Regional Director
Texas Parks & Wildlife Department
Dickinson Marine Laboratory
1502 FM 517 East
Dickinson, TX 77539

Dear Ms. Hensley:

Enclosed please find a compact disk of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement . This draft report is provided for your review pursuant to the Fish and Wildlife Coordination Act (16 USC §§661-666c), requiring coordination with USFWS and TPWD to prevent loss of and damage to wildlife resources.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@ usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosures

CF w/o encls:
Tirpak, CWSWG-PM-J

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Carter P. Smith
Executive Director

October 26, 2015

Ms. Janelle Stokes
U.S. Army Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Draft Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement

Dear Ms. Stokes:

Texas Parks and Wildlife Department (TPWD) has reviewed the subject Draft Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS), issued September 11, 2015, for coastal storm risk management (CSRM) projects in Orange, Jefferson and Brazoria counties, Texas. The tentatively selected plan (TSP) includes the following separable components: Freeport and Vicinity CSRM Plan, Port Arthur and Vicinity CSRM Plan, and Orange-Jefferson CSRM Plan. The first two components consist of improvements to existing hurricane flood protection projects at Port Arthur and Freeport. The Orange-Jefferson CSRM component would construct three new and separate levee/floodwall systems totaling 41.8 miles including the construction and installation of navigable surge gates and pump stations on Adams Bayou and Cow Bayou.

The Orange-Jefferson CSRM Plan will impact a significant amount of wetlands (Table 1). Direct impacts include complete wetland habitat loss. Indirect impacts primarily include a reduction in estuarine-dependent fish and shellfish access to the extensive marshes in the lower floodplains of Cow Bayou and Adams Bayou due to flow constriction from the surge gate structures.

Table 1. Wetland impacts.

Wetland Type	Direct Impacts (acres)	Indirect Impacts (acres)
Swamp	18.9	0.0
Bottomland hardwood	108.3	12.7
Forested wetland subtotal	127.2	12.7
Fresh marsh	50.4	785.2
Intermediate marsh	11.9	322.5
Brackish marsh	111.0	1,130.4
Emergent wetland subtotal	173.3	2,238.1
Total Impacts	**300.5**	**2,250.8**

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AUSTIN, TEXAS 78744-3291
512.389.4800
www.tpwd.texas.gov

TPWD is concerned that the Draft IFR-EIS only describes the following broadly conceptual mitigation measures for wetland impacts: coastal marsh restoration, the acquisition and long-term conservation of bottomland hardwoods and/or swamps, and possible improvements (e.g., hydrologic enhancement or control of invasive plant species) to forested wetland areas targeted for conservation. Without a specific and appropriate compensatory mitigation plan, there will be long-term adverse impacts to the Sabine Lake coastal ecosystem from the currently proposed Orange-Jefferson CSRM Plan. TPWD recommends the U.S. Army Corps of Engineers work with TPWD and the other resource agencies to develop and finalize compensatory mitigation before issuance of a Final IFR-EIS that includes the following: objectives, selection of sites, implementation details and timing, monitoring, and ecological success standards.

Construction of the Orange-Jefferson CSRM Plan would impact properties owned or managed by TPWD (Section 7.1.1). In the Lower Neches River Wildlife Management Area (WMA), 43.1 acres would be impacted (including 27 acres of coastal marsh and 9.6 acres of forested wetlands). In the Tony Houseman WMA, 4.4 acres would be impacted (including 2.1 acres of forested wetlands). Impacts to any natural resource (e.g., fish and wildlife, habitat, water, etc.), cultural resource, aesthetic resource, recreational values (i.e., public use opportunities), and/or operations (e.g., facilities, infrastructure, etc.) on lands owned or managed by TPWD must be consistent with state law (Chapter 26 of the Parks and Wildlife Code of Texas and Chapter 34 of the Texas Natural Resources Code) and Department policy.

TPWD appreciates the opportunity to review the Draft IFR-EIS and emphasizes the importance of continued coordination with our agency through the planning, engineering, design, construction, and maintenance phases of this project.

Questions can be directed to Mr. Mike Morgan at (281) 534-0146 or Winston Denton at 281-534-0138 in the Dickinson Marine Lab.

Sincerely,
Winston Denton
for

Rebecca Hensley
Regional Director, Ecosystem Resources Program
Coastal Fisheries Division

RH:WD:MNM

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Carter P. Smith
Executive Director

August 18, 2016

Mr. Timothy Nelson
Chief, Real Estate Division
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Dear Mr. Nelson:

Thank you for your letter of June 28, 2016 seeking Texas Parks & Wildlife Department's (TPWD) position on the project impacts to TPWD property from the currently proposed Sabine to Galveston Bay Coastal Storm Risk Reduction and Ecosystem Restoration Feasibility Study. We understand that this study report is being developed in coordination with the Texas General Land Office (TXGLO) and the U.S. Army Corps of Engineers (USACE).

We appreciate the opportunity to provide input during this planning phase of the project. We would like to offer our responses to the questions posed in your letter in the order in which they were presented.

1) Does TPWD acknowledge that impacts will occur on their property due to the construction of the subject project?

   Answer: Based on previous discussions, maps and presentations, it appears that some of the proposed actions associated with this project would result in negative impacts to TPWD wildlife management areas in Jefferson and Orange Counties. Please note that Chapter 26 of the Parks and Wildlife Code requires that before a state agency can approve any project that will result in the use or taking of public land designated and used as a park, public recreation area, scientific area, wildlife refuge, or historic site, that state agency must provide certain notices to the public, conduct a hearing, and render a finding that there is no feasible and prudent alternative and that the project includes all reasonable planning to minimize harm to the property. Any use or taking of TPWD property would require approval by the Texas Parks and Wildlife Commission and compliance with Chapter 26.

2) Does TPWD agree that the mitigation proposed is adequate and, if not, what more does TPWD require?

   Answer: Please first consider our concerns about the impacts of the proposed project actions on TPWD properties. TPWD is concerned about how the alteration of sheet flow from the uplands to coastal marshes may affect the hydrologic and ecological dynamics of coastal marshes

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managed by TPWD. It is our understanding that the proposed storm protection levee will have gates or other structures to allow flow of water through natural and man-made channels along its length to prevent pooling of water behind the levee or in the case of coastal flooding events, prevent the ingress of flood waters. Flow directed through these channels may not mimic the way nutrients and sediments are currently distributed throughout the marsh during overland sheet flow, and thus may have a negative impact on the long term health and function of the marsh. It is our understanding that hydrologic modeling is planned during a more in-depth study prior to construction of any storm protection levee system. TPWD suggests that this modeling also look at the potential for overbank flow within the natural channels and bayous that may occur when the water control structures are open to mimic the existing overland sheet flow patterns. The results of the modeling should be considered in any mitigation plans.

Lower Neches WMA: TPWD is willing to accept mitigation for the contemplated project impacts on the Lower Neches Wildlife Management Area (WMA) in Jefferson County, and to manage it in perpetuity, though it is unclear at this stage of project planning whether the proposed mitigation is adequate. We would do so with the understanding that the goals and benefits to be realized and attained from such mitigation must be consistent with our wetland, wildlife management and public use goals and that the total scope and extent of mitigation for such impacts be at least equal to or greater in offsetting the long term impacts from the proposed actions. Presumably, TPWD would be allowed to select the wetland plants used in mitigation in an effort to reflect the existing plant community on the wildlife management area at the time mitigation efforts begin. If mitigation occurs on lands outside of, but adjacent or in close proximity to the wildlife management area, TPWD is willing to consider adding those lands to the Lower Neches WMA contingent upon approval of the Texas Parks and Wildlife Commission.

Blue Elbow Swamp/Tony Houseman SP/WMA: Similarly, TPWD is willing to accept mitigation on the Blue Elbow Swamp/Tony Houseman Wildlife Management Area (WMA) in Orange County though it is unclear at this stage of project planning whether the proposed mitigation is adequate. We would prefer the USACE consider the value of certain restoration activities on this WMA as part of a mitigation plan. This WMA functions as one of the most frequently and intensively-visited natural sites in the State of Texas, accessed through the Texas Department

of Transportation (TxDot) visitor center on Interstate 10 at the WMA. A primary function of WMAs in Texas is to demonstrate the benefits of wetlands and the conservation values associated with certain management practices and conservation techniques employed on the WMAs. The Blue Elbow Swamp/Tony Houseman WMA serves as one of the finest examples of wildlife habitat demonstration and education in Texas. Tens of thousands of visitors frequent this site adjacent to the banks of the Sabine River on Interstate 10 every year, visiting the board walk, watching wildlife and reading interpretive messages to learn about the values of wetland habitats and marshes in this part of the state. We would request that the USACE consider these attributes as an important aspect of restoration and mitigation. One such restoration approach (following hydrologic study) that could be employed and demonstrated to the public would include removing strategic portions of spoil-bank along the main and historic logging canals in order to improve historic sheet-flow across the WMA. Additional mitigation projects could include long-term chemical control of non-native invasive plant species such as Chinese tallow trees and giant salvinia. And of course, TPWD would be willing to consider mitigation through acquisition of similar wetlands from willing sellers, adjacent-to or near the WMA, contingent upon approval of the Texas Parks and Wildlife Commission.

3) Would TPWD be interested in acquiring any/all of the private properties acquired for mitigation purposes?

   Answer: TPWD would certainly consider accepting any and possibly all of the private properties acquired for mitigation purposes, provided those properties are readily accessible to staff and the public, are practically manageable from an operations standpoint, and offer the same or greater ecological services as those being impacted by the project. Property acquisition must be approved by the Texas Parks and Wildlife Commission on a case-by-case basis.

4) Would TPWD want to keep the remnants of their property cut off by the levee or any project features?

   Answer: TPWD would be willing to divest the remnants cut off by the levee or other project features. Property divestitures must be approved by the Texas Parks and Wildlife Commission on a case-by-case basis.

TPWD greatly appreciates the efforts of the USACE to involve TPWD in the process of evaluating this flood control project and the associated mitigation. We would appreciate being involved in all aspects of project planning and associated mitigation. We would be willing to discuss potential mitigation actions resulting from direct impacts to our WMAs as well as lands outside our WMAs. TPWD received the Notice of Intent to prepare a Draft Integrated Feasibility Report and Environmental Impact Statement for the Coastal Texas Protection and Restoration Feasibility study. We would also welcome an opportunity to discuss those potential projects and associated strategies to address this broad-scale undertaking. Thank you again for the opportunity to work with the USACE during the early stages of this and other related projects. Should you have any questions or wish to follow up in more detail, please contact Dennis Gissell, Wildlife Management Area Facilities Coordinator at dennis.gissell@tpwd.texas.gov or 512-389-4407.

Sincerely,

Ross Melinchuk
Deputy Executive Director, Natural Resources

RM:DG:ng

cc: Clayton Wolf, Wildlife Division Director
Len Polasek, Wildlife Region 4 Director
Corey Mason, Wildlife Region 3 Director
Dennis Gissell, WMA Facilities Coordinator

Texas General Land Office Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

Mr. Ray Newby
Texas General Land Office
Coastal Resources Division
P.O. Box 12873
Austin, TX 78711-2873

Dear Mr. Newby:

Enclosed please find a compact disk of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement. This draft report is provided for your review of the Consistency Determination pursuant to Chapter 506 Rule §506.20, Consistency Determinations for Federal Agency Activities and Development Projects.

The proposed project is subject to the goals and priorities of the Coastal Management Program and will be undertaken in a manner consistent with the program policies. The Consistency Determination (Appendix M; Enclosure 1) addresses the policies for Major Actions (§501.15); development in critical areas (§501.23); Development in State Parks, Wildlife Management Areas or Preserves (§501.29); and Levee and Flood Control Projects § (501.34). The Consistency Determination concludes that the Tentatively Selected Plan is fully consistent to the maximum extent practicable with the Texas Coastal Management Program.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosures

CF w/o encls:
Tirpak, CESWG-PM-J

TEXAS GENERAL LAND OFFICE
GEORGE P. BUSH, COMMISSIONER

November 24, 2015

Col. Richard Pannell
District Commander
U.S. Army Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Texas Coastal Management Program Federal Consistency Review of the Draft Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement CMP#: 16-1034-F2

Dear Col. Pannell:

Pursuant to Title 31 Natural Resources and Conservation, Part 16 Coastal Coordination Council rules, Section 506.30, the project referenced above has been reviewed for consistency with the Texas Coastal Management Program (CMP).

It has been determined that there are no significant unresolved consistency issues with respect to the project. Therefore, this project is consistent with the CMP goals and policies.

Please note that this letter does not authorize the use of Coastal Public Land. No work may be conducted or structures placed on State-owned land until you have obtained all necessary authorizations, including any required by the General Land Office and the U.S. Army Corps of Engineers.

If you have any questions or concerns, please contact me at (512) 475-3624 or at ray.newby@glo.texas.gov

Sincerely,

Ray Newby, P.G.
Coastal Geologist
Coastal Resources
Texas General Land Office

email cc: Jannell Stokes, USACE

1700 North Congress Avenue, Austin, Texas 78701-1495
P.O. Box 12873, Austin, Texas 78711-2873
512-463-5001 glo.texas.gov

Texas Historical Commission Coordination

See Appendix L

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

CONCUR
by
for Mark Wolfe
State Historic Preservation Officer
Date 10/15/15
Track#

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Mr. Wolfe:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

The Area of Potential Effect (APE) for this project will be the footprint of the TSP for direct impacts to archeological resources plus a 1,500-foot buffer for indirect impacts to standing structures or buildings. The Orange-Jefferson CSRM Plan (Figures 1 through 6) overlaps five archeological sites and two cemeteries. Additionally, there are four National Register Properties within 1,500 feet of the proposed levee system (Navy Park Historic District, W.H. Stark House, Sims House, and the Woodmen of the World Lodge), all of which would experience reduced risk of storm surge damages with construction of the new levee system. The five archeological sites in Orange County (41OR15, OR39, OR59, OR60, and OR70) are all prehistoric sites that have poorly delineated boundaries, insufficient documentation, and have not been evaluated for National Register of Historic Places (NRHP) eligibility. All of these sites have the potential to be directly impacted by construction activities. The two cemeteries (Thomas Cemetery and an unknown cemetery) also have a potential to be directly affected by levee construction as their recorded boundaries overlap with the proposed project area.

These cemeteries are not well documented and their locations may not be accurate within the existing state databases.

There are numerous cultural resources that occur near the APE for the Port Arthur (Figures 7 through 9) and Freeport CSRM Plans (Figures 10 through 13); however, all of these resources as currently mapped occur outside of the areas proposed for improvements. In Port Arthur, there are no cultural resources that overlap with the areas for proposed improvements along the existing HFPP. However, there are three archeological sites (41BO4, BO119, and BO121) that are within proximity to the proposed improvement areas along the Freeport HFPP. These three sites all occur along Oyster Creek (Figure 13), are poorly delineated, lack sufficient documentation, and have not been evaluated for NRHP eligibility.

Based on the current information for the proposed levee construction and improvements, there is a potential to affect historic properties and cemeteries. These effects consist of direct impacts from earth moving and excavation activities related to construction and potential indirect effects on historic structures such as diminished view shed from the raising of levees and floodwalls. The USACE recommends intensive cultural resources investigations to identify and evaluate any historic properties within proposed construction areas. The USACE intends to execute a Programmatic Agreement (PA) to govern the scope of investigations, which will be determined in concert with the Texas SHPO and Native American Tribes. A draft PA has been developed and provided for public and tribal review as Appendix L in the Draft Integrated Feasibility Report and Environmental Impact Statement. A compact disk of this report is enclosed.

We request your comments on the proposed undertaking and the potential to affect historic properties in compliance with Section 106 of the National Historic Preservation Act of 1966. Thank you for your cooperation in this review process. If you have any questions concerning the proposed project or if we can be of further assistance, please contact John A. Campbell at 409-766-3878.

Sincerely,

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

Texas Commission on Environmental Quality Coordination

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

Mr. David Brymer
Assistant Direct, Air Quality Division
Texas Commission on Environmental Quality
P.O. Box 13087, Mail Code 206
Austin, Texas 78711-3087

Dear Mr. Brymer:

Enclosed please find a compact disk of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement (DIFR-EIS). This draft report is provided for your agency's review of projected air quality impacts of the Tentatively Selected Plan (TSP) in accordance with the Clean Air Act and the National Environmental Policy Act. The modeling determined that construction of the TSP would result in emissions below the *de minimis* threshold for nonattainment pollutants and thus a conformity determination was not prepared. The Air Emissions Modeling Report, provided in Appendix I of the DIFR-EIS, is enclosed.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosures

CF w/o encls:
Tirpak, CWSWG-PM-J

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

October 1, 2015

Janelle Stokes
Department of the Army
P.O. Box 1229
Galveston, Texas 77553
Via: Janelle.S.Stokes@usace.army.mil

Re: TCEQ NEPA Request #2015-247, Draft Feasibility Report-EIS: Coastal Storm Risk Management and Ecosystem Restoration-Sabine Pass to Galveston Bay, Orange, Jefferson and Brazoria County

Dear Ms. Stokes:

The Texas Commission on Environmental Quality (TCEQ) has reviewed the above-referenced project and offers the following comments:

A review of the project for general conformity impact in accordance with 40 CFR Part 93 indicates that the proposed action is located in Orange and Jefferson Counties, which are currently unclassified or in attainment of the National Ambient Air Quality Standards for all six criteria air pollutants. Therefore, general conformity rules do not apply.

A review of the project for General Conformity impact in accordance with 40 CFR Part 93 indicates that the proposed project is located in Brazoria County, which is currently classified by the United States Environmental Protection Agency as marginal nonattainment for the 2008 ozone National Ambient Air Quality Standard. Therefore, general conformity rules apply.

The two primary precursors to ozone formation are volatile organic compounds (VOCs) and nitrogen oxides (NO_x). A general conformity analysis may be required when a project results in an emissions increase of 100 tons per year or greater for either VOCs or NO_x. Because the emissions from this proposed project are expected to be below these thresholds it is not anticipated to impact the state implementation plan; therefore a general conformity analysis is not required.

Any debris or waste disposal should be at an appropriately authorized disposal facility.

Thank you for the opportunity to review this project. If you have any questions, please contact the agency NEPA Coordinator, at (512) 239-3500 or NEPA@tceq.texas.gov.

Sincerely,

Mark Harmon

Mark Harmon
Division Director
Intergovernmental Relations

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

REPLY TO
ATTENTION OF

September 9, 2015

Regional Planning and Environmental Center
Unit A

Mr. Gregg Easely
Water Quality Assessment Manager
Texas Commission on Environmental Quality
P.O. Box 13087, Mail Code 150
Austin, Texas 78711-3087

Dear Mr. Easely:

Enclosed please find a compact disk of the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Draft Integrated Feasibility Report – Environmental Impact Statement (DIFR-EIS). This draft report is provided for your review under Section 401 of the Clean Water Act. The U.S. Army Corp of Engineers is requesting a §401 State Water Quality certification from Texas for this action. The §404(b)(1) Evaluation, provided in Appendix H of the DIFR-EIS and as Enclosure 1, concludes that proposed placement of fill material in conjunction with the Tentatively Selected Plan would comply with Section 404(b)(1) Guidelines.

The public comment period closes on October 26, 2015, and we would appreciate receipt of your comments by that date. If you have any questions, please contact Ms. Janelle Stokes at the letterhead address, by telephone at 409-766-3039, or by email at Janelle.S.Stokes@usace.army.mil.

Sincerely,

Carolyn Murphy
Acting Chief,
Plan Formulation Section

Enclosures

CF w/o encls:
Tirpak, CWSWG-PM-J

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

October 21, 2015

Ms. Janelle Stokes
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Draft Integrated Feasibility Report and Environmental Impact Statement for the Sabine Pass to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Project

Dear Ms. Stokes:

As described in the Joint Notice of Availability, dated September 11, 2015, the U.S. Army Corps of Engineers-Galveston District (Corps) announces the release of the Draft Integrated Feasibility Report and Environmental Impact Statement (Draft IFR-EIS) for the Tentatively Selected Plan (TSP) for the Sabine Pass to Galveston Bay Coast Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Project. The purpose of the TSP is to reduce the risk of storm surge impacts to residents, industry, and infrastructure in Orange, Jefferson, and Brazoria Counties, Texas. The TSP is comprised of three separable elements, one of which would entail construction of a new CSRM levee system in southern Orange County, and two of which consist of improvements to existing hurricane flood protection projects (HFPP) at Port Arthur and Freeport.

In addition to the information contained in the public notice, the following information is needed for review of the proposed project. Responses to this letter may raise other questions that will need to be addressed before a water quality certification determination can be made.

1. Title 30, Texas Administrative Code (TAC), Chapter 279.11(c)(1), states that "No discharge shall be certified if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, ..." Appendix B (Plan Formulations) of the Draft IFR-EIS indicates that storm surge attenuation, and thus economic impacts, could not be estimated for marsh restoration and other restoration alternatives. Please explain why the effects of these alternatives on storm surge attenuation could not be modeled or otherwise estimated. Practicable alternatives are preliminarily assumed to exist, but the project sponsor does have the opportunity to clearly demonstrate that no practicable alternatives exist.

2. If the aquatic resources cannot be avoided, appropriate and practicable steps should be taken to minimize potential adverse impacts (30 TAC §279.11(c)(2)). Please provide more information on modeling and assessment of potential indirect impacts of the proposed new levee system in southern Orange County on coastal marsh. The Draft IFR-EIS notes

that coastal wetland loss has been caused, in part, by decreased input of fluvial sediment and construction of artificial levees. Please explain if potential reductions in sediment supply and local changes to sedimentation and erosion regimes were assessed for coastal marsh downstream of the proposed levee.

3. The Texas Commission on Environmentally Quality (TCEQ) is concerned that the Draft IFR-EIS may underestimate the potential of the proposed new levee system to impound drainages during large storm events. The Draft IFR-EIS assumed minimal contribution of overland flow and shallow groundwater flows when assessing the indirect impacts of the proposed new levee system on flooding and increased stage upstream of the levee system; however, floodplains may carry a majority of flows during large storm events. Please provide additional justification for these assumptions. Also, please indicate if impounding effects of the new levee during a large storm event (100-year flood or larger) have been assessed and if these effects are expected to impacts forested wetlands, fluvial sediment regime, or other aquatic resources.

4. Please provide more information on what factors were used to determine the appropriate sizing and number of culverts needed for the proposed new levee system. Please explain what data or other criteria will be used to determine whether particular bayous, creeks, or other drainages are tidally influenced and would thus require a sluice gate culvert (versus a flap gate culvert).

5. The Draft IFR-EIS indicates that impacts of the Cow Bayou and Adam Bayou surge gates on fisheries access were assessed. Please explain if a similar assessment of potential fisheries impacts was done for smaller drainages, taking into account the effects of culverts crossing the proposed levee system.

6. The Draft IFR-EIS states that final levee structural designs will incorporate fisheries-friendly guidelines recommended by the National Oceanic and Atmospheric Administration. Additional information should be provided in the Final IFR-EIS detailing which fisheries-friendly recommendations will implemented.

7. As noted in the Draft IFR-EIS, there are concerns for water quality in several water bodies in Orange and Jefferson Counties due to depressed dissolved oxygen (DO) levels. Dissolved oxygen is often correlated with and affected by flow, and flow alterations are recognized as a potential source of depressed DO. The TCEQ recommends that the Corps consider potential impacts to DO levels in area bayous and creeks via reduction in tidal exchange and other changes in stream flow regime.

8. Mitigation of impacts is considered for ". . .all unavoidable adverse impacts that remain after all practicable avoidance and minimization has been completed . . ." (30 TAC §279.11(c)(3)). The construction of the levee system would directly impact approximately 300 acres of forested wetlands and coastal marsh. Indirect impacts to approximately 2,250 acres would be associated with fisheries access and hydrologic impacts. The conceptual mitigation plan provided with the Draft IFR-EIS contained only very general information on potential mitigation options, but it was noted that a more detailed final

mitigation plan will be prepared during the final feasibility planning for the Agency Decision Milestone. The TCEQ looks forward to reviewing the final mitigation plan, and in the interim, coordinating with the Corps and other resource agencies on potential mitigation options.

The TCEQ appreciates the opportunity to comment and looks forward to receiving and evaluating other agency or public comments. Please provide any agency comments, public comments, as well as the Corps comments, to Mr. C. Brad Caston of the Water Quality Division MC-150, P.O. Box 13087, Austin, Texas 78711-3087. Mr. Caston may also be contacted by e-mail at *Charles.Caston@tceq.texas.gov*, or by telephone at (512) 239-4711.

Sincerely,

David W Galindo

David W. Galindo, Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/CBC /tc

cc: Mr. Ray Newby, Texas General Land Office, P. O. Box 12873, Austin, Texas 78711-2873

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

AUG 05 2016

Regional Planning and Environmental Center
Environmental Compliance Branch, Coastal Section

Mr. David Galindo
Director
Water Quality Division
Texas Commission on Environmental Quality
P.O. Box 13087, Mail Code 150
Austin, Texas 78711-3087

Dear Mr. Galindo:

Reference is made to your letter dated October 21, 2015, which submitted comments on the Draft Integrated Feasibility Report and Environmental Impact Assessment (DIFR-EIS) for the Sabine Pass to Galveston Bay, Texas (S2G) Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study. Due to their length, responses to the eight specific comments in your letter are provided in the enclosure.

The District is in the process of preparing a Final Integrated Feasibility Report – Environmental Impact Statement (FIFR-EIS) for the study. During the final feasibility phase, revisions were made to the Tentatively Selected Plan (TSP) which resulted in a significant reduction in wetland impacts associated with the new levee system proposed for Orange County. The Recommended Plan now consists only of the Orange 3 CSRM Plan. The Beaumont A and the Jefferson Main elements are not included in the Recommended Plan. One short levee reach (approximately 1,900 feet) in the Jefferson Main area is still recommended, but it can now be combined with the Port Arthur CSRM Plan since it is located within the jurisdiction of the non-Federal sponsor for the existing Port Arthur and Vicinity Hurricane Flood Protection (HFP) project. The locations of these features and a summary of the Recommended Plan are presented in the preliminary final Wetlands Value Assessment (WVA) Modeling Report (Appendix O of FIFR-EIS) and the Mitigation Monitoring and Adaptive Plan (Appendix P) which have been provided to your agency as part of our ongoing resource agency coordination of this study.

Revisions have also been made to the proposed Port Arthur and Freeport CSRM elements of the Recommended Plan. No wetland impacts have been identified for proposed improvements of either plan, as modifications would be constructed largely within the existing project rights-of-way and no wetlands would be impacted. The final construction and permanent rights-of-way for both elements were coordinated with your agency under separate cover.

The Recommended Orange CSRM Plan is generally the same plan referenced as Orange 3 in the DIFR-EIS. A final elevation of about 15-17 feet NAVD88 is proposed for the Recommended Plan's levee system. The length of the system remains approximately 27 miles in total, the same length as the TSP. The overall percentage of floodwalls has increased from about

20 percent of the overall system to about 40 percent. This was necessary to avoid impacts to residences and pipelines, and to minimize impacts to wetlands. The alignment has been relocated in several short segments, but overall remains similar to that presented in the DIFR-EIS.

Direct wetland impacts modeled for the TSP assumed a conservatively-wide construction right-of-way which would have resulted in the loss of about 274 acres of estuarine emergent marsh and 140 acres of forested wetlands, and indirect, functional fisheries access impacts to an additional 2,137 acres of estuarine marsh. The final construction and permanent rights-of-way for the Recommended Plan levee system are much narrower in most areas, resulting in a significant reduction in direct impacts. Direct and indirect impacts would result in the loss of about 203.0 acres of estuarine emergent marsh and 69.5 acres of forested wetlands over the 50-year period of analysis. This includes the loss of marsh due to direct impacts of levee and surge gate construction (105.3 acres), and the loss of marsh due to indirect impacts of the new levee system, such as impoundment and disruptions in hydrologic flow (97.7 acres). An additional 2,137 acres of indirect EFH impacts would result from reduced or altered fisheries access as a result of the proposed Cow and Adam Bayou surge gate structures. These indirect, functional impacts are the same as those described in the DIFR-EIS.

The WVA modeling was revised to evaluate the Recommended Plan's direct and indirect impacts, totaling a loss of -186.0 AAHUs over the period of analysis. A comprehensive list of assumptions underlying our analysis of the Recommended Plan's direct and indirect effects will be provided in the FIFR-EIS. These assumptions include:

- Impact assessment is dependent upon the exact location of the levee system features; changes in the footprint of the levee system, or identification of new access routes/work areas/system features during the PED and Construction Phases could increase project impacts and trigger additional agency consultation.
- Fill material for levee system construction is assumed to come from approved, commercial borrow sources.
- Assessment of indirect Essential Fish Habitat fisheries access impacts assumed that the proposed surge gates in Cow and Adams Bayous would constrict flow in the waterways by no more than 50 percent.
- Construction of culverts and the Cow and Adams Bayou surge gates would follow National Marine Fisheries Service's 2008 Fisheries Friendly Design and Operation Considerations for Hurricane Flood Protection Water Control Structures to the greatest extent practicable.
- Construction of mitigation areas is assumed to start concurrently with new levee system construction.
- The Operation Plan for the new Orange system would require that culverts/gates remain open during normal operations, closing for no longer than two weeks at a time during surge and maintenance events.
- Coordination with resource agencies would continue through the PED, Construction and Operations Phases to ensure appropriate consideration and coordination of project changes, implementation of mitigation, and completion of the monitoring/adaptive management plan.

A detailed mitigation plan was developed in consultation with your resource agency that compensates for all impacts that could not be avoided or minimized by Recommended Plan. The mitigation plan would restore 452.8 acres of emergent marsh and preserve in perpetuity 559.2 acres of forested wetlands, providing 262.9 AAHUs to fully compensate for total losses of -186.0 AAHUs. This plan was developed in coordination with the resource agencies; details of the plan are included in the preliminary final WVA Modeling Report provided under separate cover.

The District is moving forward with preparation of the FIFR-EIS, which is currently scheduled for release for State and Agency Review in May 2017. We would like to conclude consultation with your office on water quality concerns prior to HQUSACE review which is scheduled for the January – April 2017 timeframe. A revised 404(b)(1) Evaluation will be submitted in the next few weeks with a request for water quality certification. We are available at any time to discuss this request or to provide additional information as needed. If you have any questions or concerns, please contact Janelle Stokes at 409/766-3039 or at janelle.s.stokes@usace.army.mil for assistance.

Sincerely,

Kelly Burks-Copes
Acting Chief, Environmental Compliance Branch
Coastal Section

Enclosure

CF with encl:
Tirpak, CWSWG-PM-J

USACE-Galveston District Responses
To Texas Commission on Environmental Quality comments dated October 21, 2015

1. Title 30, Texas Administrative Code (TAC), Chapter 279.11(c)(1), states that "No discharge shall be certified if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, ... "Appendix B (Plan Formulations) of the Draft IFR-EIS indicates that storm surge attenuation, and thus economic impacts, could not be estimated for marsh restoration and other restoration alternatives. Please explain why the effects of these alternatives on storm surge attenuation could not be modeled or otherwise estimated. Practicable alternatives are preliminarily assumed to exist, but the project sponsor does have the opportunity to clearly demonstrate that no practicable alternatives exist.

Section 2.3.3 of the DIFR-EIS (and also the FIFR-EIS) evaluates the potential for coastal wetlands to attenuate hurricane storm surges. Research into the impact of landscape features, including wetlands, on surge propagation is a relatively new application for surge models. No models were available for this study which could definitively determine the effects of the marsh restoration alternatives on storm surge attenuation. And no single marsh restoration alternative would provide positive benefits for a majority of storms because the effect of wetlands in attenuating storm surge is situationally dependent. Alternatives were evaluated using a wide array of storms, varying in direction, speed, and size. While wetlands might provide protection for a storm of a certain size coming come from one specific direction, wetlands could increase surge risk for another storm of a different size and duration arriving from another direction.

The southern part of the Orange County area is currently buffered from storm surge impacts by extensive marshes north of Sabine Lake. Significant storm surge impacts to the Bridge City area occurred during Hurricane Ike despite the presence of these largely intact marshes. There is no reason to believe that restoration of areas of open water in these marshes would have made a significant difference in these impacts. Even under a scenario with the greatest potential beneficial effects on surge heights, it is estimated that maximum inland attenuation rates would range from 1 foot per 2.1 miles to 1 foot per 3.6 miles of inland penetration with intact marshes. However, there is great uncertainty surrounding the ability of marsh accretion to keep up with relative sea level rise over the 50-year period of analysis. In order to provide a significant reduction in the risk of storm surge impacts, the Recommended Plan includes levee/floodwall system elevations of 15-17 feet NAVD88, far exceeding the small amount of attenuation that might be provided by the existing marsh systems. Therefore, marsh or other wetland restoration alternatives were not practicable alternatives for significantly reducing the risk of storm surge impacts.

While marsh restoration is not a practicable alternative to achieve objectives of significantly reducing economic damages and risk to human life and critical infrastructure from storm surge impacts, the Recommended Plan minimizes impacts to existing marshes and forested wetlands from construction of the levee system. Through several iterations of revisions to the levee system footprint, impacts to wetlands were minimized to the greatest extent practicable. The plan meets Objective 3 of the screening criteria for the final alternative array, which seeks to preserve existing wetlands and their potential to attenuate minor levels of storm surge. The Recommended Plan meets this objective, ensuring that there is no practicable alternative that would have less adverse impact on the aquatic ecosystem.

2. If the aquatic resources cannot be avoided, appropriate and practicable steps should be taken to minimize potential adverse impacts (30 TAC §279.11(c)(2)). Please provide more information on modeling and assessment of potential indirect impacts of the proposed new levee system in southern Orange County on coastal marsh. The Draft IFR-EIS notes that coastal wetland loss has been caused, in part, by decreased input of fluvial sediment and construction of artificial levees. Please explain if potential reductions in sediment supply and local changes to sedimentation and erosion regimes were assessed for coastal marsh downstream of the proposed levee.

Potential reductions in sediment supply and local changes in sedimentation/erosion regimes were assessed for the coastal marshes downstream of the proposed levee system. Engineering Appendix D (Section 2.17) evaluates the effect of the new Orange levee system on sediment transport and deposition, and Section 7.2 of Appendix O (WVA Modeling Appendix) evaluates the indirect impacts of the levee system on wetlands both upstream and downstream of the new levee system. No significant effect on fluvial sediment is expected from construction of the Recommended Plan. Sediment flows to the floodplain downstream of the new levee system are expected to remain similar to the future without-project condition.

A desktop analysis of interior drainage requirements has been performed by Galveston District as required using current USACE guidance. This analysis identified all of the sub-drainage basins behind the proposed new levee alignment and the primary small drainage in each sub-basin for which existing flow will need to be maintained. A detailed description of this analysis is provided in Section 2.15 through 2.17 of Appendix D (Engineering). The analysis calculated the amount of both overland and channelized flow from each basin. The levee system would have negligible impacts on flow, stage, velocity and other factors as determined by HEC-RAS analysis. Because there is little effect on flow, there is expected to be a negligible impact on the exchange of sediment, nutrients and organic matter between wetlands upstream of the levee system and the wetlands and Sabine estuarine downstream of the system. The Cow and Adams Bayou surge gates would result in higher water velocities in the immediate vicinity of the structures, and this may cause a minor increase in shoaling near the gates. Gated culverts would be placed everywhere existing drainages intersect the new levee system, and additional culverts would be placed in areas where they are needed to ensure adequate flows to adjacent wetlands. The sluice gates would remain open except when surge protection is needed; they would be closed temporarily for a short period before and after a storm occurs.

In the existing condition, marshes in the floodplain rely primarily on rainfall and tidal push for inundation. The new levee system has been located at the upland/floodplain interface, and floodplain impacts have been minimized to the greatest extent practicable. The Neches and Sabine River floodplains and sediment transport in the floodplains are thus largely untouched by the Recommended Plan and would remain effectively the same as the future without-project condition. Freshwater and sediment inflows from the upland areas to marshes and forested wetlands in the floodplain are being conveyed primarily through existing stream channels. Water and sediment flows through these channels into minor drainages with incised beds, and in some cases flows spread out directly into wetland areas. The culvert system would replicate these flows. Overland sheet flow is temporary, occurring during intense or long duration rain events, as the majority of the area upstream of the levee is unpaved and permeable. As part of the Recommended Plan, a channel would be constructed along the inside of the levee system to collect flows and direct them

into the existing stream channels, replicating the flow pattern of the majority of flows entering the floodplain. Therefore, during normal operations (no surge event), sediment transport inside the levee system is expected to remain the same as the future without-project condition.

3. The Texas Commission on Environmentally Quality (TCEQ) is concerned that the Draft IFR-EIS may underestimate the potential of the proposed new levee system to impound drainages during large storm events. The Draft IFR-EIS assumed minimal contribution of overland flow and shallow groundwater flows when assessing the indirect impacts of the proposed new levee system on flooding and increased stage upstream of the levee system; however, floodplains may carry a majority of flows during large storm events. Please provide additional justification for these assumptions. Also, please indicate if impounding effects of the new levee during a large storm event (100-year flood or larger) have been assessed and if these effects are expected to impacts forested wetlands, fluvial sediment regime, or other aquatic resources.

It is assumed that the question relates to large rainfall events, as during a surge event, all the culverts would be shut, as well as the gates, and the pumps would be engaged. Drainage areas for the interior of the levees were delineated using a combination of LiDAR, USGS maps, aerial maps, and documents gathered from the county and cities in the area. Two different methods were used to check runoff estimates, as measured data are not available for calibration/verification/validation. Methodology for these estimates is based on equations and guidance outlined by the U.S. Department of Interior and U.S. Geological Survey (USGS) Water-Resources Investigations Report 96-4307. Results of the two methods compared well. The difference in flow estimates fit within the expected error of the previously used method, increasing confidence in the flow estimates.

The preliminary design of the levee system minimizes impacts on all existing floodplains and adjacent waterbodies. Potential impounding effects during a large storm event were assessed and no impacts to forested wetlands, fluvial sediment regime or aquatic resources within the levee system are anticipated. Outfalls for interior drainage were sized to pass the 100-year rainfall event plus at least a 10 percent increase in flow accounting for increasing rainfall predicted with climate change. The culvert outfalls were aligned and sized in a manner that mimics the existing waterways. Culvert spans and heights were chosen to provide widths that would prevent head build-up on the upstream side of the culverts. The Cow and Adams Bayou gate structures were configured to allow a 100-year flood event to be discharged without impacting their respective floodplains. Since the system has been designed to result in no impounding within the levee system, no impacts to biological or physical aquatic resources are expected.

4. Please provide more information on what factors were used to determine the appropriate sizing and number of culverts needed for the proposed new levee system. Please explain what data or other criteria will be used to determine whether particular bayous, creeks, or other drainages are tidally influenced and would thus require a sluice gate culvert (versus a flap gate culvert).

Details on the process used to size the culverts was provided in responses to Questions 2 and 3 above. The locations and numbers of culverts were determined through a thorough review of maps, satellite and LIDAR imagery which identified all major and minor drainages crossed by the proposed levee system. In addition, the proposed levee alignment was reviewed by resource agencies during coordination meetings, and additional culvert locations recommended by the

agencies were incorporated. Sluice gates are intended to provide open ingress/egress through the levee system wherever there is tidal influence. All of the new levee system is in the tidally influenced area, and therefore all culverts would likely contain sluice gates.

5. The Draft IFR-EIS indicates that impacts of the Cow Bayou and Adam Bayou surge gates on fisheries access were accessed. Please explain if a similar assessment of potential fisheries impacts was done for smaller drainages, taking into account the effects of culverts crossing the proposed levee system.

The potential for fisheries impacts to marsh systems in smaller drainages was evaluated. The alignment of the Recommended Plan crosses three small drainages in the Bridge City vicinity which have small marshes totaling 18.4 acres inside the levee system. Since the culverts would be designed to provide the same cross section, slope and flow as the original drainages, and the operating plan would require that the culverts remain open except for surge events or maintenance, impacts to fishery access would be minimal. The design, to be completed in the Pre-Construction Engineering and Design (PED) phase, would utilize NOAA-NMFS fishery friendly design recommendations. The culverts have low flowlines for environmental reasons, in order to maintain environmental connectivity (species passage) between inside and outside the levee. Even if impacts were assumed for are three areas, the estimated AAHU impacts would be less than 0.5 AAHU and thus would be considered a negligible impact.

6. The Draft IFR-EIS states that final levee structural designs will incorporate fisheries friendly guidelines recommended by the National Oceanic and Atmospheric Administration. Additional information should be provided in the Final IFR-EIS detailing which fisheries-friendly recommendations will implemented.

The Engineering Appendix of the FIFR-EIS recognizes that final design of the culvert and gate structures would incorporate elements of the NOAA recommendations wherever possible. The USACE will continue to consult with NOAA during the detailed design and construction phase of the project if authorized. The full text of the NOAA recommendations will be included in Appendix O of the FIFR-EIS, and will be referenced in the Engineering Appendix. The culvert descriptions in responses 3-5 above reflect many of the NOAA recommendations.

7. As noted in the Draft IFR-EIS, there are concerns for water quality in several water bodies in Orange and Jefferson Counties due to depressed dissolved oxygen (DO) levels. Dissolved oxygen is often correlated with and affected by flow, and flow alterations are recognized as a potential source of depressed DO. The TCEQ recommends that the Corps consider potential impacts to DO levels in area bayous and creeks via reduction in tidal exchange and other changes in stream flow regime.

Potential changes in flow were evaluated for all of the waterbodies affected by the proposed new levee system, as described in responses to questions above. In these analyses, it was determined that potential impacts to flows were possible only for Adams and Cow Bayous, because surge gates are proposed in the lower watershed of each bayou that may restrict flows. The 2014 Texas Water Body Assessment for both basins reports that there is no concern with dissolved oxygen (DO) in Cow Bayou Tidal, but that Adams Bayou Tidal has screening level concerns and a non-supporting DO rating for aquatic life. In 2015, USACE's Engineering Research and Design Center conducted desktop modeling to determine the potential impacts of constrictions created by

the proposed surge gates on both bayous. The Desktop Off-Channel Wetland Salinity Mitigation Model evaluated effects on salinity, water surface elevation and velocities. In the analysis, bayou cross-sections were reduced by a wide range of estimated parameters, up to a maximum 75 percent constriction. There were essentially no impacts on water surface elevation and salinity because baseline tidal velocities are so low that even large constrictions have very little effect. The constriction would likely result in minimally higher velocities through the structures, and this might improve DO levels in the immediate area around the gates, but in general, there is high confidence that constriction of the inlets, even significant constriction, results in minimal impacts on water surface elevation, salinity and flows within the bayous. Therefore, the structures are not expected to adversely affect depressed DO in the bayous.

8. Mitigation of impacts is considered for" ... all unavoidable adverse impacts that remain after all practicable avoidance and minimization has been completed ... " (30 TAC §279.11(c)(3)). The construction of the levee system would directly impact approximately 300 acres of forested wetlands and coastal marsh. Indirect impacts to approximately 2,250 acres would be associated with fisheries access and hydrologic impacts. The conceptual mitigation plan provided with the Draft IFR-EIS contained only very general information on potential mitigation options, but it was noted that a more detailed final mitigation plan will be prepared during the final feasibility planning for the Agency Decision Milestone. The TCEQ looks forward to reviewing the final mitigation plan, and in the interim, coordinating with the Corps and other resource agencies on potential mitigation options.

A mitigation plan that fully compensates for all impacts of the Recommended Plan has been developed in consultation with all of the state and Federal resource agencies on the study team, including TCEQ. A thorough review of mitigation options was conducted and is presented in Appendix O of the FIFR-EIS. A draft of Appendix O and Appendix P with full details of the mitigation and monitoring plans have been provided to TCEQ under separate cover. The mitigation plan fully compensates for all impacts (-186.0 AAHUs) with swamp, bottomland hardwood and marsh mitigation features that would provide 262.9 AAHUs.

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

November 1, 2016

Regional Planning and Environmental Center
Environmental Compliance Branch, Coastal Section

Mr. David Galindo
Director
Water Quality Division
Texas Commission on Water Quality
P.O. Box 13087, Mail Code 150
Austin, Texas 78711-3087

Dear Mr. Galindo:

The US Army Corps of Engineers, Galveston District, and the Texas General Land Office (non-Federal sponsor) are preparing a Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS) for the Sabine Pass to Galveston Bay (S2G), Texas, Ecosystem Restoration and Coastal Storm Risk Management (CSRM) Feasibility Study. The Recommended Plan proposes to reduce the risks of tropical storm surge impacts by constructing a new CSRM system in Orange County, and increase the level of risk reduction and resiliency of the existing Port Arthur and Vicinity and Freeport and Vicinity Hurricane Flood Protection (HFP) systems in Jefferson and Brazoria Counties, Texas, respectively. The Orange 3 CSRM Recommended Plan would consist of a 27-mile long levee and floodwall system along the edge of the Sabine and Neches River floodplains from the City of Orange to the vicinity of Orangefield, Texas. The Port Arthur and Freeport CSRM Recommended Plans would raise existing levees, construct and reconstruct floodwalls, replace vehicular closure structures and increase resiliency by installing erosion protection. The Port Arthur and Vicinity and Freeport and Vicinity CSRM Plans would result in only negligible impacts and no mitigation is needed. All environmental impacts of the Recommended Plan are associated with the Orange 3 CSRM plan, and these impacts are restricted to wetland impacts.

The Draft IFR-EIS (DIFR-EIS) presented a Tentatively Selected Plan (TSP) that was coordinated with your office by letter dated September 9, 2015, and released for public review on September 11, 2015. Subsequently, the TSP was optimized to incorporate levee/floodwall heights needed to accommodate intermediate sea level rise. Minor elements of the Orange 3 TSP plan (Beaumont A and Jefferson Main) were removed from the plan due to limited net benefits and new information indicating that these elements were not needed. Environmental and socioeconomic impacts disclosed in the DIFR-EIS were conservatively high, and impacts of the Recommended Plan have been reduced significantly when compared to the TSP. Thus, impacts were fully disclosed and evaluated by the DIFR-EIS.

Subsequent to release of the DIFR-EIS, USACE conducted eight meetings with Federal and state resource agencies, including the Texas Commission on Environmental Quality (TCEQ), from January through March, 2016. During these meetings, revisions to the TSP were discussed, and final mitigation measures were identified and modeled. The final mitigation plan was presented

and discussed in an interagency meeting on June 15, 2016. Appendices O and P of the FIFR-EIS were provided to all the resources agencies for review at that time. Appendix O includes a description of revisions made to the Orange 3 alignment to avoid and minimize impacts to floodplains, wetlands and water quality to the greatest extent practicable. Appendix P presents the monitoring and adaptive management plan. The monitoring plan identifies the ecological success criteria for the mitigation, describes the cost and duration of the monitoring, and identifies the entities responsible for the monitoring. It also contains an adaptive management plan for taking corrective actions in case monitoring demonstrates that mitigation measures are not achieving ecological success.

Ecological modeling of impacts of the final Orange 3 CSRM Plan determined that 143 average annual habitat units (AAHUs) would be lost due to direct and indirect impacts to fresh, intermediate and brackish marsh, and 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests, over the 50-year period of analysis (Appendix O). The final mitigation plan would provide a total of 263 AAHUs to compensate for the total loss of 186 AAHUs by restoring coastal marsh and preserving forested wetlands in perpetuity.

TCEQ provided comments to USACE on the TSP by letter dated October 21, 2015. A response from USACE was provided by letter dated August 5, 2016. USACE is hereby requesting §401 State Water Quality certification from Texas for this action. The §404(b)(1) Evaluation, which will be included as Appendix H of the FIFR-EIS, is provided for your review. It concludes that proposed placement of fill material in conjunction with the Recommended Plan would comply with Section 404(b)(1) Guidelines. If you have any questions regarding the project, please contact me at the letterhead address or contact my staff, Ms. Janelle Stokes, at Janelle.S.Stokes@usace.army.mil.

Sincerely,

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Kelly Burks-Copes
Chief, Coastal Section

Enclosure

EVALUATION OF SECTION 404(b)(1) GUIDELINES (SHORT FORM)

PROPOSED PROJECT: Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Final Integrated Feasibility Report and Environmental Impact Statement (covering 3 separate project elements: Orange 3 CSRM Recommended Plan, Port Arthur and Vicinity CSRM TSP Recommended Plan, and Freeport and Vicinity CSRM Recommended Plan)

	Yes	No*
1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:		
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	X	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	X	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	X	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, an economic values (if no, see values, Section 2)	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	X	

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		X	
2) Suspended particulates/turbidity impacts		X	
3) Water column impacts		X	
4) Alteration of current patterns and water circulation		X	
5) Alteration of normal water fluctuation/hydroperiod		X	
6) Alteration of salinity gradients		X	
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat		X	

2) Effect on the aquatic food web		X	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		X	
	Not Applicable	**Not Significant**	**Significant***
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges No wetland or other special aquatic site impacts are anticipated in conjunction with the Port Arthur and Vicinity or Freeport and Vicinity CSRM Plans. Wetland impacts of the Orange 3 CSRM plan were avoided and minimized to the greatest extent practicable by modifying the new levee system's alignment location. Remaining unavoidable impacts of the Orange 3 CSRM plan to "Sanctuaries and Refuges" would occur to approximately 45.0 acres as shown in the FIFR-EIS. Approximately 28.8 acres would be directly impacted by construction within the right-of-way, while approximately 16.2 acres are remnants that would be not affected by construction, but cut-off from the rest of TPWD property in the area. In the Tony Houseman Wildlife Management Area (WMA), approximately 1.4 acres of the right-of-way impacts are forested wetlands and adjacent waters. In the Lower Neches WMA, approximately 18.9 acres of the right-of-way are wetlands, with the majority of impacts occurring to coastal marsh. The TPWD wetland impacts have been evaluated and quantified with the Wetland Value Assessment model along with all wetland impacts of the Orange 3 CSRM plan. The plan would not impact any TPWD structures. All impacts are fully compensated by the overall mitigation plan described for the Orange 3 CSRM plan. TPWD has accepted the feasibility-level impact and mitigation analysis, but wants coordination to continue into the PED phase when further hydraulics and hydrology analysis would be conducted. Final approval or concurrence by TPWD cannot occur until requirements of Chapter 26 of the Parks and Wildlife Code are met, and that would occur after the project is authorized. At this time, no obstacles to this approval have been identified.			X

2) Wetlands No wetland or other special aquatic site impacts are anticipated in conjunction with the Port Arthur and Vicinity or Freeport and Vicinity CSRM Plans. Direct wetland impacts to approximately 160.2 acres, would result from construction of the Orange 3 CSRM plan. Indirect impacts on about 2,249.5 acres would be associated with functional impacts to fisheries access and sediment, nutrient and organic matter exchange in the extensive marshes in the lower Cow and Adams Bayous floodplains. These indirect impacts also include limited indirect hydrologic impacts from construction of the levee and surge gates in a few locations. Ecological modeling of impacts of the Orange 3 CSRM plan has determined that about 143 average annual habitat units (AAHUs) would be lost due to direct and indirect impacts to fresh, intermediate and brackish marsh, and about 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests, over the 50-year period of analysis (see FIFR-EIS Appendix O). A mitigation plan has been proposed that would provide a total of about 263 AAHUs to fully compensate for the total loss of 186 AAHUs by restoring coastal marsh and preserving forested wetlands in perpetuity.			X
3) Mud flats	X		
4) Vegetated shallows	X		
5) Coral reefs	X		
6) Riffle and pool complexes	X		
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies	X		
2) Recreational and Commercial fisheries impacts	X		
3) Effects on water-related recreation	X		
4) Aesthetic impacts		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves	X		

	Yes
3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	X
2) Hydrography in relation to known or anticipated sources of contaminants	X
3) Results from previous testing of the material or similar material in the vicinity of the project	X
4) Known, significant sources of persistent pesticides from land runoff or percolation	
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	X

6) Other public records of significant introduction of contaminants from industries, municipalities or other sources	X
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	

List appropriate references:

1) USACE. 2008. Final Environmental Assessment – Restoration of the Mouth of the San Bernard River to the Gulf of Mexico, Brazoria County, Texas. Galveston District, Galveston, Texas.

2) USACE. 2011. Final Environmental Impact Statement for Sabine-Neches Waterway Channel Improvement Project, Southeast Texas and Southwest Louisiana. Galveston District, Galveston, Texas.

3) USACE. 2012. Final Environmental Impact Statement for Freeport Harbor Channel Improvement Project, Brazoria County, Texas. Galveston District, Galveston, Texas.

4) USACE. 2015. Appendix N, Hazardous, Toxic and Radioactive Waste Assessment for Sabine Pass to Galveston Bay Integrated Feasibility Report and EIS.

5) SOL Engineering Services, LLC. 2012. Letter Report of Results of Sediment and Elutriate Testing and Analysis for Maintenance Dredging of the Sabine-Neches Waterway.

	Yes	No
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	X	

	Yes
4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	N/A
1) Depth of water at placement site	
2) Current velocity, direction, and variability at placement site	
3) Degree of turbulence	
4) Water column stratification	
5) Discharge vessel speed and direction	
6) Rate of discharge	
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	
8) Number of discharges per unit of time	

9) Other factors affecting rates and patterns of mixing (specify)	

List appropriate references:

	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	N/A	

	Yes	No
5. Actions to Minimize Adverse Effects (Subpart H)		
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken:

1) Silt curtains will be utilized to prevent inadvertent discharge of fill material into adjacent wetlands or waterbodies. Forestry BMPs will be utilized to prevent disturbance of forest floors.

	Yes	No*
6. Factual Determination (230.11)		
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a. 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility	
a. This evaluation was prepared by:	**Janelle Stokes**
Position:	**Regional Technical Specialist, Unit A, CESWF-PEC-CC**

8. Findings	Yes

a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions:	

List of conditions:

c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s):	
1) There is a less damaging practicable alternative	
2) The proposed discharge will result in significant degradation of the aquatic ecosystem	
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

1 November 2016	BURKS-COPES.KELLY.A.1231450927 Digitally signed by BURKS-COPES.KELLY.A.1231450927 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=BURKS-COPES.KELLY.A.1231450927 Date: 2016.11.01 10:27:33 -05'00'
Date	KELLY BURKS-COPES Chief, Coastal Section, CESWF-PEC-CC

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this "short form" procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form" evaluation process is inappropriate.

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

November 17, 2016

Ms. Kelly Burkes-Copes
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attention: Ms. Janelle Stokes

Re: Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration

Dear Ms. Burkes-Copes:

This letter is in response to your letter dated November 1, 2016, requesting state water quality certification for the US Army Corps of Engineers (Corps), Galveston District and the Texas General Land Office (GLO) proposed Sabine Pass to Galveston Bay, Texas, Ecosystem Restoration (ER) and Coastal Storm Risk Management (CSRM) project. The Recommended Plan proposes to reduce risks of tropical storm surge impacts by constructing a new CSRM system in Orange County, and increase the level of risk reduction and resiliency of the existing Port Arthur and Vicinity and Freeport and Vicinity Hurricane Flood Protection (HFP) systems in Jefferson and Brazoria Counties, Texas, respectively.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the Draft Integrated Feasibility Report and Environmental Impact Statement (Draft IFR-EIS) for the Sabine Pass to Galveston Bay CSRM and ER dated September 2015, the Corps' response to TCEQ comments in a letter dated August 5, 2016, Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS, and related information along with your letter. Although the TCEQ does not typically make a water quality certification decision for an EIS prior to review of the Final IFR-EIS and the Record of Decision (ROD), TCEQ has has determined it appropriate to make a decision in this case based on the available information, including the documents noted above. On behalf of the Executive Director and based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards. General information regarding this water quality certification, including standard provisions of the certification, is included as an attachment to this letter.

The Orange 3 CSRM Recommended Plan would consist of a 27-mile long levee and floodwall system along the edge of the Sabine and Neches River floodplains from the City of Orange to the vicinity of Orangefield, Texas. Ecological modeling of impacts of the final

Orange 3 CSRM Plan determined that 143 average annual habitat units (AAHUs) would be lost due to direct and indirect impacts to fresh, intermediate, and brackish marsh, and 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests. The Port Arthur and Freeport CSRM Recommended Plans would raise existing levees, construct and reconstruct floodwalls, replace vehicular closure structures and increase resiliency by installing erosion protection. The Port Arthur and Freeport Plans would result in only negligible impacts.

The proposed mitigation plan would provide a total of 263 AAHUs to compensate for the total loss 186 AAHUs by restoring coastal marsh and preserving forested wetlands in perpetuity.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact Mr. C. Brad Caston, Water Quality Assessment Section, Water Quality Division (MC-150), at (512) 239-4711 or by email at Charles.Caston@tceq.texas.gov.

Sincerely,

David W. Galindo, Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/CBC/tc

Attachment

cc: Mr. Ray Newby, Texas General Land Office, P. O. Box 12873, Austin, Texas 78711-2873

Ms. Kelly Burkes-Copes
U.S. Army Corps of Engineers
Sabine Pass to Galveston Bay, Texas CSRM
Attachment - Dredge and Fill Certification
Page 1 of 3
November 17, 2016

WORK DESCRIPTION: As described in Draft Integrated Feasibility Report and Environmental Impact Statement (Draft IFR-EIS) for the Sabine Pass to Galveston Bay Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) dated September 2015 and Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS.

SPECIAL CONDITIONS: None

GENERAL: This certification, issued pursuant to the requirements of Title 30, Texas Administrative Code, Chapter 279, is restricted to the work described in Draft IFR-EIS for the Sabine Pass to Galveston Bay CSRM and ER dated September 2015 and Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS. This certification may be extended to any minor revision of the project when such change(s) would not result in an impact on water quality. The Texas Commission on Environmental Quality (TCEQ) reserves the right to require full joint public notice on a request for minor revision.

STANDARD PROVISIONS: These following provisions attach to any permit issued by the COE and shall be followed by the permittee or any employee, agent, contractor, or subcontractor of the permittee during any phase of work authorized by a COE permit.

1. The water quality of wetlands shall be maintained in accordance with all applicable provisions of the Texas Surface Water Quality Standards including the General, Narrative, and Numerical Criteria.

2. The applicant shall not engage in any activity which will cause surface waters to be toxic to man, aquatic life, or terrestrial life.

3. Permittee shall employ measures to control spills of fuels, lubricants, or any other materials to prevent them from entering a watercourse. All spills shall be promptly reported to the TCEQ by calling the State of Texas Environmental Hotline at 1-800-832-8224.

4. Sanitary wastes shall be retained for disposal in some legal manner. Marinas and similar operations which harbor boats equipped with marine sanitation devices shall provide state/federal permitted treatment facilities or pump out facilities for ultimate transfer to a permitted treatment facility. Additionally, marinas shall display signs in appropriate locations advising boat owners that the discharge of sewage from a marine sanitation device to waters in the state is a violation of state and federal law.

5. Materials resulting from the destruction of existing structures shall be removed from the water or areas adjacent to the water and disposed of in some legal manner.

6. A discharge shall not cause substantial and persistent changes from ambient conditions of turbidity or color. The use of silt screens or other appropriate methods is encouraged to confine suspended particulates.

7. The placement of any material in a watercourse or wetlands shall be avoided and placed there only with the approval of the Corps when no other reasonable alternative is available. If work within a wetland is unavoidable, gouging or rutting of the substrate is prohibited. Heavy equipment shall be placed on mats to protect the substrate from gouging and rutting if necessary.

8. Dredged Material Placement: Dredged sediments shall be placed in such a manner as to prevent any sediment runoff onto any adjacent property not owned by the applicant. Liquid runoff from the disposal area shall be retained on-site or shall be filtered and returned to the watercourse from which the dredged materials were removed. Except for material placement authorized by this permit, sediments from the project shall be placed in such a manner as to prevent any sediment runoff into waters in the state, including wetlands.

9. If contaminated spoil that was not anticipated or provided for in the permit application is encountered during dredging, dredging operations shall be immediately terminated and the TCEQ shall be contacted by calling the State of Texas Environmental Hotline at 1-800-832-8224. Dredging activities shall not be resumed until authorized by the Commission.

10. Contaminated water, soil, or any other material shall not be allowed to enter a watercourse. Noncontaminated storm water from impervious surfaces shall be controlled to prevent the washing of debris into the waterway.

11. Storm water runoff from construction activities that result in a disturbance of one or more acres, or are a part of a common plan of development that will result in the disturbance of one or more acres, must be controlled and authorized under Texas Pollutant Discharge Elimination System (TPDES) general permit TXR150000. A copy of the general permit, application (notice of intent), and additional information is available at:
http://www.tceq.texas.gov/permitting/stormwater/wq_construction.html or by contacting the TCEQ Storm Water & Pretreatment Team at (512) 239-4671.

12. Upon completion of earthwork operations, all temporary fills shall be removed from the watercourse/wetland, and areas disturbed during construction shall be seeded, riprapped, or given some other type of protection to minimize subsequent soil erosion. Any fill material shall be clean and of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters.

13. Disturbance to vegetation will be limited to only what is absolutely necessary. After construction, all disturbed areas will be revegetated to approximate the pre-disturbance native plant assemblage.

14. Where the control of weeds, insects, and other undesirable species is deemed necessary by the permittee, control methods which are nontoxic to aquatic life or human health shall be employed when the activity is located in or in close proximity to water, including wetlands.

15. Concentrations of taste and odor producing substances shall not interfere with the production of potable water by reasonable water treatment methods, impart unpalatable flavor to food fish including shellfish, result in offensive odors arising from the water, or otherwise interfere with reasonable use of the water in the state.

16. Surface water shall be essentially free of floating debris and suspended solids that are conducive to producing adverse responses in aquatic organisms, putrescible sludge deposits, or sediment layers which adversely affect benthic biota or any lawful uses.

17. Surface waters shall be essentially free of settleable solids conducive to changes in flow characteristics of stream channels or the untimely filling of reservoirs, lakes, and bays.

18. The work of the applicant shall be conducted such that surface waters are maintained in an aesthetically attractive condition and foaming or frothing of a persistent nature is avoided. Surface waters shall be maintained so that oil, grease, or related residue will not produce a visible film of oil or globules of grease on the surface or coat the banks or bottoms of the watercourse.

19. This certification shall not be deemed as fulfilling the applicant's/permittee's responsibility to obtain additional authorization/approval from other local, state, or federal regulatory agencies having special/specific authority to preserve and/or protect resources within the area where the work will occur.

PART II
TRIBAL COORDINATION

Tribal Cooperating Agency Requests

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 17300
FORT WORTH, TEXAS 76102-0300

November 19, 2014

REPLY TO ATTENTION OF

NEPA/Cultural Resources Section

Bryant Celestine
Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, TX 77351

Dear Mr. Celestine:

The Galveston District, Corps of Engineers, and the non-federal sponsor, the Texas General Land Office, would like to invite your tribe to participate as a cooperating agency in the development of an Environmental Impact Statement (EIS) for the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Study. The integrated feasibility report and EIS (IFR-EIS) will evaluate structural and non-structural alternatives which address coastal storm risk management (CSRM) and ecosystem restoration (ER) opportunities in Orange, Jefferson, Chambers, Harris, Galveston and Brazoria counties on the upper Texas Gulf coast. The Draft IFR-EIS is currently scheduled to be released for public review and comment in August 2015.

Structural alternatives that will be evaluated are: (1) new surge protection levees and small, navigable surge gates on Cow and Adams Bayous in Orange and Jefferson Counties; (2) a large navigable surge gate in the Neches River near the Rainbow Bridge (eliminated); and (3) reevaluation of the existing Port Arthur and Freeport Hurricane Flood Protection (HFP) systems in Jefferson and Brazoria Counties, respectively. Maps showing the location of the existing HPFs and the structural alternatives are enclosed. Non-structural measures such as targeted buy-outs, conservation of natural landscapes, and flood-proofing will also be evaluated. Structural and non-structural alternatives to address storm surge impacts in the Galveston Bay system (Galveston, Harris and Chambers Counties), as well as ER measures throughout the six-county study area will be evaluated programmatically, with recommendations being made for detailed analyses of feasible alternatives in future studies.

If your tribe has any concerns regarding potential project impacts to Native American archeological sites or areas of religious or cultural interest from the potential project described above, we request that you contact us so that further consultation can be initiated. We would also like to coordinate with you our schedule for study completion so that all reviews and approvals will, to the maximum extent practicable, be conducted concurrently. The following review periods for the IFR-EIS have been established in accordance with the current project schedule:

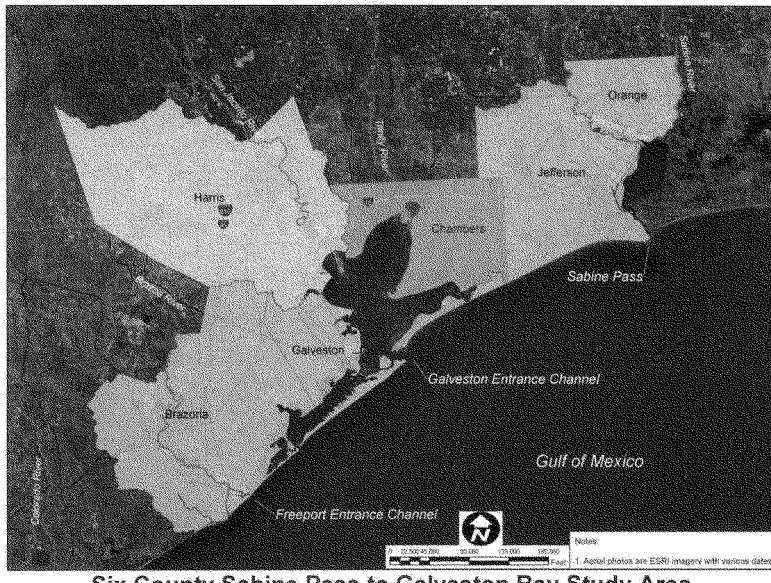
- Review of Draft IFR-EIS –45-day review period (August 29 through October 12, 2015)
- State and Agency Review of Final IFR-EIS – 30-day review (July 15 through August 14, 2016)

We appreciate this opportunity to consult regarding any concerns your tribe may have with potential project impacts or review periods. If you should have any questions regarding this request, please contact Janelle Stokes of my staff at (409) 766-3039.

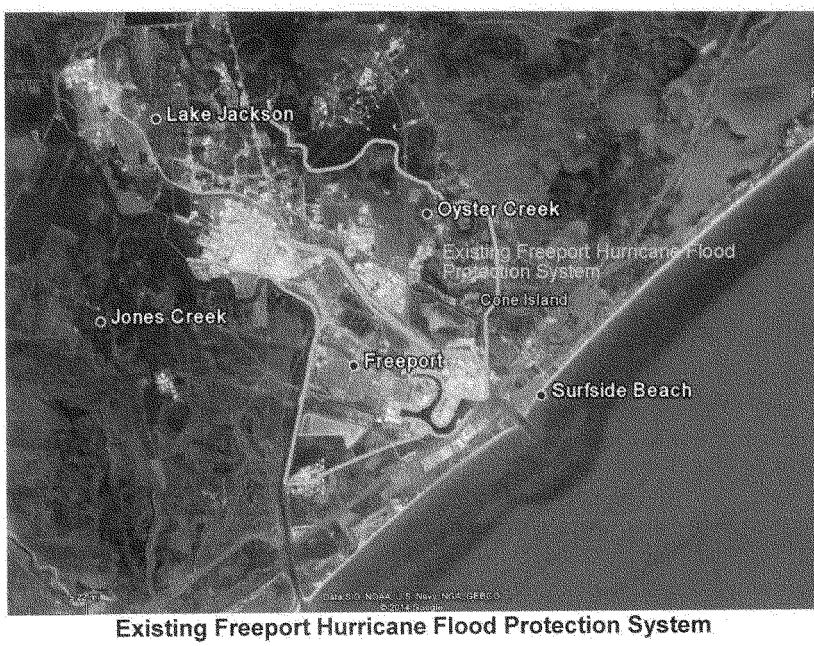
Sincerely,

Carolyn Murphy
Chief, Unit A, NEPA/Cultural
Resources Section

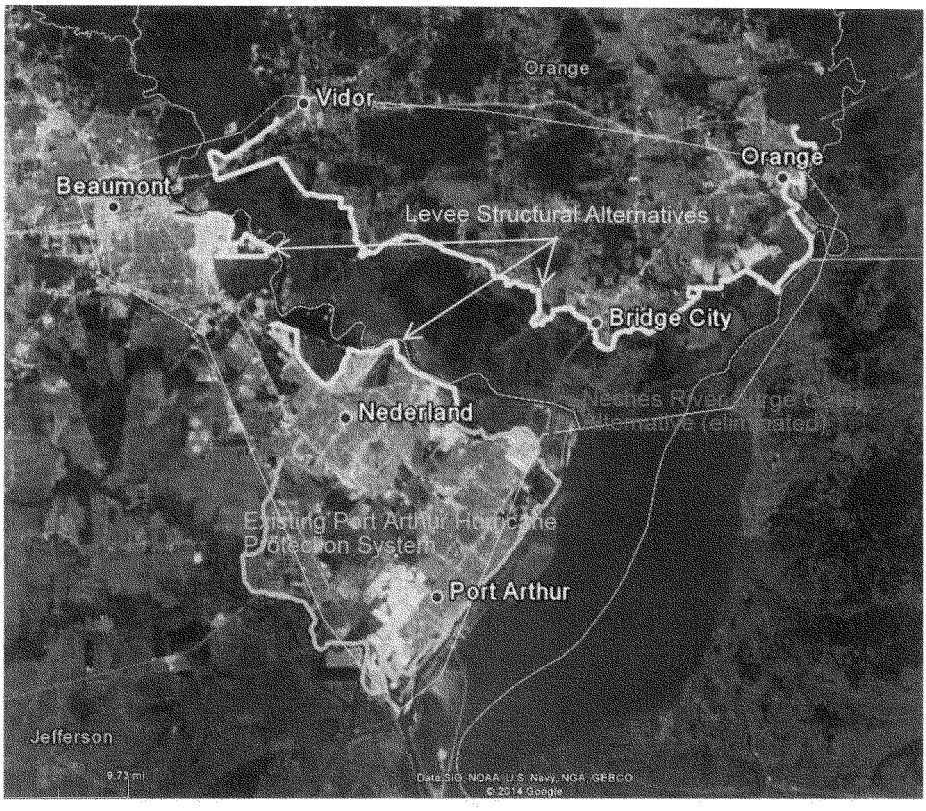
Enclosures



Six County Sabine Pass to Galveston Bay Study Area



Existing Freeport Hurricane Flood Protection System



Existing Port Arthur Hurricane Flood Protection System, Levee Structural Alternatives and Neches River Surge Gate Alternative

Identical Cooperating Agency Letters Also Sent To:

Mr. Jimmy Arterberry
Tribal Historic Preservation Officer
Comanche Nation of Oklahoma
P.O. Box 908
Lawton, OK 73502

Dr. Linda Langley
Tribal Historic Preservation Officer
Coushatta Tribe of Louisiana
Administrative Building
1940 C.C. Bel Road
Elton, Louisiana 70532

Ms. Amie Tah-Bone
Historic Preservation Office
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, OK 73015

Holly Houghton
Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, NM 88340

President Don L. Patterson
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa, OK 74653

No Tribes responded to this request, but no Tribes specifically declined.

Tribal Coordination of DIFR-EIS

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Mr. Bryant Celestine
Alabama-Coushatta Tribes of Texas
Tribal Historic Preservation Officer
571 State Park Road 56
Livingston, TX 77351

Dear Mr. Celestine:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

The Area of Potential Effect (APE) for this project will be the footprint of the TSP for direct impacts to archeological resources plus a 1,500-foot buffer for indirect impacts to standing structures or buildings. The Orange-Jefferson CSRM Plan (Figures 1 through 6) overlaps five archeological sites and two cemeteries. Additionally, there are four National Register Properties within 1,500 feet of the proposed levee system (Navy Park Historic District, W.H. Stark House, Sims House, and the Woodmen of the World Lodge), all of which would experience reduced risk of storm surge damages with construction of the new levee system. The five archeological sites in Orange County (41OR15, OR39, OR59, OR60, and OR70) are all prehistoric sites that have poorly delineated boundaries, insufficient documentation, and have not been evaluated for National Register of Historic Places (NRHP) eligibility. All of these sites have the potential to be directly impacted by construction activities. The two cemeteries (Thomas Cemetery and an unknown cemetery) also have a potential to be directly affected by levee construction as their recorded boundaries overlap with the proposed project area.

These cemeteries are not well documented and their locations may not be accurate within the existing state databases.

There are numerous cultural resources that occur near the APE for the Port Arthur (Figures 7 through 9) and Freeport CSRM Plans (Figures 10 through 13); however, all of these resources as currently mapped occur outside of the areas proposed for improvements. In Port Arthur, there are no cultural resources that overlap with the areas for proposed improvements along the existing HFPP. However, there are three archeological sites (41BO4, BO119, and BO121) that are within proximity to the proposed improvement areas along the Freeport HFPP. These three sites all occur along Oyster Creek (Figure 13), are poorly delineated, lack sufficient documentation, and have not been evaluated for NRHP eligibility.

Based on the current information for the proposed levee construction and improvements, there is a potential to affect historic properties and cemeteries. These effects consist of direct impacts from earth moving and excavation activities related to construction and potential indirect effects on historic structures such as diminished view shed from the raising of levees and floodwalls. The USACE recommends intensive cultural resources investigations to identify and evaluate any historic properties within proposed construction areas. The USACE intends to execute a Programmatic Agreement (PA) to govern the scope of investigations, which will be determined in concert with the Texas SHPO and Native American Tribes. A draft PA has been developed and provided for public and tribal review as Appendix L in the Draft Integrated Feasibility Report and Environmental Impact Statement. A compact disk of this report is enclosed.

We request your comments on the proposed undertaking and the potential to affect historic properties in compliance with Section 106 of the National Historic Preservation Act of 1966. Thank you for your cooperation in this review process. If you have any questions concerning the proposed project or if we can be of further assistance, please contact John A. Campbell at 409-766-3878.

Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

ATTACHMENTS

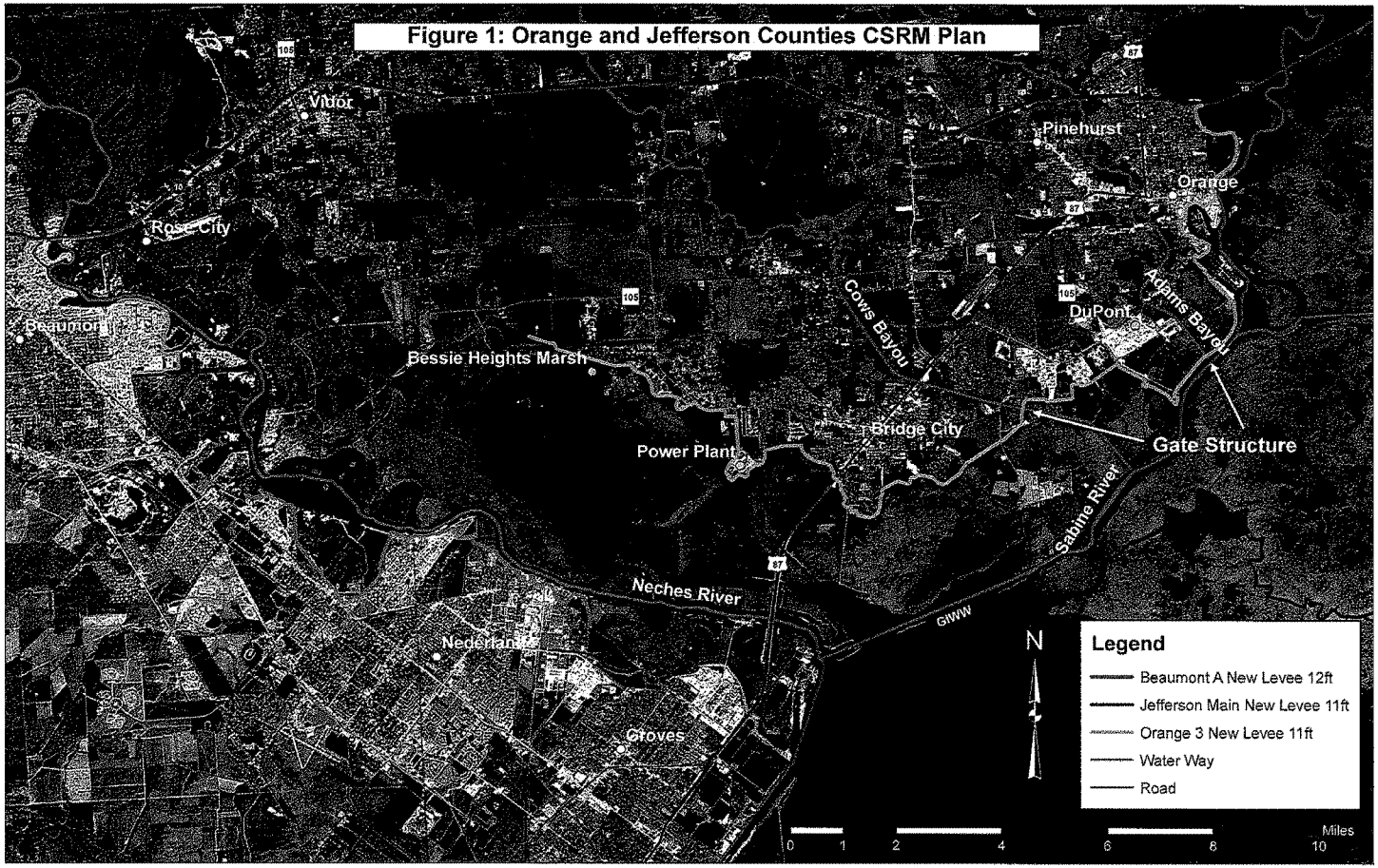


Figure 1: Orange and Jefferson Counties CSRM Plan
Vidor
Rose City
Beaumont
Bessie Heights Marsh
Power Plant
Bridge City
Pinehurst
Orange
DuPont
Cows Bayou
Adams Bayou
Gate Structure
Sabine River
Neches River
GIWW
Nederland
Groves
N
Legend
Beaumont A New Levee 12ft
Jefferson Main New Levee 11ft
Orange 3 New Levee 11ft
Water Way
Road
0 1 2 4 6 8 10
Miles

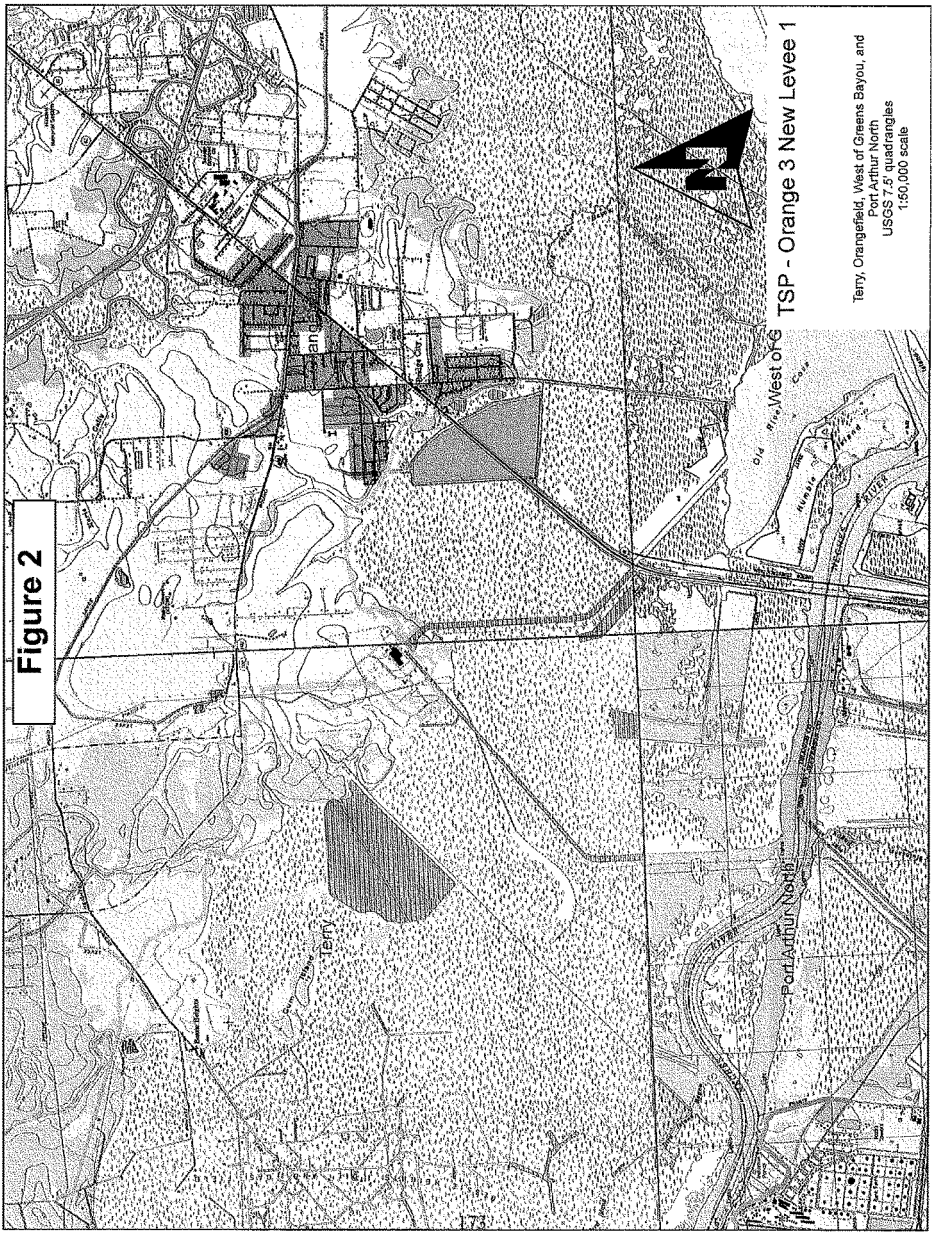


Figure 2
TSP - Orange 3 New Levee 1
Terry, Orangefield, West of Greens Bayou, and Port Arthur North
USGS 7.5' quadrangles
1:50,000 scale
Terry
Port Arthur North
West of 6
Old Rice Canal
Jefferson
Orange
173

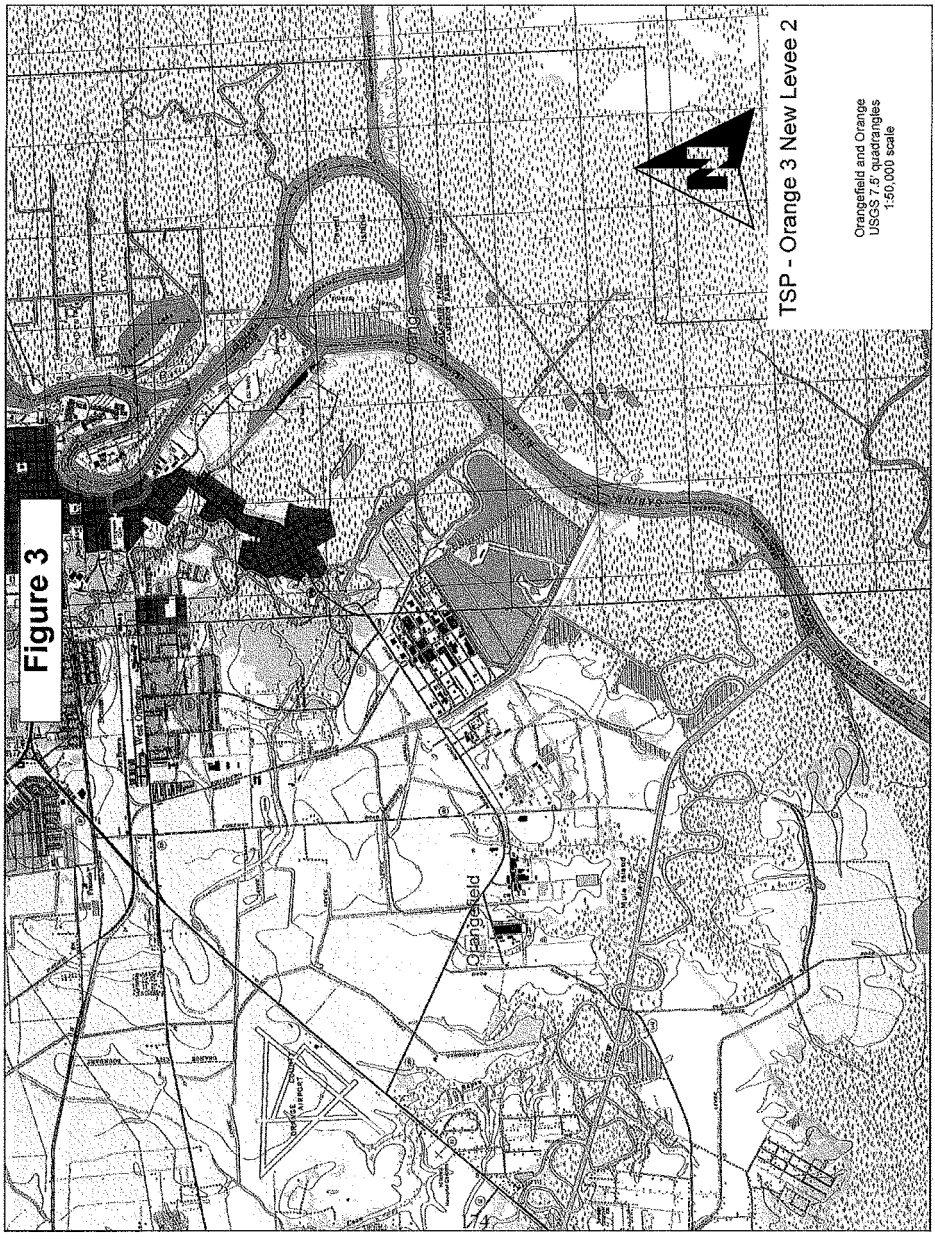


Figure 3
TSP - Orange 3 New Levee 2
Orangefield and Orange
USGS 7.5' quadrangles
1:50,000 scale
N
Orangefield

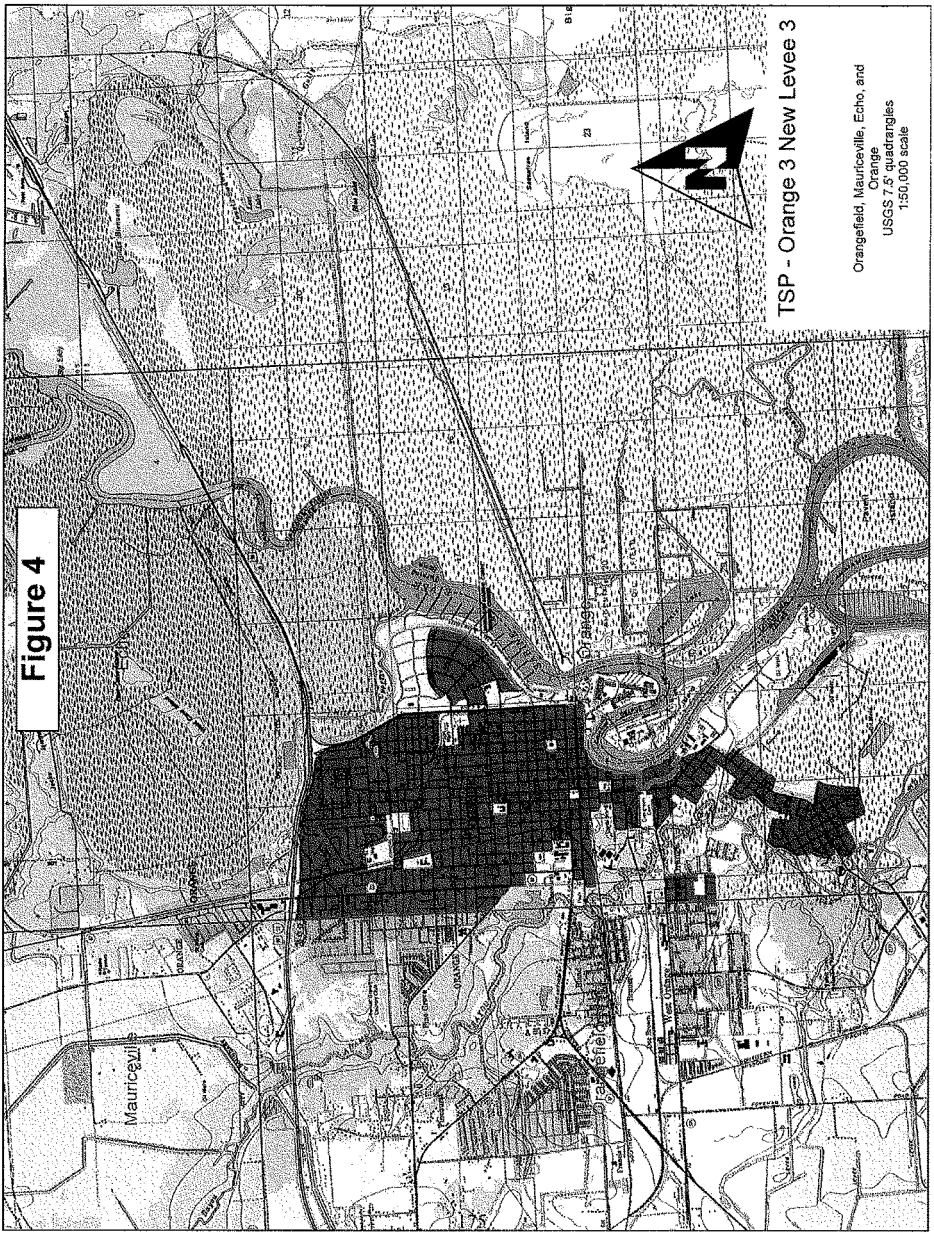


Figure 4
TSP - Orange 3 New Levee 3
Orangefield, Mauriceville, Echo, and Orange
USGS 7.5' quadrangles
1:50,000 scale
N
Mauriceville
Orangefield
Orange

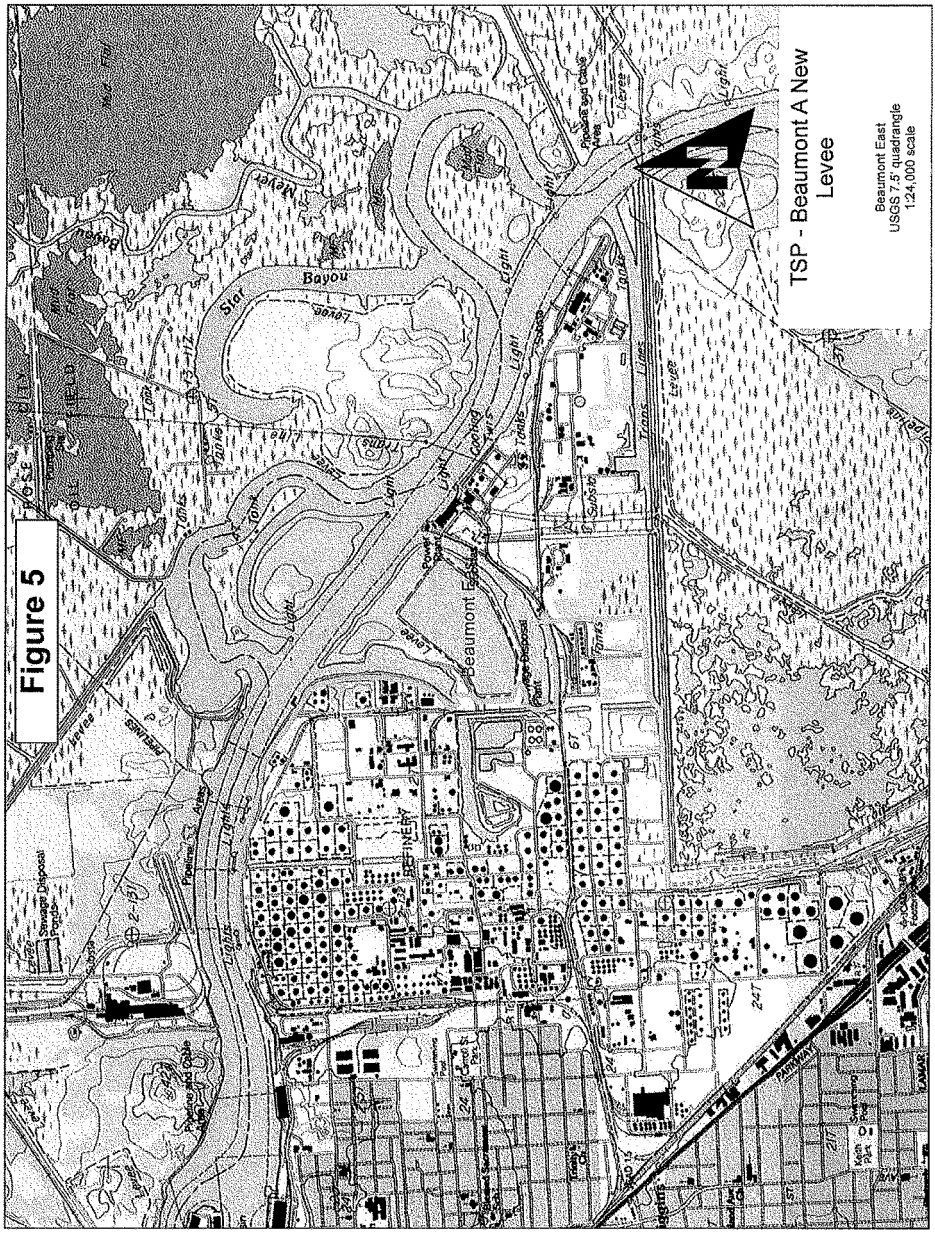


Figure 5
TSP - Beaumont A New Levee
Beaumont East
USGS 7.5' quadrangle
1:24,000 scale
Star Bayou
Beaumont Facility
Port Arthur
Trans Lines
Levee
Light
Tanks
Pipelines
Sewage Disposal
Refinery
Mud Flat
Marsh
Canal
Ditch
Bridge
Road
Railroad
Power Plant
Pumping Station
Gas Station
Church
Cemetery
Airport
Golf Course
Park
Stadium
Hospital
School
Water Tower
Oil Field
Oil Well
Gas Well
Dry Hole
Tank Farm
Refinery
Chemical Plant
Dock
Wharf
Pier
Jetty
Breakwater
Seawall
Dike
Spillway
Gate
Valve
Meter
Substation
Transformer
Switch
Fuse
Circuit Breaker
Relay
Control Panel
Instrument
Gauge
Thermometer
Pressure Gauge
Flow Meter
Level Gauge
Temperature Gauge
Pressure Transmitter
Flow Transmitter
Level Transmitter
Temperature Transmitter
Pressure Switch
Flow Switch
Level Switch
Temperature Switch
Pressure Indicator
Flow Indicator
Level Indicator
Temperature Indicator
Pressure Recorder
Flow Recorder
Level Recorder
Temperature Recorder
Pressure Controller
Flow Controller
Level Controller
Temperature Controller
Pressure Alarm
Flow Alarm
Level Alarm
Temperature Alarm
Pressure Shutdown
Flow Shutdown
Level Shutdown
Temperature Shutdown
Pressure Relief Valve
Flow Relief Valve
Level Relief Valve
Temperature Relief Valve
Pressure Regulator
Flow Regulator
Level Regulator
Temperature Regulator
Pressure Control Valve
Flow Control Valve
Level Control Valve
Temperature Control Valve
Pressure Safety Valve
Flow Safety Valve
Level Safety Valve
Temperature Safety Valve
Pressure Vacuum Valve
Flow Vacuum Valve
Level Vacuum Valve
Temperature Vacuum Valve
Pressure Vent Valve
Flow Vent Valve
Level Vent Valve
Temperature Vent Valve
Pressure Drain Valve
Flow Drain Valve
Level Drain Valve
Temperature Drain Valve
Pressure Sample Valve
Flow Sample Valve
Level Sample Valve
Temperature Sample Valve
Pressure Test Valve
Flow Test Valve
Level Test Valve
Temperature Test Valve
Pressure Bypass Valve
Flow Bypass Valve
Level Bypass Valve
Temperature Bypass Valve
Pressure Isolation Valve
Flow Isolation Valve
Level Isolation Valve
Temperature Isolation Valve
Pressure Check Valve
Flow Check Valve
Level Check Valve
Temperature Check Valve
Pressure Globe Valve
Flow Globe Valve
Level Globe Valve
Temperature Globe Valve
Pressure Gate Valve
Flow Gate Valve
Level Gate Valve
Temperature Gate Valve
Pressure Ball Valve
Flow Ball Valve
Level Ball Valve
Temperature Ball Valve
Pressure Butterfly Valve
Flow Butterfly Valve
Level Butterfly Valve
Temperature Butterfly Valve
Pressure Plug Valve
Flow Plug Valve
Level Plug Valve
Temperature Plug Valve
Pressure Needle Valve
Flow Needle Valve
Level Needle Valve
Temperature Needle Valve
Pressure Diaphragm Valve
Flow Diaphragm Valve
Level Diaphragm Valve
Temperature Diaphragm Valve
Pressure Pinch Valve
Flow Pinch Valve
Level Pinch Valve
Temperature Pinch Valve
Pressure Solenoid Valve
Flow Solenoid Valve
Level Solenoid Valve
Temperature Solenoid Valve
Pressure Motor Valve
Flow Motor Valve
Level Motor Valve
Temperature Motor Valve
Pressure Pneumatic Valve
Flow Pneumatic Valve
Level Pneumatic Valve
Temperature Pneumatic Valve
Pressure Hydraulic Valve
Flow Hydraulic Valve
Level Hydraulic Valve
Temperature Hydraulic Valve
Pressure Manual Valve
Flow Manual Valve
Level Manual Valve
Temperature Manual Valve
Pressure Automatic Valve
Flow Automatic Valve
Level Automatic Valve
Temperature Automatic Valve
Pressure Remote Valve
Flow Remote Valve
Level Remote Valve
Temperature Remote Valve
Pressure Local Valve
Flow Local Valve
Level Local Valve
Temperature Local Valve
Pressure Panel Valve
Flow Panel Valve
Level Panel Valve
Temperature Panel Valve
Pressure Field Valve
Flow Field Valve
Level Field Valve
Temperature Field Valve
Pressure Instrument Valve
Flow Instrument Valve
Level Instrument Valve
Temperature Instrument Valve
Pressure Control Panel Valve
Flow Control Panel Valve
Level Control Panel Valve
Temperature Control Panel Valve
Pressure Field Instrument Valve
Flow Field Instrument Valve
Level Field Instrument Valve
Temperature Field Instrument Valve
Pressure Panel Instrument Valve
Flow Panel Instrument Valve
Level Panel Instrument Valve
Temperature Panel Instrument Valve
Pressure Control Panel Instrument Valve
Flow Control Panel Instrument Valve
Level Control Panel Instrument Valve
Temperature Control Panel Instrument Valve

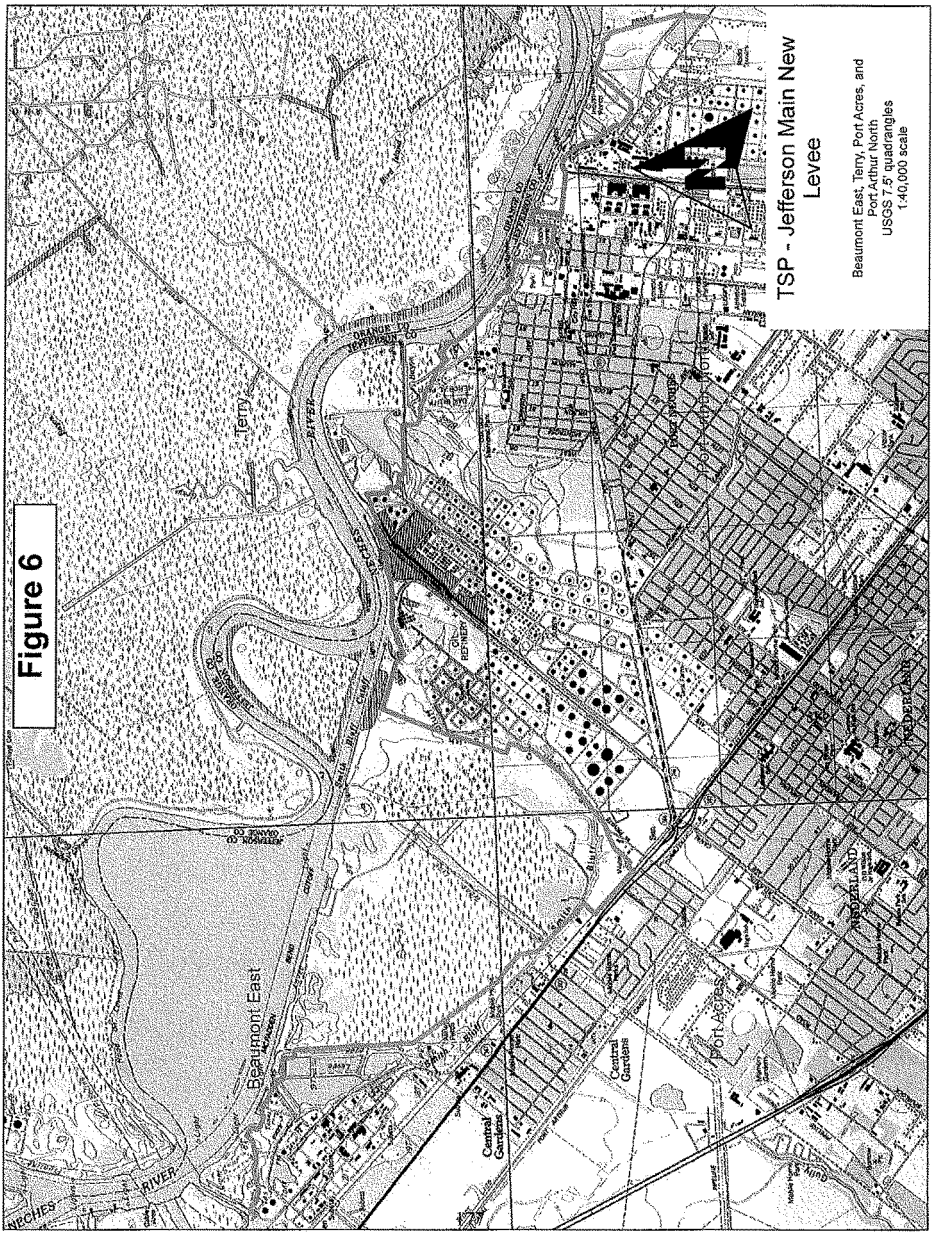


Figure 6
TSP - Jefferson Main New Levee
Beaumont East, Terry, Port Acres, and Port Arthur North
USGS 7.5' quadrangles
1:40,000 scale
Beaumont East
Terry
Port Acres
Central Gardens
NECHES RIVER
PORT ARTHUR
NEDERLAND

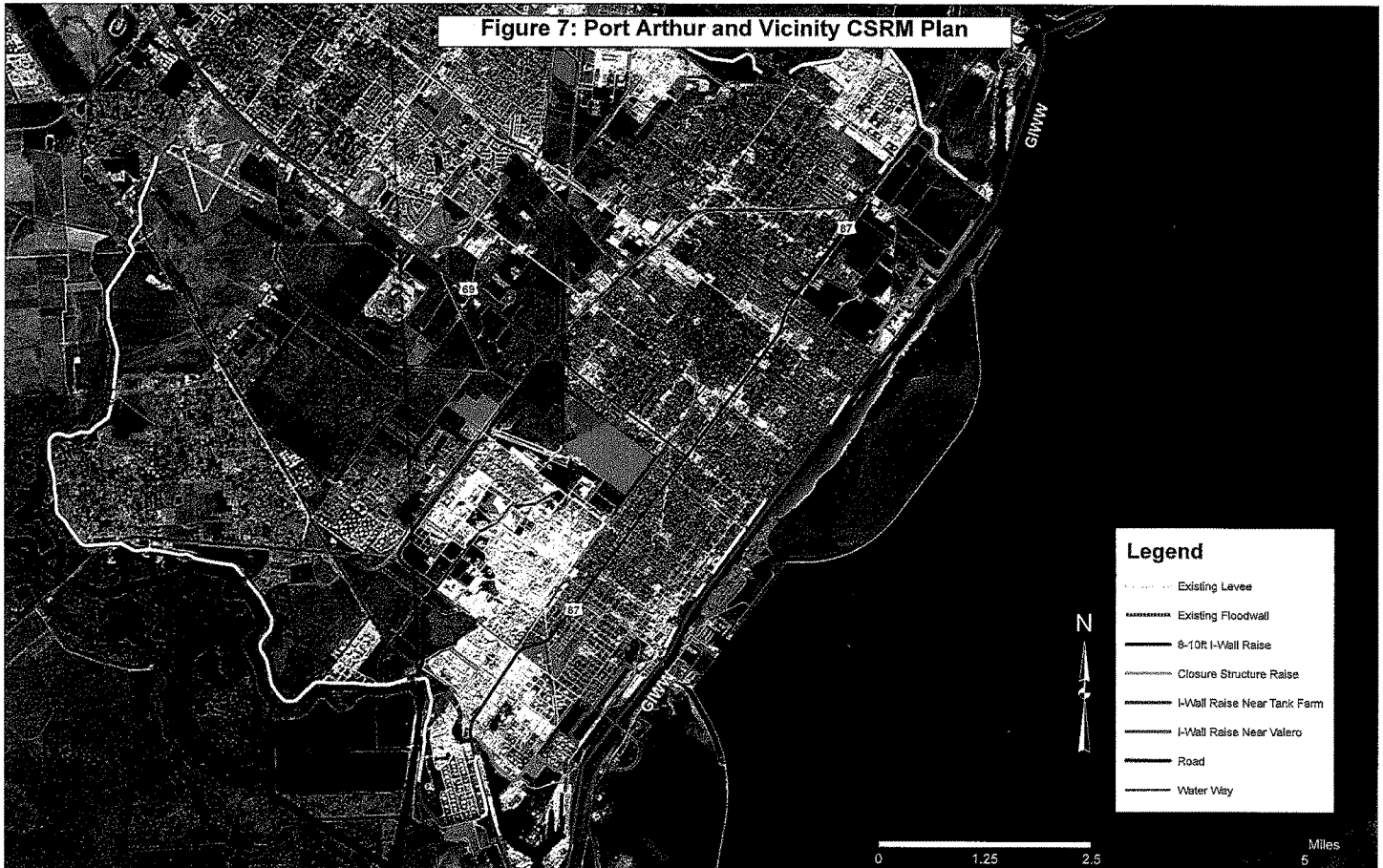


Figure 7: Port Arthur and Vicinity CSRM Plan
GIWW
87
69
87
GIWW
Legend
Existing Levee
Existing Floodwall
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Road
Water Way
N
0
1.25
2.5
Miles
5

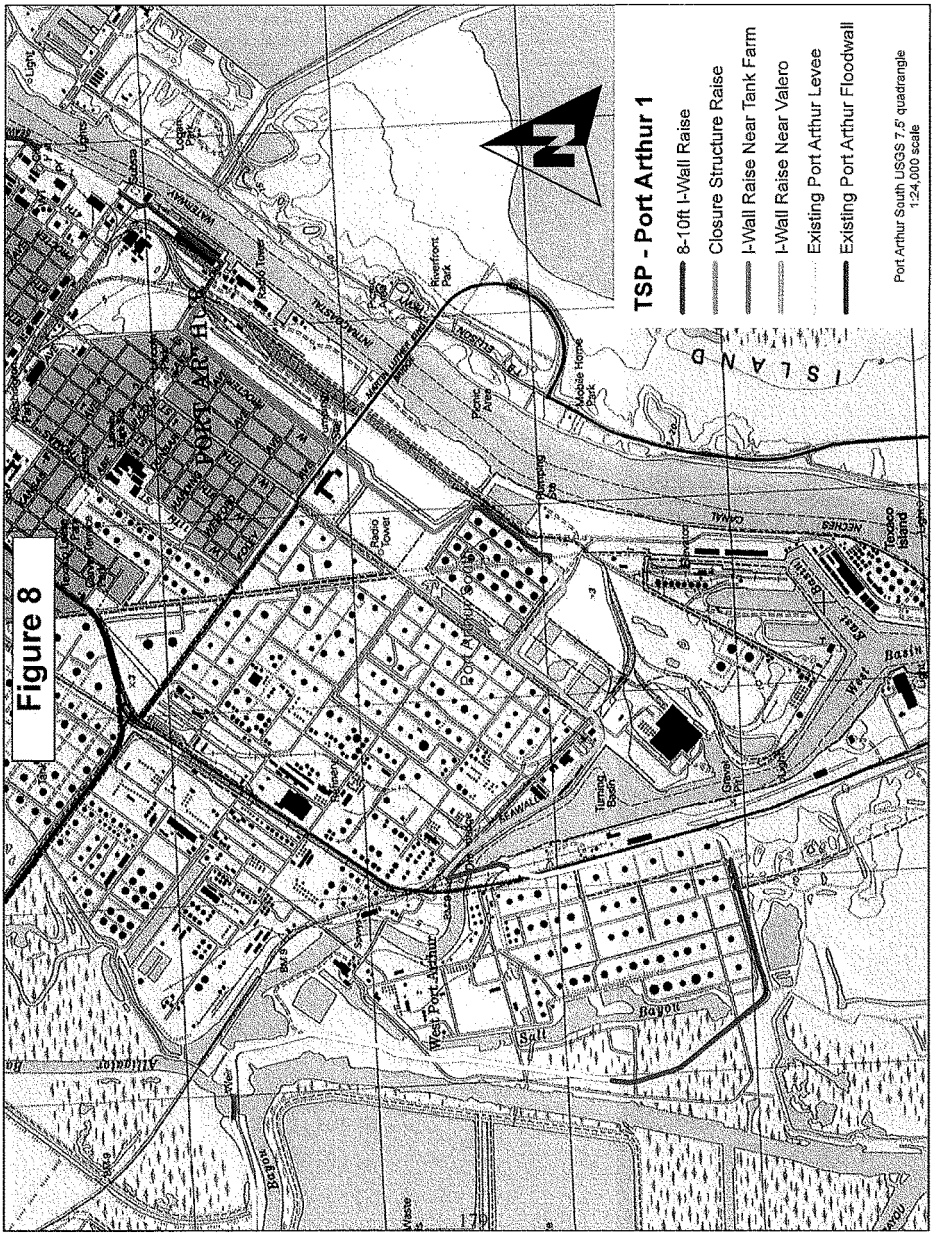


Figure 8
TSP - Port Arthur 1
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Existing Port Arthur Levee
Existing Port Arthur Floodwall
Port Arthur South USGS 7.5' quadrangle
1:24,000 scale
PORT ARTHUR
ISLAND
Riverfront Park
Mobile Home Park
Picnic Area
Pavilion
Boat Ramp
Public Boat Ramp
Port Arthur Seawall
Seawall
Turning Basin
Gravel Pit
Canal
Basin
West Basin
Rodeo Island
Bayou
Salt
West Port Arthur
Atlantic
Ave
Blvd
Rd
St
N

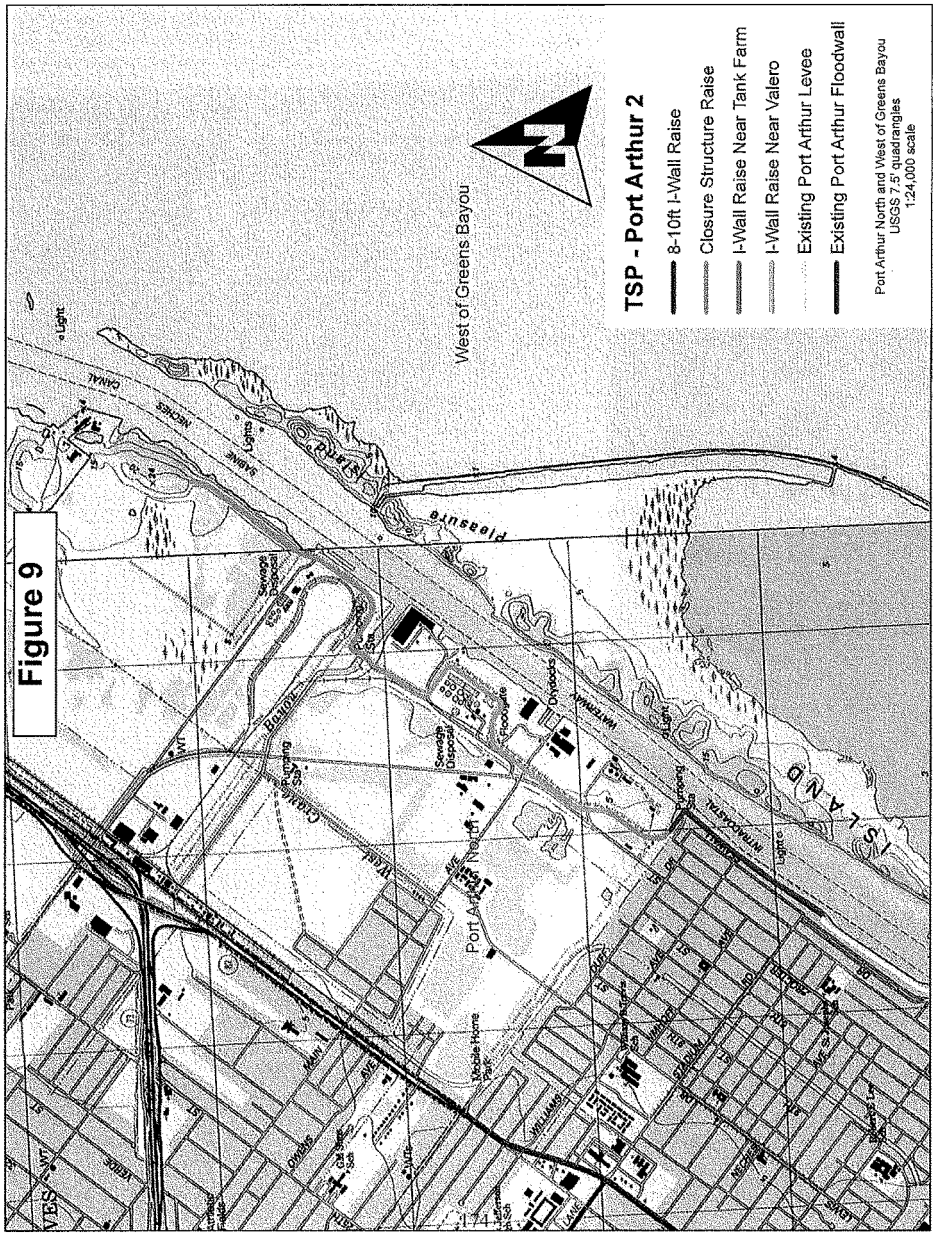


Figure 9
TSP - Port Arthur 2
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Existing Port Arthur Levee
Existing Port Arthur Floodwall
Port Arthur North and West of Greens Bayou
USGS 7.5' quadrangles
1:24,000 scale
West of Greens Bayou
Port Arthur North
ISLAND

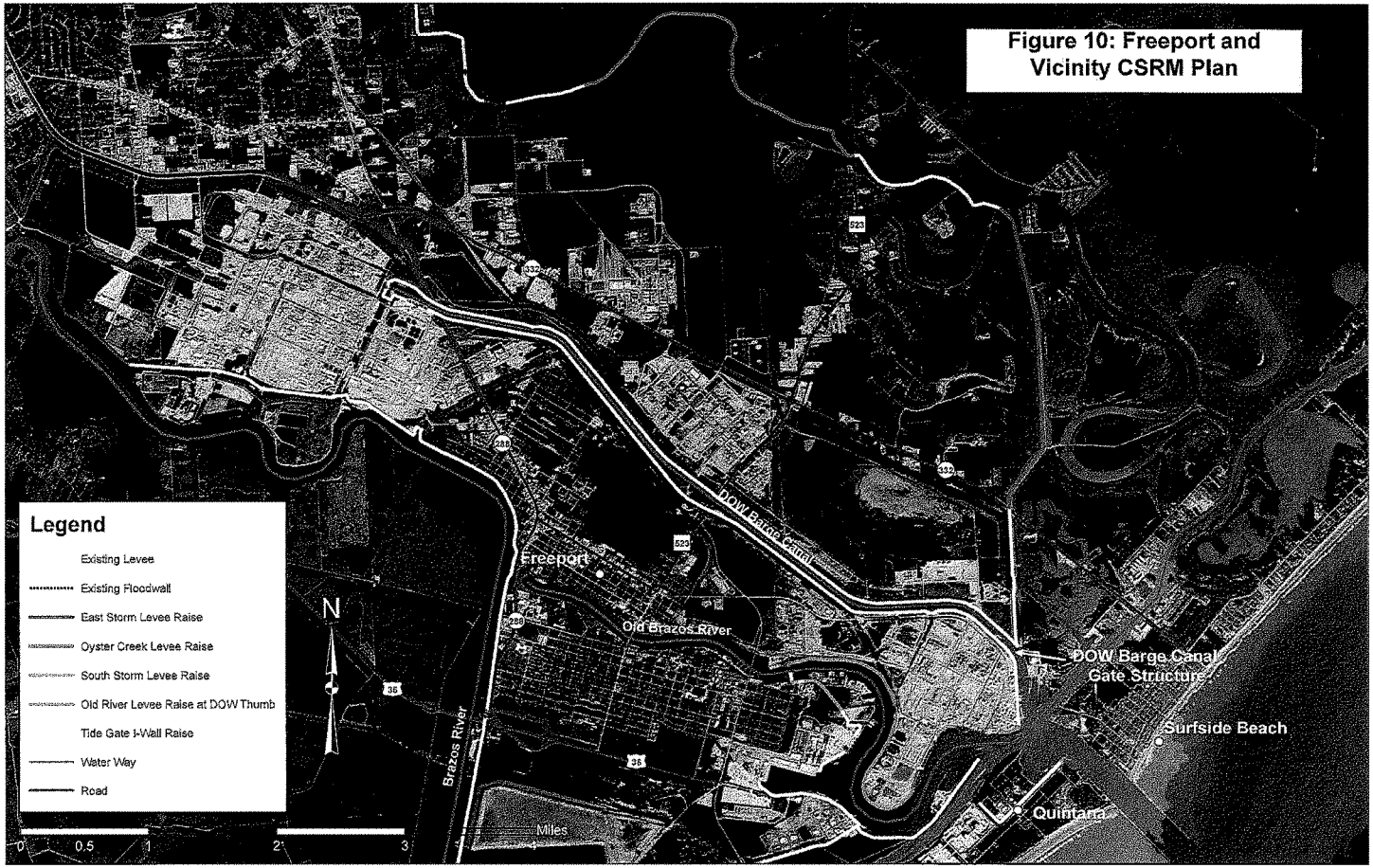


Figure 10: Freeport and Vicinity CSRM Plan
Legend
Existing Levee
Existing Floodwall
East Storm Levee Raise
Oyster Creek Levee Raise
South Storm Levee Raise
Old River Levee Raise at DOW Thumb
Tide Gate I-Wall Raise
Water Way
Road
N
0
0.5
1
2
3
Miles
Freeport
Old Brazos River
DOW Barge Canal
DOW Barge Canal Gate Structure
Surfside Beach
Quintana
Brazos River
288
523
332
36

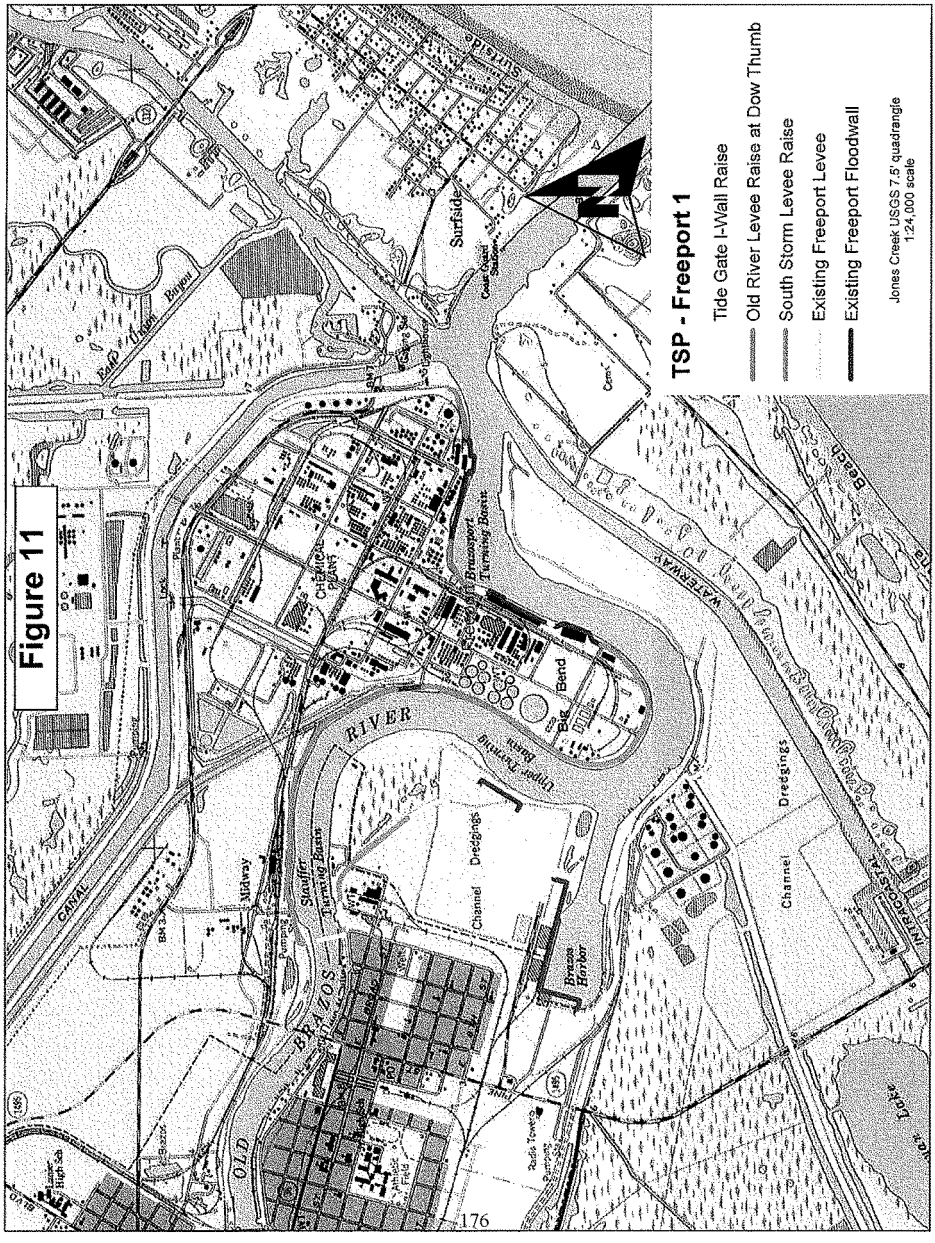


Figure 11
TSP - Freeport 1
Tide Gate I-Wall Raise
Old River Levee Raise at Dow Thumb
South Storm Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Jones Creek USGS 7.5' quadrangle
1:24,000 scale
Surfside
Surfside Coast Guard Station
Bastrop Bayou
Old Brazos River
Brazos River Diversion Channel
Brazos River Floodgates
Gulf Intracoastal Waterway
Freeport Harbor Channel
Freeport Harbor Turning Basin
Big Bend
Upper Turning Basin
Dredgings
Channel
Stauffer Turning Basin
Midway
Pumping Station
Chemical Plant
Yaklich Field
Radio Towers
Freeport High School
Canal
Beach
Jetty
Brazos River
Old Brazos River
Gulf Intracoastal Waterway
176

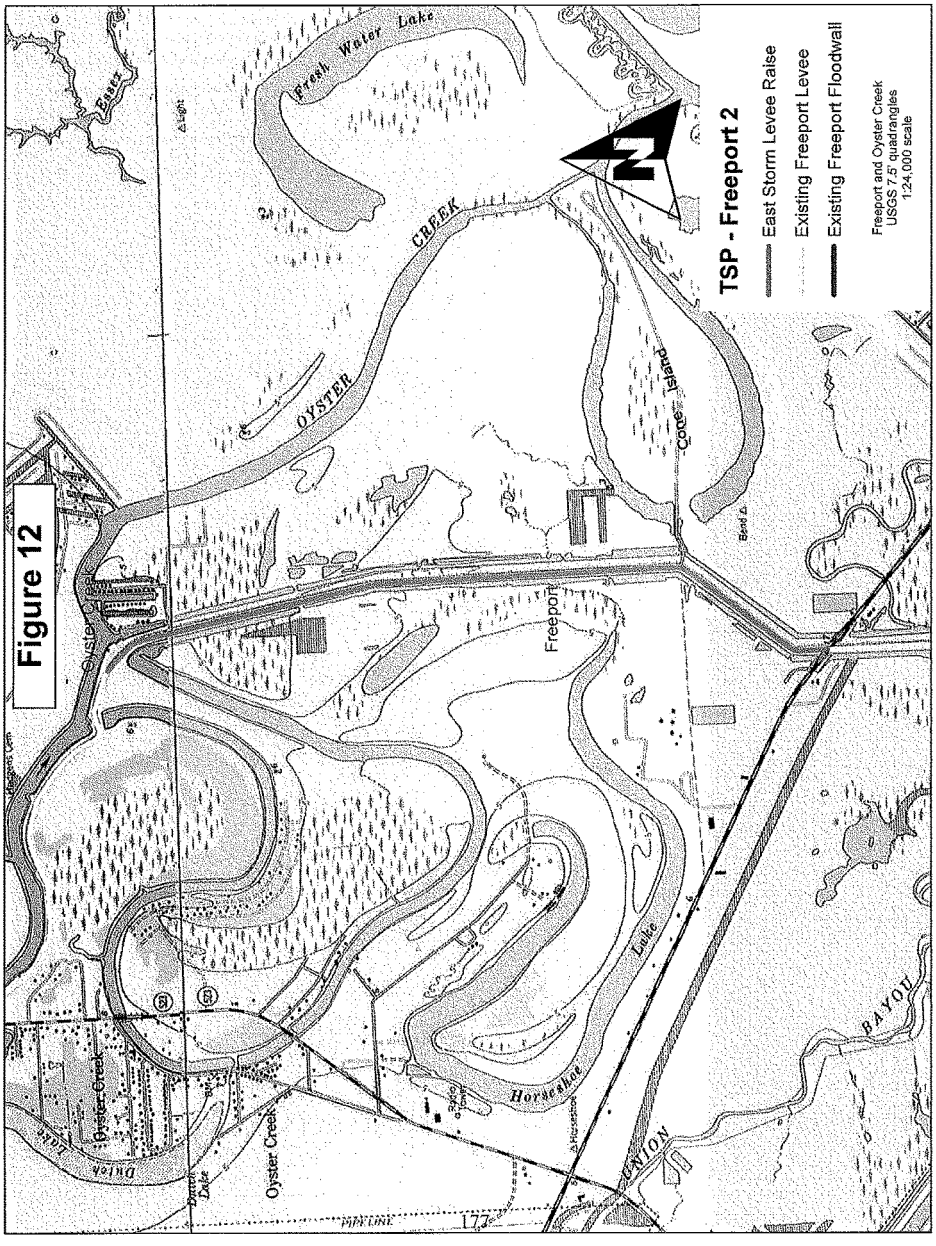


Figure 12
TSP - Freeport 2
East Storm Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Freeport and Oyster Creek
USGS 7.5' quadrangles
1:24,000 scale
Fresh Water Lake
OYSTER
CREEK
Freeport
Oyster Creek
Horseshoe
Lake
BAYOU
Dutch
Lake
Dutch Lake
Oyster Creek
Bird I.
Quintana
Island
Base Line
Light
Entrance
Jetty
Jetty
Houston
MAYTIME
177
JUNCTION

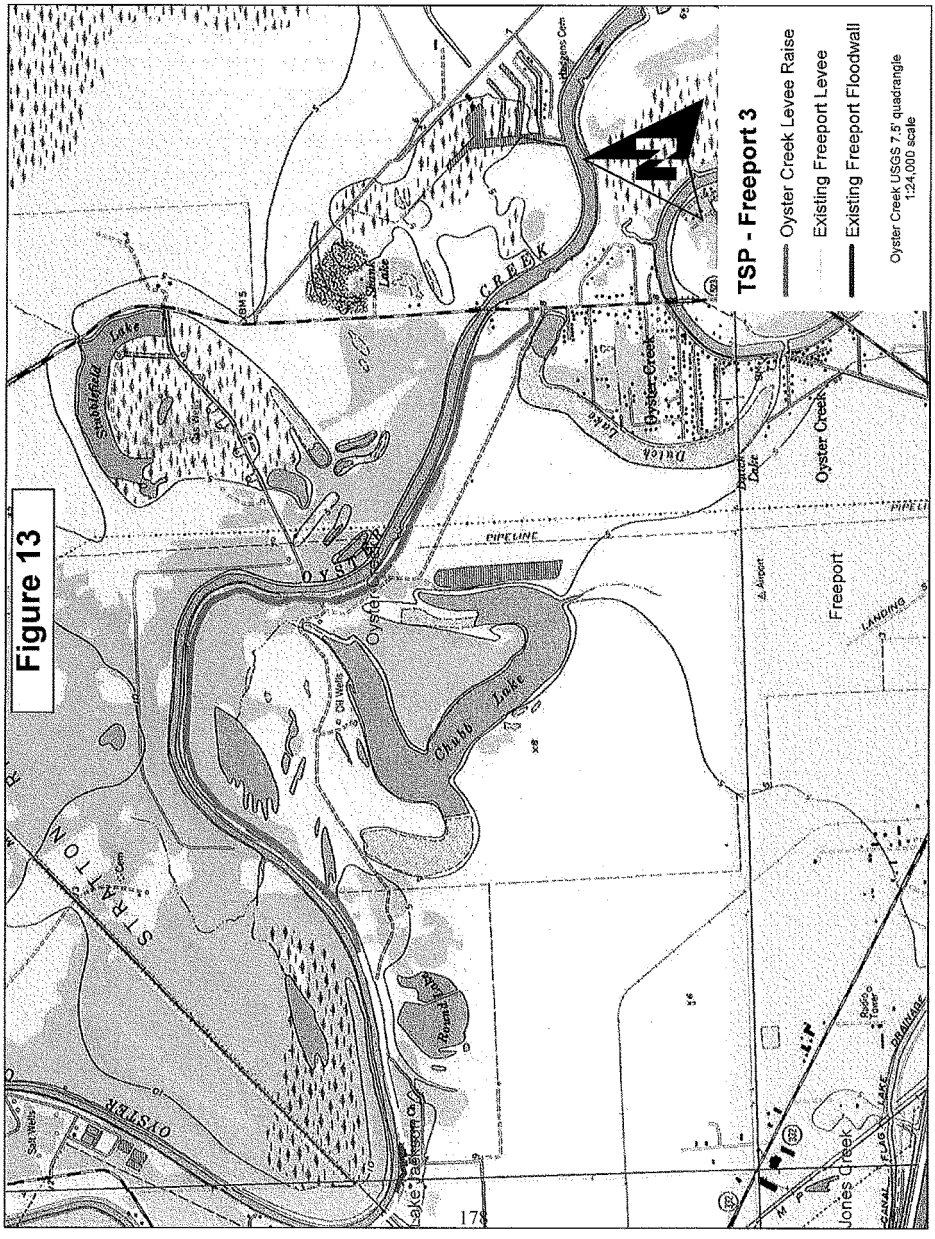


Figure 13
TSP - Freeport 3
Oyster Creek Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Oyster Creek USGS 7.5' quadrangle
1:24,000 scale
N
Oyster Creek
Freeport
Jones Creek
Clute
Lake Jackson
Oyster Lake
Duck Lake
Dutch Lake
Smith Lake
Brazoria
PIPELINE
OYSTER
STRATTON
DRAINAGE
CANAL
Salt Wells
Oil Wells
Airport
LANDING
178

Identical DIFR-EIS Coordination Letters Also Sent To:

Mr. Jimmy Arterberry
Tribal Historic Preservation Officer
Comanche Nation of Oklahoma
P.O. Box 908
Lawton, OK 73502

Dr. Linda Langley
Tribal Historic Preservation Officer
Coushatta Tribe of Louisiana
Administrative Building
1940 C.C. Bel Road
Elton, Louisiana 70532

Ms. Amie Tah-Bone
Historic Preservation Office
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, OK 73015

Holly Houghton
Tribal Historic Preservation Officer
Mescalero Apache Tribe
P.O. Box 227
Mescalero, NM 88340

President Don L. Patterson
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa, OK 74653

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix H

CLEAN WATER ACT SECTION 404(b)(1) EVALUATION

May 2017

EVALUATION OF SECTION 404(b)(1) GUIDELINES (SHORT FORM)

PROPOSED PROJECT: Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration Final Integrated Feasibility Report and Environmental Impact Statement (covering 3 separate project elements: Orange 3 CSRM Recommended Plan, Port Arthur and Vicinity CSRM TSP Recommended Plan, and Freeport and Vicinity CSRM Recommended Plan)

	Yes	No*
1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:		
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	X	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	X	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	X	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, an economic values (if no, see values, Section 2)	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	X	

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		X	
2) Suspended particulates/turbidity impacts		X	
3) Water column impacts		X	
4) Alteration of current patterns and water circulation		X	
5) Alteration of normal water fluctuation/hydroperiod		X	
6) Alteration of salinity gradients		X	
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat		X	

2) Effect on the aquatic food web		X	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		X	
	Not Applicable	**Not Significant**	**Significant***
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges No wetland or other special aquatic site impacts are anticipated in conjunction with the Port Arthur and Vicinity or Freeport and Vicinity CSRM Plans. Wetland impacts of the Orange 3 CSRM plan were avoided and minimized to the greatest extent practicable by modifying the new levee system's alignment location. Remaining unavoidable impacts of the Orange 3 CSRM plan to "Sanctuaries and Refuges" would occur to approximately 45.0 acres as shown in the FIFR-EIS. Approximately 28.8 acres would be directly impacted by construction within the right-of-way, while approximately 16.2 acres are remnants that would be not affected by construction, but cut-off from the rest of TPWD property in the area. In the Tony Houseman Wildlife Management Area (WMA), approximately 1.4 acres of the right-of-way impacts are forested wetlands and adjacent waters. In the Lower Neches WMA, approximately 18.9 acres of the right-of-way are wetlands, with the majority of impacts occurring to coastal marsh. The TPWD wetland impacts have been evaluated and quantified with the Wetland Value Assessment model along with all wetland impacts of the Orange 3 CSRM plan. The plan would not impact any TPWD structures. All impacts are fully compensated by the overall mitigation plan described for the Orange 3 CSRM plan. TPWD has accepted the feasibility-level impact and mitigation analysis, but wants coordination to continue into the PED phase when further hydraulics and hydrology analysis would be conducted. Final approval or concurrence by TPWD cannot occur until requirements of Chapter 26 of the Parks and Wildlife Code are met, and that would occur after the project is authorized. At this time, no obstacles to this approval have been identified.			X

2) Wetlands No wetland or other special aquatic site impacts are anticipated in conjunction with the Port Arthur and Vicinity or Freeport and Vicinity CSRM Plans. Direct wetland impacts to approximately 160.2 acres, would result from construction of the Orange 3 CSRM plan. Indirect impacts on about 2,249.5 acres would be associated with functional impacts to fisheries access and sediment, nutrient and organic matter exchange in the extensive marshes in the lower Cow and Adams Bayous floodplains. These indirect impacts also include limited indirect hydrologic impacts from construction of the levee and surge gates in a few locations. Ecological modeling of impacts of the Orange 3 CSRM plan has determined that about 143 average annual habitat units (AAHUs) would be lost due to direct and indirect impacts to fresh, intermediate and brackish marsh, and about 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests, over the 50-year period of analysis (see FIFR-EIS Appendix O). A mitigation plan has been proposed that would provide a total of about 263 AAHUs to fully compensate for the total loss of 186 AAHUs by restoring coastal marsh and preserving forested wetlands in perpetuity.			X
3) Mud flats	X		
4) Vegetated shallows	X		
5) Coral reefs	X		
6) Riffle and pool complexes	X		
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies	X		
2) Recreational and Commercial fisheries impacts	X		
3) Effects on water-related recreation	X		
4) Aesthetic impacts		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves	X		

	Yes
3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	X
2) Hydrography in relation to known or anticipated sources of contaminants	X
3) Results from previous testing of the material or similar material in the vicinity of the project	X
4) Known, significant sources of persistent pesticides from land runoff or percolation	
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	X

6) Other public records of significant introduction of contaminants from industries, municipalities or other sources	X
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	

List appropriate references:

1) USACE. 2008. Final Environmental Assessment – Restoration of the Mouth of the San Bernard River to the Gulf of Mexico, Brazoria County, Texas. Galveston District, Galveston, Texas.

2) USACE. 2011. Final Environmental Impact Statement for Sabine-Neches Waterway Channel Improvement Project, Southeast Texas and Southwest Louisiana. Galveston District, Galveston, Texas.

3) USACE. 2012. Final Environmental Impact Statement for Freeport Harbor Channel Improvement Project, Brazoria County, Texas. Galveston District, Galveston, Texas.

4) USACE. 2015. Appendix N, Hazardous, Toxic and Radioactive Waste Assessment for Sabine Pass to Galveston Bay Integrated Feasibility Report and EIS.

5) SOL Engineering Services, LLC. 2012. Letter Report of Results of Sediment and Elutriate Testing and Analysis for Maintenance Dredging of the Sabine-Neches Waterway.

	Yes	No
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	X	

	Yes
4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	N/A
1) Depth of water at placement site	
2) Current velocity, direction, and variability at placement site	
3) Degree of turbulence	
4) Water column stratification	
5) Discharge vessel speed and direction	
6) Rate of discharge	
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	
8) Number of discharges per unit of time	

9) Other factors affecting rates and patterns of mixing (specify)	

List appropriate references:

	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	N/A	

	Yes	No
5. Actions to Minimize Adverse Effects (Subpart H)		
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken:

1) Silt curtains will be utilized to prevent inadvertent discharge of fill material into adjacent wetlands or waterbodies. Forestry BMPs will be utilized to prevent disturbance of forest floors.

	Yes	No*
6. Factual Determination (230.11)		
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a. 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility	
a. This evaluation was prepared by:	**Janelle Stokes**
Position:	**Regional Technical Specialist, Unit A, CESWF-PEC-CC**

8. Findings	Yes

a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions:	

List of conditions:

c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s):	
1) There is a less damaging practicable alternative	
2) The proposed discharge will result in significant degradation of the aquatic ecosystem	
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

1 November 2016	BURKS-COPES.KELLY.A.1231450927 Digitally signed by BURKS-COPES.KELLY.A.1231450927 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=BURKS-COPES.KELLY.A.1231450927 Date: 2016.11.01 10:27:33 -05'00'
Date	KELLY BURKS-COPES Chief, Coastal Section, CESWF-PEC-CC

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this "short form" procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form" evaluation process is inappropriate.

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

November 17, 2016

Ms. Kelly Burkes-Copes
Galveston District
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Attention: Ms. Janelle Stokes

Re: Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration

Dear Ms. Burkes-Copes:

This letter is in response to your letter dated November 1, 2016, requesting state water quality certification for the US Army Corps of Engineers (Corps), Galveston District and the Texas General Land Office (GLO) proposed Sabine Pass to Galveston Bay, Texas, Ecosystem Restoration (ER) and Coastal Storm Risk Management (CSRM) project. The Recommended Plan proposes to reduce risks of tropical storm surge impacts by constructing a new CSRM system in Orange County, and increase the level of risk reduction and resiliency of the existing Port Arthur and Vicinity and Freeport and Vicinity Hurricane Flood Protection (HFP) systems in Jefferson and Brazoria Counties, Texas, respectively.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the Draft Integrated Feasibility Report and Environmental Impact Statement (Draft IFR-EIS) for the Sabine Pass to Galveston Bay CSRM and ER dated September 2015, the Corps' response to TCEQ comments in a letter dated August 5, 2016, Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS, and related information along with your letter. Although the TCEQ does not typically make a water quality certification decision for an EIS prior to review of the Final IFR-EIS and the Record of Decision (ROD), TCEQ has has determined it appropriate to make a decision in this case based on the available information, including the documents noted above. On behalf of the Executive Director and based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards. General information regarding this water quality certification, including standard provisions of the certification, is included as an attachment to this letter.

The Orange 3 CSRM Recommended Plan would consist of a 27-mile long levee and floodwall system along the edge of the Sabine and Neches River floodplains from the City of Orange to the vicinity of Orangefield, Texas. Ecological modeling of impacts of the final

Orange 3 CSRM Plan determined that 143 average annual habitat units (AAHUs) would be lost due to direct and indirect impacts to fresh, intermediate, and brackish marsh, and 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests. The Port Arthur and Freeport CSRM Recommended Plans would raise existing levees, construct and reconstruct floodwalls, replace vehicular closure structures and increase resiliency by installing erosion protection. The Port Arthur and Freeport Plans would result in only negligible impacts.

The proposed mitigation plan would provide a total of 263 AAHUs to compensate for the total loss 186 AAHUs by restoring coastal marsh and preserving forested wetlands in perpetuity.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact Mr. C. Brad Caston, Water Quality Assessment Section, Water Quality Division (MC-150), at (512) 239-4711 or by email at Charles.Caston@tceq.texas.gov.

Sincerely,

David W. Galindo, Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/CBC/tc

Attachment

cc: Mr. Ray Newby, Texas General Land Office, P. O. Box 12873, Austin, Texas 78711-2873

Ms. Kelly Burkes-Copes
U.S. Army Corps of Engineers
Sabine Pass to Galveston Bay, Texas CSRM
Attachment - Dredge and Fill Certification
Page 1 of 3
November 17, 2016

WORK DESCRIPTION: As described in Draft Integrated Feasibility Report and Environmental Impact Statement (Draft IFR-EIS) for the Sabine Pass to Galveston Bay Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) dated September 2015 and Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS.

SPECIAL CONDITIONS: None

GENERAL: This certification, issued pursuant to the requirements of Title 30, Texas Administrative Code, Chapter 279, is restricted to the work described in Draft IFR-EIS for the Sabine Pass to Galveston Bay CSRM and ER dated September 2015 and Appendices O and P dated September 2016 of the forthcoming Final IFR-EIS. This certification may be extended to any minor revision of the project when such change(s) would not result in an impact on water quality. The Texas Commission on Environmental Quality (TCEQ) reserves the right to require full joint public notice on a request for minor revision.

STANDARD PROVISIONS: These following provisions attach to any permit issued by the COE and shall be followed by the permittee or any employee, agent, contractor, or subcontractor of the permittee during any phase of work authorized by a COE permit.

1. The water quality of wetlands shall be maintained in accordance with all applicable provisions of the Texas Surface Water Quality Standards including the General, Narrative, and Numerical Criteria.

2. The applicant shall not engage in any activity which will cause surface waters to be toxic to man, aquatic life, or terrestrial life.

3. Permittee shall employ measures to control spills of fuels, lubricants, or any other materials to prevent them from entering a watercourse. All spills shall be promptly reported to the TCEQ by calling the State of Texas Environmental Hotline at 1-800-832-8224.

4. Sanitary wastes shall be retained for disposal in some legal manner. Marinas and similar operations which harbor boats equipped with marine sanitation devices shall provide state/federal permitted treatment facilities or pump out facilities for ultimate transfer to a permitted treatment facility. Additionally, marinas shall display signs in appropriate locations advising boat owners that the discharge of sewage from a marine sanitation device to waters in the state is a violation of state and federal law.

5. Materials resulting from the destruction of existing structures shall be removed from the water or areas adjacent to the water and disposed of in some legal manner.

6. A discharge shall not cause substantial and persistent changes from ambient conditions of turbidity or color. The use of silt screens or other appropriate methods is encouraged to confine suspended particulates.

7. The placement of any material in a watercourse or wetlands shall be avoided and placed there only with the approval of the Corps when no other reasonable alternative is available. If work within a wetland is unavoidable, gouging or rutting of the substrate is prohibited. Heavy equipment shall be placed on mats to protect the substrate from gouging and rutting if necessary.

8. Dredged Material Placement: Dredged sediments shall be placed in such a manner as to prevent any sediment runoff onto any adjacent property not owned by the applicant. Liquid runoff from the disposal area shall be retained on-site or shall be filtered and returned to the watercourse from which the dredged materials were removed. Except for material placement authorized by this permit, sediments from the project shall be placed in such a manner as to prevent any sediment runoff into waters in the state, including wetlands.

9. If contaminated spoil that was not anticipated or provided for in the permit application is encountered during dredging, dredging operations shall be immediately terminated and the TCEQ shall be contacted by calling the State of Texas Environmental Hotline at 1-800-832-8224. Dredging activities shall not be resumed until authorized by the Commission.

10. Contaminated water, soil, or any other material shall not be allowed to enter a watercourse. Noncontaminated storm water from impervious surfaces shall be controlled to prevent the washing of debris into the waterway.

11. Storm water runoff from construction activities that result in a disturbance of one or more acres, or are a part of a common plan of development that will result in the disturbance of one or more acres, must be controlled and authorized under Texas Pollutant Discharge Elimination System (TPDES) general permit TXR150000. A copy of the general permit, application (notice of intent), and additional information is available at:
http://www.tceq.texas.gov/permitting/stormwater/wq_construction.html or by contacting the TCEQ Storm Water & Pretreatment Team at (512) 239-4671.

12. Upon completion of earthwork operations, all temporary fills shall be removed from the watercourse/wetland, and areas disturbed during construction shall be seeded, riprapped, or given some other type of protection to minimize subsequent soil erosion. Any fill material shall be clean and of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters.

13. Disturbance to vegetation will be limited to only what is absolutely necessary. After construction, all disturbed areas will be revegetated to approximate the pre-disturbance native plant assemblage.

14. Where the control of weeds, insects, and other undesirable species is deemed necessary by the permittee, control methods which are nontoxic to aquatic life or human health shall be employed when the activity is located in or in close proximity to water, including wetlands.

15. Concentrations of taste and odor producing substances shall not interfere with the production of potable water by reasonable water treatment methods, impart unpalatable flavor to food fish including shellfish, result in offensive odors arising from the water, or otherwise interfere with reasonable use of the water in the state.

16. Surface water shall be essentially free of floating debris and suspended solids that are conducive to producing adverse responses in aquatic organisms, putrescible sludge deposits, or sediment layers which adversely affect benthic biota or any lawful uses.

17. Surface waters shall be essentially free of settleable solids conducive to changes in flow characteristics of stream channels or the untimely filling of reservoirs, lakes, and bays.

18. The work of the applicant shall be conducted such that surface waters are maintained in an aesthetically attractive condition and foaming or frothing of a persistent nature is avoided. Surface waters shall be maintained so that oil, grease, or related residue will not produce a visible film of oil or globules of grease on the surface or coat the banks or bottoms of the watercourse.

19. This certification shall not be deemed as fulfilling the applicant's/permittee's responsibility to obtain additional authorization/approval from other local, state, or federal regulatory agencies having special/specific authority to preserve and/or protect resources within the area where the work will occur.

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

APPENDIX I

CLEAN AIR ACT EMISSIONS MODELING

May 2017

APPENDIX I

AIR QUALITY ASSESSMENT AND IMPACTS DURING CONSTRUCTION

for the

Final Integrated Feasibility Report/Environmental Impact Statement
for
Sabine Pass to Galveston Bay, Texas
Coastal Storm Damage Risk Management Study

Prepared by:

Gulf South Research Corporation
8081 Innovation Park Drive
Baton Rouge, Louisiana 70820

August 2015

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1 BACKGROUND

The Tentatively Selected Plan (TSP) for the Sabine Pass to Galveston Bay (S2G) Draft Integrated Feasibility Report (DIFR-EIS) consists of three separable elements in two regions of the upper Texas Gulf Coast. The Orange-Jefferson Coastal Storm Risk Management (CSRM) Plan and the Port Arthur CSRM plan are located in the Sabine Region (Orange and Jefferson counties) (Figures 1 and 2); the Freeport CSRM Plan is located in the Houston-Galveston-Brazoria (HGB) Region (Brazoria County) (Figure 3). The Orange-Jefferson CSRM Plan involves the construction of a new levee/floodwall system, while the Port Arthur and Freeport CSRM plans would reconstruct portions of existing Hurricane Flood Protection systems. The Orange-Jefferson CSRM Plan is made up of three parts – Orange Reach 3 in Orange County, and the Jefferson Main Reach and Beaumont Reach A in Jefferson County. The Orange-Jefferson and Port Arthur CSMR plans fall within a common air quality region, or airshed, while the Freeport CSRM Plan falls in a separate airshed. The potential projects, along with their estimated start dates, durations, and airshed are provided in Table 1-1.

Table 1-1. S2G CSRM Alternatives

Alternatives	Start Year	Duration (years)	County	Airshed
Orange	2020	8	Orange	Sabine
Jefferson	2028	2	Jefferson	Sabine
Beaumont	2023	1	Jefferson	Sabine
Port Arthur	2024	4	Jefferson	Sabine
Freeport	2020	3	Brazoria	HGB

The air emission impacts assessed in this report are based on preliminary estimates and schedules for evaluated alternatives in accordance with USACE SMART Planning guidelines. The impact assessments utilized conservatively-high duration and quantity estimates to ensure that all potential impacts are identified and disclosed for review. Furthermore, the alternatives include all potential damage reaches, while the actual TSP recommends only the reaches listed above.

