Port Cameron, LLC

Dredged Material Management Plan

Originally prepared and submitted in June 2014 by

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Revised and resubmitted by

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ENGINEERING CONSULTANTS

April 2017

Introduction

The purpose of this document is to describe the proposed management plan for the placement of dredged material (DMMP) associated with the proposed Port Cameron facility located in the community of Cameron, LA. The purpose of this document is to fulfill the requirements of Louisiana Administrative Code Title 43 § 723.H.1.a.i., demonstrating that excess material dredged from the Port Cameron site would be beneficially used to the maximum extent practicable.

The construction of Port Cameron would require the installation of 22,000 linear feet of bulkhead, the construction of heavylift boat slips, the relocation of an existing water control structure and multiple existing pipelines, and the creation of a new private road system along with a new public road and bridge crossings. The proposed project will be constructed in a manner that avoids permanent impacts to existing wetlands to the greatest extent practicable. However, in order to logistically construct the proposed project, approximately 322.9 acres of jurisdictional wetlands and 15.4 acres of "other waters of the United States" would be impacted, affected and/or converted upon construction completion.

Port Cameron proposes to dredge approximately 9,000,000 cubic yards of material to construct the project. The Dredged Material Management Plan proposes the use of approximately 4,800,000 to 5,600,000 cubic yards (depending on the actual bulk cut to fill ratio) of this excavated material for the creation of roughly 556 acres of marsh to offset the wetland impacts associated with Port Cameron. The project's inclusion of beneficial use of dredge material for marsh creation is expected, per an LRAM model analysis, to offset the loss of wetlands at the port site; therefore, no compensatory mitigation requirement is anticipated. The following Marsh Creation Plan provides details on the proposed beneficial use portion of the project.

Proposed Marsh Creation Plan

I. Objectives- This Beneficial Use of Dredge Material/Marsh Creation plan was prepared so Port Cameron can utilize approximately 4,800,000 to 5,600,000 cubic yards of material excavated from the port site in a beneficial manner as to fill approximately 556 acres of open water on the Cameron Prairie National Wildlife Refuge, East Cove Unit and create a marsh platform with a final, post compaction and consolidation elevation ranging between +1.08 and +1.1 ft. NAVD88.

II. Site Selection- Careful consideration was given to the selection of the Cameron Prairie National Wildlife Refuge as the preferred location for the beneficial use of dredged material. Factors such as property ownership, coordination with State and Federal agencies, compliance with Louisiana's Comprehensive Master Plan for a Sustainable Coast, and interrelationship with other State and Federal marsh creation efforts were all considered in selecting the marsh creation site. According to the United

States Department of Interior, Fish and Wildlife Service, the marsh creation site on the Refuge was severely impacted by storm surges from Hurricane Ike in 2008 that would require the input of sediment to re-establish marsh. As such the Service has granted an exemption from current policy for Port Cameron to use the Cameron Prairie National Wildlife Refuge, East Cove Unit as a site to create/restore wetlands with the beneficial use of dredge material. Port Cameron believes that the beneficial use of material within the refuge would have the greatest ecological benefit given the area's shallow water bottom area, allowing for a greater acreage of created marsh given the quantity of material to be excavated and placed, and the contiguous nature of the marsh creation site with over 14,000 acres of federally protected marsh. The site also has the opportunity for expansion of the marsh creation acreage if the required acreage for impact offset is increased. Fish and Wildlife Service refuge managers were consulted in order to select the most beneficial site within the refuge.

III. Determination of Habitat Units Created- According to the draft Louisiana Wetland Rapid Assessment Method (LRAM) enclosed, the proposed 556 acre beneficial use site would adequately offset the wetland impacts associated with Port Cameron. The LRAM report is attached as Exhibit A. If any adjustments are made to the draft LRAM, demonstrating a need for additional acreage of created wetlands, the beneficial use site could be expanded to accommodate additional acreage.

IV. Marsh Creation Workplan

a. Design- In coordination with Fish and Wildlife Service, review of similar recent marsh creation projects, and analysis of the geotechnical investigation results of the beneficial use site, Port Cameron proposes to initially fill the marsh creation site to a target elevation of +3.0 ft. NAVD88. The design will result in approximately 1.9 ft of total settlement in the 20-year life of the project. As such, the site is expected to obtain final, post compaction and consolidation elevation, ranging between +1.08 and +1.10 ft. NAVD88, a range that will be comparable to the healthy marsh in the vicinity of CRMS 0650. The design for the beneficial use site is attached as Exhibit B.

b. Construction- Materials used to construct the marsh creation portion of the Port Cameron project will be generated from planned dredging of the entrance channel and internal port channels which Port Cameron expects to generate approximately 9,000,000 cubic yards of native fill. The material will be pumped through a spoil discharge pipe from the dredge site to the marsh creation site. The discharge pipe corridor to the site will head northeast from the dredge site to the southern Refuge boundary then east along the open water canal on the southern edge of the Refuge boundary to the marsh creation site.

Mechanical Dredging utilizing a barge mounted bucket dredge will start at the intersection of the Calcasieu Ship Channel and the new entrance to the port development. This will provide flotation access for hydraulic dredges and other floating equipment. Material excavated during this phase will be utilized for site development. Prior to and during this initial phase of dredging, containment dikes and the dredge discharge pipeline

will be constructed. After flotation access is complete, hydraulic dredging will commence, which will initially consist of excavating the top 8' to 10' of material less suitable for site development. Hydraulic dredging will continue to depths required to fill 556 acres of the beneficial use site within the containment dikes. Dredging to complete site development fill requirements will be performed utilizing a combination of mechanical and hydraulic dredging simultaneously.

c. Planting- Plugs or 4-inch containers (but not trade gallon containers) of appropriate marsh vegetation obtained from a registered licensed regional nursery grower and of a regional eco-type species properly stored and handled to ensure viability will be planted. If plants listed are not available, then substitutions may be made if they are approved by the USACE in cooperation with the resource agencies. Plantings will be planted between March 15th and July 15th. Consideration to fall plantings may be given if the March-July timeframe cannot be met. Port Cameron will plant appropriate species in such a manner to ensure adequate species diversity (Table 1), to include at least 2 different species.

Table 1: Plant Options for Brackish Marsh- to be determined case specifically

Common Name	Scientific Name
marshhay cordgrass	*Spartina patens* (Alton) Muhl
black needle rush	*Juncus roemerianus* Scheele
smooth cordgrass	*Spartina alterniflora* cv. Vermilion
Salt grass	*Distchilis spicata*

V. Maintenance Plan- Port Cameron agrees to maintain the marsh creation site in a vegetated state for the 20-year life of the project. Typical maintenance may require the reconstitution of areas of the site experiencing degradation and/or additional plantings.

VI. Monitoring Requirements- Monitoring of the created marsh to ensure at least 80% vegetative coverage remains within the marsh creation site will begin one year post-planting and will occur, at minimum, in years three, five, ten, fifteen, and twenty post-planting. If adaptive management or maintenance activities require additional plantings, monitoring periods will be adjusted or increased as appropriate. Monitoring reports will be provided to USACE, LDNR Office of Coastal Management and U.S. Fish and Wildlife Service within three months of each monitoring event. Reports will consist of a summary of project status, including percent vegetative cover, percent exotic species, observations made during the annual inspection and qualitative description of the condition of marsh vegetation, and recommendations, if required. A map and photographs will accompany each report to document site conditions at the time of monitoring.

Additionally, Port Cameron will conduct and submit elevation surveys (at points along the 200-foot grid) covering that respective area one (1) year following completion of placement of fill to the LDNR, Office of Coastal Management.

VII. Long Term Management Plan- To ensure the long-term sustainability of the project, Port Cameron will carefully monitor the newly established wetlands in accordance with the above monitoring plan and will plan to make mid-course corrections as necessary to ensure the project continues to perform as designed. As designed, the project is self-sustaining and has no control structures, such as tide gates or pumps, that will require long-term maintenance or replacement.

VIII. Adaptive Management Plan- Because the mitigation project is being built on the Cameron Prairie National Wildlife Refuge, unforeseen changes in site conditions due to salinity or hydrology shifts are not anticipated, with the exception of impacts due to tropical events. Should unforeseen changes occur, Port Cameron, in consultation with interested resource agencies, will evaluate the degree of impacts and measures necessary to remediate identified impacts to the marsh creation site and determine an appropriate adaptive management plan to address the issue. Port Cameron will implement the adaptive management measures necessary to remediate the identified impacts within one year of receiving the approved adaptive management plan.

Appendix A: LRAM Report

Port Cameron LLC

LRAM model in support of 404(b)(1) Permit

The following rationale was used to determine the appropriate factors to assign to the area of impact and the beneficial use site within the LRAM model for the Port Cameron project. Site visits for development of the Jurisdictional Determination were conducted of the impact site in October 2013 and January 2015. A site visit of the beneficial use site was conducted in November 2016. Data sheets from these field investigations as well as aerial imagery and site visits were used in support of the model.

Wetland Status: Degraded

The port site contains wetlands which are heavily impacted and degraded by the continued hydrologic manipulation and management of the site as cattle pasture and is thus considered wetland pasture rather than true fresh/intermediate marsh. The site is heavily rutted from the cattle grazing, which has over time altered the physical structure of the wetland habitat and provides minor habitat value for most wildlife species throughout most of the year, and highly limited access for aquatic species due to hydrologic modification. As such, the site is considered "degraded" according to this criterion.

Habitat Condition: Medium

The site is heavily impacted by previous development interspersed throughout the property, and long-term cattle grazing. The vegetative cover is a mix of native marsh grasses and invasive species. Native emergent vegetative cover is between 25% and 50% and is comprised primarily of *Spartina spartineae* and *Spartina patens*. Exotic plant species comprise between 15% and 50% of the wetland vegetative cover, including *Rosa bracteate*, *Rosa multiflora*, *Cynodon dactylon* and *Verbena litoralis*.

Hydrologic Condition: Low

The site is heavily impacted by anthropogenic alterations to natural hydrology, including levees, canals/ditches and drainage pumps. The largest alteration on the site is a public drainage canal running southeast to northwest through the middle of the property, managed by Cameron Parish, which serves to manipulate water levels within the larger community including the project site. The canal and its adjacent, higher-elevation borrow deposits serve to create a complete hydrologic disconnection between the northern and southern halves of the property. The site is also bisected by a higher-elevation road running north to south in the southern half of the property, which serves to create a complete hydrologic disconnection between the southeastern and southwestern quadrants of the site. This road continues in a northeastern direction through a portion of the northern half of the property, further disrupting hydrologic connection through the site. Additionally, the entire site is considered "under pump", as the hydrology is manipulated by the drainage district's management of the drainage pump station on the canal within the site. The site is part of a larger property which is completely isolated from adjacent wetlands by levees, roads and drainage canals.

Negative Influence: High

An elevated road and a major drainage canal divide on-site habitat into three distinct fragments, which are further fragmented internally by previous development including an abandoned airstrip in the southeastern quadrant of the property. Over 50% of the project boundary is immediately adjacent to a public two lane road (the southern portion of which is a highway) and development (commercial and industrial). The site is part of a larger property which is completely isolated from adjacent wetlands by levees, roads and drainage canals.

Impact Type: Permanent

The proposed port would be a permanent feature in the landscape, and all of the wetlands within the project site would be either dredged or filled permanently.

Mitigation Type: Re-establishment

The 550-acre site is predominantly open water in which the applicant will deposit dredged material to an elevation conducive to tidal marsh re-establishment, plant dredged material and restore/create small tidal channels for fisheries access.

Project Site Management: Active

The beneficial use site is within the larger Cameron Prairie National Wildlife Refuge, within which tidal exchange or overflow from adjacent waterbody is actively managed. Water control structures within a 19-mile levee along Calcasieu Lake are operated by the U.S. Fish and Wildlife Service to maintain optimal conditions for marsh habitat.

Negative Influences: Low

The beneficial use site is well insulated form anthropogenic influences by a buffer of surrounding marsh both within and outside of the NWR. Due to the active management of water levels within the NWR, the impact of any surrounding development such as roads is well mitigated.

Size: >500

The beneficial use site is over 550 acres, and falls within the larger (14,927 acre) East Cove Unit of the Cameron Prairie Refuge, which is Federally protected from development.

Buffer and Upland Inclusions: Inclusion

The wetland buffer for the beneficial use site far exceeds the 200-foot minimum for this criterion, as the site is within the larger (14,927 acre) East Cove Unit of the Cameron Prairie Refuge and surrounded by large expanses of wetlands on all sides.

Louisiana Wetland Rapid Assessment Method (LRAM)

CEMVN Acct #	proposed PRM cameron FIM
Acres Impacted	322.9
Watershed Basin	Calcasieu

		Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Impact Factors	Wetland Status	Degraded	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Habitat Condition	Med	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hydrologic Condition	Low	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Negative Influences	High	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Impact Type	Full/Perm	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sum:	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Area:	322.9							
	Sum x Area Affected:	2098.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

∑ Impacts: 2098.9

		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8
Mitigation Factors	Mitigation Type	Re-Est	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Management	Active	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		-2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Negative Influences	Low	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Size	>500	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Buffer / Upland	Inclusion	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
		0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sum:	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Area:	556.0	0.0						
	Sum x Area Affected:	2613.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

∑ Mitigation: 2613.2

If additional credits will be obtained from a mitigation bank, use the Bank Mit below.

Louisiana Wetland Rapid Assessment Method (LRAM)

CEMVN Acct #	proposed PRM cameron FIM
Acres Impacted	322.9
Watershed Basin	Calcasieu

Bank Mit

	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7	Bank 8
Select Bank:	SouthFork FM	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here	Pick Here
Mitigation Potential:	5.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Acres Required:	-87.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

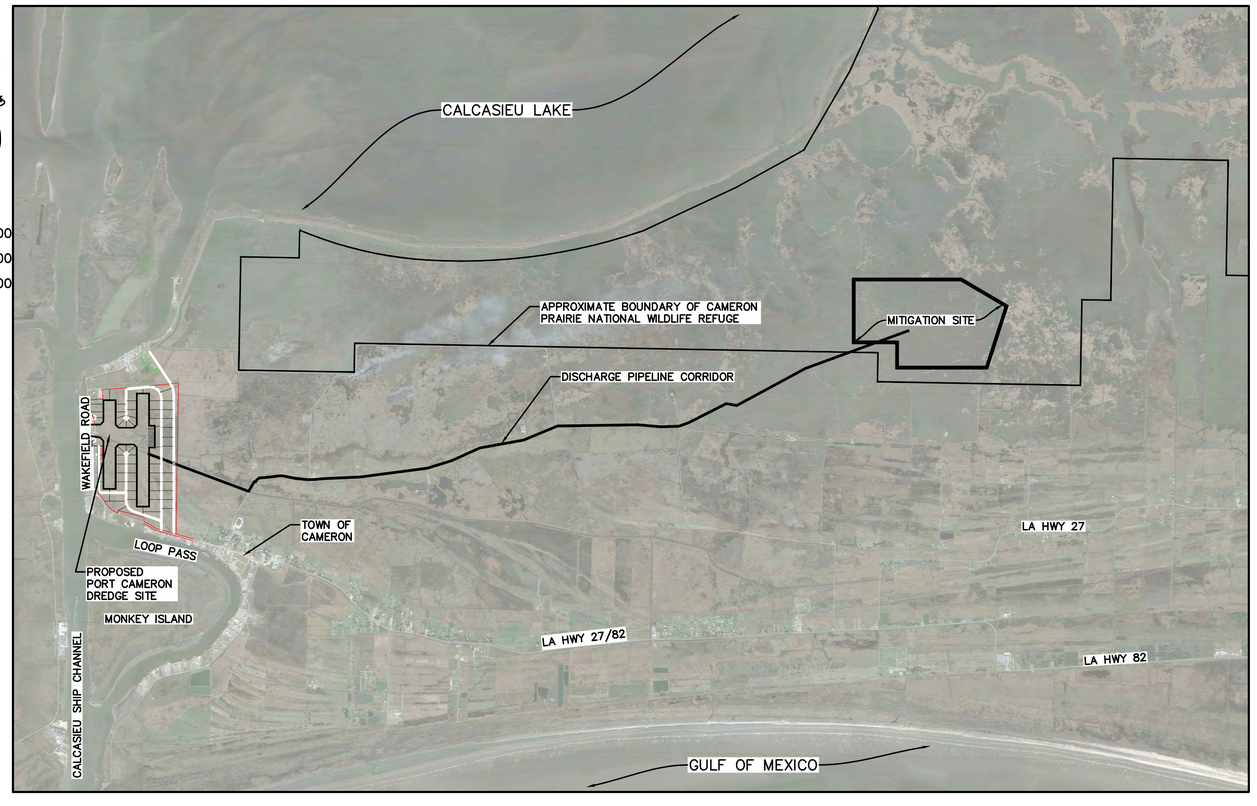
Appendix B: Beneficial Use of Dredged Material Figures

PORT CAMERON DREDGING AND MARSH CREATION PROJECT

FEBRUARY 2017

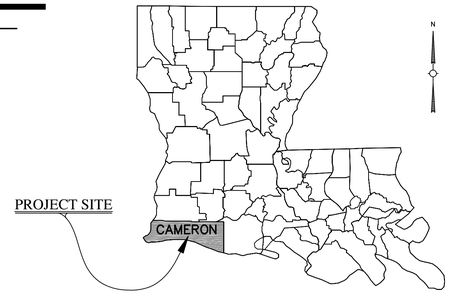
INDEX TO SHEETS

SHEET	DESCRIPTION
1	TITLE SHEET
2	SUMMARY OF ESTIMATED QUANTITIES
3	TEMPORARY DIVERSION AND DEMOLITION PLAN
4	OVERALL DREDGING PLAN
5	DREDGE CROSS SECTIONS A, B & C
6	DREDGE CROSS SECTIONS D, E & F
7	DREDGE CROSS SECTIONS G, H & I
8	DREDGE CROSS SECTIONS J, K & L
9	DREDGE CROSS SECTIONS M, N & O
10	DREDGE CROSS SECTION P
11	GRADING LAYOUT
12	MITIGATION AREA SITE MAP
13	MITIGATION AREA CROSS SECTIONS 20+00 – 40+00
14	MITIGATION AREA CROSS SECTIONS 45+00 – 65+00
15	MITIGATION AREA CROSS SECTIONS 70+00 – 90+00
16	DREDGE DISCHARGE LINE CORRIDOR
17	TYPICAL DETAILS
18	PLANTING DETAILS
19	BULKHEAD LOCATION PLAN



LOCATION MAP

SCALE: NOT TO SCALE



VICINITY MAP

TYPE OF CONSTRUCTION:

MAJOR CLASSIFICATION: HEAVY CONSTRUCTION
SUBCLASSIFICATION: DREDGING AND WHARFS, DOCKS, HARBOR IMPROVEMENTS, AND TERMINALS.

NO.	DATE	REVISIONS	BY

LLOYD R. ERIKSON
NAME
PRELIMINARY
2/25/16
DATE
31061
LICENSE NO.

THIS DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION CONVEYANCE, SALES OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT

PLANS PREPARED BY AND RECOMMENDED FOR APPROVAL:

EVANS-GRAVES ENGINEERS, INC.
ENGINEERING CONSULTANTS 9029 JEFFERSON HWY. BATON ROUGE, LA. 70809 (225) 926-1620

LLOYD R. ERIKSON, P.E.
CHIEF CIVIL ENGINEER
P.E. REG. No. 31061

DATE

SHEET NUMBER 1

PARISH	CAMERON	
FEDERAL PROJECT	N/A	
STATE PROJECT	N/A	
DESIGNED CHECKED	LRE SEW	
DETAILED CHECKED	DRW LRE	
DATE SHEET	APRIL 2017	

PRELIMINARY

TITLE SHEET

PORT CAMERON – CANAL DREDGING PLANS

LA One Call 1-800-272-3020 Call before you dig

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans\1402500_TI.dwg – Apr 04, 2017 – 2:56pm

EXISTING LEGEND:

- POWER POLE
- WATER METER
- TELEPHONE PEDESTAL
- SANITARY SEWER MANHOLE
- FIRE HYDRANT
- MAILBOX
- WATER VALVE
- RIGHT OF WAY MARKER
- ABANDONED GAS WELL SITE
- FENCE
- OVERHEAD ELECTRIC
- GAS PIPELINE
- 6" WATER LINE
- 10" WATER LINE
- EXISTING WATERWAY
- EXISTING ROADWAY
- EXISTING GROUND CONTOURS

PHASING LEGEND:

- PHASE 1 DREDGING (3,281,866 C.Y. TOTAL) TO COMMENCE @ N.T.P. AND WATER LINE RELOCATION
- PHASE 2 DREDGING (935,233 C.Y. TOTAL) TO COMMENCE @ ENLINK PIPELINE RELOCATION
- PHASE 3 DREDGING (1,753,888 C.Y. TOTAL) TO COMMENCE @ NEW WATER CONTROL STRUCTURE START-UP
- PHASE 4 DREDGING (2,802,793 C.Y. TOTAL) TO COMMENCE ONLY AS DIRECTED BY OWNER

1" = 300'

CALCASIEU SHIP CHANNEL

CROSS SECTION BASELINE FOR SECTIONS 'A-A' THRU 'G-G'

CROSS SECTION BASELINE FOR SECTIONS 'H-H', 'I-I', 'O-O' & 'P-P'

EXIST. WAKEFIELD ROAD BRIDGE (TO BE REMOVED & RELOCATED UNDER SEPARATE COVER)

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE LOWERED UNDER SEPARATE COVER)

EXIST. WAKEFIELD ROAD

EXIST. CAPPED ABANDONED GAS WELL.

REQ'D. EXIST. ENLINK PIPELINE TO BE REMOVED BY OTHERS.

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS)

REQ'D. EXIST. TRANSCANADA & KINETICA PIPELINES TO BE RELOCATED BY OTHERS.

PHASE 3 DREDGING 1,753,888 C.Y.

EXIST. W-1 CANAL WATER CONTROL STRUCTURE (TO BE RELOCATED BY OTHERS)

PHASE 4 DREDGING 1,143,548 C.Y.

EXIST. W-1 CANAL

PHASE 2 DREDGING 46,004 C.Y.

LOOP PASS

EXIST. LA HWY 27/82

EXIST. CAPPED ABANDONED GAS WELL.

FUTURE CONSTRUCTION

PHASE 1 DREDGING 3,281,866 C.Y.

EXIST. CAPPED ABANDONED GAS WELL.

ENERGY ROAD (65' R/W)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS)

CROSS SECTION BASELINE FOR SECTIONS 'J-J' THRU 'N-N'

EXIST. GRAVEL ROAD

PHASE 4 DREDGING 1,659,245 C.Y.

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE REMOVED UNDER SEPARATE COVER)

CPT-7 REQ'D. EXIST. ENLINK PIPELINES TO BE RELOCATED BY OTHERS.

PHASE 2 DREDGING 889,229 C.Y.

EXIST. CHENIERE PIPELINE

REQ'D. RELOCATED W-1 CANAL CONTROL STRUCTURE. (BY OTHERS)

EXIST. CAPPED ABANDONED GAS WELL.

APPROXIMATE LOCATION OF EXIST. 10" WATER LINE. (CONTRACTOR TO VERIFY LOCATION AND SIZE)

REQ'D. BULKHEAD WALL. (BY OTHERS)(TYP.)

PORT CAMERON DRIVE

EXIST. CAPPED ABANDONED GAS WELL.

EXPLORATION ROAD (65' R/W)

EVIATOR ROAD (UNDER SEPARATE COVER)

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS)

PROPERTY LINE (TYP.)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS)

EAST FORK

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-9 B-10 B-11

CPT-1 CPT-2 CPT-3 CPT-4 CPT-5 CPT-6 CPT-8 CPT-9

RB-1 RB-2 RB-3 RB-4 RB-5 RB-6 RB-7 RB-8 RB-9 RB-10 RB-11

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STATE PROJECT	N/A
DESIGNED	LRE
CHECKED	SEW
DETAILED	DRW
CHECKED	LRE
DATE	APRIL 2017
SHEET	

PRELIMINARY

NO. DATE REVISION DESCRIPTION BY

OVERALL DREDGING PLAN

PORT CAMERON - CANAL DREDGING PLANS

LA One Call 1-800-272-3020 Call before you dig

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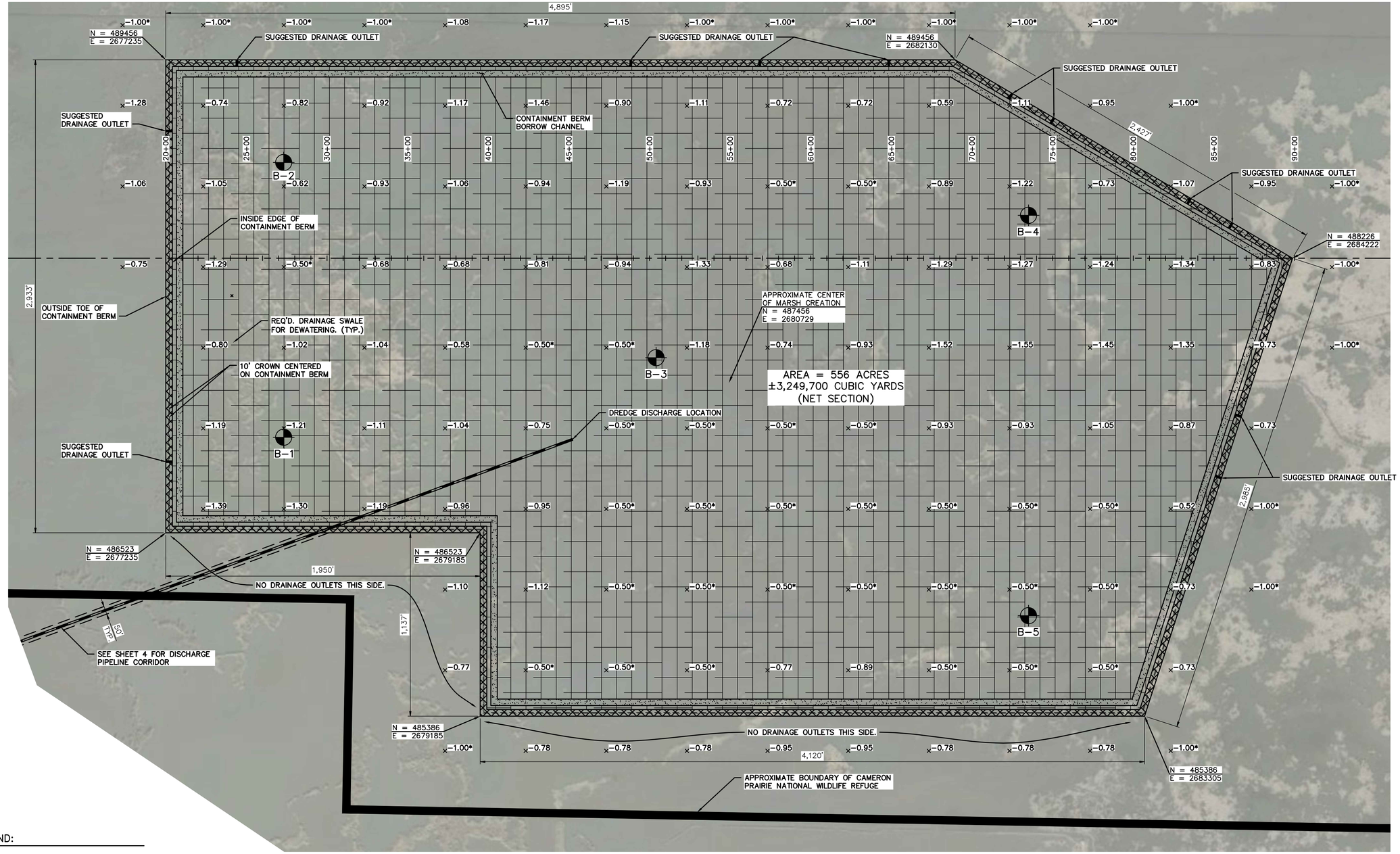

LEGEND:

- DREDGE DISCHARGE PIPELINE
- DREDGE PIPELINE CORRIDOR
- CONTAINMENT BERM (EXCAVATED MATERIAL)
- CONTAINMENT BERM BORROW CHANNEL (TO BE BACKFILLED WITH DREDGED MATERIAL)
- DREDGE FILL PLACEMENT (DREDGED MATERIAL)

MITIGATION AREA SITE MAP

300 0 300 600

SCALE IN FEET

NOTE:
THE GEOTECHNICAL INFORMATION AND ANALYSIS FOR THE BORROW AREA AND THE MARSH CREATION AREA WERE PERFORMED BY PROFESSIONAL SERVICES INDUSTRIES FROM OCTOBER 2016 TO FEBRUARY 2017. SOIL BORES ARE LOCATED IN PROJECT SPECS.

SHEET NUMBER 12

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CAMERON	N/A	N/A

DESIGNED	DRAWN	DATE
LRE	LRE	APRIL 2017
CHECKED	DETAILED	SHEET
SEW	LRE	

PRELIMINARY

NO.	REVISION DESCRIPTION	DATE	BY

MITIGATION AREA SITE MAP

PORT CAMERON – CANAL DREDGING PLANS

LA One Call
1-800-272-3020
Call before you dig

EC

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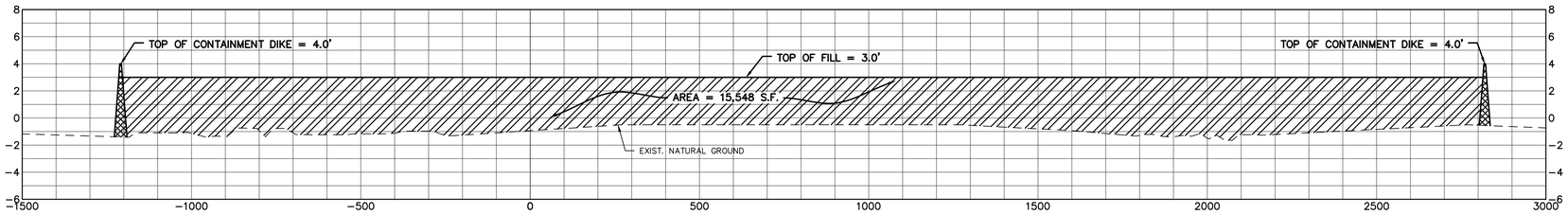

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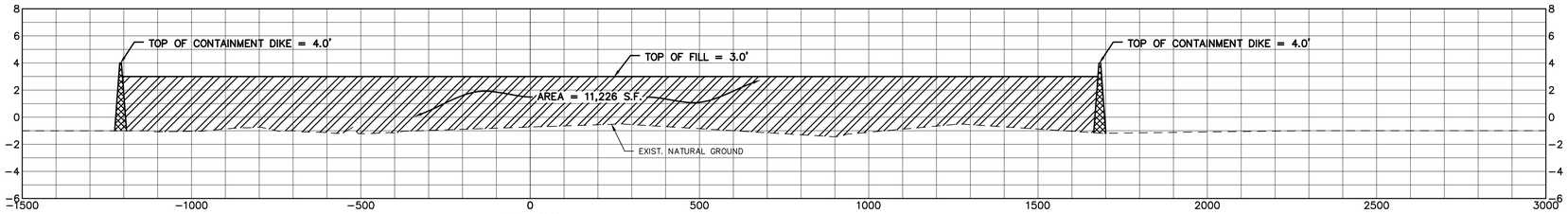

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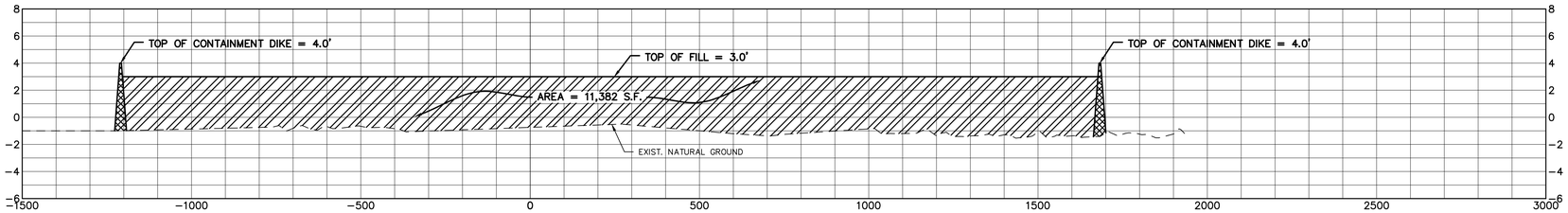

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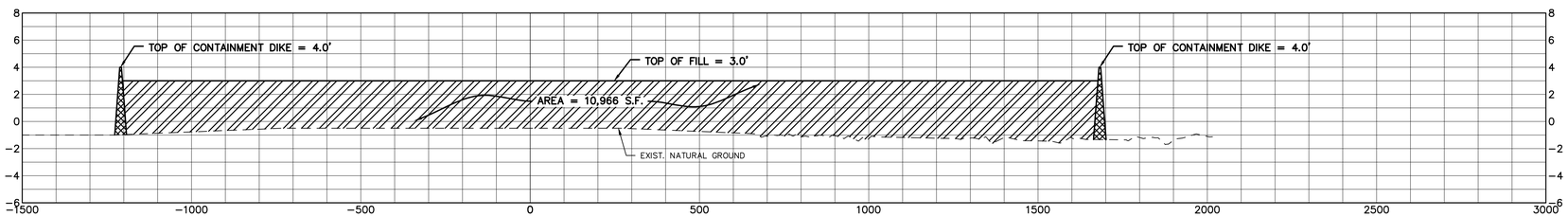

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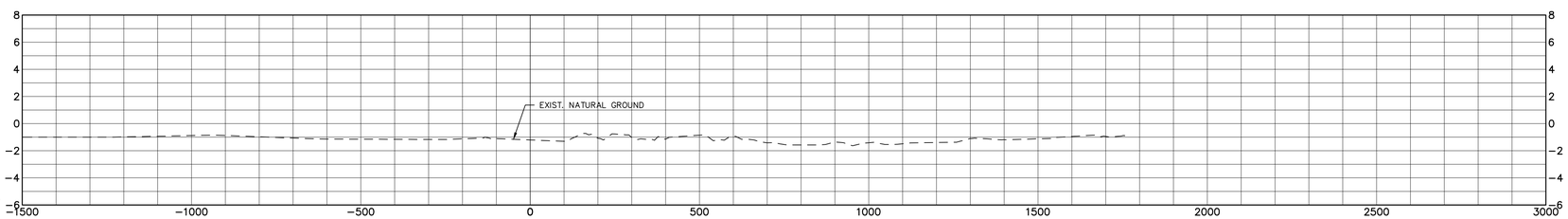


20+00

LEGEND

CONTAINMENT DIKE FILL

MITIGATION FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER 13

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW
CHECKED: LRE
DATE: APRIL 2017
SHEET

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION | BY

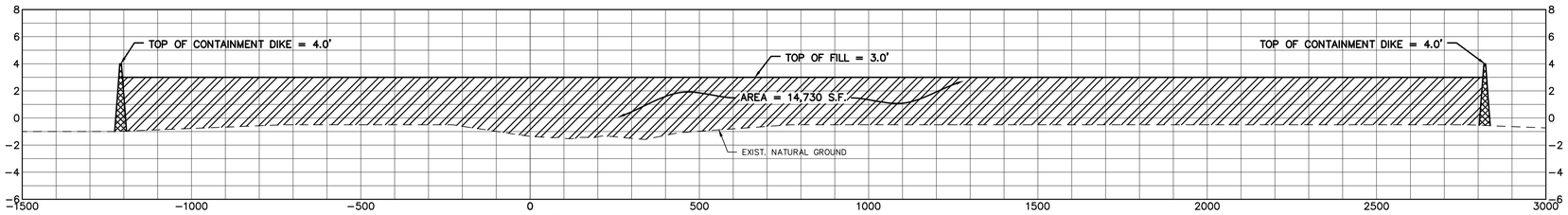
MITIGATION AREA CROSS SECTIONS
20+00 - 40+00

PORT CAMERON - CANAL DREDGING PLANS

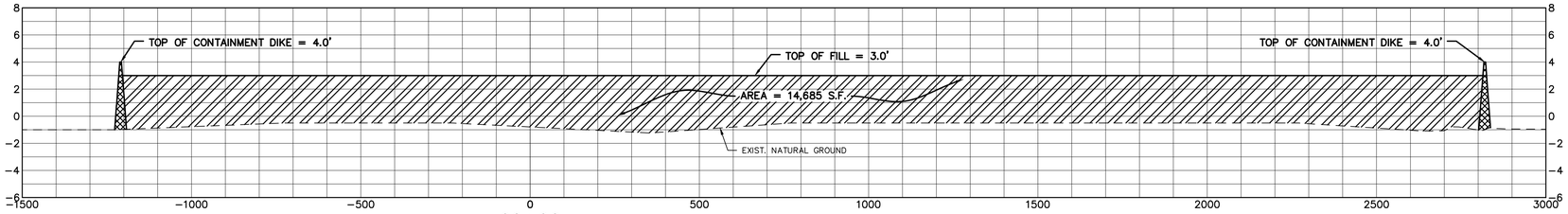
LA One Call
1-800-272-3020
Call before you dig

EG

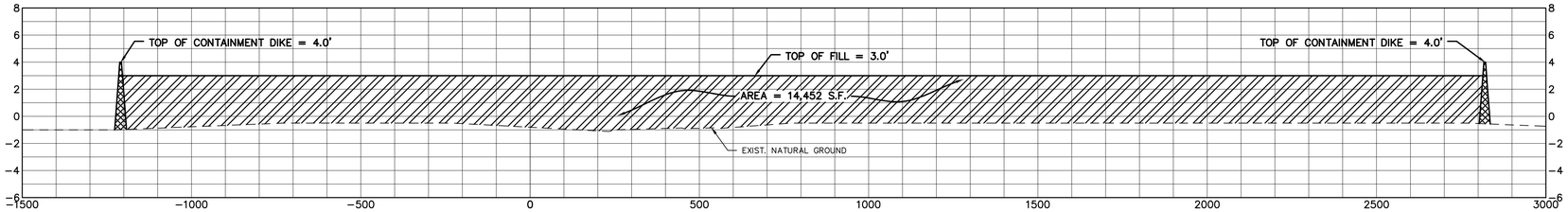
Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans\14025DG_XSEC02.dwg - Apr 04, 2017 - 2:59pm



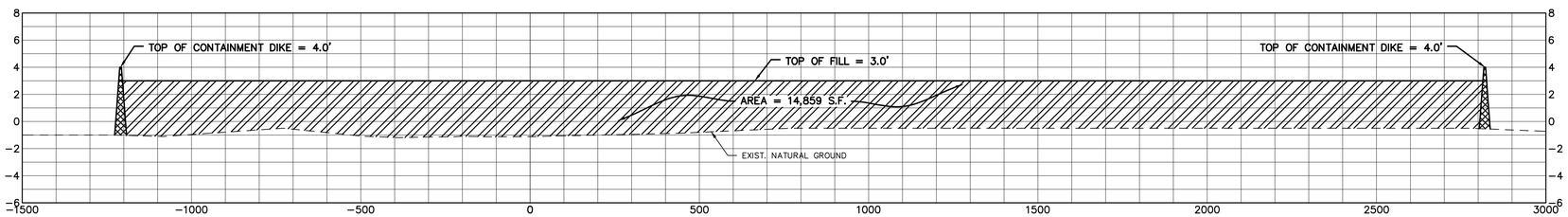
65+00



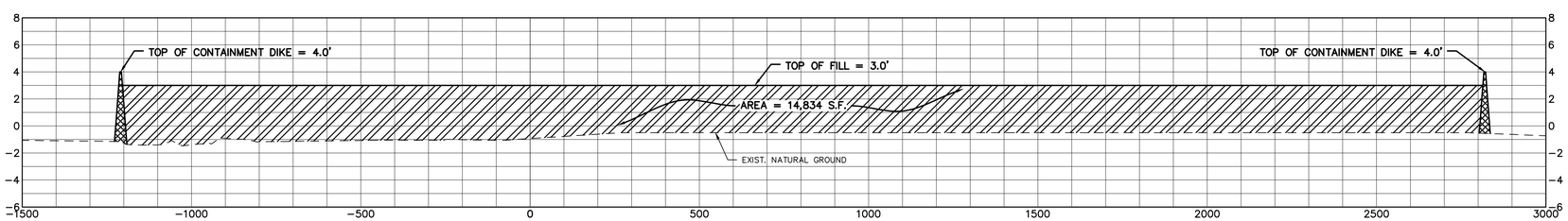
60+00



55+00



50+00



45+00

LEGEND

CONTAINMENT DIKE FILL

MITIGATION FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER 14

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW
CHECKED: LRE
DATE: APRIL 2017
SHEET

PRELIMINARY

NO. | REVISION DESCRIPTION | DATE | BY

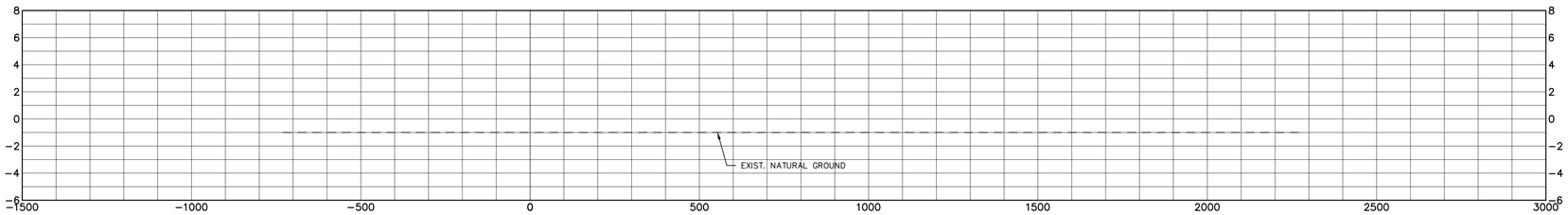
MITIGATION AREA CROSS SECTIONS
45+00 – 65+00

PORT CAMERON – CANAL DREDGING PLANS

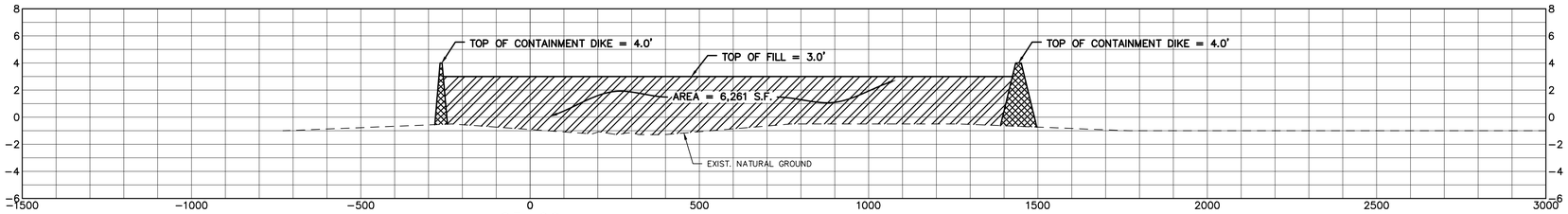
LA One Call
1-800-272-3020
Call before you dig

EG

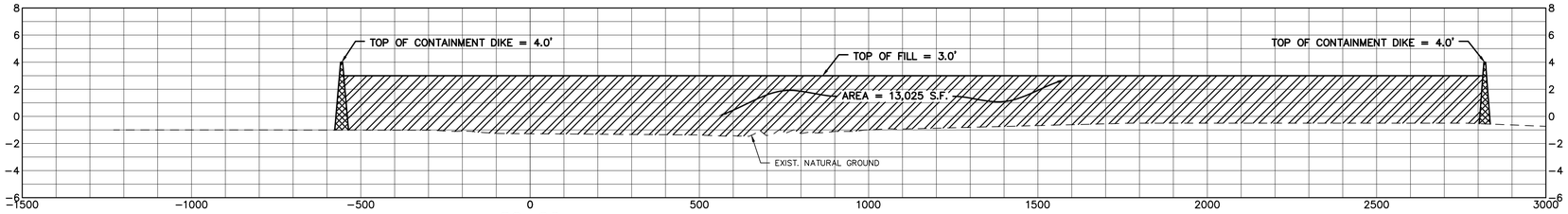
Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans\14025DG_XSEC02.dwg – Apr 04, 2017 – 2:59pm



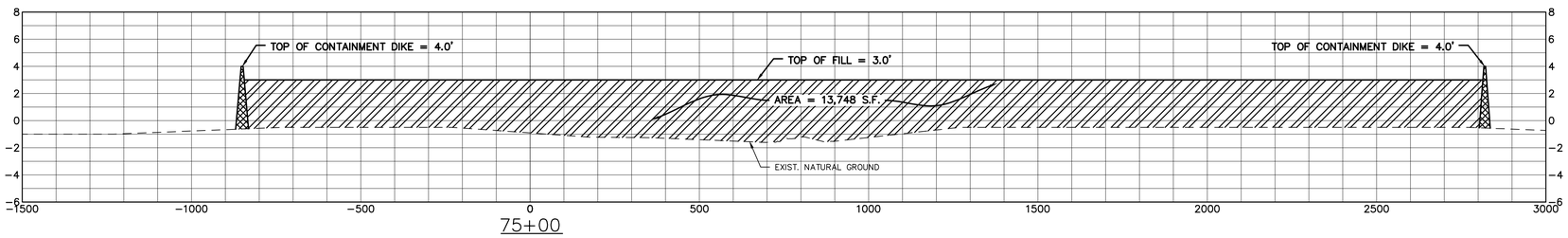
90+00



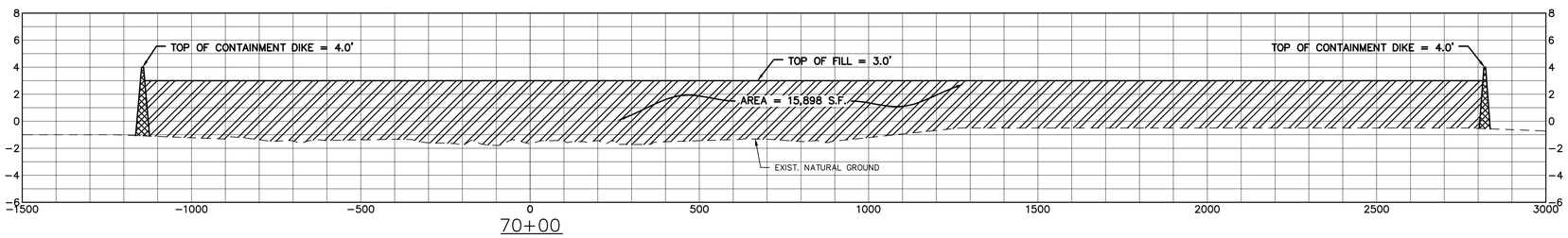
85+00



80+00



75+00



70+00

LEGEND

CONTAINMENT DIKE FILL

MITIGATION FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER 15

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW
CHECKED: LRE
DATE: APRIL 2017
SHEET

PRELIMINARY

NO. | REVISION DESCRIPTION | DATE | BY

MITIGATION AREA CROSS SECTIONS
70+00 – 90+00

PORT CAMERON – CANAL DREDGING PLANS

LA One Call
1-800-272-3020
Call before you dig

EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans\1402500_XSEC02.dwg – Apr 04, 2017 – 2:59pm

DREDGE DISCHARGE LINE CORRIDOR PI LOCATIONS

PI NUMBER	NORTHING	EASTING
1	481560	2645585
2	479878	2650088
3	480304	2650340
4	480302	2650399
5	480415	2650478
6	480480	2650572
7	480516	2651012
8	480575	2651484
9	480576	2651606
10	480460	2652189
11	480404	2652744
12	480409	2653056
13	480448	2653434
14	480522	2655098
15	480920	26588123
16	481254	2659205
17	481832	2660485
18	482185	2662454
19	482814	2663974
20	482870	2667611
21	482779	2668609
22	482804	2669430
23	482958	2669858
24	483820	2671558
25	483735	2672029
26	485404	2675117
27	487102	2679757

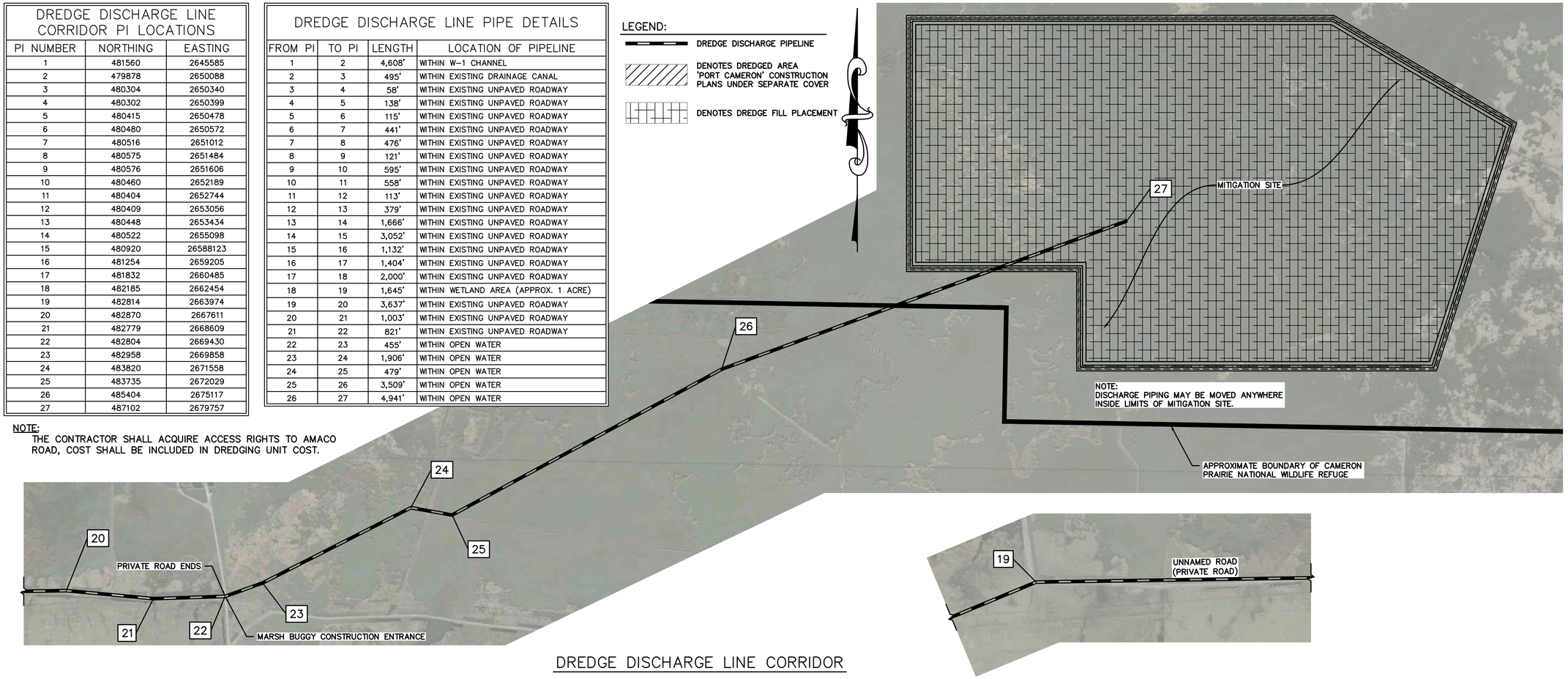
DREDGE DISCHARGE LINE PIPE DETAILS

FROM PI	TO PI	LENGTH	LOCATION OF PIPELINE
1	2	4,608'	WITHIN W-1 CHANNEL
2	3	495'	WITHIN EXISTING DRAINAGE CANAL
3	4	58'	WITHIN EXISTING UNPAVED ROADWAY
4	5	138'	WITHIN EXISTING UNPAVED ROADWAY
5	6	115'	WITHIN EXISTING UNPAVED ROADWAY
6	7	441'	WITHIN EXISTING UNPAVED ROADWAY
7	8	476'	WITHIN EXISTING UNPAVED ROADWAY
8	9	121'	WITHIN EXISTING UNPAVED ROADWAY
9	10	595'	WITHIN EXISTING UNPAVED ROADWAY
10	11	558'	WITHIN EXISTING UNPAVED ROADWAY
11	12	113'	WITHIN EXISTING UNPAVED ROADWAY
12	13	379'	WITHIN EXISTING UNPAVED ROADWAY
13	14	1,666'	WITHIN EXISTING UNPAVED ROADWAY
14	15	3,052'	WITHIN EXISTING UNPAVED ROADWAY
15	16	1,132'	WITHIN EXISTING UNPAVED ROADWAY
16	17	1,404'	WITHIN EXISTING UNPAVED ROADWAY
17	18	2,000'	WITHIN EXISTING UNPAVED ROADWAY
18	19	1,645'	WITHIN WETLAND AREA (APPROX. 1 ACRE)
19	20	3,637'	WITHIN EXISTING UNPAVED ROADWAY
20	21	1,003'	WITHIN EXISTING UNPAVED ROADWAY
21	22	821'	WITHIN EXISTING UNPAVED ROADWAY
22	23	455'	WITHIN OPEN WATER
23	24	1,906'	WITHIN OPEN WATER
24	25	479'	WITHIN OPEN WATER
25	26	3,509'	WITHIN OPEN WATER
26	27	4,941'	WITHIN OPEN WATER

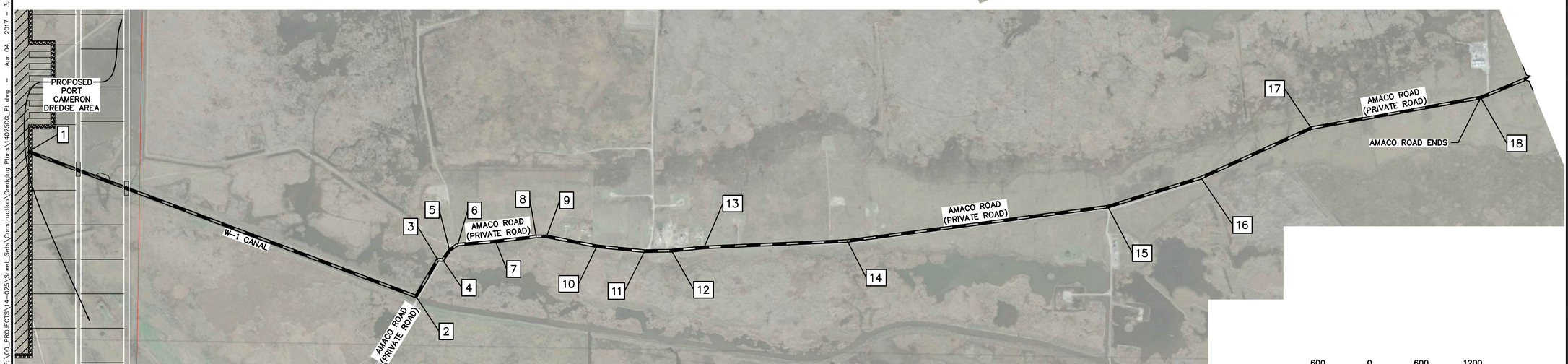
LEGEND:

- DREDGE DISCHARGE PIPELINE
- DENOTES DREDGED AREA 'PORT CAMERON' CONSTRUCTION PLANS UNDER SEPARATE COVER
- DENOTES DREDGE FILL PLACEMENT

NOTE:
THE CONTRACTOR SHALL ACQUIRE ACCESS RIGHTS TO AMACO ROAD, COST SHALL BE INCLUDED IN DREDGING UNIT COST.



DREDGE DISCHARGE LINE CORRIDOR



DREDGE DISCHARGE LINE CORRIDOR

600 0 600 1200

SCALE IN FEET

SHEET NUMBER 16

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW
CHECKED: LRE
DATE: APRIL 2017
SHEET BY

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION

DREDGE DISCHARGE LINE CORRIDOR

PORT CAMERON – CANAL DREDGING PLANS

LA One Call 1-800-272-3020 Call before you dig

EG

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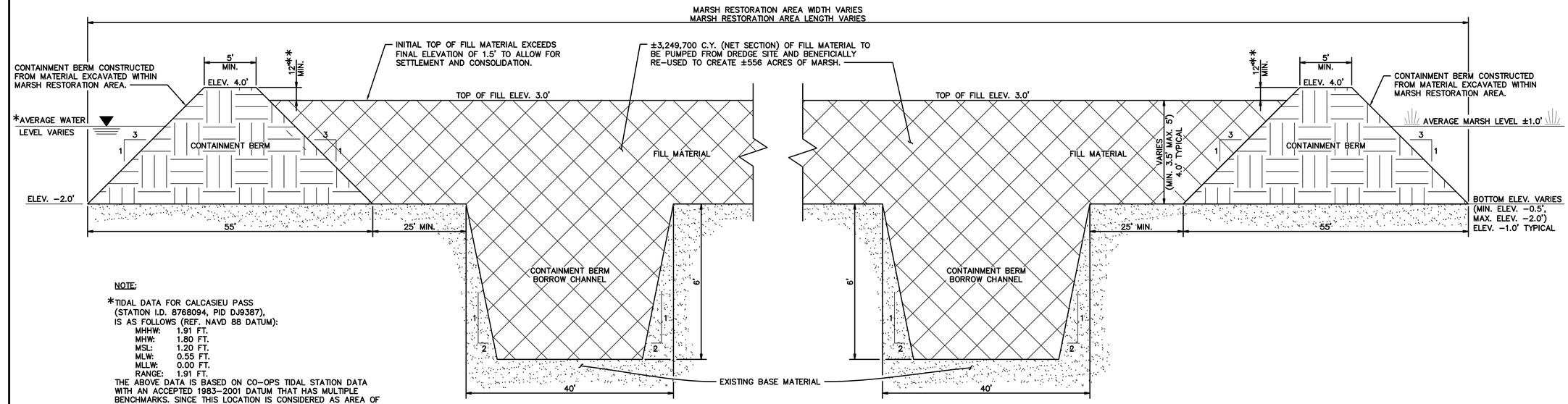


NOTE:

*TIDAL DATA FOR CALCASIEU PASS (STATION I.D. 8768094, PID DJ9387), IS AS FOLLOWS (REF. NAVD 88 DATUM):

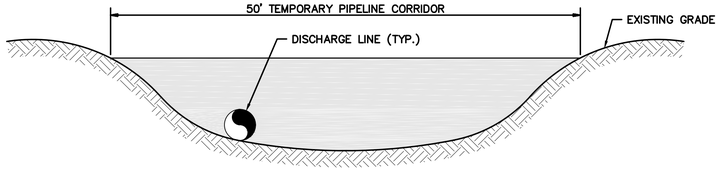
MHHW:	1.91 FT.
MHW:	1.80 FT.
MSL:	1.20 FT.
MLW:	0.55 FT.
MLLW:	0.00 FT.
RANGE:	1.91 FT.

THE ABOVE DATA IS BASED ON CO-OPS TIDAL STATION DATA WITH AN ACCEPTED 1983-2001 DATUM THAT HAS MULTIPLE BENCHMARKS. SINCE THIS LOCATION IS CONSIDERED AS AREA OF HIGH SUBSIDENCE, THESE VALUES MAY HAVE A ±1 FT. POSSIBLE ERROR.

**GAPS ARE TO BE LEFT IN UPPER ELEVATION OF CONTAINMENT BERM AS REQUIRED FOR DRAINAGE OF WATER IMPOUNDED IN DREDGE FILL AREA.

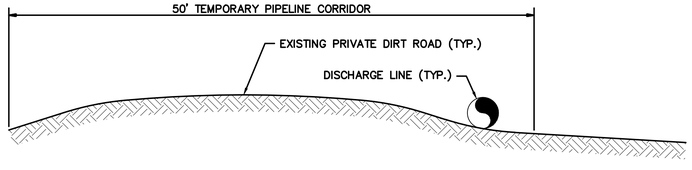
TYPICAL MARSH RESTORATION CROSS-SECTION

N.T.S.



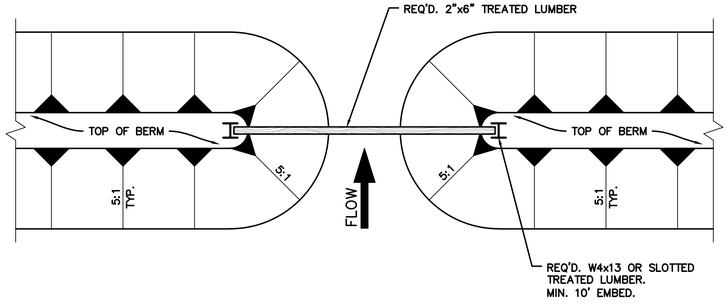
TYPICAL DISCHARGE LINE CORRIDOR IN W-1 CHANNEL

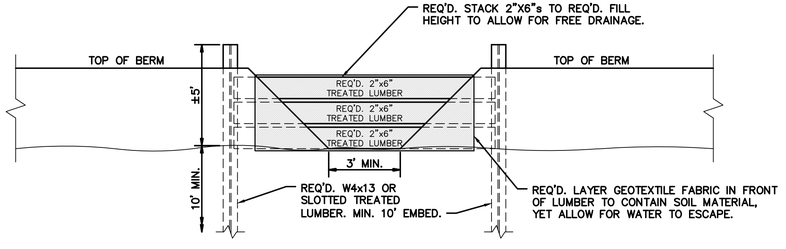
N.T.S.



TYPICAL DISCHARGE LINE CORRIDOR ALONG PRIVATE DRIVES

N.T.S.





SUGGESTED DRAINAGE OUTLET

N.T.S.

NOTE:
TYPICAL DRAINAGE OUTLET MAY BE MODIFIED. CONTRACTOR TO SUBMIT PROPOSED DRAINAGE OUTLET FOR APPROVAL.