The purpose of this assessment is to evaluate impacts on ambient air quality from the Proposed Action. Air quality impacts from the Proposed Action would be significant if emissions would:

1) increase ambient air pollution concentrations above the National Ambient Air Quality Standards (NAAQS),
2) contribute to an existing violation of the NAAQS,
3) interfere with or delay timely attainment of the NAAQS,

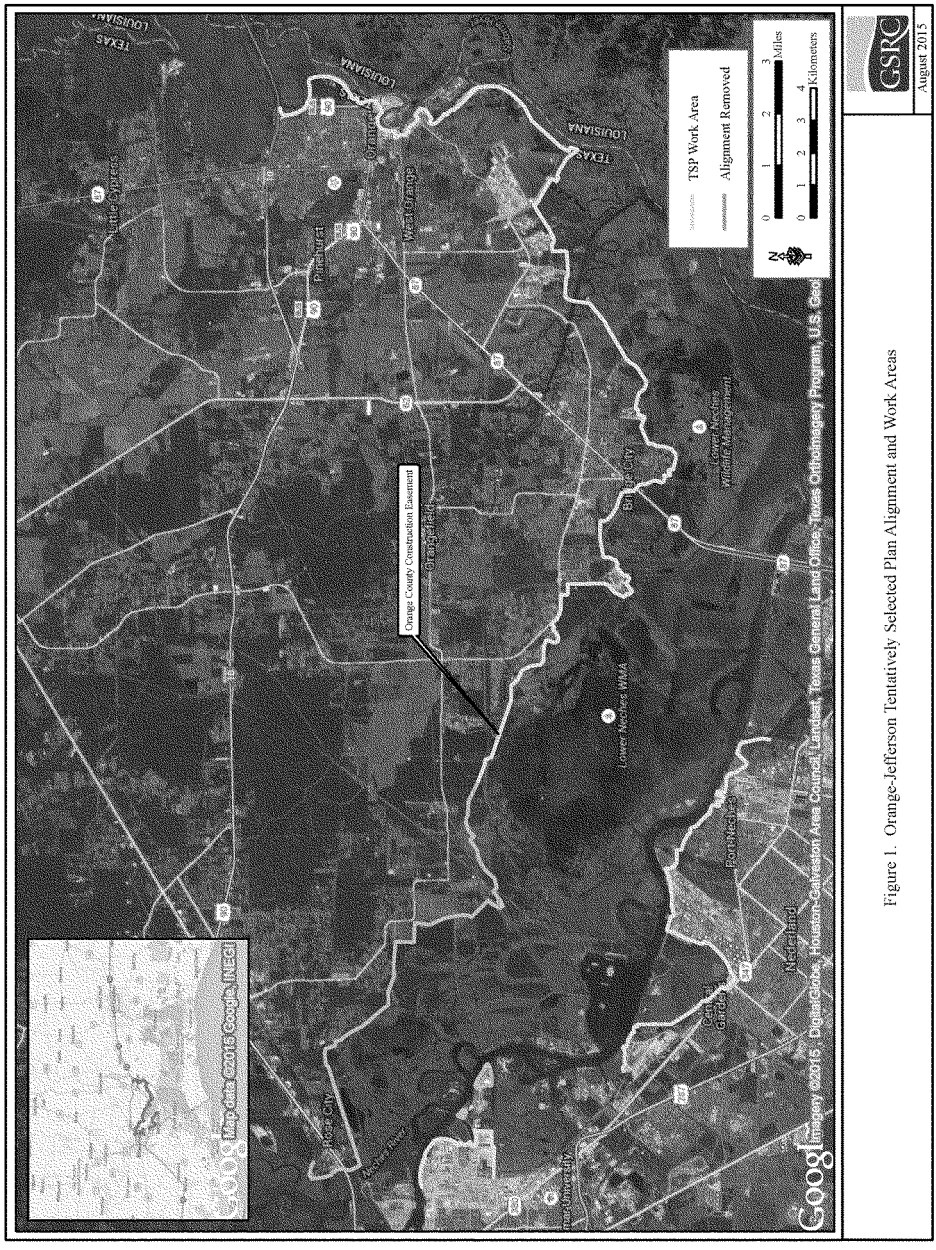


Figure 1. Orange-Jefferson Tentatively Selected Plan Alignment and Work Areas

Figure 2. Port Arthur Tentatively Selected Plan Alignment and Work Areas

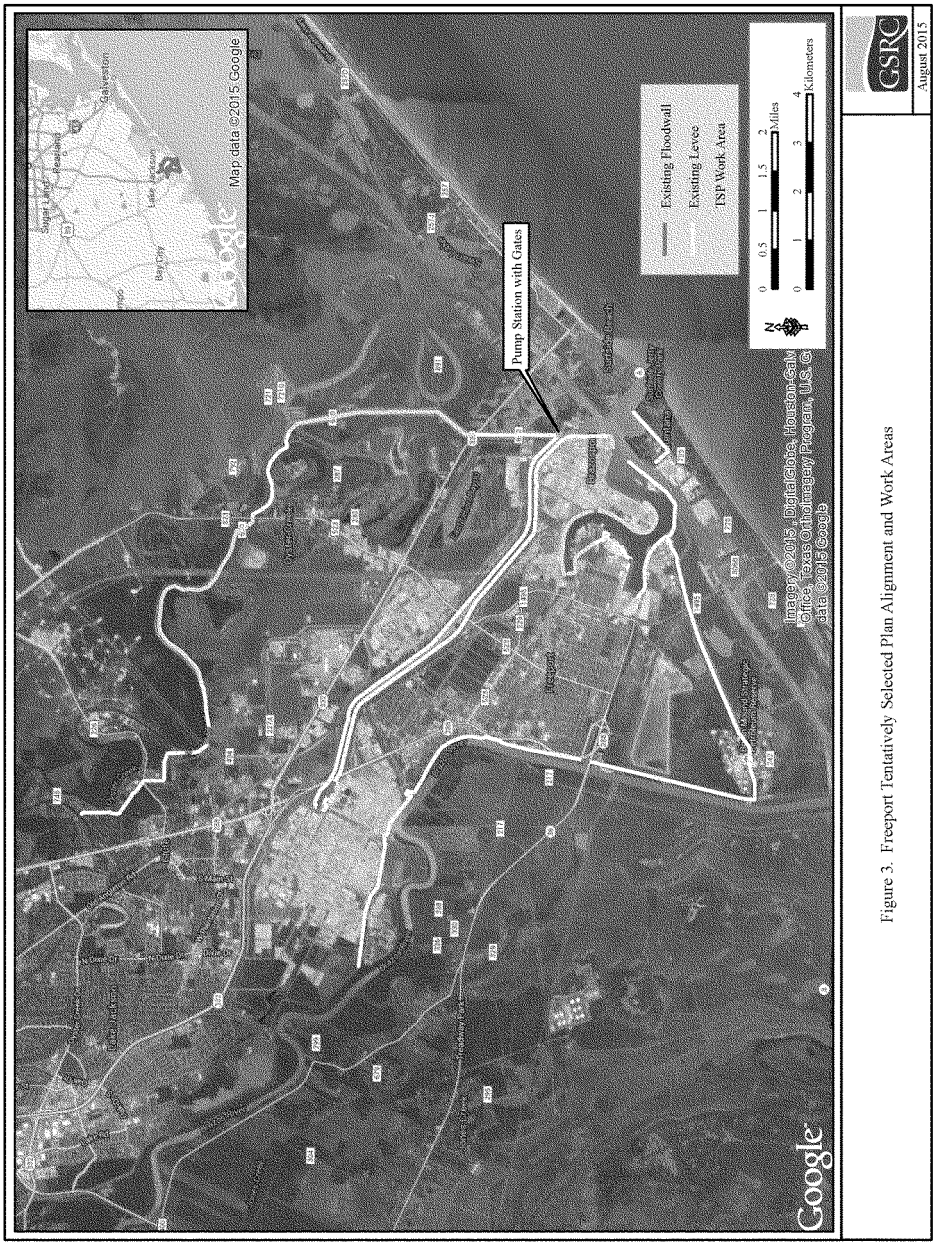


Figure 3. Freeport Tentatively Selected Plan Alignment and Work Areas

4) impair visibility within Federally mandated Prevention of Significant Deterioration (PSD) Class I areas,
5) result in the potential for any new stationary source to be considered a major source of emissions as defined in 40 Code of Federal Regulations (CFR) Part 52.21 (total emissions of any pollutant subject to regulation under the Clean Air Act (CAA) that are greater than 250 tons per year for attainment areas),
6) for mobile source emissions, the increase in emissions to exceed 250 tons per year for any pollutant, or
7) for greenhouse gases (GHG) emissions, exceed 25,000 metric tons (27,557 U.S. tons) of direct carbon dioxide (CO_2)-equivalent emissions on an annual basis.

Brazoria County is currently designated as Severe Non-attainment for the 8-Hr Ozone (1997) standard and Marginal Non-attainment for the 8-Hr Ozone (2008) standard as part of the Houston-Galveston-Brazoria (HGB) airshed region as defined in the Texas State Implementation Plan (SIP), adopted in 1972 and revisions thereafter. In compliance with the Texas SIP, fuels testing and vehicle inspections for ozone emission components are required in the HGB airshed. The HGB region is in attainment for other criteria pollutants. According to the U.S. Environmental Protection Agency (USEPA) Region 6 (http://www.epa.gov/region6/6pd/air/pd-l/non.htm), the Beaumont-Port Arthur (Sabine) region has been re-designated as attainment with the 1997 8-hour Ozone NAAQS. Further, the Sabine region is designated as attainment for all other criteria pollutants.

2 AIR QUALITY IMPACTS FROM THE PROPOSED ACTION

Sources of air quality changes from the Proposed Action are expected to result from the following:

- Direct emissions from construction and demolition equipment (nonroad equipment), such as cranes, excavators, bulldozers, concrete pumps, saws, and generators; and
- Indirect emissions from commuting workers and delivery vehicles (on-road vehicles) such as cars, pickup trucks, flatbed trucks, dump trucks, and concrete trucks.

Air quality impacts are expected to be temporary and confined to the duration of the construction events. The S2G DIFR-EIS has determined that no additional induced development would result from implementation of the Proposed Action.

A list of equipment (including anticipated hours of usage) was provided by USACE Galveston for each of the alternatives. The USEPA software package Motor Vehicle Emissions Simulator 2014 (MOVES2014) was utilized to generate emission factors based on the types of construction equipment and vehicles anticipated. MOVES2014 is the USEPA's most current software, and supersedes previous versions of MOVES, as well as legacy USEPA software such NONROAD and MOBILE 6. The equipment list provided by USACE Galveston was divided into motor vehicles (on-road) and non-road vehicles and MOVES2014 equipment categories were assigned based on the type, fuel, and size of each piece of equipment. Since the non-road and on-road equipment lists, along with their proposed operations, are quite lengthy, they have not been included in this report; however, they are available upon request.

Key assumptions that were utilized in running the emissions simulations are presented below.

Assumptions for Calculating Emissions using MOVES2014:

1. USEPA's software model MOVES2014 was used to estimate non-road and on-road equipment emissions.
2. For trucks used on the construction site, it was assumed 15 miles per hour of use onsite.
3. For commuting workers, it was assumed 1.5 workers per piece of equipment, plus 200 additional commuter vehicles per day for the duration of the project. Commuter vehicles were assumed to be an even mix of gasoline-fired passenger vehicles and passenger trucks. Commuter vehicles were assumed to each have a roundtrip of 20 miles/day.
4. The model used 2020, August, weekday, 12:00 as the daily surrogate for worst-case emissions.

5. The model used Urban Unrestricted roads for running emissions.
6. National average was used for vehicle model year.
7. Construction was assumed to occur in currently-developed urban areas; therefore, emissions from fugitive dust and asphalt paving were assumed to be negligible and not quantified.
8. The equipment list provided by USACE Galveston was matched to equipment lists and horsepower ranges provided within MOVES2014. Where fuel type or power rating were not provided, best engineering judgement was used to select an appropriate category and rating.
9. Total usage (hours, miles) and emissions were spread out evenly over the entire duration of each project.

MOVES2014 was used to generate criteria pollutant emission rates based on the type of equipment. Non-road equipment emission rates were output in grams of pollutant per horsepower-hour of usage (g/hp-hr); on-road emission rates were output in pounds of pollutant per mile driven (lb/mile). The emission rates were combined and subtotaled for the various operating conditions within each equipment type (e.g., engine start, running exhaust, refueling loss) in order to develop equipment-specific emission factors for each criteria pollutant. The non-road and on-road emission factors are provided in Attachments D and E, respectively.

The emission factors were then combined with the activity (hp-hr or miles) to calculate the emissions estimates for each piece of equipment within each alternative area for each year. The detailed emissions estimates (lb/year) for non-road and on-road equipment are quite lengthy; the estimates are summarized in the tables below; detailed estimates are available upon request. Total emissions (tons/year) for each alternative in the Sabine airshed are provided in Table 2-1, and the total emissions for the alternative in the HGB airshed are provided in Table 2-2.

Table 2-1. Air Quality Impacts in the Sabine Airshed from the Proposed Action

Year	Alternatives	Airshed	Pollutant (tons/year)						
			CO	NOx	PM-10	PM-2.5	SO_2	VOC	Lead
2020	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2021	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2022	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2023	Beaumont	Sabine	30.6	37.4	2.9	2.8	0.1	9.0	0.0
2023	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2024	Port Arthur	Sabine	17.9	44.4	2.8	2.7	0.1	6.6	0.0
2024	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2025	Port Arthur	Sabine	17.9	44.4	2.8	2.7	0.1	6.6	0.0
2025	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2026	Port Arthur	Sabine	17.9	44.4	2.8	2.7	0.1	6.6	0.0

Table 2-1, continued

Year	Alternatives	Airshed	Pollutant (tons/year)						
			CO	NOx	PM-10	PM-2.5	SO_2	VOC	Lead
2026	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2027	Port Arthur	Sabine	17.9	44.4	2.8	2.7	0.1	6.6	0.0
2027	Orange	Sabine	21.0	25.7	2.1	2.0	0.1	5.8	0.0
2028	Jefferson	Sabine	16.9	26.3	1.8	1.8	0.1	4.9	0.0
2029	Jefferson	Sabine	16.9	26.3	1.8	1.8	0.1	4.9	0.0

CO=carbon monoxide, NOx=nitrous oxides, PM-10=particulate matter less than 10 microns, PM-2.5=particulate matter less than 2.5 microns, SO_2=Sulphur dioxide, VOC=volatile organic carbons

Table 2-2. Air Quality Impacts in the HGB Airshed from the Proposed Action

Year	Alternative	Airshed	Pollutant (tons/year)						
			CO	NOx	PM-10	PM-2.5	SO_2	VOC	Lead
2020	Freeport	HGB	12.2	3.0	0.5	0.4	0.0	2.3	0.0
2021	Freeport	HGB	12.1	3.0	0.5	0.4	0.0	2.3	0.0
2022	Freeport	HGB	12.1	3.0	0.5	0.4	0.0	2.3	0.0

CO=carbon monoxide, NOx=nitrous oxides, PM-10=particulate matter less than 10 microns, PM-2.5=particulate matter less than 2.5 microns, SO_2=Sulphur dioxide, VOC=volatile organic carbons

2.1 SIGNIFICANCE OF AIR QUALITY IMPACTS FROM THE PROPOSED ACTION

Per 40 CFR Part 93, Chapter 153, a conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates. The General Conformity thresholds are provided in Table 2-3.

Table 2-3. General Conformity Rule *de minimis* Thresholds for NAAQS Nonattainment Areas

General Conformity de minimis Levels		
Pollutant	**Area Type**	**Tons/Year**
Ozone (VOC or NOx)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NOx)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100

General Conformity de minimis Levels		
Pollutant	**Area Type**	**Tons/Year**
	Moderate nonattainment and maintenance	100
PM2.5: Direct emissions, SO2, NOx (unless determined not to be a significant precursor), VOC or ammonia (if determined to be significant precursors)	All nonattainment & maintenance	100
Lead (Pb)	All nonattainment & maintenance	25
40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas.		

The Sabine airshed is classified as attainment for all NAAQS pollutants and, therefore, the General Conformity Rule does not apply. The single greatest increase of any criteria pollutant from all projects within the Sabine airshed is 70.1 tons/year of NOx (2024 – 2027). Since the General Conformity Rule *de minimis* thresholds do not apply and the total emissions from all activities are demonstrated to be below the significance thresholds identified above, the Proposed Action would not have significant impacts on ambient air quality within the Sabine airshed.

The HGB airshed is classified as Marginal Non-attainment for the 2008 ozone NAAQS, and Severe Non-attainment for the 1997 ozone NAAQS. Therefore, the General Conformity Rule applies to the precursors of ozone (NOx and VOC) resulting from the Proposed Action. The *de minimis* thresholds are 25 tons/year for NOx and VOC. Emissions of NOx and VOC are estimated to increase by 3.0 tons/year and 2.3 tons/year, respectively, for years 2020 and 2021; therefore, the *de minimis* thresholds are not exceeded and a conformity determination is not required. Emissions from the other criteria pollutants are demonstrated to be below the significance thresholds identified above. Because the Proposed Action levels fall below the *de minimis* thresholds for non-attainment pollutants and are below significance levels for attainment pollutants, the Proposed Action would not have significant impacts on ambient air quality within the HGB airshed.

2.2 GREENHOUSE GAS IMPACTS

Air emissions from the operation of internal combustion engines that produce exhaust result in Greenhouse Gases (GHG) emissions that could contribute to global climate change. The Council on Environmental Quality (CEQ) published Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change on National Environmental Policy Act Reviews, August 1, 2016 (CEQ 2016). The guidance recommends that Federal agencies use projected GHG emissions associated with proposed actions as a proxy for assessing potential effects on climate change. GHG emissions per year should be considered in a qualitative and quantitative manner in NEPA reporting; however, there are no implementing regulations to direct development of these analyses for federal projects. .All emissions would come from individual mobile internal

combustion engines in on-road and non-road equipment, and it is likely that the total GHG emissions from mobile sources for the three elements of the Recommended Plan would exceed 25,000 metric tons per year of carbon dioxide (CO2)-equivalent (CO2e) per year.

Detailed GHG analysis was not performed in conjunction with this study with the exception of the NAAQS pollutants emitted by these mobile sources as indicated in Tables 2-1 and 2-2. However, the following estimate was developed based on comparison to a similar waterfront construction project. Temporary GHG emissions from construction and commuting vehicles are expected to vary between 4,500 and 14,000 tons of CO^2 and CO^2 equivalents per year in the Sabine airshed and approximately 3,200 tons of CO^2 and CO^2 equivalent per year in the Brazoria airshed. New pump stations included in the Proposed Action would will only be used intermittently and for short periods when the gates and culverts need to be closed during storm surges. It is therefore likely that annual discharges will be below the thresholds required for state permitting and reporting. However, SWG will coordinate with the Texas Commission on Environmental Quality when final PED designs have been developed to determine if state permits will be required for the new pump stations planned in conjunction with the Orange 3 Recommended Plan.

Emissions reduction practices for non-road and gasoline engines would be implemented that would contribute significantly to many pollutant loads, including GHGs. In recent years, EPA has set standards for engines used in most new construction equipment. However, because construction equipment can last 25-30 years, it will take many years before existing equipment is fully replaced by newer, cleaner-burning equipment. With this in mind, EPA developed the Clean Construction USA program to assist operators of heavy non-road, diesel-powered equipment to reduce emissions from older engines that are in operation today. Emission reduction methods include:

- Idle-reduction practices that save money, reduce emissions, add fuel savings, extend engine life, and provide a safer and better work environment for equipment operators;
- Switching to ultra-low-sulfur fuel, which in addition to reducing sulfur (non-GHG) emissions, improves engine efficiency by reducing wear, deposits, and oil degradation;
- Retrofitting equipment to reduce emissions; and
- Installing catalysts and filters verified by EPA to ensure emissions reduction and durability of retrofit technologies. Engine upgrade kits are also available and can be installed during routinely scheduled engine rebuilds.

Roughly one-third of the temporary annual GHG emission impacts are estimated to come from delivery vehicles and worker commuter vehicles. As an additional mitigation measure, construction contractors, the USACE would encourage alternate transportation means. The encouragement of alternative transportation methods, including carpooling, public transportation,

and use of local labor could potentially reduce these GHG emissions by as much as 40 percent. Incentives for these initiatives can include preferred parking for carpoolers.

With implementation of these reduction measures, total GHG emissions may reasonably be reduced by up to 25 percent over the lifespan of the projects, resulting in emission rates as low as between 3,375 and 10,500 tons of CO^2 and CO^2 equivalents per year in the Sabine airshed and approximately 2,400 tons of CO^2 and CO^2 equivalent per year in the Brazoria airshed.

3 REFERENCES

Council on Environmental Quality (CEQ) (2016). Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. August 1, 2016.

USEPA (2015a). National Ambient Air Quality Standards (NAAQS). Available online: www.epa.gov/air/criteria.html

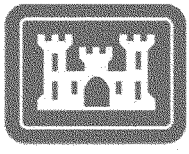
USEPA (2015b). Welcome to the Green Book Nonattainment Areas for Criteria Pollutants. Available online: www.epa.gov/oar/oaqps/greenbk

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix J

BIOLOGICAL ASSESSMENT
FOR ENDANGERED SPECIES ACT COORDINATION

May 2017



US Army Corps
of Engineers ®
Galveston District

BIOLOGICAL ASSESSMENT FOR FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES

SABINE PASS TO GALVESTON BAY, TEXAS
COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESTORATION PROJECT
TENTATIVELY SELECTED PLAN (SABINE AND FREEPORT REGIONS)
ORANGE, JEFFERSON AND BRAZORIA COUNTIES, TEXAS

PREPARED BY U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TEXAS 77550

September 2015

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LIST OF ATTACHMENTS

Attachment A: USFWS and NMFS species lists

List of Acronyms

Biological Assessment (BA)
Coastal Storm Risk Management (CSRM)
Distinct Population Segment (DPS)
Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS)
Ecosystem Restoration (ER)
Essential Fish Habitat (EFH)
Endangered Species Act (ESA)
National Marine Fisheries Service (NMFS)
National Wildlife Refuge (NWR)
Padre Island National Seashore (PINS)
Relative sea-level rise (RSLR)
Submerged aquatic vegetation (SAV)
Tentatively Selected Plan (TSP)
Texas General Land Office (GLO)
United States (U.S.)
United States Army Corps of Engineers (USACE)
United States Fish and Wildlife Service (USFWS)
Wildlife Management Area (WMA)

1 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

This Biological Assessment (BA) is being prepared for the purpose of fulfilling the U.S. Army Corps of Engineers (USACE) requirements as outlined under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended, and to assist the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) personnel in fulfilling their obligations under the ESA. The proposed Federal action (also referred to as the tentatively selected plan or TSP) consists of coastal storm risk management projects in Orange, Jefferson and Brazoria Counties, Texas. The proposed action was identified during the Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study, conducted by USACE and the non-Federal sponsor for the study, the Texas General Land Office. USACE and GLO are in the process of completing a Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) for the study. A Notice of Intent to prepare an EIS was published on November 24, 2014. The DIFR-EIS is currently scheduled to be released for public review in September, 2015. Further engineering refinement of the TSP will be conducted after comments are received on the DIFR-EIS. USACE Headquarters review will confirm the final recommended plan. If impacts of the final plan are greatly different from that presented in the DIFR-EIS, USACE will prepare a revised biological assessment and consult further with USFWS and the NMFS. Depending upon the scale and significance of the plan revisions, USACE may also prepare a revised DEIS. Currently, the Final IFR-EIS is scheduled for release in August 2016.

1.2 PROJECT SETTING

The Sabine Pass to Galveston Bay feasibility study is evaluating CSRM and ER problems in a six-county (Orange, Jefferson, Chambers, Harris, Galveston and Brazoria) study area along the upper Texas coast (Figure 1). The study area is located in the northwest Gulf of Mexico, which has a higher probability risk for occurrence of severe hurricanes and storm surge than other areas of the Gulf. Over five million people reside in these six counties, including the 4th largest U.S. city (Houston), and three other large metropolitan areas (Beaumont/Port Arthur/Orange, Galveston/Texas City and Freeport/Lake Jackson/Surfside). The population of these six counties is projected to increase to over nine million within the next 50 years. In addition to the potential population at risk, three of the world's nine largest oil refineries, 40 percent of the nation's petrochemical industry, 25 percent of the nation's petroleum-refining capacity, and three of the 10 largest U.S. seaports are also located in the study area. Waterborne commerce statistics data show that $232 billion in cargo transits the study area annually. The growing population, communities

and nationally significant industries are extremely vulnerable to risks from coastal storm events with approximately 2.26 million people in the study area living within a storm-surge inundation zone.

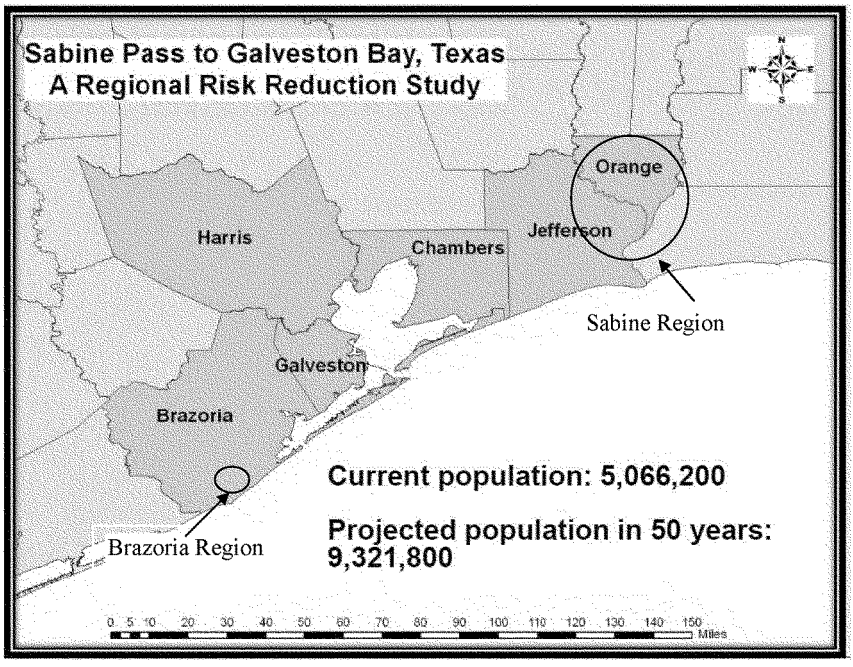


Figure 1: S2G Study and Project Areas Vicinity Map

The study area consists of three watershed-based regions: the Sabine, Galveston, and Brazoria Regions. The Sabine Region is focused on Orange and Northeast Jefferson Counties, including the three communities known as the Golden Triangle – Beaumont, Port Arthur, and Orange, Texas. The Galveston Region includes all of the Galveston Bay system, including the Gulf shoreline along Bolivar Peninsula and Galveston Island from High Island to San Luis Pass. The Brazoria Region includes the lower Brazos River Diversion and Old River Channels in the vicinity of Freeport, Texas.

In this assessment, the footprint of proposed CSRM projects and the areas affected by these systems will be referred to as the "project areas." This Biological Assessment evaluates two geographically separate project areas in detail – the Sabine Region and the Brazoria Region. The general extent of the two regions is circled on Figure 1. The DIFR-EIS has identified a Tentatively

Selected Plan (TSP) with three separate elements. The Orange-Jefferson CSRM Plan and the Port Arthur and Vicinity CSRM Plan are located in the Sabine Region, and the Freeport and Vicinity CSRM Plan is located in the Brazoria Region.

The DIFR-EIS will present a programmatic overview of coastal storm risk problems and opportunities in the entire six-county study area, but will fully evaluate only the three plans in the Sabine and Brazoria regions. A programmatic overview of coastal storm risk problems and opportunities in the Galveston Region (Chambers, Harris and Galveston Counties) will be presented in the DIFR-EIS. This overview will provide recommendations for future studies in the Galveston Region; no in-depth alternative analyses will be conducted and no recommendations for project construction will be made for this region. The study report will also present a programmatic overview of ER opportunities for the entire six-county study area. None of the ER proposals will be fully developed or recommended for construction in this report. This Biological Assessment does not evaluate potential impacts on listed species for recommended future studies in the Galveston Region or the programmatic overview of ER opportunities in the six-county study area. Assessments will be developed in the future for specific recommended projects covered by subsequent feasibility reports.

1.3 DESCRIPTION OF THE ECOLOGICAL REGION

1.3.1 General Overview

The study area lies within the Gulf Prairie and Marsh ecological region, which extends along the Texas Gulf Coast from the Sabine River south to the Rio Grande (Gould et al. 1960). The prominent features of this coastal ecosystem include tidal, micro-tidal, and freshwater coastal marshes; bays and lagoons which support extensive seagrass beds, tidal flats and reef complexes; barrier islands; tallgrass prairie with small depressional wetlands, and forest riparian corridors, oak mottes and coastal woodlots, and dense brush habitats. Wetland habitats provide important wintering and migration stopover habitat for migratory birds including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. A string of refuges and wildlife management areas (WMAs) along the coast serve as critical staging areas for waterfowl migrating to and from Mexico (TPWD, 2013; USFWS, 2013).

Natural forces, which shape the system, include dominant south to southeast winds, tropical weather systems, and a substantial rainfall of over 60 inches per year. Flooding and freshwater inflows are key systemic processes, which buffer salinity and provide nutrients and sediments to extensive estuaries in the Sabine and Galveston regions. In contrast to these regions, the Brazos River discharges directly into the Gulf of Mexico, and deltaic and barrier island processes have formed extensive coastal wetlands along the coast in Brazoria County. While highly impacted by

human activities, this ecosystem remains very productive for a wide variety of fish and wildlife.

The Sabine and greater Galveston Bay estuaries and extensive coastal wetlands in the Brazos delta region are a vital habitat for 75 percent of the fish and shellfish species found in the Gulf of Mexico. The marshes and rice prairies over the entire study area are a major wintering area for waterfowl of the central flyway. On average, 1.3 to 4.5 million ducks, or 30 to 71 percent of the total flyway population, winter annually on the Texas Gulf coast (Stutzenbaker and Weller 1989). This area also winters 90 percent of the snow, Canada, and greater white-fronted geese in the Central Flyway. On average, 180,000 pairs of colonial-nesting waterbirds nest annually in Texas coastal habitats. Near coastal forests are critically important for the nation's songbird resources as the vast majority utilize this habitat during their trans- and circum-Gulf migrations (USFWS 2008).

1.3.2 Biological Communities in the Project Areas

Coastal prairies

Remnant tracts of tall grass and salty prairies are present in the study area, often interspersed within coastal marshes. Slightly higher in elevation, the grass and prairie tracts offer a different type of habitat (USFWS 2008). Wooly rosemallow, bushy bluestem, and gulf cordgrass thrive here and provide important nesting habitat for mottled ducks, dickcissels, and other species. Black rails, short-eared owls, and LeConte's sparrow find shelter and feed within these prairie habitats. Almost all of the region's historic native coastal tall grass prairie and its associated prairie wetlands have been lost through conversion to agricultural uses and urban development (USFWS, 2008).

Coastal marshes

Salt marsh is located along the Gulf shoreline and higher salinity areas of the estuarine systems. Subjected to regular tidal inundation, low saline marsh is dominated by smooth cordgrass/oystergrass (*Spartina alterniflora*) and often accompanied by seashore saltgrass (*Distichlis spicata*), blackrush (*Juncus romerianus*), saline marsh aster (*Aster tenuifolius*), and marshhay cordgrass/wiregrass (*S. patens*). The dominant species in high salt marsh, which is subject to less-frequent tidal inundation, is glasswort (*Salicornia* spp.). Brackish marshes grade inland from salt marsh. The dominant species in low brackish marsh is saltmarsh bulrush (*Scirpus robustus*); seashore saltgrass and marshhay cordgrass are co-dominant species in high brackish marsh. Intermediate marshes are subjected to periodic pulses of salt water and maintain a year-round salinity in the range of 3 to 4 ppt. They grade inland from brackish marshes and dominate interior marshes of the Sabine and coastal Brazoria systems. The diversity and density of plant species are relatively high with marshhay cordgrass the most dominant species in high marsh. Co-dominant species in low marsh are seashore paspalum (*Paspalum vaginatum*), Olney bulrush (*S.*

americanus), California bulrush/giant bulrush (*S. californicus*), and common reedgrass/roseau cane (*Phragmites australis*); bulltongue (*Sagittari lancifolia*) and sand spikerush (*E. montevidensis*) are also frequent. Freshwater marshes dominate in upstream reaches of the Sabine and Brazos Rivers. They are heterogeneous, with local species composition governed by frequency and duration of flooding, topography, substrate, hydrology, and salinity. Co-dominant species in low marsh are maidencane (*P. hemitomen*), giant cutgrass (*Zizaniopsis milacea*), and bulltongue. Co-dominant species in high marsh are squarestem spikerush (*E. quadrangulata*) and marshhay cordgrass. Other characteristic species include American lotus (*Nelumbo lutea*), watershield (*Brasenia screben*), duckweed (*Lemna* spp.), and fanwort (*Cabomba caroliniana*). Salinity rarely increases above 2 ppt,, with a year-round average of approximately 0.5 to 1 ppt. Tidal fresh marshes support extremely high densities of wildlife, such as migratory waterfowl. Marsh serves as nursery areas for many important commercial and recreational fish and shellfish species including white and brown shrimp, blue crab, red drum, flounder, and speckled sea trout.

Coastal marsh habitats provide important functions of improving water quality in the estuarine ecosystem, providing flood control benefits, and buffering inland habitats from tropical storm-generated tidal surges. In addition, marshes are extremely biologically productive and diverse and provide detrital input, which is the basis for the estuarine food chain (USFWS 2008). The shallow Gulf of Mexico waters, tidal flats, and beaches provide important shallow water feeding, breeding, and nesting habitat utilized by a host of colonial and migrating waterfowl and shorebirds (USFWS 2008).

Forested Wetlands

Upstream of the coastal marshes in the Sabine-Neches estuary, the study area is dominated by dense bottomland hardwood forests and cypress-tupelo swamps. These wetland forests cover an intricate network of sloughs and sandy ridges formed within the rivers' relict meander belts. Bald cypress (*Taxodium distichum*) – tupelo-gum (*Nyssa aquatica*) swamps grow in the inundated areas between the ridges, and floodplain hardwood forest of oaks (*Quercus nigra, Q. phellos, Q. alba, Q. lyrata*), sweetgum (*Liquidambar styraciflua*), hickories (*Carya* spp.), American elm (*Ulmus americanus*), maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), American holly (*Ilex opaca*), and loblolly pine (*Pinus taeda*) grow atop the sandier ridges and on the Pleistocene terrace uplands which border the floodplains. In general, these are healthy, stable habitats. The hardwoods, and especially the cypress trees, have been logged repeatedly since the turn of the century and as recently, perhaps, as the 1950s (USACE 1998). Though much of the forest is secondary growth, the swamp and bottomland hardwood habitats have medium to high value for food and cover to resident and migratory fish and wildlife. Inland from the coastal zone, forested wetlands in the Brazos River system are dominated by bottomland hardwood communities.

Aquatic Habitats

Large estuarine aquatic habitats are present in the Sabine Lake area. Sabine Lake is the drowned valley of the converged Sabine and Neches River systems. In contrast to the Sabine Region, the Brazos River discharges directly into the Gulf of Mexico. Both the Sabine and Brazoria regions contain essential fish habitat (EFH), which is considered necessary for spawning, breeding, feeding, or growth to maturity of species managed by Regional Fishery Management Councils, as described in a series of Fishery Management Plans, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. The study area contains EFH for larval, juvenile, and adult brown and white shrimp (*Penaeus aztecus* and *Penaeus setiferus*); juvenile king mackerel (*Scomberomorus cavalla*), vermillion snapper (Rhomboplites aurorubens), Warsaw grouper (Epinephelus nigritus), and Wenchman snapper (*Pristipomoides aquilonaris)*; juvenile and adult red drum (*Sciaenops ocellatus*), Almaco jack (Seriola rivoliana), and gray triggerfish (Balistes capriscus); adult gag grouper (*Mycteroperca microlepis*) and gray snapper (*Lutjanus griseus*); larval, juvenile, and adult red snapper (*Lutjanus campechanus*), lane snapper (*Lutjanus synagris*), greater amberjack (*Seriola dumerili*), and cobia (*Rachycentron canadum*). The categories of EFH that occur within the study area include estuarine emergent marsh, estuarine submerged aquatic vegetation (SAV), estuarine hard bottom, and estuarine mud/soft bottoms.

1.3.3 Protected Lands

In or Adjacent to the Sabine Region

McFaddin NWR covers about 58,861 acres in Jefferson and Chambers Counties (USFWS 2012 and 2013). Along with the J.D. Murphree WMA, it protects the largest expanse of remaining freshwater marsh on the Texas Coast and thousands of acres of intermediate marsh. The Refuge's southern boundary consists of over 15 miles of Gulf of Mexico shoreline. Remnant dune/beach systems exist along the coastline, although much has been lost through erosion and shoreline retreat, leaving only a low-lying washover terrace (TPWD, 2013).

J.D. Murphree WMA comprises 24,498 acres of fresh, intermediate, and brackish marsh on the Chenier plain in Jefferson County (TPWD, 2013). Extending north and south of the GIWW west of the Sabine-Neches Waterway, the WMA is highly diverse in coastal wetland communities.

Texas Point NWR in Jefferson County encompasses 8,952 acres of fresh to saline marshes and some wooded uplands and prairie ridges (USFWS, 2012 and 2013). The Refuge's southern boundary consists of over 6 miles of Gulf of Mexico shoreline. The Chenier plain is characterized by relict beach fronts that form ridges paralleling the Gulf shore. The term derives from the French name for live oak trees (*chenier*), which typically are found growing atop these ridges.

The Lower Neches River WMA is comprised of 7,998 acres located near Bridge City in Orange

County (TPWD, 2015). The Nelda Stark and Old River units are located adjacent to the lower Neches River. The Nelda Stark Unit is primarily shallow open-water which resulted from the degradation of a former marsh system by saltwater intrusion and subsidence. The Old River Unit, near Bridge City at the mouth of the Neches River, is a mixture of intermediate marsh and open water. The Adams Bayou Unit is located on Adams Bayou, a tributary of the lower Sabine River. This unit was formerly a placement area; it is much higher than surrounding wetland habitats and remains hydrologically isolated.

The Tony Houseman WMA, managed as a cooperative effort between the TxDOT and TPWD, is located on the Sabine River at Interstate 10 (TPWD, 2015). A 600-foot boardwalk leads from the center into the swamp. Outdoor recreation includes public hunting opportunities, fishing, wildlife viewing, hiking, and canoeing. The WMA extends from the western bank of the Sabine River just north of the community of Echo, down to the confluence of Little Cypress Bayou and the Sabine River south of I-10 at Orange. More than 80 percent is cypress-tupelo swamp.

In or Adjacent to the Brazoria Region

The Brazoria NWR is a 44,414-acre wildlife conservation area along the coast in Brazoria County (USFWS, 2015). It borders the GIWW, behind Follets Island in Brazoria County. Refuge habitats are made up of salt water, fresh water, and brackish wetlands. In addition, there are prairies, woody thickets, salt and mud flats, and lakes and streams. The refuge also contains 5,000 acres of rare, native bluestem prairie, representing one of the last coastal prairies in Texas. Brazoria NWR has a key location on the Texas Gulf, which helps Freeport draw one of the highest Audubon Christmas bird counts in the nation - more than 200 species.

Justin Hurst WMA (Bryan Beach Unit) is located on the Gulf shoreline on the eastern shore of the Brazos River Diversion Channel. The unit is 440 acres dominated by a 90-acre embayment, which is flooded by Gulf waters during high tides and storms. Large vegetated coastal dunes surround the embayment and separate it from the Gulf.

The San Bernard NWR in Brazoria County serves as the end point of the Central Flyway for waterfowl in winter and an entry point for neotropical migratory songbirds tired from a 600-mile Gulf crossing from the Yucatan Peninsula (USFWS, 2015). The 57,698-acre refuge contains salt and freshwater marshes, sloughs, ponds, coastal prairies, and bottomland forest. Refuge bottomland forests and willow trees attract high numbers of warblers migrating north. Several remote islands in a sheltered bay between the GIWW and the Gulf come alive every nesting season with herons, egrets, terns, and gulls.

1.4 ALTERNATIVES CONSIDERED

A lengthy array of alternatives was considered during plan formulation. The alternatives were developed from ideas provided by the public, resource agencies, USACE, and the non-Federal sponsor. Four public scoping meetings were held in February and March 2012 to gather ideas and information on coastal storm risks and ecosystem restoration opportunities in the study area. Comments were captured in a list of about 250 initial measures, which were organized geographically by the Sabine, Galveston Bay, and Brazoria regions of the study area.

An initial array, an evaluation array, and a final array of alternatives were screened to identify the TSP. Criteria applied to evaluate the alternatives included performance related to planning objectives, potential economic benefits, preliminary environmental benefits and/or impacts, and cost. Structural alternatives evaluated for the Sabine region include Gulf shoreline protection and restoration measures such as beach nourishment, dune restoration, Chenier ridge restoration, sediment management, shoreline armoring, and submerged near-shore breakwaters. Structural alternatives evaluated for the Brazoria area include various Gulf shoreline protection and restoration measures such as beach nourishment, dune restoration, sediment management, shoreline armoring, and submerged near-shore breakwaters. Non-structural alternatives, such as raising structures to reduce surge impacts and targeted buy-outs, were also evaluated for both the Sabine and Brazoria regions. No ER alternatives will be evaluated in detail for these regions.

The following plans are being evaluated in detail in the DIFR-EIS:

The TSP in the Sabine Region is comprised of two elements, which together would provide storm surge protection to Orange and Northeast Jefferson County: 1) the Orange-Jefferson CSRM Plan, and 2) the Port Arthur and Vicinity CSRM Plan. Upgrades to the existing Port Arthur and Vicinity HFP system would, in combination with the new Orange-Jefferson levee system, reduce the risk of storm surge impacts over all of the most densely populated parts of Jefferson and Orange Counties.

The TSP in the Brazoria Region, the Freeport and Vicinity TSP Plan, would consist of improvements to the existing the Freeport HFP System.

1.5 DESCRIPTION OF THE TENTATIVELY SELECTED PLAN

1.5.1 Orange-Jefferson CSRM Plan

The TSP would include a new levee/floodwall system constructed along the upland-floodplain margin of the Sabine and Neches Rivers in south Orange County and along the Neches River in northeast Jefferson County. The maximum length of the full system in Orange County would be about 42 miles; in Jefferson County, the maximum length would be about 16.5 miles. Further evaluations are likely to result in a reduction in the overall length. The new system would protect several communities in Orange County, including Bridge City, West Orange, and Orange, as well as an area known as "Chemical Row" where Dupont, Chevron-Phillips Chemical Company, Honeywell, and Lanxess facilities are located. In northeast Jefferson County, several large petro-chemical facilities such as ExxonMobil, Dupont, ChemTreat, Oil Tanking-Beaumont, Huntsman Performance Products, Texaco, and Calabrian would be protected, in addition to some Nederland and Port Neches residential and commercial areas.

For earthen levee segments of the new system (up to a maximum of about 43 miles system-wide), dozers and front-end loaders would clear, grub, and strip the ground within the identified construction right-of-way in preparation for levee construction. Dump trucks would haul and place commercially-obtained fill material to construct the levees. All fill material would be compacted and the levee crown would be covered with crushed limestone or gravel to provide a paved surface. Revetment (riprap, reinforced concrete slab and/or articulated concrete block mattresses) would be installed along the levee embankment where necessary to prevent erosion. Construction would be conducted using equipment such as bulldozers, excavators, front-end loaders, scrapers, graders, and cranes. Best management practices such as silt curtains would be utilized to prevent fill material from entering wetlands, streams, and larger waterways during construction. It is estimated that construction of the new system could take 5 to 7 years to complete. Figure 2 illustrates the largest potential footprint of the new levee system in Orange and Northeast Jefferson County; the earthen levee is in yellow and floodwalls in red.

Some segments will require use of a floodwall rather than an earthen levee, generally because of right-of-way width constraints. The maximum length of floodwalls to be included in the system would be about 16 miles. The foundation area would be cleared, grubbed, and stripped. The subsurface would then be excavated to depth for the concrete wall footing, which is to be cast in place. Excavated areas would be subsequently backfilled and thoroughly compacted. Cranes would be used to drive piles that will provide structural stability and to drive sheet pile. Formworks would be installed to form the footing and wall stem and reinforcing steel bar would be placed. Concrete mixer trucks would pump concrete to the footing and into the stem via a

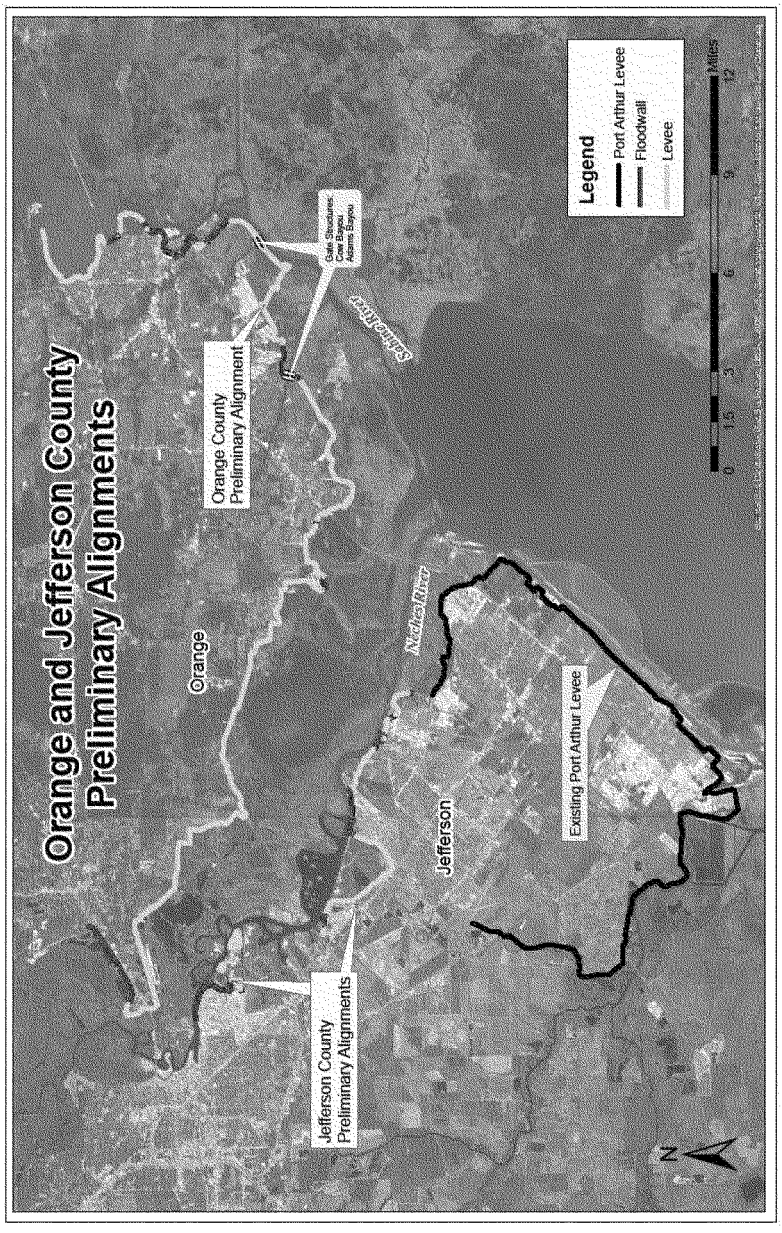


Figure 2: Orange-Jefferson Levee Alternative (Maximum Potential Length)

concrete boom. Additional earthwork would involve tying the floodwall into adjacent earthen levees and backfilling and compacting around the completed wall.

Two new navigable surge gates would be constructed on Cow and Adams Bayous. The gate locations are shown on Figure 2. Both gates would be similar to the structure shown in Figure 3. Since both streams currently accommodate barge traffic, there would be sector gates on the navigation channels with one or more flanking vertical lift gates to maintain flows on one or both sides of the navigation gates. An aerial view of this type of structure is shown in Figure 3. Coffer dams would be constructed around the gate sites so they could be constructed in the dry. A temporary navigation channel would be excavated to the side of the coffer dam to allow navigation and tidal flows to continue unobstructed during construction.

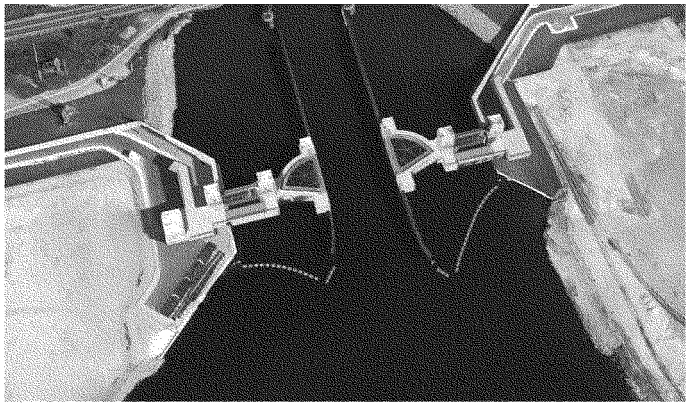


Figure 3: Conceptual Plan View of Adams and Cow Bayou Structures

Desk-top modeling was conducted to determine if operation of these gates in their normal, open condition would adversely affect water surface elevations, velocities, and salinities in the bayous (USACE 2015). The results indicate negligible impacts within Adams and Cow Bayous from potential constrictions to the channel cross-section with the proposed surge gates in their normal, open condition. This was determined by a sensitivity analysis conducted on the inlet size for each bayou, based on the assumption that construction of the gates would result in some reduction of the cross-section in their normal, open condition. In the analysis, bayou cross-sections were reduced by a wide range of estimated parameters, up to a maximum 75 percent constriction. It was determined that the limited tidal prism associated with the bayous results in minimal energy loss across the connection between the bayous and the Sabine River, and therefore, constriction of this access point results in little change in the tidal energy passing into the bayou. The insensitivity of the water surface elevation and salinity gives high confidence that the general conclusion

associated with this study is robust; constriction of the inlet, even significant constriction, results in minimal impacts on water surface elevation and salinity within the bayous. With high flows such as those occurring with tropical storms, velocities through the gated structures would be somewhat higher than the existing condition; these can be managed with appropriate armoring.

The extent to which these constrictions would impound storm water within the bayous was also examined by evaluating the effects of a significant rainfall event (Tropical Storm Allison) that had been captured in the median flow simulation. Once again, this analysis applies to the normal, open condition of the gate and evaluated the impacts of rainfall not associated with a significant storm surge event. Given the type of structures currently being evaluated (sector gates on the navigation channels with one or more flanking vertical lift gates to maintain flows on one or both sides of the navigation gates), it is estimated that existing flows may be reduced by a maximum of 50 percent. The DOWSMM analysis showed that, even for a 50 percent constriction, the volume of water resulting from such a storm could still pass through the constriction with little impact on upstream stage.

Impacts on the floodplain, both upstream and downstream of the levee system, would be minimized to the greatest extent possible. Culverts have been designed to maintain existing flows for a 100-year rainfall event, with an additional 10 percent to account for the predicted increase in rainfall due to climate change over the period of analysis. In addition, they will be designed with longer spans and lesser heights than would typically be used in an attempt to replicate the natural opening. In the existing condition, freshwater inflows from the upland areas to marshes and forested wetlands in the floodplain are being conveyed primarily though existing stream channels. The majority of the time, flows are directed toward channels and ditches that discharge into the floodplain through existing drainages. Water flows into the major rivers through those channels that have an incised bed, and in some cases flows spread out directly into wetland areas. Overland sheet flow is temporary, occurring during intense or long-duration rain events, as the majority of the area upstream of the levee is undeveloped and permeable. The degree to which shallow groundwater aquifers may contribute flows to the floodplain is unknown, but they are assumed to be a minor contributor. It is believed that marshes in the floodplain rely primarily on rainfall and tidal push for inundation.

Just before and during a surge event, the Adams and Cow Bayou surge gates and sluice gates in the levee system would be closed; pumps would be used to pump rainfall runoff from the interior to the exterior. The pumps are being conservatively sized to avoid floodplain impacts on the interior of the levee system, and to allow overbank flooding in the streams in the floodplain outside of the levee during high flow events. Hydrologic flows in the FWP condition would thus be very similar to FWOP flows and in location, duration, and magnitude, both inside and outside of the

levee system. It is assumed that the Adams and Cow Bayou gates would be closed for an estimated two weeks every 10-15 years to protect the area from surge impacts during tropical storms. The operating plan for the gates has not yet been developed, but even a worst case estimate of closure time would result in only minor and temporary impacts on fisheries access for gates with tidal flows.

New pump stations would be installed to ensure that the levee does not result in flooding upstream of the levee alignment, and the extensive system of large, new drainage structures would ensure that tidal ebb and flow in the area remains essentially the same as the FWP condition. Sluice gate culverts are planned for use everywhere there are tidal flows; flap gate culverts may be utilized in upstream areas above tidal influence. Gated culverts would be placed everywhere the red drainage lines intersect the yellow levee alignment, as shown on Figure 4. The sluice gates would remain open except when surge protection is needed; they would be closed temporarily for a short period before and after a storm occurs. Flap gate culverts would provide for one-way flow downstream from the levee system.

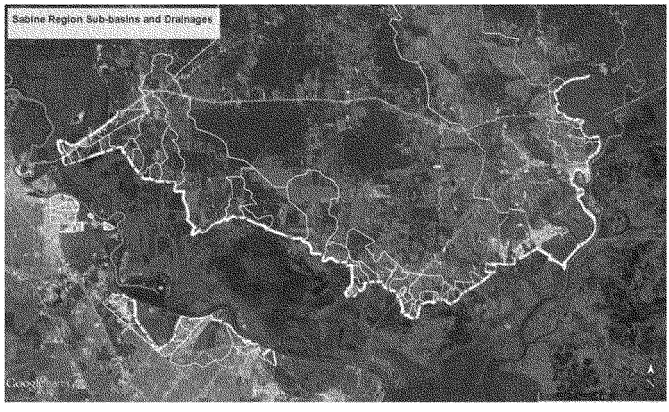


Figure 4: Sabine Region Sub-Basins and Drainages

1.5.2 CSRM Plan Improvements for Port Arthur and Freeport

Improvements to the existing HFP systems would consist of measures which increase the resiliency of the existing system features, and to accommodate future RSLR. Improvements would likely include replacement of outmoded I-Wall-type flood walls with newer, more resilient T-Wall-type floodwalls, repairs to existing earthen levees as needed, levee raisings where needed to reduce the risk of storm surge impacts under intermediate RSLR conditions, and armoring of levee toes and transitions as needed to provide resiliency during over-topping. Based on engineering

information developed to date, it is assumed that proposed improvements to the existing HFP systems can be made largely within the existing project alignments. Impacts on wetlands or fish and wildlife and their habitat from improvements to the existing Freeport and Port Arthur HFPs are not anticipated.

1.5.2.1 Port Arthur and Vicinity CSRM Plan

This existing HFP system, located west of Sabine Lake in Jefferson County, protects the Port Arthur area from coastal storm surge. The non-Federal partner for the existing project is the Jefferson County Drainage District No. 7. The system was designed and constructed in the mid-1960's to protect the area from a 100-year storm surge event. The levee system consists of 27.8 miles of earthen embankment, 6.6 miles of floodwall including 3.5 miles of coastal cantilever I-wall, and a wave barrier on Pleasure Island. In addition to residential and commercial areas in Port Arthur, the system protects the Motiva Enterprises refinery, the largest refinery in the United States. Lying adjacent to the HFP, this facility was initially constructed in 1903 during the Spindletop oil boom and now has a capacity of 600,000 barrels of crude oil per day. In addition to residential and commercial areas in Port Arthur, Nederland, and Groves, the area protected by the HFP also includes Valero Refining, Total/BASF, and the Port of Port Arthur.

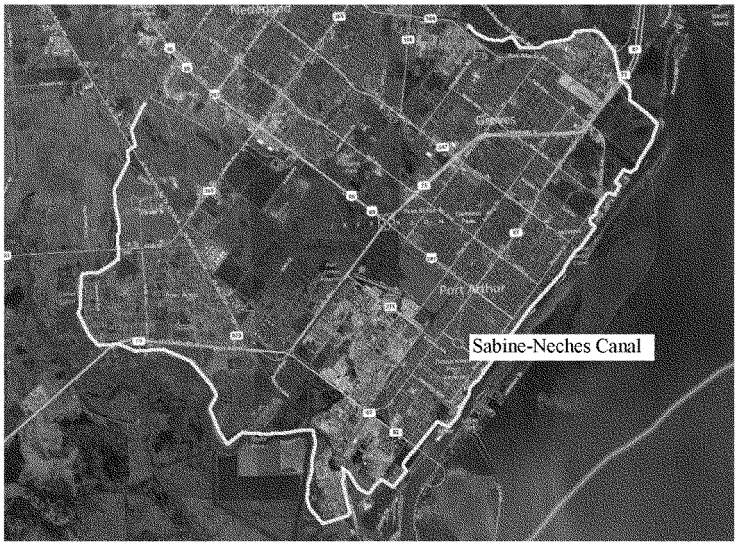


Figure 5: Existing Port Arthur HFP System

Sections of floodwall fronting the deep-draft navigation Sabine-Neches Canal would be modified

or reconstructed to accommodate intermediate RSLR and to meet current engineering standards. Other sections of earthen levee along the Sabine-Neches Canal may also be raised to match floodwall elevations. All construction activities would be conducted within the existing project right-of-way and therefore, no wetland impacts are anticipated. Construction equipment and methods would be similar to those described for the new levee system.

1.5.2.1 Freeport and Vicinity CSRM Plan

The Velasco Drainage District is the non-Federal sponsor for the existing system. Located in south-central Brazoria County, the system was designed and constructed in the early 1960's to protect the area from a 100-year storm surge event. The system consists of approximately 43 miles of levees and wave barriers, seven pump stations and multiple gates, culverts, and related facilities. Protection is provided for Dow Chemical, Dow Chemical Shipping, Gulf Chemical, and Port Freeport. Although the system primarily protects industrial areas, some residential areas in Freeport, Oyster Creek, Clute, and Lake Jackson are also protected.

Improvements to the existing system would consist of contracting a surge gate and I-wall reconstruction at the mouth of the Dow Barge Canal, raising approximately 2.5 miles of earthen levee in the East Storm/Oyster Levee to accommodate intermediate RSLR, raising approximately one-third mile of the Oyster Creek Levee, and raising approximately 3.2 miles of the Old River North Levee at the Dow Thumb. Most of the improvements can be made within the existing right-of-way. However, about 1 mile of the Oyster Creek Levee would require a minor amount of additional right-of-way; no wetland or aquatic impacts are anticipated in this area. Construction equipment and methods would be similar to those described for the new levee system.

The new navigable surge gate at the mouth of the Dow Barge Canal would be similar to the structure shown in Figure 3. This is a man-made canal with no natural habitat along the channel. A sector gate would be constructed on the navigation channel to allow barge-traffic access, with one or more flanking vertical lift gates to maintain flows. A coffer dam would probably be needed to construct the gate; existing tidal access would be maintained during construction and after construction. The gate would be constructed with bulldozers and draglines; no hopper dredges would be used to construct this gate.

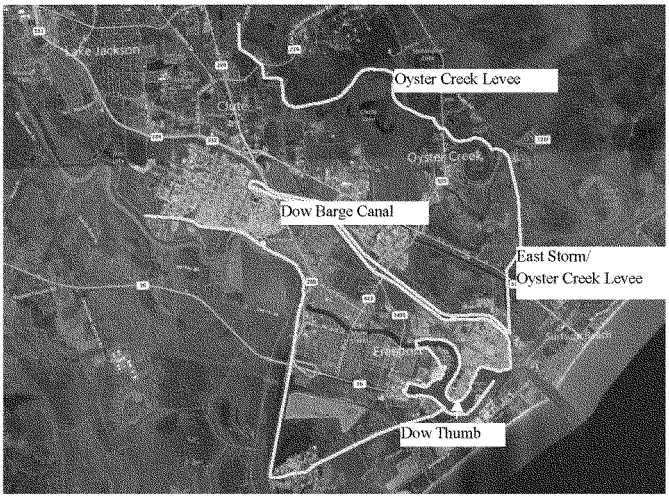


Figure 6: Existing Freeport HFP System

2.0 FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES AND CRITICAL HABITAT

Descriptions of ESA species and habitats are combined for the two geographic areas (Sabine and Brazoria Regions) being studied in detail because most of the species are present in both areas. USACE contacted the USFWS and NMFS by email, requesting information on threatened and endangered species in the project areas. The agency lists are provided in Appendix A. Endangered or threatened species listed in Table 1 are those that the agencies list as possibly occurring in the general vicinity of the two regions. The status, range, habitat, and presence are discussed separately for each species following the table order. There is no designated Critical Habitat in either region.

2.1 PIPING PLOVER

USFWS listed the piping plover (*Charadrius melodus*) as threatened and endangered on 11 December 1985 (50 FR 50726, December, 11 1985). The piping plover is an endangered species in the northern Great Plains and Great Lakes where it breeds in the summer. Piping plovers wintering in Texas are part of the northern Great Plains and Great Lakes populations and, therefore, are listed as threatened (USFWS, 2009). The wintering range on the Atlantic and Gulf coasts stretches from North Carolina to Mexico (AOU, 1998; 50 FR 50726, December, 11 1985). Migration occurs both through the interior of North America east of the Rocky Mountains (especially in the Mississippi Valley), and along the Atlantic Coast (AOU, 1998). Approximately 35 percent of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70 percent of the year. Piping plover concentrations in Texas are believed to occur in Brazoria and Jefferson counties, primarily restricted to areas along the Gulf shoreline. On their wintering grounds, piping plover use beaches, mudflats, sandflats, dunes, and offshore emergent placement areas (USFWS, 1995; AOU, 1998), as well as sandflats in existing USACE placement areas. Piping plovers are known to frequent the area immediately south of the Brazoria study area; they occur less frequently in the more inland Sabine study area.

Threats to piping plovers and their habitat in their migration and wintering ranges indicate a continuing loss and degradation of habitat due to sand placement projects, inlet stabilization, sand mining, groins, seawalls and revetments, exotic and invasive vegetation, and wrack removal (USFWS, 2009). There is also concern with projects that would impede the ability of barrier islands to respond to natural habitat building processes in the context of accelerating sea-level rise.

Table 1: Threatened and Endangered Species, Orange, Jefferson and Brazoria Counties

Common Name	Scientific Name	Listing Status	Jurisdiction
BIRDS			
piping plover	*Charadrius melodus*	Threatened	USFWS
red knot	*Calidris canutus rufa*	Threatened	USFWS
whooping crane	*Grus americana*	Endangered	USFWS
MAMMALS			
West Indian manatee	*Trichechus manatus*	Endangered	USFWS
fin whale	*Balaenoptera physalus*	Endangered	NMFS
humpback whale	*Megaptera novaeangliae*	Endangered	NMFS
sei whale	*Balaenoptera borealis*	Endangered	NMFS
sperm whale	*Physeter macrocephalus*	Endangered	NMFS
REPTILES			
green sea turtle	*Chelonia mydas*	Threatened	USFWS; NMFS
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	USFWS; NMFS
loggerhead sea turtle	*Caretta caretta*	Threatened	USFWS; NMFS
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	USFWS; NMFS
leatherback sea turtle	*Dermochelys coriacea*	Endangered	USFWS; NMFS
INVERTEBRATES			
lobed star coral	*Orbicella annularis*	Threatened	NMFS
mountainous star coral	*Orbicella faveolata*	Threatened	NMFS
boulder star coral	*Orbicella franksi*	Threatened	NMFS
elkhorn coral	*Acropora palmata*	Threatened	NMFS
CANDIDATE SPECIES			
Sprague's pipit	*Anthus spragueii*	Candidate	USFWS
smooth pimpleback clam	*Quadrula houstonensis*	Candidate	USFWS
Texas fawnsfoot clam	*Truncilla macrodon*	Candidate	USFWS

Sources: USFWS and NMFS websites:
http://www.fws.gov/southwest/es/ES_Lists_Main.cfm (accessed May 21, 2015)
http://sero.nmfs.noaa.gov/pr/esa/specieslst.htm (accessed May 21, 2015)
http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm (accessed May 21, 2015)

There is no piping plover critical habitat in the Sabine and Brazoria project areas. However, critical habitat is located in the general area, the nearest being approximately 2 miles southwest of the project area in Brazoria County (74 FR 23476, May 19, 2009).

2.2 RED KNOT

Red knots of the *rufa* subspecies (*Calidris canutus rufa*) are medium-sized shorebirds that breed only in Arctic Canada and migrate approximately 18,500 miles annually between Arctic breeding grounds and primary wintering areas in Tierra Del Fuego, at the southern tip of South America.

They also winter in three other distinct coastal areas of the Western Hemisphere: the southeastern United States (mainly Florida and Georgia, with smaller numbers in South Carolina), the Gulf of Mexico coast of Texas, and Maranhão in northern Brazil (USFWS, 2011). The USFWS began proposing that this species be considered a Candidate for listing in 2008, and published a final designation of threatened status in 2014 (79 FR 73706, December 11, 2014).

In South American wintering areas, red knots are found principally in intertidal marine habitats, especially near coastal inlets, estuaries, and bays, or along intertidal earthen shelf formations. The Delaware Bay area (in Delaware and New Jersey) is the largest known spring migration stopover area, with far fewer migrants congregating elsewhere along the Atlantic coast. The concentration in the Delaware Bay area occurs from the middle of May to early June, corresponding to the spawning season of horseshoe crabs. The knots feed on horseshoe crab eggs, rebuilding energy reserves needed to complete migrations to the Arctic. Surveys at wintering areas and at Delaware Bay during spring migration indicate a substantial decline in the red knot in recent years. Research shows that since 1998, a high proportion of red knots leaving the Delaware Bay failed to achieve threshold departure masses needed to fly to breeding grounds and survive an initial few days of snow cover, and this corresponded to reduced annual survival rates (73 FR 75176, December 10, 2008).

The primary factor threatening the red knot is destruction and modification of its habitat, particularly the reduction in key food resources resulting from reductions in horseshoe crabs, which are harvested primarily for use as bait and secondarily to support a biomedical industry. Counts of red knots within the principal wintering areas in Chile and Argentina declined by nearly 75 percent from 1985 to 2007 and declined by an additional 15 percent in the past year (2007 to 2008).

Along the Texas coast, red knots forage on beaches, oyster reefs, and exposed bay bottoms and roost on high sand flats, reefs, and other sites protected from high tides (NatureServe, 2013). They are believed to use the beaches in Brazoria County, near but not in the project area. In wintering and migration habitats, red knots commonly forage on bivalves, gastropods, and crustaceans. It has been reported that Coquina clams (*Donax variabilis*) serve as a frequent and often important food resource for red knots along Gulf beaches. Reports of the size of flocks of along the Gulf of Mexico coast vary considerably, from highs of about 2,800 to 700 (USFWS 2011).

2.3 WHOOPING CRANE

The whooping crane (*Grus americana*) was Federally listed as endangered on March 11, 1967 (32 FR 4001). Critical habitat has been designated in Aransas, Calhoun, and Refugio counties in Texas, and includes the Aransas National Wildlife Refuge (NWR). The main factors for the decline of the whooping crane are loss of habitat to agriculture, human disturbance of nesting areas, uncontrolled hunting, and collisions with power lines (NatureServe, 2015). Biological factors, such as delayed sexual maturity and small clutch size, prevent rapid population recovery. Drought during the breeding season presents serious hazards to this species (Campbell, 1995). Whooping cranes are vulnerable to loss of habitat along their long migration route (NatureServe, 2015), along which they are still subject to cataclysmic weather events, accidental shooting, collision with power lines, and predators. They are susceptible to avian tuberculosis, avian cholera, and lead poisoning (Campbell, 1995). Exposure to disease is a special problem when large numbers of birds are concentrated in limited areas, as often happens during times of drought.

The principal winter habitat in Texas is brackish bays, marshes, and salt flats, although whooping cranes sometimes feed in upland sites characterized by oak mottes, grassland swales, and ponds on gently rolling sandy soils (NatureServe, 2015). Summer foods include large insect nymphs or larvae, frogs, rodents, small birds, minnows, and berries. During the winter in Texas, they eat a wide variety of plant and animal foods. Blue crabs, clams, and berries of Carolina wolfberry (*Lycium carolinianum*) comprise the diet. Foods taken at upland sites include acorns, snails, crayfish, and insects.

Whooping cranes were originally found throughout most of North America. In the nineteenth century, the main breeding area was from the Northwest Territories to the prairie provinces in Canada, and the northern prairie states to Illinois. A nonmigratory flock existed in Louisiana, but is now extirpated. Whooping cranes wintered from Florida to New Jersey along the Atlantic Coast, along the Texas Gulf Coast, and in the high plateaus of central Mexico. They now breed in isolated, marshy areas of Wood Buffalo National Park, Northwest Territories, and Canada. They winter primarily in the Aransas NWR and adjacent areas of the central Texas Gulf Coast (USFWS, 1995). During migration they use various stopover areas in western Canada and the American Midwest.

The natural wild population of whooping cranes spends its winters at the Aransas NWR, Matagorda Island, Isla San Jose, portions of the Lamar Peninsula, and Welder Point on the east side of San Antonio Bay (NatureServe, 2015). The main stopover points in Texas for migrating birds are in the central and eastern Panhandle (USFWS, 1995).
Brazoria County is on the extreme margin of the species' migration corridor. The species is

unlikely to occur in the Brazoria project area because of the absence of suitable habitat. TPWD (2006) indicates documented records of whooping cranes from marshes west of the Brazos River; however, these likely represent vagrant birds, and no wintering populations are present in the project area.

2.4 WEST INDIAN MANATEE

Manatees (*Trichechus manatus*) are marine mammals found in marine, estuarine, and freshwater environments. The manatee ranges from the southeastern U.S. and coastal regions of the Gulf, through the West Indies and Caribbean, to northern South America. U.S. populations occur primarily in Florida, where they are effectively isolated from other populations by the cooler waters of the northern Gulf and the deeper waters of the Straits of Florida (NatureServe, 2013).

USFWS listed the West Indian manatee as endangered in 1967 (32 FR 4001, March 11, 1967). Later it received protection under the ESA of 1973. Critical habitat has been designated in Florida, but none in Texas.

The West Indian manatee inhabits shallow coastal waters, estuaries, bays, rivers, and lakes. Throughout most of its range, it appears to prefer rivers and estuaries to marine habitats. It is not averse to traveling through dredged canals or using quiet marinas. Manatees are apparently not able to tolerate prolonged exposure to water colder than 68 degrees Fahrenheit. In the northern portions of their range, during October through April, they congregate in warmer water bodies, such as spring-fed rivers and outfalls from power plants. They usually avoid areas with strong currents (NatureServe, 2013). Manatees are primarily dependent upon submergent, emergent, and floating vegetation, with the diet varying according to plant availability.

The largest known human-related cause of manatee mortality is collisions with hulls and/or propellers of boats and ships. The second-largest human related cause of mortality is entrapment in floodgates and navigation locks. Other known causes of human-related manatee mortality include poaching and vandalism, entrapment in shrimp nets and other fishing gear, entrapment in water pipes, and ingestion of marine debris (USFWS, 2001). Hunting and fishing pressures were responsible for much of its original decline because of the demand for meat, hides, and bones, which resulted in near extirpation of the species (USFWS, 1995). A prominent cause of natural mortality in some years is cold stress, and major die-offs associated with the outbreaks of red tide have occurred (USFWS, 2001). The low reproductive rate and habitat loss make it difficult for manatee populations to recover.

The West Indian manatee historically inhabited the Laguna Madre, the Gulf, and tidally influenced portions of rivers. It is currently, however, extremely rare in Texas waters and the most recent sightings are likely individuals migrating or wandering from Mexican waters. Historical records from Texas waters include Copano Bay, the Bolivar Peninsula, and the mouth of the Rio Grande River (Schmidly, 2004). In November, 2014, a live manatee was rescued from Trinity Bay (USFWS, 2015). The occurrence of the West Indian manatee in the study area is possible but not likely.

2.5 WHALES

NMFS identifies four endangered whale species of potential occurrence in the Gulf. These are the sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*) (NMFS, 2015). These species are generally restricted to deeper offshore waters; therefore, it is unlikely that any of these five species would regularly occur in either the Brazoria or Sabine project areas.

2.6 SEA TURTLES

NFMS and USFWS identify five sea turtle species of potential occurrence in both the Brazoria and Sabine regions.

2.6.1 Green Sea Turtle

The green turtle (*Chelonia mydas*) is a circumglobal species in tropical and subtropical waters. In U.S. Atlantic waters, it occurs around the U.S. Virgin Islands, Puerto Rico, and continental U.S. from Massachusetts to Texas. Major nesting activity occurs on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Relatively small numbers nest in Florida, with even smaller numbers in Georgia, North Carolina, and Texas (NMFS and USFWS, 1991a; Hirth, 1997).

The green turtle was listed in 1978 as threatened, except for Florida and the Pacific Coast of Mexico (including the Gulf of California) where it was listed as endangered (43 FR 32800, July 28, 1978). In 1998, NMFS designated critical habitat to include the coastal waters around Culebra Island, Puerto Rico (63 FR 46693, September 2, 1998). On March 23, 2015, NMFS and USFWS proposed to revise the existing listing to identify 11 green sea turtle distinct population segments (DPS) worldwide (80 FR 15271 (March 23, 2015)). The proposed DPS rule would list the North Atlantic DPS as threatened.

The green turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae and seagrasses. Hatchlings often float in masses of sea plants (e.g., rafts of sargassum) in convergence zones. Coral reefs and rocky outcrops near

feeding pastures often are used as resting areas. The adults are almost exclusively herbivorous, while the juveniles consume more invertebrates. Foods consumed include seagrasses, macroalgae and other marine plants, mollusks, sponges, crustaceans, and jellyfish (Mortimer, 1982).

Terrestrial habitat is typically limited to nesting activities (Balazs, 1980). They prefer high-energy beaches with deep sand, which may be coarse to fine, with little organic content. Most green turtles nest in Florida and in Mexico. Green turtle nests are rare in Texas. In 1987, the first confirmed nesting of a green sea turtle on the Texas coast was recorded (Shaver and Amos, 1988). More recently, two green turtle nests were documented in 2006 and three in 2007; all but one in 2007 were from the Padre Island National Seashore (PINS). In 2012, six green sea turtle nests were reported from PINS and two from South Padre Island.

The principal cause of the historical, worldwide decline of the green turtle is long-term harvest of eggs and adults on nesting beaches, and juveniles and adults on feeding grounds. These harvests continue in some areas of the world and compromise efforts to recover this species. Incidental capture in fishing gear, such as gillnets and trawls, is a serious ongoing source of mortality that also adversely affects the species' recovery (NMFS, 2013). Incidental take of green turtles has been documented with hopper dredges.

Of the green turtle strandings reported from 2004 through 2007 (last year reported) along the Texas Coast, 374 were from Zone 21, which extends from the mouth of the Rio Grande to the vicinity of Yarborough Pass (STSSN, 2013). In 2007, 233 green turtles were reported stranded; of these, at least 147 were cold-stunned turtles resulting from a strong cold front that passed in January (Sea Turtle, Inc., 2008).

The USACE Sea Turtle Data Warehouse (USACE, 2013) maintained records of documented incidental takes of sea turtles as a result of hopper dredging activities throughout southeastern coastal waters. USACE is currently developing a new system, called Operations and Dredging Endangered Species System (ODESS), to centralize and archive data regarding T&E species and impacts from dredging activities. The system is being coordinated with NMFS SERO staff. Incidences involving impacts on two green sea turtle individuals within Freeport Harbor Channel were recorded in 2006. One incident regarding impact on an individual green sea turtle within the Freeport Harbor Entrance Channel was documented in 2007. These documented events provide clear indication that swimming green turtles may be found in the entrance channel and near the Freeport Harbor jetties. They are not likely to be found in the inland channels near the Freeport CSRM project area. The project area does not include the Gulf shoreline. The southernmost extent of the Port Arthur CSRM Plan project area is 15 stream-miles inland from the Gulf shoreline; there is very little likelihood that green turtles would be found in that study area.

2.6.2 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle (*Lepidochelys kempii*) is the smallest of the sea turtles, with adults reaching about 2 feet in length and weighing up to 100 pounds. Adults are primarily restricted to the Gulf, although juveniles may range throughout the Atlantic Ocean. Important foraging areas include Campeche Bay, Mexico, and Louisiana coastal waters. Almost the entire population of Kemp's ridleys nests on an 11-mile stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, approximately 190 miles south of the Rio Grande. A secondary nesting area occurs at Tuxpan, Veracruz, and sporadic nesting has been reported from Mustang Island, Texas, southward to Isla Aquada, Campeche. Several scattered isolated nesting attempts have occurred from North Carolina to Colombia.

The Kemp's ridley sea turtle was listed as endangered throughout its range in 1970 (35 FR 18319, December 2, 1970). It is considered to be the most seriously endangered of all sea turtles (USFWS and NMFS, 1992). No critical habitat has yet been designated.

Kemp's ridleys inhabit shallow coastal and estuarine waters, usually over sand or mud bottoms. Adults are primarily shallow-water benthic feeders that specialize on crabs while juveniles feed on sargassum and associated infauna, and other epipelagic species of the Gulf (USFWS and NMFS, 1992). In some regions, blue crab (*Callinectes sapidus*) is the most common food item of adults and juveniles. Other food items include shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and occasional marine plants (Pritchard and Marquez, 1973; Shaver, 1991; Campbell, 1995).

Populations of this species have declined since 1947, when an estimated 42,000 females nested in one day, to a total nesting population of approximately 1,000 in the mid-1980s. The decline of this species was primarily the result of human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridleys have been subject to high levels of incidental capture in fishing gear, primarily in shrimp trawls, but also in gill nets, longlines, and traps (USFWS and NMFS, 1992; NMFS, 2013b). The National Research Council's (NRC) Committee on Sea Turtle Conservation estimated in 1990 that 86 percent of the human-caused deaths of juvenile and adult loggerheads and Kemp's ridleys resulted from shrimp trawling (Campbell, 1995).
Further threats to this species include collisions with boats, explosives used to remove oil rigs, and entrapment in coastal power plant intake pipes (Campbell, 1995). Dredging operations affect Kemp's ridley turtles through incidental take and by degrading the habitat. Incidental take of ridleys has been documented with hopper dredges. In addition to direct take, channelization of the

inshore and nearshore areas can degrade foraging and migratory habitat through dredged material placement, degraded water quality/clarity, and altered current flow (USFWS and NMFS, 1992). Sea turtles are also especially subject to human impacts during the time the females come ashore for nesting.

Nesting beaches were afforded official protection in 1966 and this, together with the requirement to use TEDs in shrimp trawls and other measures to reduce turtle bycatch, are some of the primary factors in recovery of this species (NMFS, 2013). Kemp's ridley appears to be in the earliest stages of recovery. In 2006, a record number of nests were recorded since monitoring began in 1978; 12,143 nests were documented in Mexico, with 7,866 of those at Rancho Nuevo (NMFS, 2013).

Kemp's ridleys may have nested sporadically in Texas in the last 50 years; however, the number of nests over recent years has shown an ever-increasing trend (NPS, 2012 and 2013). Some of these nests were from headstarted ridleys. The majority of the Kemp's ridley nests recorded in Texas were at the PINS. Such nestings, together with the proximity of the Rancho Nuevo rookery, probably account for the occurrence of hatchlings and subadults in Texas.

Kemp's ridley has been recorded from the general vicinity of the Brazoria region. The USACE Sea Turtle Data Warehouse (USACE, 2010) documents the taking of two Kemp's ridley turtles within the Freeport Harbor Entrance Channel in 2007. Documented records of Kemp's ridleys exist from Jefferson County, Texas (Dixon, 2000); however, they would not be expected to occur as far inland as the Port Arthur and Orange-Jefferson CSRM project areas.

2.6.3 Loggerhead Sea Turtle

Loggerhead sea turtles (*Caretta caretta*) were named for their relatively large heads, which support powerful jaws and enable them to feed on hard-shelled prey, such as whelks and conch. The loggerhead is widely distributed in tropical and subtropical seas, being found in the Atlantic Ocean from Nova Scotia to Argentina, the Gulf, Indian, and Pacific oceans (although it is rare in the eastern and central Pacific), and the Mediterranean Sea (Rebel, 1974; Ross, 1982; Iverson, 1986), and is the most abundant sea turtle species in U.S. coastal waters (NMFS, 2013). In the continental U.S., loggerheads nest along the Atlantic coast from Florida to as far north as New Jersey and sporadically along the Gulf Coast. In recent years, a few have nested on barrier islands along the Texas coast.

The Northwest Atlantic Ocean population of the loggerhead turtle was listed as threatened in 2011 (76 FR 58868, September 22, 2011). In 2011, the NMFS and USFWS determined that the loggerhead sea turtle is composed of nine distinct population segments (DPSs) that constitute

''species'' that may be listed as threatened or endangered under the ESA. Formerly, all populations of the loggerhead were determined threatened throughout its range (43 FR 32808, July 28, 1978). In the 2011 final rule, four DPSs were listed as threatened and five as endangered under the ESA. The four threatened DPSs are located in the Northwest Atlantic Ocean, the South Atlantic Ocean, the Southeast Indo-Pacific Ocean, and the Southwest Indian Ocean. The five endangered DTSs are located in the Mediterranean Sea, the North Indian Ocean, the North Pacific Ocean, the Northeast Atlantic Ocean, and the South Pacific Ocean. NMFS and USFWS also announced they intend to propose the designation of critical habitat for the two loggerhead sea turtle DPSs occurring within the U.S. (the Northwest Atlantic and North Pacific Oceans) in a future rulemaking. Proposed critical habitat is located in coastal counties in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi (78 FR 17999, March 25, 2013).

The loggerhead occurs in the open seas as far as 500 miles from shore, but mainly over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers. It favors warm temperate and subtropical regions not far from shorelines. The adults occupy various habitats, from turbid bays to clear waters of reefs. Subadults occur mainly in nearshore and estuarine waters. Hatchlings move directly to sea after hatching, and often float in masses of sargassum (NMFS and USFWS, 1991). Commensurate with their use of varied habitats, loggerheads consume a wide variety of both benthic and pelagic food items, which they crush before swallowing. Conches, shellfish, horseshoe crabs, prawns and other crustacea, squid, sponges, jellyfish, basket starts, fish (carrion or slow-moving species), and even hatchling loggerheads have all been recorded as loggerhead prey (Rebel, 1974; Hughes, 1974; Mortimer, 1982).

Nesting occurs usually on open sandy beaches above the high-tide mark and seaward of well-developed dunes. They nest primarily on high-energy beaches on barrier islands adjacent to continental land masses in warm-temperate and subtropical regions. Steeply sloped beaches with gradually sloped offshore approaches are favored.

Recent analyses of nesting data from southeast Florida show the population is declining. Similarly, long-term nesting data show loggerhead nesting declines in North Carolina, South Carolina, and Georgia (NMFS, 2013). The decline of the loggerhead, like that of most sea turtles, is the result of overexploitation by man, and inadvertent mortality associated with fishing and trawling activities. The most significant threats to its population are incidental capture in fishing gear, directed harvest, coastal development, increased human use of nesting beaches, and pollution (NMFS, 2013). Incidental take of loggerheads has been documented with hopper dredges.

The loggerhead is the most abundant turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring only very infrequently in the bays. It often occurs near

offshore oil rig platforms, reefs, and jetties. Loggerheads are probably present year-round but are most noticeable in the spring when a favored food item, the Portuguese man-of-war (*Physalia physalis*), is abundant. Loggerheads constitute a major portion of stranded turtles on the Texas coast each year (STSSN, 2013). A large proportion of these deaths are the result of accidental capture by shrimp trawlers, where caught turtles drown and their bodies are dumped overboard.

Before 1977, no positive documentation of loggerhead nests in Texas existed. Since that time, several nests have been recorded along the Texas coast. During the last decade, nesting has remained relatively stable on the Texas coast, with 0-6 nests per year. Although nests have been found state-wide, the largest numbers have been located at the PINS (NPS, 2013).

This species has been recorded in the Brazoria study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor Channel, and during the Freeport Harbor Project (July 13 to September 24, 2002), a relocation trawler captured one loggerhead (NMFS, 2003). More recently, an additional loggerhead was incidentally taken in the Freeport Harbor Entrance Channel in 2006 as a result of dredging activities (USACE, 2013). No nests have been recorded in the study area. Documented records of loggerheads exist from Jefferson County, Texas (Dixon, 2000); however, potential for its occurrence in the Sabine study area is low.

2.6.4 Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretmochelys imbricata*) is circumtropical, occurring in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans (Witzell, 1983). This species is probably the most tropical of all marine turtles, although it does occur in many temperate regions. The hawksbill sea turtle is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf (especially Texas), south to Brazil (NMFS, 2013d). In the continental U.S., the hawksbill largely nests in Florida, where it is sporadic at best (NFWL, 1980). However, a major nesting beach exists on Mona Island, Puerto Rico.
The hawksbill sea turtle was Federally listed as endangered in 1970 on (35 FR 84952, June 2, 1970b). In 1998, NMFS and USFWS designated critical habitat near Mona Island and Isla Monito, Puerto Rico, seaward to 5.6 kilometers (km) (63 FR 46693, September 2, 1998).

Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they occur at depths of less than 70 feet. Like some other sea turtle species, hatchlings are sometimes found floating in masses of marine plants (e.g., sargassum rafts) in the open ocean (NFWL, 1980). Hawksbills reenter coastal waters when they reach a carapace length of approximately 20 to 25 centimeters. Coral reefs are widely recognized as the resident foraging

habitat of juveniles, subadults, and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. Hawksbills also occur around rocky outcrops and high-energy shoals, which are also optimum sites for sponge growth.

While this species is omnivorous, it prefers invertebrates, especially encrusting organisms, such as sponges, tunicates, bryozoans, mollusks, corals, barnacles, and sea urchins. Pelagic species consumed include jellyfish and fish, and plant material such as algae, sea grasses, and mangroves (Rebel, 1974; Pritchard, 1977; Mortimer, 1982). The young are reported to be somewhat more herbivorous than adults (Ernst and Barbour, 1972). Terrestrial habitat is typically limited to nesting activities. The hawksbill, which is typically a solitary nester, nests on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls. Typically, the sand beaches are low energy, with woody vegetation, such as sea grape (*Coccoloba uvifera*), near the waterline (NRC, 1990).

The primary global threat to hawksbills is habitat loss of coral reef communities. There remains a continuing demand for the hawksbill's shell, as well as other products, including leather, oil, perfume, and cosmetics. Additionally, hawksbills are harvested for their eggs and meat, while whole stuffed turtles are sold as curios in the tourist trade. In addition to directed harvest, increased human presence is a threat to hawksbills. In particular, increased recreational and commercial use of nesting beaches, general harassment of turtles, and loss of nesting habitat from human activities negatively impact hawksbills. Incidental capture in fishing gear, primarily gillnets, and vessel strikes also adversely affect this species' recovery (NMFS, 2013).

Texas is the only state outside of Florida where hawksbills are sighted with any regularity. Most of these sightings involve posthatchlings and juveniles, and are primarily associated with stone jetties. These small turtles are believed to originate from nesting beaches in Mexico (NMFS, 2013). On June 13, 1998, the first hawksbill nest recorded on the Texas coast was found at PINS. This nest remains the only documented hawksbill nest on the Texas coast (NPS, 2013). Stranding data from 2004 through 2007 show that 59 hawksbills were found along Texas waters or shorelines (STSSN, 2013). No documented records of hawksbills exist from Brazoria, Jefferson, or Orange counties (Dixon, 2000) and they are not expected to be present in the project area.

2.6.5 Leatherback Sea Turtle

Leatherback sea turtles (*Dermochelys coriacea*) are named for their appearance. They do not have shells as other sea turtles do. Instead, their backs are covered by a slate black to bluish-black leathery skin with irregular white or pink patches. They are the largest turtles in the world, reaching over 6 feet in length and 650-1,200 pounds in weight (NPS, 2013).

The leatherback sea turtle was listed as endangered throughout its range in 1970 (35 FR 84952, June 2, 1970), with critical habitat designated in the U.S. Virgin Islands in 1978 and 1979 (43 FR 43688, September 26, 1978, and 44 FR 17710, March 23, 1979, respectively). In 2011, USFWS announced that revision of the critical habitat to include the coastline and offshore waters of the Northeast Ecological Corridor of Puerto Rico may be warranted and that assessment of the need for revisions to critical habitat would be conducted during a future planned status review (76 FR 47133, August 4, 2011).

The leatherback is probably the most wide-ranging of all sea turtle species. It occurs in the Atlantic, Pacific, and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain, and Norway; as far south as Australia, the Cape of Good Hope, and Argentina; and in other water bodies such as the Mediterranean Sea (NFWL, 1980). The leatherback migrates further and ventures into colder water than any other marine reptile. Adults appear to engage in routine migrations between boreal, temperate, and tropical waters, presumably to optimize both foraging and nesting opportunities. During the summer, leatherbacks tend to occur along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

Leatherbacks nest primarily in tropical regions; major nesting beaches include Malaysia, Mexico, French Guiana, Surinam, Costa Rica, and Trinidad (Ross, 1982). Leatherbacks nest only sporadically in some of the Atlantic and Gulf states of the continental U.S., with one nesting reported as far north as North Carolina (Schwartz, 1976). The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies, but represent the most significant nesting activity within the U.S. (NMFS, 2013).

The leatherback sea turtle is mainly pelagic, inhabiting the open ocean, and seldom approaches land except for nesting (Eckert, 1992). It is most often found in coastal waters only when nesting or when following concentrations of jellyfish, when it can be found in inshore waters, bays, and estuaries. It dives almost continuously, often to great depths. Despite their large size, the diet of leatherbacks consists largely of jellyfish and sea squirts. They also consume sea urchins, squid, crustaceans, fish, blue-green algae, and floating seaweed (NFWL, 1980). The leatherback typically nests on beaches with a deepwater approach (Pritchard, 1971).

Its decline is attributable to overexploitation by man and incidental mortality associated with commercial shrimping and fishing activities. Nesting populations of leatherback sea turtles are especially difficult to estimate because the females frequently change nesting beaches; however, Spotila et al. (1996) estimated the 1995 worldwide population of nesting female leatherbacks at 26,000 to 42,000. Major threats include egg collecting and mortality associated with bycatch in

longline, trawl, and gillnet fisheries throughout their range; although they are jeopardized to some extent by harvesting of adult females, destruction or degradation of nesting habitat, and ingestion of floating trash (Nature Serve, 2013). This species is probably more susceptible than other turtles to drowning in shrimp trawlers equipped with turtle extruder devices (TEDs) because adult leatherbacks are too large to pass through the TED exit opening. Because leatherbacks nest in the tropics during hurricane season, a potential exists for storm-generated waves and wind to erode nesting beaches, resulting in nest loss (NMFS and USFWS, 1992).

Apart from occasional feeding aggregations such as the large one of 100 animals reported by Leary (1957) off Port Aransas in December 1956, or possible concentrations in the Brownsville Eddy in winter, leatherbacks are rare along the Texas coast, tending to keep to deeper offshore waters where their primary food source, jellyfish, occurs. In the Gulf, the leatherback is often associated with two species of jellyfish: the cabbagehead (*Stomolophus sp.*) and the moon jellyfish (*Aurelia sp.*) (NMFS and USFWS, 1992). According to USFWS (1981), leatherbacks never have been common in Texas waters. Leatherback nests were recorded on Padre Island in the 1930's to 40's. One leatherback nest was located at PINS in 2008. Since then, no leatherback nests have been located anywhere in Texas (NPS, 2013).

No leatherbacks have been taken by dredging activities in Texas (USACE, 2013). This species is unlikely to occur in either the Brazoria or Sabine regions.

2.7 CORALS

On October 20, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of coral as either threatened or endangered under the ESA. On September 10, 2014 (70 FR 53852), NMFS published a final rule listing 20 of the petitioned coral species as threatened under the Endangered Species Act. Of these 20, the following five Caribbean species are listed as threatened on the NMFS list for Texas – lobed star (*Orbicella annularis*), mountainous star (*Orbicella faveolata*), boulder star (*Orbicella franksi*), and elkhorn coral (*Acropora palmata*) retained their listing status as threatened species. Relatively high human population densities and a long history of pervasive human impacts on coral reef systems exist across the Caribbean region (NMFS, 2012). Nearly two-thirds of Caribbean coral reefs are threatened by at least one form of human activity, with continuing threats of region-wide damage due to rising sea temperatures and disease. Additionally, none of the Caribbean's three keystone species indicative of reef health (the corals *Acropora palmata* and *A.cervicornis*, and the urchin *Diadema antillarum*) show significant recovery over decadal time scales. The region is also susceptible to strengthening storms and hurricanes, and suffers mass bleaching events, hampering ecosystem recovery. None of five species listed for Texas are known to occur in the Brazoria or Sabine regions, and their potential

range does not extend into these areas.

2.8 CANDIDATE SPECIES

2.8.1 Sprague's Pipit

The Sprague's pipit (*Anthus spragueii*) is a small passerine endemic to the Northern Great Plains and is one of the few bird species endemic to the North American prairie (75 FR 56028, September 15, 2010). Sprague's pipits are strongly tied to native prairie throughout their life cycle but will utilize nonnative planted grassland. These birds are sensitive to fragmentation and require relatively large grassland patches to form breeding territories.

USFWS initiated a status review in response to a petition filed in 2009 (74 FR 63337, December 3, 2009), which resulted in the Sprague's pipit being considered a Candidate for listing. In 2010, USFWS found that listing was warranted but precluded by higher priority listing actions (75 FR 56028, September 15, 2010).

The Sprague's pipit breeding range extends throughout North Dakota, except for the easternmost counties, northern and central Montana east of the Rocky Mountains, northern portions of South Dakota, northwestern Minnesota, southeastern Alberta, the southern half of Saskatchewan, and into southwest Manitoba. Its wintering range includes south-central and southeast Arizona, Texas, southern Oklahoma, southern Arkansas, northwest Mississippi, southern Louisiana, and northern Mexico. Migration and wintering ecology are poorly known, but migrating and wintering Sprague's pipits are found in both densely and sparsely vegetated grassland and pastures; they are rarely found in fallow cropland. Sprague's pipits exhibit a strong preference for grassland habitat during the winter and an avoidance of areas with too much shrub encroachment. They eat a wide variety of insects during the breeding season and a very small percentage of seeds (74 FR 63337, December 3, 2009).

The primary threats to the Sprague's pipit are habitat fragmentation on the breeding grounds, energy development, roads, and inadequacy of existing regulatory mechanisms. Native prairie is one of the most imperiled habitats worldwide, with loss rates approximating 70 percent in the United States and Canada, and prairie loss is accelerating. There is less specific information available on the wintering grounds, but the data available indicate that large areas of the wintering grounds are being converted from grassland habitat. The 40–year trend in Christmas Bird Count data shows an annual decline of 2.54 percent of this species in Texas. Adequate regulations are not in place at the local, State, or Federal level to adequately minimize the threat of habitat degradation and fragmentation.

While most of the population winters in Mexico, the vast majority of the winter sightings in the U.S. have been in Texas, and the majority of those were on the central and south Texas coastal plain, south of the Brazoria region (USFWS 2014). They prefer native grassland prairie but will use other grasslands if the areas are sufficiently large. They avoid edges between grassland and landscape features that are structurally different than grassland such as wetlands, cropland, trees and shrubs, and burned or mowed areas. The shape of the patch is also important; grassland areas with a low edge-to-area ratio provide optimal habitat and thus, a linear patch may not be suitable.

No native prairie has been identified in either the Brazoria or Sabine project areas, but some pasture and other grassland is present. Many of these areas are regularly grazed, mowed, or cultivated. The landscape is highly fragmented with small patches of grassland, forest, scrub-shrub, and coastal marsh distributed across the landscape in both areas. No large grassland areas have been identified that would be attractive to this species, which appears to prefer large patch sizes and specific grassland structure.

2.8.2 Freshwater Mussels

2.8.2.1 Smooth Pimpleback Clam

USFWS added the smooth pimpleback clam (*Quadrula houstonensis*) to its candidate species list in 2011 (76 FR 62166, October 6, 2011) and subsequently has confirmed that status in annual reviews. The smooth pimpleback is a nearly round, thick-shelled freshwater mussel that generally reaches at least 2.6 inches in length. It has been found in mixed mud, sand, and fine gravel substrate in medium-to-large rivers and some reservoirs throughout its range. Adult freshwater mussels are filter-feeders, siphoning algae, bacteria, detritus, microscopic animals, and dissolved organic matter. Mussels tend to grow relatively rapidly for the first few years, and then slow appreciably at sexual maturity, when energy presumably is being diverted from growth to reproductive activities. They are extremely long lived, living from two to several decades.
The smooth pimpleback is native to the Brazos and Colorado River basins of central Texas. Within the Brazos River basin, the species historically occurred throughout the length of the mainstem of the Brazos River, as well as in the Clear Fork Brazos, Leon, Navasota, Little Brazos, San Gabriel, Lampasas, and Little Rivers and Yegua Creek (USFWS 2014). The reduction in numbers and range of the smooth pimpleback is primarily the result of the long-lasting effects of habitat alterations caused by impoundments, sedimentation, dewatering, sand and gravel mining, and chemical contaminants. Impoundments occur throughout the range of the species and have far-reaching effects on riverine habitat, both upstream and downstream of the dams. The Colorado and Brazos River systems have experienced a large amount of sedimentation from agriculture, instream mining, and urban development. Sand and gravel mining affects smooth pimpleback habitat by increasing sedimentation and channel instability downstream and by causing

headcutting upstream. Chemical contaminants exceeding the standards developed to support aquatic life have been documented throughout the range of the species and may represent a significant threat to the smooth pimpleback. However, the large populations in the San Saba River, lower Brazos River, Navasota River, Leon River, and Yegua Creek indicate that some smooth pimpleback populations are not currently as vulnerable to habitat loss as others. Climate change could also affect the smooth pimpleback through the combined effects of global and regional climate change, along with the increased probability of long-term drought.

Recent surveys suggest a greater abundance and distribution of the smooth pimpleback in the central and lower Brazos River drainage than was indicated by collections from the past 40 years. The smooth pimpleback historically occurred in the Brazos River system from Haskell and Throckmorton Counties downstream to Austin and Waller Counties, as well as in numerous tributaries. Although not extirpated from the middle Brazos River, the smooth pimpleback occurs only in low numbers. Smooth pimpleback are more numerous in the lower mainstem Brazos River; however, far fewer have been reported from farther downstream in Austin and Fort Bend Counties. None are known to have occurred in Brazoria County.

2.8.2.2 Texas Fawnsfoot Clam

USFWS added the Texas fawnsfoot clam (*Truncilla macrodon*) to its candidate species list in 2011 (76 FR 62166, October 6, 2011) and subsequently has confirmed that status in annual reviews. The Texas fawnsfoot is a small, relatively thin-shelled freshwater mussel that can reach 2.4 inches in length but is usually much smaller. Since Texas fawnsfoot were not found alive for many years, very little information is available about its habitat preferences. In the past only Texas fawnsfoot shells and recently dead individuals were occasionally found along rivers following drought-related dewatering or bank deposition after high floods. These shells and recently dead individuals indicated that the Texas fawnsfoot occurs in flowing water, as it was never found in ponds, lakes, or reservoirs, suggesting that it is intolerant of deep, low-velocity waters created by artificial impoundments. The recently discovered live population in the Brazos River indicates that the species occurs in rivers with soft, sandy sediment with moderate water flow (USFWS 2014).

The Texas fawnsfoot is endemic to the Brazos and Colorado Rivers of central Texas. Until recently, relatively few Texas fawnsfoot have been documented since the species was first described in 1859, and few live individuals have been found in recent decades. It was not until 2008 when the first live population of Texas fawnsfoot was discovered in the Brazos River near its confluence with the Navasota River. In the Brazos River system, the Texas fawnsfoot persists in the mainstem Brazos River, Clear Fork Brazos River, Navasota River, and possibly in Deer Creek. It has also been found further downstream in Austin, Waller and Fort Bend Counties, the

latter being the furthest downstream collection in the mainstem of the Brazos River on record in recent years. There is no record at this time of it being found in Brazoria County.

3 EFFECTS ON LISTED SPECIES

3.1 PIPING PLOVER

On their wintering grounds, piping plovers use beaches, mudflats, sandflats, dunes, and may also use sandflats in existing USACE PAs near the coast. There is one placement area located inside of the existing Freeport HFP levee system where temporary sandflats could be attractive to piping plover. However, the Freeport CSRM project construction right-of-way does not affect this PA. None of the other landscape features attractive to plovers are present in or adjacent to the construction right-of-way. The general area is heavily industrialized with substantial disturbances from ship and roadway traffic, and plant and port activities. The Port Arthur and Orange-Jefferson CSRM project areas are located well inland from the coast and do not contain piping plover habitat, making it highly unlikely that piping plovers would occur in the area.

Construction activities associated with the TSP in both the Sabine and Brazoria regions would not occur in the placement areas; they would be confined to the levee system right-of-way. It is unlikely that piping plovers would frequent the TSP project areas because of the lack of acceptable habitat and extensive urban and industrial disturbances. Therefore, USACE has determined that the TSP would have no effect on piping plovers.

3.2 RED KNOT

The red knot winters along the Texas coast, foraging on beaches, oyster reefs, and exposed bay bottoms and roosting on high sand flats, and reefs, utilizing the same areas as piping plovers. The potential for occurrence in the TSP project areas is the same as that of the piping plover. It is unlikely that red knots would frequent the TSP project areas because of the lack of acceptable habitat and extensive urban and industrial disturbances. Therefore, USACE has determined that the TSP would have no effect on red knots.

3.3 WHOOPING CRANE

Although their primary migration route is to the west, occasionally whooping cranes may pass through the Brazoria region on the way to and from their principal winter habitat in and around the Aransas National Wildlife Refuge in the Texas coastal bend region. They may rest along the way in brackish bays, marshes, and salt flats, feeding primarily on blue crabs, clams, snails and insects. The Freeport CSRM project area is located in upland areas and the levee system surrounds extensive urban and industrial development. The type of coastal marsh system these large birds prefer is not present in the area that would be affected by construction of the TSP. The migratory

route does not extend to the Sabine region. Therefore, USACE has determined that the TSP would have no effect on whooping cranes.

3.4 WEST INDIAN MANATEE

Sightings of West Indian manatees are very rare along the Texas coast. The construction right-of-way in the Sabine and Brazoria regions would cross only three bodies of water where manatees could potentially occur, and these are the locations where surge gates are proposed. The Orange-Jefferson CSRM Plan includes the construction of tidal surge gates on Cow and Adams Bayous, and the Freeport CSRM plan includes construction of a surge gate on the Dow Barge Canal. All other construction right-of-way water crossings are shallow upland ponds or streams to which manatees would not have access. The Dow barge canal does not contain preferred habitat such as seagrass and manatees would have to traverse a heavily utilized, deepwater channel to gain access to the area. To reach the locations of the Cow and Adams Bayou structures, manatees would have to travel more than 30 miles from the Gulf through a pass with high water velocities, and waters without seagrass and preferred habitat. Given these considerations, USACE has determined that the manatee is not likely to occur in the project areas, and that the TSP would have no effect on the West Indian manatee.

3.5 WHALES

Whales occur in offshore waters and none of these species are likely to wander into shallow coastal estuaries. Therefore, USACE has determined that the Sabine and Brazoria TSPs would have no effect on these species.

3.6 SEA TURTLES

The leatherback is the not likely to occur in the project areas due to its preference for deep marine waters. No documented records of hawksbills exist from Brazoria, Jefferson or Orange counties. Green, Kemp's ridley, and loggerhead sea turtles occur in and around the Entrance Channel of the Freeport Harbor Navigation Channel and the Entrance Channel of the Sabine-Neches Waterway, but they are unlikely to occur in the inland channels of either system. They are not likely to occur near the construction rights-of-way for the Freeport, Port Arthur and Orange-Jefferson CSRM plans. Furthermore, project construction will not utilize hopper dredges, which are known to adversely impact sea turtles. Inasmuch as it would be unlikely that sea turtles would visit the area, USACE has determined that the TSP would have no effect on sea turtles.

3.7 CORALS

Corals occur in offshore waters; none of these species occur in the Sabine and Brazoria regions. Therefore, USACE has determined that the TSP would have no effect on these species.

3.8 CANDIDATE SPECIES

3.8.1 Sprague's Pipit

No native prairie, preferred habitat for Sprague's pipits, has been identified in either the Brazoria or Sabine regions, but some pasture and other grassland is present. Many of these areas are regularly grazed, mowed or cultivated. The landscape is highly fragmented with small patches of grassland, forest, scrub-shrub and coastal marsh distributed across the landscape in both regions. No large grassland areas have been identified that might be utilized by this species, which appears to prefer large patch sizes and specific grassland structure. None are known to have utilized the study areas. Therefore, USACE has determined that the TSP would have no effect on wintering Sprague's pipits

3.8.2 Freshwater Mussels

Although they are present farther upstream in the main stem of the Brazos River, neither the smooth pimpleback nor Texas fawnfoot clam has been reported anywhere near the TSP construction area in Brazoria County. The range of these mussels does not extend to the Sabine region. Therefore, USACE has determined that the TSP would have no effect on these species.

4 SUMMARY OF EFFECT

This Biological Assessment has determined that the TSP of the Sabine-Pass to Galveston Bay, Texas DIFR-EIS (specifically the Orange-Jefferson, Port Arthur and Vicinity, and Freeport and Vicinity CSRM Plans) would have no effect on the following listed animal species – piping plover, red knot, whooping crane, the West Indian manatee, four whale species (fin, humpback, sei, and sperm), four sea turtle species (green, Kemp's ridley, loggerhead and hawksbill), and four coral species (lobed star, mountainous star, boulder star and elkhorn). USACE has also determined that the TSP would have no effect on the following Candidate species: Sprague's pipit, and two freshwater mussel species (smooth pimpleback and Texas fawnsfoot).

5 LITERATURE CITED

American Ornithologists' Union (AOU). 1998. Check-list of North American birds. Seventh edition.

Armstrong, N., M. Brody, and N. Funicelli. 1987. The ecology of open-bay bottoms of Texas: a community profile. U.S. Department of the Interior Fish and Wildlife Service. Biological Report 85(7.12).

Balazs, G. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands. NOAA Technical Memorandum. NMFS-SWFC-7.

Bartlett, R.D., and P.P Bartlett. 1999. A field guide to Texas reptiles and amphibians. Gulf Publishing Company. Houston.

Blakenship, R. 2005. Texas Parks and Wildlife Department, Coastal Fisheries Division. Personal communication to Erik Huebner, PBS&J, 12 May.

Campbell, L. 1995. Endangered and threatened animals of Texas, their life history and management. Texas Parks and Wildlife Department, Resource Protection Division, Endangered Resources Branch, Austin.

Dixon, J.R. 2000. Amphibians and reptiles of Texas. Second edition. Texas A&M University Press, College Station.

Eckert, S.A. 1992. Bound for deepwater. Natural History, March 1992, pp. 28–35.

Ernst, C.H., and R.W. Barbour. 1972. Turtles of the United States. University of Kentucky Press, Lexington.

Gould, F.W., G.O. Hoffman, and C.A. Rechenthin. 1960. Vegetational Areas of Texas. Texas A&M University, Texas Agricultural Experiment Station Leaflet No. 492.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). Biological Report 97 (1). U.S. Fish and Wildlife Service, Washington, D.C.

Iverson, J.B. 1986. A checklist with distribution maps of the turtles of the world. Paust Printing, Richmond, Indiana.

Leary, T. 1957. A schooling of leatherback turtles, *Dermochelys coriacea coriacea*, on the Texas coast. Copeia 3:232.

Mortimer, J.A. 1982. Feeding ecology of sea turtles. In: Biology and conservation of sea Turtles (K. Bjorndal, ed.), 103–109. Smithsonian Institution Press, Washington, D.C.

National Fish and Wildlife Laboratory (NFWL). 1980. Selected vertebrate endangered species of the seacoast of the United States. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-80/01.

NMFS (National Marine Fisheries Service) .1979. Designated Critical Habitat; Determination of Critical Habitat for the Leatherback Sea Turtle (44 FR 17710, March 23, 1979).

_____.1998. Designated Critical Habitat; Green and Hawksbill Sea Turtles (63 FR 46693, September 2, 1998).

_____. 2012. Management Report for 82 Corals Status Review under the Endangered Species Act: Existing Regulatory Mechanisms and Conservation Efforts. Pacific Islands Regional Office.

_____. 2013. Office of Protected Species – Green Turtle (*Chelonia mydas*). http://www.nmfs.noaa.gov/pr/species/turtles/green.htm (accessed June 6, 2013).

_____. 2013. Office of Protected Species – Kemp's Ridley Turtle (*Lepidochelys kempii*). http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm (accessed June 6, 2013).

_____. 2013. Office of Protected Species – Loggerhead Turtle (*Caretta caretta*). http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm (accessed June 6, 2013).

_____. 2013. Office of Protected Species – Hawksbill Turtle (*Eretmochelys imbricata*). http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm (accessed June 6, 2013).

_____. 2013. Office of Protected Species – Leatherback Turtle (*Dermochelys coriacea*). http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm (accessed June 6, 2013).

_____. 2013f. Office of Protected Species – Threats to Marine Turtles. http://www.nmfs.noaa.gov/pr/species/turtles/threats.htm (accessed June 6, 2013).

_____.2014. Endangered and Threatened Wildlife and Plants: Final Listing Determinations on Proposal to List 66 Reef Building Coral Species and to Reclassify Elkhorn and Staghorn Corals (70 FR 53852).

_____.2015. Texas' Threatened and Endangered Species. NOAA Fisheries, Southeast Region, Protected Resources Division. http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/Documents/texas.pdf (accessed May 21, 2015).

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle. National Marine Fisheries Service, Washington, D.C.

———.1991. Recovery plan for U.S. population of loggerhead turtle. National Marine Fisheries Service, Washington, D.C.

———.1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

_____.1998. Designated Critical Habitat; Green and Hawksbill Sea Turtles (63 FR 46693, September 2, 1998).

_____. 2003. Endangered Species Act, Section 7 Consultation, Biological Opinion for Dredging of Gulf of Mexico Navigation Channels and Sand Mining (Borrow) Areas Using Hopper Dredges by COE Galveston. Issued November 19, 2003.

_____. 2011. Endangered and Threatened Species; Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened, (76 FR 58858, September 22, 2011).

National Park Service (NPS). 2012. Sea Turtle Nesting Season 2012, Padre Island National Seashore, Texas. ttp://www.nps.gov/pais/naturescience/nesting2012.htm (accessed on June 6, 2013).

_____. 2013. The Kemp's Ridley Sea Turtle. http://www.nps.gov/pais/naturescience/kridley.htm (accessed June 6, 2013).

_____. 2013. The Loggerhead Sea Turtle. http://www.nps.gov/pais/naturescience/loggerhead.htm. (accessed June 6, 2013).

_____. 2013. The Hawsbill Sea Turtle. http://www.nps.gov/pais/naturescience/hawksbill.htm (accessed June 6, 2013).

_____. 2013. The Leatherback Sea Turtle. http://www.nps.gov/pais/naturescience/leatherback.htm (accessed June 6, 2013).

National Research Council (NRC). 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C.

NatureServe. 2013. *Trichechus manatus* (West Indian Manatee) in NatureServe Explorer: An online encyclopedia of life. Accessed on the internet on June 4, 3013. http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Trichechus+manatus+

_____. 2013. *Calidris canutus rufa* (Red Knot – rufa subspecies) in NatureServe Explorer: An online encyclopedia of life. Accessed on the internet on June 4, 2013. http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Calidris+canutus+rufa

_____. 2013. *Dermochelys coriacea* (Leatherback) in NatureServe Explorer: An online encyclopedia of life. Accessed on the internet on June 4, 3013. http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Dermochelys+coriacea

_____.2015. Grus Americana (Whooping Crane) in NatureServe Explorer: An online encyclopedia of life. http://explorer.natureserve.org/servlet/NatureServe?searchName=Grus+americana (accessed on May 27, 2015).

Pritchard, P.C.H. 1971. The leatherback or leathery turtle *Dermochelys coriacea*. IUCN Monograph No. 1. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

Pritchard, P.C.H. and R. Marquez. 1973. Kemp's ridley turtle or Atlantic ridley, *Lepidochelys kempi*. IUCN Monograph 2, Morges, Switzerland.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico. Rev. Ed. University of Miami Press, Coral Gables, Florida.

Ross, J.P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. In: Biology and conservation of sea turtles (K. Bjorndal, ed.), 189–195. Smithsonian Institution Press, Washington, D.C.

Schmidley, D. J. 2004. The mammals of Texas, revised edition. University of Texas Press, Austin.

Schwartz, F. 1976. Status of sea turtles, Cheloniidae and Dermochelidae, in North Carolina. Abstr. in Proceedings and abstracts from the 73rd meeting of the North Carolina Academy of Science, Inc., April 2–3, 1976, at the Univ. N. Carolina, Wilmington, N. Carolina. J. Elisha Mitchell Sci. Soc. 92(2):76–77.

Sea Turtle, Inc. 2008. http://www.seaturtleinc.com/ (accessed February 11, 2008).

Sea Turtle Stranding and Salvage Network (STSSN). 2013. http://www.sefsc.noaa.gov/STSSN/STSSNReportDriver.jsp (accessed June 6, 2013).

Shaver, D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology 25(3):327–334.

Shaver, D.J. and A. Amos. 1988. Sea Turtle Nesting on Texas Beaches in 1987. *Marine Turtle Newsletter* 42:7-9

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conservation and Biology 2(2):209–222.

Stutzenbaker, C.D., and M.W.Weller. 1989. "The Texas Coast" in Habitat Management for Migrating and Wintering Waterfowl in North America, L.M. Smith, R. Pederson and R. Kaminski (eds). Texas Tech University Press, Lubbock.

Texas Parks and Wildlife Department (TPWD). 2013. Texas Gulf Ecological Management Sites (GEMS). http://www.tpwd.state.tx.us/landwater/water/conservation/txgems/index.phtml (accessed on June 30, 2013).

_____. 2013. J.D. Murphree Wildlife Management Area. http://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=40 (accessed on June 30, 2013).

———.2015. Lower Neches Wildlife Management Area. https://tpwd.texas.gov/huntwild/hunt/wma/find_a_wma/list/?id=58 (accessed on January 3, 2015)

_____.2015. Tony Houseman Wildlife Management Area. https://tpwd.texas.gov/huntwild/hunt/wma/find_a_wma/list/?id=38 (accessed on January 3, 2015)

U.S. Army Corps of Engineers (USACE)

———.1998. Environmental assessment for a change in location of the Neches River and tributaries, saltwater barrier at Beaumont, Texas. U.S. Army Engineer District, Galveston, Texas.

_____. 2013. Sea Turtle Data Warehouse. http://el.erdc.usace.army.mil/seaturtles/list.cfm?Code=Project&Step=2&Type=SWG (accessed June 6, 2013).

_____. 2015. Analysis of Cow and Adams Bayous in Orange County, Texas using Desktop Off-Channel Wetland Salinity Mitigation Model (DOWSMM) by B. Gunkel and G. Brown. ERDC-CHL, Vicksburg.

U.S. Fish and Wildlife Service (USFWS). 1967. Native Fish and Wildlife; Endangered Species (32 FR 4001, March 11, 1967).

_____.1970. Conservation of Endangered Species and Other Fish or Wildlife. (35 FR 84952, June 2, 1970).

_____.1978. Endangered and Threatened Wildlife and Plants; Listing and Protecting Loggerhead Sea Turtles as "Threatened Species" and Populations of Green and Olive Ridley Sea Turtles as Threatened Species or "Endangered Species." (43 FR 32808, July 28, 1978).

_____.1978. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Leatherback Sea Turtle (43 FR 43688, September 26, 1978).

_____.1981 . Endangered species assessments and surveys in Hidalgo and Willacy counties, Texas. Final report to USACE, Galveston by USFWS, Denver Wildlife Research Center.

_____.1985. Determination of Endangered and Threatened Status for Piping Plover; 50 FR 50726 (December 11, 1985).

_____. 1995. Threatened and Endangered Species of Texas. USFWS, Austin.

_____. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for Wintering Piping Plovers, 66 FR 36038 (July 10, 2001).

_____. 2001. Florida manatee (*Trichechus manatus latirostris*), third revision. USFWS, Atlanta.

_____. 2008. Texas Chenier Plain Refuge Complex Final Environmental Impact Statement, Comprehensive Conservation Plan, and Land Protection Plan. Prepared by the Division of Planning, National Wildlife Refuge System, Southwest Region, Albuquerque.

_____. 2008. Confirmed Sea Turtle Nests on South Padre Island and Boca Chica Beaches, Texas, 1999-2007. Unpublished Data.

_____. 2008. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions, Notice of Review, 73 FR 75176 (December 10, 2008).

_____. 2009. Piping Plover (*Charadrius melodus*): Spotlight Species Action Plan for the threatened Atlantic Coast and Northern Great Plains populations. Prepared by Endangered Species Program, Northeast Region.

_____. 2009. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Wintering Population of the Piping Plover (*Charadrius melodus*), 74 FR 23476 (May 19, 2009).

_____. 2009. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to List Sprague's Pipit as Threatened T or Endangered, 74 FR 63337, December 3, 2009.

_____. 2010. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Sprague's Pipit as Endangered or Threatened Throughout Its Range, 75 FR 56028 (September 15, 2010).

_____. 2011. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form "*Calidris canutus ssp. rufa*". Accessed on the internet (6/4/2013) http://ecos.fws.gov/docs/candidate/assessments/2012/r5/B0DM_V01.pdf

_____.2011. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Texas Fatmucket, Golden Orb, Smooth Pimpleback, Texas Pimpleback and Texas Fawnsfoot as Threatened or Endangered; Proposed Rule (76 FR 62166, October 6, 2011).

_____. 2011. Endangered and Threatened Wildlife and Plants; 90-Day Finding and 12-Month Determination on a Petition to Revise Critical Habitat for the Leatherback Sea Turtle (76 FR 47133, August 4, 2011).

_____. 2012. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions, Notice of Review, 77 FR 69994 (November 12, 2012).

_____.2012. Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service. http://www.fws.gov/refuges/realty/archives/pdf/2012_Annual_Report_of_LandsDataTable11162012.pdf (accessed June 30, 2013).

_____. 2013. National Wildlife Refuge System. http://www.fws.gov/southwest/refuges/statemaps/texas.html (accessed on June 30, 2013).

_____. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northwest Atlantic Ocean Distinct Population Segments of the Loggerhead Sea Turtle (*Caretta caretta*); Proposed Rule (78 FR 17999, March 25, 2013).

_____.2014. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Rufa Red Knot. Final Rule (79 FR 73706, December 11, 2014).

_____. 2014. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form (*Anthus spragueii*, Sprague's Pipit). Prepared by Region 6 (Mountain-Prairie Region), dated 8/29/2014. Accessed on May 22, 2015 at http://ecos.fws.gov/docs/candidate/assessments/2014/r6/B0GD_V01.pdf

_____. 2014. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form (*Quadrula houstonensis,* Smooth Pimpleback). Prepared by Region 6 (Southwest Region), dated5/30/2014. Accessed on May 22, 2015 at http://ecos.fws.gov/docs/candidate/assessments/2014/r2/F04G_I01.pdf

_____. 2014. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form (*Truncilla macrodon,* Texas Fawnsfoot). Prepared by Region 6 (Southwest Region), dated5/30/2014. Accessed on May 22, 2015 at http://ecos.fws.gov/docs/candidate/assessments/2014/r2/F04E_I01.pdf

_____. 2015. Brazoria National Wildlife Refuge. http://www.fws.gov/refuge/brazoria/ (accessed on January 3, 2015).

_____. 2015. San Bernard National Wildlife Refuge. http://www.fws.gov/refuge/san_bernard/ (accessed on January 4, 2015).

_____.2015. Personal communication with USFWS on manatee in Trinity Bay.

U.S. Fish and Wildlife Service and National Marine Fisheries Service (USFWS and NMFS). 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

Witzell, W.N. 1983. Synopsis of biological data on the hawksbill turtle *Eretmochelys imbricata* (Linnaeus, 1766). FAO Fisheries Synopsis No. 137. FIR/S137, SAST – Hawksbill Turtle – 5.31 (07) 017.01. Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy.

APPENDIX A
NMFS AND USFWS SPECIES LISTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 EL CAMINO REAL, SUITE 211
HOUSTON, TX 77058
PHONE: (281)286-8282 FAX: (281)488-5882
URL: www.fws.gov/southwest/es/TexasCoastal/;
www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ETTXX0-2015-SLI-0415 May 21, 2015
Event Code: 02ETTXX0-2015-E-00460
Project Name: Sabine Pass to Galvestion Bay

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 6300 Ocean Drive, Unit 5837, Corpus Christi, Texas 78412.

The enclosed species list identifies federally threatened, endangered, and proposed to be listed species; designated critical habitat; and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list is provided by the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information from updated surveys, changes in the abundance and distribution of species, changes in habitat conditions, or other factors could change the list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation for updates to species list and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Candidate species have no protection under the Act but are included for consideration because they could be listed prior to the completion of your project. The other species information should help you determine if suitable habitat for these listed species exists in any of the proposed project areas or if project activities may affect species on-site, off-site, and/or result in "take" of a federally listed species.

"Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if the activity results in the death or injury of wildlife by removing essential habitat components or significantly alters essential behavior patterns, including breeding, feeding, or sheltering.

Section 7

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species. If a "may affect" determination is made, the Federal agency shall initiate the section 7 consultation process by writing to the office that has responsibility for the area in which your project occurs.

Is not likely to adversely affect – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect – adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires the Federal action agency to initiate formal section 7 consultation with this office.

No effect – the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No further coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel

conducting the evaluation, habitat conditions, site photographs, and any other related articles.

Please be advised that while a Federal agency may designate a non-Federal representative to conduct informal consultations with the Service, assess project effects, or prepare a biological assessment, the Federal agency must notify the Service in writing of such a designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Act requirements for your projects at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Section 10

If there is no federal involvement and the proposed project is being funded or carried out by private interests and/or non-federal government agencies, and the project as proposed may affect listed species, a section 10(a)(1)(B) permit is recommended. The Habitat Conservation Planning Handbook is available at http://www.fws.gov/midwest/endangered/permits/hcp/hcphandbook.html.

Service Response

Please note that the Service strives to respond to requests for project review within 30 days of receipt, however, this time period is not mandated by regulation. Responses may be delayed due to workload and lack of staff. Failure to meet the 30-day timeframe does not constitute a concurrence from the Service that the proposed project will not have impacts to threatened and endangered species.

Candidate Species

Several species of freshwater mussels occur in Texas and five are candidates for listing under the ESA. The Service is also reviewing the status of six other species for potential listing under the ESA. One of the main contributors to mussel die offs is sedimentation, which smothers and suffocates mussels. To reduce sedimentation within rivers, streams, and tributaries crossed by a project, the Service recommends that that you implement the best management practices found at: http://www.fws.gov/southwest/es/TexasCoastal/FreshwaterMussels.html.

Candidate Conservation Agreements (CCAs) or Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements between the Service and public or private entities to implement conservation measures to address threats to candidate species. Implementing conservation efforts before species are listed increases the likelihood that simpler, flexible, and more cost-effective conservation options are available. A CCAA can provide participants with assurances that if they engage in conservation actions, they will not be required to implement additional conservation measures beyond those in the agreement. For additional information on CCAs/CCAAs please visit the Service's website at http://www.fws.gov/endangered/what-we-do/cca.html.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Many may nest in trees, brush areas or other suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals or eggs. If project activities must be conducted during this time, we recommend surveying for active nests prior to commencing work. A list of migratory birds may be viewed at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the Act on August 9, 2007. Both the bald eagle and the goden eagle (*Aquila chrysaetos*) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For more information on bald and golden eagle management guidlines, we recommend you review information provided at http://www.fws.gov/midwest/eagle/pdf/NationalBaldEagleManagementGuidelines.pdf

The construction of overhead power lines creates threats of avian collision and electrocution. The Service recommends the installation of underground rather than overhead power lines whenever possible. For new overhead lines or retrofitting of old lines, we recommend that project developers implement, to the maximum extent practicable, the Avian Power Line Interaction Committee guidelines found at http://www.aplic.org/.

Meteorological and communication towers are estimated to kill millions of birds per year. We recommend following the guidance set forth in the Service Interim Guidelines for Recommendations on Communications Tower Siting, Constructions, Operation and Decommissioning, found online at: http://www.fws.gov/habitatconservation/communicationtowers.html, to minimize the threat of avian mortality at these towers. Monitoring at these towers would provide insight into the effectiveness of the minimization measures. We request the results of any wildlife mortality monitoring at towers associated with this project.

We request that you provide us with the final location and specifications of your proposed towers, as well as the recommendations implemented. A Tower Site Evaluation Form is also available via the above website; we recommend you complete this form and keep it in your files. If meteorological towers are to be constructed, please forward this completed form to our office.

More information concerning sections 7 and 10 of the Act, migratory birds, candidate species, and landowner tools can be found on our website at: http://www.fws.gov/southwest/es/TexasCoastal/ProjectReviews.html.

Wetlands and Wildlife Habitat

Wetlands and riparian zones provide valuable fish and wildlife habitat as well as contribute to

ﬂood control, water quality enhancement, and groundwater recharge. Wetland and riparian vegetation provides food and cover for wildlife, stabilizes banks and decreases soil erosion. These areas are inherently dynamic and very sensitive to changes caused by such activities as overgrazing, logging, major construction, or earth disturbance. Executive Order 11990 asserts that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities. Construction activities near riparian zones should be carefully designed to minimize impacts. If vegetation clearing is needed in these riparian areas, they should be re-vegetated with native wetland and riparian vegetation to prevent erosion or loss of habitat. We recommend minimizing the area of soil scarification and initiating incremental re-establishment of herbaceous vegetation at the proposed work sites. Denuded and/or disturbed areas should be re-vegetated with a mixture of native legumes and grasses. Species commonly used for soil stabilization are listed in the Texas Department of Agriculture's (TDA) Native Tree and Plant Directory, available from TDA at P.O. Box 12847, Austin, Texas 78711. The Service also urges taking precautions to ensure sediment loading does not occur to any receiving streams in the proposed project area. To prevent and/or minimize soil erosion and compaction associated with construction activities, avoid any unnecessary clearing of vegetation, and follow established rights-of-way whenever possible. All machinery and petroleum products should be stored outside the ﬂoodplain and/or wetland area during construction to prevent possible contamination of water and soils.

Wetlands and riparian areas are high priority fish and wildlife habitat, serving as important sources of food, cover, and shelter for numerous species of resident and migratory wildlife. Waterfowl and other migratory birds use wetlands and riparian corridors as stopover, feeding, and nesting areas. We strongly recommend that the selected project site not impact wetlands and riparian areas, and be located as far as practical from these areas. Migratory birds tend to concentrate in or near wetlands and riparian areas and use these areas as migratory ﬂyways or corridors. After every effort has been made to avoid impacting wetlands, you anticipate unavoidable wetland impacts will occur; you should contact the appropriate U.S. Army Corps of Engineers office to determine if a permit is necessary prior to commencement of construction activities.

If your project will involve filling, dredging, or trenching of a wetland or riparian area it may require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (COE). For permitting requirements please contact the U.S. Corps of Engineers, District Engineer, P.O. Box 1229, Galveston, Texas 77553-1229, (409) 766-3002.

Beneficial Landscaping

In accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (42 C.F.R. 26961), where possible, any landscaping associated with project plans should be limited to seeding and replanting with native species. A mixture of grasses and forbs appropriate to address potential erosion problems and long-term cover should be planted when seed is reasonably available. Although Bermuda grass is listed in seed mixtures, this species and other introduced species should be avoided as much as possible. The Service also recommends the use of native trees, shrubs, and herbaceous species that are adaptable, drought tolerant and conserve water.

State Listed Species

The State of Texas protects certain species. Please contact the Texas Parks and Wildlife Department (Endangered Resources Branch), 4200 Smith School Road, Austin, Texas 78744 (telephone 512/389-8021) for information concerning fish, wildlife, and plants of State concern or visit their website at: http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/.

If we can be of further assistance, or if you have any questions about these comments, please contact 281/286-8282 if your project is in southeast Texas, or 361/994-9005 if your project is in southern Texas. Please refer to the Service consultation number listed above in any future correspondence regarding this project.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galvestion Bay

Official Species List

Provided by:

Texas Coastal Ecological Services Field Office
17629 EL CAMINO REAL, SUITE 211
HOUSTON, TX 77058
(281) 286-8282
http://www.fws.gov/southwest/es/TexasCoastal/
http://www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ETTXX0-2015-SLI-0415
Event Code: 02ETTXX0-2015-E-00460

Project Type: ** OTHER **

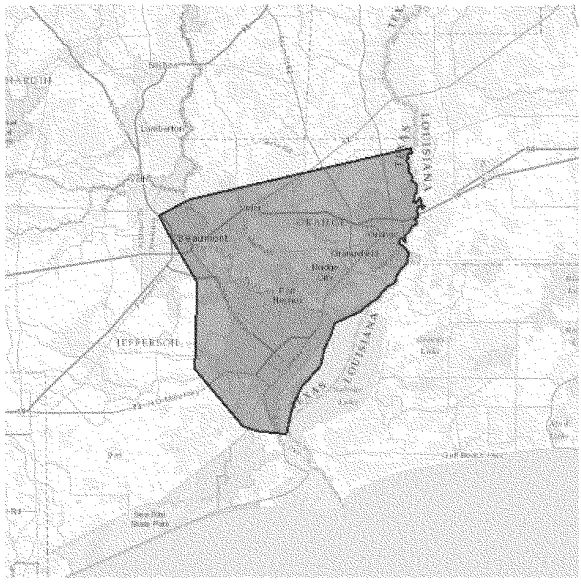
Project Name: Sabine Pass to Galvestion Bay
Project Description: Coastal storm risk management study for Beaumont/Orange Tx region.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galvestion Bay

Project Location Map:



Project Coordinates: The coordinates are too numerous to display here.

Project Counties: Jefferson, TX | Orange, TX

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galvestion Bay

Endangered Species Act Species List

There are a total of 9 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 3 of these species should be considered only under certain conditions. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Least tern *(Sterna antillarum)* Population: interior pop.	Endangered		Wind related projects within migratory route.
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed	Threatened	Final designated	Wind related projects within migratory route.
Red Knot *(Calidris canutus rufa)*	Threatened		Wind related projects within migratory route.
Mammals			
West Indian Manatee *(Trichechus manatus)* Population: Entire	Endangered	Final designated	
Reptiles			
Green sea turtle *(Chelonia mydas)* Population: Except where endangered	Threatened	Final designated	
Hawksbill sea turtle *(Eretmochelys imbricata)*	Endangered	Final designated	

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galvestion Bay

Population: Entire			
Kemp's Ridley sea turtle *(Lepidochelys kempii)* Population: Entire	Endangered		
Leatherback sea turtle *(Dermochelys coriacea)* Population: Entire	Endangered	Final designated	
Loggerhead sea turtle *(Caretta caretta)* Population: Northwest Atlantic Ocean DPS	Threatened	Proposed, Final designated	

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galvestion Bay

Critical habitats that lie within your project area

There are no critical habitats within your project area.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 EL CAMINO REAL, SUITE 211
HOUSTON, TX 77058
PHONE: (281)286-8282 FAX: (281)488-5882
URL: www.fws.gov/southwest/es/TexasCoastal/;
www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ETTXX0-2015-SLI-0103 May 21, 2015
Event Code: 02ETTXX0-2015-E-00459
Project Name: Sabine Pass to Galveston Bay - Freeport

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 6300 Ocean Drive, Unit 5837, Corpus Christi, Texas 78412.

The enclosed species list identifies federally threatened, endangered, and proposed to be listed species; designated critical habitat; and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list is provided by the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information from updated surveys, changes in the abundance and distribution of species, changes in habitat conditions, or other factors could change the list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation for updates to species list and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Candidate species have no protection under the Act but are included for consideration because they could be listed prior to the completion of your project. The other species information should help you determine if suitable habitat for these listed species exists in any of the proposed project areas or if project activities may affect species on-site, off-site, and/or result in "take" of a federally listed species.

"Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if the activity results in the death or injury of wildlife by removing essential habitat components or significantly alters essential behavior patterns, including breeding, feeding, or sheltering.

Section 7

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species. If a "may affect" determination is made, the Federal agency shall initiate the section 7 consultation process by writing to the office that has responsibility for the area in which your project occurs.

Is not likely to adversely affect – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect – adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires the Federal action agency to initiate formal section 7 consultation with this office.

No effect – the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No further coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel

conducting the evaluation, habitat conditions, site photographs, and any other related articles.

Please be advised that while a Federal agency may designate a non-Federal representative to conduct informal consultations with the Service, assess project effects, or prepare a biological assessment, the Federal agency must notify the Service in writing of such a designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Act requirements for your projects at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Section 10

If there is no federal involvement and the proposed project is being funded or carried out by private interests and/or non-federal government agencies, and the project as proposed may affect listed species, a section 10(a)(1)(B) permit is recommended. The Habitat Conservation Planning Handbook is available at http://www.fws.gov/midwest/endangered/permits/hcp/hcphandbook.html.

Service Response

Please note that the Service strives to respond to requests for project review within 30 days of receipt, however, this time period is not mandated by regulation. Responses may be delayed due to workload and lack of staff. Failure to meet the 30-day timeframe does not constitute a concurrence from the Service that the proposed project will not have impacts to threatened and endangered species.

Candidate Species

Several species of freshwater mussels occur in Texas and five are candidates for listing under the ESA. The Service is also reviewing the status of six other species for potential listing under the ESA. One of the main contributors to mussel die offs is sedimentation, which smothers and suffocates mussels. To reduce sedimentation within rivers, streams, and tributaries crossed by a project, the Service recommends that that you implement the best management practices found at: http://www.fws.gov/southwest/es/TexasCoastal/FreshwaterMussels.html.

Candidate Conservation Agreements (CCAs) or Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements between the Service and public or private entities to implement conservation measures to address threats to candidate species. Implementing conservation efforts before species are listed increases the likelihood that simpler, flexible, and more cost-effective conservation options are available. A CCAA can provide participants with assurances that if they engage in conservation actions, they will not be required to implement additional conservation measures beyond those in the agreement. For additional information on CCAs/CCAAs please visit the Service's website at http://www.fws.gov/endangered/what-we-do/cca.html.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Many may nest in trees, brush areas or other suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals or eggs. If project activities must be conducted during this time, we recommend surveying for active nests prior to commencing work. A list of migratory birds may be viewed at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the Act on August 9, 2007. Both the bald eagle and the goden eagle (*Aquila chrysaetos*) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For more information on bald and golden eagle management guidlines, we recommend you review information provided at http://www.fws.gov/midwest/eagle/pdf/NationalBaldEagleManagementGuidelines.pdf

The construction of overhead power lines creates threats of avian collision and electrocution. The Service recommends the installation of underground rather than overhead power lines whenever possible. For new overhead lines or retrofitting of old lines, we recommend that project developers implement, to the maximum extent practicable, the Avian Power Line Interaction Committee guidelines found at http://www.aplic.org/.

Meteorological and communication towers are estimated to kill millions of birds per year. We recommend following the guidance set forth in the Service Interim Guidelines for Recommendations on Communications Tower Siting, Constructions, Operation and Decommissioning, found online at: http://www.fws.gov/habitatconservation/communicationtowers.html, to minimize the threat of avian mortality at these towers. Monitoring at these towers would provide insight into the effectiveness of the minimization measures. We request the results of any wildlife mortality monitoring at towers associated with this project.

We request that you provide us with the final location and specifications of your proposed towers, as well as the recommendations implemented. A Tower Site Evaluation Form is also available via the above website; we recommend you complete this form and keep it in your files. If meteorological towers are to be constructed, please forward this completed form to our office.

More information concerning sections 7 and 10 of the Act, migratory birds, candidate species, and landowner tools can be found on our website at: http://www.fws.gov/southwest/es/TexasCoastal/ProjectReviews.html.

Wetlands and Wildlife Habitat

Wetlands and riparian zones provide valuable fish and wildlife habitat as well as contribute to

ﬂood control, water quality enhancement, and groundwater recharge. Wetland and riparian vegetation provides food and cover for wildlife, stabilizes banks and decreases soil erosion. These areas are inherently dynamic and very sensitive to changes caused by such activities as overgrazing, logging, major construction, or earth disturbance. Executive Order 11990 asserts that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities. Construction activities near riparian zones should be carefully designed to minimize impacts. If vegetation clearing is needed in these riparian areas, they should be re-vegetated with native wetland and riparian vegetation to prevent erosion or loss of habitat. We recommend minimizing the area of soil scarification and initiating incremental re-establishment of herbaceous vegetation at the proposed work sites. Denuded and/or disturbed areas should be re-vegetated with a mixture of native legumes and grasses. Species commonly used for soil stabilization are listed in the Texas Department of Agriculture's (TDA) Native Tree and Plant Directory, available from TDA at P.O. Box 12847, Austin, Texas 78711. The Service also urges taking precautions to ensure sediment loading does not occur to any receiving streams in the proposed project area. To prevent and/or minimize soil erosion and compaction associated with construction activities, avoid any unnecessary clearing of vegetation, and follow established rights-of-way whenever possible. All machinery and petroleum products should be stored outside the ﬂoodplain and/or wetland area during construction to prevent possible contamination of water and soils.

Wetlands and riparian areas are high priority fish and wildlife habitat, serving as important sources of food, cover, and shelter for numerous species of resident and migratory wildlife. Waterfowl and other migratory birds use wetlands and riparian corridors as stopover, feeding, and nesting areas. We strongly recommend that the selected project site not impact wetlands and riparian areas, and be located as far as practical from these areas. Migratory birds tend to concentrate in or near wetlands and riparian areas and use these areas as migratory ﬂyways or corridors. After every effort has been made to avoid impacting wetlands, you anticipate unavoidable wetland impacts will occur; you should contact the appropriate U.S. Army Corps of Engineers office to determine if a permit is necessary prior to commencement of construction activities.

If your project will involve filling, dredging, or trenching of a wetland or riparian area it may require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (COE). For permitting requirements please contact the U.S. Corps of Engineers, District Engineer, P.O. Box 1229, Galveston, Texas 77553-1229, (409) 766-3002.

Beneficial Landscaping

In accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (42 C.F.R. 26961), where possible, any landscaping associated with project plans should be limited to seeding and replanting with native species. A mixture of grasses and forbs appropriate to address potential erosion problems and long-term cover should be planted when seed is reasonably available. Although Bermuda grass is listed in seed mixtures, this species and other introduced species should be avoided as much as possible. The Service also recommends the use of native trees, shrubs, and herbaceous species that are adaptable, drought tolerant and conserve water.

State Listed Species

The State of Texas protects certain species. Please contact the Texas Parks and Wildlife Department (Endangered Resources Branch), 4200 Smith School Road, Austin, Texas 78744 (telephone 512/389-8021) for information concerning fish, wildlife, and plants of State concern or visit their website at: http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/.

If we can be of further assistance, or if you have any questions about these comments, please contact 281/286-8282 if your project is in southeast Texas, or 361/994-9005 if your project is in southern Texas. Please refer to the Service consultation number listed above in any future correspondence regarding this project.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galveston Bay - Freeport

Official Species List

Provided by:

Texas Coastal Ecological Services Field Office
17629 EL CAMINO REAL, SUITE 211
HOUSTON, TX 77058
(281) 286-8282
http://www.fws.gov/southwest/es/TexasCoastal/
http://www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ETTXX0-2015-SLI-0103
Event Code: 02ETTXX0-2015-E-00459

Project Type: ** OTHER **

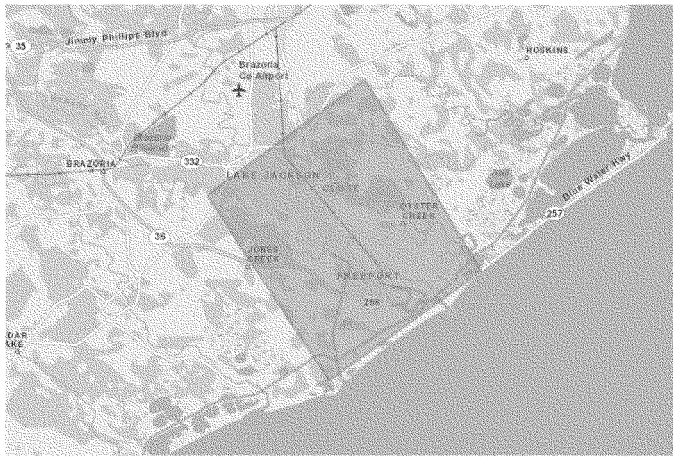
Project Name: Sabine Pass to Galveston Bay - Freeport
Project Description: The Sabine Pass to Galveston Bay feasibility study is evaluating coastal storm risk management (CSRM) and ecosystem restoration (ER) problems in in two separate areas on the upper Texas coast - Orange-NW Jefferson counties and the Freeport area in Brazoria County. This official species list request is for the Freeport area only.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galveston Bay - Freeport

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-95.4867573 29.0253992, -95.3624744 29.1166206, -95.2704639 28.9653712, -95.3906269 28.8788264, -95.4867573 29.0253992)))

Project Counties: Brazoria, TX

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galveston Bay - Freeport

Endangered Species Act Species List

There are a total of 12 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed	Threatened	Final designated	
Red Knot *(Calidris canutus rufa)*	Threatened		
Sprague's Pipit *(Anthus spragueii)*	Candidate		
Whooping crane *(Grus americana)* Population: except where EXPN	Endangered	Final designated	
Clams			
Smooth Pimpleback *(Quadrula houstonensis)*	Candidate		
Texas Fawnsfoot *(Truncilla macrodon)*	Candidate		
Mammals			
West Indian Manatee *(Trichechus manatus)* Population: Entire	Endangered	Final designated	
Reptiles			
Green sea turtle *(Chelonia mydas)*	Threatened	Final designated	

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galveston Bay - Freeport

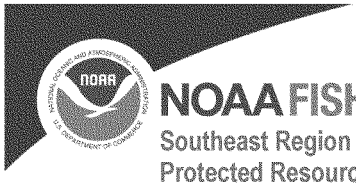
Population: Except where endangered			
Hawksbill sea turtle *(Eretmochelys imbricata)* Population: Entire	Endangered	Final designated	
Kemp's Ridley sea turtle *(Lepidochelys kempii)* Population: Entire	Endangered		
Leatherback sea turtle *(Dermochelys coriacea)* Population: Entire	Endangered	Final designated	
Loggerhead sea turtle *(Caretta caretta)* Population: Northwest Atlantic Ocean DPS	Threatened	Final designated	

United States Department of Interior
Fish and Wildlife Service

Project name: Sabine Pass to Galveston Bay - Freeport

Critical habitats that lie within your project area

There are no critical habitats within your project area.



NOAA FISHERIES
Southeast Region
Protected Resources Division

Texas' Threatened and Endangered Species

For more information on listed species please visit:
http://www.nmfs.noaa.gov/pr/species/esa/listed.htm
http://sero.nmfs.noaa.gov/protected_resources/index.html

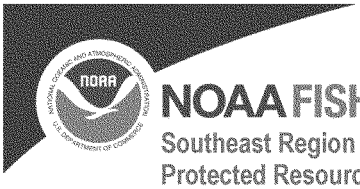
Marine Mammal Species	Scientific Name	Status
fin whale	*Balaenoptera physalus*	Endangered
humpback whale	*Megaptera novaeangliae*	Endangered
sei whale	*Balaenoptera borealis*	Endangered
sperm whale	*Physeter macrocephalus*	Endangered
Sea Turtle Species		
green sea turtle	*Chelonia mydas*	Threatened[1]
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
leatherback sea turtle	*Dermochelys coriacea*	Endangered
loggerhead sea turtle	*Caretta caretta*	Threatened[2]
Invertebrate Species		
lobed star coral	*Orbicella annularis*	Threatened
mountainous star coral	*Orbicella faveolata*	Threatened
boulder star coral	*Orbicella franksi*	Threatened
elkhorn coral	*Acropora palmata*	Threatened[3]

Critical Habitat Designations

For final rules, maps, and GIS data please visit:
http://sero.nmfs.noaa.gov/maps_gis_data/protected_resources/critical_habitat/index.html

Loggerhead sea turtle: There are 38 designated marine areas that occur throughout the Southeast Region.

[1] Florida's breeding population is listed as endangered.
[2] Northwest Atlantic distinct population segment.
[3] Colonies located at Flower Garden Banks National Marine Sanctuary.



Species Proposed for Listing Under the Endangered Species Act

Federal action agencies are encouraged to include species proposed for listing under the Endangered Species Act (ESA) in their Section 7 consultation requests. Species that are proposed for listing are those which have been found to warrant federal protection under the ESA, but a final rule formally listing the species has not yet published. By including these species in your Section 7 consultation, reinitiating consultation after the ESA listing is finalized may not be necessary.

For more information on species proposed for listing under the ESA, please visit:
http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm#proposed

Candidate and Proposed Species Under the Endangered Species Act (ESA)

Candidate species are any species that are undergoing a status review that we have announced in a *Federal Register* notice, whether or not they are the subject of a petition. For detailed definitions and explanations, please refer to the 2006 Candidate Species Definition (71 FR 61022, 10/17/2006).

Proposed species are those candidate species that were found to warrant listing as either threatened or endangered and were officially proposed as such in a *Federal Register* notice after the completion of a status review and consideration of other protective conservation measures. We always seek public comment on a proposal to list species under the ESA. We generally have one year after a species is proposed for listing under the ESA to make a final determination whether to list a species as threatened or endangered.

Candidates for Listing (25 candidate "species")

Species	Year	*Federal Register* notice
Fishes		
2 bony fish species • **grouper, comb** (*Mycteroperca fusca*) • **grouper, Gulf** (*Mycteroperca jordani*)	2014	79 FR 10104
clownfish, orange (*Amphiprion percula*)	2014	79 FR 52276
cusk (*Brosme brosme*)	2007	72 FR 10710
ray, Caribbean electric (*Narcine bancroftii*)	2014	79 FR 4877
seahorse, dwarf (*Hippocampus zosterae*)	2012	77 FR 26478
shad, Alabama (*Alosa alabamae*)	2013	78 FR 57611
shark, common thresher (*Alopias vulpinus*)	2015	80 FR 11379
shark, porbeagle (*Lamna nasus*)	2015	80 FR 16356
8 shark species • Daggernose (*Isogomphodon oxyrhynchus*) • Striped smooth-hound (*Mustelus fasciatus*) • Narrownose smooth-hound (*Mustelus schmitti*) • Sawback angelshark (*Squatina aculeata*) • Argentine angelshark (*Squatina argentina*) • Angular angel shark (*Squatina guggenheim*) • Smoothback angelshark (*Squatina oculata*) • Common angel shark (*Squatina squatina*)	2013	78 FR 69376
4 skate & ray species • **guitarfish** (*Rhinobatos rhinobatos*) • **guitarfish, blackchin** (*Rhinobatos cemiculus*) • **guitarfish, Brazilian** (*Rhinobatos horkelii*) • **skate, greytail** (*Bathyraja griseocauda*)	2014	79 FR 10104

Marine Mammals		
2 marine mammal species • dolphin, common bottlenose (1 candidate DPS) (*Tursiops truncatus*) ◦ Fiordland • dolphin, Hector's (*Cephalorhynchus hectori*)	2014	79 FR 9880
seal, Pacific harbor (1 candidate DPS) (*Phoca vitulina richardii*) ◦ Iliamna Lake	2013	78 FR 29098
whale, Bryde's (1 candidate DPS) (*Balaenoptera edeni*) ◦ Gulf of Mexico	2015	80 FR 18343

Proposed for Listing (23 proposed "species")

Species	Year Proposed	Status
Fishes		
cardinalfish, Banggai (*Pterapogon kaudemi*)	2014	proposed threatened
coelacanth, African (1 DPS) (*Latimeria chalumnae*) • Tanzanian DPS	2015	proposed threatened
grouper, Nassau (*Epinephelus striatus*)	2014	proposed threatened
shark, Harrisson's dogfish (*Centrophorus harrissoni*)	2014	proposed threatened
Marine Invertebrates		
3 coral species • (*Cantharellus noumeae*) • (*Siderastrea glynni*) • (*Tubastraea floreana*)	2014	proposed endangered
Marine Mammals		
whale, humpback (4 DPSs) (*Megaptera novaeangliae*) • Central America • Western North Pacific	2015	proposed threatened
• Arabian Sea • Cape Verde Islands/Northwest Africa		proposed endangered
Marine Reptiles		
sea snake, dusky (*Aipysurus fuscus*)	2014	proposed endangered
sea turtle, green (11 DPSs) (*Chelonia mydas*) • Central North Pacific • East Indian-West Pacific • East Pacific • North Atlantic • North Indian • South Atlantic • Southwest Indian	2015	proposed threatened
• Central South Pacific • Central West Pacific • Mediterranean		proposed endangered

Endangered and Threatened Species Under NMFS' Jurisdiction:

- All Endangered and Threatened Species under NMFS Jurisdiction
  - » Marine Mammals
  - » Sea Turtles
  - » Fish (Marine & Anadromous)
  - » Marine Invertebrates & Plants

Additional Species:

- Species Petitioned for Listing under the ESA (awaiting 90-day findings)
- Candidates for ESA Listing
- Species Proposed for ESA Listing
- Species with "Not Warranted" 12-month findings (we reviewed the status, but determined that listing was not warranted)
- Delisted Species and Species Under Review or Proposed for Delisting

Updated: May 11, 2015

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

APPENDIX K

FISH AND WILDLIFE COORDINATION ACT
FINAL COORDINATION ACTION REPORT

May 2017

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 El Camino Real, Suite 211
Houston, Texas 77058
281/286-8282 / (FAX) 281/488-5882

In Reply Refer To:
FWS/R2/02ETT
X00-2015-B-
0004

August 18, 2016

Colonel Lars Zetterstrom
US Army Corps of Engineers
Attention: Ms. Janelle Stokes
Environmental Compliance Branch, Coastal Section
PO Box 1229
Galveston, TX 77553-1229

Dear Colonel Zetterstrom:

Based on input from your review of the Service's draft report dated August 9, 2016, please find attached the final Fish and Wildlife Coordination Act Report for the Sabine Pass to Galveston Coastal Storm Risk Management and Ecosystem Restoration Study located in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria counties, Texas. This project was initiated by the Galveston District Corps of Engineers (Corps) to address storm risk problems in the Galveston Region and ecological restoration opportunities for the entire six county study areas. The purposes of this report are to identify and describe existing fish and wildlife resources within the proposed project areas; evaluate and compare currently proposed alternatives; identify modifications or additional alternatives needed to address fish and wildlife related problems, opportunities, and planning objectives; and to recommend preliminary measures for resource protection during early project planning.

The proposed protection was authorized by a resolution from the Committee on Environmental and Public Works, dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study". The U.S. Senate directed the Army to develop a comprehensive plan for severe erosion along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply and transport along the Texas coast, restoring and preserving marsh and wetlands, improving water quality, and other related purposes to the interrelated coastal ecosystem along Texas. As a result of this resolution, the Corps expects this study to culminate in a detailed report outlining several alternatives for hurricane flood protection. Procedurally, project construction is not authorized, however; attached is the report from the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.). The FWCA requires that the Section 2 (b) report be made an integral part of any report regarding further project authorization or administrative approval.

Additional Service involvement for subsequent detailed planning, engineering, design, and construction phases of each planning effort, is required to fulfill our responsibilities under the

FWCA. The Service recommends the Corps reinitiate coordination when project funding is made available.

We appreciate the opportunity to participate in the planning of this project. If you have any questions or comments concerning this report, please contact staff biologist Donna L. Anderson at (281) 286-8282.

Sincerely,

for

Chuck Ardizzone
Project Leader
Texas Coastal Ecological Services Office

SABINE PASS TO GALVESTON COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESTORATION STUDY IN ORANGE, JEFFERSON, CHAMBERS, GALVESTON, HARRIS, AND BRAZORIA COUNTIES, TEXAS

Submitted to:
Galveston District
U.S. Army Corps of Engineers

Prepared by:
Texas Coastal Ecological Services Field Office
Houston, Texas

Reviewed by:
Chuck Ardizzone
Project Leader

U.S. Fish and Wildlife Service
Region 2
Albuquerque, New Mexico
August 18, 2016

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List of and Abbreviations and Acronyms

Bald and Golden Eagle Protection Act	(BGEPA)
Birds of Conservation Concern	(BCC)
Bird Conservation Region	(BCR)
Coastal Storm Risk Management	(CRSM)
Draft Integrated Feasibility Report and Environmental Impact Statement	(DIFR-EIS)
Endangered Species Act	(ESA)
Engineer Research and Development Center	(ERDC)
Environmental Protection Agency	(EPA)
Essential Fish Habitat	(EFH)
Fish and Wildlife Coordination Act	(FWCA)
Gulf of Mexico Fishery Management Council	(GMFMC)
Hurricane Flood Protection	(HFP)
Inter-coordination Agency Team	(ICT)
Magnuson-Stevens Fishery Conservation and Management Act	(MSFCMA)
Migratory Bird and Treaty Act	(MBTA)
National Bald Eagle Management Guidelines	(NBEM)
National Marine Fisheries Service	(NMFS)
National Wildlife Refuge	(NWR)
Relative sea-level rise	(RSLR)
Tentatively Selected Plan	(TSP)
Texas Colonial Waterbird Society	(TCWBS)
Texas Commission on Environmental Quality	(TCEQ)
Texas General Land Office	(GLO)
Texas Parks and Wildlife Department	(TPWD)
United States Corps of Engineers	(Corps)
United States Fish and Wildlife Service	(Service)
Vertical Team	(VT)
Wildlife Management Area	(WMA)

Executive Summary

This report provides planning assistance on the proposed Sabine Pass to Galveston Coastal Storm Risk Management and Ecosystem Restoration Study located in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria counties. This project was initiated by the Galveston District Corps of Engineers (Corps) to address storm risk problems in the Galveston Region and ecological restoration opportunities for the entire six county study area. The study focuses on the non-structural and structural alternatives: 1) reevaluation of the existing Hurricane Flood Protection (HFP) project at Freeport 2) reevaluation of existing HFP at Port Arthur; and 3) evaluation of a new levee system along the lower Neches and Sabine Rivers in the vicinity of Beaumont and Orange, Texas. The Corps assumes that construction activities needed to provide improvements to the existing Freeport and Port Arthur Hurricane Flood Protection systems will occur within existing right-of-ways with no wetland impacts expected. To construct the full project as proposed under the intermediate Relative Sea Level Rise scenario (most likely the alternative to be proposed by the Corp), the Corps estimates the TSP would indirectly impact an estimated 2,137.2 acres of fresh, intermediate, and brackish marsh, 12.7 acres of bottomland hardwoods, and 1.9 acres of forested swamplands. Direct impacts total 44.3 acres of bottomland hardwoods, 10.6 acres of swamplands, and 105.3 acres of fresh, intermediate, and brackish marsh. Both impact acreage amounts are estimated and are considered worst case scenario.

The proposed protection was authorized by a resolution from the Committee on Environmental and Public Works, dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study". The U.S. Senate directed the Corps to develop a comprehensive plan along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply to coastal shorelines, restoring and preserving marshes and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area. As a result of this resolution, the Corps expects this study to culminate in a detailed report outlining several alternatives for hurricane flood protection. Procedurally, project construction is not authorized, however attached is the report of the Secretary of the Interior required by Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.). The FWCA requires that Section 2 (b) report be made an integral part of any report supporting further project authorization or administrative approval.

The Service understands the study, TSP, and Recommend Plans are subject to future Congressional approval and funding. We anticipate additional Service involvement for subsequent detailed planning, engineering, design, and construction phases of each planning effort and are required to fulfill our responsibilities under the FWCA. The Service recommends the Corps reinitiate coordination under a separate FWCA agreement when project funding is made available where a thorough review of the project footprint and impacts will be conducted.

This report was not reviewed by the Texas Parks and Wildlife Department (TPWD), National Marine Fisheries Service (NMFS), National Resource Conservation Service (NRCS); however, their comments on this report will be provided under separate cover.

The Service does not object to providing greater flood reduction and improved hurricane protection to a six county area provided the following fish and wildlife recommendations are incorporated into future project planning and implementation:

1. Situate flood protection features so that destruction of wetlands and non-wet bottomland hardwood forests are avoided or minimized to the maximum extent practicable. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

2. Minimize enclosure of wetlands with levee alignments. When enclosing wetlands is unavoidable, establish non-development easements directly adjacent to those wetlands, or maintain hydrologic connections with adjacent, un-enclosed wetlands to minimize secondary impacts from development and hydrologic alteration.

3. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design protection features and timing of construction. The National Bald and Golden Eagle Management Guidelines are included.

4. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable. The Migratory Bird Treaty Act (MBTA) protects all native migratory birds and prohibits the taking, killing, possession, and transportation (among other actions) of migratory birds, their eggs, and parts, except when specifically permitted by regulations of specific intentional uses. A list of birds protected under the MBTA can be found in 50 CFR 10 of the MBTA and at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandtx.html.

5. A complete mitigation plan to compensate for direct and indirect habitat impacts should be developed in consultation with the Service and other state and federal natural resource agencies during final feasibility planning and presented in the Final IFR-EIS. The Final IFR-EIS should specify the mitigation plan that will be implemented concurrently with project construction. The Service understands the scale of the mitigation and levee construction features of this project and the time required for beneficial use projects to be completed. The Corp should complete initial construction of mitigation features at any given mitigation use site within two years and additional features (channel and pond construction) to be completed as soon as possible.

6. The project's first Project Cooperation Agreement (or similar document) should include language that includes the responsibility of the local-cost sharer to provide operational and construction monitoring, and maintenance funds for mitigation features. Acquisition, habitat development, maintenance, site protection, and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the Corps should provide the necessary funding to ensure mitigation obligations are met and maintained on behalf of the public interest.

7. Further detailed planning of project features (e.g. Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service, NMFS, TPWD, NRCS, Environmental Protection Agency (EPA), Texas Commission of Environmental Quality (TCEQ), and the Texas General Land Office (TGLO). The Service shall be provided 30 days to review and submit recommendations on all the work addressed in those reports.

8. The Corps should avoid impacts to state and federal lands. If not feasible, the Corps should establish and continue coordination with state and federal agencies managing lands that may be impacted by a project feature until construction of that feature is complete and prior to any subsequent maintenance. Points of contact for the agencies potential impacts by project features are:

    - Texas Chenier Plain National Wildlife Refuges Complex (979) 267-3337
    - McFaddin National Wildlife Refuge Manager (979) 971-2909
    - J.D. Murphree Wildlife Management Area Manager (979) 736-2551
    - Pineywoods Ecosystems Project Manager (936) 569-8547

9. If mitigation lands are purchased for inclusion within a National Wildlife Refuge (NWR), those lands must meet certain requirements; a general summary of some of the requirements is provided in Appendix A. However, prior coordination with the Service's Region 2 Regional Office should be conducted early in the process to gauge the feasibility of such inclusion activities. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore agency representatives should be contacted early in the planning phase regarding such requirements.

10. If applicable, a General Plan should be developed by the Corps, through coordination with the Service, and the natural resource agencies in accordance with Section 3(b) of the FWCA for mitigation lands.

11. If the proposed project features change, the status of species change, or the project is not implemented within three years of the date of our Endangered Species Act coordination, we recommend that the Corps reevaluate the project's effects and species status and initiate any necessary consultation procedures pursuant to Section 7 of the Endangered Species Act.

12. In general, the Corps should incorporate larger, numerous openings within a diversity of locations in a protection levee aimed at maintaining estuarine dependent fishery migration.

13. Flood protection water control structures in any watercourse should maintain pre-project width and depth to the maximum extent practicable, especially structures located in tidal passes.

14. To the extent possible given any authorized channel dimensions, any flood protection water control structure sited in canals, bayous, or navigation channels that do not maintain the pre-project cross section should be designed and operated with multiple

openings within the structure. This should include openings near both sides of the channel as well as an opening in the center that extends to the bottom of the channel.

15. Should final surge gate structure designs reduce the cross section of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis will be performed to characterize potential hydrologic and fish passage impacts and determine additional mitigation requirements.

16. Flood protection surge gates, sluice gates, culverts, and any other water control structures should remain completely open except during storm events or regularly scheduled maintenance or inspections (See Appendix C). Operation, maintenance, and management plans for structures should be developed in coordination with the Service, NMFS, TPWD, TCEQ, and TGLO.

17. The operation and maintenance plan for the gates and water control structures has not yet been developed. This plan should include a schedule of maintenance events for each gate and culvert and proposed closure times for said maintenance activities. A worst case closure scenario is estimated to be 5-7 days every 10-15 years based on predicted storm surge return intervals high enough to threaten areas targeted for protection. However, in years where more than one storm event occurs, we expect the gates to remain closed (an estimated 5-7 days) for **each** storm event. Periodic maintenance of the gates and culverts (not included in the worst case scenario) may result in additional closures estimated of not more than two weeks for each instance. Therefore, it is assumed by the Corps and representative from the natural resource agencies that closure of the surge gates, sluice gates, and culverts would cause only minor and temporary impacts to fish access and coastal marsh, and no additional mitigation would be needed to offset operational impacts. Any proposed operational deviation from the estimated frequency or duration of structure closures must be assessed in coordination with the Service, NMFS, TPWD, TCEQ, and TGLO at which time additional mitigation would be required to offset such operational impacts.

18. The number and siting of openings in flood protections levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

19. Flood protection structures within a waterway should include shoreline baffles and or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered and coordinated with various resources agencies for review and comment.

20. To the maximum extent practicable, structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet per second. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.

21. To the maximum extent practicable, sluice gates or culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth (See Appendix C). The size of the sluice gates or culverts should be selected that would maintain sufficient flow to prevent siltation.

22. Temporary culverts or sluice gates should be installed in construction access roads unless otherwise recommended by the natural resource agencies. We expect these culverts to minimize hydrologic isolation within wetlands and marshes in the area by maintaining hydrologic flows across the landscape to the maximum extent possible. At a minimum, there should be one; 24-inch culvert or sluice gate placed every 500 feet and one at natural stream crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500-feet long and an area would be hydrologically isolated without that culvert.

23. Water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.

24. Levee alignment and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

25. Operational plans for water control structures should be developed to maximize the cross-sectional area open for as long as possible.

26. Any proposed change in mitigation features or plans should be coordinated in advance with the Service, NMFS, EPA, TPWD, TCRQ, and TGLO.

27. A report documenting the status of mitigation implementation and maintenance should be prepared every three years by the managing agency and provided to the Corps, the Service, NMFS, EPA, TPWD, TCEQ, and TGLO. That report should also describe future management activities and identify and propose changes to the existing management plan.

28. Fill material used during the construction of the levees or its associated features should come from an approved upland borrow source permitted by the State and testing should comply with TCEQ criteria. The Environmental Protection Agency (EPA)/Corps Inland Testing Manual criteria would apply to dredge material used for marsh restoration at mitigation sites.

29. The Corps shall fully compensate for any unavoidable losses of wetland habitat (including forested wetlands) or non-wet bottom hardwoods caused by project features as dictated by the Wetland Value Assessment modeling.

30. Acquisition, habitat development, maintenance, and management of mitigation lands should be allocated as a first-cost expense of the project to ensure mitigation obligations are met on behalf of the public interest.

Introduction

This final report provides planning assistance on the proposed Sabine Pass to Galveston, Texas Coastal Storm Risk Management (CRSM) and Ecosystem Restoration (ER) Study located in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria counties (Figure 1). The CRSM study, initiated by the Galveston District Corps of Engineers (Corps), addresses storm risk concerns in the Galveston Region; specifically a reevaluation of existing Freeport and Port Arthur hurricane flood protection systems and the evaluation of new CRSM alternatives for Orange and northeast Jefferson Counties. This study incorporates programmatic recommendation for future Galveston Bay CRSM and ER for all four regions along the Texas coast. The purposes of this report are to identify and describe existing fish and wildlife resources within the proposed study and project areas; evaluate and compare currently proposed alternatives; identify modifications or additional alternatives needed to address fish and wildlife related problems, opportunities, and planning objectives; and recommend preliminary measures for resource protection during early project planning. The Service will provide comments on the Galveston CRSM measures and coast-wide ecological restoration opportunities under the larger mega study when appropriate.

The proposed protection was authorized by a resolution from the Committee on Environmental and Public Works, dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study". The U.S. Senate directed the Corps to develop a comprehensive plan for severe erosion along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply to the coast, restoring and preserving marshes and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area. Congressional actions direct the Corps to proceed with engineering, design, modification, and construction of a hurricane protection project to provide 100-year hurricane protection. Procedurally, project construction is not authorized, however attached is the report of the Secretary of the Interior that is required by Section 2(b) of the FWCA (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.). The FWCA requires that Section 2(b) report be made an integral part of any report supporting further project authorization or administrative approval.

The Service bases our evaluation on the current data and analyses available from Corps sources and Service files. The Service understands the project is subject to Congressional approval and TSP funding will occur sometime in the future with or without project modifications. Additional Service involvement for subsequent detailed planning, engineering, design, and construction phases of each planning effort is required to fulfill our responsibilities under the FWCA. The Service recommends the Corps reinitiate coordination under a separate FWCA agreement when construction funding is made available where a thorough review of the project footprint and impacts will be conducted.

The Corps' Draft Integrated Feasibility Report and EIS (DIFR-EIS) presents a programmatic overview of coastal storm risk problems and opportunities in the Galveston Region and a programmatic overview of ER opportunities for the entire six county study area. Using previously conducted studies, the Corps proposes to provide recommendations for future studies in the Galveston Region; no in-depth alternative analyses will be conducted and no recommendations for project construction will be made during this study. As such, no ER

proposals will be fully developed, recommended for construction, or analyzed through this report. We anticipate working with the Corps to develop a full suite of ER recommendations in the near future which will require supplemental FWCA reports.

The Corps proposed federal action (known as the tentatively selected plan or TSP that consists of coastal storm risk management projects in Orange, Jefferson, and Brazoria Counties, Texas. These actions will be carried out by the Corps and the GLO (the non-federal sponsor). The DIFR-EIS was released for public review in September 2015. We expect the final project to require further engineering and recommend continued coordination during the revision process so that environmental impacts can further be assessed.

Background Information

Investigation of surge damage impacts in the Galveston and Jefferson County region began in 2001 after the initiation of a Feasibility Study with the intent of evaluating plans to develop CRSM and ER features. The Corps' completed development of the expected condition of the area if no action were taken over a 50-year period. Almost immediately after completion of that effort, the region was impacted by Hurricane Ike. The study was put on hold and the determination was made in late 2011 to re-scope the study to include surge reduction measures for a six-county region to include Orange, Jefferson, Chambers, Galveston, Harris and Brazoria Counties (USACE, 2014).

This Corps study began under the "SMART Planning" principles and 3x3x3 guidelines developed under the recent Corps planning modernization. SMART Planning (Specific, Measurable, Attainable, Risk Informed, and Timely) studies are now performed with an emphasis on risk-based decision-making and early Corps vertical team (VT) engagement Additionally, the 3x3x3 guidelines limit planning studies to a duration of 3 years and cost of $3 million dollars which are managed through a 3-tier VT within the Corps.

Strict Corps timelines and funding constraints limit the SMART process even further leaving Service staff to evaluate only what limited information and studies are made available by the Corps. While the project is geared to begin on a strong foundation of previously used data (Corps and in some cases other resource agency's data), the Corps' project delivery team must continually ask about the appropriate level of detail necessary to make risk-informed decisions. The study team must balance its choice for additional detail with the funds and time available against the risk and uncertainty of decision outcome (USACE, 2012). To do this, a suite of available tools allows the Corps a more progressively detailed analysis over a smaller array of alternatives until finally identifying the tentatively selected plan. With limited resources and in most cases not able to fund additional studies, the Corps is forced to use previous data, and assume a certain level of risk with each planning decision.

The study focuses on the detailed evaluation of the following non-structural and structural CSRM alternatives:

- evaluation of a new levee system along the lower Neches and Sabine Rivers in the vicinity of Beaumont and Orange, Texas (Figure 2),
- reevaluation of existing HFP at Port Arthur (Figure 3),
- reevaluation of the existing HFP project at Freeport (Figure 4)

This final report focuses on the evaluation of environmental impacts and mitigation alternatives for a new levee system alternative in Orange and Northeast Jefferson Counties and the reevaluation of existing HFP systems in Freeport and Port Arthur.

The Corps and representative from the natural resource agencies met throughout the planning process (detailed below in Table 1) to make recommendations on parameters used in modeling efforts, develop avoidance measures for significant resources and habitats within the project area, and identify potential mitigation alternatives .

Table 1 List of Corps Project Coordination Meetings

Date	Purpose
May 17, 2013	Introduction to the Study
Dec. 10, 2014	Update on study, introducing focus on Orange/Jefferson and Brazoria Counties
Jan. 8, 2015	Vegetation classification in Orange right-of-way
Jan. 23, 2015	Field trip – Orange right-of-way and reference area vegetation mapping
Feb. 26, 2015	Direct impacts modeling meeting
Feb. 27, 2015	Direct impacts modeling meeting
Mar. 5, 2015	Indirect impacts modeling meeting
Mar. 6, 2015	Indirect impacts modeling meeting
Mar. 27, 2015	Further impacts modeling
Jan. 8, 2016	Discussion of mitigation assumptions for modeling
Jan. 9, 2016	Mitigation measures screening
Jan. 25, 2016	Mitigation measures screening
Feb. 11, 2016	Field trip- mitigation areas
Feb. 12, 2016	Field trip – mitigation area
Mar. 2, 2016	WVA modeling of mitigation measures
Mar. 7, 2016	WVA modeling of mitigation measures
Mar. 9, 2016	WVA modeling of mitigation measures
Jun. 15, 2016	Review of Recommended Plan and Mitigation Plan

Hurricane Impacts

Texas' entire Gulf Coast historically averages three tropical storms or hurricanes every four years, generating coastal storm surges and sometimes bringing heavy rainfall and damaging winds hundreds of miles inland (USACE, 2014). Future projections suggest increases in hurricane rainfall and intensity (with a greater numbers of the strongest – Category 4 and 5 – hurricanes) (Melillo 2014). The expected rise in sea level will result in the potential for greater storm surge damage along the Gulf Coast of Texas.

Storm surge modeling conducted by the Corps' Engineer Research and Development Center (ERDC) for this study provided a predicted return interval of 10-15 years for storm surges high enough to threaten the areas targeted for protection in the Sabine Region (USACE, 2014). Over the last ten years, three hurricanes of significant importance have occurred in or near the study area with each incurring billions of dollars in damages.

Table 2 2005-2014 Hurricanes Occurring in Orange and Jefferson Counties

Name	Year	Estimated Damage
Hurricane Rita	2005	$11.3 billion
Hurricane Katrina (came ashore near the study area)	2005	$81.2 billion
Hurricane Ike	2008	$ 29 billion

In September 2005, Hurricane Rita, a Category 3 storm and ranked the fourth most intense Atlantic hurricane ever recorded, caused major flooding in the Port Arthur and Beaumont areas. The storm threatened a large amount of the oil infrastructure left undamaged by Hurricane Katrina just a month before. Communities in the "Golden Triangle" sustained enormous wind damage and Bridge City experienced 2-4 feet of flooding inundating the entire town. The heavy concentration of oil infrastructure in the Gulf of Mexico makes hurricanes of Rita's intensity very problematic. Aside from the catastrophic damage caused by hurricanes along the Texas coast, the loss of oil and gas industry revenue, and some 200,000 jobless claims were attributed to hurricanes Katrina and Rita further creating a drag on the local and national economies.

Hurricane Ike made landfall in September of 2008 as an extremely large Category 2 storm with sustained winds of 110 mph and a 22 ft. storm surge causing widespread coastal flooding. The tropical force winds extended outward up to 275 miles from the center and at its biggest, Ike would have covered most of Texas. Ike compromised many human-made structures, including buildings, roads, bridges, and other critical infrastructure. The 2.7 million workers in the counties of Harris, Galveston, Chambers, Orange, and Jefferson – those most affected by Ike represent 26.6 percent of the state's total employment and contribute $123.5 billion to the state's economy (Division of Emergency Managment, 2008).

Description of the Study Area

The Sabine Pass to Galveston Bay study area encompasses six coastal counties of the upper Texas coast. Over five million people reside in the six counties, which include the 4th largest U.S. city (Houston), and three other metropolitan areas (Beaumont/Port Arthur/Orange, Galveston/Texas City, and Freeport/Surfside). The population of the counties is projected to increase to over nine million within the next fifty years. In addition to the at risk population, three of the nine largest oil refineries in the world, 40 percent of the nation's petrochemical industry, 25 percent of the nation's petroleum-refining capacity, and three of the 10 largest US seaports are also located in the study area. The growing population, communities, and nationally significant industries are vulnerable to risks from coastal storm events. Approximately 2.26 million people across the study area live within a storm-surge inundation zone and estimates for a one-month closure of the Houston Ship Channel alone are upwards of $60 billion in damages to the national economy. The Corps has determined current hurricane flood protection systems in Port Arthur, Texas City, and Freeport do not meet current design criteria and all warrant improvements.

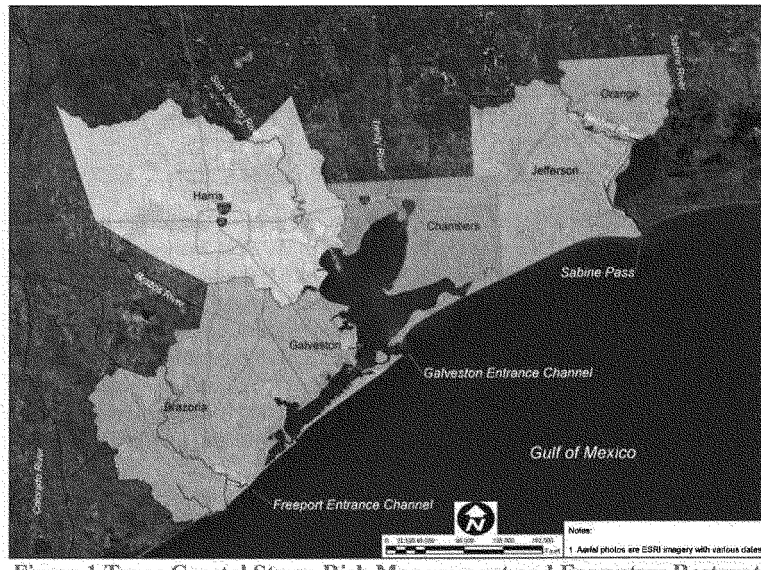

Figure 1 Texas Coastal Storm Risk Management and Ecosystem Restoration Study Area
Source: Corps 2014

Within the entire project area, the Corps has designated three distinct project areas:

Sabine: This region includes the Sabine Lake system and Gulf shoreline from Sabine Pass to High Island. The Sabine region focuses on Orange and Northeast Jefferson Counties, including the three communities known as the Golden Triangle- Beaumont, Port Arthur and Orange, Texas.

Galveston: This region consists of all of the Galveston Bay system including the Gulf shoreline along Bolivar Peninsula to San Luis Pass. Counties included are: Chambers, Harris, and Galveston.

Brazoria: Included in this region are the Brazos River Diversion and Old River Channels in the vicinity of Freeport, Texas.

Through the DIFR-EIS, the Corps will evaluate environmental impacts for two geographically separate areas only- Sabine and Brazoria Regions. The Galveston Region will be evaluated only at a programmatic level in the DIFR-EIS, will only provide recommendations for future studies with no in-depth analysis, and will provide an overview of ecological restorations opportunities for the entire six county project area.

The Corps identified a TSP with three separate elements. The Orange-Jefferson CSRM Plan and the Port Arthur and Vicinity CRSM Plan are located in the Sabine Region, while the Freeport and Vicinity CRSM Plan is located in the Brazoria Region. The Sabine Region focused on new

Orange and Jefferson CRSM and existing Port Arthur CRSM project areas. The Brazoria Region focused on an existing Freeport CRSM project area.

Figure 2 Proposed Orange County Recommended Plan
Source: (USACE, 2015)

The proposed Orange County Recommended Plan (Figure 2):
The CRSM evaluation includes evaluating various lengths and locations of new levee or floodwall alignments and surge gates on Adams and Cow Bayous and eliminating alternatives for shorter levee system with large, navigable surge gate on the Neches River.

- Orange 3 – 111,228 linear feet (LF) of levee and 32,170 LF of floodwall with a levee crest of 12 feet NAVDD88; total of 27 miles of protection.
- Jefferson Main New Levee- 40,270 LF of levee and 16,500 LF of floodwall with a levee crest of 12 feet NAVDD88; total of 11 miles of protection.
- Beaumont A New Levee – 5,800 LF of levee and 12,981 LF of floodwall with a levee crest of 13 feet NAVDD88; total of 3.6 miles of protection.

After further review, the Corps eliminated the Jefferson Main New Levee and the Beaumont A New Levee elements and will move forward with only the Orange 3 portion of the TSP as the Recommended Plan. The final elevation of the Orange 3 levees is expected to be approximately 17 feet high and 27 miles long. The Corps believes an increase in floodwalls from about 20 percent of the overall system to about 40 percent is necessary. This increase was essential to

avoid impacts to residences, pipelines and minimize impacts to wetlands. The alignment was relocated into several shorter segments resulting in a significant reduction of impacts from 64 to only 30 to existing structures.

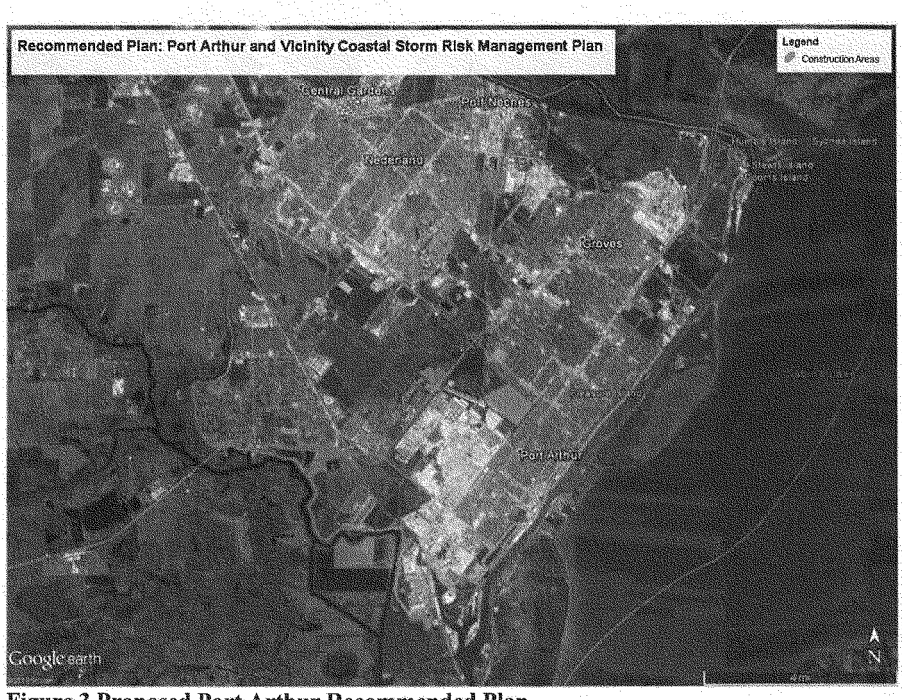

Figure 3 Proposed Port Arthur Recommended Plan
Source: (USACE, 2015)

The Port Arthur CRSM will evaluate the need for adding resiliency features to existing levees and floodwall, evaluating the need for an increased level of protection (increasing levee height), and the assumption that all improvements will be constructed within existing right-of-ways.

- 8ft-10ft I-Wall Levee Raise – 7,500 LF of 15-foot wide scour pad and 2,000 LF of levee raised one foot.
- Closure Structure Raise – Structure and 300 LF of 100-foot wide scour pad and 12,000 LF of levee raised one foot.
- I-Wall near Valero Raise – 5,000 LF of 15-foot scour pad and 3,000 LF of levee raised one foot.
- I-Wall near Tank Farm Raise – 1,800 LF of 15-foot wide scour pad and 7,000 LF of levee raised one foot.

Final design work recommended raising 11.3 miles of existing levees and constructing or reconstruction 5.3 miles of floodwalls. Final elevations would range from 14.4 to approximately 19 feet NAVD88 to account for wave run-up and relative sea level rise (RSLR). A separate 1,830 feet of new earthen levee would be constructed in the Port Neches area, in an area covered by a portion of the Jefferson Main element.

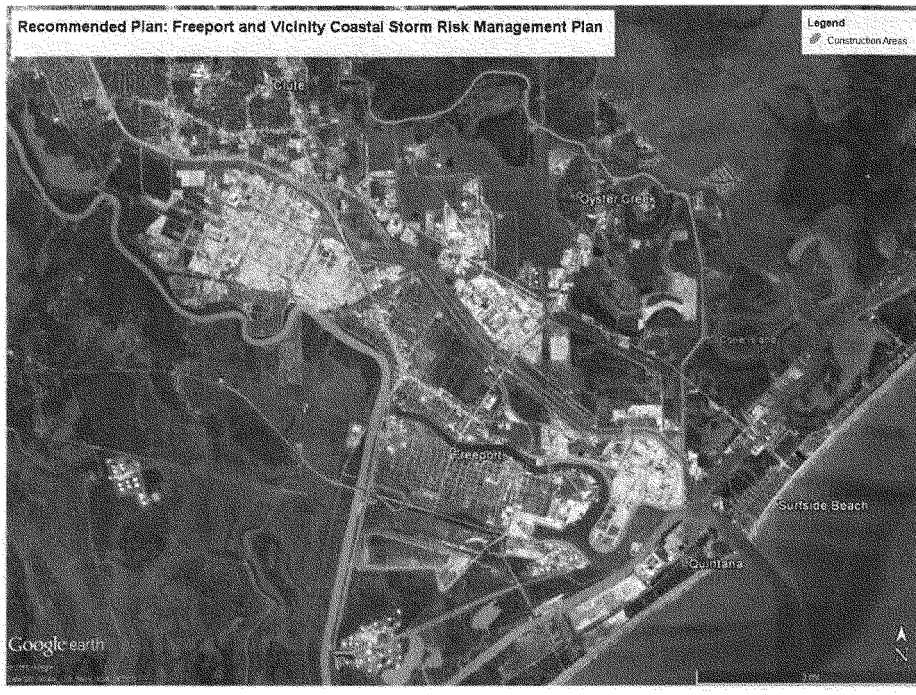

Figure 4 Proposed Freeport and Vicinity TSP
Source: (USACE, 2015)

The Freeport CRSM will evaluate the need for adding resiliency features to existing levees and floodwall, evaluating the need for an increased level of protection (increasing levee height), and the assumption that all improvements will be constructed within existing right-of-ways

- Dow Barge Canal Gate Structure – sector gate structure with navigatable opening.
- Oyster Creek Levee Raise – 13,500 LF of levee raised one foot.
- East Storm Levee Raise – 13,155 LF of levee raised one foot, topped with high performance turf reinforcement mat.
- Freeport Dock Floodwall Raise – 3,000 LF of reconstructed floodwall.
- Old River Levee at Dow Thumb Raise – 3,000LF of levee raised one foot.
- Tide Gate I-Wall Raise – reconstructed I-Wall raised one foot, and 2,000 LF of levee raised one foot.

The Recommended Plan will result in the raising or construction of a total of approximately 13.1 miles of existing levee, construct or reconstruct 5.5 miles of floodwalls and install a navigatable sector gate in the Dow Barge Canal. This does include a 5,000 foot reach of South Storm levee improvements that was added to the Recommended Plan during the final design process. The Corps expects the final elevation to range between 15.8 to 23.8 feet NAVD88 to account for wave run-up and RSLC and will only be applied to those areas needing additional height.

Construction will occur within existing right-of-ways where possible, however additional temporary and permanent right-of-ways may be required for Oyster Creek Levee Raise, Tide Gate I-Wall Raise, Old River North at DOW Thumb Levee Raise, and Freeport Dock Floodwall Raise.

The Corps estimates the total direct and indirect environmental impacts of 272.5 acres for the Orange-Jefferson portion of the project over the 50-year period of analysis. Modeling indicates indirect fisheries access impacts (functional loss) of almost 2,137.2 acres of marsh in Adams and Cow Bayou floodplains. Totals (direct, indirect, and functional loss) will result in 2,409.7 acres of forested wetlands and coastal marsh being impacted over the 50-year life span of the project. Total unavoidable impacts in this area will result in unavoidable impacts of 186.0 average annual habitat units (AAHUs) as analyzed by the Wetland Value Assessment (WVA) model (USACE, 2015) (Table 3). The Corps plans to compensate fully with in-kind mitigation for all unavoidable impacts and is discussed in a later section.

Table 3 Unavoidable Impacts Resulting From Orange County Proposed Recommended Plan

Habitat	Acres Lost from Direct and Indirect Impacts	Functional Loss (Acres)	AAHUs
Fresh marsh	24.3	785.2	-30.0
Intermediate marsh	26.0	322.5	-16.6
Brackish marsh	152.7	1029.5	-96.5
Swamp	12.5	0.0	-7.3
Bottomland hardwood	57.0	0.0	-35.4
Total for Orange County	272.5	**2137.2**	**-186.0**

Source: USACE 2016

Environmental impacts for the Port Arthur and Freeport Recommended Plans do not include mitigation since environmental impacts will be minimal and restricted to existing right-of-ways and areas of dense industrial and residential development.

The Corps did consider nonstructural buyouts and found little or no opportunities in Brazoria and Jefferson Counties. Orange County presented only small ancillary opportunities and this option was no longer considered by the Corps. The Service recommends the Corps continue to search for mitigation opportunities, however small, in all counties where impacts may occur.

Vegetative Communities

The vegetative communities of southeast Texas have been thoroughly described in several authoritative books and numerous technical articles, including O'Neil, 1949, Blair, 1950, Harcombe & Neaville, 1977, Gosselink et.al 1979, Smeins et. al. 1991, TNHP 1993, Visser et.al 2000, and TNC, 2013.

State and Federally-designated natural areas in the project area, important because of the large areas of native fish and wildlife habitat and recreational opportunities they represent as well as their inherent susceptibility to project-induced salinity changes, are shown and discussed as well. We summarize major community types in Texas, provide updated acreage estimates, update

recent changes to the current project and other channelization projects, and provide the Service's recommendations as to project-related impacts and minimization measures.

The project area contains three separate watersheds and habitat types including forested wetlands (i.e., bottomland hardwoods and/or swamps), non-wet bottomland hardwoods, marsh, open water, and developed areas. Due to urban development and a forced drainage system in many areas, the natural hydrology of most of the forested habitat has been altered. The forced drainage system has been in operation for many years and subsidence is evident throughout the project area.

Bottomland hardwood forest

Higher, intermittently-flooded strips of land immediately adjacent to the riverine ridge and to meander lakes (oxbows) are often forested by mature bottomland hardwood forest. The largest tracts are at the extreme upper end of the project area, just south of the Neches River saltwater barrier, and along the Sabine River north of I-10, within the Sabine Wildlife Management Area (600+ acres). Bottomland hardwood forest have long been identified as one of the most productive habitat types for wildlife in North America, often harboring up to four times the density and diversity of bird, mammal, and herpetofauna species of upland forests. More recently, bottomland hardwood forests in the northern Gulf of Mexico region were identified as critical fall and spring migrant stopover habitat for huge numbers, perhaps the majority, of the more than 130 species of North America's neotropical migrant songbirds (Gauthreaux, 1971). A vastly diverse and rapidly disappearing habitat, bottomland hardwood forests continues to be a focal habitat along the Texas coast where preservation remains a high priority for the Service.

The primary swamp type is cypress-tupelo swamp, which is characterized by common baldcypress *Taxodium distichum* and tupelo gum *Nyssa aquatica* overstory, and numerous aquatic understory species such as bulltongue *Sagittaria lancifolia*, swamp lily *Crinum americanum*, pickerel weed *Pontederia cordata*, smartweed *Polygonum sp.*, and blue iris *Iris sp.* Large tracts of cypress-tupelo swamp occur in permanently and semi-permanently flooded areas along the Neches River north of Interstate 10 (I 10) and along the Sabine River north of I 10 (PBS&J, 2003).

Marsh

Wetlands provide valuable water quality functions such as reduction of excessive dissolved nutrients levels, filtering of waterborne contaminants, and removal of suspended sediments. In addition, coastal wetlands buffer storm surges reducing their damaging effects to man-made infrastructure within the coastal area. Wetlands (forested, marsh, and scrub-shrub) within the study area provide plant detritus to adjacent coastal waters and thereby contribute to the production of commercially and recreationally important fishes and shellfishes. Many marsh and wetlands areas in Orange and Jefferson Counties areas experienced subsidence, salt water intrusion leading to die out of marsh vegetation, species (flora and fauna) composition change, and conversion to a much more unproductive open water habitat. White, et al., 1987 documents that over 90 percent of the emergent marshes of the Lower Neches River delta have been converted to open water. According to Sutherlin, 1997, this loss results in over half of the total wetlands loss in the state of Texas.

Marsh types within the project area include fresh, intermediate, brackish, and saline. Fresh marsh occurs at the upper ends of interdistributary basins and are often characterized by floating or semi-floating organic soils and minimal daily tidal action. Vegetation may include maidencane *Panicum hemitonon*, bulltongue *Sagittaria lancifolia*, cattail *Typha* sp., California bulrush *Schoeniplectus californicus*, pennywort *Hydrocotyle verticillata*, giant cutgrass *Zizaniopsis miliacea*, American cupscale *Sacciolepis striata*, spikerushes *Eleocharis* sp., waterhyssop B*acopa* sp., and alligatorweed *Alternanthera philoxeroides*. Associated open water habitats may often support extensive beds of floating-leafed and submerged aquatic vegetation including water hyacinth *Eichhornia crassipes*, Giant salvinia *Salvinia molesta* duckweeds *Lemna* sp., American lotus *Nelumbo lutea*, white water lily *Nymphaea odorata*, water lettuce *Pistia stratiotes*, coontail *Ceratophullum demersum*, Eurasian milfoil *Myriophyllum spicatum*, hydrilla *Hydrilla* sp., pondweeds *Potamogeton* sp., Southern naiad *Najas guadalupensis*, fanwort *Cabomba caroliniana*, wild celery *Apium graveolens*, water stargrass *Heteranthera dubia*, elodea, and others.

Intermediate marshes are a transitional zone between fresh and brackish marshes and are often characterized by organic, semi-floating soils. Typically, intermediate marshes experience low levels of daily tidal action. Salinities are negligible or low throughout much of the year, with salinity peaks occurring during late summer and fall. Vegetation includes saltmeadow cordgrass *Spartina patens*, deer pea vetch *Vicia ludoviciana*, three-cornered grass *Schoenoplectus americanus*, cattail *Typha* sp., bulltongue *Sagittaria lancifolia*, seashore paspalum *Paspalum vaginatum*, wild millet *Panicum miliaceum* , fall panicum *Panicum dichotomiflorum* , and waterhyssop B*acopa* sp. Ponds and lakes within the intermediate marsh zone often support extensive submerged aquatic vegetation including southern naiad *Najas guadalupensis*, Eurasian milfoil *Myriophyllum spicatum*, and wigeongrass *Rupia maritima*.

Brackish marshes are characterized by low to moderate daily tidal energy and by soils ranging from firm mineral soils to organic semi-floating soils. Freshwater conditions may prevail for several months during early spring; however, low to moderate salinities occur during much of the year, with peak salinities in the late summer or fall. Brackish marsh is generally considered "slightly salty"; with salinity levels varying over a wide range from location to location. In coastal Texas, the typical brackish marsh vegetation pattern occurs in areas within approximately the 4 to 15 parts per thousand (ppt) (normal) salinity range. Common, usually dominant, vegetation in these areas is saltmarsh bulrush *Bulboschoenus robustus*, seashore saltgrass *Distichlis spicata*, marshhay cordgrass *Spartina patens*, dwarf spikerush *Eleocharis parvula*, waterhemp *Amaranthus australis*, and marsh pea *Vigna luteola*. Vegetation is usually dominated by saltmeadow cordgrass, but also includes saltgrass, three-cornered grass, leafy three-square, and deer pea. Shallow brackish marsh ponds occasionally support abundant beds of wigeongrass.

Brackish marsh areas have cyclically high waterfowl populations, especially in years following high-salinity events when freshwater levels return to normal and periodic "blooms" of prime food plants such as widgeongrass and *Paspalum* sp. occur. Furbearers such as muskrat, formerly an important commercially-harvested animal in the project area, also occur in cyclically high numbers. Brackish marshes have suffered some of the highest rates of marsh loss due to subsidence and loss of organic materials as formerly fresh areas are subjected to salinity intrusion, resulting in plant loss.

Saline marshes occur along the fringe of the coastal wetlands and are higher in salinity due to repeated flooding by sea water every day. Those marshes usually exhibit fairly firm mineral soils and experience moderate to high daily tidal energy. Vegetation is dominated by saltmarsh cordgrass but may also include saltgrass *Spartina alterniflora*, saltmeadow cordgrass, black needlerush *Juncus roemerianus*, and leafy three-square *Schoenoplectus robustus* . Submerged aquatic vegetation is rare. These low-lying areas of the marsh are often covered with large, flat expanses of mud call mud flats and can harbor mussels *Mytilus* sp., clams *Cyrtopleura* sp., oysters *Crassostrea virginica*, fiddler crabs *Uca* sp., sand shrimp *Crango* sp., and bloodworms *Glycera* sp.

Scrub-Shrub Habitats

Scrub-shrub habitat is often found along the flanks of distributary ridges and in marshes altered by spoil deposition or drainage projects. Typically it is bordered by marsh at lower elevations and by developed areas, cypress-tupelo swamp, or bottomland hardwoods at higher elevations. Some scrub-shrub habitat is an early successional stage of bottomland hardwood forests.

Swamp scrub and freshwater marsh are often intermixed within cypress-tupelo tracts, either in natural meander scars or in areas completely logged in the past which have not reforested. The 1,750-acre tract immediately east of downtown Beaumont and north of I-10 is a good example of an area crisscrossed by logging ("star") canals dug in the early 1900's for extraction of commercially valuable bald cypress, which has not yet completely reforested and remains in freshwater marsh/scrub-shrub. Primary plant species here are buttonbush *Cephalanthus occidentalis*, rattlebean *Sesbania drummondii*, box elder *Acer negundo*, swamp privet *Foresteria acuminata*, cattail *Typha latifolia*, elderberry *Sambucus nigra*, wax myrtle *Morella cerifera*, black willow *Salix nigra*, Drummond red maple *Acer rubrum*, Chinese tallow-tree *Triadica sebifera*, groundselbush *Senecio vulgaris*, and Virginia tea *Itea virginica*. Because this habitat type has experienced high land loss rates, habitat restoration (beneficial use of dredge material) may want to target freshwater marsh/scrub shrub habitat, although cypress-tupelo swamp should be the long term goal in this area, due to its high productivity and recreational value to wetland users, primarily waterfowl hunters, fishermen, and birdwatchers

Open Water Habitats

Open-water habitat within the project area consists of ponds, lakes, canals, bays, and bayous. Natural marsh ponds and lakes are typically shallow, ranging in depth from 6 inches to over 2 feet. Typically, the smaller ponds are shallow and the larger lakes and bays are deeper. In fresh and low-salinity areas, ponds and lakes may support varying amounts of submerged and/or floating-leaved aquatic vegetation. Brackish and, much less frequently, saline marsh ponds and lakes may support wigeongrass beds.

Canals and larger bayous typically range in depth from 4 or 5 feet, to over 15 feet. Strong tidal flow may occur at times through those waterways, especially where they provide hydrologic connections to other large waterbodies. Such canals and bayous may have mud or clay bottoms that range from soft to firm. Dead-end canals and small bayous are typically shallow and their bottoms may be filled in to varying degrees with semi-fluid organic material. Erosion due to wave action and boat wakes, together with shading from overhanging woody vegetation, tends to retard the amount of intertidal marsh vegetation growing along the edges of those waterways.

Drainage canals in the project area may become stagnant except when pumps are operating to remove water. Runoff from developed areas has likely reduced the habitat value of that aquatic habitat by introducing various urban pollutants, such as oil, grease, and excessive nutrients. Clearing and development has eliminated much of the riparian habitat that would normally provide shade and structure for many aquatic species.

Developed Areas

Developed habitats in the study area include residential and commercial areas, as well as roads and existing levees. Those habitats do not support significant wildlife use. Most of the development is located on higher elevations, natural levees, and former distributary channels; however, vast acreages of swamp and marsh are under forced drainage systems and developed. Limited amounts of agricultural lands occur throughout the area; agriculture includes sugarcane farming, cattle production, and haying. Some development in wetlands is also occurring as a result of permitted fill activities.

Fish and Wildlife Resources

Terrestrial

Mammals known to occur in the project area bottomland hardwoods and marshes include mink *Neovison vison*, raccoon *Procyon lotor*, swamp rabbit *Sylvilagus aquaticus* , nutria Myocastor coypus, river otter *Lontra canadensis* , and muskrat *Ondatra zibethicus*. Those habitats also support a variety of birds including herons, egrets, ibises, least bittern, rails, gallinules, olivaceous cormorant *Phalacrocorax brasilianus* , white pelican *Pelecanus erythrorhynchos* , pied-billed grebe *Podilymbus podiceps*, black-necked stilt *Himantopus mexicanus* , sandpipers, gulls, and terns. Forested and scrubshrub habitats within the study area also provide habitat for many resident passerine birds and essential resting areas for many migratory songbirds including warblers, orioles, thrushes, vireos, tanagers, grosbeaks, buntings, flycatchers, and cuckoos. Many of these and other passerine birds have undergone a decline in population primarily due to habitat loss.

The study area also supports resident raptors and owls including the bald eagle *Haliaeetus leucocephalus*, red-shouldered hawk *Buteo lineatus* , barn owl *Tyto alba*, common screech owl *Megascops asio*, great homed owl *Bubo virginianus*, and barred owl *Strix varia*. The red-tailed hawk *Buteo jamaicensis*, marsh hawk *Circus cyaneus*, and American kestrel *Falco sparverius* are seasonal residents utilizing forested and wetland habitats within the study area.

Given the extent of development and drainage, waterfowl use within the hurricane protection system is likely minimal, except in the adjacent wetlands outside the levees. Swamps, fresh and intermediate marshes usually receive greater waterfowl utilization than brackish and saline marshes because they generally provide more waterfowl food. Migratory waterfowl species expected to occur in the project area include gadwall *Anas strepera* , green-Winged teal *Anas carolinensis*, blue-winged teal *Anas discors* , northern shoveler *Anas clypeata* , mallard *Anas platyrhynchos* , pintail *Anas acuta*, American widgeon *Anas americana*, lesser scaup *Aythya affinis*, ring-necked duck *Aythya collaris*, redhead *Aythya americana*, and canvasback *Aythya valisineria*. Resident species expected to occur include the mottled duck *Anas fulvigula* and wood duck *Aix sponsa*.

Amphibians such as the pig frog *Rana grylio*, bullfrog *Rana catesbeiana* , leopard frog *Rana sphenocephala*, cricket frog *Acris crepitans*, and Gulf coast toad *Incilius valliceps* are expected to occur in the fresh and low salinity wetlands of the study area. Reptiles such as the American alligator *Alligator mississippiensis*, snapping *turtle Chelydra serpentine*, softshell turtle *Apalone spinifera*, red-eared turtle *Trachemys scripta elegans*, and diamond backed terrapin *Malaclemys terrapin* are also expected to occur in the project-area wetlands and waterbodies.

Aquatic

Due to this dynamic salinity regime, Sabine Lake supports several rich and diverse fish, plankton, and invertebrate benthic communities. Heavy seasonal growths of both freshwater and marine phytoplankton, mostly diatoms (45 percent total biomass), along with the ubiquitous green algae (36 percent total biomass) occur and are heaviest in the summer (Espey, Hutson, and Associates, 1976). Zooplankton is most abundant during summer and early fall, which is similar to what occurs in Galveston Bay but opposite from what is found in the more southerly and higher salinity mid- and lower coast bays. Copepods are by far the dominant species group (over 95 percent total biomass). Dominant infaunal benthic organisms consist of the *Rangia* clam, capitellid polychaetes, and *Tubificoides* oligochaetes (Vittor and Associates, 1997).

Aquatic fauna changed since the original manmade opening of Sabine Pass from a freshwater system similar to that currently present in the upper Neches and Sabine Rivers portions of the study area, to a saline/brackish system typical of Galveston Bay and other Texas estuaries. Important forage and predator fish are typified by alligator gar *Lepisosteus spatula*, ladyfish *Elops saurus*, finescale menhaden *Brevoortia gunteri*, gizzard shad *Dorosoma cepedianum*, bay anchovy *Anchoa mitchilli*, river carpsucker *Carpiodes carpio*, hardhead catfish *Arius felis*, channel catfish *Ictalurus punctatus*, Gulf killifish *Fundulus grandis*, white bass *Morone chrysops*, largemouth bass *Micropterus punctulatus*, black crappie *Pomoxis nigromaculatus*, crevalle jack *Caranx hippos*, pigfish *Orthopristis chrysoptera*, spotted seatrout *Cynoscion nebulosus*, black drum *Pogonias cromis*, striped mullet *Mugil cephalus*, Spanish mackerel *Scomberomorus maculates*, southern flounder *Paralichthys lethostigma*, and lizardfish *Synodus foetens* (Louisiana Department of Natural Resources, 1999). These species represent fresh, marine, and euryhaline assemblages. Commercial finfish harvest is insignificant at only an average of 2,186 pounds worth $1,385 annually. Recreational fish harvest is much more important, with an estimated 500,000 man-hours of fishing and is second only to Galveston Bay (Blackburn et. al, 2001).

Important nektonic shellfish are blue crab *Callinectes sapidus*, white shrimp, brown shrimp, and swamp crayfish (*Procambarus clarkii*). The Sabine Lake blue crab fishery accounts for almost 25 percent of the total Texas commercial landings, with almost two million pounds landed annually, for a total value of $2,330,553 (NOAA, 2013).

Project-area marshes and associated open-water provide important habitat (i.e., nursery, escape cover, feeding grounds) for a variety of freshwater and estuarine-dependent fish and shellfish. Most of the economically important saltwater fishes and crustaceans harvested in Texas spawn offshore and then use estuarine areas for nursery habitat (Herke, 1995). Nekton use of estuaries is largely governed by the seasons (Day, 1989). Different species use the same locations in different seasons, and different life stages of the same species use different locations. Aquatic

species diversity peaks in the spring and summer, and is typically low in the winter. Some marine species which use estuaries as nursery habitat also have estuarine dependent life stages, typically larvae and juveniles. Larvae or juveniles immigrate into the project area during incoming tides and take advantage of the high productivity of the estuary.

Waterfowl

Southeast Texas (Jefferson and Orange Counties) and southwest Louisiana contain some of the most important and heavily utilized waterfowl habitats remaining on the Gulf coast, with many of these areas located adjacent to or a short distance from the Sabine Neches Water Way. Important Texas habitat tracts are located within Texas Point NWR, McFaddin NWR, J. D. Murphree WMA, and on privately owned marsh and swamp tracts along the Neches and Sabine Rivers. More detailed descriptions of these publicly-owned refuges are provided in the *Protected (State and Federal) Natural Sites in Project Area* section of this report.

Waterfowl use and economic impacts from hunting and outdoor-related activities in the immediate project area are impressive. The U. S. Fish and Wildlife Service's Mid-Winter Waterfowl Census numbers for 2004-2005 were very low compared to previous years, probably due to high-salinity marsh conditions. January 2005 flight lines over McFaddin NWR and Texas Point NWR counted 27,964 geese and 12,688 ducks. Peak 2005 estimates for Sabine NWR were 125,000 geese and 200,000 ducks (McFaddin/Sea Rim NWR files). McFaddin NWR hosted 1,470 hunter-days who harvested 3,694 ducks and 76 geese during the 2005-2006 season. Texas Point NWR hosted 338 hunter-days who took 501 ducks and 28 geese during the 2005-2006 season. J.D. Murphree WMA hosted 1,997 hunter-days taking 5,014 ducks and 93 geese for the 2005-2006 season. The 2.5 birds per hunter-day was one of the highest ratios of any Texas public hunting area. Numerous waterfowl guides in Texas host hunters on private marshes, rice fields, and coastal marshes in the Jefferson County. Private lands hunters almost certainly account for more hunting days and greater harvest than those on public areas.

The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation report (USDOI, 2011) shows hunter participation and expenditures by state, but not by county or region. In 2011, 1.2 million hunters in Texas (both resident and non-resident) spent 1.6 million days afield and an estimated $1.8 billion. Of these, approximately 1.1 million hunters, or 42 percent, hunted migratory birds, primarily waterfowl. While these statistics are not compiled by county, a large proportion of waterfowl hunters have historically used the marshes within the project area.

Colonial Waterbirds

Twenty-three species of cormorant, pelican, heron, egret, spoonbill, gull, tern, and skimmer regularly nest in large numbers along the Texas and Louisiana coasts, frequently on bay islands, both natural and manmade. In recent years, the majority of successful Texas colonies have been located on islands wholly or partially maintained by dredged material (Glass 1994). Colonial waterbirds are an important wildlife resource on the Gulf Coast and in the project area because of their abundance (an estimated 2,835 nesting pairs annually since 1995 in the project area), their economic significance to the tourism industry, and their status as indicators of aquatic ecosystem health. Since 1973, the Texas Colonial Waterbird Society (TCWBS) has conducted annual censuses of all coastal Texas colonies and maintains a comprehensive database which provides annual census numbers and colony locations (TCWC 2015).

While locations of most important Texas colonies are on small offshore islands (TCWC 2015), most of those in the project area are in semi-protected industrial sites and other semi-urban sites. Sydney Island, a formerly important nesting island in upper Sabine Lake, has become inactive in recent years, probably due to predator invasion (Bailey, personal communication).

Regional waterbird population trends are a more accurate picture of waterbird population health than comparing individual colony counts from specific years, since nesting populations are known to shift frequently in response to predation, habitat conditions, parasite levels, and human disturbance. For purposes of comparison, Jefferson and Orange Counties, Texas, are considered the project area, and county dimensions are probably appropriate considering known waterbird home ranges and habitat use (Custer et al. 1978). In 2005, Jefferson and Orange Counties contained 10 known colonies with a total estimated population of 8,462 nesting pairs belonging to 13 species. Only one species of gull or tern was present, in comparison to Galveston Bay, where most years the laughing gull comprises over 50 percent of the nesting pairs (TCWC 2006). Most of the nesting birds belong to the heron, egret and ibis families, which are important components of freshwater marsh and swamp systems.

Endangered and Threatened Species

The Service recommends the Corps evaluate the project effects on listed species (with consultation if necessary) on each portion of the project where impacts are expected to occur. Should the design plans change significantly, the project is relocated, or construction is not implemented within 1 year following that analysis, we recommend that the Corps reevaluate the project footprint and coordination with this office.

According to Section 7(a)(2) of the Endangered Species Act (ESA) and the implementing regulations, it is the responsibility of each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally listed species. Therefore, you should use this and other current information to evaluate the project for its potential effects to listed species. The Service's Consultation Handbook (http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm) is available to assist you with further information on definitions, process, and fulfilling ESA requirements.

Our review of the proposed project only focused on the effects of the levee and water control structure installation on sea turtle nesting since the Service only has jurisdiction of sea turtles while on land. The National Marine Fisheries Service (NMFS) has jurisdiction of sea turtles in the oceans, seas, bays, and estuaries. Based on the possible impacts the project may have on sea turtle migration within the coast's bays, we recommend that you contact NMFS at 727-824-5312 regarding their findings on the matter.

While there is no sea turtle nesting habitat within the proposed project areas, sea turtles are known to frequent the Gulf of Mexico, the Gulf Intracoastal Waterway, and adjacent bays, during the spring, summer, and fall months. Special precautions should be taken to avoid impacts to any of the sea turtle species during the construction processes.

The West Indian manatee *Trichechus manatus* is a rare visitor to the Texas coast and may be found within the project area. Manatees forage on sea grasses found in the shallow bays and

estuaries along the Texas coast. In the event a manatee is encountered during the construction processes, please contact the TCESFO – Houston at (281) 286-8282.

Other Legally Protected Species

The Migratory Bird Treaty Act (MBTA) protects all native migratory birds and prohibits the taking, killing, possession, and transportation (among other actions) or migratory birds, their eggs, and parts, except when specifically permitted by regulations for specific intentional uses. A list of birds protected under the MBTA can be found in 50 CFR 10 of the MBTA and at http://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php.

The Service published the *Birds of Conservation Concern 2008* (BCC) in December, 2008. The overall goal of the BCC is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities and to draw attention to species in need of conservation action (US. Fish and Wildlife Service, 2008). The Bird Conservation Region (BCR) 37 (Gulf Coastal Prairie U.S. Portion only) lists bird species that may utilize the habitat types within or immediately adjacent to the project area (Table 4) Mud flats, gravelly bars, beaches, shallow bays, dredge spoil, ponds, and coastal marshes support these birds for one or more of the species' lifecycles (breeding, feeding, sheltering etc.).

Table 4 Service Birds of Conservation Concern List BCR 37

Audubon's Shearwater *Puffinus lherminieri* (nb)	Red Knot (rufa ssp
Band-rumped Storm-Petrel *Oceanodroma castro* (nb)	Buff-breasted Sandpiper *Tryngites subruficollis* (nb)
American Bittern *Botaurus lentiginosus*	Short-billed Dowitcher *Limnodromus griseus* (nb)
Least Bittern *Ixobrychus exilis*	Least Tern *Sternula antillarum* (c)
Reddish Egret *Egretta rufescens*	Gull-billed Tern *Gelochelidon nilotica*
Swallow-tailed Kite *Elanoides forficatus*	Sandwich Tern *Thalasseus sandvicensis*
Bald Eagle (b) *Haliaeetus leucocephalus*	Black Skimmer *Rynchops niger*
White-tailed Hawk *Geranoaetus albicaudatus*	Short-eared Owl *Asio flammeus* (nb)
Peregrine Falcon *Falco peregrinus* (b) (nb)	Loggerhead Shrike *Lanius ludovicianus*
Yellow Rail *Coturnicops noveboracensis* (nb)	Sedge Wren *Cistothorus platensis* (nb)
Black Rail *Laterallus jamaicensis*	Sprague's Pipit *Anthus spragueii* (nb)
Snowy Plover *Charadrius nivosus* (c)	Prothonotary Warbler *Protonotaria citrea*
Wilson's Plover *Charadrius wilsonia*	Swainson's Warbler *Limnothlypis swainsonii*
Mountain Plover *Charadrius montanus* (nb)	Botteri's Sparrow *Peucaea botterii*
American Oystercatcher *Haematopus palliatus*	Grasshopper Sparrow *Ammodramus savannarum*
Solitary Sandpiper *Tringa solitaria* (nb)	Henslow's Sparrow *Ammodramus henslowii* (nb)
Lesser Yellowlegs *Tringa flavipes* (nb)	LeConte's Sparrow *Ammodramus leconteii* (nb)
Upland Sandpiper *Bartramia longicauda* (nb)	Nelson's Sharp-tailed Sparrow *Ammodramus nelsoni* (nb)
Whimbrel *Numenius phaeopus* (nb)	Seaside Sparrow *Ammodramus maritimus* (c)
Long-billed Curlew *Numenius americanus*	Painted Bunting *Passerina ciris*

Hudsonian Godwit *Limosa haemastica* (nb)	Dickcissel *Spiza americana*
Marbled Godwit *Limosa fedoa* (nb)	
Red Knot (*roselaari* ssp.) (nb)	

(a)ESA candidate, (b) ESA delisted, (c) non-listed subspecies or population of Threatened or Endangered species, (d) MBTA protection uncertain or lacking, (nb) non-breeding in the BCR.

Several birds listed above can be found nesting within colonial bird rookeries from February through August. Portions of the three proposed TSP locations are located where colonial nesting waterbirds may be present. The Service and its partner's monitor 26 species of nesting colonial waterbirds annually along the Texas coast and the TCWBS currently maintains a database of these colonies locations. While most colonies persist over time, colonies can move should resources prove better elsewhere. We recommend a comprehensive project wide survey is conducted by a qualified biologist to determine the location of newly-established nesting colonies during the nesting season. If colonies are found, work should not be conducted within 1,000 feet of the colony during the nesting season and immediate contact with TCESFO (281-286-8282) should be made. These rookeries, whether found on shore or on adjacent islands, can be easily disturbed by human presence ultimately causing nest failure in some cases. While it is entirely possible to see various avian species foraging and loafing within the project area, most nesting activity is usually confined to nearby colony locations. Review of the TCWBS Database (Texas, 2015) indicates there are four historic rookery sites located within and immediately adjacent to portions of the Jefferson Main New Levee (Table 4). The Service does not know if these sites are active or inactive at this time and as a result, the rookery sites should be re-evaluated prior to any construction.

Table 5 Rookery Sites Within and Adjacent to the Jefferson Main New Levee Footprint

Name	Location	Colony Code	Last Active
DuPont Spoils Area	-94.02222, 29.99981	587-123	2006
Beaumont Cattail Marsh	-94.00251, 29.99995	601-147	2003
Nederland Spoil Area	-94.01083, 30.01027	587-122	2001
Beaumont Ship Channel	-94.00583, 30.01583	587-121	1990

Two rookery sites are located within the Orange 3 New Levee footprint (Table 6). Again, these are historical sites and suitable habitat may or may not be present for nesting birds. Dooms Island and Sydnes Island supported large rookeries during the 1980 and 1990s. However, Sydnes has succumbed to excessive erosion and subsidence over the years where only a fraction of the island exists today. Allied Chemical and Shangrila rookery sites should be re-evaluated and surveyed for nesting waterbirds. Last active dates may be the last time the sites were surveyed.

Table 6 Colonial Nesting Sites Within and Adjacent to the Orange 3 New Levee Footprint

Name	Location	Colony Code	Last Active
Allied Chemical	-93.7593, 30.0448	588-008	1992
Shangrila	-93.73333, 30.09861	588-009	2006

Dooms Island	-93.84888, 29.96694	601-121	1995
Sydnes Island	-93.82083, 29.97694	601-120	1992

Should an active nesting colony be located within 1000-feet of the proposed construction area, please contact the Service's Texas Coastal Ecological Services Field Office – Houston (TCESFO) at (281) 286-8282 for further details and instructions.

Outside of the February through August nesting season, caution should still be exercised as many of the waterbirds can be found on the shorelines and adjacent marshes within the project area taking advantage of the abundant feeding opportunities along the Texas coast. The Service's suggested Priority of Migratory Bird Conservation Actions for Projects can be found in Appendix A. Should you feel the take of migratory species will be necessary for this project, please contact the TCESFO at (281) 286-8282 for further details and instructions.

The MBTA (40 Stat. 755, as amended~ 16 U.S.C. 703 et seq.) and the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S .C. 668ad) offer additional protection to many bird species within the project area including colonial nesting birds and the bald eagle. Forested habitat in the Orange and Jefferson County study area may provide nesting habitat for the bald eagles. Although the bald eagle was removed from the threatened and endangered species list, it continues to be protected under the MBTA and the BGEPA. The Service developed the National Bald Eagle Management Guidelines (NBEMG) to provide landowners, land managers, and others with information and recommendations regarding how to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. Those guidelines recommend maintaining: (1) a specified distance between the activity and the nest (buffer area); (2) natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to the TCESFO at 281-286-8282. A copy of the NBEM Guidelines is available at: http://www.fws.gov/southdakotafieldoffice/NationalBaldEagleManagementGuidelines.pdf If after consulting those guidelines you need further assistance in determining the appropriate size and configuration of buffers or the timing of activities in the vicinity of a bald eagle nest, the please contact the TCESFO at 281-286-8282.

National Wildlife Refuges, Parks, 404(c) areas

The unique geographic location of the project study area at the confluence of the Central and Mississippi migratory bird flyways and its inherent natural diversity is reflected in the fact that six major state or Federally-protected parks and refuges are located here (Figures 5). This list does not include private sanctuaries, city, or county parks.

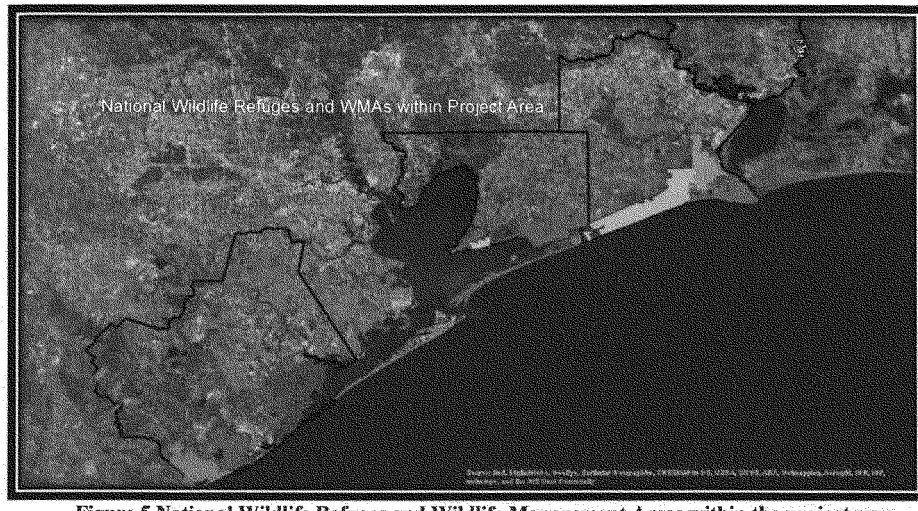

Figure 5 National Wildlife Refuges and Wildlife Management Areas within the project area

Anahuac National Wildlife Refuge
Established in 1963, the 34,000 acre tract was purchased to protect and manage the coastal marsh for migrating, wintering, and breeding waterfowl, shorebirds, and waterbirds, and to provide strategic and crucial nesting areas for the neotropical migratory songbirds migrating across the Gulf of Mexico.

McFaddin National Wildlife Refuge
This 55,000-acre Service refuge was established in 1980 and contains the largest tracts of coastal freshwater marsh remaining in Texas. The 5,400-acre White Marsh tract was added in 2000. Most of McFaddin NWR is saline to brackish marsh. It was probably was a freshwater marsh prior to GIWW construction in the 1940's and erosion and subsidence in the 1970's. Large freshwater areas still exist in interior areas west of Clam Lake. McFaddin NWR hosts approximately 10,000 visitors annually, including 2,400 annual hunter-days of waterfowl hunting. The degradation of State Highway 87 along the coastline has reduced visitation due to a 1993 hurricane.

Texas Point National Wildlife Refuge
This 11,422 acre tract lies adjacent to the Sabine Neches Water Way at Sabine Pass and extends for almost 13.5 miles along the Gulf of Mexico. This unit contains 4,898 acres of saline marsh, 2,398 acres of brackish marsh, 1,605 acres of intermediate marsh, 100 acres of fresh marsh, 1,413 acres of other upland areas, and 1,008 acres of open water. Baseline salinities for this area average 5.75 ppt for intermediate, 8.5 ppt for brackish and 12.5 ppt for the saline marshes. It should be noted that periodic hurricanes and tropical depressions do inundate these areas with high salinity waters, but usually are then punctuated by long periods of freshwater recovery (Gooch, 1996). This pattern tends to serve the beneficial function of removal of surplus above-ground vegetation, much like periodic wildfires in prairie regions, thus allowing highly productive new-growth vegetation to recover, to the benefit of wildlife populations. This is different from encroachment of chronic, slightly higher salinity levels in these communities,

which is shown to alter vegetation patterns to a less diverse and less productive state for wildlife (Palmisano, 1972).

Sea Rim State Park
This TPWD-administered, 4,141-acre tract lies south and east of McFaddin NWR. The headquarters is located and most visitations occur within the 5.2-mile long Gulf beach frontage tract located to the south of SH 87. This state park contains important beach dune, backdune marsh and prairie, and freshwater wetlands and is especially important as spring neotropic migrant songbird and waterbird habitat due to its location.

J.D. Murphree Wildlife Management Area
This State of Texas WMA is composed of three separate tracts (Big Hill, Hillebrandt, and Lost Lake Units) totaling 24,250 acres lying east of McFaddin NWR and on both the north and south sides of the GIWW. It was purchased from the McFaddin family in 1950. The fresh, intermediate, and brackish marshes of this WMA are some of the most important migrant and stopover habitat in the Central Flyway and host upwards of 50,000 ducks per year. Some marsh tracts are managed to maintain intermediate to freshwater marsh characteristics optimum for waterfowl. Round Lake, a 500-acre natural lake within a protective levee system constructed in the 1960s when salinity intrusion first became a serious problem contains some of the highest-quality freshwater aquatic habitat remaining on the upper Texas coast. Large flocks of canvasback traditionally use this area on a seasonal basis (Sutherlin, 1997).

Lower Neches Wildlife Management Area
The 7,998-acre Nelda Starks Unit and the Old River Unit are located along the Neches River north of the SH 87 (Rainbow) bridge, immediately north of the confluence of the Neches River and Sabine Lake. These brackish marshes have suffered considerable losses, accelerated during the 1960s from land subsidence and salinity intrusion into formerly freshwater systems. Two projects at Bessie Heights have restored over 250 acres of subsided open water habitat back to emergent marsh, a hopeful sign that this trend is being reversed.

Brazoria National Wildlife Refuge
Established in 1966, this 44,413 acre refuge serves as an end point for ducks and geese migrating south along the Central Flyway. Comprised of freshwater sloughs, salt marshes, native bluestem prairies, woody thickets, and coastal prairies, the refuge manages most of these habitats for fish and terrestrial wildlife. More than 300 species of birds call the refuge home for the all or part of the year and benefit from ongoing fire management and wetland restoration.

San Bernard National Wildlife Refuge
Established in 1966, this refuge is home to one of the largest tracts of old growth forest in the south. The Dance Bayou tract (1,271 acres) is comprised of bottomland hardwoods, riparian wetlands, and fluvial woodlands. San Bernard NWR was designated as an Internationally Significant Shorebird Site by the Western Hemisphere Shorebird Reserve Network due to its importance to waterfowl and migrating birds. This 54,000 acre refuge includes beach, fresh and salt water marsh, bayous, ponds, Columbia Bottomland Hardwood forests, and native coastal prairie habitats. Due to the significant loss of wetlands, wetland restoration and management remains one of the refuge's top priorities.

Wetland Value Assessment (WVA) Ecological Model(s)

Modeling was conducted by the Corps for years with project and without project conditions and for direct and indirect impacts for each of the WVA models selected. At each step, the Service along with the interagency coordination team, worked with the Corps to develop acceptable ranges for many of variables used in each WVA. For a comprehensive analysis of the WVA modeling conducted for this study, please refer to the Corps' 2015 *Sabine Pass to Galvestion Integrated Feasibility Study and Environmental Impact Study Draft Appendix O Wetland Value Assessment Modeling* (USACE, 2015) report. The Service has highlighted some of the key points from the WVA modeling effort below.

The WVA methodology was developed in the early 1990's in Louisiana for assessment and rating of wetland restoration projects by the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Environmental Work Group interagency team. The WVA methodology (USFWS, 2002) was considered appropriate for this project analysis by the Corps and the natural resource agencies because it incorporates large-scale measurements of predicted changes to salinity and vegetation of coastal Louisiana habitats identical to those of the project area.

The Corps utilized the WVA Coastal Marsh (Version [V] 1.0), Swamp (V 1.0), and Bottomland Hardwood (V 1.0) models to calculate ecosystem impacts and develop mitigation for the TSP. Recognizing that only the swamp and bottomland hardwood models are certified, the Corps requested and received approval from Headquarters on the use of the Coastal Marsh Community Model Version 1.0 for this study. The Corps was directed to conduct sensitivity analyses for application for the marsh models using a spreadsheet prepared by ERDC. Sensitivity analyses of the WVA Coastal Marsh Version 2.0 and 2.90B will be conducted after the plan is finalized.

The WVA modeling efforts evaluated only the Orange-Jefferson County portion of the TSP. Analysis of the Freeport and Port Arthur portions were not necessary because construction would be confined to existing right-of-ways not impacting any wetland habitat. Should the final alignments identify wetland impacts, these areas will be evaluated using the appropriate certified WVA model and will be compensated for appropriately with in kind mitigation.

The WVA methodology requires predictions within model units, including predictions of future changes to land loss rates. Therefore, the interagency team determined historic land loss rates for each wetland habitat type within each project hydrologic unit by GIS comparison of historic aerials from the past 20 to 25 years. From this, Future With Out Project (FWOP) land loss rates, then a Future With Project (FWP) land loss rate and projected historical rates over the 50-year project life were established using the Productivity-based Land Loss Increase Method modified from Visser et al. 2004a and 2004b. This salinity-effect information was then used in the WVA models (USFWS 2002b) by marsh habitat type. This method is based on a direct linear correlation between decreased primary productivity due to salinity increases with increased land losses due to the project.

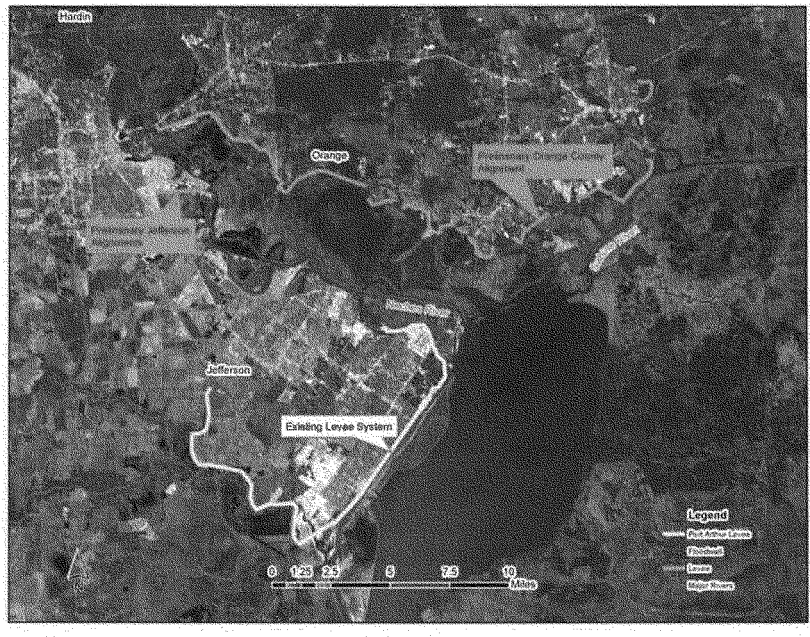

Figure 6 Orange-Jefferson County TSP
Source: (USACE, 2015)

The WVA modeling evaluated and quantified direct, indirect impacts, and function loss (affected areas) of the Orange and Jefferson CRSM Plans. Direct and indirect impacts for each reach have been summarized in Table 7.

Mitigation is necessary to compensate for the loss of 42.7 AAHUs from forested wetlands and 143.3 AAHUs from coastal wetlands. Planning for the avoidance and minimization of impacts began with the initial selection of the Orange-Jefferson levee alignment. The levee was located as close to the upland-wetland margin as possible to minimize wetland impacts, while also minimizing social effects and maximizing economic impacts. Opportunities to further avoid and minimize environmental impacts will be identified during final feasibility planning.

Since the alignment may change as a result of public, technical and policy review, conceptual mitigation plans and estimates have been developed for the DIFR-EIS. Preliminary mitigation cost estimates were developed based on these conceptual plans for use in the incremental analysis of levee reaches. Corps staff reports that mitigation costs are small in relation to overall

Wetland Type	Direct Impacts		Indirect Impacts				Total Impacts (acres)	Total AAHUs Lost
	Direct Wetland Impacts (acres)	AAHUs	Indirect Wetland Impacts (acres)	AAHUs	Functional Impacts (affected acres)	AAHUs		
Forested Wetlands								
Swamp	10.6	-7.2	1.9	-0.1	0.0	0.0	12.5	-7.3
Bottomland Hardwood	44.3	-30.3	12.7	-5.1	0.0	0.0	57.0	-35.4
Subtotal	54.9	-37.4	14.6	-5.2	0.0	0.0	69.5	-42.7
Coastal Marsh								
Fresh Marsh	24.3	-11.4	0.0	0.0	785.2	-18.8	809.5	-30.2
Intermediate Marsh	6.8	-4.0	19.2	-8.5	322.5	-4.1	348.5	-16.6
Brackish Marsh	74.2	-33.7	78.5	-35.2	1029.5	-27.6	1182.2	-96.5
Subtotal	105.3	-49.0	97.7	-43.7	2137.2	-50.5	2340.2	-143.3
Total Impacts*	**160.2**	**-86.5**	**112.3**	**-48.9**	**2137.2**	**-50.5**	**2409.7**	**-186.0**
* Totals may not add exactly due to rounding.								

Source: USACE 2016

Table 7 Recommended Plan Total Direct and Indirect Impacts

project construction costs, and therefore a final mitigation plan and more developed mitigation cost estimates are not needed to support plan selection. Final mitigation plans and cost estimates will be prepared during final feasibility planning for the Agency Decision Milestone

Relative Sea Level Rise

The Corps made 50-year-projections of relative sea-level rise (RSLR) for three scenarios – low (historic), intermediate and high as referenced in Table 8. The low or historic rate of RSLR was calculated by USGS for 12 subunits of the Sabine study area analyzing multiple dates of cloud free Landsat imagery from 1984-2014. USGS assumed the conversion of wetland acres to open water as the low or historic rate of RSLR. The RSLR values were then incorporated into the WVA modeling. The Service along with the other natural resource agencies agreed with the Corps' RSLR assumptions during the planning process. However, should there be new evidence supporting more aggressive sea level rise projections, the Service recommends the Corps reevaluate the project for negative effects not previously accounted for here and reinitiate coordination with the natural resource agencies for additional comment and recommendations.

Table 7 Relative Sea Level Rise Scenarios for Sabine Pass, Texas

Tidal Gage	Low RSLR (ft)	Intermediate RSLR (ft)	High RLSR (ft)
Sabine Pass, TX	1.63	2.32	4.51

Salinity

The Corps utilized outputs from the Sabine Neches Water Way hydrodynamic salinity modeling efforts conducted in 2009 in the WVA impacts modeling for this study and subsequently used these outputs for modeling the historic or low RSLR scenario. However, the Corps chose not to model the intermediate and high salinity scenarios for this study (due to time and funding constraints) but instead utilized efforts for the three RSLR scenarios in accordance with the same guidance utilized for the Corps' study (USACE, 2013). The Galveston District Corps adjusted the findings to accommodate the significantly higher rates of subsidence in the Corps' Morganza-to-the-Gulf Study area by reducing figures by the percentage difference between the RSLR rates between Morganza and Sabine regions. These adjusted percentage change for intermediate and high scenarios were applied to the baseline salinities to provide FWOP salinities in the 2080 and are reflected below in Table 9. The Service along with the other natural resource agencies agreed with the Corps 'salinity assumptions at this point. However, should there be new evidence supporting more aggressive salinity projections, the Service recommends the Corps reevaluate the project for negative effect not previously accounted for here.

Table 8 Method for estimating FWOP intermediate and high salinities for Sabine Region

Morganza Average Modeled Salinities from RSLR Scenarios			
	Average Salinity (ppt)		
RSLR Scenario	Brackish	Intermediate	Fresh
Historic (Low)	9.1	4.4	0.5
Intermediate	10.7	4.9	0.5
High	12.1	5.0	0.7
Percentage Morganza Salinity Change for RSLR Scenarios			
Difference between	Brackish	Intermediate	Fresh
Historic - Intermediate RSLR	18.2%	10.4%	2.6%
Historic - High RSLR	33.5%	11.8%	32.1%
Percentage Change Adjusted for Difference in Subsidence Rates			
	RSLR (ft over 75 yrs)		
RSLR Scenario	Morganza	Sabine	% Difference
Historic (Low)	1.7	0.93	-45.3%
Intermediate	2.4	1.49	-37.9%
High	4.8	3.26	-32.1%
Percentage Change in Salinity Adjusted for Difference in RSLR for Sabine Region			
Difference between	Brackish	Intermediate	Fresh
Historic - Intermediate RSLR	11.3%	6.5%	1.6%
Historic - High RSLR	22.7%	8.0%	21.8%

Period of Analysis/Target Years
The environmental period of analysis for the Orange/Northeast Jefferson County levee/floodwall system is a total of 61 years based on the following assumptions: the construction period is assumed to begin in 2020 and end in 2030; all direct impacts are assumed to occur in the first year of construction (2020); this is a conservative assumption since construction would not impact the entire project area in the first year of construction, and construction is not currently projected to be complete until 2030; indirect impacts may begin later but all are assumed to begin by 2031; mitigation area construction is assumed to be concurrent with levee system construction, beginning in 2020 and ending in 2030. The period for which mitigation benefits are analyzed is 2031-2080, which is the same as the 50-year economic period of analysis. A target year summary is provided in Table 9.

Table 9 Target Year Summary

TY0	2019 (the year before impacts begin)
TY1	2020 (all impacts occur)
TY11	2030 (levee and mitigation construction complete)
TY12	2031 (mitigation and economic benefits begin)
TY61	2080 (end of mitigation and economic period of analysis)

Service Alternatives Analysis

The Corps identified 250 potential CRSM and ER measures as part of this study through public meetings. Because of the breadth of the alternatives, the Service will only evaluate the measures put forth by the Corps, namely the TSP and Recommended Plans for Orange, Jefferson, and Brazoria Counties. While the overall footprint of the project remains quite large, the Service in coordination with the other federal and state natural resource agencies sought to avoid and minimize impacts to the greatest extent possible for each of the proposed TSPs and Recommended Plans. The result was several iterations of levee realignments reducing impacts to commercial and residential structures, marsh and forested wetland habitats, while improving hydrological connectivity with additional culverts to areas bisected by levee construction. The team also recommended staging areas within current right-of-ways minimizing impacts to adjacent property, and developed measures to reduce invasive species during times of disturbance throughout the project footprint.

Orange 3 –This area is a mosaic of commercial, industrial, and residential development where the outlined hurricane protection measures of the Recommended Plan meet the economic goals for the public at large. The final levee footprint as seen in the Recommended Plan was successively reduced to avoid and minimize impacts to all natural resources in the area. While not all habitat was spared, the Service continues to recommend the Corps fully mitigate for all impacts with in-kind mitigation measures. Please see the Mitigation Section for further mitigation recommendations.

The construction of the levee will involve the removal of structures, namely residential homes. The Service acknowledges the possible negative impacts during construction to resident aquatic and terrestrial trust species. While most terrestrial species expected to be encountered in this area are used to human presence, the Service recommends the Corps implement conservation measures during the construction phase to avoid and minimize any impacts to trust resources.

The Service has thoroughly reviewed the Corps' Recommended Plan for this portion of the study and believes the Corps should incorporate all of the Service's recommendations outlined below for the project to be successful.

Port Arthur- Considered a deep draft port; the Port of Port Arthur channel runs 40 feet deep and has a current width of 450 feet. This Port ranks 24th in total tonnage for the nation adding an annual economic impact of $128 million. Port of Port Arthur

The Recommended Plan would raise or construct a total of about 17.0 miles of levees and floodwalls in Port Arthur (this includes the construction of the new 1,830-foot levee segment) and will provide the hurricane protection measures necessary to meet the economic goals of the public at large while avoiding impacts to fish and wildlife species. No additional impacts are expected from the construction of the new levee section as all impacts will occur within existing right-of-ways. Should construction take place within the adjacent waters, any aquatic species can easily swim away and little if any suitable habitat remains for terrestrial wildlife species. Highly industrialized areas adjacent to Port Arthur bayous may not provide the habitat necessary to maintain the life cycle of for many of the fish species common to the study area. We would expect any aquatic species in the immediate area to vacate any areas impacted by construction. Those wildlife species that remain are highly adapted to human presence and should be able vacate any areas impacted by construction. The Service has thoroughly reviewed the Corps' Recommended Plan for this portion of the study and believes the Corps should incorporate all of the Service's recommendations outlined below for a successful project.

Freeport –This area is a highly industrialized petrochemical site situated along the GIWW with a Gulf of Mexico entrance via the Freeport Channel. Considered a deep draft port, the channel had a depth of 45 feet and a width of 400 feet. The Freeport Channel imports and exports a variety of goods however, the Port plans to export 13.9 million metric tonnes per annums of Liquid Natural Gas goods each year. The Port of Freeport is currently ranked 24th in foreign tonnage and 30th in total tonnage in the nation (Texas Department of Transportation, 2014). Currently, the Port of Freeport has an annual economic impact of almost $18 billion with over 13,000 direct jobs.

The Recommended Plan would raise or reconstruct approximately 18.6 miles of levees and floodwalls to occur within current right-of-ways (additional temporary staging areas may be required within currently industrialized areas) with no additional impacts to the environment are expected. Aquatic species can easily swim away and little if any suitable habitat remains for terrestrial wildlife species. Those wildlife species that remain are highly adapted to human presence and should be able to leave any areas impacted by construction. The Service has thoroughly reviewed the Corps' Recommended Plan for this portion of the study and believes the Corps should incorporate all of the Service's recommendations outlined below for the project to be successful.

Service Alternative Recommendations

Globally, coastal wetlands are considered important for a wide range of ecosystems services such as water purification, erosion control, carbon sequestration, recreation, and providing habitats for a diverse array of fish and wildlife species (Valiela, Kinney, Culbert, Peacock, & Smith, 2009) Evidence that coastal wetlands reduce storm surge and attenuate waves is well known in support of restoring Gulf Coast wetlands to protect coastal communities and property from hurricane

damage (Barbler, Georgiou, Enchelmeyer, & Reed, 2013). The President's Gulf Coast Ecosystem Restoration Task Force recommended extensive wetland restoration, given that the "Gulf's wetlands provide a natural flood attenuation function, which may reduce the impacts of flooding associated with storms" (Gulf Coast Ecosystem Recovery Task Force, 2011). The Service supports the acquisition, creation, and restoration of wetland habitats along the entire Texas coast as a first line defense for storm surge reduction to the maximum extent practicable. We have reviewed all the alternatives, TSP and Recommended Plans for this study, and believe the Corps has minimized impacts to the greatest extent possible as it relates to the scope of the project.

However, the Service recommends the Corps initiate the development of a project wide analysis focused on strategic wetland acquisition, restoration, and creation along portions of the project area where wetlands could provide the same level of storm surge protection as the proposed Recommended Plans. The Port Arthur and Freeport Recommended Plans expect construction to occur within current right-of-ways with no additional impacts to any aquatic or terrestrial habitats. In these areas, wetland habitat may not be a feasible alternative due to the proximity to the navigation channels and lack of available space for such as project. Yet, the Orange 3 Recommended Plan proposes to construct miles of new levee. In this instance, the Service continues to recommend the Corps fully consider the use of wetland habitat as a storm surge reduction alternative wherever possible. Commercial and residential buyouts, while considered and subsequently ruled out by the Corps, should receive greater consideration and used in conjunction with wetland acquisition, restoration, and creation opportunities to reduce flooding damages from coastal storms.

Mitigation

On August 31, 2009, the Corps' Directorate of Civil Works – Planning Community issued implementation guidance for Section 2036(a) of the Water Resources Development Act of 2007. This guidance requires that the preferred alternative contain a mitigation plan for the fish and wildlife resources that are lost as a result of the unavoidable impacts caused by the project. These impacts must be compensated to the extent justified and the preferred alternative must have adequate mitigation that will ensure the proposed storm surge reduction measures will not have any measurable adverse impact to the significant resources in the area. The Corps also recognizes that the wetland resources outlined in this document are significant and could suffer long term impacts due to the preferred alternative.

The resource agencies assisted the Corps with recommended mitigation opportunities and recognize the final mitigation alternatives have not been identified or selected at this time. We urge the Corps to continue to coordinate with all the natural resource agencies to fully vet out all mitigation possibilities. The Service (along with the other resource agencies) recommends the following mitigation and BU goals:

1) No net loss of wetland acres,
2) Replace lost AAHU's 1:1,
3) Replace AAHU's in-kind,

The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include:

(a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments.

The Service supports and adopts this definition of mitigation and considers its specific elements to represent the desirable sequence of steps in the mitigation planning process. Based on current and expected future without-project conditions, the planning goal of the Service is to develop a balanced project, i.e., one that is responsive to demonstrated hurricane protection needs while addressing the co-equal need for fish and wildlife resource conservation.

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value of forested wetlands and marsh for fish and wildlife and the relative scarcity of that habitat type, those wetlands are usually designated as Resource Category 2 habitats, the mitigation goal for which is no net loss of in-kind habitat value. The degraded (i.e., non-wet) bottomland hardwood forest and any wet pastures that may be impacted, however, are placed in Resource Category 3 due to their reduced value to wildlife, fisheries and lost/degraded wetland functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value. Project impacts to wetlands will be minimized to some extent by hauling in material for the levee. Because the project is already constructed, avoiding the project impacts altogether (i.e., the "no action" alternative) is not feasible. Therefore, remaining project impacts should be mitigated via compensatory replacement of the habitat values lost.

Toward that end, the Service recommends that the following planning objectives be adopted to guide future project studies:

1. Conserve important fish and wildlife habitat (i.e., bottomland hardwoods, cypress swamps, fresh and estuarine marsh and associated shallow open water habitats) by minimizing the acreage of those habitats directly affected by flood control features.
2. Minimize enclosure of wetlands with new levee alignments. When enclosing wetlands is unavoidable, acquire non-development easements on those wetlands, or maintain hydrologic connections with adjacent, un-enclosed wetlands to minimize secondary impacts from development and hydrologic alteration.
3. Operate water control structures in levees to allow for (or maintain) fish and shellfish access into enclosed wetland areas.
4. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of levees, other project features and timing of construction.
5. Fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

The Corps has identified 161 preliminary mitigation alternative areas such as those located in the floodplains of the Neches and Sabine Rivers within and adjacent to the study area. Additional sites may be identified during the final feasibility planning or suggested by resource agencies. We expect the Corps to analyze mitigation measures aimed at conservation to include coastal

marsh restoration, acquisition of and long-term conservation of bottomland hardwoods and/or swamps, and forested wetlands (See Table 12 below).

Table 10 Mitigation Measures Defined

Measure Type	Measure Description
Marsh Restoration	Fresh, intermediate and brackish marsh restoration utilizing maintenance material from the adjacent Sabine-Neches Waterway to create marsh in open water areas of degraded marsh or in former borrow pits
Hydrologic Restoration	Restoration of natural riverine, tidal, and overland flows to all wetland types by degrading levees, canal berms, roads, filling or blocking small channels which facilitate salinity intrusion, and/or installing culverts to restore connectivity.
Preservation	Preservation of forested wetland areas or emergent marsh under a perpetual conservation easement, or permanent transfer to an appropriate state conservation agency for preservation in perpetuity.
Forested Wetland Restoration	Replanting cypress-tupelo or bottomland forest vegetation in degraded wetland areas or in former borrow pits, and/or removal and long term control of Chinese tallow or other invasive vegetation species.

The primary objective of the Corps proposed mitigation plan is to restore approximately 453 acres of emergent marsh, and to preserve in perpetuity approximately 559 acres of forested wetlands. All of the impacted terrestrial and aquatic habitats play a vital conservation role along the upper Texas coast and long-term preservation of these habitats are critical for the continued economic growth and ecological resiliency of Orange, Jefferson and Brazoria Counties. The Service along with the Corps and the other natural resource agencies have selected a suite of appropriate mitigation alternatives satisfying the AAHUs necessary to satisfy the mitigation target for each habitat type (See Table 13). The Corps subsequently preformed a coast analysis and selected the Best Buy mitigation plan for each wetland type adversely affected by the Recommended Plan.

The Corps in conjunction with the natural resource agencies developed a series of assumptions for each of the mitigation modeling efforts. Appendix P of the Corps' Final Integrated Feasibility Report and Environmental Impact Study details the mitigation, monitoring, and adaptive management plans for the entire Sabine Pass to Galveston Bay Coastal Strom Risk Reduction and Ecosystem Restoration study area (USACE, 2016) and is used to reference the tables below.

Table 11 Mitigation Compensation by Habitat Type

Habitat Type	Mitigation Target	Best Buy Plan	Mitigation Compensation (AAHU)
Swamp	-7.3	S11	13.2
Bottomland Hardwood	-35.4	BH161	49.3
Fresh Marsh	-30.2	F52	33.4
Intermediate Marsh	-16. 6	I31	60.4
Brackish Marsh	-96.5	B28 and B29	100.4
Total	-186.0		262.9

The Corps used marsh restoration, preservation, and forest wetland restoration to build the seventeen mitigation alternatives that were advanced for further screening. The final screening resulted in the Recommended Plan preserving in perpetuity of 559.3 acres of swamp and bottomland hardwoods in Mitigation Area 11 in the bottomlands of the Sabine River and in Mitigation Area 161 on the upland/wetlands margin of the Neches River in the Bessie Heights area. An additional 452.8 acres of marsh (fresh, intermediate, and brackish), shallow ponds, and sinuous channels within the marsh in Mitigation Areas 28,29,31,52 (Figures 7, 8, 9, 10 and 11).

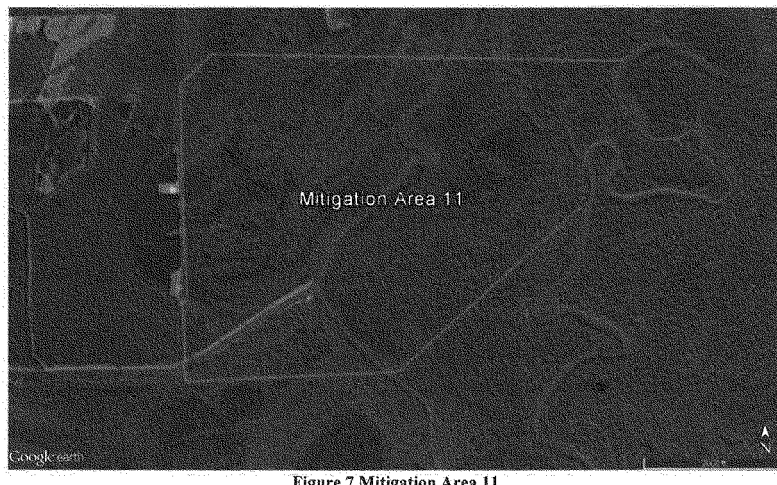

Figure 7 Mitigation Area 11

Source: USACE 2016

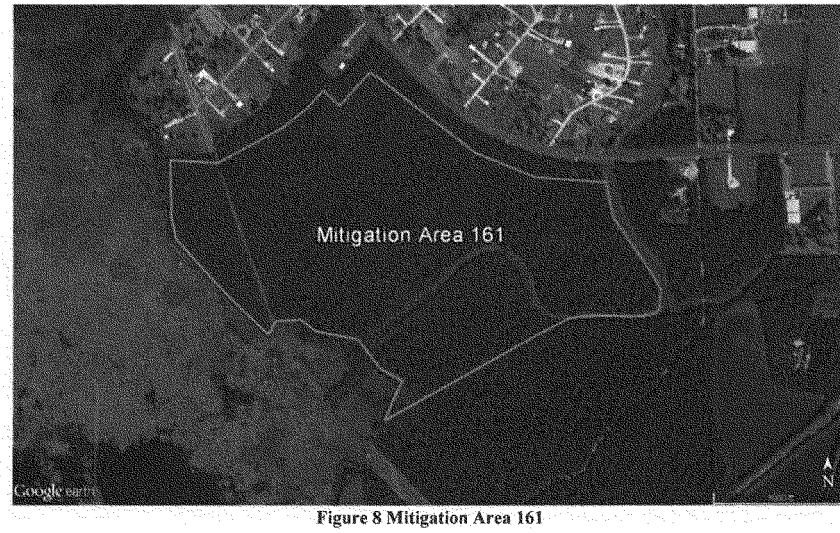

Figure 8 Mitigation Area 161

Source: USACE 2016

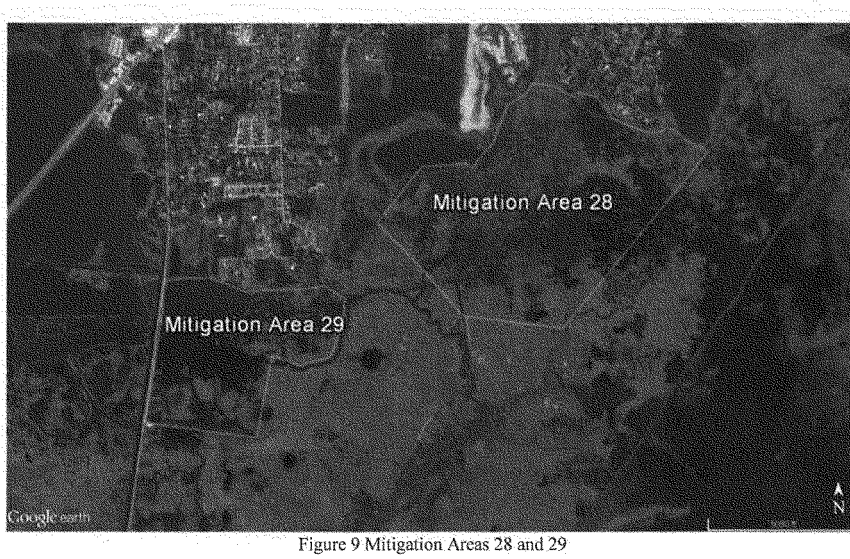

Figure 9 Mitigation Areas 28 and 29

Source: USACE 2016

Figure 10 Mitigation Area 31

Source: USACE 2016

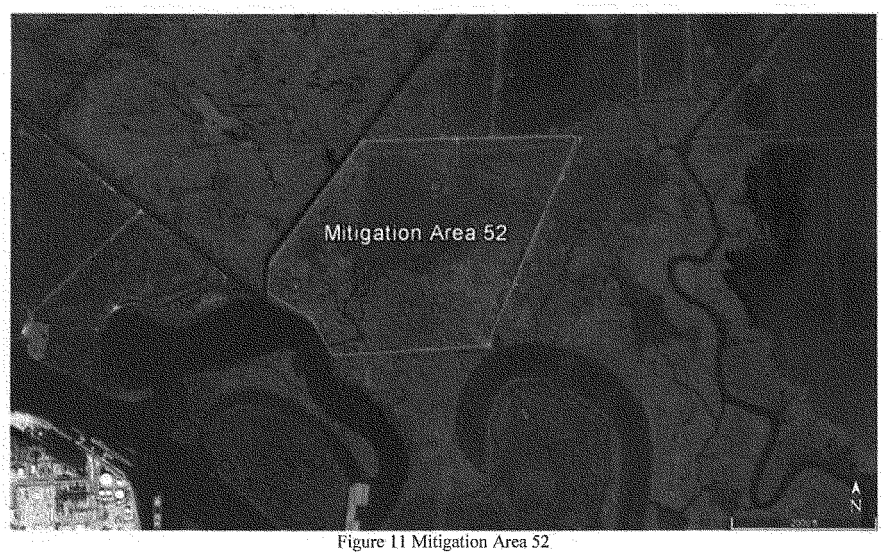

Figure 11 Mitigation Area 52

Source: USACE 2016

The Corps plans to use sediments shoaled from maintenance dredging of adjacent deep-draft navigation channels to restore marsh in areas of open water within Mitigation areas 28, 29, 31 and 52. Target elevations were developed by natural resource agency staff during the mitigation plan formulation, however the Service recommends the Corps re-evaluate target elevations just

prior to the commencement of restoration construction and adjust accordingly. An appropriate reference marsh within close proximity to the mitigation site should be identified and used to meet the target elevations. Close coordination with resource agency staff during the construction phases will assure a successful mitigation project.

The Mitigation Plan Summary (Table 14 below) demonstrates how the Corps plans to fully compensate for all wetland impacts. The Service accepts the mitigation strategy as outlined by the Corps below. However, the Service recognizes that some or all parcels of land outlined for preservation may not be available for purchase if and when the Recommend Plan becomes fully funded. The Service recommends a thorough analysis of the mitigation alternatives at that time to determine availability of said Mitigation Areas. Should any of Mitigation Areas 11, 28, 29, 31, 52, and 161 not be available for preservation or restoration as formally outlined in the Corps Mitigation Plan, the Service recommend immediate coordination to define a new array of mitigation alternatives.

Table 12 Mitigation Plan Summary

Mitigation Area ID	Wetland Type	Total Wetland Acres Preserved in Perpetuity	Total Restored Wetland (acres)*	Total Compensation (AAHUs)	Mitigation Target (AAHUs)
11	Cypress-Tupelo Swamp	291.2		13.2	-7.3
	Bottomland Hardwood	155.7		6.2	
161	Bottomland Hardwood	112.4		49.3	-35.4
	Subtotal	559.3		68.7	-42.7
28	Brackish Marsh	**	133.2	58.5	-96.6
29	Brackish Marsh	**	106.0	41.9	
31	Intermediate Marsh	**	150.7	60.4	-18.2
52	Fresh Marsh	206.8	62.9	33.4	-30.2
	Subtotal	206.8	452.8	194.2	-145.0
	Total	**860.5**		**262.9**	**-187.7**

* Total acres of restored marsh and water

** Property already owned by TPWD so it is already in preservation status.

Final Recommendations

The Service has the following final recommendations for the proposed project:

1. Situate flood protection features so that destruction of wetlands and non-wet bottomland hardwood forests are avoided or minimized to the maximum extent practicable. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

2. Minimize enclosure of wetlands with levee alignments. When enclosing wetlands is unavoidable, establish non-development easements directly adjacent to those wetlands, or maintain hydrologic connections with adjacent, un-enclosed wetlands to minimize secondary impacts from development and hydrologic alteration.

3. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design protection features and timing of construction. The National Bald and Golden Eagle Management Guidelines are included.

4. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable. The Migratory Bird Treaty Act (MBTA) protects all native migratory birds and prohibits the taking, killing, possession, and transportation (among other actions) of migratory birds, their eggs, and parts, except when specifically permitted by regulations of specific intentional uses. A list of birds protected under the MBTA can be found in 50 CFR 10 of the MBTA and at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandtx.html.

5. A complete mitigation plan to compensate for direct and indirect habitat impacts should be developed in consultation with the Service and other state and federal natural resource agencies during final feasibility planning and presented in the Final IFR-EIS. The Final IFR-EIS should specify the mitigation plan that will be implemented concurrently with project construction. The Service understands the scale of the mitigation and levee construction features of this project and the time required for beneficial use projects to be completed. The Corp should complete initial construction of mitigation features at any given mitigation use site within two years and additional features (channel and pond construction) to be completed as soon as possible.

6. The project's first Project Cooperation Agreement (or similar document) should include language that includes the responsibility of the local-cost sharer to provide operational and construction monitoring, and maintenance funds for mitigation features. Acquisition, habitat development, maintenance, site protection, and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the Corps should provide the necessary funding to ensure mitigation obligations are met and maintained on behalf of the public interest.

7. Further detailed planning of project features (e.g. Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service, NMFS, TPWD, NRCS, Environmental Protection Agency (EPA), Texas Commission of Environmental Quality (TCEQ), and the Texas General Land Office (TGLO). The Service shall be provided 30 days to review and submit recommendations on all the work addressed in those reports.

8. The Corps should avoid impacts to state and federal lands. If not feasible, the Corps should establish and continue coordination with state and federal agencies managing lands that may be impacted by a project feature until construction of that feature is

complete and prior to any subsequent maintenance. Points of contact for the agencies potential impacts by project features are:

- Texas Chenier Plain National Wildlife Refuges Complex (979) 267-3337
- McFaddin National Wildlife Refuge Manager (979) 971-2909
- J.D. Murphree Wildlife Management Area Manager (979) 736-2551
- Pineywoods Ecosystems Project Manager (936) 569-8547

9. If mitigation lands are purchased for inclusion within a National Wildlife Refuge (NWR), those lands must meet certain requirements; a general summary of some of the requirements is provided in Appendix A. However, prior coordination with the Service's Region 2 Regional Office should be conducted early in the process to gauge the feasibility of such inclusion activities. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore agency representatives should be contacted early in the planning phase regarding such requirements.

10. If applicable, a General Plan should be developed by the Corps, through coordination with the Service, and the natural resource agencies in accordance with Section 3(b) of the FWCA for mitigation lands.

11. If the proposed project features change, the status of species change, or the project is not implemented within three years of the date of our Endangered Species Act coordination, we recommend that the Corps reevaluate the project's effects and species status and initiate any necessary consultation procedures pursuant to Section 7 of the Endangered Species Act.

12. In general, the Corps should incorporate larger, numerous openings within a diversity of locations in a protection levee aimed at maintaining estuarine dependent fishery migration.

13. Flood protection water control structures in any watercourse should maintain pre-project width and depth to the maximum extent practicable, especially structures located in tidal passes.

14. To the extent possible given any authorized channel dimensions, any flood protection water control structure sited in canals, bayous, or navigation channels that do not maintain the pre-project cross section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center that extends to the bottom of the channel.

15. Should final surge gate structure designs reduce the cross section of Adams or Cow Bayous more than 50 percent, additional modeling and environmental analysis will be performed to characterize potential hydrologic and fish passage impacts and determine additional mitigation requirements.

16. Flood protection surge gates, sluice gates, culverts, and any other water control structures should remain completely open except during storm events or regularly scheduled

maintenance or inspections (See Appendix C). Operation, maintenance, and management plans for structures should be developed in coordination with the Service, NMFS, TPWD, TCEQ, and TGLO.

17. The operation and maintenance plan for the gates and water control structures has not yet been developed. This plan should include a schedule of maintenance events for each gate and culvert and proposed closure times for said maintenance activities. A worst case closure scenario is estimated to be 5-7 days every 10-15 years based on predicted storm surge return intervals high enough to threaten areas targeted for protection. However, in years where more than one storm event occurs, we expect the gates to remain closed (an estimated 5-7 days) for **each** storm event. Periodic maintenance of the gates and culverts (not included in the worst case scenario) may result in additional closures estimated of not more than two weeks for each instance. Therefore, it is assumed by the Corps and representative from the natural resource agencies that closure of the surge gates, sluice gates, and culverts would cause only minor and temporary impacts to fish access and coastal marsh, and no additional mitigation would be needed to offset operational impacts. Any proposed operational deviation from the estimated frequency or duration of structure closures must be assessed in coordination with the Service, NMFS, TPWD, TCEQ, and TGLO at which time additional mitigation would be required to offset such operational impacts.

18. The number and siting of openings in flood protections levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

19. Flood protection structures within a waterway should include shoreline baffles and or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered and coordinated with various resources agencies for review and comment.

20. To the maximum extent practicable, structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet per second. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.

21. To the maximum extent practicable, sluice gates or culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth (See Appendix C). The size of the sluice gates or culverts should be selected that would maintain sufficient flow to prevent siltation.

22. Temporary culverts or sluice gates should be installed in construction access roads unless otherwise recommended by the natural resource agencies. We expect these culverts to minimize hydrologic isolation within wetlands and marshes in the area by maintaining hydrologic flows across the landscape to the maximum extent possible. At a minimum, there should be one; 24-inch culvert or sluice gate placed every 500 feet and one at natural stream crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500-feet long and an area would be hydrologically isolated without that culvert.

23. Water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.

24. Levee alignment and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

25. Operational plans for water control structures should be developed to maximize the cross-sectional area open for as long as possible.

26. Any proposed change in mitigation features or plans should be coordinated in advance with the Service, NMFS, EPA, TPWD, TCRQ, and TGLO.

27. A report documenting the status of mitigation implementation and maintenance should be prepared every three years by the managing agency and provided to the Corps, the Service, NMFS, EPA, TPWD, TCEQ, and TGLO. That report should also describe future management activities and identify and propose changes to the existing management plan.

28. Fill material used during the construction of the levees or its associated features should come from an approved upland borrow source permitted by the State and testing should comply with TCEQ criteria. The Environmental Protection Agency (EPA)/Corps Inland Testing Manual criteria would apply to dredge material used for marsh restoration at mitigation sites.

29. The Corps shall fully compensate for any unavoidable losses of wetland habitat (including forested wetlands) or non-wet bottom hardwoods caused by project features as dictated by the Wetland Value Assessment modeling.

30. Acquisition, habitat development, maintenance, and management of mitigation lands should be allocated as a first-cost expense of the project to ensure mitigation obligations are met on behalf of the public interest.

Works Cited

Barbler, E., Georgiou, .. Y., Enchelmeyer, B., & Reed, D. J. (2013). The Value of Wetlands in Protecting Southeast Louisianna from Hurricane Storm Surges. *PLoS One*(8(3)), e58715.

Blackburn, J. C., Johnson, C., & Berryhill, M. (2001). The value of the Texas bays and adjacet wetlands. *CLE International Wetlands Conference.* Austin.

Blair, W. (1950). The biotic provinces of Texas. *Texas Journal of Science*, 93-117.

Day, J., Hall, C. S., Kemp, W. M., & Yanez-Arancibia, A. (1989). *Estuarine ecology.* New York: John Wiley and Sons.

Day, J., Hall, C. S., Kemp, W. M., & Yanez-Arancibia, A. (1989). *Estuarine ecology.* New York: John Wiley & Sons.

Division of Emergency Managment. (2008). *Hurricane Ike Impact Report.* Austin: Office of the Governor of Texas.

Espey, Hutson, and Associates. (1976). *Biological studies in Sabine Lake 1974-1975. Document No. 7644.* Austin: Espey, Hutson, and Associates .

Gauthreaux, S. (1971). A radar and direct visual study of passerine sping migration in southern Louisiana. *Auk*, 88.

Gooch, T. (1996). Rainfall patterns and historical inflows from the Sabine and Neches Rivers into Sabine Lake. *Sabine Lake Conference*, (p. 11+ appendix). Beaumont, TX.

Gosselink, J., Cordes, C. L., & Parsons, J. W. (n.d.). *An ecological characterization study of the Chenier Plain coastal ecosystems of Louisiana and Texas.* U.S. Fish and Wildlife Service, Office of Biological Services, FWS/OBS-78/11. 3 volumes.

Gulf Coast Ecosystem Recovery Task Force. (2011). Gulf Coast Ecosystem Recovery Taks Force Gulf of Mexico Regional Ecosystem Restoration Strategy. Washington D.C.: Gulf Coast Ecosystem Recovery Task Force.

Harcombe, P., & Neaville, J. E. (1977). Vegetation types of Chambers County, Texas. *Texas Journal of Science*, 209-234.

Herke, W. (1995). Natural fisheries, marsh management, and mariculture: complexity and conflict in Louisana. *Estuaries*, 18:10-17.

Knutson, P. (1977). Designing for bank erosion control with vegetation. Reprinted for teh U.S. Army, Coastal Engineering Research Center.

Louisiana Department of Natural Resources. (1999). *Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority.* Louisiana Department of Natural Resources, Baton Rouge.

Masterson, J. (n.d.). *Smithsonian Marine Station at Fort Peirce*. Retrieved 2 10, 2014, from Smithsonian Marine Station at Fort Peirce: http://www.sms.si.edu/irlspec/Seagrass_Emerging_Issues.htm

NOAA. (2013). *Annaul Commerical Landing Statistics*. Retrieved August 5, 2015, from Commerical Fisheries: https://www.st.nmfs.noaa.gov/pls/webpls/FT_HELP.SPECIES

O'Neil, T. (1949). *Vegetative Type Map of Louisiana Coastal Marshes.* New Orleans: Louisiana Department of Wildlife and Fisheries Commission.

Palmisano, A. J. (1972). The effects of salinity on germination and growth of plants important to wildlife in the Gulf coast marshes. *Preceedings of the Annual Conference of Southeastern Game and Fish Commission* , (pp. 215-223).

PBS&J. (2003). *Preliminary draft environmental impact statement affected environments section. Sabine-Neches Waterway feasibility study (channel improvment to Beaumont, Texas) Southeast Texas and Southwest Louisiana.* . Austin, TX: PBS&J.

Smeins, F. E., Diamond, D. D., & Hanselka, C. W. (1991). *Coastal Prairie in R.T. Coupland (ed.), Ecosystems of the world: Natural grasslands-introduction and western Hemisphere.* New York: Elsevier.

Stokes, J. (2015, August 3). Per. comm.

Sutherlin, J. (1997). Historical development of the marsh system on the west side of Sabine Lake. *Sabine Lake Conference Proceedings: Where Texas and Louisiana Come Together, September 13-14, 1996* (pp. TAMU-SG-97-101). Beaumont: National Sea Grant Office, National Oceanic and Atmospheric Administration, U.S, Department of Commerce.

Texas Department of Transportation. (2013). *GIWW Marine Highway and Aransas National Wildlife Refuge: A Beneficial Partnership.* Austin.

Texas Department of Transportation. (2014). *Texas Port Report.*

Texas Natural Heritage Program (TNHP). (1993). Plant communities of texas . Texas Parks and Wildife Department, Austin.

Texas Parks and Wildlife, C. F. (n.d.). Unpublished data.

Texas, A. (Ed.). (2015). Texas Colonial Waterbird Society Annual Census. *Texas Colonial Waterbird Soceity.* Texas City, Texas.

TNC. (2013). *The Gulf Coast Prairies and Marshes Ecoregion.* Retrieved August 2015, from Nature Conservancy of Texas: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/texas/placeswepro tect/gulf-coast-fact-sheet-1008-lowres-1.pdf

U.S. Department of the Interior, U. S. Fish and Wildlife Service, and U.S. Depeartment of Commerce, U.S. Census Bureau. . (2011). *2011 Survey of Fishing , Hunting, and Wildlife Associated Recreation.* Washington, DC: U.S. Department of the Interior.

U.S. Fish and Wildlife Service. (1980). *The Habitat Evaluation Procedures Manual.* Arlington, Va: U.S. Fish and Wildlife Service, Ecological Service.

US. Fish and Wildlife Service. (2008). *Bird of Conservation Concern.* Arlington: Division of Migratory Bird Management.

USACE. (2012, December 20). *Tips, Tools, and Techniques.* Retrieved April 18, 2015, from Planning Community Toobox: http://planning.usace.army.mil/toolbox/smart.cfm?Section=8&Part=1b

USACE. (2013). *Hydrodynamic and Salinity Transport Modeling of the Mogranza to the Gulf of Mexico Study area.* USACE-ERDC-CHL. Vicksburg: USACE.

USACE. (2014). *Sabine to Galveston Integrated Feasibility Report.* Galveston: U.S. Army Corps of Engineers, Galveston District.

USACE. (2015). *Sabine Pass to Galvestion Integrated Feasibility Study and Environmental Impact Study Draft Appendix O Wetland Value Assessment Modeling* . Galveston: USACE Galveston District.

USACE. (2016). *Sabine Pass to Galveston Bay, Texas Coastal Storm Rish Reduction and Ecosystem Restoration Final Integrated Feasibility Report and Environmental Impact Study* . Galveston: USACE.

USFWS. (2002). *Wetland value assessment methodology procedural manual.* Lafayette, LA: U.S. Fish and Wildlife Service.

Valiela, I., Kinney, E., Culbert, J., Peacock, E., & Smith, S. (2009). Global losses of mangroves and salt marshes. In *Global Loss of Coastal Habitats; Rates, Causes and Consequences* (pp. 109-142). Bilbao, Spain: Fundacion BBVA.

Visser, J., Sasser, C. E., Linscombe, R. G., & Chabreck, R. H. (n.d.). Marsh Vegetation Types of the Chenier Plain, Louisiana, USA. *Estuaries, 23*(3), 318-327.

Vittor and Associates. (1997). *Sabine Lke, Texas: benthic community assessment.* Mobile: Barry A. Vittor and Associates, Inc.

White, W., Calnan, T. R., Morton, R. A., Kimble, R. S., Littleton, T. G., McGowen, J. H., et al. (1987). *Submerged lands of Texas, Beaumont-Port Arthur area sediments, geochemistry, benthic macroinvertebrates, and associated wetlands.* Austin: Bureau of Economic Geology, Univerity of Texas.

Appendix A

Summary of basic/general mitigation land requirements before land is transferred to the U.S. Fish and Wildlife Service

SUBJECT: Revised Summary of basic mitigation land requirements before land is transferred over to the Service.

The following represents a summary of basic mitigation land requirements before land is transferred over to the Service. This does not necessarily represent a comprehensive list, but does represent our best effort to identify all land requirements within reason. Coordination with the Service's affected Region will be necessary to evaluate feasibility of land transfer activities pursuant to the following requirements and should occur very early in the process.

1. For inclusion into the National Wildlife Refuge (NWR) system the lands must be located within a refuge's acquisition boundary.

2. The Service must be provided copies of any easements/agreements for right-of-way on the property especially as it pertains to maintenance of such right-of-way, frequency of maintenance and costs associated with that maintenance if the maintenance is to be performed by the landowner.

3. The area must be surveyed prior to acquisition by the United States or transfer to the Fish and Wildlife Service. The survey will be conducted by the Corps of Engineers (Corps) or an approved contractor. Boundaries must be marked and permanent monuments set at all comers. Copies of the surveyor notes, plats, etc. resulting from such survey must be provided to Service.

4. Language must be placed in the deed dedicating the mitigation land to fish and wildlife conservation in perpetuity.

5. When possible any restrictive covenants or liens shall be removed, especially if they could interfere with mitigation implementation, operation and/or maintenance.

6. Completion of a Level 1 survey for hazardous, toxic, and/or radioactive wastes with a copy being provided to the Service. If the Level 1 survey indicates the need for further investigations/surveys, those investigations/surveys must be completed and a copy provided to the Service. Lands having unremediated hazardous, toxic, and/or radioactive wastes present may not be accepted into a NWR. Remediated sites will be assessed for inclusion on a case-by-case basis. Documentation of the level of remediation is to be provided to the Service.

7. Funding mechanism for operation and maintenance of the mitigation lands and mitigation features (e.g., water control structures, timber stand improvements, etc.).

8. Documentation must be provided to the Service describing the mitigation goals and objectives in addition to a description of necessary operation and maintenance activities needed to accomplish the stated goals and objectives.

9. Mineral rights should be purchased. If it is not possible to purchase, then protection of surface rights via the following language:

> "The vendors reserve for themselves, their successors and assigns, the right to explore, for, operate, produce, remove and transport, oil and gas from the lands herein described. The

vendors reserve unto themselves, their successors and assigns, the right of ingress and egress over the said lands in pursuance of the reservations set forth above.

The land is now subject to oil and gas lease in favor of

_____, as per lease of record in the records of

_____, pages _____ of

Book_____, and the conveyance is subject to the rights of the lessee in said lease.

The oil and gas reservations made by the vendors herein in favor of themselves, their successors and assigns, shall be subject to the following stipulations, and any lease made by the vendors, their successors or assigns, subsequent to the date of this deed, shall contain the following stipulations for the protection of the vendee.

The vendors, their successors and assigns, agree that prior to entry upon the land for purposes of exploration, development or production of, oil and/or gas, they shall obtain a Special Use Permit from the U.S. Fish and Wildlife Service, which permit is for the purpose of providing for access and protecting the natural resources of the area for which the land was acquired, and whose terms and conditions will not unreasonably restrain the activities of the vendors, and their successors and assigns.

It is mutually understood between the parties that the intention of the Government in acquiring this area is to create a refuge for, and the protection of, wildlife in the area herein acquired, and the vendors will conform to, and be governed by, and the vendors herein bind themselves, their successors and assigns, agents and employees, to conform to, and be governed by, the rules and regulations pertaining to the protection of wildlife and refuge administration prescribed from time to time by the Secretary of the Interior or his/her authorized agent, the Director of Fish and Wildlife Service, except that such regulations shall not unreasonably restrain the exercise and use by the vendors, their successors and assigns, of the reservation set out in this agreement. [11]

10. The Service would need a title commitment and policy in favor of United States of America that is in the American Land Title Association (ALTA) U.S. Policy 9/28/91 format as provided in Title Standards 2001 .

If the title remains with the local-sharer or the Corps a General Plan as provided for under Section 3 of the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 et seq.) must be written. However, the Service may choose to not manage lands for which it does not have title.

Appendix B

Suggested Priority of Migratory Bird Conservation Actions for Projects
U.S. Fish and Wildlife Service, Migratory Bird Management
(For External Distribution)
March 9, 2010

1. Avoid any take of migratory birds and/or minimize the loss, destruction, or degradation of migratory bird habitat while completing the proposed project or action.

2. Determine if the proposed project or action will involve below- and/or above-ground construction activities since recommended practices and timing of surveys and clearances could differ accordingly.

3. If the proposed project or action includes a reasonable likelihood that take of migratory birds will occur, then complete actions that could take migratory birds outside of their nesting season. This includes clearing or cutting of vegetation, grubbing, etc. The primary nesting season for migratory birds varies greatly between species and geographic location, but generally extends from early April to mid-July. However, the maximum time period for the migratory bird nesting season can extend from early February through late August. Also, eagles may initiate nesting as early as late December or January depending on the geographic area. Due to this variability, project proponents should consult with the appropriate Regional Migratory Bird Program (USFWS) for specific nesting seasons. Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible. Always avoid any habitat alteration, removal, or destruction during the primary nesting season for migratory birds. Additionally, clearing of vegetation in the year prior to construction (but not within the nesting season) may discourage birds from attempting to nest in the proposed construction area, thereby decreasing chance of take during construction activities.

4. If a proposed project or action includes the potential for take of migratory birds and/or the loss or degradation of migratory bird habitat and work cannot occur outside the migratory bird nesting season (either the primary or maximum nesting season), project proponents will need to provide the USFWS with an explanation for why work has to occur during the migratory bird nesting season. Further, in these cases, project proponents also need to demonstrate that all efforts to complete work outside the migratory bird nesting season were attempted, and that the reasons work needs to be completed during the nesting season were beyond the proponent's control.

   Also, where project work cannot occur outside the migratory bird nesting season, project proponents must survey those portions of the project area during the nesting season prior to construction occurring to determine if migratory birds are present and nesting in those areas. In addition to conducting surveys during the nesting season/construction phase, companies may also benefit from conducting surveys during the prior nesting season Such surveys will assist the company in any decisions about the likely presence of nesting migratory birds or sensitive species in the proposed project or work area. While individual migratory birds will not necessarily return to nest at the exact site as in

previous years, a survey in the nesting season in the year before construction allows the company to become familiar with species and numbers present in the project area well before the nesting season in the year of construction. Bird surveys should be completed during the nesting season in the best biological timeframe for detecting the presence of nesting migratory birds, using accepted bird survey protocols. USFWS Offices can be contacted for recommendations on appropriate survey guidance. Project proponents should also be aware that results of migratory bird surveys are subject to spatial and temporal variability. Finally, project proponents will need to conduct migratory bird surveys during the actual year of construction, if they cannot avoid work during the primary nesting season (see above) and if construction will impact habitats suitable for supporting nesting birds.

5. If no migratory birds are found nesting in proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

6. If migratory birds are present and nesting in the proposed project or action area, contact your nearest USFWS Ecological Services Field Office and USFWS Region Migratory Birds Program for guidance as to appropriate next steps to take to minimize impacts to migratory birds associated with the proposed project or action.

* Note: these proposed conservation measures assume that there are no Endangered or Threatened migratory bird species present in the project/action area, or any other Endangered or Threatened animal or plant species present in this area. If Endangered or Threatened species are present, or they could potentially be present, and the project/action may affect these species, then consult with your nearest USFWS Ecological Services Office before proceeding with any project/action.

** The Migratory Bird Treaty Act prohibits the taking, killing, possession, and transportation, (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. While the Act has no provision for allowing unauthorized take, the USFWS realizes that some birds may be killed during construction and operation of energy infrastructure, even if all known reasonable and effective measures to protect birds are used. The USFWS Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to avoid take of migratory birds and by encouraging others to implement measures to avoid take of migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take migratory birds without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during construction or similar activities.

*** Also note that Bald and Golden Eagles receive additional protection under the Bald and Golden Eagle Protection Act (BGEPA). BGEPA prohibits the take, possession, sale, purchase,

barter, offer to sell, purchase, or barter, transport, export or import, of any Bald or Golden Eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. Further, activities that would disturb Bald or Golden Eagles are prohibited under BGEPA. "Disturb" means to agitate or bother a Bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an Eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. If a proposed project or action would occur in areas where nesting, feeding, or roosting eagles occur, then project proponents may need to take additional conservation measures to achieve compliance with BGEPA. New regulations (50 CFR § 22.26 and § 22.27) allow the take of bald and golden eagles and their nests, respectively, to protect interests in a particular locality. However, consultation with the Migratory Bird, Ecological Services, and Law Enforcement programs of the Service will be required before a permit may be issued.

Appendix C

National Marine Fisheries Service Baton Rouge Field Office
April 2008 Version

Fisheries Friendly Design and Operation Considerations for Hurricane and Flood Protection Water Control Structures

SUMMARY

The purpose of this document is to: 1) identify design and operational guiding principles that would optimize passage of estuarine dependent marine fisheries species, or at least, minimize adverse impacts to their passage through hurricane and flood protection water control structures planned for the New Orleans District of the U.S. Army Corps of Engineers; and, 2) provide background literature for environmental justification and documentation. Specific projects for which this guidance should be considered include the Mississippi River and Tributaries, Morganza to the Gulf of Mexico Hurricane Protection Project; Donaldsonville to the Gulf Project; Supplemental Appropriations Projects, and the Louisiana Coastal Protection and Restoration Project (LACPR). However, these guiding principles would also pertain to any civil works projects that could include combinations of levees and/or water control structures. Project delivery teams should remain flexible to adapt these design principles on a case-by-case basis as new fishery resource information and project-specific hydraulics data become available.

In general, the ability of estuarine dependent marine fishery organisms to migrate to and from coastal habitats decreases as structural restrictions increase, thereby reducing fishery production. The physical ability (i.e., swimming speed) to navigate through a structure is not the only factor influencing fish passage. Both behavioral and physical responses govern migration and affect passage of fishery organisms through structures. These responses may vary by species and life stage. In addition, most marine fishery species are relatively planktonic in early life stages and are dependent on tidal movement to access coastal marsh nursery areas. For this reason, in general, the greater the flow through a structure into a hydrologically affected wetland area, the greater the marine fishery production functions provided by that area.

Data on marine fishery species migrations in the Gulf of Mexico are too limited to allow the development of definitive design and operational considerations for water control structures that would guarantee the protection of marine fishery production. Anecdotal comparisons can be made with data from water intake and fish passage studies from the west and east coasts. It should not be assumed that structures that have been determined to provide sufficient drainage capacity also optimize or provide adequate fishery passage. More investigation is warranted to refine and adaptively manage water control structure design and operations to minimize adverse impacts to fishery passage. In addition, biological background information is provided in the appendices to assist in preparation of environmental documents required by the National Environmental Policy Act (NEPA).

Summary of guiding principles for designing and operating flood protection water control structures to maintain marine fishery passage:

- **Generally, bigger and more numerous openings in hurricane and flood protection levees better maintain estuarine dependent fishery migration. As much opening as practicable, in number, size, and diversity of location should be considered.**
- **Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.**
- **Flood protection water control structures should remain completely open except during storm events.**
- **Any flood protection water control structure sited in canals, bayous, or navigation channels that does not maintain the pre-project cross section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.**
- **The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.**
- **Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.**
- **To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet/second. This may not necessarily be applicable to tidal passes or other similar major exchange points.**
- **To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.**
- **Culverts should be installed in construction access roads unless otherwise recommended by the natural resource agencies. At a minimum, there should be one, 24-inch culvert placed every 500 feet and at natural stream crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500-feet long and an area would hydrologically isolated without that culvert.**
- **Water control structures should be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.**
- **Levee alignments and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.**
- **Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.**

INTRODUCTION

Various flood protection and environmental water control structures in hurricane protection levees are being designed and considered for inclusion with ongoing local and federal civil works projects within the boundaries of the New Orleans District. Design purposes of the structures vary and may include maintaining safe navigation and optimizing drainage and passage of fishery organisms. For the Sabine to Galveston hurricane protection project, the ICT identified economically important fishery species that should be considered when assessing structure impacts on estuarine fisheries migration. Both the federal and state governments manage some of these species. Primary species that could be affected by flood protection structures in Lousiana include brown shrimp, white shrimp, blue crab, red drum, black drum, spotted seatrout, sand seatrout, southern flounder, and gulf menhaden. Some information is included herein on forage species, the production of which is important to maintain as they serve as important links of the aquatic food web for many of the managed fishery species.

The Baton Rouge office of NMFS has developed preliminary design principles for hurricane and flood protection water control structures to reduce impacts to living marine resources, especially related to migrations of estuarine dependent species. The basis for the following recommended guiding principles is briefly discussed where supporting literature is available. Basic behavior and physiology effects on the passage of fishery organisms are discussed in detail in appendices C and D, to aid federal agencies in environmental evaluations and descriptions under NEPA.

This document has been developed in consideration of input from the interagency HET, university faculty, fish passage staff of various agencies, and cursory literature reviews. These design considerations are intended to address potential impacts to living marine resources pursuant to the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act. Impacts to resources managed under other authorities, such as the Endangered Species Act or the Marine Mammal Protection Act, are not addressed in this document.

GUIDING PRINCIPLES FOR DESIGNING FISHERIES FRIENDLY FLOOD PROTECTION WATER CONTROL STRUCTURES

1. Generally, bigger and more numerous openings in hurricane and flood protection levees better maintain estuarine dependent fishery migration. As much opening as practicable, in number, size, and diversity of location should be considered.

Most of Louisiana's commercial and recreational fishery species must have access to estuarine marshes to successfully complete some part of their life cycle (i.e., they are estuarine-dependent). Estuarine-dependent fishery productivity is a measure of standing crop (the number of fishery organisms present at a point in time) and the turnover rate (the rate at which the population is replaced). All things being equal, fishery production would be lower following levee and water control construction if structures retard turnover rate. This would be the case even while standing crop may appear normal. Restrictions in tidal movement caused by water control structures and levees would result in degraded or substantially changed species composition, which could alter fishery production and/or displace fisheries.

Marine transient species emigrate (i.e., move from coastal marshes towards Gulf waters) towards higher salinity water; therefore, a structure that maintains the greatest degree of opening while allowing the project objectives to be met would be desirable (Rogers et al. 1992).

2. Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.

Water control structures should be designed to have a water flow capacity (and similar dimensions where possible) comparable to the waterway before construction. Restricted water exchange in marshes enclosed by levees and water control structures diminishes recruitment and standing stocks of species that must migrate from coastal spawning sites to marsh nurseries (Rogers et al. 1994). As the amount of hydrologic control increases, the effect on migration and production of marine transients and residents increases. Greater restriction decreases turn over rate of estuarine-dependent fishery organisms, which decreases their production (Rogers et al. 1992a). Slotted and fixed crest weirs have been found to delay immigration. As the degree of restriction increased from slotted weirs, to low elevation weir, and to fixed crest weirs, greater impacts to different fisheries species and their emigration were observed.

Design considerations for hurricane and flood protection water control structures should include features to accommodate vertical and horizontal fishery distribution patterns within interior marsh tidal pathways and coastal passes. Fishery organisms exhibit preferences by species, life stage, and in some cases tide cycle, for vertical and horizontal distribution within smaller or interior marsh tidal connections (Table 1). Behavioral and physiological responses, such as diel vertical migration, affect these preferred distribution patterns.

Study of Keith Lake Pass in Texas revealed that all portions of the water column, both vertically and horizontally, are used by fishery organisms (Hartman et al. 1987). Most estuarine-dependent fishery species preferred the bottom or shore zones during flood tides, but were much more dense near the shores of the pass, in slower moving water, on ebb tide. This lateral movement on slack to ebb tides appears to be a behavioral action to prevent displacement from the pass during ebb tide to accelerate movement to marsh nursery areas. The study identified the response to light cycles with midday densities greatest at bottom and densities greatest at surface during dawn to dusk. Similar within pass distribution patterns were reported by Sabins and Truesdale at Grand Isle, Louisiana (1974) .

Table 1. Table on fishery preference within the water column (Marotz et al. 1990; Herke and Rogers 1985; Hartman et al. 1987; Sabins and Truesdale 1974). "a" denotes juveniles; "b" denotes immigrating; "c" denotes emigrating; "e" denotes ebb tide; "f" denotes flood tide.

	Vertical Distribution			Horizontal Distribution
Species	Surface	Mid-depth	Bottom	Shore/Nearshore
brown shrimp[b]	X	X		X[c]
white shrimp[b]	X	X		
white shrimp[c]		X		X[e]
blue crab	X			Xe
red drum[a]				X[e]
red drum[b]		X	X	
red drum[c]			X	
bay anchovy	X			
striped mullet	X			
Atlantic croaker[a]	X	X		X[c]
Atlantic croaker		X	X	X[e]
spotted seatrout		X	X	
sand seatrout		X	X	X[e]
gulf menhaden	X	X		
southern flounder				X[f]
black drum				X[e]

3. Flood protection water control structures should remain completely open except during storm events.

Fish passage should be optimized by the duration that structures remain fully open. Rozas and Minello (1999) reported that even when water-control structures were open, the densities of transient species were low inside areas enclosed by levees and water control structures as compared to natural areas.

Fisheries migration that temporarily may be impacted with storm related closures are listed in Table 2. The degree of impact would be influenced by the timing and duration of a structure closure relative to peak migration.

Table 2. Migration of economically important fisheries in Louisiana that temporarily may be impacted with storm related closures.

Species	Migration Period Overlapping with Hurricane Season
brown shrimp	April - mid July
white shrimp	July – November
blue crab	June – September
spotted seatrout	April – October
sand seatrout	April – October
red drum	August - December
black drum	March – July
southern flounder	September - October

4. Any flood protection water control structures sited in canals, bayous, or navigation channels that do not maintain the pre-project cross section should be designed and operated with multiple

openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.

Hartman et al. (1987) recommended structures not be constructed in a tidal pass. If a structure was constructed, they recommended the incorporation of several gates at several vertical and horizontal locations, with baffles near shore. Baffles near shore are to direct shore or near shore fish passage on ebb tides through the available structure opening(s) (e.g., gates in wing walls).

Structures should be designed and operated with multiple openings if the pre-project water depth and widths of a channel are not maintained. Multiple openings are necessary to optimize passage of fishery organisms that prefer to migrate along the sides, bottom, and top of channels. For example, Rogers et al. (1992[a]) recommended opening some vertical slots and top, middle, and bottom gates in a structure with multiple slots and gates.

5. The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

The location and number of structures likely affects the abundance and distribution of estuarine fishery species within habitats that would be located on the protected side of levees and water control structures. Rogers et al. (1992[c]) determined that marine transient species were most numerous nearest the structures, partially due to the proximity of the openings with respect to the area enclosed. Similarly, other studies have shown there is a decrease in fishery species abundance and diversity the greater the distance from the access point (Peterson and Turner 1994). This can become more pronounced if an environmental gradient (e.g., salinity) exists between an access point and the interior habitat located on the protected side of structures (Cashner 1994).

6. Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

Study of Keith Lake Pass in Texas revealed vertical and horizontal distribution patterns of fishery organisms in the pass (Hartman et al. 1987). Estuarine-dependent fishery organisms preferred the bottom or near shore zones on flood tides. Most organisms appeared near shores of the pass on ebb tide in slower moving water. Baffles near shore are to direct shore or near shore fish passage through the structure.

Many fish migrate along the water bottom. Water control structures with crests or inverts higher than the lower portion of a channel could impede migration through the deep-water portions of channels. Ramps can provide a means to guide organisms over and through structures and increase access of fisheries organisms to enclosed habitat (Lafleur 1994). Various ramp designs need to be investigated.

7. To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet/second.

In this preliminary investigation, no studies were located that evaluated the impacts of swimming speeds for the fishery species and life stages of concern in Louisiana. To avoid preventing or

reducing ingress or egress of fishery organisms, preliminary guidance on water velocities through structures in Louisiana could be based on anecdotal comparisons with data available on general swimming speeds from studies on the west and east coasts (Tables 3 and 4).

Swimming speeds of estuarine and marine fish and crustaceans is a function of shape, stage of development, length, ambient temperature, light, and duration required for swimming performance. For most species, absolute speed increases as size increases. Generally, fish swimming speeds range from 2-4 body lengths/second with burst speeds up to 5 body lengths/second (Meyers et al. 1986).

Water intake studies have shown that maintaining water velocities less than 0.5 ft/sec would protect most fish and their life stages from being adversely affected by those flows (USEPA 2004). The species and life stages of fish for that study could not be located at this time and further investigation for Gulf of Mexico species is warranted. They also recommended creating horizontal velocity fields to avoid adverse effects on fish because fish are better able to orient to horizontal verses vertical flow. This could allow selective avoidance of water flows not preferred by fish or minimize disorientation or mortality rates caused by flows.

Eberhardt (personal communication) reported velocities exceeding 0.82 feet/second began to impede fish passage. Fish passage was decreased by 50% for velocities exceeding 2.6 feet/second. Based on evaluation of freshwater species, Gardner (2006) recommends keeping velocities through round culverts less than 1.8 ft/sec during 90% of the fish migration season. To improve fish passage through culverts, installing baffles within culverts should be considered to reduce flow velocity barriers for fish (Pacific Watershed Associates 1994).

Table 3. Water flow velocity thresholds for affecting fish passage or avoiding impingement within flows or on screens.

Source	Water Flow Velocity (ft/sec)	
Alyson Eberhardt, personal communication	0.82	Begin to impede
	2.62	Decreased fish passage by 50%
Gardner 2006	1.8	Critical velocity (freshwater fish)
Meyers et al. 1986	<0.49	To avoid impingement
USEPA 2004	<0.50	Protected 96% of the fish tested from impingement

Table 4. Sustained fish swimming speeds. Adapted from Meyers et al. (1986). Note that no data was located for the fisheries species and life stages for the Gulf of Mexico.

Fish/life stage	Swimming Speeds (ft/sec)
Atlantic herring	0.19 – 0.3
Mullet	4.19
Horse mackerel	4.46
Sole	0.19 - 0.3
most larvae	0.82 – 0.98

Based on these limited data, larval fish could be adversely impacted by water flow rates exceeding 0.82 feet/second. Post-larval and juvenile stages of flounders could be impacted by flow rates around 1.0 ft/sec. Other species or larger life stages likely would not be adversely impacted until flow rates exceed 2.62 feet/second based on inferences from these data. Water flow velocity monitoring in the Terrebonne Basin by the U.S. Fish and Wildlife Service has found maximum flows through existing open channels exceeding 1.0 feet /second and in larger saline marsh channels and passes exceeding 2.0 feet/second.

If the spatial extent of flow velocity fields exceed the distance that can be traveled with sustained or burst swimming speeds of fishery organisms, those flows could prevent or reduce ingress or egress during the time which those flows exist. However, the degree of mortality from not being able to access nursery and foraging habitat is not known. High flow rates may aid passage of larval fish that primarily depend on passive transport for migratory distribution and access to estuarine habitat on the protected side of levees, if the high flows do not induce mortality from injury or fatigue. Water flow could exceed the fish swimming rates for short periods and still provide passage during low flows or during still water.

8. To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.

Design considerations should include installing baffles within culverts to reduce flow velocity barriers (Pacific Watershed Associates 1994). Passage of salmon and herring species has been shown to be impaired by culverts. With baffles or other similar features, still water areas could be created to enhance fish passage.

If water control structures include plunge pools, the invert elevation of the structure could be equal to the depth of the plunge pool if the plunge pool is deeper than the pre-project water depth. This deeper invert would optimize passage of fisheries species, in particular bottom dweller species.

Fish often require visual cues for orientation and exhibit faster swimming speeds at increased light levels. Herring type fish (e.g., gulf menhaden) are particularly sensitive to light levels. However, although herring exhibited a preference for unshaded portions of treatments during both day and night periods, as little as 1.4% of the ambient light was necessary for their passage through a culvert (Mosser and Terra 1999).

9. Culverts should be installed in construction access roads unless otherwise recommended by the resource agencies. At a minimum, there should be one, 24-inch culvert placed every 500 feet and at all water crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary, even if the road is less than 500 feet long, if an area would be hydrologically isolated without that culvert.

10. Water control structures should be designed to allow rapid opening in the absence of an offsite power source after storm passage and return of normal water levels.

Regardless of structure size, designs and contingency plans should include means to rapidly open the water control structures when flooding risks subside after a storm. Designs and plans should include infrastructure, equipment, and staff necessary to open the structures even if offsite electricity is not available. Design safeguards should be developed to protect the structures from being damaged rendering them inoperable and locked in a closed configuration after passage of a storm.

11. Levee alignment and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

12. Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

LITERATURE CITED

Cashner R.C., F.P. Gelwick, and W.J. Matthews. Spatial and temporal variation in the distribution of the Labranche wetlands area of the Lake Pontchartrain estuary, Louisiana. Northeast Gulf Science 13(2):107-120.

Environmental Protection Agency. 2004. 69 FR 68443. National Pollutant Discharge Elimination System – Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase III Facilities; Proposed Rule.

Gardner, A.E. 2006. Fish passage through road culverts. M.S. thesis, North Carolina State University. 103 pp.

Hartman, R.D., C.F. Bryan, and J.W. Korth. 1987. Community structure and dynamics of fishes and crustaceans in a southeast Texas estuary. Submitted to: U.S. Fish and Wildlife Service. Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University Agricultural Center. 116 pp.

Lafleur, G.L. 1994. Relative fisheries recruitment past a fixed-crest and ramped weir. M.S. thesis, Louisiana State University. 97 pp.

Marotz, B.L., W.H. Herke, and B.D. Rogers. 1990. Movement of gulf menhaden through three marshland routes in southwestern Louisiana. North American Journal of Fisheries Management 10:408-417.

Meyers, E.P., D.E. Hoss, D.S Peters, W.M. Matsumota, M.P. Seki, R.N. Uchida, J.D. Ditmars, and R.A. Paddock. 1986. The potential impact of ocean thermal energy conversion (OTEC) on fisheries. NOAA Technical Report NMFS 40.

Mosser, M.L. and M.E. Terra. 1999. Low light as an impediment to river herring. Journal of Fish Biology 12:609-614.

Pacific Watershed Associates. 1994. Chapter 10. South Fork Trinity River Basin, Fishery Habitat Improvement Projects. *In* Action Plan for Restoration of the South Fork Trinity River Watershed and Its Fisheries. Prepared for U.S. Bureau of Reclamation and The Trinity River Task Force under contract No. 2-CS-20-01100.

Peterson, G.W. and R.E. Turner. 1994. The value of salt marsh edge vs interior as a habitat for fish and decapod crustaceans in a Louisiana tidal marsh. Estuaries 17(18):235-262.

Rogers, B.D. and W.H. Herke. 1985. Estuarine-dependent fish and crustacean movements and weir management. *In* C.F. Bryan, P.J. Zwank, and R.H.. Chabreck, editors. Proceedings of the fourth coastal marsh and estuary management symposium. Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University Agricultural Center, Baton Rouge. pp 201- 219.

Rogers, D.R., B.D. Rogers, and W.H. Herke. 1994. Structural marsh management effects on coastal fishes and crustaceans. Environmental Management 18(3):351-369.

Rogers, D.R. B.D. Rogers, W.H. Herke. 1992[a]. Some potential effects of the Cameron-Creole marsh management plan on fishery organisms. School of Forestry, Wildlife, and Fisheries, Louisiana State University Agricultural Center. 82 pp.

Rogers B.D., W.H. Herke, and E.E. Knudsen. 1992[b]. Effects of three different water-control structures on the movements and standing stocks of coastal fishes and macrocrustaceans. Wetlands 12(2):106-120.

Rogers, D.R., B.D. Rogers, and W.H. Herke. 1992[c]. Effects of a marsh management plan on fishery communities in coastal Louisiana. Wetlands 12(1):53-62.

Rogers, B.D., R.F. Shaw, W.H. Herke, and R.H. Blanchet. 1993. Recruitment of postlarval and juvenile brown shrimp (*Peneaus aztecus* Ives) from offshore to estuarine waters of the northwestern Gulf of Mexico. Estuarine, Coastal and Shelf Science 36:377-394.

Rozas, L.P. and T.J. Minello. 1999. Effects of structural marsh management on fishery species and other nekton before and during a spring drawdown. Wetlands Ecology and Management 7:121-139.

Sabins, D.S. and F.M. Truesdale. 1974. Diel and seasonal occurrence of immature fishes in a Louisiana tidal pass. Proceedings of the 28th Annual Conference of Southeastern Association of Game and Fish Commissioners 28:161-171.

Swimming Bibliography

Arnott, S. A., D. M. Neil, and A. D. Ansell. 1998. Tail-flip mechanism and size-dependent kinematics of escape swimming in the brown shrimp Crangon crangon. J Exp Biol 201(11):1771-1784.

Chu, K. H., C. C. Sze, and C. K. Wong. 1996. Swimming behaviour during the larval development of the shrimp metapenaeus ensis (DeHaan, 1844) (Decapoda, penaeidae). Crustaceana 69(Part 3):368-378.

Cowles, D. L. 1994. Swimming dynamics of the mesopelagic vertically migrating penaeid shrimp sergestes similis - modes and speeds of swimming. J Crustacean Biol 14(2):247-257.

Dall, W. 1986. Estimation of routine metabolic rate in a penaeid prawn, Penaeus esculentus, Haswell. Journal of Experimental Marine Biology and Ecology 96:57-74.

Engas, A., and D. Foster. 2002. The response of red snapper (Lutjanus campechanus) and pinfish (Lagodon rhomboides) to inclined water flow. Fisheries Research 58(3):315-321.

Hancock, M. A., and S. E. Bunn. 1999. Swimming response to water current in Paratya australiensis Kemp, 1917 (Decapoda, Atyidae) under laboratory conditions. Crustaceana 72:313-323.

Jordan, C. E. 1992. A Model of Rapid-Start Swimming at Intermediate Reynolds Number - Undulatory Locomotion in the Chaetognath Sagitta elegans. J Exp Biol 163(FEB):119-137.

Lawrie, S. M., and coauthors. 1999. The swimming behaviour and distribution of Neomysis integer in relation to tidal flow. J Exp Mar Biol Ecol 242(1):95-106.

Matthews, T. R., W. W. Schroeder, and D. E. Stearns. 1991. Endogenous rhythm, light and salinity effects on postlarval brown shrimp Penaeus aztecus Ives recruitment to estuaries. Journal of Experimental Marine Biology and Ecology 154(2):177-189.

Meager, J. J., I. Williamson, N. R. Loneragan, and D. J. Vance. 2005. Habitat selection of juvenile banana prawns, Penaeus merguiensis de Man: Testing the roles of habitat structure, predators, light phase and prawn size. Journal of Experimental Marine Biology and Ecology 324(2):89-98.

Neil, D. M., and A. D. Ansell. 1995. The orientation of tail-flip escape swimming in decapod and mysid crustaceans. J Mar Biol Assn Uk 75(1):55-70.

Ouellet, P., and J. P. Allard. 2006. Vertical distribution and behaviour of shrimp Pandalus borealis larval stages in thermally stratified water columns: laboratory experiment and field observations. Fisheries Oceanography 15(5):373-389.

Primavera, J. H., and J. Lebata. 1995. Diel activity patterns in *Metapenaeus* and *Penaeus* juveniles. Hydrobiologia 295(1-3):295-302.

Pryor, V. K., and C. E. Epifanio. 1993. Prey selection by larval weakfish (Cynoscion regalis) - the effects of prey size, speed, and abundance. Mar Biol 116:31-37.

Serafy, J. E., S. J. Lutz, T. R. Capo, P. B. Ortner, and P. L. Lutz. 1995. Anchor tags affect swimming performance and growth of juvenile red drum (Sciaenops ocellatus). Mar Freshw Behav Physiol 27(1):29-35.

Smith, M. E., and L. A. Fuiman. 2004. Behavioral performance of wild-caught and laboratory-reared red drum Sciaenops ocellatus (Linnaeus) larvae. Journal of Experimental Marine Biology and Ecology 302(1):17-33.