SHEET NUMBER 17

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	DETAILED	DATE
LRE	DRW	APRIL 2017
CHECKED	CHECKED	SHEET
SEW	LRE	

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

TYPICAL DETAILS

PORT CAMERON - CANAL DREDGING PLANS

LA One Call 1-800-272-3020 Call before you dig

EG

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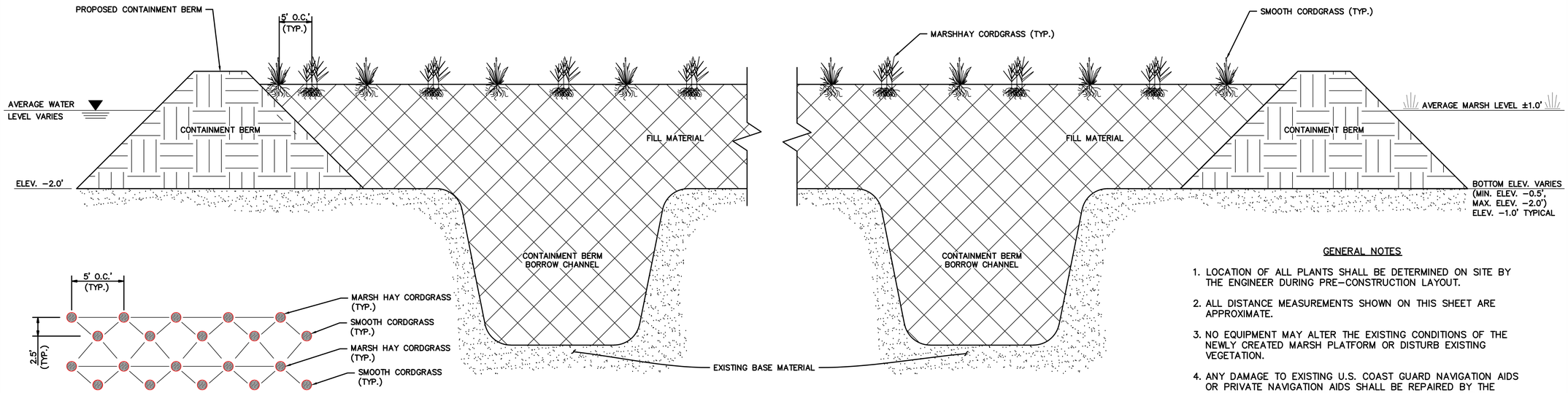
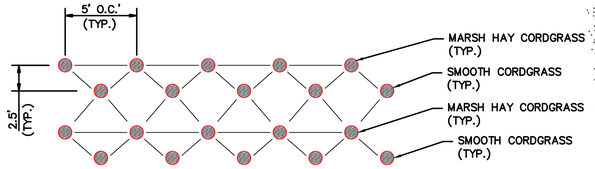




TYPICAL PLAN
PLANTING LAYOUT
N.T.S.

TYPICAL MARSH RESTORATION CROSS-SECTION
N.T.S.

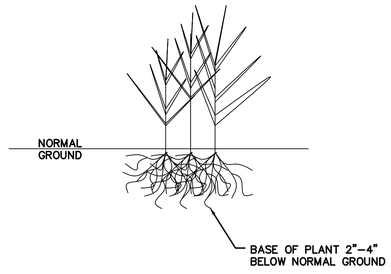
GENERAL NOTES

1. LOCATION OF ALL PLANTS SHALL BE DETERMINED ON SITE BY THE ENGINEER DURING PRE-CONSTRUCTION LAYOUT.
2. ALL DISTANCE MEASUREMENTS SHOWN ON THIS SHEET ARE APPROXIMATE.
3. NO EQUIPMENT MAY ALTER THE EXISTING CONDITIONS OF THE NEWLY CREATED MARSH PLATFORM OR DISTURB EXISTING VEGETATION.
4. ANY DAMAGE TO EXISTING U.S. COAST GUARD NAVIGATION AIDS OR PRIVATE NAVIGATION AIDS SHALL BE REPAIRED BY THE CONTRACTOR TO U.S. COAST GUARD STANDARDS AT THE EXPENSE OF THE CONTRACTOR.
5. AVERAGE MARSH LEVEL IS +1.1' AS REFERENCED TO NAVD 88, US FEET.
6. ALL EQUIPMENT SHALL BE FLOATING AT ALL TIMES DURING TRANSIT TO AND FROM THE PROJECT SITE OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.

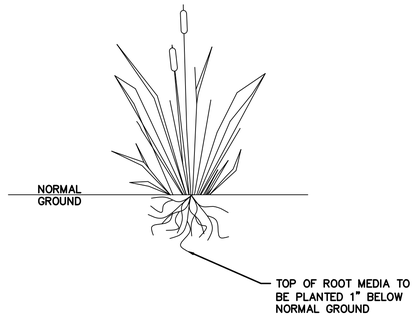
SUMMARY OF ESTIMATED QUANTITIES

REF. NO.	BOTANICAL NAME	DESCRIPTION	UNIT	SIZE	ESTIMATED QUANTITY
1.	SPARTINA PATENS "GULF COAST"	MARSHHAY CORDGRASS VEGETATIVE PLUGS	EACH	ROOT MASS NOT LESS THAN 2" ø AT ROOT CROWN WITH A MINIMUM OF 5 ACTIVELY GROWING STEMS 12" IN HEIGHT	535,600
2.	SPARTINA ALTERNIFOLIA "VERMILION"	SMOOTH CORDGRASS VEGETATIVE PLUGS	EACH	ROOT MASS NOT LESS 2" ø AT ROOT CROWN WITH A MINIMUM OF 3 ACTIVELY GROWING STEMS 10" IN HEIGHT	535,600

QUANTITIES SHOWN ARE FOR BID PURPOSES ONLY. THE OWNER RESERVES THE RIGHT TO ADJUST QUANTITIES HIGHER OR LOWER WITHOUT ADJUSTMENT TO THE UNIT PRICE.



TYPICAL PLANTING DETAIL
MARSH HAY CORDGRASS
N.T.S.



TYPICAL PLANTING DETAIL
SMOOTH CORDGRASS PLUG
N.T.S.

CONTRACTOR SHALL CHECK WITH OWNER'S REPRESENTATIVE BEFORE INITIATING ANY PLANTING ACTIVITIES. GENERALLY, PLANTINGS SHALL BE ATTEMPTED DURING MARCH 15TH THROUGH JUNE 15TH, NO LATER THAN JULY 15TH. FALL PLANTINGS SHALL NOT BE RULED OUT IF DEEMED ACCEPTABLE ON A CASE-BY-CASE BASIS.

PRIOR TO PLACING MATERIAL IN THE MARSH CREATION AREA, ALL RETENTION DIKES AND WASTE WEIRS SHALL BE CONSTRUCTED AND MAINTAINED BY THE CONTRACTOR TO CONFINE THE DREDGE MATERIAL IN THE MARSH CREATION AREA. MATERIALS NECESSARY FOR DIKE CONSTRUCTION OR MAINTENANCE SHALL BE OBTAINED FROM WITHIN THE MARSH CREATION AREA AT THE LIMITS SHOWN IN THE CONTRACT DRAWINGS.

PLANTS SHALL BE PLANTED THE SAME DAY THEY ARE DELIVERED TO THE SITE IF POSSIBLE. PLANTS SHALL NOT BECOME WATER STRESSED PRIOR TO PLANTING. PLANTS SHALL RETAIN THEIR STEM AND LEAF RIGIDITY AT ALL TIMES INDICATING ADEQUATE MOISTURE IS BEING RECEIVED. PLANTS SHALL BE WATERED WITH WATER WITHIN THE SALINITY RANGES IN WHICH THEY WERE GROWN. THE CONTRACTOR MUST TAKE THE NECESSARY PRECAUTIONS TO ENSURE THAT PLANT MATERIALS RECEIVE ADEQUATE WATER DURING ALL PHASES OF THE CONTRACT PRIOR TO ACTUAL PLANTING. TRANSPLANTS MUST STAY MOIST DURING MOBILIZATION AND WHILE ON SITE PRIOR TO PLANTING. PLANTS APPEARING DISCOLORED, SHRIVELED, DEHYDRATED, OR OTHERWISE STRESSED SHALL BE REJECTED.

THE CONTRACTOR SHALL PROVIDE OFFICIAL DOCUMENTATION THAT THE NURSERY PROVIDING PLANT MATERIAL HAS RECEIVED FOUNDATION MATERIAL FOR SPARTINA ALTERNFOLIA "VERMILION" AND SPARTINA PATENS "GULF COAST" FROM THE GOLDEN MEADOW PLANT MATERIAL CENTER. FOUNDATION MATERIAL FOR NURSERY PROPAGATION CAN BE OBTAINED FROM:

GOLDEN MEADOW PMC
438 AIRPORT ROAD
GALLIANO, LA 70354
(985) 475-5280

SHEET NUMBER 18

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	DRAWN	DATE
KDN	DRW	APRIL 2017
CHECKED	DETAILED	SHEET
LRE	LRE	BY

PRELIMINARY

NO.	REVISION DESCRIPTION	DATE	BY

PLANTING DETAILS

PORT CAMERON - CANAL DREDGING PLANS

1-800-272-3020
Call before you dig

EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans\14025DG_PNTD101.dwg - Apr 04, 2017 - 3:00pm

From: Breaux, Brian W CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: FW: Port Cameron Beneficial Use Plan Email 1
Date: Monday, November 6, 2017 10:59:37 AM
Attachments: Port Cameron Beneficial Use Marsh Creation Plan 2017.11.3.pdf
Port Cameron Beneficial Use Marsh Creation Plan Beneficial Use Marsh Creation Plan AppA_Part1.pdf

---

Additional information for your consideration.

Brian W. Breaux
Regulatory Branch, Special Projects & Policy Team
(504) 862-1938
brian.w.breaux@usace.army.mil

-----Original Message-----
From: Lee Walker [mailto:lwalker@evans-graves.com]
Sent: Friday, November 3, 2017 5:04 PM
To: Mayer, Martin S CIV USARMY CEMVN (US) <Martin.S.Mayer@usace.army.mil>; Breaux, Brian W CIV USARMY CEMVN (US) <Brian.W.Breaux@usace.army.mil>
Cc: Bob Rowlette <browlette@evans-graves.com>
Subject: [EXTERNAL] Port Cameron Beneficial Use Plan Email 1

In regards to the EPA's request for information on the beneficial use site, I am sending the beneficial use plan which includes a narrative regarding construction, maintenance and monitoring, construction plans for the site (Appendix A), and the Settlement Report used to determine the necessary initial fill height for the site to settle to marsh grade after consolidation. I have attached the first two of five files due to file size.

Once you have received all five files, please confirm that you have received them.

Thanks and have a good weekend!

Lee

Lee Walker

Evans-Graves Engineers

504-913-1857

From: Breaux, Brian W CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: FW: Port Cameron BU files
Date: Monday, November 6, 2017 10:34:29 AM
Attachments: Port Cameron Beneficial Use Marsh Creation Plan AppB.pdf

---

More info....you should have received a total of 5 emails containing a total of 7 files.

Brian W. Breaux
Regulatory Branch, Special Projects & Policy Team
(504) 862-1938
brian.w.breaux@usace.army.mil

-----Original Message-----
From: Lee Walker [mailto:lwalker@evans-graves.com]
Sent: Friday, November 3, 2017 5:06 PM
To: Mayer, Martin S CIV USARMY CEMVN (US) <Martin.S.Mayer@usace.army.mil>; Breaux, Brian W CIV USARMY CEMVN (US) <Brian.W.Breaux@usace.army.mil>
Cc: Bob Rowlette <browlette@evans-graves.com>
Subject: [EXTERNAL] Port Cameron BU files

File 5 of 5.

From:	Breaux, Brian W CIV USARMY CEMVN (US)
To:	Gutierrez, Raul
Subject:	FW: Port Cameron BU Plan email 2
Date:	Monday, November 6, 2017 10:34:41 AM
Attachments:	Port Cameron Beneficial Use Marsh Creation Plan Beneficial Use Marsh Creation Plan AppA_Part2.pdf

---

More info

Brian W. Breaux
Regulatory Branch, Special Projects & Policy Team
(504) 862-1938
brian.w.breaux@usace.army.mil

-----Original Message-----
From: Lee Walker [mailto:lwalker@evans-graves.com]
Sent: Friday, November 3, 2017 5:04 PM
To: Mayer, Martin S CIV USARMY CEMVN (US) <Martin.S.Mayer@usace.army.mil>; Breaux, Brian W CIV USARMY CEMVN (US) <Brian.W.Breaux@usace.army.mil>
Cc: Bob Rowlette <browlette@evans-graves.com>
Subject: [EXTERNAL] Port Cameron BU Plan email 2

File 3 of 5

From:	Breaux, Brian W CIV USARMY CEMVN (US)
To:	Gutierrez, Raul
Subject:	FW: Port Cameron BU
Date:	Monday, November 6, 2017 10:59:22 AM
Attachments:	Port Cameron Beneficial Use Marsh Creation Plan Beneficial Use Marsh Creation Plan AppA_Part3.pdf

---

More info

Brian W. Breaux
Regulatory Branch, Special Projects & Policy Team
(504) 862-1938
brian.w.breaux@usace.army.mil

-----Original Message-----
From: Lee Walker [mailto:lwalker@evans-graves.com]
Sent: Friday, November 3, 2017 5:05 PM
To: Mayer, Martin S CIV USARMY CEMVN (US) <Martin.S.Mayer@usace.army.mil>; Breaux, Brian W CIV USARMY CEMVN (US) <Brian.W.Breaux@usace.army.mil>
Cc: Bob Rowlette <browlette@evans-graves.com>
Subject: [EXTERNAL] Port Cameron BU

File 4 of 5

From: Breaux, Brian W CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: FW: Port Cameron HTRW information
Date: Monday, November 6, 2017 10:55:26 AM
Attachments: Port Cameron Phase I.PDF
Port_Cameron_Impact_Assessment.20170427.pdf

Raul: Please find below and attached, information (Phase I Environmental Site Assessment & an applicant provided Environmental Assessment) regarding the Beneficial Use plan of the excavated material associated with this proposed project.

Brian W. Breaux
Regulatory Branch, Special Projects & Policy Team
(504) 862-1938
brian.w.breaux@usace.army.mil

-----Original Message-----
From: Lee Walker [mailto:lwalker@evans-graves.com]
Sent: Friday, November 3, 2017 12:51 PM
To: Mayer, Martin S CIV USARMY CEMVN (US) <Martin.S.Mayer@usace.army.mil>; Breaux, Brian W CIV USARMY CEMVN (US) <Brian.W.Breaux@usace.army.mil>
Cc: Bob Rowlette <browlette@evans-graves.com>
Subject: [EXTERNAL] Port Cameron HTRW information

Martin and Brian,

In response to EPA's question regarding testing of the Port Cameron site for contamination, I've attached the previously developed Phase I Environmental Site Assessment completed on the site (First attachment; entire report with appendices is 20MB, so I'm only including report. If you need appendices, I can send separately). The below summary of finding demonstrate that no soil sampling was recommended for the site due to a lack of Recognized Environmental Conditions. The Phase I was also summarized in the Environmental Impact Assessment we submitted in April (2nd Attachment, page 55-56). Given the question raised by EPA regarding this matter, I'm wondering if they had not received the Impact Assessment previously? Or perhaps the person asking the question on your call had not been specifically made aware of the presence of the document. Either way, the findings of the Phase I ESA are summarized below:

"Spooner & Associates has performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E-1527-13 on the subject property located in Cameron, more specifically Section 25, Township 14 South, Range 10 West, of the "Cameron, Louisiana", Quadrangle Map (Figure 3). Any exceptions to or deletions from this practice are described in Section 1.3 of this report. This assessment has revealed No Evidence of Recognized Environmental Conditions in connection with the property."

I will follow up this email with a second email to you addressing their request for details on the Beneficial Use Plan.

Thanks,

Lee

Lee Walker

Evans-Graves Engineers

504-913-1857

From:	James Hartwell
To:	Breaux, Brian W MVN; mark.hogan@la.gov; Elizabeth.Hill@la.gov
Cc:	Matt Rota; Johanna deGraffenreid; Nguyen, May; Karl.Morgan@la.gov; Martin.S.Mayer@usace.army.mil; Gutierrez, Raul
Subject:	GRN Public Comment - MVN-2013-02424-MB - Port Cameron
Date:	Thursday, July 28, 2016 7:31:05 PM
Attachments:	GRNpublicComment-MVN-2013-02424-MB-PortCameron.pdf

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Please see our attached comment regarding the proposed Port Cameron project.

We thank you again for the period extension.

For a healthy Gulf,
James

--
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28 July, 2016

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re: **MVN-2013-02424-MB** - Port Cameron in Cameron Parish (**WQC 160621-01**, **P20140877**)

Dear Mr. Breaux, Ms. Hill, and Mr. Hogan,

I am writing on behalf of Gulf Restoration Network ("GRN"), a diverse coalition of individual citizens and local, regional, and national organizations committed to uniting and empowering people to protect and restore the natural resources of the Gulf of Mexico. We have serious concerns about the application for a Section 404 permit (**MVN-2013-02424-MB**), submitted to the United States Army Corps of Engineers ("Corps") by Port Cameron, LLC ("Applicant"). The Applicant also requests a Water Quality Certification ("WQC," **160621-01**) from the Louisiana Department of Environmental Quality ("LDEQ") as well as a Coastal Use Permit ("CUP," **P20140877**) from the Louisiana Department of Natural Resources ("LDNR"), for the proposed development of an oil and gas service port along the Louisiana coast ("Project").

The Project would require the installation of 22,000 linear feet of bulkhead, the construction of heavy-lift boat slips, the relocation of an existing water-control structure and multiple existing pipelines, and the creation of a new private road system along with a new public road and bridge crossings.[1] All told, the Applicant's proposal would directly impact 322.9 acres of jurisdictional wetlands, 15.4 acres of 'other waters of the United States,'[2] and 900 acres of Essential Fish Habitat.[3]

[1] Port Cameron Plans, as revised and resubmitted, June 2016
[2] Amendment to October 2013 Waters of the United States Delineation Report, June 2016
[3] Corps, LDEQ, LDNR Joint Public Notice, listed June 28th, 2016

While a project of this magnitude is significant in its own right and requires an Environmental Impact Statement, we are deeply concerned about the additive and multiplicative effects of increased fossil-fuel development and the creation of an "Energy Empire"[4] within the Lower Calcasieu watershed, southern Louisiana, and the Gulf Coast as a whole. The foreseeable plants, compressors, pipelines, railyards, housing, transportation, water-supply, and water-treatment impacts to wetlands will be significant.

The direct wetland impacts of this imperial effort are tremendous, representing roughly 3-5 years of wetland loss from an area losing a significant percentage of the nation's coastal saltwater wetlands. The safety concerns are numerous, overlapping, and alarming. Putting highly explosive facilities in such proximity to one another, in an extremely vulnerable floodplain, raises many concerns about the safety of community members and poses threats to other facilities and navigation efforts. The indirect project impacts are immense, rippling across wetlands in the Lower Calcasieu, Louisiana Coast, the Gulf Coast, and even the entire country.

The creation of an "Energy Empire" within the Gulf Coast[5] warrants the development of a Programmatic Environmental Impact Statement for the export of liquefied natural gas ("LNG") out of the United States' Gulf Coast. This is the best tool available for the Corps to assess the scope of this regional LNG effort and its impacts to the coast.

GRN opposes the Applicant's requests for a Section 404 Permit, WQC, and CUP. We ask the Corps, LDEQ, and LDNR to deny these requests based on the following concerns:

1. The Project is inconsistent with Louisiana's Comprehensive Master Plan for a Sustainable Coast and a 2016 Executive Order.

Disrupting these wetlands directly conflicts with Louisiana's restoration and community-protection goals. The *Comprehensive Master Plan for a Sustainable Coast* ("Master Plan") clearly states that valuable wetlands must be preserved.

One of the key assumptions of 2007's Master Plan is that "a sustainable landscape is a prerequisite for both storm protection and ecological restoration."[6] And in 2012's iteration, these land-use specifications were further clarified:

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[4] From "Current and Future Development in Southwest Louisiana—David Conner, Southwest Louisiana Economic Development Alliance" Gov's Advisory Commission, 6 Aug 2014 Ret. from http://coastal.la.gov/calendar/?y=2014

[5] *See* FERC Proposed and Approved LNG Export Terminals

[6] Coastal Protection and Restoration Authority of Louisiana, *Executive Summary*, *in* LOUISIANA'S COMPREHENSIVE MASTER PLAN FOR A SUSTAINABLE COAST 3 (2007).

> We do not want construction of new hurricane protection systems to encourage unwise development in high risk areas, as has occurred in the past. Such development increases overall levels of risk and diminishes the effectiveness of the protection structures themselves. This phenomenon is called "Induced Risk," and it runs counter to the master plan's objectives of sustaining wetland ecosystems and reducing the flooding risks borne by coastal communities. *Similarly, wetland areas inside the hurricane protection system need to remain intact and undeveloped* [emphasis added].[7]

Filling in these wetlands removes both the ecosystem and flood-protection functions of these tracts of land, in direct conflict with the state's goals. The Master Plan further states that "overall hydrology must be improved by minimizing impediments to water flow."[8] Allowing the Applicant to impact over 320 acres limits ecological function while also failing to minimize water-flow impediment or improving overall hydrology.

The Louisiana Legislature approved the latest version of the Coastal Master Plan during the 2012 Regular Session,[9] with overwhelming public support.[10]

On April 4th, 2016, Louisiana Governor John Bel Edwards gave even greater weight to the foundational recommendations laid out in the Master Plan by issuing Executive Order No. JBE 2016-09 ("Executive Order"). Like Executive Order No. BJ 2008-7 issued by his predecessor,[11] the Governor's mandate again requires all state agencies, departments, and offices to "administer their regulatory practices, programs, projects, contracts, grants, and all other functions vested in them in a manner consistent with the Coastal Master Plan and public interest to the maximum extent possible."[12] This requirement is intended to "effectively and efficiently pursue the State's integrated coastal protection goals."[13]

While the Executive Order strives to implement the Master Plan's goals to preserve wetland areas, the Applicant seeks to obtain permits for its Project that will potentially destroy over 320 acres of coastal wetlands that protect communities from localized flooding, all to create an oil and gas port.

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[7] Coastal Protection and Restoration Authority of Louisiana, *2012 Comprehensive Master Plan for a Sustainable Coast*, p 159*).*
[8] *Id.*
[9] SCR No.62, 2012 Leg., Reg. Sess. (La. 2012).
[10] Louisiana Coastal Master Plan Public Opinion Survey, Southern Media & Opinion Research, Inc. Online at http://www.mississippiriverdelta.org/files/2012/04/2012-Louisiana-CMP-Opinion-Survey.pdf.
[11] *See* Exec. Order No. BJ 2008-7, issued 1/23/08: http://dnr.louisiana.gov/assets/docs/conservation/groundwater/Appendix_B.pdf
[12] *See* Exec. Order No. JBE 2016-09, issued 4/4/16: http://gov.louisiana.gov/assets/ExecutiveOrders/JBE16-09.pdf
[13] *Id.*

LDNR and LDEQ cannot both follow the Executive Order and issue a CUP and WQC to the Applicant.

2. The Applicant has failed to thoroughly evaluate project alternatives.

In general, the regulations provide that no discharge of dredged or fill material shall be permitted:

> (1) if there is a practicable alternative to the proposed discharge;
> (2) if the discharge causes or contributes to violations of applicable state water quality standards;
> (3) if the discharge will cause or contribute to significant degradation of the environment;
> and (4) unless all appropriate steps have been taken to minimize potential adverse impacts.[14]

The Corps' regulations also require that destruction of wetlands is to be avoided to the maximum extent practicable.[15] The regulations further provide that "practicable alternatives" include "not discharging into the waters of the U.S. or discharging into an alternative aquatic site with potentially less damaging consequences."[16]

The intent of Corps regulation is to avoid the unnecessary destruction or alteration of Waters of the United States, including wetlands, and to compensate for the unavoidable loss of such waters. Corps regulations require that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

Based on this provision, an evaluation is required in every case for use of non-aquatic areas and other aquatic sites that would result in less adverse impact to the aquatic ecosystem, irrespective of whether the discharge site is a special aquatic site or whether the activity associated with the discharge is water dependent. A permit cannot be issued, therefore, in circumstances where an environmentally preferable practicable alternative for the proposed discharge exists.

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[14] 40 C.F.R. § 230.10.
[15] 33 C.F.R. § 320.4(r).
[16] 40 C.F.R. §§ 230.5(c), 230.10(a).

The Applicant has surprisingly already weighed geographic alternatives for its port project. It has not however adequately assessed the 'no action' alternative. Under this option, "the proposed site for this project would not be converted to a port and canal system" but it would "continue to remain adversely impacted by cattle operation, haying and other such activities."[17] It is entirely disingenuous for the Applicant to even suggest that the impacts from hay and cattle are of the same order as those related to its Project.

The Applicant also states that "there would continue to be a shortage of feasible alternative locations for offshore oil and gas support aside from Port Fourchon," under the 'no action' option.[18] The supposed need for another Fourchon-esque hub frames the Project's entire purpose, despite clear scientific realities. The Applicant recognizes that LA-1, the artery that connects Port Fourchon to the rest of the nation, will be underwater within decades. But it's unrelenting fossil-fuel activities that have caused the LA-1 problem. And the continued extraction, processing, and transport of oil and gas will only worsen impacts along coastal Louisiana. The Applicant appears to be operating in a world where activities of the past will inevitably continue into the future. This is sadly not the case.

3. Climate should be considered in the permitting process.

Today's world is one of a rapidly-changing global climate. This human-induced phenomenon threatens our nation's communities with stronger, more frequent storms, longer heat waves, more regional droughts, increased incidences of wildfires, expanded disease ranges, permafrost thawing, ocean acidification, and sea-level rise from melting glaciers. ***These impacts are felt disproportionately by communities already marginalized by histories of one-sided public policies.*** The Gulf Coast and its wetlands are without question especially vulnerable to climate-induced phenomena. Regional subsidence from continued oil, gas, and freshwater extraction only compounds these threats.

Up to this point, the Corps has not come close to fully addressing December of 2014's *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts,*[19] issued by the President's Council on Environmental Quality (CEQ). As described in the guidance, *"Unlike the 2010 draft guidance, the revised draft guidance applies to all proposed Federal agency actions."* The Corps is strongly encouraged to comply with this executive guidance and to fully address the requirements in a NEPA document.

[17] *See* Page 14, Needs, Alternatives, and Justification Analysis Report, as revised May 2016
[18] *See* Page 13, Needs, Alternatives, and Justification Analysis Report, as revised May 2016
[19] *See* https://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf

In order to stand a chance at avoiding catastrophic, irreversible climate change, scientists have repeatedly called for the majority of fossil-fuel reserves to remain underground. Natural gas in particular poses significant existential risks because of its ability to trap over 80 times as much heat as carbon dioxide.[20] The explosion of natural-gas infrastructure over the last decade proves it's impossible to scale the industry without significant atmospheric product loss.

A lifecycle analysis (LCA) of the the Project should be conducted, whereby the greenhouse-gas emissions from end-use, post-export activities are quantified alongside those released during the natural-gas extraction and transportation phases. Given the pressing need to leave fossil-fuel reserves untapped, the LCA would act as a tool to gain insight into whether the Project's expected benefits do actually outweigh its obvious costs.

More specifically, the Corps ought to analyze the climate impacts associated with the extraction, processing, transportation, and end-use combustion of the natural gas that will flow through the Project. In a world constrained by climate change, the proper measure of the Project's climate impact should not be based on assumptions inherent in business-as-usual scenarios that guarantee climate disaster. Comparisons should instead be made to readily-available, zero-emission renewable technologies, such as wind power,[21] rather than dirtier forms of fossil fuels.

The Corps (or any other decision-making agency) can theoretically even determine the amount of direct land-loss that would result from this project's implementation. A discrete amount of lifetime greenhouse-gas emissions is related to a given temperature increase, which is then tied to quantities of melting ice and rising seas. After also accounting for rates of regional subsidence, the decision-makers could be able to explicitly see the climate-related impacts of this particular project. And further, these methods could seemingly be used on a cumulative scale to quantify the connected impacts of regional LNG-related infrastructure.

The incorporation of the 'Social Cost of Carbon' into these sorts of analyses would allow for more accurate depictions of reality, while also further satisfying CEQ's guidance. Since the environmental, economic, and health impacts of climate-related projects are often understated and unaccounted, this quantitative tool can assign crucial values that would otherwise be absent.[22]

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[20] 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, doi:10.1017/CBO9781107415324.

[21] First offshore wind farm in North America has Louisiana roots. July 23, 2015 | Don Ames. retrieved 29 Jan 2016

[22] *See* Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis

To be clear, while these sorts of calculations and investigations should be conducted, the mere mention of climate considerations is also intended to highlight the fact that they have thus far been absent from all deliberations.

4. Direct, indirect, secondary, and cumulative impacts remain unassessed.

Article IX, Section 1 of Louisiana's Constitution provides that "the natural resources of the state, including air and water, and the healthful, scenic, historic, and esthetic quality of the environment shall be protected, conserved, and replenished insofar as possible and consistent with the health, safety, and welfare of the people."[23]

In its 'Save Ourselves' decision, the Louisiana Supreme Court outlined how state agencies, as public trustees, can implement this constitutional guarantee. All agencies must determine whether a project avoids or minimizes adverse environmental impacts, while balancing environmental costs and benefits with economic and social factors. Agencies must also consider whether alternate projects, sites, or mitigating measures would better protect the environment.[24]
Given the information available in public documents, it does not appear that the Applicant has fully weighed the costs and benefits relevant to the Project. Direct, indirect, secondary, and cumulative impacts of the proposed wetland fill and clear remain overlooked.

As mentioned above, the Project's direct impact to upwards of 320 wetland acres is certainly significant. The fill of such a large area is in violation of federal and state anti-degradation policy. Louisiana policy states "administrative authority will not approve any wastewater discharge or certify any activity for federal permit that would impair water quality or use of state waters."[25]

The Code of Federal Regulations also recognizes the significance of secondary impacts from wetland destruction, emphasizing that "minor loss of wetland acreage may result in major

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Under Executive Order 12866;
https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf
[23] *See* Article IX of Louisiana Constitution:
http://senate.la.gov/Documents/Constitution/Article9.htm#%C2%A71.%20Natural%20Resources%20and%20Environment;%20Public%20Policy
[24] 452 So. 2d 1152 (La. 1984).
[25] LA. ADMIN. CODE tit. 33, pt. IX §1109(A)(2).

losses through secondary impacts."[26] Where over 300 acres of wetlands are involved, it is unacceptable that the Applicant offers no analysis of these probable impacts.

Additional Federal regulations have not been fully implemented either. Per executive orders 11988 and 11990, certain aspects must be analyzed in order to prevent impacts to wetlands. Title 18 of the Code of Federal Regulations states:

> It is the policy of the Council to provide leadership in floodplain management and the protection of wetlands. Further, the Council shall integrate the goals of the Orders to the greatest possible degree into its procedures for implementing the National Environmental Policy Act. The Council shall take action to: Avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains and the destruction or modification of wetlands; Avoid direct and indirect support of floodplain development and new construction in wetlands wherever there is a practicable alternative; Reduce the risk of flood loss; Promote the use of nonstructural loss reduction methods to reduce the risk of flood loss; Minimize the impact of floods on human health, safety and welfare; Minimize the destruction, loss or degradation of wetlands; Restore and preserve the natural and beneficial values served by floodplains; Preserve and enhance the natural and beneficial values served by wetlands.[27]

The cumulative impacts on storm and flood protection must therefore be taken into consideration. The destruction of these wetlands, in direct opposition to the Master Plan, would further weaken Louisiana's storm defenses. When combined with similar wetland-destroying projects, these permit approvals could result in more flooding in nearby communities, as well as degraded water quality in surrounding watersheds. The whole area must be looked at as an interrelated ecological unit in order to truly assess impacts.

Environmental review of the first port of this nature[28] led to the documentation and undeniability of Louisiana's coastal crisis, as well as the beginning of the widespread coastal restoration program on the Louisiana coast. We demand that the second such port facility acknowledge the role that these floodplain developments have in drowning our coastal wetlands and state economy.

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[26] 40 C.F.R. §230.41.
[27] 18 C.F.R. §725.2.
[28] Final environmental impact statement on the proposed Port Fourchon Development Plan Phase IV, Lafourche Parish, Louisiana / prepared by Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, Department of Commerce

There presently exists a significant push to develop and construct LNG-associated infrastructure along the Gulf Coast. In the wake of the expansion of hydraulic fracturing, domestic natural-gas producers now possess historic supplies, along with the expectations that they will be sold to highest bidders. Allowing this project to proceed would reaffirm regional precedent for unrestrained fossil-fuel expansion, in turn jeopardizing even more valuable wetland habitat. To emphasize, permitting this project will likely induce many other permit applications for LNG development within surrounding coastal communities.

After reviewing public notices from LDNR and the Corps in the Galveston and New Orleans Districts, we have determined that significant LNG-related impacts to waterbodies and wetlands already exist. And this is without knowing the number of projects permitted under Nationwide Permits and General Permits.

From 2012 to 2016, there is a cumulative total of at least 4,465.78 acres of wetlands impacts due to proposed and permitted LNG projects and their supporting infrastructure in the New Orleans District. In the Galveston District, there are more than 1,028.61 acres of cumulative water and wetlands impacts. Under the jurisdiction of LDNR, there are at least 3,437.17 acres of cumulative water and wetlands impacts due to proposed and permitted LNG projects. These include port facilities, compression facilities, trains, terminals, transport pipelines, railways, roadways, and housing developments. Many of these different functions are combined within individual projects such as the Magnolia LNG facility (MVN-2014-01380-WII), which includes a terminal and compression facility. All of these actions are related to LNG Export, an economic activity with an unknown market.

There are 7 foreseeable, connected actions amounting to 839.72 acres related to the dredging of LNG Export service ports within Calcasieu and Cameron Parishes (Lower Calcasieu, HUC 08080206). These are connected by proximal hydrology, immediate economic purpose, floodplain impacts, and climate impacts.

There are 46 foreseeable, connected actions amounting to 3,437.17 acres related to the Coastal Louisiana (Plaquemines, Calcasieu, and Cameron Parishes) area LNG boom. Currently, the vast majority of acres of evaluated wetland impact are within the Lower Calcasieu watershed (HUC 08080206), but also include the Sabine Lake (HUC 12040201). The majority of these actions involve the construction of LNG-supporting infrastructure, while 7 are directly related to dredging and deepwater ports.

Within the Galveston District, there are 21 foreseeable, connected actions amounting to a minimum[29] of 174.23 acres related to the dredging of LNG export service ports. These are connected by hydrology, immediate economic purpose, floodplain impacts, and climate impacts. There are an additional 48 foreseeable, connected actions within Galveston District amounting to a minimum of 754.72 acres for construction of supporting infrastructure for the LNG boom, connected by proximal hydrology, immediate economic purpose, floodplain impacts, and climate impacts. There is therefore a total of 69 foreseeable, connected actions amounting to at least 928.95 acres in the Galveston District.

Across the Gulf, there are 33 foreseeable, connected actions amounting to 1,013.95 acres related to the dredging of LNG export service ports. These actions are connected by proximal hydrology, immediate economic purpose, floodplain impacts, and climate impacts. There are an additional 82 foreseeable, connected actions amounting to 3,351.72 acres related to construction of support infrastructure of LNG across the Gulf. These are once again connected by proximal hydrology, immediate economic purpose, floodplain impacts, and climate impacts. There is a total of 115 foreseeable, connected actions amounting to a minimum of 4,366.12 acres in the Gulf-wide LNG boom. The connected actions are summarized in the below tables.

Table 1: Number of federal actions associated with LNG Projects, sorted by project type and locale

	Lower Calcasieu	*Coastal Louisiana (Plaquemines, Cameron and Calcasieu)*	*Galveston District*	*Gulf-Wide*
Dredging and Ports	7	7	21	33
Facilities	7	39	48	82
Total	**14**	**46**	**69**	**115**

Table 2: Direct wetland impacts of LNG Projects in acres, sorted by project type and locale

	Lower Calcasieu	*Coastal Louisiana (Plaquemines, Cameron and Calcasieu)*	*Galveston District*	*Gulf-Wide*

[29] Most of the foreseeable LNG connected projects do not have acreage readily available to the public at this time

Dredging and Ports	839.72	839.72	~174.23	1,013.95
Facilities	759.5	2,597.45	~754.72	3,351.72
Total	**1,599.22**	**3,437.17**	**~928.95**	**4,366.12**

The above wetlands acreage impacts are derived from from what is currently available to the public. There remains a significant amount of data inaccessible to us at this time, preventing a more concrete determination of total cumulative impacts. We see the referenced values as basement estimates, as the cumulative acreage will increase after incorporating information from all of the proposed actions for LNG-related infrastructure.

Between 2004 and 2009, the United States lost a total of 360,723 wetland acres. Looking at just saltwater wetlands, the Gulf Coast suffered more acreage loss than the entire country (as there was a net gain along the Atlantic Coast). The Gulf Coast also lost over 160,000 acres of freshwater wetlands over this time frame. Combining the saltwater and freshwater values, the wetland losses for the Gulf Coast represent 71% of the country's total from 2004-2009. It's clear the Gulf Coast region is especially vulnerable to land loss.[30]

Regionally, the direct wetland loss proposed by this LNG boom is at least 5% of the saltwater wetlands lost from the Gulf (and the Nation) from 2004-2006.

At a more localized level, land loss has been concentrated in watersheds experiencing the LNG boom. The Lower Calcasieu lost upwards of 2,501 acres of saltwater coastal wetlands from 2004-2009 (Figure 17). The foreseeable Louisiana wetlands losses from LNG-related projects alone would add another 3,437.17 acres of losses, in a compressed time frame. The impacts of "Energy Empire" development are therefore analogous to one of the highest rates of wetland loss in a single watershed over a 5-year scale.[31]

[30] T.E. Dahl and S.M. Stedman. 2013. Status and trends of wetlands in the coastal watersheds of the Conterminous United States 2004 to 2009. U.S. Department of the Interior, Fish and Wildlife Service and National Oceanic and Atmospheric Administration, National Marine Fisheries Service. (46 p.)

[31] *Id*

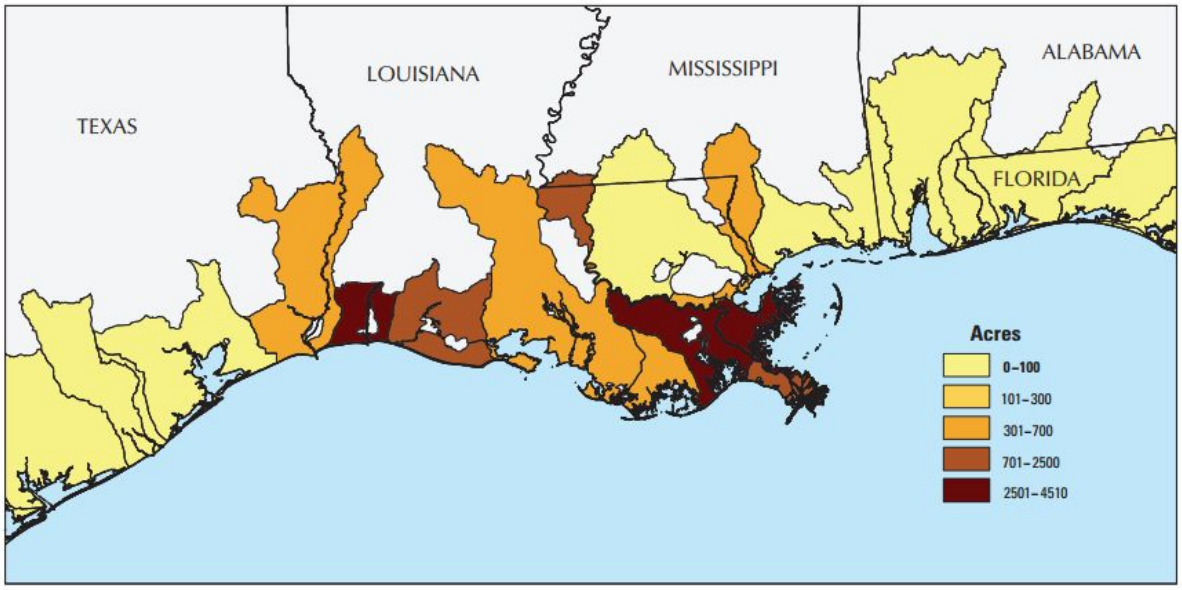

Figure 17. Coastal watersheds of the upper Gulf of Mexico showing the magnitude of saltwater (intertidal) wetland loss to open water, 2004 to 2009.

Louisiana currently has 5,000 square miles of coastal wetlands. Louisiana's 2012 Master Plan produced 2 outcomes of the effects of sea level rise on the state's wetlands, evaluating a "moderate scenario" and a "less optimistic scenario."[32] The Master Plan does not discuss sea level predictions worse than "moderate," although the NRC III (High) prediction depicts close to a .70m sea level rise by 2060.[33] Under the moderate scenario, 770 square miles of wetlands would be lost due to climate change and .30m sea level rise. Under the less optimistic scenario, 1,770 square miles of wetlands would be lost due to climate change and .45m sea level rise. If approximately 1,000 to 2,000 square miles of wetlands would be lost with little to no diversions in current methodologies and actions, the impacts to Louisiana's wetlands in a higher level of sea level rise would be devastating.[34] Should the Corps approve this project, a portion of those scores of lost square miles would be directly attributed to the Project.

In Texas, there are 161,000 acres of wetlands in Galveston Bay and Jefferson County.[35] The "Sea Level Affecting Marshes Model," or SLAMM, produces wetlands models based on a 1m sea level rise by 2100. The 1 meter sea level rise is used as a compromise between the more conservative IPCC prediction of 30cm-100cm rise and other predictions of up to 140cm.[36] The

[32] *See* Master Plan p84
[33] See Master Plan p84
[34] Coastal Protection and Restoration Authority of Louisiana, *2012 Comprehensive Master Plan for a Sustainable Coast* p 105.
[35] *See* "Informing conservation planning using sea-level rise and storm surge impact estimates in the Galveston Bay and Jefferson County, Texas area" p3
http://www.gulfmex.org/wp-content/uploads/2011/04/Texas_Conservation_Analysis_Report.pdf
[36] http://stormsmart.org/goma/slr/interface/texas_slamm.html

SLAMM Texas Conservation Report states between 2004 and 2100, over 52,000 acres are at risk to be critical marsh refuge, and 28,899 acres of marsh will be lost due to sea level rise.[37] The Texas SLAMM does not evaluate the effects from more pessimistic predictions of greater than 1m of sea level rise, which would be even more devastating to the Texas wetlands.

Continuing development at the current rate without taking action to diminish carbon output will accelerate future wetlands loss. As LNG projects are proposed and permitted without cumulative impact analyses, climate change and sea level rise impacts will remain neglected and unevaluated. In areas where the land has always buffered storms and absorbed floodwaters, removing said land places people directly in the path of destruction. The purpose of this project and other connected projects in the LNG boom is intimately tied to a level of climate pollution that sinks the Louisiana coast under a swollen Gulf of Mexico.

We at GRN request the Crops, LDEQ, and LDNR to use their data and resources to assess these cumulative impacts. We are only able to scratch the surface. LNG-related development is clearly growing rapidly, and the connected environmental impacts must be determined as definitively as possible. Since the Project in question is designed to create a hub for further LNG development, it is vital that a detailed environmental assessment be completed before issuing a decision on the Applicant's permit requests. The Applicant's project cannot be adequately assessed for environmental impacts without assessing total cumulative environmental impacts of LNG-related projects.

Since the Applicant does not assess, or even recognize the potential direct, indirect, and cumulative impacts that will result from the disruption of over 320 acres of wetlands, the Corps, LDEQ, and LDNR cannot approve the Applicant's permit requests as submitted.

5. The Applicant must develop disaster-response plans and perform a quantitative risk assessment. Local floodplain officials should be included in the notification of this permit, since the Project sits in an area vulnerable to flooding.

The Applicant must have plans for disaster response scenarios, in place prior to project permitting. We have yet to see any mention of this sort, in any public documents. The Applicant even goes as far to say that the Project does not involve the drilling, production, and/or storage of oil and gas, despite branding itself as an oil and gas industry waterfront support facility.[38]

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[37] Texas Conservation Analysis p12, 24

[38] *See* Section 12, part C, Joint Permit Application For Work Within the Louisiana Coastal Zone, filed 6/21/16: http://sonris-www.dnr.state.la.us/sundown/cart_prod/cart_crm_application?pcup_num=P20140877&pline_id=14&pshow_appl_email=N

In fact, the Applicant explicitly states that its facility will serve newly constructed, under construction, and planned LNG facilities, and the industries that support LNG businesses, including Lake Charles LNG (formerly known as Trunkline LNG).[39]

LDNR and LDEQ cannot be "passive umpires" when it comes to permitted materials. This responsibility was distinctly highlighted in the recent ruling, *Sierra Club Delta Chapter v. La. Dep't Nat. Res.*, No. 00060916, Div. A.[40] LDNR and LDEQ must accept responsibility for materials permitted under the umbrellas of coastal-use and water-quality. Until the Applicant has drafted adequate disaster-response plans, its applications for a CUP and WQC ought to be deemed inadequate.

LDNR should also order a thorough and objective quantitative risk assessment (QRA) for any and all facilities associated with the storage and transport of LNG. There are already many people at risk within the Lake Charles area, and more people put at risk in Cameron Parish each day. Risks to the population of Cameron Parish should be evaluated on a proportional basis, since its remaining population are crucial to preserving Louisiana's culture of living with and on the water. Those still residing are the coast are extremely vulnerable to the impacts of the LNG boom.

The Project site lies within the 100-year floodplain and is clearly susceptible to storm-surge events (Figure 1).[41] The proposed site's distinct geography compounds disaster risks, furthering the need for comprehensive response plans.

The responsibility of managing flood risk in Louisiana lies largely with individual parishes. Since parish officials are charged with administering the hazard mitigation program, they should also be informed of the Project and its permit requests that impact flood-mitigating wetlands. Relevant to this particular instance, the Cameron Parish Floodplain Administrator is Myles Hebert (337-775-2800, mh_cppj@camtel.net) and the Emergency Preparedness Contact is Danny Lavergne (337-775-7048).

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[39] *See* Page 6, Needs, Alternatives, and Justification Analysis Report, as revised May 2016
[40] La. 19th JDC Dec. 23, 2014.
[41] FEMA Flood Map, Cameron Parish http://maps.lsuagcenter.com/floodmaps/.

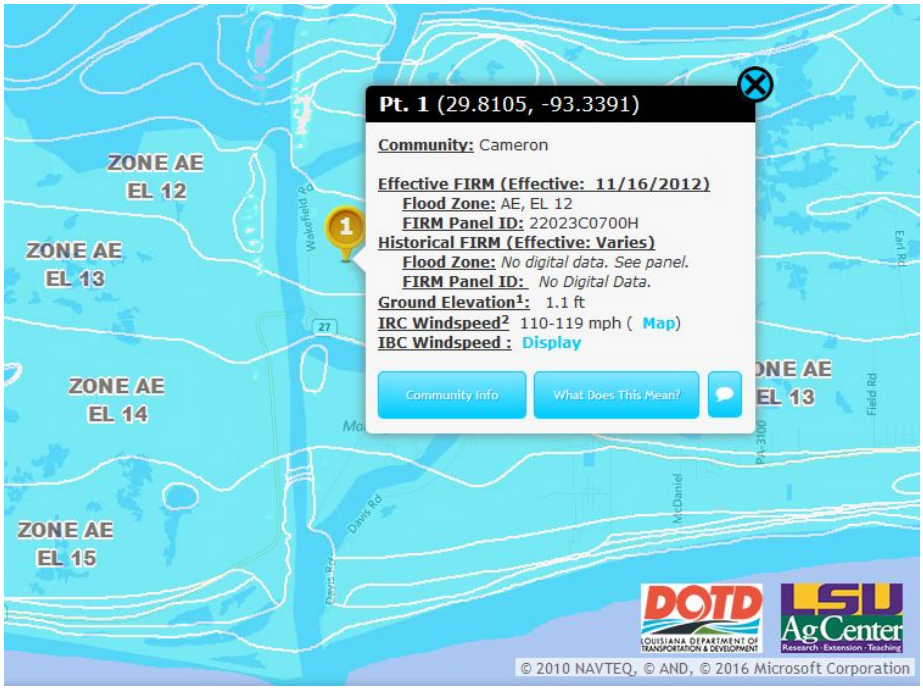

Figure 1: The Project sits in an area especially at-risk for flooding

The Applicant's application must be deemed inadequate until it submits disaster-response plans and performs a quantitative risk analysis. We also request that local floodplain managers be notified of the associated, significant flood and disaster risks.

6. The mitigation plan for the Project is incomplete.

Federal law requires the Applicant to compensate for, or mitigate, the damages resulting from the destruction of our nation's wetlands, should a permit be issued. In the Project's joint public notice though, no mention of compensatory activity is included.[42] The Corps "must ensure that adequate [mitigation plan] information is included in the Public Notice to enable the public to provide meaningful comment," offering exception only for data which is "legitimately confidential for business purposes."[43]

According to the joint EPA/USACE "Compensatory Mitigation for Losses of Aquatic Resources; Final Rule," mitigation plans for all wetland compensatory mitigation projects must contain the twelve elements, including:[44]

[42] Corps, LDEQ, LDNR Joint Public Notice, listed June 28th, 2016
[43] 40 CFR § 230.94(b).
[44] 33 CFR § 322.4[c].

- site selection criteria
- baseline information for impact and compensation sites
- ecological performance standards
- monitoring requirements

Just merely mentioning legally-required details does not satisfy the requirement of "adequate information" to allow "meaningful comment." Communities along the Gulf Coast have a strong public interest in minimizing the effects of storm surge and localized flooding. The nature and location of compensatory mitigation is of vital importance to those who wish to provide public comments. For the sake of detail, further mitigation requirements in 33 C.F.R. § 332 are included below.

To satisfy the Clean Water Act, mitigation plans must provide a level of detail "commensurate with the scale and scope of the impacts"[45] and include the following information:

1. "A description of the resource type(s) and amount(s) that will be provided, the method of ecoregion, physiographic province, or other geographic areas of interest."[46]

2. "A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site."[47]

3. "A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the compensatory mitigation project."[48]

4. "A description of the ecological characteristics of the proposed compensatory mitigation project site.... This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other site characteristics appropriate to the type of resource proposed as compensation. The baseline information should also include a delineation of waters of the United States on the proposed compensatory mitigation project site."[49]

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[45] 33 C.F.R. § 332.4(c).
[46] 33 C.F.R. § 332.4(c)(2).
[47] 33 C.F.R. § 332.4(c)(3).
[48] 33 C.F.R. § 332.4(c)(4).
[49] 33 C.F.R. § 332.4(c)(5).

5. “A description of the number of credits to be provided, including a brief explanation of the rationale for this determination,” including “an explanation of how the compensatory mitigation project will provide the required compensation for unavoidable impacts to aquatic resources resulting from the permitted activity.”[50]

6. “Detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures.”[51]

7. “A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.”[52]

8. “Ecologically-based standards that will be used to determine whether the compensatory mitigation project is achieving its objectives.”[53]

9. “A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included.”[54] The mitigation plan must provide for a monitoring period that is sufficient to demonstrate that the compensatory mitigation project has met performance standards, but not less than five years. A longer monitoring period must be required for aquatic resources with slow development rates (e.g., forested wetlands, bogs).[55]

10. “A description of how the compensatory mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resources, including long-term financing mechanisms and the party responsible for long-term management.”[56]

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[50] 33 C.F.R. § 332.4(c)(6).
[51] 33 C.F.R. § 332.4(c)(7).
[52] 33 C.F.R. § 332.4(c)(8).
[53] 33 C.F.R. § 332.4(c)(9).
[54] 33 C.F.R. § 332.4(c)(10).
[55] 33 C.F.R. § 332.6.
[56] 33 C.F.R. § 332.4(c)(11).

11. “A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success.”[57]

12. “A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards.”[58]

13. The mitigation plan must provide for a monitoring period that is sufficient to demonstrate that the compensatory mitigation project has met performance standards, but not less than five years. A longer monitoring period must be required for aquatic resources with slow development rates (e.g., forested wetlands, bogs).[59]

14. The compensatory mitigation requirements must be clearly stated and include special conditions that “must be enforceable.” The special conditions must: “(i) Identify the party responsible for providing the compensatory mitigation; (ii) Incorporate, by reference, the final mitigation plan approved by the district engineer; (iii) State the objectives, performance standards, and monitoring required for the compensatory mitigation project, unless they are provided in the approved final mitigation plan; and (iv) Describe any required financial assurances or long-term management provisions for the compensatory mitigation project, unless they are specified in the approved final mitigation plan....”[60] “The special conditions must clearly indicate the party or parties responsible for the implementation, performance, and long-term management of the compensatory mitigation project.”[61]

15. “The real estate instrument, management plan, or other mechanism providing long-term protection of the compensatory mitigation site must, to the extent appropriate and practicable, prohibit incompatible uses (e.g., clear cutting or mineral extraction) that might otherwise jeopardize the objectives of the compensatory mitigation project.”[62]

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[57] 33 C.F.R. § 332.4(c)(12).
[58] 33 C.F.R. § 332.4(c)(13).
[59] 33 C.F.R. § 332.6.
[60] 33 C.F.R. § 332.3(k).
[61] 33 C.F.R. § 332.3(l).
[62] 33 C.F.R. § 332.7(a).

A key element of a legally adequate mitigation plan is the inclusion of ecological performance standards for assessing whether the mitigation is achieving its objectives, and these are described under 33 C.F.R. § 332.5:

> "Performance standards should relate to the objectives of the compensatory mitigation project, so that the project can be objectively evaluated to determine if it is developing into the desired resource type, providing the expected functions, and attaining any other applicable metrics (e.g., acres)."[63]

And, further:

> "Performance standards must be based on attributes that are objective and verifiable. Ecological performance standards must be based on the best available science that can be measured or assessed in a practicable manner. Performance standards may be based on variables or measures of functional capacity described in functional assessment methodologies, measurements of hydrology or other aquatic resource characteristics, and/or comparisons to reference aquatic resources of similar type and landscape position. The use of reference aquatic resources to establish performance standards will help ensure that those performance standards are reasonably achievable, by reflecting the range of variability exhibited by the regional class of aquatic resources as a result of natural processes and anthropogenic disturbances. Performance standards based on measurements of hydrology should take into consideration the hydrologic variability exhibited by reference aquatic resources, especially wetlands. Where practicable, performances standards should take into account the expected stages of the aquatic resource development process, in order to allow early identification of potential problems and appropriate adaptive management."[64]

The information presently provided by the Applicant on impacts and mitigation is wildly insufficient to allow for meaningful comments. However, what is clear is that the federal regulations are not being followed.

The Applicant intends to implement its own 'Permittee Responsible Mitigation Plan' (PRM), by putting dredged material to beneficial use. The selected placement site is just east of the potential Project, which ensures 'in-watershed' habitat creation. That is unfortunately as much detail as the Applicant is willing to share with the public. Any sort of performance standards or monitoring requirements are glaring absences, let alone the more detailed requirements listed above.[65]

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[63] 33 C.F.R. § 332.5(a).
[64] 33 C.F.R. § 332.5(b).
[65] *See* Dredged Material Management Plan, as revised 2016

It also appears the Applicant would prefer to simply purchase mitigation credits, though there currently exists a lack of credits for the coastal marshes of Louisiana. This over-saturation of the mitigation-bank market highlights the rampant wetland destruction that has plagued our region. The thought of issuing 'advance credits' for restoration projects that do not yet exist is extremely troubling. The Applicant cannot satisfy its legal obligations by paying money that will not directly be put towards mitigation.

The Applicant even offers the point that "[i]n addition to the Port Cameron project, as you know, there are other projects currently proposed which will impact wetlands in the same area. Some or all of these developments may be permitted and require considerable mitigation."[66]

"[T]hese projects, such as, Port Cameron, are proposals that are directly related to energy, including exploration, production and transportation," further details the Applicant.[67]

Connected by geography and nature, these foreseeable actions must be assessed as such. The great lack of mitigation options only serves to emphasize this need. Taken as one, and together, the indirect and cumulative impacts that will likely result from the Project will outweigh the mitigation provided by the Applicant - perhaps by orders of magnitude.

7. The Project does not appear to offer actual public benefit or be in the public interest.

As already noted, the Applicant and the Corps must not only consider project alternatives, they must also choose the *least-damaging* practicable alternative.[68] The least-damaging practicable alternative is the "no action" alternative. This alternative goes to the heart of this entire process – whether there even exists a public need for the Project.

For the sake of emphasis, the purpose of the Project is to accommodate the oil and gas industry.
According to the Applicant, "[t]he primary demand generators for this facility are domestic deep water oil and gas exploration, drilling and production companies, and service companies operating in the Gulf of Mexico."[69]

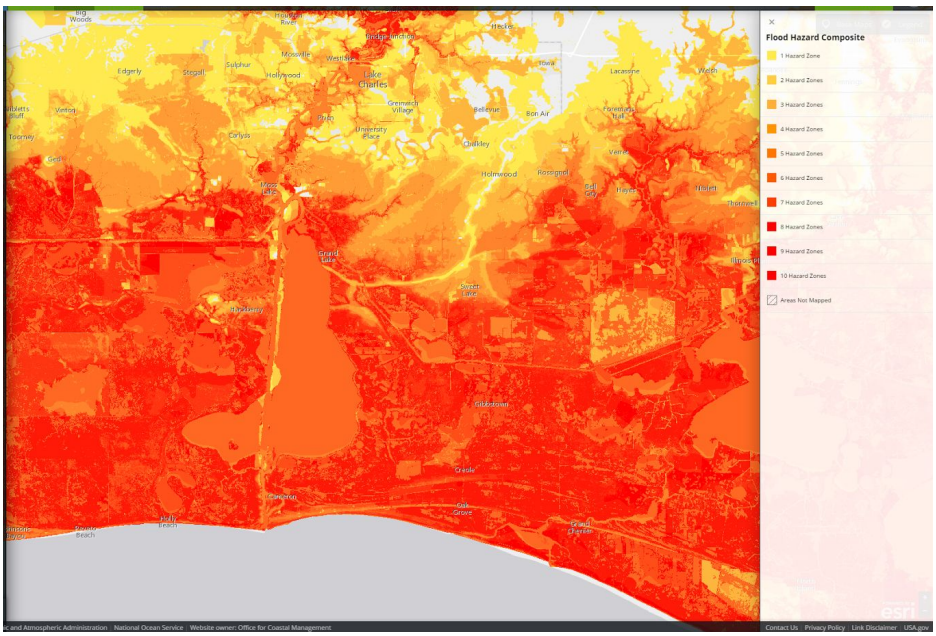
The Applicant has furthermore framed its Project as a necessity to buffer any potential disruptions to Port Fourchon, the current hub that services over 90% of the Gulf of Mexico's

[66] *See* Page 2, Request for Consideration of Advance Credit Issuance, dated May 28, 2015
[67] *See* Page 1, Request for Consideration of Advance Credit Issuance, dated May 28, 2015
[68] 40 C.F.R. § 230.10(a).
[69] *See* Page 8, Needs, Alternatives, and Justification Analysis Report, as revised May 2016

deep water oil production. The Applicant repeatedly references a 2011 Department of Homeland Security study that predicts "LA-1 will eventually succumb to mean sea level rise sometime between the years 2030 and 2040."[70] Given this vulnerability of Port Fourchon, the Applicant concludes that another hub for oil and gas activities must be made available.

Despite references to sea level rise, the Applicant does not appear to acknowledge the cause of this rise in any documentation available to the public. The human-induced leaking and combustion of fossil fuels is actively warming the entire planet, causing ice to melt and oceans to rise. When combined with the regional land subsidence that has been accelerated by oil and gas-related activities, the threats posed by rising seas to coastal Louisiana are only heightened. Perhaps ironically, the very same Department of Homeland Security even perceives climate change to be a "threat multiplier to global security."[71] *So as a solution to potential disruptions of a fossil-fuel hub, induced by fossil-fuel activities, the Applicant proposes to create a new hub for fossil-fuel activities.*

For reference, the below figure is included to illustrate the vulnerabilities of the Lower Calcasieu region to rising seas.[72] It is clearly no better prepared for a climate-disrupted future than southern Lafourche Parish.



[70] *See* Page 9, Needs, Alternatives, and Justification Analysis Report, as revised May 2016
[71] https://climateandsecurity.org/2015/07/09/dhs-to-congress-climate-change-a-threat-multiplier-to-global-security/
[72] Coastal Flood Exposure Mapper. Project Site includes 9 of 10 coastal hazards studied by NOAA, including sea level rise, hurricanes, and shallow flooding.

Besides simply claiming its project as a necessity, the Applicant touts the economic benefits it will bring. These expected benefits all appear to be derived from a single document, prepared by Loren C. Scott & Associates, Inc. This firm makes clear that the Project will offer both direct and indirect economic impacts, although the indirect impacts are the most significant:[73]

> However, these direct impacts alone would significantly understate the role of the port on the economy. The reason is that port clients also buy from, and sell to, many other firms in the economy. Too, employees at the port spend money at grocery stores, car dealerships, movie theaters, etc., which creates new earnings in those establishments, which are then spent, etc., etc. Thus, any change in the activity of a particular firm **indirectly** affects these other companies and their employees, which in turn affects firms that buy from and sell to these firms and employees, etc. For example, when a decision is made by a firm that creates a new job, a chain-reaction is started which works its way throughout the economy. This chain-reaction (multiplier effect) causes even more jobs to be created.

The so-called 'multiplier effect' is further defined, as quoted below:[74]

> Think of the Louisiana economy as a large economic pond. Into that pond a new rock is dropped called Port Cameron. However, when that rock hits the pond it sends ripples all the way out to the edge of the pond. It is these ripples that we refer to as the "multiplier effect".

From the ripples then emerge billions of dollars of potential economic growth. This methodology serves as the grounding framework of the Applicant's economic vision. And yet the Applicant ignores the indirect, secondary, and cumulative wetland and waterbody impacts of its project. This lack of consideration has been outlined in detail above. The rock that's dropped into a large economic pond is also dropped into a large environmental pond, rippling through the Lower Calcasieu, the Gulf Coast, and the nation. This fundamental contradiction offers further reasoning for the Project and its permit requests to be denied outright.

Not to be forgotten, the economic argument for the Project also hinges on its expected job creation. Nowhere however is it explicit that this job creation will stimulate employment for current residents of Cameron Parish and the surrounding region. All too often, the workers hired to construct these sorts of projects are contractors hailing from outside of coastal

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[73] *See* THE ECONOMIC IMPACT OF THE PROPOSED PORT CAMERON ON THE LAKE CHARLES MSA, THE STATE OF LOUISIANA AND THE NATION, as prepared April 2015

[74] *Id*

Parishes, even beyond Louisiana. The transplants live in 'man camps,' often situated in wetlands and injecting stimulus into local economies solely via gas pumps and their adjoined casinos.

Present community members are instead likely to be left with all the unaccounted, external costs of the Project: health and environmental impacts, reduced flood protections, heightened disaster risks, and the countless other costs associated with the climate-disrupting reliance on fossil-fuel infrastructure.

Crucially, the eventual export of LNG is not isolated from natural-gas extraction. *Natural gas must first be extracted from underground deposits, before it can be transported anywhere.* Recognizing this connection allows for the 'total cost' of the Project to be calculated. The Applicant is currently unwilling to ground itself in this reality.[75]

There is currently a race to approve LNG-related projects throughout watersheds of the Gulf Coast. This scramble threatens significant, maximal wetland destruction, all to overbuild industrial infrastructure of questionable use. Companies with undue advantages are skirting environmental-review processes, leaving the United States and Louisiana depauperate. Just as the LNG-import fad filled many wetlands to no economic benefit, this fad in a capital-intensive, volatile industry will leave empty industrial spaces where coastal communities once had flood protection and fisheries habitat.

Given the well-known volatility of natural-gas markets, the Applicant ought to demonstrate the long-term viability of the Project. To demonstrate at least some of the projected project-related benefits, an analysis that includes no fewer than five years of historical natural-gas market data should be included and weighed in the decision-making process.

8. The Project warrants a Programmatic, or Area-Wide, Environmental Impact Statement (PEIS).

Approval of this permit could induce many other permit applications for LNG-related developments within the Lower Calcasieu watershed, coastal Louisiana, and the Gulf region as a whole. We strongly encourage the Corps to conduct an appropriate study of the impacts of connected actions. We submit this additional section to address concerns that have been raised about comprehensive environmental review.

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[75] *See* Section 12, part C, Joint Permit Application For Work Within the Louisiana Coastal Zone, filed 6/21/16: http://sonris-www.dnr.state.la.us/sundown/cart_prod/cart_crm_application?pcup_num=P20140877&pline_id=14&pshow_appl_email=N

Claim: A PEIS is not warranted because the Corps has no program for comprehensively analyzing impacts to wetlands.
Facts: Wrong. NEPA expressly contemplates preparation of an EIS for situations just like this one: where an agency is facing multiple independent permitting decisions that have overlapping, shared, or cumulative impacts.[76,77,78]

Federal guidance and courts sometimes refer to these reviews as ”programmatic,” ‖ while in other cases, they are called “area-wide” or “overview” EISs. The label is not important. Rather, it is the content of such an assessment that matters. The Federal Council on Environmental Quality offers further guidance, provided in Q&A format:

Question: When is an area-wide or overview EIS appropriate?
Answer: The preparation of an area-wide or overview EIS may be particularly useful when **similar actions, viewed with other reasonably foreseeable or proposed agency actions, share common timing or geography.** For example, when a variety of energy projects may be located in a single watershed, or when a series of new energy technologies may be developed through federal funding, the overview or area-wide EIS would serve as a valuable and necessary analysis of the affected environment and the potential cumulative impacts of the reasonably foreseeable actions under that program or within that geographical area.[79]

Courts have agreed that a single EIS is required for multiple discrete actions under some circumstances, for example, when the projects have common timing, geography, and/or impacts.[80,81] Such circumstances undoubtedly exist here.

Claim: A comprehensive review of port, industrial, and pipeline projects would be “unprecedented.” ‖
Facts: Wrong. There is ample precedent for such a review, including area-wide EIS processes that are underway right now. For example, The Corps reviewed four independent phosphate

[76] See Native Ecosystems Council v. Dombeck, 304 F.3d 886 (9th Cir. 2002) (“A single NEPA review document is required for distinct projects when … the projects are _connected,‘ _cumulative‘ or _similar‘ actions …”).
[77] 40 C.F.R. § 1508.25 (mandating single EIS for separate independent actions under some circumstances).
[78] 40 C.F.R. §1502.4(a), (c) (requiring a single EIS where proposals are “related to each other closely”).
[79] Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations 40 CFR Parts 1500 - 1508 (1987). http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf.
[80] See, e.g., Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1215 (9th Cir. 1998) (multiple timber sales must be evaluated in a single EIS where the sales were reasonably foreseeable, in a single general area, disclosed at the same time, and developed as part of a comprehensive strategy).

mining projects that have cumulative impacts within a 1.32 million acre area of Central Florida.[82] This Florida EIS examined multiple independent projects from different applicants that share impacts on important resources.

Similarly, the National Marine Fisheries Service is conducting a large-scale programmatic EIS on anticipated permitting activities for exploratory drilling in an area of over 200,000 square miles in the Beaufort and Chuckchi Seas.[83] In a 2010 letter to The Corps, Region IV of the EPA asked for an area-wide EIS for multiple phosphate mines in central Florida, observing the following: Addressing cumulative and secondary (indirect) effects in a piecemeal manner through the regulatory process (i.e. permit by permit) for impacts of this magnitude, cannot effectively or sufficiently address cumulative impacts to the Peace River Watershed as a whole. An area-wide EIS could adequately address these cumulative and secondary effects.[84]

Claim: A programmatic EIS will take too much time, and be too speculative.
Facts: Wrong. Should the cumulative impacts information be necessary to make an informed and lawful decision—which it is—the agencies must develop it, whether it is part of a PEIS or individual EISs.

There is furthermore no reason why one particular EIS would proceed faster than another. Nor are the questions to be asked speculative. It is relatively straightforward to calculate what a boom in LNG development means for wetland impacts, hydrology impacts, climate impacts, health impacts, truck traffic, road damage, lost property values, and lost commercial opportunities in the region. For issues where there is a disagreement over the existing facts, the PEIS will provide the best opportunity to develop data that is crucial to an informed decision.

Regulatory agencies are currently determining the level of environmental review for different projects based on political pressures, rather than environmental impact. Conducting the necessary PEIS would level the playing field moving forward, so that companies that employ the best environmental practices would rise to the top.

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[82] Areawide Environmental Impact Statement for Phosphate Mining in the Central Florida Phosphate District http://www.saj.usace.army.mil/Media/News-Releases/Article/479889/us-army-corps-of-engineers-releases-areawide-environmental-impact-statement-add/

[83] Supplemental Draft Environmental Impact Statement (SDEIS) on the Effects of Oil and Gas Activities in the Arctic Ocean. http://www.alaskafisheries.noaa.gov/protectedresources/arctic/.

[84] Need for Area Wide Environmental Impact Statement "Bone Valley Phosphate Mining Region (Peace River Watershed, Florida) 10 Mar, 2010.

SUMMARY

1. **The Project is inconsistent with Louisiana's Comprehensive Master Plan for a Sustainable Coast and a 2016 Executive Order.**

2. **The Applicant has failed to thoroughly evaluate project alternatives.**

3. **Climate should be considered in the permitting process.**

4. **Direct, indirect, secondary, and cumulative impacts remain unassessed.**

5. **The Applicant must develop disaster-response plans and perform a quantitative risk assessment. Local floodplain officials should be included in the notification of this permit, since the Project sits in an area vulnerable to flooding.**

6. **The mitigation plan for the Project is incomplete.**

7. **The Project does not appear to offer actual public benefit or be in the public interest.**

8. **The Project warrants a Programmatic, or Area-Wide, Environmental Impact Statement (PEIS).**

The Corps, LDEQ, and LDNR must take the mandates put forth by the Clean Water Act, Louisiana's *Comprehensive Master Plan for a Sustainable Coast,* Governor John Bel Edwards, Louisiana's Constitution, the Louisiana Supreme Court, and the federal government seriously. These responsibilities are only heightened when faced with the inadequacy of the Applicant's public documents. A detailed environmental assessment evaluating the cumulative impacts of permits issued for liquified natural gas projects must be incorporated into the decisionmaking process for the proposed permits related to Port Cameron, LLC. Public hearings are the ideal tools to complement these scientific investigations.

Almost 11 years after Louisiana was lost, in an era following the Paris Agreement, the climate impacts of such a massive number of actions must be examined critically. The cumulative impacts stemming from the Project and connected proposals, if all are permitted and functional, would be the drowning of thousands of square miles of wetlands along the Gulf Coast. This loss of land disproportionately affects Louisiana, where many federal investments and projects affect the economy of the entire nation, as well as where much of GRN's membership calls home.

We sincerely hope the Corps, LDEQ, and LDNR will act upon the above comments accordingly.

In order to keep us and the public properly informed, we request notification of denials, approvals, and/or changes to the Applicant's requests for a Section 404 Permit, WQC, and CUP. We look forward to a written response.

For a healthy Gulf,
[sent via e-mail]

Scott Eustis, MS
Coastal Wetland Specialist

James G. Hartwell, MSPH
Coastal Wetland Analyst

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cc: Matt Rota, Senior Policy Director
Johanna de Graffenreid, Coastal Campaign Organizer

May Nguyen, Tulane Environmental Law Clinic
Karl Morgan, LDNR
Martin Mayer, USACE
Raul Gutierrez, U.S. EPA, Region 6

From: Mayer, Martin S CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: More Port Cameron Info
Date: Thursday, July 27, 2017 12:40:40 PM
Attachments: NeedsAlternativesandJustificationReportrevised20170427.pdf

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

July 27, 2016

Mr. Martin Mayer, Chief
Regulatory Functions Branch
New Orleans District
U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Dear Mr. Mayer:

The U.S. Environmental Protection Agency (EPA) has reviewed the joint public notice dated June 28, 2016, concerning Department of the Army Permit Application Number MVN-2013-02424-MB, submitted by Port Cameron, LLC. The Port Cameron, LLC proposed development focuses on providing a secondary/western oil and gas service port along the Louisiana coast in Cameron Parish. Approximately 22,000 linear feet of bulkhead shall be installed to provide water front industrial access for the Port Cameron facility with a total of approximately 9,665,683 cubic yards of excavation. 5,658,636 cubic yards will be excavated and placed onsite. 4,007,047 cubic yards will be hauled off site and placed in a sediment disposal area. Approximately 1138 acres of vegetated marsh may be impacted as a result of their proposed activities. The comments that follow are being provided for use in reaching a decision relative to compliance with the EPA's *404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230).*

Wetlands and other aquatic resources in the project area support a range of animal and plant species, some of which are of special management concern. In addition to these fish and wildlife values, the wetland and aquatic resources of the Calcasieu River Basin ecosystem help maintain the water quality of the Calcasieu River and Calcasieu Lake. Equally important, such wetlands can also help attenuate flooding during storms or heavy rain events.

According to the public notice, these potential impacts include the direct loss of approximately 350 acres of wetlands and other waters of the United States. The proposed site would be located in relatively undeveloped portions of Cameron Parish, and in so doing would further fragment blocks of wetland habitat. Such habitat fragmentation can alter species composition and usage by reducing habitat, increasing opportunities for colonization by invasive species and increasing noise production. Wetlands in the project area could be further degraded by hydrologic disruption caused by the increase in roads and other impervious surfaces. The EPA is concerned with the potential indirect adverse impacts to the Calcasieu River due to the loss of water quality enhancement functions performed by the wetlands, compounded by an increase in industrial runoff and the lack of the ability for the water in the slips to circulate and possibly stagnate.

The potential direct and indirect impacts discussed above would contribute to cumulative losses of wetlands along the Calcasieu River. The Lake Charles area is expected to experience rapid growth over the next decade. The associated construction of homes, businesses, and roads may result in significant cumulative losses in marsh, forested wetlands, scrub-shrub wetlands, and other habitat. The incremental adverse impacts of this project, when added to the reasonably foreseeable adverse impacts to wetlands and other aquatic resources that are likely to occur as a result of future development in the area, will be significant. While some of the cumulative impacts may be offset by the creation and restoration of marsh in the Cameron Prairie National Wildlife Refuge, the site of the mitigation project is in an area that is experiencing rapid land loss due to erosion, especially after large named storms such as Hurricanes Gustav and Isaac. Allowing impacts to occur in a more stable area and compensating for these impacts in an area that is rapidly eroding will in time contribute to the cumulative losses of wetlands in the Calcasieu River Basin.

When the impacts of the Port Cameron project are considered, it is not clear the current proposal could serve as a basis for supporting a finding of no significant impact. Given the potential adverse direct, indirect, and cumulative impacts to wetlands and other aquatic resources along the Calcasieu River Ship Channel, the EPA believes that an Environmental Impact Statement (EIS) should be prepared. Other projects in the vicinity (Magnolia LNG, Venture Global LNG, Delfin LNG) of similar magnitude have submitted or are in the process of completing Environmental Impact Statements for review by the public and resource agencies. We have included recommendations for the content of an EIS should the Corps find it in the public's interest to prepare one.

Thank you for your continued collaboration with the EPA on this and other Clean Water Act matters in the New Orleans District. Should you have any questions or wish to discuss this matter further, please contact Dr. Raul Gutierrez of my staff at (504) 862-2371.

Sincerely,

Maria L. Martinez
Chief
Wetlands Section

Enclosure

cc: Brian Breaux, USACE, New Orleans, LA
Joshua Marceaux, USFWS, Lafayette, LA
Kyle Balkum, LDWF, Baton Rouge, LA
Twyla Cheatwood, NMFS, Baton Rouge, LA
Mark Hogan, LDNR, Baton Rouge, LA
Elizabeth Hill, LDEQ, Baton Rouge, LA

Environmental Impact Statement Recommendations for Port Cameron (MVN-2013-02424)

Statement of Purpose and Need

We recommend the EIS clearly identify the underlying purpose and need to which the USACE is responding in proposing the alternatives (40 CFR 1502.13). The purpose of the proposed action is typically the specific objectives of the activity, while the need for the proposed action may be to eliminate a broader underlying problem or take advantage of an opportunity.

Recommendation:

The purpose and need should be a clear, objective statement of the rationale for the proposed project. We recommend the EIS discuss the proposed project in the context of the natural gas supply and the need for an additional export capabilities.

Alternatives Analysis

The National Environmental Policy Act (NEPA) requires evaluation of reasonable alternatives, including those that may not be within the jurisdiction of the lead agency (40 CFR Section 1502.14(c)). A robust range of alternatives will include options for avoiding significant environmental impacts. We recommend the EIS provide a clear discussion of the reasons for the elimination of alternatives which are not evaluated in detail.

The environmental impacts of the proposal and alternatives should be presented in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14). The potential environmental impacts of each alternative should be quantified to the greatest extent possible (e.g., acres of bay bottom impacted, tons per year of emissions produced).

Recommendations:

We recommend the EIS describe how each alternative was developed, how it addresses each project objective, and how it will be implemented. The alternatives analysis should include a discussion of alternatives. We recommend the EIS clearly describe the rationale used to determine whether impacts of an alternative are significant or not. We recommend the EIS describe the methodology and criteria used for determining project siting. Thresholds of significance should be determined by considering the context and intensity of an action and its effects (40 CFR 1508.27).

Water Supply and Water Quality

Public drinking water supplies and/or their source areas often exist in many watersheds. Source water is water from streams, rivers, lakes, springs, and aquifers that is used as a supply of drinking water. Source water areas are delineated and mapped by the state for each federally-regulated public water system. The 1996 amendments to the Safe Drinking Water Act require

federal agencies to protect sources of drinking water for communities. We recommend the EIS address the potential effects of project discharges, if any, on surface water quality. Specific discharges should be identified and potential effects of discharges on designated beneficial uses of affected waters should be analyzed.

Recommendations:

EPA recommends the EIS address the potential effects of project discharges, if any, on surface water quality. Specific discharges should be identified and potential effects of discharges on designated beneficial uses of affected waters should be analyzed.

We recommend the EIS describe water reliability for the proposed project and clarify how existing and/or proposed sources may be affected by climate change. At a minimum, the EPA expects a qualitative discussion of impacts to water supply and the adaptability of the project to these changes.

Groundwater

EPA recommends the EIS address potential adverse impacts to groundwater. For each alternative under consideration, we request that the EIS satisfy the recommendations below to ensure groundwater resources are protected and any unavoidable impacts are fully assessed in the EIS.

Recommendations:

EPA recommends the EIS describe current groundwater conditions in the project area and fully assess any impacts to groundwater quality and quantity associated with the proposed project construction and operational activities.

We also recommend the EIS identify mitigation measures to prevent or reduce adverse impacts to groundwater quality and discuss their effectiveness. EPA asks that the lead agency work closely with state and local agencies which regulate the protection of groundwater resources (i.e., state health departments and water pollution control agencies.)

Stormwater Considerations

EPA recommends the EIS describe the original (natural) drainage patterns in the project locale, as well as the drainage patterns of the area during project operations. Also, we recommend the EIS identify whether any components of the proposed project are within a 50 or 100-year floodplain. We also recommend noting that, under the Federal Clean Water Act, any construction project disturbing a land area of one or more acres requires a construction stormwater discharge permit.

Recommendations:

EPA recommends the EIS document the project's consistency with applicable stormwater permitting requirements. Requirements of a stormwater pollution prevention plan should be reflected as appropriate in the EIS.

We also recommend the EIS discuss specific mitigation measures that may be necessary or beneficial in reducing adverse impacts to water quality and aquatic resources.

Clean Water Act (CWA) Section 303(d)

The CWA requires States to develop a list of impaired waters that do not meet water quality standards, establish priority rankings, and develop action plans, called Total Maximum Daily Loads (TMDL), to improve water quality. We recommend the EIS provide information on CWA Section 303(d) impaired waters in the project area, if any, and efforts to develop and revise TMDLs. EPA further recommends the EIS describe existing restoration and enhancement efforts for those waters, and any mitigation measures that will be implemented to avoid further degradation of impaired waters.

Recommendation:

EPA recommends the EIS provide information on CWA Section 303(d) impaired waters in the project area, if any, and efforts to develop and revise TMDLs. We recommend the EIS describe existing restoration and enhancement efforts for those waters, how the proposed project will coordinate with on-going protection efforts, and any mitigation measures that will be implemented to avoid further degradation of impaired waters.

Dredge and Fill Impacts to Waters of the United States

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, which will require placement of fill required for construction of aboveground facilities and pipelines, including potential placement in WOUS, it will require a Section 404 permit under the CWA, and therefore the applicant should coordinate with the U.S. Army Corps of Engineers (Corps).

The EPA recommends that the Corps include a wetland delineation for the project area in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* and the December 2006 *Atlantic and Gulf Coast Region Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual*. A Corps approved jurisdictional determination (JD) will also be required to confirm the extent of the jurisdictional WOUS in the project area that may be directly or indirectly impacted by the project.

Pursuant to 40 CFR 230, any permitted discharge into WOUS must be the least environmentally damaging practicable alternative available to achieve the project purpose. We recommend the EIS includes an evaluation of the project alternatives in this context in order to demonstrate the project's compliance with the 404(b)(1) Guidelines. If, under the proposed project, dredged or fill material would be discharged into WOUS, we recommend the EIS discuss alternatives to avoid and minimize those discharges.

Finally, the EPA recommends that the Corps include a wetland compensatory mitigation plan that would compensate for unavoidable impacts to aquatic resources, in the EIS for review and comment by EPA and other interested agencies and stakeholders. The mitigation plan should be included in the EIS along with the applicant's alternatives analysis and any additional information relevant to potential impacts to wetlands and other aquatic resources. This would ensure that the EIS has sufficient information to demonstrate whether potential adverse wetlands impacts have been adequately addressed.

Recommendation*:*

The EPA asks the Corps to determine the extent of jurisdictional wetlands and other WOUS present at the project site. We recommend the EIS includes the results of the jurisdictional determination for the project site and address any other relevant requirements pursuant to the CWA Section 404(b)(1), including the requirements to consider less damaging practicable alternatives for any discharges of dredged or fill material into WOUS, to avoid and minimize impacts to aquatic habitats due to discharges of dredge and fill material, and to provide a compensatory mitigation plan for all unavoidable impacts to WOUS.

Biological Resources, Habitat and Wildlife

EPA asks that the EIS identify all petitioned and listed threatened and endangered species and critical habitat that might occur within the project area. We further recommend the EIS identify which species or critical habitat might be directly, indirectly, or cumulatively affected by each alternative and describe possible mitigation for each of the species. EPA asks that USACE consult with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act. We also recommend that the USACE coordinate across field offices and with USFWS, NMFS, and the Louisiana Department of Wildlife and Fisheries (LDWF) to ensure that current and consistent surveying, monitoring, and reporting protocols are applied in protection and mitigation efforts.

Recommendations:

EPA recommends that USACE coordinate across field offices and with the USFWS, NMFS and LDWF to ensure that current and consistent surveying, monitoring, and

reporting protocols are applied in protection and mitigation efforts. Analysis of impacts and mitigation on covered species should include:

- Baseline conditions of habitats and populations of the covered species.
- A clear description of how avoidance, mitigation and conservation measures will protect and encourage the recovery of the covered species and their habitats in the project area.
- Monitoring, reporting and adaptive management efforts to ensure species and habitat conservation effectiveness.
- A discussion of how the projects potential impacts such as air emissions and/or wastewater discharges may impact species.
- If the applicant is to acquire compensation lands, the location(s) and management plans for these lands should be discussed in the EIS.
- EPA recommends incorporating information on the compensatory mitigation proposals (including quantification of acreages, estimates of species protected, costs to acquire compensatory lands, etc.) for unavoidable impacts to WUS and biological resources in the EIS.
- We recommend identifying compensatory mitigation lands or quantify available lands for compensatory habitat mitigation for this project, as well as reasonably foreseeable projects in the area. Specify provisions that will ensure habitat selected for compensatory mitigation will be protected in perpetuity in the EIS.
- EPA recommends incorporating mitigation, monitoring, and reporting measures that result from consultation with the USFWS or NMFS that incorporate recently released guidance to avoid and minimize adverse effects to sensitive biological resources in the EIS.
- We further request that the EIS describe the potential for habitat fragmentation and obstructions for wildlife movement from the construction of this project and other projects in the area.
- The EIS should discuss the need for monitoring, mitigation, and if applicable, translocation management plans for the sensitive biological resources, approved by the USFWS, NMFS and the biological resource management agencies.
- We recommend the EIS describe the extent of potential impacts from

construction, installation, and maintenance activities, including all interrelated and interdependent facilities.

- We recommend the EIS describe the ROW vegetation management techniques to be used and their potential associated environmental impacts, especially if mechanical methods or herbicides are to be used.

- We recommend the EIS indicate the location of important marine and wildlife habitat areas. We recommend the EIS describe what measures will be taken to protect important wildlife habitat areas and to preserve linkages between them.

- We recommend the EIS provide detailed information on any proposed fencing design and placement, and its potential effects on drainage systems on the project site. Fencing proposed for this project should meet appropriate hydrologic, wildlife protection and movement, and security performance standards.

Invasive Species

Human actions are the primary means of invasive species introductions. Pipeline construction causes disturbance of ROW soils and vegetation through the movement of people and vehicles along the ROW, access roads, and lay down areas. These activities can contribute to the spread of invasive species. Parts of plants, seeds, and root stocks can contaminate construction equipment and essentially "seed" invasive species wherever the vehicle travels. Invasive species infestations can also occur during periodic ROW maintenance activities especially if these activities include mowing and clearing of vegetation. Once introduced, invasive species will likely spread and impact adjacent properties with the appropriate habitat.

Executive Order 13112, *Invasive Species* (February 3, 1999), mandates that federal agencies take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. Executive Order 13112 also calls for the restoration of native plants and tree species. If the proposed project will entail new landscaping, we recommend the EIS describe how the project will meet the requirements of Executive Order 13112.

In addition, we encourage alternative management practices that limit herbicide use (as a last resort), focusing instead on other methods to limit invasive species vegetation and decrease fire risk. Possible alternatives include mowing and weed control fabric, which may need a layer of soil to prevent degradation due to ultraviolet light.

Recommendations:

EPA recommends the EIS describe the invasive plant management plan used to monitor and control noxious weeds. If herbicides or pesticides will be used to manage vegetation,

we recommend the EIS disclose the projected quantities and types of chemicals. The invasive plant management plan should identify methods that can be used to limit the introduction and spread of invasive species during and post-construction. These measures can include marking and avoidance of invasives, timing construction activities during periods that would minimize their spread, proper cleaning of equipment, and proper disposal of woody material removed from the ROW.

Because construction measures may not be completely effective in controlling the introduction and spread of invasives, we recommend the EIS describe post-construction activities that will be required such as surveying for invasive species following restoration of the construction site and measures that will be taken if infestations are found.

Air Quality

EPA recommends the EIS provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards (NAAQS) and non-NAAQS pollutants, criteria pollutant nonattainment areas, and potential air quality impacts of the proposed project (including cumulative and indirect impacts). Such an evaluation is necessary to understand the potential impacts from temporary, long-term, or cumulative degradation of air quality.

We further recommends the EIS describe and estimate air emissions from potential construction and maintenance activities, as well as proposed mitigation measures to minimize those emissions. EPA recommends an evaluation of the following measures to reduce emissions of criteria air pollutants and hazardous air pollutants (air toxics).

Recommendations:

- *Existing Conditions* – We recommend the EIS provide a detailed discussion of ambient air conditions, National Ambient Air Quality Standards, and criteria pollutant nonattainment areas in the vicinity of the project.

- *Quantify Emissions* – We recommend the EIS estimate emissions of criteria and hazardous air pollutants (air toxics) from the proposed project and discuss the timeframe for release of these emissions over the lifespan of the project. We recommend the EIS describe and estimate emissions from potential construction activities, as well as proposed mitigation measures to minimize these emissions.

- *Specify Emission Sources* – We recommend the EIS specify all emission sources by pollutant from mobile sources, stationary sources, fugitive emission sources, area sources, and ground disturbance. This source specific information should be used to identify appropriate mitigation measures and areas in need of the greatest attention.

- *Construction Emissions Mitigation Plan* – We recommend the EIS include a draft Construction Emissions Mitigation Plan and ultimately adopt this plan in the Record of Decision. In addition to all applicable local, state, or federal requirements, we recommend the following control measures (Fugitive Dust, Mobile and Stationary Source and Administrative) be included in the Construction Emissions Mitigation Plan in order to reduce impacts associated with emissions of particulate matter and other toxics from construction-related activities.

- Fugitive Dust Source Controls*:* The PDEIS should identify the need for a Fugitive Dust Control Plan to reduce Particulate Matter 10 and Fine Particulate Matter 2.5 emissions during construction and operations. 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*:*
    - If practicable, lease new, clean equipment meeting the most stringent of applicable Federal[1] or State Standards[2]. In general, commit to the best available emissions control technology. Tier 4 engines should be used for project construction equipment to the maximum extent feasible[3].
    - Where Tier 4 engines are not available, use construction diesel engines with a rating of 50 hp or higher that meet, at a minimum, the Tier 3 California Emission Standards for Off-Road Compression-Ignition Engines, unless such engines are not available.
    - Where Tier 3 engine is not available for off-road equipment larger than 100 hp, use a Tier 2 engine, or an engine equipped with retrofit controls to reduce exhaust emissions of nitrogen oxides and diesel particulate matter to no more than Tier 2 levels.
    - Consider using electric vehicles, natural gas, biodiesel, or other alternative fuels during construction and operation phases to reduce the project's criteria and greenhouse gas emissions.
    - Plan construction scheduling to minimize vehicle trips.
    - Limit idling of heavy equipment to less than 5 minutes and verify through unscheduled inspections.
    - Maintain and tune engines per manufacturer's specifications to perform at CARB and/or EPA certification levels, prevent tampering, and conduct unscheduled inspections to ensure these measures are followed.

- 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

[1] EPA's website for nonroad mobile sources is http://www.epa.gov/nonroad/.
[2] For California, see ARB emissions standards, see: http://www.arb.ca.gov/msprog/offroad/offroad.htm.
[3] Diesel engines < 25 hp rated power started phasing in Tier 4 Model Years in 2008. Larger Tier 4 diesel engines will be phased in depending on the rated power (e.g., 25 hp - <75 hp: 2013; 75 hp - < 175 hp: 2012-2013; 175 hp - < 750 hp: 2011 - 2013; and ≥ 750 hp 2011- 2015).

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 plumes.

Hazardous Materials/Hazardous Waste/Solid Waste

EPA recommends the EIS address potential direct, indirect and cumulative impacts of hazardous waste from construction and operation of the proposed pipeline and other facilities. The document should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans.

Recommendations*:*

We recommend the EIS address the applicability of state and federal hazardous waste requirements. Appropriate mitigation should be evaluated, including measures to minimize the generation of hazardous waste (i.e., hazardous waste minimization). Alternate industrial processes using less toxic materials should be evaluated as mitigation since such processes could reduce the volume or toxicity of hazardous materials requiring management and disposal as hazardous waste.

Coordination with Tribal Governments

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000), was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the United States government-to-government relationships with Indian tribes. If applicable, we recommend the EIS describe the process and outcome of government-to-government consultation between the USACE and with any and each of the tribal governments within the project area, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative.

Recommendation:

We recommend the EIS describe the process and outcome of government-to-government consultation between the USACE and each of the tribal governments within the project area, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative.

National Historic Preservation Act and Executive Order 13007

Consultation for tribal cultural resources is required under Section 106 of the National Historic Preservation Act. Historic properties under the NHPA are properties that are included

in the National Register of Historic Places or that meet the criteria for the National Register. Section 106 of the NHPA requires a federal agency, upon determining that activities under its control could affect historic properties, consult with the appropriate State Historic Preservation Officer (SHPO)/Tribal Historic Preservation Officer (THPO), Indian tribes, or any other interested party. Under NEPA, any impacts to tribal, cultural, or other treaty resources must be discussed and mitigated. Section 106 of the NHPA requires that Federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800.

Recommendation:

We recommend the EIS address the existence of cultural and historic resources, including Indian sacred sites, in the project areas, and address compliance with Section 106 of the NHPA. It should also address Executive Order 13007, distinguish it from Section 106 of the NHPA, and discuss how the applicant will avoid adversely affecting the physical integrity, accessibility, or use of sacred sites, if they exist. We recommend the EIS provide a summary of all coordination with Tribes, the SHPO/THPO, or any other party; and identify all NRHP listed or eligible sites, and the development of a Cultural Resource Management Plan.

Environmental Justice and Impacted Communities

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994) and the Interagency Memorandum of Understanding on Environmental Justice (August 4, 2011) direct federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process. Guidance[4] by CEQ clarifies the terms low-income and minority population (which includes Native Americans) and describes the factors to consider when evaluating disproportionately high and adverse human health effects. We recommend the EIS include an evaluation of environmental justice populations within the geographic scope of the projects. Assessment of the projects impact on minority and low-income populations should reflect coordination with those affected populations. We recommend the EIS also describe outreach conducted to all other communities that could be affected by the project, since rural communities may be among the most vulnerable to health risks associated with the project.

Recommendations:

EPA recommends the EIS include an evaluation of environmental justice populations within the geographic scope of the projects. If such populations exist, EPA recommends

[4] Environmental Justice Guidance under the National Environmental Policy Act, Appendix A (Guidance for Federal Agencies on Key Terms in Executive Order 12898), CEQ, December 10, 1997.

the EIS address the potential for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation by these populations. Assessment of the projects impact on minority and low-income populations should reflect coordination with those affected populations.

We recommend the EIS describe outreach conducted to all other communities that could be affected by the project, since rural communities may be among the most vulnerable to health risks associated with the project.

Coordination with Land Use Planning Activities

We recommend the EIS discuss how the proposed action would support or conflict with the objectives of federal, state, tribal or local land use plans, policies and controls in the project areas. The term "land use plans" includes all types of formally adopted documents for land use planning, conservation, zoning and related regulatory requirements. Proposed plans not yet developed should also be addressed if they have been formally proposed by the appropriate government body in a written form (CEQ's Forty Questions, #23b).

Port Cameron, LLC

Needs, Alternatives, and Justification Analysis Report

Originally prepared and submitted in June 2014 by

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April 2017

Introduction

The purpose of this document is to provide a thorough explanation of the need for a deep water access port facility (Port Cameron, LLC) along the Gulf Coast to service the needs of oil and gas industries operating in the Gulf of Mexico. This document also includes a description of the alternative development and proposed action selection process for the proposed project. The framework of this document follows the guidance provided in the Louisiana Department of Natural Resources (LDNR) Alternatives and Justification Analysis Guide for New Port Facilities. Figure 1 shows the proposed layout of the facility which will be along the eastern bank of the Calcasieu River Ship Channel (CSC) between Louisiana Hwy 27/82 and the East Fork of the Calcasieu River in the town of Cameron, Louisiana.

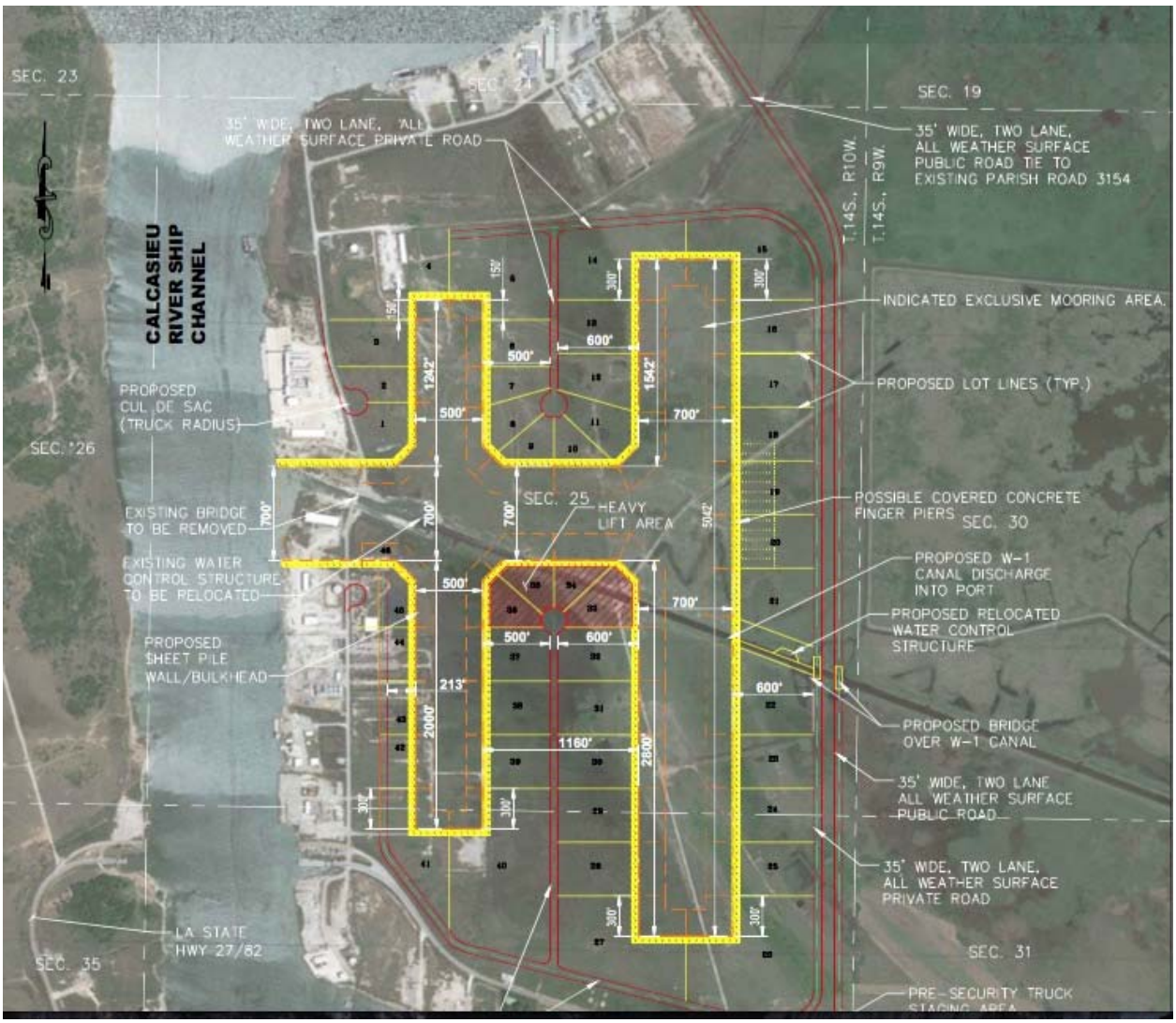

Figure 1: Proposed Port Cameron site plan

Project Description

The Port Cameron project proposes to install approximately 22,000 linear feet of bulkhead with seven covered boat slips and additional land based infrastructure for the development of an oil and gas industry waterfront support facility in southwest Louisiana. The facility is designed to facilitate vessels with loaded draft depths up to 30 feet. The Port will provide all standard utilities to the tenants including water, sewer, and electricity to facilitate their operations. In order to provide waterfront industrial access to the proposed facility, a bridge along Wakefield Road will be removed and the channel will be widened. This will cut access off to the north portion of Wakefield Road. A new proposed roadway will be constructed to connect LA 27/82 to existing Parish Road 3154 and the north portion of Wakefield Road north of the proposed port facility. Driveway access to the proposed facility will be along the new connection road.

The proposed Port Cameron facility has a footprint of approximately 476 acres, of which approximately 322.9 acres are classified as wetlands and/or waterbottoms. The applicant proposes to offset these impact through the beneficial use of dredged material for marsh creation within the Cameron Prairie National Wildlife Refuge. Additional details on the proposed beneficial use of dredge material are available in the accompanying Dredged Material Management Plan (see attached “DMMPrevised20170424”).

Gravity Drainage District No. 3 of Cameron Parish has reviewed the preliminary layouts and details of the proposed project and has no objection to the project at this time (See attached “Gravity Drainage District letter”). A Level 3 Hydrologic Modification Impact Analysis (HMIA) was performed for this project and shows no major impacts to the surrounding area (Appendix F). The landowners and adjacent landowners have provided letters of support for the project to the development team (See attached "Support Letters.pdf"). There is no property zoning in Cameron Parish, therefore no zoning variances will be required prior to development.

Surrounding Land Use

The area immediately south and north of the proposed Port Cameron entrance along the eastern side of the Calcasieu Ship Channel is comprised of old docks and wharves that primarily support the seafood industry. Some older oil and gas support facilities for storage, load-out and drilling and production operations are located along the ship channel within one mile of the proposed site.

The land directly to the west of the proposed site on the western bank of the Calcasieu Ship Channel is comprised of undeveloped property and consists of mainly wetland, a former dredge spoil bank, and is currently used as a cattle pasture. A liquefied natural gas company has filed with the U.S. Department of Energy to export LNG from a facility to be constructed on this site on the western bank of the Ship Channel.

The property to the east of the proposed site is primarily undeveloped, and consists mainly of coastal prairie landform significantly impacted by cattle grazing and hay production. To the northeast of the project is open water and marsh comprising the Cameron Prairie Wildlife Refuge.

Industrial Development and Prospective Tenants

The anticipated tenant-developed facilities would likely consist mainly of deep water support facilities and related businesses. A typical facility would include a steel framed elevated office structure, warehouses, storage tanks, etc. constructed by the tenant. Numerous cranes capable of quickly loading support vessels and several heavy lift cranes are anticipated as part of these tenant-developed sites.

It is also anticipated that several support service businesses, such as construction, food, lodging, fuel supply, boat repair, helicopter transportation, etc. could be located within the facility. The Gulf Stream Valuation Market Study Report (Appendix A) includes a representation of existing industrial tenant developments at Port Fourchon which will most likely occur at Port Cameron once the facility is constructed, and a list of prospective tenants for the Port Cameron Facility.

Port Cameron is expected to attract the following industries:
Offshore Transportation
Shipyard Maintenance
Vessel supply, fueling, loading
Oil field exploration / survey
Oil field supply, i.e. drill stem, drilling fluids, valves, rigging, etc.
Off shore tanks and containers
Energy Companies, i.e. Shell, BP, Chevron
Port Management Services
Pipeline maintenance and construction
Offshore / Inshore marine construction
Offshore / Inshore marine construction equipment rental, and material sales
Janitorial services
Vessel wastewater removal and treatment
Environmental services
Fabricators

The "Gulf Stream Valuation Market Study Report, Port Cameron", dated 5 May 2014 surveyed the existing tenant base at Port Fourchon, as well as current tenants in Cameron and have compiled the following list of potential tenants for Port Cameron:

Anadarko Petroleum

Baker Hughes
B. J. Services
British Petroleum
Cameron Oil
Chevron
Crain Brothers
Drilco
Express Weld
Francis Drilling Fluids
Galliano Marine Services
Global Marine
Halliburton Energy Services
HESS
Hoover Offshore
Hydro Carbon Flow Specialist
Petroleum Helicopters
Martin Holdings
National Oilwell Varco
Offshore Rental/Tiger Tanks
OneSubsea
PMI Production Management
Rowan Marine Services
Schlumberger
Shell Pipeline
Weatherford

This list is only some of the larger tenants, many of which lease multiple, contiguous and non-contiguous sites. Many smaller tug, equipment rental, tank, welding, maintenance, trucking, boat servicing and oil service facilities would be potential tenants.

The proposed project has several competitive advantages as an offshore Oil and Gas supply port as well as in LNG production and services including shipping repair. It is very close to the Gulf of Mexico, particularly the Western Planning Area. Additionally, it has very good water access to the GIWW for barged supplies (liquid bulk such as water, fuel, mud).

The primary comparative facility is Port Fourchon located at the southernmost part of LaFourche Parish. Port Fourchon services approximately 90% of the offshore rigs in the Gulf of Mexico and serves as a host for the Louisiana Offshore Port (LOOP). The almost exclusive reliance on Port Fourchon puts the offshore industry in a vulnerable position in the case of natural or environmental disasters. Land access to Port Fourchon is via Louisiana Highway 1 (LA-1) and there are no alternative roads to transport supplies to Fourchon from inland locations. A closure of this

road effectively closes the port itself. While it is anticipated that Port Cameron will be fully occupied within five years of operation with businesses not otherwise located at Port Fourchon, it is probable that similar or comparable businesses will occupy Port Cameron.

The appraiser of the Gulf Stream Valuation Market Study Report interviewed a representative sample of the potential tenant companies that are listed in the Prospective Tenant section of the report. All of the representatives were familiar with Port Fourchon. All of the representatives confirmed a need for an alternative port to Port Fourchon for access, loading, shipping, fabrication, blending and preparation facilities for their operations in the Gulf of Mexico.

Additionally, the Port Cameron (West Cameron Port) Strategic Economic Development Plan dated June 2013, indicated that Port Fourchon is currently the largest supply base for the offshore industry in the Gulf of Mexico. As more companies related to offshore supply located there, synergies emerged from having access to a wide range of service providers. However, tenants without facilities in multiple ports have expressed concern about the vulnerability of having too much infrastructure concentrated at Port Fourchon, and some companies may be interested in establishing operations at second locations.

Port Cameron will also serve other interests, such as the newly constructed, under construction and planned LNG facilities and the industries that support LNG businesses. These industries include Martin Energy, Dii Dynamic, Leevac Shipyards, Trunkline LNG and Alcoa Primary Metals. An estimated $47 billion in petrochemical projects have been identified in the Lake Charles MSA that will create significant demand for businesses independent of comparative ports. According to the Economic Impact Study of the Calcasieu Ship Channel, prepared for the Lake Charles Harbor & Terminal District, October 2015, the Calcasieu Ship Channel drives Southwest Louisiana's oil, gas, and chemical industries, thus driving southwest Louisiana's economy. As a result of the Channel, economic forecasts show that the LNG and petrochemical industries will substantially grow, generating significant economic impacts locally, regionally, and nationally by 2023.

In December 20, 2013, Mexico's President Enrique Pena Nieto signed sweeping constitutional reforms of Mexico's energy sector aimed at reversing oil and gas production declines. On August 11, 2014, secondary laws to implement those reforms officially opened Mexico's oil, natural gas and power sectors to private investment. As a result PEMEX, the state sponsored oil company, can partner with international companies that have the experience and capital required for exploring Mexico's vast deep water resources. Port Cameron will be uniquely located to serve these forthcoming international partnerships which plan to increase oil and gas exploration entities in the Gulf.

According to confidential records provided by the applicant, over $32 million in total predevelopment and development capital contributions have been raised for the project.

The applicant retained Jones Lang LaSalle (JLL), a global real estate advisory firm and a proven leader in delivering optimal brokerage services, solutions and results to prelease and lease industrial real estate space in Port Cameron. Also, they retained CEVA Logistics (a global logistics company) as Port Cameron's property manager consultant whose responsibility includes maintaining a 95% occupancy at Port Cameron.

JLL, CEVA and the Owner accept Port Cameron LOI's, lease and reservations of space for use in marketing materials, including those tenants they have represented, either in LOI's and/or leases pending review and approval by the legal advisors for the respective firms.

Figure 2, from the applicant's official website (http://portcameron.com/), depicts the 9 slips that have been reserved for the clients as of the date of this submission.

Figure 2: Currently leased slips

Demonstration of Need for Project

The primary demand generators for this facility are domestic deep water oil and gas exploration, drilling and production companies, and service companies operating in the Gulf of Mexico. Currently Port Fourchon services over 90% of the Gulf of Mexico's deep water oil production, making the industry extremely vulnerable should Port Fourchon become closed and/or damaged due to natural or man-made disasters. Additionally, LA-1 provides the only land access to Port Fourchon, prohibiting the transport of supplies to and from the facility in the event of a road closure. Due to its geographical location, it is reasonable to perceive that LA-1 could become significantly damaged by storm surge, resulting in an indefinite closure of the roadway. The Department of Homeland Security (2011) predicts that LA-1 will eventually succumb to mean sea

level rise sometime between the years 2030 and 2040, causing road closure by the Department of Transportation and Development.

According to the Department of Homeland Security 2011 report, disruptions to Port Fourchon would be significant. Because supplies and materials destined for drill rigs in the Gulf are brought to Port Fourchon via LA-1, a closure of LA-1 would effectively close the port. As part of the Department of Homeland Security study, Gulf region oil and gas professionals were surveyed to determine the logistical impacts associated with closure of LA-1. The majority of respondents noted their preference of Port Fourchon over other Gulf deepwater ports due to its central location, ample bulkhead space and its level of support services. As will be described in the below alternatives analysis, Port Cameron would also provide a port location central to the focused area of exploration and production operations in the Gulf.

The Department of Homeland Security report also surveyed logistical costs such as rental fees for vessels and fuel costs associated with the use of alternative ports. The average daily operating cost at Port Fourchon was $1,370, compared to $1,270 at Galveston, TX, $1,200 at Theodore, AL, $1,270 at Harbor Island, TX and $1,200 at Cameron, LA. A company could potentially save approximately 12% per vessel, per year in operating expenses by operating daily out of Cameron rather than Fourchon.

Our project team has interviewed a representative sample of potential tenant companies that are listed in the Prospective Tenant section of the attached Market Study Report by Gulf Stream Valuation (Appendix A). All representatives confirmed a need for an alternative port to Port Fourchon for access, loading, shipping, fabrication, blending and preparation facilities for operations in the Gulf of Mexico. The Gulf Stream Valuation Market Study report contains a detailed market analysis which describes projected balance sheets, proposed development schedule, projected leasing schedule, and projected cash flows associated with the Port Cameron development.

Project Infrastructure Needs and Impacts

Port Cameron will operate as an oil and gas service facility and not a typical cargo port. Offshore supply ports need conditions that are distinct from traditional cargo transfer ports. For example, rail access is not required for the offshore supply industry. Liquid bulk such as potable water, fuel, and drilling mud can be easily transported via barge, and equipment such as rented machinery and supplies is transported via truck to and from the port.

Calcasieu River Ship Channel Infrastructure

During the oil and gas operations in the Gulf, the drilling sites could be supplied with tools, drilling supplies, fuel, construction equipment, personnel, food, water, etc. through the use of supply vessels that are stationed and loaded in the proposed Port Cameron and delivered to the drilling rigs in the Gulf of Mexico via the Calcasieu Ship Channel. NOAA Nautical Chart 11347 shows

channel depths between 35 and 46 feet from the jetties at the entrance to the Gulf of Mexico, providing ample draft for vessels needing to access the proposed port facility.

According to the attached Navigation Impact Study (Appendix E), the navigation traffic to the Port Cameron site would represent an increase in channel traffic (by 2021) from 2,200 vessels to more than 7,000 per year. It is estimated that the Port Cameron site would see approximately 4,000 to 5,000 vessel calls annually, or 10 to 15 vessel transits per day. Although, on the surface this would appear to represent a significant increase in traffic, the majority of port calls at the Port Cameron development would not require pilotage as the offshore supply vessels are below 16,000 DWT (confirmed through discussion with the Lake Charles Pilot Association). Given the location of the proposed site and the non-requirement for pilotage, the opinion of the study is that this increase in traffic could be accommodated at the downstream reaches of the Calcasieu River. Other than the development of the port itself, no additional modifications to the Calcasieu River Ship Channel would be necessary to support Port Cameron operations.

Interstate and Road Infrastructure

Smaller specialized equipment, tools, or supplies necessary to supply and maintain operations in the Gulf will likely arrive to the Port Cameron via local truck deliveries. Cameron is accessible by State Highways 27 and 82. State Highway 27 forms a "U" from Interstate 10, thence south along the westerly side of the Calcasieu River Ship Channel and through Cameron by way of a ferry across the Ship Channel. This ferry, which is operated by the Louisiana Department of Transportation and Development, provides access across the Calcasieu River. The ferry operates 24 hours, 7 days a week. The ferry is scheduled to depart once each 15 minutes from either bank completing two round trips per hour. Although an upgrade to the ferry service would certainly assist in the redevelopment of the project area, and is a high priority for residents of Cameron, port users, elected officials, and the port commission, the upgrade is not a requirement for the Port Cameron Facility. State Highway 27 then extends north to the eastern area of Lake Charles. Highway 82 extends east through Grand Chenier to Abbeville, LA. All state roadways and most parish roads are constructed of asphaltic concrete. The state highways are in excellent condition

In order to create Calcasieu Ship Channel access to the port facility, a portion of Wakefield Road will be closed and traffic will be rerouted to a proposed connection road east of the proposed facility. Wakefield Road will be closed at the bridge approximately 0.5 miles north of the LA 27/82 intersection. Therefore, traffic accessing businesses/locations north of the closure point must now use the proposed connection road for access. The majority of the land along Wakefield is undeveloped while some serves industrial land uses. It was determined that an estimate of 30% of the trips entering and exiting Wakefield Road in the AM and PM peak hours will need to be rerouted to the proposed connection road. The assumption is based on knowledge of the project area as well as current land use of the property along Wakefield Road.

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A Traffic Impact Study was performed for this project, which analyzed the existing conditions and the "Existing plus Project" conditions for 2016 traffic volumes during the AM and PM peak hour periods (see attached Port Cameron, LLC Traffic Impact Study, Cameron, Louisiana, Appendix D). The results of the analyses indicate that the proposed development will not reduce the existing levels of service of the roadway network in the vicinity of the site. However, based on the volume of left and right turning vehicles at the proposed intersection of the project entry and LA 27/82, the study recommends that an eastbound left turn lane and westbound right turn lane be provided at the intersection.

Utilities

According to the Port Cameron (West Cameron Port) Strategic Economic Development Plan dated June 2013, all utilities necessary for typical port infrastructure are in place including electrical service, sewer treatment and transmission, road networks and potable water treatment and distribution.

On the east side of the ship channel, everything from and including the MI Dock south on Wakefield Rd is connected to the Cameron City Sewer System. All locations (from MI dock south) along Wakefield Road and Marshall St. (Hwy. 82) are connected to the main line and fed through gravity to a pumping station located at the intersection of Marshall St. and Davis Rd. where a force main then transmits sewer to the sewer treatment facility and holding ponds on Davis Rd. All existing businesses along Davis Rd. have individual pumping systems that force their waste into the Cameron force main and on to the treatment facility. The current northernmost reach of the system is the MI dock and southernmost reach is the Dehyco dock.

The primary infrastructure concern during evacuation operations would be the capacity of the Port of Lake Charles to safely harbor or the capacity of the Calcasieu Ship Channel (CSC) to handle additional outgoing vessels. If a vessel larger than 16,000 DWT were occupying the proposed Port Cameron during an evacuation event, the ship would be required by legislation to be under the control of a pilot from the Lake Charles Pilot Association when operating in the Calcasieu Ship Channel (CSC) to ensure safe passage. During emergency situations the pilots direct the vessels between berths at the proposed Port Cameron to the Gulf of Mexico during evacuation procedures. However, ships of this size would not be a regular occurrence at Port Cameron. The United States Coast Guard Lake Charles Marine Safety Unit (USCG Lake Charles MSU) also has the responsibility to recommend and direct actions that should be taken by vessels and waterfront facilities to minimize storm related deaths, injuries, property damage and threats to the environment. Vessels occupying the proposed Port Cameron would be required to follow this guidance. Both these organizations appear to have policies and procedures in place to safely harbor or evacuate additional vessels occupying the proposed Port Cameron without any impacts to the existing infrastructure. The roadway volumes in the area are significantly less than the roadway's capacity and the network can operate at acceptable levels of service even during evacuation operations.

No rail exists in the parish, and no further development of rail spurs would be necessary to operate the proposed port.

At this time, the additional permits anticipated to be required for this project include an access connection permit from LADOTD to access the site from the state highway, USACE 404/Section 10 Permit, LaDEQ 401 Water Quality Certification, and possibly a USACE Section 408 Permit.

Project Benefits

Port Cameron will operate as an oil and natural gas service facility and not a typical cargo port. The primary demand generators for this facility are the domestic deep water oil and gas exploration, drilling and production companies, and service companies operating in the Gulf of Mexico. Therefore, the impact this project will have on traditional shipping costs for cargo and commodities is not necessarily relevant. However, one of the primary benefits that would result from this project would be avoiding the loss in business to many firms in Louisiana and other states that provide goods and services to the petroleum industry as well as the National consequences should there be a disruption of operations at Port Fourchon in the event of a natural or environmental disaster. Land access to Port Fourchon is via LA-1 and there are no alternative roads to transport supplies to Fourchon from inland locations. A closure of this road from a natural or environmental disaster effectively closes the port itself.

The July 15, 2011 Louisiana Highway 1/Port Fourchon Study by the US Department of Homeland Security studied the local and national consequences of the disruptions to LA- 1. The study concluded there would be considerable disruptions to oil and gas production as well as a loss of business through the chain of suppliers to the petroleum industry in Louisiana and in other states.

The Economic Impact Study of the Proposed Port Cameron on the Lake Charles MSA by Loren C. Scott & Associates, Inc, demonstrates just how vital Port Fourchon is to the nation's economy. Just a three-week cessation of Port Fourchon activities would cause a loss of over $11.2 billion in sales at U.S. businesses. Almost four-fifths of this loss would be due to the interruption of oil production ($8.8 billion) and about one-fifth would be due to the loss of natural gas ($2.4 billion). Of course a loss in business sales translates into a loss of earnings by U.S. citizens. According to the report, households in the U.S. would find their incomes falling by nearly $3.2 billion, with again the split being again about four-fifths due to oil disruption and one-fifth due to natural gas shortages. The job impact of the loss of Port Fourchon activities could result in the loss of 65,502 jobs about 51,510 due to oil disruption and 13,992 due to the loss of natural gas.

The proposed Port Cameron plays a key role in mitigating those projected losses. Other service ports in the Gulf can currently only replicate approximately 25% of the service capacity provided by Port Fourchon in the event that Port Fourchon becomes temporarily inaccessible or unusable. Note that even though the amount of business that Port Cameron might absorb from Port Fourchon during the emergency situation is a fairly small percentage, the positive benefits on the national economy are not insignificant. Sensitivity analysis was used to estimate the impact on the nation if Port Cameron could absorb either 10% or 20% of the business lost at Port Fourchon.

In the case of a 10% shift, the savings to the country would be $1,122.7 million in business sales, $315.6 million in household earnings for the nation's citizens, and 6,550 jobs. In the case of a 20% shift, the savings to the country would be $2,245.3 million in business sales, $631.2 million in household earnings for the nation's citizens, and 13,100 jobs.

The Department of Homeland Security report also surveyed logistic costs such as rental fees for vessels or fuel costs. The average daily operating cost at Port Fourchon was $1,370, compared to $1,270 at Galveston, TX, $1,200 at Theodore, AL, $1,270 at Harbor Island, TX and $1,200 at Cameron, LA. A company could save approximately $62,000 per vessel, per year by operating daily out of Port Cameron rather than Port Fourchon.

The attached Economic Impact Study of the Proposed Port Cameron on the Lake Charles MSA by Loren C. Scott & Associates, Inc provides excellent information regarding the project's expected net benefits to the Lake Charles MSA, the State of Louisiana, and the nation over the long term life of the project.

- In summary the report concludes that while over the 4-year initial construction cycle, it will cost the port and its tenants an estimated $5.4 billion to build out the port site, spending at the proposed port will create:
  - Almost $9.5 billion in new sales at firms in the MSA;
  - Nearly $3 billion in new household earnings for MSA residents;
  - An average of 16,262 jobs a year; and
  - $103.5 million in new sales taxes for Calcasieu Parish.

- The port is expected to be fully leased up by Year 5. Once that occurs, operational activity at the port will create:
  - Over $2.5 billion in sales at firms in the MSA;
  - $469.2 million in new household earnings in the MSA;
  - 8,057 new jobs in the MSA, and;
  - $16.4 million in new sales tax collections in Calcasieu Parish

No Action Alternative

Under a No Action Alternative, there would continue to be a shortage of feasible alternative locations for offshore oil and gas support aside from Port Fourchon. According to the Department of Homeland Security, a 90-day closure of Port Fourchon would cause a loss in revenue to countless businesses in Louisiana and across the nation that provide goods and services to the petroleum industry. The analysis estimated a $7.8-$10.4 billion reduction in the national GDP due to a 90-day closure of Port Fourchon.

According to the Department of Homeland Security report, other service ports can currently only substitute approximately 25% of the service capacity provided by Port Fourchon in the event that Port Fourchon becomes temporarily inaccessible or unusable.

Under the No Action Alternative, the proposed site for this project would not be converted to a port and canal system; however, the site would continue to remain adversely impacted by cattle operation, haying and other such activities.

Geographic Limits of Action Alternatives

As the primary demand generators behind this project are domestic deep water oil and gas exploration, drilling and production companies, and service companies operating in the Gulf of Mexico, the project team analyzed the location of offshore platforms to define the geographic limits of alternative locations for this project. According to the "Port Fourchon Platform Service Study" cited in The Department of Homeland Security's report, the most obvious detail of Port Fourchon that makes it attractive to all survey responders was its central location to operations in the Gulf of Mexico. The central location within the Gulf of Mexico is one of the driving factors behind the Gulf oil and gas industry's preference to use Port Fourchon as its service hub; therefore, the project team considered proximity to the majority of platforms, using distance to Port Fourchon as a metric, in defining the geographic limits of the alternative development.

The Gulf of Mexico is approximately 900 miles wide, putting the central location of the entire Gulf to the southwest of Port Fourchon. However, because drilling in the eastern Gulf is restricted until 2022, the currently "drillable" gulf is approximately 650 miles wide, putting the central point of the "drillable" gulf just southeast of Port Cameron. Port Fourchon is approximately 150 miles from that central point.

According to the Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017 (BOEM, 2012), the estimated undiscovered, technically recoverable oil and gas resource potential of the Central Gulf is roughly twice that of the Western Gulf. In the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program (BOEM, January 2015), there are approximately 1,197 active leases and 7,800 drilled wells in the Western Gulf of Mexico Planning Area, as opposed to 4,103 active leases and 43,4000 drilled wells in the Central Gulf of Mexico Planning Area. As of March 2014, 985 million barrels of oil and 34.1 Tcf of natural gas have been produced in the Western Gulf of Mexico, as opposed to 17.7 BBO and 150 Tcf of natural gas from the Central Gulf of Mexico.

The below map of active platforms in the Gulf of Mexico (figure 3) shows the greatest concentration of rigs west of Houma and East of Port Arthur in the Central Gulf of Mexico, indicating the need to focus the location of a new support port within a reasonable travel

distance from this area, to minimize travel time for vessels from the majority of rigs. For example, according to the Department of Homeland Security 2011 Report, BP explained that it takes an average of twelve hours for a service vessel to reach Port Fourchon from any of BPs rigs or platforms, whereas it would take the same vessel 26-32 hours to reach Galveston, TX.