Wakeman, J. M., and D. Wohlshlag. 1979. Salinity stress and swimming performance of spotted seatrout. Pages 357-361 *in* Ann. Conf. S.E. Assoc. Fish. & Wild.

APPENDIX A

BEHAVIOR

The physical ability (i.e., swimming speed) to navigate a structure is not the only factor influencing fish passage, especially for small structures. Behavioral responses to stimuli individually or interactively affect passage with physiological constraints or responses. Behavior generally can be categorized as schooling and non-schooling behavior.

SCHOOLING BEHAVIOR

Schooling behavior consists of strategies that provide hydrodynamic efficiency, reduced predation, increased efficiency in finding food, and increased reproductive success. Water control structures for flood protection impact large numbers of fishery organisms due to this group response. This could be because fish exhibit the tendency to approach and orient to other members of the species (i.e., biotaxis). This orientation confers a hydrodynamic advantage that is more efficient than individuals due primarily to vortices setup by lead fish. Schools function as a living organism where the group reacts to stimuli as an individual. It is this group reaction that influences greater affect on passage through water control structures.

NON-SCHOOLING BEHAVIOR

Agonistic, territorial, and hierarchical behavior are examples of non-schooling behavior exhibited by fish. Agonistic and territorial behaviors are largely unknown for the listed estuarine and marine fishery species of concern and their life stages. Structures that create physically taxing water flow velocities and some low flow areas may encourage these behaviors as fish compete for resting areas similar to competition seen with fish competing for resting areas within shrimp trawls or behind rocks in river riffle/pool habitat. It is possible these behavioral responses overall may not be that influential on fish passage through a structure, but may come more into play during low flow conditions such as lower tides or slack tide. Hierarchical behavior can often be driven by a combination of physiological responses and will be discussed in that section. Overall, investigation on behavioral responses to water control structures is needed to avoid and minimize adversely impacting fishery passage if not optimizing it.

APPENDIX B

PHYSIOLOGICAL

Fishery species and life stages react differently to a current of water (i.e., rheotaxis). Generally, fish are better able to orient to horizontal verses vertical flow (Meyers et al. 1986).

Locomotion

There are two means for migratory transport of estuarine and marine fish and crustaceans: passive and active transport. Passive transport is drift of organisms carried by the tides and currents. Larval and post-larval fish and crustacean life stages are predominately transported passively by tides and currents. Passive transport via tidal forcing can play a strong role in migration of sub-adult and adult brown shrimp, white shrimp, and blue crabs. Active transport is movement by swimming, which is the primary means of locomotion for sub-adults and adult fish.

SWIMMING SPEED

Refer to guiding principles number 7 for details on swimming speeds relative to impacts on fish passage.

BEHAVIORAL/PHYSIOLOGY INTERACTION

Many fishery organisms exhibit hierarchical behavior. This is a direct response to stimuli, such as astronomical (e.g., tidal rhythm) or meteorological driven flows. For example, brown shrimp mediate transport by circadian or diel vertical migration. Brown shrimp move down in the water column or cease activity as the become negatively buoyant when low salinity and temperature water develop in estuaries with north winds associated with spring fronts. Brown shrimp activity resumes with their movement up in the water column with increasing water temperature, salinity, and hydrostatic pressure associated with the southerly gulf return following after a cold front (Rogers et al. 1993). Similar selective tidal stream transport was reported by Hartman et al. (1987). Fishery organisms identify tide changes by detecting altered velocity, salinity, temperature, all of which can cue staging for immigration with an incoming tide. Future tidal pass or inlet studies are needed for better information on vertical distribution, depth preferences, and changes in buoyancy or behavior to evaluate active and passive transport of fishery organisms.

APPENDIX C - Reference Websites, Fish Passage Agency Representatives, and University Faculty

Baker, C. and J. Boubee. 2003. Using ramps for fish passage past small barriers. Water and Atmosphere 11(2). June.
http://www.niwascience.co.nz/pubs/wa/11-2/passage

Corps Portland District, Fish Passage Team
http://www.nwp.Corps.army.mil/pm/e/en_fish.asp

Corps, ERDC, Coastal Hydraulics Lab
http://chl.erdc.Corps.army.mil/CHL.aspx?p=s&a=ResearchAreas;22
USFWS Fish Passage Decision Support System
http://fpdss.fws.gov/index.jsp

NC State's Center for Transportation and the Environment website:
http://www.itre.ncsu.edu/

http://itre.ncsu.edu/CTE/gateway/downloads/Culvert%20Impact%20Study(December2002).pdf

http://itre.ncsu.edu/CTE/gateway/downloads/FishPassage.pdf

FishXing software and learning systems for fish passage through culverts. This software is intended to assist engineers, hydrologists, and fish biologists in the evaluation and design of culverts for fish passage. It is free and available for download.
http://stream.fs.fed.us/fishxing/

- Allows for comparison of multiple culverts designs within a single project.

- Calculates hydraulic conditions within circular, box, pipe-arch, open-bottom arch, and embedded culverts.
- Contains default swimming abilities for numerous North American fish species.
- Contains three different options for defining tailwater elevations.
- Calculates water surface profiles through the culvert using gradually varied flow equations, including hydraulic jumps.
- Outputs tables and graphs summarizing the water velocities, water depths, outlet conditions, and lists the limiting fish passage conditions for each culvert.

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Louisiana State University Coastal Fisheries Institute
Jim Cowan; jhcowan@lsu.edu

University of Texas Marine Science Institute
Lee Fuiman; lee@utmsi.utexas.edu

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix L

National Historic Preservation Act Coordination

May 2017

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Mr. Wolfe:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

The Area of Potential Effect (APE) for this project will be the footprint of the TSP for direct impacts to archeological resources plus a 1,500-foot buffer for indirect impacts to standing structures or buildings. The Orange-Jefferson CSRM Plan (Figures 1 through 6) overlaps five archeological sites and two cemeteries. Additionally, there are four National Register Properties within 1,500 feet of the proposed levee system (Navy Park Historic District, W.H. Stark House, Sims House, and the Woodmen of the World Lodge), all of which would experience reduced risk of storm surge damages with construction of the new levee system. The five archeological sites in Orange County (41OR15, OR39, OR59, OR60, and OR70) are all prehistoric sites that have poorly delineated boundaries, insufficient documentation, and have not been evaluated for National Register of Historic Places (NRHP) eligibility. All of these sites have the potential to be directly impacted by construction activities. The two cemeteries (Thomas Cemetery and an unknown cemetery) also have a potential to be directly affected by levee construction as their recorded boundaries overlap with the proposed project area.

These cemeteries are not well documented and their locations may not be accurate within the existing state databases.

There are numerous cultural resources that occur near the APE for the Port Arthur (Figures 7 through 9) and Freeport CSRM Plans (Figures 10 through 13); however, all of these resources as currently mapped occur outside of the areas proposed for improvements. In Port Arthur, there are no cultural resources that overlap with the areas for proposed improvements along the existing HFPP. However, there are three archeological sites (41BO4, BO119, and BO121) that are within proximity to the proposed improvement areas along the Freeport HFPP. These three sites all occur along Oyster Creek (Figure 13), are poorly delineated, lack sufficient documentation, and have not been evaluated for NRHP eligibility.

Based on the current information for the proposed levee construction and improvements, there is a potential to affect historic properties and cemeteries. These effects consist of direct impacts from earth moving and excavation activities related to construction and potential indirect effects on historic structures such as diminished view shed from the raising of levees and floodwalls. The USACE recommends intensive cultural resources investigations to identify and evaluate any historic properties within proposed construction areas. The USACE intends to execute a Programmatic Agreement (PA) to govern the scope of investigations, which will be determined in concert with the Texas SHPO and Native American Tribes. A draft PA has been developed and provided for public and tribal review as Appendix L in the Draft Integrated Feasibility Report and Environmental Impact Statement. A compact disk of this report is enclosed.

We request your comments on the proposed undertaking and the potential to affect historic properties in compliance with Section 106 of the National Historic Preservation Act of 1966. Thank you for your cooperation in this review process. If you have any questions concerning the proposed project or if we can be of further assistance, please contact John A. Campbell at 409-766-3878.

Sincerely,

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

ATTACHMENTS

Figure 1: Orange and Jefferson Counties CSRM Plan
Orange
Pinehurst
Adams Bayou
DuPont
Gate Structure
Sabine River
Vidor
Cows Bayou
Bridge City
GIWW
Port Arthur
Beaumont
Bessie Heights Marsh
Power Plant
Neches River
Nederland
Groves
Legend
Beaumont A New Levee 12ft
Jefferson Main New Levee 11ft
Orange 3 New Levee 11ft
Water Way
Road
N
0
1
2
4
6
8
Miles
10

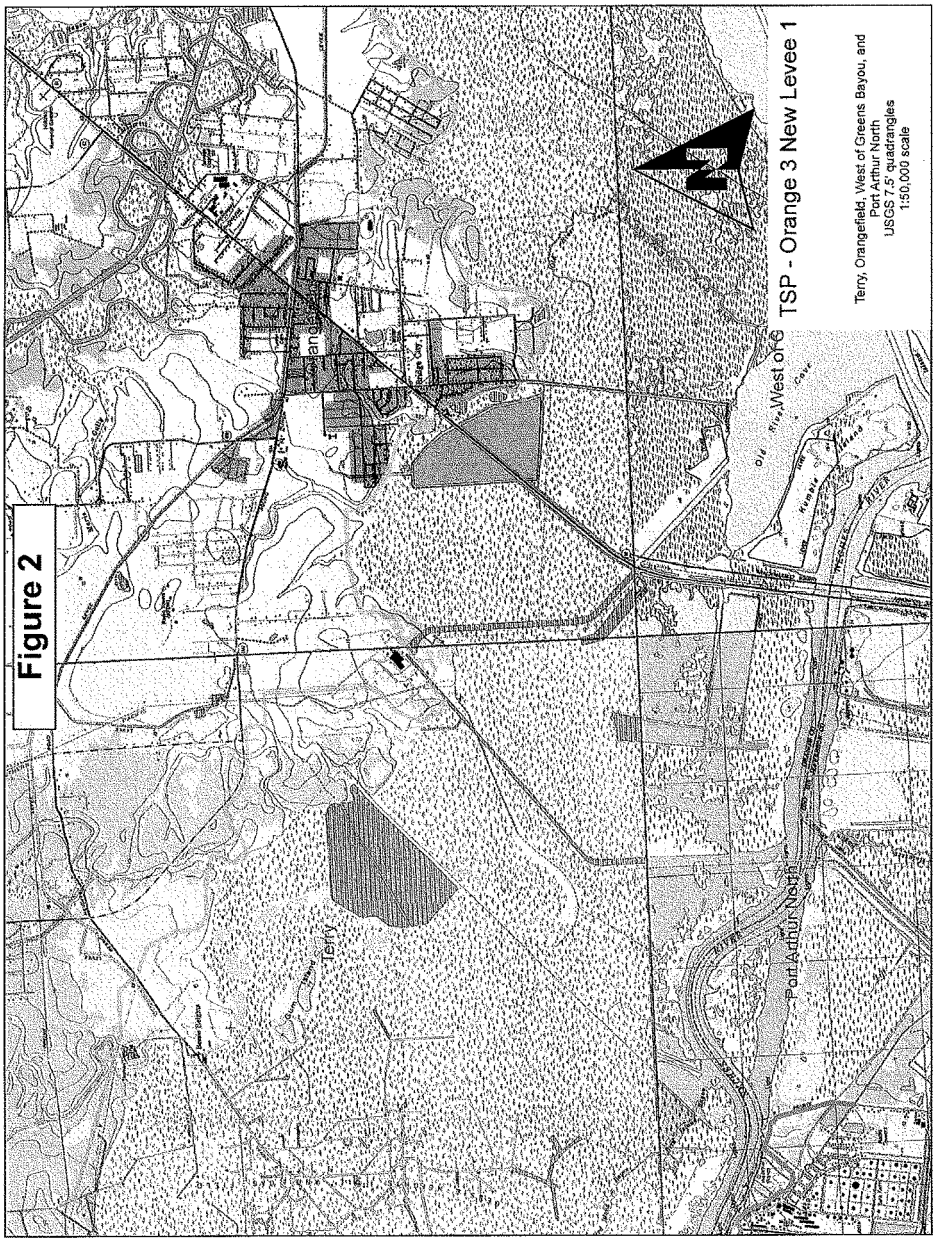
Figure 2
TSP - Orange 3 New Levee 1
Terry, Orangefield, West of Greens Bayou, and Port Arthur North
USGS 7.5' quadrangles
1:50,000 scale
N
Terry
Port Arthur North
Old River
West of 6

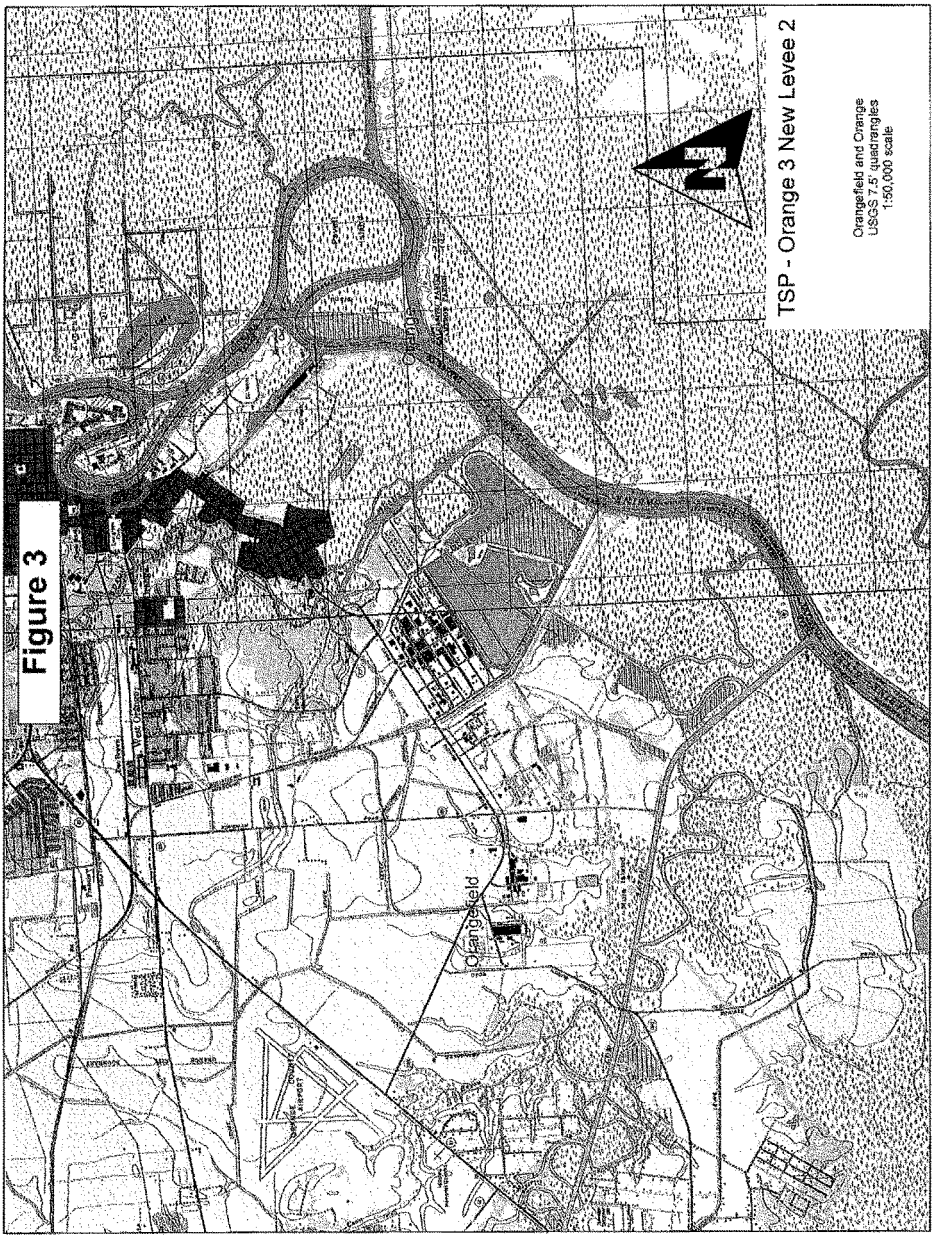
Figure 3
TSP - Orange 3 New Levee 2
Orangefield and Orange
USGS 7.5' quadrangles
1:50,000 scale
N
Orangefield
Orange

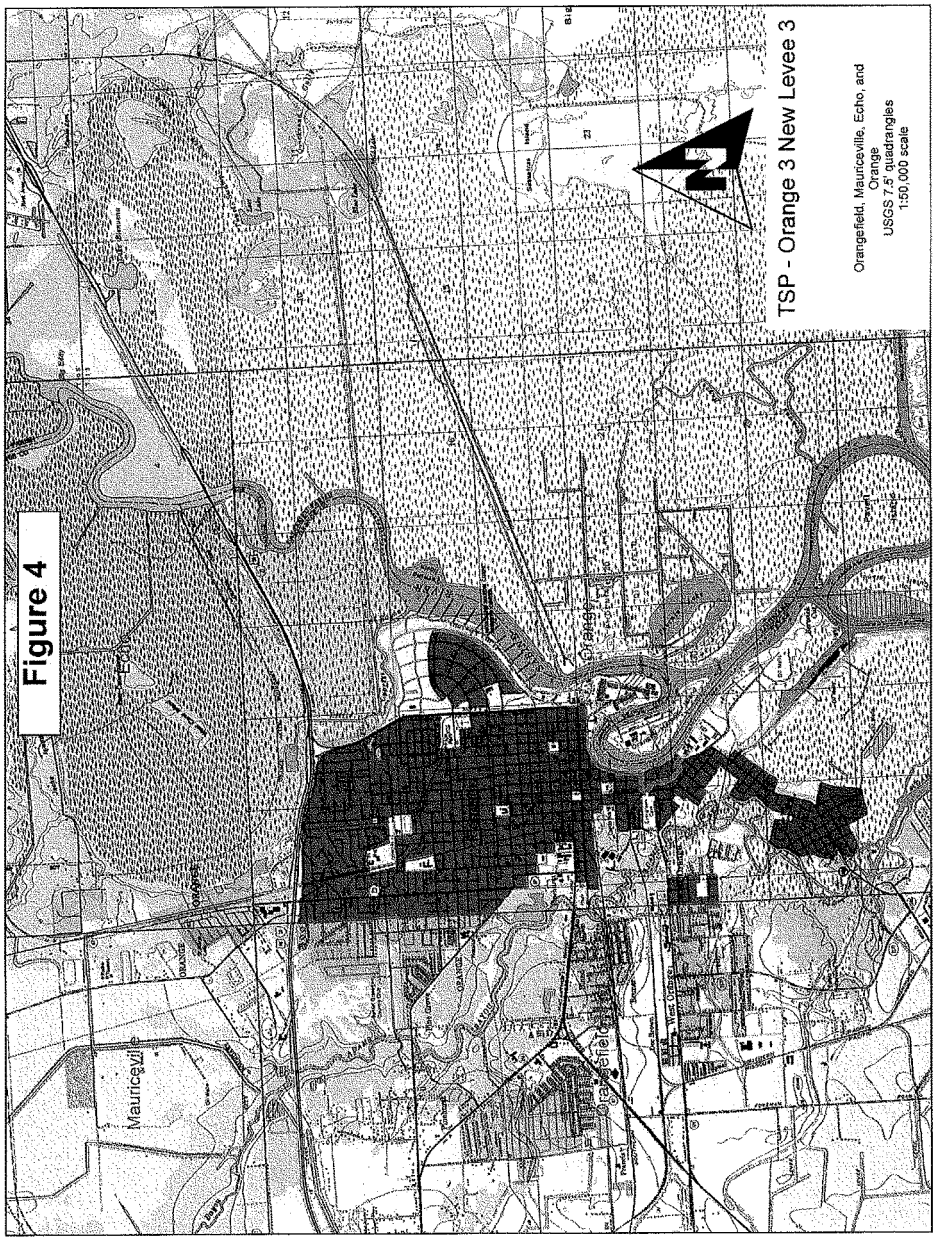
Figure 4
TSP - Orange 3 New Levee 3
Orangefield, Mauriceville, Echo, and Orange
USGS 7.5' quadrangles
1:50,000 scale
N
Mauriceville
Orangefield
Orange
Echo

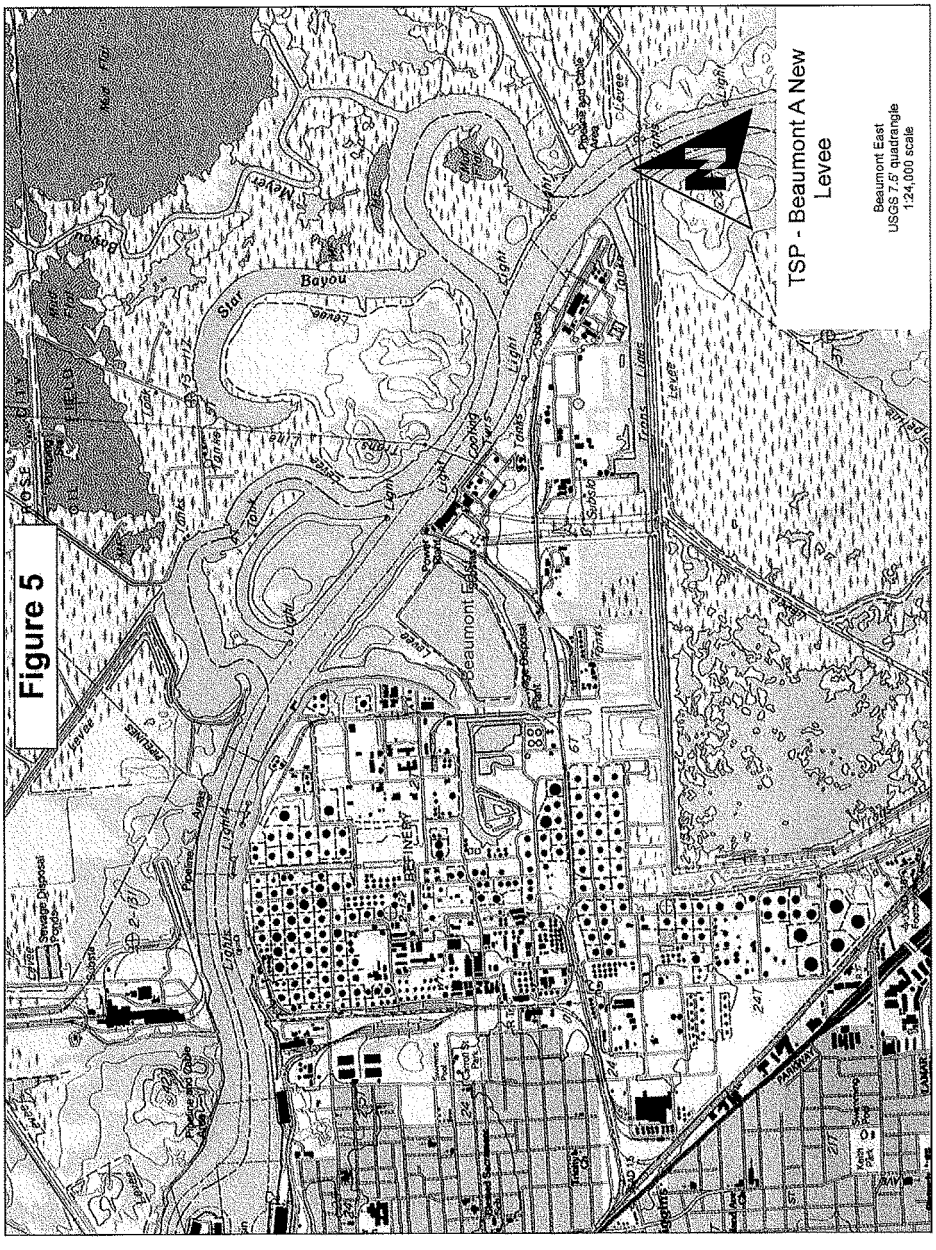
Figure 5
TSP - Beaumont A New Levee
Beaumont East
USGS 7.5' quadrangle
1:24,000 scale
Star Bayou
Beaumont Port
N

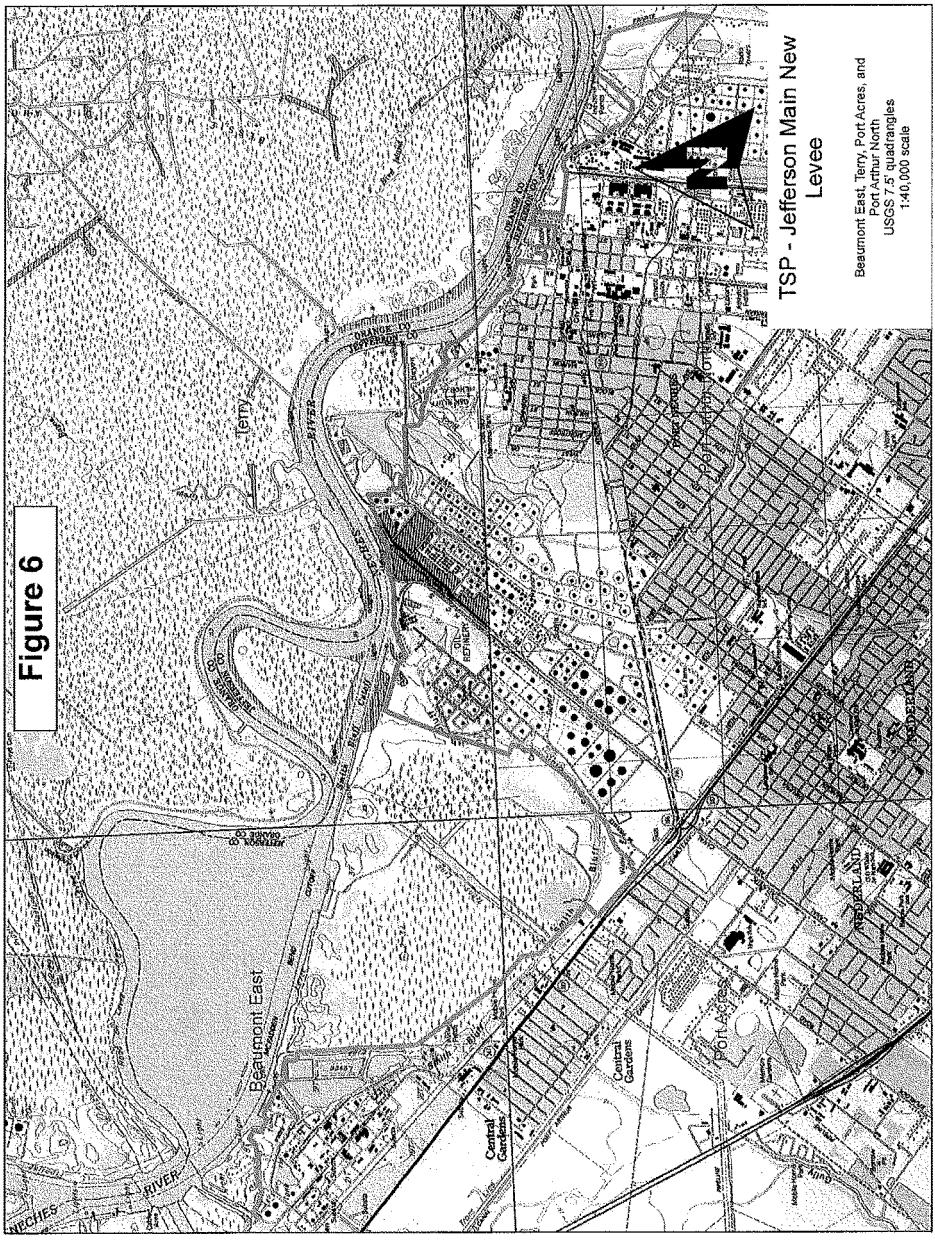
Figure 6
TSP - Jefferson Main New Levee
Beaumont East, Terry, Port Acres, and Port Arthur North
USGS 7.5' quadrangles
1:40,000 scale
Beaumont East
Terry
Port Acres
Central Gardens
NECHES RIVER

Figure 7: Port Arthur and Vicinity CSRM Plan
GIWW
GIWW
Legend
Existing Levee
Existing Floodwall
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Road
Water Way
N
0
1.25
2.5
5
Miles

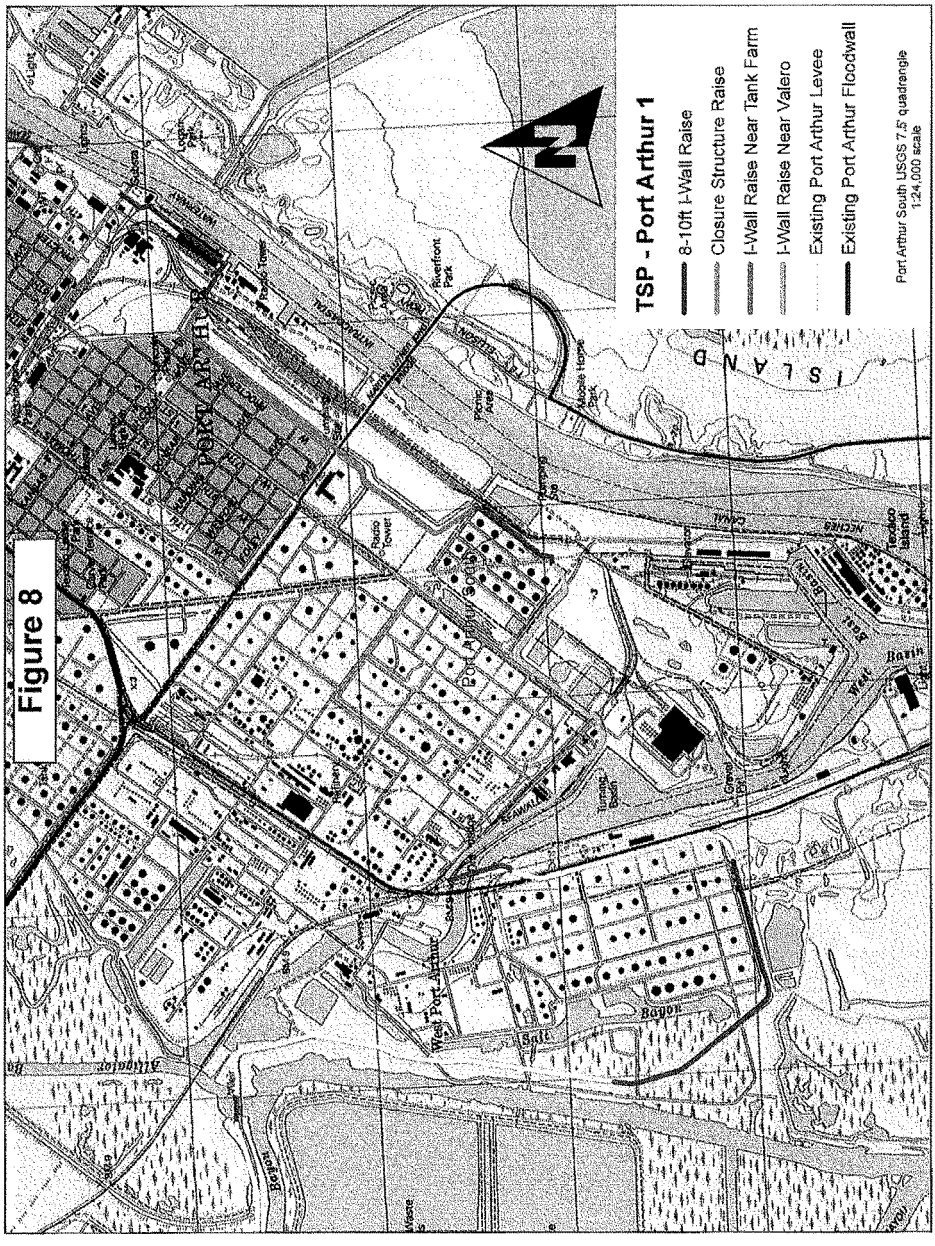
Figure 8
TSP - Port Arthur 1
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Existing Port Arthur Levee
Existing Port Arthur Floodwall
Port Arthur South USGS 7.5' quadrangle
1:24,000 scale
PORT ARTHUR
ISLAND
West Port Arthur
Bayou
Riverfront Park
Nichols Canal
Taylors Bayou

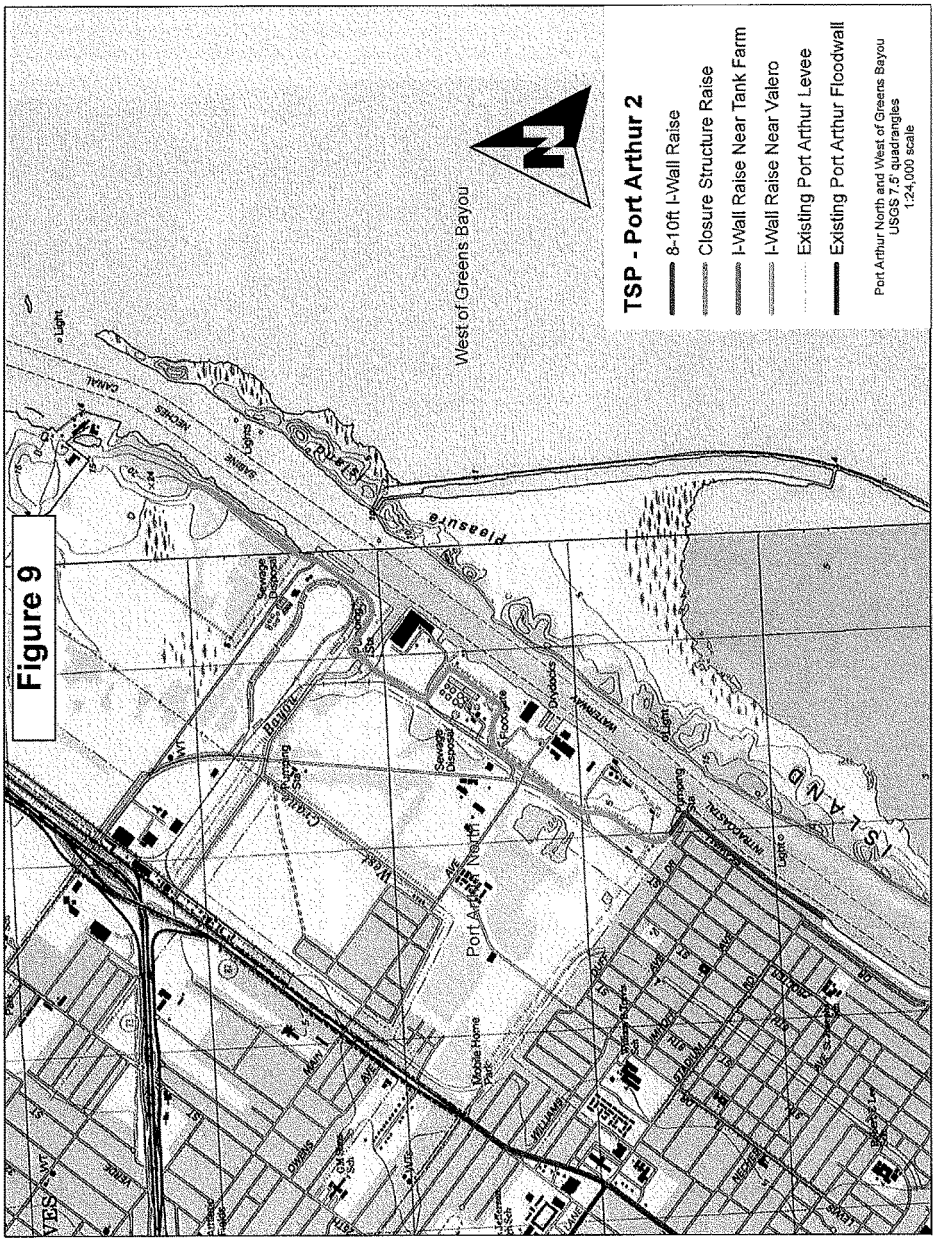
Figure 9
TSP - Port Arthur 2
8-10ft I-Wall Raise
Closure Structure Raise
I-Wall Raise Near Tank Farm
I-Wall Raise Near Valero
Existing Port Arthur Levee
Existing Port Arthur Floodwall
Port Arthur North and West of Greens Bayou
USGS 7.5' quadrangles
1:24,000 scale
West of Greens Bayou
Port Arthur North
ISLAND

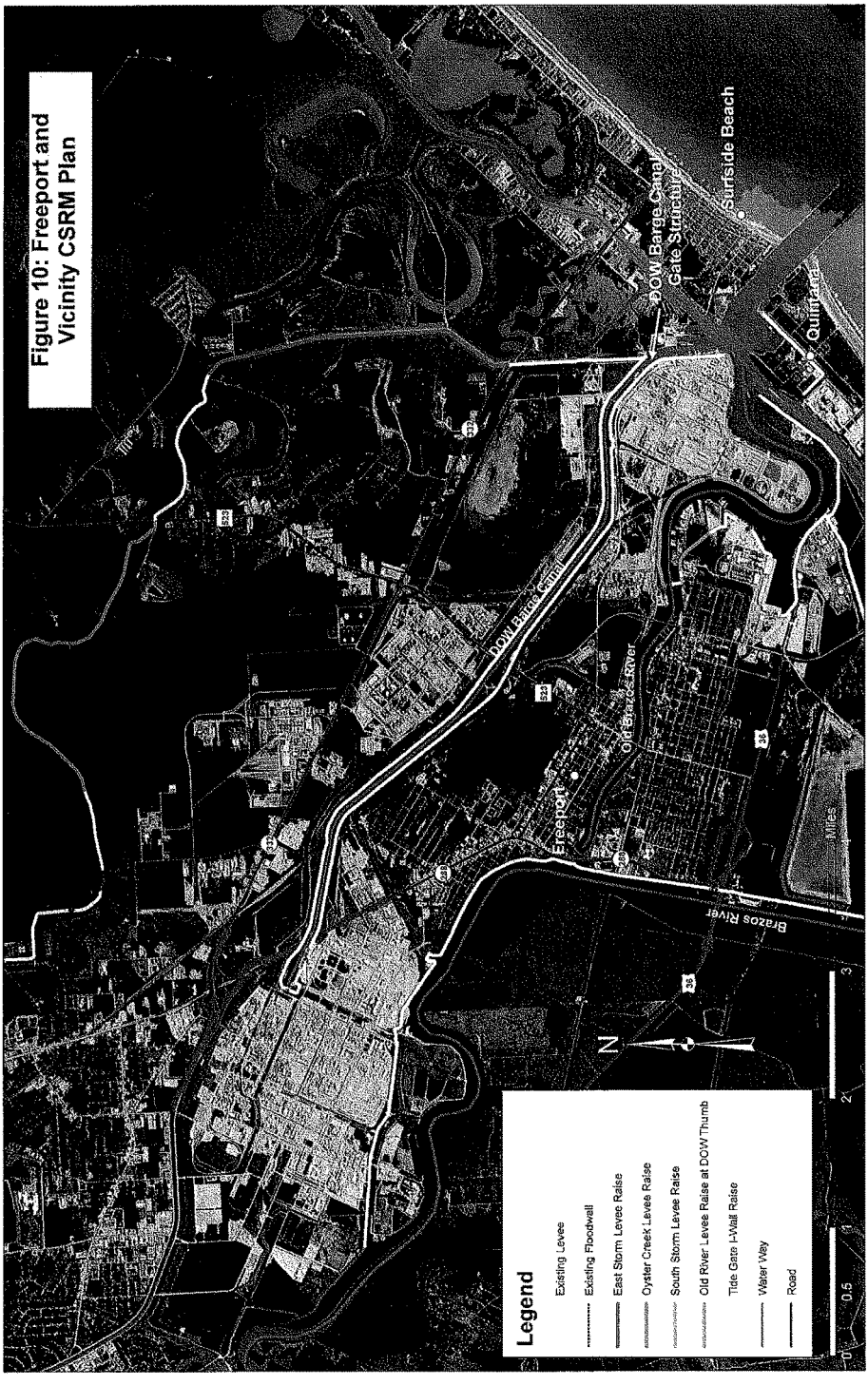
Figure 10: Freeport and Vicinity CSRM Plan
Legend
Existing Levees
Existing Floodwall
East Storm Levee Raise
Oyster Creek Levees Raise
South Storm Levee Raise
Old River Levee Raise at DOW Thumb
Tide Gate I-Wall Raise
Water Way
Road
0
0.5
1
2
3
Miles
N
Freeport
Old Brazos River
DOW Barge Canal
DOW Barge Canal Gate Structure
Surfside Beach
Quintana
Brazos River
332
36
288
332
36
288
332
36
288

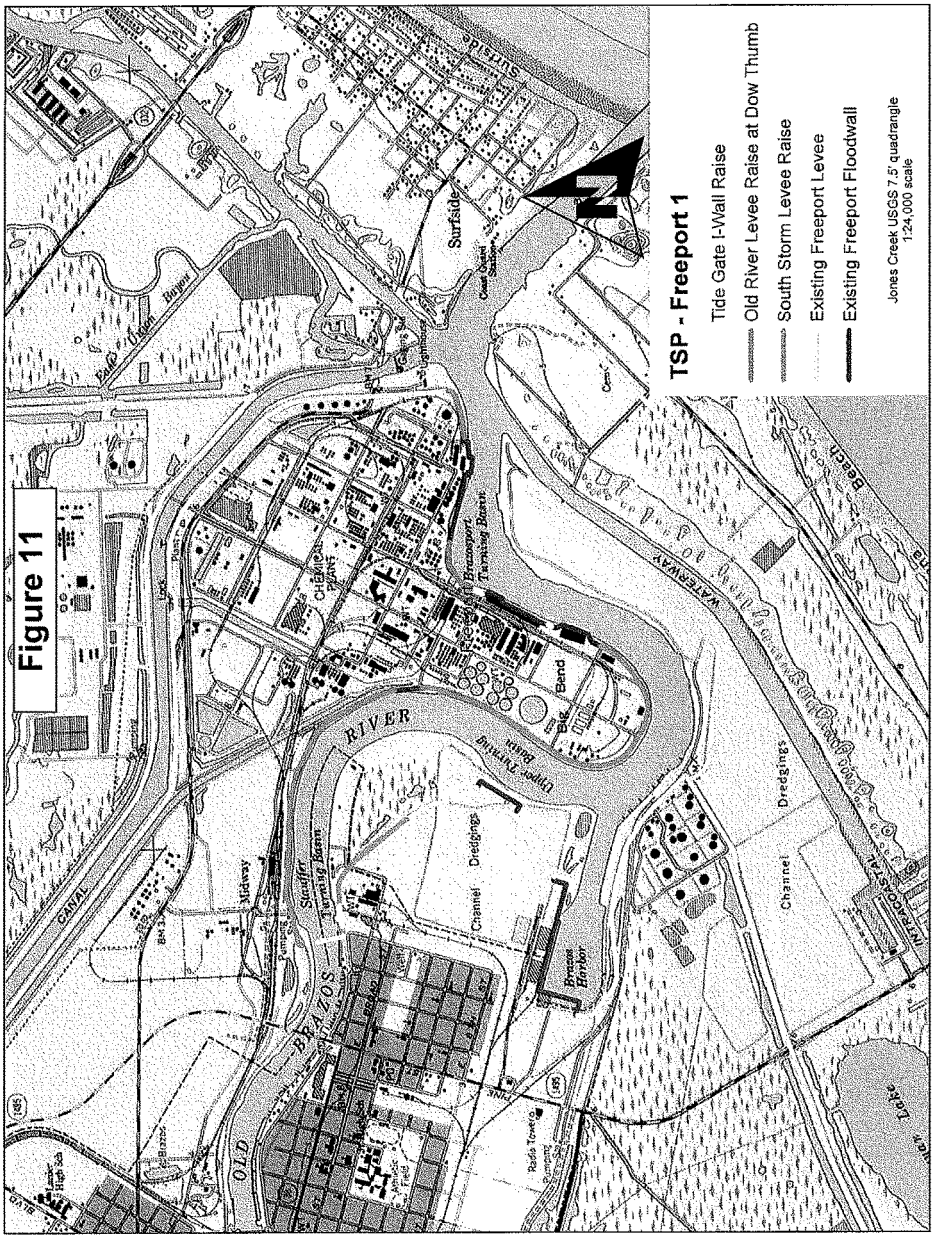
Figure 11
TSP - Freeport 1
Tide Gate I-Wall Raise
Old River Levee Raise at Dow Thumb
South Storm Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Jones Creek USGS 7.5' quadrangle
1:24,000 scale
N
Surfside
Freeport Turning Basin
Big Bend
RIVER
BRAZOS
OLD
CANAL
Midway
Stauffer Turning Basin
Channel Dredgings
Upper Turning Basin
Chemical Plant
Bryan Breton
Radio Tower
WATERWAY
Dredgings
Channel
Beach
Tower

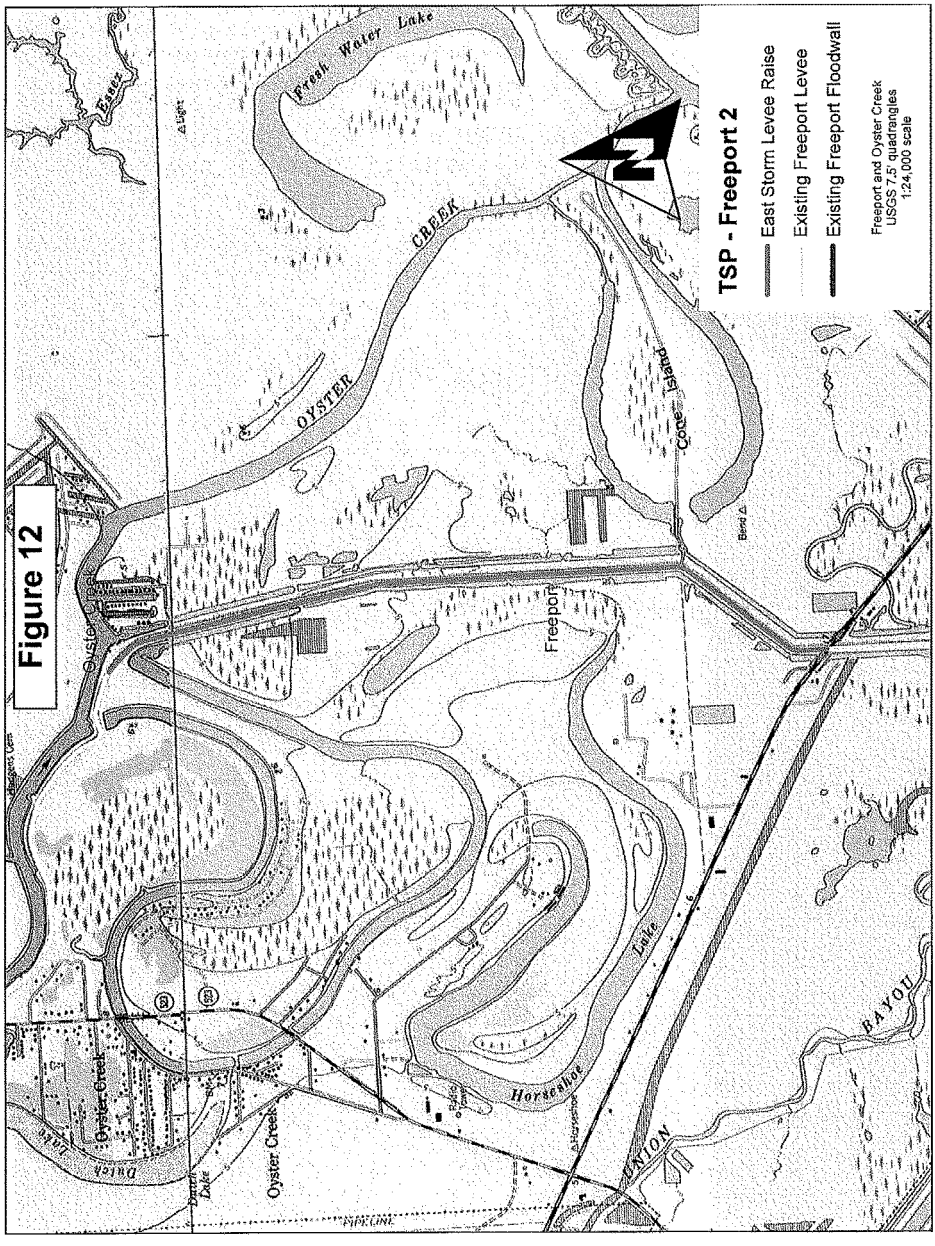
Figure 12
TSP - Freeport 2
East Storm Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Freeport and Oyster Creek
USGS 7.5' quadrangles
1:24,000 scale
Fresh Water Lake
OYSTER
CREEK
Freeport
Oyster Creek
Horseshoe
Lake
BAYOU
Oyster Creek
Dutch Lake
Cone Island

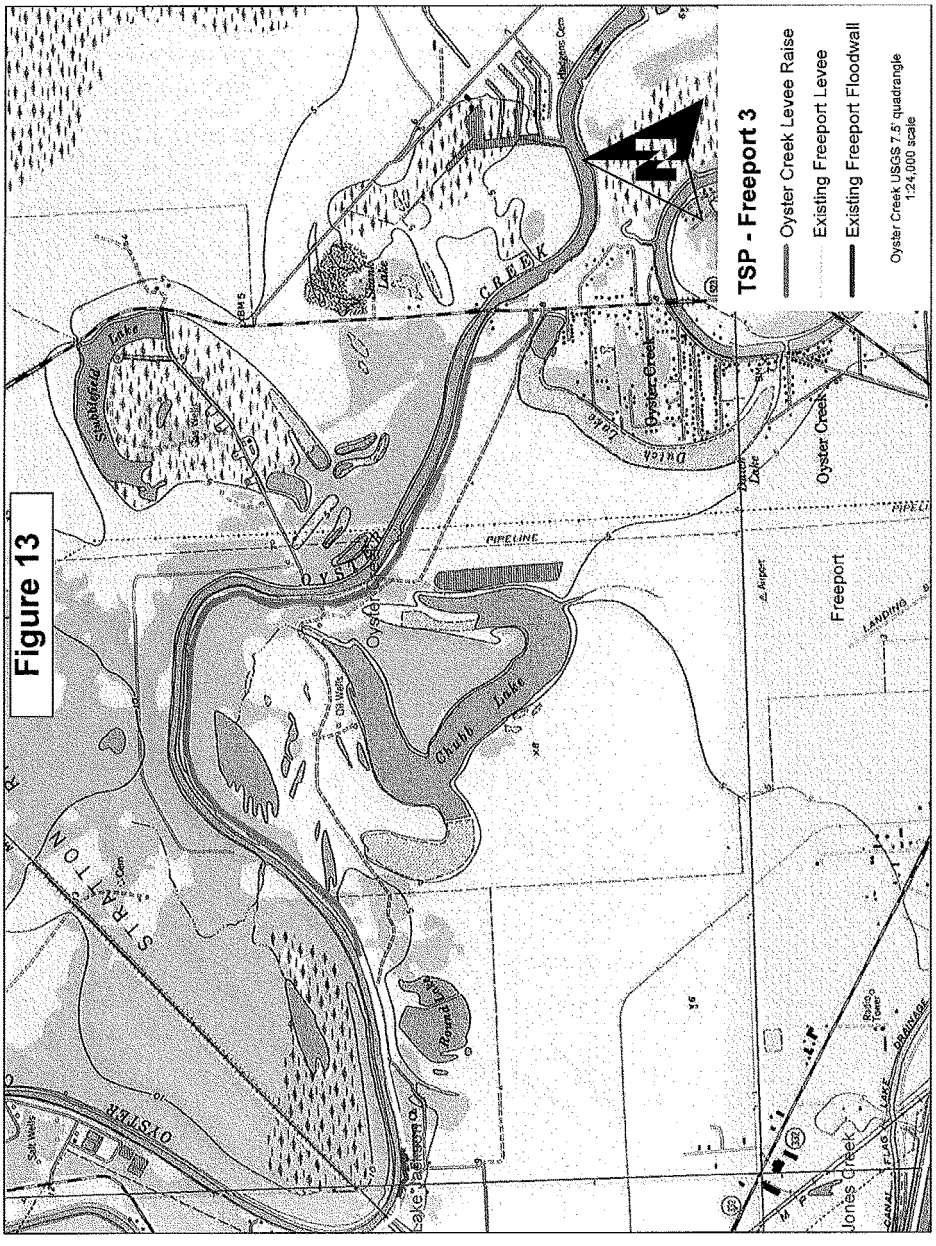
Figure 13
TSP - Freeport 3
Oyster Creek Levee Raise
Existing Freeport Levee
Existing Freeport Floodwall
Oyster Creek USGS 7.5' quadrangle
1:24,000 scale
N
Oyster Creek
Freeport
Jones Creek
Oyster Creek
Stratton Ridge
Clute
Lake Jackson
Dow Chemical
Airport
Pipeline
Landing
Drainage
Canal
Flag Lake
Dutch Lake
Sandy Lake
Stratton Ridge
Oyster Creek
Clute
Lake Jackson
Jones Creek

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Dr. Ian Thompson
Choctaw Nation of Oklahoma
Tribal Historic Preservation Officer
P.O. Drawer 1210
Durant, OK 74072-1210

Dear Dr. Thompson:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

The Area of Potential Effect (APE) for this project will be the footprint of the TSP for direct impacts to archeological resources plus a 1,500-foot buffer for indirect impacts to standing structures or buildings. The Orange-Jefferson CSRM Plan (Figures 1 through 6) overlaps five archeological sites and two cemeteries. Additionally, there are four National Register Properties within 1,500 feet of the proposed levee system (Navy Park Historic District, W.H. Stark House, Sims House, and the Woodmen of the World Lodge), all of which would experience reduced risk of storm surge damages with construction of the new levee system. The five archeological sites in Orange County (41OR15, OR39, OR59, OR60, and OR70) are all prehistoric sites that have poorly delineated boundaries, insufficient documentation, and have not been evaluated for National Register of Historic Places (NRHP) eligibility. All of these sites have the potential to be directly impacted by construction activities. The two cemeteries (Thomas Cemetery and an unknown cemetery) also have a potential to be directly affected by levee construction as their recorded boundaries overlap with the proposed project area.

These cemeteries are not well documented and their locations may not be accurate within the existing state databases.

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We request your comments on the proposed undertaking and the potential to affect historic properties in compliance with Section 106 of the National Historic Preservation Act of 1966. Thank you for your cooperation in this review process. If you have any questions concerning the proposed project or if we can be of further assistance, please contact John A. Campbell at 409-766-3878.

Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

Choctaw Nation of Oklahoma

Historic Preservation
P.O. Box 1210 • Durant, OK 74702-1210

Gary Batton
Chief

Jack Austin, Jr.
Assistant Chief

October 27, 2015

Carolyn Murphy
Department of the Army
Galveston District, Corps of Engineers
PO Box 1229
Galveston, TX 77553-1229

RE: Draft Report on the Feasibility and Environmental Suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas.

Dear Ms. Murphy,

The Choctaw Nation of Oklahoma thanks you for the correspondence regarding the above referenced project. Orang, Jefferson, and Brazoria Counties, Texas lie outside of the Choctaw Nation of Oklahoma's area of historic interest. The Choctaw Nation of Oklahoma respectfully defers to the other Tribes that have been contacted. If you have any questions, please contact me by email.

Sincerely,

Dr. Ian Thompson, Ph.D., RPA
Tribal Historic Preservation Officer
Tribal Archaeologist, NAGPRA Specialist

By:

Daniel Ragle
NHPA Section 106 Reviewer
dragle@choctawnation.com
Choctaw Nation of Oklahoma
P.O. Drawer 1210
Durant, OK 74701

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DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Mr. Bryant Celestine
Alabama-Coushatta Tribes of Texas
Tribal Historic Preservation Officer
571 State Park Road 56
Livingston, TX 77351

Dear Mr. Celestine:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 28, 2015

SWF-PEC-TN

Mr. Jim Arterberry
The Comanche Nation
Tribal Historic Preservation Officer
#6 SW "D" Avenue, Suite A
Lawton, OK 73507

Dear Mr. Arterberry:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Sincerely,

Carolyn Murphy

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 28, 2015

SWF-PEC-TN

Dr. Linda Langley
Coushatta Tribe of Louisiana
Tribal Historic Preservation Officer
1940 C.C. Bel Road
Elton, LA 70532

Dear Dr. Langley:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Carolyn Murphy

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
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Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Ms. Amie Tahbone
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, OK 73015

Dear Ms. Tahbone:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Sincerely,

Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Ms. Holly Houghton
Mescalero Apache Tribe, for Lipan
Tribal Historic Preservation Officer
P.O. Box 227
Mescalero, NM 88340

Dear Ms. Houghton:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Carolyn Murphy

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NEPA & Cultural Resources Section
Environmental Technical Services Branch
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Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

September 18, 2015

SWF-PEC-TN

Ms. Miranda Allen
Tonkawa Tribe of Indians of Oklahoma
1 Rush Buffalo Road
Tonkawa, OK 74653

Dear Ms. Allen:

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared a draft report on the feasibility and environmental suitability of Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) projects between Sabine Pass and the Brazos River in Orange, Jefferson, and Brazoria Counties, Texas. Authorization for this study is based on a resolution from the Committee on Environmental and Public Works dated June 23, 2004, entitled "Coastal Texas Protection and Restoration Study." The study identified several alternatives for CSRM and ER projects in the study area and, more specifically, a tentatively selected plan (TSP) with three components: 1) a new levee/floodwall system in Orange and Northeast Jefferson counties called the Orange-Jefferson CSRM Plan; 2) improvements to existing floodwalls in the Port Arthur and Vicinity Hurricane Flood Protection Project (HFPP) called the Port Arthur and Vicinity CSRM Plan; and 3) improvements to existing levees and floodwalls in the Freeport and Vicinity HFPP called the Freeport and Vicinity CSRM Plan. Maps of the three TSP project components are attached as Figures 1 through 13.

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Sincerely,

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Carolyn Murphy
Chief, Unit A
NEPA & Cultural Resources Section
Environmental Technical Services Branch
Regional Planning & Environmental Center

Enclosures

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

Burks-Copes
PEC_TN

May 26, 2016

Regional Planning & Environmental Center
Coastal Section

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dear Mr. Wolfe:

The U.S. Army Corps of Engineers (USACE) proposes to initiate a Programmatic Agreement (PA) pursuant to 36CFR800.14 to address impacts associated with the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Project in Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria Counties, Texas. Because effects on historic properties cannot be fully determined prior to approval of the undertaking, we find it necessary to defer identification and evaluation of historic properties. A Draft PA is included as an enclosure for your review.

The purpose of the project is to reduce the damages and risks associated with coastal storms and associated flooding as well as maintain and/or restore coastal habitat that contributes to storm surge attenuation. The recommended plan would include the construction of levees, floodwalls and gate structures as well as improvements to existing hurricane systems and ecosystem restoration.

The Area of Potential Effects (APE) includes all areas to be affected by new construction, construction staging and access areas, new or extensions of existing levees or borrow areas, ecological mitigation features, and project maintenance activities, defined as the footprint of all areas of direct impacts and a 1,500-foot buffer for indirect impacts to standing structures or buildings. A preliminary records search for previously recorded cultural resources revealed that the recommended plan has the potential to affect eight archeological sites (41OR15, OR39, OR59, OR60, OR70, BO4, BO119, and BO121), four National Register of Historic Places properties (Navy Park Historic District, W.H. Stark House, Sims House, and the Woodmen of the World Lodge), and two cemeteries (Evergreen and Thomas cemeteries). A review of prior archeological investigations indicates that only isolated pockets of the APE have been surveyed. Additional cultural resources investigations will be performed when specific construction plans have been finalized and impact areas identified.

In conclusion, we request your review and comment on the draft PA. We invite your signature pursuant to 36CFR800.6.(b)(1). We are inviting the Advisory Council on Historic Preservation as a signatory to this PA to afford that agency an opportunity to join the consultation if it so chooses. We have invited the non-Federal sponsors of this project, Orange

County, Jefferson County Drainage District No. 7, and Velasco Drainage District to be signatories to the PA as well.

Thank you for your cooperation in this review process. If you have any questions concerning this project or if we can be of further assistance, please contact John A. Campbell at 409-766-3878.

Sincerely,

Kelly A. Burks-Copes
Acting Chief, Coastal Section

Enclosure

PROGRAMMATIC AGREEMENT REGARDING COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT FOR THE SABINE PASS TO GALVESTON BAY COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESOTRATION PROJECT IN ORANGE, JEFFERSON, CHAMBERS, GALVESTON, HARRIS, AND BRAZORIA COUNTIES, TEXAS AMONG THE U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT, THE TEXAS STATE HISTORIC PRESERVATION OFFICER, AND ORANGE COUNTY, TEXAS, JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7, AND THE VELASCO DRAINAGE DISTRICT

WHEREAS, the U.S. Army Corps of Engineers, Galveston District (USACE) has determined that new construction, improvements to existing facilities, and maintenance of existing facilities of the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Study (hereinafter, "undertaking") may have an effect on historic properties eligible for listing in the National Register of Historic Places (NRHP) (hereinafter, "historic properties") pursuant to Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108) (NHPA), as amended, and its implementing regulations (36 CFR 800); and

WHEREAS, the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Study was authorized by resolution by the Committee of Transportation and Infrastructure of the United States House of Representatives dated February 16, 2000, in accordance with Section 110 of the Rivers and Harbors Act of 1962 requesting the Secretary of the Army to review the feasibility of providing shore protection and related improvements between Sabine Pass and the entrance of Galveston Bay; and

WHEREAS, Orange County, the Jefferson County Drainage District No. 7, and the Velasco Drainage District are the non-Federal partners with the USACE for construction and maintenance of this undertaking, and are providing the necessary lands, easements, relocations and rights-of-way; and

WHEREAS, the Area of Potential Effect (APE) includes the footprint of all areas of direct impacts and a 1,500-foot buffer for indirect impacts to standing structures or buildings, as a result of new construction, improvements to existing facilities, and maintenance of existing facilities; and

WHEREAS, this Programmatic Agreement (PA) is being executed to describe the process the USACE and Orange County, the Jefferson County Drainage District No. 7,

and the Velasco Drainage District will utilize in the event that unanticipated discoveries are identified during construction and maintenance activities; and

WHEREAS, the USACE, the Texas State Historic Preservation Officer (SHPO), and the Non-Federal Sponsor have agreed that it is advisable to execute this PA for the purposes stated above in accordance with 36 CFR 800.6 and 36 CFR 800.14(b)(1)(ii); and

WHEREAS, the USACE has invited the Advisory Council on Historic Preservation (Council) to participate and the Council has declined to enter into the Section 106 process; and

WHEREAS, in accordance with 36 C.F.R. § 800.14(b), the USACE has notified the Alabama-Coushatta Tribe of Texas, the Comanche Indian Tribe, the Coushatta Tribe of Louisiana, the Mescalero Apache Tribe, Kiowa Indian Tribe of Oklahoma, and the Tonkawa Tribe of Indians of Oklahoma of the development and execution of this PA.

NOW, THEREFORE, the USACE, the SHPO, and Orange County, the Jefferson County Drainage District No. 7, and the Velasco Drainage District agree that the proposed undertaking shall be implemented and administered in accordance with the following stipulations in order to take into account the effects of the undertaking on historic properties and to satisfy the USACE's Section 106 responsibilities for all individual aspects of the undertaking.

STIPULATIONS

I. Identification, Evaluation, Effect Determination, and Resolution

A. Scope of Undertaking. This PA shall be applicable to all new construction, improvements, and maintenance activities related to the proposed Coastal Storm Risk Management and Ecosystem Restoration project. The APE shall be established by the USACE in consultation with the SHPO and shall include all areas to be directly affected by new construction, construction staging and access areas, new or extensions of existing levees or borrow areas, ecological mitigation features, and project maintenance activities.

B. Qualifications and Standards. The USACE shall ensure that all work conducted in conjunction with this PA is performed in a manner consistent with the Secretary of Interior's "Standards and Guidelines for Archeology and Historic Preservation" (48 FR 44716-44740; September 23, 1983), as amended, or the Secretary of the Interior's "Standards for the Treatment of Historic Properties" (36 CFR 68), as appropriate.

C. Definitions. The definitions set forth in 36 CFR 800.16 are incorporated herein by reference and apply throughout this PA.

D. Identification of Historic Properties. Prior to the initiation of construction, the USACE shall make a reasonable and good faith effort to identify historic properties located within the APE. These steps may include, but are not limited to, background research, consultation, oral history interviews, sample field investigations, and field survey. The level of effort for these activities shall be determined in consultation with the SHPO and any Native American Indian Tribe or Tribes (Tribes) that attach religious and cultural significance to identified properties. All draft reports of survey or site testing investigations shall be submitted to the SHPO for review and comment. If the SHPO comments are not received by the USACE within thirty (30) days of receipt, the reports and their recommendations shall be considered adequate and the reports may be finalized. Comments received by the USACE from the SHPO or Tribes shall be addressed in the final reports, which shall be provided to all consulting parties. If no historic properties are identified in the APE, the USACE shall document this finding pursuant to 36 CFR 800.11(d), provide this documentation to the SHPO.

E. Evaluation of National Register Eligibility. If cultural resources are identified within the APE, the USACE shall determine their eligibility for the NRHP in accordance with the process described in 36 CFR 800.4(c) and criteria established in 36 CFR 60. All draft reports of NRHP site testing or other NRHP investigations shall be submitted to the SHPO and Tribes for review and comment. If SHPO comments are not received by the USACE within 30 days of receipt, the reports or investigations and their recommendations shall be considered adequate and the reports may be finalized. Comments received by the USACE from the SHPO or Tribes shall be addressed in the final report, which shall be provided to all consulting parties. The determinations of significance shall be conducted in consultation with the SHPO and Tribes. Should the USACE and the SHPO agree that a cultural resource is or is not eligible, then such consensus shall be deemed conclusive for the purpose of this PA. Should the USACE and the SHPO not agree regarding the eligibility of a cultural resource, the USACE shall obtain a determination of eligibility from the Keeper of the National Register pursuant to 36 CFR 63. For cultural resources found not eligible for the NRHP, no further protection or consideration of the site will be afforded for compliance purposes.

F. Assessment of Adverse Effects.

1. No Historic Properties Affected. The USACE shall make a reasonable and good faith effort to evaluate the effect of each undertaking on historic properties in the APE. The USACE, in consultation with the SHPO, may conclude that no historic properties are affected by an undertaking if no historic properties are present in the APE, or the undertaking will have no effect as defined in 36 CFR 800.16(i). This finding shall be documented in compliance with 36 CFR 800.11(d) and the documentation shall be provided to the SHPO and retained by the USACE for at least seven (7) years. The

USACE shall provide information on the finding to the public upon request, consistent with the confidentiality requirements or 36 CFR 800.11(c).

2. Finding of No Adverse Effect. The USACE, in consultation with the SHPO, and Tribes shall apply the criteria of adverse effect to historic properties within the APE in accordance with 36 CFR 800.5. The USACE may propose a finding of no adverse effect if the undertaking's effects do not meet the criteria of 36 CFR 800.5(a)(1) or the undertaking is modified to avoid adverse effects in accordance with 36 CFR 68. The USACE shall provide to the SHPO documentation of this finding meeting the requirements of 36 CFR 800.11(e). The SHPO shall have 30 days in which to review the findings and provide a written response to the USACE. The USACE may proceed upon receipt of written concurrence from the SHPO. Failure of the SHPO to respond with 30 calendar days of receipt of the finding shall be considered agreement with the finding. The USACE shall maintain a record of the finding and provide information on the finding to the public upon request, consistent with the confidentiality requirements of 36 CFR 800.11(c).

3. Resolution of Adverse Effect. If the USACE, in consultation with the SHPO, determines that the undertaking will have an adverse effect on historic properties as measured by criteria in 36 CFR 800.5(a)(1), the USACE shall consult with the SHPO and Tribes to resolve adverse effects in accordance with 36 CFR 800.6.

   a) For historic properties that the USACE and the SHPO agree will be adversely affected, the USACE shall:

      (1) Consult with the SHPO to identify other individuals or organizations to be invited to become consulting parties. If additional consulting parties are identified, the USACE shall provide them copies of documentation specified in 36 CFR 800.11(e) subject to confidentiality provisions of 36 CFR 800.11(c).

      (2) Afford the public an opportunity to express their views on resolving adverse effects in a manner appropriate to the magnitude of the project and its likely effects on historic properties.

      (3) Consult with the SHPO, Tribes, and any additional consulting parties to seek ways to avoid, minimize or mitigate adverse effects.

      (4) Prepare an historic property plan (Plan) which describes mitigation measures the USACE proposes to resolve the undertaking's adverse effects and provide this Plan for review and comment to all consulting parties. All parties have 30 days in which to provide a written response to the USACE.

b) If the USACE and the SHPO fail to agree on how adverse effects will be resolved, the USACE shall request that the Council join the consultation and provide the Council and all consulting parties with documentation pursuant to 36 CFR 800.11(g).

c) If the Council agrees to join the consultation, the USACE shall proceed in accordance with 36 CFR 800.9.

d) If, after consulting to resolve adverse effects, the Council, the USACE, or the SHPO determines that further consultation will not be productive, then any party may terminate consultation in accordance with the notification requirements and processes prescribed in 36 CFR 800.7.

II. Post Review Changes and Discoveries

A. Changes in the Undertaking. If construction on the undertaking has not commenced and the USACE determines that it will not conduct the undertaking as originally coordinated, the USACE shall reopen consultation pursuant to Stipulation I. D-F.

B. Unanticipated Discoveries or Effects. Pursuant to 36 CFR 800.13(b)(3), if historic properties are discovered or unanticipated effects on historic properties are found after construction on an undertaking has commenced, the USACE shall develop a treatment plan to resolve adverse effects and notify the SHPO and Tribes within 48 hours of the discovery. The notification shall include the USACE assessment of the NRHP eligibility of affected properties and proposed actions to resolve the adverse effects. Comments received from the SHPO and Tribes within 48 hours of the notification shall be taken into account by the USACE in carrying out the proposed treatment plan. The USACE may assume SHPO concurrence in its eligibility assessment and treatment plan unless otherwise notified by the SHPO within 48 hours of notification. USACE shall provide the SHPO and Tribes a report of the USACE actions when they are completed.

III. Curation and Disposition of Recovered Materials, Records, and Reports

A. Curation. The USACE shall ensure that all archeological materials and associated records owned by the State of Texas or the Non-federal Sponsor (NFS), which result from identification, evaluation, and treatment efforts conducted under this PA, are accessioned into a curation facility in accordance with the standards of 36 CFR 79, the Antiquities Code of Texas (Texas Natural Resource Code, Chapter 191), the Texas Administrative Code 13 TAC §29.5, and the Council of Texas Archeologists Guidelines and Standards for Curation, except as specified in Stipulation IV for human remains. Any collected items owned by the State of Texas or the NFS shall be curated in perpetuity by the NFS at a repository certified by the Texas Historical Commission. Archeological items and materials from privately owned lands shall be returned to their owners upon completion of

analyses required for Section 106 compliance under this PA, unless the owners agree to donate the items for curation in perpetuity.

B. Reports. The USACE shall provide copies of final technical reports of investigations and mitigation to the consulting parties and the SHPO, as well as additional copies for public distribution. All consulting parties shall withhold site location information or other data that may be of a confidential or sensitive nature pursuant to 36 CFR 800.11(c).

IV. Treatment of Native American Human Remains

A. Prior Consultation. If the USACE's investigations, conducted pursuant to Stipulation I of this PA, indicate a high likelihood that Native American Indian human remains may be encountered, the USACE shall develop a treatment plan for these remains in consultation with the SHPO and Tribes. The USACE shall ensure that Tribes indicating an interest in the undertaking are afforded a reasonable opportunity to identify concerns, provide advice on identification and evaluation, and participation in the resolution of adverse effects in compliance with the terms of this PA.

B. Inadvertent Discovery. Immediately upon the inadvertent discovery of human remains during historic properties investigations or construction activities conducted pursuant to this PA, the USACE shall ensure that all ground disturbing activities cease in the vicinity of the human remains and any associated grave goods and that the site is secured from further disturbance or vandalism. The USACE shall be responsible for immediately notifying local law enforcement officials, and within 48 hours of the discovery, shall initiate consultation with the SHPO and Tribes to develop a plan for resolving the adverse effects.

C. Dispute Resolution. If, during consultation conducted under paragraphs A and B of Stipulation IV, all consulting parties cannot agree upon a consensus plan for resolving adverse effects, the matter shall be referred to the Council for resolution in accordance with the procedures outlines in 36 CFR 800.9.

V. PA Amendments, Disputes and Termination

A. Amendments. Any party to the PA may propose to the other parties that it be amended, whereupon the parties will consult in accordance with 36 CFR 800.6(c)(7) to consider such an amendment.

B. Disputes. Disputes regarding the completion of the terms of this agreement shall be resolved by the signatories. If the signatories cannot agree regarding a dispute, any one of the signatories may request the participation of the Council in resolving the dispute in accordance with the procedures outlined in 36 CFR 800.9. The USACE shall forward to the Council and all consulting parties within fifteen (15) days of such a request all documentation relevant to the dispute, including

the USACE's proposed resolution of the dispute. The Council will respond to the request within thirty (30) days of receiving all documentation. The USACE will take any recommendations or comments from the Council into account in resolving the dispute. In the event that the Council fails to respond to the request within thirty (30) days of receiving all documentation, the USACE may assume the Council's concurrence with its proposed resolution and proceed with resolving the dispute.

C. Termination of PA. Any party to this PA may terminate it by providing a sixty (60) day notice to the other parties, provided that the parties will consult during the period prior to the termination to seek agreement on amendments or other actions that will avoid termination. In the event of termination of this PA the USACE shall comply with the provisions of 36 CFR 800, Subpart B.

VI. Term of this Agreement

A. This PA remains in force for a period of ten (10) years from the date of its execution by all signatories, unless terminated pursuant to Stipulation V.C. Sixty (60) days prior to the conclusion of the ten (10) year period, the USACE shall notify all parties in writing of the end of the ten year period to determine if they have any objections to extending the term of this PA. If there are no objections received prior to expiration, the PA will continue to remain in force for a new ten (10) year period.

Execution of this PA and implementation of its terms evidences that the USACE has afforded the Council an opportunity to comment on the undertaking and its effects on historic properties, and that the USACE has taken into account those effects and fulfilled Section 106 responsibilities regarding the undertaking.

COL, EN 24 FEB 17

Colonel Lars N. Zetterstrom, District Engineer **Date**

Signature Page for State Historic Preservation Officer

**PROGRAMMATIC AGREEMENT
REGARDING COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT FOR
THE SABINE PASS TO GALVESTON BAY COASTAL STORM RISK MANAGEMENT AND ECOSYSTEM RESOTRATION PROJECT
IN
ORANGE, JEFFERSON, CHAMBERS, GALVESTON, HARRIS, AND BRAZORIA COUNTIES, TEXAS
AMONG
THE U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND
ORANGE COUNTY, TEXAS, JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7, AND THE VELASCO DRAINAGE DISTRICT**

Mark W Wolfe 2/17/17

Mark Wolfe, Texas State Historic Preservation Officer **Date**

Signature Page for Orange County, Texas

**PROGRAMMATIC AGREEMENT
REGARDING COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT FOR
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AND
ORANGE COUNTY, TEXAS, JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7, AND THE VELASCO DRAINAGE DISTRICT**

14 Feb 2017

Signatory for, Orange County, Texas **Date**

Signature Page for Jefferson County Drainage District No. 7

**PROGRAMMATIC AGREEMENT
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AND
ORANGE COUNTY, TEXAS, JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7, AND THE VELASCO DRAINAGE DISTRICT**

Richard Beaumont — 02/16/17

Signatory for, Jefferson County Drainage District No. 7 **Date**

Signature Page for Velasco Drainage District

**PROGRAMMATIC AGREEMENT
REGARDING COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT FOR
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AND
ORANGE COUNTY, TEXAS, JEFFERSON COUNTY DRAINAGE DISTRICT NO. 7, AND THE VELASCO DRAINAGE DISTRICT**

George L. Kidwell, CHAIRMAN 2-16-17

Signatory for, Velasco Drainage District **Date**

The Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Project, Orange, Jefferson, Chambers, Galveston, Harris, and Brazoria Counties, Texas

Cultural Resources and Project Summary For the Programmatic Agreement

U.S. Army Corps of Engineers Galveston District

Study Purpose

The US Army Corps of Engineers (USACE) has prepared an Integrated Feasibility Report and Environmental Impact Statement (IFR-EIS) (USACE, 2017) that presents the results of a feasibility study to recommend for Congressional approval a regional Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) project that encompasses the six coastal counties of the upper Texas coast between Sabine Pass and Galveston Bay. Authorization for the study is derived from a resolution from the Committee on Environmental and Public Works dated June 23, 2004 entitled "Coastal Texas Protection and Restoration Study".

> *By resolution dated June 23, 2004 entitled "Coastal Texas Protection and Restoration Study", the Committee on Environment and Public Works, U.S. Senate has requested that in accordance with Section 110 of the Rivers and Harbors Act of 1962 the Secretary of the Army develop a comprehensive plan for severe erosion along coastal Texas for the purposes of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply to coast, restoring and preserving marshes and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area.*

The study fits into the overall concept of the authorization to conduct an integrated and coordinated approach to locating and implementing opportunities for CSRM and ER. The non-

Federal sponsors include Orange County, Texas, the Jefferson County Drainage District No. 7, and the Velasco Drainage District. This document has been prepared to provide background information supporting coordination of a draft Cultural Resources Programmatic Agreement. Information is presented on the proposed project, the area of potential effects (APE), cultural resources in the study area, investigations that have been conducted to identify historic properties, and potential project effects on these properties.

Description of Existing Project

The proposed project area for the Sabine to Galveston Bay, Texas Coastal Storm Risk Management and Ecosystem Restoration Study is located along the upper Texas coast and has been occupied by humans since the Paleoindian period dating to around 11,500 BP. The study area is characterized by upland coastal prairies dissected by streams and rivers and extensive bay and estuarine systems along the coast. The study area is primarily drained by the Trinity River, the San Jacinto River, Buffalo Bayou, and the Brazos River. Sediments in the region are generally fluvial sandy and silty clays overlying Pleistocene aged clay. Prehistoric sites are commonly found within these upper sediments along streams and rivers and along the shorelines of the bays and gulf coast, close to prime areas for resource exploitation. These sites include campsites, dense shell middens, and cemeteries, containing projectile points, stone, bone, and shell tools, aquatic and terrestrial faunal remains, hearth features, ceramics, and in some cases human remains and associated funerary objects. Historic age resources in the region consist of farmsteads and ranches, houses, buildings, bridges, tunnels, oil industry structures, cemeteries, lighthouses, shipwrecks, and the ruins of these buildings and structures. Although historic age resources can occur anywhere, these sites tend to be concentrated in small towns and urban areas, along roads, and within current and historic navigation paths. Shipwrecks may also occur in numerous locales due to the dynamic nature of the sea floor and bay bottoms and the lack of navigation improvements until the latter part of the 19th century. These dynamic conditions can result in shifting shoals and reefs that endanger ships as well as bury their wrecks as shorelines and bars migrate through time.

A preliminary assessment of the cultural resources within the region was conducted using a desktop review of the databases maintained by the Texas Historical Commission and the Texas

Archeological Research Laboratory for terrestrial and marine cultural resources as well as the shipwreck and obstruction databases of the National Oceanic and Atmospheric Administration and the Bureau of Ocean Energy Management. There are over 3,600 cultural resources located within this region of the upper Texas Coast. These cultural resources include National Historic Landmarks, National Register of Historic Places (NRHP) listed properties, archeological sites, cemeteries, historical markers, and shipwrecks and submerged resources. The National Historic Landmarks in the region include the San Jacinto Battlefield, the Battleship Texas, and the Tall Ship Elissa as well as National Historic Landmark Districts, the Galveston Strand Historic District and the Galveston East End Historic District. The NRHP Properties are generally located in urban areas and consist of historic houses, commercial and government buildings, and structures such as the Navy Park Historic District, W.H. Stark House, Sims House, Woodmen of the World Lodge, Main Street/Market Square Historic District, Pomeroy Homestead, Ross S. Sterling House, Ashbel Smith Building, Fort Travis, Washburn Tunnel and others.

Within the areas of the proposed new levee construction and improvements, a study area was examined within 200 feet of the proposed work for archeological resources and cemeteries and 1500 feet for historic structures and buildings. There are a total of eight archeological sites (41OR15, OR39, OR59, OR60, OR70, BO4, BO119, and BO121, three NRHP Properties (Navy Park Historic District, W.H. Stark House, and the Sims House), and two cemeteries (Thomas and an unknown cemetery) within this study area (Table 1). The eight archeological sites and three cemeteries have not been evaluated for NRHP eligibility.

The primary considerations concerning cultural resources are threats from direct impacts to intact terrestrial archeological sites and indirect impacts to historic structures and buildings from new construction and improvements. A large portion of the study area has been altered for industrial and commercial use, especially in the cities of Orange, Port Arthur, and Freeport. As such, these urban areas have a low probability for intact prehistoric archeological sites to occur. However, there is a moderate to high potential for encountering historic age archeological sites and cemeteries, as well as historic age structures and buildings. In those areas outside of the urban centers the potential for encountering prehistoric archeological sites is moderate to high. There

are no proposed actions within marine environments and therefore no potential to impact submerged cultural resources.

Table 1. Cultural Resources Located within the Study Area.

Resource	Type	Alternative	Component	Description	NR Status
41OR15	archeological	Orange	Prehistoric	shells, pottery, and bones exposed along west bank of Little Cypress Bayou	undetermined
41OR39	archeological	Orange	Prehistoric	shells, arrow points, debitage along the west bank of Little Cypress Bayou	undetermined
41OR59	archeological	Orange	Prehistoric	shell midden	undetermined
41OR60	archeological	Orange	Prehistoric	shell midden with ceramics	undetermined
41OR70	archeological	Orange	Prehistoric	shell midden	undetermined
Navy Park Historic District	district	Orange	Historic	eligible under criteria A and C; period of significance 1925 to 1949	listed
W.H. Stark House	building	Orange	Historic	eligible under criteria B and C; period of significance 1875 to 1924	listed
Sims House	building	Orange	Historic	eligible under criteria A, B, and C; period of significance 1900-1924	listed
Thomas	cemetery	Orange	Historic	private; Late 19th century	undetermined
unknown cemetery	cemetery	Port Arthur	Historic		undetermined
41BO4	archeological	Freeport	Prehistoric & Historic	single burial and hearth excavated in 1962; shell, debitage, pottery, brick, historic pipe fragment, and metal	undetermined
41BO119	archeological	Freeport	Prehistoric	shell midden, pottery, charcoal, possible hearth feature	undetermined
41BO121	archeological	Freeport	Prehistoric	shell midden	undetermined

Recommended Plan

The Sabine Pass to Galveston Bay CSRM and ER project consists of the construction of the new Orange CSRM levee/floodwall system, and levee raising/floodwall improvements in the Port Arthur and Freeport CSRM Plans. The recommended plan includes construction of the following elements:

- The Orange 3 CSRM Plan would add about 15.4 miles of new levees, at elevations ranging from 12.0 to 17.5 feet above NAVD88 and about 11.4 miles of new floodwalls at elevations ranging from 13.5 to 16 feet above NAVD88. New pump stations would be constructed to mitigate interior flooding during surge events, and navigable sector gates would be constructed in Adams and Cow Bayous to reduce surge penetration (Figure 1).

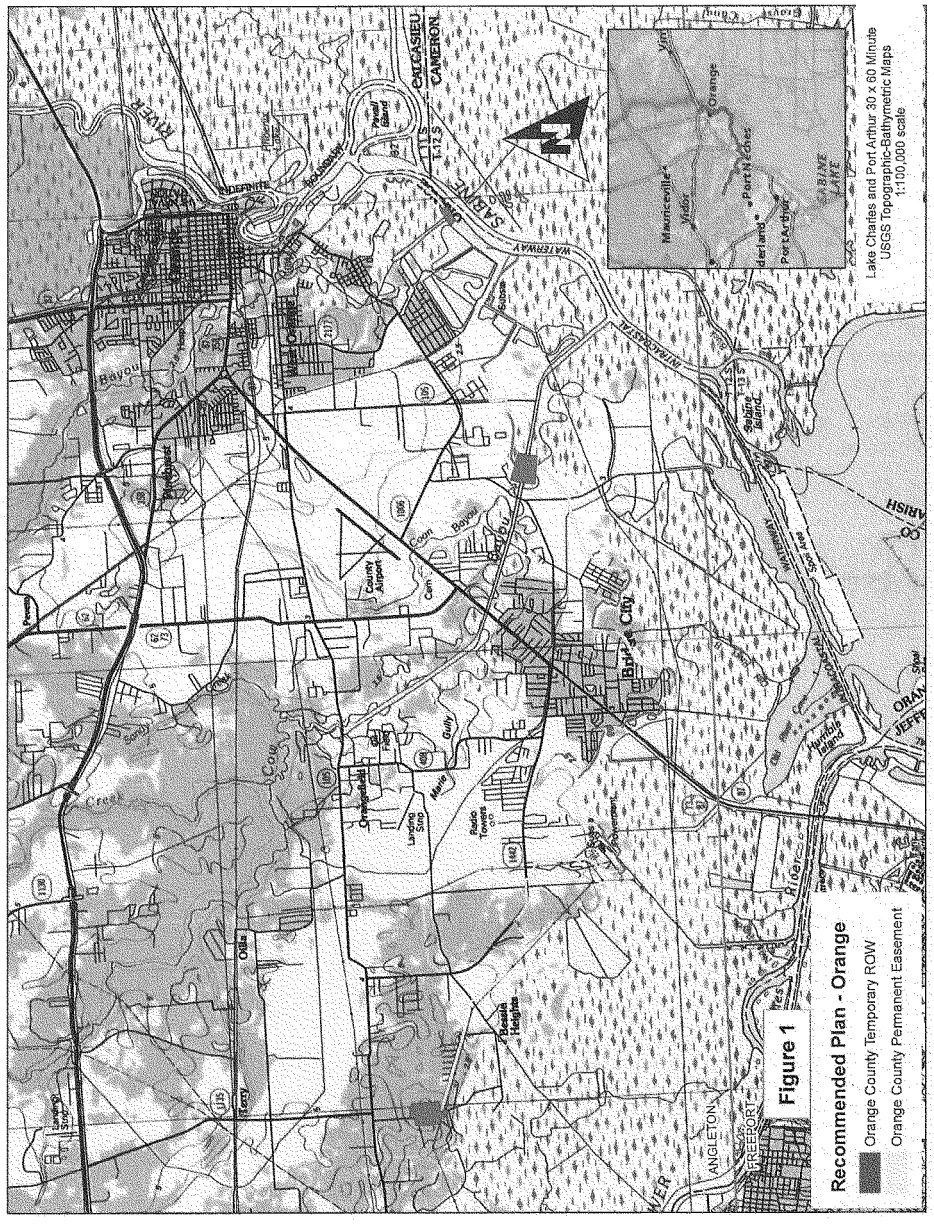
- The Port Arthur and Vicinity CSRM Plan would raise about 11.3 miles of the existing 27.8 miles of earthen levee to elevations ranging from 14.4 to 17.2 feet above NAVD88, and construct or reconstruct about 5.3 miles of floodwall to elevations ranging from about 14.4 to 19.4 feet above NAVD88. A separate 1,830 feet of new earthen levee would be constructed in the Port Neches area northwest of the existing northern terminus. Numerous vehicle closure structures would be replaced and erosion protection would be added (Figure 2). The areas designated as Work Reaches on Figure 2 will not be affected.

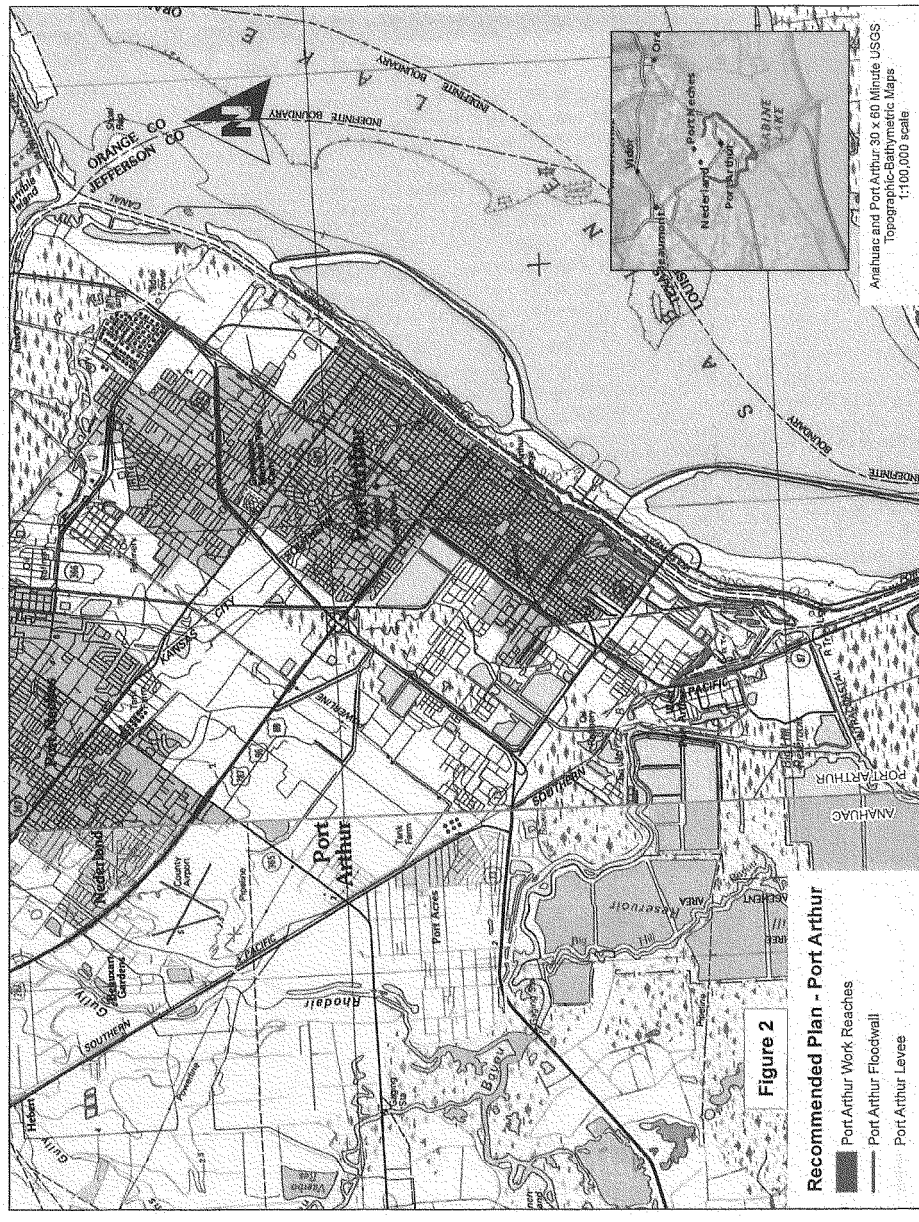
- The Freeport and Vicinity CSRM Plan would raise about 13.1 miles of the existing earthen levee system and construct or reconstruct about 5.5 miles of floodwall, improving approximately 43 percent of the existing 43-mile long system. Final elevations would range from 15.8 to 23.8 feet above NAVD88. Navigable sector gates would be installed in the Dow Barge Canal to reduce surge penetration in that area. Numerous vehicle closure structures would be replaced and erosion protection would be added. Other project features include raising and reconstructing the Highway 332 crossing, installation of a drainage structure at the head of the Dow Barge Canal, and raising the floodwall at Port Freeport's Berth 5 dock (Figure 3). The areas designated as Work Reaches on Figure 3 will not be affected.

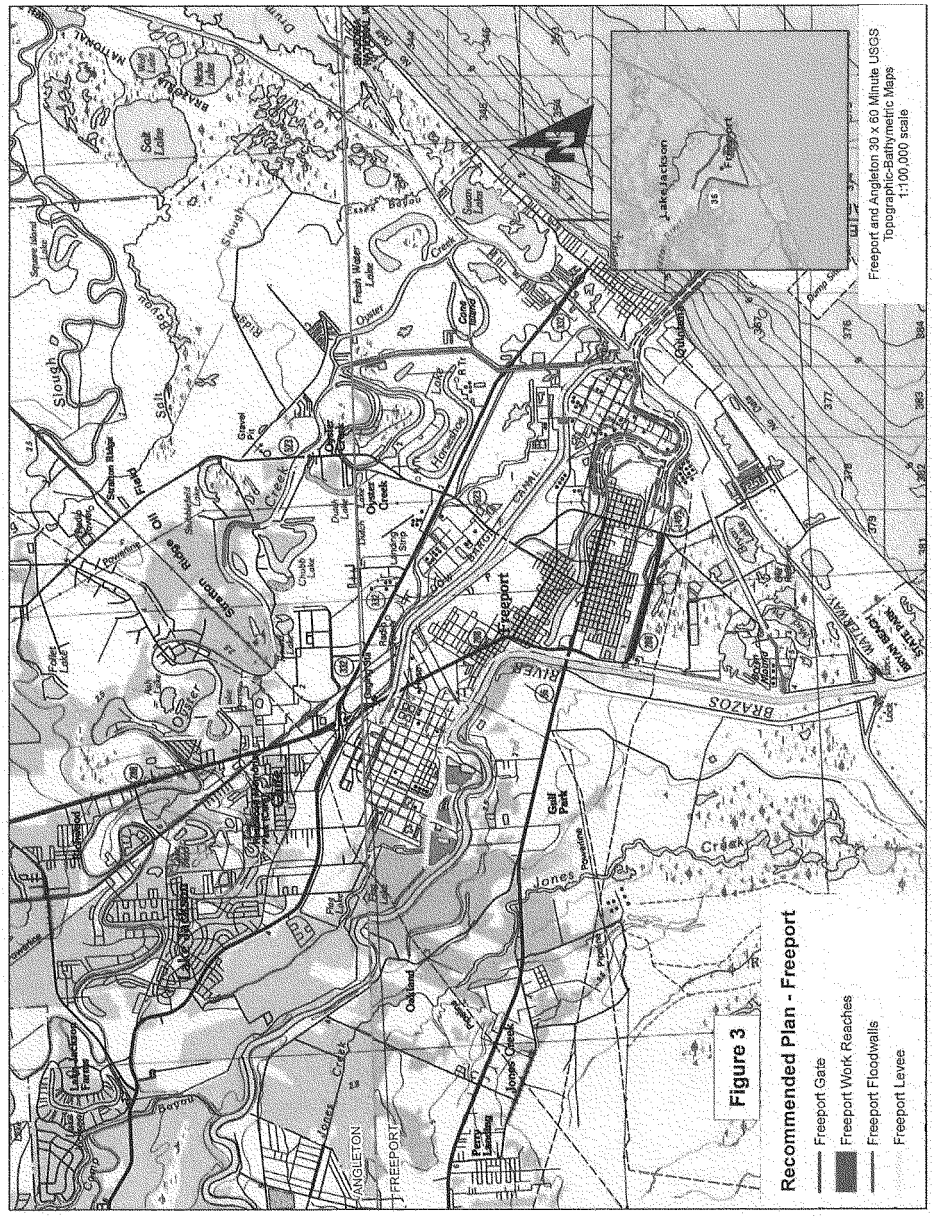
Cultural Resources and Area of Potential Effects

The activities associated with the proposed undertaking include all new construction, improvements, and maintenance activities related to the proposed Coastal Storm Risk Management and Ecosystem Restoration project. The Area of Potential Effect (APE) includes the footprint of all areas of direct impacts and a 1,500-foot buffer for indirect impacts to standing structures or buildings, as a result of new construction, construction of staging and access areas, new levees or extensions of existing levees or borrow areas, ecological mitigation features, and project maintenance activities.

Cultural resource surveys have been performed for much of the surrounding region and some of these investigations overlap with the proposed APE. The majority of the recommended plan in


Recommended Plan - Orange
Orange County Temporary ROW
Orange County Permanent Easement
Lake Charles and Port Arthur 30 x 60 Minute
USGS Topographic-Bathymetric Maps
1:100,000 scale
Figure 1
CALCASIEU
CAMERON
ORANGE
JEFFERSON
ANGLETON
FREEPORT
Orange
Bridge City
Orangefield
Pleasure Island
Port Arthur
Sabine Lake
Sabine River
Intracoastal Waterway
Cow Bayou
Adams Bayou
Hurricane Bayou
Mauriceville
Vidor
Deweyville
Port Neches


Recommended Plan - Port Arthur
Port Arthur Work Reaches
Port Arthur Floodwall
Port Arthur Levee
Figure 2
Port Arthur
Nederland
Groves
Port Neches
ANAHUAC
PORT ARTHUR
ORANGE CO
JEFFERSON CO
INDEPENDENCE BOULEVARD
Anahuac and Port Arthur 30 x 60 Minute USGS
Topographic-Bathymetric Maps
1:100,000 scale


Recommended Plan - Freeport
Freeport Gate
Freeport Work Reaches
Freeport Floodwalls
Freeport Levee
Figure 3
Freeport and Angleton 30 x 60 Minute USGS
Topographic-Bathymetric Maps
1:100,000 scale
Lake Jackson
Freeport
Angleton
FREEPORT
ANGLETON
BRAZOS
RIVER
Jones
Creek
Oyster
Creek
Old
Brazos
River
Dow
Barge
Canal
Intracoastal
Waterway
Gulf
Park
Golf
Park
Oakland
Cemetery
Perry
Landing
Scanlon
Ridge
Oil
Field
Scanlon
Ridge
Gravel
Pit
Soil
Lake
Fresh Water
Lake
Cone
Island
Horseshoe
Lake
Oyster
Creek
Lake
Jackson
Airport
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Orange County has not been previously investigated for historic properties. There are several previous cultural resources surveys which intersect with the current study area however only three of these investigations has identified cultural resources within the current study area. These three investigations were USACE surveys of the shoreline along Adams Bayou and identified archeological sites 41OR60, 61, and 62 (Celmer 1985). Additional project that have intersected with the proposed study area include a survey by the Texas Department of Transportation along the IH-10 service road in 1981, two surveys of the Port of Orange berthing areas in 1993, a survey of U.S. Navy Operations Support Center in 2003, a survey of the City of Orange boat ramps, pier, and parking facility in 2004 (Cramer 2004), a survey of the Orangefield Water Supply Corporation (Corbin 1995), and a survey of the Shell Pipeline Company's Westward Ho pipeline in 2013. Freeman (1995) and Freeman and Freeman (1996) have also conducted Historic American Engineering Record documentation for U.S. Naval Station in Orange.

There have been fewer surveys in the Port Arthur study area and no cultural resources were recorded as a result of these investigations. Linear surveys have been conducted for the Port Arthur CO_2 Pipeline in 2011 (Dafoe and Lackowicz 2011), the Original Spindletop to Port Arthur Pipeline Corridor in 2008 (Leezer 2008), and a Texas Department of Transportation survey of State Highway 87 just south of the Neches River in 1975 (Weir 1975). Two larger surveys were conducted along Taylors Bayou by USACE as part of the Taylors Bayou Drainage and Flood Control Project in 1972 and 1986 (Aten 1972; Wooley 1986).

The entire Freeport study area was surveyed in 1976 for USACE by Texas A&M University as part of the Freeport, Texas Hurricane Flood Protection Project (Baxter and Ippolito 1976). Numerous sites were revisited or identified during these investigations including sites 41BO4, BO119, and BO121; the only three cultural resources within the study area. Baxter and Ippolito documented extensive damage to site 41BO4 and BO121 and recommended no further work at these locations, but they did recommend additional investigations at 41BO119 to determine its eligibility for inclusion in the NRHP.

Additional surveys have been conducted within the survey area including investigations for Velasco Drainage District (Celmer and Stokes 1985), Cluster Petroleum, Inc. pipeline (Good 1986), the Phillips 66 Old Ocean to Freeport pipeline (Turpin 1996), and the Freeport LNG pipeline (Lawrence and Miller 2004) and associated facilities (Pickering and Hughey 2005). Two surveys were also conducted for residential areas in 2010 and 2014 (Scott 2010).

The recommended plan will include new levee construction in parts of Orange and Jefferson Counties and improvements to existing hurricane protection systems in Port Arthur and Freeport, Texas. The new levee construction in Orange and Jefferson Counties overlaps with five archeological sites and two cemeteries. Additionally, there are three National Register Properties (Navy Park Historic District, W.H. Stark House, and the Sims House) within 1500 feet of the proposed levee system. The five archeological sites in Orange County (41OR15, OR39, OR59, OR60, and OR70) are all prehistoric sites that have poorly delineated boundaries, insufficient documentation, and have not been evaluated for NRHP eligibility. All of these sites have the potential to be directly impacted by construction activities. The two cemeteries also have a potential to be directly affected by levee construction as their recorded boundaries overlap with the proposed project area. These cemeteries, the Thomas cemetery and an unknown cemetery, are not well documented and their locations may not be accurate within the existing state databases.

There are numerous cultural resources that occur near the existing hurricane protection systems in Port Arthur and Freeport, however most of these resources occur outside of the areas proposed for improvements. In Port Arthur, there are no cultural resources that overlap with the areas for proposed improvements along the existing hurricane protection system. However, there are three archeological sites (41BO4, BO119, and BO121) that are within close proximity to the proposed improvement areas along the Freeport hurricane protection system. These three sites all occur along Oyster Creek, are poorly delineated, lack sufficient documentation, and have not been evaluated for NRHP eligibility.

Based on the current information for the proposed levee construction and improvements, there is a potential to affect historic properties and cemeteries. These effects consist of direct impacts

from earth moving and excavation activities related to construction and potential indirect effects such as diminished view shed from the raising of levees and floodwalls. The USACE recommends intensive cultural resources investigations to identify and evaluate any historic properties within proposed construction areas. The scope of these investigations will be determined in concert with the Texas State Historic Preservation Officer and Native American Tribes and in accordance with the Programmatic Agreement for this project.

References Cited

Aten, L.E.
1972 An Assessment of the Archeological Resources to be affected by the Taylors Bayou Drainage and Flood Control Project, Texas. Research Report No. 7, Texas Archeological Salvage Project, University of Texas at Austin, Texas.

Baxter, E.P. and J.E. Ippolito
1976 An Archeological Survey of the Freeport, Texas Hurricane Flood Protection Project, Brazoria County, Texas. Report No. 22, Anthropology Laboratory, Texas A&M University, College Station, Texas.

Celmer, G.
1985 Cultural Resources Survey Report for Operation and Maintenance Project: Dredging around Orange Harbor Island. U.S. Army Corps of Engineers, Galveston, Texas.

Celmer, G and J. Stokes
1985 Letter Report of Survey, Army Permit No. 11175(04), Velasco Drainage District. U.S. Army Corps of Engineers, Galveston, Texas.

Corbin, J.E.
1995 Archaeological Survey of the Proposed Orangefield Water Supply Corporation (FMHA, F2, F13), Orange County, Texas. James E. Corbin, Nacogdoches, Texas.

Cramer, J.J.
2004 A Cultural Resources Archival and Field Assessment of the Proposed City of Orange Boat Ramps, Pier, and Parking Facility, Orange, Orange County, Texas. Coastal Environments, Inc., Baton Rouge, Louisiana.

Dafoe, H. and R. Lackowicz
2011 Phase I Cultural Resources Investigation, Air Products and Chemicals, Inc. Proposed Port Arthur (TX) CO_2 Pipeline Project in Jefferson County, Texas. Texas Antiquities Permit No. 5884, URS Group, Inc., Baton Rouge, Louisiana.

Freeman, M.D.
1996 Historic American Engineering Record: U.S. Naval Station, Orange, Texas Group, Atlantic Reserve Fleet. HAER No. TX-26-C, National Park Service, Santa Fe, New Mexico.

Freeman, M.D. and J.C. Freeman
1995 Historic American Engineering Record: U.S. Naval Station, Orange, Texas Group, Atlantic Reserve Fleet. HAER No. TX-26-A, National Park Service, Denver, Colorado.

Good, C.
1986 Army Permit No. 17683, Cluster Petroleum Inc., Applicant, Oyster Creek Drainage, Brazoria County, Texas. U.S Army Corps of Engineers, Galveston.

Lawrence, K. and K.A. Miller
2004 Cultural Resource Investigations for the Freeport LNG Project in Brazoria County, Texas. Cultural Resource Report No. 04-366, SWCA Environmental Consultants, Austin, Texas.

Leezer, C.
2008 Cultural Resource Investigations of Valero Corporation's Proposed Liquid Petroleum Pipelines along the Original Spindletop to Port Arthur Pipeline Corridor, Jefferson County, Texas. William Self Associates, Inc., Round Rock, Texas.

Pickering, T. and J. Hughey
2005 Intensive Pedestrian Survey of the Proposed Freeport LNG Phase II Expansion Project in Brazoria County, Texas. HRA Gray & Pape, LLC, Houston, Texas.

Scott, T.L.
2010 A Cultural Resources Survey of 119 Acres Proposed for the Development of a Residential Community in Brazoria County, Texas. HRA Gray & Pape, LLC, Houston, Texas.

Turpin, J.
1996 Cultural Resource Assessment of Selected Tracts along a Phillips 66 Pipeline Corridor, Old Ocean to Freeport, Brazoria County, Texas. TAS, Inc., Austin, Texas.

Weir, F.
1975 SH 87: 0.2 Mile E. of FM 366 to Neches River. Texas State Depart of Highways and Public Transportation, Austin, Texas.

Wooley, W.
1986 Taylors Bayou Flood Control Project, Disposal Area 5A. U.S. Army Corps of Engineers, Galveston, Texas.

Preserving America's Heritage

February 21, 2017

Ms. Kelly A. Burks-Copes
Acting Chief, Coastal Section
Galveston District, Corp of Engineers
P. O. Box 1229
Galveston, TX 77553-1229

Ref: *Proposed Sabina Pass to Galveston Bay Coastal Storm Risk Management & Ecosystem Restoration Project*
Orange, Jefferson, Chambers, Galveston, Harris and Brazoria Counties, Texas

Dear Ms. Burks-Copes:

The Advisory Council on Historic Preservation (ACHP) has received your notification and supporting documentation regarding the adverse effects of the referenced undertaking on a property or properties listed or eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer, affected Indian tribe, a consulting party, or other party, we may reconsider this decision. Additionally, should circumstances change, and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Programmatic Agreement (PA), developed in consultation with the Texas State Historic Preservation Office's (SHPO's) and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require further assistance, please contact Christopher Daniel at 202 517-0223 or via e-mail at cdaniel@achp.gov.

Sincerely,

Artisha Thompson
Historic Preservation Technician
Office of Federal Agency Programs

Preserving America's Heritage

June 15, 2016

Ms. Kelly Burks-Copes
Acting Chief, Coastal Section
Galveston District, Corp of Engineers
P. O. Box 1229
Galveston, TX 77553-1229

Ref: *Proposed Sabina Pass to Galveston Bay Coastal Storm Risk Management & Ecosystem Restoration Project*
Orange, Jefferson, Chambers, Galveston, Harris and Brazoria Counties, Texas

Dear Ms. Burks-Copes:

The Advisory Council on Historic Preservation (ACHP) has received your notification of adverse effect for the referenced undertaking that was submitted in accordance with Section 800.6(a)(1) of our regulations, "Protection of Historic Properties" (36 CFR Part 800). The background documentation included with your submission does not meet the specifications in Section 800.11(e) of the ACHP's regulations. We, therefore, are unable to determine whether Appendix A of the regulations, *Criteria for Council Involvement in Reviewing Individual Section 106* Cases, applies to this undertaking. Accordingly, we request that you submit the following additional information so that we can determine whether our participation in the consultation to resolve adverse effects is warranted.

- A description of the undertaking, specifying the Federal involvement, and its area of potential effects, including photographs, maps, drawings, as necessary;
- A description of the affected historic properties, including information on the characteristics that qualify them for the National Register;
- A description of the undertaking's effects on historic properties;
- Copies or summaries of any views or comments provided by consulting parties, the public, and the Texas State Historic Preservation Officer.
- Copies or summaries of any views or comments provided by any affected Indian tribe.

Upon receipt of the additional information, we will notify you within 15 days of our decision.

If you have any questions, please contact Mr. Brian Lusher at 202-517-0221 or via e-mail at blusher@achp.gov.

Sincerely,

Historic Preservation Technician
Office of Federal Agency Programs

TEXAS HISTORICAL COMMISSION
real places telling real stories

June 23, 2016

Kelly Burks-Copes
Acting Chief, Coastal Section
Department of the Army
Galveston District, Corps of Engineers
P.O. Box 1229
Galveston, TX 77553

Re: Project review under Section 106 of the National Historic Preservation Act of 1966, Programmatic Agreement for proposed coastal storm risk management and ecosystem restoration (106/CORPS)
THC Track #201607850

Dear Ms. Burks-Copes,

Thank you for your correspondence describing the above referenced project which we received on May 31, 2016. This letter serves as comment on the proposed undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission.

The History Programs, Regional Reviewer, Archaeology, and Marine Archaeology staff have completed their review of the Programmatic Agreement (PA) documentation provided. Some minor changes have been requested and can be found in red on the attached PA draft. In addition, we are requesting a full map of the project area be included and a better description of the possible activities be added to the possible activities in the preamble.

Thank you for your cooperation in this federal review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Lydia Woods, at 512/463-9122 or lydia.woods@thc.state.tx.us .**

Sincerely,

Lydia Woods, East Texas Project Reviewer
For: Mark Wolfe, State Historic Preservation Officer

MW/lw

Cc: Theresa Goodness, Chair, Jefferson County Historical Commission

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix M

Texas Coastal Management Program Consistency Determination

May 2017

INTRODUCTION

To reduce the risk of coastal storm surge impacts, the U.S. Army Corps of Engineers (USACE) proposes to construct a new levee/floodwall system in Orange and Jefferson counties, and to modify the existing Port Arthur and Freeport Hurricane Flood Protection Projects (HFPP).

The Orange-Jefferson Coastal Storm Risk Management (CSRM) Plan is comprised of three separate levee segments, one in Orange County and two in Jefferson County, totaling about 39 miles in length (Figure 1). The levees and floodwalls would be constructed to a minimum 11 to 12 feet elevation (NAVD88), adjusted as needed to accommodate for relative sea-level rise over a 50-year project life. The new system would require a maximum of 15 million cubic yards of fill to construct; the fill would be obtained from commercial borrow sources and tested to ensure that it is suitable for use. Tidal surge gates would be constructed on Adams and Cow Bayous in the Orange County segment; these gates would normally remain open, but would be closed for short periods when the area is threatened by storm surge. Culverts would be designed to accommodate future tidal flows and ensure that flows inside and outside of the levee system maintain future without-project conditions. Orange County has agreed to be the non-Federal sponsor for the Orange County portion of the Orange-Jefferson CSRM Plan, and Jefferson County has agreed to sponsor the Jefferson Main and Beaumont A segments. Plan details are provided in the Sabine Pass to Galveston Draft Integrated Feasibility Report-Environmental Impact Statement (DIFR-EIS) Appendix D.

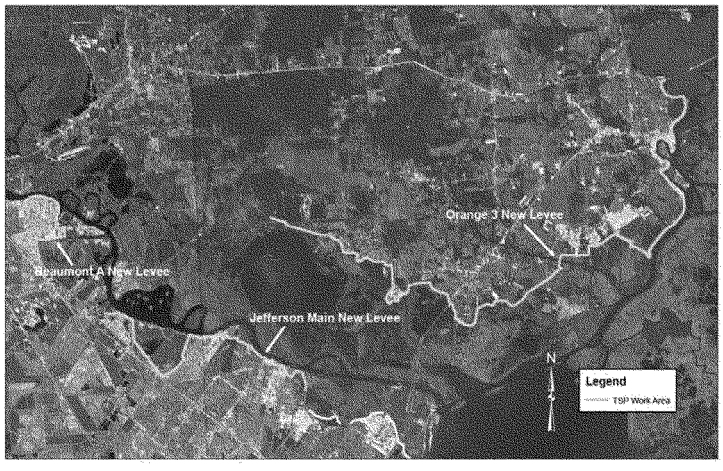

Figure 1: Orange-Jefferson CSRM Plan

The Port Arthur and Vicinity CSRM Plan would raise three I-Walls and one railroad track closure structure by one foot. Areas to be modified are shown in green on Figure 2. Jefferson County Drainage District No. 7 would continue as the non-Federal sponsor the Port Arthur and Vicinity CSRM Plan.

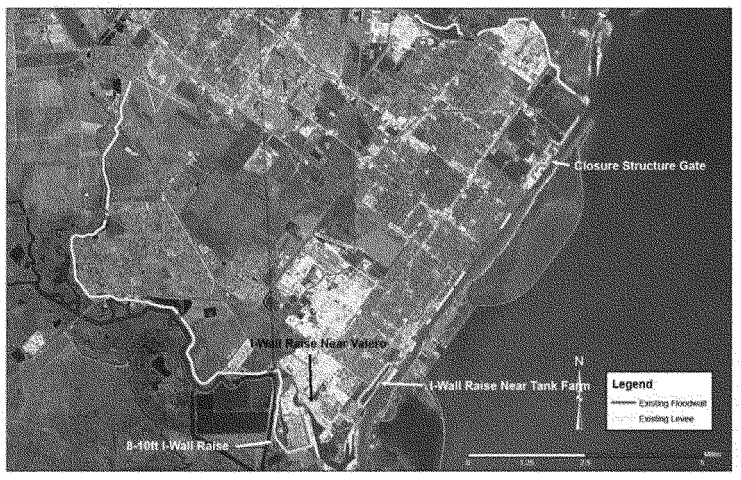

Figure 2: Port Arthur and Vicinity CSRM Plan

The Freeport and Vicinity CSRM Plan would raise the Oyster Creek, East Storm Levee and Old River Levee at DOW Thumb by one foot, raise the Tide Gate I-Wall by one foot, and add resiliency features to the Freeport Dock Floodwall. It would also construct a tidal surge gate structure at the mouth of the DOW Barge Canal. Fill required for levee raises would be obtained from commercial borrow sources and tested to ensure that it is suitable for use. The Velasco Drainage District would continue to serve as the non-Federal sponsor for the Freeport and Vicinity CSRM Plan. Areas to be modified are shown in green on Figure 3.

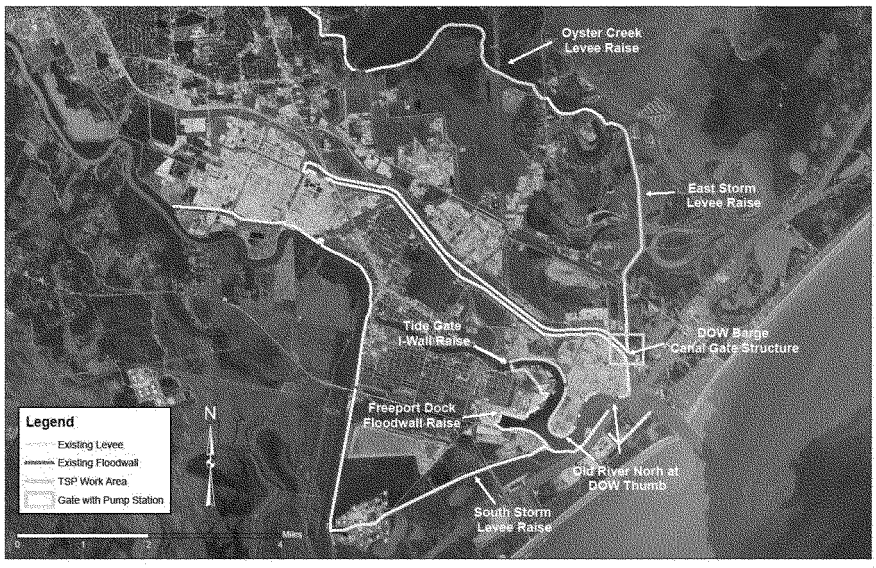

Figure 3: Freeport and Vicinity CSRM Plan

COMPLIANCE WITH GOALS AND POLICIES

The following goals and policies of the Texas Coastal Management Program (TCMP) were reviewed for compliance:

***§501.15* Policy for Major Actions**

1. For purposes of these policy categories, "major action" means an individual agency or subdivision action listed in §505.11 of this title (relating to Actions and Rules Subject to the Coastal Management Program), §506.12 of this title (relating to Federal Actions Subject to the Coastal Management Program), or §505.60 of this title (relating to Local Government Actions Subject to the Coastal Management Program), relating to an activity for which a federal environmental impact statement under the National Environmental Policy Act, 42 United States Code Annotated, §4321 et seq. is required.

Compliance: This project has been determined to be a "major action" requiring the preparation of an environmental impact statement (EIS). A Notice of Intent to prepare an EIS was published in November 2014. A DIFR-EIS will be issued for public review in September 2015.

2. Prior to taking a major action, the agencies and subdivisions having jurisdiction over the activity shall meet and coordinate their major actions relating to the activity. The agencies and subdivisions shall, to the greatest extent practicable, consider the cumulative and secondary adverse effects, as described in the federal environmental impact assessment process, of each major action relating to the activity.

Compliance: Extensive coordination has been conducted with the Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Natural Resource Conservation Service and Texas Parks and Wildlife to identify and quantify project impacts. Cumulative and secondary adverse impacts have been considered and are identified in the DIFR-EIS.

3. No agency or subdivision shall take a major action that is inconsistent with the goals and policies of this chapter. In addition, an agency or subdivision shall avoid and otherwise minimize the cumulative adverse effects to CNRAs of each of its major actions relating to the activity.

Compliance: These resource agencies listed above will also be involved in development of the mitigation plan. Areas targeted for evaluation exclude areas already identified for beneficial use or mitigation in conjunction with other projects. Specifically, authorized improvements to the SNWW navigation project include the restoration of large areas within both Bessie Heights and Old River Cove marshes with the beneficial use of dredged material. In addition, areas targeted for restoration by TPWD have also been excluded. Any mitigation sites selected for this project would augment, not replace, these other proposals.

§ 501.23 Policies for Development in Critical Areas

(a) Dredging and construction of structures in, or the discharge of dredged or fill material into, critical areas shall comply with the policies in this section. In implementing this section, cumulative and secondary adverse effects of these activities will be considered.

(1) The policies in this section shall be applied in a manner consistent with the goal of achieving no net loss of critical area functions and values.

Compliance: The mitigation plan will fully compensate for all wetland impacts such that the project will result in "no net loss" of wetlands.

(2) Persons proposing development in critical areas shall demonstrate that no practicable alternative with fewer adverse effects is available.

Compliance: Planning for the avoidance and minimization of impacts began with the initial selection of the Orange-Jefferson levee alignment. The levee was located as close to the upland-wetland margin as possible to minimize wetland impacts, while also minimizing social effects and maximizing economic impacts. Opportunities to further avoid and minimize environmental impacts will be evaluated during final feasibility planning. The project is will reduce the risk of storm surge in areas at risk to flooding, and thus must be situated in special hazard areas.

(3) In evaluating practicable alternatives, the following sequence shall be applied:

(A) Adverse effects on critical areas shall be avoided to the greatest extent practicable.

(B) Unavoidable adverse effects shall be minimized to the greatest extent practicable by limiting the degree or magnitude of the activity and its implementation.

(C) Appropriate and practicable compensatory mitigation shall be required to the greatest extent practicable for all adverse effects that cannot be avoided or minimized.

Compliance: Adverse effects on critical areas have been avoided to the greatest extent practicable. The project would primarily impact coastal wetlands; small areas of submerged lands and submerged aquatic vegetation (SAV) are incorporated into the wetland impact analysis as waters within the wetland systems. Total direct construction impacts would affect 300.5 acres of coastal wetlands; indirect impacts would affect 2,551 acres (2,137 acres of which are functional impacts to fisheries access). Direct and indirect impacts would result in a loss of 261.8 AAHUs. Approximately 47.5 acres of coastal preserve areas (Texas Parks and Wildlife Department's [TPWD] Tony Houseman and Lower Neches River Wildlife Management Areas [WMAs]) would also be impacted. None of the other Coastal Natural Resource Areas (CNRAs) would be affected by the proposed project.

(4) Compensatory mitigation includes restoring adversely affected critical areas or replacing adversely affected critical areas by creating new critical areas. Compensatory mitigation should be undertaken, when practicable, in areas adjacent or contiguous to the affected critical areas (on-site). If on-site compensatory mitigation is not practicable, compensatory mitigation should be undertaken in close physical proximity to the affected critical areas if practicable and in the same watershed if possible (off-site). Compensatory mitigation should also attempt to replace affected critical areas with critical areas with characteristics identical to or closely approximating those of the affected critical areas (in-kind). The preferred order of compensatory mitigation is:(A) on-site, in-kind;(B) off-site, in-kind;(C) on-site, out-of-kind; and(D) off-site, out-of-kind.

In-kind mitigation areas would be selected during final feasibility planning. Areas being evaluated for mitigation are off-site, but in close proximity to the affected areas and within the Neches and Sabine watersheds. Mitigation of direct impacts could not be on-site, because affected areas would be covered by the levee system. Indirect impacts are primarily fisheries access impacts; mitigation within these areas would not be optimal because the areas are behind the surge gates which create the impact.

(5) Mitigation banking is acceptable compensatory mitigation if use of the mitigation bank has been approved by the agency authorizing the development and mitigation credits are available for withdrawal. Preservation through acquisition for public ownership of unique critical areas or other ecologically important areas may be acceptable compensatory mitigation in exceptional circumstances. Examples of this include areas of high priority for preservation or restoration, areas whose functions and values are difficult to replicate, or areas not adequately protected by regulatory programs. Acquisition will normally be allowed only in conjunction with preferred forms of compensatory mitigation.

Compliance: Mitigation banks will be investigated to determine if sufficient and appropriate mitigation is available; none are known at this time. If mitigation banks are not available to compensate for all or a portion of project impacts, areas in the floodplains of the Neches and Sabine Rivers within and adjacent to the study area will be reviewed to identify potential in-kind mitigation sites.

(6) In determining compensatory mitigation requirements, the impaired functions and values of the affected critical area shall be replaced on a one-to-one ratio. Replacement of functions and values on a one-to-one ratio may require restoration or replacement of the physical area affected on a ratio higher than one-to-one. While no net loss of critical area functions and values is the goal, it is not required in individual cases where mitigation is not practicable or would result in only inconsequential environmental benefits. It is also important to recognize that there are circumstances where the adverse effects of the activity are so significant that, even if alternatives are not available, the activity may not be permitted regardless of the compensatory mitigation proposed.

Compliance: Compensatory mitigation requirements will be determined using the Wetlands Value Assessment Model. This model considers functions and values of swamp, bottomland hardwood, and marsh communities.

(7) Development in critical areas shall not be authorized if significant degradation of critical areas will occur. Significant degradation occurs if:

(A) the activity will jeopardize the continued existence of species listed as endangered or threatened, or will result in likelihood of the destruction or adverse modification of a habitat determined to be a critical habitat under the Endangered Species Act, 16 United States Code Annotated, §§1531 - 1544;

Compliance: The project would have no effect on threatened or endangered species.

(B) the activity will cause or contribute, after consideration of dilution and dispersion, to violation of any applicable surface water quality standards established under §501.21 of this title;

Compliance: The project would not violate applicable water quality standards.

(C) the activity violates any applicable toxic effluent standard or prohibition established under §501.21 of this title;

Compliance: Material used to construct the new or modify the existing levee systems would be tested to determine if it is suitable for use.

(D) the activity violates any requirement imposed to protect a marine sanctuary designated under the Marine Protection, Research, and Sanctuaries Act of 1972, 33 United States Code Annotated, Chapter 27; or

Compliance: The project would not affect any marine sanctuaries.

(E) taking into account the nature and degree of all identifiable adverse effects, including their persistence, permanence, areal extent, and the degree to which these effects will have been mitigated pursuant to subsections (c) and (d) of this section, the activity will, individually or collectively, cause or contribute to significant adverse effects on:

(i) human health and welfare, including effects on water supplies, plankton, benthos, fish, shellfish, wildlife, and consumption of fish and wildlife;

(ii) the life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, or spread of pollutants or their byproducts beyond the site, or their introduction into an ecosystem, through biological, physical, or chemical processes;

(iii) ecosystem diversity, productivity, and stability, including loss of fish and wildlife habitat or loss of the capacity of a coastal wetland to assimilate nutrients, purify water, or reduce wave energy; or

(iv) generally accepted recreational, aesthetic or economic values of the critical area which are of exceptional character and importance.

Compliance: The project would not cause significant adverse effects on human health and welfare or any of the natural resources or systems listed above. It would not reduce ecosystem diversity, productivity, or the capacity of the wetland systems to assimilate nutrients, purify water, or reduce wave energy.

(b) The TCEQ and the RRC shall comply with the policies in this section when issuing certifications and adopting rules under Texas Water Code, Chapter 26, and the Texas Natural Resources Code, Chapter 91, governing certification of compliance with surface water quality standards for federal actions and permits authorizing development affecting critical areas; provided that activities exempted from the requirement for a permit for the discharge of dredged or fill material, described in Code of Federal Regulations, Title 33, §323.4 and/or Code of Federal Regulations, Title 40, §232.3, including but not limited to normal farming, silviculture, and ranching activities, such as plowing, seeding, cultivating, minor drainage, and harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices, shall not be considered activities for which a certification is required. The GLO and the SLB shall comply with the policies in this section when approving oil, gas, or other mineral lease plans of operation or granting surface leases, easements, and permits and adopting rules under the Texas Natural Resources Code, Chapters 32, 33 and 51 - 53, and Texas Water Code, Chapter 61, governing development affecting critical areas on state submerged lands and private submerged lands, and when issuing approvals and adopting rules under Texas Natural Resources Code, Chapter 221, for mitigation banks operated by subdivisions of the state.

Compliance: A 404(b)(1) analysis has been prepared and will be submitted to TCEQ for approval.

(c) Agencies required to comply with this section will coordinate with one another and with federal agencies when evaluating alternatives, determining appropriate and practicable mitigation, and assessing significant degradation. Those agencies' rules governing authorizations for development in critical areas shall require a demonstration that the requirements of subsection (a)(1) - (7) of this section have been satisfied.

Compliance: Extensive coordination has been conducted with the Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Natural Resource Conservation Service and Texas Parks and Wildlife to identify and quantify project impacts. These agencies will also be involved in development of the mitigation plan.

(d) For any dredging or construction of structures in, or discharge of dredged or fill material into, critical areas that is subject to the requirements of §501.15 of this title (relating to Policy for Major Actions), data and information on the cumulative and secondary adverse affects of the project need not be produced or evaluated to comply with this section if such data and information is produced and evaluated in compliance with §501.15(b) - (c) of this title.

Compliance: The project complies with §501.15(b) - (c).

§501.29 Policies for Development in State Parks, Wildlife Management Areas or Preserves
Development by a person other than the Parks and Wildlife Department that requires the use or taking of any public land in such areas shall comply with Texas Parks and Wildlife Code, Chapter 26 Protection of Public Parks and Recreational Lands.

Compliance: USACE has determined that there is no feasible and prudent alternative to the taking of approximately 47.5 acres of TPWD lands in the Tony Houseman and Lower Neches River WMAs for construction of a portion of the Orange-Jefferson CSRM Plan. Project construction will employ best management practices to minimize harm to remaining WMA lands that would result from the taking.

§501.34 – Levee Improvement or Flood Control Projects
1. a) Drainage, reclamation, channelization, levee construction or modification, or flood- or floodwater-control infrastructure projects shall be designed, constructed, and maintained to avoid the impoundment and draining of coastal wetlands to the greatest extent practicable. If impoundment or draining of coastal wetlands cannot be avoided, adverse effects to the wetlands shall be mitigated in accordance with the sequencing requirements found in the critical areas policy(§ 501.23).

Compliance: No significant environmental impacts have been identified for the Port Arthur and Freeport and Vicinities CSRM Plans. All environmental impacts identified for the TSP are associated with the Orange-Jefferson CSRM Plan, and these are limited to wetland impacts. Planning for the avoidance and minimization of impacts began with the initial selection of the Orange-Jefferson levee alignment. The levee was located as close to the upland-wetland margin as possible to minimize wetland impacts, while also minimizing social effects and maximizing economic impacts. Opportunities to further avoid and minimize environmental impacts will be evaluated during final feasibility planning.

Indirect impacts on drainage associated with installation of the levee system would be minimized by maintaining flows in tidal bayous and streams equivalent to the future without-project (FWOP) condition. Culverts would be sized and modified as needed to provide for increased tidal flows

expected with RSLC. With tidal access maintained at FWOP flows, RSLC-related landscape and wetland changes to areas both inside and outside of the levee system would occur with the project in place as they would have occurred in the FWOP condition. A few small areas have been identified where marsh and forested wetland would be impounded between the upland terrace margin and the new levee system, and where hydrologic connectivity would be permanently disrupted by levee system construction. Impacts for all of these areas, as well as direct impacts associated levee system construction, have been quantified. In total, mitigation would be needed to compensate for a loss of 80.1 AAHUs from forested wetlands and 181.7 AAHUs from coastal wetlands. All impacts would be fully compensated with a mitigation plan to be developed during final feasibility planning. WVA modeling will be conducted to quantify benefits (AAHUs) of mitigation measures. Selection of potential mitigation sites and modeling of benefits will be conducted in coordination with resource agencies. Feasibility-level costs of selected mitigation measures will be developed, and the costs and benefits will be used to identify a best buy mitigation plan using Cost Effectiveness-Incremental Cost Analysis that will fully compensate for all impacts.

1. b) TCEQ rules and approvals for the levee construction, modification, drainage, reclamation, channelization, or flood- or floodwater-control projects, pursuant to the Texas Water Code, §16.236, shall comply with the policies in this section.

Compliance: Extensive hydrology and hydraulics evaluations conducted in development of the Orange-Jefferson, Port Arthur and Vicinity, and Freeport and Vicinity CSMR Plans are presented in the Engineering Appendix (Appendix D) of the Sabine Pass to Galveston Bay DIFR-EIS. These studies evaluated the effects of the levees on storm surge coincident with heavy inland rainfall events and determined that the design would not adversely impact the flood carrying capacity of adjacent rivers, will not increase flooding or divert waters such that lives and property would be endangered or subject to significantly increased flooding. Orange and Jefferson Counties have indicated a willingness to serve as local sponsors for the new Orange-Jefferson CSMR system; Jefferson County Drainage District No 7 would continue as the sponsor of the Port Arthur and Vicinity CSRM project, and Velasco Drainage District would continue to sponsor the Freeport and Vicinity CSRM project. Landowners that would be affected by construction of the new Orange-Jefferson CSRM system and modifications of the Port Arthur and Freeport and Vicinities CSRM projects are identified in the DIFR-EIS Distribution List (Section 9.2).

IMPACTS ON COASTAL NATURAL RESOURCE AREAS

Potential impacts to Coastal Natural Resource Areas (CNRAs) listed in 31 Texas Administrative Code (TAC) §501.3, and of methods to minimize or avoid potential impacts, are discussed below.

Waters of the Open Gulf of Mexico

Waters of the open Gulf of Mexico (Gulf) are not located in any of the three CSRM project areas.

Waters Under Tidal Influence

All three CSRM project areas include streams and bayous that experience tidal influence. Levee, floodwall and surge gate construction activities would result in a negligible impact because the potential release of suspended solids is minimized by using appropriate best management practices (BMPs) such as silt curtains, and compliance with the required State §401 Certification.

Submerged Lands

Small areas of submerged lands within the Orange-Jefferson CSRM Plan construction right-of-way would be impacted by construction of the new levee system. Impacts on submerged lands have been minimized to the greatest extent possible. Total acres of marsh and forested wetland impacts are included in the impact areas evaluated with the Wetlands Value Assessment model, and thus impacts will be fully compensated by the mitigation plan. Construction of the Cow and Adams Bayou surge gates would result in the loss of approximately 11 acres of submerged lands. The structures themselves would provide artificial hard bottom habitat in the same area, increasing the diversity of bottom types in the area, resulting in negligible long-term impacts. No impacts on submerged lands are expected with construction of the Port Arthur and Vicinity CSRM Plan. The Freeport and Vicinity CSRM Plan would impact a small area of submerged bottom with construction of a surge gate in DOW Barge Canal. This is an artificial canal with little fish and wildlife value; the impacts would result in negligible long-term impacts.

Coastal Wetlands

Direct and indirect impacts associated with construction of the Orange-Jefferson CSRM Plan would result in the loss of about 275.9 acres of estuarine emergent marsh and 139.9 acres of forested wetlands over the period of analysis. Impacts were minimized to the greatest extent practicable. Remaining unavoidable impacts will be fully compensated by in-kind mitigation; all impacts would be fully compensated with the restoration of estuarine emergent marsh and shallow water.

Total acres include water within the wetlands and small drainages; some SAV in the estuarine marsh areas would also be lost. These acres would be replaced by in-kind mitigation in the amount determined using the WVA model and the CE/ICA incremental analysis

Construction of the Cow and Adams Bayou surge gates would result in the loss of approximately 11 acres of estuarine soft bottom EFH. This is the area estimated for the footings of the gate structures. The structures themselves would provide artificial hard bottom habitat in the same area, increasing the diversity of EFH bottom types in the area. The net long-term loss to EFH bottom habitat from the Cow and Adams gate structures would therefore be negligible.

Submerged Aquatic Vegetation
Some submerged aquatic vegetation is present in waters in the wetlands that will be impacted by construction of the Orange-Jefferson CSRM Plan. These acres would be replaced by in-kind mitigation in the amount determined using the WVA model.

Tidal Sand and Mud Flats
No tidal sands and mud flats occur in the project areas.

Oyster Reefs
No oyster reefs occur in the project areas.

Hard Substrate Reefs
No hard substrate reefs occur in the project areas.

Coastal Barriers
No coastal barriers occur in the project areas.

Coastal Shore Areas
No coastal shore areas occur in the project areas.

Gulf Beaches
No Gulf beaches occur in the project areas.

Critical Dune Areas
No critical dune areas occur in the project areas.
Special Hazard Areas
Special hazard areas are areas designated by the Administrator of the Federal Insurance Administration under the National Flood Insurance Act as having special flood, mudslide, and/or flood-related erosion hazards. The new Orange-Jefferson CSRM Plan alignment is predominantly located in or adjacent to the 100-year floodplain in special hazard zones A8 and AE. Project objectives would decrease the hazard of the flood-prone areas, and a beneficial effect to the hazard area is expected. The Port Arthur and Freeport and Vicinities CSRM Plans are modifications of existing projects which have decreased flood hazards in those areas; no special hazard areas would be affected by modifications of these systems.

Critical Erosion Areas
No critical erosion areas occur in the project areas.

Coastal Historic Areas

No coastal historic areas (sites in the National Register of Historic Places on public land or State Archeological Landmarks that are identified by the Texas Historical Commission as being coastal in character) would be impacted by the project.

Coastal Preserves

The project would directly impact approximately 47.5 acres of TPWD lands in the Tony Houseman and Lower Neches River WMAs. The lands are required for construction of a portion of the Orange-Jefferson CSRM Plan. USACE has determined that there is no feasible and prudent alternative to the taking of these lands. These acres would be replaced by in-kind mitigation in the amount determined using the WVA model on TPWD lands in close proximity to the impact areas.

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix N
HAZARDOUS, TOXIC AND RADIOACTIVE WASTE ASSESSMENT

May 2017

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE AND HAZARDOUS MATERIALS ASSESSMENT

for the

Integrated Feasibility Report/Environmental Impact Statement for Sabine Pass to Galveston Bay, Texas Coastal Storm Damage Risk Management Study

Prepared by:

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July 2015

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HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Introduction

This appendix identifies sites and activities in proximity to the tentative levee and floodwall alignments in the Orange County, Jefferson County-Port Arthur, and Freeport, Texas, project areas with a potential for environmental risk due to hazardous materials use or generation of hazardous waste, as outlined by the U.S. Army Corps of Engineers, Galveston District (USACE), for the Southwestern Division's Regional Planning and Environmental Center Draft Integrated Feasibility Report/Environmental Impact Statement (DIFR-EIS) for the Sabine Pass to Galveston Bay Coastal Storm Risk Management and Ecosystem Restoration Study (S2G Study). Gulf South Research Corporation (GSRC) was tasked with identifying Hazardous, Toxic, and Radioactive Waste (HTRW) sites and facilities within a distance of the tentative storm risk management levees and floodwalls to pose an environmental risk. The alignments analyzed here are the full potential alignments evaluated during alternatives analysis. Incremental analysis of levee/floodwall reaches may result in shorter alignments for the Tentatively Selected Plan.

The USACE is obligated under Executive Resolution (ER) 1165-2-132 to assume responsibility for reasonable identification and evaluation of all contamination within the vicinity of the tentative levee and floodwall corridors. ER 1165-2-132 identifies USACE's HTRW policy to avoid use of project funds for HTRW removal and remediation activities. Costs for necessary special handling or remediation of wastes (e.g., Resource Conservation and Recovery Act [RCRA] regulated wastes), pollutants, and other contaminants that are not regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) would be treated as project costs if the requirement is the result of a validly promulgated Federal, state, or local regulation.

Existing Conditions

The three general project corridor areas (Orange County, Jefferson County-Port Arthur, and Freeport) (Figure 1) were investigated as separate project corridors with regard to the presence of hazardous materials, hazardous waste, and the potential for contamination by current or past industrial or other activities. The location basis for the investigations is the tentative levee and floodwall centerlines as indicated by geographic information system (GIS) alignments provided by the USACE. The locations of HTRW areas of concern were identified by latitude and longitude along the alignments in the absence of any surveyed segments or stations. For the purposes of this investigation, a risk to the tentative levee and floodwall alignments is defined as the presence of an HTRW contamination site or HTRW generation site on or adjacent to an alignment, the presence of an activity with the potential for contamination adjacent to or within 0.25 mile of an alignment, or the presence of a past HTRW contamination site or activity adjacent to or within 0.25 mile of an alignment. It is GSRC's experience that, with the exception of large oil refining and chemical plants, small HTRW sites such as commercial gas stations in excess of 0.25 mile from the alignment corridor do not pose an environmental risk to the project. Very large facilities, such as refineries and chemical plants, are shown on the project area maps even when they are more than 0.25 mile from the alignments.

HTRW concerns were investigated through a review of state and Federal databases maintained to monitor permits and activities regulated by state and Federal agencies, such as the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (USEPA). Envirosite Corporation was contracted to search relevant environmental databases for sites and activities on or near the levee and floodwall alignments. The USEPA's

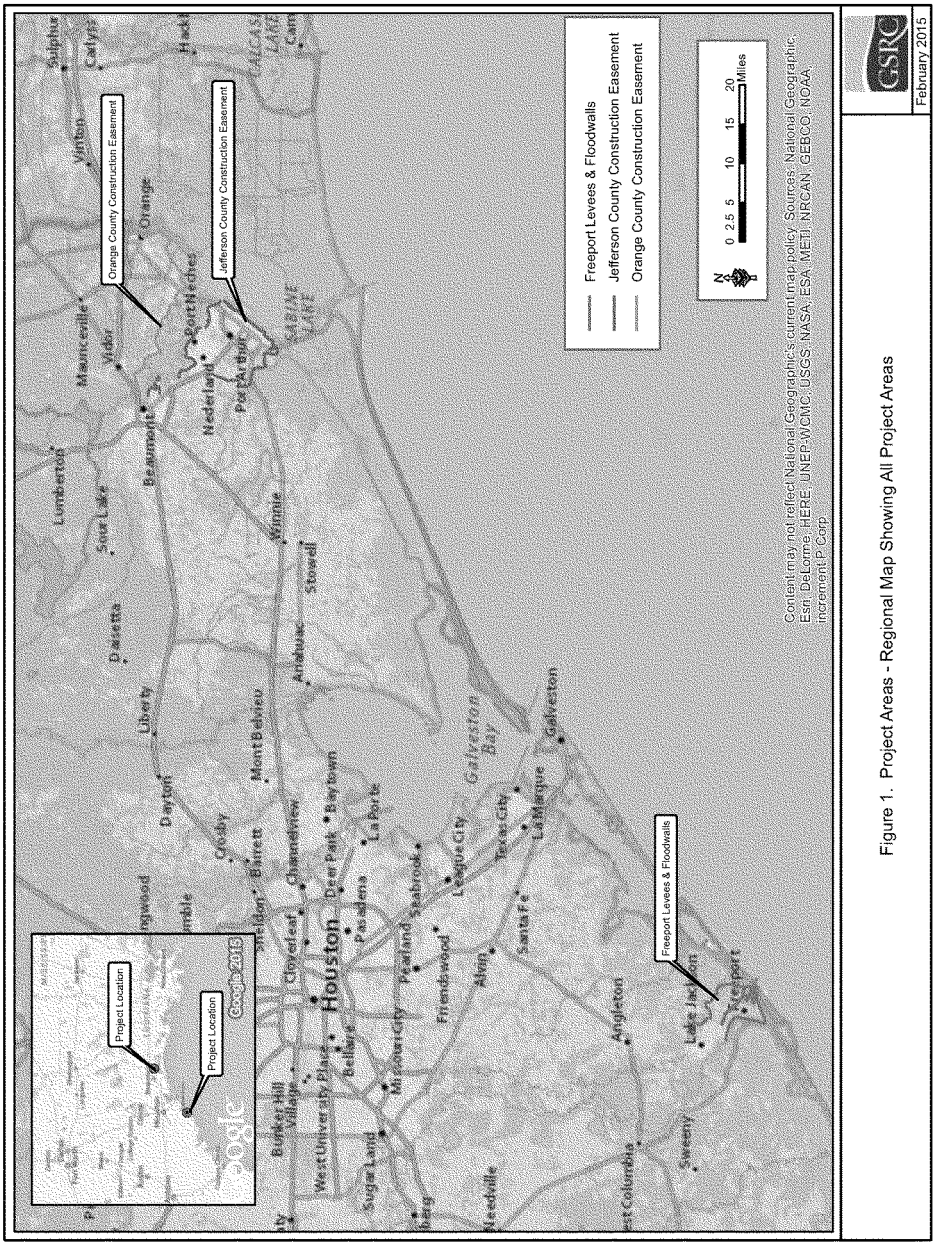

Figure 1. Project Areas - Regional Map Showing All Project Areas

Enforcement and Compliance History Online (ECHO) website was visited to identify past HTRW incidents or permit noncompliance violations for sites identified in the Envirosite Corporation database reviews, primarily violations of the Clean Air Act (CAA), Clean Water Act (CWA), and RCRA. In addition, historical U.S. Geological Survey (USGS) topographic maps and historical aerial photographs were obtained along the levee and floodwall alignments to identify former industrial or other activities that may have contributed to HTRW contamination in the project areas. The volume of material examined for this HTRW report is too large to include in this appendix (over 28,500 pages of reports and maps), but the data are available in electronic format from the USACE for further review.

HTRW information for the project corridors is summarized in individual tables for each of the three project areas. The level of risk posed by a facility to a project corridor is defined as:

- *Low* - the facility generates or stores hazardous waste with the potential to contaminate the project corridor from a release incident;
- *Moderate* - the facility generates or stores hazardous waste with a recent release to the environment near the project corridor that has been resolved; and
- *High* - the facility has a recent or current release of hazardous materials near or in the project corridor that is unresolved.

In addition to facilities and industrial sites handling or generating HTRW, there are numerous points along the tentative levee and floodwall alignments where pipelines or other conveyances cross the alignments transporting hazardous materials for shipment or processing. These pipeline crossings are identified as points of concern along the tentative alignments where special caution should be exercised during construction to avoid damage to the pipelines and release of hazardous materials into the environment. Database entries in the tables for each site are abbreviated from the following definitions:

Database Abbreviations and Definitions

FEDERAL CERCLIS LIST

CERCLIS	Comprehensive Environmental Response Compensation and Liability Act program sites reported to the Environmental Protection Agency and can be proposed for the NPL List
CERCLIS NFRAP	Comprehensive Environmental Response Compensation and Liability Act No Further Remedial Action Planned sites that have been removed and archived
FEDERAL FACILITY	Sites where Federal Facilities Restoration and Reuse Office (FFRRO) arranged cleanup for Base Closure and Property Transfer at Federal Facilities

FEDERAL RCRA CORRACTS FACILITIES LIST

CORRACTS	Hazardous Waste Corrective Action: List of facilities where Resource Conservation and Recovery Act Corrective Action Program was used to investigate and remediate hazardous releases

FEDERAL DELISTED NPL SITE LIST

DELISTED NPL	Delisted National Priority List of sites that were delisted and no longer require action

DELISTED PROPOSED NPL	Sites that have been delisted from the proposed National Priority List
FEDERAL ERNS LIST	
ERNS	Emergency Response Notification System records of reported spills (maintained by the U.S. Coast Guard)
FEDERAL INSTITUTIONAL CONTROLS / ENGINEERING CONTROLS REGISTRIES	
FED EC	Engineering Controls: Federal listing of remediation sites with engineering controls
FED IC	Institutional Controls: Federal listing of remediation sites with institutional controls
FED-PUBLISHED INSTITUTIONAL CONTROLS	A land use restricted site is a property where there are limits or requirements on future use of the property due to varying levels of cleanup possible, practical, or necessary at the site. Published Institutional Controls
RCRA IC EC	RCRA sites with Institutional and Engineering Controls related to the Resource Conservation and Recovery Act
FEDERAL NPL SITE LIST	
NPL	National Priority List: List of priority contaminated sites among identified releases or threatened releases of hazardous substances, pollutants, or contaminants nationally (Superfund Sites)
NPL LIENS	National Priority List of sites with Liens
PART NPL	Sites that are part of a National Priority List site referred to as the parent site
PROPOSED NPL	Sites that have been proposed for the National Priority List
FEDERAL RCRA GENERATORS LIST	
RCRA CESQG	Resource Conservation and Recovery Act listing of licensed conditionally exempt small quantity generators
RCRA LQG	Resource Conservation and Recovery Act listing of licensed large quantity generators
RCRA SQG	Resource Conservation and Recovery Act listing of licensed small quantity generators
FEDERAL RCRA NON-CORRACTS TSD FACILITIES LIST	
RCRA TSDF	Resource Conservation and Recovery Act hazardous waste transportation storage disposal and treatment facilities
STATE AND TRIBAL REGISTERED STORAGE TANK LISTS	
FEMA UST	FEMA Underground Storage Tank listing
MSD-TX	Municipal Settings Designation Database: Designation given to property within a municipality that certifies that designated groundwater at the property is not used as potable water
PST-TX	Registered Petroleum Storage Tanks in Texas

PST NON REGISTERED-TX	Non-Registered Petroleum Storage Tanks in Texas
UST-TX	Registered Underground Storage Tanks in Texas

RECORDS OF EMERGENCY RELEASE REPORTS

HMIRS (DOT)	Hazardous Material spills reported by the Department of Transportation

STATE AND TRIBAL LANDFILL AND/OR SOLID WASTE DISPOSAL SITE LISTS

SWF/LF-TX	Solid Waste Facilities and Landfills in Texas
WASTE MGT-TX	Commercial Hazardous and Solid Waste Management Facilities locations in Texas
CLI–TX	Closed or abandoned landfills in Texas

STATE- AND TRIBAL - EQUIVALENT CERCLIS

DEL SHWS-TX	Delisted State Hazardous Waste Sites in Texas
IOP-TX	Innocent Owner/Operator Program sites in Texas

STATE AND TRIBAL LEAKING STORAGE TANK LISTS

LTANK-TX	Leaking Petroleum Storage Tank Database for Texas

STATE- AND TRIBAL - EQUIVALENT NPL

SSR-TX	State Superfund Registry for Texas

STATE AND TRIBAL VOLUNTARY CLEANUP SITES

VCP-TX	Voluntary Cleanup Program sites in Texas
VCP RRC-TX	Voluntary Cleanup Program sites registered with the Texas Railroad Commission

OTHER ASCERTAINABLE RECORDS

RCRA FULL DETAIL	Full detail of related sites to the Resource Conservation and Recovery Act
RCRA NONGEN	Resource Conservation and Recovery Act listing of licensed non-generators

LOCAL LISTS OF HAZARDOUS WASTE / CONTAMINATED SITES

FED CDL	U.S. Department of Justice listing of Clandestine Drug Lab locations
US HIST CDL	Historical Clandestine Drug Lab locations listed by the U.S. Department of Justice

LOCAL LAND RECORDS

LIENS 2	CERCLA sites with lien Information
LIENS-TX	Listing of sites with Environmental Liens in Texas

LOCAL LISTS OF LANDFILL / SOLID WASTE DISPOSAL SITES

ODI	Open Dump Inventory sites
TRIBAL ODI	Indian Land Open Dump Inventory sites

LOCAL BROWNFIELD LISTS

BROWNFIELDS-TX	List of Brownfield remediation sites in Texas

RECORDS OF EMERGENCY RELEASE REPORTS

SPILLS-TX	List of reported chemical spills from the TCEQ

OTHER ASCERTAINABLE FEDERAL RECORDS

AFS	Air Facility Systems quarterly extract
BRS	Biennial Reporting Systems: Reporting of hazardous waste generation and management from large quantity generators
CDC HAZDAT	Hazardous Substance Release and Health Effects Information: The Agency for Toxic Substances and Disease Registry's Hazardous Substance Release/Health Effects Database.
COAL ASH DOE	Coal Ash: Department of Electricity steam electric plant operation
COAL ASH EPA	Coal combustion residues surface impoundments list
COAL GAS	Former Manufactured Gas Plant locations
CONSENT (DECREES)	Superfund locations with legal decisions regarding responsibility
DIGITAL OBSTACLE	Obstacles of interest to aviation users
DOT OPS	Department of Transportation Office of Pipeline Safety incident data reports
ENOI	Electronic Notice of Intent database containing construction sites, industrial facilities, pesticide facilities, and vessel operators required to apply for coverage and submit a variety of other reports electronically required under EPAs Construction General Permit (CGP), Multi-Sector General Permit (MSGP), Pesticides General Permit (PGP), and Vessel General Permit (VGP)
FA HWF	Hazardous Waste Facilities with Financial Assurance
FEDLAND	Federal land locations
FRS	Facility Index Systems
FTTS	Tracking system of administrative and enforcement activities related to FIFRA/TSCA
FTTS INSP	Tracking of inspections related to FIFRA/TSCA
FUDS	Formerly Used Defense Sites that require cleanup
ICIS	Comprised of all Federal Administrative and Judicial enforcement information [intended to replace PCS] by tracking enforcement and compliance information (also contains what used to be known as FFTS)
LEAD SMELTER	Listing of former Lead Smelter Sites
LUCIS	Land Use Control Information Systems
MLTS	Material Licensing Tracking Systems for sites in possession/use of radioactive materials regulated by the NRC
OSHA	Occupational Safety & Health Administration listing of inspections violations and fatality information
PADS	Listing of generators, transporters, commercial store/ brokers, and disposers of PCB
PCB TRANSFORMER	Polychlorinated Biphenyls Transformers registry

RAATS	Listing of major violators with enforcement actions issued under RCRA, includes administrative and civil actions filed by the EPA.
RADINFO	Radiation Information Systems: EPA regulated facilities with radiation and radioactive materials
ROD	Record of Decision: Permanent remedy at an NPL site
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners
SSTS	Section 7 Tracking Systems: Tracking of facilities that produce pesticides and their quantity
TOSCA-CHEMICAL	Toxic Substance Control Act: Controlled Chemicals
TOSCA-PLANT	Toxic Substance Control Act: Controlled Plants
TRANSMISSIONS	Electrical power line transmissions
TRIS	Information regarding toxic chemicals that are being used/manufactured/treated/ transported/released into the environment

OTHER ASCERTAINABLE STATE RECORDS

AIRS-TX	Air Emission Inventory Data
AUL-TX	Sites with Activity and Use Limitations in place
COMP HIST-TX	Compliance History
DRYCLEANERS-TX	Drycleaners facilities
ENF-TX	Sites with notice of violations and enforcement
FA-TX	Underground Storage Tanks with Financial Assurance
IND HAZ WASTE-TX	Industrial and Hazardous Waste reports regarding handlers, generators, and shippers of waste
PRIORITY CLEANERS-TX	Drycleaner sites in the Drycleaner Remediation Program that have contamination caused by drycleaning solvents.
PST STAGE II-TX	Stage II Petroleum Storage Tanks
RWS-TX	Sites used to dispose, store, and process radioactive waste
T 2-TX	Facilities that must submit a hazardous chemical inventory report
UIC-TX	Regulated Class V Underground Injection Controlled wells

Orange County Corridor

The Orange County levee and floodwall corridor comprises approximately 42.84 miles from north of the intersection of the Sabine River with Interstate 10, around the cities of Orange and Bridge City, Texas, and up to and along Interstate 10 near the Neches River to the City of Vidor, Texas (Figure 2). The corridor runs near numerous industrial facilities, including the Port of Orange, several ship-building yards, DuPont-Invista Sabine River Works, Lanxess Chemical Corporation, Firestone Polymers, and Chevron Phillips Chemical Company. The locations of the industrial facilities are indicated in Figures 3 and 4. The Federal and state hazardous materials database listings for all facilities and prior events are found in Table 1, along with the latitude and longitude locations of the HTRW sites along the Orange County corridor alignment, as well as pipeline crossings. For sites other than a single point, a location is given for each end of the site that intersects the corridor alignment. Shaded outlines of the apparent footprint for major facilities are also shown in Figures 3 and 4.