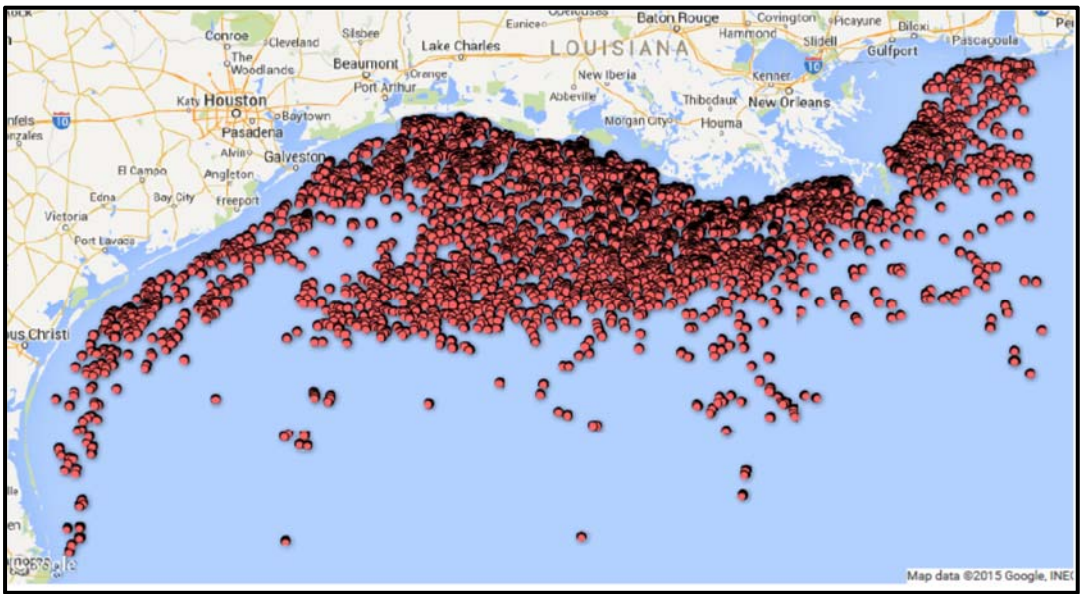

Figure 3: Active platforms in Gulf of Mexico. Source: U.S. Bureau of Ocean Energy Management

Based on the above, the area of investigation for alternative port expansions was limited to 200 miles from a central point in the "drillable" gulf, such that vessels would not have to travel a great deal more than they do now to get to Port Fourchon. Ports exist outside of a 200 mile range from this central area that can currently service the more sparse platforms in the periphery of the gulf. The greatest need for additional service support exists in the center of the "drillable" gulf.

Alternative Site Characteristics

In order to minimize the overall cost of the project, minimize environmental impacts, and increase the feasibility and viability of the project, alternatives were limited to the expansion of existing ports, rather than development of brand new ports due to the presence of infrastructure and support services, such as, existing highways, rail systems and rig cranes. Sites which would require significant infrastructure development or upgrades were not considered practicable.

In addition to this requirement, the project requires enough bulkhead length to operate the facility in an efficient manner, which requires suitable acreage and/or waterfront. Approximately 500 acres would be required to accommodate the 22,000 linear feet of bulkhead required for this project.

As the primary tenants of this facility would be deepwater support facilities, access to the port must have a maintained channel depth of 30 feet or greater during low tide conditions to allow access of marine vessels drafting up to 30 feet.

To minimize travel time to a new port, any existing inland port facility was not considered as an alternative if a suitable port exists closer to the Gulf of Mexico on the same ship channel or waterway. For example, as will be described later in this document, Port Arthur was considered a reasonable alternative; therefore, the Port of Orange and Port of Beaumont, which are further inland on the same waterway, were eliminated from further consideration. In the case of the Port of Lake Charles, Port Cameron is closer to the Gulf of Mexico on the same ship channel. According to the Ausenco Port of Lake Charles Calcasieu Ship Channel Traffic Study Final Report dated 6 Jan 2015, simulation transit speeds on the Inner Channel were calculated from the transit times using historical vessel data. Using the study's simulations speed of 7 knots or 8.055 mph for all inbound and outbound vessels on the Inner Channel, use of the Port of Lake Charles (located near mile marker 36) would add an additional 4.22 hours of travel time from the Port Cameron site. Thus, expansion of the Port of Lake Charles was eliminated from further consideration.

Finally, in order to accomplish the purpose and need of this project, namely provision of a port to complement Port Fourchon in the event of significant disruption, existing ports in close proximity to Port Fourchon were eliminated from further consideration. For example, the Port of Morgan City is less than 100 miles from Port Fourchon. If a storm capable of significantly damaging and/or disrupting operations were to hit Port Fourchon, it is reasonable to assume that operations could likewise be disrupted at the Port of Morgan City, given their proximity to one another, thus limiting the utility of such a complementary port.

Existing Port Alternatives

Based on the above parameters regarding distance from the central Gulf of Mexico, Port Fourchon and existing port characteristics, the following discussion outlines the existing port alternatives which were considered for this project, with a comparative assessment of their suitability for this project. The four existing ports considered for this project are Port Cameron, Port Arthur, Port of Galveston/Texas City and Port of Freeport (figure 4).

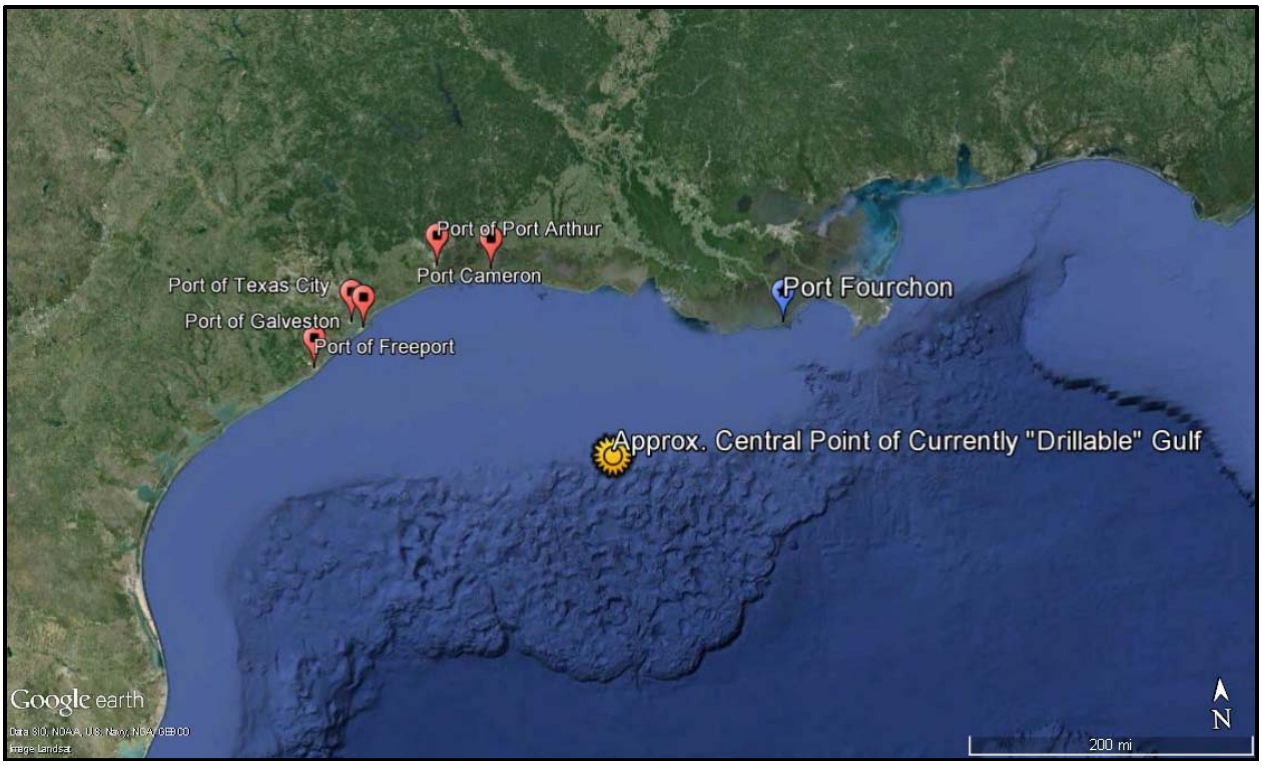

Figure 4: Location of existing ports considered in relation to central point of "drillable" Gulf of Mexico and Port Fourchon

Port Cameron

Port Cameron is the most central location of the five existing ports considered. It is much closer to the entrance to the Gulf of Mexico than Port Arthur and roughly equivalent distance to an opening to the Gulf of Mexico as the other ports considered. Several expanses of large acreage exist within the vicinity of the existing port, though they consist largely of wetlands, which are discussed in the below section titles "Port Cameron Site Alternatives." Finally, the NOAA Nautical Chart 11347 shows channel depths between 35 and 46 feet from the jetties at the entrance to the Gulf of Mexico to the proposed port site, providing ample draft for port access.

Port Arthur

Port Arthur is by far the furthest inland of all ports considered, situated approximately 15 miles inland from the Gulf of Mexico, significantly increasing inland travel by support vessels. Although there are several large undeveloped parcels of land in the vicinity of the port, National Wetland Inventory maps show that these areas are classified as freshwater emergent wetland, estuarine and marine wetlands, similar to that found in areas surrounding Port Cameron (figure 5). Some of the larger unoccupied tracts in the area are utilized as ongoing dredge material placement areas for the maintenance of Sabine Pass Channel and Sabine-Neches Canal. Finally, NOAA

Nautical Chart 11342 shows that portions of Sabine Pass have a depth of only 24 feet, considerably shallow given the required 30 feet depth. Given these shortcomings, expansion of Port Arthur is considered less favorable than expansion of Port Cameron.

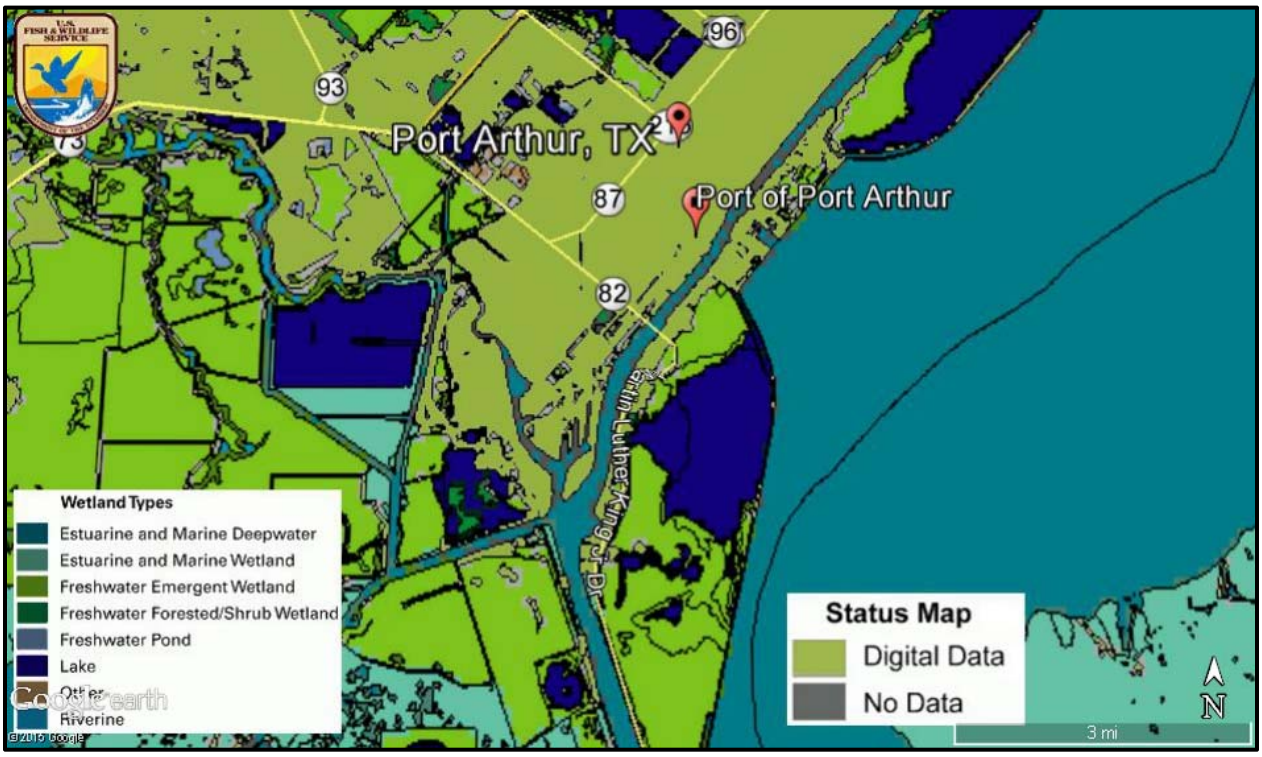

Figure 5: NWI Wetland classifications for Port Arthur area, Source: U.S. Fish and Wildlife Service National Wetland Inventory

Port of Galveston/ Texas City

The Port of Galveston has a strong focus on oil and gas support at its facility, and the Houston Ship Channel has maintained depths suitable for this project; however, the opportunities for expansion are limited. According to Rice (2013), Galveston Island does not have room to expand its port, but a proposed new bridge between Galveston and Pelican Island could facilitate port development on the island, which is approximately 3.5 miles from the entrance to the Gulf of Mexico (figure 6). However, according to the Request for Interest by the Port of Galveston for Pelican Island Development in 2013, 235 acres are available for development on the island, split into two parcels on opposite sides of the island. This acreage is not adequate to meet the desired bulkhead length for this project.

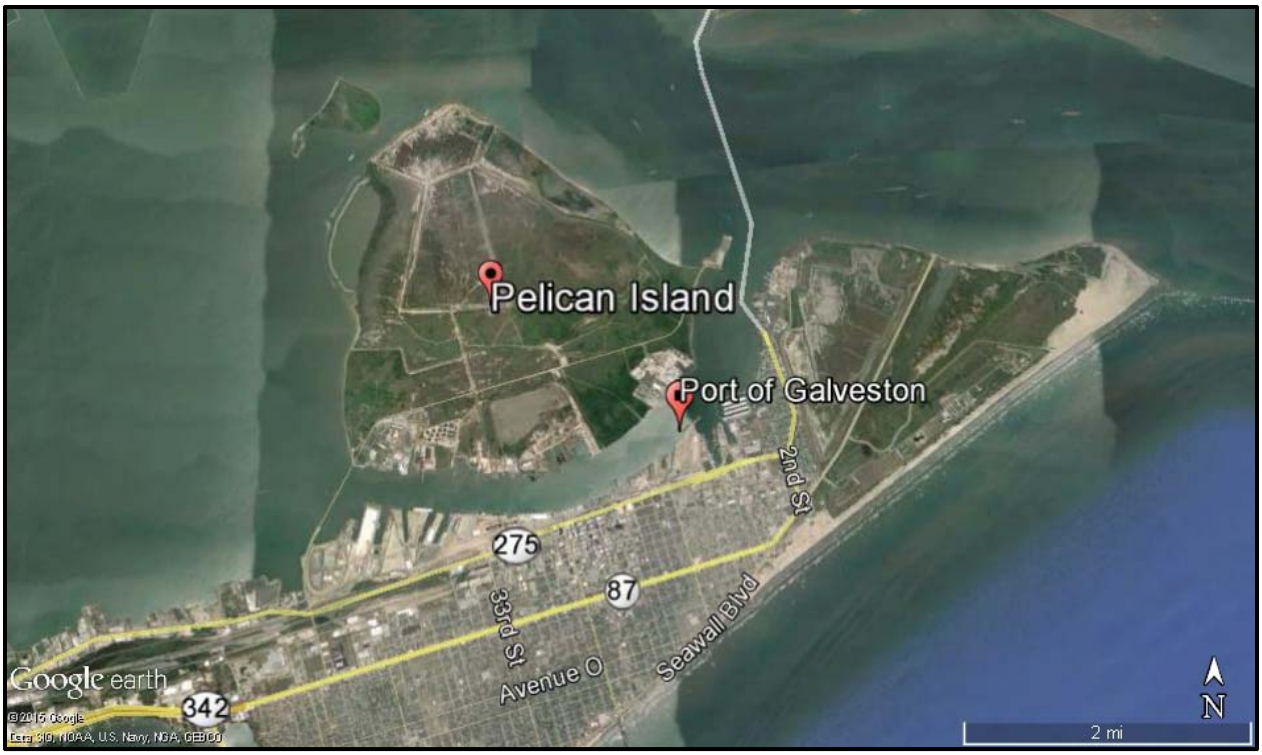

Figure 6: Port of Galveston and Pelican Island

The Port of Texas City sits across the Gulf Intracoastal Waterway from the Port of Galveston, approximately 8 miles from the entrance to the Gulf of Mexico. The largest expanse of open land in the area surrounding the Port of Texas City is Shoal Point (figure 7), but the area is used as an ongoing dredge disposal site for the ship channel. Therefore, the only remaining developable land is southwest of the existing port. Regardless, the Houston Ship Channel is only dredged through a small portion of Galveston Bay and Galveston Harbor/Channel, and the deeper draft portion does not extend westward of Texas City and Shoal Point. Given this lack of suitable land with adequate draft for access, expansion of Port Galveston/Texas City is considered less favorable than expansion of Port Cameron.

Figure 7: Port of Texas City and Shoal Point in Relation to Port of Galveston

Port of Freeport

The Port of Freeport is situated on the Brazos River Channel, which is a circuitous 4.5 mile route from the Gulf of Mexico (figure 8), maintained at a 45 foot depth until Freeport Harbor. According to the Freeport Harbor 2014 Annual Report, the Harbor has only 60 acres available for development. Because the Brazos River is not maintained deeper than 18-20 feet past the harbor, land north of the existing port would be unsuitable for this project. Extensive other developable land with water access exists along the Gulf Intracoastal Waterway (GIWW) south of the existing port, but the GIWW is draft limited to 12 feet.

Other developable land is available on the Brazos River Diversion Channel to the west of the port, but according to the NOAA Chart 11321 BookletChart, the mouth of the diversion is not used as an entrance to the river due to logs, shoaling and general foul ground. Instead, access to the upper reaches of the Brazos River Diversion Channel has to occur through the GIWW, which is draft limited and thus would extend the time required to access any new port development in the area. Given this lack of suitable land with adequate draft, expansion of the Port of Freeport is considered less favorable than expansion of Port Cameron.

Figure 8: Port of Freeport, showing location of Brazos River Channel and Diversion Channel

Summary Comparison of Existing Port Alternatives

The following chart provides a summary comparison of the existing ports within 200 miles of the central point of the "drillable" gulf, as they relate to the necessary site characteristics for this project.

Existing Port	Developable Acreage	Draft Access	Distance to Gulf
Port of Cameron	Large open parcels; primarily wetlands	35'-46'	3.5 mi
Port Arthur	Large open parcels; primarily wetlands	24' in portions of pass	15 mi.
Port of Galveston/Texas City	Inadequate amount: 235 available acres on Pelican Island; Shoal Point utilized for ship channel/harbor dredge disposal	Galveston Harbor/Channel: 23-48' Not maintained westward of Texas City	3.5-8 mi
Port Of Freeport	Inadequate amount: 60 acres on River; developable land on Diversion Channel draft limited	Brazos River Channel: 45' to Freeport Harbor GIWW: 12'	4.5 mi

Based on this comparison, expansion of port services in the vicinity of the existing Port of Cameron seemed most favorable due to its proximity to the Gulf of Mexico, the maintained depth of the Calcasieu Ship Channel, and the available open land in the general area of the existing port. Although wetlands would be impacted at the Port Cameron site, the only other existing port alternative with adequate available land and draft depth would also result in equivalent or more significant impact to wetlands (Port Arthur). As a result of this analysis and selection, the alternatives development process was taken a step further to consider four alternative sites in the vicinity of the existing Port of Cameron as potential locations of the project. These four sites are discussed below.

Port Cameron Alternate Site One – Monkey Island – Cameron, LA

Monkey Island (figure 9) sits between the Calcasieu River Ship Channel and the Calcasieu River Loop Pass and is located in the town of Cameron, LA. Historically, Monkey Island was accessible by a LADOTD operated ferry but it was taken out of operation around the time of Hurricane Rita (2005).

Figure 9: Monkey Island

There is a considerable amount of available acreage on Monkey Island for the development, and the Calcasieu River Loop Pass was recently dredged through a maintenance cycle by the Cameron Parish Police Jury.

The Monkey Island site would require dredging and filling of wetlands. The project area is comprised of undeveloped property and consists mainly of coastal prairie landform and spoil banks. The vegetation found within this alternate site is typically a brackish marsh. Typical

vegetation is often dominated by Spartina patens, but is occasionally dominated by Spartina cynosuroides, Spartina spartinae, or Bolboschoenus robustus. Both intermediate and brackish marshes can be dominated by Spartina patens, but brackish marshes dominated by Spartina patens typically have a small number of other species such as Spartina alterniflora, Distichlis spicata, Juncus roemerianus, or Bolboschoenus robustus (Sasser 2014). Primary wetland hydrology indicators identified by our project team indicated, saturation, surface water, and high water table.

A fixed span bridge would be required to access Monkey Island from the mainland, which would add significant cost to the project. It would not be practical to construct a land-based support facility which would require ferry access, which would be contrary to the concept of providing a supplementary facility to Fourchon that is accessible via multiple roadways, especially considering the potential closures due to ferry maintenance periods.

Based on the facts presented herein, this site is not considered a practicable alternative and is being eliminated as a potential location due to the lack of roadway access and other infrastructure to the island.

Port Cameron Alternative Site Two – South Cameron – Cameron, LA

The South Cameron Site sits across the Calcasieu River Loop Pass from the southern point of Monkey Island, east of Davis Road in Cameron, LA (figure 10).

Figure 10: South Cameron Site

As with the Monkey Island and the proposed site, there is considerable amount of available acreage in the area for the development, and the Calcasieu River Loop Pass was recently dredged through a maintenance cycle by the Cameron Parish Police Jury.

The project area is comprised of undeveloped property and consists of coastal prairie landform, including some fresh marsh and dune habitat and is currently undeveloped with some use as a cattle pasture. This alternate site is located both east and west of Davis Road, the northwest corner is bordered by partially developed land to the northeast, and the Cameron Loop to the northwest. The majority of the site is bordered by undeveloped land to the north, south, east, and west. This alternate site would require dredging and filling of wetlands just as the other sites.

The vegetation found within this alternate site is typically Fresh and Saline marsh types. Typical fresh marsh vegetation is frequently dominated by Panicum hemitomon, Sagittaria lancifolia, Eleocharis baldwinii, or Cladium jamaicense. Other than these dominant plants, the following species primarily occur in fresh marsh: Boehmeria cylindrica, Cephalanthus occidentalis, Colocasia esculenta, Decodon verticillatus, Nymphaea odorata, Sagittaria latifolia, Sagittaria platyphylla, Schoenoplectus deltarum, and Triadenum virginicum (Sasser 2014). Saline marshes in this region are frequently dominated by Spartina alterniflora, Distichlis spicata, or Avicennia germinans (Sasser 2014). The wetlands on this site seem greater in quantity and superior in quality than the proposed project site, as described in the attached Wetland Investigation and Habitat Assessment (Appendix B), rendering this alternative more environmentally damaging than the proposed site.

Port Cameron Alternative Site Three – West Cameron – Cameron, LA

The West Cameron Site sits along the west bank of the Ship Channel, just north of the LA Hwy 27/82 ferry (figure 11).

Figure 11: West Cameron Site

As with the other alternate sites, there is a considerable amount of available acreage, the Calcasieu River is naturally 50+ feet deep in this area and is also approved to be dredged through maintenance cycles by the USACE.

Like the previously mentioned sites, this location will require dredging and filling of wetlands. The project area is comprised of undeveloped property and consists of mainly coastal prairie landform, a former spoil bank, and is currently used as a cattle pasture. This alternate site is located north of Highway 82, west of Calcasieu Ship Channel, and bordered on the north, south, and west by undeveloped land, which would require the installation of utilities to the site, further impacting approximately 10 acres of wetlands outside the port footprint. This alternate site is bordered to the east by a spoil bank and ridge along the Calcasieu Ship Channel and surface water throughout the site appears to drain west and northwest to the surrounding marsh. Primary wetland hydrology indicators identified by the desktop review indicated, saturation, surface water, and high water table.

In addition to the ecological impacts, a liquefied natural gas company has filed with the U.S. Department of Energy to export LNG from a facility to be constructed on this site. The project team has been informed that the port facility would impact their development plans if built in this location. Based on the ecological impacts and the conflicting site location with a future LNG facility, this site has been determined to be less desirable, impracticable and unavailable.

Proposed Project Site – Port Cameron – Cameron, LA

The proposed site provides an ample amount of acreage, and the Calcasieu River is naturally 50+ feet deep in this area and is also approved to be dredged through maintenance cycles by the USACE.

Unlike the other alternative sites, this site has readily accessible potable water, sewer collection and treatment to an existing facility that has the available capacity, and the local electric utility can easily provide the needed power for the facility.

The project area is comprised of approximately 550 acres of undeveloped property and consists mainly of coastal prairie landform significantly impacted by cattle grazing and hay production, a former spoil bank, and is currently used as a cattle pasture and hay field. The Proposed Site is located north of Highway 82, west of Wakefield road, is bordered by partially developed land to the north, and undeveloped to the east. The property is dissected by a maintained drainage canal.

The vegetation found within this alternate site is typically a brackish marsh. Typical vegetation is often dominated by *Spartina patens* but is occasionally dominated by *Spartina cynosuroides, Spartina spartinae*, or *Bolboschoenus robustus*. Both intermediate and brackish marshes can be dominated by *Spartina patens*, but brackish marshes dominated by *Spartina patens* typically have a small number of other species such as *Spartina alterniflora, Distichlis spicata, Juncus roemerianus,* or *Bolboschoenus robustus* (Sasser 2014). The quality of the wetlands on site have

been diminished by publicly managed forced drainage, cattle grazing, hay production, oil and gas exploration, elevated roads, the existence of remnants of a former air strip and surrounding development.

The project site is dissected by a maintained drainage canal and surface water north and south of the canal seems to be affected by leaks in the canal. The northern portion of the property has local drainage to adjacent marsh and small ditches and borrows pits as well as a canal. The area south of the canal appears to drain toward the canal for the majority of the site and the southernmost portion of the property appears to drain toward Highway 82. The portion of the project site near the spoil banks drains to the east into the marsh due to the higher elevation (4-5 feet higher than the marsh areas). The higher areas of the project site located in the southeast portion of the property have local drainage to adjacent marsh. The property appears to be well drained in all non-wet areas due to higher elevation. In light of the impacts to wetlands on site, expansion of the existing Cameron Port is the least damaging practicable alternative and, furthermore, will have less adverse impacts on coastal resources than any available alternative.

Summary Comparison of Port Cameron Site Alternatives

A Modified Charleston Method (MCM) "Adverse Impacts Table" was completed for each site to determine the relative wetland impacts between alternative sites. The applicant is aware of the ongoing conversion to a different wetland assessment methodology by USACE. However, the MCM was still in use by the USACE New Orleans District when this habitat analysis was developed. Because this methodology was used in this report only to compare sites in a relative fashion, the applicant believes that its use remains suitable for this purpose until a revised methodology is adopted by USACE.

The MCM tables showing the wetland area impacts for each site can be found within Appendix B. Due to the varying acreages of each site, the credits impacted by the project are relative. However, the "Sum of Factor" for each site is representative of the quality and impacts for each project area (see table below). The attached MCM report (Appendix B) includes assessment of an alternate site which was originally investigated for expansion of Port Arthur (Sabine Pass site). However, as discussed earlier, expansion of Port Arthur was considered less favorable than expansion of Port Cameron; therefore, the Sabine Pass site is not discussed herein.

	Project Site			
Factors	**Port Cameron**	**Monkey Island**	**South**	**Cameron West**
Priority Category	Tertiary	Primary	Primary	Primary
Existing Habitat Condition	Condition 4	Condition 2	Condition 1	Condition 2
Existing Hydrologic Condition	Condition 5	Condition 2	Condition 1	Condition 2
Duration	Over 10	Over 10	Over 10	Over 10
Dominant Impact	Fill	Drain	Drain	Drain
Cumulative Impact	Low	High	High	High
Sum of Adverse Factors	**5.4**	**14.3**	**15.5**	**22.1**

In summary, all four sites had a suitable amount of undeveloped land with suitable water access, although the West Cameron site is slated for use by a future liquefied natural gas facility, rendering it unavailable during the course of this study. Use of any of the sites will cause wetland impacts; however, the expansion of the existing Cameron Port site, given existing impacts which have diminished wetlands functions, is the least environmentally damaging practicable alternative and will result in less impacts to coastal resources that use of any of the alternative sites. Further, in light of the existing facilities and utilities, including current consolidated sewer treatment capacity, less secondary or cumulative wetland impacts adjacent to the port footprint would occur because it would not require significant new utilities or road relations as required on the other three sites. As such, the Port Cameron site was selected as the preferred and least damaging practicable alternative site for this project.

Impacts of Implementing the Proposed Project

Economic Impacts

The economic impacts of the proposed Port Cameron facility will be significant at the local, state, and federal levels. The project team has relied upon an Economic Impact Study dated April 2013 by Dr. Loren C. Scott to determine the economic impacts resulting from the Port Cameron project and his study titled The Economic Impact of the Proposed Port Cameron on the Lake Charles MSA, the State of Louisiana and the Nation and has been included in the permit support document package. This report documents in great detail the anticipated economic benefits to Cameron Parish, the Lake Charles MSA, the State of Louisiana and the national economy based upon new sales for businesses, new household earnings and new jobs.

Based upon the findings from the report, the impact of the proposed Port Cameron on the State of Louisiana economy during the 4-year construction period and within the first 4 years of operation is estimated to be:

Impacts	4 Year Construction Period	4 Years in Operation
Increased Sales	$865.3 Million	$1,404 Million
Increased Household Earnings	$294.4 Million	$320.3 Million
Additional Jobs	1,685 Jobs (Average per Year)	6,124 Jobs
Tax Revenue	$20.6 Million	$22.4 Million

Impacts on the local economy are outlined in Scott's study, which has been included as an appendix for reference (Appendix C).

Environmental Impacts

The least damaging practicable alternative site was selected for this project. As such, impacts to wetlands were minimized to the maximum extent practicable. Streams, tidal passes, beaches, dunes, and barrier islands will not be impacted by the proposed project. Freshwater flow and natural circulation patterns within the project site would not be significantly altered, as the site is dissected by a drainage canal and the site's natural hydrology is already impacted by water control management. A Stormwater Pollution Prevention Plan will be implemented as per LAR 10000 during construction of the project, to prevent detrimental discharges of inorganic nutrient compounds into coastal waters, alterations in the natural concentration of oxygen in coastal waters, detrimental discharges of suspended solids into coastal waters, or discharges of pathogens or toxic substances into coastal waters. Because of this control of discharges, alteration of temperature or salinity regime of coastal waters is not anticipated. No impaired waters exist in the vicinity of the project area. All tenants of the facility would be required to abide by all applicable laws regarding stormwater pollution prevention, spill containment and solid and hazardous waste management.

Given the altered and degraded nature of the wetlands that would be impacted by this project, the wetland impacts of this project are not anticipated to adversely disrupt coastal wildlife and fishery migration patterns on a population scale, reduce the long term biological productivity of the coastal ecosystem, or adversely alter or destroy unique habitats, critical habitats for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas or forestlands. Likewise, adverse secondary and cumulative impacts are not anticipated.

As the project is proposed on private land, it would not adversely alter or destroy public parks, shoreline access points, designated recreation areas, scenic rivers or other areas of public use or concern. The existing public works on the site (publicly managed drainage structure) will be relocated and continue to function as originally intended in their location adjacent to the proposed project.

Because excavation of this project will occur adjacent to and outside of existing waterways, namely the Calcasieu Ship Channel, no detrimental changes in littoral and sediment transport processes are anticipated. No additional land loss aside from the initial construction of the internal channels is anticipated, and the project is not anticipated to cause erosion, subsidence, or increased potential for flood, hurricane or storm damage.

Conclusion

In January 2014, the Louisiana Department of Natural Resources Office of Coastal Management (OCM) released a manual titled A Coastal User's Guide to the Louisiana Coastal Resources Program to inform the general public of the coastal resources management program goals, rules, regulations, and procedures associated with permitting, implementing, and maintaining projects in the coastal zone. Contained within this manual is a section aptly named Program Guidelines, which explains the importance of the permitting process and provides insight on the basis approving coastal use permits (CUPs). The following statements were extracted from this manual.

> "The use will be in compliance with the guidelines and may be permitted if, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in §701F, and a balancing of their relative significance, the decision maker finds that the proposed use meets all of the three following tests:
>
> 1. The benefits resulting from the use would clearly outweigh the adverse impacts that would result from compliance with the modified standard, and
> 2. There are no feasible and practical alternative locations, methods, or practices for the use that are in compliance with the modified standard, and
> 3. The use meets one of the following three criteria:
>   a. Significant public benefits will result from the use, or;
>   b. The use would serve important regional, state, or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or;
>   c. The use is coastal water dependent.
>
> If, but only if, the proposed use meets all three of the above criteria, may it then be permitted."

The Port Cameron project satisfies all criteria sited above and will have significant positive impacts to the local and State economies and likely global markets as well.

References

Rice, Harvey (January 9, 2013) “Proposed bridge could boost island economy.” Houston Chronicle, http://www.houstonchronicle.com/news/houston-texas/houston/article/Proposed-bridge-could-boost-island-economy-4181107.php.

U.S. Department of Homeland Security. July 15, 2011. Louisiana Highway 1/Port Fourchon Study. National Infrastructure Simulation and Analysis Center, Risk Development and Modeling Branch, Homeland Infrastructure Threat and Risk Analysis Center, Office of Infrastructure Protection.

Appendix A

Gulf Stream Valuation – Port Cameron Market Study Report

Appendix B

Wetland Investigation and Habitat Assessment of Alternative Sites

Appendix C

Economic Impact Study

Appendix D

Traffic Impact Study

Appendix E

Navigation Impact Study

Appendix F

Hydrologic Modification Impact Analysis

Port Cameron, LLC

Proposed Beneficial Use/Marsh Creation Plan

October 2017

Introduction

The purpose of this document is to describe the proposed beneficial use of dredged material plan for the proposed creation of 496.74 acres and nourishment of 59.26 acres of brackish marsh habitat to offset impacts to 322.9 acres of intermediate marsh habitat to result from the construction of the proposed Port Cameron facility.

The construction of Port Cameron would require the installation of 22,000 linear feet of bulkhead, the construction of heavylift boat slips, the relocation of an existing water control structure and multiple existing pipelines, and the creation of a new private road system along with a new public road and bridge crossings. The proposed project will be constructed in a manner that avoids permanent impacts to existing wetlands to the greatest extent practicable. However, in order to logistically construct the proposed project, approximately 322.9 acres of intermediate marsh would be impacted, affected and/or converted upon construction completion.

Port Cameron proposes to dredge approximately 9,000,000 cubic yards of material to construct the project. The plan proposes the use of a portion (depending on the actual bulk cut to fill ratio) of this excavated material for the creation/nourishment of approximately 556 acres of marsh to offset the wetland impacts associated with Port Cameron. The following plan provides details on the proposed project.

Proposed Marsh Creation Plan

I. Objectives- This mplan was prepared so Port Cameron can utilize a portion of material excavated from the port site in a beneficial manner as to fill approximately 497 acres of open water and 59 acres of existing marsh on the Cameron Prairie National Wildlife Refuge, East Cove Unit and create a brackish marsh platform with a final, post compaction and consolidation elevation ranging between +1.08 and +1.1 ft. NAVD88.

II. Site Selection- Careful consideration was given to the selection of the U.S. Fish and Wildlife's Cameron Prairie National Wildlife Refuge as the preferred location for the marsh creation site. Factors such as property ownership, coordination with State and Federal agencies, compliance with Louisiana's Comprehensive Master Plan for a Sustainable Coast, and interrelationship with other State and Federal marsh creation efforts were all considered in selecting the marsh creation site. According to the United States Department of Interior, Fish and Wildlife Service, the proposed marsh creation site on the Refuge was severely impacted by storm surges from Hurricane Ike in 2008 that would require the input of sediment to re-establish marsh. As such the Service has granted an exemption from current policy for Port Cameron to use the Cameron Prairie National Wildlife Refuge, East Cove Unit as a site for Port Cameron to create/restore wetlands. Port Cameron believes that the beneficial use of material within the refuge would have the greatest ecological benefit given the area's shallow water bottom area, allowing for a greater acreage of created marsh given the quantity of material to be excavated and placed, and the contiguous nature of the marsh creation site with over 14,000 acres of federally protected marsh. The site also has the opportunity for expansion

of the marsh creation acreage if the required acreage for impact offset is increased. Fish and Wildlife Service refuge managers were consulted in order to select the most ecologically beneficial site within the refuge. Given that this site is within a National Wildlife Refuge whose mission is to manage, protect, and perpetuate coastal marshes to provide high-quality food and habitat for wintering migratory waterfowl, and other migratory birds and native wildlife, the project is afforded the added assurance of federal protection.

The site, while largely open water (approximately 496 acres), includes scattered remnants of marsh totaling approximately 59 acres. Within the open water areas of the site, limited submerged aquatic vegetation (SAV) exists (less than 20% of the acreage containing SAV), with the majority of the SAV found immediately adjacent to the existing remnant marsh.

III. Marsh Creation Workplan

a. Design- The design for the site is attached as Attachment A.
In coordination with Fish and Wildlife Service, review of similar recent marsh creation projects, and analysis of the geotechnical investigation results of the impact and site, Port Cameron proposes to initially fill the marsh creation site to a target elevation of +3.0 ft. NAVD88 based upon the settlement curve data included in Attachment D. The design will result in approximately 1.15 ft of total settlement by year 3 and 1.75 ft of total settlement by year 10, settling to approximately EL +1.10 NAVD88 at Year 15. This height is comparable to the healthy marsh in the vicinity of CRMS 0650, which has been used as the reference marsh elevation height for a recent marsh creation project in the Cameron Prairie National Wildlife Refuge: CWPPRA's CS-54 Cameron Creole Watershed Grand Bayou Marsh Creation Project. Other CRMS sites in vicinity of the project are located in open water and therefore do not offer marsh elevations for comparison. However, Cameron Prairie National Wildlife Refuge staff have reviewed the project plans and agree that the selected target elevation is comparable to the surrounding marsh.

b. Construction- Materials used to construct the marsh creation portion of the Port Cameron project will be generated from planned dredging of the entrance channel and internal port channels which Port Cameron expects to generate approximately 9,000,000 cubic yards of native fill. Commencement of the marsh creation project will therefore occur concurrently with project impacts. The material will be pumped through a spoil discharge pipe from the dredge site to the marsh creation site. The discharge pipe corridor to the site will head northeast from the dredge site to the southern Refuge boundary then east along the open water canal on the southern edge of the Refuge boundary to the marsh creation site.

Mechanical Dredging utilizing a barge mounted bucket dredge will start at the intersection of the Calcasieu Ship Channel and the new entrance to the port development. This will provide flotation access for hydraulic dredges and other floating equipment.

Material excavated during this phase will be utilized for site development. Prior to and during this initial phase of dredging, containment dikes and the dredge discharge pipeline will be constructed. After flotation access is complete, hydraulic dredging will commence, suitable for site development. Hydraulic dredging will continue to depths required construct each phase of the port facility, and material that is geotechnically suitable for marsh creation will be pumped into cells created by internal containment dikes within the larger dredge placement area to reach the required initial fill elevation within the marsh creation site. Material that is more geotechnically suitable for site development will remain on the port site. Dredge and fill activities will proceed in three consecutive phases, followed by a fourth phase that may or may not be consecutive. However, the first three consecutive phases will produce more than an adequate quantity of material to build the full 556-acre site, which is estimated to offset the intermediate marsh impacts of the entire proposed port project, including Phase 4. The estimated dredge quantities and durations for the three consecutive phases are as follows:

Phase 1: 3,281,866 – 330 days
Phase 2: 935,233 – 100 days
Phase 3: 1,753,888 – 180

As-builts- Port Cameron will provide to /USACE/OCM As-built drawings of the area including on-ground photographs taken depicting a completed project with the photo date and approximate scale noted within 30 days of completion of the project.

c. Planting- Approximately 547,300 plugs or 4-inch containers (but not trade gallon containers) of appropriate brackish marsh vegetation obtained from a registered licensed Louisiana nursery grower will be planted every 3.5 feet on center. Port Cameron will obtain and provide certification to USACE/OCM from the contracting nursery that the plants are of a Louisiana ecotype species and have been acclimated to Louisiana climatic and habitable conditions for at least 90 days prior to planting. Precautions will be taken to ensure that all plant materials stay moist during mobilization and while on the site prior to planting and receive adequate water during planting. If plants listed are not available, then substitutions may be made if they are approved by USACE/OCM. Plantings will be planted between March 15th and July 15th. Consideration to fall plantings may be given if the March-July timeframe cannot be met. Port Cameron will coordinate with the refuge to plant appropriate species in such a manner to ensure adequate species diversity (Table 1) and cohesion with surrounding habitat, to include at least 2 different species.

Table 1: Plant Options for Brackish Marsh- to be determined case specifically

Common Name	Scientific Name
marshhay cordgrass	*Spartina patens* (Alton) Muhl
black needle rush	*Juncus roemerianus* Scheele
smooth cordgrass	*Spartina alterniflora* cv. Vermilion
Salt grass	*Distchilis spicata*

Port Cameron will establish evenly-spaced vegetative transects throughout the site so that a representative sample of the entire track is obtained. Along these transects, Port Cameron will establish evenly spaced elevation survey plots. At the elevation survey plots, Port Cameron will establish a 2m x 2m permanent vegetative plot for every 5 acres of the site that are evenly spaced along the transects. The beginning and ending points of each transect and each vegetative plot shall be marked with a permanent marker (e.g., an 8-foot PVC pipe anchored with a metal T post) and GPS coordinates shall be recorded for these points. A map will be provided that depicts the location of the vegetative transects and plots as well as a coordinating list containing the coordinates for each with the submittal of elevation surveys.

d. Containment Dike Degradation – Containment dikes will be degraded when post settlement marsh elevations are reached.

e. Port Cameron will conduct and submit elevation surveys (at points along the 200-foot grid) covering that respective area one (1) year following completion of placement of fill to USACE/OCM.

IV. Maintenance Plan- Maintenance of the site will ensure that the average of the elevation survey measurements taken from the site during the initial elevation surveys one (1) year following completion of placement of fill beginning at year 3 and throughout the 15-year maintenance period are at or above the target settled marsh elevation and a minimum of 80% of the site is within 6 inches of the target settle marsh elevation identified in the approved Plan Proposal.

Port Cameron agrees to maintain a minimum of 80% vegetative cover by year 3 within the 556-acre site and throughout the 15-year life of the project. Typical maintenance may require the reconstitution of areas of the site experiencing degradation and/or additional plantings.

V. Monitoring Requirements- Monitoring of the created marsh to ensure success of vegetative plantings within the marsh creation site will begin one-year post-planting and will occur, at minimum, in years three, five, ten and fifteen post-planting. Monitoring will also ensure that the average of the elevation survey measurements taken from the site during the initial elevation surveys one year following completion of fill placement and for the life of the project are at or above the target settled marsh elevation, and that a minimum of 80% of the site is within 6 inches of target settled marsh elevation.

If the vegetative coverage of species indicative to the surrounding habitat is less than 80% after the third growing season, Port Cameron will, on an annual basis, plant USACE/OCM approved intermediate marsh vegetative species or replace dead and/or missing plants until 80% coverage has been achieved through a complete growing season. Percent vegetative coverage will not include exotic/invasive species.

Exotic/invasive species control methods will be implemented as warranted in order to ensure the percentage of exotic/invasive species does not exceed 3% of the total vegetative cover. If adaptive management or maintenance activities require additional plantings, monitoring periods will be adjusted or increased as appropriate.

Monitoring reports will be provided to USACE, OCM and U.S. Fish and Wildlife Service within three months of each monitoring event. Reports will consist of a summary of project status, acreage of marsh habitat created and currently remaining, percent vegetative cover, percent of each vegetative species, percent exotic species, observations made during the annual inspection and qualitative description of the condition of marsh vegetation at each of the established vegetative transects and plots, and recommendations/adaptive management plan, if warranted. A map and photographs will accompany each report to document site conditions at the time of monitoring.

VI. Long Term Management Plan- To ensure the long-term sustainability of the project, Port Cameron will carefully monitor the newly established wetlands in accordance with the above monitoring plan and will plan to make mid-course corrections as necessary to ensure the project continues to perform as designed. As designed, the project is self-sustaining and has no control structures, such as tide gates or pumps, that will require long-term maintenance or replacement.

Port Cameron agrees that if the plan does not result in the projected level of marsh creation, 80% of the site is within 6 inches of the target settle marsh elevation or does not result in 80% vegetative coverage, the permittee shall implement remedial measures necessary to ensure full compensation, may be required to extend the required maintenance/monitoring period, or may be required to provide additional or alternative marsh creation to compensate for any deficiency.

VII. Adaptive Management Plan- Because the project is being built on the Cameron Prairie National Wildlife Refuge, unforeseen changes in site conditions due to salinity or hydrology shifts are not anticipated, with the exception of impacts due to tropical events. Should unforeseen changes occur, Port Cameron, in consultation with interested resource agencies and the Refuge, will evaluate the degree of impacts and measures necessary to remediate identified impacts to the marsh creation site and determine an appropriate adaptive management plan to address the issue. Port Cameron will implement the adaptive management measures necessary to remediate the identified impacts within one year of receiving the approved adaptive management plan.

Information To Build On
Engineering • Consulting • Testing

January 25, 2017

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Attn: Mr. Eric Erikson
Phone: (225) 926-1620
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Re: Geotechnical Engineering Services Report
Proposed Port Cameron – Marsh Creation Project
Cameron Prairie National Wildlife Refuge
Cameron Parish, Louisiana
PSI Project Number 0254869-1

Dear Mr. Erikson:

Professional Service Industries, Inc. (PSI) is pleased to transmit this Geotechnical Engineering Services Report for the proposed Port Cameron – Marsh Creation Project. This report presents the results of our field exploration and laboratory testing, as well as site-specific geotechnical analyses and recommendations for the Port Cameron – Marsh Creation site in Cameron Parish, Louisiana.

We appreciate the opportunity to perform this geotechnical study and look forward to continued participation during construction. If you have any questions pertaining to this report, please contact our office.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

Ayan Mehrotra

Ayan Mehrotra, P.E.
Senior Geotechnical Engineer
Geotechnical Services

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psi

GEOTECHNICAL ENGINEERING SERVICES REPORT

PROPOSED PORT CAMERON – MARSH CREATION PROJECT
CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
CAMERON PARISH, LOUISIANA

PSI PROJECT NO. 0254869-1

PREPARED FOR

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JANUARY 25, 2017

BY

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PROJECT INFORMATION

Project Authorization

Professional Service Industries, Inc. (PSI) has completed their geotechnical exploration pertaining to the Port Cameron – Marsh Creation site, which is located within the Cameron Prairie National Wildlife Refuge in Cameron Parish, Louisiana. The geotechnical exploration services were performed in general accordance with PSI Proposal No. 254-181761-R1, dated August 1, 2016. Authorization to proceed with this project was provided by Evans-Graves Engineers, Inc. by signing PSI's proposal on October 5, 2016. This report presents the results of our field exploration and laboratory testing, as well as geotechnical analyses and recommendations for the subject project.

Overall Project Description and Objective

This project is a part of the development of the Port Cameron site in Cameron Parish, Louisiana. PSI performed a separate geotechnical study for that borrow sediment site as part of PSI Project No. 0254834. The Port Cameron project consists of the construction of a new oil and gas service port facility that will be located along the east bank of the Calcasieu Ship Channel. Construction of the port facility will include the excavation of approximately 7 million cubic yards of sediments from the site of the proposed port facility. It is understood that about 3 million cubic yards of the excavated material will be utilized to create/restore about 500 acres of marsh at the Cameron Prairie National Wildlife Refuge, meanwhile the remaining material will be used to raise the site grades at the port facility.

The major objective of this marsh restoration project is to use hydraulically-dredged soil material obtained from construction of the oil and service port facility to create new marshland within a 500-acre area of the Cameron Prairie Wildlife Refuge. Geotechnical and engineering services were performed by PSI to evaluate settlement and slope stability of the proposed project features.

Project Site Description

The marsh creation project site is located within the Cameron Prairie National Wildlife Refuge located in Cameron, Louisiana. The site is located approximately 1 ½ miles north of Highway 27 (WW. Creole Highway), near its intersection with Murphy Lane. This site comprises approximately 500 acres of predominately open water with relatively small swaths of existing marsh. The site is bordered by open water and some marsh areas on all sides. However, Calcaseu Lake is located approximately 1 ½ miles north of the norther boundary of the project area. At the time of our field exploration, the water depth at the marsh creation area was approximately two (2) to four (4) feet above the existing mudline.

Purpose and Scope of Services

The purpose of this study was to explore subsurface conditions at the marsh creation area and provide geotechnical engineering analyses and recommendations for slope stability and construction of the earthen containment levees, as well as estimates of the anticipated long-term settlement for the marsh fill and containment levees. Field exploration included performing five (5) soil borings within the interior of the proposed marsh creation area. It should be noted that PSI only

performed soil borings within the interior of the marsh creation area; no soil borings were performed along the alignment of the proposed containment levee.

Additionally, PSI previously performed soil borings in the borrow area, which is the site of the proposed oil and gas port facility. Those borings were performed as part of PSI Project No. 0254834, and the results of those borings will be presented under a separate report cover. A preliminary geotechnical services report, PSI Report No. 0254834-1 was already issued dated October 26, 2016 which include the results of the soil borings in the borrow area. It is our understanding that a portion of the excavated sediments from the construction of the oil and gas port facility will be transported to the marsh creation area. PSI performed multiple soil borings and CPT soundings in the borrow area. It is understood that only Slip 1 will be constructed at this time at the oil and gas port facility; therefore, it is understood that the dredged sediments will come mostly from the area of borings B-1 thru B-3, B-5, and B-6 made along the alignment of the entrance channel and slip 1.

The engineering analyses performed for the marsh creation project included the following:

- Settlement estimates of marsh fill over a project design life of 20 years;
- Determination of maximum construction elevation, minimum side slopes and crown width for earthen containment levees based on the required final marsh elevations;
- Slope stability and settlement analyses for the design of the earthen containment levees;
- Bearing capacity analyses for the proposed containment levees;
- Long-term settlement analyses of the dredge borrow and fill areas using the U.S. Army Corps of Engineers (USACE) **P**rimary consolidation, **S**econdary compression, and **D**esiccation of **D**redged **F**ill (PSDDF) program and the commercial program Settle 3D; and
- Estimated cut/fill ratio for earthwork.

The results of these analyses are included in the following sections along with those of the field investigation and laboratory tests. Also given in this report are some general geotechnical related discussions and recommendations for the proposed marsh creation project.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The marsh creation site is located within the Cameron Pairie National Wildlife Refuge in Cameron, Louisiana. The site is located approximately 1 ½ miles north of Highway 27 (WW. Creole Highway), near its intersection with Murphy Lane. This location comprises approximately 500 acres of predominately open water with relatively small swaths of existing marsh. The site is bordered by open water and some marsh areas on all sides. However, Calcaseu Lake is located approximately 1 ½ north of the norther boundary of the project area. The borrow area site is located approximately 6 to 7 miles southwest, on the eastbank of the Calcasieu Ship Channel. Approximate locations of the marsh creation and borrow area are indicated on the Site Vicinity Maps attached in Appendix I of this report based on a Google Earth image dated January, 2015.

According to the U.S. Geological Survey (USGS) GIS Database, the both sites fall within the Chenier Plain, Saline Marsh formation. The Chenier Plain located in southwestern Louisiana is a Holocene strand plain composed of wooded beach ridges (cheniers) and intervening mudflat grassy wetlands. The formation of the Chenier Plain is related to the process of the Mississippi River delta shifting eastward overtime. The mudflats were created when the Mississippi River delta was closer, and the cheniers formed as the delta shifted eastward allowing waves to build cheniers. The chenier/ridges are dominated by deposits of sand/shell while the mudflats consist of mainly Holocene marsh dominated by clay and silty clay sediments.

Field Exploration

The field exploration, which was performed to evaluate the engineering characteristics of the foundation soils in the marsh creation area, included a reconnaissance of the project site by PSI representatives, drilling the soil borings, and recovering soil samples. The site reconnaissance visit was performed on October 4, 2016; PSI personnel along with a Client representative from Hydrik Wetland Consulting used an airboat to explore the project site/proposed boring locations and to determine accessibility for drilling equipment.

Field exploration included drilling five (5) borings to depths of approximately 50 to 60 feet below the existing mudline within the footprint of the proposed marsh creation area. As previously discussed, no borings were made along the alignment of the proposed earthen levees to be constructed along the perimeter of the marsh creation area due to site and project constraints. In addition, soil borings and CPT soundings were previously made at the sediment borrow area as part of PSI Project No. 0254834. The 50 to 60 feet deep borings were sampled continuously to approximately 20 feet below the existing mudline, and at 5-foot intervals thereafter to the boring termination depth. The boreholes were backfilled with a cement-bentonite grout mixture as per state requirements. Five (5) 5-gallon buckets of water from the project site were collected for use with the column settling test in order to maintain the in-situ salinity concentrations.

Table 2 summarizes the boring locations, depths, and approximate water depth to mudline, or ground surface, at the time of drilling.

Table 2. Boring Information

Boring Location	Boring Number	Coordinates From Hand-Held GPS Unit		Boring Depth* (feet)[1]	Approximate Water Depth to Mudline (feet)
		Latitude	Longitude		
Marsh Creation Area	MC-1	29°49'34.34"N	93°14'4.58"W	50	2 ½
	MC-2	29°49'50.87"N	93°14'4.97"W		1
	MC-3	29°49'39.44"N	93°13'38.41"W	60	2
	MC-4	29°49'48.51"N	93°13'11.97"W	50	2
	MC-5	29°49'23.71"N	93°13'11.72"W		2
Borrow Area Borings[2]	B-1 (VST)	29°48'43.39"N	93°20'45.39"W	120[3]	N/A
	B-2 (VST)	29°48'54.11"N	93°20'34.23"W		
	B-3 (VST)	29°48'43.52"N	93°20'26.21"W		
	B-5 (VST)	29°48'39.67"N	93°20'44.08"W		
	B-6	29°48'34.14"N	93°20'34.00"W		

[1]Boring depths in reference to the existing ground surface or mudline
[2]Borrow area borings performed at the proposed oil and gas port facility site (PSI Project No. 0254834)
[3]Composite samples taken from a depth of about 0 to 30 feet, which is anticipated dredge stratum

Drilling and Sampling Procedures: The borings drilled in the marsh creation areas were performed using a marsh-buggy mounted drilling equipment. Wet-rotary drilling techniques were used to advance the boreholes. Samples were generally obtained continuously from the mudline to a depth of about 20 feet and at maximum five (5) foot intervals thereafter to the boring completion depth. Drilling and sampling techniques were accomplished in general accordance with ASTM Standard Procedures.

Undisturbed samples of cohesive soils were generally obtained using thin-walled tube sampling procedures in general accordance with the procedures for "Thin-Walled Tube Geotechnical Sampling of Soils" (ASTM D-1587). The Shelby tubes with soil were sealed at both ends with expandable packers and capped with plastic end caps. The Shelby tubes were identified according to boring number and depth and then transported to the laboratory in secure containers. The cohesive soil samples were extruded in the laboratory, classified, wrapped in aluminum foil, and placed in polyethylene plastic bags to protect against moisture loss.

For cohesionless and semi-cohesive soils, Standard Penetration Tests (SPT) were performed to obtain standard penetration values (N value) of the soil. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling 30 inches, required to advance the split-barrel sampler one (1) foot into the soil. To perform the test and obtain a sample, the sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third

incremental numbers. The results of the standard penetration test indicate the relative density of cohesionless soils and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. Samples of granular soils were obtained utilizing a two (2) inch O.D. split-barrel sampler in general accordance with procedures for "Penetration Test and Split-Barrel Sampling of Soils" (ASTM D-1586).

Laboratory Testing Program

A laboratory testing program was conducted to evaluate pertinent engineering characteristics of the subsurface materials. The laboratory testing program was conducted in general accordance with ASTM Standard Procedures.

The borings were classified for the entire depth in general accordance with ASTM D2487 and ASTM D2488. In addition, Atterberg Limits tests (ASTM D4318), Natural Moisture Content tests (ASTM D2216), Unconsolidated Undrained (UU) Triaxial (1 point) (ASTM D2850), Unconfined Compression tests (ASTM D2166), One-Dimensional Consolidation tests (ASTM D2435), Grain Size Distributions (ASTM D422), Specific Gravities (ASTM D854), Unit Weight, and Natural Organic Content (ASTM D2974) tests were performed on selected samples. Additionally, Low-Pressure One-Dimensional Consolidation tests (EM 1110-2-5027) and Self-Weight Column Settling tests (EM 1110-2-5027) were performed on composite samples of the proposed dredged fill material, which was obtained from the soil borings performed for the oil and gas port facility. As previously discussed, in-situ water obtained from the marsh creation area was used to perform the column settling tests.

Additional estimates of undrained shear strength were determined through the use of a torvane and minature vane. Laboratory test data along with detailed descriptions of the soils can be found on the boring logs included in Appendix I of this report. The logs of borrow area borings are also presented in Appendix I. Laboratory test reports for the one-dimensional consolidation tests of the subsurface materials are included in Appendix II of this report. Results of the one-dimensional consolidation and column settling tests are included in Appendix IV.

Subsurface Conditions

Table 3 presents a generalized subsurface profile for the marsh creation area based on the results of borings MC-1 thru MC-5. Meanwhile, Table 4 shows a generalized profile of the borrow area (e.g., along the alignment of the entrance channel and slip 1 at the oil and gas port facility site).

Table 3: Generalized Subsurface Profile at the Marsh Creation Area

Approximate Depth Range	Consistency	Subsoil Description
0 – 4	Very Soft	Gray and Black Organic Clay (OH) or Fat Clay with Organic (CH)
4 – 40	Very soft to soft	Gray Fat Clay (CH) with Organic and Shells[(2)]
40 – 60[(3)]	Firm to Stiff	Reddish Green/Brown Fat Clay (CH) with Sand and Shells[(4)]

[(1)] *Depth is referenced from the mudline at the boring locations at the time of drilling*

[(2)] *Probable Holocene Age clay deposit. Boring MC-5 encountered a sand stratum at a depth of approximately 16 to 37 feet*

[(3)] *Only boring MC-3 was extended to a depth of approximately 60 feet below the mudline*

[(4)] *Probable Pleistocene Age soils. This stratum was not encountered in boring MC-1.*

Table 4: Generalized Subsurface Profile at Borrow Area

Approximate Depth Range (feet)[(1)]	General Description
0 to 55	Very soft to soft fat clay (CH) with organic, and intermittent sand and shell layers – Probably Holocene Age soils
55[(2)] to 120	Firm to stiff fat clay (CH) – Probably Pleistocene Age soils CPT soundings indicated some relatively thin sand layers at depth of about 70 to 80 feet bgs.

[(1)] *Depth is referenced from the existing ground surface at the boring locations, at the time of drilling*

[(2)] *This depth represents the average depth where the Pleistocene Age soils were encountered. The actual depth generally varied between about 50 to 60 feet bgs. Furthermore, Pleistocene Age soils were not encountered in boring B-6 up to the boring termination depth (120 feet bgs).*

The above subsurface descriptions are of a generalized nature to highlight the major subsurface stratification features and material characteristics at both sites. The boring logs included in Appendix I should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistance, locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials, and the actual transition may be gradual. The samples which were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

ENGINEERING ANALYSES AND RECOMMENDATIONS

It is our understanding that the project includes the restoration of about 500 acres of predominantly open water at this time through the deposition of dredged material obtained from the construction site (borrow area) of the proposed oil and gas port facility located approximately five (5) to six (6) miles away from the marsh creation site. The process will include the construction of containment levees along the perimeter of the marsh creation area utilizing native excavated material from within the marsh creation area. The confined area will then be filled with hydraulically transported material dredged from the oil and gas port facility site.

Settlement, slope stability, and bearing capacity analyses were performed for the marsh fill area and containment levees for use by others to establish the construction design grades and to develop other geotechnical related physical parameters for the project. The details of the various analyses are described in the following sections.

Settlement Evaluation

The existing mudline elevation in the marsh creation area is approximately at El. -1 feet according to the furnished site information. Based on a target marsh fill elevation provided by Evans-Graves Engineers, it is understood that the elevation at the created marsh should remain at or above about elevation El. +1 feet throughout the design life for the project of 20 years. Consequently, marsh fill thicknesses of 3, 3 ½, 4, and 4 ½ feet were evaluated to establish the target marsh elevation.

Laboratory test data, in conjunction with the data provided in the furnished project documents, was used to derive settlement curves over a 20-year project design life for four (4) different construction thicknesses of marsh fill varying between three (3) and four-and-one-half (4½) feet. Long-term settlement analyses of the filled area was performed using the U.S. Army Corps of Engineers' (USACE) **P**rimary consolidation, **S**econdary compression, and **D**esiccation of **D**redged **F**ill (PSDDF) program and the Settle 3D program developed by Rocscience.

Settlement of Marsh Fill

Settlement calculations were performed to determine the maximum construction elevation that would be required to attain the target marsh surface at about El. +1 feet over a period of 20 years after construction. Four (4) components of settlement were considered to determine the total anticipated long-term settlement in the newly-created marsh area:

1) Primary consolidation settlement of dredged fill and foundation soils;
2) Secondary compression of dredged fill and foundation soils;
3) Desiccation of the dredged fill material; and,
4) Regional geologic subsidence.
    a. Subsidence rates vary considerably across coastal Louisiana and a coastwide system for quantifying subsidence for various regions has not yet been fully stablished. PSI obtained the estimated subsidence rate for the Cameron-Creole region from the "Southwest Coastal Louisiana – Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement" authored by the United States Army Corps of Engineers (USACE)

and dated December, 2013. As per the USACE, the subsidence rate for the Cameron-Creole range was estimate to be about 1.1 to 2 feet per century. Therefore, subsidence on the order of 2 ½ to 5 inches could occur in the marsh creation area within 20 years after construction. For the purpose of analysis, a regional subsidence of 5 inches was assumed to occur in the marsh creation area within 20 years after fill placement.

As previously discussed, the PSDDF program as well as the commercial program Settle 3D were utilized to estimate the long-term settlement of the marsh fill. The PSDDF program utilizes the one-dimensional finite strain theory of consolidation to predict settlement of the dredged fill and foundation soils due to primary consolidation. The finite strain theory is well suited for modeling of newly placed dredged fill because of the relatively large strains (particularly fine-grained dredged fill) experienced during the initial phase of self-weight/low-pressure primary consolidation following dredged fill placement. However, our past experience and published literature indicate that PSDDF does not necessarily accurately model primary consolidation settlement of foundation materials, especially for the type of soils commonly encountered in coastal south Louisiana region (very soft to soft normally consolidated clay, or under-consolidated, soils with relatively high plasticity and low permeability). Therefore, PSI utilized a coupled model to evaluate the anticipated overall settlement of the marsh fill, as described below:

- Primary consolidation, desiccation, and secondary compression settlement of the dredged fill was evaluated utilizing PSDDF
- Primary consolidation settlement of the foundation soils was evaluated utilizing Settle 3D where marsh fill was modeled as a uniform flexible load applied over a relatively large area

In both cases, the soil parameters and stratification were selected based on the results of the subsoil investigations performed at the borrow site and the marsh creation area.

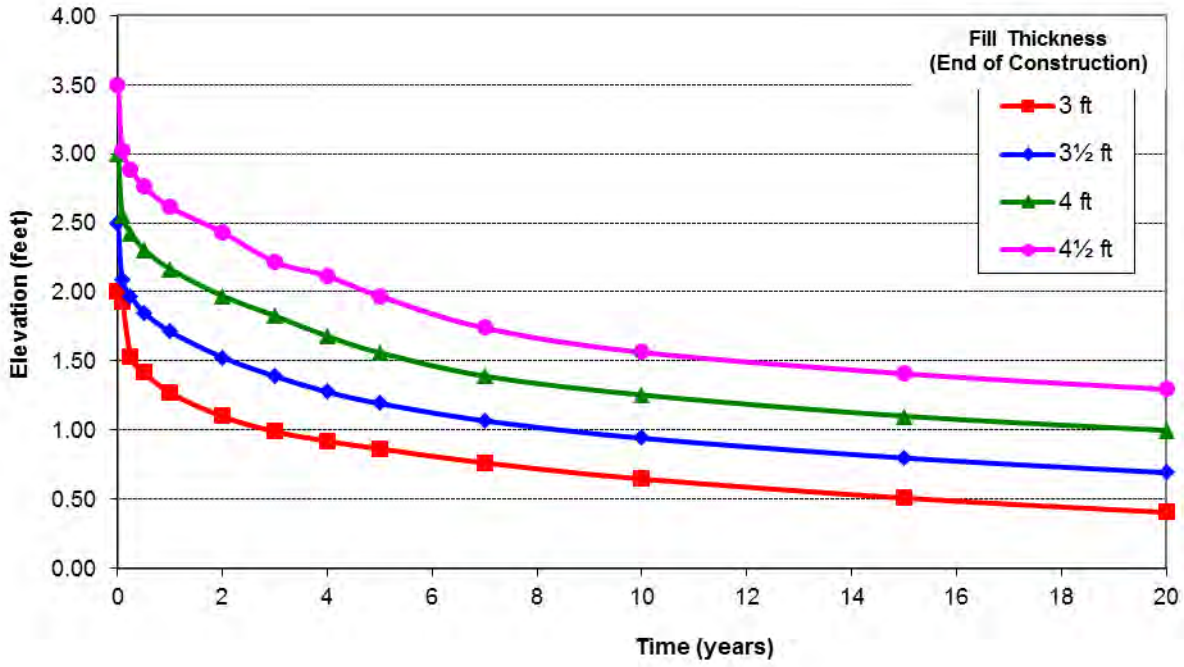
Based on PSI's previous experience with marsh creation projects that utilized dredged fill of a similar character, settlement due to secondary compression and desiccation is generally negligible. The coupled approach described above was used to evaluate the anticipated long-term settlements in the marsh creation area. Marsh fill thicknesses of 3, 3½, 4, and 4½ feet were modeled in an effort to maintain the target marsh elevation at the end of the 20-year design life. A plot showing the settlement at the end of Year 20 for the different marsh fill thicknesses is included in Appendix III. As seen on the plot, an initial marsh fill thickness of four (4) feet results in the marsh surface settling to approximately elevation El. +1 feet over a 20-year period, which conforms to the criterion as specified by Evans-Graves Engineers. PSDDF and Settle 3D output files including the input soil parameters and the results of the settlement evaluation for a fill thickness four (4) feet is included in Appendix IV. Based on the foregoing coupled calculations, on the order of approximately 24 inches of total settlement is expected to be experienced in the created marsh surface with the 20-year project design life for an initial marsh fill thickness of four (4) feet. Table 5 below shows the results of the settlement analyses for each of the four (4) components previously indicated. Figure 1 depicts settlement curves of surface elevation versus time for each of the evaluated fill thicknesses. Figure 1 assumes an initial ground surface at El. -1 feet within the marsh creation area.

It should be noted that most of the settlement is expected to develop due to primary consolidation of the placed fill and the underlying foundation soils. Meanwhile, results of the analysis indicated that negligible settlement was expected due to secondary compression and desiccation.

Table 5. Estimated Total Settlement for Four (4) Feet of Fill

Settlement Component	Estimated Settlement at Year 20 (inches)
Primary Consolidation (Dredge Material)	6 ½
Primary Consolidation (Foundation Material)	13 ½
Secondary Compression	0
Desiccation	0
Regional Subsidence	4
Total:	24

Figure 1. Settlement Curves for Evaluated Marsh Fill Thicknesses



Based on our analyses using the coupled PSDDF/Settle 3D model, an initial marsh fill thickness of four (4) feet results in the marsh settling to approximately El. +1 feet over a 20-year period. Thus, this elevation (El. +3 feet) was considered to be the target fill elevation for the marsh creation area at the end of construction. However, results of the analysis indicates that some additional settlement should be expected to develop after 20 years due to residual primary

consolidation and regional settlement. In addition, some variations should also be expected in the magnitude of settlement over the relatively large marsh creation area of about 500 acres with distance away from its center. Edge settlement should be about one-half of the settlement at the center. Some localized differences in final elevation should be expected due to variations in subsoil character and stratification throughout the relatively large area.

Time-Rate of Settlement – Dredged Marsh Fill

Additional analyses were made to determine the estimated time needed to achieve various degrees of consolidation in the subsoils and percent of long-term settlements in the area of the proposed marsh creation area. Results of the analyses are presented in Tables 6 and 7.

Table 6: Time-Rate of Consolidation for Dredged Fill (4 feet)

APPROXIMATE TIME RATE OF CONSOLIDATION	
PERCENT PRIMARY CONSOLIDATION (% OF ULTIMATE PRIMARY SETTLEMENT)	**TIME**
25 to 30	8 to 12 months
50	3 years
75	20 years

Table 7: Time-Rate of Consolidation for Foundation Soils due to Dredge Fill Placement (4 feet)

APPROXIMATE TIME RATE OF CONSOLIDATION	
PERCENT PRIMARY CONSOLIDATION (% OF ULTIMATE PRIMARY SETTLEMENT)	**TIME**
40 to 50	4 to 8 months
75	3 to 5 years
95+	20 to 25 years

Additional residual primary and some secondary settlements could also develop over an extended period of time on the order of another 10 to 25 years. These settlements do not consider any future lifts needed to raise the grades or reshape the geometry of the containment structure. These settlement predictions are only due to the proposed construction and include those due to regional or global settlements which are expected to be relatively uniform throughout the subject site and on the order of 4 inches.

It should be noted that time-rate estimates are difficult to predict with high certainty considering the size of the structure and the limited number of borings made. Additionally, theoretically estimated settlements based on one-dimensional Consolidation tests would typically yield higher settlement predictions. This difference could be significant particularly for thick and/or highly stratified clay deposits underlain by poor draining substrata. Therefore, actual values may vary by about 20 to 50% from these estimated values considering the possible variations in subsoil conditions and geometry of the structure. In addition, settlement analyses and time-rate of consolidation are highly dependent on the selected characteristics and geometry of the

proposed containment structure, its construction materials and methods, water level during and after construction and long-term maintenance considerations. More detailed field investigation and laboratory testing could be performed, if needed, once the design is finalized for use in developing a monitoring and maintenance program. This could consist of settlement plates or electronic sensors placed at selected locations throughout the filled area to monitor settlement progress with time.

Cut/Fill Ratio (Marsh Fill)

Since the marsh fill will be hydraulically transported from the borrow site and placed in a very saturated loose state (slurry with 30 to 40 percent solids), and considering the relatively low in-situ dry density of the fine-grained soils to be obtained from the proposed borrow area (Slip 1 – oil and gas port facility), significantly higher volume of dredged material will be needed to achieve an equivalent placed volume within the containment levees. The bulk factor represents the ratio of the dry density of the in-situ soils in the borrow area to the dry density of the marsh fill immediately after placement. The bulk factor calculations are presented in Appendix IV, and they utilize the results of the low pressure consolidation tests as well as the results of the column settling tests (CST).

PSI performed two (2) CST's for two different Total Suspended Solids (TSS) concentrations of 98 g/L and 150 g/L. It is understood that as per EM 1110-2-5027 100 to g/L to 150 g/L is the general range for TSS for hydraulically dredged fine-grained soils. PSI evaluated the estimate bulk factor based on the results of the two CST's and the results of PSI's calculations are presented in Appendix IV. The calculations show that that the bulk factor for this project will be on the order of 2.4 to 3.1. However, it should be noted that the amount of bulking varies with the sediment type and dredging operations. In view of the limited number of tests performed and the variations in the character and stratification of the soils at the borrow site, the actual bulk factor may be lower than these values. PSI estimates that the actual bulk factor will be on the order of 2.5, which could be utilized to estimate cut/fill quantities.

Settlement of Containment Levee

Settlement of the containment earthen levee is expected to generally parallel the settlement of the marsh fill, both in magnitude and time rate, as the levee and fill will generally behave as a contiguous unit. However, since the containment levee will be constructed on the perimeter of the marsh fill area, we estimate that the containment levee will settle approximately 12 to 14 inches over a design period of 20 years. It is understood that long-term containment levee crown elevation at El. +2.3 (approximately one (1) foot higher than the long-term elevation of the marsh fill) is desired. Therefore, it is recommended that the containment levee be built to an elevation of El. +3.5 feet to account for long-term settlement. This will ensure that the containment levee crown will remain higher than the marsh fill, which is anticipated to be at El. +3 feet, at the end of construction and will settle to about El. +2.3 feet within the design period of about 20 years.

Cut/Fill Ratio (Containment Levee)

It is understood that fill material for the containment levee will be excavated from borrow trenches within the marsh creation area. Semi-compacted containment levee fill material excavated from the marsh areas will likely be lighter than the in-situ soils in their original state. The in-situ soil in the

upper 10 to 12 feet in the borings generally consists of very soft organic or fat clays. Considering the relatively low in-situ dry density of the near-surface organic soils and the fact that the containment levee fill will be lightly compacted (excavator-bucket tamping), PSI recommends a bulk factor ranging from 1.3 to 1.5 when estimating cut/fill quantities. The bulk factor represents the ratio of the dry density of the in-situ marsh soil to the dry density of the levee fill (lightly compacted).

Slope Stability Analyses

Generally, slope failure occurs when the weight of the sliding soil prism exceeds the resistance derived from the shear strength of the soil along the sliding surface. Slope stability analyses involve the determination of the most likely potential sliding surface by computing the ratio of the developed shear stresses (resisting forces) to the gravitational forces associated with the sliding soil (driving forces or moments). This ratio is termed the "factor of safety".

Two-dimensional limit-equilibrium slope stability analyses considering circular-shaped failure surfaces were performed for an idealized cross section of the earthen containment levee and the placed marsh fill to determine the critical failure surface (least factor of safety). The following cases were analyzed:

- Q-Case ("Short-Term" Undrained Parameters) – During Construction – Containment Levee Constructed to El. + 3.5 feet and no marsh fill is present
- Q-Case – After Construction – Containment Levee Constructed to El. +3.5 feet and interior marsh fill within the confined area up to a height of El. +3 feet
- S-Case ("Long-Term" Drained Parameters) – After Construction - Containment Levee Constructed to El. +3.5 feet and interior marsh fill placed to a height of El. +3 feet

Both end-of-construction (Q-case) and long-term (S-case) loading conditions were considered. The end-of-construction case assumes that both the containment levee fill and interior marsh fill are placed within a relatively short construction period such that excess pore-water pressure within the placed fill and foundation soils does not dissipate. A minimum factor of safety of 1.2 (for both end-of-construction and long-term cases) is considered to be appropriate for the containment levees as the risk associated with slope movement is believed to be inherently low.

As discussed previously, a crown elevation of El. +3½ feet was assumed (equivalent to a 4½ foot high levee, assuming an average existing marsh mudline at El. -1 feet). Based on discussions with the Client, it is understood that side slope inclinations of 5H to 1V will be utilized. From a construction standpoint, it may be impractical to construct slopes steeper than 5H to 1V given the high moisture content and low shear strength of the freshly excavated and placed fill. A conservative bulk unit weight of approximately 95 pcf was assigned to the levee fill, and a levee crown width of six (6) feet was selected based on practical considerations. The present analysis did not consider any surcharge loads acting on the levee crown. A wider crown to allow for vehicular access would be of no consequence, but additional analyses will be required if it is anticipated that heavy equipment will traverse along the crown of the levee or along its toes. A static phreatic surface elevation of El. +1 feet, which is generally consistent with the depth of water encountered at the time of drilling, was utilized.

The computer program, Slope/W (version 8.11) used to perform the slope stability analysis utilizes the method of slices to calculate the factor of safety for an assumed failure surface. Spencer's

Method, which satisfies both force and moment equilibrium, was utilized to generate trial failure surfaces. In this procedure, the program executes a search routine based on user input to determine the potential critical circular failure surface.

Slope stability analyses were performed based on single-stage construction of the containment levee to El. +3½ feet. Table 8 presents the calculated minimum factors of safety (FOS) obtained from the Slope/W analyses.

Table 8: Slope Stability Analyses Results – Earthen Containment Levee

Loading Condition	Soil Parameters	Acceptable Factor of Safety (FOS)	Estimated Minimum Factor of Safety (FOS)
After Construction[(1)]	Q-Case	1.2	3.1
During Construction[(2)]	Q-Case	1.2	3.1
After Construction	S-Case	1.2	1.4

[(1)] *Marsh fill and containment levee present*
[(2)] *Only containment levee is present*

Detailed configuration of the trench excavation to obtain material for construction of the perimeter containment levee was not available at the time this report was prepared. PSI performed a preliminary slope stability analysis to evaluate a general safe distance to be maintained between the toe of the containment levee and the top of bank of the trench excavation. Based on the analysis, it is recommended that the borrow trench for the containment levee fill be performed a minimum distance of 20 feet away from the toe of the containment levee. The preliminary analyses was based on the borrow trench having a minimum side slope of 2H to 1V. It is recommended that the contractor evaluate the stability of the trench slope prior to construction activities to evaluate the minimum side slope and distance requirements. No stockpiles or construction traffic was assumed within the 20-foot berm or on the levee crown. This assumes that the construction equipment will be operating on the marsh side of the containment levee. Additional analyses will be needed depending on the selected construction methods, means, and sequence.

Geosynthetic Inclusion

The stability analysis performed by PSI indicates that geosynthetic reinforcement of the containment levee is not needed for the cases analyzed. However, consideration could still be given to utilizing either a geosynthetic separation fabric or a high-strength geosynthetic reinforcement fabric. A fabric placed beneath the entire footprint of the containment levee would provide separation between the freshly placed levee fill from the underlying very soft bottom surface soils.

If a high-strength geosynthetic reinforcing fabric is utilized, bearing capacity and long-term overall stability of the proposed containment levee will be enhanced. The additional resistance provided by the geotextile fabric would provide additional resistance against developing a shear

failure or slope instability due to any additional loads imposed by future lifts to be placed over the proposed containment structure to maintain its design grades. In addition, the geotextile fabric will minimize the impact of lateral spreading, elastic deformation and potential for developing mud waves over the soft bottom surface soils during the construction of the containment levee and any future lifts. Consideration could be given to using other geosynthetic products, such as geotubes or geobags, for construction of the proposed containment levees if believed viable and cost effective. If believed needed, stabilizing aggregate underlain by a geotextile fabric could also be placed over the exposed side slopes of the earthen levee on the flood (exterior) side to provide protection against erosion.

All geotextile fabrics and geosynthetic products should be designed to meet the hydraulic, installation and mechanical requirements of the specific application and design. Reference is made to the US Army Corps of Engineers report entitled "Shore Protection Manual" (SPM, 1984) for design requirements of the geotextile fabrics and geosynthetic products.

Bearing Capacity (Containment Levee)

Soil borings along the alignment of the containment dike were not performed. Therefore, bearing capacity was evaluated utilizing the marsh creation area soil borings and the strength profile presented in Appendix I. For a minimum factor of safety equal to 3.0, the allowable bearing pressure is estimated to be 400 psf, which should be sufficient considering the proposed levee height and unit weight of the levee fill. Assimilation and "mud-waving", should they occur, will provide a confinement effect once some settlement is mobilized, thereby further increasing the factor of safety. However, it is recommended that fill placement proceeds relatively slow to avoid shock loading which would induce a shear failure of the underlying soils or slope instability.

Should other sources of borrow material be identified for use as levee fill (particularly those with higher unit weight), PSI should be notified to determine if suitable factors of safety can be achieved without the use of reinforcement.

CONSTRUCTION CONSIDERATIONS

Construction Sequence

For construction of the marsh fill containment levees, PSI recommends that approximately ¾ of the total planned construction height be placed in the first lift, followed approximately 21 days later with the second and final lift. This two-stage construction process will allow for some immediate subsidence to occur and the primary consolidation to begin. This process should also increase the bearing capacity and minimize the potential for developing shear failure in the near surface soils.

Dredged Material

It is understood that a hydraulic dredge will be used to deliver the material to the fill area via pipeline. As previously discussed, it is understood that the dredge material will consist of the material excavated during construction of Slip 1 at the oil and gas port facility. The results of the field exploration for that are presented under PSI Project No. 0254834, and include the results of detailed grain-size analyses laboratory testing (e.g., hydrometers, percent passing no. 200 sieve,

sieve analysis). However, laboratory results from a composite soil sample, consisting of soils from the anticipated dredge stratum (anticipated to extend from the ground surface to a depth of about 30 feet) are presented herein. An Atterberg limits test was conducted on a composite sample obtained from borings B-1 thru B-6 (performed under PSI Project No. 0254834). The Atterberg limits test results consisted of a liquid limit of 80 and a Plasticity Index of 54, which classifies as a CH material. It should be noted that some variations should be expected during the dredging operations, including the depth of dredging as well as dredging in areas not sampled and represented by the project soil borings.

Two (2) low-pressure consolidation tests were performed on a composite sample from the dredge material and their results are included in Appendix II. It should be noted that for the settlement analyses, results from only one (1) low-pressure consolidation test were utilized since it was believed to be more representative of the characteristics of the anticipated dredge material. Two (2) column settling tests as specified in the Corps of Engineers Manual EM 1110-2-5027 were also performed and their results are included in Appendix IV.

Construction Related Issues

In general, methods, means and sequence of construction of the containment levees should be the responsibility of the contractor who should be specialized in this type of construction. It is understood that the materials to be used for construction of containment levees will be placed in relatively shallow water (mudline at about El. -1 feet). It should be noted that the foregoing analyses assumed that all construction will be performed in the "wet" with the water level in the area at about Elev. +1 feet. It is further understood that the construction materials will not be compacted and only hydraulic compaction under their own self-weight (sedimentation) and light tamping with the bucket will be expected.

Volume control over the containment levee and dredged spoil placement area is rather challenging and highly dependent on the experience of the contactor and construction methods. Volume control is of prime concern during construction and for use in the development of a long-term maintenance and remediation program. As previously discussed, given the site variability, limited number of borings and the unknown design parameters, specific construction-related recommendations and exact recovery rates cannot be determined with certainty at this time. However, some general recommendations in this regard are given herein.

General Construction Recommendations

It is understood that the proposed containment levee will be constructed using bucket excavated in-situ cohesive material from the marsh creation area. The borrow fill material should be free of organic, wood, twigs, deleterious material, etc. It is believed that best results could be achieved by constructing the containment levee in several longitudinal "passes" or lifts of placed material about 1 to 1½ ft. thick.

Construction of the containment levee should proceed starting from the center of the containment levee alignments outwards. By constructing the containment levee in lifts or stages, some time would be provided between passes to allow the fill material to strengthen and to allow for sufficient time for settlements due to sedimentation (compact under self weight), consolidation and shrinkage (exposed segments) to occur prior to the placement of the

subsequent lift. Wide, low height borrow fill placement of up to 1 to 1½ ft. thick would result in maximum quantities of material "curing" before the next pass. It is our opinion that several months of settling, compacting and drying would be required before shaping, grading, etc. could be made. It is difficult to precisely determine the length of time required as this would be affected by the character of the fill material after placement, water level, climatic conditions, etc.

Once the containment levee is constructed, placement of the dredged spoil could then proceed within the confined area. Sediments placement should proceed from near the center of the marsh creation area and moving outwards towards the containment levee. This will allow for the sediment to spread uniformly and to delay imposing internal loads on the newly constructed contain levee. The dredged sediment delivery rate will depend on the design of the dredging operations.

It is expected that the dredged spoils will be comprised of primarily highly plastic clays with some organic matter. Cuttability (removal) of this type soils at the dredging site and their flowability through pipelines are typically high. Their recovery rate within a confined disposal site should be good to excellent. However, some clay balling may develop in long pipelines depending on the dredging plant characteristics. Clay balling may prove to be beneficial as clay balls will settle faster than a cohesive clay slurry. Sedimentation rate within a confined disposal site is typically slow and would take several hours. Therefore, these sediments are generally suitable for hopper, mechanical and pipeline dredging. Possible dredging equipment includes bucket, hopper, backhoe, clamshell and dragline. While less likely to be used for a project of this size, cutter head and bucket wheel dredges could also be considered.

While containment levee borrow area has not been identified at this time, the analyses assumed that cohesive fill will be used for construction of the containment levee. More specific recommendations can be provided in this regard once the borrow sources are identified. Additional field investigation and laboratory testing will be necessary to provide construction recommendations relative to suitability, recovery rate and behavior of these materials at the placement site.

REPORT LIMITATIONS

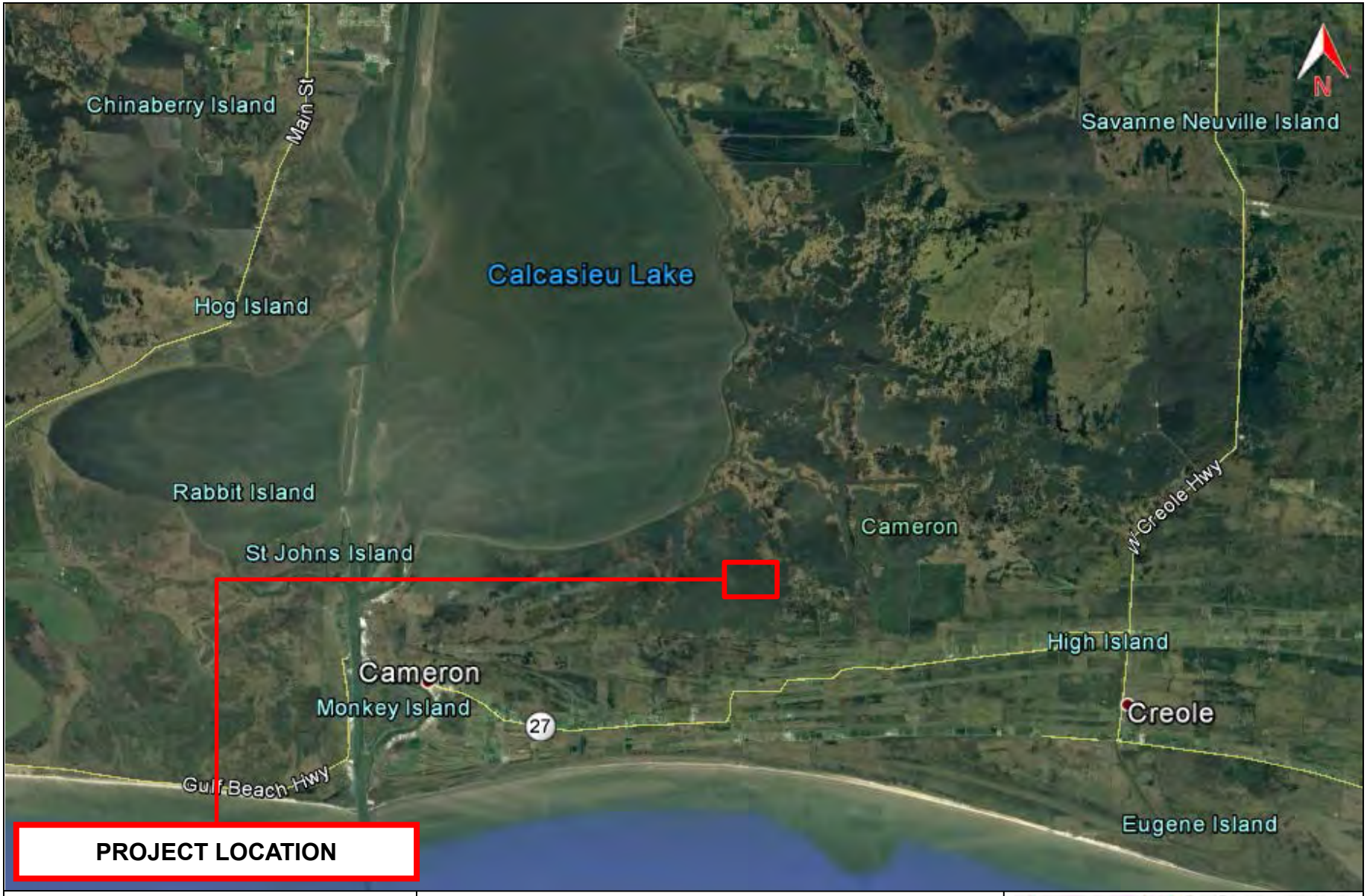
The recommendations submitted in this report are based on the available project information and subsurface information obtained by PSI. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the project information are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

PSI warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, PSI should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Evans-Graves Engineers for the specific application to the High Ridge Marina site as a part of the proposed Port Cameron – Marsh Creation within the Cameron Prairie National Wildlife Refuge in Cameron, Louisiana.

APPENDIX I

Site Vicinity Map
Boring Location Plan
Boring Logs
Key to Terms and Symbols Used on Boring Logs
Soil Properties Profile – Marsh Area



GEOTECHNICAL ENGINEERING SERVICES
PORT CAMERON – MARSH CREATION
CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
CAMERON, LOUISIANA

SITE VICINITY MAP

(Google Earth Image Dated January, 2015)

PSI REPORT NO. 0254869-1

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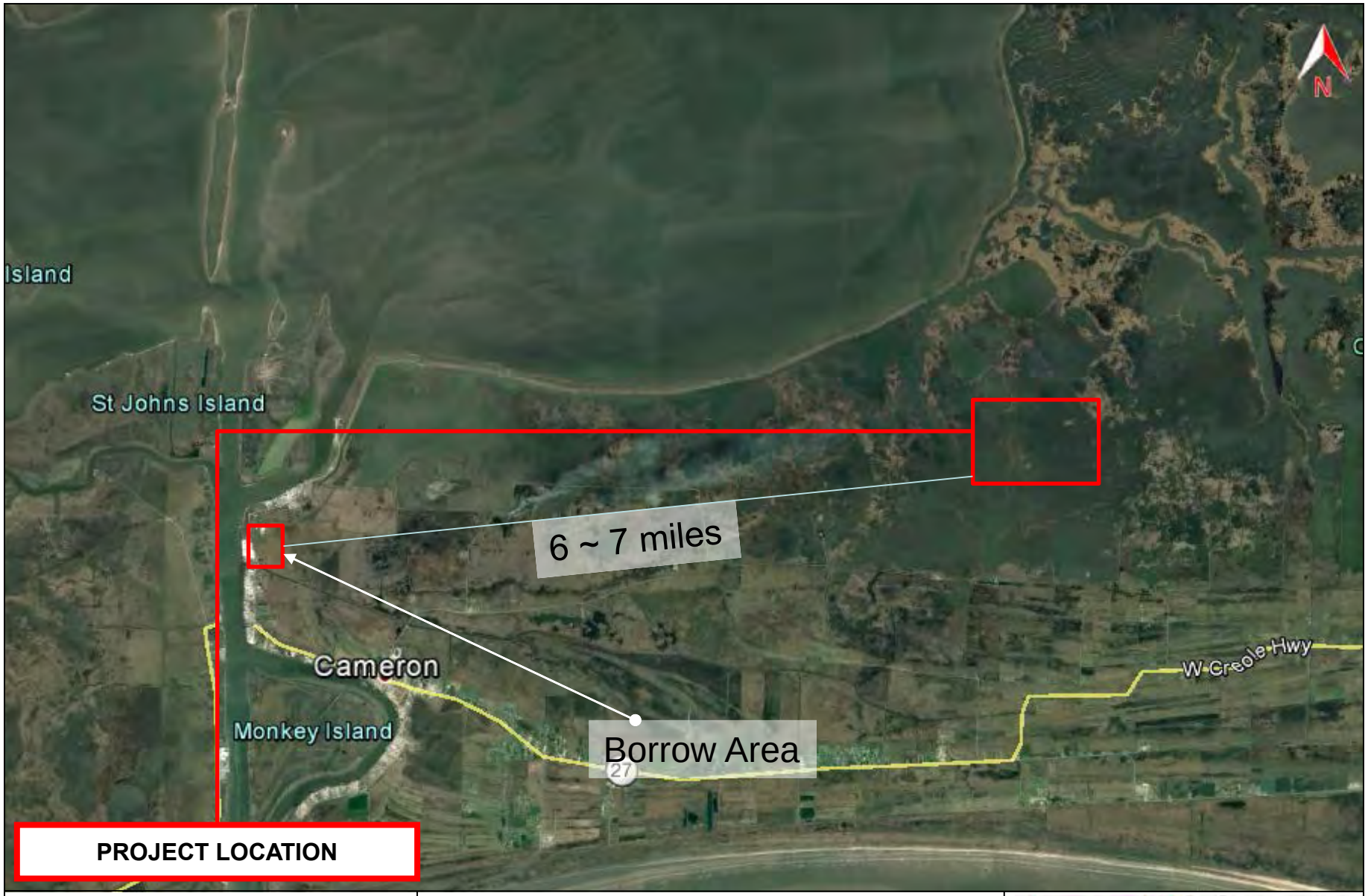

GEOTECHNICAL ENGINEERING SERVICES
PORT CAMERON – MARSH CREATION
CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
CAMERON, LOUISIANA

SITE VICINITY MAP
(Google Earth Image Dated January, 2015)

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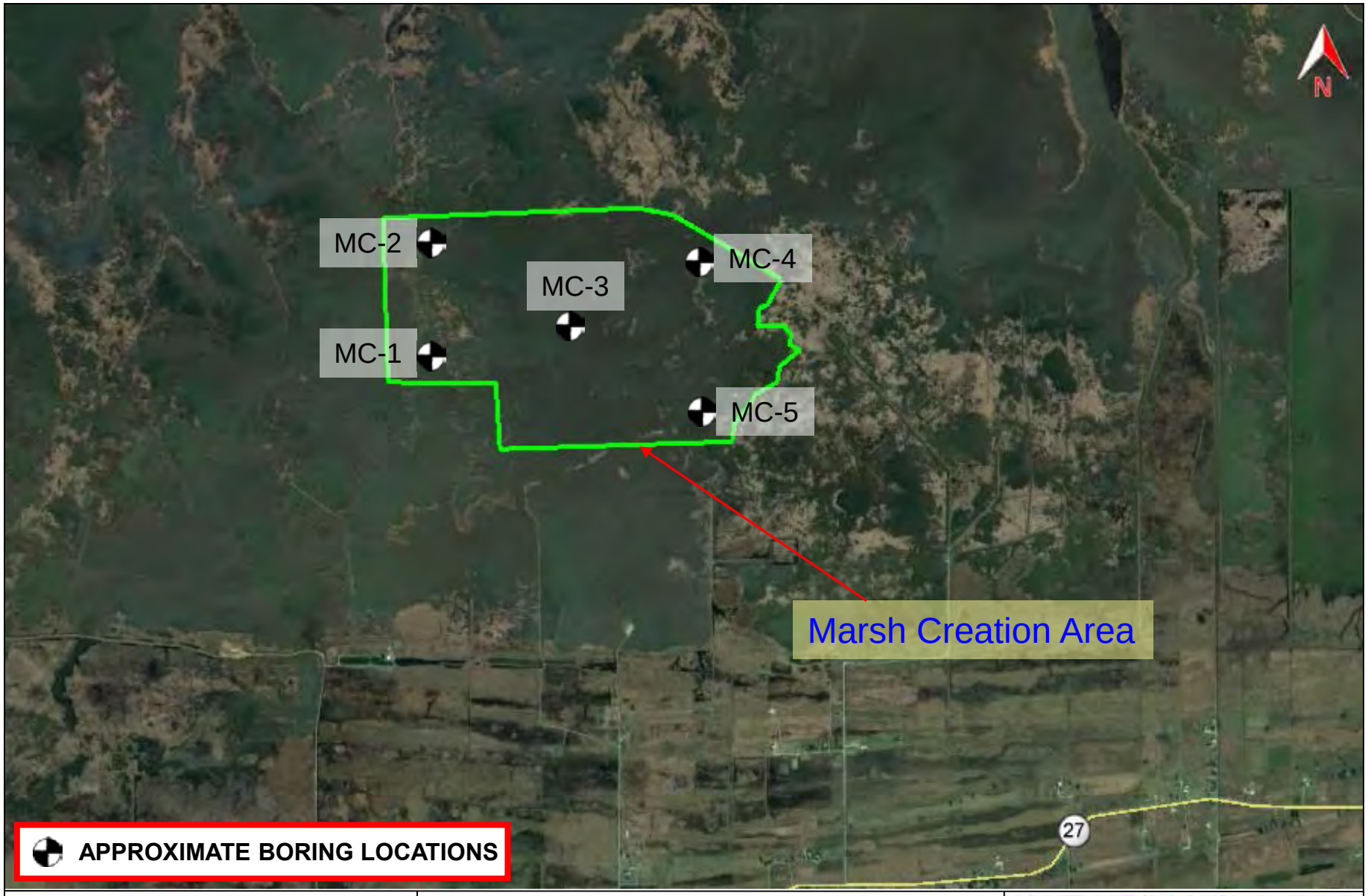

GEOTECHNICAL ENGINEERING SERVICES
PORT CAMERON – MARSH CREATION
CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
CAMERON, LOUISIANA

SITE VICINITY MAP
(Google Earth Image Dated January, 2015)

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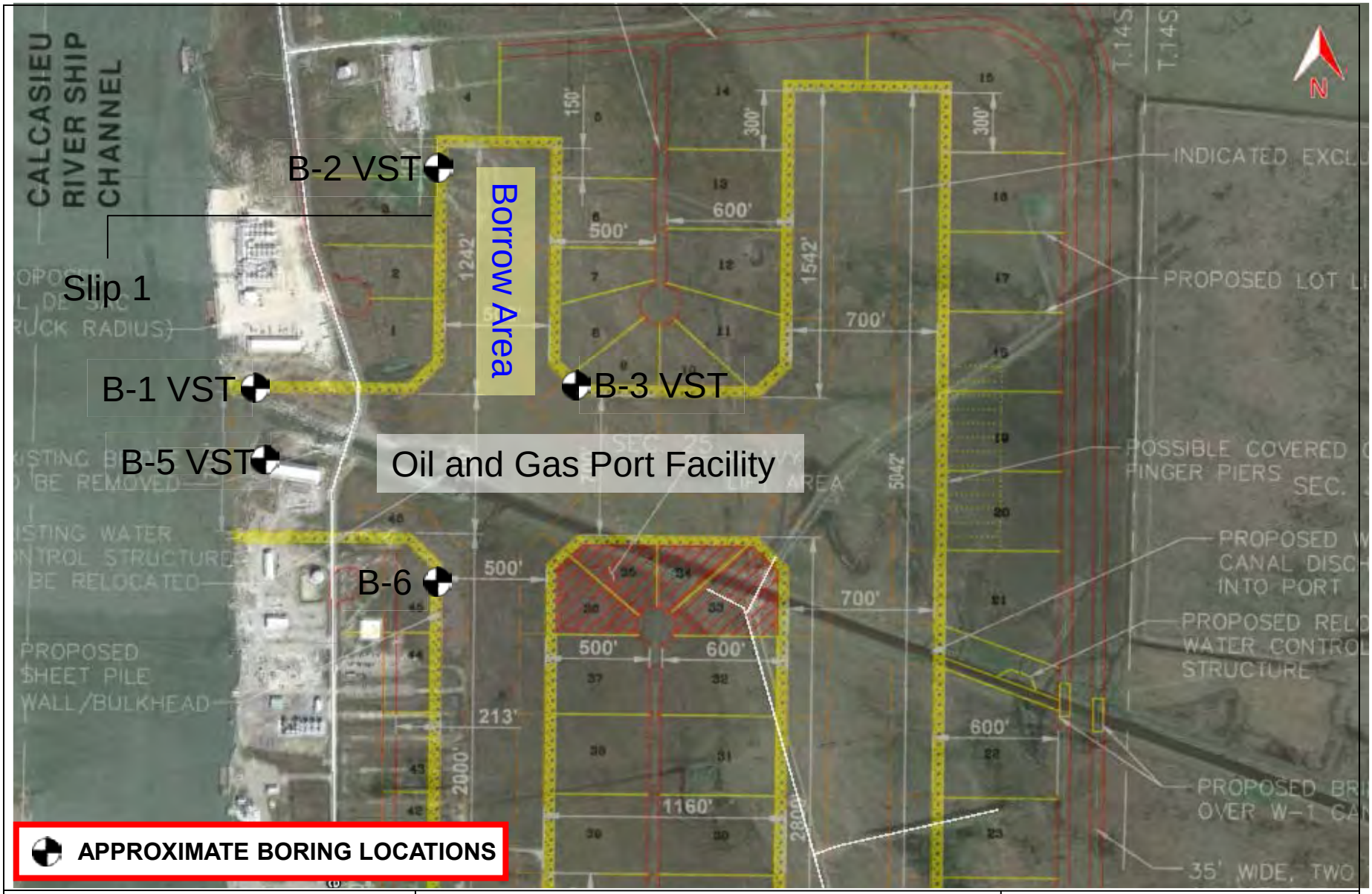

GEOTECHNICAL ENGINEERING SERVICES
PORT CAMERON – MARSH CREATION
CAMERON PRAIRIE NATIONAL WILDLIFE REFUGE
CAMERON, LOUISIANA

BORROW AREA BORINGS
(Google Earth Image Dated January, 2015)

PSI REPORT NO. 0254869-1
Soil Borings from PSI Project No. 0254834

psi Information To Build On
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MARSH CREATION AREA BORING LOGS

LOG OF BORING MC-1

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	USCS SYMBOL	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU (0.0 0.5 1.0 1.5)	STRENGTH (tsf) HP (tsf)	STRENGTH (tsf) UC (tsf)	STRENGTH (tsf) TV (tsf)	STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
	OH	Very soft dark gray and black **ORGANIC CLAY**	WOH	116										
2.5	CH	Very soft to soft gray **FAT CLAY** with ferrous nodules (2-4')		49					△			0.15		
5.0				67	92	26	66		▲			0.15	0.12	61
		-with organic, 6 to 10 feet		98					△			0.10		
7.5				94	67	24	43		△			0.15		
10.0				62					△			0.15		
12.5				62	56	21	35		▲			0.10	0.12	64
		-with shell, from 14 to 40 feet		72					△			0.05		
15.0				57				89	▲			0.10	0.09	64
17.5				45					△			0.10		
20.0														
22.5														
				48					△			0.05		
25.0														
27.5		*(minature vane - 0.12 tsf)*		49					△			0.15		
30.0														
32.5		-becomes firm		46	58	16	42		△			0.35		
35.0														
37.5				37					△			0.20		
40.0														
42.5				39					△			0.25		
45.0														
47.5		-with sand lenses below 48 feet		67				100	△			0.25		
50.0		Boring terminated at 50 feet												

DEPTH OF BORING: 50 FEET
DATE DRILLED: 10/6/16
NOTE: Water Depth to Mudline @ 2 1/2 feet

▽ GROUNDWATER DURING DRILLING: N /A
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 1/23/17 17:27 - 0254

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Jefferson Louisiana 70121
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LOG OF BORING MC-2

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
0		CH		Very soft light gray **FAT CLAY**	WOH	73	81	24	57							
				-with roots, from 0 to 6 feet												
2.5					WOH	83										
5.0						72					△			0.10		
				-with ferrous nodules (6-10')		74	69	26	43	97	▲			0.10	0.10	57
7.5				-with shell, from 8 to 25 feet												
						57					△			0.15		
10.0						50				87	△			0.10		
12.5						48	49	17	32		△			0.10		
15.0						45					△			0.10		
17.5						55					△			0.10		
						56					△			0.05		
20.0																
22.5				-with silt seams		44	51	17	34		△			0.10		
25.0																
27.5																
						46					▲			0.15	0.13	84
30.0																
32.5		CH		Very soft gray **SANDY FAT CLAY** with silt												
						36				68	△			0.10		
35.0																
37.5		CH		Soft gray **FAT CLAY** with shells												
						46					△			0.10		
40.0																
42.5		CH		Stiff reddish green **SANDY FAT CLAY**												
						16	56	17	39	55	○▲	0.33			0.55	95
45.0																
47.5																
						36					○	0.67				
50.0				Boring terminated at 50 feet												

DEPTH OF BORING: 50 FEET
DATE DRILLED: 10/7/16
NOTE: Water Depth to Mudline @ 2 feet

▽ GROUNDWATER DURING DRILLING: N /A
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING MC-3

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
2.5		CH		Very soft dark gray and black **FAT CLAY**	WOH	67										
					WOH	63	77	23	54							
5.0		CH		Very soft gray **FAT CLAY**, with silt		60					△			0.10		
7.5						66					△			0.10		
10.0						59	62	21	41	96	▲			0.15	0.12	65
				-with shell, 10 to 20 feet		46					△			0.15		
12.5						56					△			0.10		
15.0						46					△			0.10		
17.5						45	49	16	33	82	▲			0.15	0.10	76
20.0						54					△			0.10		
22.5																
25.0						37					△			0.15		
27.5		CL		Soft gray **LEAN CLAY**												
30.0						32	40	14	26		▲			0.15	0.17	92
32.5		CH		Stiff reddish brown **FAT CLAY** with shell												
35.0						38	75	24	51		○	0.50				
37.5				-with sand and shell, from 38 to 40 feet		34					○	0.58				
40.0																
42.5				-with sand lenses, from 43 to 45 feet		41	87	29	58	100	○	0.83				
45.0																
47.5						42					○ ▲	0.33			0.62	81
50.0																

DEPTH OF BORING: 60 FEET
DATE DRILLED: 10/7/16
NOTE: Water Depth to Mudline @ 1 foot

▽ GROUNDWATER DURING DRILLING: N /A
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING MC-3

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	STRENGTH (tsf) HP (tsf)	STRENGTH (tsf) UC (tsf)	STRENGTH (tsf) TV (tsf)	STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
52.5		CH		Firm light gray and brown **FAT CLAY**												
						52					○ ▲	0.33			0.68	80
55.0																
57.5						45	66	22	44		▲			0.45	0.37	79
60.0				Boring terminated at 60 feet												
62.5																
65.0																
67.5																
70.0																
72.5																
75.0																
77.5																
80.0																
82.5																
85.0																
87.5																
90.0																
92.5																
95.0																
97.5																
100.0																

DEPTH OF BORING: 60 FEET
DATE DRILLED: 10/7/16
NOTE: Water Depth to Mudline @ 1 foot

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LOG OF BORING MC-4

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
		OH		Very soft gray **ORGANIC CLAY**	WOH	111										
2.5		CH		Very soft gray **FAT CLAY**, with silt -with organic, 2 to 4 feet	WOH	85	91	23	68							
5.0						67	76	23	53		▲			0.15	0.10	60
7.5				-miniature vane: 0.08 tsf		57					△			0.10		
						55					△			0.05		
10.0		CL		Very soft gray **LEAN CLAY WITH SAND**		60	45	16	29	78	▲			0.15	0.09	70
12.5						65					△			0.05		
15.0		CH		Soft to firm gray **FAT CLAY**		38					△			0.15		
17.5						43					△			0.10		
20.0						36					△			0.20		
22.5																
25.0						36					△			0.10		
27.5				-with silt seams												
30.0						34	50	19	31		○	0.33				
32.5																
35.0						41					○	0.25				
37.5																
40.0						39	52	20	32		▲	0.33			0.40	84
42.5		CH		Firm reddish green **FAT CLAY** with trace sand		47					○	0.33				
45.0																
47.5						44					○	0.33				
50.0				Boring terminated at 50 feet												

DEPTH OF BORING: 50 FEET
DATE DRILLED: 10/7/16
NOTE: Water Depth to Mudline @ 2 feet

▽ GROUNDWATER DURING DRILLING: N /A
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING MC-5

PORT CAMERON MARSH CREATION
PORT CAMERON MARSH
PORT CAMERON, LOUISIANA

TYPE OF BORING: WET ROTARY | LOCATION: MARSH AREA | PSI Project No.: 0254869

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
0		CH		Very soft black **FAT CLAY**	WOH	59	88	26	62							
2.5		CH		Very soft to soft gray **FAT CLAY**	WOH	57										
5.0						56	51	20	31		▲△			0.35	0.24	74
7.5						57					△			0.10		
		CL		Very soft gray **SANDY LEAN CLAY** with shell		47	49	17	32	70	△			0.10		
10.0		CH		-miniature vane: 0.14 tsf												
				Soft gray **FAT CLAY**		55	65	17	48		△			0.10		
12.5				-miniature vane: 0.08 tsf		45	57	19	38	87	△			0.15		
15.0				-miniature vane: 0.09 tsf		62					△			0.05		
		SC		Gray **CLAYEY SAND**		31				40	△			0.05		
17.5						28					△			0.10		
20.0																
22.5		SM		Medium dense gray **SILTY SAND** with shell	13	20										
25.0																
27.5																
30.0					15	21				11						
32.5																
35.0					19	27										
37.5		CH		Soft to firm reddish brown **FAT CLAY**		31					△			0.20		
40.0																
42.5																
45.0						48	75	24	51		▲			0.25	0.22	71
47.5																
50.0						47					○▲		0.25		0.55	73
				Boring terminated at 50 feet												

DEPTH OF BORING: 50 FEET
DATE DRILLED: 10/8/16
NOTE: Water Depth to Mudline @ 2 feet

▽ GROUNDWATER DURING DRILLING: N /A
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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BORROW AREA (PORT FACILITY) BORING LOGS

LOG OF BORING B-1

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
		CH		Firm gray **SANDY FAT CLAY**, with shell		25				66	0.33				
2.5		CH		Very soft to firm gray **FAT CLAY**		41					0.33				
5.0						46	86	26	60		0.33			0.42	78
						47							0.30		
7.5				▽											
						64							0.10		
10.0						83	105	31	74				0.15	0.07	50
12.5						68							0.10		
						90							0.10		
15.0						68	94	30	64				0.15	0.07	59
17.5				-with shell, 16 to 18 feet		94	104	32	72	98			0.10		
20.0						86							0.10		
22.5						86							0.05		
25.0						80	100	33	67				0.10		
27.5					WOH	87									
					WOP	93									
30.0															
32.5															
35.0				-with sand seams, from 33 to 35 feet		80	104	33	71	96			0.25	0.20	53
37.5															
40.0				-miniature vane = 0.36 tsf		83							0.15		
42.5															
45.0						40					0.33				
47.5		CH		Firm to stiff reddish brown **FAT CLAY**											
50.0						33	61	23	38		0.42			0.53	88

SHEAR STRENGTH (tsf): ○ HP ● UC △ TV ▲ UU; 0.0 0.5 1.0 1.5

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/2/16
NOTE: AUGERED TO 28 FEET THEN SWITCHED TO WET ROTARY

▽ GROUNDWATER DURING DRILLING: 8 FEET
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

Professional Service Industries, Inc.
724 Central Avenue
Jefferson Louisiana 70121
(504) 733-9411

LOG OF BORING B-1

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
52.5		CH		Firm to stiff reddish brown **FAT CLAY**		43						0.33				
55.0																
57.5						49								0.50		
60.0																
62.5		CL		Stiff reddish brown **LEAN CLAY** with sand												
65.0				-miniature vane = 0.51 tsf		33	38	16	22			0.50			0.36	91
67.5		CH		Firm reddish brown **FAT CLAY**												
70.0				-miniature vane = 0.46 tsf		47						0.25				
72.5		CL		Firm reddish brown LEAN CLAY, with sand layer on bottom												
75.0						29				93				0.25		
77.5		ML		Loose to medium dense brown **SANDY SILT**												
80.0					14	25				59						
82.5																
85.0					9	26										
87.5		CH		Firm reddish green **FAT CLAY**, with sand seams												
90.0						25	53	22	31	99		0.75			0.39	96
92.5																
95.0						30								0.25		
97.5																
100.0						34						0.25				

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/2/16
NOTE: AUGERED TO 28 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

Professional Service Industries, Inc.
724 Central Avenue
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LOG OF BORING B-1

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
102.5		CH		Firm reddish green **FAT CLAY**, with sand seams												
105.0																
107.5		CL		Stiff reddish green **LEAN CLAY**, with sand seams		27	33	17	16			0.58			0.56	97
110.0																
112.5																
115.0																
117.5						30						0.50				
120.0				Boring terminated at 20 feet												
122.5																
125.0																
127.5																
130.0																
132.5																
135.0																
137.5																
140.0																
142.5																
145.0																
147.5																
150.0																
152.5																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/2/16
NOTE: AUGERED TO 28 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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LOG OF BORING B-2

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
0		CH		Soft to firm gray **FAT CLAY**		65								0.35		
2.5						43				88		0.25				
5.0						33	92	24	68			0.67			0.39	81
7.5						67								0.40		
10.0						67								0.20		
12.5						70	102	25	77					0.20	0.13	60
15.0						77	100	32	68	91				0.20		
17.5						69								0.15		
20.0				▽		76								0.15		
22.5						75								0.15		
25.0				-sand layer, 22 to 24 feet -trace organic, 22 to 24 feet		78	55	20	35					0.15	0.09	62
27.5						39								0.20		
30.0						74	67	33	34	74				0.10		
32.5						60								0.10		
35.0				-with sand pockets below 28 feet		55								0.15		
37.5		CL		Very soft gray **LEAN CLAY**, with silt												
40.0				-miniature vane = 0.22 tsf	WOP	45	36	16	20							
42.5		CH		Very soft gray **FAT CLAY**												
45.0					2	51										
47.5																
50.0					2	42										

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/3/16
NOTE: AUGERED TO 18 FEET THEN SWITCHED TO WET ROTARY

▽ GROUNDWATER DURING DRILLING: 20 FEET
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING B-2

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
		CH		Very soft gray **FAT CLAY**												
52.5		CH		Firm to stiff gray **FAT CLAY** with ferrous stains		50	80	24	56		▲	0.58			0.62	74
55.0																
57.5				-with sand layer		51					△			0.40		
60.0																
62.5		CH		Firm to stiff reddish brown **FAT CLAY**		35	71	22	49		▲			0.50	0.49	85
65.0																
67.5						49					○	0.33				
70.0																
72.5						48	79	21	58	99	△			0.50		
75.0																
77.5		CH		Firm to stiff reddish green **FAT CLAY**		47					○	0.33				
80.0																
82.5						43					○	0.25				
85.0																
87.5				-with organic		98	81	22	59	98	△▲			0.55	0.75	76
90.0																
92.5						47					○	0.33				
95.0																
97.5						48					○	0.33				
100.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/3/16
NOTE: AUGERED TO 18 FEET THEN SWITCHED TO WET ROTARY

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LOG OF BORING B-2

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
102.5		CH		Firm to stiff reddish green **FAT CLAY**												
105.0																
107.5						52					△			0.25		
110.0																
112.5																
115.0																
117.5						48	77	12	65		▲○	0.58			0.49	75
120.0				Boring terminated at 120 feet												
122.5																
125.0																
127.5																
130.0																
132.5																
135.0																
137.5																
140.0																
142.5																
145.0																
147.5																
150.0																
152.5																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/3/16
NOTE: AUGERED TO 18 FEET THEN SWITCHED TO WET ROTARY

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LOG OF BORING B-3

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
		CH		Soft gray **FAT CLAY**		38					○	0.33				
2.5						45	77	25	52		△▲			0.30	0.13	77
5.0						29					○	0.33				
		SHELLS		**SHELL**, with clay		19				13						
7.5				▽		26										
10.0		CH		Very soft dark gray **FAT CLAY**		64	60	23	37	79	△			0.10		
				-with shells, 10 to 14 feet												
12.5						68					△			0.10		
				-with trace organic below 14 feet												
15.0						55					△			0.10		
						54	55	10	45	82	△			0.10		
17.5				-with sand												
						60	58	23	35	79						
20.0					WOH	50										
22.5					WOH	54	52	21	31							
25.0					WOH	54										
27.5					WOH	59										
				-with shells, 28 to 30 feet		63	64	23	41		△			0.10		
30.0																
32.5																
						70					△			0.10		
35.0																
37.5																
						52					△			0.10		
40.0																
42.5																
						60					△			0.15		
45.0																
47.5																
				-miniature vane = 0.08 tsf		57	54	17	37		▲			0.10	0.07	64
50.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/9/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

▽ GROUNDWATER DURING DRILLING: 8 FEET
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING B-3

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
		CH		Very soft gray **FAT CLAY**												
52.5		CH		Firm to stiff light gray **FAT CLAY**												
						52					○	0.25				
55.0																
57.5		CH		Firm to stiff reddish green **FAT CLAY** with sand seams												
						46					○	0.25				
60.0																
62.5																
						41					○▲	0.25			0.38	
65.0																
67.5																
						51	72	25	47		△			0.45		72
70.0																
72.5																
						46					○	0.25				
75.0																
77.5																
						25					△			0.20		
80.0																
82.5																
						45	82	27	55		▲	0.58			0.60	77
85.0																
87.5																
						48					○	0.33				
90.0																
92.5		ML		Medium dense brown **SILT WITH SAND**												
					13	30				79						
95.0																
97.5																
					18	29										
100.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/9/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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LOG OF BORING B-3

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
102.5																
105.0																
107.5		ML		Brown **SILT WITH SAND**		26				75	△			0.20		
110.0																
112.5																
115.0		CL		Soft gray **SANDY LEAN CLAY**												
117.5						30	43	21	22		△			0.25		
120.0				Boring terminated at 120 feet												
122.5																
125.0																
127.5																
130.0																
132.5																
135.0																
137.5																
140.0																
142.5																
145.0																
147.5																
150.0																
152.5																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/9/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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LOG OF BORING B-5

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
		FILL		Gray shell with clay **FILL**		13				14						
2.5		FILL		Gray silty sand **FILL**		12										
5.0				▽		25				17						
		CH		Very soft to soft gray **FAT CLAY**		67					△			0.20		
7.5				-with shell and trace sand, 6 to 8 feet		70					△			0.25		
10.0						70	102	25	77		▲			0.15	0.13	62
12.5						86					△			0.10		
15.0				-layer of shell and sand, 14 to 16 feet		90					△			0.10		
17.5						76					△			0.10		
20.0				-miniature vane = 0.045 tsf		77	114	30	84		△			0.05		
						83					△			0.05		
22.5						81	110	27	83		▲			0.10	0.07	52
25.0					3	85	78	21	57							
27.5					WOH	55										
						80	103	27	76							52
30.0																
32.5																
35.0					WOH	56										
37.5																
40.0					3	72										
42.5																
45.0					WOH	75	105	26	79							
47.5				Sample sent to PND												
50.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

▽ GROUNDWATER DURING DRILLING: 6 FEET
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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LOG OF BORING B-5

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
52.5		CH		Very soft gray **FAT CLAY** with sand and shell layers (53-55')												
						77	99	25	74		△			0.05		
55.0																
57.5				-with silt seams												
						60	93	25	68							67
60.0																
62.5				Samples sent to PND (63-65' and 68-70')												
65.0																
67.5																
70.0																
72.5		CH		Firm to stiff reddish green **FAT CLAY**												
				-miniature vane = 0.42 tsf		48	69	21	48		▲△			0.40	0.30	78
75.0																
77.5						48					△			0.50		
80.0																
82.5						43					△			0.35		
85.0																
87.5						53					△			0.20		
90.0																
92.5						50					○	0.25				
95.0																
97.5						42	78	23	55		▲○	0.58			0.42	78
100.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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Jefferson Louisiana 70121
(504) 733-9411

LOG OF BORING B-5

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
102.5		CH		Firm to stiff reddish green **FAT CLAY**											
105.0															
107.5						46	66	20	46	98		0.50			0.50	77
110.0															
112.5															
115.0															
117.5						47						0.25				
120.0															
122.5															
125.0															
127.5															
130.0															
132.5															
135.0															
137.5															
140.0															
142.5															
145.0															
147.5															
150.0															
152.5															

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

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LOG OF BORING B-6

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
		CH		Firm gray **FAT CLAY**		46								0.35		
2.5						48								0.40		
5.0						27	84	22	62			0.58		0.35	0.39	88
7.5				▽		54								0.35		
						64								0.30		
10.0		CH		Very soft to soft gray **FAT CLAY**		62								0.15		
12.5						85	115	30	85					0.15	0.09	51
15.0						74								0.10		
17.5						66								0.10		
						59								0.25	0.08	
20.0						75	100	27	73	96				0.10		55
22.5						68								0.10		
25.0						90								0.05		
27.5						94								0.05		
			⊠		WOH	70	103	28	75	98						
30.0																
32.5																
			⊠		WOH	71										
35.0																
37.5																
			⊠		WOH	70	86	22	64							
40.0																
42.5																
			■			86	90	25	65							
45.0																
47.5				Samples sent to PND												
50.0																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

▽ GROUNDWATER DURING DRILLING: 7.5 FEET
▼ GROUNDWATER UPON COMPLETION: N /A
▼ DELAYED GROUNDWATER: N / A

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LOG OF BORING B-6

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	UC (tsf)	TV (tsf)	UU (tsf)	DRY UNIT WEIGHT (pcf)
52.5		CH		Very soft to soft dark gray **FAT CLAY**												
55.0				-with sand, 53 to 55'	WOH	75				80						
57.5																
60.0					WOH	76										
62.5																
65.0					4	74										
67.5																
70.0					4	79	94	24	70							
72.5																
75.0						72					△			0.05		
77.5																
80.0						64	97	24	73		▲			0.10	0.10	58
82.5				-with sand and shell layers, 83-85'												
85.0						85	95	24	71		△			0.15		
87.5				-with shell, 88 to 95 feet												
90.0						85					△			0.15		
92.5																
95.0						78	110	28	82	95	△			0.30		
97.5																
100.0						84					△			0.25		

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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LOG OF BORING B-6

PORT CAMERON
INTERSECTION OF HIGHWAY 27 AND WAKERFIELD ROAD
PORT CAMERON, LOUISIANA

TYPE OF BORING: SOLID STEM AUGER / WET ROTARY LOCATION: PSI Project No.: 0254834

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	% PASSING No. 200 SIEVE	SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5	SHEAR STRENGTH (tsf) HP (tsf)	SHEAR STRENGTH (tsf) UC (tsf)	SHEAR STRENGTH (tsf) TV (tsf)	SHEAR STRENGTH (tsf) UU (tsf)	DRY UNIT WEIGHT (pcf)
102.5		CH		Very soft to soft gray **FAT CLAY**												
105.0																
107.5				-with sand seams, 108-110'		80					△			0.25		
110.0																
112.5																
115.0																
117.5						54	75	21	54		●		0.25	0.20	0.25	72
120.0				Boring terminated at 120 feet												
122.5																
125.0																
127.5																
130.0																
132.5																
135.0																
137.5																
140.0																
142.5																
145.0																
147.5																
150.0																
152.5																

DEPTH OF BORING: 120 FEET
DATE DRILLED: 8/11/16
NOTE: AUGERED TO 8 FEET THEN SWITCHED TO WET ROTARY

BORINGLOG_JEFFERSON - PSIHOUSTON.GDT - 10/26/16 10:56 - 0254

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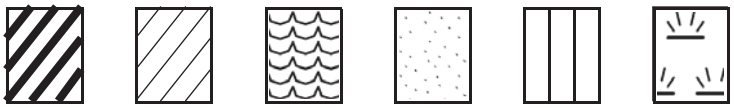
KEY TO TERMS AND SYMBOLS USED ON LOGS

SOIL TYPE

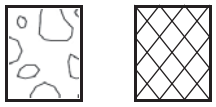


FAT CLAY | LEAN CLAY | ORGANIC CLAY | SAND | SILT | PEAT

SAMPLER TYPE

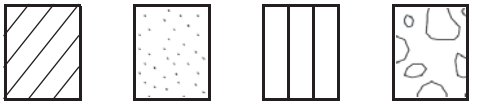
NO RECOVERY | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