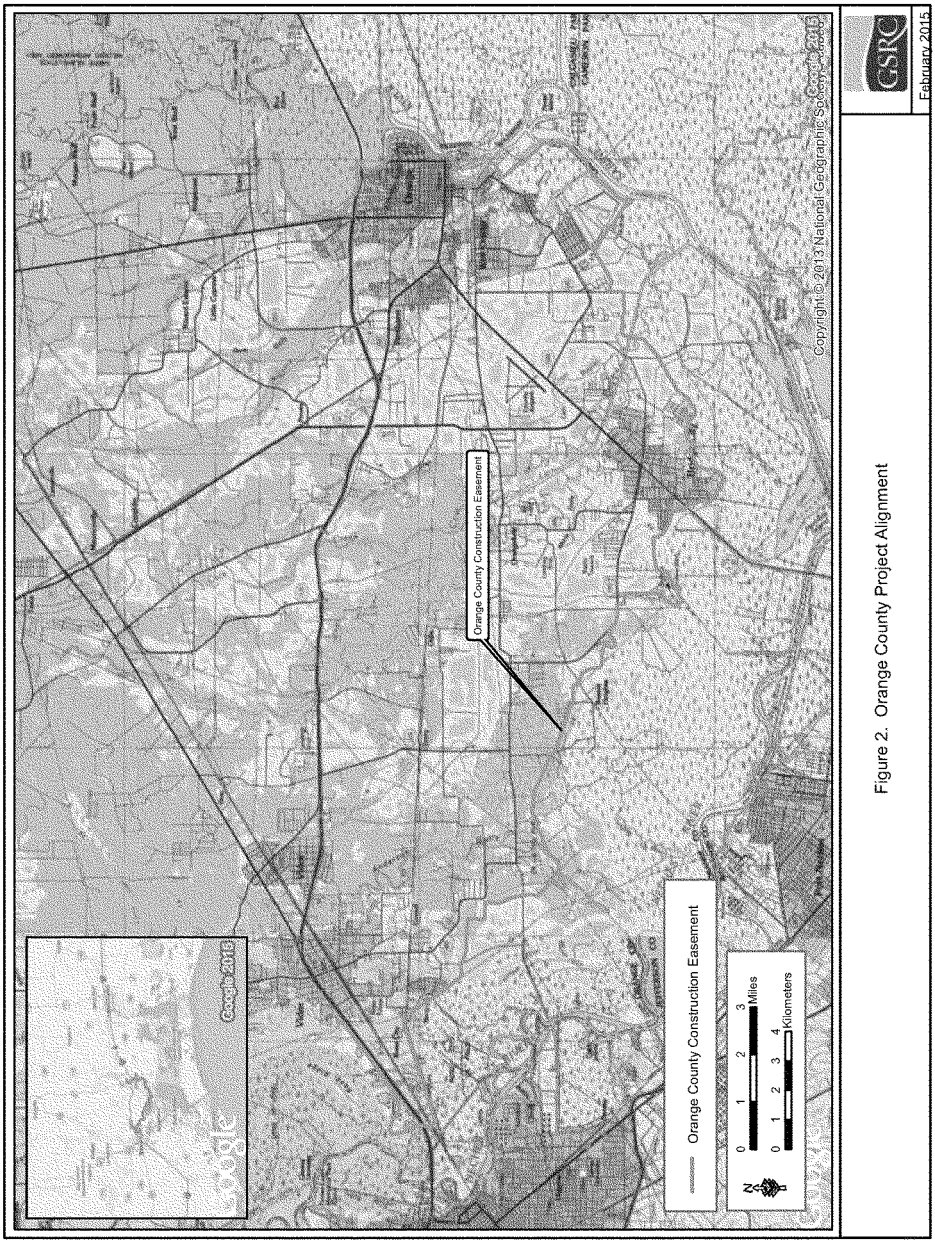

Figure 2. Orange County Project Alignment

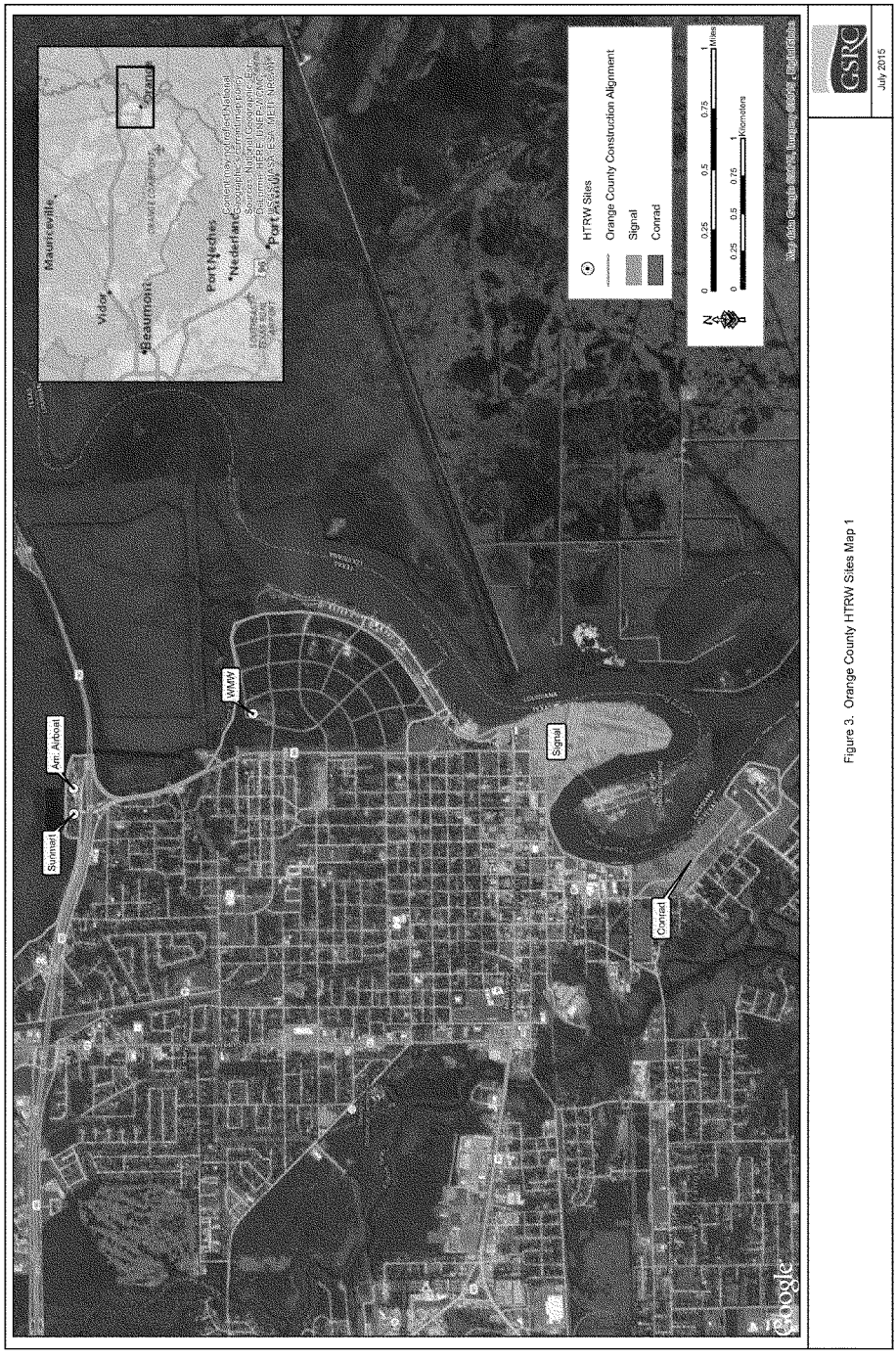

Figure 3. Orange County HTRW Sites Map 1

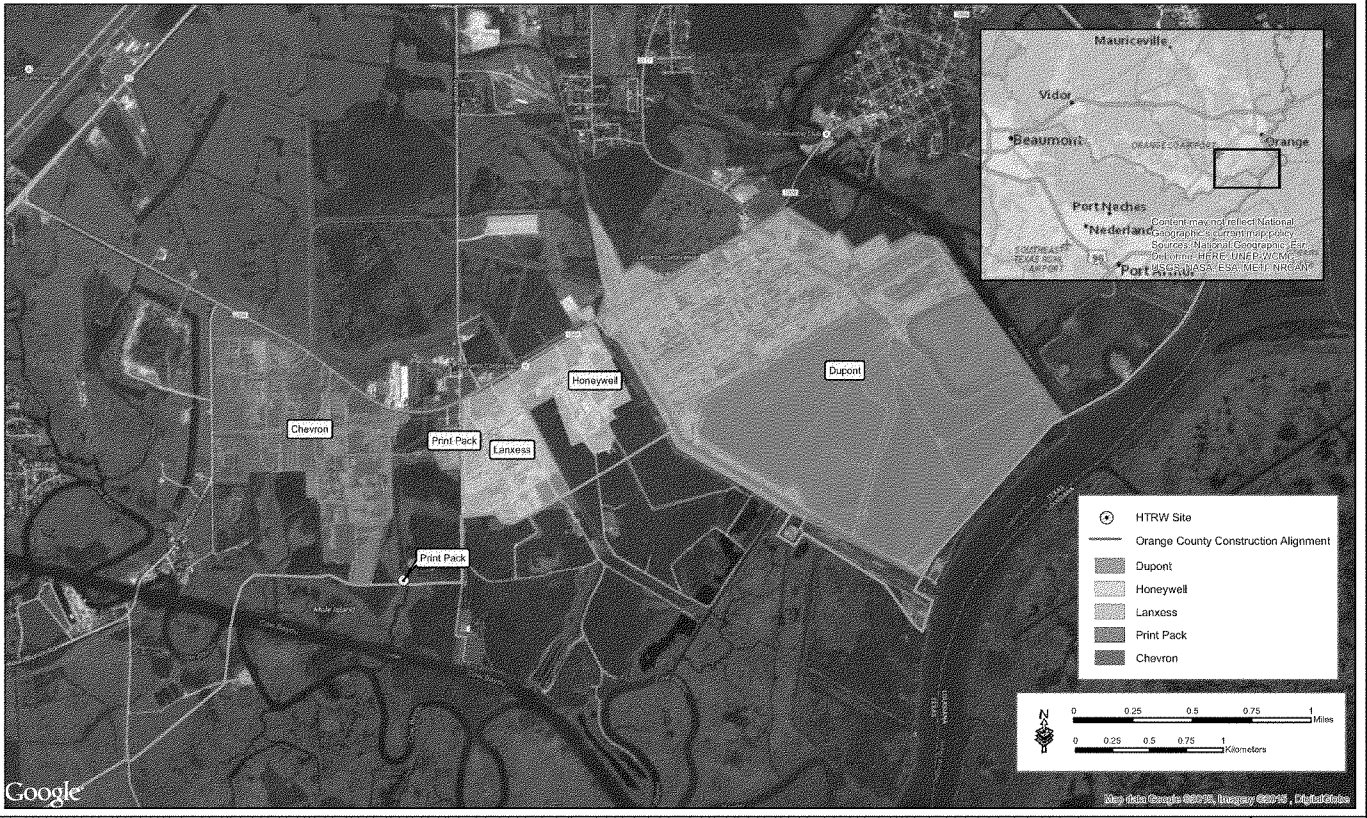

Figure 4. Orange County HTRW Sites Map 2

GSRC

July 2015

Table 1. Orange County Construction Corridor HTRW Sites

Date	Description	Distance from Corridor	Latitude	Longitude	Database Listing	Contaminants of Concern	Risk Analysis
2015	**Sunmart 363**, active service station with USTs	Adjacent	30.120011	-93.731346	LTANK-TX, FA-TX, UST-TX	Gasoline, diesel	Low Risk, UST release in 2012, remediated with well closure pending
2015	**American Airboat**, boat manufacturing	Adjacent	30.119984	-93.729735	PST NONREGISTERED-TX	Gasoline	Low Risk, non-registered petroleum storage tank on-site
1996	**WMW Holding Company**, 1904 Simmons Drive. Closed industrial hazardous waste disposal site	Adjacent	30.109252	-93.724115	RCRA-NONGEN, IND HAZ WASTE-TX	Unknown, site closed	Low Risk, site closed by TCEQ and classified as clean
2015	**Signal International-Front Street Yard**. Ship-building and repair yard.	Adjacent	N30.092851 S30.090391	N-93.725069 S-93.727924	T2-TX, PST-TX, RCRA-CESQG,	Lead, other metals, fuel, ignitable wastes, past RCRA violations found	Low Risk, no reported spills
2015	**Conrad Orange Shipbuilding Company**, Ship-building and repair yard.	Adjacent	N30.084696 S30.080593	N-93.736064 S-93.730085	FTTS INSP, T2-TX, TRIS, RCRA-LQG, RCRA-NONGEN, RAATS, RCRA-CESQG, ICIS, IND HAZ WASTE-TX,	Lead, other metals, fuel, ignitable wastes	Low Risk, no reported spills
2015	**DuPont–Invista Sabine River Works**, chemical manufacturing plant, wastewater treatment ponds adjacent	Adjacent	E30.048432 W30.046977	E-93.730468 W-93.758410	RMP, T2-TX, RCRA-LQG, RCRA-TSDF, TOSCA-Plant, AFS, AIRS-TX, IND HAZ Waste-TX, RAATS, BRS, TRIS, UST-TX, CERCLIS NFRAP	Petrochemicals. numerous past RCRA, CAA, and NPDES violations resulting in penalties	Low Risk, site generates and stores large quantities of hazardous chemicals and wastes, no recent RCRA violations
2015	**Lanxess Corporation**, chemical manufacturing plant	Adjacent	E30.043513 W30.041803	E-93.765022 W-93.772889	RCRA-LQG	Numerous past NPDES violations resulting in penalties	Low Risk, no recent RCRA violations
2015	**Honeywell, Inc.**, chemical manufacturing plant, runoff overflow canal intersecting	Adjacent	30.045433	-93.761306	RCRA-LQG, RMP	No past NPDES violations found, past CAA violations found	Low Risk, no recent RCRA violations
2015	**Chevron Phillips Chemical Company**, overflow drainage canal intersecting	1,300 feet north	30.038288	-93.786072	RCRA-LQG, TOSCA-PLANT, RMP, ICIS, FTTS INSP	Petrochemicals, numerous past NPDES and CAA violations	Low Risk, no recent RCRA violations
2015	**Firestone Polymers, Firestone Synthetic Rubber & Latex Company**, drainage canal intersecting	2,400 feet north	30.038288	-93.786072	CERCLIS NFRAP, CORRACTS, RMP, RCRA-LQG, T 2-TX	Numerous past NPDES violations resulting in penalties, RCRA permit in violation for manifest	Low Risk, current RCRA manifest violation
2015	**PrintPack, Inc.**, drainage canal intersecting	1,150 feet north	30.037789	-93.776636	RCRA-SQG	No past violations found	Low Risk, no violations

Note: Where a facility borders a project alignment for some distance, the start and end points are indicated by North (N), South (S), East (E), and West (W) end points in the tables.

There are seven major HTRW sites and facilities near or adjacent to the Orange County levee and floodwall alignment corridor identified from the research conducted. These sites consist of industrial facilities currently operating that are listed in databases identifying the generation, handling, or release of hazardous materials and waste. The largest of these, DuPont Chemical Corporation, maintains several large wastewater treatment and cooling ponds along the tentative alignment. No pipelines were identified crossing the alignment in Orange County.

The general HTRW risk for the levee alignment in Orange County is classified as *Low*, since no unresolved current or recent hazardous material releases were found, and no significant recent RCRA or CWA permit violations were identified. The HTRW facilities indicated should be more thoroughly investigated with visual inspections and interviews with facility managers to confirm the potential HTRW risks along the levee alignment prior to construction or more detailed design.

Jefferson County-Port Arthur Corridor

The Jefferson County and Port Arthur levee and floodwall alignment corridor comprises approximately 45.6 miles around the cities of Port Arthur, Groves, and Port Neches, Texas, as well as around the Exxon Mobil refinery in Beaumont, Texas (Figure 5). The corridor runs near 11 major petroleum and chemical facilities, including the Exxon Mobil refinery, DuPont Chemical Corporation, the Huntsman refinery, the Texaco refinery, the Total-BASF refinery, the Valero refinery, and the Motiva Enterprises refinery, as well as numerous petroleum and chemical tank farms and loading facilities. The locations of the major industrial facilities are indicated with shaded facility boundaries in Figures 6, 7, 8, and 9. The Federal and state hazardous materials database listings for all facilities and prior events are found in Table 2, along with the latitude and longitude locations of the sites along the project corridor alignment. For sites other than a single point, a location is given for each end of the site that intersects the corridor alignment. There are numerous pipelines crossing the levee alignment in Jefferson County transporting hazardous materials for shipment or further processing, as indicated in Figures 6, 7, 8, and 9. These pipeline crossings are identified as points of concern along the tentative alignment where special caution should be exercised during construction to avoid damage to the pipelines and release of hazardous materials into the environment.

Most of the refineries and chemical plants have numerous Clean Air Act violations in the past or currently in effect due to stack emissions. No currently active spills or land/water releases of hazardous materials were found. The Star Lake Canal, emanating from the Huntsman Refinery, runs adjacent to the Jefferson County alignment and is listed as an active NPL site due to past release of wastewater and storm runoff containing hazardous materials (Figure 8). This canal is scheduled for remediation by USEPA with proposed removal of contaminated bottom sediments. Due to the presence of toxic sediments, this canal would be considered a *High* risk; however, minor construction on the existing levee along the canal would not expose any sediments within the canal. Therefore, despite the large number of potential HTRW release facilities, the Jefferson County-Port Arthur project area is classified as a generally *Low* risk for HTRW. The HTRW facilities indicated should be more thoroughly investigated with visual inspections and interviews with facility managers to confirm the potential HTRW risks along the alignment corridor prior to construction or more detailed design. Coordination with USEPA remediation of the Star Lake Canal would also be required. Some large refineries and chemical plants are shown in the figures, even though they are not within 0.25 mile of the project alignment, since a major release from these facilities could affect the project corridor.

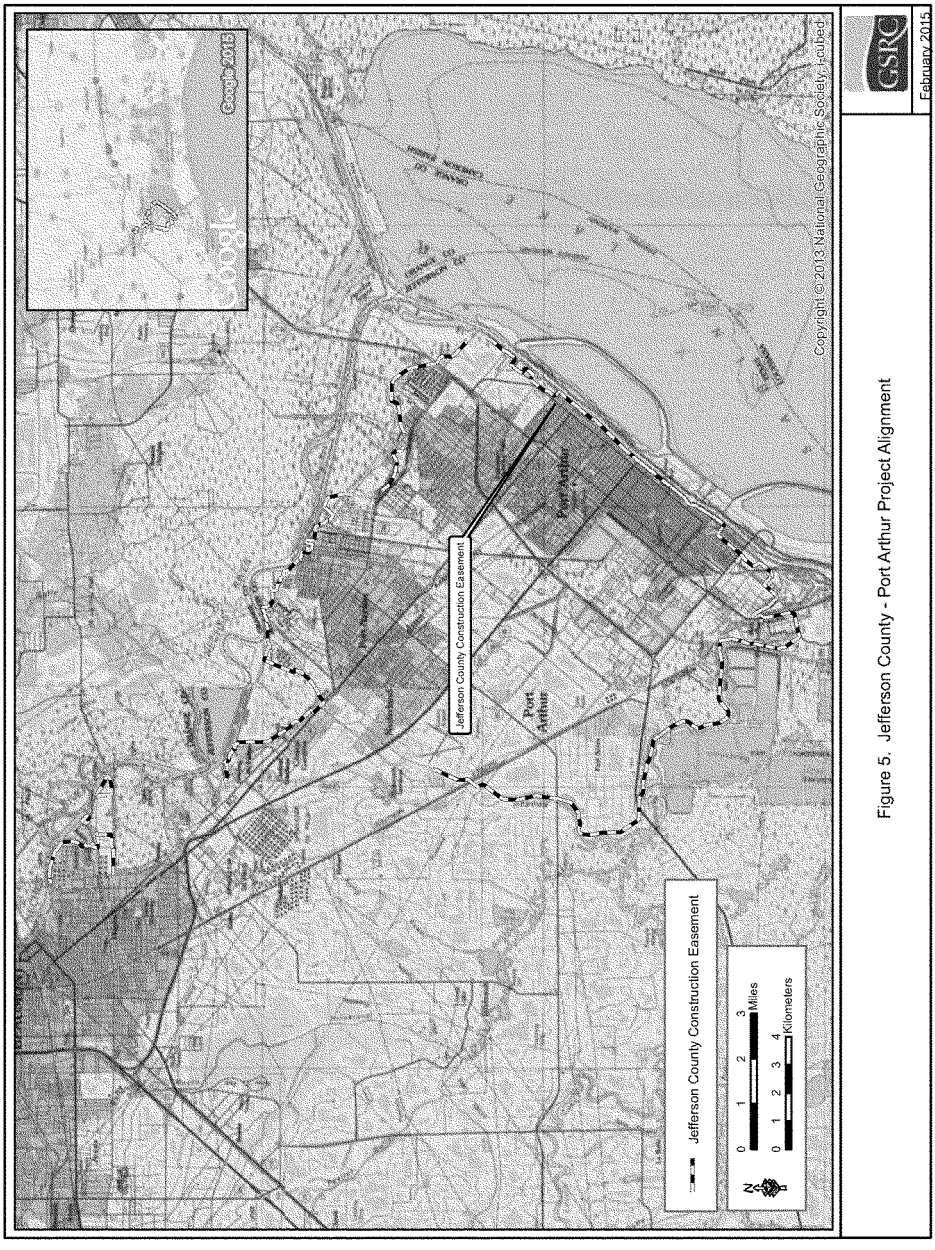

Figure 5. Jefferson County - Port Arthur Project Alignment

Figure 6. Beaumont HTRW Sites

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Figure 7. Jefferson County - Port Arthur HTRW Sites Map 1

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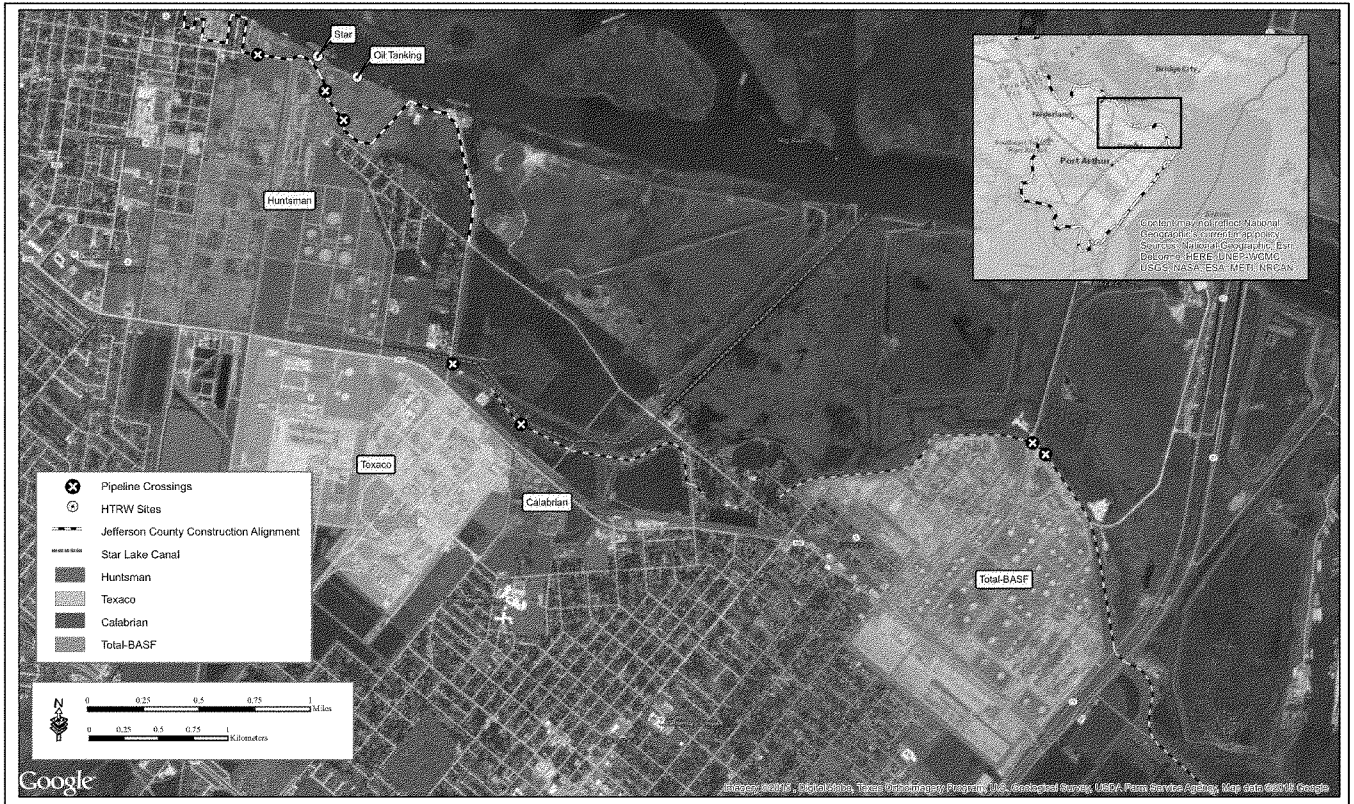

Figure 8. Jefferson County - Port Arthur HTRW Sites Map 2

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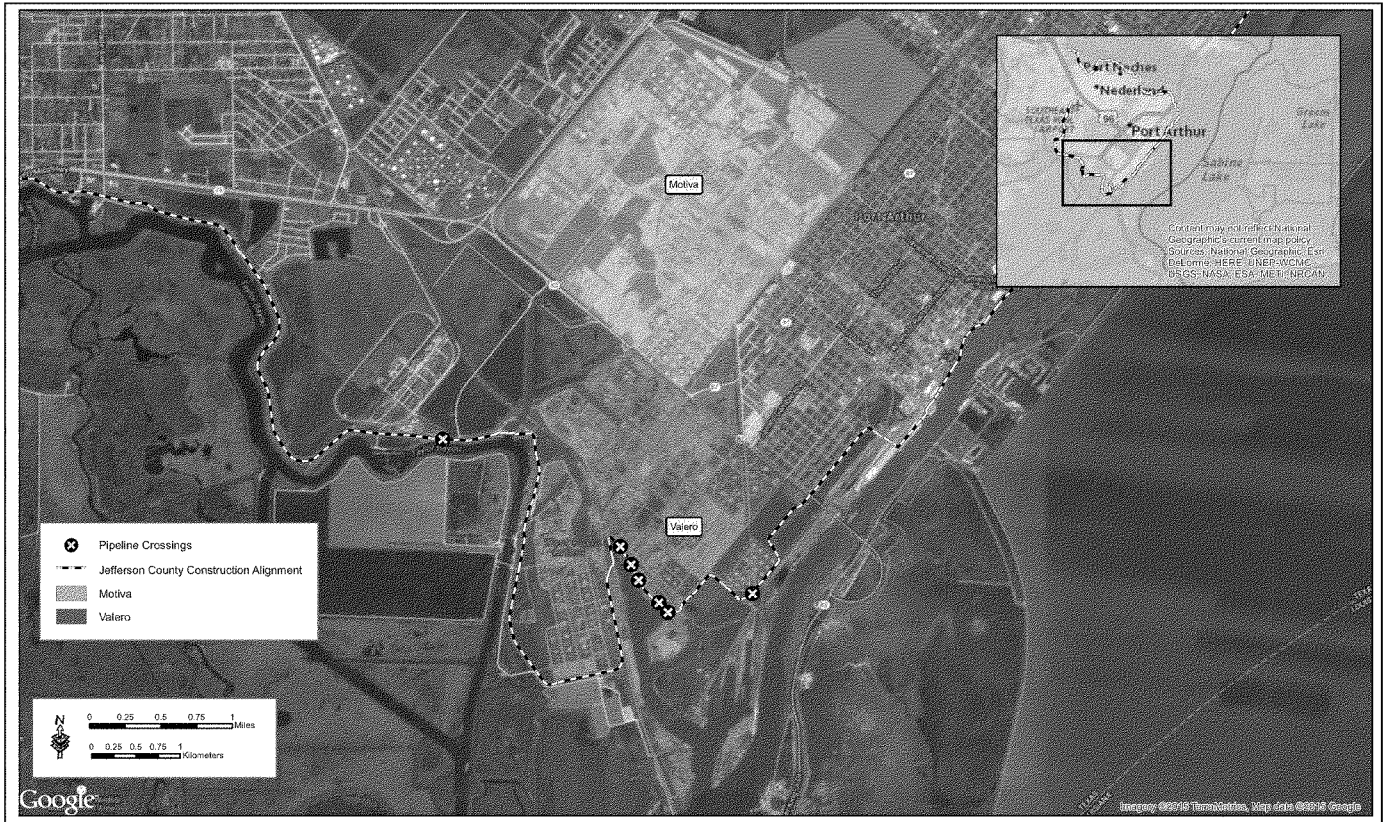

Figure 9. Jefferson County - Port Arthur HTRW Sites Map 3

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Table 2. Jefferson County-Port Arthur Construction Corridor HTRW Sites

Date	Description	Distance from Corridor	Latitude*	Longitude*	Database Listing	Contaminants of Concern	Risk Analysis
2015	**ExxonMobil Refinery**	Adjacent	N30.076237 S30.055130 PL30.076578 PL30.076650 PL30.075969 PL30.073820 PL30.061092	N-94.071964 S-94.067497 PL-94.071180 PL-94.067250 PL-94.064658 PL-94.059460 PL-94.054895	CORRACTS, RAATS, RCRA-IC-EC, RMP, TRIS, RCRA-NONGEN, IND HAZ WASTE-TX, AFS, SPILLA-TX, FA-TX, UST-TX, T2-TX, FTTS-INSP, CERCLIS-NFRAP	Petroleum products, petrochemicals	Low Risk, no recent RCRA violations
2015	**Mobil Chemical Company**	Adjacent	30.059844	-94.175100	RCRA-TSDF, RCRA-NONGEN, ICIS-NPDES, TSCA	Industrial chemicals	Low Risk, no recent RCRA violations
2015	**DuPont Beaumont Works**	Adjacent	N30.020781 S30.007482 PL30.019668 PL30.019512 PL30.019380 PL30.019460 PL30.019319	N-94.035557 S-94.020509 PL-94.026980 PL-94.026636 PL-94.026127 PL-94.025391 PL-94.025051	CORRACTS, COAL GAS,	Industrial chemicals	Low Risk, no recent RCRA violations
2015	**Star-Motiva Enterprise**, Spur 136, refinery site	Adjacent	29.992446	-93.941171	RCRA-TSDF, RCRA-LQG	Petroleum products, petrochemicals	Low Risk, no recent RCRA violations
2015	**ChemTreat**	Adjacent	W29.990788 E30.006014 PL30.008385 PL30.007448 PL30.007195 PL30.007414 PL30.007519 PL30.007735 PL30.008607 PL30.008938 PL30.007522	W-94.004383 E-93.964307 PL-93.989742 PL-93.985832 PL-93.983449 PL-93.982740 PL-93.979995 PL-93.975545 PL-93.973193 PL-93.971318 PL-93.970163	T2-TX, RCRA-CESQG, HMIRS (DOT), RCRA-LQG, RAATS, RMS, SSTA, TRIS	Organic and industrial chemicals and waste	Low Risk, no recent violations
2015	**OilTanking Port Neches, LLC., Motiva Terminal, Port Neches Terminal, Flint Hills Resources Terminal**	Adjacent	29.991272 PL29.990396 PL29.988502	-93.937148 PL-93.939531 PL-93.938145	T2-TX, RCRA-CESQG. RCRA-LQG, BRS, ICIS, AFS, RCR, COAL GAS, RAATS	Oil and petroleum products storage and shipping	Low Risk, CWA violations in 2013, significant CAA violations
2010	Former tank farm	550 feet south	30.006058	-93.968661	N/A	Tank farm active from <1938 to 2010	Low Risk, tanks removed
2015	**Star-Motiva Enterprises Port Neches Terminal Plant**	Adjacent	29.886540	-93.963144	RAATS, ERNS, RCRA-LQG, BRS, ICIS, T2-TX, CORRACTS	RCRA metals	Low Risk, oil spill in river in 2014 remediated
2015	**Trans-Global Solutions, Erickson Refining**	Adjacent	30.001459	-93.957237	CORRACTS, RAATS, BROWNFIELDS-TX, VCP-TX	Surface disposal, oil terminal	Low Risk, no current action
2015	**Huntsman Refinery**	Adjacent	W29.994666 E29.989649 PL29.992718	W-93.945494 E-93.932334 PL-93.944609	RCRA-LQG, T2-TX, DOCKET, TRIS, TOSCA-PLANT, RAATS, AFS, RCRA-NONGEN. RCRA-TSDF, CORRACTS	Petroleum products, petrochemicals	Low Risk, no recent RCRA violations
2015	**Star Lake Canal**	Adjacent	W29.972980 E29.966582	W-93.972890 E-93.916250	NPL	Petroleum products, heavy metals, PCBs	High Risk, cleanup and remediation scheduled, construction coordination required
2015	**Texaco Chemical Company Neches Plant**	Adjacent	W29.989297 E29.968645 PL29.972692 PL29.968799	W-93.931014 E-93.924453 PL-93.929838 PL-93.924668	RCRA-TSDF, RCRA-LQG, FTTS, CERCLIS-NFRAP	Petroleum products, petrochemicals	Low Risk, no recent RCRA violations

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Table 2, continued

Date	Description	Distance from Corridor	Latitude*	Longitude*	Database Listing	Contaminants of Concern	Risk Analysis
2015	**Calabrian Corporation**	900 feet west	29.965704	-93.923863	CERCLIS-NFRAP, RCRA-NONGEN, TRIS, DOCKET, T2-TX, TRIS, RMP, RAATS, RCRA-CESQG, RCRA-LQG	Chemicals	Low Risk, site required no further action in 1979
2015	**Total Refinery-BASF Chemicals**	Adjacent	W29.965529 E29.954440 PL29.968329 PL29.967866 PL29.967116	W-93.901281 E-93.880116 PL-93.982561 PL-93.886376 PL-93.885393	RCRA-TSDF, RMP,	Petroleum products and petrochemicals, past CAA violations with significant penalties, full range of organic, petroleum, and metals waste releases	Low Risk, no recent CWA or RCRA violations
2015	**Valero Refinery**	Adjacent	E29.850291 W29.856403 PL29.846451 PL29.944990 PL29.844470 PL29.845460 PL29.847722 PL29.849298 PL29.384972 PL29.851135 PL29.861893	E-93.952668 W-93.981225 PL-93.955676 PL-93.964052 PL-93.965528 PL-93.966585 PL-93.968972 PL-93.969865 PL-93.970179 PL-93.971134 PL-93.991987	RCR, ICIS, AFS	Petroleum products and petrochemicals, past and current CAA violations	Low Risk, recent and current RCRA manifest violations, no releases

* PL=pipeline crossing

Freeport Corridor

The Freeport project area consists of levee and floodwall protection around the cities of Clute, Oyster Creek, and Freeport, Texas, extending along Oyster Creek in the northeast, down to the Intracoastal Waterway, then north along both sides of the Dow Access Canal, around the port facilities at Freeport, west to the Bryan Mound Strategic Petroleum Reserve on the Brazos River, and then north along the Brazos River to the Dow Chemical plant. The entire levee alignment comprises 43.2 miles of levees and floodwalls (Figure 10). Nine major industrial facilities are located in the vicinity of the proposed levees and floodwalls in the Freeport area.

The largest of these is the Dow Chemical facility, which includes three large chemical processing plants. Other chemical and refining facilities are located in close proximity to the Dow operations, and include numerous shipping points along the Port of Freeport, and Intracoastal Waterway shipping corridors. The major industrial plants with HTRW concerns are indicated in Figures 11, 12, and 13 with shaded property boundaries. Smaller sites of less concern are also indicated. The Federal and state hazardous materials database listings for all facilities and prior events are found in Table 3, along with the latitude and longitude locations of the sites along the project alignment corridor. For sites other than a single point, a location is given for each end of the site that intersects the alignment. Dow Chemical Company has three plant sites in the area, Dow Chemical Company Texas Operations, Dow Chemical Oyster Creek Site, and Dow Chemical Shipping Site located along the Intracoastal Waterway.

There are numerous pipeline crossings along the tentative levee and floodwall alignments, and these are also indicated in Figures 11, 12, and 13. Many of the pipeline crossings transport hazardous materials between processing facilities, and others transport finished products to shipping terminals. These pipeline crossings are identified as points of concern along the alignments where special caution should be exercised during construction to avoid damage to the pipelines and release of hazardous materials into the environment. Some sites are not shown on the maps due to their lack of risk to the project corridor.

The tentative alignment corridor also crosses the Bryan Mound Strategic Petroleum Reserve facility located on the Brazos River. There is a large, 48-inch buried pipeline connecting the Bryan Mound facility to the refineries at Texas City to the northeast, but the exact location of this pipeline is not known.

The general risk level for the Freeport area is indicated as *Low* risk, since no current or recent unresolved RCRA or CWA releases were identified for any of the industrial facilities in the Freeport area. Many of the facilities have ongoing CAA violations due to stack emissions. The HTRW facilities indicated should be more thoroughly investigated with visual inspections and interviews with facility managers to confirm the potential HTRW risks along the alignment corridor prior to construction or more detailed design.

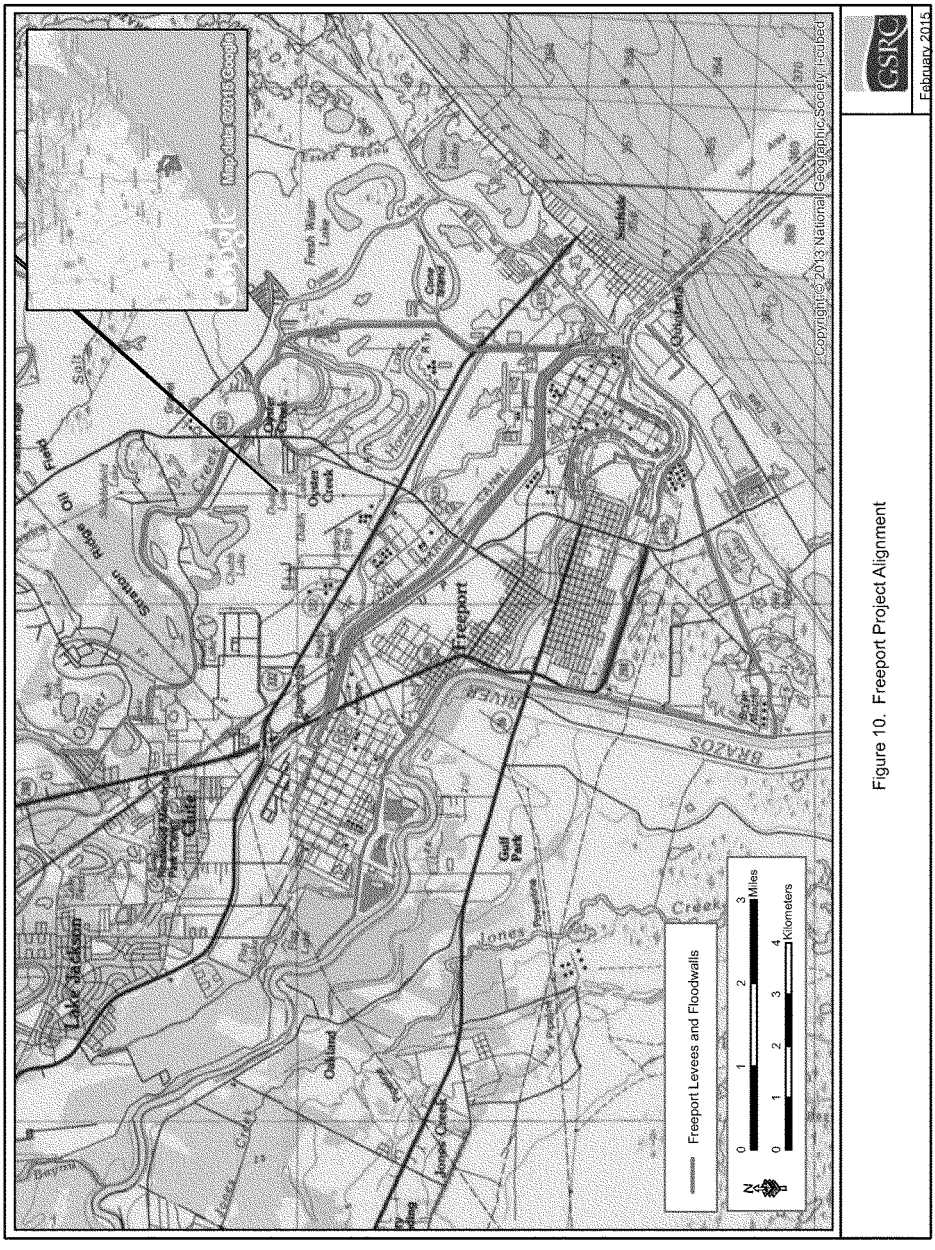

Figure 10. Freeport Project Alignment

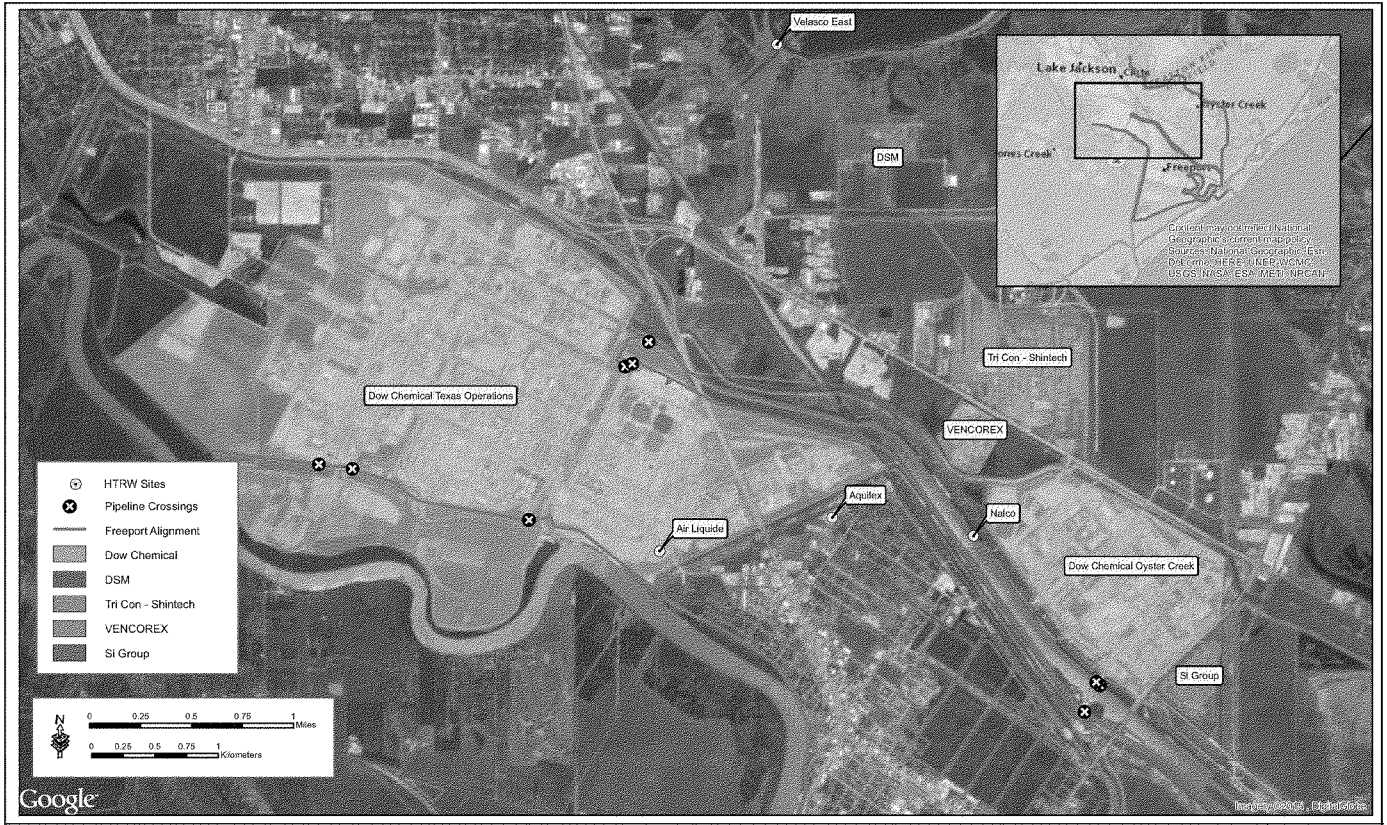

Figure 11. Freeport HTRW Sites Map 1

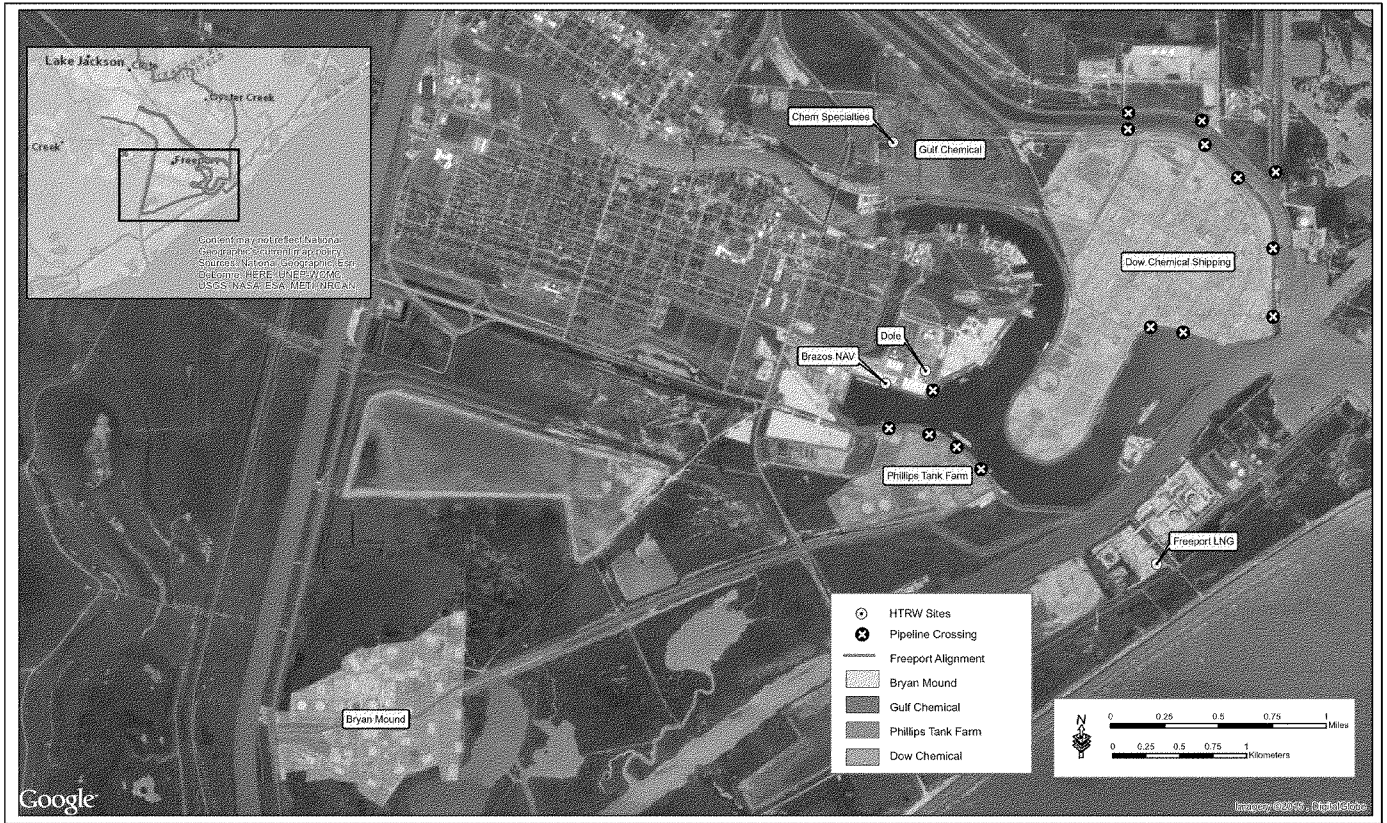

Figure 12. Freeport HTRW Sites Map 2

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Figure 13. Freeport HTRW Sites Map 3

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Table 3. Freeport Levees and Floodwalls Corridor HTRW Sites

Date	Description	Distance from Corridor	Latitude*	Longitude*	Database Listing	Contaminants of Concern	Risk Analysis
2015	**Velasco Drainage District**, East Levee Pump Station Intersecting	Adjacent	29.018125	-95.377201	PST-TX, T2-TX	No past violations found	Low Risk, site stores small quantities of diesel, no reported spills
2015	**Velasco Drainage District**, office building and equipment warehouse	Adjacent	29.030164	-95.384500	T2-TX, PST-TX, UST-TX	No past violations found	Low Risk, site stores small quantities of gasoline , diesel, and hazardous chemicals, no reported spills
2015	**Vernor Material Pit 2**, construction sand and gravel pit, petroleum storage tank located at site	1,107 feet east	29.012213	-95.325799	PST-TX	No past violations found	Low Risk, site stores small quantities of refined petroleum fuel in an above ground storage tank
2015	**Montgomery Tank Lines**, General trucking shipping and receiving facility	600 feet southwest	29.005582	-95.327108	RCRA_NONGEN, RAATS, IND HAZ WASTE – TX, UST-TX	Numerous past RCRA violations, currently in violation of RCRA permit for manifest	Low Risk, site handles and transports limited quantities of hazardous materials, no reported spills, UST removed from ground 1/31/1990
2015	**Turtle Cove Lot Owners Assoc., Inc.**, Marina	600 feet east	29.00528	-95.305931	T2-TX	Chlorine, fuel, no past violations found.	Low Risk, site stores limited quantity(≤ 1000 gallons) of fuel and ≤ 500 gallons of chlorine in ASTs, no reported spills
2015	**Nalco Freeport Plant**, chemical plant, pipelines adjacent, pipelines intersecting	Adjacent, co-located with Dow Oyster Creek facility	E28.971264 W28.985289	E-95.347570 W-95.362111	RMP, CORRACTS, RAATS, RCRA_LQG, T2-TX	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past RCRA and CWA/NPDES violations, currently in violation of RCRA permit for manifest	Low Risk, site generates and stores large quantities of hazardous materials.
2015	**Buccaneer Gas Plant**, crude petroleum and natural gas processing plant,	2,195 feet west	28.976987	-95.315579	COAL GAS	Crude petroleum and natural gas , no past violations found	Low Risk, site processes crude petroleum and natural gas brought on site from a pipeline system, no reported spills
2015	**Aquilex Hydrochem Inc.**, industrial cleaning, office building and equipment warehouse,	2,199 feet west	28.984552	-95.371929	HMIRS (DOT)	Industrial chemicals and solvents, corrosive/caustic materials, no past violations found	Low Risk, site generates and stores limited quantities of hazardous chemical used in industrial cleaning processes, one spill of 2 gallons of 50% caustic solution was reported 8/13/1997, no remediation was required
2015	**Tejas Power**, natural gas transmission and distribution, drainage canal intersecting	Adjacent	28.972154 28.969880	-95.312046 -95.310607	IND HAZ WASTE-TX	Crude petroleum and natural gas, fuel no past violations found	Low Risk, site generates and stores small quantities of hazardous materials, no reported spills
2015	**Galveston Island Gathering System**, natural gas gathering system, drainage canal intersecting	Adjacent	28.971988 28.969880	-95.312520 -95.310607	COAL GAS	Crude petroleum and natural gas, fuel, ignitable waste, no past violations found	Low Risk, site generates and stores small quantities of hazardous materials. No reported spills
2015	Chemical pipeline crossing		PL28.953970	PL-95.309568	N/A	Unknown	
2015	**Dow Chemical Company, Texas Operations**, chemical manufacturing plant, drainage canal intersecting, storage tanks adjacent, pipelines adjacent, pipelines intersecting	Adjacent	W28.988025 E28.980275 N28.996764 S28.988593 PL28.996796 PL28.983943 PL28.987601 PL28.987335 PL28.994996 PL28.995223	W-95.418540 E-95.385853 N-95.386950 S-95.366624 PL-95.387094 PL-95.396517 PL-95.413620 PL-95.410900 PL-95.388963 PL-95.388383	DOT OPS, PIPELINES, RCRA-TSDF, RCRA-LQG, TRI	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past RCRA and CWA/NPDES violations with significant penalties, currently in violation of RCRA permit for manifest	Low Risk, site generates and stores large quantities of hazardous material
2015	**Dow Chemical, Oyster Creek**, chemical manufacturing plant, drainage canal intersecting, railway intersecting, wastewater treatment ponds adjacent, pipelines intersecting	Adjacent	PL28.973006 PL28.973219 PL28.971087	PL-95.350005 PL-95.350309 PL-95.351212	CORRACTS, RCRA-TSDF, RCRA-LQG, TRIS	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past RCRA and CWA/NPDES violations with significant penalties, currently in violation of RCRA permit for manifest	Low Risk, site generates and stores large quantities of hazardous material

Table 3, continued

Date	Description	Distance from Corridor	Latitude*	Longitude*	Database Listing	Contaminants of Concern	Risk Analysis
2015	**Dow Chemical, Shipping**, chemical manufacturing plant, drainage canal intersecting, railway intersecting, wastewater treatment ponds adjacent, pipelines intersecting	Adjacent	PL28.949513 PL28.958024 PL28.944908 PL28.958439 PL28.957334 PL28.956393 PL28.954216 PL28.944917 PL28.943743 PL28.944034	PL-95.309665 PL-95.315321 PL-95.309574 PL-95.320980 PL-95.320980 PL-95.315062 PL-95.312451 PL-95.309569 PL-95.316439 PL-95.318939	DOT OPS, PIPELINES, RCRA-TSDF, RCRA-LQG, TRI	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past RCRA and CWA/NPDES violations with significant penalties, currently in violation of RCRA permit for manifest	Low Risk, site generates and stores large quantities of hazardous material
2015	**Gulf Chemical, Chemical Specialties Inc.**, chemical manufacturing plant	Adjacent	28.956143	-95.338945	RCRA-LQG, TRIS	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past RCRA and CWA/NPDES violations with significant penalties, currently in violation of RCRA permit-informal	Low Risk, site generates and stores large quantities of hazardous material
2015	**SI Group Operations Texas**, chemical manufacturing plant, drainage canal adjacent	1,757 feet east	28.972379	-95.341854	RMP, RCRA-LQG	Organic and industrial chemicals and waste, ignitable waste, corrosive waste. Numerous past CWA/NPDES, CAA, and RCRA violations	Low Risk, site generates and stores large quantities of hazardous material. Not currently in violation of any Federal regulation or permit
2015	**Freeport LNG Receiving Storage**, liquefied natural gas import terminal, drainage canal adjacent	Adjacent, across the shipping channel	28.928100	-95.318117	RAATS	Crude petroleum and natural gas, fuel, ignitable waste , 3 past CAA violations and 1 past CWA violation	Low Risk, site generates and stores small quantities of hazardous materials. No reported spills, separated by shipping channel
2015	**Air Liquide Freeport HYCO Plant**	Adjacent, co-located with Dow	28.981913	-95.385863	TRIS, RCRA-CESQG	Organic and industrial chemicals and waste, 2 past CWA/NPDES violations found	Low Risk, site generates and stores small quantities of hazardous materials, no current violations, no spills reported
2015	**Bryan Mound Strategic Petroleum Reserve**, crude oil storage, petroleum bulk stations, pipeline intersecting, storage tanks adjacent	Adjacent	E28.919680 W28.917303	E-95.369450 W-95.385544	IND HAZ WASTE-TX, RAATS, T2-TX, RCRA-CESQG, TRI	Crude petroleum, No past violations found	Low Risk, site receives and stores large quantities of crude oil and unrefined petroleum products, no spills reported
2015	**Dole Fresh Fruit**, produce shipping facility	Adjacent	28.940818 PL28.939497	-95.336110 PL-95.335519	T2-TX	No past violations found	Low Risk, site generates and stores small quantities of hazardous materials, no spills reported
2015	**Brazos River Harbor NAV District**, marine shipping terminal	Adjacent	28.939905	-95.339160	UST-TX	No past violations	Low Risk, UST removed from ground 3/15/1999. No spills or leaks reported
2015	**DSM Nutritional Products**, manufacturing plant	0.35 mile south	29.011557	-95.367157	RCRA-LQG, TRIS	Past CWA and RCRA violations	Low Risk, no recent CWA violations
2015	**Phillips Tank Farm,** loading dock	Adjacent	PL28.936885 PL28.936515 PL28.935719 PL28.934275	PL-95.338848 PL-95.335747 PL-95.333615 PL-95.331719	N/A	Unknown, probably unrefined petroleum	Low Risk, potential spills loading petroleum products and chemicals
2015	**Tri Con - Shintech**	2,500 feet east	28.994118	-95.356273	SPILLS-TX, RMP, ICIS, T2-TX	No current violations or spills	Low Risk due to distance
2015	**VENCOREX**	1,300 feet east	28.990266	-95.360870	ICIS	NO other information available	Low Risk due to distance and no violations

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix O

WETLAND VALUE ASSESSMENT MODELING

May 2017

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1 MODEL APPROVAL FOR USE

In the Review Plan for the Sabine Pass to Galveston Bay, Texas (S2G), Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Study, Galveston District proposed to use the Wetland Value Assessment (WVA) coastal marsh, swamp and bottomland hardwood community models to evaluate ecosystem impacts. The U.S Army Corps of Engineers (USACE) National Ecosystem Restoration Planning Center of Expertise (ECO-PCX) agreed, noting that while the swamp and bottomland hardwood models are certified, use of the coastal marsh models would require approval by USACE Headquarters (HQUSACE) (Attachment 1). By memo dated May 6, 2014 (Attachment 2), the HQUSACE Model Certification Panel reported that it had reviewed the WVA marsh model in accordance with EC 1105-2-412 and determined that the model and its accompanying documentation are sufficient to approve the Coastal Marsh Community Model Version 1.0 for use on the S2G Feasibility Study. Since several unresolved issues exist with the form of suitability graphs for Variables 1, 2, and 3 and the aggregation methods used to combine marsh and open water habitat units, Galveston District was directed to conduct sensitivity analyses for application of the marsh models using a sensitivity spreadsheet prepared by the Engineering Research and Development Center's (ERDC) Environmental Lab. These analyses have been coordinated with the ECO-PCX and reported in a separate appendix to the Final Integrated Feasibility Report and EIS (FIFR-EIS).

2 STUDY OVERVIEW

The Sabine Pass to Galveston Bay study area encompasses six coastal counties of the upper Texas coast (Orange, Jefferson, Chambers, Galveston, Harris and Brazoria) (Figure 2-1). The study area consists of three watershed-based regions: the Sabine, Galveston, and Brazoria Regions. Although the S2G study addresses coastal storm risk management and ecosystem restoration problems and opportunities within the six-county region, the detailed evaluation of alternatives focused on two regions outlined in Figure 2-1, the Sabine and Brazoria regions. The FIFR-EIS presents a programmatic overview of coastal storm risk problems and opportunities in the Galveston region and a programmatic overview of ER opportunities for the entire six-county study area. This overview provides recommendations for future studies in the Galveston Region; no in-depth alternative analyses were conducted and no recommendations for project construction are made for this region. None of the ER proposals were fully developed or recommended for construction and thus no environmental modeling was conducted.

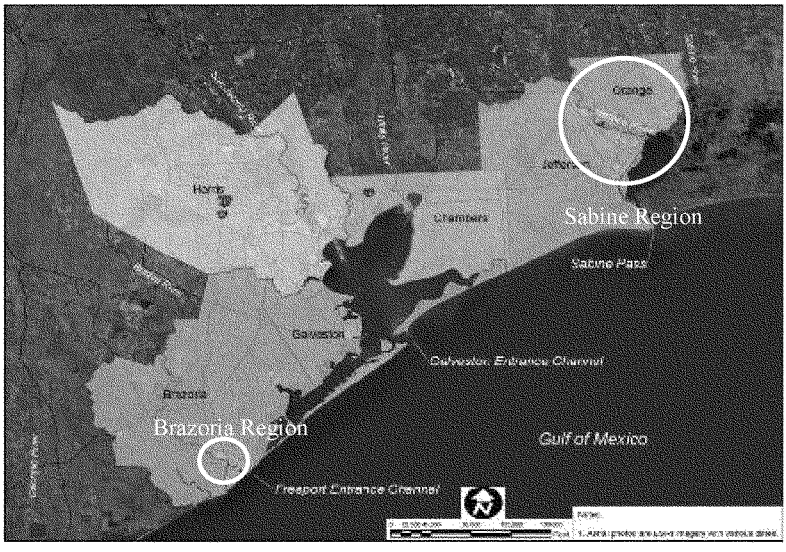

Figure 2-1. Six-County Study Area – Sabine and Brazoria Regions

The S2G Draft Integrated Feasibility Report and EIS (DIFR-EIS) study conducted a detailed evaluation of the following structural plans: 1) the Freeport and Vicinity CSRM Plan (Figure 2-2); 2) the Port Arthur and Vicinity CSRM Plan (Figure 2-3); and 3) the Orange-Jefferson CSRM Plan (Figure 2-4). The Port Arthur and Orange-Jefferson project areas are located in the Sabine

region in the vicinity of Port Arthur, Beaumont, and Orange, Texas, and the Freeport project area is located in the Brazoria region in the vicinity of Freeport, Clute, and Oyster Creek.

The Tentatively Selected Plan (TSP) presented in the DIFR-EIS retained the following elements: Orange 3, Beaumont A, and the Jefferson Main (Figure 2-5). Orange 1 and 2 reaches were eliminated from consideration, as well as Beaumont A and B.

As a result of the final feasibility analyses, additional reaches of the Orange-Jefferson CSRM plan were eliminated from further consideration. Beaumont A and most of the Jefferson Main reach were eliminated and the final Recommended Plan, which is shown in Figure 2-6, is comprised of the Orange 3 reach presented in the TSP, and a 1,900 feet-long new levee in Jefferson County, called the Port Arthur Addition. The Addition will be incorporated into the Port Arthur and Vicinity CSRM Plan.

Figure 2-2. Existing Freeport HFP System

Figure 2-3. Existing Port Arthur HFP System

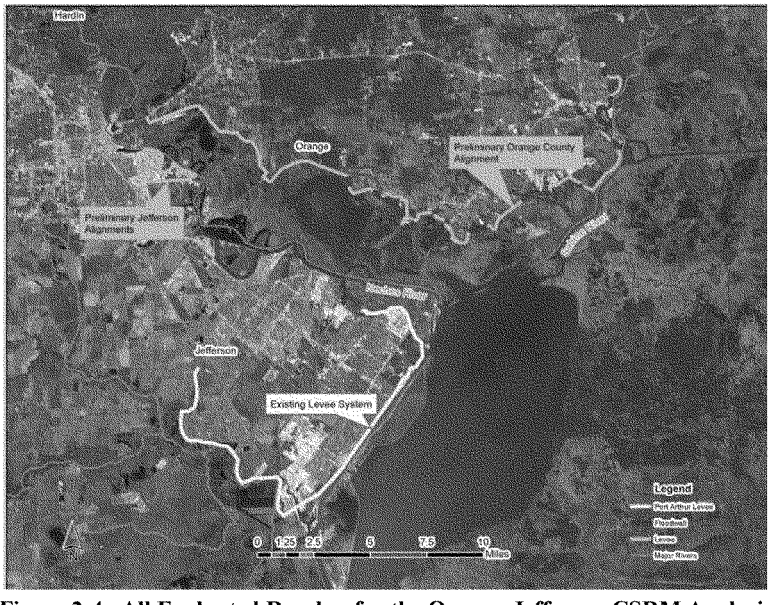

Figure 2-4. All Evaluated Reaches for the Orange-Jefferson CSRM Analysis

Figure 2-5. Orange-Jefferson CSRM TSP Plan

Figure 2-6. Recommended Plan for Orange and Port Arthur Addition CSRM

This WVA modeling appendix focuses on an evaluation of the final Recommended Plan and its two remaining elements, the Orange CSRM Plan. The Freeport and Port Arthur and Vicinity CSRM plans involve improvements to existing Hurricane Flood Protection (HFP) projects. WVA evaluation of the Freeport and Port Arthur CSRM Plans was not needed because these projects would have no wetland impacts. Construction would be confined primarily to the existing project rights-of-way, and no wetland or other significant habitats would be affected.

3 EXISTING CONDITIONS IN THE STUDY AREA

3.1 WETLAND VEGETATION COMMUNITIES

In the study area, coastal marshes occur in four types that are differentiated by salinity, elevation, and soil regimes. Information on indicator species, salinity regime, and lists of vegetation community species provided by marsh type below was completed from references cited here (The Nature Conservancy, 2006; USFWS, 1998; White et al., 1987).

Salt marsh is located primarily along the Gulf shoreline and the shores of Sabine Pass. Small areas of salt marsh can also be found north of Sabine Lake, primarily in areas regularly exposed to higher salinities in the deep draft navigation channels. Subjected to regular tidal inundation, low saline marsh is dominated by smooth cordgrass/oystergrass (*Spartina alterniflora*) and often accompanied by seashore saltgrass (*Distichlis spicata*), blackrush (*Juncus romerianus*), saline marsh aster (*Aster tenuifolius*), and marshhay cordgrass/wiregrass (*S. patens*). The dominant species in high salt marsh, which is subject to less-frequent tidal inundation, is glasswort (*Salicornia* spp.). Relative to other marsh types, salt marsh typically supports fewer terrestrial vertebrates although some shorebird species are common.

Brackish marshes in the study area are located primarily along the lower reaches of the Neches and Sabine Rivers, and the north shore of Sabine Lake. The dominant species in low brackish marsh is saltmarsh bulrush (*Scirpus robustus*); seashore saltgrass and marshhay cordgrass are co-dominant species in high brackish marsh. These species are often accompanied by marsh pea (*Vigna luteola*), waterhemp (*Amaranthus tamariscinus*), and dwarf spikerush (*Eleocharis parvula*). Brackish marshes are extremely important as nurseries for fish and shellfish. Other characteristic species include fur-bearers and shorebirds.

Intermediate marshes are subjected to periodic pulses of salt water and maintain a year-round salinity in the range of 3 to 4 parts per thousand (ppt). In the study area, they are the major marsh type along the Neches and Sabine Rivers. The diversity and density of plant species are relatively high with marshhay cordgrass the most dominant species in high marsh. Co-dominant species in low marsh are seashore paspalum (*Paspalum vaginatum*), Olney bulrush (*S. americanus*), California bulrush/giant bulrush (*S. californicus*), and common reedgrass/roseau cane (*Phragmites australis*); bulltongue (*Sagittari lancifolia*) and sand spikerush (*E. montevidensis*) are also frequent. Intermediate marshes are considered extremely important for many wildlife species, such as alligators and wading birds, and serve as important nursery areas for larval marine organisms.

Freshwater marshes are heterogeneous, with local species composition governed by frequency and duration of flooding, topography, substrate, hydrology, and salinity. Tidal fresh marsh is located in the riparian zone of the Neches and Sabine rivers. Co-dominant species in low marsh are maidencane (*P. hemitomen*), giant cutgrass (*Zizaniopsis milacea*), and bulltongue. Co-dominant species in high marsh are squarestem spikerush (*E. quadrangulata*) and marshhay cordgrass. Other characteristic species include American lotus (*Nelumbo lutea*), watershield (*Brasenia screben*), duckweed (*Lemna* spp.), and fanwort (*Cabomba caroliniana*). Salinity rarely increases above 2 ppt, with a year-round average of approximately 0.5 to 1 ppt. Tidal fresh marshes support extremely high densities of wildlife, such as migratory waterfowl.

Upstream of the coastal marshes in Sabine Lake estuary, the area north of Interstate 10 is dominated by dense bottomland hardwood forests and cypress-tupelo swamps. These wetland forests cover an intricate network of sloughs and sandy ridges formed within the rivers' relict meander belts. Bald cypress (*Taxodium distichum*) – tupelo-gum (*Nyssa aquatica*) swamps grow in the inundated areas between the ridges, and floodplain hardwood forest of oaks (*Quercus nigra, Q. phellos, Q. alba, Q. lyrata*), sweetgum (*Liquidambar styraciflua*), hickories (*Carya* spp.), American elm (*Ulmus americanus*), maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), American holly (*Ilex opaca*), and loblolly pine (*Pinus taeda*) grow atop the sandier ridges. In general, these are healthy, stable habitats. The hardwoods, and especially the cypress trees, have been logged repeatedly since the turn of the century and as recently, perhaps, as the 1950s (USACE, 1998). Pockets of bottomland hardwood forest remain in the uplands south of Interstate 10, and cypress swamp can still be found in low lying drainages such as Cow and Adams Bayous. Though much of the forest is secondary growth, the swamp and bottomland hardwood habitats have medium to high value for food and cover to resident and migratory fish and wildlife.

3.2 LOSS OF EMERGENT MARSH

Marshes in the study area are severely threatened, with the conversion of numerous large marshes to open water documented by various mapping studies (Barras et al., 2004; Texas Parks and Wildlife Department (TPWD), 2003). Immediately east of the study area in the Chenier Plain subregion of coastal Louisiana, a net land loss of 21 percent between 1978 and 2000 has been reported (USACE, 2004: MR 2-24; Appendix B). In Texas, the most-extensive losses of interior coastal wetlands in the state (12,632 acres between 1930 and 1978) have occurred in the Neches River delta. In total, over 90 percent of the emergent marshes in the Lower Neches River delta have been converted to open water (White et al., 1987; Morton and Paine, 1990), which is more than half of the total wetland loss in the State of Texas (Sutherlin, 1997). The breakup of previously intact emergent marsh is apparent, and shoreline erosion is occurring around larger lakes. In the conversion of marsh to open water, topsoils and nutrients have eroded, leaving dense

clay substrates that do not support marsh vegetation. More recently, however, the rate of land loss in the Chenier Plain region appears to have ameliorated and interior marshes appear to have stabilized. Over the last 20-30 years, rates of loss have declined and marshes do not appear to be undergoing rapid conversion of large areas to open-water like areas to the east in Louisiana (LCWCR/WCRA, 1998; TPWD, 2003; USACE, 2004; USGS 2014). For example, 61 percent of the total land loss in the Chenier Plain region occurred between 1978 and 1990 as compared to 39 percent between 1990 and 2000 (Barras et al., 2004). A recent analysis of satellite images covering the period from 1984 and 2014 in Orange County documented much lower marsh loss rates, as well as documenting increases in areas with active marsh restoration projects (USGS 2014).

3.3 EFFECTS OF RECENT HURRICANES

Three large hurricanes have occurred in and near the study area within the last ten years. In 2005, Hurricane Katrina devastated areas to the east but did not affect this area. The same year, Hurricane Rita's storm surge at Louisiana Point was 10.6 feet as recorded by USGS sensors (Farris et al., 2007). The surged deposited 3.3 feet of new sediment on the Hackberry Beach chenier ridge and inundated thousands of acres of coastal marsh. Bar welding of nearshore sediments to the lower shore face was also evident (Guidroz et al., 2006). Immediately after the storm, hundreds of acres of marshhay cordgrass marsh in Cameron Parish appeared to have been severely impacted by extensive flooding of high-salinity waters. When the water finally subsided, the vegetation in some areas appeared dead, and the marsh had areas that were 30 to 50 percent devegetated. Over time, porewater salinity levels should decline as rainwater flushes salinity from the system (Farris et al., 2007).

In 2008, Hurricane Ike struck the north Texas Gulf Coast, with the eye passing over the city of Galveston, approximately 60 miles southwest of the study area. Ike's hurricane-force winds, record-breaking levels of storm surge, and extensive coastal and inland flooding had a direct impact on the coastal wetlands, including significant marsh loss, scouring, and compression (Federal Emergency Management Agency [FEMA], 2008). The secondary effects of saltwater intrusion, in which freshwater habitats and species are stressed by elevated soil salinities from the surge overwash and sediments, may not be fully realized for years to come.

Chenier plain marshes in the Sabine and Neches River floodplains are concave in shape, and under normal conditions, do not drain as rapidly as tidal fringe marshes. The normal drainage of these marshes is also impaired by numerous human-caused hydrologic modifications within and adjacent to these marshes, such as the GIWW, the Sabine-Neches Waterway, numerous roads and other infrastructure (FEMA, 2009). In addition to inundating salt marshes near the coast, tidal surges resulted in significantly increased salinities in large areas of swamp and freshwater marsh

in the Sabine system for months after the storms (FEMA, 2009). The marshes of Sabine Lake are comprised of generally brackish and intermediate vegetation communities which were not tolerant of the higher salinity of Ike's storm surge. Therefore, the high salinity water was either lethal to these plants or had sub-lethal effects ranging from reduced seed production, vegetative stress and increased vulnerability to disease (Linthurst and Seneca, 1981; Howard and Mendelssohn, 1999). Further compounding the problem is the organic soils that are typical of these marshes, and when exposed to saline waters, can produce high amounts of hydrogen sulfide, which can lead to sulfide toxicity and death in marsh plants. Organic soils are also dependent on plant roots for cohesion; therefore, upon plant death, these soils are subject to rapid erosion and dissolution in normal marsh conditions (FEMA 2009).

4 FUTURE WITHOUT-PROJECT CONDITIONS

4.1 EXPECTED NAVIGATION CHANNEL IMPROVEMENTS

Deepening of the existing Sabine-Neches Waterway (SNWW) 40-foot deep-draft navigation channel to 48 feet was authorized by the Water Resources Reform and Development Act (WRDDA) 2014. Deepening of the channel will allow the saltwater wedge in the deep draft navigation channel to reach further inland and increase salinity in the lower Neches and Sabine River channels, as well as Sabine Lake (USACE 2011). Since project implementation is likely, projected future with-project (FWP) salinities from the SNWW feasibility study have been utilized as the future without-project (FWOP) salinities for this study.

4.2 PROJECTIONS OF FUTURE RELATIVE SEA-LEVEL CHANGE

Future rates of freshwater inflow and relative sea-level change (RSLC) are likely to result in significant changes in the FWOP condition for the study area (National Research Council [NRC], 1987; Intergovernmental Panel on Climate Change [IPCC], 2013; Milliken et al., 2008a). FWOP forecasts of salinity, marsh loss, and related impacts on plant and animal communities in the study area are important in establishing the baseline condition against which FWP impacts are measured. For the purpose of predicting FWOP salinities in the Orange-Jefferson study area, this modeling effort utilized the results of 3-dimensional TABS-MDS hydrodynamic salinity (HS) modeling conducted for the SNWW deepening feasibility study (USACE 2009). The HS model incorporated the effects of relative sea-level change (RSLC) and forecasts of future freshwater inflows into the FWOP and FWP conditions through 2069. Salinities and tidal circulation through the environmental period of analysis for this study (2019-2080) are expected to be similar to those projected by the SNWW HS model.

The projected rate of RSLC at the Sabine-Neches estuary is very uncertain. The uncertainty inherent in the rates of eustatic sea level rise is evident in the wide range of various estimates from the NRC (1987) and the IPCC (2013). The confidence that any estimate will match actual future sea levels decreases over time, and significant deviations are possible. In order to incorporate a risk-based assessment given this uncertainty, Galveston District used current USACE guidance to assess the effects of changes in RSL over the period of analysis on economic benefits and engineering design considerations. USACE guidance (ER 1100-2-8162, December 2013 and ETL 1100-2-1, June 2014) specifies the procedures for incorporating climate change and relative sea level change into planning studies and engineering design projects. Projects must consider alternatives that are formulated and evaluated for a wide range of possible future rates of relative sea level change for both existing and proposed projects. The USACE guidance requires that

projects be evaluated using "low", "intermediate", and "high" rates of future sea level change, as defined below.

Low - Use the historic rate of local mean sea level change as the "low" rate. The guidance further states that historic rates of sea level change are best determined by local tide records (preferably with at least a 40-year data record).

Intermediate - Estimate the "intermediate" rate of local mean sea level change using the modified NRC Curve I. It is corrected for the local rate of vertical land movement.

High - Estimate the "high" rate of local mean sea level change using the modified NRC Curve III. It is corrected for the local rate of vertical land movement.

Project impacts and costs of the Orange-Jefferson CSRM Plan have been assessed against 50-year projections of the three potential rates of RSLC calculated for Sabine Pass, Texas (Table 4-1). The computed future rates of RSLC given here give the predicted change by 2080 for the Sabine Lake system. The SNWW HS modeling (2009) included an estimate of +1.1 feet of RSLC over a period of analysis ending in 2069. The estimated amount of historic RSLC applied for this study is 1.63 feet for the period of analysis ending in 2080. Use of the SNWW HS modeling for salinity estimates provides reasonable salinity values for this study.

Table 4-1. Projected RSLC at Sabine Pass, Texas by 2080

Tidal Gage	Low RSLC (feet)	Intermediate RSLC (feet)	High RLSC (feet)
Sabine Pass, Texas	1.63	2.32	4.51

Recent wetland loss rates (1984-2014) have been calculated by USGS for 12 subunits of the study area by analyzing multiple dates of cloud free Landsat imagery from 1984-2014 (USGS 2014). The conversion of wetland acres to open water is assumed to have occurred under the low (or historic) rate of RSLC. For the low RSLC scenario, the historic marsh loss rates were held constant and projected forward to provide yearly wetland acres through the period of analysis. This was considered to be the baseline loss rate.

4.3 CLIMATE CHANGE AND CHANGES IN FRESHWATER INFLOWS

Future projections of freshwater inflows for the study area are also highly uncertain. These flows would be influenced by changes in the timing and amount of precipitation, temperature, water demand, and water supply strategies. The Texas State Climatologist concluded that it is impossible to predict with confidence what precipitation trends will be in Texas over the next half century

(Nielsen-Gammon, 2009). Unlike precipitation, there is more consensus for a predicted temperature increase in Texas of close to 4 degrees Fahrenheit (°F) by 2060. Patterns of precipitation change are affecting coastal areas in complex ways. The Texas coast saw a 10 to 15 percent increase in annual precipitation for 1991-2012 compared to the 1901-1960 average. Texas coastal areas will see heavier runoff from inland areas, with the already observed trend toward more intense rainfall events continuing to increase the risk of extreme runoff and flooding.

Projections of future water demand and supply strategies are also very difficult to make and often involve controversial subjects such as interbasin transfer and new reservoirs. Freshwater inflows applied in the 2009 SNWW HS modeling were based upon the 2007 Texas State Water Plan and the associated regional plan for the study area (TWDB, 2007), and Run 8 of the Texas Commission on Environmental Quality (TCEQ) Water Availability Models (WAMs) for the lower Sabine and Neches Rivers.

The 2007 State Water Plan took into consideration existing flows in the Sabine River that are dedicated to the State of Louisiana as prescribed by the Sabine River Compact. The states of Texas and Louisiana are apportioned equal shares of the total Sabine River flow, and therefore freshwater inflows for Louisiana in the HS modeling were equivalent to Texas inflows. The plans were based upon evaluations of population projections, water demand projections, and existing water supplies available during drought. By 2060, population in the region encompassing the study area was projected to grow 36 percent. In the 2007 plan, water demands were projected to increase 41 percent but the region was assessed as having surplus water available beyond projected demands.

Texas updated its State Water Plan in 2012 (TWDB 2012). Projections still apply to a planning horizon ending in 2060, with the same projection of 36 percent growth in population. However, water demands are now projected to more than double, with the existing water supply projected to meet demands through 2040. Conservation, new water-supply reservoirs, and new diversion from existing reservoirs are recommended water management strategies.

The Texas Water Code requires that flow quantities adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats be maintained. Work on setting target inflows for the Sabine-Neches area was undertaken as part of the Texas Senate Bill (SB) 3 Environmental Flows Allocation Process (TCEQ 2014). The Texas Commission on Environmental Quality (TCEQ) adopted environmental flow standards for the Sabine-Neches region in 2011; however, there are some questions that the standards are adequate to support a sound ecological environment in the coastal estuarine system. To address this concern, the Stakeholder Committee developed a work plan for adaptive management which was approved. It requires additional monitoring and studies, with a review of the Sabine-Neches environmental

flow standards on a 5-year cycle. The first review of the current standards may be completed by 2016.

4.4 FREQUENCY OF HURRICANES

Texas' entire Gulf Coast historically averages three tropical storms or hurricanes every four years, generating coastal storm surges and sometimes bringing heavy rainfall and damaging winds hundreds of miles inland. The expected rise in sea level will result in the potential for greater damage from storm surge along the Gulf Coast of Texas. Tropical storms have increased in intensity in the last few decades. Future projections suggest increases in hurricane rainfall and intensity (with a greater number of the strongest – Category 4 and 5 – hurricanes) (Melillo 2014).

Storm surge modeling conducted by ERDC for this study (USACE 2014) provided a predicted return interval of 10-15 years for storm surges high enough to threaten the areas targeted for protection in the Sabine Region. Upland areas in Orange and Jefferson Counties are generally 7-10 feet higher than the structure locations.

4.5 EMERGENT MARSH LOSS

For the WVA wetland change analysis for the Sabine region, trend line projections were made for three scenarios – low (historic), intermediate and high RSLC. These scenarios were based on the 50-year projections of RSLC calculated by SWG for Sabine Pass, Texas (see Table 4-1).

Recent wetland loss rates (1984-2014) were calculated by USGS for 12 subunits of the Sabine study area by analyzing multiple dates of cloud free Landsat imagery from 1984-2014. The historic rate of conversion of wetland acres to open water is assumed to have occurred under the low (or historic) rate of RSLC. For the low RSLC scenario, the historic marsh loss rates was held constant and projected forward to provide yearly wetland acres through the period of analysis. This was considered the baseline loss rate.

For the intermediate and high RSLC scenarios, the annual FWOP wetland loss rates for each subunit of the study area were gradually increased (beginning at Target Year 1 or 2020) by adding an additional annual increment of loss in the landloss spreadsheet that is based on the projected annual RSLC increase for the intermediate and high scenarios. The annual wetland loss rate increases were based on the negative relationship that has been observed between wetland loss rates and RSLC from coastwide non-fresh marshes outside of active deltaic influences in Louisiana (USACE 2013). The percentage change per year from the Low to Intermediate RSLC rate and from the Low to High RSLC rate were computed as shown in Table 4-2. The annual percentage change from Low to Intermediate RSLC was .01 feet/year; and from Low to High RSLC was 0.04

feet/year. This additional RSLC related wetland loss was added to the baseline or historic wetland loss rate to obtain total annual loss rates for each year to project wetland loss over the period of analysis for the intermediate and high RSLC scenarios.

Table 4-2. RSLC Scenarios for Sabine Pass, Texas

Tidal Gage	Low RSLC (feet)	Intermediate RSLC (feet)	High RLSC (feet)
Sabine Pass, TX	1.633	2.32	4.51
Percent Total Change by Year 2080			
Low to Intermediate	0.4233		
Low to High	1.77		
Percent Change Per Year			
Low to Intermediate	0.01		
Low to High	0.04		

4.6 SALINITY

In the FWOP condition, RSLC would also increase salinity in the floodplain portions of the study area due open hydrologic connections to the tidally-influenced reaches of the Sabine and Neches Rivers. The RSLC estimates for the intermediate and high scenarios would be expected to increase tidal flows over historic rates, and this higher tidal energy would likely increase water surface elevation and salinity. WVA impacts modeling for the intermediate RSLC scenario utilized outputs from the SNWW hydrodynamic salinity modeling as inputs for the salinity variables in the WVA marsh and swamp models. Because the rates of RSLC utilized for the SNWW hydrodynamic-salinity modeling are lower than the rates predicted for this study (i.e. 1.1 feet by 2069 as compared to 2.3 feet by 2080), an independent check on the salinity values used for the WVA modeling was conducted using modeled output from a similar study in the northwest Gulf of Mexico region..

ERDC hydrodynamic salinity modeling conducted for the Morganza to the Gulf of Mexico Project (USACE 2013) provided salinity projections for the three RSLC scenarios in accordance with the same guidance utilized for this study. Modeled outputs of salinities within ranges associated with fresh, intermediate and brackish marshes were averaged over the Morganza study area and used to calculate a percentage change in salinity between the baseline (or historic) rate and the intermediate and high rates of RSLC occurring over 75 years. Since the Morganza area has significantly higher rates of subsidence than this study area, the percentage changes calculated for the Morganza area were adjusted by reducing them by the percentage difference of the RSLC rates between Morganza and the Sabine region. The adjusted percentage change for the intermediate and high scenarios was applied to the baseline salinities to provide estimates of FWOP salinities in year 2080. The calculations described here are presented in Table 4-3.

Table 4-3. Method for Estimating FWOP Intermediate and High Salinities for Sabine Region

Morganza Average Modeled Salinities from RSLC Scenarios			
	Average Salinity (parts per thousand)		
RSLC Scenario	Brackish	Intermediate	Fresh
Historic (Low)	9.1	4.4	0.5
Intermediate	10.7	4.9	0.5
High	12.1	5.0	0.7
Percentage Morganza Salinity Change for RSLC Scenarios			
Difference between	Brackish	Intermediate	Fresh
Historic – Intermediate RSLC	18.2%	10.4%	2.6%
Historic – High RSLC	33.5%	11.8%	32.1%
Percentage Change Adjusted for Difference in Subsidence Rates			
	RSLC (feet over 75 years)		
RSLC Scenario	Morganza	Sabine	% Difference
Historic (Low)	1.7	0.93	-45.3%
Intermediate	2.4	1.49	-37.9%
High	4.8	3.26	-32.1%
Percentage Change in Salinity Adjusted for Difference in RSLC for Sabine Region			
Difference between	Brackish	Intermediate	Fresh
Historic – Intermediate RSLC	11.3%	6.5%	1.6%
Historic – High RSLC	22.7%	8.0%	21.8%

This comparison indicates that salinities associated with Intermediate RSLC would increase by 11.3% in brackish marsh areas, 6.5% in intermediate marsh areas, and 1.6% in fresh marsh areas. WVA modeling for this study assumed that salinities for all marsh types would increase by an average of 50% over the period of analysis, well over the increase indicated by the Morganza comparison. Thus, using the SNWW modeling for salinity inputs provides a conservative estimate of salinity changes for the WVA modeling.

5 WVA MODELING METHODOLOGY

This study applies WVA Coastal Marsh (Version [V] 1.0), Swamp (V 1.0) and Bottomland Hardwood (V 1.0) models to calculate impacts and develop mitigation for the Recommended Plan (USFWS 2002; 2010). Sensitivity analyses of WVA Coastal Marsh Versions 2.0 and 2.0B will be conducted after the plan has been finalized; the sensitivity analysis will be presented in an appendix to the Final IFP-EIS. Plan selection and mitigation utilized WVA Model V 1.0 outputs.

The WVA methodology is similar to the USFWS Habitat Evaluation Procedures (HEP), in that habitat quality and quantity are measured for baseline conditions and predicted for FWOP and FWP conditions. Instead of the species-based approach of HEP, the WVA models use an assemblage of variables considered important to the suitability of a given habitat type for supporting a diversity of fish and wildlife species. As with HEP, the WVA allows a numeric comparison of each future condition and provides a combined quantitative and qualitative estimate of project-related impacts on fish and wildlife resources.

WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each habitat type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Indices) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

The habitat variable-habitat suitability relationships within these WVA models have not been verified by field experiments or validated through a rigorous scientific process. However, the variables were originally derived from HEP suitability indices taken from species models for species found in that habitat type. An independent external peer review of the WVA Models has been conducted by the USACE Eco-PCX (Battelle 2010). The reviewers agreed that the concept and application of the models are sound for planning efforts. The models seem to sufficiently capture the habitats being modeled and do not have any irreparable deficiencies. However, some aspects of the WVA Coastal Marsh Model concerning variables 1, 2, and 3 were found to have been defined primarily by policy and/or functional considerations of Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA). These concerns are being evaluated with a sensitivity analysis presented in DIFR-EIS Appendix Q. Plan formulation for this study will be based on V 1.0 of these models.

A new WVA spreadsheet has been developed by ERDC that allows for all three versions of the Marsh Model (V1.0, V2.0 and V2.0B) to be run simultaneously. The Swamp and Bottomland Hardwood models (V 1.0) are also included in the spreadsheet, as well as other WVA models not used for this study. The capability to handle risk and uncertainty was incorporated by the use of a Monte Carlo simulation and the ability of the user to either input High/Low or Standard Deviations for inputs. One hundred iterations were run each time the model was applied and results are reported for the 95 percent confidence level with standard deviations.

5.1 PERIOD OF ANALYSIS/TARGET YEARS

The environmental period of analysis for the Orange-Jefferson CSRM Plan is a total of 61 years based on the following assumptions. The construction period is assumed to begin in 2020 and end in 2030. All direct impacts are assumed to occur in the first year of construction (2020). This is conservative assumption since construction would not impact the entire project area in the first year of construction, and construction is not currently projected to be complete until 2030. Indirect impacts may begin later but all are assumed to begin by 2031. Mitigation area construction is assumed to be concurrent with levee system construction, beginning in 2020 and ending in 2030. The period for which mitigation benefits are analyzed is 2031-2080, which is the same as the 50-year economic period of analysis. A target year summary is provided in Table 5-1.

Table 5-1. Target Year Summary

TY0	2019 (the year before impacts begin)
TY1	2020 (all impacts occur)
TY11	2030 (levee and mitigation construction complete)
TY12	2031 (mitigation and economic benefits begin)
TY61	2080 (end of mitigation and economic period of analysis)

5.2 LAND AREA CHANGE ANALYSIS

Recent historic land area change rates (1984-2014) were calculated by USGS (2014b) for 12 subunits of the study area, and separately for Jefferson and Orange Counties, by analyzing multiple dates of cloud free Landsat imagery from 1984-2014. These change rates are shown in Table 5-2. Those shown in red are loss rates; those in black are accretion rates. They are uniformly very low and reflect lower subsidence rates that have resulted from decreased water and oil/gas withdrawals in the region in recent decades. The areas showing accretion are largely degraded swamp or marsh areas with significant ongoing beneficial use projects where marsh has been restored. Since none of the construction ROW is located in areas directly affected by these beneficial use projects, the applicable overall county change rate (which both show losses) was applied when evaluating marsh impacts in hydro-units which exhibited overall accretion (TX 3, 11 and 12 specifically).

Land loss change rates were not applied to the Swamp or Bottomland Hardwoods models because land loss is either not a factor in these areas or too small to warrant tracking

Table 5-2. USGS Aerial Photography Analysis of Marsh Change Rates

Hydrologic Unit	Name	Rate perc/yr	r^2
TX 1	North Neches River	0.0085%	0.15
TX 2	Neches River	-0.0567%	0.289
TX 3	Rose City	0.0543%	0.0201
TX 4	Beaumont South	0.0703%	0.165
TX 5	Bessie Heights	-0.0052%	0.000113
TX 6	Old River Cove	-0.0892%	0.0345
TX 10	Cow Bayou	-0.0203%	0.0424
TX 11	Adam Bayou	0.0032%	0.00106
TX 12	Blue Elbow South	0.0110%	0.0994
TX 13	Lower Neches	-0.0456%	0.0809
Texas/LA 1	Sabine Island	0.0036%	0.0115
Texas/LA 2	Blue Elbow North	0.0087%	0.0513
Jefferson County	Marshes county-wide	-0.0196%	0.00138
Orange County	Marshes county-wide	-0.0183%	0.217

The wetland loss rates were calculated separately for subdivisions of the Sabine Region study area called hydrounits. The hydrounits are subdivisions of the Sabine and Neches River floodplains that are distinguishable by topography and hydrology from surrounding areas. They were developed for WVA modeling of impacts of the proposed deepening of the Sabine-Neches Waterway (SNWW) (USACE 2011). Inasmuch as they cover the same geographic area affected by this study, the same units were adopted for this WVA modeling effort. The hydrologic areas included in the wetland change mapping for this study are shown in Figure 5-1.

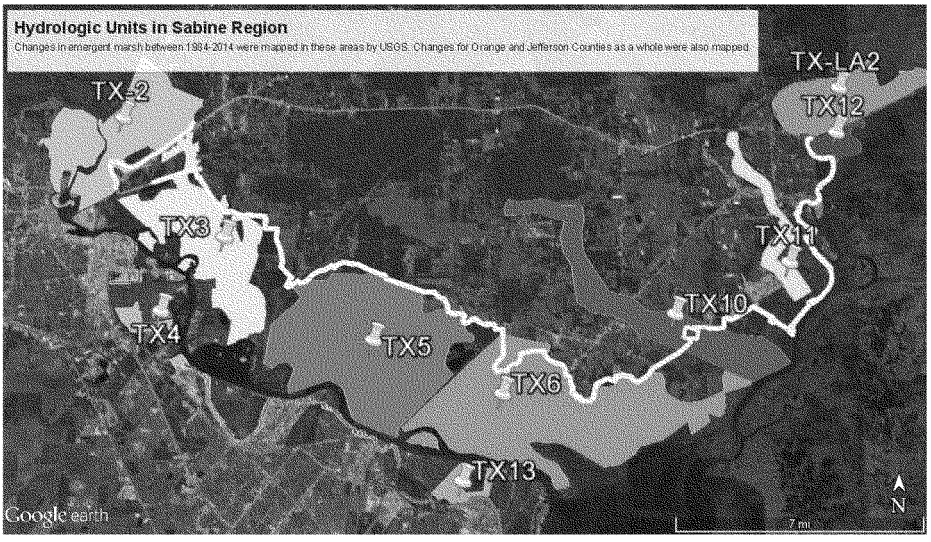

Figure 5-1. Hydrologic Units in Sabine Region

5.3 WETLAND VEGETATION MAPPING

Marsh vegetation and water acreages are based on a USGS classification using 2010 imagery (USGS 2014a). Forested wetland acreages are based on the 1992 National Wetland Inventory classification that were updated within impact areas by referencing 2015 Google Earth imagery. As impacts are not projected to start until the year 2020, the relative percentage of emergent marsh and water acreage in each subunit were updated to reflect changes in emergent marsh acreage occurring between 2010 and 2020 due to the baseline emergent marsh loss rate. Wetland vegetation maps of the Recommended Plan alignment are shown in Figures 5-2 through 5-13. Color numbers in the maps legends indicate 1) fresh marsh, 2) intermediate marsh, 3) brackish marsh; 4) saline marsh, 5) water, 6) other (non-wetland), 7) bottomland hardwood and 8) cypress tupelo swamp. Marsh and forested wetland acreages within the Recommended Plan alignment right-of-ways were aggregated by wetland type within each hydrounit. Water acreages within the ROW were tracked separately associated with adjacent marsh areas or forested wetland areas.

Figure 5-2. East Bank Neches River 1

Figure 5-3. East Bank Neches River 2

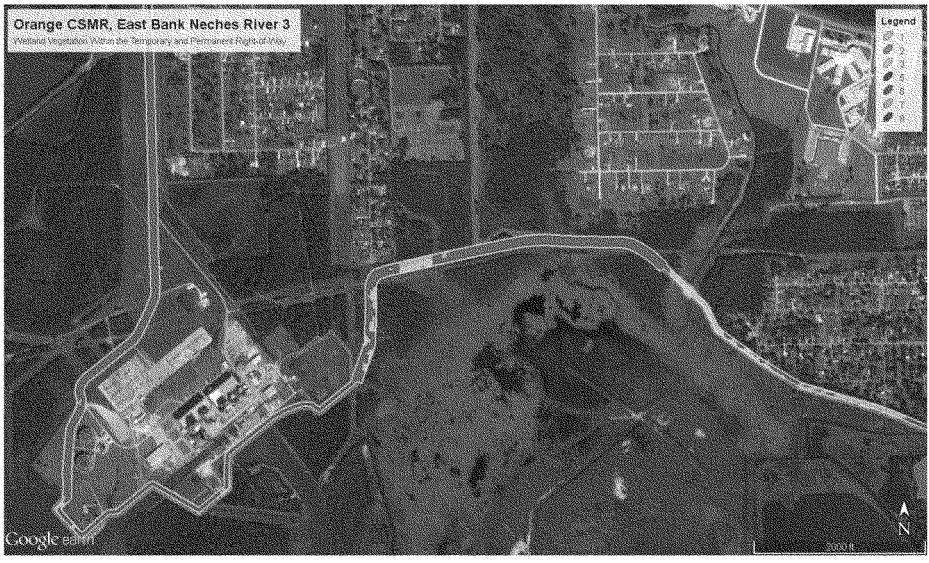

Figure 5-4. East Bank Neches River 3

Figure 5-5. East Bank Neches River 4

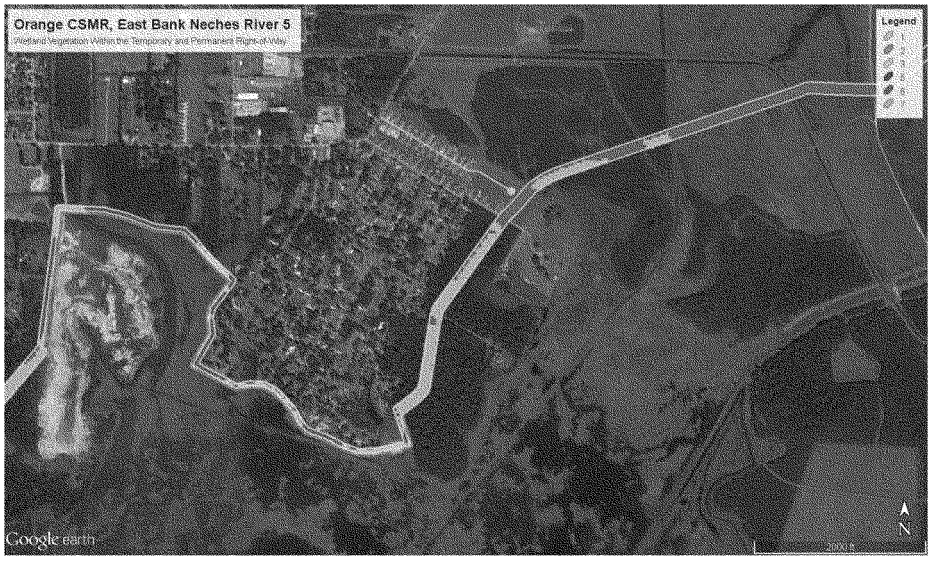

Figure 5-6. East Bank Neches River 5

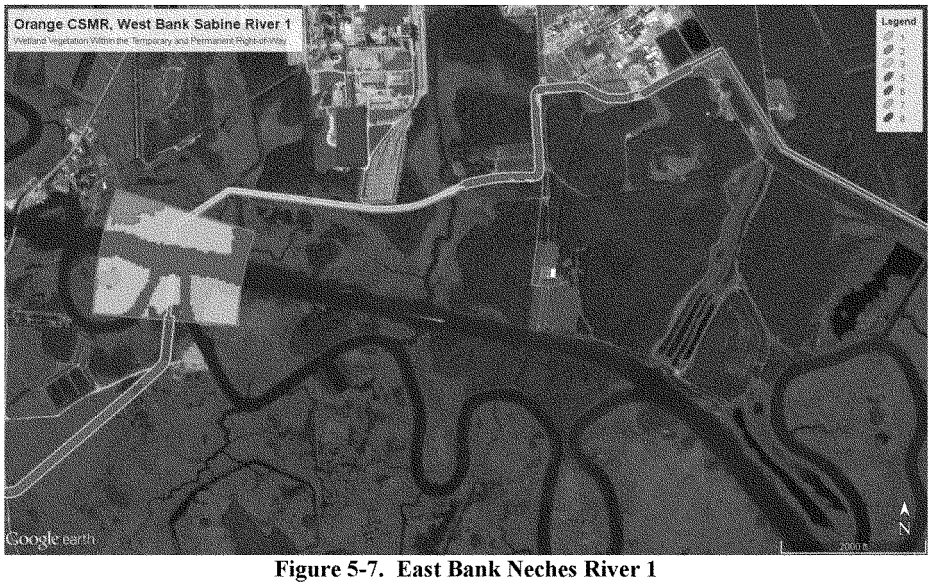

Figure 5-7. East Bank Neches River 1

Figure 5-8. East Bank Neches River 2

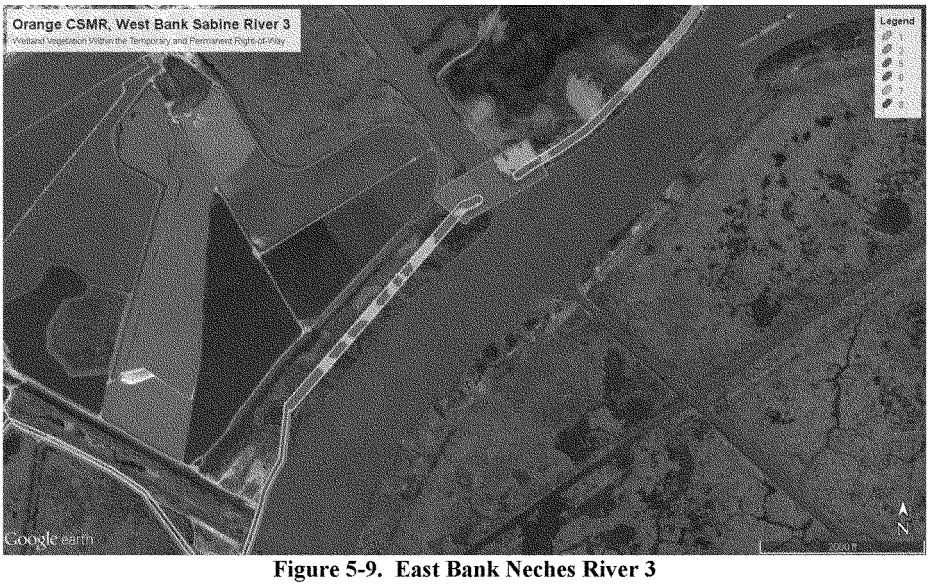

Figure 5-9. East Bank Neches River 3

Figure 5-10. East Bank Neches River 4

Figure 5-11. East Bank Neches River 5

Figure 5-12. East Bank Neches River 6

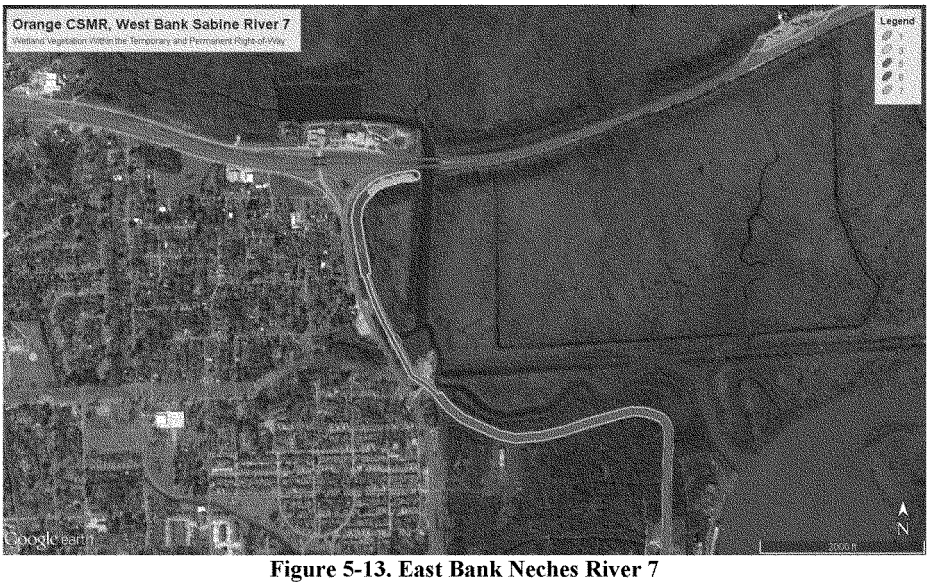

Figure 5-13. East Bank Neches River 7

5.4 DATA COLLECTION/GROUNDTRUTHING

Groundtruthing of wetland types and collection of data from WVA variable inputs were based upon field investigations and previous observations of the S2G study area by the Habitat Workgroup of the Interagency Coordination Team for the Sabine-Neches Waterway (SNWW) Channel Improvement Project (USACE, 2011). In addition, these observations were updated with current observations of the resource agency review team for this study, and field trips conducted in 2015 and 2016 specifically for this study. Data were collected from a total of 17 bottomland hardwood and swamp reference sites on the Neches and Sabine Rivers in August and October, 2014, January, 2015, and February, 2016. The forested wetland reference sites are in areas affected by this study, and conditions have not changed sufficiently to make comparison to these areas invalid.

6 FWP ANALYSIS OF DIRECT IMPACTS

Direct impacts are those that would result from construction of the Recommended Plan's new levee system alignments in Orange and Jefferson counties. All WVA impacts modeling was redone for the Recommended Plan, using the same procedures and assumptions that were applied for the TSP. For alignment segments that were the same as the TSP alignment, the same variable inputs developed by the resource agency team for the DIFR-EIS analysis were applied to the Recommend Plan alignment. In areas where the alignment diverged from that presented in the DIFR-EIS, variable input was developed following the same basic premises. The RSLC procedures and assumptions for the WVA modeling of direct impacts to emergent marsh, cypress-tupelo swamp, and bottomland hardwoods are presented below, followed at the end of this section with a summary of the direct impacts of the Recommended Plan. The specific areas of divergence between the TSP and Recommended Plan alignments are also mapped and described in this last section.

6.1 RSLC MARSH MODELING – PROCEDURES AND ASSUMPTIONS

Since the marsh vegetation and water acreages are based on a classification conducted using 2010 imagery (USGS 2014), and impacts are not projected to start until the year 2020, the relative percentages of emergent marsh and water acreage in each subunit were updated to reflect changes projected to occur between 2010 and 2020 due to the baseline land loss rate. A Microsoft Excel spreadsheet was used to calculate this change, and to track changes in wetland/water acres associated with the USGS wetland change rates over the period of analysis. Impacts were developed utilizing the intermediate RSLC rate for the FWOP and FWP conditions.

6.1.1 V1 Emergent Marsh

Persistent emergent vegetation provides foraging, resting, and breeding habitat for a variety of coastal fish and wildlife species. Detritus from coastal marshes also provides a source of mineral and organic nourishment for organisms at the base of the food chain. In this model, an area that is 100 percent shallow water is assumed to have minimal habitat suitability (SI = 0.1). For all marsh types, optimal vegetative coverage is assumed to be 100 percent (SI = 1.0) because the loss of emergent coastal marsh is a serious existing condition in the study area, and it is assumed that this loss will continue due to RSLC. This assumption diverges from the general biological understanding that optimum cover falls in the 60 to 80 percent range. The HQUSACE single-use approval of the WVA marsh model for this study requires the use of Version 1.0 for plan formulation, and the preparation of a sensitivity analysis that is described in Section 1.0 and presented in Appendix P. The results of the sensitivity analysis will be used by the ECO-PCX in decisions regarding assumptions related to variables 1, 2 and 3 of the WVA Coastal Marsh Model only and its application to future studies.

Existing Condition. Baseline total marsh and water acres of each affected wetland area are based on the acreages provided in Attachment 3, adjusted using the baseline emergent marsh loss rate to reflect marsh and water acres in 2019 (TY0). As uncertainty associated with the baseline marsh/water acres is very low, a narrow range for the baseline percent emergent marsh was assumed; typically one percent higher and lower than the mapped acreage.

FWOP. The baseline acreage at TY0 will be reduced each year of the period of analysis by the USGS (2014b) percent loss per year for the specific hydrounit, using the landloss spreadsheet. It is assumed that the emergent marsh that is lost is converted to water, and therefore, the acres lost from the marsh are added to the water acres. The baseline rate of emergent marsh loss includes chronic, regional effects of subsidence, altered sediment delivery, historical rates of sea level rise, and tropical storms or hurricanes that occurred during the period of observation. The effects of the intermediate rate of RSLC on marsh loss were included in the FWOP condition by adding the additional RSLC-related wetland loss to the baseline loss rate (see Table 4-2). The uncertainty of the estimation of the percent of emergent marsh coverage at the beginning of the period of analysis is low because it is based on a recent GIS classification. Therefore, a narrow range (one percent higher and lower than the mapped acreage) was assumed. The uncertainty of projections of emergent marsh percentage for TY61 are higher given greater uncertainties associated with average temperatures, precipitation, freshwater inflows and RSLC. Therefore, for TY 61, a total range of 20 percent was assumed.

FWP. It is assumed that construction impacts will begin in TY1, and that all wetlands within the construction right-of-way will be removed and replaced by levees, floodwalls, pump stations, staging areas or other project features. Wetland and water acres would fall to zero at TY1 and remain unchanged through TY61. There is no uncertainty associated with the projection of zero percent wetland coverage in TY61, and therefore a range of zero to 0.1 percent was assumed.

6.1.2 V2 Percent Submerged Aquatic Vegetation

For the purpose of this model, SAV is defined as any of the diverse array of floating-leaved and submerged aquatic plants that are typically found in the study area. Seagrasses, included in the SAV designation, are flowering plants that grow entirely underwater. SAV coverage is included as an important marsh variable because it provides important food and cover to a wide variety of fish and wildlife (Virnstein, 1987; Thomas et al., 1990; Castellanos and Rozas, 2001; Raz-Guzman and Huidobro, 2002; Wyda et al., 2002; Lazzari and Stone, 2006). SAV provides a refuge from predation, and because of this protection, densities of many invertebrates (infaunal and epifaunal) and small fishes are greater in SAV than in nearby unvegetated areas. SAV (including seagrasses)

provide additional benefits by stabilizing sediments and filtering water. SAV (including seagrasses) tolerate or require a wide range of salinities.

The species composition and primary productivity of SAV communities corresponds to the salinity regime (Haller et al., 1974; Longstreth et al., 1984; Dunton, 1990; Bonis et al., 1993; Bortone, 2002; La Peyre and Rowe, 2003; Singh and Arora, 2003; Paresh and Freedman, 2006). Fresh and intermediate marshes, in particular, often support diverse communities of submerged and floating-leaved vegetation. Open water with no aquatics within a fresh or intermediate marsh is assumed to have low suitability (SI = 0.1). Optimal conditions are assumed when 100 percent of the open water is dominated by aquatic vegetation (SI = 1.0). Brackish marshes can also support aquatic plants that provide food and cover for several species of fish and wildlife. Although amounts are generally less than that which occurs in fresh or intermediate marshes, certain species such as widgeon-grass, coontail, and milfoil, can be abundant under some conditions, and widgeon grass, in particular, is an important food source for waterfowl. The SI graph for brackish marsh is identical to the fresh/intermediate model.

Existing Condition. Baseline values for this variable were based largely upon previous observations in the area by SNWW Habitat Workgroup members, the current review team's knowledge of SAV types and prevalence in the general area and examination of Google Earth's 2015 and earlier historic images. Since SAV cover and species can change rapidly in response to a complex interaction of environmental conditions, even TY0 values are fairly uncertain. Therefore, a total range of 10 percent was assumed for TY0.

FWOP. No change in percentage SAV cover was assumed through TY61. While the intermediate rate of RSLC would result in slightly higher salinities and a slightly larger tidal prism, it was assumed that salinity and water depth changes would not be great enough to result in a change in SAV coverage in TY1 through TY61. However, greater uncertainty associated with climate change and RSLC exists for the later years of the period of analysis, and therefore, a larger total range of 20 percent was assumed for TY61.

FWP. All water areas would be converted to levees, floodwalls or other project features in TY1 and remain unchanged through TY61. There is no uncertainty associated with the projection of zero percent wetland coverage in TY61, and therefore a range of zero to 0.1 percent was assumed.

6.1.3 V3 Interspersion

This variable takes into account the relative amount of marsh to open water, and the degree to which open water is dispersed throughout the marsh. Interspersion is an important characteristic for freshwater and estuarine fish and shellfish nursery and foraging habitat in all marsh types (Rakocinski et al., 1992; Baltz et al., 1993, 1998; Rozas and Reed, 1993; Minello et al., 1994; Peterson and Turner, 1994; Rozas and Zimmerman, 2000; Minello and Rozas, 2002; Whaley and Minello, 2002; Rozas and Minello, 2007). The marsh/open-water edge provides cover for postlarval and juvenile organisms. Smaller, isolated ponds are less turbid and contain more aquatic vegetation, thereby providing more suitable waterfowl habitat. Conversely, a large degree of interspersion is assumed indicative of marsh degradation, as solid marsh converts to ever-larger areas of open water. Areas with a high degree on interspersion in the form of tidal channels and small ponds, Class 1 interspersion was assigned (SI = 1.0). Large ponds (Class 3) and open water areas with little surrounding marsh (Class 4) offer lower interspersion values and indicate advanced stages of marsh loss. Class 3 was also assigned to areas of "carpet" marsh which contain no or relatively insignificant tidal channels, creeks, or ponds but still provide aquatic organism habitat during tidal flooding. If the entire area is open water or contains a few small marsh islands, Class 5 interspersion was assigned (SI = 0.1).

Existing Condition. The degree of marsh/waterbody interspersion was assessed for each wetland group within the construction right-of-way using Google Earth 2015 imagery at the same scale as the photographs of class examples shown in the WVA marsh model (V1.1). Each wetland group was carefully examined and assigned interspersion classes by comparing them to the photographic examples. In some cases, the wetland groups contain wetlands of more than one interspersion class. The percentage of acreage exhibiting each class was entered in the spreadsheet, such that all added up to 100 percent.

FWOP. No change in interspersion was assumed for TY1. The greater the percentage loss of emergent wetland tracked with V1 was assumed to relate to changes in interspersion by TY61. Changes greater or equal to 1 percent were reflected in similar changes in interspersion classes.

FWP. All marsh and water areas within the construction right-of-way would be converted to levees, floodwalls or other project features in TY1 and remain unchanged through TY61. Therefore, all were assumed to convert to the class associated with conversion to a non-marsh area (Class 5). There are no uncertainty ranges required for this variable in the sensitivity spreadsheet.

V4 Percent Open Water ≤ 1.5 Feet

Deeper water is assumed to be less biologically productive than shallow water because sunlight, oxygen, and temperature are reduced as depth increases. Shallow water also provides better bottom access for waterfowl, better foraging habitat for wading birds, and more-favorable conditions for the growth of aquatic vegetation. Certain species typically use shallow water for spawning, feeding, and/or shelter during various life stages (e.g., white/brown shrimp, Gulf flounder, red drum, roseate spoonbill, and mottled duck). SIs for shallow water are calculated differently for fresh/intermediate, brackish and saline marshes. Optimal shallow-water conditions in fresh/intermediate marsh are assumed when 80 to 90 percent of the open water is equal to or less than 1.5 feet deep. It is assumed that brackish marshes generally contain deeper open-water areas because of tidal scouring, and therefore lower percentages of shallow water receive a higher SI than in fresh/intermediate marsh.

Existing Condition. Baseline values for this variable were based largely upon previous observations in the area by SNWW Habitat Workgroup members, the current review team's knowledge of the area and examination of Google Earth imagery (2015 and earlier historic images). As uncertainty associated with the baseline V4 acres is low, a fairly narrow range for the baseline percent emergent marsh was assumed; typically a 10 percent range.

FWOP. No change in V4 was assumed for TY1. RSLC of about 2.3 feet by TY61 is assumed to increase the depth of current shallow water, and to inundate new areas, resulting in no net change from existing conditions. The uncertainty range for TY61 would be higher, associated primarily with uncertainties in the intermediate RSLC rate. Uncertainties related to three evaluated rates of RSLC were evaluated under separate WVA model runs for those scenarios. The total range of the percentage of open water at the beginning of the period of analysis was assumed to be 10 percent.

FWP. All shallow water areas would be converted to levees, floodwalls or other project features at TY1 and remain unchanged through TY61. There is no uncertainty associated with the projection of zero percent wetland and wetland coverage in TY61, and therefore a range of zero to 0.1 percent was assumed.

V5 Salinity

This variable may appear to duplicate or overlap with V1 (emergent marsh cover) because the functionality and potential land loss of the marsh vegetation are related to salinity. However, this variable was included as a separate variable in order to account for salinity impacts on fish and wildlife as well as on vegetation.

Salinity is one of the most important factors affecting coastal marsh loss. Salinity projections affect all of the other WVA variables with the exception of aquatic organism access. Small increases in mean salinity can adversely affect aquatic systems by reducing overall biological productivity. An extensive literature review (Visser et al., 2004) compiled information on the effect of salinity on the productivity of emergent tidal marsh. Productivity algorithms, based upon measurements of total biomass, stem/leaf elongation, and photosynthesis, were developed that predict changes in primary productivity for every part per thousand (ppt) change in salinity. Salinity and primary productivity were found to be inversely related, as salinity increases, primary productivity decreases by different amounts dependent upon the salinity tolerance of the vegetation community.

For fresh/intermediate marshes, the mean high salinity (calculated as a roaming mean of the highest 33 percent consecutive salinity readings) during the growing season is used to assess impacts. For brackish and saline marshes, average annual salinity is recommended. Optimum salinity ranges assumed by the WVA model for the various habitat types are as follows: swamp and bottomland hardwood (≤1 ppt), fresh marsh (≤2 ppt), intermediate marsh (≤4 ppt), brackish marsh (≤10 ppt), and saline marsh (≥9 and ≤ 1 ppt). For V5, salinity changes within the optimal salinity ranges of each marsh type are not considered an impact, and are assigned a maximum suitability index score of "1." But even a small salinity change outside of these optimal ranges, as shown in the formulas for the salinity variable, reduces the suitability index scores below "1."

Existing Condition. Baseline salinities for the wetland areas in the construction right-of-way were taken from baseline salinities reported by the 3-D hydrodynamic-salinity model for the SNWW navigation project (USACE 2009) and from Texas Parks and Wildlife data. Mean salinities associated with median flows during the growing season were used for all marsh types, and were taken from the SNWW 48-foot deepening FWP runs. Model values were obtained from the nearest model output node, and in some cases, salinity values were adjusted for the salinity gradient observed on isohaline maps for swamps located upstream of the nearest node. The uncertainty range of the salinity projection was based on the standard deviation of the average of the surface and mid-depth salinity values at the nearest station at which salinity data was collected for validation of the HS model.

FWOP. It was assumed that salinity will also change with RSLC, based on the SNWW modeling which estimated 1.1 feet of RSLC by year 2069, which is very close to the 0.93 foot of RSLC now projected for S2G by year 2080. In general, the model predicted an increase of between 1.0 and 1.5 ppt in the Neches River near Bessie Heights and Old River, and on the lower Sabine River in the vicinity of Cow and Adams Bayous.

FWP. All water areas would be converted to levees, floodwalls or other project features at TY1 and remain unchanged through TY61. Using a value of zero for the salinity variable is not appropriate, since it would be interpreted by the model as an optimal condition for all marsh types, and inappropriately increase the quality of the FWP habitat units. Therefore, the salinity value utilized for TY1 through TY61 was the same as FWOP. There are no uncertainty ranges required for this variable in the sensitivity spreadsheet.

6.1.4 V6 Aquatic Organism Access

Access by estuarine-dependent fishes and shellfishes, as well as other aquatic organisms, is important in assessing the quality of marsh systems. It is assumed that a high degree of surface hydrologic connectivity with adjacent systems provides high organism access, as well as providing greater nutrient exchange. The SI is calculated by determining an Access Value that is based on an interaction between the wetland area accessible to aquatic organisms during normal tidal fluctuations and the type of man-made structures (if any) blocking access channels (USFWS, 2002c: Appendix B). Access ratings for specific structures, developed by the Louisiana EnvWG, were adopted for the SNWW application. The installation and operation of water control structures has been shown to significantly impact marine fishery access to, use of, and production on wetlands behind those structures (Rogers and Herke, 1985; Herke et al., 1992; Rogers et al., 1992; Sanzone and McElroy, 1998); therefore, optimal conditions are assumed when the entire wetland area is accessible and access points are unobstructed. Brackish and saline marshes are assumed to be more important than fresh/intermediate marshes as habitat for estuarine-dependent fish and shellfish.

Existing Condition. Baseline values for this variable were based largely upon previous observations in the area by SNWW Habitat Workgroup members, the current review team's knowledge of the area and examination of Google Earth imagery (2015 and earlier historic images). Fisheries access is not blocked to any of the marshes in the construction right-of-way and therefore all were assigned a value of "1".

FWOP. The review group has no knowledge of planned water control structures, impoundments, or other impediments to fisheries access through the period of analysis. No changes to the fisheries access value is projected TY1 though TY61; all were assigned a value of "1".

FWP. All water areas would be converted to levees, floodwalls or other project features at TY1 and remain unchanged through TY61. This would result in the complete blockage of access to the area within the construction right-of-way. Therefore, a value of "0" was applied for TY1 through TY61. There are no uncertainty ranges required for this variable in the sensitivity spreadsheet.

6.2 SWAMP MODELING – PROCEDURES AND ASSUMPTIONS

6.2.1 V1 Stand Structure

Wildlife foods in swamp habitats consist predominantly of soft mast, other edible seeds, invertebrates, and vegetation. Since most swamp tree species produce soft mast or edible seeds, the actual tree species composition is not considered a limiting factor. However, a variety of stand structure should be present to provide appropriate habitat for resting, foraging, breeding, nesting, and nursery activities. Three structures are evaluated: (1) overstory closure, (2) scrub-shrub midstory cover, and (3) herbaceous cover. The variable assigns the lowest suitability to sites with a limited amount of all three stand structures, and the highest suitability to sites with significant amounts of all three stand structures.

Existing Condition. WVA input data for percentage overstory, midstory, and understory cover in swamp areas that would be directly impacted by construction were estimated using data from the most similar reference sites. These sites were selected based upon knowledge of the study area and close examination of Google Earth imagery. As reference sites were used as the basis for input data, uncertainty in the accuracy of the input is reflected in a 10 percent range for overstory, midstory and understory coverage estimates.

FWOP. Predicted changes in percentage overstory, midstory, and understory cover were based on the existing overstory closure; higher overstory growth rates were assumed for moderately open areas and slower growth rates for moderately dense swamp areas. With steady maturation, an increase in percentage overstory coverage was generally associated with a decrease in percentage of understory coverage. Generally, no changes in midstory coverage were predicted, as it was assumed that trees growing into the overstory would be replaced by trees growing from the understory. Steady maturation was projected for all hydro-units, as changes related to historic rates of sea-level rise and changes in salinity would not be large enough to affect growth rates substantially. Greater uncertainty exists for TY61 projections, primarily related to changes in rainfall and RSLC; therefore, a 30 percent range was applied around overstory and midstory coverages, and a 20 percent range around understory.

FWP. A 10-year construction period is assumed, beginning TY1. No specifics are available at this time regarding construction contracts or timing. Therefore, all impacts are assumed to occur in TY1. It is assumed that all swamps within the construction right-of-way will be removed and replaced by levees, floodwalls or other project features through the period of analysis. There is little uncertainty associated with this projection, so a conservatively small range of zero to 0.1 was used for all percentage cover input.

6.2.2 V 2 Stand Maturity

Swamps with mature sizable trees are considered to be rare and ecologically important because of the historical loss of swamp habitat from timber harvesting, saltwater intrusion, and a reduced growth rate in the subsiding coastal zone. Two components, stand age and stand density, are combined in the SI for this variable. Stand age is included because older trees provide important wildlife requisites such as snags, nesting cavities, and the medium for invertebrate production. Additionally, as the older, stronger trees establish themselves in the canopy, weaker trees die and form additional snags that would not be present in younger stands. Stand age is determined by average trunk diameter measured at breast height (DBH). The optimal size for canopy-dominant and canopy co-dominant bald cypress is greater than 16 inches, and greater than 12 inches for tupelo-gum and other species. Stand density allows evaluation of mature swamp ecosystems that contain an overstory of a few widely scattered, mature bald cypresses but in which other stand characteristics important for nesting, foraging, and other habitat functions are absent. Basal area is used as a measure of stand density; it measures how much of the forest floor is covered by the area of standing tree trunks. Stand age and density are evaluated separately for cypress and tupelo-gum.

Existing Condition. Baseline values for the relative percentage of the canopy provided by baldcypress and tupelo, the average DBH of each of these species, and estimates of abundance of each species based on average basal area per acre were estimated using data from the most similar reference sites. These sites were selected based upon knowledge of the study area and close examination of Google Earth imagery. As reference sites were used as the basis for input data, uncertainty in the accuracy of the input is reflected in a 10 percent range around canopy coverage estimates and a 2-3 inches^2 range was used around the DHB estimates. Since basal area inputs were estimated based upon an association with percentage overstory cover (i.e., a moderate DBH range would be associated with a moderate overstory coverage), the full range of DBH for each density class as defined in the model was used as the low and high range for DBH values. For example, a swamp site with a moderately open overstory coverage was estimated to have a DBH range from 40 feet^2 to 80 feet^2.

FWOP. Rates of tree growth were based on data for relevant species from the USDA Silvics of North America (USDA, 2004), and other forest research literature (Brown and Montz, 1986) that generally reflect optimum growth conditions on managed lands. This is appropriate because swamps in the study area are generally not impounded and in relatively good condition. Steady growth throughout the period of analysis was assumed. For TY1, a 10 percent range around canopy coverage estimates and a 2-3 inches^2 range was used to bracket the DHB estimates. For TY61, a larger range was used to capture the uncertainties associated with climate change and

RSLC. For the percentage of cypress and tupelo canopy coverage, a 20 percent range was assumed. For DBH growth projections, a range of 10 inch^2 was utilized. Annual basal area growth rates were estimated for cypress and tupelo using information from the US Forest Service Silvics Manual (USDA, 2004).

FWP. It is assumed that all swamps within the construction right-of-way will be removed and replaced by levees, floodwalls or other project features through the period of analysis. There is little uncertainty associated with this projection, so a conservatively small range of zero to 0.1 was used for all percentage canopy cover by species and for DBH. For basal area, the range for TY1 through TY61 was entered as 5.0 to 5.1, based on ERDC instructions that the sensitivity spreadsheet being used for this modeling will not accept a value less than 5.

6.2.3 Water Regime

Seasonal flooding with periodic drying cycles increases nutrient cycling, vertical structure complexity, and recruitment of dominant overstory trees. The optimal water regime is assumed to be seasonal flooding with abundant and consistent riverine/tidal input and water flow-through. Optimal flow-through is assumed to be an abundant and consistent input, allowing maximum use as fish and wildlife habitat. Temporary or seasonal flooding is optimal because permanent flooding produces poor water quality during warm weather and reduces fish and invertebrate production.

Existing Condition. Baseline values for flooding duration and exchange were based on the review group's knowledge of the swamp impact areas and on careful review of Google Earth imagery.

FWOP. The FWOP values consider the effects of gradual RSLC on water surface elevation and tidal circulation. The increase in water surface elevation was forecast by the HS model, which in addition to RSLC, also incorporated forecasted changes in freshwater inflow. The effects of higher FWOP water surface elevations on hydrologic conditions were estimated by comparing FWOP water surface elevations over the period of analysis to existing land elevations within the swamp areas. The 2.3- feet increase in water surface elevation projected with intermediate RSLC was added to existing average and extreme water surface elevations, and compared to the land surface elevations taken from recent LIDAR survey data (CADGIS, 2009; NOAA Coastal Service Center, 2009). While some of the lower-lying areas could see a marginal increase in the depth and duration of tidal flooding by the end of the period of analysis, the gradual change in water surface elevation due to RSLC would not permanently inundate swamp substrate throughout the year, and therefore no change in flooding duration and exchange classes were forecast through TY61.

FWP. At TY1, it is assumed that all swamps within the construction right-of-way would be removed and replaced by levees, floodwalls or other project features through the period of analysis. Existing water regimes would be permanently disrupted. In order to capture the effect on water regime, the FWP assumed a change to classes with the lowest SI values for TY1 through TY61 (permanently flooded with no flows/exchange).

6.2.4 Mean High Salinity

Many swamp species, especially tupelo-gum and many herbaceous species, are salinity sensitive (Conner et al., 1997; Pezeshki et al., 1989). Swamp systems may be acutely affected by the sudden addition of only a few parts per thousand of salt during an intrusion event (Reid and Wood, 1976). Primary biological productivity is lowered 8.4 percent for each 1 ppt increase in salinity, slowing growth rates for dominant overstory species such as tupelo-gum (and, to a lesser degree, bald cypress since it is more salt tolerant), reducing the overstory coverage, and reducing the percentage cover and variety of fresh, herbaceous understory vegetation. These changes would result in lower wildlife values for forage, cover, and reproduction (Palmisano, 1972).

Bald cypress is able to tolerate higher salinities than the other species. Optimal conditions are assumed to occur at salinities less than 1 ppt, and habitat suitability is assumed to decrease rapidly as mean high salinities exceed that mark. Mean high salinity during the growing season (March 1 through October 31) is defined as the average of the highest 33 percent consecutive salinity readings.

Existing Condition. Baseline salinity values were based upon SNWW HS model (USACE 2009) output or empirical data provided by resource agencies, if available. The HS model salinities are the mean of the highest consecutive 33 percent of values, median flow scenario during the growing season, with the SNWW 48-foot deepening in place. Model values were obtained from the nearest model output node, and in some cases, salinity values were adjusted for the salinity gradient observed on isohaline maps for swamps located upstream of the nearest node. The uncertainty range of the salinity projection was based on the standard deviation of the average of the surface and mid-depth salinity values at the nearest station at which salinity data was collected for validation of the HS model. Inasmuch as prevailing salinities in the swamp areas are generally fresh, the uncertainty range for the existing condition was zero to zero.

FWOP. FWP salinities values were obtained from the authorized SNWW 48-foot channel deepening model runs. FWP TY1 salinities were expected to be the same as TY0 salinities because the deepening of the inland portions of the SNWW channels would not be expected to occur by 2020 (TY1). The HS model incorporates the most likely effects of RSLC and future freshwater

inflows for the period of analysis. On average, the uncertainty range for was very small, with the low being zero and the high range less than or equal to 1.2 ppt for most areas. However, swamps on the Sabine River near Interstate 10 are an exception. The high range for salinity at TY61 was 2.3 ppt in these areas because of salinities introduced by the 30-foot-deep Channel to Orange in the lower Sabine River, and higher salinity waters entering through the GIWW from the Calcasieu Ship Channel in Louisiana.

FWP. Destruction of swamps within the construction right-of-way would not affect salinities in the area generally. To avoid the model interpreting any change as a move toward optimal conditions, the FWP salinity range was equal to the FWOP salinity range for TY61.

6.3 BOTTOMLAND HARDWOOD MODELING – PROCEDURES AND ASSUMPTIONS

6.3.1 V1 Tree Species Association

Bottomland hardwood wildlife depends heavily on mast, other edible seeds, and tree buds as primary sources of food. The model assumes that more production of mast and other edible seeds is better than less, and that hard mast is more critical than soft mast because it is available during late fall and winter and has high energy content. Typical hard mast producers in the SNWW study area are oaks, pecan, and other hickories. Soft mast and other edible seeds are produced by red maple, sugarberry, green ash, boxelder, common persimmon, sweetgum, honeylocust, red mulberry, bald cypress, tupelo-gum, American elm, and cedar elm. Nonmast/inedible seed producers are eastern cottonwood, black willow, and American sycamore. The model defines five classes based upon the percentage of the overstory that contains mast-producing trees, and the percentage of hard mast producers in the canopy.

Existing Condition. WVA input data for the percentages of mast-producing trees and hard mast producers in the overstory were estimated using data from the most similar reference sites. The reference sites were selected based upon knowledge of the study area and close examination of Google Earth imagery.

FWOP. It was assumed that the bottomland hardwood sites would remain intact and mature at a steady rate. All bottomland hardwoods in the study area appear to have some hard mast producers in them and, therefore, there were no Class 1 sites. For Classes 2-4, it was assumed that the percentage of hard mast producers would steadily increase over the period of analysis, such that Class 2 sites become Class 3, and Class 4 sites become Class 5 by TY61. Class 5 sites were assumed to remain Class 5 through TY61, as changes in climate and RSLC are not expected to significantly affect the health and growth of these forested wetlands.

FWP. It was assumed that all bottomland hardwoods within the construction right-of-way would be removed and replaced by levees, floodwalls, or other project features through TY61. To best capture this effect, the classification was changed to Class 1 from TY1 through TY61, as it has the lowest SI value for this variable.

6.3.2 V2 Stand Maturity

Mature stands of bottomland hardwood are rare in the study area and ecologically important. Historical and ongoing timber harvesting has reduced the number of mature stands and increased the ecological importance of those that remain. These stands provide more hard and soft mast, other edible seeds, and buds than younger stands. They provide important wildlife requisites such as snags, nesting cavities, and medium for invertebrate production. Older, stronger trees in the canopy outcompete understory trees and stimulate the production of additional snags and downed treetops as younger trees die. The model allows for either the average age of stands, or the average DBH to be entered for this variable. As we do not have reliable data on age, DBH was utilized.

Existing Condition. WVA input data for the stand maturity, as reflected in DBH, were estimated using data from the most similar reference sites. The reference sites were selected based upon knowledge of the study area and close examination of Google Earth imagery. As reference sites were used as the basis for input data, uncertainty in the accuracy of the input is reflected in a 2-inch^2 range for smaller average sizes, and a 3-inch^2 range for larger average sizes.

FWOP. An average rate of growth was developed based on data for species prevalent in the study area from the USDA Silvics of North America (USDA, 2004). These growth rates generally reflect optimum growth conditions on managed lands. This is appropriate because bottomland hardwood stands in the study area are generally not impounded and in relatively good condition. Steady growth throughout the period of analysis was assumed. For TY61, a larger range was used to capture the uncertainties associated with climate change and RSLC. For DBH growth projections, a range of 10 inch^2 was utilized.

FWP. At TY1, it is assumed that all bottomland hardwoods within the construction right-of-way will be removed and replaced by levees, floodwalls or other project features through the period of analysis. Since there is little uncertainty in this projection, a range of zero to 0.1 was entered for TY1 through TY61.

6.3.3 V3 Understory/Midstory

Midstory and understory plants also provide important food sources for bottomland hardwood wildlife, and also are preferable habitat for breeding, nesting, and feeding activities. The percentage coverage of understory and midstory is the variable input. Highest SIs apply to a mid-range coverage. The optimal range for understory is between 30 and 60 percent, while for midstory, it is between 20 and 50 percent.

Existing Condition. WVA input data for understory/midstory percentage coverage were estimated using data from the most similar reference sites. The reference sites were selected based upon knowledge of the study area and close examination of Google Earth imagery. As reference sites were used as the basis for input data, uncertainty in the accuracy of the input is typically reflected in a 20 percent range for understory and midstory.

FWOP. Changes over the period of analysis are assumed to be associated with canopy growth. It was assumed that the steady growth of BH stands will result in greater closure of the canopy. As the canopy closes, it is assumed that the percentage midstory coverage would decrease by 27 percent and understory coverage would decrease by 33 percent by TY61.

FWP. At TY1, it is assumed that all bottomland hardwoods within the construction right-of-way will be removed and replaced by levees, floodwalls or other project features through the period of analysis. Since there is little uncertainty in this projection, a range of zero to 0.1 was entered for TY1 through TY61.

6.3.4 V4 Hydrology

The model assumes that the optimum hydrology for stands of bottomland hardwood is one that is essentially unaltered from natural conditions, allowing natural wetting and drying cycles that are beneficial to vegetation and associated fish and wildlife species. The variable utilizes two sets of classes to evaluate and compare flooding duration and flow/exchange. The highest SI value is applied to temporary flooding with high flow/exchange, and the lowest is permanent flooding or dewatering and no flow/exchange.

Existing Condition. WVA input data for flooding duration and flow/exchange were estimated using the review team's knowledge of the study area and elevation data for specific areas.

FWOP. The bottomland hardwoods are generally located in elevations high enough that they would not be affected by changes in water surface elevation associated with RSLC. Changes in precipitation and freshwater inflows could affect them, but the uncertainty associated with current

predictions is very large. Therefore no change in flooding duration and exchange classes were forecast through TY61.

FWP. At TY1, it is assumed that all bottomland hardwoods within the construction right-of-way will be removed and replaced by levees, floodwalls or other project features through the period of analysis. In order to capture the effect on water regime, the FWP assumed a change to classes with the lowest SI values for TY1 through TY61 (permanently flooded with no flows/exchange).

6.3.5 V5 Size of Contiguous Forest Area

The model assumes that larger forested tracts are less common and offer higher-quality habitat than smaller tracts, and that species in greatest need of conservation are specialists in habitat use requiring large forested tracts. It is recognized that forest edge and diversity are important, but the model assumes that species that thrive in edge habitat are highly mobile and occur in substantial numbers because of the increase in forest fragmentation. Species found in "edge" habitat are generalists in habitat use but are capable of existing in larger tracts. For this model, tracts greater than 500 acres in size are considered optimal.

Existing Condition. For the direct impacts of the construction corridor, small parcels of bottomland hardwood have been aggregated into groups within hydrounits. For this reason, it was not appropriate to consider the total acreage of each group as the forest size. Since the construction right-of-way is a linear corridor that crosses forest areas, the size of the encompassing contiguous forest area was used to identify the class size for each bottomland hardwood group. The measurement was made using Google Earth.

FWOP. It was assumed that the size of the encompassing forested area would not change by TY61.

FWP. In order to capture the effect on contiguous forest size, the FWP assumed a change from TY 1 through TY61 to the class representing the size of smallest forest area left after bisection by the levee alignment.

6.3.6 V6 Surrounding Land Use

The model assumes that surrounding land uses affect the wildlife value of specific bottomland hardwood tracts. Many wildlife species commonly use adjacent areas as temporary escape or resting cover, as seasonal or diurnal food sources, or as connecting corridors to other desirable habitats. Surrounding areas that meet these needs can make a specific bottomland hardwood area more valuable. Furthermore, some types of surrounding land use are more valuable than others in providing food sources or encouraging wildlife movement. The model defines five types of

surrounding land use that are typically found in the study area, and assigns weighting factors that reflect their estimated potential in meeting specific needs. The effect of surrounding land use is measured within a 0.5-mile perimeter of the bottomland hardwood tract. The percent of this area occupied by each of the land use types is calculated and summed.

Existing Condition. Since bottomland hardwood parcels that would be impacted by the construction right-of-way have been aggregated within each hydrounit, the 0.5-mile perimeter was drawn around the aggregated individual stands. The existing condition was assessed using Google Earth imagery dated May 2016. Uncertainty associated with the assessment for TY1 in 2020 was assumed to be a range of 10 percent.

FWOP. The review group had no specific information regarding future land use or development changes in the areas surrounding the construction right-of-way. Land use types identified in the study area were predominantly nonhabitat (linear, residential, commercial, and industrial development) and natural habitats such as forested wetlands and marsh. In areas with existing industrial development, professional judgment was used to estimate the likely percentage increase in developed areas. Between 5 and 10 percent of forested or marsh areas in some of the bottomland hardwood groups were assumed to convert to developed areas by TY61. It was assumed that no changes would occur in state lands managed for fish and wildlife conservation purposes, and that navigation project placement areas would not change in use over the period of analysis. Significant uncertainty is associated with any prediction of land use change over 60 years from now. For those areas where no change was projected, a range of 20 percent was assumed. For those areas where a change was projected, a larger range of uncertainty (30 percent) was assumed. Land changes were predicted based upon recent development and general socioeconomic trends in the area.

FWP. Development is occurring now in the absence of storm surge protection, and the majority of the alignment would protect areas that are already developed. For those areas that are currently undeveloped, it was assumed that changes in surrounding land use would occur with or without the project, and therefore, the projected change was the same as the FWOP. However, significant uncertainty is associated with any prediction of land use change over 60 years from now. Therefore, a 20 percent uncertainty range at TY61 was assumed for those areas where no change was predicted and a 30 percent range was assumed for those areas where change was predicted.

6.3.7 V7 Disturbance

The model assumes that human-induced disturbance can displace individuals, modify home ranges, interfere with reproduction, cause stress, and force animals to use important energy

reserves. The model measures the effect of disturbance using two components: (1) type of disturbance, and (2) distance from disturbance. The magnitude of the effect of each type of disturbance is a factor of the distance to that disturbance.

Existing Condition. Since bottomland hardwood parcels that would be impacted by the construction right-of-way have been aggregated within each hydrounit, the distance to disturbance was measured in Google Earth from the edge of the right-of-way to the nearest disturbance type. Disturbance classes are predominantly frequent/moderate due to roads and industry or seasonal/intermittent due to distance from disturbances. Since the construction right-of-way follows the transition between the floodplain and the upland terrace margin to the greatest extent possible, distance to disturbance was often quite close, primarily in the 50- to 500-foot range.

FWOP. The review group had no specific information regarding future land use or development changes in the areas surrounding the construction right-of-way. Therefore, TY-1 through TY61 projections on type and distance to disturbance were the same as TY 0.

FWP. Since the source of the disturbance would be within the bottomland hardwood stands in the construction right-of-way, the FWP assumed a change from TY 1 through TY61 to the class representing constant/major disturbance, and distance was changed to the closest range (zero to 50 feet).

6.4 SUMMARY OF DIRECT IMPACTS FOR THE RECOMMENDED PLAN

For the FIFR-EIS, temporary and permanent construction rights-of-way containing all areas needed to construct and operate the new levee system were developed in GIS and applied to the USGS wetland vegetation files to identify all wetland vegetation and water areas that would be affected by levee construction. All of the wetlands located within temporary and permanent rights-of-way would be destroyed by construction. It is assumed that all material needed to construct the levee system will be obtained from commercial borrow sources. If other sources of fill material are proposed during PED, additional environmental evaluation will be required as requested by USFWS and NMFS Conservation Recommendation 6. It is assumed that the majority of excavated material resulting from construction will be utilized for other construction features. If there is excavated material in excess of construction needs, placement areas will need to be identified. During the construction phase, proposed placement areas will be identified and reviewed for environmental and wetland impacts. The plan for the disposal of this material will avoid or minimize additional adverse impacts to the maximum extent practicable. If significant impacts are identified for a proposed placement area, environmental review and coordination will be

conducted in compliance with the National Environmental Policy Act and other applicable regulations.

As explained in Section 2.0, the Orange 3 Recommended Plan is very similar to the plan referenced as Orange 3 in the DIFR-EIS. The DIFR-EIS evaluated the impacts of a range of levee system elevations (11-14 feet), and disclosed that an additional 3 feet would likely be necessary to account for the effects of wave run-up and RSLC. The highest final elevation of Recommended Plan is about 17 feet, but the height in any specific location is dependent upon the existing ground elevation at that location and the needed levee/floodwall height established by storm surge modeling and wave run-up analysis. The length of the system remains approximately 27 miles in total, the same length as the TSP. The overall percentage of floodwalls has increased from about 20 percent of the overall system to about 40 percent. This was necessary to avoid impacts to residences and pipelines, and to minimize impacts to wetlands. The alignment has been relocated in several short segments, but overall remains similar to that presented in the DIFR-EIS. Differences in the two alignments are shown by overlying the Recommended Plan alignment on the TSP alignment (Figures: 6-1 through 6-4).

The Port Arthur Addition is significantly smaller than the TSP Plan in Jefferson County (Figure 6-5). The Beaumont A and most of the Jefferson Main elements are not included in the Recommended Plan. A reevaluation of the existing protection system at Beaumont A found that it provides a similar level of protection to that proposed by the TSP. It was determined that, for the most part, the Jefferson Main element was not needed when elevation data was revised in some sections and local preferences for no levee system were taken into account. One short levee reach (approximately 1,900 feet long) in the Jefferson Main area is still recommended, but it can now be combined with the Port Arthur CSRM Plan since it is located within the jurisdiction of the non-Federal sponsor for the existing Port Arthur Hurricane Flood Protection (HFP) project. This short levee segment connects high ground to high ground, and completes the risk reduction measure for Jefferson County. The TSP and Recommended Plans, therefore, reduce the risks of storm surge impacts to the same general areas. The Port Arthur Addition impacts are negligible and no mitigation is required.

Since conservative assumptions were applied in estimating TSP wetland impacts, direct impacts of the Recommended Plan are approximately 50 percent lower than those presented in the DIFR-EIS. Total direct impacts for the TSP (-161.8 AAHUs) have been reduced to -86.5 AAHUs for the Recommended Plan. Details of the Recommended Plan direct impacts are presented in Table 6-1. Revisions in the alignment have also resulted in a significant reduction of impacts to existing structures, from about 64 structures under the TSP to about 30 structures in the Recommended

Plan. Indirect impacts, which increase the total wetland impacts of the Recommended Plan, are described in Section 7.

The direct impacts reflect the assumed loss of all forested and marsh wetlands within the construction right-of-way of the Recommended Plan due to construction impacts in the first year of construction. Detailed tables of WVA model output of direct impacts for the intermediate RSLC scenario are presented in Attachment 3. Direct impacts that would occur under the low RSLC scenario was not modeled, as they are expected to be similar by slightly less than the intermediate scenario, and the differences in mitigation costs would not be large enough to affect plan selection. The width of the right-of-way might be slightly narrower under the low RSLC scenario; the right-of-way width for the high scenario would be similar to that modeled for the TSP.