SOIL TYPE



GRAVEL | FILL

MODIFIERS



CLAYEY | SANDY | SILTY | GRAVELY

GROUNDWATER DURING DRILLING

GROUNDWATER UPON COMPLETION

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

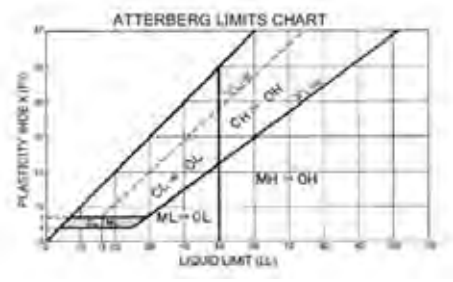
MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE	GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR NO FINES	GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		W/ APPRECIABLE FINES	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN 50% PASSING NO. 4 SIEVE	CLEAN SANDS LITTLE FINES	SW	WELL GRADED SAND, GRAVELY SAND (LITTLE FINES)
			SP	POORLY GRADED SANDS, GRAVELY SAND (L.FINES)
		SANDS WITH APPREA. FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS,SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/ LOW PI
			CL	INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH	ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT
HIGHLY ORGANIC SOIL			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS
UNCLASSIFIED FILL MATERIALS				ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS AND MAN MADE SOIL MIXTURES

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	SHEAR STRENGTH IN TONS/FT^2
VERY SOFT	0 TO 0.125
SOFT	0.125 TO 0.25
FIRM	0.25 TO .50
STIFF	0.50 TO 1.00
VERY STIFF	1.00 TO 2.00
HARD	> 2.00 OR 2.00+

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	N-VALUE (BLOWS/FOOT)
VERY LOOSE	0-4
LOOSE	4-9
MEDIUM DENSE	10-29
DENSE	30-49
VERY DENSE	> 50 OR 50+



ABBREVIATIONS

HP - HAND PENETROMETER
TV - TORVANE
MV - MINIATURE VANE
UC - UNCONFINED COMPRESSION TEST
UU - UNCONSOLIDATED UNDRAINED TRAIXIAL
CU - CONSOLIDATED UNDRAINED

NOTE: PLOT INDICATES SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

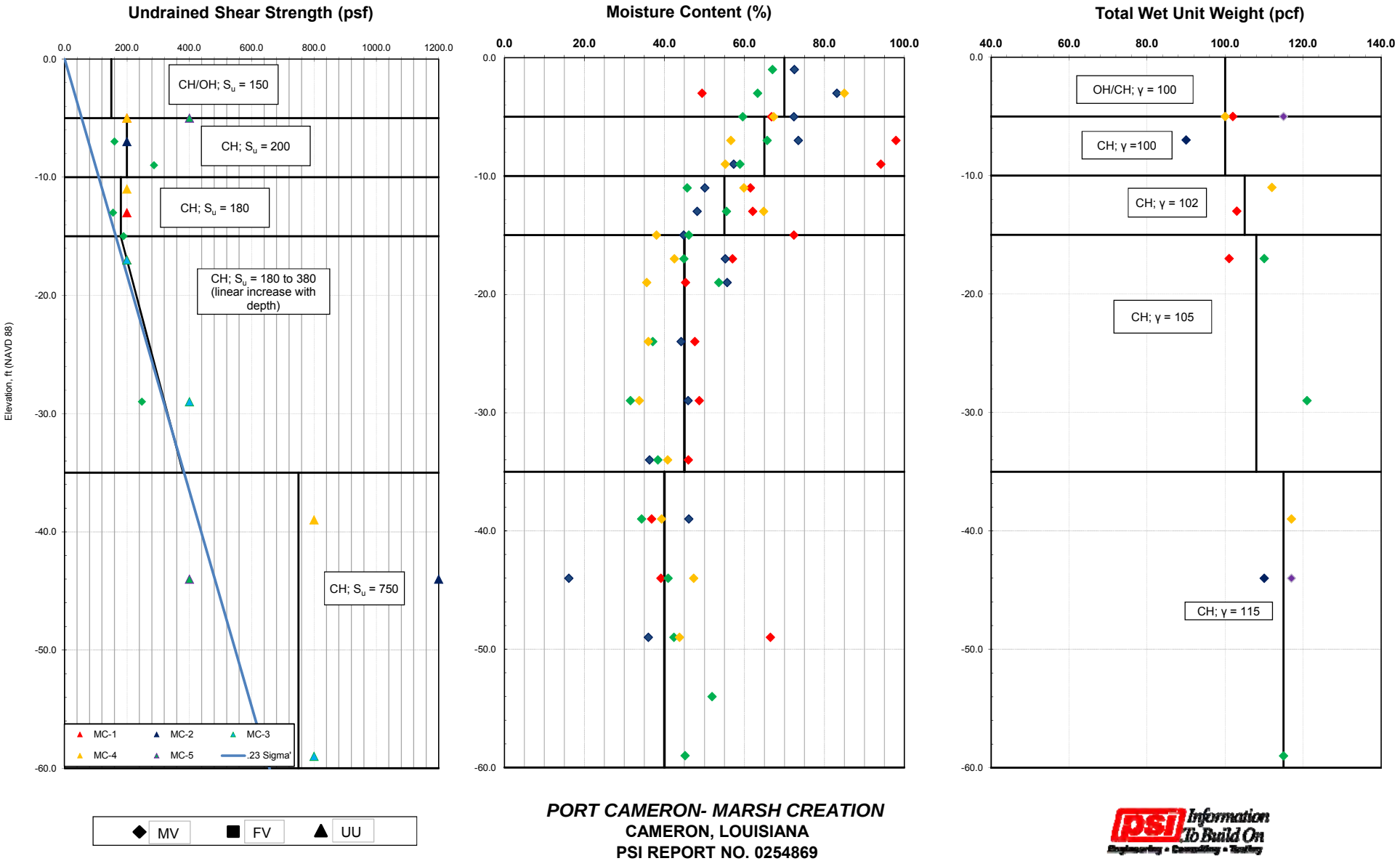
6"	3"	3/4"	4	10	40	200

BOUL--DERS	COBBLES	GRAVEL		SAND			SILT OR CLAY	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

152	76.2	19.1	4.76	2.0	0.42	0.074	0.002

GRAIN SIZE IN MM

SOIL PROPERTIES PROFILE



PORT CAMERON- MARSH CREATION
CAMERON, LOUISIANA
PSI REPORT NO. 0254869

PSI Information To Build On
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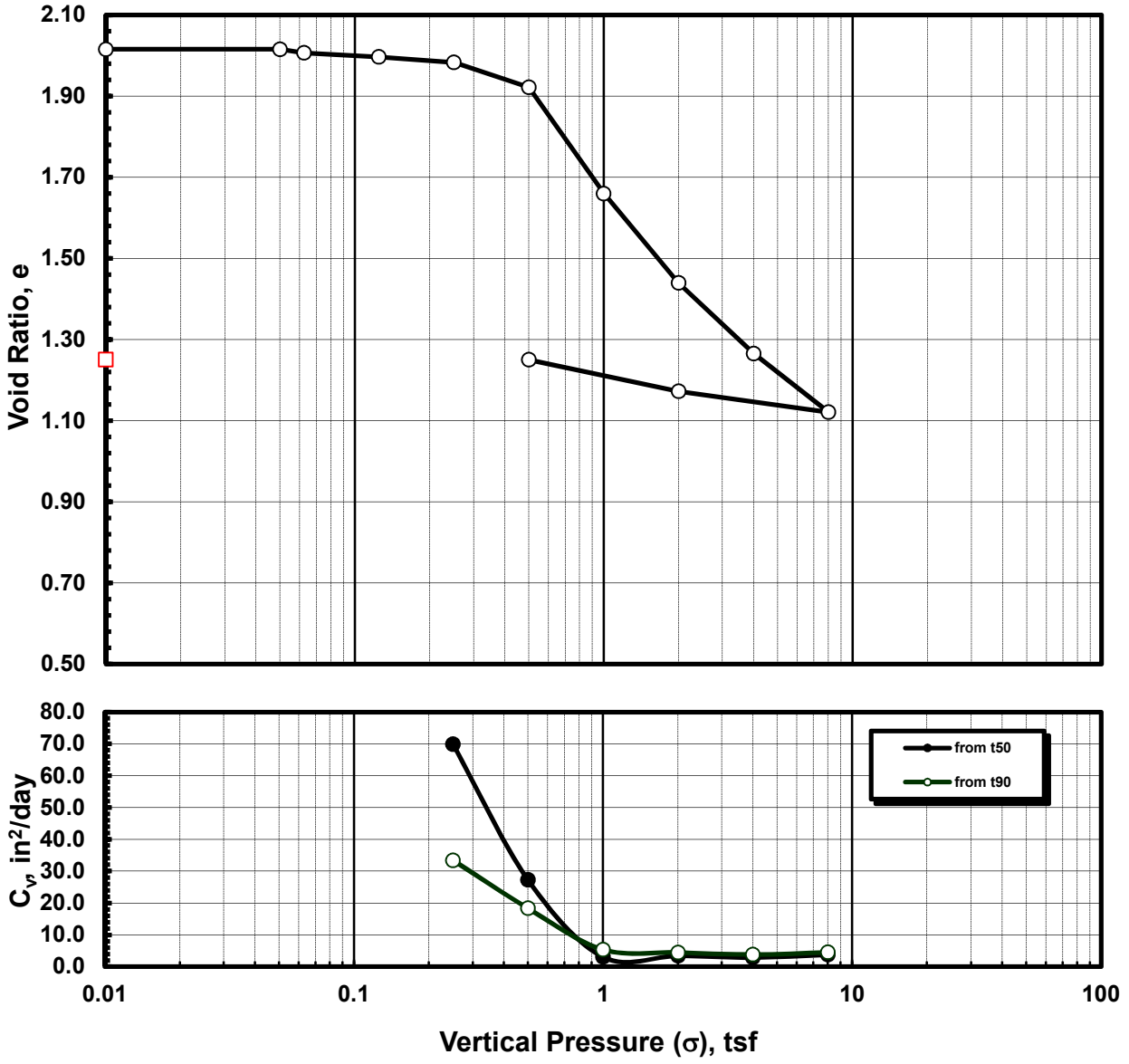
APPENDIX II

Consolidation Test Results

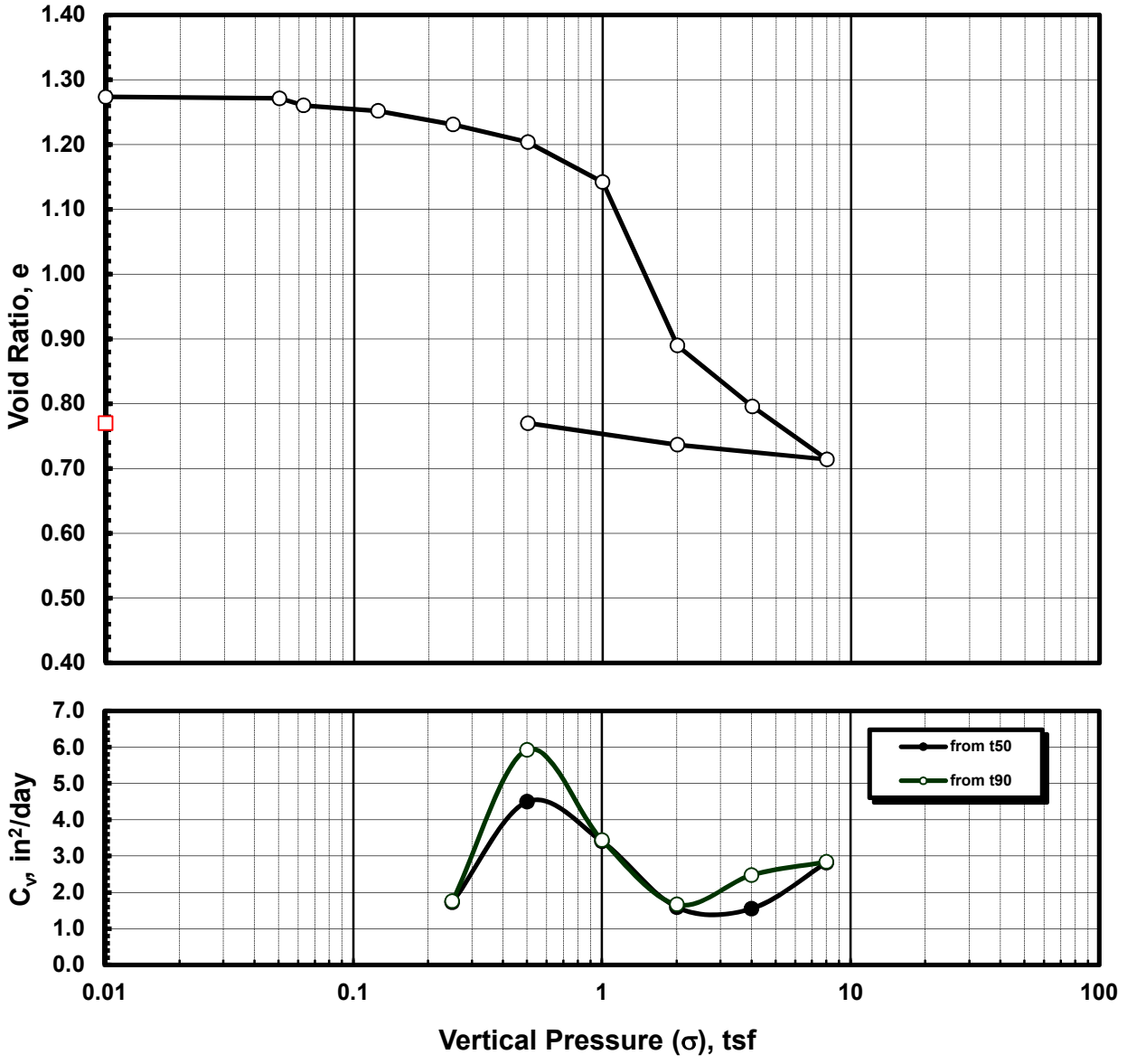
CONSOLIDATION TEST RESULTS - ASTM D 2435



Sample Condition	Before	After	Consolidation Parameters	
Moisture Content, %:	76.2%	40.7%	Overburden Pressure, tsf:	0.5
Sample Height, in.:	1.0010	0.7471	Preconsolidation Pressure, tsf:	0.6
Void Ratio, e:	2.0151	1.2502	Compression Index, (Cc):	0.660
Unit Weight, pcf:	54.8	73.5	Re-Compression Index, (Cr)	0.107
Degree of Saturation:	1.00	0.86	Swell Index, Cs:	0.000

Project Number:	254869	Liquid Limit:	67	Hand Pen:	.15 tsf
Project Name	Port Cameron - Marsh Creation	Plastic Limit:	24	-200 %:	NA
Boring No.:	MC-1	Plasticity Index:	43	SPG:	2.65
Sample ID, Depth:	8-10 feet	Classification:	Gray Fat Clay		

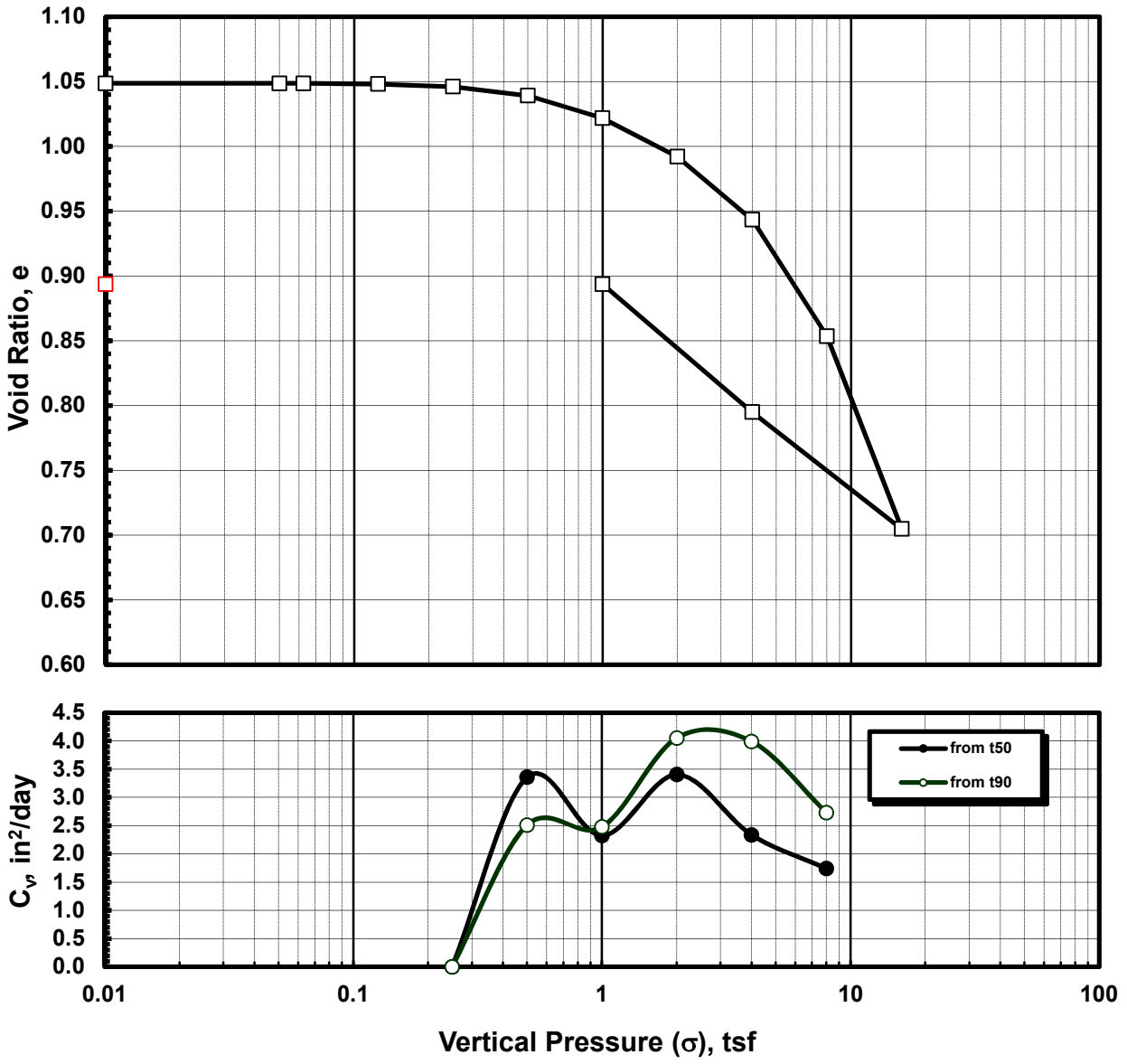
CONSOLIDATION TEST RESULTS - ASTM D 2435



Sample Condition	Before	After	Consolidation Parameters	
Moisture Content, %:	46.8%	25.5%	Overburden Pressure, tsf:	0.8
Sample Height, in.:	1.0000	0.7786	Preconsolidation Pressure, tsf:	0.9
Void Ratio, e:	1.2733	0.7700	Compression Index, (Cc):	0.630
Unit Weight, pcf:	74.9	96.2	Re-Compression Index, (Cr)	0.050
Degree of Saturation:	1.00	0.90	Swell Index, Cs:	0.000

Project Number:	0254869-1	Liquid Limit:	56	Torvane:	.15 tsf
Project Name	Port Cameron - Marsh Creation	Plastic Limit:	21	-200 %:	NA
Boring No.:	MC-5	Plasticity Index:	35	SPG:	2.73
Sample ID, Depth:	S-7, 12-14'	Classification:	Gray Fat Clay		

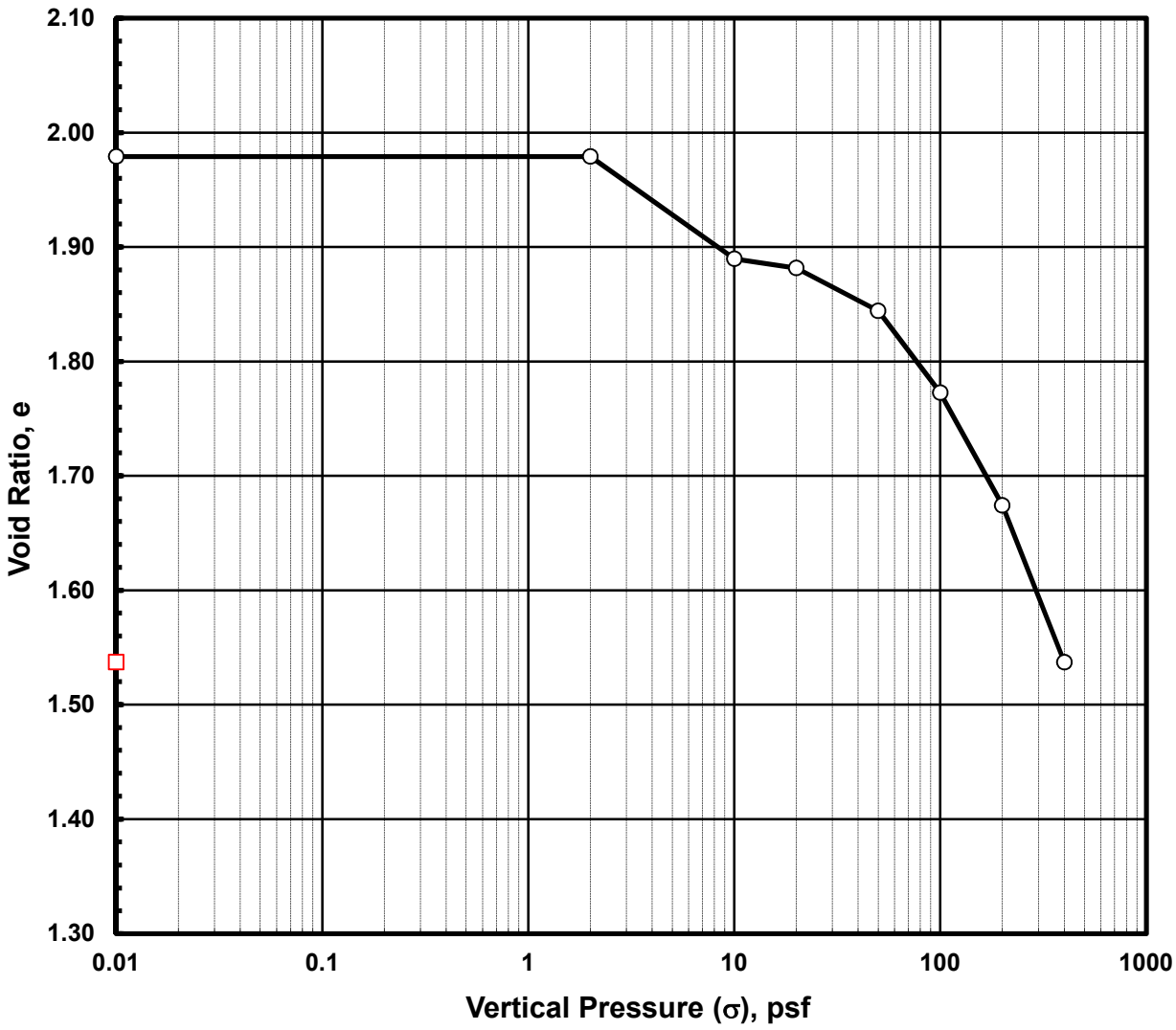
CONSOLIDATION TEST RESULTS - ASTM D 2435



Sample Condition	Before	After	Consolidation Parameters	
Moisture Content, %:	39.6%	36.9%	Overburden Pressure, tsf:	2.6
Sample Height, in.:	1.0000	0.9244	Preconsolidation Pressure, tsf:	4.5
Void Ratio, e:	1.0485	0.8936	Compression Index, (Cc):	0.490
Unit Weight, pcf:	80.7	87.3	Re-Compression Index, (Cr)	0.157
Degree of Saturation:	1.00	1.09	Swell Index, Cs:	0.000

Project Number:	254869	Liquid Limit:	87	Hand Pen:	0.833 tsf
Project Name	Port Cameron Marsh Creation	Plastic Limit:	29	-200 %:	99.6
Boring No.:	MC-3	Plasticity Index:	58	SPG:	2.65
Sample ID, Depth:	S-15, 43-45'	Classification:	Tan Fat Clay		

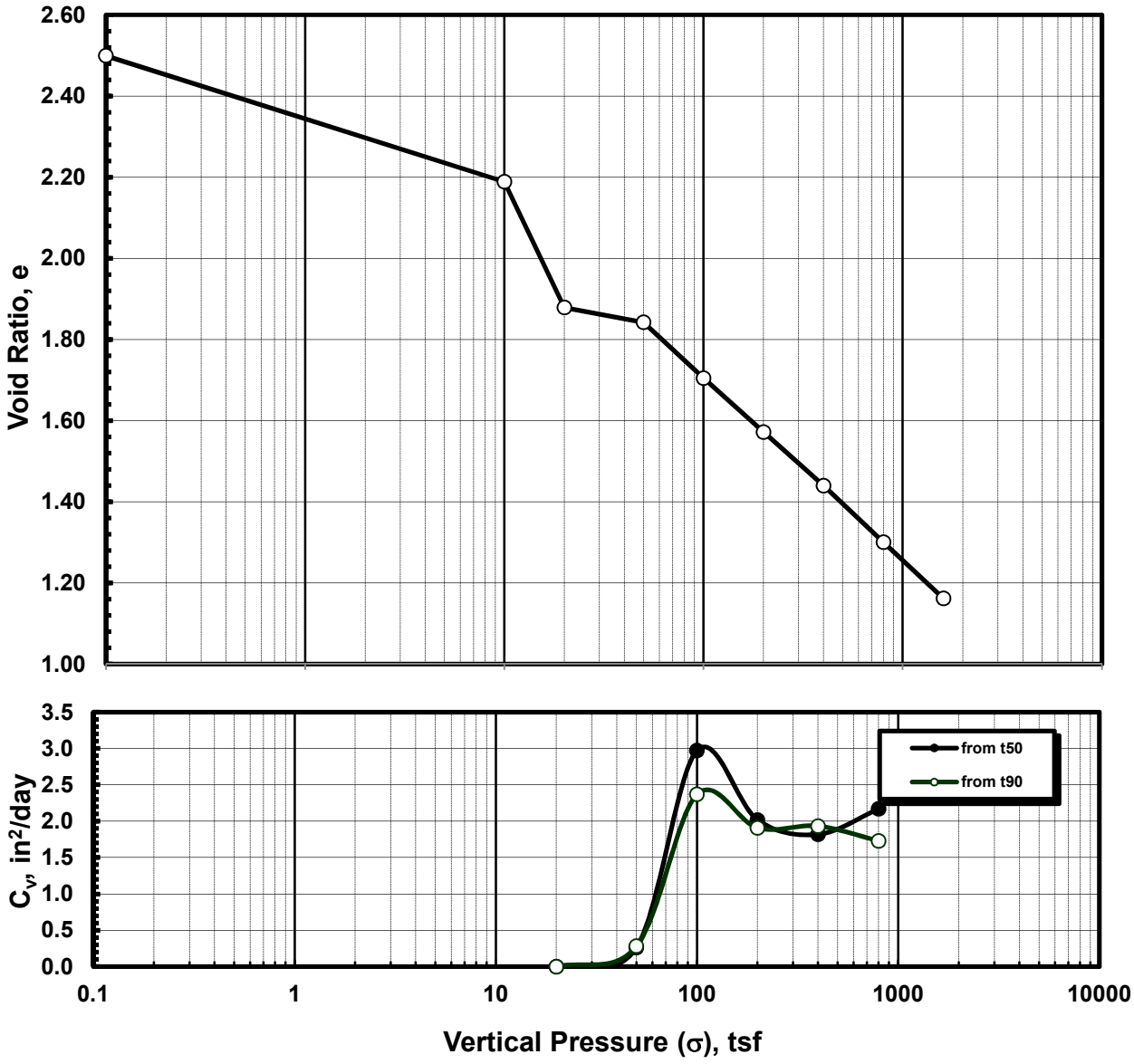
CONSOLIDATION TEST RESULTS - ASTM D 2435



Sample Condition	Before	After	Consolidation Parameters	
Moisture Content, %:	75.0%	62.6%	Overburden Pressure, tsf:	N/A
Sample Height, in.:	1.0000	0.8517	Preconsolidation Pressure, tsf:	N/A
Void Ratio, e:	1.9791	1.5373	Compression Index, (Cc):	0.400
Unit Weight, pcf:	55.5	65.2	Re-Compression Index, (Cr)	N/A
Degree of Saturation:	1.00	1.00	Swell Index, Cs:	N/A

Project Number:	254869	Liquid Limit:	80	Hand Pen:	-
Project Name	Port Cameron - Marsh Creation	Plastic Limit:	26	-200 %:	90.5
Boring No.:	Composite Sample (834 Borings)	Plasticity Index:	54	SPG:	2.654
Sample ID, Depth:	0-40	Classification:	Gray Clay		

CONSOLIDATION TEST RESULTS - ASTM D 2435



Sample Condition	Before	After	Consolidation Parameters	
Moisture Content, %:	92.6%	47.0%	Overburden Pressure, tsf:	N/A
Sample Height, in.:	1.0000	0.6178	Preconsolidation Pressure, tsf:	N/A
Void Ratio, e:	2.4990	1.1617	Compression Index, (Cc):	0.740
Unit Weight, pcf:	47.3	76.6	Re-Compression Index, (Cr)	0.111
Degree of Saturation:	0.98	1.07	Swell Index, Cs:	N/A

Project Number:	0254869-1	Liquid Limit:	80	Hand Pen:	NA
Project Name	Port Cameron - Marsh Creation	Plastic Limit:	26	-200 %:	90.5
Boring No.:	Composite Sample (0254834 Borings)	Plasticity Index:	54	SPG:	2.654
Sample ID, Depth:	0 - 40 feet - Composite Sample	Classification:	Gray Clay		

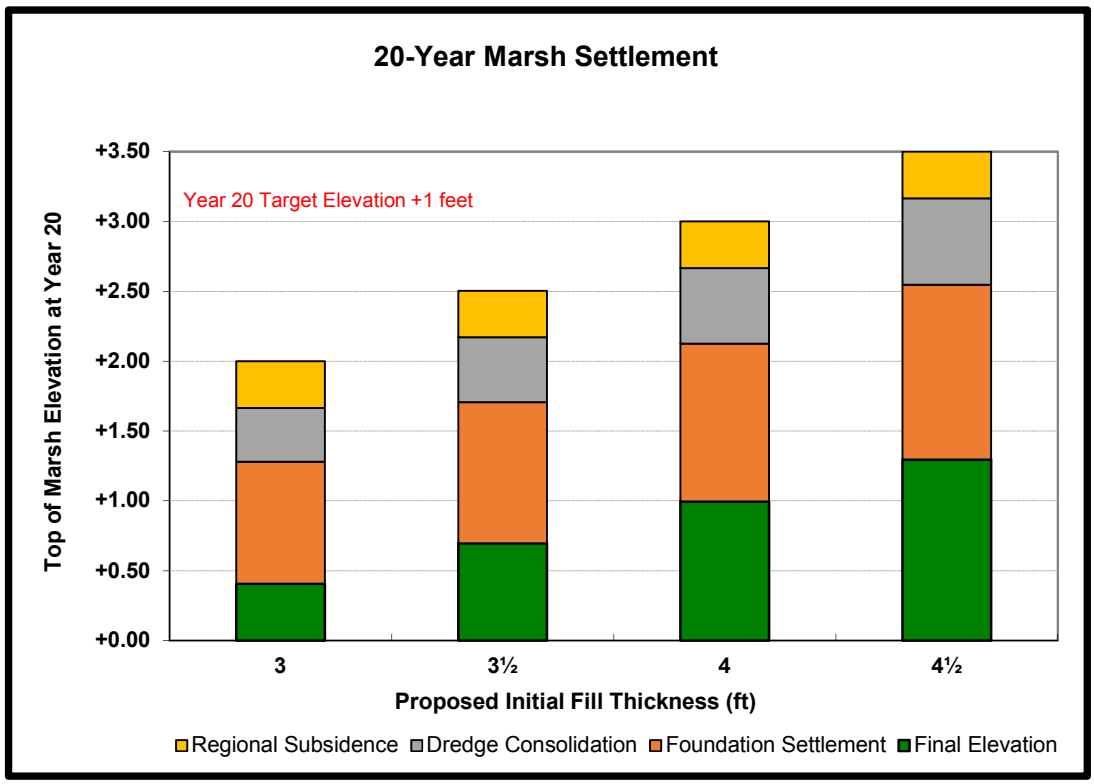
APPENDIX III

Settlement Calculation Results
Slope Stability Analyses Results

HIGH RIDGE MARINA

MARSH SETTLEMENT PROFILE

Theoretical 20-Year Settlement (inches)	Proposed Initial Fill Thickness (ft)			
	3	3½	4	4½
Primary Consolidation (Dredge Material)	4 1/2	5 1/2	6 1/2	7 1/2
Primary Consolidation (Foundation Material)	10 1/2	12	13 1/2	15
Secondary Consolidation	0	0	0	0
Desiccation	0	0	0	0
Regional Subsidence	4	4	4	4
TOTAL (inch)	19	21 1/2	24	26 1/2



PORT CAMERON - MARSH CREATION

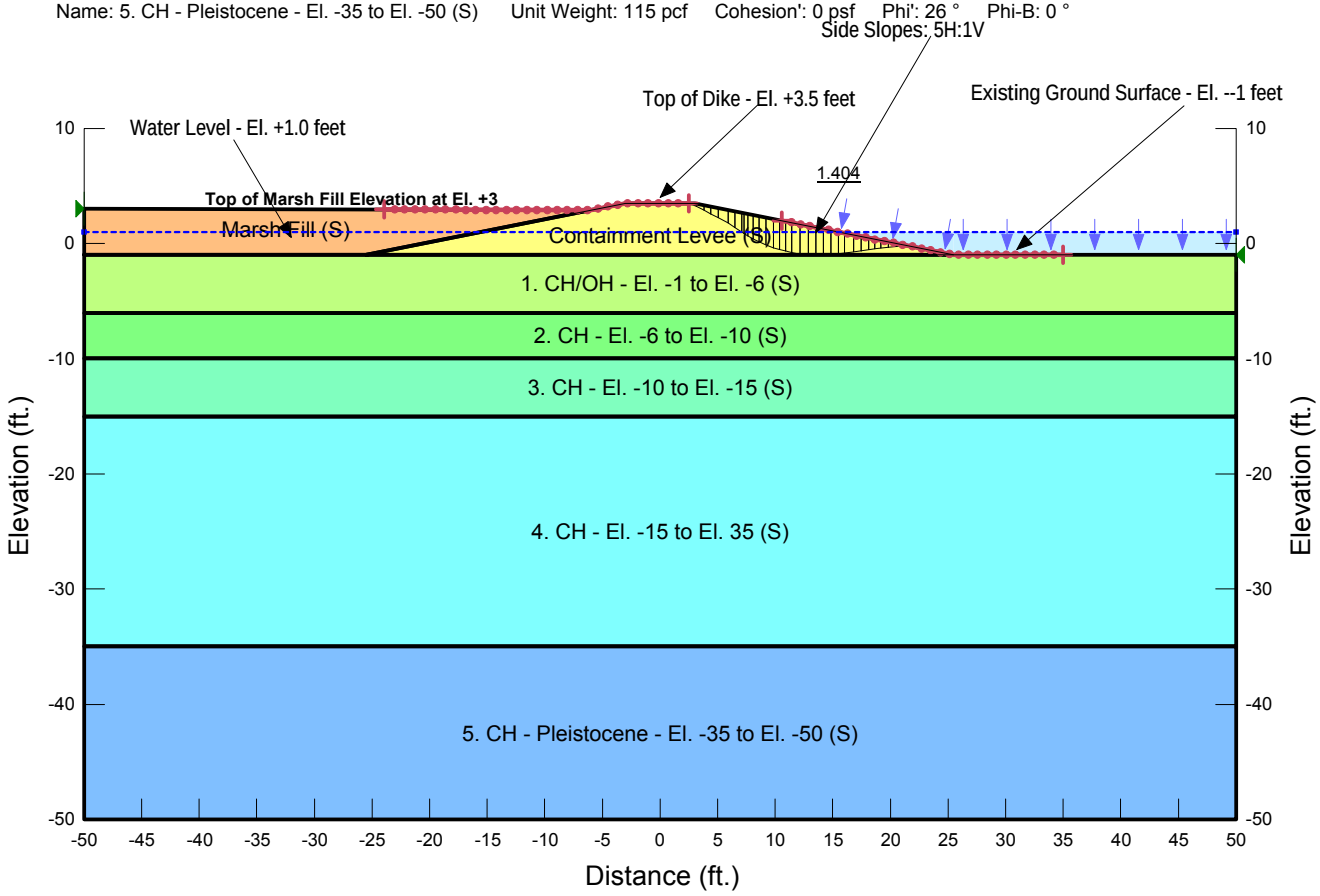
CAMERON, LOUISIANA

PSI REPORT NO. 0254869-1

Port Cameron - Marsh Creation
Containment Levee
PSI Project 0254869-1

Name: Long Term Case
Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes
F of S: 1.404

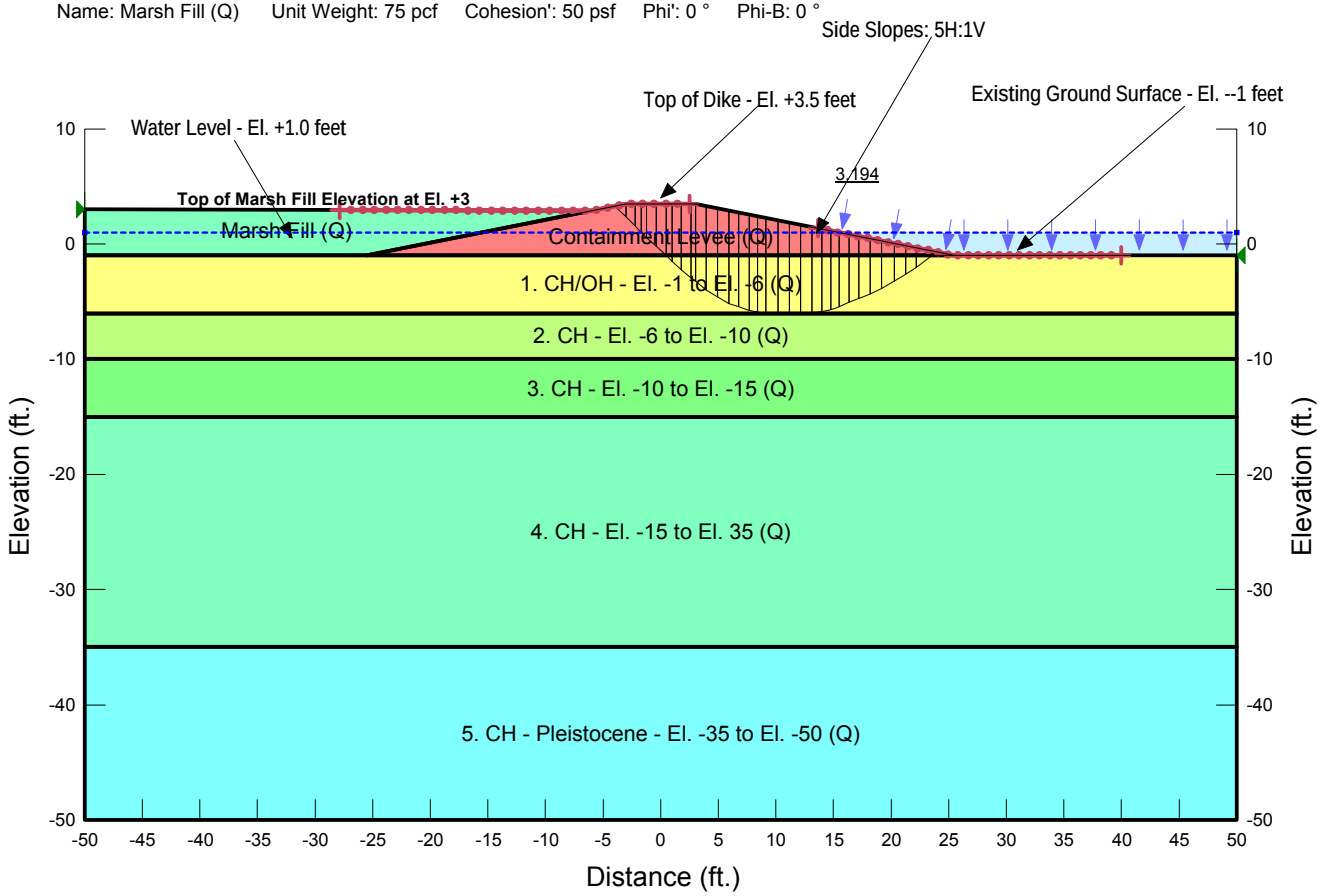
Name: Marsh Fill (S) Unit Weight: 75 pcf Cohesion': 0 psf Phi': 21 ° Phi-B: 0 °
Name: Containment Levee (S) Unit Weight: 90 pcf Cohesion': 0 psf Phi': 21 ° Phi-B: 0 °
Name: 1. CH/OH - El. -1 to El. -6 (S) Unit Weight: 100 pcf Cohesion': 0 psf Phi': 23 ° Phi-B: 0 °
Name: 2. CH - El. -6 to El. -10 (S) Unit Weight: 100 pcf Cohesion': 0 psf Phi': 23 ° Phi-B: 0 °
Name: 3. CH - El. -10 to El. -15 (S) Unit Weight: 102 pcf Cohesion': 0 psf Phi': 23 ° Phi-B: 0 °
Name: 4. CH - El. -15 to El. 35 (S) Unit Weight: 105 pcf Cohesion': 0 psf Phi': 23 ° Phi-B: 0 °
Name: 5. CH - Pleistocene - El. -35 to El. -50 (S) Unit Weight: 115 pcf Cohesion': 0 psf Phi': 26 ° Phi-B: 0 °



Port Cameron - Marsh Creation
Containment Levee
PSI Project 0254869-1

Name: Q- Case - After Construction
Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes
F of S: 3.194

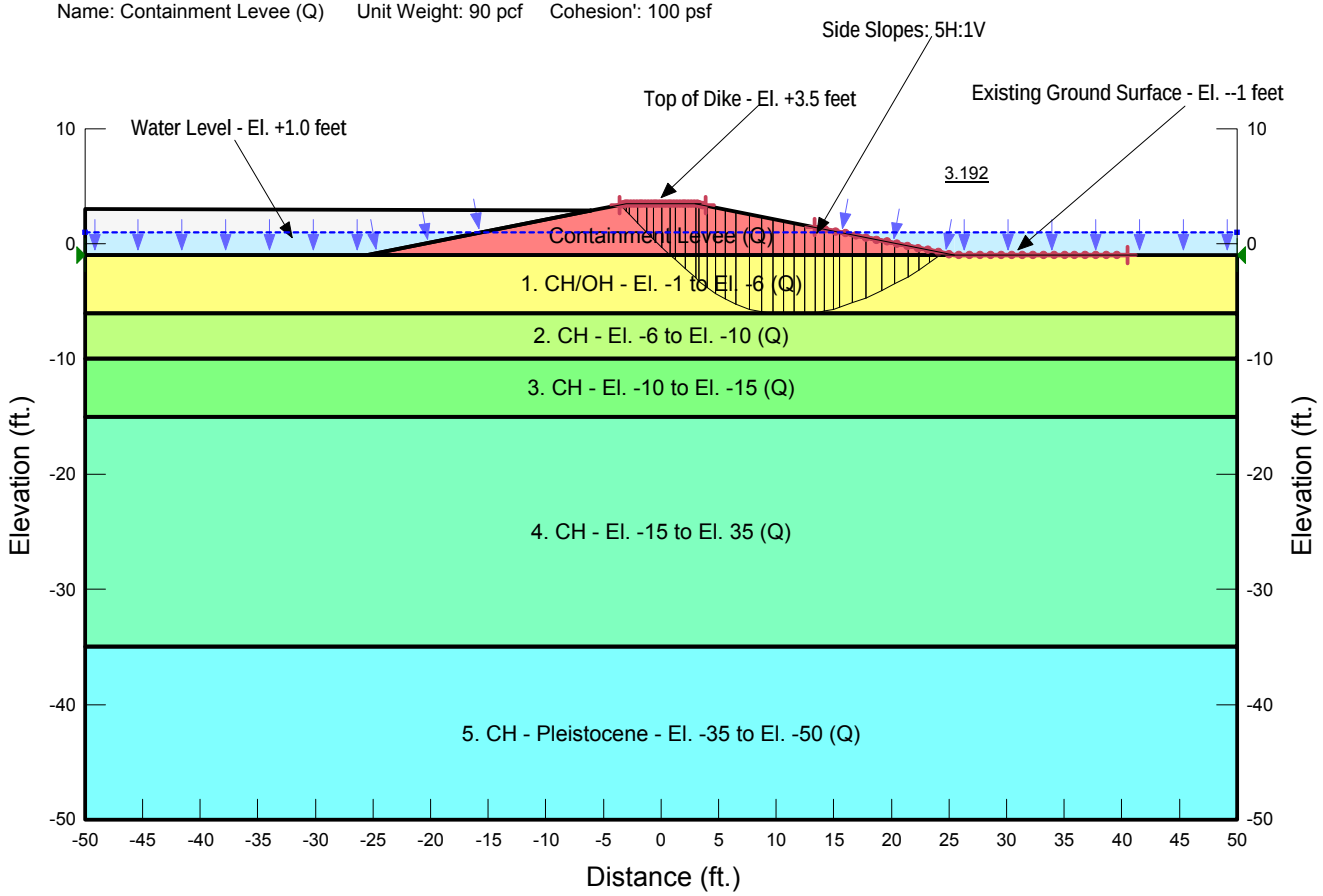
Name: 1. CH/OH - El. -1 to El. -6 (Q) Unit Weight: 100 pcf Cohesion': 150 psf
Name: 2. CH - El. -6 to El. -10 (Q) Unit Weight: 100 pcf Cohesion': 200 psf
Name: 3. CH - El. -10 to El. -15 (Q) Unit Weight: 102 pcf Cohesion': 180 psf
Name: 4. CH - El. -15 to El. 35 (Q) Unit Weight: 105 pcf C-Top of Layer: 180 psf C-Rate of Change: 10 psf/ft C-Maximum: 380 psf
Name: 5. CH - Pleistocene - El. -35 to El. -50 (Q) Unit Weight: 85 pcf Cohesion': 750 psf
Name: Containment Levee (Q) Unit Weight: 90 pcf Cohesion': 100 psf
Name: Marsh Fill (Q) Unit Weight: 75 pcf Cohesion': 50 psf Phi': 0 ° Phi-B: 0 °



Port Cameron - Marsh Creation
Containment Levee
PSI Project 0254869-1

Name: Q- Case - During Construction
Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes
F of S: 3.192

Name: 1. CH/OH - El. -1 to El. -6 (Q) Unit Weight: 100 pcf Cohesion': 150 psf
Name: 2. CH - El. -6 to El. -10 (Q) Unit Weight: 100 pcf Cohesion': 200 psf
Name: 3. CH - El. -10 to El. -15 (Q) Unit Weight: 102 pcf Cohesion': 180 psf
Name: 4. CH - El. -15 to El. 35 (Q) Unit Weight: 105 pcf C-Top of Layer: 180 psf C-Rate of Change: 10 psf/ft C-Maximum: 380 psf
Name: 5. CH - Pleistocene - El. -35 to El. -50 (Q) Unit Weight: 85 pcf Cohesion': 750 psf
Name: Containment Levee (Q) Unit Weight: 90 pcf Cohesion': 100 psf



APPENDIX IV

PSDDF Soil and Weather Input Parameters
PSDDF Output File for Four (4) Feet of Fill
Settle 3D Output for Four (4) Feet of Fill
Column Settling Report and Test Results
Bulk Factor Calculation for Dredged Fill

PSDDF Soil Input Parameters

Project Name: Port Cameron-Marsh Creation
PSI Project No.: 0254869

Soil Stratum: Dredged Fill
Soil Type: CH (Composite Sample)

SG	2.654
Cα/Cc	0.02
Cr/Cc	0.15
e_{DL}	0.823
e_{SL}	1.44
S_{DL}	0.50
e_0	1.88
Evap. Eff.	0.75
Drain. Eff.	0.3

e	σ (psf)	k
2.50	0	0.0010000
2.19	10	0.0010000
1.90	20	0.0010000
1.84	50	0.0000500
1.71	100	0.0012800
1.57	200	0.0004400
1.44	400	0.0002100
1.30	800	0.0001400
1.16	1600	0.0000600

Soil Stratum: Foundation Layer 1
Soil Type: Fat Clay (CH)

SG	2.65
Cα/Cc	0.02
Cr/Cc	0.15

e	σ (psf)	k
2.02	0	0.0005800
2.00	250	0.0005200
1.98	500	0.0005600
1.92	1000	0.0004900
1.66	2000	0.0001240
1.44	4000	0.0000630
1.27	8000	0.0000230
1.12	16000	0.0000130

Soil Stratum: Foundation Layer 2
Soil Type: Fat Clay (CH)

SG	2.73
Cα/Cc	0.02
Cr/Cc	0.15

e	σ (psf)	k
1.27	0	0.000858
1.26	125	0.000858
1.25	250	0.000060
1.23	500	0.000028
1.20	1000	0.000048
1.14	2000	0.000042
0.89	4000	0.000043
0.80	8000	0.0000085
0.71	16000	0.000007

Soil Stratum: Foundation Layer 3

Soil Type: Organic Clay (OH)

SG	2.43
Cα/Cc	0.02
Cr/Cc	0.15

e	σ (psf)	k
1.05	0	0.000013
1.04	1000	0.000010
1.02	2000	0.000009
0.99	4000	0.000011
0.94	8000	0.000006
0.85	16000	0.000004
0.70	32000	0.000002

PSDDF Weather Input Parameters

Project Name: Port Cameron-Marsh Creation
PSI Project No.: 254869

Summary of Monthly Rainfall and Evaporation Potential (feet)
Cameron, Louisiana NOAA Station

Month	Rainfall	Evaporation
January	0.42	0.21
February	0.30	0.25
March	0.32	0.37
April	0.30	0.45
May	0.37	0.55
June	0.59	0.56
July	0.54	0.55
August	0.40	0.50
September	0.43	0.46
October	0.42	0.41
November	0.37	0.27
December	0.39	0.21

Source: "Climate Data Online", National Climatic Data Center, National Oceanic and Atmospheric Administration, http://www7.ncdc.noaa.gov/CDO/cdo

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Consolidation and desiccation dredged fill
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Problem Settlement of Dredge Fill

**********Soil data for compressible foundation**********

Material Type	Layer Thickness	Numbers of Sub-layers	Ca/Cc	Cr/Cc
4	15.00	15	.020	.150
3	23.00	20	.020	.150
2	12.00	12	.020	.150

Material type : 2 Specific Gravity of Solids: 2.65

I	Void Ratio	Effective Stress	Perm-eability	k/1+e PK	Beta	Dsde	Alpha
1	2.020	.000E+00	.580E-03	.192E-03	.936E-03	-.125E+05	-.240E+01
2	2.000	.250E+03	.520E-03	.173E-03	.103E-03	-.125E+05	-.217E+01
3	1.980	.500E+03	.560E-03	.188E-03	.691E-04	-.937E+04	-.176E+01
4	1.920	.100E+04	.490E-03	.168E-03	.442E-03	-.469E+04	-.787E+00
5	1.660	.200E+04	.124E-03	.466E-04	.296E-03	-.625E+04	-.291E+00
6	1.440	.400E+04	.630E-04	.258E-04	.935E-04	-.154E+05	-.397E+00
7	1.270	.800E+04	.230E-04	.101E-04	.615E-04	-.375E+05	-.380E+00
8	1.120	.160E+05	.130E-04	.613E-05	.267E-04	-.533E+05	-.327E+00

Material type : 3 Specific Gravity of Solids: 2.73

I	Void Ratio	Effective Stress	Perm-eability	k/1+e PK	Beta	Dsde	Alpha
1	1.270	.000E+00	.858E-03	.378E-03	-.167E-03	-.125E+05	-.472E+01
2	1.260	.125E+03	.858E-03	.380E-03	.176E-01	-.125E+05	-.475E+01
3	1.250	.250E+03	.600E-04	.267E-04	.122E-01	-.125E+05	-.333E+00
4	1.230	.500E+03	.280E-04	.126E-04	.970E-04	-.150E+05	-.188E+00
5	1.200	.100E+04	.480E-04	.218E-04	-.786E-04	-.167E+05	-.364E+00
6	1.140	.200E+04	.420E-04	.196E-04	-.301E-05	-.968E+04	-.190E+00
7	.890	.400E+04	.430E-04	.228E-04	.438E-04	-.176E+05	-.401E+00
8	.800	.800E+04	.850E-05	.472E-05	.104E-03	-.667E+05	-.315E+00
9	.710	.160E+05	.700E-05	.409E-05	.699E-05	-.889E+05	-.364E+00

Material type : 4 Specific Gravity of Solids: 2.43

I	Void Ratio	Effective Stress	Perm-eability	k/1+e PK	Beta	Dsde	Alpha
1	1.050	.000E+00	.130E-04	.634E-05	.144E-03	-.100E+06	-.634E+00
2	1.040	.100E+04	.100E-04	.490E-05	.629E-04	-.667E+05	-.327E+00
3	1.020	.200E+04	.900E-05	.446E-05	-.125E-04	-.600E+05	-.267E+00
4	.990	.400E+04	.110E-04	.553E-05	.170E-04	-.750E+05	-.415E+00
5	.940	.800E+04	.600E-05	.309E-05	.240E-04	-.857E+05	-.265E+00
6	.850	.160E+05	.400E-05	.216E-05	.798E-05	-.100E+06	-.216E+00
7	.700	.320E+05	.200E-05	.118E-05	.657E-05	-.107E+06	-.125E+00

**********Soil data for dredged fill**********

Material Type	Specific Gravity	Ca/Cc	Cr/Cc	Saturation Limit	Disication Limit
1	2.654	.020	.150	1.440	.823

Material type : 1

I	Void Ratio	Effective Stress	Perm-eability	k/1+e PK	Beta	Dsde	Alpha
1	2.500	.000E+00	.100E-02	.286E-03	-.896E-04	-.323E+02	-.922E-02
2	2.190	.100E+02	.100E-02	.313E-03	-.985E-04	-.333E+02	-.104E-01
3	1.900	.200E+02	.100E-02	.345E-03	.845E-03	-.114E+03	-.394E-01
4	1.840	.500E+02	.500E-04	.176E-04	-.671E-03	-.421E+03	-.741E-02
5	1.710	.100E+03	.128E-02	.472E-03	-.569E-03	-.556E+03	-.262E+00
6	1.570	.200E+03	.440E-03	.171E-03	.143E-02	-.111E+04	-.190E+00
7	1.440	.400E+03	.210E-03	.861E-04	.409E-03	-.222E+04	-.191E+00
8	1.300	.800E+03	.140E-03	.609E-04	.208E-03	-.429E+04	-.261E+00
9	1.160	.160E+04	.600E-04	.278E-04	.236E-03	-.571E+04	-.159E+00

Summary of lifts and print detail

Time days	Material Type	Fill Height	# Sub-layers	Void ratio	Start Day	Dessic. Month	Print detai
0.	1	4.0	4	2.49	30.	6	1
30.					10000.	1	1
60.					10000.	1	1
90.					10000.	6	1
180.					10000.	6	1
365.					10000.	6	1
730.					10000.	1	1
1095.					10000.	1	1
1495.					10000.	1	1
1825.					10000.	1	1
2555.					10000.	1	1
3650.					10000.	1	1
5475.					10000.	1	1
7300.					10000.	1	1

Summary of monthly rainfall and evaporation potential

Month	Rainfall	Evaporation
1	.420	.210
2	.300	.250
3	.320	.370
4	.300	.450
5	.370	.550

6	.590	.560
7	.540	.550
8	.400	.500
9	.430	.460
10	.420	.410
11	.370	.270
12	.390	.210

**********Calculation data**********

tau	Lower layer Void ratio	Lower layer Permeability	drainage path Length
1.43	.500	.10000E-01	z = .67

Summary of desiccation parameters

Parameter	Value
Surface Drainage Efficiency	.30
maximum evaporation efficiency	.75
saturation at desiccation limit	.50
maximum crust thickness	1.50
time to desic. after initial fill	30.00
month of initial desiccation	6
elevation of fixed water table	.00
elevation of top of incompres. found.	-51.00

**********Initial Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	50.00	21.86	2.02	2.02	2.01
48.99	48.99	21.52	2.02	2.02	2.01
47.99	47.99	21.19	2.01	2.01	2.01
46.99	46.99	20.86	2.01	2.01	2.00
45.98	45.98	20.53	2.01	2.01	2.00
44.98	44.98	20.19	2.01	2.01	2.00
43.98	43.98	19.86	2.00	2.00	1.99
42.98	42.98	19.53	2.00	2.00	1.99

Material
2
2
2
2
2
2
2
2

2	41.98	41.98	19.19	2.00	2.00	1.99
2	40.99	40.99	18.86	2.00	2.00	1.99
2	39.99	39.99	18.53	1.99	1.99	1.98
2	38.99	38.99	18.19	1.99	1.99	1.98
2	38.00	38.00	17.86	1.99	1.99	1.98
3	38.00	38.00	17.86	1.24	1.24	1.23
3	36.83	36.83	17.34	1.23	1.23	1.22
3	35.67	35.67	16.82	1.23	1.23	1.22
3	34.50	34.50	16.29	1.23	1.23	1.22
3	33.34	33.34	15.77	1.22	1.22	1.21
3	32.18	32.18	15.25	1.22	1.22	1.21
3	31.02	31.02	14.73	1.22	1.22	1.21
3	29.87	29.87	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.56	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	14.00	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02

4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	50.00	367.89	.00	367.89	249.60	118.29
2	48.99	464.88	34.28	430.60	312.31	118.29
2	47.99	561.81	68.56	493.25	374.96	118.29
2	46.99	658.69	102.83	555.85	437.56	118.29
2	45.98	755.50	137.11	618.39	500.10	118.29
2	44.98	852.26	171.39	680.87	562.58	118.29
2	43.98	948.97	205.67	743.30	625.01	118.29
2	42.98	1045.61	239.94	805.67	687.38	118.29
2	41.98	1142.20	274.22	867.98	749.69	118.29
2	40.99	1238.74	308.50	930.23	811.94	118.29
2	39.99	1335.21	342.78	992.43	874.14	118.29
2	38.99	1431.63	377.06	1054.57	936.28	118.29
2	38.00	1527.99	411.34	1116.66	998.37	118.29
3	38.00	1527.99	411.34	1116.66	998.37	118.29
3	36.83	1657.22	467.72	1189.50	1071.20	118.29
3	35.67	1786.30	524.11	1262.19	1143.90	118.29
3	34.50	1915.26	580.49	1334.77	1216.48	118.29
3	33.34	2044.12	636.88	1407.24	1288.95	118.29
3	32.18	2172.86	693.26	1479.60	1361.31	118.29
3	31.02	2301.49	749.65	1551.85	1433.56	118.29
3	29.87	2430.02	806.03	1623.99	1505.69	118.29
3	28.71	2558.43	862.42	1696.01	1577.72	118.29
3	27.56	2686.73	918.80	1767.93	1649.64	118.29
3	26.41	2814.92	975.19	1839.74	1721.45	118.29
3	25.26	2943.01	1031.57	1911.44	1793.14	118.29
3	24.11	3070.98	1087.96	1983.02	1864.73	118.29
3	22.97	3198.84	1144.34	2054.50	1936.21	118.29

21.82	3326.59	1200.73	2125.86	2007.57	118.29	3
20.68	3454.23	1257.11	2197.12	2078.83	118.29	3
19.54	3581.76	1313.50	2268.27	2149.97	118.29	3
18.40	3709.18	1369.88	2339.30	2221.01	118.29	3
17.27	3836.49	1426.27	2410.23	2291.93	118.29	3
16.13	3963.69	1482.65	2481.04	2362.75	118.29	3
15.00	4090.78	1539.04	2551.75	2433.45	118.29	3
15.00	4090.78	1539.04	2551.75	2433.45	118.29	4
14.00	4197.48	1583.15	2614.33	2496.04	118.29	4
12.99	4304.15	1627.26	2676.89	2558.60	118.29	4
11.99	4410.79	1671.38	2739.42	2621.13	118.29	4
10.99	4517.41	1715.49	2801.92	2683.63	118.29	4
9.99	4624.00	1759.60	2864.40	2746.10	118.29	4
8.99	4730.56	1803.72	2926.84	2808.55	118.29	4
7.99	4837.09	1847.83	2989.27	2870.97	118.29	4
6.99	4943.60	1891.94	3051.66	2933.37	118.29	4
5.99	5050.08	1936.06	3114.03	2995.74	118.29	4
4.99	5156.53	1980.17	3176.37	3058.07	118.29	4
3.99	5262.96	2024.28	3238.68	3120.39	118.29	4
2.99	5369.37	2068.39	3300.97	3182.68	118.29	4
1.99	5475.75	2112.51	3363.24	3244.95	118.29	4
1.00	5582.12	2156.63	3425.49	3307.20	118.29	4
.00	5688.46	2200.73	3487.73	3369.44	118.29	4

Time = 0. Degree of Consolidation = 0.%

Total Settlement = .000

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 0. = .000

Settlement caused by Secondary Compression at time 0. = .000

**********Initial Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	4.00	1.15	2.49	2.49	2.50	1

3.00	3.00	.86	2.49	2.49	1.88
2.00	2.00	.57	2.49	2.49	1.82
1.00	1.00	.29	2.49	2.49	1.74
.00	.00	.00	2.49	2.49	1.68