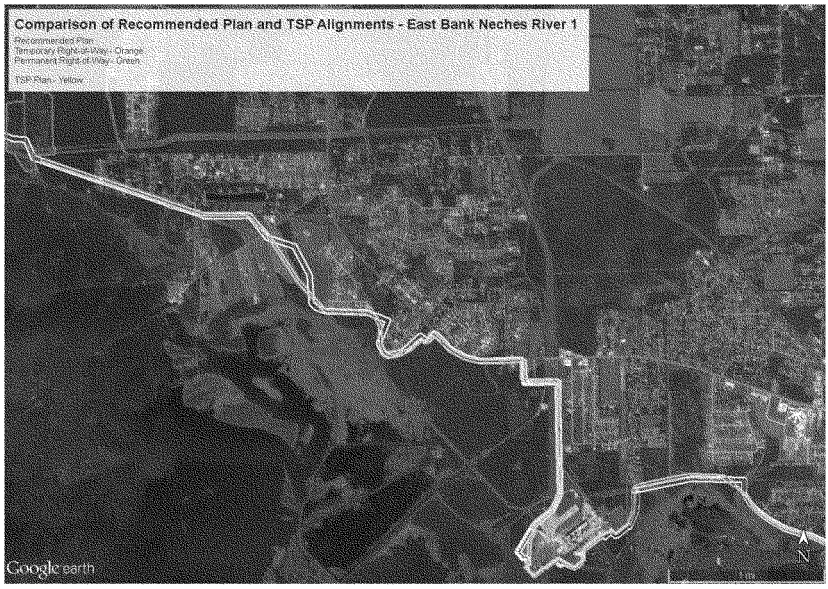

Figure 6-1. Comparison of TSP and Recommended Plan Alignments – Neches 1

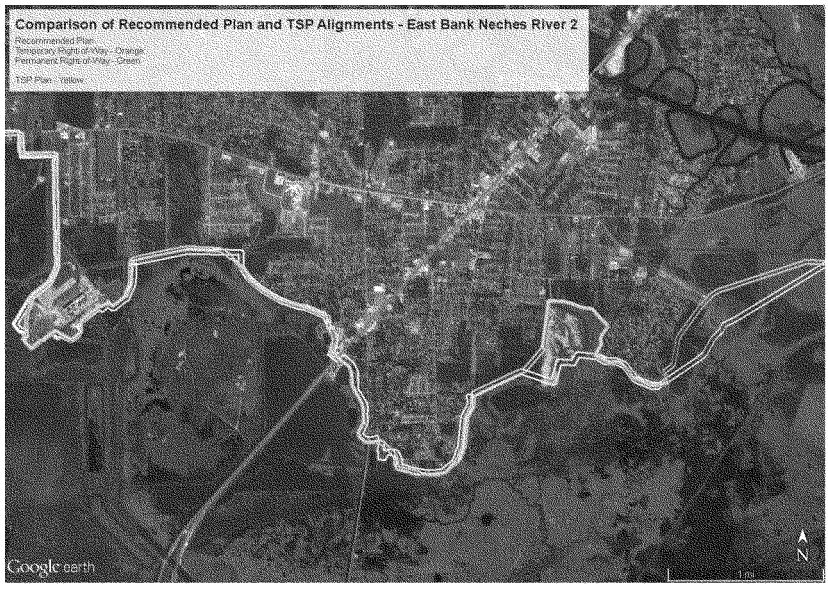

Figure 6-2. Comparison of TSP and Recommended Plan Alignments – Neches 2

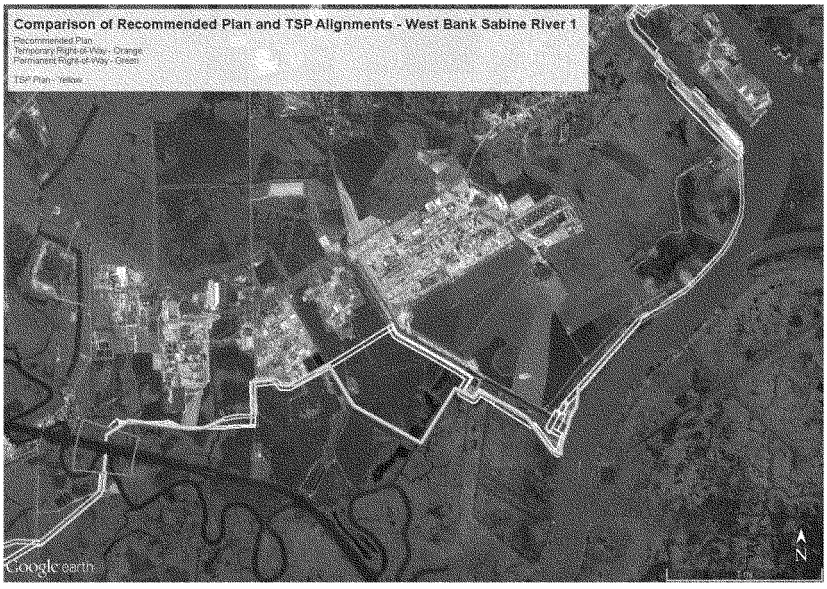

Figure 6-3. Comparison of TSP and Recommended Plan Alignments – Sabine 1

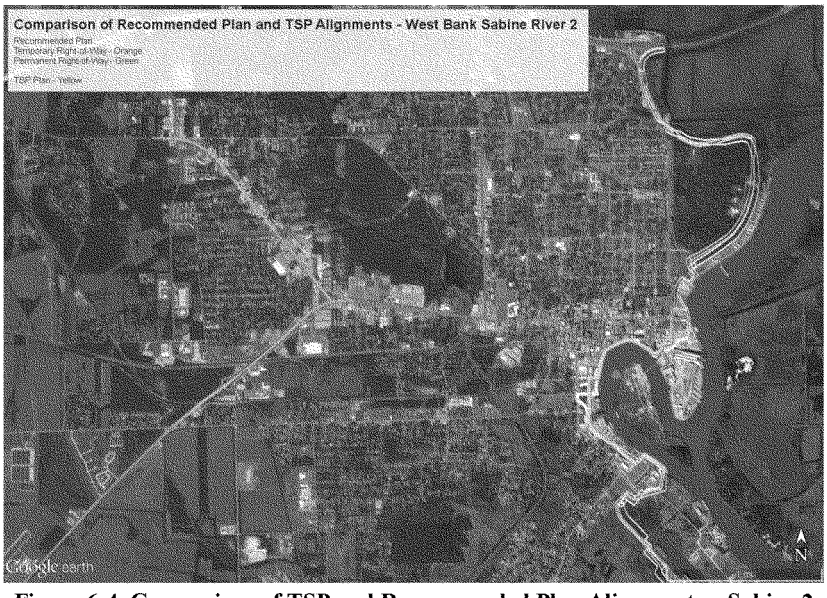

Figure 6-4. Comparison of TSP and Recommended Plan Alignments – Sabine 2

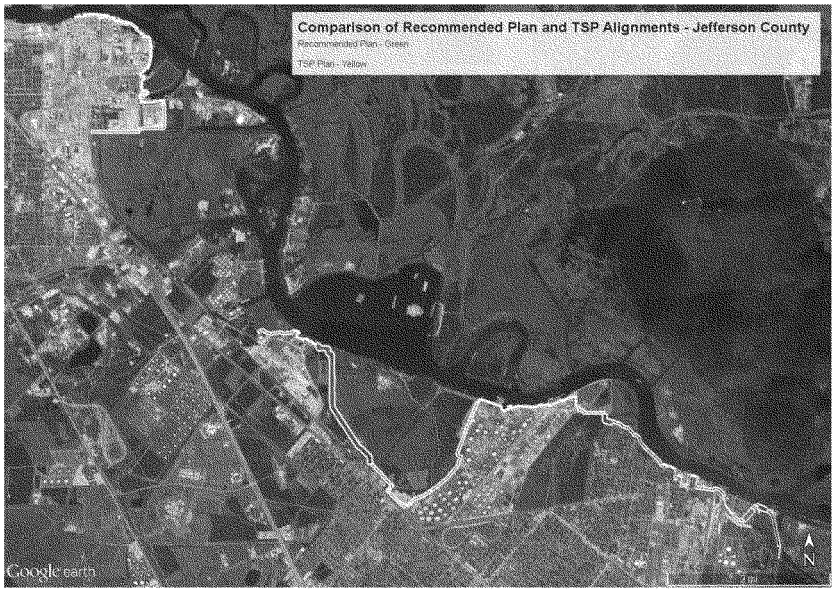

Figure 6-5. Comparison of TSP and Recommended Plan Alignments – Jefferson County

Table 6-1. Recommended Plan Direct Impacts (Intermediate RSLC)

Direct Impacts		
	Orange 3 CSRM Plan	
Wetland Type	Acres	AAHUs
Forested Wetlands		
Swamp	10.5	-7.2
Bottomland Hardwood	43.9	-30.3
Subtotal	54.4	-37.5
Coastal Marsh		
Fresh Marsh	24.3	-11.4
Intermediate Marsh	6.8	-4.0
Brackish Marsh	74.2	-33.7
Subtotal	105.3	-49.0
Total Direct Impacts*	**159.7**	**-86.5**

* Totals may not add exactly due to rounding.

7 FWP ANALYSIS OF INDIRECT IMPACTS

Indirect impacts of the Recommended Plan are related to two primary project effects – those associated with fisheries access impacts on the extensive marshes in the lower Cow and Adams Bayous floodplains and indirect impacts related to changes in hydrologic connectivity caused by the new levee system and the Cow Bayou structure. The Port Arthur Addition has no indirect impacts.

The potential for hydrologic impacts of the Adams and Cow Bayou surge gate structures on the Adams and Cow Bayou watersheds was evaluated using desktop hydrologic modeling as presented below. It is assumed that normal flows would be constricted by the presence of surge gates in the bayous in their normal open condition, and that this constriction would result in fisheries access impacts. An analysis of the location of the levee system alignment identified small, localized areas that would experience changes in hydrologic connectivity by being impounded between the new levee system and terrace bluff. Construction of the Cow Bayou gate structure and levee system would indirectly affect a few areas both inside and outside the levee system by permanently disrupting tidal connections. Tidal access to one bottomland hardwood area outside of the levee would also be permanently disrupted by levee construction.

WVA models were used to quantify the indirect impacts of these effects; methods and assumptions used in this modeling are presented below. Wetland areas affected by the indirect impacts of the levee system would change in type and extent due to different levels of tidal flooding under the three RSLC scenarios, and therefore impacts were modeled for each scenario. For example, it was assumed that some swamp would convert to brackish marsh under the Intermediate and High RSLC, because of changes to the salinity regime and higher water elevations. Likewise, some marsh areas switched from intermediate to brackish or brackish to saline due to the changing salinity regime. At other locations, former uplands were assumed to convert to marsh as tides push into new areas due to intermediate and high RSLC. These wetland switches were assumed to occur at the midpoint of the period of analysis (TY 31) which simulates a gradual change over the period of analysis. Indirect fisheries impacts on marsh function associated with the surge gates in Adams and Cow Bayous were modeled for the low RSLC scenario, and these impacts were applied to the intermediate and high scenarios. Higher tidal inundation would improve fisheries access even with the structures in place; the low RSLC condition thus provides a conservatively high impact assessment. Table 7-1 displays all of the indirect impacts described in this section.

Table 7-1. Recommended Plan Indirect Impacts (Intermediate RSLC)

Orange CSRM Plan Indirect Impacts					
Wetland Type	**Indirect Wetland**	**AAHUs**	**Functional**	**AAHUs**	**Total AAHU**
Forested Wetlands					
Forested Wetlands					
Swamp	1.9	-0.1	0.0	0.0	-0.1
Bottomland Hardwood	12.7	-5.1	0.0	0.0	-5.1
Subtotal	14.6	-5.2	0.0	0.0	-5.2
Coastal Marsh					
Fresh Marsh	0.0	0.0	785.2	-18.8	-18.8
Intermediate Marsh	19.2	-8.5	322.5	-4.1	-12.6
Brackish Marsh	78.5	-35.2	1029.5	-27.6	-62.8
Subtotal	97.7	-43.7	2137.2	-50.5	-94.2
Total Indirect Impacts*	**112.3**	**-48.9**	**2137.2**	**-50.5**	**-99.4**
* Totals may not add exactly due to rounding.					

Indirect fisheries impacts associated with the surge gates in Adams and Cow Bayous would affect about 2,137 marsh acres in those watersheds under all RSLC scenarios, resulting in the loss of 50.5 AAHUs. These are functional losses only; the wetlands would not be physically impacted by construction of the levee system. All other indirect impacts would affect about 112 acres with the loss of 48.9 AAHUs. These reflect hydrologic impacts that are predicted to lead to actual wetland loss. Modeling assumptions for all of these impact evaluations are described in more detail below. Tables of WVA model output of indirect impacts are presented in Attachment 4.

7.1 ANALYSIS OF SURGE GATE IMPACTS ON ADAMS AND COW BAYOUS

7.1.1 Hydrologic Modeling of the Surge Gates

ERDC's DOWSMM modeling (USACE 2015) indicates negligible impacts on the water surface elevation and salinity within Adams and Cow Bayous from potential constrictions to the channel cross-section with the proposed surge gates in their normal open condition. This was determined by a sensitivity analysis conducted on the inlet size for each bayou, based on the assumption that construction of the gates would result in some reduction of the cross-section in their normal, open condition. In the analysis, bayou cross-sections were reduced by a wide range of estimated parameters, up to a maximum 75 percent constriction. It was determined that the limited tidal

prism associated with the bayous results in minimal energy loss across the connection between the bayous and the Sabine River, and therefore constriction of this access point results in little change in the tidal energy passing into the bayou. The insensitivity of the water surface elevation and the salinity impacts gives high confidence that the general conclusion associated with this study is robust; constriction of the inlet, even significant constriction, results in minimal impacts on water surface elevation and salinity within the bayous.

The extent to which these constrictions would impound storm water within the bayous was also examined by evaluating the effects of a significant rainfall event (Tropical Storm Allison) that had been captured in the median flow simulation. Once again, this analysis applies to the normal, open condition of the gate and evaluated the impacts of rainfall not associated with a significant storm surge event. Given the type of structures currently being evaluated (sector gates on the navigation channels with one or more flanking vertical lift gates to maintain flows on one or both sides of the navigation gates), it is estimated that existing flows may be reduced by a maximum of 50 percent. An aerial view of this type of structure is shown in Figure 7-1. The DOWSMM analysis showed that, even for a 50 percent constriction, the volume of water resulting from such a storm could still pass through the constriction with little impact on upstream stage. There was no attempt made to determine if this storm event represented a project flood, and hence a larger storm could have a more significant impact.

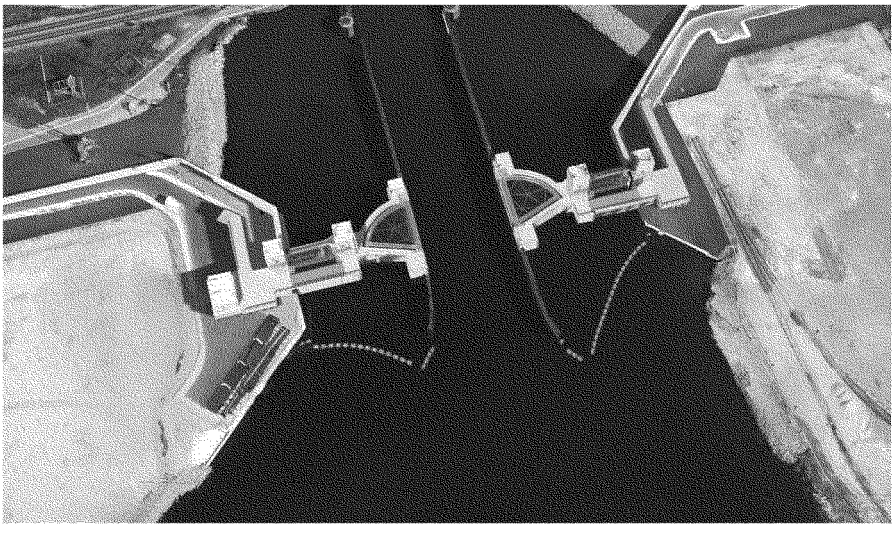

Figure 7-1. Conceptual Plan View of Adams and Cow Bayou Structures

7.1.2 Indirect Impacts on Coastal Marsh and Aquatic Organisms

Impacts related to the temporary closure of the gates were also considered to determine whether fisheries migration would be impacted with placement of the gates in the bayous and temporary surge-related gate closures. Potential impacts to the transport of sediments, nutrients and organic matter between wetlands upstream of the gates and the wetlands and estuary downstream of the gates are addressed in Section 7.2.

The degree of impact would be influenced by the timing and duration of a structure closure relative to peak migration seasons. However, given the predicted return interval of 10 to15 years for storm surges high enough to threaten the areas targeted for protection by this study (which are generally 7 to 10 feet higher than the structure locations), interruption of fishery migrations would be rare. In addition, it is not anticipated that the gates, once closed, would remain closed for an extended period. The project design includes a pump system that would significantly reduce the flood duration upstream of the structures after the gates have been closed to protect against storm surge impacts. Gates or water control structures would need to be closed for large storm events, even if the storms occur more frequently than the predicted return period. The operating plan for the gates has not yet been developed, but an estimated closure time of one week for surge events would result in only minor and temporary impacts to fisheries access. In addition to storm event closures, the gates would need to be closed periodically for maintenance. These closures would also generally be of short duration with only minor and temporary impacts. It must be noted, however, that should the final structure design reduce the cross section by more than 50 percent, additional modeling and environmental analysis would be needed to more thoroughly characterize potential hydrologic impacts of the gate structures.

Based on all of the above analyses and assumptions, it appears that the only significant impact of the Cow and Adam Bayous structures would be fisheries access impacts associated with the day-to-day operation in the open condition. For the historic RSLC scenario, indirect impacts on swamps and bottomland forests upstream of the gated structures are expected to be negligible because changes in water surface elevation and salinity are expected to be negligible (USACE 2015). Therefore, no WVA impact modeling was needed for the Adams and Cow Bayou forested wetlands. However, indirect impacts associated with fisheries access through the gated structures would be expected for extensive marshes in the bayou floodplains upstream of the gated structures (Figures 7-2 and 7-3). These impacts could be expected to affect approximately 1,237 and 900 acres of coastal marsh in the Cow and Adams Bayou floodplains, respectively. The upstream limit of the affected areas, defined to include all upstream marshes in the bayou floodplains, is approximately 7.7 stream miles upstream of the Cow Bayou structure and 4.4 stream miles upstream of the Adams Bayou structure. Despite the limited hydrologic effect demonstrated by

the modeling, functional impacts to the marshes may result from potential interference with aquatic organism movement into and out of the bayou caused by the physical presence of the tide gate structures in the bayous.

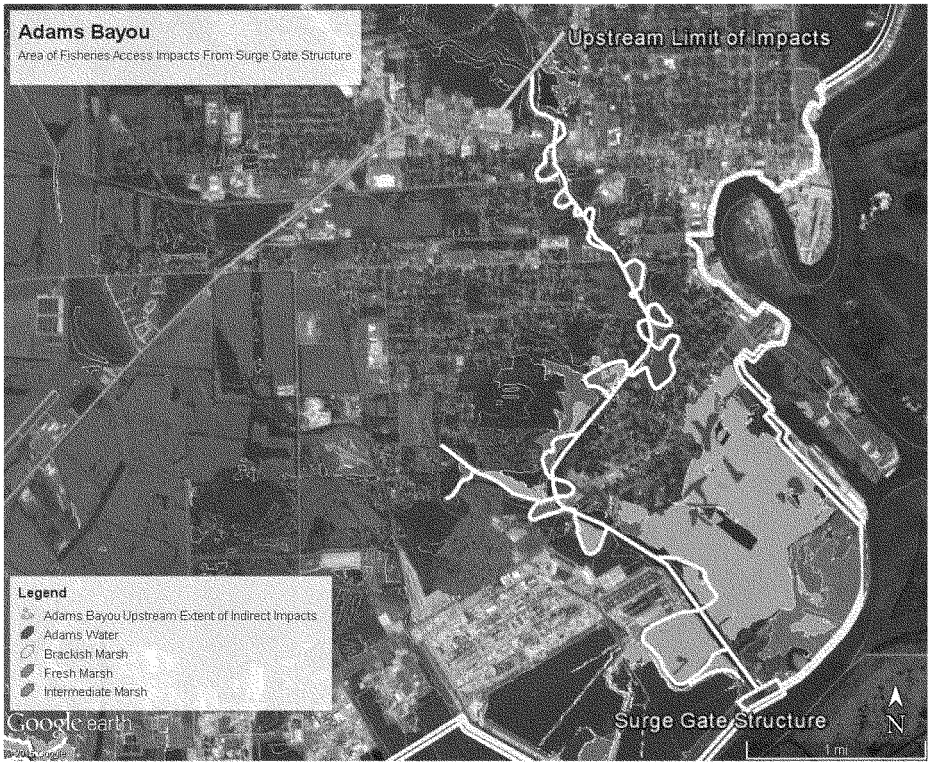

Figure 7-2. Adams Bayou Indirect Impact Area of Surge Gate Structure

According to the NMFS (2008), the ability of estuarine dependent marine fishery organisms to migrate to and from coastal habitats decreases as structural restrictions increase, thereby reducing fishery production (Hartman et al. 1987; Rogers et al. 1992; Rozas and Minello 1999). The physical ability (i.e., swimming speed) to navigate through a structure is not the only factor influencing fish passage. Both behavioral and physical responses govern migration and affect passage of fishery organisms through structures. These responses may vary by species and life stage. In addition, most marine fishery species are relatively planktonic in early life stages and are dependent on tidal movement to access coastal marsh nursery areas. For this reason, in general, the greater the flow through a structure into a hydrologically affected wetland area, the greater the

marine fishery production functions provided by that area. It should not be assumed that structures that have been determined to provide sufficient drainage capacity also optimize or provide adequate fishery passage. More investigation is warranted to refine and adaptively manage water control structure design and operations to minimize adverse impacts to fishery passage. Structures constructed along the sides of Cow and Adams Bayou would interfere with organism movement into and out of the bayou, but this impact would be minimized by following specific NMFS design recommendations (NOAA 2008).

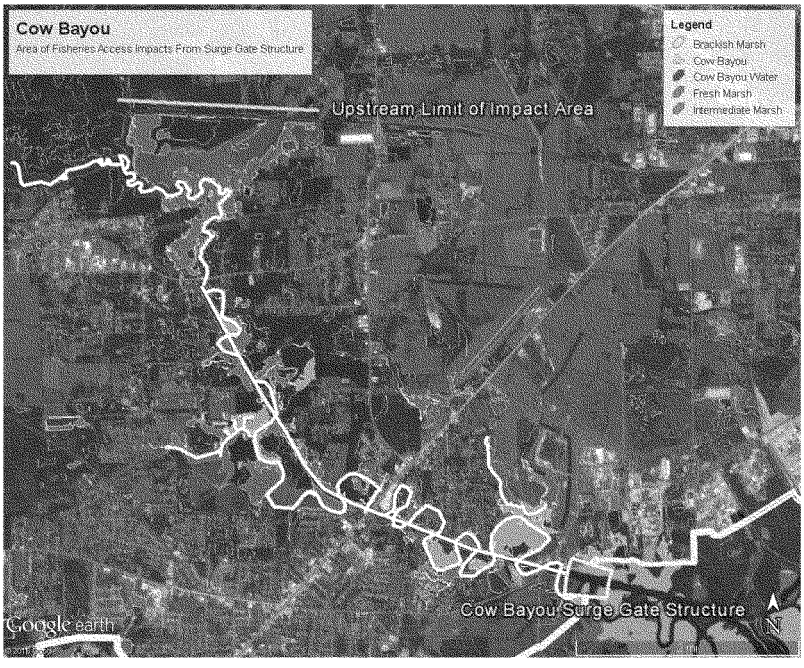

Figure 7-3. Cow Bayou Indirect Impact Area of Surge Gate Structure

Since only preliminary information on the Cow and Adams gate structures is available at this time, the WVA indirect impacts analysis assumed that the structures would reduce the cross-sectional area of the inlets by 50 percent. Final structural designs will incorporate fisheries-friendly considerations recommended by NMFS (2008) to the greatest extent possible (Attachment 4). Final feasibility design will be completed during PED. If it is determined at that time that the design will reduce the cross-sectional area of the bayou inlets by more than 50 percent, additional modeling and environmental analysis will be initiated in consultation with the resource agencies, and as requested by NMFS Conservation Recommendation 3.

7.1.3 WVA Coastal Marsh Modeling of Indirect Impacts

The following method was used to develop input for the WVA Coastal Marsh variables 1 through 6 to capture the indirect effects described above, particularly the fisheries access affects. The WVA marsh models include a variable (V6) that can evaluate impacts on fisheries access. Persistent emergent marsh vegetation and associated open water play an important role in coastal wetlands by providing foraging, resting, and breeding habitat for a variety of fish and wildlife species; and by providing a source of detritus and energy for lower trophic organisms that form the basis of the food chain. Access to these marsh and water systems by aquatic organisms, particularly estuarine-dependent fishes and shellfishes, is considered to be a critical component in assessing the quality of a given marsh system. Additionally, a marsh with a relatively high degree of access by default also exhibits a relatively high degree of hydrologic connectivity with adjacent systems, and therefore may be considered to contribute more to nutrient exchange than would a marsh exhibiting a lesser degree of access.

For V1 input (Percent Emergent Marsh and Water), emergent marsh and water acres within the Cow and Adams floodplains upstream of the gates was taken from the USGS wetland vegetation classification of the Cow and Adam water basins (USACE 2014). These are the only basins for which surge gate structures are proposed; large marsh areas are located upstream of the levee right-of-way on both bayous. Marsh polygons were lumped within each basin for each marsh type - brackish, intermediate, and fresh (no saline marsh is present in these areas). Lumping all polygons of one marsh type for the WVA modeling of each basin is appropriate because of the general uniformity of the marshes in these basins.

Two areas on Adams Bayou were investigated to determine if they should be modeled separately. An area of impounded fresh and intermediate marsh within a former dredged material placement area at the mouth of Adams Bayou (the TPWD Adams Bayou Unit) was found to be hydrologically isolated from the adjacent Sabine River and Adams Bayou. Dredged material placement has raised the elevation of the area to between 7 and 10 feet, and there is no tidal access from the Sabine River or Adams Bayou. Since the proposed surge gate would have no additional impact on fisheries access to this area, the Adams Bayou Unit was excluded from the impact analysis. Separate WVA modeling of the 475-acre marsh west of the Adams Bayou Unit was considered but it was ultimately lumped together with the other Adams Bayou marshes. Primary access is provided by Adams Bayou on its southwestern side, although up to an estimated 40 percent of the flows enter the area near its northernmost point through a bridge-culvert under the road leading into the Port of Orange. An old levee, which bisects the area from northwest to southeast, is degraded in many areas, allowing flows to pass unencumbered to both sides of the levee. Since the Adams Bayou hydrologic openings are capable by themselves of providing full access to the

entire area, the separate marsh types in this area were lumped with the rest of the marshes in the impact area, and all were assigned a structure rating of 1.0 since no impediments to access are known.

The total amount of the classified water in each basin, including the channelized bayou reaches and the natural oxbows within the tidal segment, is included in the V1 water acres since all are important avenues for fisheries access, and all would be affected in some way by the structures. Water acres were subdivided and associated with each of the three marsh types in accordance with the total relative percentages of the marsh types themselves. All of the polygons for each marsh type within each basin were added together, and the relative percentages of fresh, intermediate, and brackish marsh were calculated. If, for example, 30 percent of the marsh in the basin was brackish, then 30 percent of the water in the affected reach of the bayou was associated with brackish marsh.

The percent of aquatic vegetation cover (V2) was estimated based upon observations documented for these areas for the SNWW Channel Improvement Project Feasibility Study and Environmental Impact Statement (USACE 2011), review of Google Earth 2015 imagery and best professional judgment.

The degree of marsh/waterbody interspersion (V3) was assessed for each marsh type over each drainage using Google Earth 2015 imagery at the same scale as the examples shown in the WVA marsh model V 1.0

The percent shallow water (V4) of total water in each drainage was calculated by apportioning the shallow water percentage across the marsh types in accordance with their relative percentages. The percent shallow water was estimated using a weighted average based on length of the dredged channel, natural oxbow channels, and small shallow streams with the assumptions that the dredged channel has 10 percent shallow water along its edges, the natural oxbows have 30 percent shallow water along their edges, and the shallow tributaries have 40 percent shallow water along their edges. The breakdown of the three water body types is shown in Table 7-1 for each bayou. Calculations to estimate the percentage of shallow water in the affected areas of for Adams and Cow Bayous are shown in Tables 7-2 and 7-3 below.

Table 7-2. Affected Bayou and Stream Miles in Cow and Adams Bayous

	Adams Bayou		Cow Bayou	
Water Body Types	Total Length (miles)	Water Body Type (%)	Total Length (miles)	Water Body Type (%)
Channelized Bayou	4.1	33.0%	4.4	19%
Natural Bayou	7.12	57.3%	14.8	65%
Shallow Streams	1.2	9.7%	3.6	16%
Total	12.42	100.0%	22.8	100%

Table 7-3. Estimation of Percentage Shallow Water for Adams Bayou

Adams Bayou						
Calculations to Estimate Percent Shallow Water (V4)						
	Marsh Type Percentage	Emergent Marsh by Type (acres)	Water Acres Proportioned by Relative Percentage of Water Body Type	Assumed Percentage Shallow Water*	Calculated Shallow Water (Acres)	Total Marsh & Water (Acres)
Fresh Marsh (F Indirect-3)	21.2%	63.1	47.5			110.6
Channelized Water (19%)			9.0	10%	0.9	
Natural Channels (65%)			30.9	30%	9.3	
Shallow Streams (16%)			7.6	40%	3.0	
Subtotal					13.2	
Intermediate Marsh (I Indirect-4)	7.3%	35.8	16.4			52.2
Channelized Water (19%)			3.1	10%	0.3	
Natural Channels (65%)			10.6	30%	3.2	
Shallow Streams (16%)			2.6	40%	1.0	
Subtotal					4.6	
Brackish Marsh (B Indirect-5)	71.5%	578.7	160.3			739.0
Channelized Water (19%)			30.5	10%	3.0	
Natural Channels (65%)			104.2	30%	31.3	
Shallow Streams (16%)			25.7	40%	10.3	
Subtotal					44.6	
Totals		677.6	224.3		62.3	901.9
Percentage Shallow Water Associated with All Marsh Types					**35.7%**	

*Weighting based on following assumptions:
Channelized bayou has 10 percent shallow water along edges.
Natural bayou and oxbows have 30 percent shallow water along edges.
Small shallow streams have 40 percent shallow water along edges.

Table 7-4. Estimation of Percentage Shallow Water for Cow Bayou

Cow Bayou						
Calculations to Estimate Percent Shallow Water (V4)						
	Marsh Type Percentage	Emergent Marsh by Type (acres)	Water Acres Proportioned by Relative Percentage of Water Body Type	Assumed Percentage Shallow Water*	Calculated Shallow Water (Acres)	Total Marsh & Water (Acres)
Fresh Marsh (F Indirect-2)	54.6%	421.0	253.6			674.6
Channelized Water (19%)			48.2	10%	4.8	
Natural Channels (65%)			164.8	30%	49.4	
Shallow Streams (16%)			40.6	40%	16.2	
Subtotal					70.5	
Intermediate Marsh (I Indirect-3)	21.9%	168.7	101.6			270.3
Channelized Water (19%)			19.3	10%	1.9	
Natural Channels (65%)			66.0	30%	19.8	
Shallow Streams (16%)			16.3	40%	6.5	
Subtotal					28.2	
Brackish Marsh (B-Indirect-4)	23.5%	181.3	109.2			290.5
Channelized Water (19%)			20.7	10%	2.1	
Natural Channels (65%)			71.0	30%	21.3	
Shallow Streams (16%)			17.5	40%	7.0	
Subtotal					30.4	
Totals		771.0	464.4		129.1	1,235.4
Percentage Shallow Water Associated with All Marsh Types					**27.8%**	

*Weighting based on following assumptions:
Channelized bayou has 10 percent shallow water along edges.
Natural bayou and oxbows have 30 percent shallow water along edges.
Small shallow streams have 40 percent shallow water along edges.

Salinity (V5) for the existing condition (historic RSLC) was based on salinity projections developed for the SNWW 48-foot channel improvement project as described for WVA modeling of S2G direct impacts.

Impacts to fisheries access (V6) were assessed based on limited, preliminary information on the type of surge prevention structure planned for Cow and Adams Bayous. Fisheries access impacts for the affected tidal areas are associated solely with the proposed surge gate structures. The final

design will attempt to minimize impacts on the existing flow and cross-sectional area of the bayous, and will utilize fisheries-friendly design concepts recommended by NOAA (2008). However, to provide a conservatively high estimate of potential impacts, the WVA modeling assumed a 50 percent reduction in the cross-section of the channel. Based on a curve developed with data from Rogers et al. (1992) for the "Percent Open Channel Method" for calculating fisheries access impacts, this equates to a structure rating of 0.7 for the type of open structure planned (Figure 7-4). This method has been used by NOAA-NMFS and USACE on recent projects in Louisiana (NMFS 2012).

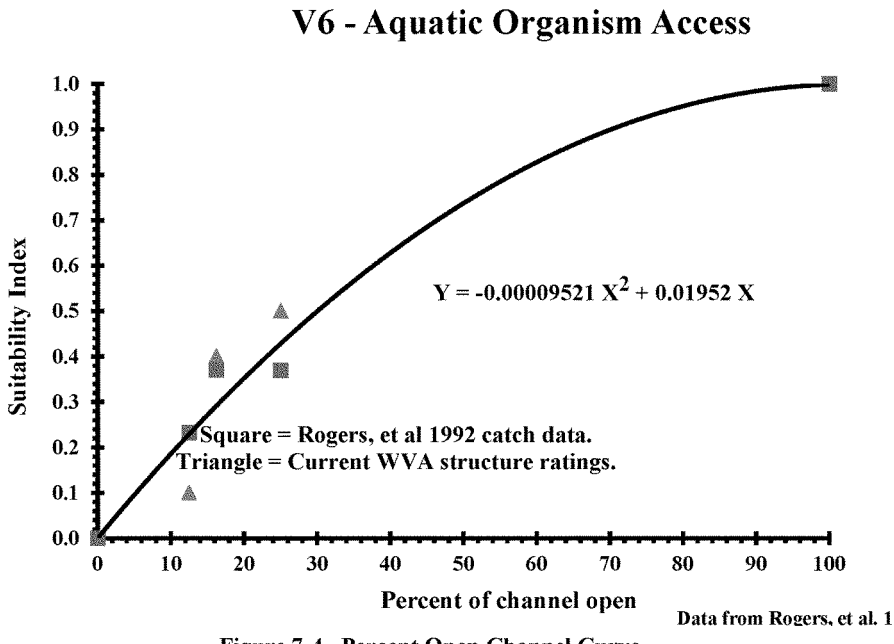

Figure 7-4. Percent Open Channel Curve

7.1.4 Intermediate and High RSLC Scenarios

Indirect impacts related to the Cow and Adams gated structures were modeled for the historic RSLC scenario. Surge gate structures on Cow and Adams Bayou would be open the vast majority of the time, allowing sea levels to rise upstream of the structure as they would in the FWOP condition. In Cow and Adams Bayous, water levels under intermediate RSLC should remain largely within the existing channels; with high RSLC, water elevations would encroach into some developed areas of Bridge City which are adjacent to the bayou and tidal inundation of all wetland

areas would be deeper. Large areas of brackish marsh in the floodplains downstream of the Cow Bayou gate and around the mouth of Adams Bayou on the Sabine River would experience much deeper daily tidal inundation with high RSLC, with some areas possibly converting to open water. Higher tidal inundation would improve fisheries access even with the structures in place. However, the degree of improvement is difficult to estimate, and therefore indirect fisheries impacts were not modeled for the intermediate and high RSLC scenarios; impacts quantified for the historic scenario were applied, providing a conservatively-high impact assessment.

Indirect fisheries impacts of the Adams and Cow Bayous structures would affect about 2,137 acres, resulting in the loss of 50.5 AAHUs. Inasmuch as impacts of the three RSLC scenarios are assumed to similar, differences in mitigation costs would not affect plan selection.

7.2 ANALYSIS OF INDIRECT IMPACTS OF THE LEVEE SYSTEM

7.2.1 Historic RSLC Scenario

7.2.1.1 FWOP Condition

A desktop analysis of interior drainage requirements has been performed by Galveston District as required using current USACE guidance contained in ER 1100-2-8162 and ETL 1100-2-1. This analysis identified all of the sub-drainage basins behind the proposed new levee alignment and the primary small drainage in each sub-basin for which existing flow will need to be maintained. Figure 7-5 shows the sub-basins outlined in white, the primary drainage in each sub-basin in red, and the major rivers in blue. The longest evaluated levee alignment is shown in yellow. The analysis calculated the amount of both overland and channelized flow from each basin. The Recommended Plan alignment does not affect large segments on both the western and eastern ends of the illustrated alignment.

7.2.1.2 FWP Condition

An analysis of potential impacts to the Sabine and Neches River floodplains is presented in Appendix D (Engineering) of the FIFR-EIS. The Sabine and Neches River floodplains are largely untouched by the Recommended Plan, as the levee system has been located along the upland/floodplain interface, or situated to follow existing levee systems or upland placement areas which impound some floodplain areas in the existing condition. The levee system will have negligible impacts on flow, stage, velocity and other factors as determined by HEC-RAS analysis. Because there is little effect on flow, there is expected to be a negligible impact on the exchange of sediment, nutrients and organic matter between wetlands upstream of the levee system and the wetlands and Sabine estuarine downstream of the system. The Cow and Adams Bayou surge gates will result in higher water velocities in the immediate vicinity of the structures, and this may cause

a minor increase in shoaling downstream of the gates. Minor scouring of the stream bed adjacent to the structures may also result.

Sluice gate culverts are planned for use everywhere there is tidal influence (Figure 7-6); flap gate culverts may be utilized in upstream areas above tidal influence (Figure 7-7). It is likely that all of the culverts would be sluice gates because the entire proposed Orange levee system is located in areas that are tidally influenced. Gated culverts would be placed everywhere the red drainage lines intersect the yellow levee alignment, and they would be placed in additional areas where they are needed to ensure adequate flows to adjacent wetlands. The sluice gates would remain open except when surge protection or maintenance is needed; they would be closed temporarily for a short period before and after a storm occurs. Flap gate culverts would provide for one-way flow downstream from the levee system.

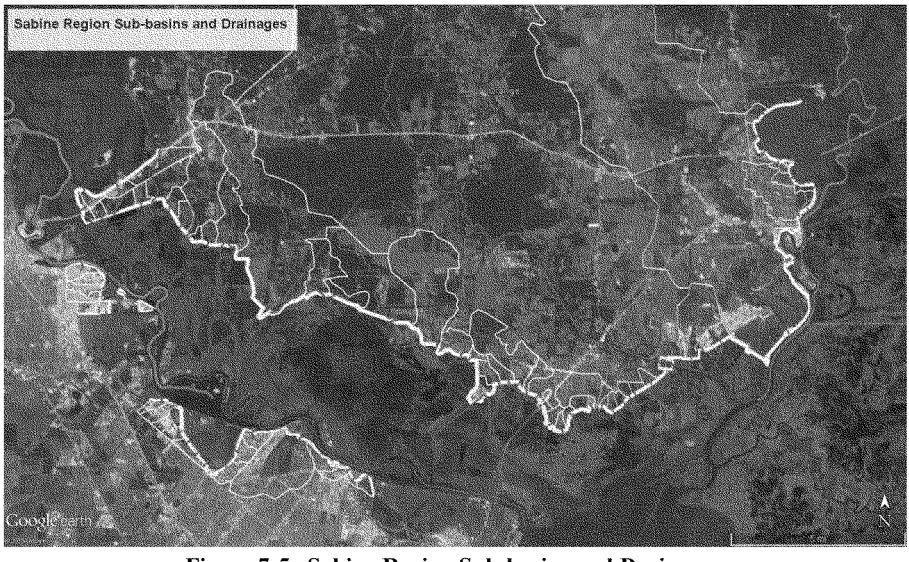

Figure 7-5. Sabine Region Sub-basins and Drainages

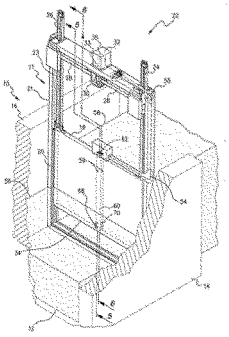

Figure 7-6. Sluice Gate Example

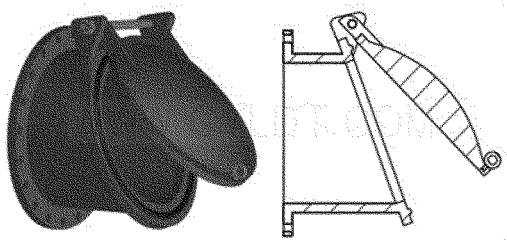

Figure 7-7. Flap Gate Example

Impacts on the floodplain, both upstream and downstream of the levee system, would be minimized such that remaining impacts are negligible. Culverts have been designed to maintain existing flows for a 100-year rainfall event, with an additional 10 percent to account for the predicted increase in rainfall due to climate change over the period of analysis. In addition, they will be designed with longer spans and lower heights than would typically be used in an attempt to replicate the natural openings. In the existing condition, freshwater inflows from the upland areas to marshes and forested wetlands in the floodplain are being conveyed primarily through existing stream channels. The majority of the time, flows are directed toward channels and ditches that discharge into the floodplain through existing drainages. Water flows through these channels into minor drainages with incised beds, and in some cases flows spread out directly into wetland areas. Overland sheet flow is temporary, occurring during intense or long duration rain events, as the majority of the area upstream of the levee is undeveloped and permeable. The degree to which shallow groundwater aquifers may contribute flows to the floodplain is unknown, but they are assumed to be a minor contributor. It is believed that marshes in the floodplain rely primarily on rainfall and tidal push for inundation.

During a surge event the sluice gates would be closed, pumps would be used to pump rainfall runoff from the interior to the exterior. The pumps are being conservatively sized to avoid floodplain impacts to the interior of the levee system, and to allow overbank flooding in the streams in the floodplain outside of the levee during high flow events. Hydrologic flows, as well as the exchange of sediment, nutrients and organic material would thus be very similar to FWOP flows and in location, duration and magnitude, both upstream and downstream of the levee system. Like the Cow and Adams Bayou structures, it is assumed that these gates would need to be closed for one week for each storm event or up to two weeks for periodic maintenance. The operating plan for the gates has not yet been developed, but even a worst case estimate of closure time would

result in only minor and temporary impacts on fisheries access for gates with tidal flows. Groundwater flow from shallow aquifers may be affected by compaction of aquifer sediments due to the weight of the overlying levee, or by construction of seepage barriers beneath the levee. The location and extent of these will not be known until final levee design.

Based on these assumptions, it was determined that the levee would have minor impacts on the hydrology of the floodplain and sediment/nutrient exchange both inside and outside of the levee system. Because this determination rests heavily on these assumptions, resource agencies have requested to be involved in the development of Operating Manuals during the PED Phase and during subsequent periodic reviews when operating plans are reevaluated to determine project performance under future conditions, including potentially higher than anticipated rates of RSLC. Requirements that the surge gates, sluice gates, and culverts remain open except during storm events would be incorporated into the Operating Manual, as requested by NMFS Conservation Recommendation 4. Should future conditions change to the extent that more frequent closure of these features becomes necessary, coordination with the NMFS and other resource agencies would be initiated as requested by NMFS Conservation Recommendation 5 to determine if additional hydrologic and fish passage modeling is warranted and if additional compensatory mitigation is needed.

The levee alignment, drainage basins and proposed culvert locations were evaluated in detail using Google Earth 2015 imagery to check for smaller, secondary drainages where culverts would also be needed to ensure that flows to adjacent wetlands are maintained. At a minimum, 13 new culverts have been incorporated into the project design where additional connectivity appeared to be needed. With the exception of the Cow and Adams Bayou basins discussed above, the majority of the wetlands in the uplands behind the levee alignment are swamp or bottomland hardwoods. A few small areas of marsh are scattered inside of the levee alignment. Since drainage and tidal connections would be maintained in essentially the FWOP condition as described above, no indirect impacts were identified on most of the marshes, bottomland hardwoods and swamps located inside and outside the levee system.

The potential for indirect impacts related to induced development was also considered. The general area is vulnerable to storm surge impacts, and construction of this alternative would reduce the risk of storm surge damages in the future. Development has been occurring in the area because of the concentration of petro-chemical industries and the Port of Beaumont, and this development is expected to occur with or without the project. A study of the potential for induced development in coastal areas due to shoreline protection projects found that the existence of such projects is not statistically significant in generating changes in the pattern and growth of development (Cordes and Yezer 1995). For this study, therefore, it is assumed that the existing patterns of employment

and income would persist, and that the pattern and extent of development would be similar in both the FWOP and FWP conditions.

However, impacts were identified for wetland areas immediately adjacent to the levee that would be impounded between the levee and the higher elevation upland terrace margin. In many areas, the transition between the floodplain and the upland is an abrupt bluff, averaging from 4 to 8 feet high. Marsh or forested wetlands caught between the new levee and bluff would be cut-off from daily tidal inundation, denied nutrients and sediments; the health of the wetlands would decline and they would eventually die. For the marshes, it was assumed that this process would occur quickly with emergent marsh converting to open water by TY 1; for swamps, it was assumed that the disrupted hydrology and impounded rainwater would result in a slow decline in the health of cypress and tupelo, with eventual loss of the entire stand by TY61. For bottomland hardwoods, however, the soil would become saturated due to the impoundment of rainfall and it was assumed that the trees would die off quickly, with a complete loss by TY2.

In addition, the construction zone impacts for the Cow Bayou gate and one levee segment would block the flow of small channels feeding adjacent marsh or swamp. For these areas, it was assumed that tidal connectivity would be disrupted permanently and that wetland vegetation would no longer be supported in the FWP condition. Similar to the impoundment impacts, it was assumed that marsh would be lost by TY1. Bottomland hardwoods and swamps would survive longer under these conditions because the soils would not be saturated; however, lower water availability would create stress and increase susceptibility to pests and diseases. These stands were assumed to be totally lost by TY25. The indirect impact areas and the acres of impacts are listed in Table 7-5 and shown on Figures 7-8 through 7-12. The WVA outputs for indirect impacts are provided in Attachment 5.

Table 7-5. Indirect Impact Areas for Orange 3 CSRM Plan

Hydro-unit	Area ID	Acres						Total Wetland Acres	Impact Description
		Swamp	BH	Fresh Marsh	Int Marsh	Brackish Marsh	Water in Wetland		
TX 10	F Indirect-2			421.0			253.6	674.6	Fishery access primarily controlled by Cow Bayou surge gate
TX 10	I Indirect-1				5.7		1.2	6.9	Hydrologic access permanently disrupted
TX 10	I Indirect -2				11.4		1.3	12.7	Hydrologic access permanently disrupted
TX 10	I Indirect-3				168.7		101.6	270.3	Fishery access primarily controlled by Cow Bayou surge gate
TX 10	B Indirect-2					18.9	7.2	26.1	Hydrologic access permanently disrupted
TX 10	B Indirect-3					14.1	4.3	18.4	Hydrologic access permanently disrupted
TX 10	B Indirect-3					34.0		34.0	FWOP marsh migration (Intermediate RSLC)
TX 10	B Indirect-4					181.3	109.2	290.5	Fishery access primarily controlled by Cow Bayou surge gate
TX 10	S Indirect-2	1.9						1.9	Hydrologic access permanently disrupted
TX 11	F Indirect-3			63.1			47.5	110.6	Fishery access primarily controlled by Adams Bayou surge gate
TX 11	I Indirect-4				35.8		16.4	52.2	Fishery access primarily controlled by Adams Bayou surge gate
TX 11	B Indirect-5					578.7	160.3	739.0	Fishery access primarily controlled by Adams Bayou surge gate
TX 11	BH Indirect-2		12.7					12.7	Hydrologic access permanently disrupted
	Totals*	1.9	12.7	484.1	221.6	827.0	702.6	2249.5	
*Totals may not add due to rounding									

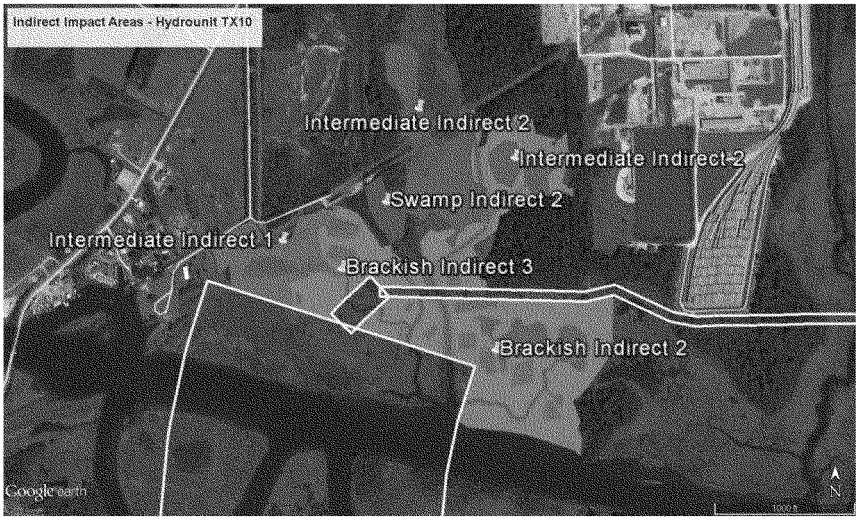

Figure 7-8. Indirect Impact Areas in Hydro-unit TX10 (Historic RSLC Scenario)

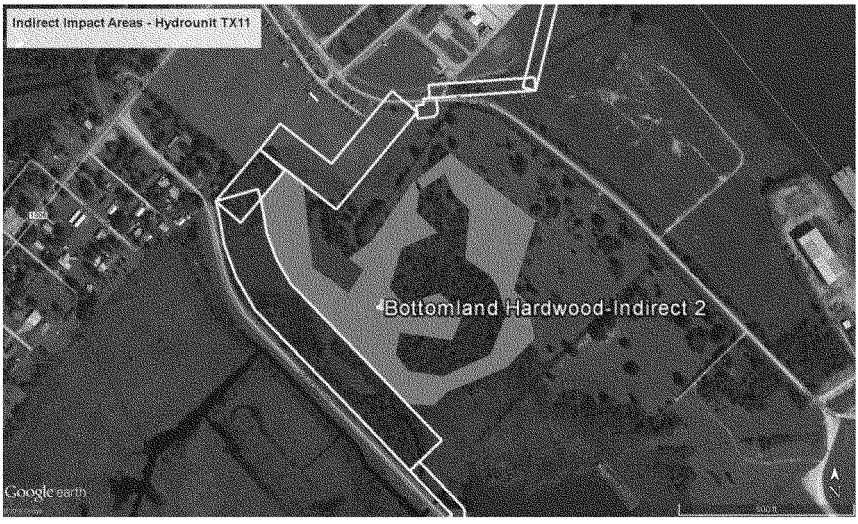

Figure 7-9. Indirect Impact Area in Hydro-unit TX11 (Historic RSLC Scenario)

7.2.2 Intermediate and High RSLC Scenarios

7.2.2.1 Method for Evaluating Impacts

The general area of the levee alignment was carefully evaluated to identify areas into which wetlands would have migrated under the intermediate or high RSLC scenarios in the FWOP condition. The NOAA Sea-Level Rise Viewer (NOAA 2015) was used to identify new tidally-influenced areas and the NOAA marsh impacts/migration viewer was used to map changes in marsh type and extent. The data and maps in this NOAA tool illustrate the scale of potential flooding and a general location, and do not account for erosion, subsidence, or future construction. Water levels are shown as they would appear during the highest high tides or MHHW, and do not include wind driven tides.

The NOAA method for mapping marsh migration due to RSLC assumes that specific wetland types exist within an established tidal elevation range, based on an accepted understanding of what types of vegetation can exist given varying frequency and time of inundation, as well as salinity impacts from such inundation (NOAA 2012). The viewer maps changes associated with sea-level rise from the current MHHW up to 6 feet, in 1-foot increments. The potential changes associated with intermediate and high RSLC by TY61 in the Sabine region were evaluated using the 2- and

4-foot Sea Level Rise and Marsh Impacts views. Marsh impacts were evaluated with no accretion rate, as data for this is unavailable, and this will provide a conservatively high impact evaluation.

7.2.2.2 FWOP Condition

Natural areas vulnerable to sea level rise and marsh migration in the FWOP condition were mapped in Google Earth and are shown relative to the Orange 3 CSRM Plan alignment in Figures 7-10 through 7-12. Developed areas and leveed areas were excluded from this analysis, as the purpose was identify wetland impacts. RSLC migration of wetlands into formerly upland zones would be expected to occur with increasing RSLC where the migration is not blocked by existing hard structures, natural bluffs or development. The significant elevation difference between the floodplain and the uplands in this study area (approximately 7 to 10 feet) would block this migration is most areas. However, increasing sea levels would also increase the tidal prism in the smaller bayous and streams which cut from the upland to the floodplain. The higher water levels would flood low lying areas adjacent to these bayous and streams, creating new wetlands in the areas shown in the following figures.

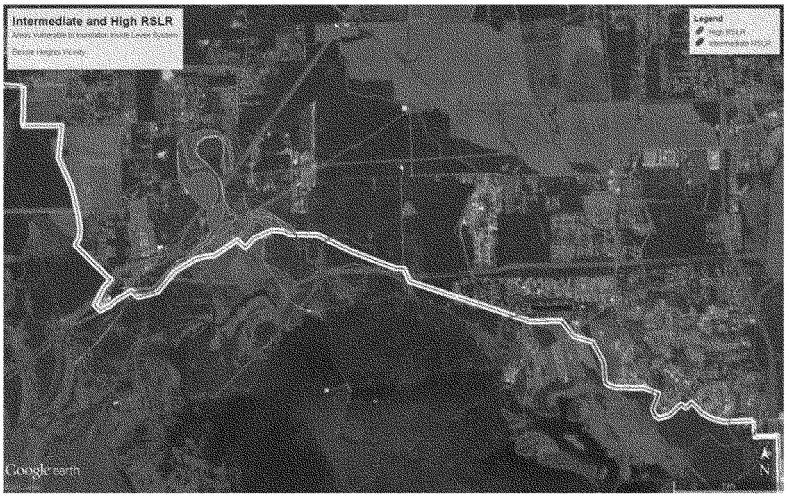

Figure 7-10. Bessie Heights–Areas Vulnerable to RSLC and Wetland Change/Migration

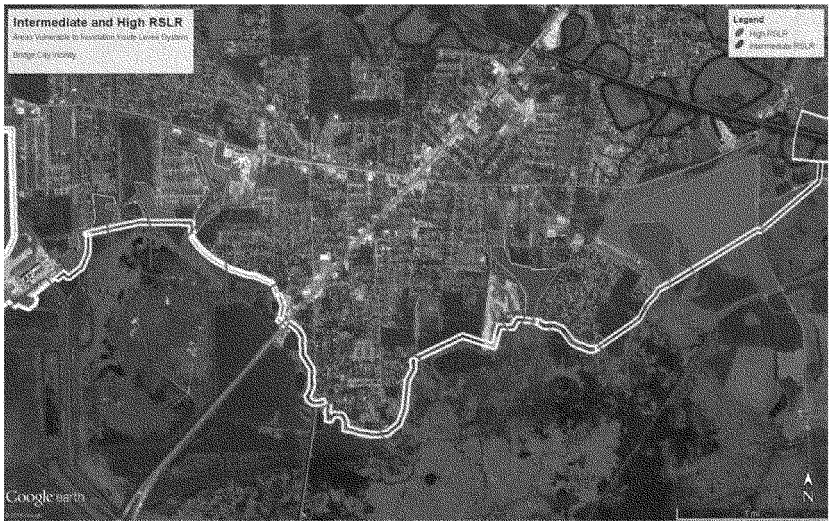

Figure 7-11. Bridge City Vicinity–Areas Vulnerable to RSLC and Wetland Change/Migration

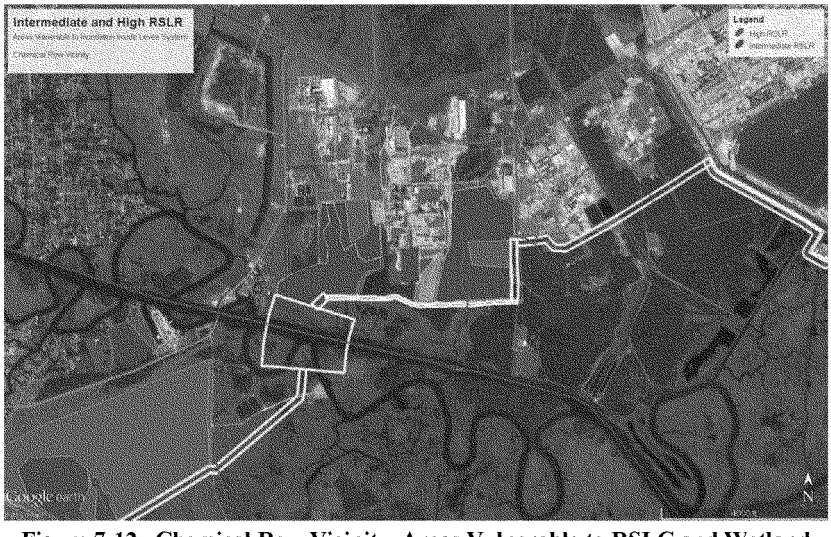

Figure 7-12. Chemical Row Vicinity–Areas Vulnerable to RSLC and Wetland Change/Migration

In general, bluffs on the upland terraces of the Sabine and Neches River prevent large-scale overland flooding over the period of analysis. The most vulnerable areas are located within the lower reaches of bayous and streams that would be flooded to greater depths and inland extent with RSLC. As sea level rises, higher elevations will become more frequently inundated, allowing for marsh migration landward. At the same time, some lower-lying areas will be so often inundated that the marshes will no longer be able to thrive, becoming lost to open water. Depending upon elevation and projected salinities, in the intermediate RSLC scenario wetlands would switch from swamps to intermediate scrub-shrub marshes, or from fresh/intermediate to brackish/saline marshes. Significant areas of open-water would develop only in the high RSLC scenario, and these were located primarily in the Bridge City and Chemical Row vicinities. With high RSLC, swamps and intermediate marshes would switch to brackish or saline marshes. Because of generally higher elevations, bottomland hardwoods would generally persist in their existing locations through the period of analysis.

Conversion from one wetland type to another would result from changing water elevations and salinities associated with RSLC. The exact conditions and rate under which this change would occur are difficult to predict and thus an even rate of change was assumed in the WVA modeling of the FWOP condition. This is achieved by assuming that the conversion from one wetland type to another occurs at the midpoint of the period of analysis (TY31). The existing wetland was assumed to persist through TY30, with increased loss rates for emergent marsh and gradually increasing salinities. The annual FWOP wetland loss rate was gradually increased by a percentage change of 0.012 feet/year and 0.05 feet/year for intermediate and high RSLC, respectively, based on the negative relationship that has been observed between wetland loss rates and RSLC in Louisiana. For intermediate RSLC, salinity was increased by 6.5 percent and 11.3 percent for intermediate and brackish marsh, respectively, over the period of analysis based upon a modeled relationship between RSLC and salinity. For high RSLC, salinity was increased by 8.0 percent for intermediate and 22.7 percent for brackish marsh. Methods and calculations for these projections were described in Sections 3.5 and 3.6 above.

7.2.2.3 FWP Condition

Indirect impacts associated with construction of the Recommended Plan in the intermediate and high RSLC scenarios would be minimized by maintaining flows in tidal bayous and streams equivalent to the FWOP condition. New levees would be constructed to reduce the risk of storm surges damages under the intermediate RSLC scenario. The temporary and permanent construction right-of-way used to determine direct impacts was drawn large enough to encompass the construction right-of-way width required for Intermediate RSLC.

Culverts would be modified as described for indirect impacts in the historic RSLC scenario to provide for increased tidal flows. Daily flooding of natural areas and wetland creation would occur as they would have under the FWOP condition. With tidal access maintained at FWOP flows, RSLC-related landscape and wetland changes to areas within the levee system would occur for FWP as they would have occurred in the FWOP condition with only minimal differences. Most of the areas vulnerable to RLSR inundation are currently undeveloped but are located immediately adjacent to ongoing current development. It is assumed that this development would continue in the FWOP condition, and therefore the alternative would cause no impacts related to induced development.

One exception to the negligible impacts described above was identified in the vicinity of the Cow Bayou surge gate structure (Figure 7-13). It is assumed that extensive construction in the gate area would permanently disrupt tidal streams and prevent daily flooding of areas in which marsh migration would have occurred under the intermediate and high RSLC scenarios. Under the Intermediate RSLC scenario, existing intermediate marsh and a small area of swamp would convert to brackish marsh and existing brackish marsh would persist and expand inland, adding 34.0 acres that was not impacted under the Historic RSLC scenario. Under the high RSLC scenario, existing intermediate and brackish marsh, and the same small area of swamp, would convert to saline marsh, and the same 34 acres of brackish marsh would be added as it migrates inland. In addition, 11.7 acres of new saline marsh would be created from inundated upland areas. Table 7-6 describes the indirect impact areas and impact assumptions for the Orange 3 CSRM Plan under the intermediate and high RSLC scenarios.

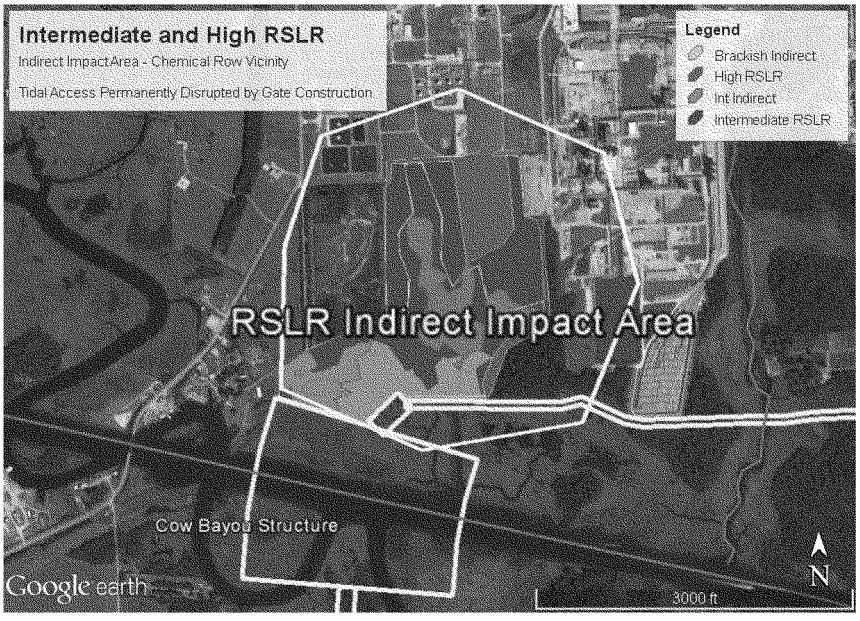

Figure 7-13. Chemical Row Indirect Impact Area, Intermediate and High RSLC

The indirect impact areas described above would be affected as tidal elevations rise under the intermediate and high RSLC scenarios, as they would remain open to the effects of RSLC. For the other indirect impact areas, impacts under the intermediate and high RSLC scenarios would be the same as those under the low RSLC scenario because tidal access would be permanently altered by construction of the Orange 3 CSRM Plan, and thus the effects would be the same across all RSLC scenarios. Table 7-1, above, includes all of the areas permanently removed from tidal access in all three scenarios, as well as the area near Chemical Row that will remain open and be affected differently under the three scenarios. Fisheries access impacts in the Cow and Adams Bayou watershed are also included. Total indirect impacts could range from about 2216 acres and a loss of 94.4 AAHUs for the low RSLC scenario, to about 2276 acres and a loss of 133.3 AAHUs for the high RSLC scenario. Mitigation will be calculated using the impacts from the Intermediate RSLC scenario which would impact about 2271 acres and result in the loss of 101.1 AAHUs.

Table 7-6. Description of Indirect Impact Areas – Intermediate and High RSLC Scenarios

		Wetland Type - TY0						
Hydrounit	Indirect Impact Area ID	Upland	Swamp	Intermd Marsh	Brackish Marsh	Water in Wetland	Group Total Acres	Impact Assumptions
Intermediate RSLR Indirect Impact Areas								
TX10	I Indirect-1 and 2			17.1		2.5	19.6	Persists as intermediate through TY30; switches to brackish TY 31-61
	B Indirect 3				14.9	3.5	18.4	Persists as brackish TY0-TY61
	New Brackish Migration	34.0					34.0	Brackish marsh gradually migrates into former upland TY0-61
	S-Indirect 2		1.9			0.0	1.9	Persists as swamp through TY30; switches to brackish scrub-shrub TY31-61
Totals			1.9	17.1	14.9	6.0	73.9	
High RSLR Indirect Impact Areas								
TX10	I Indirect-1 and 2			17.1		2.5	19.6	Persists as intermediate through TY30; converts to saline TY31-61
	B Indirect 3				14.9	3.5	18.4	Persists as brackish thru TY30; converts to saline TY31-61
	New Brackish Migration	34.0					34.0	Brackish marsh gradually migrates into former upland TY0-61
	New Saline Migration	11.7					11.7	Saline marsh gradually migrates into former uplands TY0-61
	S-Indirect 2		1.9			0.0	1.9	Persists as swamp through TY30; switches to brackish scrub-shrub TY31-61
Totals		45.7	1.9	17.1	14.9	6.0	85.6	

8 MITIGATION PLAN

8.1 MITIGATION TARGETS

The WVA modeling evaluated and quantified direct and indirect impacts of the Orange 3 element of the Recommended Plan under the intermediate RSLC scenario. The Port Arthur and Freeport and Vicinities CSRM Plans would result in no wetland impacts and require no mitigation. See Figure 2-6 for a map of the Recommended Plan. Direct and indirect impacts are summarized in Table 8-1.

Table 8-1. Recommended Plan Total Direct and Indirect Impacts

Wetland Type	Direct Impacts		Indirect Impacts				Total Impacts (acres)	Total AAHUs Lost
	Direct Wetland Impacts (acres)	AAHUs	Indirect Wetland Impacts (acres)	AAHUs	Functional Impacts (affected acres)	AAHUs		
Forested Wetlands								
Swamp	10.6	-7.2	1.9	-0.1	0.0	0.0	12.5	-7.3
Bottomland Hardwood	44.3	-30.3	12.7	-5.1	0.0	0.0	57.0	-35.4
Subtotal	54.9	-37.4	14.6	-5.2	0.0	0.0	69.5	-42.7
Coastal Marsh								
Fresh Marsh	24.3	-11.4	0.0	0.0	785.2	-18.8	809.5	-30.2
Intermediate Marsh	6.8	-4.0	19.2	-8.5	322.5	-4.1	348.5	-16.6
Brackish Marsh	74.2	-33.7	78.5	-35.2	1029.5	-27.6	1182.2	-96.5
Subtotal	105.3	-49.0	97.7	-43.7	2137.2	-50.5	2340.2	-143.3
Total Impacts*	**160.2**	**-86.5**	**112.3**	**-48.9**	**2137.2**	**-50.5**	**2409.7**	**-186.0**
* Totals may not add exactly due to rounding.								

Under the Intermediate RSLC scenario, the new levee system would negatively impact approximately 2,410 acres in Orange and Jefferson Counties. Total direct impacts (wetland loss), affecting approximately 160.2 acres, would result from construction of the levee system. Indirect impacts (wetland loss) related to construction of the levee system would impact about 112 acres. Functional loss to fisheries access would affect about 2,137 acres.

Mitigation would be needed to compensate for a loss of 7.3 AAHUs for cypress tupelo swamp impacts, 35.4 AAHUs for bottomland hardwood impacts, 30.2 AAHUs for fresh marsh impacts,

16.6 AAHUs for intermediate marsh impacts, and 96.5 AAHUs for brackish marsh impacts. Adverse impacts on ecological resources resulting from construction of the Recommended Plan have been avoided or minimized to the greatest extent practicable. Planning for the avoidance and minimization of impacts began with the layout of the first draft alignment, with additional rounds of alignment revisions to minimize wetland impacts to the greatest extent possible. The levee was located as close to the upland-wetland margin as possible to minimize wetland impacts, while also minimizing social effects and maximizing economic impacts. Remaining unavoidable impacts are fully compensated with in-kind mitigation. The quantification of required compensatory mitigation for the loss of wetlands and functional impacts to fisheries access was accomplished by applying the same WVA models that were used to determine impacts. All areas of Essential Fish Habitat (EFH) (estuarine emergent marsh, estuarine submerged aquatic vegetation, and estuarine mud/soft bottoms) impacted from construction have been captured by the impacts modeling, and compensation for those impacts will be provided by the in-kind emergent marsh mitigation plans developed with the WVA modeling and selected using the Institute for Water Resource (IWR) Planning Suite.

8.2 MITIGATION MEASURES AND ALTERNATIVES

8.2.1 Mitigation Measures

USACE and the S2G resource agency team met numerous times to identify types of mitigation measures and alternatives, agree on specific locations where these mitigation alternatives could be located, discuss assumptions underlying WVA modeling of the mitigation benefits, and select an evaluation array of mitigation alternatives. The IWR Planning Suite was utilized to perform a cost-effective/incremental cost analysis and select the Best Buy mitigation plan for each of wetland types adversely affected by the Recommended Plan. Mitigation measures considered in developing the initial array of mitigation alternatives are presented in Table 8-2.

Table 8-2. Mitigation Measures

Measure Type	Measure Description
Marsh Restoration	Fresh, intermediate and brackish marsh restoration utilizing maintenance material from the adjacent Sabine-Neches Waterway to create marsh in open water areas of degraded marsh or in former borrow pits
Hydrologic Restoration	Restoration of natural riverine, tidal, and overland flows to all wetland types by degrading levees, canal berms, roads, filling or blocking small channels which facilitate salinity intrusion, and/or installing culverts to restore connectivity.

Preservation	Preservation of forested wetland areas or emergent marsh.
Forested Wetland Restoration	Replanting cypress-tupelo or bottomland forest vegetation in degraded wetland areas or in former borrow pits, and/or removal and long term control of Chinese tallow or other invasive vegetation species.

8.2.2 Development of Mitigation Alternatives

Mitigation alternatives were developed based on one mitigation measure, or a combination of measures. In total, 161 mitigation alternatives were discussed and analyzed for inclusion in the evaluation array. These alternatives are listed and described in Attachment 6, along with the screening decision. They are located throughout the Neches and Sabine River bottomlands surrounding the Orange CSRM project area. Reasons for exclusion from the evaluation array varied but generally were based on small benefits relative to amount of compensation needed, lack of need for the restoration, incompatibility with existing land use, contamination concerns, or combination/incorporation with other mitigation alternatives.

Three measures (marsh restoration, preservation, and forested wetland restoration) were used to build the seventeen mitigation alternatives that were advanced for screening in the evaluation array. The identification numbers of the alternatives were retained from the initial array. In those cases where measures were combined into one alternative, the first (lowest) number of the measures was retained as the identifier. Mitigation alternatives 11, 12, 14 and 15 would purchase and preserve in perpetuity large areas for swamp and/bottomland hardwood mitigation north of Interstate 10 in the Sabine River bottomlands. Mitigation alternatives 17, 22, and 24 would implement hydrologic restoration for large swamps in the Tony Houseman WMA. Mitigation alternatives 27, 28, 29, 31, 32, 42, 52 and 143 would restore marsh in the Old River, Bessie Heights and Rose City areas of the Neches River bottomlands. All but three (28, 29 and 31) would also need to be purchased and preserved in perpetuity. Mitigation alternatives 28 and 29 are located in the Lower Neches River WMA's Old River and Nelda Stark Units. Mitigation alternatives 26 and 161 would preserve in perpetuity BH acreage along the upland/wetland interface of the Neches River and Scale 2 of Mitigation alternative 161 would implement a tallow removal and control program in the same area. The locations of these alternatives are shown in Figures 8-1 through 8-3.

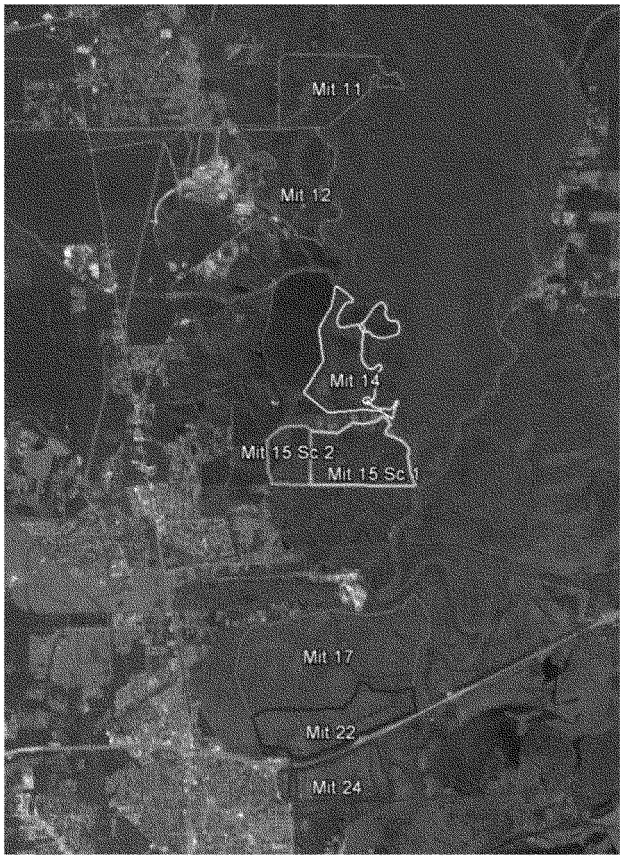

Figure 8-1. Mitigation Alternatives 11, 12, 14, 15, 17, 22, and 24

Figure 8-2. Mitigation Alternatives 27-29, 31, 32, 143 and 161

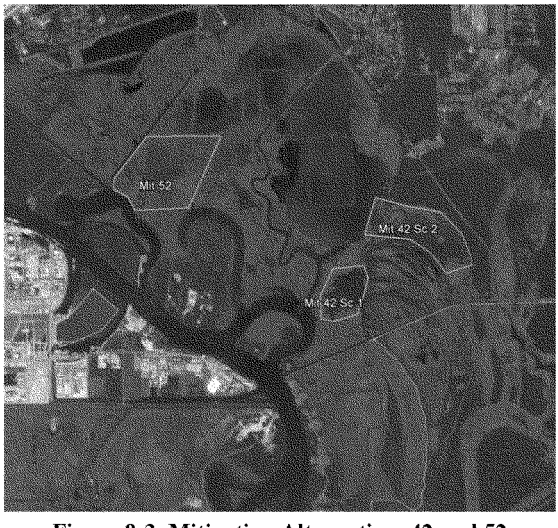

Figure 8-3. Mitigation Alternatives 42 and 52

8.3 WVA MODELING OF MITIGATION EVALUATION ARRAY

8.3.1 Assumptions for Forested Wetland Mitigation Alternatives 11, 12, 14 and 15

These mitigation alternatives, located in the Sabine River bottomlands north of Interstate 10, would preserve the forested wetlands in perpetuity, preventing projected future losses of forested wetlands in these areas. They are large tracts of largely undeveloped floodplain swamps, interspersed with ridges covered by bottomland hardwoods, and some forested uplands. Acreages of BH and swamp were tracked separately within each alternative area, and the WVA Swamp and BH models were applied to the applicable wetland acreage within each area; upland areas were excluded. Alternative 15 was developed with two scales. Scale 1 is a larger area adjacent to the Sabine River that is owned by individuals. Scale 2 in located between Scale 1 and the upland margin; it was identified as a separate scale because it is owned by a large paper products company. Lands comprising the other alternatives are either owned by individuals (11) or owned by the same paper products company (12 and 14). They were evaluated separately because of estimated sizable differences in property values.

Most of the virgin growth timber stands in the lower Sabine and Neches River floodplains were harvested in the late 19th and early 20th century, with the last harvesting occurring in the 1950s (UT, 2004; USACE, 1997). Commercial logging of managed forest stands is currently practiced in the floodplain forests north of Interstate 10 on the Sabine River. Logging may be conducted without mitigation under a Department of Army Nationwide permit if silviculture is ongoing or established and specific best management practices are followed. Given the prevalence of silviculture in the lower Sabine River watershed and the industry practice in this region of clearcutting forest stands (Stovall, 2016), WVA modeling assumed that there would be some clear-cut logging losses of the BH and swamp forested wetlands in areas not preserved by the state or Federal government. A GIS analysis of forested wetlands in this area compared indicators of logging disturbance or silviculture (i.e. clearcutting or linear plantation plantings) between 1989 and 2015 aerial images of the area. This analysis found that an average of 3.28 percent of the forested wetland areas had been disturbed prior to 1989 and an average of 4.27 percent had been disturbed between 1989 and 2015. Based on these analyses, the future without-project (FWOP) condition assumed a 3.28% loss of forested wetlands for the years TY5 through TY31, and a 4.37% loss of forested wetlands fromTY32 through TY61.

Cypress-tupelo swamp and bottomland hardwood acreages were determined with the same USGS (2014) classification utilized for the impacts mapping. The future with-project (FWP) condition assumed no loss of forested wetland acreage. The non-Federal sponsor responsible for constructing and managing the project would be responsible for acquiring areas selected for inclusion in the mitigation plan, and ensuring their preservation. Ownership of the selected mitigation areas could

also be transferred to a state agency, such as TPWD. Ownership and management arrangements would be finalized during PED.

Existing conditions for stand structure and tree size were estimated using data from the most similar reference sites, as described for the impact analysis. Changes in the percentage of overstory, midstory and herbaceous or understory cover were estimated for TY 61 using the dbh growth estimates for cypress and tupelo applied for the impacts analysis. Since existing silviculture is likely to continue in the future, the FWOP condition assumed that Chinese tallow (*Triadica sebifera*) would rapidly encroach into cleared or disturbed sites over the period of analysis (USGS, 2000). Increases in Chinese tallow have been observed within canopy gaps in relatively closed-canopy, mixed-BH forests in the region (USFS, 2016; USGS, 2000). A recent field study along the Neches River in southeast Texas evaluated the effects of Chinese tallow on stand dynamics in forested ecosystems. The study found that variables associated with stand structure (density, basal area, and quadratic mean diameter) were about 25 percent higher in native bottomland hardwood plots than in tallow plots (Camarillo et. al., 2015).

To reflect this tallow effect in localized areas of Mitigation Alternatives 11, 12, 14 and 15, the growth rate of BH diameter breast height (dbh), cypress-tupelo dbh and basal area (V2 for both Swamp and BH Models) over all swamp or BH acres in each mitigation measure area were reduced by 25 percent over the 50-year period of analysis. For BH V3, midstory coverage was increased by 30 percent by TY61 in the FWOP condition to reflect increase tallow presence in the midstory. Understory coverage was assumed to drop by about 50 percent because the denser overstory would reduce light reaching the forest floor. In the BH model, V1 (Species Association) was also changed to reflect a change from Class 5 to Class 4 at the midpoint of the period of analysis. Since the presence of tallow in BH stands has been documented as reducing the diversity of overstory species (Camarillo et al 2015), the class was assumed to change from 5 to 4 at TY31, reflecting a predicted gradual drop in hard mast-producers in the overstory below 20 percent of the canopy. In the FWP condition, it is assumed that the effects of tallow on stand structure would continue as in the FWOP, even though silviculture would no longer be permitted, since the existing tallow would remain and serve as seed sources into the foreseeable future.

All of the inputs for the other variables described below were the same for both the FWOP and FWP conditions as no changes were predicted due to implementation of the mitigation alternatives. For the BH stands in Mitigation Alternatives 11 and 12, model inputs for V4 Hydrology assumed limited riverine or tidal water exchange. For Mitigation Alternatives 14 and 15, moderate riverine and tidal water exchange was assumed because they are located further downstream and are more subject to tidal influence. For all four areas it was assumed that the areas were seasonally flooded. For the swamp areas, V3 (Water Regime) assumed moderate riverine and tidal water exchange

because the swamp areas occur in the low sloughs between the BH ridges, and thus experience higher flows. Flooding duration was assumed to be temporary during the growing season. The remaining variables (BH model - V5 Size of Contiguous Forested Area, V6 Surrounding Land Use, and V7 Disturbance; and Swamp Model -V4 Mean High Salinity) for all of the BH and Swamp mitigation measures were developed using the methods and data described for the impacts modeling.

8.3.2 Assumptions for Swamp Mitigation Alternatives 17, 22 and 24

These mitigation alternatives, located in Sabine River bottomland just north and south of Interstate 10, would provide hydrologic restoration of primarily cypress-tupelo swamps by removing berms which prevent and divert overland flows. All of the areas are located within the Tony Houseman Wildlife Management Area (WMA) which is jointly managed with the Texas Department of Transportation (TXDOT). The Blue Elbow Mitigation Bank was established on these lands for the sole use of TXDOT for compensatory mitigation credits needed to compensate for forested wetland impacts of highway construction projects. Implementation of any of these measures would require TXDOT approval and additional agency review. During resource agency coordination for this study, TPWD has expressed support for these restoration activities.

The berms are relicts of past logging activities. Evidence of logging in the distant past is present throughout Mitigation Alternatives 17, 22 and 24. "Star-shaped" canal patterns are discernable on satellite images and in the field throughout this area. The 2016 resource agency field visit determined that the small, radial "star-shaped" canals did not have berms adversely affecting overland flows. However, the larger, longer logging access canals were typically lined on one or both sides with side-cast berms ranging from 35 to 50 feet wide and 0.5 to 3.5 feet tall. The berms along the canal prevent overbank flooding during seasonal high tides and frequent, low elevation flooding events, preventing sediments and nutrients from routinely reaching into the swamps beyond the canal. The boundary of each area was drawn to capture the full geographic extent of the hydrologic effects of the main access canal leading into that area; this was determined by evaluating elevations of the swamp areas relative to the berm heights.

Existing conditions for BH and swamp in Mitigation Alternatives 17 and 22 were based on data collected by the S2G resource agency team at two locations near the main access canal in Mitigation Alternative 17. Existing conditions for Mitigation Alternative 24 were based on data collected in this area by the SNWW resource agency team in 2004, and augmented with observations from the 2016 field visit. For the FWOP condition, changes in stand structure (V1) were based on expected growth of the overstory and midstory, assuming the same overstory species growth rates utilized for the impacts analysis. No tallow effects were projected for swamp

areas because no significant tallow presence was noted in these areas during the 2016 field visit. WVA modeling input for V2 assumed a dbh growth rate 20 percent less than optimum based on the effects of the modified hydrology. The AAHUs were calculated using the entire acreage of each alternative as the entire area was assumed to be adversely affected by the reduced flows.

The area is exposed to seasonal flows, influenced by releases from the Toledo Bend Reservoir and seasonal rain. Variable input for V3 (Water Regime) was based on observations at the alternative areas which indicate they are currently subject to limited riverine and tidal input, and surface water is present for extended periods in the growing season. Due to generally low elevations and tidal connectivity, intermediate RSLC would likely increase flow exchange in the area from low to moderate by TY61. Although the annual number of coastal flooding events for intermediate RSLR would rise from an average of 1 day per year to about 50 days per year at the projected intermediate RSLR rate (NOAA, 2015), flooding duration would remain seasonal. For V4 (Mean High Salinity during the Growing Season), salinity projections are based on a hydrodynamic-salinity model (USACE 2009) which incorporates the effects of RSLR. Salinity is estimated to increase from around 0 parts per thousand (ppt) currently to about 1-2 ppt by TY 61.

In the FWP condition, vegetation growing on berms along the major logging access canals would be removed, working from a barge in the canal, and berms would be degraded to the same elevation of adjacent marsh. The berm sediment, which is sidecast material from canal construction, would be placed in the water along the edge of the canal, slightly reducing the canal cross-sections. The resource agency field visit observed tallow on high natural ridges and levees in BH areas within Mitigation Alternative 17, but tallows did not have a significant presence in the swamp bottomlands in this area or in Mitigation Alternatives 22 and 24. The BH acreages were not included in the swamp acreage to which WVA modeling was applied. With hydrology restored to more natural conditions, optimum growth estimates equivalent to those used for the impacts analysis were applied to V1 (Stand Structure) and V2 (Stand Maturity) through TY61. FWP inputs for V3 (Water Regime) and V4 (Mean High Salinity during the Growing Season) were the same as FWOP inputs.

8.3.3 Assumptions for BH Mitigation Alternatives 26 and 161

Mitigation Alternatives 26 and 161 are BH stands located on the upland/wetland interface in the Old River and Bessie Heights areas, respectively. These alternatives would preserve the forested wetlands, preventing projected future losses of forested wetlands in these areas. No evidence of silviculture in these locations was observed in satellite images dating from 1989 to 2015, but immediately adjacent residential developments are assumed to expand and result in the loss of all BHs in both areas. Autumn satellite images show the characteristic red leaf color of tallow

scattered throughout both areas. A tallow removal and control scale was included as Scale 2 of the Mitigation Alternative 161 to see if this restoration action could produce a sufficient boost in compensation to be cost effective.

Existing conditions at Mitigation Alternatives 26 and 161 for stand structure and tree size were estimated using data from the most similar reference sites, as described for the impact analysis. For the FWOP condition, assumptions about the effect of tallows on stand structure and tree growth were the same as those applied for Mitigation Alternatives 11, 12, 14 and 15. However, these effects are limited to the period between TY0 and TY20 for Mitigation Area 26 and between TY0 and TY15 for Mitigation Area 161, after which it is assumed that both BH areas would be totally lost to suburban development. The area surrounding Mitigation Alternative 161 is developing faster than Mitigation Alternative 26, and modeling team believed it would likely be developed earlier. These projections are based on growth and development patterns in the Bridge City vicinity. The FWP condition assumed no loss of forested wetland acreage through the period of analysis since the areas would be permanently preserved. Input for all of variables in the FWOP and FWP conditions were based on those developed for BH impact areas located immediately adjacent to the mitigation areas.

For Mitigation Alternatives 26 and 161, Scale 1, the FWP condition assumed that the effects of tallow on stand structure and tree growth would continue as in the FWOP, since the existing tallow would remain and serve as seed sources into the foreseeable future. For Mitigation Alternative 161, Scale 2, a tallow removal and control effort was added which assumed annual aerial application of a specific herbicide (which has minimal effects on other overstory and understory species) for 3 consecutive years, with a follow-up application after the last of the three initial applications, and repeated aerial applications of the herbicide every 5 years through the period of analysis. FWOP assumptions for inputs reflecting tallow effects for V1 (Species Association), V2 (Maturity) and V3 (Understory/Midstory) were the same as those applied for Mitigation Areas 11, 12, 14, and 15. FWP inputs for these variables also were based on the assumptions for these variables; optimum growth estimates equivalent to those used for the impacts analysis were applied through TY61.

8.3.4 Assumptions for Marsh Mitigation Alternatives 27, 28, 29, 31, 32, 42 and 52

These mitigation alternatives would restore emergent marsh in degraded marshes with large areas of open water, using maintenance material from adjacent channels of the SNWW. High levels of marsh loss have occurred on the lower Neches River where large areas of open water have developed within former marsh and swamp lands due a combination of many factors, including subsidence, logging, saltwater intrusion, oil and gas withdrawals, and sea level rise (White et.al.,

1987; Morton and Paine, 1990; Sutherlin, 1997). These historical rates of loss have slowed in recent years, as described in Section 5.3. However, it was assumed that the low baseline land loss rates shown in Table 5-3 would continue in the FWOP condition, with the increase in land loss attributable to RSLC shown in Table 4-2.

For the FWP condition, marsh restoration alternatives were developed in the Bessie Heights, Old River Cove and Rose City vicinities. Areas considered for mitigation excluded areas already identified for beneficial use or mitigation in conjunction with other projects. Specifically, authorized improvements to the SNWW navigation project include the restoration of large areas within both Bessie Heights and Old River Cove marshes with the beneficial use of dredged material. In addition, areas targeted for restoration by TPWD have also been excluded, as well as private mitigation sites that could be identified. Any mitigation alternatives evaluated for this project would augment, not replace, these other restoration or mitigation activities.

Mitigation Alternatives 28, and 29 and 131 are located wholly on TPWD property. TPWD has indicated a preference that wetland impacts from the Orange 3 CSRM Plan be mitigated in areas encompassed by Mitigation Alternatives 28 and 131. Mitigation Alternatives 27, 32, 42 and 52 are located on private property. The non-Federal sponsor responsible for constructing and managing the project would also be responsible for acquiring mitigation areas selected for inclusion in the mitigation plan, and ensuring their preservation Ownership and management arrangements would be finalized during PED.

Marsh and water acreages were determined with the same USGS (2014) classification utilized for the impacts mapping (see Section 5.3). To ensure in-kind mitigation, several alternatives were developed for each marsh type that would be adversely impacted. Mitigation Alternatives 27, 28 and 29 were developed to provide compensation for impacts to brackish marsh in the Old River Cove vicinity. Mitigation Alternatives 42 (Scales 1 and 2) and 52 were developed in the fresh marsh areas of Rose City. The salinity regimes and associated marsh types in these areas match historical and current data for these areas. Mitigation Alternatives 31, 32 and 143 were developed to provide compensation for impacts to intermediate marsh. The USGS classification identified a majority of the marshes in Mitigation Alternative 31 as brackish. The resource agencies noted that this classification was determined based upon field work completed at the end of a lengthy drought. Historical and current TPWD salinity and vegetation data in adjacent areas of the Nelda Stark Unit support an intermediate marsh classification. For these reasons, the area was evaluated with the intermediate marsh model. Mitigation Alternative 143 is comprised of two adjacent leveed areas which are managed as a freshwater fishing club. If marsh were to be restored in these areas, the surrounding levees would be degraded to marsh elevation and the restored marsh type would be

determined by prevailing salinities. Based on the salinity data provided by TWPD, it was determined that this area also would be modeled using the intermediate marsh model.

The construction and cost estimates assume that sediments from maintenance dredging of the adjacent SNWW would be used to restore marsh to an elevation of about 1.5 feet (NAVD88) in areas of open water within the outlined areas shown on Figures 8-2 and 8-3. This is a conservatively high elevation estimate. The target elevation for construction will be reevaluated during PED in coordination with the resource agencies, utilizing comparisons to nearby reference marshes to determine the appropriate post-settlement elevation. Temporary containment dikes, constructed with in-situ materials excavated from immediately adjacent open water areas, would hold dredged material slurry while it decants and consolidates to form new marsh in open water areas. For all of the marsh mitigation alternatives, it was assumed that marsh would be restored in 65 percent of the open water, and that sinuous channels and ponds would be created in the remaining 35 percent of open water. Dredged material would be allowed to flow into existing marsh surrounding the open water areas within the containment dikes; marsh vegetation would winnow the fine-grained material and nourish existing marsh. Temporary erosion control measures (such as concrete mats or riprap) for the containment dikes may be installed where needed.

It was assumed that construction would take 2 years (TY 1-2), beginning at the start of the 10-year construction period for the overall project. It was assumed that settlement and consolidation of the material would take 3 years (TY 3-5), and that channels and ponds would be created in TY 4-5. *Spartina patens* would be planted on 5-foot centers in TY 6, and it is assumed that 50 percent of the patens would need to be replanted in TY 7 based on TPWD's recent restoration experience in the general area. *Spartina alterniflora* would likely also establish itself in the mitigation areas within 1-2 years, as nearby seed sources are abundant. Containment dikes or temporary erosion control features would be removed in TY 6 to maximize edge for aquatic organisms to utilize exterior and interior marsh areas.

In the WVA model, V1 (Emergent Marsh) input assumed that one quarter of the total amount of marsh to be created (e.g. one quarter of the total marsh acreage determined by calculating 65 percent of the open water) would be functioning as a marsh in TY 6, and that the remainder would be functioning in TY10. For V2 (Percent SAV), it was assumed that all SAV within the mitigation area would die-off in TY 2 due to turbidity associated with dredged material placement, gradually rebound to pre-construction levels by TY 6, and increase by about 20-30 percent by TY 61. V3 (Interspersion) classes were changed in the FWP condition based on the overall percentage of marsh fill by TY 6; this generally resulted in a one or two class improvement over the FWOP condition. For V4 (percent shallow open water), it was assumed that approximately 85-95 percent of the open water remaining after dredged material placement in TY 2 would be less than or equal

to 1.5 feet deep and that this would persist through TY 61 with a 5 to 10 percent decrease in shallow water, based on the background land loss rate and RSLC in each area. V5 (Salinity) values were based on the SNWW salinity modeling as described for the impacts analysis. V6 (Access Value) was based on knowledge of access to the general vicinity of the mitigation area. It was assumed to be reduced to "0" from TY 1 to TY 6 while containment dikes are in place, and then restored to the FWOP value (generally a "1') when containment dikes would be removed and access restored.

The construction estimate assumes that shoaled material from Sabine-Neches Canal B, which extends across the north end of Sabine Lake from the mouth of the Neches River to the mouth of the Sabine River, would be used to construct mitigation alternatives 27, 28 and/or 29 in the Old River area. This is the closest segment of the SNWW to the Old River mitigation sites. This channel is not regularly dredged, so cost estimates included the full cost of maintenance dredging to hydraulically dredge the material and pump it into targeted open water areas. Maintenance material from the Neches River Channel might be used instead of, or in addition to, the Sabine-Neches Canal B material for the Old River alternatives. Material from regularly scheduled maintenance dredging of nearby reaches of the Neches River Channel is proposed for construction of mitigation alternatives 31, 32, 42, and 52. Only the incremental cost of additional hydraulic pipeline, pumping and pipe movement needed to create the marsh is included in the cost estimates for these alternatives.

SNWW sediment quality is generally of good quality and suitable for beneficial use. New work and maintenance material has already been approved for extensive beneficial use (marsh restoration) at Bessie Heights and Old River in conjunction with the authorized deepening of the Sabine-Neches Waterway (USACE, 2011). Recent testing and analysis of water and sediment in the Neches River (SOL/Atkins 2013), concluded that there is no concern with the placement of these sediments, under the guidance provided by Inland Testing Manual (EPA/USACE, 1998).

8.4 COST EFFECTIVE/INCREMENTAL COST ANALYSIS

8.4.1 Final Mitigation Alternative Array

Results of the WVA modeling for each of the mitigation alternatives are shown in Table 8-3, along with estimated real estate, construction, and monitoring/adaptive management cost for each alternative. Per-acre acquisition costs for each tract were developed by a USACE real estate appraiser. Preliminary construction costs were developed by Galveston District Engineering Division based upon the construction assumptions described above. Acquisition costs are based

Table 8-3. Mitigation Alternatives Estimated Costs

Mitigation Alternative No.	Description	Wetland Type	Total Wetland Acres	Total Estimated Real Estate Cost	Total Estimated Construction Cost	Preliminary Monitoring/ Adaptive Management Cost	Total Present Value Cost
11	Preservation	Cypress-Tupelo Swamp	291.2	$ 132,822	$ -	$ 16,000	$ 148,822
		Bottomland Hardwood	155.7				
12	Preservation	Cypress-Tupelo Swamp	207.3	$ 508,680	$ -	$ 16,000	$ 524,680
		Bottomland Hardwood	221.4				
14	Preservation	Cypress-Tupelo Swamp	291	$ 716,220	$ -	$ 16,000	$ 732,220
		Bottomland Hardwood	153.1				
15 Scale 1	Preservation	Cypress-Tupelo Swamp	213.1	$ 216,656	$ -	$ 16,000	$ 232,656
		Bottomland Hardwood	223.5				
15 Scale 2	Preservation	Cypress-Tupelo Swamp	264.8	$ 309,936	$ -	$ 16,000	$ 325,936
		Bottomland Hardwood	312.2				
17	Hydrologic Restoration	Cypress-Tupelo Swamp	1320.9	$ 918,720	$ 12,438,875	$ 19,200	$ 13,376,795
22	Hydrologic Restoration	Cypress-Tupelo Swamp	367	$ 357,060	$ 1,086,024	$ 19,200	$ 1,462,284
24	Hydrologic Restoration	Cypress-Tupelo Swamp	284	$ 199,420	$ 7,404,250	$ 19,200	$ 7,622,870
26	Purchase and Preserve	Bottomland Hardwood	34.9	$ 34,368	$ -	$ 16,000	$ 50,368
27	Marsh Restoration	Brackish Marsh	224.8	$ 69,750	$ 4,375,466	$ 315,000	$ 4,760,216
28	Marsh Restoration	Brackish Marsh	410.7	$ 128,030	$ 5,867,374	$ 315,000	$ 6,310,404
29	Marsh Restoration	Brackish Marsh	189.6	$ 60,450	$ 3,418,416	$ 315,000	$ 3,793,866
31	Marsh Restoration	Intermediate Marsh	371.5	$ 162,130	$ 7,342,385	$ 315,000	$ 7,819,515
32	Marsh Restoration	Intermediate Marsh	87.8	$ 27,466	$ 6,936,787	$ 315,000	$ 7,279,253
42 Scale 1	Marsh Restoration	Fresh Marsh	73.5	$ 45,323	$ 2,306,554	$ 315,000	$ 2,666,877
42 Scale 2	Marsh Restoration	Fresh Marsh	210.8	$ 132,553	$ 8,303,746	$ 315,000	$ 8,751,299
52	Marsh Restoration	Fresh Marsh	206.8	$ 89,010	$ 2,379,557	$ 315,000	$ 2,783,567
143	Marsh Restoration	Intermediate Marsh	305.1	$ 94,860	$ 17,611,630	$ 315,000	$ 18,021,490
161 Scale 1	Preservation	Bottomland Hardwood	112.4	$ 71,875	$ -	$ 16,000	$ 87,875
161 Scale 2	Forested Wetland Restoration (Tallow Removal & Control)	Bottomland Hardwood	112.4	$ 71,875	$ 128,040	$ 1,312,000	$ 1,511,915

on the total acreage of each tract, which in most cases is larger than the wetland acreage utilized in the WVA modeling. Acreages shown under the "Wetland Acreages" column, are those determined by the USGS wetlands classification. Preliminary monitoring and adaptive management costs were developed for each type of mitigation alternative, and the same costs were applied to all of the alternatives for each wetland type. Average annualized costs were calculated using the IWR Planning Suite Annualizer tool. For alternatives with scales (15, 42 and 161), scale 2 acreages, costs and AAHUs are cumulative amounts, representing the totals of Scale 1 and 2. Monitoring/adaptive management plans will be developed for each of the mitigation alternatives selected for inclusion in the Mitigation. The details and costs of those plans will likely differ from the preliminary assumptions applied here. The CE/ICA would still have resulted in the same best buy plan selection, because these new costs would be applied equally to all of the alternatives for each wetland type.

8.4.2 IWR-Planning Suite Application

The Mitigation Plan was selected using the certified IWR Planning Suite V 2.0 software, following instructions in the User's Guide (CDM and USACE-IWR, 2006). The IWR Planning Suite uses a cost effectiveness/incremental cost analysis (CE/ICA) to weigh the costs of mitigation plans against their nonmonetary output. Cost-effectiveness analysis is used to identify least-cost plans, and incremental cost analysis identifies the subset of cost-effective plans that are superior financial investments, called "best buys plans." Best buys plans are the most efficient plans at producing the output variable (in this case, AAHUs); they provide the greatest increase in AAHUs for the lowest incremental cost.

Mitigation alternatives advanced for final screening with the IWR Planning Suite are listed in Table 8-4. For the CE/ICA, the mitigation alternatives were coded with a letter(s) indicating wetland type (i.e, S for swamp, BH for bottomland hardwood, F for fresh marsh, I for intermediate marsh and B for brackish marsh) followed by the mitigation alternative number shown in the first column of Table 8-3 (for example, B27). In a few cases, alternatives were evaluated at different scales. The scales for S15 and BH15 (Preservation) reflected an estimated significant difference in real property costs for sections of a large area of mixed BH and Swamp immediately adjacent to the Tony Houseman WMA. The area identified as Scale 2 (western portion of Mitigation Alternative 15) is owned by a large paper products company. This alternative was of particular interest because it could be more easily incorporated into the existing WMA than the other BH/Swamp Preservation alternatives (11, 12 and 14). The scales for F42 (Marsh Restoration) were based on the assumption that construction would be accomplished sequentially, with the Scale 2 costs reflecting the additional costs needed to extend pumping from the Scale 1 area to the Scale 2 area. The cost to reach the Scale 2 would not include costs to reach the Scale 1 area, and therefore the incremental cost would be lower. The scales for BH161 assumed different solutions applied sequentially to the same area. Scale 1 would purchase and preserve the area in perpetuity; Scale 2 would restore the BH by removing and controlling Chinese tallow through the period of analysis. Mitigation outputs from the WVA models for each of the alternatives in the final evaluation array are presented in Attachment 7.

The analysis was structured to ensure that the Best Buy Plans would provide sufficient in-kind mitigation for each wetland type. To achieve this, separate planning sets were developed for swamp, BH, and each of the marsh types (fresh, intermediate and brackish). Present value costs presented in the last column are simple additions of real estate, construction and monitoring/adaptive management costs. These costs were annualized using the IWR-Plan Annualizer. Construction costs include construction of containment dikes, pumping dredged material into open water areas, dewatering, marsh plantings and containment dike removal.

Table 8-4. IWR Planning Suite Sets and Scales

Mitigation Alternative Code	Measure Description	Scale Number	Scale Acres	Habitat Benefits (AAHUs)	Avg Annual Costs ($1,000)**
Cypress Tupelo Mitigation Planning Set*					
S11	Swamp Preservation	1	291.2	13.2	$ 4.4
S12	Swamp Preservation	1	207.3	9.5	$ 16.4
S14	Swamp Preservation	1	291.0	13.1	$ 23.0
S15	Swamp Preservation	1	231.1	9.6	$ 7.1
S15	Swamp Preservation	2	282.8	11.9	$ 10.1
S17	Hydrologic Restoration-Swamp	1	1,320.9	40.0	$ 425.3
S22	Hydrologic Restoration-Swamp	1	367.0	11.1	$ 46.2
S24	Hydrologic Restoration-Swamp	1	284.0	5.8	$ 242.2
Bottomland Hardwood Mitigation Planning Set*					
BH11	BH Preservation	1	155.7	6.2	$ 4.4
BH12	BH Preservation	1	221.4	6.7	$ 16.4
BH14	BH Preservation	1	153.1	6.8	$ 23.0
BH15	BH Preservation	1	223.5	9.5	$ 7.1
BH15	BH Preservation	2	312.2	13.4	$ 10.1
BH26	BH Preservation	1	34.9	18.4	$ 1.3
BH161	BH Preservation	1	112.4	49.3	$ 2.5
BH161	BH Restoration -Tallow Control	2	112.4	55.7	$ 14.2
Fresh Marsh Mitigation Planning Set					
F42	Fresh Marsh Restoration	1	73.5	14.6	$ 79.1
F42	Fresh Marsh Restoration	2	210.8	45.0	$ 197.9
F52	Fresh Marsh Restoration	1	206.8	33.4	$ 82.9
Intermediate Marsh Mitigation Planning Set					
I31	Intermediate Marsh Restoration	1	371.5	60.4	$ 243.1
I32	Intermediate Marsh Restoration	1	87.8	22.7	$ 225.9
I143	Intermediate Marsh Restoration	1	305.1	75.6	$ 567.6
Brackish Marsh Mitigation Planning Set					
B27	Brackish Marsh Restoration	1	224.8	40.2	$ 145.7
B28	Brackish Marsh Restoration	1	410.7	58.5	$ 195.1
B29	Brackish Marsh Restoration	1	189.6	41.9	$ 114.0
*	Total cost of tracts 11, 12, 14 and 15 used for both swamp and BH measures because swamp and bottomland hardwood are intermingled in each tract.				
**	Annualized using IWR-Plan Annualizer at rate of 3.125% over 60 year period of analysis; first cost of construction entered at year 5 (midpoint of 10 year construction period); monitoring/adaptive management costs added in year cost expected to be incurred.				

The costs were entered into the Annualizer program in the year they are projected to be expended. For the marsh restoration alternatives, regular field inspections would be held during the construction period to ensure attainment of appropriate marsh elevations and vegetation growth. It was assumed that 50 percent of the *Spartina paten* plants would require replanting in TY 7 to ensure establishment of the marsh vegetation. Subsequent to construction, satellite photo analysis and field vegetation surveys would be conducted every 5 years through the period of analysis. For the forested wetland areas to be preserved in perpetuity, it was assumed that regular inspection visits would be conducted through the period of analysis. O&M costs were not included as they are believed to be negligible. Neither the preservation areas nor the marsh restoration areas include construction features that would require periodic maintenance.

8.4.3 Selection of Best Buy Plans

The result of the incremental analysis is illustrated on Table 8-5. The IWR Planning Suite identified multiple best buy plans for each of the wetland types (8 each for Swamp for BH; 3 each for fresh, intermediate and brackish marsh). Column 3 "Best Buy Plan #" identifies the plan number from the Planning Suit's "Incremental Cost of Best Buy Plans" table. Plan 1 is always the No-Action Plan, with no cost and no output. For all wetland types, the Best Buy Plan with the lowest incremental cost (Plan 2) was selected for inclusion in the Mitigation Plan. The fourth column "Best Buy Plans" lists all of the wetland alternative codes in that planning set for the indicated Best Buy Plan, with a "0" following those that were not included in the Best Buy Plan, and a "1" after those codes which are included. The codes with the number "1" indicator are shown in bold. Each Plan 2 provided compensation greater than the target for that specific wetland type. Other Best Buy plans were evaluated to determine if they were worth the additional cost. When considered together, the Best Buy plans for all of the affected wetland types provide 262.9 AAHUs of compensation for a total mitigation target of -186.0 AAHUs.

Table 8-5. Best Buy Plans

Wetland Type	Mitigation Target	Best Buy Plan #	Best Buy Plan(s)	Best Buy Alternatives	AAHUs	Average Annual Cost ($1,000)
Swamp	-7.3	2	**S111**S120S140S150H170H220H240	S11	13.2	$ 4.4
Bottomland Hardwood	-35.4	2	BH110BH120BH140BH150BH260**BH1611**	BH161, Scale 1	49.3	$ 2.5
Fresh Marsh	-30.2	2	F420**F521**	F52	33.4	$ 82.9
Intermediate Marsh	-16.6	2	**I311**I320I1430	I31	60.4	$ 243.1
Brackish Marsh	-96.5	3	B270**B281B291**	B28 and B29	100.4	$ 310.1
Totals	-186.0				262.9	$ 643.0
*S11 provides bottomland hardwood (BH) benefits of 6.2 AAHUs at no additional cost because BH are intermingled with swamp.						

8.5 MITIGATION PLAN

The mitigation plan for the S2G Recommended Plan consists of preservation of 559.3 acres of swamp and bottomland hardwoods in Mitigation Area 11 in the bottomlands of the Sabine River, and in Mitigation Area 161 on the upland/wetlands margin of the Neches River in the Bessie Heights area (Figures 8-4 and 8-5). In addition, the plan would restore 452.8 acres of marsh (fresh, intermediate and brackish) and shallow ponds and sinuous channels within the marsh in Mitigation Areas 28, 29, 31 and 52 (Figures 8-6, 8-7 and 8-8). The mitigation plan is summarized in Table 8-6 and summarized below.

Table 8-6. Mitigation Plan Summary

Mitigation Area ID	Wetland Type	Total Wetland Acres Preserved in Perpetuity	Total Restored Wetland (acres)*	Total Compensation (AAHUs)	Mitigation Target (AAHUs)
11	Cypress-Tupelo Swamp	291.2		13.2	-7.3
	Bottomland Hardwood	155.7		6.2	
161	Bottomland Hardwood	112.4		49.3	-35.4
	Subtotal	559.3		68.7	-42.7
28	Brackish Marsh	**	133.2	58.5	-96.5
29	Brackish Marsh	**	106.0	41.9	
31	Intermediate Marsh	**	150.7	60.4	-16.6
52	Fresh Marsh	206.8	62.9	33.4	-30.2
	Subtotal	206.8	452.8	194.2	-143.3
	Total	**766.1**	**452.8**	**262.9**	**-186.0**

* Total acres of restored marsh and water

** Property already owned by TPWD so it is already in preservation status.

Figure 8-4. Mitigation Area 11

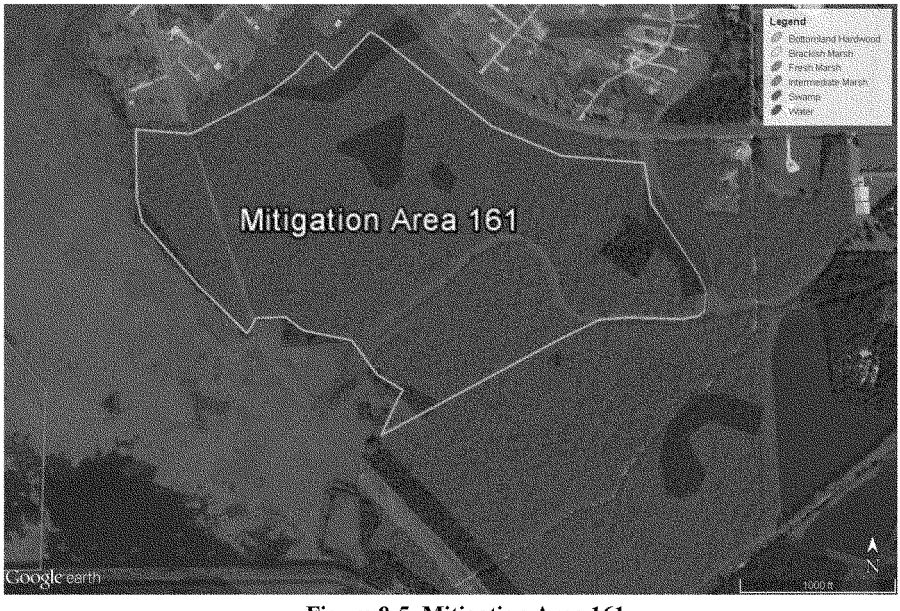

Figure 8-5. Mitigation Area 161

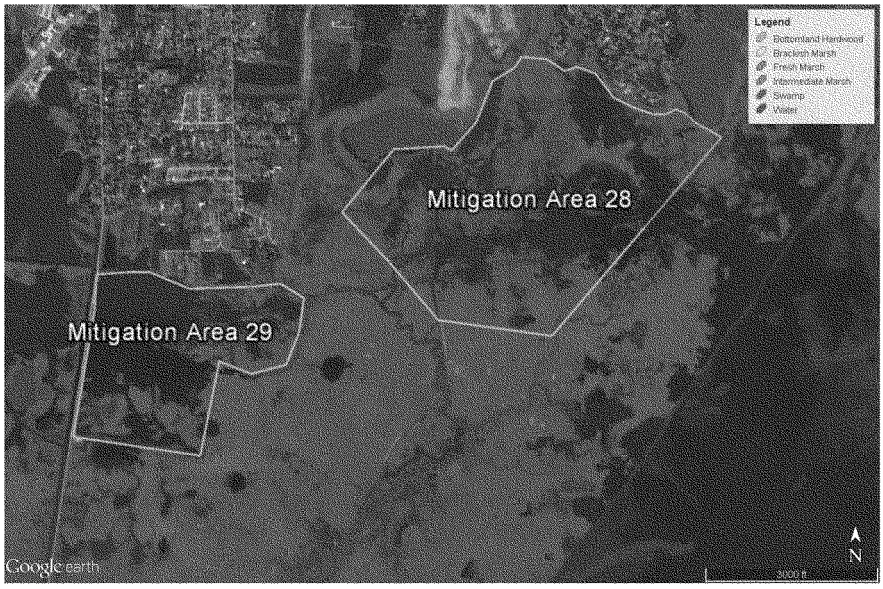

Figure 8-6. Mitigation Areas 28 and 29

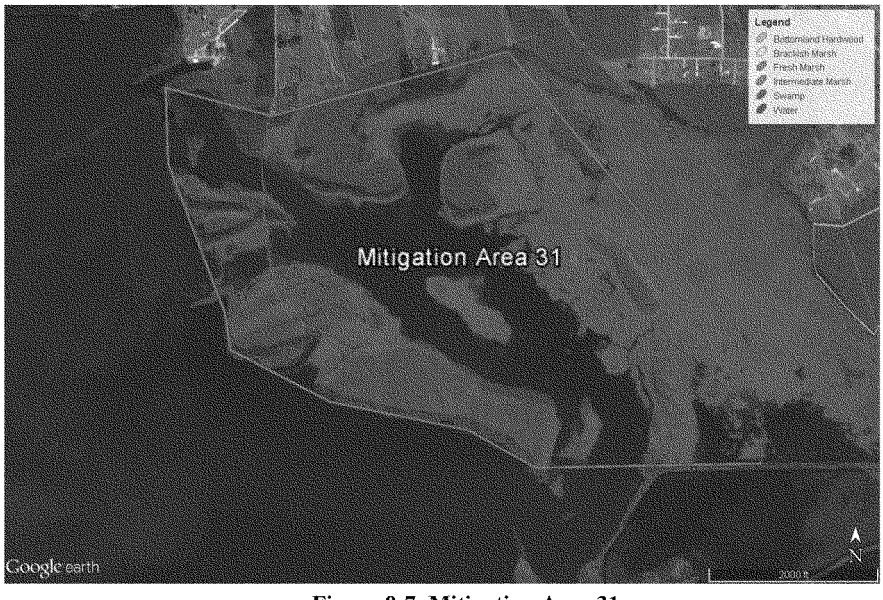

Figure 8-7. Mitigation Area 31

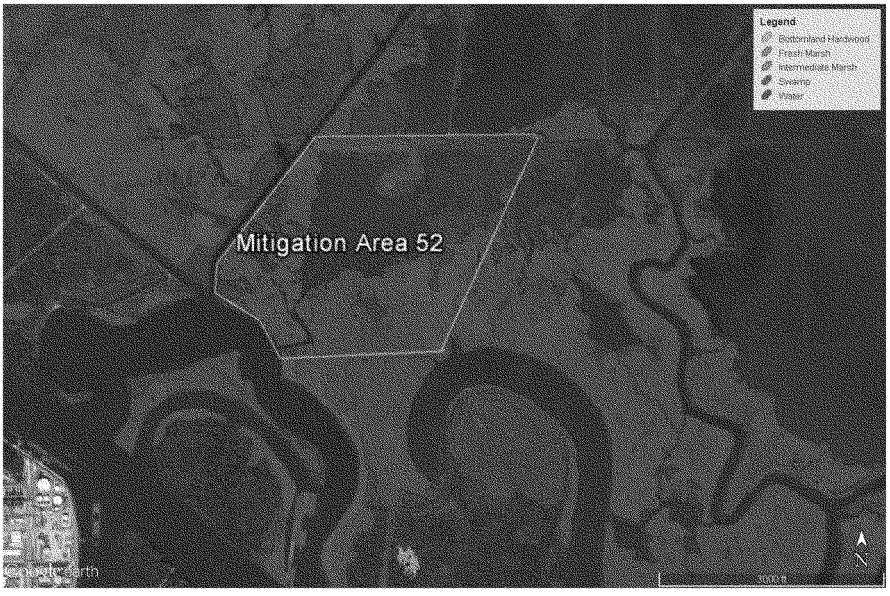

Figure 8-8. Mitigation Area 52

8.5.1 Forested Wetlands Mitigation

This plan would provide compensatory mitigation of 13.2 AAHUs for impacts of -7.3 AAHUs to cypress-tupelo swamp, and it would also provide incidental benefits of 6.2 AAHUs to bottomland hardwoods. Mitigation Area 161 would provide 49.3 AAHUs to compensate for -35.4 AAHUs total impacts to bottomland hardwoods. The mitigation plan consists of preservation in perpetuity of approximately 447 acres of swamp and bottomland hardwoods in Mitigation Area 11 in the bottomlands of the Sabine River and about 112.5 acres of bottomland hardwood forest in Mitigation Area 161 on the upland/wetlands margin of the Neches River in the Bessie Heights area. These lands would be acquired during the PED or construction phases by the NFS for project implementation. Baseline surveys of the forested wetland mitigation areas would be conducted during PED to determine the extent of Chinese tallow cover of selected areas. Extensive existing tallow cover is not anticipated, but baseline information is needed to track changes over the 50-year period of analysis.

A perpetual conservation easement would be placed on the property to ensure that the forested wetlands are protected and preserved in perpetuity. The NFS would manage the property and grant USACE right of entry for monitoring to verify preservation through the 50 year period of analysis. In lieu of managing the property itself, the NFS may arrange to transfer the property to a state conservation agency, such as TPWD.

8.5.2 Emergent Marsh Mitigation

Mitigation Areas 28 and 29 would provide 100.4 AAHUs to compensate for impacts of -96.5 AAHUs to brackish marsh. Mitigation Area 31 would provide 60.4 AAHUs to compensate for impacts of -16.6 to intermediate marsh. Mitigation Area 52 would provide 33.4 AAHUs to compensate for impacts of -30.2 AAHUs to fresh marsh. The mitigation plan would restore approximately 63 acres of fresh marsh and associated shallow ponds and sinuous channels in Mitigation Area 52, 151 acres of intermediate marsh and associated waters in Mitigation Area 31, and 239 acres of brackish marsh and associated waters in Mitigation Areas 28 and 29. Mitigation Areas 28, 29 and 31 are owned by TPWD. An interagency agreement would be negotiated with TPWD during the PED phase that would allow USACE to construct and monitor the mitigation features. Mitigation Area 52 is privately owned; acquisition and preservation of this area would be accomplished as described for Mitigation Areas 11 and 161.

Shoaled sediments from maintenance dredging of the adjacent deep-draft navigation channels of the Sabine-Neches Waterway (SNWW) would be used to restore marsh in areas of open water within the outlined areas shown on Figures 8-6 through 8-8. Marsh would be constructed to target elevations determined during the PED phase in coordination with the resource agencies, utilizing comparisons to nearby reference marshes to establish the optimum post-settlement elevation range.

The construction estimate assumes that shoaled material from SNWW's Sabine-Neches Canal B would be used to construct mitigation areas 28 and 29 as this is the closest segment of the SNWW. This channel is not regularly dredged, so cost estimates include the full cost of maintenance dredging to hydraulically dredge the material and pump it into targeted open water areas. Maintenance material from the SNWW's Neches River Channel might be used instead of, or in addition to, the Sabine-Neches Canal B material for these areas. Material from regularly scheduled maintenance dredging of nearby reaches of the Neches River Channel is proposed for construction of mitigation areas 31 and 52. Only the incremental cost of additional hydraulic pipeline, pumping and pipe movement needed to create the marsh is included in the cost estimates for these alternatives.

Existing canals provide access routes for floating hydraulic pipelines into all of the mitigation areas. If deepening of the access canals is required, that material would be used to restore marsh elevation in the mitigation areas or in adjacent open water areas acceptable to resource agencies.

Temporary board roads may be constructed along access corridors and staging areas wherever emergent marsh exists. Fill material may be deposited to offset damage to underlying marsh caused by soil compression under the board road. Details of construction/flotation access corridors and staging areas would be developed during the PED phase. Every effort would be made to avoid and minimize environmental impacts to the extent practicable. Any unavoidable wetland impacts would be determined in consultation with resource agencies and the mitigation areas would be enlarged as needed to compensate for impacts which exceed AAHUs provided by the Best Buy Mitigation Plans.

Temporary containment dikes, constructed with in-situ materials excavated from immediately adjacent open water areas, would hold dredged material slurry while it decants and consolidates to form new marsh platforms in open water areas. For all of the marsh mitigation alternatives, it was assumed that marsh would be restored in 65 percent of the open water, and that sinuous channels and ponds would be created in the remaining 35 percent of open water. Dredged material would be allowed to flow into existing marsh surrounding the open water areas within the containment dikes; marsh vegetation would winnow the fine-grained material and nourish existing marsh. Temporary erosion control measures (such as concrete mats or riprap) for the containment dikes may be installed where needed.

Construction of the mitigation areas would begin as soon as possible after project construction is initiated. Construction would need to proceed on several areas concurrently because it is estimated that the total construction period for each area, from initiation through establishment of marsh vegetation would be 8 years. It is estimated that initial construction of each area would take 2 years; settlement and consolidation of the dredged material would take up to 3 years; and channels and ponds would be created within 4-5 years of beginning construction. Containment dikes or temporary erosion control features would be removed in the sixth year of the construction period to encourage marsh plant growth and to maximize edge for aquatic organisms. *Spartina patens* would be planted on 5-foot centers in the year following completion of pond/channel construction, and replanted the following year as needed. It is also expected that *Spartina alterniflora* and other native wetland vegetation would grow in the mitigation areas within 1-2 years, as nearby seed sources are abundant. Invasive and nuisance vegetation would be removed in the last year of the mitigation construction period to facilitate growth of native vegetation over the restored marsh areas.

8.5.3 Mitigation Summary

In total, the mitigation plan would provide 262.9 AAHUs to fully compensate for losses totaling –186.0 AAHUs due to direct and indirect impacts of the Recommended Plan. This mitigation plan fully compensates for all impacts to significant resources, as required by Section 2036(a) of WRDA 2007 and ER 1105-2-100 (USACE, 2000). In addition, Mitigation Areas 28, 29 and 31 complement on-going state conservation and restoration actions of TPWD in the Lower Neches River WMA, as encouraged by Section 1040 of WRDA 2014. The plan also fulfills recommendations by USFWS (August, 2016), and letters from EPA (Oct 30, 2015), NMFS (October 26, 2015), TCEQ (October 21, 2015) and TPWD (October 26, 2015). However, EPA Section 404 "CWA" comments (provided as an attachment to their Oct 30, 2015 letter) indicate that "preservation only" mitigation plans are the "lowest priority, and thus least desirable option." No other resource agencies provided similar comments indicating that "preservation only" was the least desirable solution.

A Monitoring and Adaptive Management Plan for the Mitigation Plan has been developed and is presented in Appendix P of the FIFR-EIS. Monitoring/adaptive management measures and costs (see Table 8-3) and total mitigation costs (see Table 8-5) were developed for screening purposes only. Changes in final costs would apply proportionately to all mitigation alternatives for each wetland type, and thus would not affect plan selection. Final plans and costs are presented in Appendix P. In addition, Appendix Q presents sensitivity analyses of the WVA coastal marsh models using a sensitivity spreadsheet prepared by the ERDC Environmental Lab. These sensitivity analyses provide additional information to assist in the investigation of several unresolved issues related to the suitability graphs for Variables 1, and 2, and the aggregation method used to combine the marsh habitat units and open water habitat units.

9 REFERENCES

Baltz, D.M., C. Rakocinski, and J.W. Fleeger. 1993. Microhabitat use by marsh-edge fishes in a Louisiana estuary. Environ. Biolog. Fish. 36:109–126.

Brown, C.A., and G.N. Montz. 1986. Baldcypress, the tree unique, the wood eternal. Claitor's Publishing Division, Baton Rouge, Louisiana.

Camarillo, S.A., J. P. Stovall, and C.J. Sunda. 2015. The impact of Chinese tallow (*Triadica Sebifera*) on stand dynamics in bottomland hardwood forests. Forest Ecology and Management: Vol 344, 15 May 2015, pp 10-19.

Castellanos, D.L., and L.P. Rozas. 2001. Nekton use of submerged aquatic vegetation, marsh, and shallow unvegetated bottom in the Atchafalaya River delta, a Louisiana Tidal Freshwater Ecosystem. Estuaries 24(2):184–197.

CDM and USACE Institute for Water Resources (IWR). 2006. IWR Planning Suite User's Guide.

Conner, W.H., K.W. McLeod, and J.K. McCarron. 1997. Flooding and salinity effects on growth and survival of four common forested wetland species. Wetlands Ecology and Management, Vol 5 (2):99–109.

Cordes, J.J and A.M. Yezer. 1995. Shoreline Protection and Beach Erosion Control Study: Economic Effects of Induced Development in Corps-Protected Beachfront Communities, IWR Report 95-PS-1. Prepared by The George Washington University, Washington, D.C. for the U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources, Alexandria, VA.

Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1998. Evaluation of Dredged Material for Discharges in Waters of the U.S., Inland Testing Manual. EPA-823/B/98/004. February 1998.

Farris, G.S., G.J. Smith, M.P. Crane, C.R. Demas, L.L. Robbins, and D.L. Lavoie, eds. 2007. Science and the storms: the USGS response to the hurricanes of 2005. USGS Circular 1306.

Federal Emergency Management Agency (FEMA). 2008. Hurricane Ike impact report. Emergency Support Function #14, Long-Term Community Recovery Interagency Analysis.

Gardner, L.R., and D.E. Porter. 2001. Stratigraphy and geologic history of a southeastern salt marsh basin. North Inlet, South Carolina. Wetlands Ecology and Management 9:371–382.

Gardner, L.R., B.R. Smith, and W.K. Michener. 1992. Soil evolution along a forest-marsh transect under a regime of slowly rising sea level, North Inlet, South Carolina. Geoderma 55:141–157.

Guidroz, W.S., G.W. Stone, and D. Dartez. 2006. Hurricane Rita, 2005: Assessment of a storm-induced geological event along the southwestern Louisiana Coast and adjacent interior marsh. Gulf Coast Association of Geological Societies Transactions 56:229–239.

Hartman, R.D., C.F. Bryan, and J.W. Korth. 1987. Community structure and dynamics of fishes and crustaceans in a southeast Texas estuary. Submitted to: U.S. Fish and Wildlife Service. Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University Agricultural Center. 116 pp.

Howard, R.J., and I.A. Mendelssohn. 1999. Salinity as a constraint on growth of oligohaline marsh macrophytes. II. Salt pulses and recovery potential. American Journal of Botany 86(6):795–806.

Intergovernmental Panel on Climate Change (IPCC). 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Linthurst, R.A., and E.D. Seneca. 1981. Aeration, nitrogen and salinity as determinants of *Spartina alterniflora* Loisel. growth response. Estuaries 4(1):53–63.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority (LCWCR/WCRA). 1998. Coast 2050: toward a sustainable coastal Louisiana, Louisiana Department of Natural Resources, Baton Rouge. http://www.coast2050. gov/reports/

Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

Milliken K.T., J.B. Andersen, and A.B. Rodriguez. 2008a. Tracking the Holocene evolution of Sabine Lake through the interplay of eustasy, antecedent topography, and sediment supply variations, Texas and Louisiana, USA. The Geological Society of America, Special Paper 443-05.

_____. 2008b. A new composite Holocene sea-level curve for the northern Gulf of Mexico, in Anderson, J.B. and A. B. Rodriguez, eds., Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise: Geological Society of America Special Paper 443, p. 1-11.

Minello, T.J. 2000. Temporal development of salt marsh value for nekton and epifauna: utilization of dredged material marshes in Galveston Bay, Texas, USA. Wetlands Ecology and Management 8:327–341.

Minello, T.J., and L.P. Rozas. 2002. Nekton populations in Gulf Coast wetlands: fine-scale spatial distributions, landscape patterns, and restoration implications. Ecological Applications 12:441–455.

Minello, T.J., and J.W. Webb, Jr. 1993. The development of fishery habitat value in created salt marshes, pp. 1–3. In Proceedings of the 8th Symposium on Coastal and Ocean Management, Vol 2, edited by O. Magoon, W.S. Wilson, H. Converse and L.T. Tobin. American Society of Civil Engineers, New York.

———. 1997. Use of natural and created *Spartina alterniflora* salt marshes by fishery species and other aquatic fauna in Galveston Bay, Texas, USA. Marine Ecology Progress Series, Vol 151:165–179.

Minello, T.J., and R.J. Zimmerman. 1992. Utilization of natural and transplanted Texas salt marshes by fish and decapod crustaceans. Marine Ecology Progress Series, Vol. 90:273–285.

Minello, T.J., R.J. Zimmerman, and R. Medina. 1994. The importance of edge for natant macrofauna in a created salt marsh. Wetlands 14:184–198.

Morris, J.T., P.V. Sundareshwar, C.T. Nietch, B. Kjerfve, and D.R. Cahoon. 2002. Responses of coastal wetlands to rising sea level: Ecology, v. 83, no. 10, p. 2869–2877.

Morton, R.A., and J.G. Paine. 1990. Coastal land loss in Texas – an overview. Transactions – Gulf Coast Association of Geological Societies 40:625–634.

National Marine Fisheries Service (NMFS). 2008. Fisheries Friendly Design and Operation Considerations for Hurricane Flood Protection Water Control Structures. Baton Rouge Field Office, April 2008.

_____. 2012. Data and Calculations to Derive Percent Open Channel Method. Provided by Pat Williams, NMFS, Baton Rouge.

National Oceanic and Atmospheric Administration. 2008. Fisheries Friendly Design and Operation Considerations for Hurricane Flood Protection Water Control Structures. National Marine Fisheries Service, Baton Rouge Field Office, April 2008.

_____. 2012. Detailed Method for Mapping Sea Level Rise Marsh Migration. NOAA Coastal Services Center.

_____. 2015. Sea Level Rise and Coastal Flooding Impacts. Accessed at http://coast.noaa.gov/slr/

National Research Council (NRC). 1987. Responding to changes in sea level: engineering implications. Commission of Engineering and Technical Systems, National Research Council, National Academy Press, Washington, D.C.

Nielsen-Gammon, J.W. 2009. The changing climate of Texas in "The Impact of Global Warming on Texas" edited by Gerald North, Jurgen Schmandt and Judith Clarkson, University of Texas Press, Austin.

Palmisano, A.W. 1972. Habitat preference of waterfowl and fur animals in the northern gulf coast marshes. Pp. 163–190 in R.H. Chabreck, ed. Coastal Marsh and Estuary Management Symposium. Louisiana State University, Baton Rouge.

Peterson, G.W., and R.E. Turner. 1994. The value of salt marsh edge vs. interior as a habitat for fish and decapod crustaceans in a Louisiana tidal marsh. Estuaries 17:235–262.

Pezeshki, S.R., R.D. DeLaune, and W.H. Patrick Jr. 1987a. Response of Baldcypress (*Taxodium distichum* L. var. *distichum*) to increases in flooding salinity in Louisiana's Mississippi River Deltaic Plain. Wetlands 7:1–10.

Raz-Guzman, A., and L. Huidobro. 2002. Fish communities in two environmentally different estuarine systems of Mexico. Journal of Fish Biology 61 (sa), 182–195.

Reid, G.K., and R.D. Wood. 1976. Ecology of inland waters and estuaries. D. Van Nostrand Co., New York. 485 p.

Rogers B.D., W.H. Herke, and E.E. Knudsen. 1992. Effects of three different water-control structures on the movements and standing stocks of coastal fishes and macrocrustaceans. Wetlands 12(2):106-120.

Rogers, B.D., and W.H. Herke. 1985. Estuarine-dependent fish and crustacean movements and weir management. Pages 201–219 in C.F. Bryan, P.J. Zwank, and R.H. Chabreck (editors), Proceedings of the fourth coastal marsh and estuary management symposium, Louisiana State University Agricultural Center, Louisiana Cooperative Fish and Wildlife Research Unit, Baton Rouge, Louisiana.

Rozas, L.P. and T.J. Minello. 1999. Effects of structural marsh management on fishery species and other nekton before and during a spring drawdown. Wetlands Ecology and Management 7:121-139.

_____. 2007. Restoring coastal habitat using marsh terracing: the effect of cell size on nekton use. Wetlands 27(3):595–609.

Rozas, L.P., and D.J. Reed. 1993. Nekton use of marsh-surface habitats in Louisiana (USA) deltaic salt marshes undergoing submergence. Mar. Ecol. Prog. Ser. 96:147–157.

Rozas, L.P., and R.J. Zimmerman. 2000. Small-scale patterns of nekton use among marsh and adjacent shallow nonvegetated areas of the Galveston Bay estuary, Texas (USA). Mar. Ecol. Prog. Ser. 193:217–239.

Sanzone, S., and A. McElroy, editors. 1998. Ecological impacts and evaluation criteria for the use of structures in marsh management. Report of the EPA Science Advisory Board. EPA-SAB-EPEC-98-003. 50 pp.

SOL Engineering Services, LLC/Atkins. 2013. Letter Report on Water and Sediment Sampling and Analysis for maintenance dredging of the Sabine-Neches Waterway – Lower, Middle and Upper Reach. Completed under Contract W912HY-11-D-003, Task Order DY01.

Sutherlin, J. 1997. Historical development of the marsh system on the west side of Sabine Lake. Sabine Lake Conference: Where Texas and Louisiana Come Together (conference proceedings). Sabine Lake Conference, Beaumont, Texas. Texas A&M University, College Station (TAMU-SG-97-101).

Stovall, J. 2016. Personal communication with Stephen McDowell, Texas Parks and Wildlife Department, March 9, 2016.

Sutherlin, J. 1997. "Historical development of the marsh system on the west side of Sabine Lake." Sabine Lake Conference: Where Texas and Louisiana Come Together, September 13–14, 1996, Beaumont, Texas. National Sea Grant Office, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, TAMU-SG-97-101.

Texas Commission on Environmental Quality. 2014. Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder Committee and Expert Science Team – Environmental Flow Recommendations. Accessed on March 22, 2015: http://www.tceq.texas.gov/permitting/water_rights/eflows/sabinenechessabinelakebay.html

Texas Parks and Wildlife Department (TPWD). 2003. Salt Bayou open water trend analysis, 2003 and 2004 Revision. GIS Department, Austin.

Texas Water Development Board (TWDB). 2007. Water for Texas. TWDB Document GP-8-1, Austin, Texas.

_____. 2012. Water for Texas 2012 State Water Plan.

The Nature Conservancy. 2006. Gulf Coast Prairies and Marshes. http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/art6866.html.

The Nature Conservancy and National Oceanic and Atmospheric Administration. 2011. Marshes on the Move: A Manager's Guide to Understanding and Using Model Results Depicting Potential Impacts of Sea Level Rise on Coastal Wetlands.

Thomas, J.L., R.J. Zimmerman, and T.J. Minello. 1990. Abundance patterns of juvenile blue crabs (*Callinectes sapidus*) in nursery habitats of two Texas bays. Bulletin of Marine Science 46(1):115–125.

U.S. Army Corps of Engineers (USACE). 1998. Neches River Saltwater Barrier Feasibility Study and Environmental Impact Statement, Galveston District.

———. 2000. Planning Guidance Notebook. Proponent: CECW-P. http://www.usace.army.mil/publications/eng-regs/er1105-2-100/toc.htm.

———. 2004. Louisiana Coastal Area – Ecosystem Restoration Study. New Orleans District, Louisiana.

_____. 2009. Numerical Model Study of Potential Salinity Impacts Due to Proposed Navigation Improvements to the Sabine-Neches Waterway, TX Volume 1: DRAFT Report by G. Brown and J. Stokes. ERDC-CHL, Vicksburg.

_____. 2011. Sabine-Neches Waterway Final Feasibility Report and Environmental Impact Statement. Galveston District.

_____. 2013. Hydrodynamic and Salinity Transport Modeling of the Morganza to the Gulf of Mexico Study area, by T. McAlpin, J. Letter, Jr, G. Savant, and F. Carson. USACE ERDC-CHL TR-13-7, Vicksburg.

_____. 2015. Analysis of Cow and Adams Bayous in Orange County, Texas using Desktop Off-Channel Wetland Salinity Mitigation Model (DOWSMM) by B. Gunkel and G. Brown. ERDC-CHL, Vicksburg.

_____. 2005. ERDC Storm Surge Modeling for Sabine Pass to Galveston Bay, Texas Study.

U.S. Department of Agriculture (USDA), Forest Service. 1983. Water tupelo in the Atchafalaya Basin does not benefit from thinning.

_____. US Forest Service Database. 2016. *Triadica sebifera*. http://www.fs.fed.us/database/feis/plants/tree/triseb, accessed on June 16, 2016.

_____. 2004. Agriculture Handbook 654, Silvics of North America, R.M. Burns and B.H. Honkala, technical coordinators. http://www.na.fs.fed.us/spfo/pubs/silvics_manual/.

U.S. Fish and Wildlife Service (USFWS). 1998. Final habitat stewardship program, Texas Chenier Plain. U.S. Fish and Wildlife Service, Department of the Interior, Washington, D.C.

_____. 2002. Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Procedural Manual, Emergent Marsh Community Models, and Swamp Marsh Community Model. Prepared by Environmental Work Group, CWPPRA Technical Committee, USFWS, Lafayette, Louisiana.

_____. 2010. Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Bottomland Hardwood Community Model. Prepared by Environmental Work Group, CWPPRA Technical Committee, USFWS, Lafayette, Louisiana.

U.S. Geological Survey (USGS). 2004. Historical and projected coastal Louisiana land changes: 1978–2050: U.S. Geological Survey, by J. Barras, S. Beville, D. Britsch, S. Hartley, S. Hawes, J. Johnston, P. Kemp, Q. Kinler, A. Martucci, J. Porthouse, D. Reed, K. Roy, S. Sapkota, and J. Suhayda. 2003. USGS Open File Report 03-334, 39 p. (Revised January 2004).

_____, 2000. Chinese Tallow: Invading the Southeastern Coastal Plain.

_____. 2014a. Delineation of marsh types of the Texas coast from Corpus Christi Bay to the Sabine River in 2010, by N. Enright, S. Hartley, M. Brasher, J. Visser, M. Mitchell, B. Ballard, M. Parr, B. Couvillion and B Wilson. USGS National Wetlands Research Center, Lafayette.

_____.2014b. Land change analysis of Orange and Jefferson Counties, Texas, 1984-2014, prepared by Brady Couvillion. USGS National Wetlands Research Center, Lafayette.

Virnstein, R.W. 1987. Seagrass-associated invertebrate communities of the Southeastern U.S.A.: a review. Florida Marine Research Publications 42:89–116.

Visser, J.M., G.D. Steyer, G.P. Shaffer, S.S. Höppner, M.W. Hester, E. Reyes, P. Keddy, I.A. Mendelssohn, C.E. Sasser, and C. Swarzenski. 2004. Chapter 9, Habitat Switching Module in Appendix C, Hydrodynamic and Ecological Modeling, Louisiana Coastal Area Ecosystem Restoration Study. U.S. Army Corps of Engineers, New Orleans District, Louisiana, pp C143–157.

White, W.A., T.R. Calnan, R.A. Morton, R.S. Kimble, T.G. Littleton, J.H. McGowen, and H.S. Nance. 1987. Submerged lands of Texas, Beaumont – Port Arthur area: sediments,

geochemistry, benthic macro invertebrates, and associated wetlands. The University of Texas at Austin, Bureau of Economic Geology, Austin.

Wyda, J.C., L.A. Deegan, J.E. Hughes, and M.J. Weaver. 2002. The response of fishes to submerged aquatic vegetation complexity in two ecoregions of the mid-Atlantic bight: Buzzards Bay and Chesapeake Bay. Estuaries and Coasts 25(1):86–100.

ATTACHMENT 1
ECOPCX MEMO – APPROVAL TO USE WVA MODELS

ATTACHMENT 2
HQUSACE MEMO – SINGLE USE APPROVAL FOR
WVA MARSH MODEL

ATTACHMENT 3
WVA MODEL OUTPUT OF DIRECT IMPACTS

ATTACHMENT 4
FISHERIES FRIENDLY DESIGN CONSIDERATIONS

ATTACHMENT 5
WVA MODEL OUTPUT OF INDIRECT IMPACTS

ATTACHMENT 6
INITIAL ARRAY OF MITIGATION ALTERNATIVES

ATTACHMENT 7
WVA MODEL OUTPUT – FINAL ARRAY OF MITIGATION ALTERNATIVES

ATTACHMENT 1
ECOPCX MEMO – APPROVAL TO USE WVA MODELS

DEPARTMENT OF THE ARMY
MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
P.O. BOX 80
VICKSBURG, MISSISSIPPI 39181-0080

REPLY TO
ATTENTION OF:

CEMVD-PD-N 07 April 2014

MEMORAMDUM FOR CECW-SWD (Gore)

SUBJECT: Wetland Value Assessment Models – Marsh Model, Recommendation for Single-use Approval on Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study

1. References

a. Engineering Circular 1105-2-412: Assuring Quality of Planning Models, dated 31 March 2011.

b. Coastal Marsh Community Models, CWPRRA Wetland Value Assessment Methodology, 19 March 2010 (Encl 1)

c. Final Model Review Report for the Wetland Value Assessment Models, dated 31 August 2010, Battelle Memorial Institute (Encl 2)

d. CECW-P Memorandum dated 28 Feb 2012 Subject: Wetland Value Assessment Models – Costal Marsh Model Version 1.0- Approval for Use (Encl 3)

e. Sample output of sensitivity analyses, Analysis of the WVA Model Outputs for the Mitigation of Lake Pontchartrain and Vicinity (LPV) and West Bank and Vicinity (WBV) projects of the Hurricane Storm Damage Risk Reduction System. ERDC Environmental Lab, dated 28 August 2011 (ftp://ftp.usace.army.mil/usace/mvd/ECO-PCX/Model Certification/WVA/WVA_Mitigation_Sensitivity082911.pdf)

2. The National Ecosystem Planning Center of Expertise (ECO-PCX) recommends single-use approval of the Wetland Value Assessment (WVA) Coastal Marsh Community Models 1.0 on the Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study. The Coastal Marsh Community model is one of seven WVA community models that were developed by the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Environmental Work Group, an interagency team including US Fish and Wildlife Service, National Marine Fisheries Services, US Environmental Protection Agency, Natural Resources Conservation Service, USACE, and Louisiana Office of Coastal Protection and Restoration. The WVA Community model point of contact is Mr. Kevin Roy, US Fish and Wildlife Service, Lafayette Ecological Services Field Office.

3. The Coastal Marsh Community Models consist of sub-models for fresh marsh, brackish marsh/intermediate and saline marsh. The three sub-models have the same variables, but there are variations in the form of the suitability graphs and aggregation formulas. Model documentation consists of the Coastal Marsh Community Models (Encl 1) and 3 Excel spreadsheets (one for each sub-community). The Coastal Marsh Models were approved for use on a specific list of New Orleans District studies by CECW-P

memorandum dated 28 February 2012 (Encl 2). The subject project was not included in this list of projects as the ECO-PCX not coordinate with the Galveston District regarding anticipated use of the WVA Marsh Models in SWG.

4. Battelle Memorial Institute conducted a review of all the WVA community models and associated spreadsheets to assess the technical quality and usability of the model. Review results are found in the Final Model Review Report for the Wetland Value Assessment Models dated 31 August 2010 (Enclosure 3). The models were reviewed in accordance with EC 1105-2-412 Assuring Quality of Planning Models. The model review panel included 6 individuals with expertise in Habitat Evaluation Procedures, planning, hydraulic engineering, coastal wetland ecology, coastal ecosystems, and software programming/spreadsheet auditing. All panel members had PhDs in relevant fields of study.

5. Technical Quality. The recommended models meet the technical quality criterion. The models are based on the well-established contemporary theory that habitat quality can be estimated using key physical parameters. The model represents the key critical components of the system and properly incorporates key analytical requirements with the exception of Sea Level Rise. The model can be used to assess impacts of Sea Level Rise through separate model runs for each sea-level rise scenario. The model documentation has been revised to include literature citations and assumptions to support the selection, form and aggregation of the model variables. The model is in line with USACE policies and accepted procedures. It doesn't include any non-compliant components. The spreadsheet formulas were thoroughly checked for accuracy.

6. There are a few of unresolved issues related to the technical quality of the model. The unresolved issues are related to the form of suitability graphs for Variables 1, 2 and 3 and the aggregation methods used to combine the marsh habitat units and open water habitat units for each sub-model. The interagency user group and the ECO-PCX are working together to increase understanding of the sensitivity of the model to the unresolved issues and the impact the model differences may have on decision-making.

The PDT is directed to conduct sensitivity analyses for application of the marsh models to the subject project using the sample sensitivity analysis and spreadsheets prepared by ERDC Environmental Lab (Reference e). A summary of the sensitivity analyses should be presented in the project report or appendices. The Agency Technical Review team will be charged with reviewing the adequacy and findings of the sensitivity analysis.

7. The ECO-PCX planned to work with the users group and ERDC to compile findings of multiple sensitivity analyses and describe the impact the unresolved issues have on decision-making and facilitate resolution of issues. Progress on this effort has been slow due to inactivity on numerous studies that planned to use these models.

CEMVD-PD-N
SUBJECT: Wetland Value Assessment Models – Marsh Model, Recommendation for Single-use Approval on Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study

8. System Quality. Excel spreadsheets are used to run the model. Significant improvements were made to the spreadsheets in response to the model review. All spreadsheets are computationally correct, have a notes sheet with instructions, cue users for input including units, have data validation for input cells, and all non-input cells are locked for editing.

9. Usability. The model meets the usability criteria. The model inputs are readily available and model outputs are easily understandable and useful in supporting USACE civil works planning activities. The model is transparent – calculations and outputs can be easily verified. The user documentation is available and user friendly. The spreadsheets are also user-friendly. While formal training is not currently available, members of the CWPPRA Environmental Work Group provide on-the-job training to new and junior staff, as needed.

10. In summary, the ECO-PCX recommends single use approval of Wetland Value Assessment Coastal Marsh Community Model 1.0 on the Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study. Model application shall address model sensitivity associated with Variables 1-3 and the marsh/open water aggregation methods. Please notify the ECO-PCX of the findings of the Model Certification Panel.

Encls (3)

Jodi K. Creswell
Operational Director, Ecosystem Restoration
Planning Center of Expertise

CF:
CF (without enclosures):
CECW-PC (Coleman, Matusiak, Bee, Ware)
CECW-CP (Kitch, Hughes)
CECW-PB (Carlson)
CECW-SWD (Haberer, Brown)
CESWD-PDP (Clay, Conley, Johanning, Kelly, Varghese)
CESWF-PEC (Verwers)
CESWF-PEC-T (Davee)
CESWF-PEC-P (Laird)
CESWF-PEC-PF (Willey, Heinly)
CESWF-PEC-TN (Stokes, Murphy, Sims)
CEMVD-PD-N (Wilbanks, Lachney, Creswell)
CENAD-PD-X (Cocchieri)
CEERD-EE-E (Fischenich)
CEMVN-PDN-CEP (Dayan)
CEMVP-PD-P (Richards)

ATTACHMENT 2
HQUSACE MEMO – SINGLE USE APPROVAL FOR
WVA MARSH MODEL

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

CECW-P

6 May 2014

MEMORANDUM FOR MEMORANDUM FOR Director, National Ecosystem Restoration Planning Center of Expertise (ECO-PCX)

SUBJECT: Recommendation for Single-use Approval of the Wetland Value Assessment (WVA) Coastal Marsh Community Models for the Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study

1. The HQUSACE Model Certification Panel has reviewed the WVA marsh model in accordance with EC 1105-2-412 and has determined that the model and its accompanying documentation are sufficient to approve the model for use on the Sabine Pass to Galveston Bay, Texas, Coastal Storm Damage Risk Management and Ecosystem Restoration Feasibility Study. Adequate technical reviews have been accomplished and the HQUSACE panel has considered the assessments of the technical reviews and the recommendations of the ECO-PCX in making this determination.

2. The Coastal Marsh Community Models consist of sub-models for fresh marsh, brackish marsh/intermediate and saline marsh. The three sub-models have the same variables, but there are variations in the form of the suitability graphs and aggregation formulas. Model documentation consists of the Marsh Community Models and three Excel spreadsheets (one for each sub-community). Several unresolved issues exist related to the suitability graphs for Variables 1, 2 and 3 and the aggregation methods used to combine the marsh habitat units and open water habitat units for each sub-model. The model developers and the ECO-PCX are working together to resolve these issues and to evaluate the potential effects of the model outputs on the planning process.

3. In response to the unresolved issues discussed in paragraph 2 above, the Sabine to Galveston study is directed to conduct sensitivity analyses for application of the marsh models project using the sample sensitivity analysis and spreadsheets prepared by ERDC Environmental Lab. These sensitivity analyses shall be coordinated with the ECO-PCX. In addition, a summary of the sensitivity analyses should be presented in the Sabine to Galveston project report. The Agency Technical Review team will be charged with reviewing the adequacy and findings of the sensitivity analyses.

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APPLICABILITY: This approval for use of the WVA is limited to the subject study.