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
4.00	.00	.00	.00	.00	.00
3.00	91.97	.00	91.97	62.40	29.57
2.00	183.95	.00	183.95	124.80	59.15
1.00	275.92	.00	275.92	187.20	88.72
.00	367.89	.00	367.89	249.60	118.29

Time = 0. Degree of Consolidation = 0.%

Total Settlement = .000

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 0. = .000

Settlement caused by Secondary Compression at time 0. = .000

**********Current Conditions in Compressible Foundation**********

	***** Coordinates *****		***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.99	21.86	2.02	2.02	2.01
48.99	48.99	21.52	2.02	2.02	2.01
47.99	47.99	21.19	2.01	2.01	2.01
46.99	46.98	20.86	2.01	2.01	2.00
45.98	45.98	20.53	2.01	2.01	2.00
44.98	44.98	20.19	2.01	2.01	2.00
43.98	43.98	19.86	2.00	2.00	1.99
42.98	42.98	19.53	2.00	2.00	1.99
41.98	41.98	19.19	2.00	2.00	1.99
40.99	40.98	18.86	2.00	2.00	1.99
39.99	39.99	18.53	1.99	1.99	1.98
38.99	38.99	18.19	1.99	1.99	1.98

2	38.00	38.00	17.86	1.99	1.99	1.98
3	38.00	38.00	17.86	1.24	1.24	1.23
3	36.83	36.83	17.34	1.23	1.23	1.22
3	35.67	35.66	16.82	1.23	1.23	1.22
3	34.50	34.50	16.29	1.23	1.23	1.22
3	33.34	33.34	15.77	1.22	1.22	1.21
3	32.18	32.18	15.25	1.22	1.22	1.21
3	31.02	31.02	14.73	1.22	1.21	1.21
3	29.87	29.87	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.56	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	14.00	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02

	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02
4						

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.99	363.16	27.88	335.28	244.86	90.41
2	48.99	460.10	56.39	403.71	307.53	96.18
2	47.99	557.00	85.44	471.56	370.15	101.41
2	46.98	653.85	115.02	538.84	432.73	106.11
2	45.98	750.65	145.36	605.29	495.25	110.04
2	44.98	847.40	176.43	670.97	557.72	113.25
2	43.98	944.10	208.32	735.78	620.14	115.64
2	42.98	1040.74	240.90	799.85	682.51	117.34
2	41.98	1137.33	274.26	863.07	744.82	118.25
2	40.98	1233.86	308.50	925.36	807.07	118.29
2	39.99	1330.34	342.78	987.56	869.27	118.29
2	38.99	1426.76	377.06	1049.70	931.41	118.29
2	38.00	1523.12	411.51	1111.61	993.49	118.11
2	38.00	1523.12	411.51	1111.61	993.49	118.11
3	36.83	1652.34	470.81	1181.53	1066.32	115.21
3	35.66	1781.42	524.11	1257.31	1139.02	118.29
3	34.50	1910.38	582.58	1327.79	1211.59	116.20
3	33.34	2039.23	639.17	1400.06	1284.06	116.00
3	32.18	2167.97	695.47	1472.49	1356.41	116.08
3	31.02	2296.59	751.74	1544.85	1428.66	116.19
3	29.87	2425.11	808.01	1617.11	1500.79	116.32
3	28.71	2553.52	864.25	1689.27	1572.82	116.45
3	27.56	2681.82	920.36	1761.46	1644.73	116.73
3	26.41	2810.01	975.97	1834.05	1716.53	117.51
3	25.26	2938.09	1031.57	1906.52	1788.23	118.29
3	24.11	3066.06	1087.96	1978.11	1859.82	118.29
3	22.97	3193.93	1144.34	2049.59	1931.29	118.29
3	21.82	3321.68	1200.73	2120.95	2002.66	118.29
3	20.68	3449.32	1257.11	2192.21	2073.92	118.29
3	19.54	3576.85	1313.50	2263.35	2145.06	118.29
3	18.40	3704.27	1369.88	2334.39	2216.10	118.29
3						

3	17.27	3831.58	1426.27	2405.31	2287.02	118.29
3	16.13	3958.78	1482.65	2476.13	2357.84	118.29
3	15.00	4085.87	1539.04	2546.83	2428.54	118.29
4	15.00	4085.87	1539.04	2546.83	2428.54	118.29
4	14.00	4192.57	1583.15	2609.42	2491.13	118.29
4	12.99	4299.24	1627.26	2671.98	2553.68	118.29
4	11.99	4405.88	1671.38	2734.51	2616.21	118.29
4	10.99	4512.50	1715.49	2797.01	2678.72	118.29
4	9.99	4619.09	1759.60	2859.48	2741.19	118.29
4	8.99	4725.65	1803.72	2921.93	2803.64	118.29
4	7.99	4832.18	1847.83	2984.35	2866.06	118.29
4	6.99	4938.69	1891.94	3046.75	2928.46	118.29
4	5.99	5045.17	1936.06	3109.11	2990.82	118.29
4	4.99	5151.62	1980.17	3171.45	3053.16	118.29
4	3.99	5258.05	2024.28	3233.77	3115.48	118.29
4	2.99	5364.45	2069.87	3294.58	3177.77	116.81
4	1.99	5470.84	2121.53	3349.31	3240.04	109.27
4	1.00	5577.19	2197.82	3379.38	3302.28	77.10
4	.00	5683.50	2319.03	3364.47	3364.48	.00

Time = 31. Degree of Consolidation = 3.%

Total Settlement = .004

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 31. = .004

Settlement caused by Secondary Compression at time 31. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	3.92	1.15	2.49	2.49	2.50	1
3.00	2.92	.86	2.49	2.49	1.88	1
2.00	1.92	.57	2.49	2.49	1.82	1
1.00	.92	.29	2.49	2.44	1.74	1
.00	.00	.00	2.49	1.88	1.68	1

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.92	.00	.00	.00	.00	.00
2.92	92.26	.32	91.94	62.69	29.25
1.92	183.94	.36	183.58	124.79	58.79
.92	275.90	1.83	274.07	187.18	86.89
.00	363.16	27.88	335.28	244.86	90.42

Time = 31. Degree of Consolidation = 10.%

Total Settlement = .076

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 31. = .076

Settlement caused by Secondary Compression at time 31. = .000

Settlement Due to Desiccation = .000

Surface Elevation = 2.92

**********Current Conditions in Compressible Foundation**********

	***** Coordinates *****		***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.99	21.86	2.02	2.02	2.01
48.99	48.99	21.52	2.02	2.02	2.01
47.99	47.98	21.19	2.01	2.01	2.01
46.99	46.98	20.86	2.01	2.01	2.00
45.98	45.98	20.53	2.01	2.01	2.00
44.98	44.98	20.19	2.01	2.01	2.00
43.98	43.98	19.86	2.00	2.00	1.99
42.98	42.98	19.53	2.00	2.00	1.99
41.98	41.98	19.19	2.00	2.00	1.99
40.99	40.98	18.86	2.00	2.00	1.99
39.99	39.99	18.53	1.99	1.99	1.98
38.99	38.99	18.19	1.99	1.99	1.98
38.00	38.00	17.86	1.99	1.99	1.98
38.00	38.00	17.86	1.24	1.24	1.23

Material
1
1
1
1
1
2
2
2
2
2
2
2
2
2
2
3

3	36.83	36.83	17.34	1.23	1.23	1.22
3	35.67	35.66	16.82	1.23	1.23	1.22
3	34.50	34.50	16.29	1.23	1.22	1.22
3	33.34	33.34	15.77	1.22	1.22	1.21
3	32.18	32.18	15.25	1.22	1.22	1.21
3	31.02	31.02	14.73	1.22	1.21	1.21
3	29.87	29.87	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.56	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	14.00	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
Material					
49.99	362.14	29.76	332.38	243.85	88.53
2					
48.99	459.09	59.19	399.90	306.52	93.38
2					
47.98	555.98	88.88	467.10	369.13	97.97
2					
46.98	652.82	118.86	533.97	431.70	102.27
2					
45.98	749.62	149.20	600.42	494.21	106.21
2					
44.98	846.36	179.96	666.40	556.68	109.72
2					
43.98	943.05	211.19	731.86	619.09	112.77
2					
42.98	1039.69	242.94	796.75	681.46	115.30
2					
41.98	1136.28	275.36	860.92	743.76	117.16
2					
40.98	1232.81	308.62	924.19	806.02	118.17
2					
39.99	1329.29	342.78	986.51	868.21	118.29
2					
38.99	1425.71	377.06	1048.65	930.36	118.29
2					
38.00	1522.07	411.58	1110.49	992.44	118.05
2					
38.00	1522.07	411.58	1110.49	992.44	118.05
3					
36.83	1651.28	471.90	1179.38	1065.27	114.11
3					
35.66	1780.36	524.32	1256.04	1137.96	118.08
3					
34.50	1909.32	584.14	1325.18	1210.54	114.65
3					
33.34	2038.16	641.21	1396.96	1283.00	113.96
3					
32.18	2166.90	697.54	1469.35	1355.35	114.01
3					
31.02	2295.52	753.73	1541.80	1427.59	114.21
3					
29.87	2424.04	809.86	1614.18	1499.72	114.46
3					
28.71	2552.44	865.90	1686.55	1571.74	114.81
3					
27.56	2680.74	921.63	1759.11	1643.65	115.46
3					
26.41	2808.93	976.64	1832.29	1715.45	116.84
3					
25.26	2937.01	1031.59	1905.42	1787.15	118.27
3					
24.11	3064.98	1087.96	1977.02	1858.73	118.29
3					
22.97	3192.84	1144.34	2048.50	1930.21	118.29
3					
21.82	3320.59	1200.73	2119.87	2001.58	118.29
3					
20.68	3448.23	1257.11	2191.12	2072.83	118.29
3					
19.54	3575.77	1313.50	2262.27	2143.98	118.29
3					
18.40	3703.19	1369.88	2333.30	2215.01	118.29
3					
17.27	3830.50	1426.27	2404.23	2285.94	118.29
3					
16.13	3957.70	1482.65	2475.04	2356.75	118.29
3					

15.00	4084.78	1539.04	2545.75	2427.46	118.29	3
15.00	4084.78	1539.04	2545.75	2427.46	118.29	4
14.00	4191.48	1583.15	2608.33	2490.04	118.29	4
12.99	4298.15	1627.26	2670.89	2552.60	118.29	4
11.99	4404.80	1671.38	2733.42	2615.13	118.29	4
10.99	4511.41	1715.49	2795.92	2677.63	118.29	4
9.99	4618.00	1759.60	2858.40	2740.11	118.29	4
8.99	4724.56	1803.72	2920.85	2802.56	118.29	4
7.99	4831.10	1847.83	2983.27	2864.98	118.29	4
6.99	4937.61	1891.94	3045.66	2927.37	118.29	4
5.99	5044.09	1936.06	3108.03	2989.74	118.29	4
4.99	5150.54	1980.17	3170.37	3052.08	118.29	4
3.99	5256.97	2024.28	3232.69	3114.39	118.29	4
2.99	5363.37	2074.69	3288.68	3176.68	112.00	4
1.99	5469.75	2134.98	3334.76	3238.95	95.82	4
1.00	5576.10	2216.51	3359.59	3301.18	58.41	4
.00	5682.40	2319.03	3363.37	3363.37	.00	4

Time = 61. Degree of Consolidation = 4.%

Total Settlement = .005

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 61. = .005

Settlement caused by Secondary Compression at time 61. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	3.91	1.15	2.49	2.49	2.50	1
3.00	2.91	.86	2.49	2.49	1.88	1
2.00	1.91	.57	2.49	2.49	1.82	1
1.00	.92	.29	2.49	2.40	1.74	1
.00	.00	.00	2.49	1.88	1.68	1

***** Stresses ***** ***** Pore Pressures *****

XI	Total	Effective	Total	Static	Excess	Material
3.91	.00	.00	.00	.00	.00	1
2.91	92.13	.33	91.81	62.56	29.25	1
1.91	183.92	.45	183.47	124.77	58.70	1
.92	275.47	3.12	272.35	186.75	85.60	1
.00	362.14	29.76	332.38	243.85	88.53	1

Time = 61. Degree of Consolidation = 13.%

Total Settlement = .092

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 61. = .092

Settlement caused by Secondary Compression at time 61. = .000

Surface Elevation = 2.90

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
50.00	49.99	21.86	2.02	2.02	2.01	2
48.99	48.99	21.52	2.02	2.02	2.01	2
47.99	47.98	21.19	2.01	2.01	2.01	2
46.99	46.98	20.86	2.01	2.01	2.00	2
45.98	45.98	20.53	2.01	2.01	2.00	2
44.98	44.98	20.19	2.01	2.01	2.00	2
43.98	43.98	19.86	2.00	2.00	1.99	2
42.98	42.98	19.53	2.00	2.00	1.99	2
41.98	41.98	19.19	2.00	2.00	1.99	2
40.99	40.98	18.86	2.00	2.00	1.99	2
39.99	39.99	18.53	1.99	1.99	1.98	2
38.99	38.99	18.19	1.99	1.99	1.98	2
38.00	38.00	17.86	1.99	1.99	1.98	2
38.00	38.00	17.86	1.24	1.24	1.23	3
36.83	36.83	17.34	1.23	1.23	1.22	3
35.67	35.66	16.82	1.23	1.23	1.22	3
34.50	34.50	16.29	1.23	1.22	1.22	3

3	33.34	33.34	15.77	1.22	1.22	1.21
3	32.18	32.18	15.25	1.22	1.22	1.21
3	31.02	31.02	14.73	1.22	1.21	1.21
3	29.87	29.87	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.56	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	14.00	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess

Material

22	49.99	361.23	30.91	330.32	242.94	87.38
22	48.99	458.18	60.61	397.57	305.61	91.96
22	47.98	555.07	90.50	464.56	368.22	96.34
22	46.98	651.91	120.60	531.31	430.78	100.53
22	45.98	748.70	150.96	597.74	493.30	104.44
22	44.98	845.44	181.64	663.80	555.76	108.04
22	43.98	942.13	212.68	729.44	618.17	111.27
22	42.98	1038.77	244.15	794.62	680.53	114.09
22	41.98	1135.35	276.22	859.13	742.84	116.30
22	40.98	1231.88	309.07	922.81	805.09	117.72
22	39.99	1328.36	342.78	985.58	867.29	118.29
22	38.99	1424.78	377.06	1047.72	929.43	118.29
22	38.00	1521.14	411.61	1109.53	991.51	118.02
23	38.00	1521.14	411.61	1109.53	991.51	118.02
33	36.83	1650.35	472.44	1177.91	1064.34	113.58
33	35.66	1779.43	525.04	1254.38	1137.03	117.36
33	34.50	1908.38	585.55	1322.83	1209.60	113.23
33	33.34	2037.23	643.09	1394.14	1282.06	112.08
33	32.18	2165.96	699.54	1466.42	1354.41	112.01
33	31.02	2294.58	755.66	1538.91	1426.64	112.27
33	29.87	2423.09	811.65	1611.44	1498.77	112.68
33	28.71	2551.49	867.43	1684.06	1570.79	113.28
33	27.56	2679.79	922.76	1757.02	1642.69	114.33
33	26.41	2807.97	977.28	1830.69	1714.50	116.19
33	25.26	2936.05	1031.80	1904.26	1786.19	118.07
33	24.11	3064.02	1087.96	1976.07	1857.78	118.29
33	22.97	3191.89	1144.34	2047.55	1929.25	118.29
33	21.82	3319.64	1200.73	2118.91	2000.62	118.29
33	20.68	3447.28	1257.11	2190.17	2071.88	118.29
33	19.54	3574.81	1313.50	2261.31	2143.02	118.29
33	18.40	3702.23	1369.88	2332.35	2214.06	118.29
33	17.27	3829.54	1426.27	2403.27	2284.98	118.29
33	16.13	3956.74	1482.65	2474.09	2355.80	118.29
33	15.00	4083.83	1539.04	2544.79	2426.50	118.29
34	15.00	4083.83	1539.04	2544.79	2426.50	118.29
44	14.00	4190.53	1583.15	2607.38	2489.09	118.29

12.99	4297.20	1627.26	2669.93	2551.64	118.29	4
11.99	4403.84	1671.38	2732.46	2614.17	118.29	4
10.99	4510.46	1715.49	2794.97	2676.68	118.29	4
9.99	4617.05	1759.60	2857.44	2739.15	118.29	4
8.99	4723.61	1803.72	2919.89	2801.60	118.29	4
7.99	4830.14	1847.83	2982.31	2864.02	118.29	4
6.99	4936.65	1891.94	3044.71	2926.42	118.29	4
5.99	5043.13	1936.06	3107.07	2988.78	118.29	4
4.99	5149.58	1980.17	3169.41	3051.12	118.29	4
3.99	5256.01	2025.38	3230.63	3113.44	117.20	4
2.99	5362.41	2080.51	3281.91	3175.72	106.18	4
1.99	5468.79	2145.73	3323.06	3237.99	85.07	4
1.00	5575.13	2226.50	3348.63	3300.21	48.42	4
.00	5681.43	2319.03	3362.40	3362.40	.00	4

Time = 91. Degree of Consolidation = 5.%

Total Settlement = .006

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 91. = .006

Settlement caused by Secondary Compression at time 91. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	3.89	1.15	2.49	2.49	2.50	1
3.00	2.89	.86	2.49	2.49	1.88	1
2.00	1.89	.57	2.49	2.48	1.82	1
1.00	.91	.29	2.49	2.37	1.74	1
.00	.00	.00	2.49	1.88	1.68	1

***** Stresses *****			***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
3.89	.00	.00	.00	.00	.00	1
2.89	92.04	.33	91.70	62.46	29.24	1

1.89	183.89	.59	183.30	124.74	58.56	1
.91	275.06	4.25	270.80	186.34	84.47	1
.00	361.23	30.91	330.32	242.94	87.38	1

Time = 91. Degree of Consolidation = 15.%

Total Settlement = .107

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 91. = .107

Settlement caused by Secondary Compression at time 91. = .000

Surface Elevation = 2.89

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
50.00	49.99	21.86	2.02	2.02	2.01	2
48.99	48.99	21.52	2.02	2.01	2.01	2
47.99	47.98	21.19	2.01	2.01	2.01	2
46.99	46.98	20.86	2.01	2.01	2.00	2
45.98	45.98	20.53	2.01	2.01	2.00	2
44.98	44.98	20.19	2.01	2.01	2.00	2
43.98	43.98	19.86	2.00	2.00	1.99	2
42.98	42.98	19.53	2.00	2.00	1.99	2
41.98	41.98	19.19	2.00	2.00	1.99	2
40.99	40.98	18.86	2.00	2.00	1.99	2
39.99	39.98	18.53	1.99	1.99	1.98	2
38.99	38.99	18.19	1.99	1.99	1.98	2
38.00	37.99	17.86	1.99	1.99	1.98	2
38.00	37.99	17.86	1.24	1.24	1.23	3
36.83	36.83	17.34	1.23	1.23	1.22	3
35.67	35.66	16.82	1.23	1.23	1.22	3
34.50	34.50	16.29	1.23	1.22	1.22	3
33.34	33.34	15.77	1.22	1.22	1.21	3
32.18	32.18	15.25	1.22	1.22	1.21	3
31.02	31.02	14.73	1.22	1.21	1.21	3

3	29.87	29.87	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.56	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	14.00	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
Material					
2	49.99	358.98	33.29	325.69	240.68	85.01
2	48.99	455.91	63.07	392.84	303.34	89.50
2	47.98	552.80	92.99	459.81	365.95	93.86

22	46.98	649.64	123.05	526.59	428.51	98.08
22	45.98	746.42	153.30	593.12	491.02	102.10
22	44.98	843.16	183.79	659.37	553.48	105.89
22	43.98	939.85	214.57	725.27	615.89	109.39
22	42.98	1036.48	245.70	790.79	678.24	112.54
22	41.98	1133.06	277.36	855.70	740.55	115.15
22	40.98	1229.59	309.76	919.83	802.80	117.03
22	39.98	1326.07	342.98	983.09	865.00	118.10
22	38.99	1422.49	377.06	1045.43	927.14	118.29
22	37.99	1518.85	411.67	1107.18	989.22	117.96
23	37.99	1518.85	411.67	1107.18	989.22	117.96
33	36.83	1648.06	473.50	1174.56	1062.05	112.52
33	35.66	1777.13	527.84	1249.29	1134.73	114.56
33	34.50	1906.08	589.66	1316.42	1207.30	109.12
33	33.34	2034.92	648.19	1386.73	1279.75	106.98
33	32.18	2163.64	705.04	1458.59	1352.08	106.51
33	31.02	2292.25	761.07	1531.18	1424.31	106.87
33	29.87	2420.75	816.56	1604.19	1496.43	107.76
33	28.71	2549.14	871.54	1677.60	1568.43	109.17
33	27.56	2677.43	925.84	1751.59	1640.34	111.26
33	26.41	2805.61	979.23	1826.38	1712.13	114.25
33	25.26	2933.69	1032.71	1900.97	1783.82	117.15
33	24.11	3061.66	1087.96	1973.70	1855.41	118.29
33	22.97	3189.52	1144.34	2045.18	1926.89	118.29
33	21.82	3317.27	1200.73	2116.54	1998.25	118.29
33	20.68	3444.91	1257.11	2187.80	2069.51	118.29
33	19.54	3572.44	1313.50	2258.95	2140.65	118.29
33	18.40	3699.86	1369.88	2329.98	2211.69	118.29
33	17.27	3827.17	1426.27	2400.91	2282.61	118.29
33	16.13	3954.37	1482.65	2471.72	2353.43	118.29
33	15.00	4081.46	1539.04	2542.42	2424.13	118.29
34	15.00	4081.46	1539.04	2542.43	2424.13	118.29
44	14.00	4188.16	1583.15	2605.01	2486.72	118.29
44	12.99	4294.83	1627.26	2667.57	2549.28	118.29
44	11.99	4401.47	1671.38	2730.10	2611.81	118.29
44	10.99	4508.09	1715.49	2792.60	2674.31	118.29

9.99	4614.68	1759.60	2855.08	2736.78	118.29	4
8.99	4721.24	1803.72	2917.52	2799.23	118.29	4
7.99	4827.77	1847.83	2979.95	2861.65	118.29	4
6.99	4934.28	1891.94	3042.34	2924.05	118.29	4
5.99	5040.76	1936.06	3104.71	2986.42	118.29	4
4.99	5147.21	1980.17	3167.05	3048.75	118.29	4
3.99	5253.64	2032.66	3220.98	3111.07	109.91	4
2.99	5360.04	2095.56	3264.48	3173.35	91.13	4
1.99	5466.41	2164.67	3301.74	3235.61	66.13	4
1.00	5572.74	2240.15	3332.59	3297.83	34.76	4
.00	5679.04	2319.03	3360.01	3360.01	.00	4

Time = 181. Degree of Consolidation = 6.%

Total Settlement = .008

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 181. = .008

Settlement caused by Secondary Compression at time 181. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	3.86	1.15	2.49	2.49	2.50	1
3.00	2.86	.86	2.49	2.49	1.88	1
2.00	1.86	.57	2.49	2.46	1.82	1
1.00	.89	.29	2.49	2.29	1.74	1
.00	.00	.00	2.49	1.87	1.68	1

***** Stresses *****			***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
3.86	.00	.00	.00	.00	.00	1
2.86	91.85	.40	91.45	62.28	29.18	1
1.86	183.73	1.18	182.55	124.59	57.97	1
.89	273.93	6.91	267.02	185.21	81.81	1
.00	358.98	33.29	325.69	240.68	85.01	1

Time = 181. Degree of Consolidation = 20.%

Total Settlement = .143

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 181. = .143

Settlement caused by Secondary Compression at time 181. = .000

Surface Elevation = 2.85

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
50.00	49.99	21.86	2.02	2.02	2.01	2
48.99	48.98	21.52	2.02	2.01	2.01	2
47.99	47.98	21.19	2.01	2.01	2.01	2
46.99	46.98	20.86	2.01	2.01	2.00	2
45.98	45.97	20.53	2.01	2.01	2.00	2
44.98	44.97	20.19	2.01	2.01	2.00	2
43.98	43.97	19.86	2.00	2.00	1.99	2
42.98	42.97	19.53	2.00	2.00	1.99	2
41.98	41.98	19.19	2.00	2.00	1.99	2
40.99	40.98	18.86	2.00	2.00	1.99	2
39.99	39.98	18.53	1.99	1.99	1.98	2
38.99	38.99	18.19	1.99	1.99	1.98	2
38.00	37.99	17.86	1.99	1.99	1.98	2
38.00	37.99	17.86	1.24	1.24	1.23	3
36.83	36.82	17.34	1.23	1.23	1.22	3
35.67	35.66	16.82	1.23	1.23	1.22	3
34.50	34.50	16.29	1.23	1.22	1.22	3
33.34	33.34	15.77	1.22	1.22	1.21	3
32.18	32.18	15.25	1.22	1.22	1.21	3
31.02	31.02	14.73	1.22	1.21	1.21	3
29.87	29.86	14.21	1.21	1.21	1.20	3
28.71	28.71	13.68	1.21	1.21	1.20	3
27.56	27.56	13.16	1.20	1.20	1.20	3

3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.99	355.79	35.91	319.89	237.50	82.38
2	48.98	452.73	65.62	387.11	300.16	86.95
2	47.98	549.61	95.42	454.20	362.76	91.43
2	46.98	646.44	125.32	521.12	425.32	95.80
2	45.97	743.23	155.39	587.84	487.82	100.01
2	44.97	839.96	185.67	654.29	550.28	104.01

22	43.97	936.64	216.22	720.43	612.68	107.74
22	42.97	1033.28	247.08	786.20	675.04	111.16
22	41.98	1129.86	278.47	851.39	737.34	114.05
22	40.98	1226.38	310.57	915.81	799.59	116.22
22	39.98	1322.86	343.48	979.38	861.79	117.59
22	38.99	1419.28	377.25	1042.03	923.93	118.10
22	37.99	1515.64	411.95	1103.69	986.01	117.68
23	37.99	1515.64	411.95	1103.69	986.01	117.68
33	36.82	1644.84	475.45	1169.39	1058.83	110.56
33	35.66	1773.91	533.45	1240.46	1131.51	108.95
33	34.50	1902.85	597.32	1305.52	1204.06	101.46
33	33.34	2031.66	657.12	1374.55	1276.50	98.05
33	32.18	2160.37	714.46	1445.91	1348.81	97.09
33	31.02	2288.96	770.23	1518.72	1421.02	97.70
33	29.86	2417.44	824.86	1592.59	1493.12	99.47
33	28.71	2545.82	878.48	1667.34	1565.11	102.22
33	27.56	2674.10	931.15	1742.94	1637.00	105.94
33	26.41	2802.27	982.79	1819.47	1708.79	110.68
33	25.26	2930.34	1034.61	1895.73	1780.48	115.26
33	24.11	3058.31	1088.28	1970.03	1852.06	117.97
33	22.97	3186.17	1144.34	2041.83	1923.54	118.29
33	21.82	3313.92	1200.73	2113.19	1994.90	118.29
33	20.68	3441.56	1257.11	2184.45	2066.16	118.29
33	19.54	3569.09	1313.50	2255.60	2137.31	118.29
33	18.40	3696.51	1369.88	2326.63	2208.34	118.29
33	17.27	3823.82	1426.27	2397.56	2279.27	118.29
33	16.13	3951.02	1482.65	2468.37	2350.08	118.29
33	15.00	4078.11	1539.04	2539.07	2420.79	118.29
34	15.00	4078.11	1539.04	2539.08	2420.79	118.29
44	13.99	4184.81	1583.15	2601.66	2483.37	118.29
44	12.99	4291.48	1627.26	2664.22	2545.93	118.29
44	11.99	4398.12	1671.38	2726.75	2608.46	118.29
44	10.99	4504.74	1715.49	2789.25	2670.96	118.29
44	9.99	4611.33	1759.60	2851.73	2733.44	118.29
44	8.99	4717.89	1803.72	2914.18	2795.88	118.29
44	7.99	4824.43	1847.83	2976.60	2858.31	118.29

6.99	4930.93	1892.38	3038.55	2920.70	117.85	4
5.99	5037.41	1937.77	3099.65	2983.07	116.58	4
4.99	5143.86	1984.59	3159.27	3045.40	113.87	4
3.99	5250.29	2044.12	3206.16	3107.71	98.45	4
2.99	5356.68	2110.81	3245.87	3169.99	75.88	4
1.99	5463.04	2179.29	3283.75	3232.24	51.51	4
1.00	5569.36	2249.08	3320.29	3294.45	25.84	4
.00	5675.66	2319.03	3356.63	3356.63	.00	4

Time = 365. Degree of Consolidation = 9.%

Total Settlement = .011

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 365. = .011

Settlement caused by Secondary Compression at time 365. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
4.00	3.81	1.15	2.49	2.49	2.50	1
3.00	2.81	.86	2.49	2.48	1.88	1
2.00	1.82	.57	2.49	2.42	1.82	1
1.00	.87	.29	2.49	2.19	1.74	1
.00	.00	.00	2.49	1.87	1.68	1

***** Stresses *****			***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
3.81	.00	.00	.00	.00	.00	1
2.81	91.70	.71	90.99	62.13	28.86	1
1.82	183.22	2.69	180.54	124.07	56.46	1
.87	272.02	10.11	261.91	183.30	78.61	1
.00	355.79	35.91	319.89	237.50	82.38	1

Time = 365. Degree of Consolidation = 27.%

Total Settlement = .194

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 365. = .194

Settlement caused by Secondary Compression at time 365. = .000

Surface Elevation = 2.79

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.98	21.86	2.02	2.02	2.01
48.99	48.98	21.52	2.02	2.01	2.01
47.99	47.97	21.19	2.01	2.01	2.01
46.99	46.97	20.86	2.01	2.01	2.00
45.98	45.97	20.53	2.01	2.01	2.00
44.98	44.97	20.19	2.01	2.00	2.00
43.98	43.97	19.86	2.00	2.00	1.99
42.98	42.97	19.53	2.00	2.00	1.99
41.98	41.97	19.19	2.00	2.00	1.99
40.99	40.97	18.86	2.00	1.99	1.99
39.99	39.98	18.53	1.99	1.99	1.98
38.99	38.98	18.19	1.99	1.99	1.98
38.00	37.99	17.86	1.99	1.99	1.98
38.00	37.99	17.86	1.24	1.24	1.23
36.83	36.82	17.34	1.23	1.23	1.22
35.67	35.66	16.82	1.23	1.23	1.22
34.50	34.49	16.29	1.23	1.22	1.22
33.34	33.33	15.77	1.22	1.22	1.21
32.18	32.17	15.25	1.22	1.22	1.21
31.02	31.02	14.73	1.22	1.21	1.21
29.87	29.86	14.21	1.21	1.21	1.20
28.71	28.71	13.68	1.21	1.21	1.20
27.56	27.56	13.16	1.20	1.20	1.20
26.41	26.41	12.64	1.20	1.20	1.19
25.26	25.26	12.12	1.20	1.20	1.19
24.11	24.11	11.59	1.19	1.19	1.19

Material
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3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.27	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.98	349.71	39.79	309.93	231.42	78.51
2	48.98	446.64	69.42	377.22	294.07	83.15
2	47.97	543.51	99.12	444.39	356.67	87.73
2	46.97	640.34	128.95	511.40	419.22	92.18
2	45.97	737.12	158.93	578.19	481.72	96.47
2	44.97	833.85	189.14	644.71	544.17	100.54
2	43.97	930.52	219.61	710.91	606.56	104.35
2	42.97	1027.15	250.42	776.73	668.91	107.82
2	41.97	1123.73	281.78	841.95	731.21	110.74

22	40.97	1220.25	313.88	906.37	793.45	112.91
22	39.98	1316.72	346.80	969.92	855.64	114.27
22	38.98	1413.13	380.59	1032.54	917.78	114.76
23	37.99	1509.48	415.34	1094.14	979.86	114.28
33	37.99	1509.48	415.34	1094.14	979.86	114.28
33	36.82	1638.68	479.78	1158.90	1052.67	106.23
33	35.66	1767.73	543.17	1224.56	1125.33	99.23
33	34.49	1896.65	609.31	1287.34	1197.87	89.48
33	33.33	2025.44	670.38	1355.06	1270.27	84.79
33	32.17	2154.12	728.05	1426.06	1342.56	83.50
33	31.02	2282.68	783.31	1499.38	1414.75	84.63
33	29.86	2411.14	836.72	1574.42	1486.82	87.60
33	28.71	2539.50	888.66	1650.84	1558.79	92.05
33	27.56	2667.76	939.33	1728.42	1630.66	97.76
33	26.41	2795.91	988.85	1807.06	1702.44	104.63
33	25.26	2923.98	1038.64	1885.34	1774.11	111.22
33	24.11	3051.94	1090.36	1961.57	1845.69	115.88
33	22.97	3179.80	1144.40	2035.40	1917.17	118.23
33	21.82	3307.55	1200.73	2106.82	1988.53	118.29
33	20.68	3435.19	1257.11	2178.08	2059.79	118.29
33	19.54	3562.72	1313.50	2249.23	2130.93	118.29
33	18.40	3690.14	1369.88	2320.26	2201.97	118.29
33	17.27	3817.45	1426.27	2391.19	2272.89	118.29
33	16.13	3944.65	1482.65	2462.00	2343.71	118.29
33	15.00	4071.74	1539.04	2532.70	2414.41	118.29
34	15.00	4071.74	1539.04	2532.71	2414.41	118.29
44	13.99	4178.44	1583.15	2595.29	2477.00	118.29
44	12.99	4285.11	1627.26	2657.85	2539.56	118.29
44	11.99	4391.75	1671.38	2720.38	2602.09	118.29
44	10.99	4498.37	1715.49	2782.88	2664.59	118.29
44	9.99	4604.96	1759.78	2845.18	2727.06	118.11
44	8.99	4711.52	1804.57	2906.95	2789.51	117.44
44	7.99	4818.05	1849.96	2968.10	2851.93	116.16
44	6.99	4924.56	1896.16	3028.40	2914.33	114.08
44	5.99	5031.04	1943.45	3087.59	2976.69	110.90
44	4.99	5137.48	1992.10	3145.39	3039.02	106.36

3.99	5243.90	2055.47	3188.43	3101.33	87.10
2.99	5350.29	2121.67	3228.62	3163.60	65.02
1.99	5456.64	2187.84	3268.80	3225.84	42.96
1.00	5562.97	2253.73	3309.24	3288.05	21.19
.00	5669.26	2319.03	3350.23	3350.23	.00

Time = 730. Degree of Consolidation = 13.%

Total Settlement = .016

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 730. = .016

Settlement caused by Secondary Compression at time 730. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.71	1.15	2.49	2.49	2.50
3.00	2.72	.86	2.49	2.44	1.88
2.00	1.75	.57	2.49	2.29	1.82
1.00	.84	.29	2.49	2.04	1.74
.00	.00	.00	2.49	1.86	1.68

***** Stresses *****			***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.71	.00	.00	.00	.00	.00
2.72	91.54	1.95	89.59	61.97	27.62
1.75	181.54	6.84	174.70	122.39	52.30
.84	267.67	15.30	252.37	178.95	73.42
.00	349.71	39.79	309.92	231.42	78.50

Time = 730. Degree of Consolidation = 40.%

Total Settlement = .291

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 730. = .291

Settlement caused by Secondary Compression at time 730. = .000

Surface Elevation = 2.69

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
50.00	49.98	21.86	2.02	2.02	2.01	2
48.99	48.97	21.52	2.02	2.01	2.01	2
47.99	47.97	21.19	2.01	2.01	2.01	2
46.99	46.97	20.86	2.01	2.01	2.00	2
45.98	45.97	20.53	2.01	2.01	2.00	2
44.98	44.97	20.19	2.01	2.00	2.00	2
43.98	43.97	19.86	2.00	2.00	1.99	2
42.98	42.97	19.53	2.00	2.00	1.99	2
41.98	41.97	19.19	2.00	2.00	1.99	2
40.99	40.97	18.86	2.00	1.99	1.99	2
39.99	39.97	18.53	1.99	1.99	1.98	2
38.99	38.98	18.19	1.99	1.99	1.98	2
38.00	37.98	17.86	1.99	1.99	1.98	2
38.00	37.98	17.86	1.24	1.24	1.23	3
36.83	36.82	17.34	1.23	1.23	1.22	3
35.67	35.65	16.82	1.23	1.23	1.22	3
34.50	34.49	16.29	1.23	1.22	1.22	3
33.34	33.33	15.77	1.22	1.22	1.21	3
32.18	32.17	15.25	1.22	1.22	1.21	3
31.02	31.02	14.73	1.22	1.21	1.21	3
29.87	29.86	14.21	1.21	1.21	1.20	3
28.71	28.71	13.68	1.21	1.21	1.20	3
27.56	27.56	13.16	1.20	1.20	1.20	3
26.41	26.41	12.64	1.20	1.20	1.19	3
25.26	25.26	12.12	1.20	1.20	1.19	3
24.11	24.11	11.59	1.19	1.19	1.19	3
22.97	22.97	11.07	1.19	1.19	1.18	3
21.82	21.82	10.55	1.19	1.19	1.18	3
20.68	20.68	10.03	1.18	1.18	1.18	3

19.54	19.54	9.50	1.18	1.18	1.17	3
18.40	18.40	8.98	1.18	1.18	1.17	3
17.27	17.26	8.46	1.17	1.17	1.17	3
16.13	16.13	7.94	1.17	1.17	1.16	3
15.00	15.00	7.42	1.17	1.17	1.16	3
15.00	15.00	7.42	1.03	1.03	1.03	4
14.00	13.99	6.92	1.03	1.03	1.03	4
12.99	12.99	6.43	1.03	1.03	1.03	4
11.99	11.99	5.93	1.03	1.03	1.02	4
10.99	10.99	5.44	1.03	1.03	1.02	4
9.99	9.99	4.94	1.02	1.02	1.02	4
8.99	8.99	4.45	1.02	1.02	1.02	4
7.99	7.99	3.95	1.02	1.02	1.02	4
6.99	6.99	3.46	1.02	1.02	1.02	4
5.99	5.99	2.97	1.02	1.02	1.02	4
4.99	4.99	2.47	1.02	1.02	1.02	4
3.99	3.99	1.98	1.02	1.02	1.02	4
2.99	2.99	1.48	1.02	1.02	1.02	4
1.99	1.99	.99	1.02	1.02	1.02	4
1.00	1.00	.49	1.02	1.02	1.02	4
.00	.00	.00	1.02	1.02	1.02	4

	***** Stresses *****		***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
49.98	345.12	41.44	303.67	226.82	76.85	2
48.97	442.04	71.21	370.83	289.47	81.36	2
47.97	538.91	101.03	437.88	352.06	85.82	2
46.97	635.74	130.96	504.77	414.61	90.16	2
45.97	732.51	161.05	571.46	477.11	94.35	2
44.97	829.23	191.34	637.89	539.55	98.34	2
43.97	925.91	221.90	704.01	601.95	102.06	2
42.97	1022.53	252.79	769.74	664.29	105.45	2
41.97	1119.10	284.23	834.87	726.59	108.29	2
40.97	1215.62	316.41	899.21	788.83	110.38	2
39.97	1312.08	349.40	962.69	851.01	111.68	2
38.98	1408.49	383.24	1025.25	913.14	112.10	2

2	37.98	1504.84	418.04	1086.80	975.22	111.59
2	37.98	1504.84	418.04	1086.80	975.22	111.59
3	36.82	1634.03	483.19	1150.84	1048.02	102.82
3	35.65	1763.07	550.57	1212.51	1120.67	91.83
3	34.49	1891.97	618.03	1273.94	1193.19	80.75
3	33.33	2020.75	679.74	1341.01	1265.58	75.43
3	32.17	2149.40	737.47	1411.93	1337.85	74.08
3	31.02	2277.95	792.31	1485.64	1410.02	75.62
3	29.86	2406.40	844.98	1561.42	1482.07	79.34
3	28.71	2534.74	895.90	1638.83	1554.03	84.80
3	27.56	2662.98	945.39	1717.59	1625.89	91.70
3	26.41	2791.13	993.64	1797.49	1697.65	99.84
3	25.26	2919.18	1042.23	1876.95	1769.32	107.63
3	24.11	3047.14	1092.81	1954.33	1840.89	113.44
3	22.97	3174.99	1145.63	2029.36	1912.36	117.00
3	21.82	3302.75	1200.73	2102.02	1983.73	118.29
3	20.68	3430.39	1257.11	2173.27	2054.98	118.29
3	19.54	3557.92	1313.50	2244.42	2126.13	118.29
3	18.40	3685.34	1369.88	2315.45	2197.16	118.29
3	17.26	3812.65	1426.27	2386.38	2268.09	118.29
3	16.13	3939.85	1482.65	2457.19	2338.90	118.29
3	15.00	4066.94	1539.04	2527.90	2409.61	118.29
3	15.00	4066.94	1539.04	2527.90	2409.61	118.29
4	13.99	4173.63	1583.15	2590.49	2472.19	118.29
4	12.99	4280.31	1627.26	2653.04	2534.75	118.29
4	11.99	4386.95	1671.38	2715.57	2597.28	118.29
4	10.99	4493.56	1715.80	2777.76	2659.78	117.98
4	9.99	4600.15	1760.69	2839.46	2722.26	117.20
4	8.99	4706.71	1806.09	2900.62	2784.71	115.91
4	7.99	4813.25	1852.23	2961.01	2847.13	113.89
4	6.99	4919.75	1899.20	3020.55	2909.52	111.04
4	5.99	5026.22	1947.04	3079.19	2971.88	107.31
4	4.99	5132.67	1995.93	3136.74	3034.21	102.53
4	3.99	5239.08	2060.53	3178.56	3096.51	82.05
4	2.99	5345.47	2126.06	3219.41	3158.78	60.63
4	1.99	5451.82	2191.04	3260.78	3221.02	39.76

1.00	5558.15	2255.44	3302.70	3283.23	19.47
.00	5664.44	2319.03	3345.41	3345.41	.00

Time = 1095. Degree of Consolidation = 16.%

Total Settlement = .020

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 1095. = .020

Settlement caused by Secondary Compression at time 1095. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.63	1.15	2.49	2.49	2.50
3.00	2.64	.86	2.49	2.38	1.88
2.00	1.71	.57	2.49	2.16	1.82
1.00	.83	.29	2.49	1.97	1.74
.00	.00	.00	2.49	1.86	1.68

***** Stresses *****			***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.63	.00	.00	.00	.00	.00
2.64	91.38	3.85	87.53	61.80	25.72
1.71	179.34	11.20	168.14	120.20	47.94
.83	263.59	17.60	245.99	174.87	71.12
.00	345.12	41.44	303.67	226.82	76.85

Time = 1095. Degree of Consolidation = 50.%

Total Settlement = .365

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 1095. = .365

Settlement caused by Secondary Compression at time 1095. = .000

Surface Elevation = 2.62

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material
50.00	49.97	21.86	2.02	2.02	2.01	2
48.99	48.97	21.52	2.02	2.01	2.01	2
47.99	47.97	21.19	2.01	2.01	2.01	2
46.99	46.97	20.86	2.01	2.01	2.00	2
45.98	45.96	20.53	2.01	2.01	2.00	2
44.98	44.96	20.19	2.01	2.00	2.00	2
43.98	43.96	19.86	2.00	2.00	1.99	2
42.98	42.96	19.53	2.00	2.00	1.99	2
41.98	41.97	19.19	2.00	2.00	1.99	2
40.99	40.97	18.86	2.00	1.99	1.99	2
39.99	39.97	18.53	1.99	1.99	1.98	2
38.99	38.98	18.19	1.99	1.99	1.98	2
38.00	37.98	17.86	1.99	1.99	1.98	2
38.00	37.98	17.86	1.24	1.24	1.23	3
36.83	36.81	17.34	1.23	1.23	1.22	3
35.67	35.65	16.82	1.23	1.23	1.22	3
34.50	34.49	16.29	1.23	1.22	1.22	3
33.34	33.33	15.77	1.22	1.22	1.21	3
32.18	32.17	15.25	1.22	1.22	1.21	3
31.02	31.01	14.73	1.22	1.21	1.21	3
29.87	29.86	14.21	1.21	1.21	1.20	3
28.71	28.71	13.68	1.21	1.21	1.20	3
27.56	27.56	13.16	1.20	1.20	1.20	3
26.41	26.41	12.64	1.20	1.20	1.19	3
25.26	25.26	12.12	1.20	1.20	1.19	3
24.11	24.11	11.59	1.19	1.19	1.19	3
22.97	22.97	11.07	1.19	1.19	1.18	3
21.82	21.82	10.55	1.19	1.19	1.18	3
20.68	20.68	10.03	1.18	1.18	1.18	3
19.54	19.54	9.50	1.18	1.18	1.17	3
18.40	18.40	8.98	1.18	1.18	1.17	3
17.27	17.26	8.46	1.17	1.17	1.17	3

3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.97	340.27	42.32	297.95	221.98	75.97
2	48.97	437.19	72.15	365.05	284.62	80.42
2	47.97	534.07	102.03	432.04	347.22	84.82
2	46.97	630.89	132.02	498.87	409.76	89.11
2	45.96	727.66	162.16	565.50	472.26	93.25
2	44.96	824.38	192.51	631.88	534.70	97.18
2	43.96	921.05	223.12	697.94	597.09	100.84
2	42.96	1017.67	254.06	763.61	659.44	104.17
2	41.97	1114.24	285.57	828.68	721.73	106.95
2	40.97	1210.76	317.80	892.95	783.97	108.99
2	39.97	1307.22	350.84	956.38	846.15	110.23
2	38.98	1403.63	384.74	1018.88	908.28	110.61
2	37.98	1499.97	419.58	1080.39	970.35	110.05
3	37.98	1499.97	419.58	1080.39	970.35	110.05
3	36.81	1629.16	485.51	1143.66	1043.15	100.51

3	35.65	1758.19	555.99	1202.20	1115.79	86.41
3	34.49	1887.08	624.61	1262.47	1188.30	74.18
3	33.33	2015.84	686.87	1328.97	1260.67	68.29
3	32.17	2144.48	744.72	1399.76	1332.93	66.83
3	31.01	2273.02	799.35	1473.67	1405.08	68.58
3	29.86	2401.45	851.51	1549.94	1477.13	72.81
3	28.71	2529.78	901.73	1628.05	1549.07	78.98
3	27.56	2658.01	950.37	1707.64	1620.92	86.72
3	26.41	2786.15	997.67	1788.48	1692.67	95.80
3	25.26	2914.20	1045.35	1868.84	1764.33	104.51
3	24.11	3042.15	1095.03	1947.12	1835.90	111.22
3	22.97	3170.00	1146.82	2023.18	1907.37	115.81
3	21.82	3297.75	1200.83	2096.92	1978.73	118.19
3	20.68	3425.39	1257.11	2168.28	2049.99	118.29
3	19.54	3552.92	1313.50	2239.42	2121.13	118.29
3	18.40	3680.34	1369.88	2310.46	2192.17	118.29
3	17.26	3807.65	1426.27	2381.38	2263.09	118.29
3	16.13	3934.85	1482.65	2452.20	2333.91	118.29
3	15.00	4061.94	1539.04	2522.90	2404.61	118.29
3	15.00	4061.94	1539.04	2522.91	2404.61	118.29
4	13.99	4168.64	1583.15	2585.49	2467.20	118.29
4	12.99	4275.31	1627.26	2648.05	2529.75	118.29
4	11.99	4381.95	1671.69	2710.27	2592.28	117.98
4	10.99	4488.57	1716.54	2772.02	2654.79	117.24
4	9.99	4595.16	1761.87	2833.29	2717.26	116.03
4	8.99	4701.72	1807.72	2894.00	2779.71	114.29
4	7.99	4808.25	1854.12	2954.13	2842.13	112.00
4	6.99	4914.75	1901.29	3013.46	2904.52	108.95
4	5.99	5021.22	1949.34	3071.89	2966.88	105.01
4	4.99	5127.67	1998.32	3129.35	3029.21	100.14
4	3.99	5234.08	2063.47	3170.61	3091.51	79.11
4	2.99	5340.46	2128.60	3211.86	3153.77	58.08
4	1.99	5446.81	2192.89	3253.93	3216.01	37.91
4	1.00	5553.14	2256.36	3296.78	3278.22	18.56
4	.00	5659.43	2319.03	3340.40	3340.40	.00

Time = 1496. Degree of Consolidation = 18.%

Total Settlement = .023

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 1496. = .023

Settlement caused by Secondary Compression at time 1496. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.56	1.15	2.49	2.49	2.50
3.00	2.58	.86	2.49	2.27	1.88
2.00	1.68	.57	2.49	2.04	1.82
1.00	.83	.29	2.49	1.93	1.74
.00	.00	.00	2.49	1.86	1.68

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.56	.00	.00	.00	.00	.00
2.58	90.37	7.28	83.09	60.79	22.30
1.68	176.12	15.21	160.91	116.97	43.94
.83	258.95	18.93	240.02	170.23	69.79
.00	340.27	42.32	297.95	221.98	75.97

Material 1 1 1 1 1

Time = 1496. Degree of Consolidation = 61.%

Total Settlement = .443

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 1496. = .443

Settlement caused by Secondary Compression at time 1496. = .000

Surface Elevation = 2.53

**********Current Conditions in Compressible Foundation**********

***** Coordinates ***** ***** Void Ratios *****

A	XI	Z	Einitial	E	Eeop	Material
50.00	49.97	21.86	2.02	2.02	2.01	2
48.99	48.97	21.52	2.02	2.01	2.01	2
47.99	47.97	21.19	2.01	2.01	2.01	2
46.99	46.96	20.86	2.01	2.01	2.00	2
45.98	45.96	20.53	2.01	2.01	2.00	2
44.98	44.96	20.19	2.01	2.00	2.00	2
43.98	43.96	19.86	2.00	2.00	1.99	2
42.98	42.96	19.53	2.00	2.00	1.99	2
41.98	41.96	19.19	2.00	2.00	1.99	2
40.99	40.97	18.86	2.00	1.99	1.99	2
39.99	39.97	18.53	1.99	1.99	1.98	2
38.99	38.98	18.19	1.99	1.99	1.98	2
38.00	37.98	17.86	1.99	1.99	1.98	2
38.00	37.98	17.86	1.24	1.24	1.23	3
36.83	36.81	17.34	1.23	1.23	1.22	3
35.67	35.65	16.82	1.23	1.23	1.22	3
34.50	34.49	16.29	1.23	1.22	1.22	3
33.34	33.33	15.77	1.22	1.22	1.21	3
32.18	32.17	15.25	1.22	1.22	1.21	3
31.02	31.01	14.73	1.22	1.21	1.21	3
29.87	29.86	14.21	1.21	1.21	1.20	3
28.71	28.71	13.68	1.21	1.21	1.20	3
27.56	27.56	13.16	1.20	1.20	1.20	3
26.41	26.41	12.64	1.20	1.20	1.19	3
25.26	25.26	12.12	1.20	1.20	1.19	3
24.11	24.11	11.59	1.19	1.19	1.19	3
22.97	22.97	11.07	1.19	1.19	1.18	3
21.82	21.82	10.55	1.19	1.19	1.18	3
20.68	20.68	10.03	1.18	1.18	1.18	3
19.54	19.54	9.50	1.18	1.18	1.17	3
18.40	18.40	8.98	1.18	1.18	1.17	3
17.27	17.26	8.46	1.17	1.17	1.17	3
16.13	16.13	7.94	1.17	1.17	1.16	3
15.00	15.00	7.42	1.17	1.17	1.16	3
15.00	15.00	7.42	1.03	1.03	1.03	4

14.00	13.99	6.92	1.03	1.03	1.03	4
12.99	12.99	6.43	1.03	1.03	1.03	4
11.99	11.99	5.93	1.03	1.03	1.02	4
10.99	10.99	5.44	1.03	1.03	1.02	4
9.99	9.99	4.94	1.02	1.02	1.02	4
8.99	8.99	4.45	1.02	1.02	1.02	4
7.99	7.99	3.95	1.02	1.02	1.02	4
6.99	6.99	3.46	1.02	1.02	1.02	4
5.99	5.99	2.97	1.02	1.02	1.02	4
4.99	4.99	2.47	1.02	1.02	1.02	4
3.99	3.99	1.98	1.02	1.02	1.02	4
2.99	2.99	1.48	1.02	1.02	1.02	4
1.99	1.99	.99	1.02	1.02	1.02	4
1.00	1.00	.49	1.02	1.02	1.02	4
.00	.00	.00	1.02	1.02	1.02	4

	***** Stresses *****		***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
49.97	337.41	42.75	294.66	219.12	75.54	2
48.97	434.33	72.61	361.72	281.76	79.96	2
47.97	531.20	102.52	428.68	344.35	84.32	2
46.96	628.02	132.55	495.48	406.90	88.58	2
45.96	724.79	162.72	562.07	469.39	92.69	2
44.96	821.51	193.10	628.42	531.83	96.58	2
43.96	918.18	223.74	694.45	594.22	100.22	2
42.96	1014.80	254.71	760.09	656.57	103.52	2
41.96	1111.37	286.25	825.12	718.86	106.27	2
40.97	1207.89	318.52	889.37	781.09	108.28	2
39.97	1304.35	351.58	952.76	843.27	109.49	2
38.98	1400.75	385.51	1015.24	905.40	109.84	2
37.98	1497.10	420.38	1076.72	967.47	109.25	2
37.98	1497.10	420.38	1076.72	967.47	109.25	3
36.81	1626.28	486.75	1139.53	1040.27	99.26	3
35.65	1755.31	559.02	1196.29	1112.91	83.38	3
34.49	1884.19	628.31	1255.88	1185.41	70.47	3
33.33	2012.94	690.99	1321.95	1257.77	64.18	3

3	32.17	2141.58	748.96	1392.61	1330.03	62.59
3	31.01	2270.10	803.52	1466.58	1402.17	64.41
3	29.86	2398.52	855.45	1543.07	1474.20	68.87
3	28.71	2526.85	905.30	1621.55	1546.14	75.41
3	27.56	2655.07	953.47	1701.60	1617.98	83.62
3	26.41	2783.21	1000.27	1782.94	1689.73	93.21
3	25.26	2911.25	1047.46	1863.79	1761.39	102.41
3	24.11	3039.20	1096.65	1942.54	1832.95	109.59
3	22.97	3167.05	1147.93	2019.11	1904.41	114.70
3	21.82	3294.79	1201.39	2093.41	1975.78	117.63
3	20.68	3422.43	1257.11	2165.32	2047.03	118.29
3	19.54	3549.97	1313.50	2236.47	2118.18	118.29
3	18.40	3677.39	1369.88	2307.50	2189.21	118.29
3	17.26	3804.70	1426.27	2378.43	2260.14	118.29
3	16.13	3931.90	1482.65	2449.24	2330.95	118.29
3	15.00	4058.99	1539.04	2519.95	2401.66	118.29
4	15.00	4058.99	1539.04	2519.95	2401.66	118.29
4	13.99	4165.68	1583.15	2582.53	2464.24	118.29
4	12.99	4272.35	1627.39	2644.97	2526.80	118.17
4	11.99	4379.00	1672.04	2706.96	2589.33	117.63
4	10.99	4485.61	1717.12	2768.49	2651.83	116.66
4	9.99	4592.20	1762.69	2829.51	2714.31	115.20
4	8.99	4698.76	1808.77	2889.99	2776.75	113.24
4	7.99	4805.29	1855.42	2949.87	2839.17	110.70
4	6.99	4911.79	1902.67	3009.13	2901.56	107.57
4	5.99	5018.26	1950.72	3067.55	2963.92	103.63
4	4.99	5124.71	1999.70	3125.00	3026.25	98.76
4	3.99	5231.12	2065.15	3165.97	3088.54	77.42
4	2.99	5337.50	2129.85	3207.65	3150.81	56.84
4	1.99	5443.85	2193.71	3250.15	3213.05	37.09
4	1.00	5550.18	2256.76	3293.41	3275.26	18.15
4	.00	5656.47	2319.03	3337.44	3337.44	.00

Time = 1825. Degree of Consolidation = 19.%

Total Settlement = .024

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 1825. =
.024

Settlement caused by Secondary Compression at time 1825. =
.000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.51	1.15	2.49	2.49	2.50
3.00	2.55	.86	2.49	2.20	1.88
2.00	1.67	.57	2.49	1.99	1.82
1.00	.83	.29	2.49	1.91	1.74
.00	.00	.00	2.49	1.85	1.68

***** Stresses *****			***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.51	.00	.00	.00	.00	.00
2.55	89.36	9.76	79.60	59.79	19.81
1.67	174.01	16.82	157.18	114.86	42.32
.83	256.25	19.60	236.64	167.53	69.12
.00	337.41	42.75	294.66	219.12	75.54

Material
1
1
1
1
1

Time = 1825. Degree of Consolidation = 67.%

Total Settlement = .489

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 1825. =
.489

Settlement caused by Secondary Compression at time 1825. =
.000

Surface Elevation = 2.49

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.97	21.86	2.02	2.02	2.01

Material
2

2	48.99	48.97	21.52	2.02	2.01	2.01
2	47.99	47.96	21.19	2.01	2.01	2.01
2	46.99	46.96	20.86	2.01	2.01	2.00
2	45.98	45.96	20.53	2.01	2.01	2.00
2	44.98	44.96	20.19	2.01	2.00	2.00
2	43.98	43.96	19.86	2.00	2.00	1.99
2	42.98	42.96	19.53	2.00	2.00	1.99
2	41.98	41.96	19.19	2.00	2.00	1.99
2	40.99	40.97	18.86	2.00	1.99	1.99
2	39.99	39.97	18.53	1.99	1.99	1.98
2	38.99	38.97	18.19	1.99	1.99	1.98
2	38.00	37.98	17.86	1.99	1.99	1.98
3	38.00	37.98	17.86	1.24	1.24	1.23
3	36.83	36.81	17.34	1.23	1.23	1.22
3	35.67	35.65	16.82	1.23	1.23	1.22
3	34.50	34.49	16.29	1.23	1.22	1.22
3	33.34	33.33	15.77	1.22	1.22	1.21
3	32.18	32.17	15.25	1.22	1.21	1.21
3	31.02	31.01	14.73	1.22	1.21	1.21
3	29.87	29.86	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.55	13.16	1.20	1.20	1.20
3	26.41	26.41	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.97	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.26	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03

	11.99	11.99	5.93	1.03	1.03	1.02
4						
	10.99	10.99	5.44	1.03	1.03	1.02
4						
	9.99	9.99	4.94	1.02	1.02	1.02
4						
	8.99	8.99	4.45	1.02	1.02	1.02
4						
	7.99	7.99	3.95	1.02	1.02	1.02
4						
	6.99	6.99	3.46	1.02	1.02	1.02
4						
	5.99	5.99	2.97	1.02	1.02	1.02
4						
	4.99	4.99	2.47	1.02	1.02	1.02
4						
	3.99	3.99	1.98	1.02	1.02	1.02
4						
	2.99	2.99	1.48	1.02	1.02	1.02
4						
	1.99	1.99	.99	1.02	1.02	1.02
4						
	1.00	1.00	.49	1.02	1.02	1.02
4						
	.00	.00	.00	1.02	1.02	1.02
4						

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
	49.97	334.42	43.94	290.48	216.13	74.35
2						
	48.97	431.34	73.78	357.56	278.77	78.79
2						
	47.96	528.21	103.69	424.52	341.36	83.16
2						
	46.96	625.03	133.70	491.33	403.90	87.43
2						
	45.96	721.80	163.86	557.94	466.39	91.54
2						
	44.96	818.52	194.23	624.28	528.84	95.45
2						
	43.96	915.19	224.87	690.32	591.23	99.09
2						
	42.96	1011.80	255.85	755.96	653.57	102.39
2						
	41.96	1108.37	287.39	820.97	715.85	105.12
2						
	40.97	1204.88	319.68	885.20	778.09	107.11
2						
	39.97	1301.34	352.77	948.57	840.27	108.31
2						
	38.97	1397.74	386.72	1011.03	902.39	108.63
2						
	37.98	1494.09	421.61	1072.48	964.46	108.02
2						
	37.98	1494.09	421.61	1072.48	964.46	108.02
3						
	36.81	1623.27	488.46	1134.81	1037.26	97.55
3						
	35.65	1752.29	563.14	1189.15	1109.89	79.26
3						
	34.49	1881.16	633.46	1247.70	1182.38	65.32
3						
	33.33	2009.90	696.70	1313.21	1254.74	58.47
3						
	32.17	2138.53	754.93	1383.60	1326.97	56.63
3						
	31.01	2267.04	809.44	1457.60	1399.10	58.50
3						

33	29.86	2395.45	861.10	1534.35	1471.13	63.22
33	28.71	2523.76	910.52	1613.24	1543.06	70.19
33	27.55	2651.98	958.10	1693.88	1614.89	78.99
33	26.41	2780.10	1004.34	1775.77	1686.63	89.14
33	25.26	2908.14	1050.99	1857.15	1758.28	98.87
33	24.11	3036.08	1099.49	1936.60	1829.83	106.76
33	22.97	3163.93	1149.95	2013.98	1901.29	112.68
33	21.82	3291.67	1202.46	2089.21	1972.65	116.56
33	20.68	3419.31	1257.11	2162.20	2043.91	118.29
33	19.54	3546.84	1313.50	2233.34	2115.05	118.29
33	18.40	3674.26	1369.88	2304.38	2186.09	118.29
33	17.26	3801.57	1426.27	2375.31	2257.01	118.29
33	16.13	3928.77	1482.65	2446.12	2327.83	118.29
33	15.00	4055.86	1539.04	2516.82	2398.53	118.29
34	15.00	4055.86	1539.04	2516.83	2398.53	118.29
44	13.99	4162.56	1583.15	2579.41	2461.12	118.29
44	12.99	4269.23	1627.61	2641.62	2523.68	117.95
44	11.99	4375.87	1672.48	2703.39	2586.20	117.19
44	10.99	4482.49	1717.80	2764.69	2648.71	115.99
44	9.99	4589.07	1763.60	2825.48	2711.18	114.30
44	8.99	4695.63	1809.91	2885.72	2773.63	112.09
44	7.99	4802.16	1856.79	2945.37	2836.04	109.33
44	6.99	4908.66	1904.28	3004.38	2898.43	105.95
44	5.99	5015.13	1952.42	3062.71	2960.79	101.92
44	4.99	5121.58	2001.66	3119.92	3023.12	96.80
44	3.99	5227.99	2066.79	3161.20	3085.41	75.78
44	2.99	5334.37	2131.06	3203.31	3147.68	55.63
44	1.99	5440.72	2194.50	3246.22	3209.92	36.30
44	1.00	5547.04	2257.15	3289.89	3272.13	17.76
44	.00	5653.34	2319.03	3334.31	3334.31	.00