HARRY E. KITCH, P.E.
Deputy Chief, Planning and Policy Division
Directorate of Civil Works

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ATTACHMENT 3
WVA MODEL OUTPUT OF DIRECT IMPACTS

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Direct Impacts
Cypress-Tupelo Swamp Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
0.3	S2G S-1 Recommended Plan Impacts Bessie Heights 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project AAHUs=	0.19	0.00	0.18	0.19
	Net Benefit (FWP - FWOP)=	-0.18	0.00	-0.18	-0.18
0.35	S2G S-2 Recommended Plan Direct Impacts Old River		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project AAHUs=	0.24	0.00	0.24	0.24
	Net Benefit (FWP - FWOP)=	-0.24	0.00	-0.24	-0.24
3.81	S2G S-3 Recommended Plan Impacts Cow Bayou 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.05	0.00	0.05	0.05
	B. Future Without Project AAHUs=	2.78	0.04	2.77	2.79
	Net Benefit (FWP - FWOP)=	-2.73	0.04	-2.74	-2.72
1.94	S2G S-4 Recommended Plan Impacts Adams Bayou 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.03	0.00	0.03	0.03
	B. Future Without Project AAHUs=	1.18	0.01	1.18	1.19
	Net Benefit (FWP - FWOP)=	-1.16	0.01	-1.16	-1.16
4.13	S2G S-5 Recommended Plan impacts Blue Elbow 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.06	0.00	0.06	0.06
	B. Future Without Project AAHUs=	2.85	0.02	2.85	2.86
	Net Benefit (FWP - FWOP)=	-2.79	0.02	-2.80	-2.79

0.11	S2G S-6 Recommended Plan Impacts Port Arthur Addition 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project AAHUs=	0.07	0.00	0.07	0.07
	Net Benefit (FWP - FWOP)=	-0.07	0.00	-0.07	-0.07

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Direct Impacts
Bottomland Hardwood Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
9.34	S2G BH-1 Recommended Plan Impacts Bessie Heights 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.99	0.00	0.99	0.99
	B. Future Without Project AAHUs=	7.12	0.02	7.12	7.13
	Net Benefit (FWP - FWOP)=	-6.13	0.02	-6.14	-6.13
19.62	S2G BH-2 Recommended Plan Impacts Old River 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	2.11	0.00	2.11	2.12
	B. Future Without Project AAHUs=	17.12	0.03	17.11	17.12
	Net Benefit (FWP - FWOP)=	-15.00	0.03	-15.01	-15.00
9.34	S2G BH-3 Recommended Plan Impacts Cow Bayou 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	1.01	0.00	1.01	1.01
	B. Future Without Project AAHUs=	7.44	0.02	7.43	7.44
	Net Benefit (FWP - FWOP)=	-6.43	0.02	-6.43	-6.42
4.27	S2G BH-4 Recommended Plan Impacts - Adams Bayou Unit 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.42	0.00	0.42	0.42
	B. Future Without Project AAHUs=	2.25	0.03	2.24	2.25
	Net Benefit (FWP - FWOP)=	-1.83	0.03	-1.84	-1.83
1.28	S2G BH-5 Recommended Plan Impacts - Blue Elbow 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.14	0.00	0.14	0.14
	B. Future Without Project AAHUs=	0.85	0.01	0.85	0.85
	Net Benefit (FWP - FWOP)=	-0.71	0.01	-0.71	-0.71

0.42	S2G BH-6 Recommended Plan Impacts - Port Arthur Addition 2016		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.04	0.00	0.04	0.04
	B. Future Without Project AAHUs=	0.21	0.00	0.21	0.21
	Net Benefit (FWP - FWOP)=	-0.17	0.00	-0.17	-0.17

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Direct Impacts
Fresh Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
1.83	S2G F-1 Revised Impacts Bessie Heights 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.02	0.00	0.02	0.02
	B. Future Without Project Emergent Marsh AAHUs=	1.70	0.00	1.70	1.70
	Net Change (FWP - FWOP)=	-1.67	0.00	-1.67	-1.67
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-1.67	0.00	-1.67	-1.67
	B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00
	Net Benefits=	-1.13	0.00	-1.13	-1.13
8.6	S2G F-2 Recommended Plan Impacts Old River Cove 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.11	0.00	0.11	0.11
	B. Future Without Project Emergent Marsh AAHUs=	7.34	0.01	7.34	7.35
	Net Change (FWP - FWOP)=	-7.24	0.01	-7.24	-7.24
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.25	0.00	0.25	0.25
	Net Change (FWP - FWOP)=	-0.25	0.00	-0.25	-0.25
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-7.24	0.01	-7.24	-7.24
	B. Open Water Habitat Net AAHUs=	-0.25	0.00	-0.25	-0.25
	Net Benefits=	-4.98	0.01	-4.99	-4.98

0.62	S2G F-3 Recommended Plan Impacts Chemical Row 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.01	0.00	0.01	0.01
	B. Future Without Project Emergent Marsh AAHUs=	0.54	0.00	0.54	0.54
	Net Change (FWP - FWOP)=	-0.53	0.00	-0.53	-0.53
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-0.53	0.00	-0.53	-0.53
	B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00
	Net Benefits=	-0.36	0.00	-0.36	-0.36

13.28	S2G F-4 Recommended Plan Impacts Adams Bayou 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.09	0.00	0.09	0.09
	B. Future Without Project Emergent Marsh AAHUs=	6.44	0.01	6.44	6.45
	Net Change (FWP - FWOP)=	-6.35	0.01	-6.36	-6.35
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.03	0.00	0.03	0.03
	B. Future Without Project Open Water AAHUs=	1.85	0.02	1.85	1.86
	Net Change (FWP - FWOP)=	-1.83	0.02	-1.83	-1.82
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-6.35	0.01	-6.36	-6.35
	B. Open Water Habitat Net AAHUs=	-1.83	0.02	-1.83	-1.82
	Net Benefits=	-4.89	0.01	-4.89	-4.89

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Direct Impacts
Intermediate Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
0.32	S2G I-1 Recommended Plan Impacts Old River Cove 2016				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Emergent Marsh AAHUs=	0.26	0.00	0.26	0.26
	Net Change (FWP - FWOP)=	-0.26	0.00	-0.26	-0.26
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-0.26	0.00	-0.26	-0.26
	B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00
	Net Benefits=	-0.18	0.00	-0.18	-0.18
5.02	S2G I-2 Recommended Plan Impacts Cow Bayou 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.06	0.00	0.06	0.06
	B. Future Without Project Emergent Marsh AAHUs=	4.37	0.01	4.37	4.37
	Net Change (FWP - FWOP)=	-4.30	0.01	-4.31	-4.30
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.02	0.00	0.02	0.02
	Net Change (FWP - FWOP)=	-0.02	0.00	-0.02	-0.02
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-4.30	0.01	-4.31	-4.30
	B. Open Water Habitat Net AAHUs=	-0.02	0.00	-0.02	-0.02
	Net Benefits=	-2.92	0.01	-2.92	-2.92

1.46	S2G I-3 Recommended Plan Impacts Adams Bayou 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.02	0.00	0.02	0.02
	B. Future Without Project Emergent Marsh AAHUs=	1.30	0.00	1.30	1.30
	Net Change (FWP - FWOP)=	-1.29	0.00	-1.29	-1.29
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-1.29	0.00	-1.29	-1.29
	B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00
	Net Benefits=	-0.87	0.00	-0.87	-0.87

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Direct Impacts
Brackish Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
6.2	**S2G B-1 Recommended Plan Impacts Old River Cove 2016**	**Version 1.0**			
	Marsh	**Mean**	**SD**	**95% C.I.**	
	NET CHANGE IN AAHUs DUE TO PROJECT			**Lower**	**Upper**
	A. Future With Project Emergent Marsh AAHUs=	0.08	0.00	0.08	0.08
	B. Future Without Project Emergent Marsh AAHUs=	5.21	0.02	5.21	5.21
	Net Change (FWP - FWOP)=	-5.13	0.01	-5.14	-5.13
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.19	0.00	0.19	0.19
	Net Change (FWP - FWOP)=	-0.19	0.00	-0.19	-0.19
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-5.13	0.01	-5.14	-5.13
	B. Open Water Habitat Net AAHUs=	-0.19	0.00	-0.19	-0.19
	Net Benefits=	-4.04	0.01	-4.04	-4.03
67.8	**S2G B-2 Revised Impacts Cow Bayou 2016**	**Version 1.0**			
	Marsh	**Mean**	**SD**	**95% C.I.**	
	NET CHANGE IN AAHUs DUE TO PROJECT			**Lower**	**Upper**
	A. Future With Project Emergent Marsh AAHUs=	0.48	0.00	0.48	0.48
	B. Future Without Project Emergent Marsh AAHUs=	35.06	0.12	35.03	35.08
	Net Change (FWP - FWOP)=	-34.57	0.12	-34.59	-34.55
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.16	0.01	0.16	0.16
	B. Future Without Project Open Water AAHUs=	11.81	0.09	11.79	11.83
	Net Change (FWP - FWOP)=	-11.65	0.09	-11.67	-11.63
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-34.57	0.12	-34.59	-34.55
	B. Open Water Habitat Net AAHUs=	-11.65	0.09	-11.67	-11.63
	Net Benefits=	-29.48	0.09	-29.50	-29.46

0.2	S2G B-3 Revised Impacts Adams Bayou 2016	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Emergent Marsh AAHUs=	0.20	0.02	0.20	0.21
	Net Change (FWP - FWOP)=	-0.20	0.02	-0.20	-0.20
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.00	0.01	0.00	0.00
	Net Change (FWP - FWOP)=	0.00	0.01	0.00	0.00
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-0.20	0.02	-0.20	-0.20
	B. Open Water Habitat Net AAHUs=	0.00	0.01	0.00	0.00
	Net Benefits=	-0.16	0.02	-0.16	-0.15

ATTACHMENT 4
FISHERIES FRIENDLY DESIGN CONSIDERATIONS

NATIONAL MARINE FISHERIES SERVICE BATON ROUGE FIELD OFFICE
April 2008 Version

FISHERIES FRIENDLY DESIGN AND OPERATION CONSIDERATIONS FOR HURRICANE AND FLOOD PROTECTION WATER CONTROL STRUCTURES

SUMMARY

The purpose of this document is to: 1) identify design and operational guiding principles that would optimize passage of estuarine dependent marine fisheries species, or at least, minimize adverse impacts to their passage through hurricane and flood protection water control structures planned for the New Orleans District of the U.S. Army Corps of Engineers; and, 2) provide background literature for environmental justification and documentation. Specific projects for which this guidance should be considered include the Mississippi River and Tributaries, Morganza to the Gulf of Mexico Hurricane Protection Project; Donaldsonville to the Gulf Project; Supplemental Appropriations Projects, and the Louisiana Coastal Protection and Restoration Project (LACPR). However, these guiding principles would also pertain to any civil works projects that could include combinations of levees and/or water control structures. Project delivery teams should remain flexible to adapt these design principles on a case-by-case basis as new fishery resource information and project-specific hydraulics data become available.

In general, the ability of estuarine dependent marine fishery organisms to migrate to and from coastal habitats decreases as structural restrictions increase, thereby reducing fishery production. The physical ability (i.e., swimming speed) to navigate through a structure is not the only factor influencing fish passage. Both behavioral and physical responses govern migration and affect passage of fishery organisms through structures. These responses may vary by species and life stage. In addition, most marine fishery species are relatively planktonic in early life stages and are dependent on tidal movement to access coastal marsh nursery areas. For this reason, in general, the greater the flow through a structure into a hydrologically affected wetland area, the greater the marine fishery production functions provided by that area.

Data on marine fishery species migrations in the Gulf of Mexico are too limited to allow the development of definitive design and operational considerations for water control structures that would guarantee the protection of marine fishery production. Anecdotal comparisons can be made with data from water intake and fish passage studies from the west and east coasts. It should not be assumed that structures that have been determined to provide sufficient drainage capacity also optimize or provide adequate fishery passage. More investigation is warranted to refine and adaptively manage water control structure design and operations to minimize adverse impacts to fishery passage. Case specific recommendations for some features under the Mississippi Tributaries, Morganza to the Gulf of Mexico Hurricane Protection Project and LACPR are provided in the appendices. In addition, biological background information is provided in the appendices to assist in preparation of environmental documents required by the National Environmental Policy Act (NEPA).

Summary of guiding principles for designing and operating flood protection water control structures to maintain marine fishery passage:

- Generally, bigger and more numerous openings in hurricane and flood protection levees better maintain estuarine dependent fishery migration. As much opening as practicable, in number, size, and diversity of location should be considered.
- Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.
- Flood protection water control structures should remain completely open except during storm events.
- Any flood protection water control structure sited in canals, bayous, or navigation channels that does not maintain the pre-project cross section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.
- The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.
- Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.
- To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet/second. This may not necessarily be applicable to tidal passes or other similar major exchange points.
- To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.
- Culverts should be installed in construction access roads unless otherwise recommended by the natural resource agencies. At a minimum, there should be one, 24-inch culvert placed every 500 feet and at natural stream crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500-feet long and an area would hydrologically isolated without that culvert.
- Water control structures should be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.
- Levee alignments and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.
- Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect

freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

INTRODUCTION

Various flood protection and environmental water control structures in hurricane protection levees are being designed and considered for inclusion with ongoing local and federal civil works projects within the boundaries of the New Orleans District. Design purposes of the structures vary and may include maintaining safe navigation and optimizing drainage and passage of fishery organisms. For the Morganza to the Gulf of Mexico hurricane protection project, an interagency Habitat Evaluation Team (HET) and NOAA's National Marine Fisheries Service (NMFS) identified economically important fishery species that should be considered when assessing structure impacts on estuarine fisheries migration. Both the federal and state governments manage some of these species. Primary species that could be affected by flood protection structures in Louisiana include brown shrimp, white shrimp, blue crab, red drum, black drum, spotted seatrout, sand seatrout, southern flounder, and gulf menhaden. Some information is included herein on forage species, the production of which is important to maintain as they serve as important links of the aquatic food web for many of the managed fishery species.

The Baton Rouge office of NMFS has developed preliminary design principles for hurricane and flood protection water control structures to reduce impacts to living marine resources, especially related to migrations of estuarine dependent species. The basis for the following recommended guiding principles is briefly discussed where supporting literature is available. Case specific examples for some features under the Mississippi River and Tributaries, Morganza to the Gulf of Mexico hurricane protection project and the Louisiana Coastal Protection and Restoration Project are provided in the appendices. Basic behavior and physiology effects on the passage of fishery organisms are discussed in detail in appendices C and D, to aid federal agencies in environmental evaluations and descriptions under NEPA.

This document has been developed in consideration of input from the interagency HET, university faculty, fish passage staff of various agencies, and cursory literature reviews. These design considerations are intended to address potential impacts to living marine resources pursuant to the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act. Impacts to resources managed under other authorities, such as the Endangered Species Act or the Marine Mammal Protection Act, are not addressed in this document.

GUIDING PRINCIPLES FOR DESIGNING FISHERIES FRIENDLY FLOOD PROTECTION WATER CONTROL STRUCTURES

1. Generally, bigger and more numerous openings in hurricane and flood protection levees better maintain estuarine dependent fishery migration. As much

opening as practicable, in number, size, and diversity of location should be considered.

Most of Louisiana's commercial and recreational fishery species must have access to estuarine marshes to successfully complete some part of their life cycle (i.e., they are estuarine-dependent). Estuarine-dependent fishery productivity is a measure of standing crop (the number of fishery organisms present at a point in time) and the turnover rate (the rate at which the population is replaced). All things being equal, fishery production would be lower following levee and water control construction if structures retard turnover rate. This would be the case even while standing crop may appear normal. Restrictions in tidal movement caused by water control structures and levees would result in degraded or substantially changed species composition, which could alter fishery production and/or displace fisheries.

Marine transient species emigrate (i.e., move from coastal marshes towards Gulf waters) towards higher salinity water; therefore, a structure that maintains the greatest degree of opening while allowing the project objectives to be met would be desirable (Rogers et al. 1992).

2. Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.

Water control structures should be designed to have a water flow capacity (and similar dimensions where possible) comparable to the waterway before construction. Restricted water exchange in marshes enclosed by levees and water control structures diminishes recruitment and standing stocks of species that must migrate from coastal spawning sites to marsh nurseries (Rogers et al. 1994). As the amount of hydrologic control increases, the effect on migration and production of marine transients and residents increases. Greater restriction decreases turn over rate of estuarine-dependent fishery organisms, which decreases their production (Rogers et al. 1992[a]). Slotted and fixed crest weirs have been found to delay immigration. As the degree of restriction increased from slotted weirs, to low elevation weir, and to fixed crest weirs, greater impacts to different fisheries species and their emigration were observed.

Design considerations for hurricane and flood protection water control structures should include features to accommodate vertical and horizontal fishery distribution patterns within interior marsh tidal pathways and coastal passes. Fishery organisms exhibit preferences by species, life stage, and in some cases tide cycle, for vertical and horizontal distribution within smaller or interior marsh tidal connections (Table 1). Behavioral and physiological responses, such as diel vertical migration, affect these preferred distribution patterns.

Study of Keith Lake Pass in Texas revealed that all portions of the water column, both vertically and horizontally, are used by fishery organisms (Hartman et al. 1987). Most

estuarine-dependent fishery species preferred the bottom or shore zones during flood tides, but were much more dense near the shores of the pass, in slower moving water, on ebb tide. This lateral movement on slack to ebb tides appears to be a behavioral action to prevent displacement from the pass during ebb tide to accelerate movement to marsh nursery areas. The study identified the response to light cycles with midday densities greatest at bottom and densities greatest at surface during dawn to dusk. Similar within pass distribution patterns were reported by Sabins and Truesdale at Grand Isle, Louisiana (1974).

Table 1. Table on fishery preference within the water column (Marotz et al. 1990; Herke and Rogers 1985; Hartman et al. 1987; Sabins and Truesdale 1974). "a" denotes juveniles; "b" denotes immigrating; "c" denotes emigrating; "e" denotes ebb tide; "f" denotes flood tide.

	Vertical Distribution			Horizontal Distribution
Species	Surface	Mid-depth	Bottom	Shore/Nearshore
brown shrimp[b]	X	X		X[e]
white shrimp[b]	X	X		
white shrimp[c]		X		X[e]
blue crab	X			Xe
red drum[a]				X[e]
red drum[b]		X	X	
red drum[c]			X	
bay anchovy	X			
striped mullet	X			
Atlantic croaker[a]	X	X		X[e]
Atlantic croaker		X	X	X[e]
spotted seatrout		X	X	
sand seatrout		X	X	X[e]
gulf menhaden	X	X		
southern flounder				X[f]
black drum				X[e]

3. Flood protection water control structures should remain completely open except during storm events.

Fish passage should be optimized by the duration that structures remain fully open. Rozas and Minello (1999) reported that even when water-control structures were open, the densities of transient species were low inside areas enclosed by levees and water control structures as compared to natural areas.

Fisheries migration that temporarily may be impacted with storm related closures are listed in Table 2. The degree of impact would be influenced by the timing and duration of a structure closure relative to peak migration.

Table 2. Migration of economically important fisheries in Louisiana that temporarily may be impacted with storm related closures.

Species	Migration Period Overlapping with Hurricane Season
brown shrimp	April - mid July
white shrimp	July – November
blue crab	June – September
spotted seatrout	April – October
sand seatrout	April – October
red drum	August - December
black drum	March – July
southern flounder	September - October

4. Any flood protection water control structures sited in canals, bayous, or navigation channels that do not maintain the pre-project cross section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.

Hartman et al. (1987) recommended structures not be constructed in a tidal pass. If a structure was constructed, they recommended the incorporation of several gates at several vertical and horizontal locations, with baffles near shore. Baffles near shore are to direct shore or near shore fish passage on ebb tides through the available structure opening(s) (e.g., gates in wing walls).

Structures should be designed and operated with multiple openings if the pre-project water depth and widths of a channel are not maintained. Multiple openings are necessary to optimize passage of fishery organisms that prefer to migrate along the sides, bottom, and top of channels. For example, Rogers et al. (1992[a]) recommended opening some vertical slots and top, middle, and bottom gates in a structure with multiple slots and gates.

5. The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

The location and number of structures likely affects the abundance and distribution of estuarine fishery species within habitats that would be located on the protected side of levees and water control structures. Rogers et al. (1992[c]) determined that marine transient species were most numerous nearest the structures, partially due to the proximity of the openings with respect to the area enclosed. Similarly, other studies have

shown there is a decrease in fishery species abundance and diversity the greater the distance from the access point (Peterson and Turner 1994). This can become more pronounced if an environmental gradient (e.g., salinity) exists between an access point and the interior habitat located on the protected side of structures (Cashner 1994).

6. Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

Study of Keith Lake Pass in Texas revealed vertical and horizontal distribution patterns of fishery organisms in the pass (Hartman et al. 1987). Estuarine-dependent fishery organisms preferred the bottom or near shore zones on flood tides. Most organisms appeared near shores of the pass on ebb tide in slower moving water. Baffles near shore are to direct shore or near shore fish passage through the structure.

Many fish migrate along the water bottom. Water control structures with crests or inverts higher than the lower portion of a channel could impede migration through the deep-water portions of channels. Ramps can provide a means to guide organisms over and through structures and increase access of fisheries organisms to enclosed habitat (Lafleur 1994). Various ramp designs need to be investigated.

7. To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet/second.

In this preliminary investigation, no studies were located that evaluated the impacts of swimming speeds for the fishery species and life stages of concern in Louisiana. To avoid preventing or reducing ingress or egress of fishery organisms, preliminary guidance on water velocities through structures in Louisiana could be based on anecdotal comparisons with data available on general swimming speeds from studies on the west and east coasts (Tables 3 and 4).

Swimming speeds of estuarine and marine fish and crustaceans is a function of shape, stage of development, length, ambient temperature, light, and duration required for swimming performance. For most species, absolute speed increases as size increases. Generally, fish swimming speeds range from 2-4 body lengths/second with burst speeds up to 5 body lengths/second (Meyers et al. 1986).

Water intake studies have shown that maintaining water velocities less than 0.5 ft/sec would protect most fish and their life stages from being adversely affected by those flows (USEPA 2004). The species and life stages of fish for that study could not be located at this time and further investigation for Gulf of Mexico species is warranted. They also recommended creating horizontal velocity fields to avoid adverse affects on fish because fish are better able to orient to horizontal verses vertical flow. This could allow selective

avoidance of water flows not preferred by fish or minimize disorientation or mortality rates caused by flows.

Eberhardt (personal communication) reported velocities exceeding 0.82 feet/second began to impede fish passage. Fish passage was decreased by 50% for velocities exceeding 2.6 feet/second. Based on evaluation of freshwater species, Gardner (2006) recommends keeping velocities through round culverts less than 1.8 ft/sec during 90% of the fish migration season. To improve fish passage through culverts, installing baffles within culverts should be considered to reduce flow velocity barriers for fish (Pacific Watershed Associates 1994).

Table 3. Water flow velocity thresholds for affecting fish passage or avoiding impingement within flows or on screens.

Source	Water Flow Velocity (ft/sec)	
Alyson Eberhardt, personal communication	0.82	Begin to impede
	2.62	Decreased fish passage by 50%
Gardner 2006	1.8	Critical velocity (freshwater fish)
Meyers et al. 1986	<0.49	To avoid impingement
USEPA 2004	<0.50	Protected 96% of the fish tested from impingement

Table 4. Sustained fish swimming speeds. Adapted from Meyers et al. (1986). Note that no data was located for the fisheries species and life stages for the Gulf of Mexico.

Fish/life stage	Swimming Speeds (ft/sec)
Atlantic herring	0.19 – 0.3
Mullet	4.19
Horse mackerel	4.46
Sole	0.19 - 0.3
most larvae	0.82 – 0.98

Based on these limited data, larval fish could be adversely impacted by water flow rates exceeding 0.82 feet/second. Post-larval and juvenile stages of flounders could be impacted by flow rates around 1.0 ft/sec. Other species or larger life stages likely would not be adversely impacted until flow rates exceed 2.62 feet/second based on inferences from these data. Water flow velocity monitoring in the Terrebonne Basin by the U.S. Fish and Wildlife Service has found maximum flows through existing open channels exceeding 1.0 feet /second and in larger saline marsh channels and passes exceeding 2.0 feet/second.

If the spatial extent of flow velocity fields exceed the distance that can be traveled with sustained or burst swimming speeds of fishery organisms, those flows could prevent or reduce ingress or egress during the time which those flows exist. However, the degree of mortality from not being able to access nursery and foraging habitat is not known. High flow rates may aid passage of larval fish that primarily depend on passive transport for migratory distribution and access to estuarine habitat on the protected side of levees, if the high flows do not induce mortality from injury or fatigue. Water flow could exceed the fish swimming rates for short periods and still provide passage during low flows or during still water.

8. To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.

Design considerations should include installing baffles within culverts to reduce flow velocity barriers (Pacific Watershed Associates 1994). Passage of salmon and herring species has been shown to be impaired by culverts. With baffles or other similar features, still water areas could be created to enhance fish passage.

If water control structures include plunge pools, the invert elevation of the structure could be equal to the depth of the plunge pool if the plunge pool is deeper than the pre-project water depth. This deeper invert would optimize passage of fisheries species, in particular bottom dweller species.

Fish often require visual cues for orientation and exhibit faster swimming speeds at increased light levels. Herring type fish (e.g., gulf menhaden) are particularly sensitive to light levels. However, although herring exhibited a preference for unshaded portions of treatments during both day and night periods, as little as 1.4% of the ambient light was necessary for their passage through a culvert (Mosser and Terra 1999).

9. Culverts should be installed in construction access roads unless otherwise recommended by the resource agencies. At a minimum, there should be one, 24-inch culvert placed every 500 feet and at all water crossings. If the depth of water crossings allow, larger sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary, even if the road is less than 500 feet long, if an area would be hydrologically isolated without that culvert.

10. Water control structures should be designed to allow rapid opening in the absence of an offsite power source after storm passage and return of normal water levels.

Regardless of structure size, designs and contingency plans should include means to rapidly open the water control structures when flooding risks subside after a storm. Designs and plans should include infrastructure, equipment, and staff necessary to open the structures even if offsite electricity is not available. Design safeguards should be developed to protect the structures from being damaged rendering them inoperable and locked in a closed configuration after passage of a storm.

11. Levee alignment and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

12. Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

LITERATURE CITED

Cashner R.C., F.P. Gelwick, and W.J. Matthews. Spatial and temporal variation in the distribution of the Labranche wetlands area of the Lake Pontchartrain estuary, Louisiana. Northeast Gulf Science 13(2):107-120.

Environmental Protection Agency. 2004. 69 FR 68443. National Pollutant Discharge Elimination System – Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase III Facilities; Proposed Rule.

Gardner, A.E. 2006. Fish passage through road culverts. M.S. thesis, North Carolina State University. 103 pp.

Hartman, R.D., C.F. Bryan, and J.W. Korth. 1987. Community structure and dynamics of fishes and crustaceans in a southeast Texas estuary. Submitted to: U.S. Fish and Wildlife Service. Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University Agricultural Center. 116 pp.

Lafleur, G.L. 1994. Relative fisheries recruitment past a fixed-crest and ramped weir. M.S. thesis, Louisiana State University. 97 pp.

Marotz, B.L., W.H. Herke, and B.D. Rogers. 1990. Movement of gulf menhaden through three marshland routes in southwestern Louisiana. North American Journal of Fisheries Management 10:408-417.

Meyers, E.P., D.E. Hoss, D.S Peters, W.M. Matsumota, M.P. Seki, R.N. Uchida, J.D. Ditmars, and R.A. Paddock. 1986. The potential impact of ocean thermal energy conversion (OTEC) on fisheries. NOAA Technical Report NMFS 40.

Mosser, M.L. and M.E. Terra. 1999. Low light as an impediment to river herring. Journal of Fish Biology 12:609-614.

Pacific Watershed Associates. 1994. Chapter 10. South Fork Trinity River Basin, Fishery Habitat Improvement Projects. *In* Action Plan for Restoration of the South Fork Trinity River Watershed and Its Fisheries. Prepared for U.S. Bureau of Reclamation and The Trinity River Task Force under contract No. 2-CS-20-01100.

Peterson, G.W. and R.E. Turner. 1994. The value of salt marsh edge vs interior as a habitat for fish and decapod crustaceans in a Louisiana tidal marsh. Estuaries 17(18):235-262.

Rogers, B.D. and W.H. Herke. 1985. Estuarine-dependent fish and crustacean movements and weir management. *In* C.F. Bryan, P.J. Zwank, and R.H.. Chabreck, editors. Proceedings of the fourth coastal marsh and estuary management symposium. Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University Agricultural Center, Baton Rouge. pp 201- 219.

Rogers, D.R., B.D. Rogers, and W.H. Herke. 1994. Structural marsh management effects on coastal fishes and crustaceans. Environmental Management 18(3):351-369.

Rogers, D.R. B.D. Rogers, W.H. Herke. 1992[a]. Some potential effects of the Cameron-Creole marsh management plan on fishery organisms. School of Forestry, Wildlife, and Fisheries, Louisiana State University Agricultural Center. 82 pp.

Rogers B.D., W.H. Herke, and E.E. Knudsen. 1992[b]. Effects of three different water-control structures on the movements and standing stocks of coastal fishes and macrocrustaceans. Wetlands 12(2):106-120.

Rogers, D.R., B.D. Rogers, and W.H. Herke. 1992[c]. Effects of a marsh management plan on fishery communities in coastal Louisiana. Wetlands 12(1):53-62.

Rogers, B.D., R.F. Shaw, W.H. Herke, and R.H. Blanchet. 1993. Recruitment of postlarval and juvenile brown shrimp (*Peneaus aztecus* Ives) from offshore to estuarine waters of the northwestern Gulf of Mexico. Estuarine, Coastal and Shelf Science 36:377-394.

Rozas, L.P. and T.J. Minello. 1999. Effects of structural marsh management on fishery species and other nekton before and during a spring drawdown. Wetlands Ecology and Management 7:121-139.

Sabins, D.S. and F.M. Truesdale. 1974. Diel and seasonal occurrence of immature fishes in a Louisiana tidal pass. Proceedings of the 28th Annual Conference of Southeastern Association of Game and Fish Commissioners 28:161-171.

Swimming Bibliography

Arnott, S. A., D. M. Neil, and A. D. Ansell. 1998. Tail-flip mechanism and size-dependent kinematics of escape swimming in the brown shrimp Crangon crangon. J Exp Biol 201(11):1771-1784.

Chu, K. H., C. C. Sze, and C. K. Wong. 1996. Swimming behaviour during the larval development of the shrimp metapenaeus ensis (DeHaan, 1844) (Decapoda, penaeidae). Crustaceana 69(Part 3):368-378.

Cowles, D. L. 1994. Swimming dynamics of the mesopelagic vertically migrating penaeid shrimp sergestes similis - modes and speeds of swimming. J Crustacean Biol 14(2):247-257.

Dall, W. 1986. Estimation of routine metabolic rate in a penaeid prawn, Penaeus esculentus, Haswell. Journal of Experimental Marine Biology and Ecology 96:57-74.

Engas, A., and D. Foster. 2002. The response of red snapper (Lutjanus campechanus) and pinfish (Lagodon rhomboides) to inclined water flow. Fisheries Research 58(3):315-321.

Hancock, M. A., and S. E. Bunn. 1999. Swimming response to water current in Paratya australiensis Kemp, 1917 (Decapoda, Atyidae) under laboratory conditions. Crustaceana 72:313-323.

Jordan, C. E. 1992. A Model of Rapid-Start Swimming at Intermediate Reynolds Number - Undulatory Locomotion in the Chaetognath Sagitta elegans. J Exp Biol 163(FEB):119-137.

Lawrie, S. M., and coauthors. 1999. The swimming behaviour and distribution of Neomysis integer in relation to tidal flow. J Exp Mar Biol Ecol 242(1):95-106.

Matthews, T. R., W. W. Schroeder, and D. E. Stearns. 1991. Endogenous rhythm, light and salinity effects on postlarval brown shrimp Penaeus aztecus Ives recruitment to estuaries. Journal of Experimental Marine Biology and Ecology 154(2):177-189.

Meager, J. J., I. Williamson, N. R. Loneragan, and D. J. Vance. 2005. Habitat selection of juvenile banana prawns, Penaeus merguiensis de Man: Testing the roles of habitat structure, predators, light phase and prawn size. Journal of Experimental Marine Biology and Ecology 324(2):89-98.

Neil, D. M., and A. D. Ansell. 1995. The orientation of tail-flip escape swimming in decapod and mysid crustaceans. J Mar Biol Assn Uk 75(1):55-70.

Ouellet, P., and J. P. Allard. 2006. Vertical distribution and behaviour of shrimp Pandalus borealis larval stages in thermally stratified water columns: laboratory experiment and field observations. Fisheries Oceanography 15(5):373-389.

Primavera, J. H., and J. Lebata. 1995. Diel activity patterns in *Metapenaeus* and *Penaeus* juveniles. Hydrobiologia 295(1-3):295-302.

Pryor, V. K., and C. E. Epifanio. 1993. Prey selection by larval weakfish (Cynoscion regalis) - the effects of prey size, speed, and abundance. Mar Biol 116:31-37.

Serafy, J. E., S. J. Lutz, T. R. Capo, P. B. Ortner, and P. L. Lutz. 1995. Anchor tags affect swimming performance and growth of juvenile red drum (Sciaenops ocellatus). Mar Freshw Behav Physiol 27(1):29-35.

Smith, M. E., and L. A. Fuiman. 2004. Behavioral performance of wild-caught and laboratory-

reared red drum Sciaenops ocellatus (Linnaeus) larvae. Journal of Experimental Marine Biology and Ecology 302(1):17-33.

Wakeman, J. M., and D. Wohlshlag. 1979. Salinity stress and swimming performance of spotted seatrout. Pages 357-361 *in* Ann. Conf. S.E. Assoc. Fish. & Wild.

APPENDIX A - Mississippi River Tributaries, Morganza to the Gulf of Mexico Hurricane Protection Project Recommendations

The following are some case specific comments for features under the Morganza to the Gulf project. Formal and complete guidance will be provided through Project Delivery Team and Habitat Evaluation Team coordination procedures on all features for that project.

BAYOU GRAND CAILLOU

All design alternatives evaluated thus far for the Bayou Grand Caillou Floodgate would decrease the present cross sectional area of the bayou and therefore reduce passage of fishery organisms. Because dredging of the bayou is being considered to maintain existing water flows, enlarging the channel by dredging also could be considered to allow the present cross section not to be reduced with the floodgate in place. Vertical slots in the structure wing walls could be considered. Alternatively, baffles could be considered to direct fishery species that prefer to migrate along the shorelines through the structure. An operation plan that minimizes closure of the structure to avoid adversely impacting fishery migration should be developed with consideration of the potential dual purpose of the project to reduce salt water intrusion. Closing the structure to reduce saltwater intrusion only should be considered if modeling demonstrates that benefit could be achieved.

REACH J1

In addition to the existing open culverts under the highway. Trenassing was recommended along the levee toe to prevent isolating enclosed wetlands from fishery access. Culverts (24-inch) were recommended to be installed under the temporary and permanent access roads. In the future for other reaches or projects, culverts should be installed when the road is constructed rather than later if compaction from construction equipment is not expected to be problematic. Installing culverts or gapping an existing road dump also was recommended to prevent isolating enclosed wetlands. The P2 plug along Island Road was recommended to be removed to allow additional connection with Bayou Pointe aux Chenes.

REACH J2

The crest of the environmental water control structures (NAWCA Unit) should be equal to or less than the pre-project water elevation. Structures designs with invert elevations equal to or lower than the depth of the plunge pool could be considered if the necessary plunge pool is deeper than the pre-project water depth. This deeper invert would optimize passage of fish species, in particular bottom dwelling species. The articulated concrete mat integrated to armor the plunge pool could serve as a ramp to improve fishery passage, if sloped to the structure crest.

ENVIRONMENTAL WATER CONTROL STRUCTURES

The number, size, and location of environmental water control structures identified during planning should be reconsidered as the project progresses into advanced design

phases. Inclusion and operation of flap gates to prevent saltwater from entering the system should be considered only after water salinity data and modeling demonstrate the benefit of that feature balanced against the reduction in fishery passage. Specifically, the design and operation should be re-evaluated in this regard for the environmental water control structures planned in the levee at the south end of the Lake Boudreaux basin.

OPERATION

Programmatic and contingency plans should be developed to open the structures as soon as practicable after storm events. This is particularly critical in instances when utility services are offline, if the structures are damaged, or access to the structures is restricted by storm debris.

APPENDIX B - CATEGORY 5/LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT (LACPR)

In addition to the above design consideration, the following are case specific recommendations for some representative structures if they are included as components to the LACPR Project.

SEABROOK, CHEF MENTEUR, AND RIGOLETS

If structures are included in the LACPR Project for these connections with Lake Pontchartrain, they should be floodgates designed to maintain the size and dimensions of the existing openings with the gates in place and open. The structures should only be closed during storm events of sufficient magnitude that flooding is a concern. Sector or tainter gates should be considered prior to more restrictive structure designs. If unsafe flow velocities for navigation are determined would exist during a high head differential requiring consideration of a lock, incorporation of openings (e.g., gates) in the wing walls with the combination of baffles and ramps should be considered to maintain or enhance fish passage while the lock is open and closed, respectively. The need to maintain Seabrook open will continue to be evaluated with consideration of the effects on the lake ecology given different levee alignments and closure options for the Mississippi River Gulf Outlet whether under LACPR or supplemental appropriations funding.

BAYOU BOEUF

If any water control structure is included in Bayou Boeuf, the structure should be a floodgate that does not reduce the present size and dimension of the bayou. Prior to consideration of a pump station and lock to minimize backwater flooding and potential enhancement of forested wetlands, fisheries studies should be re-initiated to document the degree (i.e., diversity and density) and timing of use of the lakes sub-basin by estuarine transient species. If the preferred alternative consists of a pump and lock, sluice gates should be included with some level of structure opening. Mitigating measures to offset the loss of estuarine fishery habitat would be necessary if estuarine-dependent fishery migration is reduced or eliminated.

BAYOU DES ALLEMANDS

If a water control structure is included in Bayou Des Allemands, only a floodgate should be considered. The floodgate should be designed to not reduce the present size and dimensions of the bayou and should remain open except during storm events. Bayou Des Allemands should not be plugged and replaced by Bayou Gauche as the main connection with Lac Des Allemands.

RESTORATION FEATURES

Ridges of bay shoreline armorment could impede fishery ingress/egress. For ridges constructed in open water, gaps should be included on average at least every 1,000 feet.

The gap should be no less 25-feet wide (bottom width) and the pre-project water depth or a depth –2 feet NAVD 88, which ever is deeper, should be maintained. Deviations from this general guidance may be evaluated on a case-by-case basis. For example, if storm surge modeling suggests the number of gaps undermine the surge suppression function, fewer, but larger gaps might be an option.

If a foreshore rock dike is included for shoreline protection, fish gaps should be included at least every 1,000 feet. These openings should be 25-feet wide and the pre-project water depth should be maintained.

If a revetment is included for shoreline protections, fish dips should be included at least every 1,000 feet. These dips are lower sections in the rock that should be 25-feet wide and with a depth of 0.0 ft NAVD88.

APPENDIX C

BEHAVIOR

The physical ability (i.e., swimming speed) to navigate a structure is not the only factor influencing fish passage, especially for small structures. Behavioral responses to stimuli individually or interactively affect passage with physiological constraints or responses. Behavior generally can be categorized as schooling and non-schooling behavior.

SCHOOLING BEHAVIOR

Schooling behavior consists of strategies that provide hydrodynamic efficiency, reduced predation, increased efficiency in finding food, and increased reproductive success. Water control structures for flood protection impact large numbers of fishery organisms due to this group response. This could be because fish exhibit the tendency to approach and orient to other members of the species (i.e., biotaxis). This orientation confers a hydrodynamic advantage that is more efficient than individuals due primarily to vortices setup by lead fish. Schools function as a living organism where the group reacts to stimuli as an individual. It is this group reaction that influences greater affect on passage through water control structures.

NON-SCHOOLING BEHAVIOR

Agonistic, territorial, and hierarchical behavior are examples of non-schooling behavior exhibited by fish. Agonistic and territorial behaviors are largely unknown for the listed estuarine and marine fishery species of concern and their life stages. Structures that create physically taxing water flow velocities and some low flow areas may encourage these behaviors as fish compete for resting areas similar to competition seen with fish competing for resting areas within shrimp trawls or behind rocks in river riffle/pool habitat. It is possible these behavioral responses overall may not be that influential on fish passage through a structure, but may come more into play during low flow conditions such as lower tides or slack tide. Hierarchical behavior can often be driven by a combination of physiological responses and will be discussed in that section. Overall, investigation on behavioral responses to water control structures is needed to avoid and minimize adversely impacting fishery passage if not optimizing it.

APPENDIX D

PHYSIOLOGICAL

Fishery species and life stages react differently to a current of water (i.e., rheotaxis). Generally, fish are better able to orient to horizontal verses vertical flow (Meyers et al. 1986).

LOCOMOTION

There are two means for migratory transport of estuarine and marine fish and crustaceans: passive and active transport. Passive transport is drift of organisms carried by the tides and currents. Larval and post-larval fish and crustacean life stages are predominately transported passively by tides and currents. Passive transport via tidal forcing can play a strong role in migration of sub-adult and adult brown shrimp, white shrimp, and blue crabs. Active transport is movement by swimming, which is the primary means of locomotion for sub-adults and adult fish.

SWIMMING SPEED

Refer to guiding principles number 7 for details on swimming speeds relative to impacts on fish passage.

BEHAVIORAL/PHYSIOLOGY INTERACTION

Many fishery organisms exhibit hierarchical behavior. This is a direct response to stimuli, such as astronomical (e.g., tidal rhythm) or meteorological driven flows. For example, brown shrimp mediate transport by circadian or diel vertical migration. Brown shrimp move down in the water column or cease activity as the become negatively buoyant when low salinity and temperature water develop in estuaries with north winds associated with spring fronts. Brown shrimp activity resumes with their movement up in the water column with increasing water temperature, salinity, and hydrostatic pressure associated with the southerly gulf return following after a cold front (Rogers et al. 1993). Similar selective tidal stream transport was reported by Hartman et al. (1987). Fishery organisms identify tide changes by detecting altered velocity, salinity, temperature, all of which can cue staging for immigration with an incoming tide. Future tidal pass or inlet studies are needed for better information on vertical distribution, depth preferences, and changes in buoyancy or behavior to evaluate active and passive transport of fishery organisms.

APPENDIX E - Reference Websites, Fish Passage Agency Representatives, and University Faculty

Baker, C. and J. Boubee. 2003. Using ramps for fish passage past small barriers. Water and Atmosphere 11(2). June.
http://www.niwascience.co.nz/pubs/wa/11-2/passage

USACE Portland District, Fish Passage Team
http://www.nwp.usace.army.mil/pm/e/en_fish.asp

USACE, ERDC, Coastal Hydraulics Lab
http://chl.erdc.usace.army.mil/CHL.aspx?p=s&a=ResearchAreas;22

USFWS Fish Passage Decision Support System
http://fpdss.fws.gov/index.jsp

NC State's Center for Transportation and the Environment website:
http://www.itre.ncsu.edu/

http://itre.ncsu.edu/CTE/gateway/downloads/Culvert%20Impact%20Study(December2002).pdf

http://itre.ncsu.edu/CTE/gateway/downloads/FishPassage.pdf

FishXing software and learning systems for fish passage through culverts. This software is intended to assist engineers, hydrologists, and fish biologists in the evaluation and design of culverts for fish passage. It is free and available for download.
http://stream.fs.fed.us/fishxing/

- Allows for comparison of multiple culverts designs within a single project.
- Calculates hydraulic conditions within circular, box, pipe-arch, open-bottom arch, and embedded culverts.
- Contains default swimming abilities for numerous North American fish species.
- Contains three different options for defining tailwater elevations.
- Calculates water surface profiles through the culvert using gradually varied flow equations, including hydraulic jumps.
- Outputs tables and graphs summarizing the water velocities, water depths, outlet conditions, and lists the limiting fish passage conditions for each culvert.

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ATTACHMENT 5
WVA MODEL OUTPUT OF INDIRECT IMPACTS

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Indirect Impacts
Swamp Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area		Statistics		
1.9	S2G S Indirect-2 thru TY30		SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	0.30	0.01	0.30	0.30
	B. Future Without Project AAHUs=	0.39	0.01	0.39	0.39
	Net Benefit (FWP - FWOP)=	-0.09	0.01	-0.09	-0.09

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Indirect Impacts
Bottomland Hardwood Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area		AAHUs	Statistics			Net Mean AAHUs
					95% C.I.		
			Mean	SD	Lower	Upper	
12.7	BH Indirect-2						
		Future With Project =	1.57	0.01	1.57	1.57	
		Future Without Project =	6.69	0.10	6.67	6.71	
		Net Benefit (FWP - FWOP)=	-5.12	0.10	-5.14	-5.11	-5.12
							-5.1

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Indirect Impacts
Fresh Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
674.6	S2G F Indirect-2 Cow Bayou Fisheries Access				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	291.05	1.75	290.71	291.40
	B. Future Without Project Emergent Marsh AAHUs=	299.07	1.73	298.73	299.41
	Net Change (FWP - FWOP)=	-8.02	2.38	-8.48	-7.55
	Open Water NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	125.61	1.58	125.30	125.92
	B. Future Without Project Open Water AAHUs=	130.78	1.48	130.49	131.07
	Net Change (FWP - FWOP)=	-5.18	2.25	-5.62	-4.74
	Total TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-8.02	2.38	-8.48	-7.55
	B. Open Water Habitat Net AAHUs=	-5.18	2.25	-5.62	-4.74
	Net Benefits=	-7.10	1.78	-7.45	-6.75

110.6	S2G F Indirect-3-Adams Bayou Fisheries Access	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	37.27	0.23	37.22	37.31
	B. Future Without Project Emergent Marsh AAHUs=	43.02	0.25	42.97	43.07
	Net Change (FWP - FWOP)=	-5.76	0.31	-5.82	-5.69
	Open Water NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.63	0.03	0.62	0.63
	B. Future Without Project Open Water AAHUs=	24.94	0.30	24.89	25.00
	Net Change (FWP - FWOP)=	-24.32	0.30	-24.38	-24.26
	Total TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-5.76	0.31	-5.82	-5.69
	B. Open Water Habitat Net AAHUs=	-24.32	0.30	-24.38	-24.26
	Net Benefits=	-11.74	0.25	-11.79	-11.69

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Indirect Impacts
Intermediate Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
19.2	S2G I Indirect-1 and 2 Thru TY30				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.34	0.00	0.34	0.34
	B. Future Without Project Emergent Marsh AAHUs=	11.92	0.11	11.90	11.94
	Net Change (FWP - FWOP)=	-11.58	0.11	-11.61	-11.56
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.06	0.00	0.06	0.06
	B. Future Without Project Open Water AAHUs=	2.20	0.03	2.20	2.21
	Net Change (FWP - FWOP)=	-2.14	0.03	-2.15	-2.14
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-11.58	0.11	-11.61	-11.56
	B. Open Water Habitat Net AAHUs=	-2.14	0.03	-2.15	-2.14
	Net Benefits=	-8.54	0.08	-8.55	-8.52

270.3	S2G I Indirect-3-Cow Bayou Fisheries	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	123.23	0.70	123.09	123.37
	B. Future Without Project Emergent Marsh AAHUs=	127.03	0.69	126.89	127.17
	Net Change (FWP - FWOP)=	-3.80	0.95	-3.99	-3.61
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	52.92	0.63	52.79	53.04
	B. Future Without Project Open Water AAHUs=	55.35	0.59	55.23	55.46
	Net Change (FWP - FWOP)=	-2.43	0.89	-2.60	-2.25
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-3.80	0.95	-3.99	-3.61
	B. Open Water Habitat Net AAHUs=	-2.43	0.89	-2.60	-2.25
	Net Benefits=	-3.36	0.71	-3.50	-3.22

52.2	S2G I Indirect-4-Adams Bayou Fisheries Access	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	26.91	0.16	26.88	26.94
	B. Future Without Project Emergent Marsh AAHUs=	27.76	0.15	27.73	27.79
	Net Change (FWP - FWOP)=	-0.85	0.20	-0.89	-0.81
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	8.51	0.10	8.49	8.53
	B. Future Without Project Open Water AAHUs=	8.90	0.09	8.88	8.92
	Net Change (FWP - FWOP)=	-0.39	0.15	-0.42	-0.36
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-0.85	0.20	-0.89	-0.81
	B. Open Water Habitat Net AAHUs=	-0.39	0.15	-0.42	-0.36
	Net Benefits=	-0.70	0.14	-0.73	-0.68

Sabine Pass to Galveston Bay Feasibility Study
Recommended Plan Indirect Impacts
Brackish Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Impact Area	Version 1.0			
*	**S2G B Indirect-Intermediate 1 and 2 Switch to Brackish TY31**				
	Marsh	**Mean**	**SD**	**95% C.I.**	
	NET CHANGE IN AAHUs DUE TO PROJECT			**Lower**	**Upper**
	A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Emergent Marsh AAHUs=	6.10	0.06	6.09	6.12
	Net Change (FWP - FWOP)=	-6.10	0.06	-6.12	-6.09
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	1.35	0.02	1.34	1.35
	Net Change (FWP - FWOP)=	-1.35	0.02	-1.35	-1.34
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-6.10	0.06	-6.12	-6.09
	B. Open Water Habitat Net AAHUs=	-1.35	0.02	-1.35	-1.34
	Net Benefits=	-5.05	0.05	-5.06	-5.04

26.1	**S2G B Indirect-2 Cow Bayou**	**Version 1.0**			
	Marsh	**Mean**	**SD**	**95% C.I.**	
	NET CHANGE IN AAHUs DUE TO PROJECT			**Lower**	**Upper**
	A. Future With Project Emergent Marsh AAHUs=	0.21	0.01	0.21	0.21
	B. Future Without Project Emergent Marsh AAHUs=	14.49	0.07	14.47	14.50
	Net Change (FWP - FWOP)=	-14.28	0.07	-14.30	-14.27
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.08	0.01	0.08	0.08
	B. Future Without Project Open Water AAHUs=	5.80	0.04	5.79	5.81
	Net Change (FWP - FWOP)=	-5.72	0.04	-5.73	-5.71
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-14.28	0.07	-14.30	-14.27
	B. Open Water Habitat Net AAHUs=	-5.72	0.04	-5.73	-5.71
	Net Benefits=	-12.38	0.06	-12.39	-12.37

18.4	S2G B Indirect-3 Persistent	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.17	0.00	0.17	0.17
	B. Future Without Project Emergent Marsh AAHUs=	11.79	0.07	11.77	11.80
	Net Change (FWP - FWOP)=	-11.62	0.07	-11.63	-11.60
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.04	0.00	0.04	0.04
	B. Future Without Project Open Water AAHUs=	2.81	0.02	2.81	2.82
	Net Change (FWP - FWOP)=	-2.78	0.02	-2.78	-2.77
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-11.62	0.07	-11.63	-11.60
	B. Open Water Habitat Net AAHUs=	-2.78	0.02	-2.78	-2.77
	Net Benefits=	-9.65	0.06	-9.66	-9.64

34.0	S2G B Indirect-3 Marsh Migration	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Emergent Marsh AAHUs=	9.53	0.12	9.51	9.56
	Net Change (FWP - FWOP)=	-9.53	0.12	-9.56	-9.51
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.21	0.00	0.21	0.21
	Net Change (FWP - FWOP)=	-0.21	0.00	-0.21	-0.21
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-9.53	0.12	-9.56	-9.51
	B. Open Water Habitat Net AAHUs=	-0.21	0.00	-0.21	-0.21
	Net Benefits=	-7.46	0.10	-7.48	-7.44

290.5	S2G B Indirect-4 Cow Bayou Fisheries Impact	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	129.21	0.70	129.07	129.35
	B. Future Without Project Emergent Marsh AAHUs=	135.85	0.67	135.72	135.99
	Net Change (FWP - FWOP)=	-6.64	0.89	-6.82	-6.47
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	55.64	0.85	55.47	55.81
	B. Future Without Project Open Water AAHUs=	60.53	0.85	60.36	60.70
	Net Change (FWP - FWOP)=	-4.89	1.22	-5.13	-4.65
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-6.64	0.89	-6.82	-6.47
	B. Open Water Habitat Net AAHUs=	-4.89	1.22	-5.13	-4.65
	Net Benefits=	-6.25	0.78	-6.41	-6.10

739	S2G B Indirect-5 Adams Bayou Fishery Access	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	478.19	2.14	477.77	478.61
	B. Future Without Project Emergent Marsh AAHUs=	503.45	2.17	503.03	503.88
	Net Change (FWP - FWOP)=	-25.27	2.93	-25.84	-24.69
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	88.39	0.94	88.21	88.58
	B. Future Without Project Open Water AAHUs=	95.88	0.94	95.70	96.07
	Net Change (FWP - FWOP)=	-7.49	1.38	-7.76	-7.22
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-25.27	2.93	-25.84	-24.69
	B. Open Water Habitat Net AAHUs=	-7.49	1.38	-7.76	-7.22
	Net Benefits=	-21.32	2.31	-21.77	-20.86

**	S2G B Indirect-S-2 Switch TY31		Version 1.0		
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	0.00	0.01	0.00	0.00
	B. Future Without Project Emergent Marsh AAHUs=	0.74	0.02	0.74	0.74
	Net Change (FWP - FWOP)=	-0.74	0.01	-0.74	-0.74
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	0.00	0.01	0.00	0.00
	B. Future Without Project Open Water AAHUs=	0.01	0.01	0.01	0.02
	Net Change (FWP - FWOP)=	-0.01	0.01	-0.01	-0.01
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	-0.74	0.01	-0.74	-0.74
	B. Open Water Habitat Net AAHUs=	-0.01	0.01	-0.01	-0.01
	Net Benefits=	-0.58	0.01	-0.58	-0.58

* Same acreage as Intermediate Indirect-1 and 2 Thru TY30

** Same acreage as Swamp Indirect 2

ATTACHMENT 6
INITIAL ARRAY OF MITIGATION ALTERNATIVES

Sabine Pass to Galveston Bay Study - Mitigation Target Areas - Screening of Initial Array

#	Location	Acres	Veg	Action	Notes	Screening Result
1	Upper Neches	297	Swp	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
2	Upper Neches	266	Swp	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
3	Upper Neches	266	Swp	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
4	Upper Neches	271	Swp/BH	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
5	Upper Neches	213	Fr Mrsh/Swp/BH	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
6	Upper Neches	483	Swp/BH/Fr Mrsh	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
7	Upper Neches	410	Fr Mrsh/Swp	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
8	Upper Neches	345	Swp/BH/Fr Mrsh	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
9	Upper Neches	246	Fr Mrsh/Swp	Already preserved/HydroRest (berms not restricting hydrology per field observation)	in Big Thicket National Preserve (BTNP)	Out
10	Upper Neches	378	Fr Mrsh/Swp/BH	Preservation/HydroRest-benefits to marsh/uplands; would be few hydrologic benefits from 67 and 68	Degraded swamp, any restoration would provide few benefits to forested wetlands,would be few hydrologic benefits from 67 and 68; higher priority marsh mitigation areas available south of 110	Out
11	Upper Sabine	758	Swp/BH	Preservation	major Sabine River Authority (SRA) facility on canal; could not fill canal which is only hydrologic restoration possibility; excellent for preservation only	In
12	Upper Sabine	818	Swp/BH	Preservation only - no hydro restoration opportunities	High RE costs; owned by Temple-Inland, subsidiary of International Paper	In
13	Upper Sabine	300	BH/Swp	Preservation only - no hydro restoration opportunities; already planted as pine silviculture; now overgrown with other species; little restoration opportunity	High RE costs; owned by Temple-Inland, subsidiary of International Paper	Out
14	Upper Sabine	519	Swp/BH	Preservation only - no hydro restoration opportunities	High RE costs; owned by Temple-Inland, subsidiary of International Paper	In
15	Upper Sabine	705	BH/Swp	Preservation/Connectivity to WMA - no hydro restoration opportunites	Western portion owned by Temple-Inland; remainder multiple ownership; TPWD would support adding to WMA	In
16	Houseman WMA/Blue Elbow Mitigation Bank	95	Swp	Hydrologic restoration-remove high berms (avg 2-4 ft) along large logging canal to restore overland flow; small radial scars/ditches have no impact; EPA suggests that filling canals to natural wetland elevation would provide additional benefits (restoration of wetland acreage and slower drainage); elevation of areas beyond the berms (max set at 2km based on Turner and Rao 1990); higher natural BH ridge excluded from influence acreage. Areas 17-21 merged under Mit Measure 17.	Located too far from canal for significant hydrologic affect	Out
17	Houseman WMA/Blue Elbow Mitigation Bank	672	Swp/BH			In; TXDOT approval required to include in recommended mitigation plan
18	Houseman WMA/Blue Elbow Mitigation Bank	195	Swp			
19	Houseman WMA/Blue Elbow Mitigation Bank	80	Swp			
20	Houseman WMA/Blue Elbow Mitigation Bank	151	Swp		TPWD supports removing the spoil banks; this large canal appears to provide drainage	

#	Location	Acres	Veg	Action	Notes	Screening Result
21	Houseman WMA/Blue Elbow Mitigation Bank	211	Swp		for north section of Orange. Measure located within Blue Elbow Mitigation Bank which is controlled by TXDOT. TXDOT permission and resource agency approval required for implementation. USACE-Regulatory review determined that measure could be implemented in compliance with existing banking instrument .	
22	Houseman WMA/Blue Elbow Mitigation Bank	349	Swp	Hydrologic restoration-remove high berms (avg 2 ft) along logging canal to restore overland flow; EPA suggests that filling canals to natural wetland elevation would provide additional benefits (restoration of wetland acreage and slower drainage); extent of influence based on elevation of berms and elevation of areas beyond the berms (max set at 2km based on Turner and Rao 1990). Areas 22 and 23 merged under Mit Measure 22.		In; TXDOT approval required to include in recommended mitigation plan
23	Houseman WMA/Blue Elbow Mitigation Bank	180	Fr Mrsh/Swp			
24	Houseman WMA/Blue Elbow Mitigation Bank	270	Swp	Hydrologic restoration to restore overland flow-remove high berms (avg 2-3 ft high east and 3-4 ft high west of Little Cypress Bayou) along southern perimeter logging canal; no significant berms on east, west and north perimeter canals; EPA suggests that filling canals to natural wetland elevation would provide additional benefits (restoration of wetland acreage and slower drainage); extent of influence based on elevation of berms and elevation of areas beyond the berms (max set at 2km based on Turner and Rao 1990).		In; TXDOT approval required to include in recommended mitigation plan
25	Houseman WMA/Blue Elbow Mitigation Bank	88	Swp	small radial scars/ditches have no impact; no other hydrologic restoration possible; already preserved		Out
26	Old River/Bridge City	47	BH	Preservation/Connectivity to WMA	Alignment deliberately placed to avoid impacts to BH; immediately adjacent to developed upland; one large private residence affected-wasn't affected in DIFR-EIS but was outside levee; strong chance all would be lost to development; TPWD would support adding to WMA	In
27	Old River/Bridge City	937	Br Mrsh	Preservation/Mrsh Restoration/Connectivity to WMA	TPWD would support adding to WMA	In
28	Old River Unit/WMA	583	Br Mrsh	Mrsh Restoration on WMA; TPWD identified this area a location of mitigation for project impacts to TPWD property.		In
29	Old River Unit/WMA	881	Br Mrsh	Mrsh Restoration on WMA		In
30	Nelda Stark Unit/WMA	91	Br/Fr Mrsh	Preservation/Minor Mrsh Restoration/Connectivity to WMA	Onlyh small area would benefit from marsh restoration; too small for scale-up of Area 31	Out
31	Nelda Stark Unit/WMA	631	Br/Fr Mrsh/BH	Mrsh Restoration on WMA; TPWD identified this area a location of mitigation for project impacts to TPWD property.		In
32	Bessie Heights	537	Br Mrsh	Pres/Mrsh Restoration/Connectivity to proposed beneficial use/marsh restoration area planned in conjunction with authorized deepening of Sabine-Neches Waterway.		In
33	Bessie Heights	542	Br/Int Mrsh	Pres/Mrsh Restoration/Connectivity to WMA	combined with 147 ; good potential but not needed; adjacent Area 32 providing more than sufficient AAHUs.	In

EPA Mitigation Suggestions

34	Beaumont1-A	25	Upland	Hydrologic Restoration-degrade levees	Encircled by industry; USGS veg layer does not identify this as wetland;	Out
35	Beaumont1-B	380	Marsh	Hydrologic Restoration-degrade levees	Exising PA 24 for SNWW nav channel	Out
36	Beaumont1-C and D	1300	Marsh	Hydrologic Restoration-degrade levees	Existing PA25 and 25A for SNWW nav Channel	Out
37	Beaumont1-E	10	Marsh	Hydrologic Restoration-Bridges, culverts)	Have no info that there actually is a problem	Out
38	Beaumont1-F		Marsh, forested	Hydrologic Restoration-Bridges, culverts)	All land west of road to be new PA24A; would not have much benefit	Out
39	Beaumont1-G	63	Marsh	marsh restoration	Former PA, planned for port development	Out
40	Beaumont1-H		Marsh	Hydrologic Restoration-degrade levees	Former PA, planned for port development	Out
41	Beaumont1-I		Marsh	Hydrologic Restoration-Bridges, culverts)	All land south of road planned for Port development; little benefit	Out

#	Location	Acres	Veg	Action	Notes	Screening Result
42	Beaumont1-J	74	Marsh	marsh restoration, becomes Scale 1 to combination with Measure 4	Large pond in fresh marsh near Bessie Heights.	In
43	Beaumont1-K	2.5	Marsh	Hydrologic Restoration, Backfill channel	Channel leads into area planned for marsh restoration under SNWW project and mitigation by others; would be part of SNWW Rose City BU design	Out
44	Beaumont1-L	113	Marsh	Marsh restoration, combined as Scale 2 with Measure 42, referenced as Measure 42	Large pond in fresh marsh near Neches River	In
45	Beaumont1-M		Canal in Marsh	Hydrologic Restoration to fresh/brackish marsh, Backfill channel	Affected area would be very small.	Out
46	Beaumont1-N		Marsh/BH	Hydrologic Restoration,degrade road	Have no info that there actually is a problem, benefits would be smaller than marsh restoration measures; BH benefits would also be limited	Out
47	RoseCity1-A	580	Marsh	marsh restoration	SNWW BU site; mitigation by others	Out
48	RoseCity1-B		Marsh	Hydrologic Restoration, Backfill channel	Leads into terrace field; mitigation by others	
49	RoseCity1-C	86	Marsh	marsh restoration	Restoration being conducted by others	Out
50	RoseCity1-D	195	Marsh	marsh restoration	Marsh restoration combined with Measure 52 as Scale 2; Scale 2 ultimately dropped because sufficient compensation provided by Measure 52.	Out
51	RoseCity1-E		Marsh	Hydrologic Restoration, Backfill channel	Restoration would be accomplished in conjunction with Measure 52.	Out
52	RoseCity1-F	204	Marsh	Hydrologic Restoration,degrade levee road	Marsh restoration (Scale 1) combined with Measure 50 as Scale 2; Scale 2 ultimately dropped because sufficient compensation provided by Measure 52.	In
53	RoseCity1-G		Marsh	Hydrologic restoration, degrade pads, roads		
54	RoseCity1-H		Marsh	Hydrologic Restoration, Backfill channel		
55	RoseCity1-I		Marsh	Hydrologic restoration, degrade pads, roads	Effects of hydrologic restoration would be small compared to marsh restoration measures in area.	Out
56	RoseCity1-J		Marsh	Hydrologic restoration, degrade pads, roads		
57	RoseCity1-K		Marsh	Hydrologic Restoration, Backfill channel		
58	RoseCity1-L	119	Marsh	marsh restoration	owned by SNND and E Arnaud; would be expensive to fill;	Out
59	Beaumont2hires-A	90	Pond in Borrow Pit	forested wetland restoration would require filling, hydrologic access, long term management	pond bordered by houses/boat ramps - screened out based on cost to fill and slow benefits to reforest ;	Out
60	Beaumont2hires-B	24	Pond in Borrow Pit			
61	Beaumont2hires-C	70	Pond in Borrow Pit			
62	Beaumont2hires-D	61	Pond in Borrow Pit			
63	Beaumont2hires-E	29	Pond in Borrow Pit			
64	Beaumont2hires-F	46	Pond in Borrow Pit			
65	Beaumont2hires-G	97		forested wetland restoration would require filling, hydrologic acces	active borrow pit ; screened out based on cost to fill and slow benefits to reforest	Out
66	Beaumont2hires-H		Swp/Marsh	Hydrologic Restoration, Backfill channel	In Mitigation area 8 and BTNP	Out
67	Beaumont2hires-I		Marsh/Swp	Hydrologic Restoration, Backfill channel	In Mitigation area 10	Out
68	Beaumont2hires-J		BH/Swp	Hydrologic Restoration, Backfill channel	could have benefit for forested habitat in northern part of area; benefits expected to be low	Out
69	Beaumont2hires-K	93	BH/ Swp	forested wetland restoration	fill pond, in mitigation area 7	Out
70	Beaumont2hires-L		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation area 7 and BTNP	Out
71	Beaumont2hires-M		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation area 5 and BTNP	Out
72	Beaumont2hires-N		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation areas 4 and 6 and BTNP	Out
73	Beaumont2hires-O		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation area 6 and BTNP	Out
74	Beaumont2hires-P		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation area 3 and BTNP	Out
75	Beaumont2hires-Q		BH/Swp	Hydrologic Restoration, Backfill channel	In mitigation area 2 and BTNP	Out
76	Beaumont3hires-A		BH/Swp	Hyrdologic restoration, bridges, culverts	road to Neches Saltwater Barrier	Out
77	Beaumont3hires-B	21	Borrow Pit Ponds/Swp	Forested wetland restoration, backfill borrow pits; lowest priority due to cost and time it takes for benefits - thru 83	Parkwood Land company	Out
78	Beaumont3hires-C	9	Borrow Pit Ponds/Upland forest	Forested wetland restoration, backfill borrow pits	hydologic restoration needed provide flow; privately owned	Out
79	Beaumont3hires-D	11				
80	Beaumont3hires-E	10				
81	Beaumont3hires-F	17				

#	Location	Acres	Veg	Action	Notes	Screening Result
82	Beaumont3hires-G	25				
83	Beaumont3hires-H	40				
84	Beaumont3hires-I		Road in upland forest	Hyrdologic restoration for upland forest, bridges, culverts	screened out - county or state road	Out
85	NOrange	529	Man-made lake in BH/Swp	Forested wetland restoration, backfill lake	Named "Tailings Lake"; HTRW concerns	Out
86	Orange1hires-A		Logging Channel in Swp	Hydrologic Restoration for Swp, Backfill channel	WMA, In mitigation area 18 TWPD does not support backfilling of channel	Out
87	Orange1hires-B		Logging Channel in Swp	Hydrologic Restoration for Swp, Backfill channel	WMA/mit bank, In mitigation areas 17, 20, 21; provides city drainage: TPWD does not support backfilling of channel	Out
88	Orange1hires-C		Logging Channel in Swp	Hydrologic Restoration for Swp/Marsh, Backfill channel	WMA/mit bank, In mitigation areas 22, 23; TPWD does not support backfilling of channel	Out
89	Orange1hires-D	12	Borrow pit pond in swp	Forested wetland restoration, backfill borrow pits	WMA, Existing marina/boat repair;	Out
90	Orange1hires-E	5.5	Channel in marsh/swp	Hydrologic Restoration, Backfill channel	WMA, Channel from existing marina/boat repair/ Could put gap in spoil bank to help area drain, benefits would likely be low	Out
91	Orange1hires-F		Logging Channel in Swp/marsh	Hydrologic Restoration for Swp/Marsh, Backfill channel	WMA/Blue Elbow mit bank, In mitigation area 24; TPWD does not support backfilling of channel	Out
92	Orange1hires-G		Channel in Swp/marsh	Hydrologic Restoration, Backfill channel	WMA/mit bank, TPWD and marina access channel out	Out
93	Orange3hires-A	1.1	Marsh	marsh restoration	small affected areas and small benefits	Out
94	Orange3hires-B	0.5	Marsh	marsh restoration		
95	Orange3hires-C	1	Marsh	marsh restoration		
96	Orange3hires-D	1.4	Marsh	marsh restoration		
97	Orange3hires-E		Marsh	Hyrdologic restoration, bridges, culverts		
98	Orange3hires-F		Marsh	Hyrdologic restoration, bridges, culverts		
99	Orange3hires-G		Marsh	Hyrdologic restoration, degrade levee		
100	Orange3hires-H	2.5	Marsh	Forested wetland restoration, backfill access channel		
101	CowBayou1-A	6.5	PEM/FW	Backfill bottow pit/FW and/or marsh restoration	Industrial treatment ponds; HTRW concerns	Out
102	CowBayou1-B	4.4	PEM/FW	Backfill bottow pit/FW and/or marsh restoration		
103	CowBayou1-C	14	PEM/FW	Backfill bottow pit/FW and/or marsh restoration		
104	CowBayou1-D		marsh	hydrologic restoration	small affected areas and small benefit	Out
105	CowBayou1-E	7	marsh	marsh restoration	Industrial treatment ponds; HTRW concerns	Out
106	CowBayou1-F	4.5	marsh	marsh restoration		
107	CowBayou1-G(1&2)	5	marsh	marsh restoration	small affected areas and small benefits	Out
108	CowBayou1-H	6	marsh	backfill/marsh restoration		
109	CowBayou1-I	1.5	marsh	backfill/marsh restoration		
110	CowBayou1-J	0.7	marsh	backfill/marsh restoration		
111	CowBayou1-K	0.5	marsh	backfill/marsh restoration		
112	BridgeCity1hires-A	5	marsh	marsh restoration, backfill channel		
113	BridgeCity1hires-C		marsh	Hydrologic Restoration, Backfill channel; degrade or add culverts to roads	Hunting club; managed for waterfowl; additional marsh mitigation not needed	Out
114	BridgeCity1hires-B	179	marsh			
115	BridgeCity1hires-B	24	marsh			
116	BridgeCity1hires-C	163	marsh			
117	BridgeCity1hires-D		marsh			
118	BridgeCity1hires-E		marsh			
119	BridgeCity1hires-F		marsh			
120	BridgeCity1hires-G	334	marsh	Marsh restoration	already included in mitigation areas 27 and 28;	Out
121	BridgeCity2hires-A		marsh	Hydrologic Restoration, Backfill channel	located in WMA and in mitigation area 28; TPWD does not support backfilling of channel	Out
122	BridgeCity2hires-B		marsh	Hydrologic Restoration, remove levee/roads	located in WMA; benefits would be small compared to marsh restoration in vicinity	Out
123	BridgeCity2hires-C	113	marsh	Marsh restoration	located in WMA; included in mitigation area 29; referenced as Measure 29	In

#	Location	Acres	Veg	Action	Notes	Screening Result
124	BridgeCity2hires-D		marsh	Hydrologic Restoration, Backfill channel	located in WMA; access channel for Bridge City; filling channel not advisable	Out
125	BridgeCity2hires-E	109	marsh	marsh restoration	leveed area owned by oil co; more marsh rest not needed	Out
126	BridgeCity3hires-A		marsh	Hydrologic Restoration, remove levees	WMA; part of TPWD restoration effort	Out
127	BridgeCity3hires-B	66	marsh	marsh restoration		
128	BridgeCity3hires-C		marsh	Hydrologic Restoration, remove levee/roads		
129	BridgeCity3hires-D	45	marsh	Hydrologic Restoration, remove levee/roads		
130	BridgeCity3hires-E	113	marsh	marsh restoration	partially in WMA; Chevron restoration site	Out
131	BridgeCity3hires-F	57	marsh	marsh restoration	located in WMA; small area and small benefits	Out
132	BridgeCity3hires-G	0.35	marsh	marsh restoration; combine with 131		
133	BridgeCity3hires-H	31	marsh	hydrologic restoration, degrade levee /backfill?	adjacent to Old River WMA; small area affected, small benefits	Out
134	BridgeCity3hires-I	2.4	marsh	backfill/marsh restoration	drainage for Hwy 73	Out
135	BridgeCity3hires-J	76	marsh	backfill/marsh restoration	inflow canal for electric power plant	Out
136	BridgeCity3hires-K	1539	marsh	marsh restoration	WMA: SNWW CIP Old River BU feature	Out
137	BridgeCity3hires-L	62	marsh	hydrologic restoration/degrade levee/rest marsh	mostly in WMA;previous restoration site	Out
138	BridgeCity3hires-M		marsh	hydrologic restoration/degrade levee/rest marsh	small additional benefits	Out
139	BridgeCity3hires-N	138	marsh	hydrologic restoration/degrade levee/rest marsh	leveed area managed for unknown purpose	Out
140	bessieheightsnehires-A	491	marsh	marsh restoration	SNWW CIP Neches BU site	Out
141	bessieheightsnehires-B	458	marsh	marsh restoration	SNWW CIP Neches BU site	Out
142	bessieheightsnehires-C	129	marsh	marsh restoration	SNWW CIP Neches BU site	Out
143	bessieheightsnehires-D	160	marsh	marsh restoration	fishing club, leveed for fresh water fish; might be better extra scale instead of 30, combined with 31	In
144	bessieheightsnehires-E	134	marsh	marsh restoration	might be better extra scale instead of 30, combined with 31	In
145	bessieheightsnehires-E	1965	marsh	marsh restoration	partially WMA; SNWW CIP Neches BU site	Out
146	bessieheightsnwhires-A	347	marsh	marsh restoration	SNND property, nearby marsh mitigation areas provided more than adequate compensation; furthest pumping distance	Out
147	bessieheightsnwhires-B	843	marsh	marsh restoration	partially within WMA; considered with 33; sufficient compensation provided by Measure 32.	Out
148	bessieheightsnwhires-C	680	marsh	marsh restoration	partially within WMA and SRA property; sufficient compensation provided by Measure 32.	Out
149	portneches1hires-A	12	marsh	Hydrologic Restoration, backfill channel/gate?	canal access to Bessie Heights; not now	Out
150	portneches1hires-B	11	marsh	Hydrologic Restoration, backfill channel/gate?		
151	portneches1hires-C	2	marsh	backfill/marsh restoration	SNWW PA 20	Out
152	portneches1hires-D	147	marsh	Hydrologic Restoration,degrade levee	SNWW PA 20	Out
153	portneches1hires-E	4	marsh	backfill/marsh restoration	small area and small benefit	Out
154	portneches2hires-A		marsh	hydrologic restoration/degrade road	road to MARAD facility	Out
155	portneches2hires-B	510	marsh	hydrologic restoration/degrade levee	existing SNWW CIP PA 23	Out
156	portneches2hires-C	254	marsh	hydrologic restoration/degradelevee	existing SNWW CIP PA 23A	Out
157	portneches3hires-D	75	former swamp	forested wetland restoration	Encircled by industry ; screened out	Out
158	bessieheights2-A	3	forested wetland	backfill/forested wetland restoration	small area and small benefit	Out
159	bessieheights2-B	11	forested wetland	backfill/forested wetland restoration	small area and small benefit	Out
160	Neches EPA add	76	Swp/BU	impounded and degraded forested wetland; remove encircling road; replant forest	small area and long time needed to earn benefits; retain as lowest priority	Out
161	Bessie Heights USACE add	209	BH/Swp	BH with small swamp sloughs.	In FWOP, area would be lost to development, has developed neighborhoods on 2 sides; Nelda Stark unit not contiguous but very close	In
161	Bessie Heights USACE add	209	BH/Swp	Tallow removal and control	Tallow removal and control difficult to maintain in long run;tallows would likely reestablish if management is ever discontinued; incremental cost is high;	Out

ATTACHMENT 7
WVA MODEL OUTPUT – FINAL ARRAY OF MITIGATION ALTERNATIVES

Sabine Pass to Galveston Bay Feasibility Study
Mitigation Plan Evaluation Array
Swamp Summary Table
Intermediate RSLR Scenario

Total Acres	Mitigation Alternative		Statistics		
291.2	S2G Mit 11 Swamp		SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	252.92	1.40	252.65	253.19
	B. Future Without Project AAHUs=	239.74	1.21	239.50	239.98
	Net Benefit (FWP - FWOP)=	13.18	1.73	12.84	13.52

207.3	S2G Mit 12 Swamp		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	179.74	1.01	179.55	179.94
	B. Future Without Project AAHUs=	170.37	0.84	170.21	170.54
	Net Benefit (FWP - FWOP)=	9.37	1.24	9.12	9.61

291.0	S2G Mit 14 Swamp		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	252.32	1.42	252.04	252.59
	B. Future Without Project AAHUs=	239.19	1.17	238.96	239.42
	Net Benefit (FWP - FWOP)=	13.12	1.74	12.78	13.47

213.1	S2G Mit 15 Scale 1 Swamp		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	184.96	0.94	184.78	185.15
	B. Future Without Project AAHUs=	175.40	0.99	175.20	175.59
	Net Benefit (FWP - FWOP)=	9.56	1.34	9.30	9.83

51.7	S2G Mit 15 Scale 2 Swamp		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	44.90	0.25	44.85	44.95
	B. Future Without Project AAHUs=	42.55	0.21	42.51	42.59
	Net Benefit (FWP - FWOP)=	2.36	0.31	2.30	2.42

1321	S2G Mit 17 Swamp		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	1043.56	7.79	1042.04	1045.09
	B. Future Without Project AAHUs=	1003.61	7.43	1002.15	1005.06
	Net Benefit (FWP - FWOP)=	39.96	10.68	37.86	42.05

367	S2G Mit 22 Swamp		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	289.92	2.18	289.49	290.34
	B. Future Without Project AAHUs=	278.82	2.06	278.42	279.23
	Net Benefit (FWP - FWOP)=	11.09	2.97	10.51	11.68

284	S2G Mit 24 Swamp		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	212.13	1.76	211.79	212.48
	B. Future Without Project AAHUs=	206.33	2.27	205.88	206.77
	Net Benefit (FWP - FWOP)=	5.81	2.99	5.22	6.39

Sabine Pass to Galveston Bay Feasibility Study
Mitigation Plan Evaluation Array
Bottomland Hardwood Summary Table
Intermediate RSLR Scenario

Total Acres	Mitigation Alternative		Statistics		
155.7	S2G Mit 11 BH		SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	119.99	0.38	119.91	120.06
	B. Future Without Project AAHUs=	113.81	0.41	113.73	113.89
	Net Benefit (FWP - FWOP)=	6.18	0.60	6.06	6.30

221.4	S2G Mit 12 BH		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	124.49	0.40	124.41	124.57
	B. Future Without Project AAHUs=	117.81	0.43	117.73	117.90
	Net Benefit (FWP - FWOP)=	6.68	0.62	6.56	6.80

153.1	S2G Mit 14 BH		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	127.63	0.27	127.58	127.69
	B. Future Without Project AAHUs=	120.83	0.25	120.78	120.88
	Net Benefit (FWP - FWOP)=	6.80	0.38	6.73	6.88

223.5	S2G Mit15, Scale 1 BH		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	185.91	0.47	185.82	186.01
	B. Future Without Project AAHUs=	176.38	0.37	176.31	176.45
	Net Benefit (FWP - FWOP)=	9.53	0.65	9.40	9.66

88.7	S2G Mit 15 Scale 2 BH		Statistics		
			SD	95% C.I.	
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project AAHUs=	72.52	0.17	72.48	72.55
	B. Future Without Project AAHUs=	68.61	0.18	68.58	68.65
	Net Benefit (FWP - FWOP)=	3.90	0.24	3.86	3.95

34.9	S2G Mit 26 BH		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	29.34	0.02	29.34	29.34
	B. Future Without Project AAHUs=	10.90	0.00	10.90	10.90
	Net Benefit (FWP - FWOP)=	18.44	0.02	18.43	18.44

112.4	S2G Mit 161-Scale 1 BH		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	78.89	0.43	78.80	78.97
	B. Future Without Project AAHUs=	29.55	0.10	29.53	29.57
	Net Benefit (FWP - FWOP)=	49.34	0.45	49.25	49.43

112.4	S2G Mit 161-Scale 2		Statistics		
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT		SD	95% C.I.	
				Lower	Upper
	A. Future With Project AAHUs=	85.25	0.28	85.20	85.31
	B. Future Without Project AAHUs=	29.56	0.11	29.54	29.58
	Net Benefit (FWP - FWOP)=	55.69	0.31	55.63	55.76

Sabine Pass to Galveston Bay Feasibility Study
Mitigation Plan Evaluation Array
Fresh Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Mitigation Alternative	Version 1.0			
73.5	S2G Mit 42 Scale 1 Fresh				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	45.21	0.16	45.18	45.25
	B. Future Without Project Emergent Marsh AAHUs=	19.79	0.10	19.77	19.81
	Net Change (FWP - FWOP)=	25.42	0.19	25.39	25.46
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	7.24	0.04	7.23	7.25
	B. Future Without Project Open Water AAHUs=	15.34	0.06	15.33	15.36
	Net Change (FWP - FWOP)=	-8.10	0.07	-8.12	-8.09
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	25.42	0.19	25.39	25.46
	B. Open Water Habitat Net AAHUs=	-8.10	0.07	-8.12	-8.09
	Net Benefits=	14.61	0.13	14.58	14.63

137.3	S2G Mit 42 Scale 2 Fresh	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	75.87	0.29	75.81	75.93
	B. Future Without Project Emergent Marsh AAHUs=	22.41	0.05	22.40	22.42
	Net Change (FWP - FWOP)=	53.46	0.29	53.40	53.52
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	16.42	0.08	16.40	16.43
	B. Future Without Project Open Water AAHUs=	34.33	0.13	34.31	34.36
	Net Change (FWP - FWOP)=	-17.92	0.16	-17.95	-17.89
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	53.46	0.29	53.40	53.52
	B. Open Water Habitat Net AAHUs=	-17.92	0.16	-17.95	-17.89
	Net Benefits=	30.43	0.21	30.39	30.47

206.8	S2G Mit 52 Fresh	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	161.43	0.51	161.33	161.53
	B. Future Without Project Emergent Marsh AAHUs=	106.74	0.40	106.66	106.81
	Net Change (FWP - FWOP)=	54.70	0.60	54.58	54.81
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	11.96	0.07	11.95	11.97
	B. Future Without Project Open Water AAHUs=	23.41	0.13	23.39	23.44
	Net Change (FWP - FWOP)=	-11.45	0.14	-11.48	-11.42
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	54.70	0.60	54.58	54.81
	B. Open Water Habitat Net AAHUs=	-11.45	0.14	-11.48	-11.42
	Net Benefits=	33.36	0.41	33.28	33.44

Sabine Pass to Galveston Bay Feasibility Study
Mitigation Plan Evaluation Array
Intermediate Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Mitigation Alternative	Version 1.0			
371.5	S2G Mit 31 Intermediate				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	258.86	0.88	258.69	259.03
	B. Future Without Project Emergent Marsh AAHUs=	151.36	0.66	151.23	151.49
	Net Change (FWP - FWOP)=	107.50	1.07	107.29	107.71
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	33.39	0.38	33.31	33.46
	B. Future Without Project Open Water AAHUs=	71.87	0.74	71.73	72.01
	Net Change (FWP - FWOP)=	-38.48	0.85	-38.65	-38.32
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	107.50	1.07	107.29	107.71
	B. Open Water Habitat Net AAHUs=	-38.48	0.85	-38.65	-38.32
	Net Benefits=	60.41	0.77	60.26	60.56

87.8	S2G Mit 32 Intermediate	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	36.12	0.17	36.08	36.15
	B. Future Without Project Emergent Marsh AAHUs=	1.07	0.01	1.07	1.07
	Net Change (FWP - FWOP)=	35.05	0.17	35.01	35.08
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	17.16	0.21	17.12	17.20
	B. Future Without Project Open Water AAHUs=	20.31	0.08	20.29	20.32
	Net Change (FWP - FWOP)=	-3.15	0.23	-3.20	-3.11
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	35.05	0.17	35.01	35.08
	B. Open Water Habitat Net AAHUs=	-3.15	0.23	-3.20	-3.11
	Net Benefits=	22.72	0.14	22.70	22.75

305.1	S2G Mit 143 Intermediate	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	132.44	0.62	132.32	132.56
	B. Future Without Project Emergent Marsh AAHUs=	7.20	0.03	7.19	7.20
	Net Change (FWP - FWOP)=	125.24	0.61	125.12	125.36
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	61.08	1.25	60.84	61.33
	B. Future Without Project Open Water AAHUs=	89.75	1.93	89.38	90.13
	Net Change (FWP - FWOP)=	-28.67	2.39	-29.14	-28.20
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	125.24	0.61	125.12	125.36
	B. Open Water Habitat Net AAHUs=	-28.67	2.39	-29.14	-28.20
	Net Benefits=	75.59	0.89	75.42	75.77

Sabine Pass to Galveston Bay Feasibility Study
Mitigation Plan Evaluation Array
Brackish Marsh Summary Table
Intermediate RSLR Scenario

Total Acres	Mitigation Alternatives	Version 1.0			
224.8	S2G Mit 27 Brackish				
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	139.66	0.47	139.57	139.76
	B. Future Without Project Emergent Marsh AAHUs=	77.24	0.35	77.17	77.30
	Net Change (FWP - FWOP)=	62.43	0.57	62.32	62.54
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	35.49	0.38	35.41	35.56
	B. Future Without Project Open Water AAHUs=	72.88	0.75	72.74	73.03
	Net Change (FWP - FWOP)=	-37.39	0.86	-37.56	-37.23
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	62.43	0.57	62.32	62.54
	B. Open Water Habitat Net AAHUs=	-37.39	0.86	-37.56	-37.23
	Net Benefits=	40.24	0.47	40.15	40.34

410.7	S2G Mit 28 Brackish	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	281.12	0.89	280.94	281.29
	B. Future Without Project Emergent Marsh AAHUs=	191.34	0.74	191.19	191.48
	Net Change (FWP - FWOP)=	89.78	1.13	89.56	90.00
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	48.47	0.52	48.37	48.57
	B. Future Without Project Open Water AAHUs=	99.28	1.02	99.08	99.48
	Net Change (FWP - FWOP)=	-50.81	1.18	-51.04	-50.58
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	89.78	1.13	89.56	90.00
	B. Open Water Habitat Net AAHUs=	-50.81	1.18	-51.04	-50.58
	Net Benefits=	58.54	0.91	58.36	58.72

189.6	S2G Mit 29 Brackish	Version 1.0			
	Marsh	Mean	SD	95% C.I.	
	NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper
	A. Future With Project Emergent Marsh AAHUs=	98.99	0.34	98.92	99.06
	B. Future Without Project Emergent Marsh AAHUs=	40.90	0.22	40.86	40.94
	Net Change (FWP - FWOP)=	58.09	0.40	58.01	58.17
	Open Water				
	NET CHANGE IN AAHUs DUE TO PROJECT				
	A. Future With Project Open Water AAHUs=	30.63	0.31	30.57	30.69
	B. Future Without Project Open Water AAHUs=	45.26	0.42	45.18	45.35
	Net Change (FWP - FWOP)=	-14.63	0.54	-14.74	-14.53
	Total				
	TOTAL BENEFITS IN AAHUs DUE TO PROJECT				
	A. Emergent Marsh Habitat Net AAHUs=	58.09	0.40	58.01	58.17
	B. Open Water Habitat Net AAHUs=	-14.63	0.54	-14.74	-14.53
	Net Benefits=	41.93	0.33	41.87	41.99

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix P

Monitoring and Adaptive Management Plan

May 2017

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1 MITIGATION PLAN OVERVIEW

This document outlines the feasibility-level monitoring and adaptive management plan for the Sabine Pass to Galveston Bay, Texas (S2G), Recommended Plan. The monitoring and adaptive management plan was developed with assistance from several resource agencies and the Project Delivery Team (PDT). It identifies and describes the monitoring and adaptive management activities, as well as the duration and periodicity of these activities, and estimates their cost and duration. This plan will be further developed in the preconstruction, engineering, and design (PED) phase as specific design details are made available. This document also contains an adaptive management plan for taking corrective actions in case monitoring demonstrates that mitigation measures are not achieving ecological success. The plan was developed by USACE in consultation with the S2G Resource Agency Coordination Team to fully compensate for both the direct and indirect wetland habitats of the Recommended Plan.

1.1 AUTHORIZATION FOR MITIGATION MONITORING/ADAPTIVE MANAGEMENT

Section 2036(a) of Water Resources Development Act (WRDA) 2007 directs the Secretary of the Army to ensure that any project with unavoidable non-negligible adverse impacts to significant ecological resources, that is being recommended for Congressional authorization, a) recommend a specific plan to mitigate fish and wildlife losses; b) ensure that other habitat types are mitigated to not less than in-kind condition, to the extent possible; and c) include the following specific mitigation plan components: 1) monitoring until successful; 2) criteria for determining ecological success; 3) a description of available lands for mitigation and the basis for the determination of availability; 4) the development of an adaptive management plan; 5) identification of the entity responsible for monitoring and 6) establishment of a process for consultation with Federal and state resource agencies to determine the success of mitigation. The implementation guidance for Section 2036(a) was issued in a CECW-PC Memorandum dated 31 August 2009.

The mitigation plan, presented in Appendix O, addresses requirements "a" and "b" described above, and this document addresses requirement "c". The mitigation monitoring plan identifies the ecological success criteria for the mitigation, describes the cost and duration of the monitoring, and identifies the entities responsible for the monitoring.

1.2 MITIGATION OBJECTIVES

The primary objective of the proposed mitigation plan is to restore approximately 453 acres of emergent marsh, and preserve in perpetuity approximately 559 acres of forested wetlands. Wetland Value Assessment (WVA) models (see Appendix O) were run for the cited impacts to determine the wetland functions and values that would be lost. Such functions/values are expressed in terms

of Average Annual Habitat Units (AAHUs). As indicated in Table 1-1 below, these models predicted that approximately 143 AAHUs would be lost due to direct and indirect impacts to existing fresh, intermediate and brackish marsh habitats combined, while approximately 43 AAHUs would be lost due to direct and indirect impacts to cypress-tupelo swamp and bottomland hardwood forests, over the course of the 50-year period of analysis. The Mitigation Plan would provide a total of 262.9 AAHUs to compensate for total losses of 186.0 AAHUs.

Table 1-1. Mitigation Plan Summary

Wetland Type	Direct Impacts		Indirect Impacts				Total Impacts (acres)	Total AAHUs Lost
	Direct Wetland Impacts (acres)	AAHUs	Indirect Wetland Impacts (acres)	AAHUs	Functional Impacts (affected acres)	AAHUs		
Forested Wetlands								
Swamp	10.6	-7.2	1.9	-0.1	0.0	0.0	12.5	-7.3
Bottomland Hardwood	44.3	-30.3	12.7	-5.1	0.0	0.0	57.0	-35.4
Subtotal	54.9	-37.4	14.6	-5.2	0.0	0.0	69.5	-42.7
Coastal Marsh								
Fresh Marsh	24.3	-11.4	0.0	0.0	785.2	-18.8	809.5	-30.2
Intermediate Marsh	6.8	-4.0	19.2	-8.5	322.5	-4.1	348.5	-16.6
Brackish Marsh	74.2	-33.7	78.5	-35.2	1029.5	-27.6	1182.2	-96.5
Subtotal	105.3	-49.0	97.7	-43.7	2137.2	-50.5	2340.2	-143.3
Total Impacts*	**160.2**	**-86.5**	**112.3**	**-48.9**	**2137.2**	**-50.5**	**2409.7**	**-186.0**
* Totals may not add exactly due to rounding.								

1.3 MITIGATION WORKPLAN

1.3.1 Acquisition and Preservation of Forested Wetland Features

The mitigation plan for forested wetlands consists of preservation in perpetuity of approximately 447 acres of swamp and bottomland hardwoods (BH) in Mitigation Area 11 in the bottomlands of the Sabine River and about 112.5 acres of BH forest in Mitigation Area 161 on the upland/wetlands margin of the Neches River in the Bessie Heights area (Figures 1-1 and 1-2). No restoration of these areas is included so the work plan is comprised of real property acquisition activities only. These lands would be acquired during the construction phase by the non-Federal sponsor (NFS) for project implementation. Properties would be acquired in accordance with Public Law 91-646, as both properties are privately owned. The NFS would manage the property and grant USACE right of entry for monitoring. .

1.3.2 Acquisition, Construction and Planting of Marsh Restoration Features

The mitigation plan would restore approximately 63 acres of fresh marsh and associated shallow ponds and sinuous channels in Mitigation Area 52, 151 acres of intermediate marsh and associated waters in Mitigation Area 31, and 239 acres of brackish marsh and associated waters in Mitigation Areas 28 and 29 (Figures 1-3, 1-4 and 1-5).

Mitigation Areas 28, 29 and 31 are owned by TPWD. Mitigation Area 52 is privately owned; acquisition and preservation of this area would be accomplished as described for Mitigation Areas 11 and 161 (see Section 1.3.1).

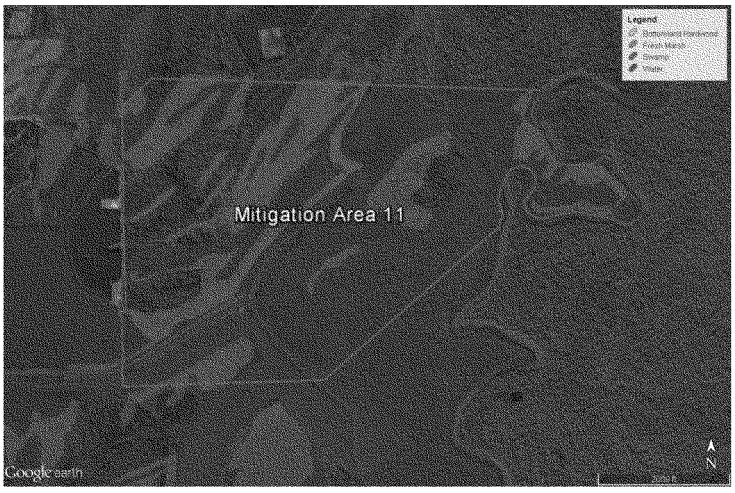

Figure 1-1. Swamp and Bottomland Hardwood Mitigation Area 11

Figure 1-2. Bottomland Hardwood Mitigation Area 161

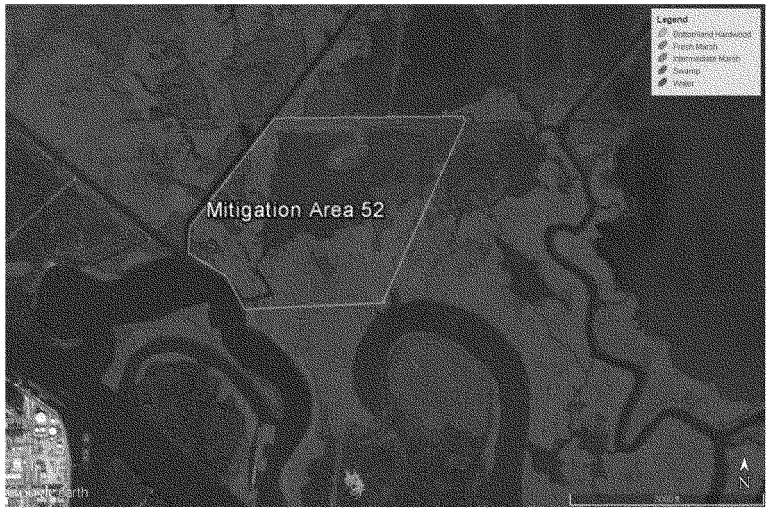

Figure 1-3. Fresh Marsh Mitigation Area 52

Figure 1-4. Intermediate Marsh Mitigation Area

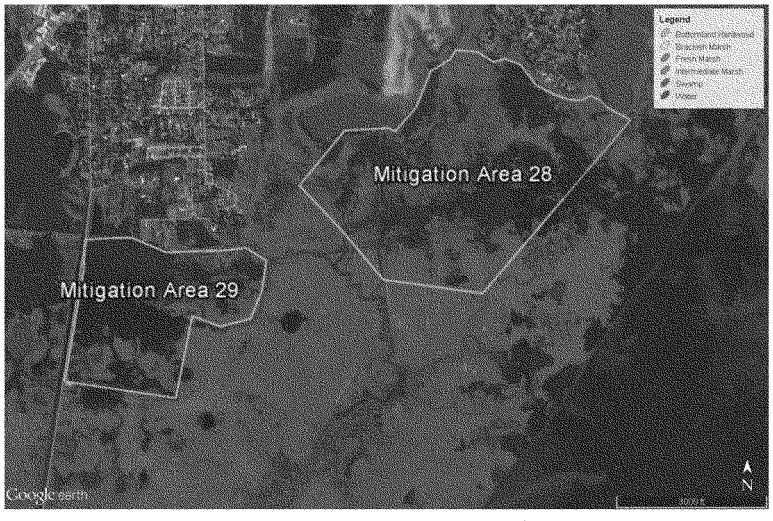

Figure 1-5. Brackish Marsh Mitigation Areas

Shoaled sediments from maintenance dredging of the adjacent deep-draft navigation channels of the Sabine-Neches Waterway (SNWW) would be used to restore marsh in areas of open water within the outlined areas shown on Figures 1-3 through 1-5. Marsh would be constructed to target

elevations determined during the PED phase in coordination with the resource agencies, utilizing comparisons to nearby reference marshes to establish the optimum post-settlement elevation range. At this time, it is projected that a range of elevations between 1.2 and 1.5 feet (NAVD88) would be achieved for emergent marsh and 0 to – 2.0 feet MLLW for restored ponds and channels within the marsh. One permanent staff gage would be established early in the PED phase near each mitigation area to measure water elevations to be used in establishing the optimum marsh elevation range and to monitor the marsh elevations during the O&M phase.

The construction estimate assumes that shoaled material from SNWW's Sabine-Neches Canal B, which extends across the north end of Sabine Lake from the mouth of the Neches River to the mouth of the Sabine River, would be used to construct mitigation areas 28 and 29. This is the closest segment of the SNWW to the Old River mitigation sites. This channel is not regularly dredged, so cost estimates included the full cost of maintenance dredging to hydraulically dredge the material and pump it into targeted open water areas. Maintenance material from the SNWW's Neches River Channel might be used instead of, or in addition to, the Sabine-Neches Canal B material for these areas. Material from regularly scheduled maintenance dredging of nearby reaches of the Neches River Channel is proposed for construction of mitigation areas 31 and 52. Only the incremental cost of additional hydraulic pipeline, pumping and pipe movement needed to create the marsh is included in the cost estimates for these alternatives.

Existing canals provide access routes for floating hydraulic pipelines into all of the mitigation areas. If deepening of the access canals is required in order to facilitate hydraulic pipeline flotation or to transport other necessary construction equipment, that material would be used to restore marsh elevation in the mitigation areas or in adjacent open water areas acceptable to resource agencies. Temporary board roads may be constructed along access corridors and staging areas wherever emergent marsh exists. Board roads would be removed when work is completed. Fill material may be deposited to offset damage to underlying marsh caused by soil compression under the board road. Details of construction/flotation access corridors and staging areas would be developed during the PED phase. Every effort would be made to avoid and minimize environmental impacts to the extent practicable. Any unavoidable wetland impacts would be determined in consultation with resource agencies and the mitigation areas would be enlarged as needed to compensate for impacts which exceed AAHUs provided by the Best Buy Mitigation Plans.

Temporary containment dikes, constructed with in-situ materials excavated from immediately adjacent open water areas, would hold dredged material slurry while it decants and consolidates to form new marsh platforms in open water areas. For all of the marsh mitigation alternatives, it was assumed that marsh would be restored in 65 percent of the open water, and that sinuous channels and ponds would be created in the remaining 35 percent of open water. Dredged material would

be allowed to flow into existing marsh surrounding the open water areas within the containment dikes; marsh vegetation would winnow the fine-grained material and nourish existing marsh. Temporary erosion control measures (such as concrete mats or riprap) for the containment dikes may be installed where needed.

Construction of the mitigation areas would begin as soon as possible after project construction is initiated. Construction would need to proceed on several areas concurrently because it is estimated that the total construction period for each area, from initiation through establishment of marsh vegetation would be 8 years. Initial construction of each area is estimated to take 2 years; settlement and consolidation of the material would take up to 3 years; and channels and ponds would be created in within 4-5 years of beginning construction. Containment dikes or temporary erosion control features would be removed in the sixth year of the construction period to encourage marsh plant growth and to maximize edge for aquatic organisms to utilize exterior and interior marsh areas. *Spartina patens* would be planted on 5-foot centers in the year following completion of pond/channel construction (year 6 of mitigation construction). Based on recent experience in similar marsh restoration areas in the same area, it is assumed that 50 percent of the *Spartina patens* plants would need to be replanted the year following initial planting (year 7 of the construction period). It is also expected that *Spartina alterniflora* and other native wetland vegetation would grow in the mitigation areas within 1-2 years, as nearby seed sources are abundant. Invasive and nuisance vegetation would be removed in year 8 (the last year of the construction period) to facilitate growth of native vegetation over the restored marsh areas. Baseline surveys of the forested wetland mitigation areas would be conducted in the last year of the mitigation implementation period (year 10), and to determine the extent of Chinese tallow cover of selected areas.

1.4 MAINTENANCE MANAGEMENT PLAN

All of the mitigation areas would require periodic inspection as part of normal operations and maintenance (O&M), in accordance with ER 1105-2-100, Section C-3(e)(10) and Section 2(d) of implementation guidance for WRDA 2007 Section 2036(a) (USACE, 2006). None of the mitigation plans include structures intended to last beyond the initial construction period, and therefore no long-term inspection or maintenance activities/costs are needed for the Recommended Plan. Post-construction monitoring to determine the success of mitigation measures is primarily the responsibility of the NFS for project implementation; this plan is presented in Section 2.2. Monitoring reports described in Section 2.3 would be prepared by the NFS, with copies provided to USACE for upward reporting. The monitoring and reporting costs have been included in the O&M cost.

2 MONITORING PLAN

An effective monitoring program is required to determine if the mitigation outcomes are consistent with performance standards. Mitigation success criteria were developed as the basis of determining ecological success and to determine if adaptive management actions are required. Upon completion of the mitigation area acquisition and construction, monitoring for ecological success would be initiated and would continue until ecological success is achieved, as defined by the mitigation success criteria. The following objectives, performance standards and success criteria would be further refined during the PED phase.

USACE would be responsible for monitoring, reporting and resource agency coordination during the Construction Phase. The non-Federal implementation sponsor would be responsible for monitoring, reporting and agency coordination during the O&M Phase. Resource agency coordination would be initiated and documented by the NFS for each monitoring activity; USACE would be notified of each consultation meeting. All monitoring reports prepared by the NFS would be provided to USACE for upward reporting.

If one or more of the monitoring reports detailed in Section 2.3 indicates that mitigation success is threatened, as determined by USACE and the NFS in coordination with the resource agencies, significant corrective actions would be necessary as described in the Adaptive Management Plan (Section 3.0). The need for such actions could trigger the need for additional monitoring not identified below, including the need to extend monitoring beyond the times indicated. The NFS would be responsible for conducting this additional monitoring, preparing monitoring reports, and conducting required corrective actions. Necessary corrective actions would be determined by USACE in coordination with the NFS and the resource agencies.

2.1 CONSTRUCTION PHASE

At this time the construction period for the Recommended Plan is estimated to be 10 years in length. The mitigation implementation period would coincide with, and begin concurrently with, the general construction period as none of the mitigation areas are co-located with Recommended Plan construction areas. Year references in the descriptions below refer to the mitigation implementation period. For example, if a feature is completed by the end of Year 5, it would be finished 5 years from the start of the mitigation implementation period, and 5 years prior to the end of project construction and the beginning of project operation.

2.1.1 Forested Wetland Mitigation Areas

Construction Phase - Forested Wetlands (CFW) Objective 1 - Acquire Real Estate Interests

Performance Standard: All procedures relating to the procurement of title evidence, title clearance, and closing for acquisition of the appropriate real estate interest will be in accordance with ER 405-1-12-5.

Success Criteria CFW1:

- Complete acquisition of forested wetland Mitigation Areas 11 and 161 by the end of Year 7 of the mitigation implementation period.
- Obtain right-of-entry for monitoring activities by end of Year 8.

2.1.2 Emergent Marsh Mitigation Areas

2.1.2.1 Construction Phase – Emergent Wetlands (CEM) Objective 1 – Acquire Real Estate Interests

Mitigation Areas 28, 29 and 31 are owned by TPWD. Mitigation Area 52 is privately owned; acquisition and preservation of this area would be accomplished as described for Mitigation Areas 11 and 161.

Performance Standard: Acquisition of the appropriate real estate interest in accordance with USACE Real Estate guidance and regulation.

Success Criteria CEM 1:

- Complete acquisition of Mitigation Area 52 by the end of Year 1 of the mitigation implementation period
- Obtain right-of-entry for construction and monitoring activities in Mitigation Areas 28, 29 and 31 by the end of Year 1

It is estimated that construction of the marsh mitigation areas and establishment of wetland vegetation therein would take a total of 8 years. Therefore, all necessary real estate interests must be acquired by end of Year 1 of the mitigation implementation period.

2.1.2.2 CEM Objective 2 – Create Emergent Marsh in Mitigation Areas 28, 29, 31 and 52

Performance Standard: Create approximately 452.8 acres of emergent marsh and associated shallow ponds and sinuous channels in Mitigation Areas 28, 29, 31 and 52, as detailed in Table 2-1.

Table 2-1. Mitigation Areas - Acres of Emergent Marsh and Water

Marsh Mitigation Area	Emergent Marsh Created (acres)	Shallow Ponds/Channels Created (acres)	Total Restored Area (acres)
28	86.0	47.2	133.2
29	69.0	37.0	106.0
31	98.0	52.7	150.7
52	40.9	22.0	62.9
Total	293.9	158.9	452.8

Success Criteria CEM2:

- Initial construction activities (construction of containment dikes and drainage structures, hydraulic pumping of shoaled material, and construction of erosion control features, if needed) completed by the end of Year 2. Material for all sites would be obtained from nearby channel segments of the Sabine-Neches Waterway (SNWW) deep draft navigation project.
- Settlement and consolidation of the marsh fill (sized in accordance with acres shown in Table 2-1) completed by the end of Year 5, when initial target marsh elevations would be reached.
- Construction of shallow ponds and sinuous channels in the Mitigation Area (sized in accordance with acres shown in Table 2-1) completed by the end Year 5.
- Containment dikes and temporary erosion control features degraded or removed by the end of Year 6.
- Completion of *Spartina patens* plantings on 5-foot centers over the restored marsh platforms by the end of Year 6, and in Year 7, up to 50 percent of the plants would be replaced if needed. Other marsh plants, and in particular *Spartina alterniflora,* are expected to volunteer in the newly restored marsh areas due to the abundance of seeds in the dredged material and in established adjacent marshes.

2.1.2.3 CEM Objective 3 – Establish Marsh Elevation and Topography

Performance Standard: Attain functional marsh and water elevations determined by comparison with reference marshes and the staff gages installed early in the PED phase. The target elevation range would be determined in coordination with resource agencies.

CEM3 Success Criteria:

- 80 percent of the restored areas in each marsh mitigation area exhibit surface elevations within 0.5 feet of the desired final target elevation ranges by the end of Year 5
- 90 percent of the restored areas in each marsh mitigation area exhibit surface elevations within 0.5 feet of the desired final target elevation ranges by the end of Year 7

Initial planting of wetland vegetation (CEM Objective 4- Year 6) cannot begin until the desired final target elevations are achieved in Year 5. If the CEM3 success criterion for Year 5 has not been achieved, then construction modifications would be implemented by USACE to achieve the appropriate elevations and plants would not be installed until the marsh elevation/topography success criterion is achieved.

2.1.2.4 CEM Objective 4 – Establish Native Wetland Vegetation

Performance Standard: Native wetland vegetation would be established over a majority of the restored marsh acreage.

Success Criteria CEM4:

- Complete initial plantings in each marsh mitigation area by the end of Year 6. Plantings would be accomplished in accordance with contract specifications to be developed during the PED phase, in coordination with the resource agencies.
- By the middle of Year 7, attain at least 50 percent survival of planted *Spartina patens* or achieve a minimum average cover of 65 percent in the restored marsh areas, comprised of planted or volunteer, native, herbaceous wetland species included on the National Wetland Plant List for the Gulf Coastal Plain (USACE, 2016). If neither of these criterions are met, a maximum of 50 percent of the original *Spartina patens* plants would be replaced with new plantings by the end of Year 7.
- By the end of Year 8, achieve a minimum average cover of 75 percent planted or volunteer, native, herbaceous wetland species in the restored marsh areas.

2.1.2.5 CEM Objective 5 – Remove Invasive and Nuisance Vegetation

Performance Standard: Facilitate establishment of native wetland vegetation by removing invasive and nuisance vegetation.

Success Criterion CEM 5: In Year 8, remove a minimum of 90 percent of invasive and nuisance vegetation in the restored marsh of Mitigation Areas 28, 29, 31 and 52.

2.1.3 Cost

First costs for acquisition or other real estate interests for all mitigation areas associated with CFW Objective 1 and CEM Objective 1 are included in the overall project construction cost and are tracked in line item 01 Lands and Damages in the Total Project Cost Summary (TPCS). These are reported in the Cost Section of the Engineering Appendix (Appendix D) and they are described in the Real Estate Plan (Appendix E).

First costs for mitigation construction monitoring and reporting associated with CEM Objectives 2, 3, 4 and 5 have been included in line item 06 Fish and Wildlife Facilities presented in the TPCS (Appendix D).

2.2 O&M PHASE

All mitigation areas must be maintained to provide the ecological functions and values required to fully compensate for project impacts. Year references in the descriptions below refer to the post-construction monitoring period, which begins after the construction and mitigation implementation period is complete.

2.2.1 Forested Wetland Mitigation Areas

2.2.1.1 OMFW Objective 1 - Preservation of Forested Wetland Mitigation Areas

Performance Standard: Preserve 447 acres of swamp and BH in Mitigation Area 11 and 112.5 acres of BH forest in Mitigation Area 161.

Success Criteria OMFW 1:

- Perform visits in Years 2 and 4 to Mitigation Areas 11 and 161 and provide reports to verify that the mitigation areas remain in preservation status. Random surveys may be performed during these visits to record forested wetland species composition and tree size in the swamp areas of Mitigation Area 11 and BH areas of Mitigation Area 161. This information would be collected to inform long-term management; it would not be considered a baseline condition which must be maintained by the non-Federal sponsor.

- If more than 5 acres of swamp or BH in Mitigation Areas 11 and 161, respectively, are sold or otherwise distributed, the lost acres would be replaced as specified in the Adaptive Management Plan.

2.2.1.2 OMFW Objective 2 – Management of Invasive Chinese Tallow

Performance Standard: Maintain forested wetlands in Mitigation Areas 11 and 161 without significant new infestations of Chinese tallow.

Success Criteria OMFW 2:

- In Year 5, satellite photographs would be reviewed and field survey would be conducted as needed to document Chinese tallow growth (dbh growth and cover percentages) within known gaps and to identify new gaps meeting the size and hydrologic criteria. Survey methods would be established in coordination with resource agencies. Chinese tallow prefers mesic conditions and is more likely to invade bottomland hardwood stands than the swamp stands, but it is able to tolerate a wide range of site conditions (Camarillo et al. 2015). Growth can occur within mature forest stands if gaps develop and if the area is only flooded seasonally. However, if acres of tallow infestation (defined as majority of midstory or overstory canopy) exceed 40 percent of existing swamp or BH acreage in the monitored blow-down areas or gaps, a tallow control program would be initiated as specified in the Adaptive Management Plan.

2.2.2 Marsh Mitigation Areas

2.2.2.1 O&M Emergent Marsh (OMEM) Objective 1 – Continuity of Marsh Mitigation Areas 28, 29, 31, and 52

Performance Standard: Continued existence of acres of created marsh and shallow ponds/channels specified in Table 2-1 at functional marsh elevations through the monitoring period.

Success Criterion OMEM1: In Year 5, obtain LIDAR data or conduct field surveys to determine surface elevations of restored marsh areas. At least 90 percent of the restored marsh areas in Mitigation Areas 28, 29, 31 and 52 must maintain a surface elevation that is within the functional marsh elevation range. The targeted functional range would be established by comparison to reference marshes in the vicinity. Reference marshes and specific survey methods would be identified in coordination with resource agencies during the PED phase.

2.2.2.2 OMEM Objective 2: Maintain Native Wetland Vegetation Coverage

Performance Standard: Maintain species composition and percent cover of wetland vegetation in the restored marsh areas with herbaceous wetland species from the Gulf Coastal Plain Regional Wetlands Plant list (USACE, 2016).

Success Criteria OMEM2:

- In Year 5, conduct and report on field surveys of vegetation in the restored marsh areas of Mitigation Areas 28, 29, 31 and 52 using the Braun-Blanquet vegetation survey method.
- Maintain a minimum 80 percent average coverage of native herbaceous species in the restored marsh mitigation areas.

2.2.2.3 OMEM Objective 3: Control of invasive and nuisance plant species.

Performance Standard: Manage Mitigation Areas 28, 29, 31 and 52 to minimize invasive and nuisance plant species.

Success Criteria OMEM3:

- In Years 1 and 3, remove a minimum of 90 percent of invasive and nuisance vegetation from the restored marsh areas.
- For the remainder of the monitoring period, 5 percent or less of the emergent marsh vegetation cover in the restored marsh areas would contain invasive and nuisance vegetation. Invasive/nuisance vegetation coverage would be determined during the vegetation surveys conducted under OMEM Objective 2. The invasives/nuisance vegetation coverage would be determined with satellite image analysis and field verification. Specific survey methodology would be determined in coordination with resource agencies during the PED phase.

2.2.3 Cost

O&M costs of the monitoring and reporting associated with OMFW Objectives 1, 2 and 3, and OMEM Objectives 1, 2 and 3 were calculated using the IWR-Plan Version 2.0 Annualizer developed using October 2016 price levels, a 3.125 percent discount rate, and a 50-year period of analysis. Average annual costs for monitoring and reporting the forested wetland mitigation areas and the marsh mitigation areas are estimated to be $4,628 and $35,660, respectively. Total average annual costs for monitoring and reporting (as described in Section 2.3 below) of $40,288 would be included in the O&M cost of the project, in accordance with USACE Implementation Guidance for Section 2036(a) of WRDA 2007, paragraph 5(c).

2.3 MITIGATION MONITORING REPORTING

2.3.1 Baseline Monitoring Reports

2.3.1.1 Forested Wetland Mitigation Areas

In year 9 of the mitigation implementation period, USACE Galveston District Real Estate Division would provide a report on the status of acquisition actions and agreements governing access for monitoring activities. If acquisition activities are not complete, status reports would be provided biannually until acquisition activities are complete.

2.3.1.2 Emergent Marsh Mitigation Areas

In Year 10 of the mitigation implementation period, after completion of the final mitigation construction activities, the mitigation areas would be monitored in coordination with resource agencies, and a baseline monitoring report prepared. USACE would be responsible for the monitoring and report preparation. Information provided would include the following items:

- A discussion of all completed mitigation construction activities.
- A description of the completed marsh mitigation features, including acres of marsh and acres of ponds/channels that were created within each mitigation area.
- As built planview drawings of the mitigation areas showing their approximate boundaries, finished elevations as well as ponds and channels established within the marshes, permanent photo stations and staff gages.
- An assessment of whether construction success criteria CEM2 (Marsh Creation), CEM3 (Elevation and Topography), CEM4 (Native Vegetation Plantings, and CEM 5 (Invasives Removal) have been satisfied.
- Photos taken at permanent photo stations established within the marsh mitigation areas. At least two photos would be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations would vary depending on the mitigation feature, to be determined in coordination with the resource agencies and the NFS during the PED phase.
- Mean high and mean low water level elevation readings collected from the permanent staff gages installed near each mitigation area during the PED phase.
- Qualitative observations to assess the status and success of the mitigation areas, including an estimate of the average percent cover by native plant species (planted and volunteer) and invasive/nuisance plant species; general condition of native vegetation; the condition of ponds and channels constructed within the marsh areas; and any other potential problems or concerns that could affect the success of the mitigation program.

- Recommendations for actions needed to meet mitigation and management/maintenance goals and mitigation success criteria and to increase the likelihood of success.

2.3.2 O&M Phase Monitoring Reports

2.3.2.1 Forested Wetland Mitigation Areas

In Years 2 and 4, Mitigation Areas 11 and 161 would be visited and a brief report prepared to verify that the areas remain in preservation status. In Year 5, blow down areas or gaps that have been identified would be visited, and mitigation success would be assessed. Information provided would include the following items:

- An assessment of whether O&M success criteria OMFW1 (Forested Wetland Preservation) and OMFW2 (Chinese Tallow Management) have been satisfied.
- Verification that the areas remain in preservation status.
- Brief description of the survey methodology and maps of surveyed areas or transects.
- General descriptions of species composition and tree size (dbh) of cypress-tupelo swamp areas in Mitigation Area 11 and BH in Mitigation Area 161
- Identification of blow-down areas or gaps in cypress-tupelo canopy cover on satellite image of each mitigation area, and those selected for field survey
- Within the gaps selected for field survey, the relative percentage of dominant species in the midstory and overstory canopies (with specific consideration given to the presence of Chinese tallow), and qualitative observations of the understory to identify tallow seedlings.
- Qualitative observations of hydrologic flows, general condition of native vegetation, evidence of unauthorized use, or any other observations or concerns that could affect the success of the mitigation program.
- Recommendations for actions needed to meet mitigation and management goals and mitigation success criteria.

Thereafter, it is recommended that the non-Federal sponsor make biennial visits to Mitigation Areas 11 and 161 to ensure that the areas remain in preservation status. It is also recommended that the non-Federal sponsor make site visits every 10 years (Years 15, 25, 35, and 45) and prepare reports with information on species composition and size, blow down areas and tallow growth comparable to that required in Year 5.

2.3.2.2 Emergent Marsh Mitigation Areas

In Years 1 and 3, reports would be prepared on the removal of invasive/nuisance vegetation from the restored marsh areas. Information provided in the reports would include:

- A discussion of all completed invasive/nuisance vegetation removal activities.
- An assessment of whether the O&M success criterion OMEM3 (Control of Invasive/Nuisance Vegetation) for Years 1 and 3, respectively, has been satisfied.

In Year 5, the marsh mitigation areas would be monitored and a monitoring report prepared which includes the following bulleted items. It is recommended that the non-Federal sponsor continue to conduct the same monitoring and reporting every 5 years thereafter to ensure continued existence of the mitigation areas.

- An assessment of whether O&M success criteria OMEM1 (Marsh Continuity), OMEM2 (Native Wetland Vegetation, OMEM3 (Invasive/Nuisance Vegetation Control) have been satisfied.
- Photos taken at permanent photo stations established within the marsh mitigation areas for the baseline survey. At least two photos would be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next.
- Mean high and mean low water level elevation readings collected from the permanent staff gages installed near each mitigation area during the PED phase.
- Qualitative observations to assess the status and success of the mitigation areas, including an estimate of the average percent cover by native plant species (planted and volunteer) and invasive/nuisance plant species; general condition of native vegetation; the condition of ponds and channels constructed within the marsh areas, noting excessive scouring and/or siltation; and any other potential problems or concerns that could affect the success of the mitigation program.
- Recommendations for actions needed to meet mitigation and management and maintenance goals and mitigation success criteria, and to improve the likelihood of success.

2.3.3 District Consultation and USACE Civil Works Project Mitigation Database Reports

Section 2036(a) of WRDA 2007 requires the USACE to conduct annual consultation with appropriate Federal and State agencies to assess the success of mitigation plans and to prepare annual reports summarizing the results of the consultations until the mitigation objectives have been achieved. To satisfy these requirements, annual consultation reports (District Consultation Reports) will be prepared by Galveston District and submitted to the USACE Southwestern Division (SWD), or the reports will be submitted as directed by SWD. Information needed to compile these reports would be provided by the NFS. Each report will provide the following information:

- List of the types of mitigation implemented.
- Brief description of the mitigation, including acres implemented and acres remaining to be implemented (if any).
- Description of the steps taken to consult with other Federal agencies and State agencies.
- Discussion of the status of consultation, identifying the agencies involved and the outcome. If consultation is complete, a listing of the outcome as one of the following: no action needed; no response from Federal or state agencies on consultation; on schedule with no adaptive management implemented due to consultation, or on schedule with adaptive management implemented due to consultation; behind schedule with adaptive management implemented due to consultation; or, behind schedule for reasons not related to consultation.
- Discussion of the outcome of consultation (if completed). This discussion would include: an assessment of the likelihood that the mitigation will achieve the success criteria.

In addition to the District Consultation Reports discussed above, data and information concerning the mitigation would be entered by Galveston District into the USACE's Civil Works Project Mitigation Database on an annual basis. The data and information required for entry into this database are specified within the database itself.

2.4 PROJECT CLOSEOUT

Annual monitoring reports would cease when it is determined that the objectives of the marsh and forested wetland mitigation plans have been achieved. USACE and resource agencies would meet to evaluate monitoring reports, and provide a recommendation to the Division Commander in the last scheduled annual report to confirm that mitigation is complete. At this time, it is estimated that monitoring would be conducted for 5 years to ensure the success of the mitigation features.

3 ADAPTIVE MANAGEMENT PLAN

3.1 FORESTED WETLANDS

3.1.1 Objective 1 - Preservation of Forested Wetland Mitigation Areas

3.1.1.1 Performance Standard

Ownership and management of the forested wetland acres specified in Table 2-1 would be maintained by the NFS or state conservation agency in accordance with the terms of the perpetual conservation easement. However, sale or release of up to 5 acres of cypress-tupelo swamp in Mitigation Area 11 or BH in Mitigation Area 161 would be allowed without replacement, if sale or release is approved by the agency owner, determined to be in the public interest, and reported to USACE.

3.1.1.2 Adaptive Management Threshold/Trigger

Mitigation Area 11. If more than 50 acres of swamp are permanently lost due to detrimental changes in hydrologic conditions (flows and duration), severe hurricane damage or fire, actions to encourage reforestation, improve hydrologic conditions to enable reforestation, or acquire additional forested wetland acreage within the watershed would be required to maintain a minimum of 241 acres of swamp in perpetuity.

Mitigation Area 161. If more than 25 acres of BH are permanently lost due to detrimental changes in hydrologic conditions (flows and duration), hurricane damage or fire, actions to encourage reforestation, improve hydrologic conditions to enable reforestation, or acquire additional forested wetland acreage would be required such that a minimum of 87 acres of BH forest are maintained in perpetuity.

The minimum acreage thresholds were established with the Wetlands Value Assessment (WVA) model to determine the minimum number of acres needed to match the mitigation targets and fully compensate for the loss of 7.3 AAHUs due to swamp impacts and 35.4 AAHUs due to BH impacts. Further details of this Adaptive Management Plan would be developed in coordination with resource agencies during the PED phase.

3.1.1.3 Cost

Inasmuch as risks of permanent losses in excess of the thresholds due to a hurricane or fire are considered to be low, no specific adaptive management actions are included in the O&M cost estimate. No significant adverse changes in hydrology are anticipated, and fire risk in this area is generally low due to the humid environment and high rainfall rates. At least one hurricane would

be expected during the period of analysis, but the risk of permanent tree loss in excess of the specified thresholds is considered to be low.

3.1.2 Objective 2 – Management of Invasive Chinese Tallow

3.1.2.1 Threshold/Trigger

If acres of tallow infestation (defined as a majority of midstory or overstory canopy) exceed 40 percent of existing swamp or BH acreage in the monitored blow-down areas or gaps, a tallow control program would be initiated. Management to prevent Chinese tallow from replacing native species in bottomland hardwood forests includes proper density management of stands in areas where Chinese tallow is likely to grow and early detection of gap formation to allow treatment of establishing Chinese tallow before it outcompetes regenerating native species (Camarillo et al. 2015). The tallow removal and control effort would consist of annual aerial applications of a specific herbicide (which has minimal effects on other overstory and understory species) to the infested areas for 3 consecutive years, with up to two follow-up applications within 5 years of the last annual application.

3.1.2.2 Cost

While Chinese tallow infestation of the swamp areas in Mitigation Area 11 are possible, the likelihood of infestation in the swamp areas is considered to be low because of the prevalent hydrologic conditions. Therefore, no cost for tallow control in Mitigation Area 11 are included in the cost estimate.

Contrary to the swamps in Mitigation Area 11, the potential for tallow infestation in the BH of Mitigation Area 161 is considered more likely due to mesic conditions in this area. Costs for a tallow control program as described above are therefore included in the project construction cost line item 06 Fish and Wildlife Facilities in conformance with USACE Implementation Guidance for Section 2036(a) of WRDA 07, paragraph 5.d. The estimated first cost of this tallow removal and control effort is $166,000.

3.2 EMERGENT MARSH

3.2.1 Optimum Marsh Elevations

3.2.1.1 Threshold/Trigger

There is uncertainty in both future rates of relative sea level change (RSLC) and marsh accretion rates, but based on the best available information at this time, it is possible that the marsh mitigation areas would adapt to sea level changes and remain ecologically successful through the period of analysis. Productive and valuable coastal salt marshes have evolved in response to rising

sea-levels (Pethic, 1981; Delaune et al., 1983). Marsh accretion is a natural process which changes the elevation of marsh. Biomass accumulation could offset much if not all of the RSLC in water surface elevation. "Primary productivity of salt marsh vegetation is regulated by changes in sea level, and the vegetation, in turn, constantly modifies the elevation of its habitat toward an equilibrium with sea level" (Morris et al., 2002:2876). A rise in relative sea level brings an increase in production and biomass density that enhances sediment deposition by increasing the efficiency of sediment trapping. This can lead to an absolute increase in the elevation of the marsh platform and result in a landward migration of the marsh (Gardner et al., 1992; Gardner and Porter, 2001). However, a rapid rise is sea level could lead to the death of marsh vegetation, which in this area generally leads to the loss of organic soils and the replacement of marsh by open water.

A marsh accretion study is currently underway in the McFaddin National Wildlife Refuge (Patrick Walther, 2016 personal communication); however, data is too preliminary to determine rates or trends in this area. A NOAA study of marsh accretion rates for the upper Texas coast (Feagin and Yeager, 2008) found contrasting accretion rates for two different marshes on the Upper Texas Coast. In one case on Galveston Island, in an area with a steeply sloping marsh edge and significant erosion due to its direct exposure to West Bay, an average -3.16 inches (in)/year of vertical loss was documented. On the Matagorda Peninsula, accretion rates appear to be keeping up with relative sea level rise in *Spartina alterniflora* low marshes before faulting (+0.31 in/year). Other average rates cited by this study include +0.4 in/year in the Trinity River Estuary (Williams 2003) and an average of +0.06 in/year in the Trinity River floodplain marsh (Yeager et al. 2007). Thus, rates can be extremely varied in the same general area depending upon the precise conditions in each location.

The intermediate RSL change rate for the project area developed for this study is predicted to be an average of 0.43 in/year through 2080 – slightly higher than the accretion rate recorded in the Matagorda Peninsula marshes and about the same as one accretion rate recorded in the Trinity River estuary. The S2G marsh mitigation areas are all situated in the wide floodplain of the Neches River, between 20 and 30 miles inland from the Gulf of Mexico. They are located in gently sloping marshes inland of the open river channel. All of these areas were affected by subsidence related to mid-20th century oil and gas withdrawal which has waned significantly in recent decades (USACE 2011, Appendix C). Production has either ceased in these fields or has been low and steady over the last 25 years. Subsidence rates are thus much lower than in the past. This is reflected in the extremely low to nonexistent, recent land loss rates measured by USGS for the area (see Appendix O). There is great uncertainty about the rate of future sea level rise and thus the future rate of marsh accretion is also uncertain. If the rate of rise is higher than the intermediate level, it is probable that marsh accretion would not be able to keep up and additional material would be required to maintain functioning marsh systems in the mitigation areas.

3.2.1.2 Cost

Based on the best available information, it is possible that the marsh mitigation areas would adapt to sea level changes and remain ecologically successful through the period of analysis. Therefore, no specific adaptive management actions are included in the mitigation cost estimate. However, if O&M monitoring of the marsh elevations determine a need for physical modifications to maintain the functions and values of the mitigation measures in the future, arrangements would need to be made to pump dredged material to restore functional elevations. All of the mitigation areas are located near SNWW navigation channels, making it feasible to pump and place material in the mitigation areas if determined necessary. It is possible that this corrective action could be undertaken as part of regular maintenance dredging. Funding needed to pay incremental differences in cost above the Federal standard, would be provided by the NFS.

3.2.2 Control of invasive and nuisance plant species

3.2.2.1 Threshold/Trigger

Adaptive management actions to remove invasive/nuisance vegetation would be implemented if they comprise more than 5 percent of marsh cover in the restored marsh of Mitigation Area 28, 29, 31 or 52. USACE, in coordination with resource agencies, would determine if the percentage of invasive/nuisance vegetation is exceeding the specified percentage, based on observations recorded during regular monitoring visits and review of satellite images.

The likelihood of the need for corrective actions is considered to be low, because functional marsh elevations would be attained during construction (as ensured by monitoring during construction) and full coverage by native marsh would be achieved (as ensured by monitoring during construction and implementation of the invasives/nuisance vegetation removal plan following initial planting). The likelihood for the need to control invasive vegetation beyond Year 3 of the O&M phase would generally not become an issue in these marshes as long as the appropriate elevation is attained and native vegetation remains in place.

3.2.2.2 Cost

The likelihood of the need for corrective actions is considered to be low because sufficient elevation would be provided by initial construction, and full coverage by native marsh vegetation would be achieved. Therefore, no specific adaptive management actions are included in the mitigation cost estimate.

4 REFERENCES

Camarillo, S.A., J. P. Stovall, and C.J. Sunda. 2015. The impact of Chinese tallow (*Triadica Sebifera*) on stand dynamics in bottomland hardwood forests. Forest Ecology and Management: Vol 344, 15 May 2015, pp 10-19.

Delaune, R. D., R. H. Baumann, and J. G. Gosselink. 1983. Relationships among vertical accretion, coastal submergence, and erosion in a Louisiana Gulf Coast marsh. Journal of Sedimentary Petrology 53: 147-157.

Feagin, R. A. and K. M. Yeager. 2008. Final Report: Salt Marsh Accretion Rates on the Upper Texas Coast: Will Sea Level Rise Drown Our Marshes. A report of the Texas Coastal Management Program, Coastal Coordination Council pursuant to NOAA Award No. NA06NOS4190129 and Texas GLO grant #07-005-07.

Gardner, L.R., and D.E. Porter. 2001. Stratigraphy and geologic history of a southeastern salt marsh basin. North Inlet, South Carolina. Wetlands Ecology and Management 9:371–382.

Gardner, L.R., B.R. Smith, and W.K. Michener. 1992. Soil evolution along a forest-marsh transect under a regime of slowly rising sea level, North Inlet, South Carolina. Geoderma 55:141–157.

Morris, J.T., P.V. Sundareshwar, C.T. Nietch, B. Kjerfve, and D.R. Cahoon. 2002. Responses of coastal wetlands to rising sea level: Ecology, v. 83, no. 10, p. 2869–2877.

Pethic, J. 1981. Long-term accretion rates on tidal salt marshes. Journal of Sedimentary Petrology 51: 571-577.

U.S. Army Corps of Engineers (USACE). 2016. National Wetland Plant List – Atlantic and Gulf Coastal Plain 2016 Regional Wetland Plant List. http://wetland-plants.usace.army.mil/

_____. 2011. Sabine-Neches Waterway Final Feasibility Report and Environmental Impact Statement. Galveston District.

Williams, H. 2003. Modeling shallow autocompaction in coastal marshes using Cesium-137 fallout: Preliminary results from the Trinity River Estuary, Texas. Journal of Coastal Research, v. 19: 180-188.

Yeager, K.M., P.H. Santschi, H. Rifai, M. Suarez, R. Brinkmeyer, C-C Hung, K.J. Schindler, M. Adres and E.A. Weaver. 2007. Dioxin chronology and fluxes in sediments of the Houston Ship Channel, Texas.

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Appendix Q

WETLANDS VALUE ASSESSMENT
COASTAL MARSH MODEL SENSITIVITY ANALYSIS

May 2017

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ATTACHMENTS

Attachment 1: WVA Marsh Impacts Sensitivity Results
Attachment 2: WVA Marsh Mitigation Sensitivity Results

1 OVERVIEW

In conjunction with the U.S. Army Corps of Engineers Headquarters' (HQUSACE) single-use approval of the Wetland Value Assessment's (WVA) Coastal Marsh Community Model, the U.S. Army Corps of Engineers, Galveston District (CESWG) was directed to conduct sensitivity analyses of the model's evaluation of marsh impacts and mitigation for the Sabine Pass to Galveston Bay, Texas (S2G), Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) Feasibility Study. The HQUSACE Model Certification Panel reviewed the WVA marsh model in accordance with EC 1105-2-412 and determined that the model and its accompanying documentation were sufficient to approve the marsh model Version 1.0 for use on the S2G Feasibility Study. However, based on the recommendations of an independent external peer review of the WVA Community Index models (Battelle, 2010), a sensitivity analysis was required to evaluate several unresolved issues with the form of marsh model suitability indices (SI) for Variables (V) 1, 2, and 3 and the aggregation method used to combine marsh and open water habitat units. Galveston District was directed to use a WVA spreadsheet prepared by the Engineering Research and Development Center's (ERDC) Environmental Lab (USACE, 2013) to conduct the sensitivity analyses, and to have the analyses reviewed as part of the overall Agency Technical Review process. ERDC's WVA spreadsheet contains Version 1.0, as well as two updated versions (2.0 and 2.0B) that have incorporated comments made by Battelle (2010).

1.1 WVA SUMMARY

Version 1.0 of the WVA marsh model, developed by the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Environmental Workgroup (USFWS, 2010), was applied to evaluate ecosystem impacts and mitigation in support of alternative comparisons for the Orange County element of the S2G Feasibility Study. WVA outputs were entered into the IWR Planning Suite to select best buy plans from the final array of alternatives for each affected marsh type.

The WVA model suite uses a quantitative habitat-based assessment methodology originally developed for wetland restoration and planning projects in coastal Louisiana and east Texas. It directly applies the Habitat Evaluation Procedures (HEP), which was developed by the U.S. Fish and Wildlife Service to evaluate project impacts on fish and wildlife resources and benefits of ecosystem restoration projects. The WVA methodology employs a community approach that assumes that optimal conditions for all fish and wildlife within a specific type of coastal wetland habitat can be characterized by a group of significant variables, and that existing or future conditions can be compared to that optimum, providing an index of habitat quality like that provided by the HEP methodology. Using this methodology, several habitat-specific community models have been developed by the EnvWG, and three were selected for use in this study: the Coastal Marsh Model, the Swamp Community Model, and the Bottomland Hardwood Model. As

the variables in question are part of the coastal marsh model, the sensitivity analysis applies only to the marsh model of the WVA suite. There are four variations of the marsh models, for application to fresh, intermediate, brackish, and saline marsh. No saline marsh was in the S2G affected area, and therefore, the sensitivity analyses presented here do not cover that wetland type.

1.2 CERTIFICATION REVIEW COMMENTS

Battelle's reviewers of the WVA Model Suite suggested an alternative treatment for the SIs for three marsh model variables (V1 - percent of wetland area covered by emergent vegetation, V2 - percent of open water area covered by submerged aquatic vegetation, and V3 - marsh edge and interspersion). For these variables, the reviewers commented that policy decisions appear to supersede what is known about the ecology and hydrology of the relationships. Some reviewers also questioned the overall aggregation method used to combine net marsh and open water habitat suitability index (HSI) components (Battelle, 2010). They commented that spreadsheet formulas for the marsh models incorrectly combined open water and emergent marsh average annual habitat units (AAHUs) by taking the weighted average of the net benefits for marsh and open water.

1.3 ERDC'S WVA SPREADSHEET

ERDC's WVA Spreadsheet was developed to be utilized for all of the community models in the WVA Model Suite. Spreadsheet pages include input and output, landloss, and calculation pages for each of the models included in the WVA suite. The model type to be applied is selected on the input page, along with the total number of simulation years. An example of the input page is presented in Figure 1-1 (note: target years have been truncated to allow a readable presentation). A landloss spreadsheet can be linked to the model spreadsheet on the landloss page, making data input for emergent marsh and open water acres easier and reducing the risk of data input errors. The input page is linked to the calculation pages, which present all of the formulas that are applied to calculate AAHUs, and they are locked to prevent unintended changes to formulas and other errors. The capability to handle risk and uncertainty was incorporated by the use of a Monte Carlo simulation and the ability to input data using either a low to high range or standard deviation, and it also allows the user to select between linear and stepwise transitions between target years. WVA modeling for the S2G study utilized ranges and linear transitions, as the former were more easily determined by the resource agency workgroup, and the latter better represented the changes between the selected target years. For the Monte Carlo simulations, 100 iterations of the statistics of outputs were performed.

Simulation Date: 6/6/2016
Model User: Jan S
Simulation Name: B-1 Direct Int RSLR

Model Type: Marsh - Brackish
Uncertainty: Range (Low to High)
Transitions: Linear
Acreage Entry: Land Loss

Simulation Years: 61
Monte Carlo Iterations: 100

Project: 526 B-1Direct Impacts Old River Cove

Condition: Future Without Project

			Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Project Area (acres)		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Emergent Marsh (acres)		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Open Water (acres)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V1	% Emergent	Low	94	94	94	93	93	93	93	92	92	92	92	91	91	91	91	91	90	90	90	90	89
		High	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	99	99	99	99	99
V2	% Aquatic	Low	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	9	9	8	8
		High	20	20	20	20	20	20	20	21	21	21	21	21	21	21	21	21	21	21	21	22	22
V3	Interspersion																						
	Class 1		35	35	35	35	35	35	35	34	34	34	34	34	34	34	34	34	34	34	34	33	33
	Class 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 3		65	65	65	65	65	65	65	66	66	66	66	66	66	66	66	66	66	66	66	67	67
	Class 4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V4	% Open Water <= 1.5ft	Low	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
		High	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
V5	Salinity (ppt)		10	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11
V6	Access Value		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Condition: Future With Project

			Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Project Area (acres)		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Emergent Marsh (acres)		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Open Water (acres)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V1	% Emergent	Low	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		High	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V2	% Aquatic	Low	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		High	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V3	Interspersion																						
	Class 1		35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 3		65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Class 5		0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
V4	% Open Water <= 1.5ft	Low	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		High	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V5	Salinity (ppt)		10	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11
V6	Access Value		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 1-1. Example of ERDC Spreadsheet Model Input Page

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A sensitivity analysis was incorporated into the fresh/intermediate, brackish and saline marsh pages of the spreadsheet which calculates and presents the outputs for Versions 1.0, 2.0 and 2.0B of the marsh models. Version 2.0 applies the SI curves suggested by reviewers for V1 and V2, and the weighted arithmetic mean Total Net AAHU calculation which is also used in Version 1.0. Version 2.0B applies the same suitability index (SI) curves for V1 and V2 but changes the aggregation method to that suggested by Battelle reviewers, which adds the net HSI marsh and open water AAHUs. All three versions incorporate the change to V3 which reduces the value of carpet marsh. Inasmuch as the change to V3 has already been incorporated into the most recent CWPPRA Marsh Model Version 1.0, a sensitivity analysis of this variable was not conducted.

Output for all three versions are shown in a table of output statistics that appear at the bottom of both the input and output pages. The original output tables for all S2G marsh impacts and mitigation measures are presented in Attachments 1 and 2, respectively. All outputs present the mean of the Monte Carlo simulation with the calculated standard deviation as well as a 95% confidence interval. Incorporating these statistics allows the user to visualize the amount of uncertainty of each simulation.

2 COMPARISON OF WVA MODEL VERSIONS

2.1 VERSION 1.0

2.1.1 V1 – Percent Emergent Marsh

The EnvWG assigned an SI of 1.0 to areas with 100 percent marsh cover of all marsh types, and an SI of 0 for areas with no marsh cover. This was based on the well–established concept that "persistent emergent vegetation plays an important role in coastal wetlands by providing foraging, resting, and breeding habitat for a variety of fish and wildlife species; and by providing a source of detritus and energy for lower trophic organisms that form the basis of the food chain (USFWS, 2010)." The model was developed for application in Coastal Louisiana and the western extent of the Chenier Plain in the east Texas coastal zone, which is losing marsh faster than any other place in the US (USACE, 2004). In this unique disappearing landscape, 100 percent emergent marsh cover was considered optimum by the EnvWG. The suitability graph is shown in Figure 2-1.

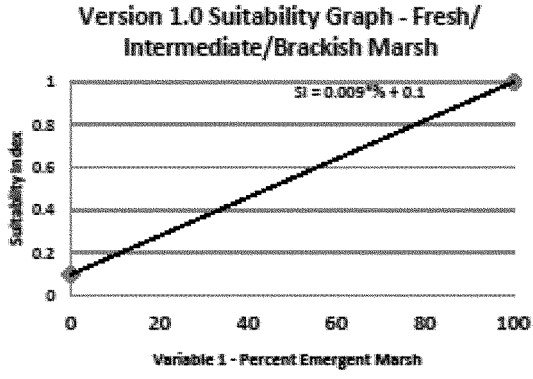

Figure 2-1. Variable 1 (Version 1.0) Marsh Suitability Graph

2.1.2 V2 – Percent Submerged Aquatic Vegetation

"Fresh and intermediate marshes often support diverse communities of floating-leaved and submerged aquatic plants that provide important food and cover to a wide variety of fish and wildlife species. A fresh/intermediate open water area with no aquatics is assumed to have low suitability (SI=0.1). Optimal conditions (SI=1.0) are assumed to occur when 100 percent of the open water is dominated by aquatic vegetation (USFWS, 2010)."

"Brackish marshes also have the potential to support aquatic plants that serve as important sources of food and cover for several species of fish and wildlife. Although brackish marshes generally do not support the amounts and kinds of aquatic plants that occur in fresh/intermediate marshes, certain species, such as widgeon-grass, and coontail and milfoil in lower salinity brackish marshes, can occur abundantly under certain conditions. Those species, particularly widgeon-grass, provide important food and cover for many species of fish and wildlife. Therefore, the V_2 Suitability Index graph in the brackish marsh model is identical to that in the fresh/intermediate model (USFWS, 2010)." The suitability graph for fresh/intermediate and brackish marsh is shown in Figure 2-2.

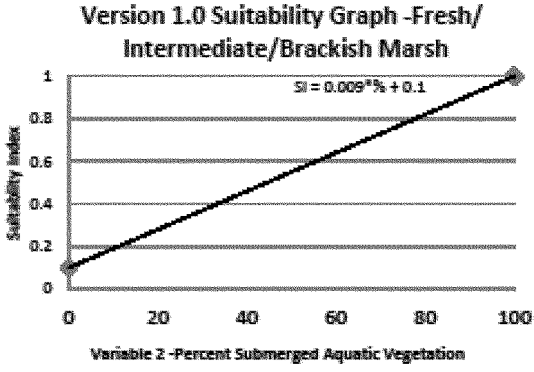

Figure 2-2. Variable 2 (Version 1.0) Marsh Suitability Graph

2.1.3 V3 – Marsh Edge and Interspersion

"This variable takes into account the relative juxtaposition of marsh and open water for a given marsh:open water ratio and is measured by comparing the project area to sample illustrations … depicting different degrees of interspersion. … A relatively high degree of interspersion in the form of tidal channels and small ponds (Class 1) is assumed to be optimal (SI=1.0); tidal channels and small ponds offer interspersion, yet are not indicative of active marsh deterioration. Numerous small marsh ponds (Class 2) offer a high degree of interspersion, but can be indicative of the onset of marsh break-up and deterioration, and are therefore assigned a lower SI of 0.6. Large ponds (Class 3) and open water areas with little surrounding marsh (Class 4) offer lower interspersion values and usually indicate advanced stages of marsh loss. Therefore, Classes 3 and 4 are assigned SIs of 0.4 and 0.2, respectively. Also grouped within Class 3 are areas of "carpet" marsh which contain no or relatively insignificant tidal channels, creeks, trenasses, ponds, or other features of interspersion but may still provide habitat for aquatic organisms during tidal flooding. Class 5 is

characterized by very small marsh islands (i.e., less than 5% emergent marsh) or areas made up entirely of open water. Habitat of this type provides little to no marsh edge and its function as nursery habitat for marine organisms or foraging habitat for avian predators has been significantly reduced. Although habitats represented by this classification are predominantly unvegetated open water areas, they still provide habitat for many fish and shellfish species and provide loafing areas for waterfowl and other waterbirds. Class 5 is assigned an SI of 0.1. Also grouped within Class 5 are areas characterized as solid land with no interspersion features and little to no vegetation. Newly created marsh with no ponds, creeks, or other tidal features would fall within this class (EnvWG, 2010)." The suitability graph is shown in Figure 2-3.

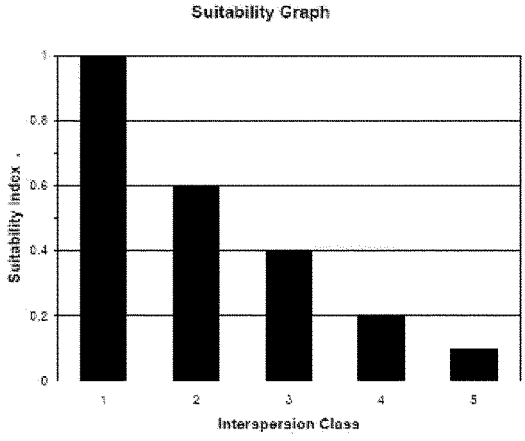

Figure 2-3. Variable 3 (Version 1) All Marsh Suitability Graph

2.1.4 Aggregation of Total Benefits

In the Version 1.0 aggregation method, weighted arithmetic means for emergent marsh and open water are added to calculate the Total Benefits in AAHUs. WVA emergent marsh models employ a split model format to account for the value of both marsh and open-water habitats. Two HSI formulas are calculated for each marsh type—one for emergent marsh habitat and one for open-water habitat. The HSI formula for emergent marsh contains only those variables that are important for evaluating its habitat quality (V_1, V_3, V_5, and V_6). The HSI formula for open-water habitat contains only those variables important to that habitat component (V_2, V_3, V_4, V_5, and V_6). The HSI formulae for fresh/intermediate and brackish marsh, respectively, are shown below.

Fresh/Intermediate Marsh HSI

$$\textit{Emergent Marsh HSI} = \frac{(3.5 \times (SIV_1{}^{5} \times SIV_6{}^{1})^{(1/6)}) + (SIV_3 + SIV_5)}{4.5}$$

$$\textit{Open Water HSI} = \frac{(3.5 \times (SIV_2{}^{3} \times SIV_6{}^{1})^{(1/4)}) + (SIV_3 + SIV_4 + SIV_5)}{4.5}$$

Brackish Marsh HSI

$$\textit{Emergent Marsh HSI} = \frac{(3.5 \times (SIV_1{}^{5} \times SIV_6{}^{1.5})^{(1/6.5)}) + (SIV_3 + SIV_5)}{4.5}$$

$$\textit{Open Water HSI} = \frac{(3.5 \times (SIV_2{}^{3} \times SIV_6{}^{2})^{(1/5)}) + (SIV_3 + SIV_4 + SIV_5)}{4.5}$$

Since the marsh models are split into emergent marsh and open-water components, an HSI is calculated for both. Net AAHUs, determined for both components, must be combined to determine total net benefits. In the weighted formulas for determining net AAHUs for each marsh type (below), AAHUs for emergent marsh are weighted higher than open-water AAHUs to reflect the EnvWG emphasis on marsh restoration/protection over open-water habitat.

$$\textit{Fresh/Intermediate Marsh Net AAHUs} = \frac{2.1\ (\textit{Emergent Marsh AAHUs}) + \textit{Open-water AAHUs}}{3.1}$$

$$\textit{Brackish Marsh Net AAHUs} = \frac{2.6\ (\textit{Emergent Marsh AAHUs}) + \textit{Open-water AAHUs}}{3.6}$$

2.2 VERSION 2.0

2.2.1 V1 – Percent Emergent Marsh

While the EnvWG recognized that assigning 100 percent emergent marsh coverage an optimal SI of 1.0 is not supported by generally accepted ecological science, they believed it to be necessary because of the extreme marsh loss rates in the area. The reviewers felt that the inclusion of policy goals for the construction of marsh vegetation cover variables is not appropriate. One-hundred percent emergent vegetation coverage in marshes is not optimal for foraging and breeding by fish and wildlife, and it is not realistic since tidal wetlands must have tidal creeks to survive. Therefore, Version 2.0 applies the SI curves suggested by reviewers. The same curve was applied for fresh and intermediate marsh, and a slightly different curve for brackish marsh; saline marsh was not evaluated for this study and

is not covered by this sensitivity analysis. The suitability graphs for fresh/intermediate and brackish marsh are shown in Figures 2-4 and 2-5, respectively.

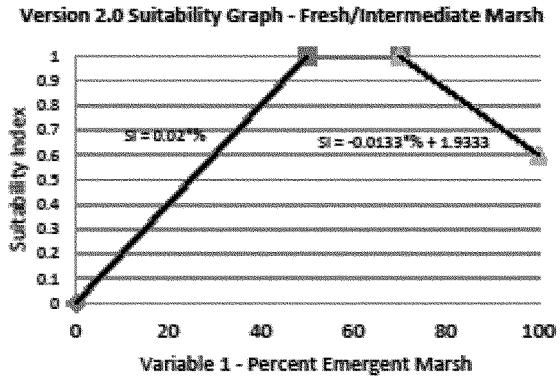

Figure 2-4. Variable 1 (Version 2.0) Fresh/Intermediate Marsh Suitability Graph

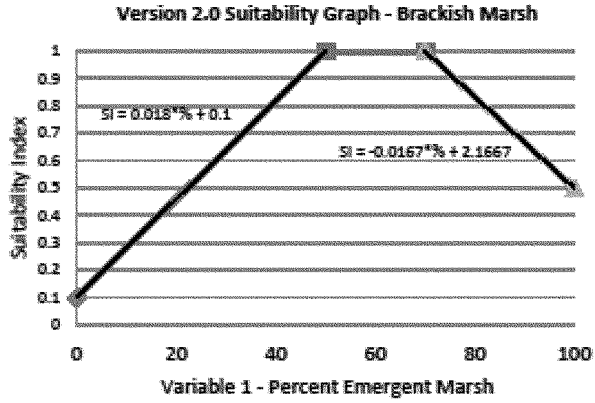

Figure 2-5. Variable 1 (Version 2.0) Brackish Marsh Suitability Graph

2.2.2 V2 – Percent Submerged Aquatic Vegetation

The reviewers commented that the SI curve for V2 is designed similarly to V1 and is not reasonable at the high end. Setting the SI value to 1.0 at 100 percent SAV cover severely limits the model. A 100 percent SAV cover is not likely to occur naturally, and thus the model can never generate an SI of 1.0, and optimum habitat conditions could never be reflected. Reviewers suggested that

an optimal cover of 70 or 80 percent would make more biological sense. The suitability graphs for fresh/intermediate and brackish marsh are shown in Figures 2-6 and 2-7, respectively.

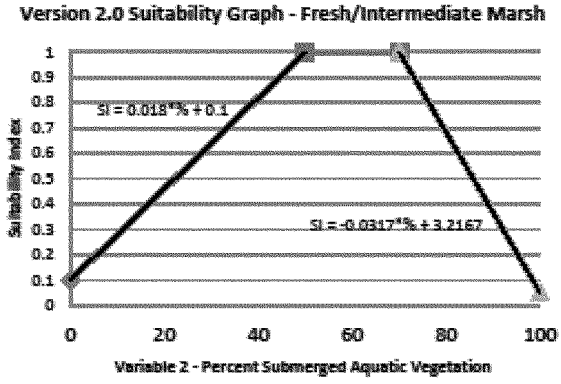

Figure 2-6. Variable 2 (Version 2.0) Fresh/Intermediate Marsh Suitability Graph

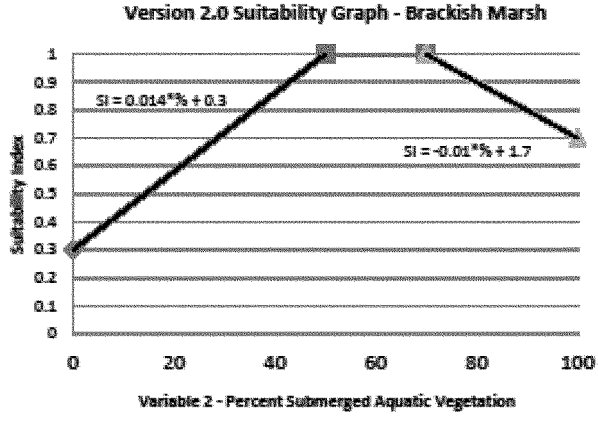

Figure 2-7. Variable 2 (Version 2.0) Brackish Marsh Suitability Graph

2.2.3 V3 – Marsh Edge and Interspersion

Battelle reviewed an earlier iteration of the Version 1.0 marsh model (USFWS, 2008), and that version ranked areas exhibiting a high degree of marsh cover (also called carpet marsh) as optimal, assigning them an SI 1.0. This was done to avoid conflicts with the premises underlying the SI

graph for V1 in Version 1.0. The rankings for this variable were modified in the Version 1.0 (USFWS, 2010) model which was utilized for the S2G WVA modeling, and is described in Section 2.1.3. Carpet marsh is ranked as Class 3 in this most recent version.

2.2.4 Aggregation of Total Benefits

WVA Version 2.0 utilizes the Version 1.0 aggregation method described in Section 2.1.4.

2.3 VERSION 2.0B

2.3.1 V1 (Percent Emergent Marsh) and V2 (Percent Submerged Aquatic Vegetation

WVA Version 2.0B utilizes the Version 2.0 SIs for both V1 and V2.

2.3.2 V3 – Marsh Edge and Interspersion

WVA Version 2.0B utilizes the Version 1.0 SI for V3.

2.3.3 Aggregation of Total Benefits

In Version 2.0B, the net marsh and open water AAHUs are calculated by simple addition. The reviewers believed that averaging the emergent marsh and open water values in any form is incorrect, because it results in model output of fewer AAHUs than are being evaluated. The reviewers stated that "It is inappropriate to carry out the weighting when calculating benefits measured by AAHUs. Weighting would more appropriately be applied at the HSI level, not the AAHU level (Battelle, 2010).

3 SENSITIVITY ANALYSIS AND RESULTS

3.1 METHODOLOGY

The sensitivity of the WVA model outputs for impacts and mitigation measures to the suggested SI changes in V1 and V2 has been assessed. AAHUs of direct and indirect impacts associated with construction and operation of the proposed Orange levee system, and compensation provided by each mitigation measure in the final array of mitigation measures, were calculated using the ERDC WVA spreadsheet. This spreadsheet referenced the data input cells of the Version 1.0 model using the Version 2.0/2.0B model equations, and all model results are contained in the same Excel workbook. The results for impacts and mitigation are provided in Attachments 1 and 2, respectively.

The magnitude of change was quantified in terms of the percent change of the total AAHUs, as well as to the emergent marsh and open water habitats. The effects of the new model outputs on the selection of Best Buy mitigation plans are also assessed. Tables 3-1 and 3-2 summarize the results of the application of the new SIs in terms of percent change of net AAHUs to relative to Version 1.0 model runs. Percentage differences are calculated using the following equation.

$$Percent\ AAHU\ change = \frac{AAHU_{Version\ 2.0\ or\ 2.0B} - AAHU_{Version\ 1.0}}{AAHU_{Version\ 2.0\ or\ 2.0B}} \times 100$$

3.2 RESULTS OF THE ANALYSIS

WVA Versions 2.0 and 2.0B generally resulted in higher AAHU impacts than Version 1.0. The overall percentage change in mean AAHU impact output for Version 2.0 was a 16.3 percent increase, and the percent change for Version 2.0B was a 50.9 percent increase. For mitigation, the overall percentage change in mean AAHU output for Version 2.0 was a 59 percent increase in required compensation, and the percent change for Version 2.0B was a 119.9 percent increase. Some of the percentage changes for the mitigation measures shown in Table 3-2 are extremely large (i.e. -3319 percent), and this was the result of making the percentage comparisons to very small numbers; thus percentage changes were very large.

Care must be taken when evaluating the percentage changes, especially when reviewing the Version 2.0B results for mitigation. Version 2.0B actually yielded negative results (i.e. impacts versus benefits) for some of the mitigation measures; the reason for this will be discussed below. This results in positive percentage changes for mitigation measures 27, 28, and 31, which mean that the negative values are increasing under Version 2.0B.

Table 3-1. Percent Change in Marsh Impacts Between Versions 2.0/2.0B and Version 1.0

	Version 2.0 Percent Change			Version 2.0B Percent Change		
	Emergent Marsh	Open Water	Total Net Benefits	Emergent Marsh	Open Water	Total Net Benefits
Fresh Marsh						
F-1 Direct Impacts Bessie Heights	-35.0%	16.3%	-35.0%	-35.0%	16.3%	8.7%
F-2 Direct Impacts Old River Cove	-34.1%	29.0%	-32.2%	-34.1%	29.0%	13.3%
F-3 Direct Impacts Chemical Row	-38.1%	22.1%	-37.9%	-38.1%	22.1%	6.9%
F-4 Direct Impacts Adams Bayou	18.7%	27.8%	19.9%	28.8%	27.8%	52.7%
F Indirect-2 Cow Bayou Fisheries Access	34.2%	33.8%	34.1%	34.2%	33.8%	64.5%
F Indirect-3-Adams Bayou Fisheries Access	34.3%	26.4%	29.3%	34.3%	26.4%	71.9%
Net Change			21.2%			62.0%
Intermediate Marsh						
I-1 Direct Impacts Old River Cove	-31.3%	16.9%	-30.7%	-31.3%	16.9%	12.7%
I-2 Direct Impacts Cow Bayou	-31.5%	14.5%	-31.4%	-31.5%	14.5%	11.3%
I-3 Direct Impacts Adams Bayou	-36.8%	25.4%	-36.7%	-36.8%	25.4%	7.6%
I Indirect-1 and 2 Thru TY30 Hydrologic Impacts	5.9%	24.2%	7.7%	5.9%	24.2%	43.6%
I Indirect-3-Cow Bayou Fisheries Access	33.3%	33.6%	33.4%	33.3%	33.6%	64.1%
I Indirect-4-Adams Bayou Fisheries Access	28.8%	33.8%	29.8%	28.8%	33.8%	60.6%
Net Change			9.4%			46.1%
Brackish Marsh						
B-1 Direct Impacts Old River Cove	-30.0%	28.6%	-28.9%	-30.0%	28.6%	4.2%
B-2 Direct Impacts Cow Bayou	19.9%	28.2%	20.7%	19.9%	28.2%	50.4%
B-3 Direct Impacts Adams Bayou	-41.1%	29.0%	-41.0%	-41.1%	29.0%	-8.9%
B Indirect-I 1 and2 Switch Brackish TY31 - Hydrologic Impacts	6.5%	25.6%	7.9%	6.5%	25.6%	39.5%
B Indirect-2 Cow Bayou-Hydrologic Impacts	14.2%	16.1%	14.4%	14.2%	16.1%	47.2%
B Indirect-3 Persistent Marsh- Hydrologic Impacts	-0.1%	16.1%	1.1%	-0.1%	16.1%	35.3%
B Indirect-3 Marsh Migration-Hydrologic Impacts	24.8%	-0.4%	24.6%	24.8%	-0.4%	42.1%
B Indirect-4 Cow Bayou Fisheries Impacts	30.3%	35.0%	31.1%	30.3%	35.0%	63.3%
B Indirect-5 Adams Bayou Fishery Access Impacts	11.9%	34.3%	14.1%	11.9%	34.3%	46.8%
B Indirect-S-2 Switch TY31-Hydrologic Impacts	-10.7%	1.5%	-10.7%	-10.7%	1.5%	15.1%
Net Change			15.8%			46.8%
Overall Totals						
Total Net Mean		-171.1			-291.4	
Lower 95% Confidence Interval		-172.5			-294.1	
Upper 95% Confidence Interval		-169.7			-288.7	
Standard Deviation		1.4			2.7	
Total Percent Net Change From Version 1.0 Total Net Mean (-143.1)		16.3%			50.9%	

3.2.1 Sensitivity of the Impacts Analysis

As would be expected, total net outputs are greatly influenced by the existing percentage of marsh cover (V1) (USFWS, 2010). The relative contribution of V1 to the overall HSI equation for fresh/

Table 3-2. Percent Change in Marsh Mitigation Between Version 2.0/2.0B and Version 1.0

	Version 2.0 Percent Change			Version 2.0B Percent Change		
	Emergent Marsh	Open Water	Total Net Benefits	Emergent Marsh	Open Water	Total Net Benefits
Fresh Marsh						
Mit 42 Scale 1	-32.6%	12.2%	-45.9%	-32.6%	12.2%	-46.9%
Mit 42 Scale 2	2.5%	12.7%	0.2%	2.5%	12.7%	11.2%
Mit 52	-225.2%	13.4%	-368.0%	-225.2%	13.4%	-826.5%
Net Change						
Intermediate Marsh						
Mit 31	-135.0%	21.6%	-298.6%	-135.0%	21.6%	1909.1%
Mit 32	22.4%	536.6%	26.3%	22.4%	536.6%	50.5%
Mit 143	21.1%	29.1%	20.0%	21.1%	29.1%	36.1%
Net Change						
Brackish Marsh						
Mit 27	-84.1%	24.2%	-161.1%	-84.1%	24.2%	360.9%
Mit 28	-322.2%	23.8%	-3319.3%	-322.2%	23.8%	228.8%
Mit 29	-19.6%	40.5%	-29.8%	-19.6%	40.5%	-74.8%
Net Change						
Overall Totals						
Total Net Mean	237.6			171.8		
Lower 95% Confidence Interval	236.3			169.4		
Upper 95% Confidence Interval	238.8			174.2		
Standard Deviation	1.2			2.4		
Total Percent Net Change From Version 1.0 Total Net Mean (377.84)	-59.0%			-119.9%		

intermediate and brackish marsh are 43.9 percent and 43.2 percent, respectively. V2 has a lower contribution, providing 18.8 percent and 13.0 percent of the total net output for the fresh/intermediate and brackish marsh HSI models, respectively.

In Version 2.0 of the model, the V1 SI for fresh/intermediate marsh drops from 1.0 at 70 percent cover to 0.6 at 100 percent marsh cover; for brackish marsh, the SI drops from 1.0 at 70 percent cover to 0.5 at 100 percent marsh cover. In the S2G impact areas, generally there were two degrees of marsh cover – either around 100 percent cover or within a range of 50 to 75 percent cover. For 100 percent marsh cover, Version 2.0 results in lower impacts because total marsh cover percentages between 70-100 percent are not ranked as highly as in Version 1.0. The decrease in impacts is about -30 to -40 percent. For those areas with marsh cover in the 50-75 percent range,

impacts are higher for Version 2.0 because this percentage of marsh cover receives an SI at or near 1.0, while in Version 1.0, the SIs for this degree of cover ranges from 0.5 to 0.7.

The Version 2.0 changes to the V2 SI also resulted in increasing impacts, but to a much lesser overall degree than for V1. Almost all of the impact areas exhibited SAV cover between 0-50 percent. Version 2.0 results in slightly higher impacts for this range (SI between 0.1 - 1.0) than Version 1.0, with SIs between 0.1 and 0.6.

Version 2.0B results in higher impacts overall with impacts increasing for 100 percent marsh cover by 7 to 40 percent. For areas with 50-75 percent marsh cover, impacts increased from 44 to 63 percent. This is due solely to the different aggregation method, which adds net marsh and net open water AAHUs rather than using the weighted average method that is applied in Versions 1.0 and 2.0. Using simple addition results in higher net impacts, and it also gives equal weighting to marsh and open water habitat. The appropriateness of an equal weighting is questionable. Although neither marsh nor open water could be ecological viable without the other in this estuarine environment, marsh has greater relative value because it provides nutrients and cover for aquatic species that would not be available in a 100 percent open water environment. In other words, it takes less open water than marsh cover to make a marsh system valuable to all aquatic and terrestrial species. The WVA models were developed specifically for the coastal regions of Louisiana and East Texas where rates of marsh loss are extremely high (USFWS, 2010). The marshes in this region are comprised of organic soils, which erode more easily when marsh vegetation is lost due to relative sea level rise or salinity intrusion, and convert readily to open water. In this area, giving marsh a greater weight than water in determining net AAHUs appears to be more appropriate.

The new models would have had no effect on selection of the Tentatively Selected Plan (TSP). The screening of alternatives for inclusion in the TSP used estimates of mitigation costs included in the preliminary cost/benefit analysis, but these costs were small when compared to overall construction costs and, therefore, they did not affect plan selection. The mitigation estimates were based on the cost per acre of similar mitigation measures developed for previous studies in this area. A detailed mitigation plan was not developed for the TSP because the final feasibility design was developed after release of the TSP report. Final impacts and mitigation were developed using the WVA model and the IWR Planning Suite (Version 2.0) during the final feasibility phase.

3.2.2 Sensitivity of the Mitigation Plan

Selection of the final mitigation plan would be highly sensitive to the WVA model version applied. Compensation (e.g. benefits) provided by the mitigation measures was highly dependent upon the resulting percentage cover of emergent marsh and the amount of existing marsh within the area prior to restoration. When marsh restoration results in total emergent marsh between 50 and about

75 percent, Versions 2.0 and 2.0B yield higher net benefits that Version 1.0. For Versions 2.0 and 2.0B only, when the total restored area of emergent marsh exceeds about 75 percent, the net benefits are generally lower than Versions 1.0.

Three mitigation measures (27, 28 and 31) actually yielded negative AAHUs under Version 2.0B. The aggregation method used for Version 2.0B, which gives equal weight to net marsh and open water HSIs, quantifies the restoration as a reduction in the overall quality of the marsh below that of the existing condition. These areas include substantial percentages of existing, though degraded, marsh. Figure 3-1 shows the existing conditions at mitigation measures 28 and 29. The proposed restoration effort would nourish existing, breaking and subsiding marsh and create new marsh in 65 percent of the existing open water. Sinuous channels and small, shallow ponds would be created in 35 percent of the existing open water. This results in a total marsh percentage, after restoration, of about 85 percent. Under Version 2.0B, the resulting restoration effort would be considered an impact and result in negative AAHUs, with total net benefits being reduced by 75 percent when compared to Version 1.0.

Marsh restoration in areas with little or no existing marsh such as I-32 (a mitigation measure not selected for the Mitigation Plan using Version 1.0, and shown in Figure 3-2) result in a total percentage of emergent marsh within the optimum range (between 50 and 70 percent), and benefits that are higher than those produced under Version 1.0. Versions 2.0 and 2.0B produce increases in benefits of about 25 percent and 50 percent, respectively. Use of Version 2.0 would make it difficult to identify cost effective measures for nourishing areas within existing, degraded marsh, and Version 2.0B would make it impossible to produce net benefits.

As noted above, impacts generally increased under both new versions. In most cases, the compensation provided by the mitigation measures also decreased, and the cost effectiveness ranking of mitigation measures changed. This would result in different mitigation plans and additional mitigation under either of the new versions. Mitigation compensation (AAHUs), determined using WVA Versions 2.0 and 2.0B, was compared to average annual costs using the IWR Planning Suite. The cost effectiveness/incremental cost analysis identified new Best Buy plans identified in Table 3-3.

Using Version 2.0, the mitigation target (e.g. total impacts) increased from -145.0 to -171 AAHUs, All of the fresh marsh mitigation areas combined would provide 37.9 AAHUs, which is roughly equal to the -38.4 AAHUs of fresh marsh impacts calculated in this version. The Best Buy plan selected for intermediate marsh changed to measure 143, which provides well more than the needed compensation. However, all of the brackish marsh mitigation areas combined would provide 49.4 AAHUs of compensation, well short of the -114.5 AAHUs of impacts calculated under Version 2.0.

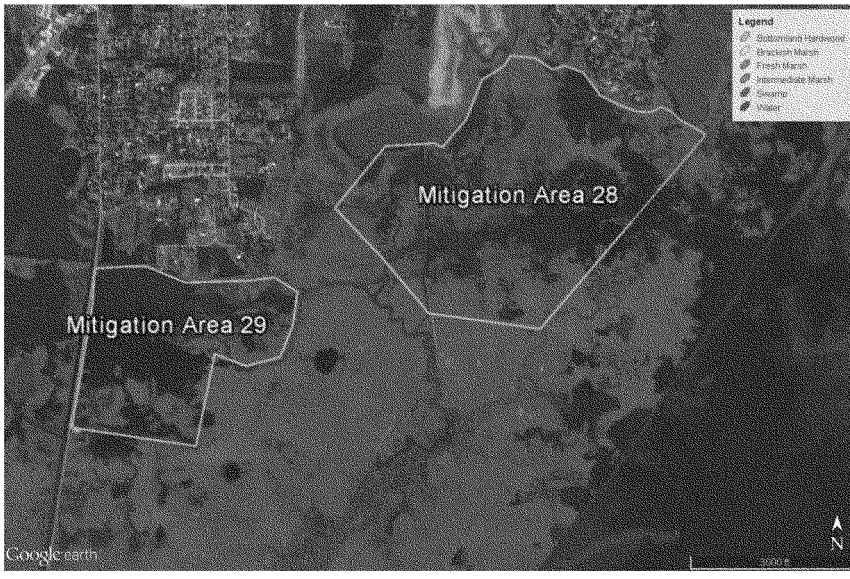

Figure 3-1. Brackish Marsh Mitigation Measures 28 and 29

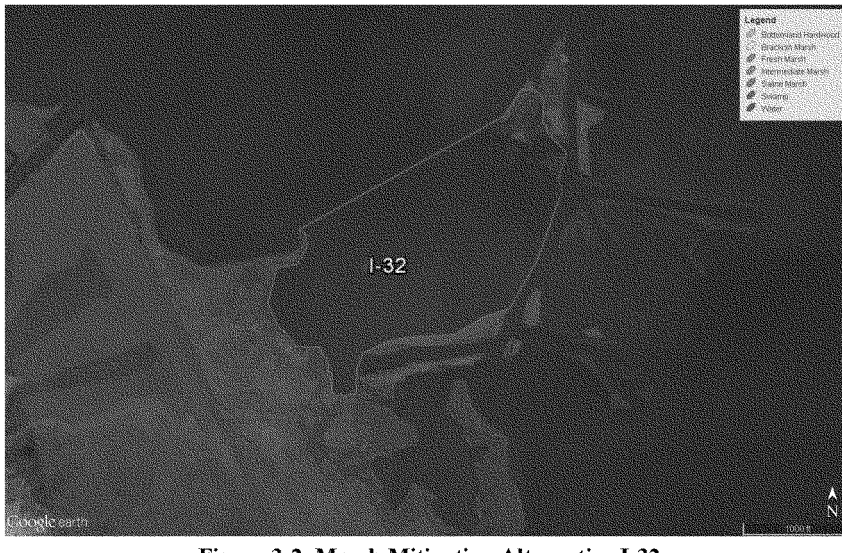

Figure 3-2. Marsh Mitigation Alternative I-32

Table 3-3. Comparison of Mitigation Between WVA Versions 2.0/2.0B and Version 1.0

Marsh Type	WVA Version 1.0				WVA Version 2.0				WVA Version 2.0B			
	Mitigation Target	Best Buy (BB) Plan Measure(s)	Mitigation Compensation (AAHUs)	Average Annual Cost ($1,000)	Mitigation Target	BB Plan Measure(s)	Mitigation Compensation (AAHUs)	Average Annual Cost ($1,000)	Mitigation Target	BB Plan Measure(s)	Mitigation Compensation (AAHUs)	Average Annual Cost ($1,000)
Fresh	-30.2	F52	33.4	$ 82.9	-38.4	F42(2)+F52	37.9	$ 355.6	-79.6	F42(2)+F52	37.9	$ 711.2
Intrmd	-18.2	I31	60.4	$ 243.1	-18.3	I143	94.5	567.6	-30.7	I143	118.3	567.6
Brackish	-96.6	B28 & B29	100.4	$ 310.1	-114.5	B27+B28+ B29	49.4	683.7	-181.1	B29	24.0	920.0
Totals	-145.0		194.2	$ 636.1	-171.2		181.8	$ 1,606.9	-291.4		180.2	$ 2,198.8

Red numbers indicate that the compensation is lower than the mitigation target for the specific marsh type.

It is estimated that the average annual cost of the mitigation plan would be about $1,600, or a 150 percent increase over Version 1.0.

Using Version 2.0B, the mitigation target (e.g. total impacts) increased from -145.0 to -291.4 AAHUs. All of the fresh marsh mitigation areas combined would provide 37.9 AAHUs, which is 41.7 AAHUs less than the amount needed to fully compensate for impacts to fresh marsh. New mitigation areas would need to be identified for brackish marsh as well, as Mitigation Areas 27 and 28 yield negative AAHUs under Version 2.0B, and Mitigation Area 29 provides only 24.0 AAHUs of compensation, well below the brackish marsh mitigation target of 181 AAHUs. Mitigation Area 29 has less existing marsh than the others, and therefore scores better under Version 2.0B. It is estimated that the average annual cost of the mitigation plan would be about $2,200, or about a 250 percent increase over Version 1.0. The magnitude of the mitigation plan cost increase under Version 2.0B increases the possibility that the selection of the Recommended Plan could be different than that chosen using Version 1.0.

3.3 CONCLUSION

In conclusion, use of WVA Versions 2.0 and 2.0B in this case study generally resulted in higher impacts and greater mitigation than Version 1.0, and could significantly affect plan selection if applied to future studies. Version 2.0 results in higher impacts for those areas with marsh cover in the 50-75 percent range. In this case study, impacts ranged from 1 to 41 percent higher than Version 1.0, with a total net percentage increase of about 16 percent.

Version 2.0B increases impacts in areas with existing emergent marsh less than or equal to about 50 percent. Since available mitigation sites in this study area generally contain well more than 50 percent emergent marsh, impacts ranged from 7 to 72 percent, with a total net percentage increase of about 51 percent.

The total net percent changes in compensation provided by mitigation areas under Versions 2.0 and 2.0B were generally lower than Version 1.0. Percentage changes varied widely, and were

greatly affected by the amount of existing marsh within the proposed mitigation areas. For Version 2.0, the percentage change in total net AAHUS ranged from +26 to -3,319 percent, with the majority ranging from -46 to -368 percent, and a total net percentage of -59 percent. For Version 2.0B, the percentage change in total net AAHUs ranged from +1,909 to -826 AAHUs, with the majority ranging from +360 to -47 AAHUs, and a total net percentage of about -120 percent. Large positive percent changes were often the result of a large change toward negative AAHUs.

These results are affected primarily by changes made to V1 in both versions, and the aggregation method used in Version 2.0B. Under Version 2.0B, many of the proposed mitigation areas would result in negative AAHUs because of the presence of a significant percentage of existing, degraded marsh. This would make it very difficult to identify cost effective mitigation measures that would nourish degrading marsh and restore new marsh in the same general area.

4 REFERENCES

Battelle. 2010. Final Report for the Model Review of the Wetland Value Assessment Community Index Models.

Engineering Research and Development Center (ERDC). No date. WVA User Manual and Sensitivity Analyses Excel Spreadsheet. ERDC Environmental Laboratory, Vicksburg, Mississippi.

USACE. 2004. Final Programmatic EIS for the Louisiana Coastal Areas Ecosystem Restoration Study, New Orleans District.

_____. 2013. Final Programmatic Individual Environmental Report #36, Lake Pontchartrain and Vicinity Hurricane Storm Damage Risk Reduction System Mitigation, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, and St. Tammany Parishes, Louisiana.

USFWS. 2008. Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Wetland Value Assessment Methodology Swamp Community Models. CWPPRA Environmental Work Group, Lafayette, Louisiana.

_____. 2010. Wetland Value Assessment Methodology – Coastal Marsh Community Models. CWPPRA Environmental Work Group, Lafayette, Louisiana.

ATTACHMENT 1
WVA MARSH IMPACTS SENSITIVITY RESULTS

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Fresh Marsh

DIRECT IMPACTS

S2G F-1 Revised Impacts Bessie Heights 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.02
B. Future Without Project Emergent Marsh AAHUs=	1.26	0.00	1.26	1.26	1.26	0.00	1.26	1.26	1.70	0.00	1.70	1.70
Net Change (FWP - FWOP)=	-1.24	0.00	-1.24	-1.24	-1.24	0.00	-1.24	-1.24	-1.67	0.00	-1.67	-1.67
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-1.24	0.00	-1.24	-1.24	-1.24	0.00	-1.24	-1.24	-1.67	0.00	-1.67	-1.67
B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Benefits=	-0.84	0.00	-0.84	-0.84	-1.24	0.00	-1.24	-1.24	-1.13	0.00	-1.13	-1.13

S2G F-2 Recommended Plan Impacts Old River Cove 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.08	0.00	0.08	0.08	0.08	0.00	0.08	0.08	0.11	0.00	0.11	0.11
B. Future Without Project Emergent Marsh AAHUs=	5.48	0.02	5.47	5.48	5.48	0.02	5.47	5.48	7.34	0.01	7.34	7.35
Net Change (FWP - FWOP)=	-5.40	0.02	-5.40	-5.40	-5.40	0.02	-5.40	-5.40	-7.24	0.01	-7.24	-7.24
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.36	0.00	0.35	0.36	0.36	0.00	0.35	0.36	0.25	0.00	0.25	0.25
Net Change (FWP - FWOP)=	-0.35	0.00	-0.35	-0.35	-0.35	0.00	-0.35	-0.35	-0.25	0.00	-0.25	-0.25
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-5.40	0.02	-5.40	-5.40	-5.40	0.02	-5.40	-5.40	-7.24	0.01	-7.24	-7.24
B. Open Water Habitat Net AAHUs=	-0.35	0.00	-0.35	-0.35	-0.35	0.00	-0.35	-0.35	-0.25	0.00	-0.25	-0.25
Net Benefits=	-3.77	0.01	-3.77	-3.77	-5.75	0.02	-5.76	-5.75	-4.98	0.01	-4.99	-4.98

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Fresh Marsh

S2G F-3 Recommended Plan Impacts Chemical Row 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01
B. Future Without Project Emergent Marsh AAHUs=	0.39	0.00	0.39	0.39	0.39	0.00	0.39	0.39	0.54	0.00	0.54	0.54
Net Change (FWP - FWOP)=	-0.38	0.00	-0.38	-0.38	-0.38	0.00	-0.38	-0.38	-0.53	0.00	-0.53	-0.53
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-0.38	0.00	-0.38	-0.38	-0.38	0.00	-0.38	-0.38	-0.53	0.00	-0.53	-0.53
B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Benefits=	-0.26	0.00	-0.26	-0.26	-0.39	0.00	-0.39	-0.38	-0.36	0.00	-0.36	-0.36

S2G F-4 Recommended Plan Impacts Adams Bayou 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.11	0.00	0.11	0.11	0.11	0.00	0.11	0.11	0.09	0.00	0.09	0.09
B. Future Without Project Emergent Marsh AAHUs=	7.93	0.02	7.93	7.93	7.93	0.02	7.93	7.93	6.44	0.01	6.44	6.45
Net Change (FWP - FWOP)=	-7.82	0.02	-7.82	-7.81	-7.82	0.02	-7.82	-7.81	-6.35	0.01	-6.36	-6.35
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.04	0.00	0.04	0.04	0.04	0.00	0.04	0.04	0.03	0.00	0.03	0.03
B. Future Without Project Open Water AAHUs=	2.57	0.03	2.56	2.57	2.57	0.03	2.56	2.57	1.85	0.02	1.85	1.86
Net Change (FWP - FWOP)=	-2.53	0.03	-2.54	-2.52	-2.53	0.03	-2.54	-2.52	-1.83	0.02	-1.83	-1.82
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-7.82	0.02	-7.82	-7.81	-7.82	0.02	-7.82	-7.81	-6.35	0.01	-6.36	-6.35
B. Open Water Habitat Net AAHUs=	-2.53	0.03	-2.54	-2.52	-2.53	0.03	-2.54	-2.52	-1.83	0.02	-1.83	-1.82
Net Benefits=	-6.11	0.01	-6.11	-6.11	-10.35	0.03	-10.35	-10.34	-4.89	0.01	-4.89	-4.89

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Fresh Marsh

INDIRECT IMPACTS

S2G F Indirect-2 Cow Bayou Fisheries Access	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	381.86	0.39	381.78	381.94	381.86	0.39	381.78	381.94	291.05	1.75	290.71	291.40
B. Future Without Project Emergent Marsh AAHUs=	394.04	0.37	393.97	394.11	394.04	0.37	393.97	394.11	299.07	1.73	298.73	299.41
Net Change (FWP - FWOP)=	-12.18	0.42	-12.26	-12.10	-12.18	0.42	-12.26	-12.10	-8.02	2.38	-8.48	-7.55
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	170.72	2.75	170.18	171.26	170.72	2.75	170.18	171.26	125.61	1.58	125.30	125.92
B. Future Without Project Open Water AAHUs=	178.54	2.56	178.04	179.04	178.54	2.56	178.04	179.04	130.78	1.48	130.49	131.07
Net Change (FWP - FWOP)=	-7.82	3.90	-8.58	-7.06	-7.82	3.90	-8.58	-7.06	-5.18	2.25	-5.62	-4.74
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-12.18	0.42	-12.26	-12.10	-12.18	0.42	-12.26	-12.10	-8.02	2.38	-8.48	-7.55
B. Open Water Habitat Net AAHUs=	-7.82	3.90	-8.58	-7.06	-7.82	3.90	-8.58	-7.06	-5.18	2.25	-5.62	-4.74
Net Benefits=	-10.77	1.26	-11.02	-10.53	-20.00	3.88	-20.76	-19.24	-7.10	1.78	-7.45	-6.75

S2G F Indirect-3-Adams Bayou Fisheries Access	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	50.53	0.09	50.51	50.55	50.53	0.09	50.51	50.55	37.27	0.23	37.22	37.31
B. Future Without Project Emergent Marsh AAHUs=	59.30	0.10	59.28	59.32	59.30	0.10	59.28	59.32	43.02	0.25	42.97	43.07
Net Change (FWP - FWOP)=	-8.77	0.12	-8.79	-8.74	-8.77	0.12	-8.79	-8.74	-5.76	0.31	-5.82	-5.69
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.82	0.05	0.81	0.83	0.82	0.05	0.81	0.83	0.63	0.03	0.62	0.63
B. Future Without Project Open Water AAHUs=	33.88	0.52	33.78	33.99	33.88	0.52	33.78	33.99	24.94	0.30	24.89	25.00
Net Change (FWP - FWOP)=	-33.06	0.52	-33.17	-32.96	-33.06	0.52	-33.17	-32.96	-24.32	0.30	-24.38	-24.26
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-8.77	0.12	-8.79	-8.74	-8.77	0.12	-8.79	-8.74	-5.76	0.31	-5.82	-5.69
B. Open Water Habitat Net AAHUs=	-33.06	0.52	-33.17	-32.96	-33.06	0.52	-33.17	-32.96	-24.32	0.30	-24.38	-24.26
Net Benefits=	-16.60	0.20	-16.64	-16.56	-41.83	0.55	-41.94	-41.72	-11.74	0.25	-11.79	-11.69

IMPACT SUMMARY

Direct Impact Subtotals	-10.98		-10.99	-10.98	-17.73		-17.74	-17.71	-11.37		-11.37	-11.36
Indirect Impact Subtotals	-27.38		-27.66	-27.09	-61.83		-62.70	-60.96	-18.84		-19.24	-18.45
Totals	**-38.36**		**-38.65**	**-38.07**	**-79.55**		**-80.43**	**-78.67**	**-30.21**		**-30.61**	**-29.81**

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Intermediate Marsh

DIRECT IMPACTS

S2G I-1 Recommended Plan Impacts Old River Cove 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Emergent Marsh AAHUs=	0.20	0.00	0.20	0.20	0.20	0.00	0.20	0.20	0.26	0.00	0.26	0.26
Net Change (FWP - FWOP)=	-0.20	0.00	-0.20	-0.20	-0.20	0.00	-0.20	-0.20	-0.26	0.00	-0.26	-0.26
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Net Change (FWP - FWOP)=	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-0.20	0.00	-0.20	-0.20	-0.20	0.00	-0.20	-0.20	-0.26	0.00	-0.26	-0.26
B. Open Water Habitat Net AAHUs=	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00
Net Benefits=	-0.13	0.00	-0.13	-0.13	-0.20	0.00	-0.20	-0.20	-0.18	0.00	-0.18	-0.18

S2G I-2 Recommended Plan Impacts Cow Bayou 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.05	0.00	0.05	0.05	0.05	0.00	0.05	0.05	0.06	0.00	0.06	0.06
B. Future Without Project Emergent Marsh AAHUs=	3.32	0.01	3.32	3.32	3.32	0.01	3.32	3.32	4.37	0.01	4.37	4.37
Net Change (FWP - FWOP)=	-3.27	0.01	-3.28	-3.27	-3.27	0.01	-3.28	-3.27	-4.30	0.01	-4.31	-4.30
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.02
Net Change (FWP - FWOP)=	-0.02	0.00	-0.02	-0.02	-0.02	0.00	-0.02	-0.02	-0.02	0.00	-0.02	-0.02
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-3.27	0.01	-3.28	-3.27	-3.27	0.01	-3.28	-3.27	-4.30	0.01	-4.31	-4.30
B. Open Water Habitat Net AAHUs=	-0.02	0.00	-0.02	-0.02	-0.02	0.00	-0.02	-0.02	-0.02	0.00	-0.02	-0.02
Net Benefits=	-2.22	0.01	-2.23	-2.22	-3.29	0.01	-3.30	-3.29	-2.92	0.01	-2.92	-2.92

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Intermediate Marsh

S2G I-3 Recommended Plan Impacts Adams Bayou 2016	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.00	0.02	0.02
B. Future Without Project Emergent Marsh AAHUs=	0.95	0.00	0.95	0.95	0.95	0.00	0.95	0.95	1.30	0.00	1.30	1.30
Net Change (FWP - FWOP)=	-0.94	0.00	-0.94	-0.94	-0.94	0.00	-0.94	-0.94	-1.29	0.00	-1.29	-1.29
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Change (FWP - FWOP)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-0.94	0.00	-0.94	-0.94	-0.94	0.00	-0.94	-0.94	-1.29	0.00	-1.29	-1.29
B. Open Water Habitat Net AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Benefits=	-0.64	0.00	-0.64	-0.64	-0.94	0.00	-0.94	-0.94	-0.87	0.00	-0.87	-0.87

INDIRECT IMPACTS

S2G I Indirect-1 and 2 Thru TY30 Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.37	0.00	0.36	0.37	0.37	0.00	0.36	0.37	0.34	0.00	0.34	0.34
B. Future Without Project Emergent Marsh AAHUs=	12.68	0.15	12.65	12.71	12.68	0.15	12.65	12.71	11.92	0.11	11.90	11.94
Net Change (FWP - FWOP)=	-12.31	0.15	-12.34	-12.28	-12.31	0.15	-12.34	-12.28	-11.58	0.11	-11.61	-11.56
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.08	0.00	0.08	0.08	0.08	0.00	0.08	0.08	0.06	0.00	0.06	0.06
B. Future Without Project Open Water AAHUs=	2.91	0.06	2.90	2.92	2.91	0.06	2.90	2.92	2.20	0.03	2.20	2.21
Net Change (FWP - FWOP)=	-2.83	0.06	-2.84	-2.82	-2.83	0.06	-2.84	-2.82	-2.14	0.03	-2.15	-2.14
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-12.31	0.15	-12.34	-12.28	-12.31	0.15	-12.34	-12.28	-11.58	0.11	-11.61	-11.56
B. Open Water Habitat Net AAHUs=	-2.83	0.06	-2.84	-2.82	-2.83	0.06	-2.84	-2.82	-2.14	0.03	-2.15	-2.14
Net Benefits=	-9.25	0.11	-9.27	-9.23	-15.14	0.16	-15.17	-15.11	-8.54	0.08	-8.55	-8.52

Sabine Pass to Galveston Bay Feasibility Study
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Intermediate Marsh

S2G I Indirect-3-Cow Bayou Fisheries Access	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	159.39	0.16	159.36	159.42	159.39	0.16	159.36	159.42	123.23	0.70	123.09	123.37
B. Future Without Project Emergent Marsh AAHUs=	165.09	0.15	165.06	165.12	165.09	0.15	165.06	165.12	127.03	0.69	126.89	127.17
Net Change (FWP - FWOP)=	-5.70	0.17	-5.73	-5.67	-5.70	0.17	-5.73	-5.67	-3.80	0.95	-3.99	-3.61
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	70.82	1.09	70.61	71.03	70.82	1.09	70.61	71.03	52.92	0.63	52.79	53.04
B. Future Without Project Open Water AAHUs=	74.48	1.03	74.28	74.68	74.48	1.03	74.28	74.68	55.35	0.59	55.23	55.46
Net Change (FWP - FWOP)=	-3.66	1.55	-3.96	-3.35	-3.66	1.55	-3.96	-3.35	-2.43	0.89	-2.60	-2.25
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-5.70	0.17	-5.73	-5.67	-5.70	0.17	-5.73	-5.67	-3.80	0.95	-3.99	-3.61
B. Open Water Habitat Net AAHUs=	-3.66	1.55	-3.96	-3.35	-3.66	1.55	-3.96	-3.35	-2.43	0.89	-2.60	-2.25
Net Benefits=	-5.04	0.50	-5.14	-4.94	-9.36	1.54	-9.66	-9.05	-3.36	0.71	-3.50	-3.22

S2G I Indirect-4-Adams Bayou Fisheries Access	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	33.04	0.10	33.02	33.06	33.04	0.10	33.02	33.06	26.91	0.16	26.88	26.94
B. Future Without Project Emergent Marsh AAHUs=	34.24	0.11	34.22	34.26	34.24	0.11	34.22	34.26	27.76	0.15	27.73	27.79
Net Change (FWP - FWOP)=	-1.20	0.11	-1.22	-1.18	-1.20	0.11	-1.22	-1.18	-0.85	0.20	-0.89	-0.81
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	11.41	0.18	11.37	11.44	11.41	0.18	11.37	11.44	8.51	0.10	8.49	8.53
B. Future Without Project Open Water AAHUs=	12.00	0.16	11.96	12.03	12.00	0.16	11.96	12.03	8.90	0.09	8.88	8.92
Net Change (FWP - FWOP)=	-0.59	0.25	-0.64	-0.54	-0.59	0.25	-0.64	-0.54	-0.39	0.15	-0.42	-0.36
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-1.20	0.11	-1.22	-1.18	-1.20	0.11	-1.22	-1.18	-0.85	0.20	-0.89	-0.81
B. Open Water Habitat Net AAHUs=	-0.59	0.25	-0.64	-0.54	-0.59	0.25	-0.64	-0.54	-0.39	0.15	-0.42	-0.36
Net Benefits=	-1.00	0.11	-1.02	-0.98	-1.79	0.28	-1.84	-1.73	-0.70	0.14	-0.73	-0.68

Direct Impact Subtotals	-1.41		-1.41	-1.41	-2.09		-2.09	-2.09	-1.92		-1.92	-1.92
Indirect Impact Subtotals	-15.30		-15.44	-15.16	-26.29		-26.67	-25.90	-12.60		-12.78	-12.42
Totals	**-16.71**		**-16.85**	**-16.57**	**-28.37**		**-28.76**	**-27.98**	**-14.52**		**-14.70**	**-14.34**

Sabine Pass to Galveston Bay Feasibility Study
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Brackish Marsh

DIRECT IMPACTS

S2G B-1 Direct Impacts Old River Cove	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.06	0.00	0.06	0.06	0.06	0.00	0.06	0.06	0.08	0.00	0.08	0.08
B. Future Without Project Emergent Marsh AAHUs=	4.01	0.03	4.00	4.01	4.01	0.03	4.00	4.01	5.21	0.02	5.21	5.21
Net Change (FWP - FWOP)=	-3.95	0.03	-3.96	-3.94	-3.95	0.03	-3.96	-3.94	-5.13	0.01	-5.14	-5.13
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.27	0.00	0.26	0.27	0.27	0.00	0.26	0.27	0.19	0.00	0.19	0.19
Net Change (FWP - FWOP)=	-0.26	0.00	-0.26	-0.26	-0.26	0.00	-0.26	-0.26	-0.19	0.00	-0.19	-0.19
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-3.95	0.03	-3.96	-3.94	-3.95	0.03	-3.96	-3.94	-5.13	0.01	-5.14	-5.13
B. Open Water Habitat Net AAHUs=	-0.26	0.00	-0.26	-0.26	-0.26	0.00	-0.26	-0.26	-0.19	0.00	-0.19	-0.19
Net Benefits=	-3.13	0.02	-3.14	-3.13	-4.21	0.03	-4.22	-4.21	-4.04	0.01	-4.04	-4.03

S2G B-2 Direct Impacts Cow Bayou	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.60	0.00	0.60	0.60	0.60	0.00	0.60	0.60	0.48	0.00	0.48	0.48
B. Future Without Project Emergent Marsh AAHUs=	43.77	0.02	43.76	43.77	43.77	0.02	43.76	43.77	35.06	0.12	35.03	35.08
Net Change (FWP - FWOP)=	-43.17	0.02	-43.17	-43.16	-43.17	0.02	-43.17	-43.16	-34.57	0.12	-34.59	-34.55
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.22	0.01	0.22	0.22	0.22	0.01	0.22	0.22	0.16	0.01	0.16	0.16
B. Future Without Project Open Water AAHUs=	16.44	0.10	16.42	16.46	16.44	0.10	16.42	16.46	11.81	0.09	11.79	11.83
Net Change (FWP - FWOP)=	-16.22	0.10	-16.24	-16.20	-16.22	0.10	-16.24	-16.20	-11.65	0.09	-11.67	-11.63
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-43.17	0.02	-43.17	-43.16	-43.17	0.02	-43.17	-43.16	-34.57	0.12	-34.59	-34.55
B. Open Water Habitat Net AAHUs=	-16.22	0.10	-16.24	-16.20	-16.22	0.10	-16.24	-16.20	-11.65	0.09	-11.67	-11.63
Net Benefits=	-37.18	0.03	-37.18	-37.17	-59.39	0.11	-59.41	-59.37	-29.48	0.09	-29.50	-29.46

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Brackish Marsh

S2G B-3 Direct Impacts Adams Bayou	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Emergent Marsh AAHUs=	0.14	0.02	0.14	0.15	0.14	0.02	0.14	0.15	0.20	0.02	0.20	0.21
Net Change (FWP - FWOP)=	-0.14	0.02	-0.15	-0.14	-0.14	0.02	-0.15	-0.14	-0.20	0.02	-0.20	-0.20
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Net Change (FWP - FWOP)=	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-0.14	0.02	-0.15	-0.14	-0.14	0.02	-0.15	-0.14	-0.20	0.02	-0.20	-0.20
B. Open Water Habitat Net AAHUs=	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Net Benefits=	-0.11	0.02	-0.11	-0.11	-0.14	0.03	-0.15	-0.14	-0.16	0.02	-0.16	-0.15

INDIRECT IMPACTS

S2G B Indirect-I 1 and2 Switch Brackish TY31 - Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Emergent Marsh AAHUs=	6.53	0.10	6.51	6.55	6.53	0.10	6.51	6.55	6.10	0.06	6.09	6.12
Net Change (FWP - FWOP)=	-6.53	0.10	-6.55	-6.51	-6.53	0.10	-6.55	-6.51	-6.10	0.06	-6.12	-6.09
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	1.81	0.03	1.80	1.81	1.81	0.03	1.80	1.81	1.35	0.02	1.34	1.35
Net Change (FWP - FWOP)=	-1.81	0.03	-1.81	-1.80	-1.81	0.03	-1.81	-1.80	-1.35	0.02	-1.35	-1.34
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-6.53	0.10	-6.55	-6.51	-6.53	0.10	-6.55	-6.51	-6.10	0.06	-6.12	-6.09
B. Open Water Habitat Net AAHUs=	-1.81	0.03	-1.81	-1.80	-1.81	0.03	-1.81	-1.80	-1.35	0.02	-1.35	-1.34
Net Benefits=	-5.48	0.08	-5.49	-5.46	-8.34	0.10	-8.36	-8.32	-5.05	0.05	-5.06	-5.04

Sabine Pass to Galveston Bay Feasibility Study
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Brackish Marsh

S2G B Indirect-2 Cow Bayou-Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.24	0.01	0.24	0.24	0.24	0.01	0.24	0.24	0.21	0.01	0.21	0.21
B. Future Without Project Emergent Marsh AAHUs=	16.88	0.09	16.87	16.90	16.88	0.09	16.87	16.90	14.49	0.07	14.47	14.50
Net Change (FWP - FWOP)=	-16.64	0.09	-16.66	-16.63	-16.64	0.09	-16.66	-16.63	-14.28	0.07	-14.30	-14.27
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.10	0.01	0.09	0.10	0.10	0.01	0.09	0.10	0.08	0.01	0.08	0.08
B. Future Without Project Open Water AAHUs=	6.91	0.02	6.91	6.92	6.91	0.02	6.91	6.92	5.80	0.04	5.79	5.81
Net Change (FWP - FWOP)=	-6.82	0.01	-6.82	-6.81	-6.82	0.01	-6.82	-6.81	-5.72	0.04	-5.73	-5.71
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-16.64	0.09	-16.66	-16.63	-16.64	0.09	-16.66	-16.63	-14.28	0.07	-14.30	-14.27
B. Open Water Habitat Net AAHUs=	-6.82	0.01	-6.82	-6.81	-6.82	0.01	-6.82	-6.81	-5.72	0.04	-5.73	-5.71
Net Benefits=	-14.46	0.07	-14.47	-14.45	-23.46	0.09	-23.48	-23.44	-12.38	0.06	-12.39	-12.37

S2G B Indirect-3 Persistent Marsh- Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.17	0.00	0.17	0.17	0.17	0.00	0.17	0.17	0.17	0.00	0.17	0.17
B. Future Without Project Emergent Marsh AAHUs=	11.77	0.13	11.74	11.79	11.77	0.13	11.74	11.79	11.79	0.07	11.77	11.80
Net Change (FWP - FWOP)=	-11.60	0.13	-11.63	-11.58	-11.60	0.13	-11.63	-11.58	-11.62	0.07	-11.63	-11.60
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.05	0.00	0.05	0.05	0.05	0.00	0.05	0.05	0.04	0.00	0.04	0.04
B. Future Without Project Open Water AAHUs=	3.35	0.01	3.35	3.35	3.35	0.01	3.35	3.35	2.81	0.02	2.81	2.82
Net Change (FWP - FWOP)=	-3.31	0.01	-3.31	-3.30	-3.31	0.01	-3.31	-3.30	-2.78	0.02	-2.78	-2.77
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-11.60	0.13	-11.63	-11.58	-11.60	0.13	-11.63	-11.58	-11.62	0.07	-11.63	-11.60
B. Open Water Habitat Net AAHUs=	-3.31	0.01	-3.31	-3.30	-3.31	0.01	-3.31	-3.30	-2.78	0.02	-2.78	-2.77
Net Benefits=	-9.76	0.10	-9.78	-9.74	-14.91	0.13	-14.93	-14.88	-9.65	0.06	-9.66	-9.64

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Brackish Marsh

S2G B Indirect-3 Marsh Migration-Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Emergent Marsh AAHUs=	12.67	0.16	12.64	12.70	12.67	0.16	12.64	12.70	9.53	0.12	9.51	9.56
Net Change (FWP - FWOP)=	-12.67	0.16	-12.70	-12.64	-12.67	0.16	-12.70	-12.64	-9.53	0.12	-9.56	-9.51
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.21	0.00	0.21	0.21	0.21	0.00	0.21	0.21	0.21	0.00	0.21	0.21
Net Change (FWP - FWOP)=	-0.21	0.00	-0.21	-0.21	-0.21	0.00	-0.21	-0.21	-0.21	0.00	-0.21	-0.21
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-12.67	0.16	-12.70	-12.64	-12.67	0.16	-12.70	-12.64	-9.53	0.12	-9.56	-9.51
B. Open Water Habitat Net AAHUs=	-0.21	0.00	-0.21	-0.21	-0.21	0.00	-0.21	-0.21	-0.21	0.00	-0.21	-0.21
Net Benefits=	-9.90	0.12	-9.92	-9.88	-12.88	0.16	-12.91	-12.85	-7.46	0.10	-7.48	-7.44

S2G B Indirect-4 Cow Bayou Fisheries Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	164.54	0.18	164.51	164.58	164.54	0.18	164.51	164.58	129.21	0.70	129.07	129.35
B. Future Without Project Emergent Marsh AAHUs=	174.07	0.16	174.04	174.10	174.07	0.16	174.04	174.10	135.85	0.67	135.72	135.99
Net Change (FWP - FWOP)=	-9.53	0.21	-9.57	-9.49	-9.53	0.21	-9.57	-9.49	-6.64	0.89	-6.82	-6.47
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	75.56	0.99	75.36	75.75	75.56	0.99	75.36	75.75	55.64	0.85	55.47	55.81
B. Future Without Project Open Water AAHUs=	83.07	0.99	82.88	83.27	83.07	0.99	82.88	83.27	60.53	0.85	60.36	60.70
Net Change (FWP - FWOP)=	-7.52	1.42	-7.80	-7.24	-7.52	1.42	-7.80	-7.24	-4.89	1.22	-5.13	-4.65
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-9.53	0.21	-9.57	-9.49	-9.53	0.21	-9.57	-9.49	-6.64	0.89	-6.82	-6.47
B. Open Water Habitat Net AAHUs=	-7.52	1.42	-7.80	-7.24	-7.52	1.42	-7.80	-7.24	-4.89	1.22	-5.13	-4.65
Net Benefits=	-9.08	0.35	-9.15	-9.01	-17.05	1.43	-17.33	-16.77	-6.25	0.78	-6.41	-6.10

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Impacts Sensitivity Analysis
Brackish Marsh

S2G B Indirect-5 Adams Bayou Fishery Access Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	499.17	3.69	498.44	499.89	499.17	3.69	498.44	499.89	478.19	2.14	477.77	478.61
B. Future Without Project Emergent Marsh AAHUs=	527.83	3.72	527.10	528.56	527.83	3.72	527.10	528.56	503.45	2.17	503.03	503.88
Net Change (FWP - FWOP)=	-28.67	5.00	-29.65	-27.69	-28.67	5.00	-29.65	-27.69	-25.27	2.93	-25.84	-24.69
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	118.10	1.10	117.88	118.31	118.10	1.10	117.88	118.31	88.39	0.94	88.21	88.58
B. Future Without Project Open Water AAHUs=	129.49	1.10	129.28	129.71	129.49	1.10	129.28	129.71	95.88	0.94	95.70	96.07
Net Change (FWP - FWOP)=	-11.40	1.61	-11.71	-11.08	-11.40	1.61	-11.71	-11.08	-7.49	1.38	-7.76	-7.22
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-28.67	5.00	-29.65	-27.69	-28.67	5.00	-29.65	-27.69	-25.27	2.93	-25.84	-24.69
B. Open Water Habitat Net AAHUs=	-11.40	1.61	-11.71	-11.08	-11.40	1.61	-11.71	-11.08	-7.49	1.38	-7.76	-7.22
Net Benefits=	-24.83	3.90	-25.59	-24.06	-40.06	5.24	-41.09	-39.04	-21.32	2.31	-21.77	-20.86

S2G B Indirect-S-2 Switch TY31-Hydrologic Impacts	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
B. Future Without Project Emergent Marsh AAHUs=	0.67	0.03	0.66	0.67	0.67	0.03	0.66	0.67	0.74	0.02	0.74	0.74
Net Change (FWP - FWOP)=	-0.67	0.02	-0.67	-0.66	-0.67	0.02	-0.67	-0.66	-0.74	0.01	-0.74	-0.74
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
B. Future Without Project Open Water AAHUs=	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
Net Change (FWP - FWOP)=	-0.01	0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	-0.67	0.02	-0.67	-0.66	-0.67	0.02	-0.67	-0.66	-0.74	0.01	-0.74	-0.74
B. Open Water Habitat Net AAHUs=	-0.01	0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01
Net Benefits=	-0.52	0.02	-0.53	-0.52	-0.68	0.03	-0.69	-0.68	-0.58	0.01	-0.58	-0.58

IMPACT SUMMARY

Direct Impact Subtotals	-40.42		-40.43	-40.41	-63.75		-63.78	-63.71	-33.67		-33.69	-33.65
Indirect Impact Subtotals	-74.03		-74.94	-73.12	-117.37		-118.78	-115.97	-62.69		-63.34	-62.03
Totals	**-114.45**		**-115.37**	**-113.53**	**-181.12**		**-182.56**	**-179.68**	**-96.35**		**-97.04**	**-95.67**

ATTACHMENT 2
WVA MARSH MITIGATION SENSITIVITY RESULTS

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Mitigation Sensitivity Analysis

Fresh Marsh Mitigation Areas

Mit 42 Scale 1	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	47.96	0.24	47.91	48.01	47.96	0.24	47.91	48.01	45.21	0.16	45.18	45.25
B. Future Without Project Emergent Marsh AAHUs=	28.78	0.19	28.75	28.82	28.78	0.19	28.75	28.82	19.79	0.10	19.77	19.81
Net Change (FWP - FWOP)=	19.17	0.32	19.11	19.24	19.17	0.32	19.11	19.24	25.42	0.19	25.39	25.46
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	8.47	0.06	8.46	8.48	8.47	0.06	8.46	8.48	7.24	0.04	7.23	7.25
B. Future Without Project Open Water AAHUs=	17.70	0.10	17.68	17.72	17.70	0.10	17.68	17.72	15.34	0.06	15.33	15.36
Net Change (FWP - FWOP)=	-9.23	0.12	-9.26	-9.21	-9.23	0.12	-9.26	-9.21	-8.10	0.07	-8.12	-8.09
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	19.17	0.32	19.11	19.24	19.17	0.32	19.11	19.24	25.42	0.19	25.39	25.46
B. Open Water Habitat Net AAHUs=	-9.23	0.12	-9.26	-9.21	-9.23	0.12	-9.26	-9.21	-8.10	0.07	-8.12	-8.09
Net Benefits=	10.01	0.22	9.97	10.05	9.94	0.34	9.87	10.01	14.61	0.13	14.58	14.63

Mit 42 Scale 2	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	85.63	0.41	85.55	85.70	85.63	0.41	85.55	85.70	75.87	0.29	75.81	75.93
B. Future Without Project Emergent Marsh AAHUs=	30.82	0.09	30.81	30.84	30.82	0.09	30.81	30.84	22.41	0.05	22.40	22.42
Net Change (FWP - FWOP)=	54.80	0.42	54.72	54.88	54.80	0.42	54.72	54.88	53.46	0.29	53.40	53.52
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	19.22	0.14	19.19	19.25	19.22	0.14	19.19	19.25	16.42	0.08	16.40	16.43
B. Future Without Project Open Water AAHUs=	39.74	0.23	39.70	39.79	39.74	0.23	39.70	39.79	34.33	0.13	34.31	34.36
Net Change (FWP - FWOP)=	-20.52	0.28	-20.58	-20.47	-20.52	0.28	-20.58	-20.47	-17.92	0.16	-17.95	-17.89
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	54.80	0.42	54.72	54.88	54.80	0.42	54.72	54.88	53.46	0.29	53.40	53.52
B. Open Water Habitat Net AAHUs=	-20.52	0.28	-20.58	-20.47	-20.52	0.28	-20.58	-20.47	-17.92	0.16	-17.95	-17.89
Net Benefits=	30.50	0.30	30.45	30.56	34.28	0.51	34.18	34.38	30.43	0.21	30.39	30.47

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Mitigation Sensitivity Analysis

Mit 52	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	148.94	0.77	148.79	149.09	148.94	0.77	148.79	149.09	161.43	0.51	161.33	161.53
B. Future Without Project Emergent Marsh AAHUs=	132.12	0.21	132.08	132.17	132.12	0.21	132.08	132.17	106.74	0.40	106.66	106.81
Net Change (FWP - FWOP)=	16.82	0.78	16.66	16.97	16.82	0.78	16.66	16.97	54.70	0.60	54.58	54.81
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	13.95	0.12	13.92	13.97	13.95	0.12	13.92	13.97	11.96	0.07	11.95	11.97
B. Future Without Project Open Water AAHUs=	27.16	0.20	27.12	27.20	27.16	0.20	27.12	27.20	23.41	0.13	23.39	23.44
Net Change (FWP - FWOP)=	-13.22	0.23	-13.26	-13.17	-13.22	0.23	-13.26	-13.17	-11.45	0.14	-11.48	-11.42
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	16.82	0.78	16.66	16.97	16.82	0.78	16.66	16.97	54.70	0.60	54.58	54.81
B. Open Water Habitat Net AAHUs=	-13.22	0.23	-13.26	-13.17	-13.22	0.23	-13.26	-13.17	-11.45	0.14	-11.48	-11.42
Net Benefits=	7.13	0.53	7.03	7.23	3.60	0.79	3.45	3.75	33.36	0.41	33.28	33.44

Intermediate Marsh

Mit 31	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	251.42	1.33	251.16	251.68	251.42	1.33	251.16	251.68	258.86	0.88	258.69	259.03
B. Future Without Project Emergent Marsh AAHUs=	205.67	0.01	205.67	205.67	205.67	0.01	205.67	205.67	151.36	0.66	151.23	151.49
Net Change (FWP - FWOP)=	45.75	1.33	45.49	46.01	45.75	1.33	45.49	46.01	107.50	1.07	107.29	107.71
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	42.94	0.67	42.81	43.08	42.94	0.67	42.81	43.08	33.39	0.38	33.31	33.46
B. Future Without Project Open Water AAHUs=	92.03	1.30	91.78	92.29	92.03	1.30	91.78	92.29	71.87	0.74	71.73	72.01
Net Change (FWP - FWOP)=	-49.09	1.50	-49.38	-48.79	-49.09	1.50	-49.38	-48.79	-38.48	0.85	-38.65	-38.32
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	45.75	1.33	45.49	46.01	45.75	1.33	45.49	46.01	107.50	1.07	107.29	107.71
B. Open Water Habitat Net AAHUs=	-49.09	1.50	-49.38	-48.79	-49.09	1.50	-49.38	-48.79	-38.48	0.85	-38.65	-38.32
Net Benefits=	15.16	1.02	14.96	15.36	-3.34	2.00	-3.73	-2.95	60.41	0.77	60.26	60.56

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Mitigation Sensitivity Analysis

Mit 32	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	46.04	0.04	46.04	46.05	46.04	0.04	46.04	46.05	36.12	0.17	36.08	36.15
B. Future Without Project Emergent Marsh AAHUs=	0.89	0.02	0.89	0.89	0.89	0.02	0.89	0.89	1.07	0.01	1.07	1.07
Net Change (FWP - FWOP)=	45.15	0.05	45.14	45.16	45.15	0.05	45.14	45.16	35.05	0.17	35.01	35.08
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	22.13	0.36	22.06	22.20	22.13	0.36	22.06	22.20	17.16	0.21	17.12	17.20
B. Future Without Project Open Water AAHUs=	21.41	0.15	21.38	21.44	21.41	0.15	21.38	21.44	20.31	0.08	20.29	20.32
Net Change (FWP - FWOP)=	0.72	0.40	0.64	0.80	0.72	0.40	0.64	0.80	-3.15	0.23	-3.20	-3.11
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	45.15	0.05	45.14	45.16	45.15	0.05	45.14	45.16	35.05	0.17	35.01	35.08
B. Open Water Habitat Net AAHUs=	0.72	0.40	0.64	0.80	0.72	0.40	0.64	0.80	-3.15	0.23	-3.20	-3.11
Net Benefits=	30.82	0.13	30.80	30.85	45.88	0.40	45.80	45.96	22.72	0.14	22.70	22.75

Mit 143	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	165.87	0.31	165.81	165.93	165.87	0.31	165.81	165.93	132.44	0.62	132.32	132.56
B. Future Without Project Emergent Marsh AAHUs=	7.08	0.05	7.07	7.08	7.08	0.05	7.07	7.08	7.20	0.03	7.19	7.20
Net Change (FWP - FWOP)=	158.80	0.31	158.74	158.86	158.80	0.31	158.74	158.86	125.24	0.61	125.12	125.36
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	80.77	2.09	80.36	81.18	80.77	2.09	80.36	81.18	61.08	1.25	60.84	61.33
B. Future Without Project Open Water AAHUs=	121.24	3.40	120.57	121.90	121.24	3.40	120.57	121.90	89.75	1.93	89.38	90.13
Net Change (FWP - FWOP)=	-40.47	4.14	-41.28	-39.66	-40.47	4.14	-41.28	-39.66	-28.67	2.39	-29.14	-28.20
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	158.80	0.31	158.74	158.86	158.80	0.31	158.74	158.86	125.24	0.61	125.12	125.36
B. Open Water Habitat Net AAHUs=	-40.47	4.14	-41.28	-39.66	-40.47	4.14	-41.28	-39.66	-28.67	2.39	-29.14	-28.20
Net Benefits=	94.52	1.37	94.25	94.79	118.33	4.18	117.51	119.15	75.59	0.89	75.42	75.77

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Mitigation Sensitivity Analysis

Brackish Marsh

Mit 27	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	142.55	0.87	142.38	142.72	142.55	0.87	142.38	142.72	139.66	0.47	139.57	139.76
B. Future Without Project Emergent Marsh AAHUs=	108.64	0.19	108.60	108.68	108.64	0.19	108.60	108.68	77.24	0.35	77.17	77.30
Net Change (FWP - FWOP)=	33.91	0.91	33.74	34.09	33.91	0.91	33.74	34.09	62.43	0.57	62.32	62.54
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	44.77	0.20	44.73	44.81	44.77	0.20	44.73	44.81	35.49	0.38	35.41	35.56
B. Future Without Project Open Water AAHUs=	94.11	0.51	94.01	94.21	94.11	0.51	94.01	94.21	72.88	0.75	72.74	73.03
Net Change (FWP - FWOP)=	-49.34	0.58	-49.45	-49.23	-49.34	0.58	-49.45	-49.23	-37.39	0.86	-37.56	-37.23
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	33.91	0.91	33.74	34.09	33.91	0.91	33.74	34.09	62.43	0.57	62.32	62.54
B. Open Water Habitat Net AAHUs=	-49.34	0.58	-49.45	-49.23	-49.34	0.58	-49.45	-49.23	-37.39	0.86	-37.56	-37.23
Net Benefits=	15.41	0.74	15.27	15.56	-15.43	1.16	-15.65	-15.20	40.24	0.47	40.15	40.34

Mit 28	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	264.97	1.72	264.64	265.31	264.97	1.72	264.64	265.31	281.12	0.89	280.94	281.29
B. Future Without Project Emergent Marsh AAHUs=	243.71	0.09	243.69	243.73	243.71	0.09	243.69	243.73	191.34	0.74	191.19	191.48
Net Change (FWP - FWOP)=	21.26	1.72	20.93	21.60	21.26	1.72	20.93	21.60	89.78	1.13	89.56	90.00
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	61.48	0.30	61.43	61.54	61.48	0.30	61.43	61.54	48.47	0.52	48.37	48.57
B. Future Without Project Open Water AAHUs=	128.20	0.70	128.06	128.34	128.20	0.70	128.06	128.34	99.28	1.02	99.08	99.48
Net Change (FWP - FWOP)=	-66.72	0.80	-66.87	-66.56	-66.72	0.80	-66.87	-66.56	-50.81	1.18	-51.04	-50.58
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	21.26	1.72	20.93	21.60	21.26	1.72	20.93	21.60	89.78	1.13	89.56	90.00
B. Open Water Habitat Net AAHUs=	-66.72	0.80	-66.87	-66.56	-66.72	0.80	-66.87	-66.56	-50.81	1.18	-51.04	-50.58
Net Benefits=	1.71	1.38	1.44	1.98	-45.45	2.03	-45.85	-45.06	58.54	0.91	58.36	58.72

Sabine Pass to Galveston Bay Feasibility Study
WVA Marsh Mitigation Sensitivity Analysis

Mit 29	Version 2.0				Version 2.0B				Version 1.0			
Marsh	Mean	SD	95% C.I.		Mean	SD	95% C.I.		Mean	SD	95% C.I.	
NET CHANGE IN AAHUs DUE TO PROJECT			Lower	Upper			Lower	Upper			Lower	Upper
A. Future With Project Emergent Marsh AAHUs=	107.64	0.60	107.52	107.76	107.64	0.60	107.52	107.76	98.99	0.34	98.92	99.06
B. Future Without Project Emergent Marsh AAHUs=	59.08	0.38	59.01	59.16	59.08	0.38	59.01	59.16	40.90	0.22	40.86	40.94
Net Change (FWP - FWOP)=	48.56	0.74	48.42	48.70	48.56	0.74	48.42	48.70	58.09	0.40	58.01	58.17
Open Water												
NET CHANGE IN AAHUs DUE TO PROJECT												
A. Future With Project Open Water AAHUs=	38.82	0.19	38.78	38.86	38.82	0.19	38.78	38.86	30.63	0.31	30.57	30.69
B. Future Without Project Open Water AAHUs=	63.40	0.49	63.31	63.50	63.40	0.49	63.31	63.50	45.26	0.42	45.18	45.35
Net Change (FWP - FWOP)=	-24.58	0.53	-24.68	-24.47	-24.58	0.53	-24.68	-24.47	-14.63	0.54	-14.74	-14.53
Total												
TOTAL BENEFITS IN AAHUs DUE TO PROJECT												
A. Emergent Marsh Habitat Net AAHUs=	48.56	0.74	48.42	48.70	48.56	0.74	48.42	48.70	58.09	0.40	58.01	58.17
B. Open Water Habitat Net AAHUs=	-24.58	0.53	-24.68	-24.47	-24.58	0.53	-24.68	-24.47	-14.63	0.54	-14.74	-14.53
Net Benefits=	32.31	0.59	32.19	32.42	23.98	0.91	23.80	24.16	41.93	0.33	41.87	41.99

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix R

STUDY AREA DEMOGRAPHICS

May 2017

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1 STUDY AREA DEMOGRAPHICS

The socioeconomic characteristics of the study area are important to understand in the process of alternative formulation and making choices among the alternatives. This section provides data that describe the socioeconomic makeup of the study area and surrounding county.

1.1 RACE AND ETHNICITY

Table 1 breaks down the total population, as well as the racial and ethnic makeup, for Brazoria, Jefferson, and Orange counties and the study areas within each of these counties for the years 2000 and 2010.

Table 1. County and Study Area Racial Composition

	Brazoria County				Study Area			
	2000		2010		2000		2010	
Population	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	241,767	100%	313,166	100%	24,195	100%	46,208	100%
Male	124,837	51.6%	159,000	50.8%	12,382	51.2%	23,733	51.4%
Female	116,930	48.4%	154,166	49.2%	11,813	48.8%	22,475	48.6%
White*	131,320	54.3%	166,674	53.2%	11,442	47.3%	28,203	61.0%
Hispanic	55,063	22.8%	86,643	27.7%	7,393	30.6%	12,415	26.9%
Black	20,540	8.5%	36,880	11.8%	1,465	6.1%	3,589	7.8%
Asian	4,842	2.0%	17,013	5.4%	88	0.4%	514	1.1%
Am. Indian	1,280	0.5%	1,013	0.3%	137	0.6%	314	0.7%
Hawaiian, PI	73	0.0%	105	0.0%	5	0.0%	7	0.0%
Other	28,649	11.8%	4,838	1.5%	3,665	15.1%	1,166	2.5%
*White, Not Hispanic								
	Jefferson County				Study Area			
	2000		2010		2000		2010	
Population	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	252,051	100%	252,273	100%	41,486	100%	40,576	100%
Male	126,689	50.3%	128,946	51.1%	26,285	63.4%	24,435	60.2%
Female	125,362	49.7%	123,327	48.9%	15,201	36.6%	16,141	39.8%
White	117,738	46.7%	112,503	44.6%	18,524	44.7%	18,136	44.7%
Hispanic	26,536	10.5%	42,899	17.0%	6,078	14.7%	7,069	17.4%
Black	85,046	33.7%	84,500	33.5%	13,278	32.0%	13,394	33.0%
Asian	7,274	2.9%	8,525	3.4%	1,204	2.9%	975	2.4%
Am. Indian	857	0.3%	747	0.3%	205	0.5%	207	0.5%
Other	14,600	5.8%	3,099	1.2%	2,197	5.3%	795	2.0%

Table 1, continued

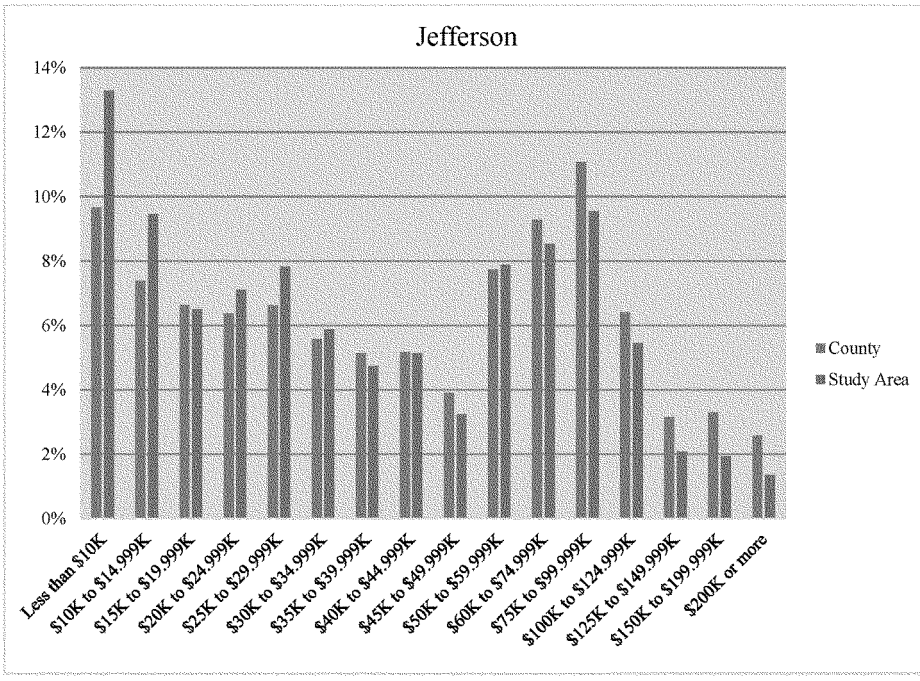
	Orange County				Study Area			
	2000		2010		2000		2010	
Population	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total	84,966	100%	81,837	100%	46,684	100%	45,195	100%
Male	41,696	49.1%	40,708	49.7%	22,944	49.1%	22,488	49.8%
Female	43,270	50.9%	41,129	50.3%	23,740	50.9%	22,707	50.2%
White	71,676	84.4%	67,895	83.0%	37,699	80.8%	35,770	79.1%
Hispanic	3,073	3.6%	4,766	5.8%	1,802	3.9%	2,700	6.0%
Black	7,124	8.4%	6,922	8.5%	5,292	11.3%	5,110	11.3%
Asian	664	0.8%	797	1.0%	479	1.0%	514	1.1%
Am. Indian	473	0.6%	340	0.4%	259	0.6%	224	0.5%
Other	1,956	2.3%	1,117	1.4%	1,153	2.5%	877	1.9%

Source: U.S. Bureau of the Census, 2010

Brazoria County's population increased by almost 30 percent between 2000 and 2010. Jefferson County increased by only 0.1 percent while Orange decreased almost four percent for the same period. The study area in Brazoria County, by contrast, increased by almost 91 percent from 2000 to 2010. The study area in Jefferson County decreased by 2.2 percent, while the study area in Orange County decreased by 3.2 percent. The study areas in the three counties represented 19.4 percent of the total population of the three counties in the year 2000 and around 20 percent in 2010. Minority population comprised 45.7 percent of the population for Brazoria County in 2000 and 46.8 percent in 2010. Minorities made up 53.3 percent of the population in Jefferson County in 2000 and 55.4 percent in 2010. Minorities made up 15.6 percent of the population in Orange County in 2000 and 17 percent in 2010. The study area minority population in Brazoria County was almost 53 percent in 2000 but decreased to 39 percent in 2010. The minority population in the study area of Jefferson County was 53.3 percent in both 2000 and 2010, while the minority population for the study area in Orange County was 19.2 percent in 2000 and 20.9 in 2010.

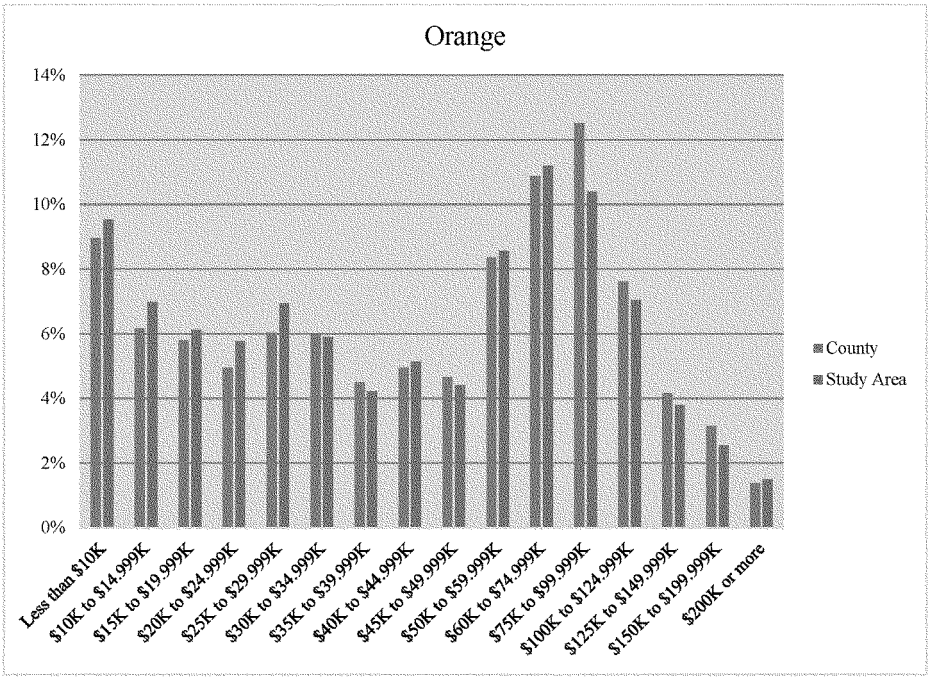
1.2 INCOME

On the next page, Figures 1, 2, and 3 illustrate the income distribution based on household income for the three counties, as well as the study areas within the three counties in 2010. As the charts illustrate, the distribution of income of the Counties as a whole are similar to the income distribution of the study areas within the three counties. Brazoria has relatively higher percentages of households with incomes ranging from $50K up to $125K. Jefferson has more relatively low levels of income but incomes increase between the levels of $50K to $125K. Orange County, like the other two counties, has relatively substantial high percentages of incomes between $50K up to $125K, but also has nearly 10 percent of its population that have household incomes of less than $10K.



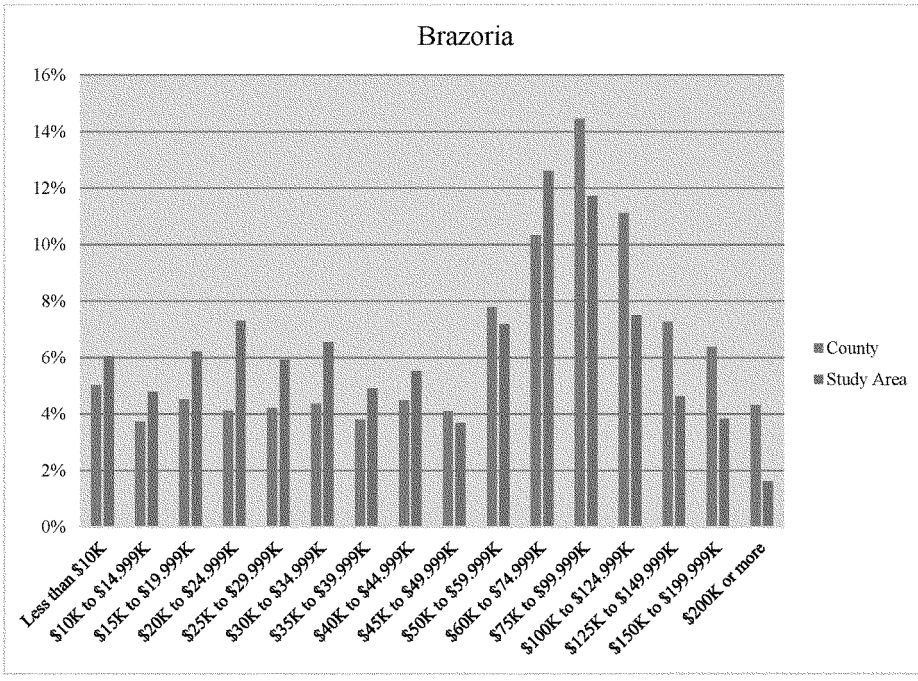
Source: U.S. Bureau of the Census, 2010

Figure 1. 2010 Income Distribution for Jefferson County



Source: U.S. Bureau of the Census, 2010

Figure 2. 2010 Income Distribution for Orange County



Source: U.S. Bureau of the Census, 2010

Figure 3. 2010 Income Distribution for Brazoria County

As the charts illustrate, the distribution of income of the study areas of each county is similar to that of the counties as a whole. All have relatively higher percentages of households with incomes in the range of $50K to $125K, with the exception of Orange, which has fairly large segment of the population with incomes below $10K.

Table 2 displays the number of households, aggregate household income, and average household income for counties and the study areas in 2010.

Table 2. 2010 Household Income

Household Characteristic	Brazoria County	Study Area
Total Households	101,656	15,398
Aggregate Income	$8,131,315,866	$941,129,375
Average Income	$79,989	$61,120
	Jefferson County	**Study Area**
Total Households	90,671	16,833
Aggregate Income	$5,316,131,170	$814,135,843
Average Income	$58,631	$48,365
	Orange County	**Study Area**
Total Households	31,271	21,553
Aggregate Income	$1,868,247,406	$1,235,127,500
Average Income	$59,744	$57,307

Source: U.S. Bureau of the Census, 2010

While the pattern of the income distribution between the study areas within the counties and the income distribution of the counties as a whole is similar, slightly higher percentages of households in the study areas have lower incomes than those of the entire counties. This is evident when examining the average household income for the study areas and the counties. Average household income for the study area in Brazoria County is approximately 76 percent of the average income for the entire county. In Jefferson County, the study area household income is approximately 82.5 percent of the county, while the study area in Orange County is 96 percent of the household income of the entire county. The study area in Jefferson County also has the lowest average household income of the three counties.

Table 3 describes the poverty status for the three counties and the study areas within the three counties. Brazoria and Orange counties have relatively low poverty levels, while Jefferson County

has a higher percentage of its population below the poverty level; 23.4 percent for the study area and 18.8 percent for the entire county.

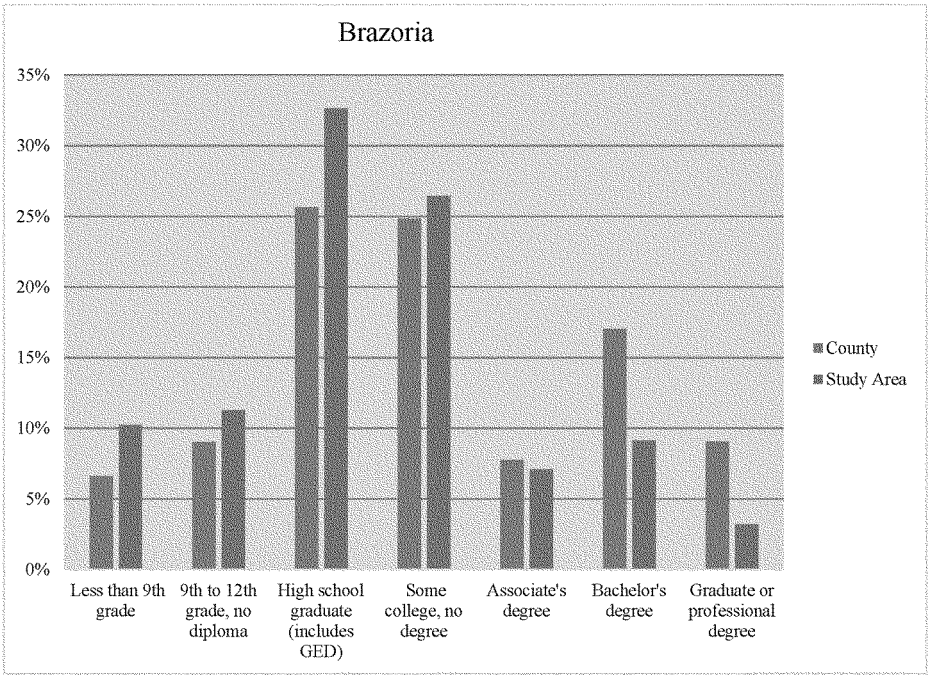
Table 3. Poverty Status

Population Characteristic	Brazoria County	Study Area
Total for Poverty Determination	287,910	42,357
Total Above Poverty Level	257,324	36,265
Total Below Poverty Level	30,586	6,092
Percent Above Poverty Level	89.4%	85.6%
Percent Below Poverty Level	10.6%	14.4%
	Jefferson County	**Study Area**
Total for Poverty Determination	233,086	44,806
Total Above Poverty Level	189,366	34,300
Total Below Poverty Level	43,720	10,506
Percent Above Poverty Level	81.2%	76.6%
Percent Below Poverty Level	18.8%	23.4%
	Orange County	**Study Area**
Total for Poverty Determination	80,925	54,734
Total Above Poverty Level	69,694	46,450
Total Below Poverty Level	11,231	8,284
Percent Above Poverty Level	86.1%	84.9%
Percent Below Poverty Level	13.9%	15.1%

Source: U.S. Bureau of the Census, 2010

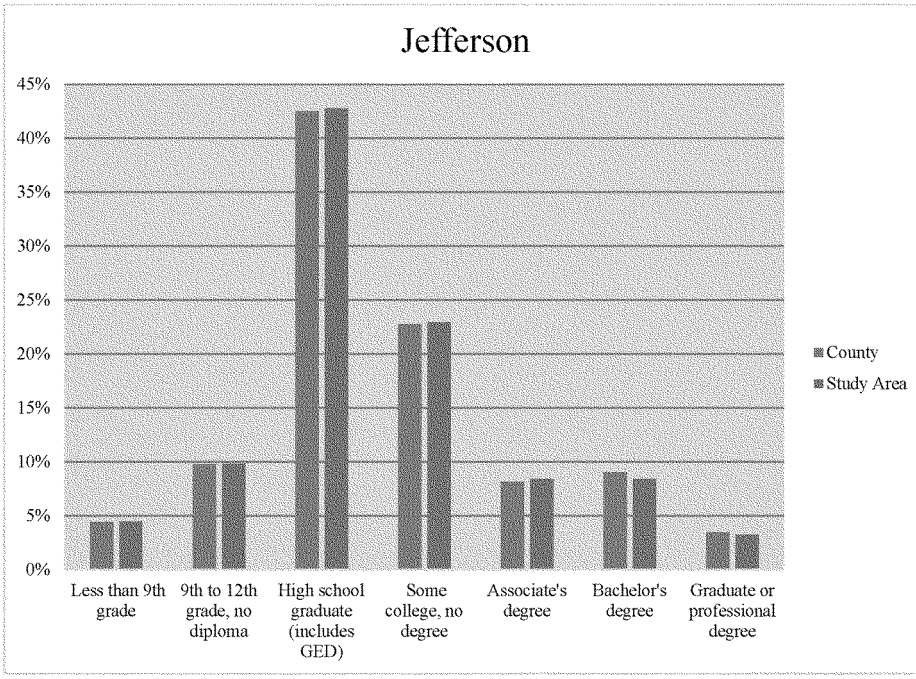
1.3 EDUCATION

Figures 4, 5, and 6 depict educational attainment for Brazoria, Jefferson, and Orange counties, as well as the study areas within those counties for 2010. The study area in Brazoria County has higher percentages of lower levels of educational attainment than the county as a whole. Educational attainment for the study area in Jefferson County closely mirrors that of the county. Orange County exhibits a pattern similar to that of Brazoria County.



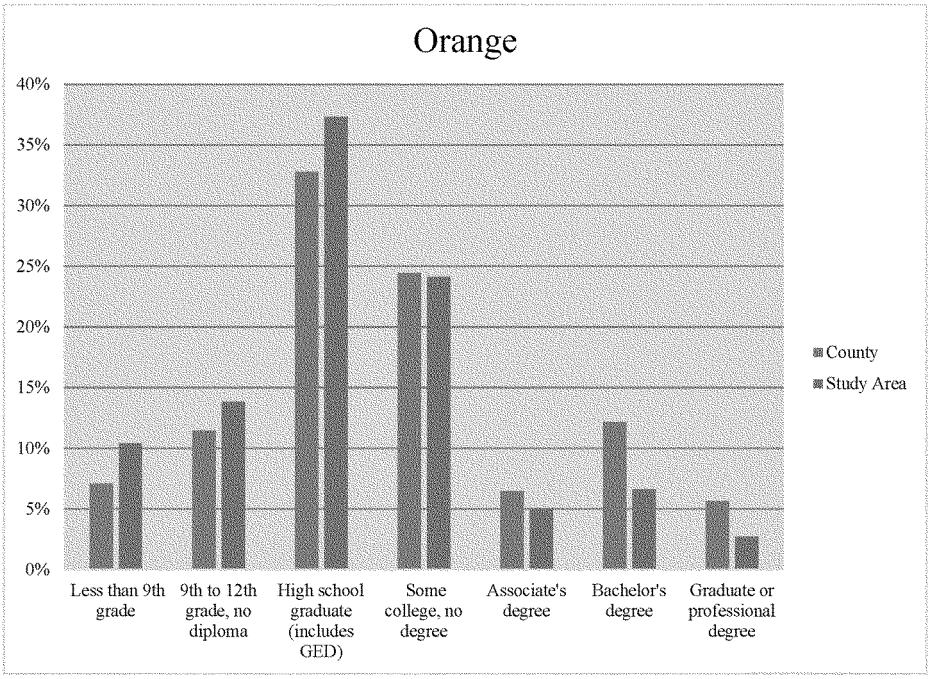
Source: U.S. Bureau of the Census, 2010

Figure 4. Educational Attainment for Brazoria County and Study Area



Source: U.S. Bureau of the Census, 2010

Figure 5. Educational Attainment for Jefferson County and Study Area



Source: U.S. Bureau of the Census, 2010

Figure 6. Educational Attainment for Orange County and Study Area

1.4 EMPLOYMENT

Table 4 displays the unemployment rates for Brazoria, Jefferson, and Orange counties, as well as the study areas within those counties for 2010. Unemployment rates are lowest for Brazoria County but highest for Jefferson County, both for the study area and the entire county.

Table 4. County and Study Area Unemployment Rates

Labor Force Characteristic	Brazoria County	Study Area
Total Civilian Labor Force	147,009	20,310
Employed	138,962	19,002
Unemployed	8,047	1,308
Unemployment Rate	5.5%	6.4%
	Jefferson County	Study Area
Total Civilian Labor Force	113,225	19,471
Employed	103,135	17,552
Unemployed	10,090	1,919
Unemployment Rate	8.9%	9.9%
	Orange County	Study Area
Total Civilian Labor Force	36,743	24,998
Employed	34,012	23,074
Unemployed	2,731	1,924
Unemployment Rate	7.4%	7.7%

Source: U.S. Bureau of the Census, 2010

1.5 HOUSING

Table 5 describes the occupancy status, vacancy rates, and the percentages of home ownership and rentals for Brazoria, Jefferson, and Orange counties, as well as the study areas within those counties, for 2010. Vacancy rates for all three of the study areas within the three counties are higher than the vacancy rates for the three counties as a whole, with Brazoria County being the highest at 20.7 percent. Vacancy rates for the three counties range from 9.9 percent in Brazoria County to 12.1 percent in Orange County. Home ownership is highest in Orange County with a rate of 76.7 percent, and lowest in Jefferson County with rate of 63.2 percent. However, among the study areas, home ownership was lowest in Brazoria County with a rate of 66.7 percent.

Table 5. County and Study Area Housing Statistics

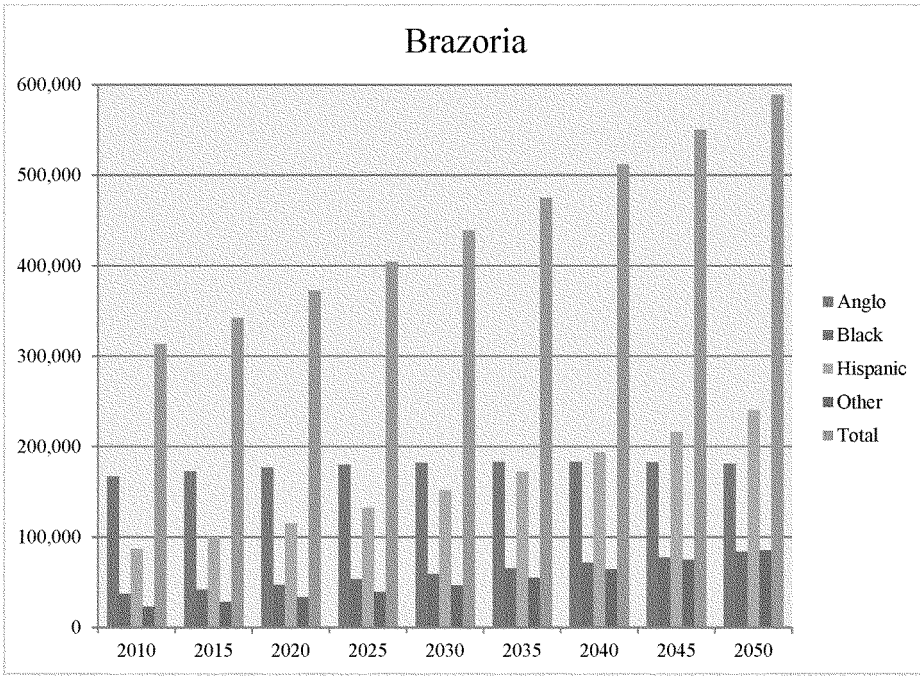
Housing Characteristic	Brazoria County	Study Area
Total Units	118,336	19,952
Occupied Units	106,589	15,816
Vacant Units	11,747	4,136
Owner Occupied	79,477	10,557
Renter Occupied	27,112	5,259
Owner Occupied (Percent of Total Occupied)	74.6%	66.7%
Renter Occupied (Percent of Total Occupied)	25.4%	33.3%
Vacancy Rate	9.9%	20.7%
	Jefferson County	Study Area
Total Units	104,424	19,833
Occupied Units	93,441	16,998
Vacant Units	10,983	2,835
Owner Occupied	59,066	11,407
Renter Occupied	34,375	5,591
Owner Occupied (Percent of Total Occupied)	63.2%	67.1%
Renter Occupied (Percent of Total Occupied)	36.8%	32.9%
Vacancy Rate	10.5%	14.3%
	Orange County	Study Area
Total Units	35,313	24,747
Occupied Units	31,031	21,303
Vacant Units	4,282	3,444
Owner Occupied	23,808	15,694
Renter Occupied	7,223	5,609
Owner Occupied (Percent of Total Occupied)	76.7%	73.7%
Renter Occupied (Percent of Total Occupied)	23.3%	26.3%
Vacancy Rate	12.1%	13.9%

Source: U.S. Bureau of the Census, 2010

1.6 POPULATION PROJECTIONS

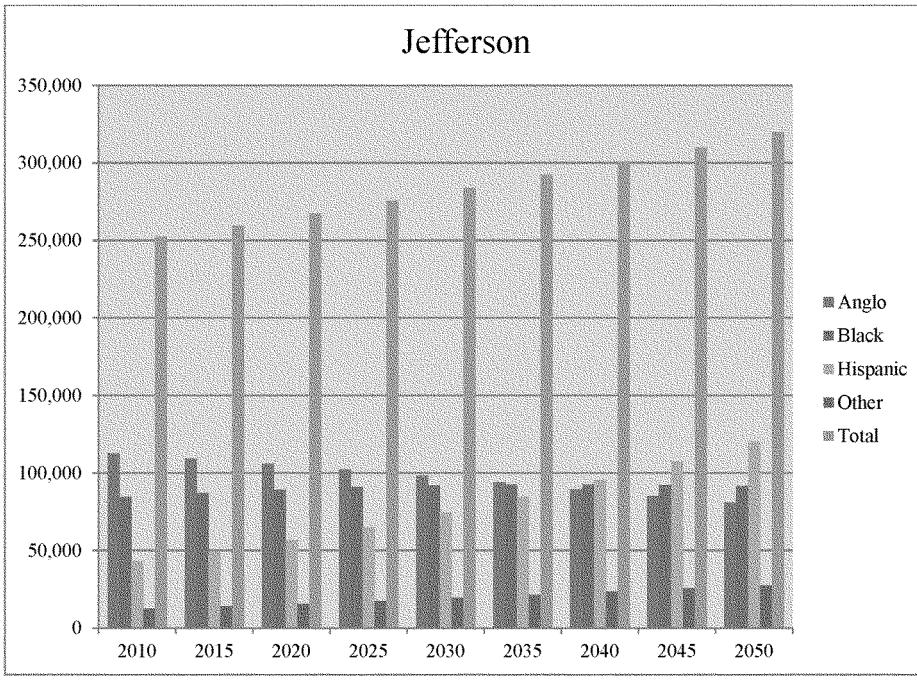
The following population projections for Brazoria, Jefferson, and Orange counties come from the Texas State Data Center and reflect the projections based on its 2000–2010 migration scenario, which takes into account post-2000 population trends for age, sex, race, and ethnicity. Based on these projections, the total population for Brazoria, Jefferson, and Orange counties is expected to grow by 88, 27, and 18 percent, respectively, between 2010 and 2050. This compares with a

growth rate for the State of Texas of 61 percent for the same period under the same scenario. For Brazoria County, virtually all of the growth is through the non-white population. Growth in Jefferson and Orange counties is dependent on the Hispanic populations, which are projected to increase by 180 percent in Jefferson County and 211 percent in Orange County by 2050, and by Other populations. Alternately, Anglo populations will actually decrease in Jefferson County by 28 percent and just under 2 percent in Orange County. Black populations will stay fairly steady in Jefferson County and increase moderately in Orange County. Figures 7, 8, and 9 reflect the population growth of the three counties themselves, and Figure 10 and the growth rates of the State and the counties in comparison.



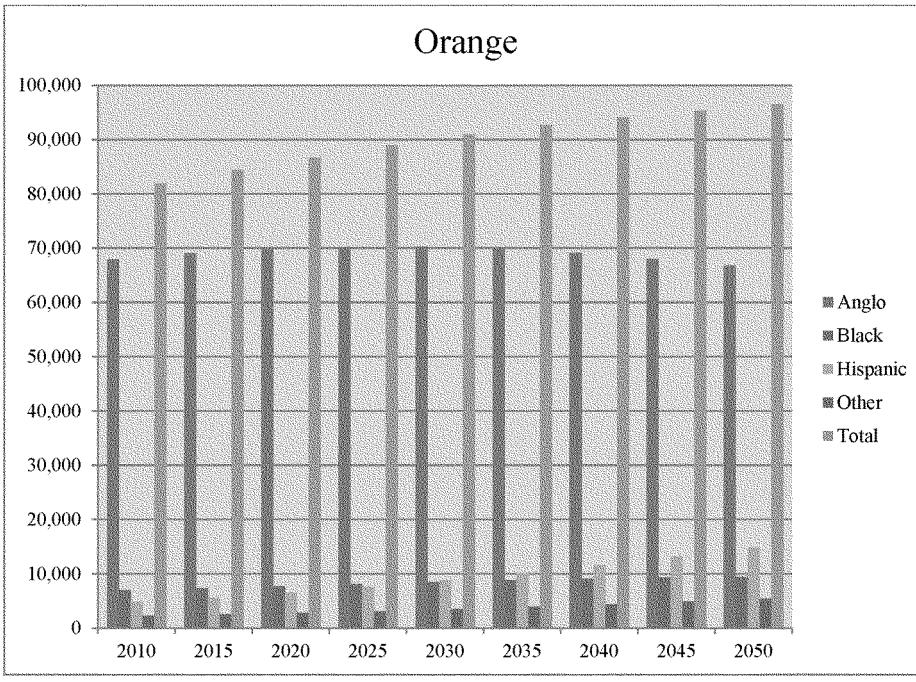
Source: Texas State Data Center

Figure 7. Brazoria County Population Growth by Race



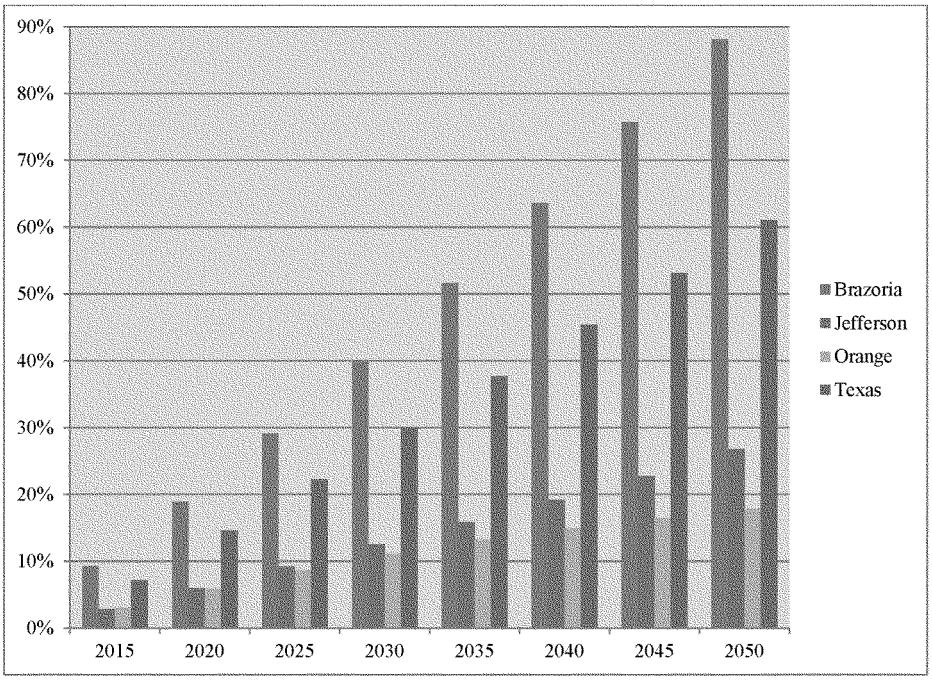
Source: Texas State Data Center

Figure 8. Jefferson County Population Growth by Race



Source: Texas State Data Center

Figure 9. Orange County Population Growth by Race



Source: Texas State Data Center

Figure 10. Population Growth in Texas vs. Brazoria, Jefferson, Orange Counties

1.7 AFFECTED POPULATIONS

In accordance with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," data were compiled to help assess the potential impacts on minority and low-income populations within the study area. This information indicates that 10 of the 39 2010 Census tracts in the Brazoria County study area, 20 of the 33 tracts in the Jefferson County study area, and 7 of the 40 tracts in the Orange County study area have minority populations higher than 50 percent. Table 6 shows the racial makeup percentages of each census block that intersects the study area. Those with minority populations above 50 percent are highlighted in red.

Table 6. Distribution of Population by Race/Ethnicity per Census Tract

Brazoria							
Census Tract	White*	Hispanic	Black	Asian	Am. Indian	Hawaiian / PI	Other
6617.1	71.2%	22.8%	3.0%	0.1%	0.3%	0.0%	2.5%
6617.2	72.7%	20.0%	3.1%	0.0%	0.9%	0.0%	3.3%
6617.3	76.6%	20.6%	0.0%	0.0%	1.1%	0.0%	1.7%
6620.4	78.4%	13.4%	3.2%	0.8%	1.2%	0.0%	3.0%
6621.1	50.4%	38.9%	7.8%	0.3%	0.9%	0.2%	1.6%
6624.3	79.5%	15.5%	1.5%	0.4%	0.7%	0.0%	2.4%
6624.4	80.0%	15.7%	0.1%	0.5%	0.4%	0.0%	3.3%
6625.1	79.8%	12.8%	4.2%	0.6%	0.8%	0.0%	1.8%
6626.3	75.1%	17.3%	5.4%	0.3%	0.7%	0.0%	1.2%
6628.1	65.8%	11.7%	17.8%	0.7%	1.2%	0.0%	2.8%
6628.6	74.1%	10.5%	11.6%	0.3%	0.6%	0.0%	2.9%
6629.1	63.5%	19.7%	13.3%	0.5%	0.8%	0.0%	2.3%
6629.3	64.7%	25.0%	6.6%	0.6%	1.0%	0.0%	2.1%
6629.4	78.2%	12.6%	5.2%	1.7%	0.5%	0.0%	1.8%
6630.2	77.0%	16.3%	5.3%	0.0%	0.3%	0.0%	1.1%
6630.3	21.6%	37.0%	39.8%	0.7%	0.3%	0.0%	0.8%
6630.4	64.1%	11.5%	22.4%	0.2%	0.2%	0.1%	1.7%
6631.4	82.2%	10.4%	1.9%	3.9%	0.4%	0.0%	1.2%
6634.1	67.6%	15.6%	5.1%	9.3%	0.2%	0.0%	2.2%
6640.2	58.7%	35.9%	2.3%	0.4%	0.2%	0.0%	2.5%
6641.4	46.6%	45.6%	4.0%	0.6%	1.1%	0.0%	2.1%
6641.5	72.5%	22.8%	1.7%	0.9%	0.3%	0.0%	1.9%
6642.1	76.3%	15.5%	3.6%	0.6%	1.2%	0.0%	2.8%
6642.2	67.1%	24.6%	2.9%	0.1%	1.9%	0.0%	3.4%
6642.3	89.2%	5.8%	1.7%	0.9%	1.1%	0.0%	1.3%
6643.2	24.2%	59.7%	13.2%	0.7%	0.3%	0.0%	1.9%
6643.3	24.4%	62.4%	7.0%	0.2%	1.2%	0.0%	4.8%
6644.1	12.9%	68.5%	14.9%	0.3%	0.8%	0.0%	2.5%
6644.2	36.6%	43.9%	13.5%	0.3%	0.7%	0.0%	5.0%
6644.3	22.2%	69.5%	5.0%	0.5%	0.1%	0.0%	2.6%
6644.4	23.8%	58.5%	9.8%	0.3%	1.6%	0.0%	5.9%
6644.5	38.4%	42.0%	10.5%	0.8%	1.7%	0.0%	6.6%
6644.6	36.0%	52.2%	8.5%	0.4%	0.5%	0.1%	2.3%
6616.02.1	73.1%	20.9%	2.4%	1.8%	0.1%	0.0%	1.7%
6645.01.1	56.3%	38.2%	3.2%	0.1%	0.2%	0.0%	2.0%
6645.01.2	80.6%	10.3%	4.2%	0.6%	0.9%	0.0%	3.3%
6645.01.3	82.8%	8.1%	7.4%	0.3%	0.1%	0.0%	1.4%
6645.01.4	60.7%	13.7%	22.1%	0.1%	0.3%	0.0%	3.1%

Table 6, continued

6645.01.5	77.7%	16.6%	2.6%	1.0%	0.6%	0.0%	1.6%
9900.0	-	-	-	-	-	-	-
Jefferson							
Census Tract	**White**	**Hispanic**	**Black**	**Am. Indian**	**Asian**	**Other**	
7.4	4.2%	1.6%	92.8%	0.0%	0.0%	1.4%	
17.1	13.6%	7.5%	76.2%	1.9%	0.1%	0.6%	
51.1	13.3%	3.2%	82.8%	0.2%	0.0%	0.5%	
55.1	4.8%	19.6%	38.1%	34.3%	0.0%	3.2%	
55.2	9.7%	30.8%	42.5%	11.1%	1.8%	4.1%	
55.3	9.8%	25.4%	59.3%	1.5%	1.2%	2.8%	
56.1	8.2%	46.7%	35.5%	4.3%	0.5%	4.8%	
61.3	7.9%	7.2%	81.9%	0.2%	0.6%	2.3%	
66.1	77.8%	17.0%	1.4%	2.5%	0.9%	0.5%	
66.2	12.2%	14.0%	57.3%	14.1%	0.1%	2.3%	
69.1	28.9%	3.8%	59.4%	5.7%	0.3%	2.0%	
69.2	37.9%	5.9%	53.7%	0.7%	0.1%	1.7%	
71.1	67.7%	24.0%	4.5%	1.3%	0.6%	1.9%	
71.3	77.6%	17.8%	2.6%	0.2%	0.4%	1.4%	
101.1	12.5%	50.6%	28.9%	4.3%	1.4%	2.3%	
108.1	88.4%	8.3%	1.0%	0.5%	0.9%	0.9%	
108.2	84.5%	8.5%	1.9%	1.3%	0.9%	2.9%	
116.1	86.7%	8.2%	3.7%	0.4%	0.3%	0.8%	
116.2	78.9%	19.2%	0.5%	0.2%	0.0%	1.2%	
117.1	6.8%	15.2%	72.5%	0.7%	0.7%	4.2%	
117.2	23.2%	46.6%	26.0%	0.8%	0.2%	3.1%	
118.2	3.0%	10.1%	84.3%	0.3%	0.0%	2.3%	
1.03.2	8.5%	2.9%	86.3%	0.2%	0.3%	1.8%	
112.01.1	61.7%	7.0%	27.6%	1.0%	0.6%	2.1%	
112.01.2	81.7%	14.3%	0.6%	0.6%	0.3%	2.5%	
112.01.5	90.2%	6.7%	0.1%	1.1%	0.3%	1.6%	
112.03.1	10.9%	39.1%	49.4%	0.0%	0.6%	0.0%	
113.02.1	24.1%	31.4%	39.4%	0.8%	1.3%	2.9%	
113.03.1	89.3%	8.7%	0.4%	0.2%	0.4%	1.1%	
113.03.2	89.5%	7.8%	0.7%	0.5%	0.5%	1.0%	
113.04.1	48.1%	18.5%	32.4%	0.3%	0.1%	0.5%	
113.04.2	75.5%	7.5%	12.6%	2.0%	0.3%	2.0%	
13.03.2	21.3%	14.1%	62.2%	0.3%	0.4%	1.7%	
Orange							
Census Tract	**White**	**Hispanic**	**Black**	**Asian**	**Am. Indian**	**Other**	
202.1	44.1%	4.2%	49.3%	0.1%	0.0%	2.3%	

Table 6, continued

202.2	14.6%	4.6%	78.7%	0.7%	0.1%	1.3%	
202.3	38.8%	8.2%	51.1%	0.1%	0.2%	1.6%	
202.4	7.3%	2.3%	88.9%	0.0%	0.0%	1.5%	
203.1	87.8%	3.6%	6.2%	0.6%	0.1%	1.6%	
203.2	75.5%	10.4%	10.6%	1.1%	0.5%	2.0%	
203.3	74.0%	7.3%	15.9%	0.5%	0.6%	1.6%	
205.1	81.6%	9.4%	4.6%	0.6%	0.3%	3.5%	
205.2	79.9%	11.9%	5.4%	0.5%	0.9%	1.3%	
205.3	78.2%	7.8%	9.3%	0.7%	1.1%	2.9%	
205.4	70.3%	20.1%	6.5%	0.5%	0.4%	2.1%	
207.1	86.9%	4.4%	1.5%	4.9%	0.5%	1.8%	
208.1	81.0%	3.8%	12.4%	0.0%	1.1%	1.7%	
208.2	68.8%	5.8%	21.2%	1.0%	0.7%	2.5%	
209.1	46.2%	5.4%	44.1%	1.2%	0.3%	2.8%	
209.2	30.1%	7.8%	57.7%	2.0%	1.0%	1.4%	
209.3	57.0%	4.8%	33.2%	3.6%	0.1%	1.3%	
209.4	40.2%	2.9%	53.2%	1.0%	0.3%	2.4%	
210.1	88.4%	3.7%	3.9%	0.7%	0.7%	2.5%	
211.1	92.1%	3.7%	0.8%	0.5%	0.2%	2.6%	
216.1	92.6%	5.0%	0.1%	0.1%	1.3%	0.9%	
216.3	95.1%	2.8%	0.0%	0.2%	0.4%	1.6%	
217.1	92.6%	3.8%	0.1%	1.6%	0.9%	1.0%	
217.2	90.9%	6.7%	0.1%	0.4%	0.4%	1.5%	
219.5	92.1%	4.9%	0.3%	0.3%	0.5%	1.9%	
219.6	92.2%	3.8%	0.1%	1.0%	0.6%	2.3%	
220.2	91.9%	5.1%	0.6%	0.2%	0.1%	2.1%	
220.3	91.7%	5.9%	0.1%	0.2%	0.7%	1.4%	
222.1	97.5%	1.5%	0.2%	0.0%	0.3%	0.5%	
222.2	88.4%	6.7%	0.7%	1.1%	1.1%	1.9%	
223.1	69.8%	23.4%	0.1%	2.9%	0.5%	3.3%	
223.2	92.1%	4.1%	0.6%	1.6%	0.1%	1.6%	
223.3	88.5%	6.3%	0.1%	2.3%	1.0%	1.7%	
223.4	92.0%	4.3%	0.0%	1.9%	0.2%	1.6%	
223.5	92.4%	4.8%	0.0%	0.8%	0.5%	1.4%	
224.1	89.8%	6.1%	0.1%	1.6%	0.1%	2.3%	
224.2	87.7%	6.0%	0.8%	2.8%	0.5%	2.1%	
224.3	92.1%	5.0%	0.1%	1.7%	0.0%	1.2%	
224.4	84.0%	9.4%	0.4%	2.3%	0.4%	3.4%	
224.5	86.3%	7.6%	0.2%	3.0%	0.2%	2.7%	

Source: U.S. Bureau of the Census, 2010

In assessing the existence of low-income populations for the study area, mean household incomes were examined for all of the study area Census tracts. Based on a poverty threshold for a family size of three (considering that average number of persons per household for each county ranged from 2.53 to 2.85), an income of $17,373 was used for comparison. None of the census blocks fall below this poverty threshold. Table 7 presents the median income for each census block in the study area and the amount by which the median income per block is above the poverty threshold.

Table 7. Comparison of Median Household Income to Poverty Threshold

Brazoria		
Census Tract	**Mean Income ($)**	**Amount Above Threshold ($)**
6617	$69,081	$51,708
6624	$71,093	$53,720
6634	$79,836	$62,463
6640	$43,502	$26,129
6641	$69,890	$52,517
6642	$52,756	$35,383
6643	$45,711	$28,338
6644	$51,619	$34,246
6645.01	$58,736	$41,363
Jefferson		
Census Tract	**Mean Income ($)**	**Amount Above Threshold ($)**
1.03	$24,042	$6,669
7	$32,178	$14,805
51	$36,852	$19,479
55	$37,200	$19,827
56	$38,209	$20,836
61	$35,204	$17,831
66	$46,176	$28,803
69	$55,319	$37,946
71	$52,409	$35,036
101	$42,027	$24,654
108	$57,895	$40,522
113.02	-	-
113.03	$58,886	$41,513
113.04	$91,518	$74,145
116	$65,128	$47,755
117	$31,085	$13,712

Table 7, continued

118	$35,397	$18,024
Orange		
Census Tract	**Mean Income ($)**	**Amount Above Threshold ($)**
202	$35,156	$17,783
203	$46,024	$28,651
205	$44,221	$26,848
207	$55,514	$38,141
208	$56,216	$38,843
209	$53,690	$36,317
210	$79,447	$62,074
211	$68,920	$51,547
216	$54,361	$36,988
217	$51,534	$34,161
219	$49,657	$32,284
220	$46,415	$29,042
222	$89,753	$72,380
223	$76,427	$59,054
224	$62,656	$45,283

Source: U.S. Bureau of the Census, 2010

1.9 ASSESSMENT OF PROTECTED POPULATIONS AND POTENTIAL IMPACTS

1.9.1 Orange-Jefferson CSRM

The potential for impacts from the Tentatively Selected Plan on protected populations exists primarily at the Orange-Jefferson CSRM since it encompasses the construction of new levees and floodwalls. Both Freeport and Port Arthur have systems that are being proposed for improvements over their existing conditions. For the purposes of making a determination on the potential for impacts on potentially protected populations, the racial makeup of the Census block groups that intersect the footprint of the proposed features of the Orange-Jefferson portion of the TSP were examined. Of the eleven Census block groups, only one displayed a population where more than 50 percent of the population was non-white. Census block 202.1 has a white population of 44.1 percent with the remaining belonging to historically identified minority groups. There is no indication that populations may be protected on the basis of existing income among these Census block groups. Census block 202.1, however, resides at the very end of the Orange 3 reach of the proposed TSP in Orange County where impacts would not be expected to be as great as the potential impacts in other areas. Regardless, there should be no disproportionate impacts on the populations in this Census block.

1.9.1.1 County Economic Profile

To compare economic sectors of the three counties with those of the study areas within those three counties, information in Table 8 was obtained from the 2007 County Business Patterns, which outlines the number of employees and establishments for the major North American Industry Classification System (NAICS) classifications. The table gives the total number of employees per broad NAICS category for the three counties and for the zip codes that intersect the study areas within the three counties.

Table 8. 2010 County and Study Area Civilian Employment by NAICS Sector

	Brazoria County		Study Area	
Sector	**Number**	**Percent**	**Number**	**Percent**
Total Employees	142,798	100%	44,289	100%
Agriculture, Forestry, Fishing and Hunting, and Mining	3,588	2.5%	1,341	3.0%
Construction	13,429	9.4%	0	0.0%
Manufacturing	19,645	13.8%	7,069	16.0%
Wholesale Trade	4,598	3.2%	1,118	2.5%
Retail Trade	14,176	9.9%	5,755	13.0%
Transportation and Warehousing, and Utilities	7,485	5.2%	2,616	5.9%
Information	2,449	1.7%	726	1.6%
Finance and Insurance, and Real Estate and Rental and Leasing	7,106	5.0%	2,150	4.9%
Professional, Scientific, and Management, and Administrative and Waste Management Services	15,207	10.6%	4,344	9.8%
Educational Services, and Health Care and Social Assistance	32,421	22.7%	9,624	21.7%
Arts, Entertainment, and Recreation, and Accommodation and Food Services	9,164	6.4%	4,177	9.4%
Other Services, except Public Administration	6,777	4.7%	2,947	6.7%
Public Administration	6,753	4.7%	2,422	5.5%
	Jefferson County		**Study Area**	
Sector	**Number**	**Percent**	**Number**	**Percent**
Total Employees	102,898	100%	67,201	100%
Agriculture, Forestry, Fishing and Hunting, and Mining	1,289	1.3%	973	1.4%
Construction	10,321	10.0%	7,767	11.6%
Manufacturing	11,433	11.1%	7,643	11.4%
Wholesale Trade	2,236	2.2%	1,307	1.9%
Retail Trade	11,913	11.6%	7,950	11.8%
Transportation and Warehousing, and Utilities	5,399	5.2%	3,358	5.0%
Information	1,465	1.4%	906	1.3%
Finance and Insurance, and Real Estate and Rental and Leasing	4,461	4.3%	2,866	4.3%

Table 8, continued

Professional, Scientific, and Management, and Administrative and Waste Management Services	9,573	9.3%	5,978	8.9%
Educational Services, and Health Care and Social Assistance	24,852	24.2%	15,638	23.3%
Arts, Entertainment, and Recreation, and Accommodation and Food Services	8,267	8.0%	5,643	8.4%
Other Services, except Public Administration	5,788	5.6%	3,705	5.5%
Public Administration	5,901	5.7%	3,467	5.2%

	Orange County		Study Area	
Sector	**Number**	**Percent**	**Number**	**Percent**
Total Employees	34,026	100%	34,026	100%
Agriculture, Forestry, Fishing and Hunting, and Mining	389	1.1%	389	1.1%
Construction	4,257	12.5%	4,257	12.5%
Manufacturing	6,338	18.6%	6,338	18.6%
Wholesale Trade	659	1.9%	659	1.9%
Retail Trade	4,226	12.4%	4,226	12.4%
Transportation and Warehousing, and Utilities	1,700	5.0%	1,700	5.0%
Information	332	1.0%	332	1.0%
Finance and Insurance, and Real Estate and Rental and Leasing	1,283	3.8%	1,283	3.8%
Professional, Scientific, and Management, and Administrative and Waste Management Services	2,433	7.2%	2,433	7.2%
Educational Services, and Health Care and Social Assistance	6,877	20.2%	6,877	20.2%
Arts, Entertainment, and Recreation, and Accommodation and Food Services	2,142	6.3%	2,142	6.3%
Other Services, except Public Administration	2,435	7.2%	2,435	7.2%
Public Administration	955	2.8%	955	2.8%

Source: U.S. Bureau of the Census, 2010

In terms of total employment, both Brazoria County and the study area within Brazoria County have more Educational Services and Health Care and Social Assistance employees than any other business sector. This also true for Jefferson County and Orange County.

Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix S

List of Preparers

May 2017

LIST OF PREPARERS

The following U.S. Army Corps of Engineers staff prepared this Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS):

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Franchelle Craft, Project Manager, 6 years of experience

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Lauren Kruse, Lead Planner/Plan Formulation, 14 years of experience
Seth Jones, Lead Planner/Plan Formulation, 8 years of experience
Sheridan Willey, Lead Planner/Plan Formulation, 16 years of experience

Janelle Stokes, Lead Environmental Planner/Environmental Impact Assessment and Analysis, NEPA Specialist and Cultural Resource Specialist, 35 years of experience

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Sabine Pass to Galveston Bay, Texas
Coastal Storm Risk Management and Ecosystem Restoration
Final Integrated Feasibility Report and Environmental Impact Study

Appendix T

DISTRIBUTION LIST

May 2017

Appendix T - Study Distribution List

The following is a list of agencies, organizations, and persons to whom copies of the Notice of Availability for the Final Integrated Feasibility Report/ Environmental Impact Statement was sent. The document will be available for review on the Galveston District website (www.swg.usace.army.mil/) and compact disc copies of the report will be available on request.

Federal, State and Local Government Representatives	
Senator John Cornyn	Senator Ted Cruz
Representative Gene Green	Representative Sheila Jackson Lee
Representative Randy Weber	Representative Brian Babin
Representative Pete Olson	Commanche Indian Tribe
Alabama-Coushatta Tribe of Texas	Mescalero Apache Tribe
Coushatta Tribe of Louisiana	Kiowa Indian Tribe of Oklahoma
Tonkawa Tribe of Indians of Oklahoma	State Representative James White
State Representative Dade Phelan	State Representative Joe Deshotel
State Representative Greg Bonnen	State Representative Dennis Bonnen
State Representative Ed Thompson	State Representative Briscoe Cain
State Representative Dennis Paul	State Representative Harold Dutton Jr.
State Representative Ana Hernandez	State Representative Carol Alvarado
State Representative Garnet Coleman	State Representative Gilbert Peña
State Representative Brandon Creighton	State Representative Sylvia Garcia
State Representative Larry Taylor	State Representative Rodney Ellis
State Representative Joan Huffman	Brazoria County Judge
Brazoria County Commissioner-Pct.1	Brazoria County Commissioner-Pct.2
Brazoria County Commissioner-Pct.3	Brazoria County Commissioner-Pct.4
Brazoria County Flood Plain Management	Director, Brazoria County Health Department
Brazoria Drainage District No. 4	Velasco Drainage District, Chairman
Velasco Drainage District, Op Superintendent	Chambers County Judge
Chambers County Commissioner Pct 1	Chambers County Commissioner Pct 2
Chambers County Commissioner Pct 3	Chambers County Commissioner Pct 4
Chambers County, County Engineer	Chambers County Parks Department
Chambers County Environmental Proection	Chambers County Historical Commission
Chambers-Liberty Counties Navigation Dist	Galveston County Commissioner-Pct. 1
Galveston County Judge	Galveston County Commissioner-Pct. 2
Galveston County Commissioner-Pct. 3	Galveston County Commissioner-Pct. 4
Galveston County Consolidated Drainage Dist	Harris County Commissioner-Pct. 1
Harris County Judge	Harris County Commissioner-Pct. 2
Director Harris County Flood Control District	Jefferson County Comissioner Precinct 1
Jefferson County Judge	Jefferson County Commissioner Precinct 2
Jefferson County Commissioner Precinct 3	Jefferson County Commissioner Precinct 4
Jefferson County Engineer	Jefferson County Drainage District No. 7
Orange County Judge	Orange County Commissioner Precinct 1
Orange County Commissioner Precinct 2	Orange County Commissioner Precinct 3
Orange County Commissioner Precinct 4	Pleasure Island Commission
ORANGE COUNTY	ORANGE COUNTY DRAINAGE DISTRICT
ORANGE COUNTY NAVIGATION & PORT DIST	ORANGE ECONOMIC DEVELOPMENT CORP
Mayor, City of Alvin	Mayor, City of Vidor
Mayor, City of Anahuac	Mayor, City of Baytown
Mayor, City of Angleton	Mayor, City of Beach City

Mayor, City of Beaumont	City Manager, City of Beaumont
Mayor, City of Bevil Oaks	Mayor, City of Brazoria
Mayor, City of Bridge City	Mayor, City of Brookside Village
Mayor, City of China	Mayor, City of Clear Lake Shores
Mayor, City of Clute	City Manager, City of Clute
Mayor, City of Danbury	Mayor, City of Deer Park
Mayor, City of Dickinson	Mayor, City of Houston
Mayor, City of El Lago	Mayor, City of Groves, Texas
Mayor, City of Freeport	City Manager, City of Freeport
Mayor, City of Friendswood	City Manager, City of Friendswood
Mayor, City of La Porte	City Manager, City of La Porte
Mayor, City of Lake Jackson	Mayor, City of Liverpool
Mayor, City of League City	City Manager, City of League City
Mayor, City of Mont Belvieu	Mayor, City of Nederland
Mayor, City of Nassau Bay	City Manager, City of Nassau Bay
Mayor, City of Nederland	Mayor, City of Port Neches
Mayor, City of Old River-Winfree	Mayor, City of Oyster Creek
Mayor, City of Orange	City Manager, City of Orange
Mayor, City of Pasadena	Mayor, City of Pearland
Mayor, City of Port Arthur	City Manager, City of Port Arthur
Mayor, City of Richwood	Mayor, City of Rose City
Mayor, City of Seabrook	Mayor, City of Shoreacres
City Manager, City of Shoreacres	City Manager, City of Seabrook
Mayor, City of Taylor Lake Village	Mayor, City of Sweeny
Mayor, Village of Surfside Beach	City Secretary, Village of Surfside Beach
Mayor, City of Texas City	Emergency Manager, City of Texas City
Mayor, Town of Quintana	City Secretary, Town of Quintana
Mayor, City of West Columbia	Mayor, City of Webster
Port of Beaumont, Director Corporate Affairs	Port of Beaumont, Deputy Port Director
Port of Beaumont, Port Director	Port of Galveston, Port Director
Port of Galveston, Sr. Executive Manager	Port of Galveston, Port Director
Port Freeport, Port Director	Port of Houston Authority, Chairman
Port of Houston Authority, Executive Director	Port of Houston Authority, Emergency Mgmt
Port of Orange, President	Port of Port Arthur, Port Director
President, Port of Texas City	Gen Manager, Sabine-Neches Navigation Dist
Trinity River Authority, Southern Region	Sabine River Authority, Texas
Chamber of Commerce- Groves	Chamber of Commerce - Nederland
Chamber of Commerce - Port Arthur	Chamber of Commerce- Port Neches
Galveston Bay Estuary Program	Big Thicket National Preserve
Brazoria National Wildlife Refuge	Bureau of Ocean Energy Management
McFaddin National Wildlife Refuge	Texas Point National Wildlife Refuge
National Marine Fisheries Service, Hab Consrv	National Marine Fisheries Service-SERO
National Resource Conservation Service	San Bernard & Big Boggy Nat'l Wildlife Ref
Texas Chenier Plain NWR Complex	Texas Mid-Coast NWR Complex
U.S. Coast Guard, Port Arthur	U.S. Coast Guard, New Orleans
U.S. Coast Guard, Freeport	U.S. DOE - Bryan Mound
U.S. Environmental Protection Agency	U.S. Fish and Wildlife Service, Texas Field Office
USDA-Natural Resources Conservation Service	U.S. Maritime Administration
NOAA's Office of National Marine Sanctuaries	Governor's Office of Budget & Planning
Texas Parks and Wildlife Department	Lower Neches Valley Authority
San Jacinto State Park Superintendent	Texas Commission on Environmental Quality
Texas Department of Transportation	Texas General Land Office
Texas Historical Commission	Texas Water Development Board

Landowners In and Near Project Areas	
7UP TRUST ATTN: FRANK BROWN	ABATE, LANCE A. & DEANNA L.
ACR, L. P	AKROTEX FILMS, INC. PROPERTY TAX DEPT.
AMAIMO, DELORES JEAN	ASHWORTH, ERVIN E.
ASHWORTH, MICHAEL & LAURA	ATWOOD, ANN JENELLE
BABB, JAMES	BAILEY, MIRANDA NICOLE
BANKS, J. W., Jr & JOHN S. MAY	BARRON, DONALD RAY
BARRY, IVAN D. PARTNERSHIP, LTD	BATES, C. DELLE
BEALL, LARRY G. & WENDY T.	BEAN, TERRY & MELINDA
BECKER, BILLIE BRYANT LIVING TRUST	BELLARD, RAYMOND
BENNETT, DUANE A.	BIGELOW, RICHARD R.
BOITER, WILLIAM M.	BONSALL, JAMES D.
BOREN, BARRY E.	BOULER, MARIE & BOBBIE JO COLEMAN
BOZMAN, BRYAN M. & KAREN L.	BRIDGE CITY LIQUOR DBA: Doc's Package Store
BRIDGE CITY MASONIC LODGE # 1345	BRITNELL, ROGER
BROUSSARD, CHARLOTTE	BRYANT, ROBERT L & DANA
C & E LAND COMPANY	CALHOUN, JOHN L. & JAYNA CALHOUN
CARRICO, BERTIS RAY	CEO INVESTMENTS, INC. c/o William Tim Edgar
CHAUVIN, TIMOTHY W. & JENNIFER W	CHEVRON PHILLIPS CHEMICAL CO c/o Prop Tax
CHIANTI REALTY PROPERTY TAX DPT	CLARK, ARVEL & KAREN
COATES, NITA F.	COOLEY, JASON & WENDY
CORMIER FAMILY LIMITED PARTNERSHIP	COTTEN, MARY ALIF
COTTLE, JESSE & JOSEFINA	CRENSHAW, PAULA
CRIGLER, RAYMOND EARL	CROWN CASTLE GT CO, LLC Property Tax Dept
CROWN PINE TIMBER 1, L.P.	CURL, ROBERT D. & DONNA L.
DAIGLE, CLIFFORD ALLEN	DALLAS, LELA FAYE
DARDER, JESSICA L	DARDER, JOHNNY
DAVIS, DAVID ALLEN	DAVIS, MACK WAYNE, Sr
DEMUTH, JEFFERY GEORGE & LINDA B.	DENHAM, LYNN W. & ALEXIS A. TOUCHSTONE
DIE, MICHAEL C.	DORN, JEFF & AMI c/o DEBORAH STAGG
DUNIGAN, STEVEN A. & RANDI N.	DUNN, ROY L.
DUPONT, E.I. DE NEMOURS & CO.Attn: Porprty Tax	DURMON, R. F.
EDGERLY, SHANE D. & MALISA L.	ELAM, THEDA SUE
ELLIS, TROY	ENTERGY GULF STATES, INC.
EVERGREEN CEMETARY ASSOC	EVERGREEN PARK-HICKORY HILLS WATER SYS
FABACHER, CLARENCE R. & SHARON S	FABRE, KENNETH N. & ANN W.
FIRESTONE POLYMERS, LLP	FISCHER, MARGOT E.
FLORER, ROBERT R. & MARY E.	FOLEY, DEBORAH KAY
FOX, CURLY J	FUKUDA, MAUREEN A
FULTON, JAMES M. & DOROTHY C.	FURBY, A. B. MRS. ESTATE c/o Martha F. Wagar
GARNER, GERALDINE	GARRISON, JOHN EARL
GERDAU AMERISTEEL US INC.	GILBERT, MARY LYNN
GINN, JR., MICHAEL L. & FAY L.	GOBERT, JOHN WILLIAM & MARTHA
GRANGER, ERNEST OVIE	GREER, STUART
GULF STATES UTILITIES COMPANY	HAEGGQUIST, BRAD & SHELLIE
HALTOM, SUSAN M. & GREGORY L.	HAMRICK, THOMAS, Sr
HANSON, DAVID & PEGGY	HANTZ, JOSEPH L. & GWENDOLYN D.
HARVEY, CARL DAVID & AGNES M.	HAWK CLUB, LTD
HAWTHORNE, EDWARD & CLARA	HEBERT, WINDELL C.
HENAGAN, BILLY G. & MARK A. SMIETH ETAL	HESTER, JOE
HIGMAN MARINE SERVICES	HIGMAN TOWING COMPANY

HONEYWELL (ALLIED)	HORNSBY, JOHN & TAMMY MINTER
HORTON, MARK & NANCY A.	HOWELL, ROGER A.
HUEBNER, DONALD LEE & LORA LEIGH	HUTCHISON, KATHRYN ANN c/o Allan Bailey et al.
I-ACR, L.P.	J & D PARTNERS, LTD
JACK, SHERLITA T.	JENNINGS, RUTH
JJ & A PARTNERSHIP RENTAL	JOHNSON, JOHNNIE
JOHNSON, WILLIAM	JONES, OLA C.
JORDAN, SCOTT	JORDAN, W. H.
KARR, GLYNN H. & DAVID KARR	KILIMANJARO CORPORATION
KIRK, DONNA	KIRK, KENT
KNIPPERS, JAMES D	KOSH, STEPHEN P. & DEBORAH N.
KUDU LIMITED II, INC.	LANDRY, DENNIS JOHN
LANG, DONNA LURIE	LANGHAM, ALMA FRANCES c/o Gerald Langham
LANXESS CORPORATION	LAPRAIRE, BARBARA
LAWS, MICHAEL	LE, DAP T
LEBLANC, LISA PARKHURST	LEDOUX, FRED H. & NORA FAMILY TRUST
LEWIS, JARRED	LIBERTY BAPTIST CHURCH
LIVELY, DENNIS N.	LONADIER PHILEN, BOBBIE FAY
LOPEZ, JOHN J.	M & R ONE, LLC
MALONE, RICHARD E. & ANDRA	MANNING, MARGARET SUE
MARATHON OIL COMPANY C/O STANCIL & CO	MARTIN, P. EUGENE & JANET
MASSEY, RICKY GENE	MCBRYDE, WENDY SUZANNE
MCCLAIN, JOYCE % SANDRA DOLLARHIDE	MENARD, WOOD P.
MENDOZA, ISMAEL & LEONILA	MESSER, S. MARK
MICHAEL, EDWIN LYNN	MICHAEL, MORGAN D. & DEVEN A.
MICHAEL, ROBERT C.	MILDRED LOUISE SHANE LIFE ESTATE
MIRES, RUSSELL W. & CRYSTAL	MITCHELL, CORY L. & JENNIE E.
MOORE, FLOYD STEVE & MARY SUSAN	MOORE-ODOM WILDLIFE FOUNDATION, INC.
MORENO, JOHNNIE, Jr	MORPHEW, BRAD BURCH
NEXGEN STRUCTURES OF TEXAS,LLC	NUGENT, RUTH LAMAR
OCEGUERA, HECTOR & RACHEL	OCEGUERA, REFUGIO & PATRICIA A. GAITAN
OCF PROPERTIES, LTD.	ODOM, R. E.
ORANGE SHIPBUILDING CO., INC	ORANGE SHIPBUILDING INC.
OUTHOUSE, WAYNE THOMAS, Jr	OUTPOST DEVELOPMENT, LTD
OVERMAN, JEFFREY L. & CINDY A	P. C. I., INC.
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PEPPER, THOMAS A. & YVETTE	PEVETO, DAREN
PLANT, RANDY R	PRICE, MICHAEL
PUENTE, JESUS JR. & CHRISTINA C.	PURCELL, THOMAS A
QUIBODEAUX, STEVE L. & CAROLYN S.	QWEST COMMUNICATIONS CORPORATION LLC
RACHAL FAMILY PARTNERSHIP	RAMIREZ, ROBERT
RANKIN, CLIFTON EARL	REESE, KAREN L.
REID, EDWIN THOMAS	RICHARDSON, CHARLES G. % CLUB 88
RICHEY, WILLIAM B. & RHONDA K.	ROMERO, RANDY
ROSE ACCEPTANCE, INC.	ROSE CITY SAND CORP
SAJET PROPERTIES, LLC	SANDERS & OWENS, P.C.
SANFORD, SAM	SCOTT, DAVID ANTHONY
SEIGRIST, VERNON & LOIS	SHANE, ROBERT R., Jr
SERRATO, SYLVIA	SIGNAL INTERNATIONAL TEXAS LP
SMITH, GARY M. & NORA	SMITH, ODRICK L. & SUE A.,dba Melting Pot Candle

SMITH, RICHARD S.	SMITH, TILLIE S. & CRYSTAL MEREDITH
SONA LODGING, LLC, HUSMUKHBAI C. PATEL	ST JAMES MISSIONARY BAPTIST CHURCH
STABA, ZUMA LEE & DANA JO GRIBBEN	STAGG, RITA JANE
STANLEY, TERRY	STARNES, JOHN & DAWN
STEPHENS, MARGARET G. ET AL	STEPHENSON, ALVIN A.
STEPHENSON, MELVIN K.	STEVENS, ERIC
STEVENSON, JONATHAN PAUL	STOCKWELL, ALVIE L., Jr
STORY, SANDRA M.	STRAUS-FRANK ENT. LTD
SWANSON, JANE KATHRYN	TALIAFERRO HEIRS
TALLANT, JOHN & GWENDOLYN	TATE, LESLIE ELLIS & MARIA G
TERRELL, RONALD LEE & ANGELA MARIE	THE WALL INVESTMENT CO. LTD Attn: Ron Wall
THOMSON, E. JOHN & HEIDI	TOUCHSTONE, ROBERT D. & MARY
TRAHAN, TIMOTHY L. & DENISE Y	TRIPLE L INVESTMENTS, INC
TRUONG, THEM & KAREN	U. S. A. BIG THICKET NATIONAL PRES
UNION PACIFIC RAILROAD CO	VARGAS, RAFAEL
VERRETT, THOMAS M. & JUDY E.	VICKERS, ARNOLD R.
VIENOT, CHARLES	WALDREP, JAMES MADISON
WALDROPE, MILDRED, ELIZABETH GOODSELL	WALKER, GREGORY A.
WALKER, MARY	WATSON, GARY LYNN
WEBB REAL ESTATE INVESTMENT INC	WEBB, LARRY
WELDON, DONOVAN R	WHITMIRE, CLINTON JAMES
WILKINSON, WENDELL	WILLIAMS, AUSTIN L. & CICILYE D.
WILSON, LISA D.	WINFREE, WILLIAM EDWARD
WINSTEAD, WENDELL & SANDRA	YATES, JOHN W.
YOUNG, TERI SELF	ZUNIGA, JOHN & BRENDA S
Organizations	
Arcadis U.S., Inc	Air Product and Chemicals
American Rice, Inc.	Angleton Chamber of Commerce
Audubon Society - Golden Triangle	Atakapa-Ishak Tribe
Audubon Society-Houston	Ameripol Synpol Corporation
American Eagle	AtoFina
Dewberry	BASF
Bayou Preservation Association	Beaumont Yacht Club
Beaumont Chamber of Commerce	Brazos Pilots Association
Brazoria Chamber of Commerce	Brown & Gay Engineering, Inc.
Carriage Services	Centana Intrastate Pipeline
Cheniere Energy, Inc	Chambers Recovery Team
Chiquita Brands International, Inc.	Chevron Pipe Line Company
Citgo Pipeline Company	Chuck's Guide Service
Clean Air & Water	Clear Creek Environmental Foundation
Coastal Conservation Association-Texas	Colonial Pipeline Co.
J. Connor Consulting Co.	ConocoPhillips
Cradle of TX Conservancy	CSC - DCP Midstream
DCP/Targa	DG's Guide Service
DCP Midstream, LLC	Dole Fresh Fruit Company
Dow Chemical	Dunan Entergy Partners, L.P.
Ducks Unlimited	J.S. Edwards & Sherlock Insurance Agency
Econo Rail Corp	E.I. DuPont de Nemours
Ecosystems Insurance Associates, LLC	East Texas Regional Water Planning Group
Entergy Texas	Entergy Gulf States, Inc.
Enterprise	Enterprise Products Partners, L.P.
Enterprise Products Company	Environmental Banc & Exchange, LLC
Environmental Services	Exxon Mobil

Explorer Pipeline Company	FOCC (Refinery) (TotalFina, Inc.)
ExxonMobil Pipeline	Freeport LNG
Fulbright & Jaworski, L.L.P.	Galveston Bay Foundation
Galveston-Texas City Pilots Association	Golden Triangle Sierra Club
Galveston Bay Estuary Program	Gulf Chemical & Metallurgical Corp.
GP LNG	Gulf Restoration Network
Great Lakes Carbon	HDR Engineering Inc.
Gulf South Pipeline Company, L.P.	Gulf Intracoastal Canal Association
Harte Research Institute	Houston Pilots
Houston-Galveston Area Council	Houston Pipeline Company
Houston Regional Group of the Sierra Club	Huntsman
Investa, B.V.	Jep's Island Emporium Charting Service
I.M. Skaugen SE	Kinder Morgan
J & S Marine	Kirby Inland Marine
Kinder Morgan Texas Pipeline, L.P.	Krewe of Port Freeport
Koch Pipeline	Marathon Pipe Line LLC- Houston Region
Kudu Limited II, Inc.	Maurer Advisory & Consulting Services, Inc.
LNG Stakeholder Relations	Military Sealift
MeadWestvaco Corporation	Motiva Enterprises, LLC
Mobile Oil Corp	Nederland Chamber of Commerce
National Audubon Society	Nederland EDC
Oaks, Hartline, & Daly, LLP	Oil Tanking
Panhandle Eastern Corp	Pearland Chamber of Commerce
PB Energy	PB Energy Storage Services, Inc.
Plains All American Pipeline, L.P.	Pt. Arthur EDC
Port Arthur Yacht Club	Port Neches EDC
Port City Petroleum, Inc.	Premcor
RBC Projects, LLC	Praxair, Inc.
Rodino, Inc.	RS&H
Sabine Lake Guide Service	Sabine Pass Port Authority
Sabine Pilots Association	Save our Beach Association
Sea Grant	Shead Conservation Solutions
Shell Pipeline Corporation	Shell Oil Company
Shiner Moseley & Assoc.	Steinberg & Assoc.
Sidon Gulf Charter, Inc.	Sierra Club-Golden Triangle
Sierra Club-Houston Group	Sierra Club-Lone Star Chapter
Skip's Guide Service	SE Texas Plant Managers Forum
Southeast Texas Waterways Advisory Council	Southern Union Gas
Spectra Energy	Sun Pipeline Company
Sonoco	Surfrider Foundation Texas Chapter
Surveying and Mapping, LLC	SWCA Environmental Consultants
Sweeny Chamber of Commerce	Targa Midstream Services Limited Partnership
Texas Archaeological Studies Association	Texas Archeological Stewardship Network
Texas Audubon Society	Texas Eastern Petroleum Pipeline Company
Texas Eastern Gas Pipeline	Texas Energy Coalition
Texas Pipeline Association	TPC Group LLC/DuPont/Invista
Texas Sea Grant College Program	Texas Waterway Operators Association
The Nature Conservancy of Texas	Time Warner Cable
TPC Group, Inc.	TransGlobal Solutions
UCAR Pipeline Inc, ROW Department	Unocal
2C3	V.I.T., Inc.
Vastar Resources, Inc	Western Seafood
Wetland Technologies Corporation	Williams Gas Pipeline - Transco

Younger & Associates	
Individuals	
Abbott, James R.	Acrey, Rose Mary
Adams, Stacy	Anderson, Thomas & Patricia
Andrews, Serena	Anene, Darlene
Arnaud, Eddie	Austin, Michael
Bailey, Lisa	Bailey, James & Charlotte
Barker, Glen	Baker, Curtis
Barras, Leslie	Barksdale, Woody T. & Leta W.
Barth, Kathleen	Barrington, Ray
Batty, Barbara	Baughman, Michael
Becker, Al & Sandra	Bell, Regina
Bellard, Mary Ellen	Bellmyer, Larry
Benavides, Sarah	Benner, Tricia & Steve
Benoit, Dick	Benoit, Katie
Berlitz, Richard	Bevill, Anna
Bissel, Alice	Black, Clifton
Blake, Frank	Blansit , Frankie and Max
Bludworth, Richard	Blumentritt, David
Bolcar, Blinn S.	Bourg, John
Boyce, Judith	Boykin, Cecil
Breeland , Joanne	Brennan, Ron & Mary Ellen
Brennan, Jeff	Brizendine, Kim
Broussard, Dwight J. & Ann	Brown, James Jr.
Brown, Colleen & Delbert	Browne, Richard
Bryan, JP & Cassie Perry	Buckman, Steve & Kelly
Burch, Ralph	Burgess, Selmer Ray
Burkett, Winnie	Burns, Don & Millicent
Boudreaux, Lowell	Burns, Kevin
Butler, George	Caldwell, Mary C.
Cacioppo, James	Casey, Terry
Carraway, Rosemary	Charvoz, David
Chimenti, Katie	Chand, Dan
Christensen, Scott	Chang, Nelson
Clark, Ken	Christen, Barry & Elizabeth
Coleman, Steven	Christensen,J anice & Marc
Cornelison, Theresa	Clinton, Russell
Coward, Alfred Jr.	Cooley, James
Crist, James & Wanda	Cortney, Dennis
Crouch, Billy	Crawford, John
Cuclis, E.J. (Tery) & Velda	Crocker, Glen
Cunningham, Peter and Marilyn	Cruse, Leonard
Cunningham, Luther	Damon, John
Davenport, Tobey	Daigre, JoAnne
Deshotel, Russell	Danz, Suzanne
Dodson, Mary	Davis, Roger
Dolan, Garrett Ph.D.	Dickenson, Richard
Dunlap, Sherri	Dudney, Newton E. & R. Fay
Durand, Eugene E.	Dupaquier, Lauri
Durham, Bob	Edwards, James
Edwards, Roy	Ehlers, Louis
Eichhorn, Greg	Eisen, Bill
Erickson, Jon	Evans,Troy

Farmer, Stuart	Flaniken, Greg
Ferguson, Cecil & Kay	Flickinger, David
Fitzgerald , Tyler	Flickinger, Marie
Flannigan, Michael	Flowers, Jim & Caty
Fowkes, Wayne	Frankie, Edward
Fratila, Nick P.E.	Freeman, Steven
Fuka, Lisa	Gallagher, Andrew
Garner, B.J. & Laura	Gardner, George
Gatten, Kenneth & Glenda	Garst, Jean
Gilmore, Ira & Carolyn	Germany, Garvin
Goodman, Teri	Glanton, Theo
Graham, James C. & Wanda L.	Goodwin, Theresa
Green, James	Gratzfeld, George & Norma
Gupta, Rohan	Greer, Faye & Lewis
Guthery, Lemuel & Jo	Guth, Sandra
Halbach, Joe	Hahn, Oscar
Hambright, Betty & Rhea	Halle, Roy &Carole
Hanks, Wayne	Hammond, Mark
Harder, James	Hannah, John
Harris, Gary	Hargrove, John
Harrison, Ray	Harris, Jack & Mary Ellen
Hawkins, Charles	Hatchett, Thomas &Lou Ellen
Heckendorn, Rob	Hays, Jack
Heinly, Joanie	Hesley, Susan
Hill, Carl & Connie	Hodge, Mike
Holbrook, Ray	Hodgson, Charles
Horecky, Carl	Hood, Jeremy & Janet Grobe
Howard, Spencer	Horn, Dennis & Mary
Hudson, Wade & Nancy	Hughes, James & Shirley
Dusek, Imogene (Jean)	Illerich, Daniel & Mary
Iyer, Aishwarya	Island, Gordon
Jalowy, David	Jackson, Kathleen
Jenkins, Mike	James, George & Sonia
Jess, Raymond	Jenkins,Mabelee
Johnson, Don	Johnson, Cheryl
Jones, Scott	Johnson, Mark
Keeney, Jon	Keele, Betty & Bevard
Keschinger, Richard	Kelly, Carol
Kie, Bruce & Jean	Key, Lonnie
Kirby, Meta	King, Craig
Knight, Phillip	Kneupper, Doug
Kocurek, David	Kobayashi, Herbert
Kologinczak, Teresa	Kouches, J
Krejei, Mike	Kucherka, Billie & Clarence
LaBlanc, Mary	Land, David
Lang, L.G.	Larsen, Ivar
Ledkins, Thomas	Leech, Ted
Legendre, Abel & Audrey	Leheny, Lisa
Lelsz, David	Lenamon, Ben
Lester, Phil	Lloyd, Lila
Lotz, Frank & Tricia	Luce, Jay
Luycx, Susan	Machol, John
Mallios, Laura	Maloney, Donna

Mannchen, Brandt	Marcott, Larry
Marlow, Marie	Martin, Jacqueline
Martin, Betty	Martin, Trent
Masters, Jerry	Mastrofrancesco, Nancy
Matter, Donald	McClain, Wilson
McAlister, Gay	McCloskey, Meghan
McCrary, Rod	McDonough, Mark
McGaughy, Belinda	McKay, Scott
McKinney, Umphrey	McLeon, Pat
McMaster, Dan & Connie	McNutt, W.C.
Measeles, Melvin	Meeks, Barbara
Meineke, Robert and Barbara	Meinhardt, Cliff
Messina, Jake	Middleton, William
Miley, Joyce	Miller, David
Miller, Frederic	Mills, Stephen
Minak, Bill	Mitchell, Pamela
Mitchell, Julea	Moon, Ronald
Moon, Dennis	Mooney, Sonny
Morgan, Joe & Pat	Morris, Marth
Morrison, W.J.	Mowery, Curt
Mullins, Erin	Murphy, Jack
Nealy, Jimmy	Nelson, Oscar
Newell, C.	Nghiem, Doan
Nikolis, William	O'Brien, Catherine
O'Donell, Alice Anne	O'Kane, Ramona
O'Keeffe, Dennis	Oldham, Melanie
O'Neill, Natalie	Ong, Natalie
Orsak, Charles	Osburn, Richard
Ostera Murray, Catherine & Larry F.	Oxford, Hubert
Oxford, Hubert III	Parker, Robin
Parsons, Daniel C.	Pautsch, Richard & Nancy
Pearson, Ric	Pederson, Gordon
Perkowski, Edward & Trudi	Phillips, John
Pirtle, Shane	Polah, Victor
Pool, Tom	Poor, Barry
Porter, Brooks W.	Powell, Darrell
Ramey, T.B. Jr.	Randall, Charlie & Paula
Rasch, Hans and Ann	Ratcliff, Jeremy
Reed, Christine	Reeves, Rose
Reisert, Donald	Reitan, Leo
Reixach, A.J.	Reynolds, Jeffery M.
Richers, John	Richey, Billie
Richey, Robert Jr	Ritter, Ronald
Roane, G. Grant	Robb, Sandra
Roberts, Joseph & Josephine	Robinson, John & Bertha Lee
Roark, Karen	Roberts, Joseph Wayne
Roder, Charles	Rodriguez, Angela
Roesler, Doug	Rosen, Judy
Ryan, Barbara	Ryder, Drew
Saccomanno, Jim	Salatkowski, Ken
Salmen, Fred	Sawyer, Ralph
Schoellkopf, F.C.	Schroeder, Bert
Schenke, Diane	Schubert, Jamie

Scott, Lamoin	Sederdahl, Pamela
Seeger, Klaus	Seidensticker, Eddie
Seidule, Frank	Seymour, Chris
Sharp, Joanna	Shaw, Billy
Shead, Linda	Shores, Kenneth
Shoup, Mona	Sickels, Jerilu
Siddall, Lon	Silverman, Karl & Deborah
Smith, Charles	Smith, Naomi
Smith, Ron	Smith, Barbara
Smith, David	Smith, Edward
Spaunhorst, Clark	Spencer, Nina & Ty
Stanley, Jack	Steik, Peter
Stevens, Chris	Stevens, Frank W.
Stevens, Elizabeth & Guy	Stewart, Sharron
Stokan, Marie & Gerald	Stotler, Mary
Stuart, Ed	Sullivan, Tom & Mary Jane
Strate, K.C.	Strube, Kim
Sweeney, Doug	Sydes, Joe
Tabor, Farris & Mary	Talje ,Sam
Taylor, Susan	Taylor, William and Janice
Taylor, Larry	Taylor, Joel
Taylor, Charles & Susan	Taylor, Christie Walne
Tobin, Laurence	Thompson, James
Treiman, Allan and Diane Humes	Trapman, August & Jeanie
Turberville, Mary	Troxell, Robert
Underwood, David	Tully, John
Van Dussen, Neal	Valek, Millicent
Vaughan, Scott & Helen	Vargas, Karen
Wade, Lorna	Wagner, Liz
Walden, Louis	Walker, George
Wallace, Bernice	Ward, Rex
Wang, Richard	Warren, Mary B.
Warren, Al	Webb, Pat
Weisiger, Craig & Sheri	Westgate, Jim
Wells, Kathy	Whitcomb, J.
Whitaker, Harold	Whitworth, Mary Ellen
Whiteley, Linda	Wiesenborn, Robert
Whynott, Virginia	Williams, Kenneth
Wilcox, Charles	Williams, Donald
Williams, Jim	Wilson, Jack & Carol
Wilson, Donald	Winstead, Mrs.
Ethel & Erwin Wind	Wolf, James
Dan Yarberry	Yandell, Sandra
Yost, Mike	Yarnall, Ann
Zolandz, Julia	Zeigler, Ila & John