Time = 2556. Degree of Consolidation = 21.%

Total Settlement = .027

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 2556. = .027

Settlement caused by Secondary Compression at time 2556. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.46	1.15	2.49	2.49	2.50
3.00	2.53	.86	2.49	2.11	1.88
2.00	1.66	.57	2.49	1.96	1.82
1.00	.82	.29	2.49	1.90	1.74
.00	.00	.00	2.49	1.85	1.68

***** Stresses *****			***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.46	.00	.00	.00	.00	.00
2.53	88.01	12.91	75.10	58.44	16.66
1.66	171.60	18.03	153.58	112.46	41.12
.82	253.43	21.82	231.61	164.71	66.90
.00	334.42	43.94	290.48	216.13	74.35

Time = 2556. Degree of Consolidation = 74.%

Total Settlement = .536

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 2556. = .536

Settlement caused by Secondary Compression at time 2556. = .000

Surface Elevation = 2.44

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.97	21.86	2.02	2.02	2.01
48.99	48.97	21.52	2.02	2.01	2.01
47.99	47.96	21.19	2.01	2.01	2.01
46.99	46.96	20.86	2.01	2.01	2.00

2	45.98	45.96	20.53	2.01	2.01	2.00
2	44.98	44.96	20.19	2.01	2.00	2.00
2	43.98	43.96	19.86	2.00	2.00	1.99
2	42.98	42.96	19.53	2.00	2.00	1.99
2	41.98	41.96	19.19	2.00	2.00	1.99
2	40.99	40.96	18.86	2.00	1.99	1.99
2	39.99	39.97	18.53	1.99	1.99	1.98
2	38.99	38.97	18.19	1.99	1.99	1.98
2	38.00	37.98	17.86	1.99	1.99	1.98
3	38.00	37.98	17.86	1.24	1.24	1.23
3	36.83	36.81	17.34	1.23	1.23	1.22
3	35.67	35.65	16.82	1.23	1.23	1.22
3	34.50	34.48	16.29	1.23	1.22	1.22
3	33.34	33.33	15.77	1.22	1.22	1.21
3	32.18	32.17	15.25	1.22	1.21	1.21
3	31.02	31.01	14.73	1.22	1.21	1.21
3	29.87	29.86	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.55	13.16	1.20	1.20	1.20
3	26.41	26.40	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.96	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.26	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02

	8.99	8.99	4.45	1.02	1.02	1.02
4						
	7.99	7.99	3.95	1.02	1.02	1.02
4						
	6.99	6.99	3.46	1.02	1.02	1.02
4						
	5.99	5.99	2.97	1.02	1.02	1.02
4						
	4.99	4.99	2.47	1.02	1.02	1.02
4						
	3.99	3.99	1.98	1.02	1.02	1.02
4						
	2.99	2.99	1.48	1.02	1.02	1.02
4						
	1.99	1.99	.99	1.02	1.02	1.02
4						
	1.00	1.00	.49	1.02	1.02	1.02
4						
	.00	.00	.00	1.02	1.02	1.02
4						

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
	49.97	334.14	44.32	289.82	215.85	73.97
2						
	48.97	431.06	74.22	356.84	278.49	78.35
2						
	47.96	527.93	104.17	423.76	341.08	82.68
2						
	46.96	624.75	134.22	490.52	403.62	86.90
2						
	45.96	721.52	164.43	557.09	466.11	90.97
2						
	44.96	818.24	194.85	623.39	528.55	94.83
2						
	43.96	914.90	225.52	689.38	590.94	98.44
2						
	42.96	1011.52	256.54	754.97	653.28	101.69
2						
	41.96	1108.08	288.13	819.95	715.57	104.38
2						
	40.96	1204.59	320.46	884.13	777.80	106.33
2						
	39.97	1301.05	353.58	947.47	839.98	107.49
2						
	38.97	1397.45	387.56	1009.89	902.10	107.79
2						
	37.98	1493.80	422.48	1071.32	964.17	107.15
2						
	37.98	1493.80	422.48	1071.32	964.17	107.15
3						
	36.81	1622.98	489.75	1133.23	1036.96	96.27
3						
	35.65	1751.99	566.18	1185.81	1109.59	76.22
3						
	34.48	1880.86	637.20	1243.66	1182.07	61.58
3						
	33.33	2009.59	700.86	1308.73	1254.42	54.31
3						
	32.17	2138.21	759.26	1378.94	1326.65	52.29
3						
	31.01	2266.71	813.76	1452.95	1398.77	54.17
3						
	29.86	2395.11	865.28	1529.83	1470.79	59.04
3						
	28.71	2523.42	914.41	1609.01	1542.71	66.30
3						
	27.55	2651.63	961.59	1690.03	1614.53	75.50
3						

3	26.40	2779.75	1007.47	1772.28	1686.27	86.01
3	25.26	2907.77	1053.73	1854.04	1757.91	96.13
3	24.11	3035.71	1101.74	1933.97	1829.46	104.51
3	22.96	3163.55	1151.62	2011.93	1900.92	111.01
3	21.82	3291.29	1203.43	2087.86	1972.28	115.59
3	20.68	3418.93	1257.33	2161.60	2043.53	118.07
3	19.54	3546.46	1313.50	2232.97	2114.68	118.29
3	18.40	3673.88	1369.88	2304.00	2185.71	118.29
3	17.26	3801.19	1426.27	2374.93	2256.64	118.29
3	16.13	3928.39	1482.65	2445.74	2327.45	118.29
3	15.00	4055.48	1539.04	2516.45	2398.16	118.29
3	15.00	4055.48	1539.04	2516.45	2398.16	118.29
4	13.99	4162.18	1583.15	2579.03	2460.74	118.29
4	12.99	4268.85	1627.61	2641.24	2523.30	117.95
4	11.99	4375.49	1672.48	2703.02	2585.83	117.19
4	10.99	4482.11	1717.80	2764.31	2648.33	115.99
4	9.99	4588.70	1763.60	2825.10	2710.80	114.30
4	8.99	4695.26	1809.91	2885.34	2773.25	112.09
4	7.99	4801.79	1856.79	2944.99	2835.66	109.33
4	6.99	4908.29	1904.28	3004.01	2898.05	105.95
4	5.99	5014.76	1952.42	3062.33	2960.41	101.92
4	4.99	5121.20	2001.66	3119.54	3022.74	96.80
4	3.99	5227.61	2066.79	3160.82	3085.04	75.78
4	2.99	5333.99	2131.06	3202.93	3147.30	55.63
4	1.99	5440.34	2194.50	3245.84	3209.54	36.30
4	1.00	5546.67	2257.15	3289.51	3271.75	17.76
4	.00	5652.96	2319.03	3333.93	3333.93	.00

Time = 3651. Degree of Consolidation = 22.%

Total Settlement = .028

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 3651. = .028

Settlement caused by Secondary Compression at time 3651. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.46	1.15	2.49	2.49	2.50
3.00	2.52	.86	2.49	2.10	1.88
2.00	1.66	.57	2.49	1.95	1.82
1.00	.82	.29	2.49	1.90	1.74
.00	.00	.00	2.49	1.85	1.68

***** Stresses *****			***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.46	.00	.00	.00	.00	.00
2.52	87.89	13.21	74.68	58.32	16.37
1.66	171.38	18.14	153.24	112.24	41.01
.82	253.17	22.50	230.67	164.45	66.22
.00	334.14	44.32	289.82	215.85	73.97

Time = 3651. Degree of Consolidation = 75.%

Total Settlement = .541

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 3651. = .541

Settlement caused by Secondary Compression at time 3651. = .000

Surface Elevation = 2.43

**********Current Conditions in Compressible Foundation**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.97	21.86	2.02	2.02	2.01
48.99	48.96	21.52	2.02	2.01	2.01
47.99	47.96	21.19	2.01	2.01	2.01
46.99	46.96	20.86	2.01	2.01	2.00
45.98	45.96	20.53	2.01	2.01	2.00
44.98	44.96	20.19	2.01	2.00	2.00
43.98	43.96	19.86	2.00	2.00	1.99

2	42.98	42.96	19.53	2.00	2.00	1.99
2	41.98	41.96	19.19	2.00	2.00	1.99
2	40.99	40.96	18.86	2.00	1.99	1.99
2	39.99	39.97	18.53	1.99	1.99	1.98
2	38.99	38.97	18.19	1.99	1.99	1.98
2	38.00	37.98	17.86	1.99	1.99	1.98
3	38.00	37.98	17.86	1.24	1.24	1.23
3	36.83	36.81	17.34	1.23	1.23	1.22
3	35.67	35.65	16.82	1.23	1.23	1.22
3	34.50	34.48	16.29	1.23	1.22	1.22
3	33.34	33.32	15.77	1.22	1.22	1.21
3	32.18	32.17	15.25	1.22	1.21	1.21
3	31.02	31.01	14.73	1.22	1.21	1.21
3	29.87	29.86	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.55	13.16	1.20	1.20	1.20
3	26.41	26.40	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.96	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.26	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02

4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02
4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.97	334.14	44.33	289.81	215.85	73.96
2	48.96	431.06	74.24	356.82	278.49	78.33
2	47.96	527.93	104.20	423.73	341.08	82.65
2	46.96	624.75	134.26	490.48	403.62	86.86
2	45.96	721.51	164.48	557.03	466.11	90.92
2	44.96	818.23	194.91	623.33	528.55	94.77
2	43.96	914.90	225.59	689.31	590.94	98.37
2	42.96	1011.52	256.63	754.89	653.28	101.61
2	41.96	1108.08	288.23	819.85	715.57	104.28
2	40.96	1204.59	320.57	884.02	777.80	106.22
2	39.97	1301.05	353.70	947.35	839.98	107.37
2	38.97	1397.45	387.70	1009.75	902.10	107.65
2	37.98	1493.79	422.64	1071.16	964.17	106.99
3	37.98	1493.79	422.64	1071.16	964.17	106.99
3	36.81	1622.97	490.21	1132.76	1036.96	95.80
3	35.65	1751.98	567.58	1184.41	1109.59	74.82
3	34.48	1880.85	639.05	1241.79	1182.06	59.73
3	33.32	2009.58	703.02	1306.56	1254.41	52.15
3	32.17	2138.19	761.61	1376.57	1326.64	49.94
3	31.01	2266.69	816.18	1450.51	1398.75	51.76
3	29.86	2395.09	867.64	1527.45	1470.76	56.69
3	28.71	2523.39	916.62	1606.76	1542.68	64.08
3	27.55	2651.59	963.63	1687.96	1614.50	73.46
3	26.40	2779.71	1009.34	1770.37	1686.23	84.14
3	25.26	2907.73	1055.43	1852.30	1757.87	94.43
3	24.11	3035.66	1103.20	1932.47	1829.42	103.05

3	22.96	3163.50	1152.75	2010.76	1900.87	109.89
3	21.82	3291.24	1204.21	2087.03	1972.23	114.81
3	20.68	3418.88	1257.74	2161.14	2043.48	117.66
3	19.54	3546.41	1313.50	2232.91	2114.62	118.29
3	18.40	3673.83	1369.88	2303.95	2185.66	118.29
3	17.26	3801.14	1426.27	2374.88	2256.58	118.29
3	16.13	3928.34	1482.65	2445.69	2327.40	118.29
3	15.00	4055.43	1539.04	2516.39	2398.10	118.29
4	15.00	4055.43	1539.04	2516.40	2398.10	118.29
4	13.99	4162.13	1583.15	2578.98	2460.69	118.29
4	12.99	4268.80	1627.61	2641.19	2523.24	117.95
4	11.99	4375.44	1672.48	2702.96	2585.77	117.19
4	10.99	4482.06	1717.80	2764.26	2648.28	115.99
4	9.99	4588.64	1763.60	2825.05	2710.75	114.30
4	8.99	4695.20	1809.91	2885.29	2773.20	112.09
4	7.99	4801.73	1856.79	2944.94	2835.61	109.33
4	6.99	4908.23	1904.28	3003.95	2898.00	105.95
4	5.99	5014.70	1952.42	3062.28	2960.36	101.92
4	4.99	5121.15	2001.66	3119.48	3022.69	96.80
4	3.99	5227.56	2066.79	3160.77	3084.98	75.78
4	2.99	5333.94	2131.06	3202.88	3147.25	55.63
4	1.99	5440.29	2194.50	3245.79	3209.49	36.30
4	1.00	5546.61	2257.15	3289.46	3271.70	17.76
4	.00	5652.91	2319.03	3333.88	3333.88	.00

Time = 5476. Degree of Consolidation = 22.%

Total Settlement = .029

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 5476. = .029

Settlement caused by Secondary Compression at time 5476. = .000

**********Current Conditions in Dredged Fill**********

	***** Coordinates *****		***** Void Ratios *****			
A	XI	Z	Einitial	E	Eeop	Material

4.00	3.46	1.15	2.49	2.49	2.50
3.00	2.52	.86	2.49	2.10	1.88
2.00	1.66	.57	2.49	1.95	1.82
1.00	.82	.29	2.49	1.89	1.74
.00	.00	.00	2.49	1.85	1.68

	***** Stresses *****		***** Pore Pressures *****		
XI	Total	Effective	Total	Static	Excess
3.46	.00	.00	.00	.00	.00
2.52	87.89	13.21	74.68	58.32	16.36
1.66	171.38	18.14	153.24	112.23	41.01
.82	253.17	22.51	230.66	164.45	66.21
.00	334.14	44.34	289.81	215.85	73.96

Time = 5476. Degree of Consolidation = 75.%

Total Settlement = .541

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 5476. = .541

Settlement caused by Secondary Compression at time 5476. = .000

Surface Elevation = 2.43

**********Current Conditions in Compressible Foundation**********

	***** Coordinates *****		***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
50.00	49.97	21.86	2.02	2.02	2.01
48.99	48.96	21.52	2.02	2.01	2.01
47.99	47.96	21.19	2.01	2.01	2.01
46.99	46.96	20.86	2.01	2.01	2.00
45.98	45.96	20.53	2.01	2.01	2.00
44.98	44.96	20.19	2.01	2.00	2.00
43.98	43.96	19.86	2.00	2.00	1.99
42.98	42.96	19.53	2.00	2.00	1.99
41.98	41.96	19.19	2.00	2.00	1.99
40.99	40.96	18.86	2.00	1.99	1.99

2	39.99	39.97	18.53	1.99	1.99	1.98
2	38.99	38.97	18.19	1.99	1.99	1.98
2	38.00	37.98	17.86	1.99	1.99	1.98
3	38.00	37.98	17.86	1.24	1.24	1.23
3	36.83	36.81	17.34	1.23	1.23	1.22
3	35.67	35.65	16.82	1.23	1.23	1.22
3	34.50	34.48	16.29	1.23	1.22	1.22
3	33.34	33.32	15.77	1.22	1.22	1.21
3	32.18	32.17	15.25	1.22	1.21	1.21
3	31.02	31.01	14.73	1.22	1.21	1.21
3	29.87	29.86	14.21	1.21	1.21	1.20
3	28.71	28.71	13.68	1.21	1.21	1.20
3	27.56	27.55	13.16	1.20	1.20	1.20
3	26.41	26.40	12.64	1.20	1.20	1.19
3	25.26	25.26	12.12	1.20	1.20	1.19
3	24.11	24.11	11.59	1.19	1.19	1.19
3	22.97	22.96	11.07	1.19	1.19	1.18
3	21.82	21.82	10.55	1.19	1.19	1.18
3	20.68	20.68	10.03	1.18	1.18	1.18
3	19.54	19.54	9.50	1.18	1.18	1.17
3	18.40	18.40	8.98	1.18	1.18	1.17
3	17.27	17.26	8.46	1.17	1.17	1.17
3	16.13	16.13	7.94	1.17	1.17	1.16
3	15.00	15.00	7.42	1.17	1.17	1.16
4	15.00	15.00	7.42	1.03	1.03	1.03
4	14.00	13.99	6.92	1.03	1.03	1.03
4	12.99	12.99	6.43	1.03	1.03	1.03
4	11.99	11.99	5.93	1.03	1.03	1.02
4	10.99	10.99	5.44	1.03	1.03	1.02
4	9.99	9.99	4.94	1.02	1.02	1.02
4	8.99	8.99	4.45	1.02	1.02	1.02
4	7.99	7.99	3.95	1.02	1.02	1.02
4	6.99	6.99	3.46	1.02	1.02	1.02
4	5.99	5.99	2.97	1.02	1.02	1.02
4	4.99	4.99	2.47	1.02	1.02	1.02
4	3.99	3.99	1.98	1.02	1.02	1.02

4	2.99	2.99	1.48	1.02	1.02	1.02
4	1.99	1.99	.99	1.02	1.02	1.02
4	1.00	1.00	.49	1.02	1.02	1.02
4	.00	.00	.00	1.02	1.02	1.02

		***** Stresses *****		***** Pore Pressures *****		
Material	XI	Total	Effective	Total	Static	Excess
2	49.97	334.14	44.33	289.81	215.85	73.96
2	48.96	431.06	74.24	356.82	278.49	78.33
2	47.96	527.93	104.20	423.73	341.08	82.65
2	46.96	624.75	134.26	490.48	403.62	86.86
2	45.96	721.51	164.48	557.03	466.11	90.92
2	44.96	818.23	194.91	623.33	528.55	94.77
2	43.96	914.90	225.59	689.31	590.94	98.37
2	42.96	1011.52	256.63	754.89	653.28	101.61
2	41.96	1108.08	288.23	819.85	715.57	104.28
2	40.96	1204.59	320.57	884.02	777.80	106.22
2	39.97	1301.05	353.70	947.35	839.98	107.37
2	38.97	1397.45	387.70	1009.75	902.10	107.65
2	37.98	1493.79	422.64	1071.16	964.17	106.99
3	37.98	1493.79	422.64	1071.16	964.17	106.99
3	36.81	1622.97	490.21	1132.76	1036.96	95.80
3	35.65	1751.98	567.58	1184.41	1109.59	74.82
3	34.48	1880.85	639.05	1241.79	1182.06	59.73
3	33.32	2009.58	703.02	1306.56	1254.41	52.15
3	32.17	2138.19	761.61	1376.57	1326.64	49.94
3	31.01	2266.69	816.18	1450.51	1398.75	51.76
3	29.86	2395.09	867.64	1527.45	1470.76	56.69
3	28.71	2523.39	916.62	1606.76	1542.68	64.08
3	27.55	2651.59	963.63	1687.96	1614.50	73.46
3	26.40	2779.71	1009.34	1770.37	1686.23	84.14
3	25.26	2907.73	1055.43	1852.30	1757.87	94.43
3	24.11	3035.66	1103.20	1932.47	1829.42	103.05
3	22.96	3163.50	1152.75	2010.76	1900.87	109.89
3	21.82	3291.24	1204.21	2087.03	1972.23	114.81
3	20.68	3418.88	1257.74	2161.14	2043.48	117.66

3	19.54	3546.41	1313.50	2232.91	2114.62	118.29
3	18.40	3673.83	1369.88	2303.95	2185.66	118.29
3	17.26	3801.14	1426.27	2374.88	2256.58	118.29
3	16.13	3928.34	1482.65	2445.69	2327.40	118.29
3	15.00	4055.43	1539.04	2516.39	2398.10	118.29
4	15.00	4055.43	1539.04	2516.40	2398.10	118.29
4	13.99	4162.13	1583.15	2578.98	2460.69	118.29
4	12.99	4268.80	1627.61	2641.19	2523.24	117.95
4	11.99	4375.44	1672.48	2702.96	2585.77	117.19
4	10.99	4482.06	1717.80	2764.26	2648.28	115.99
4	9.99	4588.64	1763.60	2825.05	2710.75	114.30
4	8.99	4695.20	1809.91	2885.29	2773.20	112.09
4	7.99	4801.73	1856.79	2944.94	2835.61	109.33
4	6.99	4908.23	1904.28	3003.95	2898.00	105.95
4	5.99	5014.70	1952.42	3062.28	2960.36	101.92
4	4.99	5121.15	2001.66	3119.48	3022.69	96.80
4	3.99	5227.56	2066.79	3160.77	3084.98	75.78
4	2.99	5333.94	2131.06	3202.88	3147.25	55.63
4	1.99	5440.29	2194.50	3245.79	3209.49	36.30
4	1.00	5546.61	2257.15	3289.46	3271.70	17.76
4	.00	5652.91	2319.03	3333.88	3333.88	.00

Time = 7301. Degree of Consolidation = 22.%

Total Settlement = .029

Settlement at End of Primary Consolidation = .129

Settlement caused by Primary Consolidation at time 7301. = .029

Settlement caused by Secondary Compression at time 7301. = .000

**********Current Conditions in Dredged Fill**********

***** Coordinates *****			***** Void Ratios *****		
A	XI	Z	Einitial	E	Eeop
4.00	3.46	1.15	2.49	2.49	2.50
3.00	2.52	.86	2.49	2.10	1.88
2.00	1.66	.57	2.49	1.95	1.82

Material
1
1
1

1.00	.82	.29	2.49	1.89	1.74	1
.00	.00	.00	2.49	1.85	1.68	1

	***** Stresses *****		***** Pore Pressures *****			
XI	Total	Effective	Total	Static	Excess	Material
3.46	.00	.00	.00	.00	.00	1
2.52	87.89	13.21	74.68	58.32	16.36	1
1.66	171.38	18.14	153.24	112.23	41.01	1
.82	253.17	22.51	230.66	164.45	66.21	1
.00	334.14	44.34	289.81	215.85	73.96	1

Time = 7301. Degree of Consolidation = 75.%

Total Settlement = .541

Settlement at End of Primary Consolidation = .724

Settlement caused by Primary Consolidation at time 7301. = .541

Settlement caused by Secondary Compression at time 7301. = .000

Surface Elevation = 2.43

Settle3D Analysis Information
Port Cameron - Marsh Creation

Project Settings

Document Name	Marsh - 4feet of fill.s3z
Project Title	Port Cameron - Marsh Creation
Date Created	1/17/2017, 3:51:51 PM
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	months
Permeability Units	feet/day
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use properties from first layer to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name	Time [months]
1	Stage 1	0
2	Stage 2	1
3	Stage 3	3
4	Stage 4	6
5	Stage 5	12
6	Stage 6	24
7	Stage 7	48
8	Stage 8	96
9	Stage 9	240

Results

Time taken to compute: 0 seconds

Stage: Stage 1 = 0 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	0
Consolidation Settlement [in]	0	0
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0	1.0985
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	0	0
Pore Water Pressure [tons/ft2]	0.14	1.68466
Excess Pore Water Pressure [tons/ft2]	0.0710739	0.14
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [tons/ft2]	0.00752	4.5
Over-consolidation Ratio	1.1	7.63951
Void Ratio	1.1	1.8
Permeability [ft/d]	2.11771e-005	0.0206158
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.2197

Stage: Stage 2 = 1 mon

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000145081	4.43901
Consolidation Settlement [in]	-0.000145081	4.43901
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.0625503	1.09809
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	-0.000158698	0.378889
Pore Water Pressure [tons/ft2]	0	1.68512
Excess Pore Water Pressure [tons/ft2]	0	0.138451
Degree of Consolidation [%]	0	62.5897
Pre-consolidation Stress [tons/ft2]	0.0944032	4.5
Over-consolidation Ratio	1	7.63287
Void Ratio	0.739111	1.7983
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.219684

Stage: Stage 3 = 3 mon

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000277922	5.56139
Consolidation Settlement [in]	-0.000277922	5.56139
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.0875801	1.09779
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	-0.000251191	0.382015
Pore Water Pressure [tons/ft2]	0	1.68543
Excess Pore Water Pressure [tons/ft2]	0	0.137358
Degree of Consolidation [%]	0	77.8362
Pre-consolidation Stress [tons/ft2]	0.112945	4.5
Over-consolidation Ratio	1	6.75619
Void Ratio	0.730358	1.78144
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.219671

Stage: Stage 4 = 6 mon

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000163054	6.51409
Consolidation Settlement [in]	-0.000163054	6.51409
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.111784	1.09817
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	-0.000256268	0.382597
Pore Water Pressure [tons/ft2]	0	1.68499
Excess Pore Water Pressure [tons/ft2]	0	0.136347
Degree of Consolidation [%]	0	84.8332
Pre-consolidation Stress [tons/ft2]	0.127489	4.5
Over-consolidation Ratio	1	5.76631
Void Ratio	0.728729	1.76296
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.219687

Stage: Stage 5 = 12 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.5003
Consolidation Settlement [in]	0	7.5003
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.14	1.10492
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	-0.000168283	0.382913
Pore Water Pressure [tons/ft2]	0	1.67823
Excess Pore Water Pressure [tons/ft2]	0	0.13469
Degree of Consolidation [%]	0	89.7853
Pre-consolidation Stress [tons/ft2]	0.142299	4.5
Over-consolidation Ratio	1	5.76536
Void Ratio	0.727844	1.73064
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.219956

Stage: Stage 6 = 24 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	8.48791
Consolidation Settlement [in]	0	8.48791
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.14	1.12935
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	0	0.383086
Pore Water Pressure [tons/ft2]	0	1.6538
Excess Pore Water Pressure [tons/ft2]	0	0.126292
Degree of Consolidation [%]	0	93.2736
Pre-consolidation Stress [tons/ft2]	0.142477	4.5
Over-consolidation Ratio	1	5.76471
Void Ratio	0.72736	1.68378
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.220921

Stage: Stage 7 = 48 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.75705
Consolidation Settlement [in]	0	9.75705
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.14	1.16939
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	0	0.38318
Pore Water Pressure [tons/ft2]	0	1.61377
Excess Pore Water Pressure [tons/ft2]	0	0.0966084
Degree of Consolidation [%]	0	96.2227
Pre-consolidation Stress [tons/ft2]	0.142567	4.5
Over-consolidation Ratio	1	5.76416
Void Ratio	0.727097	1.65819
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.222465

Stage: Stage 8 = 96 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.8942
Consolidation Settlement [in]	0	11.8942
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.14	1.20582
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	0	0.383233
Pore Water Pressure [tons/ft2]	0	1.57734
Excess Pore Water Pressure [tons/ft2]	0	0.0496622
Degree of Consolidation [%]	0	98.7648
Pre-consolidation Stress [tons/ft2]	0.142615	4.5
Over-consolidation Ratio	1	5.7637
Void Ratio	0.726948	1.6444
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.223834

Stage: Stage 9 = 240 mon

Data Type	Minimum	Maximum
Total Settlement [in]	0	13.6005
Consolidation Settlement [in]	0	13.6005
Immediate Settlement [in]	0	0
Secondary Settlement [in]	0	0
Loading Stress [tons/ft2]	0.0710739	0.14
Effective Stress [tons/ft2]	0.14	1.22258
Total Stress [tons/ft2]	0.14	2.78316
Total Strain	0	0.383265
Pore Water Pressure [tons/ft2]	0	1.56058
Excess Pore Water Pressure [tons/ft2]	0	0.0057639
Degree of Consolidation [%]	0	99.9579
Pre-consolidation Stress [tons/ft2]	0.142641	4.5
Over-consolidation Ratio	1	5.76348
Void Ratio	0.726859	1.63673
Permeability [ft/d]	2.11771e-005	0.00412317
Coefficient of Consolidation [ft^2/d]	0.02	0.06
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.224453

Loads

1. Rectangular Load

Length	500 ft
Width	500 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	250000 ft^2
Load	0.14 tons/ft2
Depth	0 ft
Installation Stage	Stage 1 = 0 mon

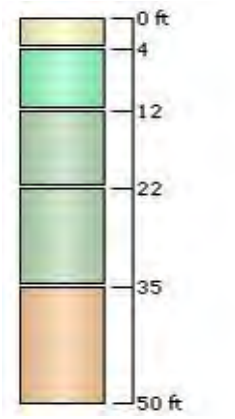
Coordinates

X [ft]	Y [ft]
-215	-260
285	-260
285	240
-215	240

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	Layer 1 - CH/OH - 0 -4	4	0	No
2	Layer 2 - CH - 4 - 12	8	4	No
3	Layer 3 - CH - 12 - 35	10	12	No
4	Layer 3 - CH - 12 - 35	13	22	Yes
5	Layer 4 - Pleistocene - 35-50	15	35	No



Soil Properties

Property	Layer 1 - CH/OH - 0 -4	Layer 3 - CH - 12 - 35	Layer 4 - Pleistocene - 35-50	Layer 2 - CH - 4 - 12
Color				
Unit Weight [tons/ft^3]	0.05	0.052	0.0575	0.05
Saturated Unit Weight [tons/ft^3]	0.05	0.052	0.0575	0.05
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cc	0.8	0.42	0.4	0.7
Cr	0.16	0.084	0.06	0.14
e0	1.8	1.2	1.1	1.5
Pc [t/ft2]			4.5	0.6
OCR	2	1.1		
Cv [ft^2/d]	0.02	0.049	0.06	0.03
B-bar	1	1	1	1
Undrained Su A [t/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0312 tons/ft^3

Piezometric Line Entities

ID	Depth (ft)
1	0 ft

Query Lines

Line #	Start Location	End Location	Horizontal Divisions	Vertical Divisions
1	-210, -10	280, -10	20	Auto: 63

January 16, 2017

Professional Service Industries, Inc. (PSI)
724 Central Avenue
Jefferson, LA 70121

Attn: Ayan Mehrotra, P.E.
Senior Geotechnical Engineer
504-733-9411 (office)
504-733-9415 (fax)
ayan.mehrotra@psiusa.com (email)

Re: Report on Settling Properties of Dredged Sediments for
Port Cameron – Marsh Creation
Cameron, Louisiana
(PSI Project No. 0254869)

Dear Mr. Mehrotra:

As requested by you, we are pleased to submit this data report related to a column settling test (solids concentration = 100 g/L) performed on a composite borrow sample for the Cameron Prairie wildlife refuge marsh restoration project in Cameron, Louisiana.

We appreciate the opportunity to work on this project. Please do not hesitate to contact us if you have any questions or need additional information.

Sincerely,

Malay Ghose Hajra

Malay Ghose-Hajra, Ph.D., P.E., ENV SP
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Department of Civil and Environmental Engineering
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Report on Settling Properties of Dredged Sediments for Port Cameron – Marsh Creation Cameron, Louisiana (PSI Project No. 0254869)

Submitted to:

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Submitted by:

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January 16, 2017

Introduction:

This report presents the results of Settling Column test performed on a composite sediment sample which may be hydraulically dredged and used for the Cameron Prairie Wildlife Refuge marsh restoration project in Cameron, Louisiana. The project was authorized by Mr. Ayan Mehrotra, P.E. with Professional Service Industries, Inc. (PSI) on December 6, 2016.

Project Information:

It is understood that hydraulically dredged sediments from a borrow area will be used to restore and create approximately 500 acres of marshland in within the Cameron Prairie Wildlife Refuge in Cameron, Louisiana. The sediments will be dredged from the proposed site of the new oil and gas port service facility being constructed adjacent to the east bank of the Calcasieu Ship Channel. The proposed maximum depth of cut in the borrow area is 30 feet below mudline. The composite sample for the settling column test was provided to us my PSI. It is understood that the composite sample was prepared by combining soil samples from five (5) soil borings drilled to a depth of 120 feet below mudline in the borrow area. The borrow area boring were drilled under PSI Project No. 0254834. The composite sample(s) were obtained from the samples within the upper 30 feet of the five (5) soil borings. The boring numbers and GPS coordinates of the borings are given in the following Table 1:

Table 1: GPS coordinates of borrow soil borings

Boring No.	**GPS Coordinates**	
B-1 (VST)	29°48'43.39"N	93°20'45.39"W
B-2 (VST)	29°48'54.11"N	93°20'34.23"W
B-3 (VST)	29°48'43.52"N	93°20'26.21"W
B-5 (VST)	29°48'39.67"N	93°20'44.08"W
B-6	29°48'34.14"N	93°20'34.00"W

Additionally five (5) buckets of site water was provided to us by PSI. The site water was used in performing the settling column test. Appendix A of this report includes the Boring Location plan for the Port Cameron – Marsh Creation project (provided to us by PSI).

Experimental Procedure:

PSI provided us with homogenized sediment and site water from the proposed borrow area for use in the Settling Column test. Geotechnical characterization testing was performed on the homogenized sample that was used for the Settling Column test. The test results are presented in Table 2 below:

Table 2: Geotechnical properties of homogenized sediment

Homogenized Sample ID	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Specific Gravity	Organic Content (%)	% passing No. 200 sieve	Measured Salinity (ppt)
2016-4	80*	26*	54*	2.65*	4.2	90*	2.43

* Test results provided by Professional Services Industries, Inc.

Slurry was prepared using the homogenized sediment and site water from the proposed borrow area. As described in the US Army Corps of Engineers Manual EM 1110-2-5027, slurry containing fine-grained fraction of the soil sediments was obtained by thoroughly mixing the slurry and allowing the coarse grained material to separate by differential settling. The fine grained portion was used to fill a large plexiglass column (8 inch inside diameter). Solids concentration in the slurry at the start of test was measured in samples collected along the height of the column from designated ports. The total suspended solids (TSS) concentration at the start of the settling test was measured as **98 g/L**. Figure 1 shows the schematic of the apparatus for the settling column test.

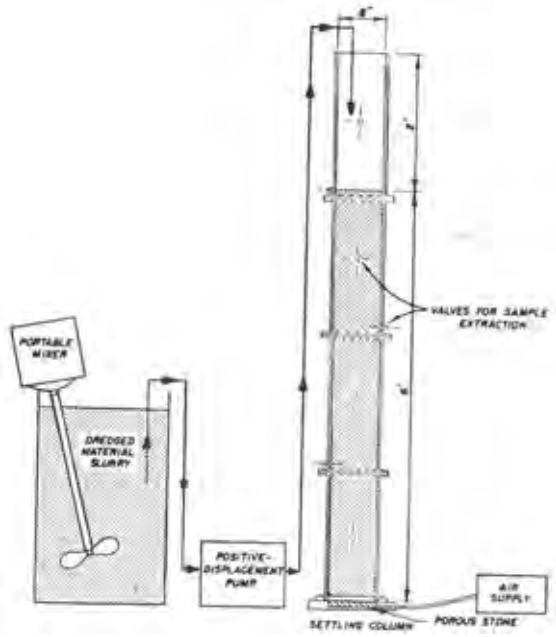


Figure 1: Schematic of apparatus for settling test (source: EM 1110-2-5027)

A sediment-water interface was observed shortly after the start of the test (less than 1 hour). The height of the sediment-water interface above the bottom of the column was measured and recorded over a period of 15 days. The sediment-water interface height as a function of time is included in Appendix B of this report. Photographs of the settling characteristics of the sediments were taken throughout the duration of the test. Appendix C of this report contains the photographs taken during the duration of this test.

Water samples were collected from the clarified layer above the sediment-water interface for measurement of Total Suspended Solids (TSS) as described in the US Army Corps of Engineers Manual EM 1110-2-5027. Because the TSS concentrations in the samples collected for characterization of flocculent settling in the zone above the sediment-water interface were low, the mass of suspended solids retained on the filters was lower than the 5 mg recommended by the US Army Corps of Engineers Manual EM 1110-2-5027.

Results:

According to the US Army Corps of Engineers Manual EM 1110-2-5027, the settling process can be categorized according to four basic classifications. If the particle maintains its individuality and does not change in size, shape, or density during the settling process, it is known as ***discreet settling***. ***Flocculent settling*** occurs when particles agglomerate during the settling period with a change in physical properties and settling rate. **Zone settling** is characterized by a lattice structure formed by flocculent suspension which settles as a mass. The high solids concentration blocks the release of water and hinders settling of neighboring particles and a distinct interface between the slurry and the supernatant water is exhibited during the settling process. And lastly, **compression settling** occurs where settling takes place by compression of the lattice structure. All of the above sedimentation processes may occur simultaneously in a disposal area, and any one may control the design of the marsh creation project.

Figure 2 shows the sediment-water interface height as a function of testing time for the above referenced homogenized sample.

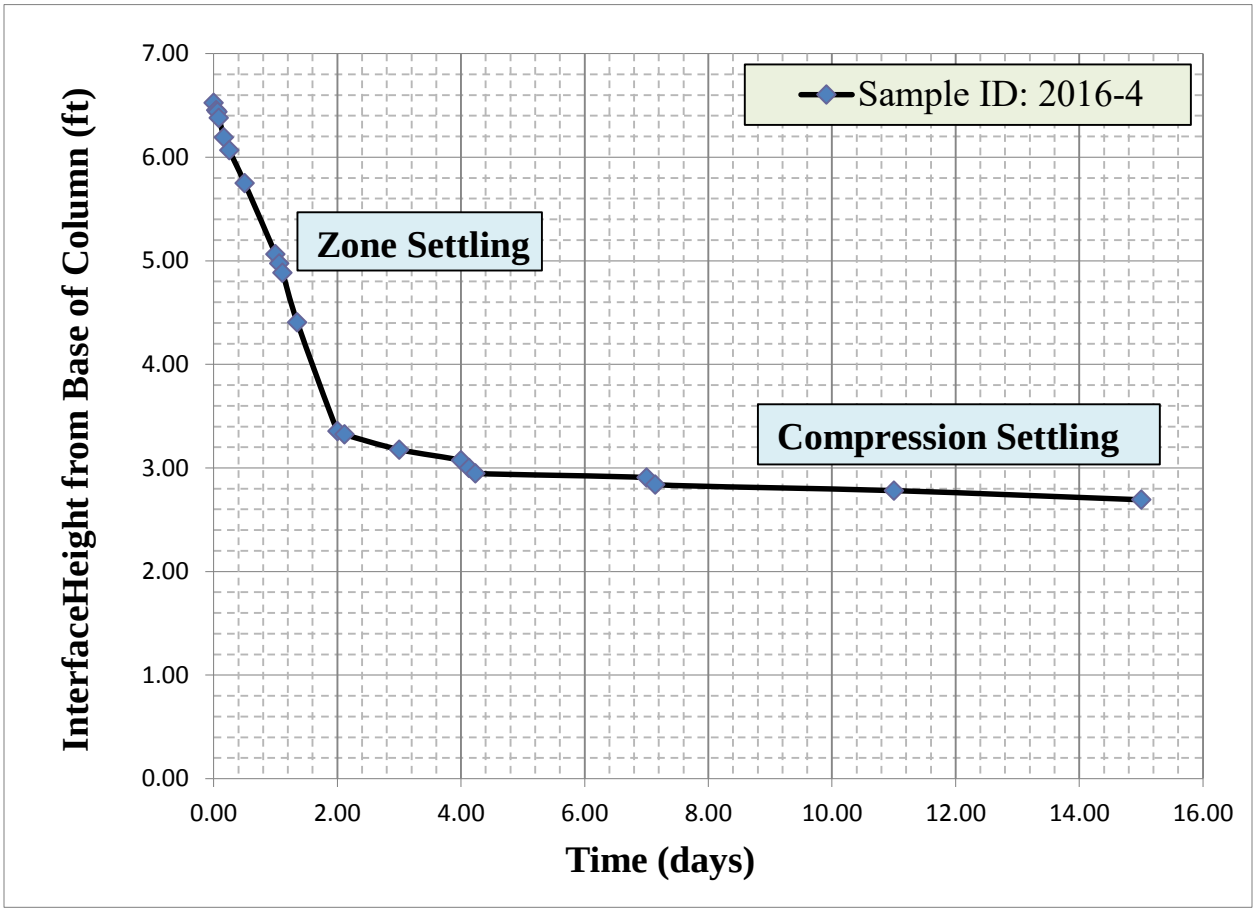


Figure 2: Sediment-water interface height as a function of time for sample 2016-4

As shown in Figure 2, zone settling was observed within 2 days from the start of the settling column test. This was followed by a region of compression settling which continued throughout the remaining duration of the test. Laboratory test data for the first 30 hours (~1.3 day) of the settling column test, during which zone settling was observed, was plotted separately in Figure 3. A linear regression was performed with the resulting equation and correlation coefficient shown on Figure 3.

The slope of the regression line, which corresponds to the zone settling velocity, was 1.48 ft/day. This high settling velocity resulted in a short duration of the zone settling portion of the test.

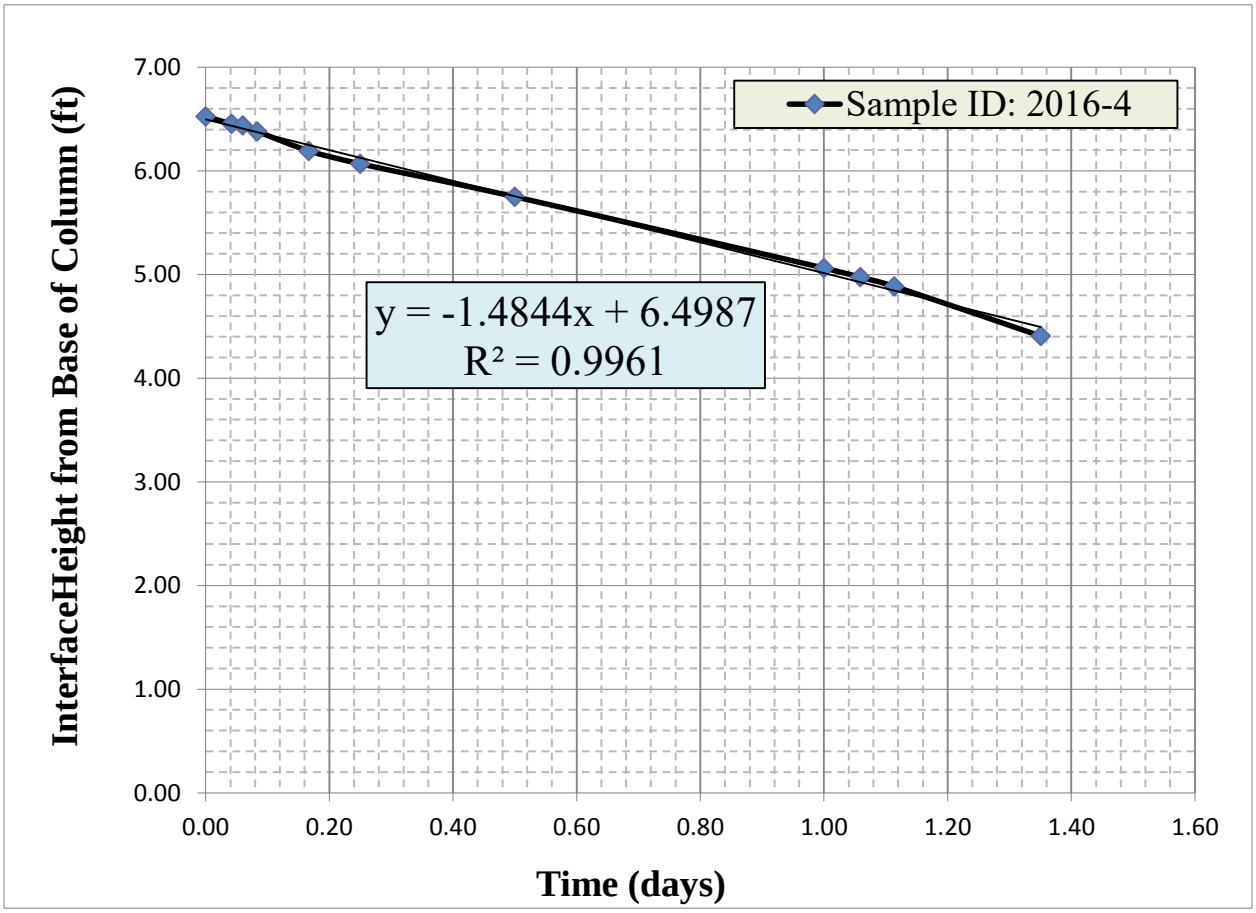


Figure 3: Sediment-water interface height as a function of time during zone settling for sample 2016-4

For the portion of the column settling test during which compression settling was observed, the concentration of sediments for various interface heights was calculated using the following formula (source: US Army Corps of Engineers Manual EM 1110-2-5027):

$$C = \frac{C_0 \ H_i}{H_t} \quad \text{.....(1)}$$

where, C = slurry concentration at time t, (g/L)
C_0 = initial slurry concentration (g/L)
H_i = initial slurry height (ft)
H_t = height of interface at time t (ft)

Figure 4 shows the variation of slurry sediment concentration as a function of time during the compression settling portion of the test.

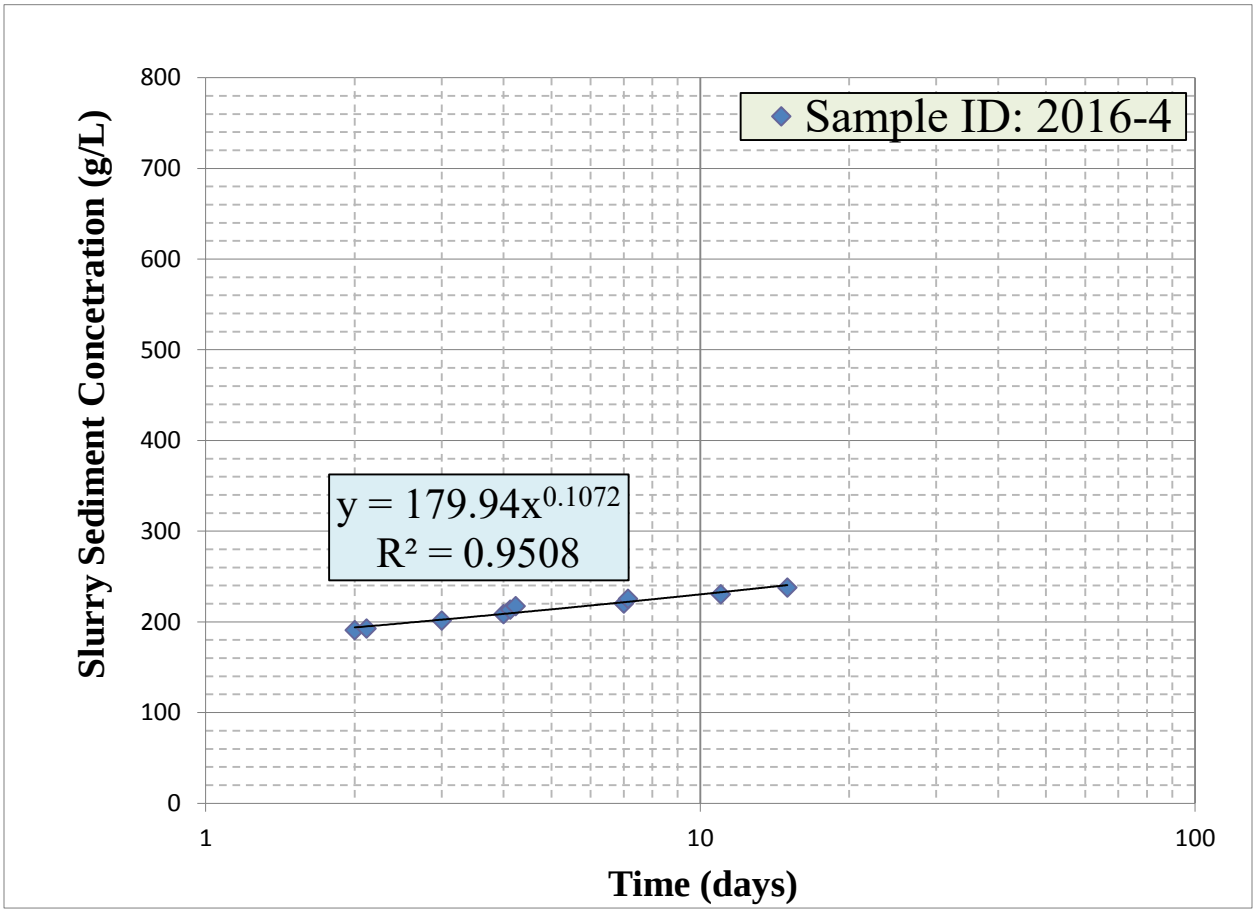


Figure 4: Slurry Sediment Concentration as a function of time during compression settling for Sample 2016-4

References:

1. US Army Corps of Engineers (1987) Engineering and Design – Confined Disposal of Dredged Material, Engineer Manual No. EM 1110-2-5027
2. American Society for Testing and Materials (2016) – Annual Book of ASTM Standards

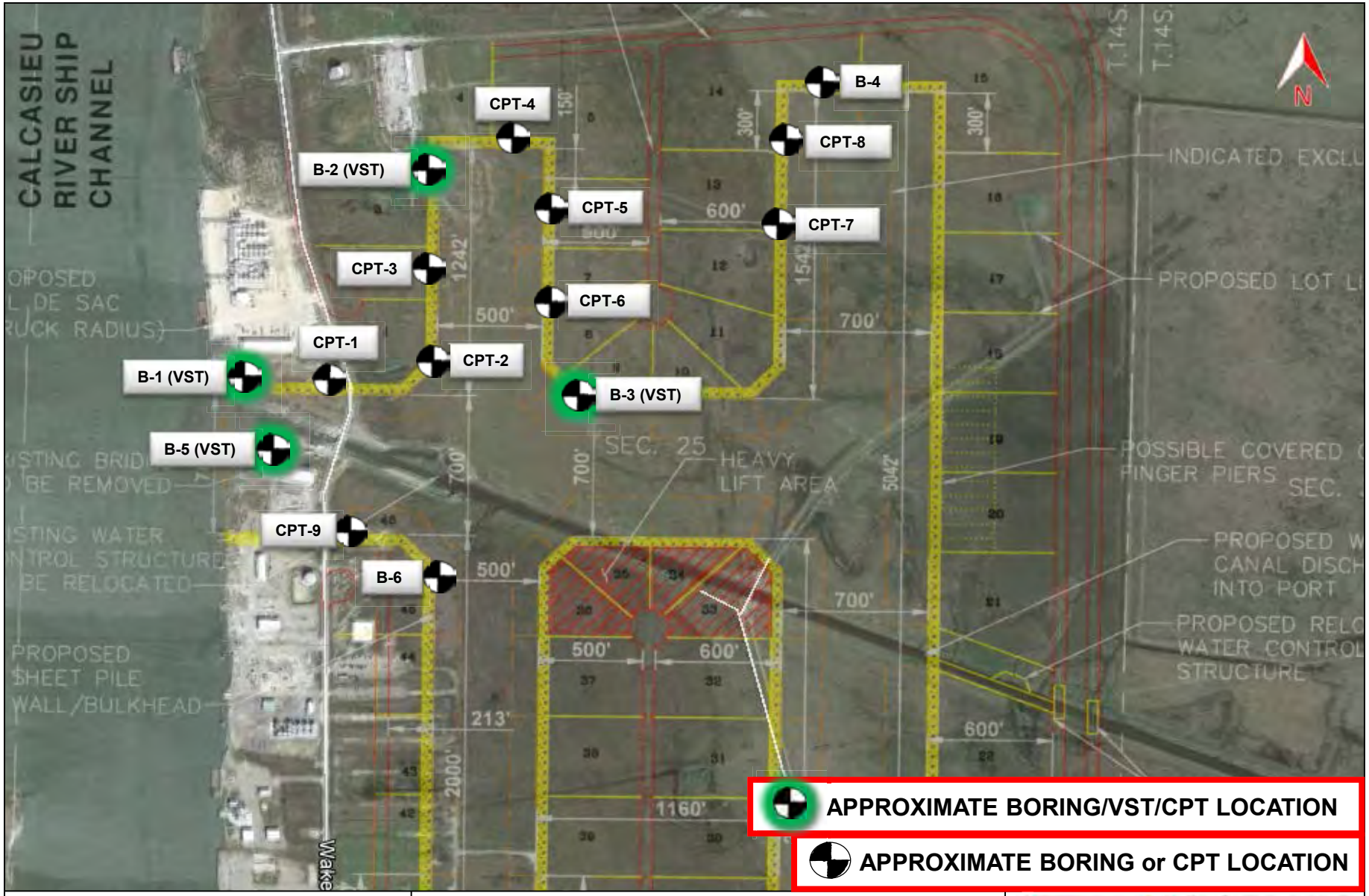
Appendices

Appendix A: Boring Location Plan for Port Cameron – Marsh Creation Project

Appendix B: Sediment-water interface height as a function of time (Sample ID: 2016-4)

Appendix C: Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-4)

Appendix A



Port Cameron
Cameron Parish, Louisiana
Plate 1

Phase I Test Location Plan

PSI Project No. 0254834-1

Google Earth Image Dated January, 2015

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Appendix B

Sediment-water interface height as a function of time (Sample ID: 2016-4)

Elapsed Time (hour)	**Interface Height (feet)**	**H/H_0**
0.00	6.53	1
1.00	6.45	0.98
1.43	6.44	0.985
2.00	6.38	0.977
4.00	6.19	0.948
6.00	6.07	0.929
12.00	5.75	0.880
24.00	5.06	0.775
25.42	4.97	0.761
26.73	4.89	0.748
32.42	4.41	0.674
48.02	3.35	0.513
50.75	3.32	0.508
72.00	3.18	0.486
96.00	3.07	0.470
99.08	3.00	0.459
101.58	2.95	0.451
168.00	2.91	0.445
171.33	2.84	0.434
264.08	2.78	0.425
360.08	2.69	0.412

Appendix C

Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-4)

Start of Settling Column Test

1 hour after start of Settling Column Test

2 hours after start of Settling Column Test

4 hours after start of Settling Column Test

6 hours after start of Settling Column Test

12 hours after start of Settling Column Test

Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-4)

1 day after start of Settling Column Test

2 days after start of Settling Column Test

3 days after start of Settling Column Test

4 days after start of Settling Column Test

7 days after start of Settling Column Test

15 days after start of Settling Column Test

January 16, 2017

Professional Service Industries, Inc. (PSI)
724 Central Avenue
Jefferson, LA 70121

Attn: Ayan Mehrotra, P.E.
Senior Geotechnical Engineer
504-733-9411 (office)
504-733-9415 (fax)
ayan.mehrotra@psiusa.com (email)

Re: Report on Settling Properties of Dredged Sediments for
Port Cameron – Marsh Creation
Cameron, Louisiana
(PSI Project No. 0254869)

Dear Mr. Mehrotra:

As requested by you, we are pleased to submit this data report related to a column settling test (solids concentration = 150 g/L) performed on a composite borrow sample for the Cameron Prairie wildlife refuge marsh restoration project in Cameron, Louisiana.

We appreciate the opportunity to work on this project. Please do not hesitate to contact us if you have any questions or need additional information.

Sincerely,

Malay Ghose Hajra

Malay Ghose-Hajra, Ph.D., P.E., ENV SP
Assistant Professor
Department of Civil and Environmental Engineering
Engineering Building, Room #813
The University of New Orleans
2000 Lakeshore Drive
New Orleans, Louisiana 70148
504-280-7062 (office)
mghoseha@uno.edu (email)

Report on Settling Properties of Dredged Sediments for Port Cameron – Marsh Creation Cameron, Louisiana (PSI Project No. 0254869)

Submitted to:

Ayan Mehrotra, P.E.
Senior Geotechnical Engineer
Professional Service Industries, Inc. (PSI)
724 Central Avenue
Jefferson, LA 70121
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504-733-9415 (fax)
ayan.mehrotra@psiusa.com (email)

Submitted by:

Malay Ghose-Hajra, Ph.D., P.E., ENV SP
Assistant Professor
Department of Civil and Environmental Engineering
Engineering Building, Room #813
The University of New Orleans
2000 Lakeshore Drive
New Orleans, Louisiana 70148
504-280-7062 (office)
mghoseha@uno.edu (email)

January 16, 2017

Introduction:

This report presents the results of Settling Column test performed on a composite sediment sample which may be hydraulically dredged and used for the Cameron Prairie Wildlife Refuge marsh restoration project in Cameron, Louisiana. The project was authorized by Mr. Ayan Mehrotra, P.E. with Professional Service Industries, Inc. (PSI) on December 6, 2016.

Project Information:

It is understood that hydraulically dredged sediments from a borrow area will be used to restore and create approximately 500 acres of marshland in within the Cameron Prairie Wildlife Refuge in Cameron, Louisiana. The sediments will be dredged from the proposed site of the new oil and gas port service facility being constructed adjacent to the east bank of the Calcasieu Ship Channel. The proposed maximum depth of cut in the borrow area is 30 feet below mudline. The composite sample for the settling column test was provided to us my PSI. It is understood that the composite sample was prepared by combining soil samples from five (5) soil borings drilled to a depth of 120 feet below mudline in the borrow area. The borrow area boring were drilled under PSI Project No. 0254834. The composite sample(s) were obtained from the samples within the upper 30 feet of the five (5) soil borings. The boring numbers and GPS coordinates of the borings are given in the following Table 1:

Table 1: GPS coordinates of borrow soil borings

Boring No.	**GPS Coordinates**	
B-1 (VST)	29°48'43.39"N	93°20'45.39"W
B-2 (VST)	29°48'54.11"N	93°20'34.23"W
B-3 (VST)	29°48'43.52"N	93°20'26.21"W
B-5 (VST)	29°48'39.67"N	93°20'44.08"W
B-6	29°48'34.14"N	93°20'34.00"W

Additionally five (5) buckets of site water was provided to us by PSI. The site water was used in performing the settling column test. Appendix A of this report includes the Boring Location plan for the Port Cameron – Marsh Creation project (provided to us by PSI).

Experimental Procedure:

PSI provided us with homogenized sediment and site water from the proposed borrow area for use in the Settling Column test. Geotechnical characterization testing was performed on the homogenized sample that was used for the Settling Column test. The test results are presented in Table 2 below:

Table 2: Geotechnical properties of homogenized sediment

Homogenized Sample ID	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Specific Gravity	Organic Content (%)	% passing No. 200 sieve	Measured Salinity (ppt)
2016-5	80*	26*	54*	2.65*	4.2	90*	2.84

***** Test results provided by Professional Service Industries, Inc.

Slurry was prepared using the homogenized sediment and site water from the proposed borrow area. As described in the US Army Corps of Engineers Manual EM 1110-2-5027, slurry containing fine-grained fraction of the soil sediments was obtained by thoroughly mixing the slurry and allowing the coarse grained material to separate by differential settling. The fine grained portion was used to fill a large plexiglass column (8 inch inside diameter). Solids concentration in the slurry at the start of test was measured in samples collected along the height of the column from designated ports. The total suspended solids (TSS) concentration at the start of the settling test was measured as **150 g/L.** Figure 1 shows the schematic of the apparatus for the settling column test.

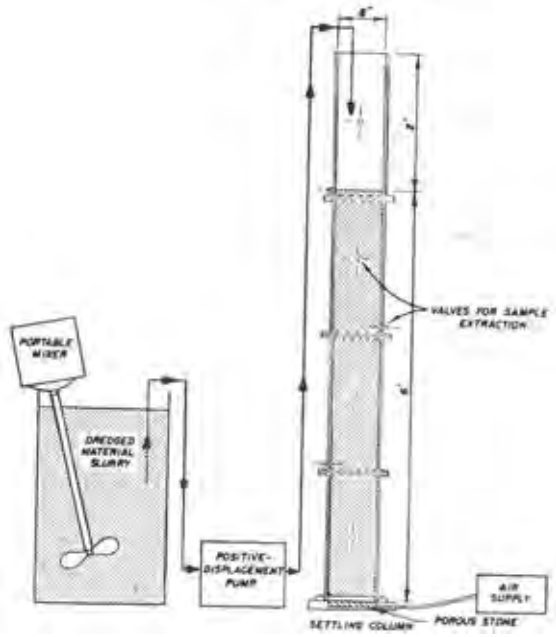


Figure 1: Schematic of apparatus for settling test (source: EM 1110-2-5027)

A sediment-water interface was observed shortly after the start of the test. The height of the sediment-water interface above the bottom of the column was measured and recorded over a period of 15 days. The sediment-water interface height as a function of time is included in Appendix B of this report. Photographs of the settling characteristics of the sediments were taken throughout the duration of the test. Appendix C of this report contains the photographs taken during the duration of this test.

Water samples were collected from the clarified layer above the sediment-water interface for measurement of Total Suspended Solids (TSS) as described in the US Army Corps of Engineers Manual EM 1110-2-5027. Because the TSS concentrations in the samples collected for characterization of flocculent settling in the zone above the sediment-water interface were low, the mass of suspended solids retained on the filters was lower than the 5 mg recommended by the US Army Corps of Engineers Manual EM 1110-2-5027.

Results:

According to the US Army Corps of Engineers Manual EM 1110-2-5027, the settling process can be categorized according to four basic classifications. If the particle maintains its individuality and does not change in size, shape, or density during the settling process, it is known as ***discreet settling***. ***Flocculent settling*** occurs when particles agglomerate during the settling period with a change in physical properties and settling rate. **Zone settling** is characterized by a lattice structure formed by flocculent suspension which settles as a mass. The high solids concentration blocks the release of water and hinders settling of neighboring particles and a distinct interface between the slurry and the supernatant water is exhibited during the settling process. And lastly, **compression settling** occurs where settling takes place by compression of the lattice structure. All of the above sedimentation processes may occur simultaneously in a disposal area, and any one may control the design of the marsh creation project.

Figure 2 shows the sediment-water interface height as a function of testing time for the above referenced homogenized sample.

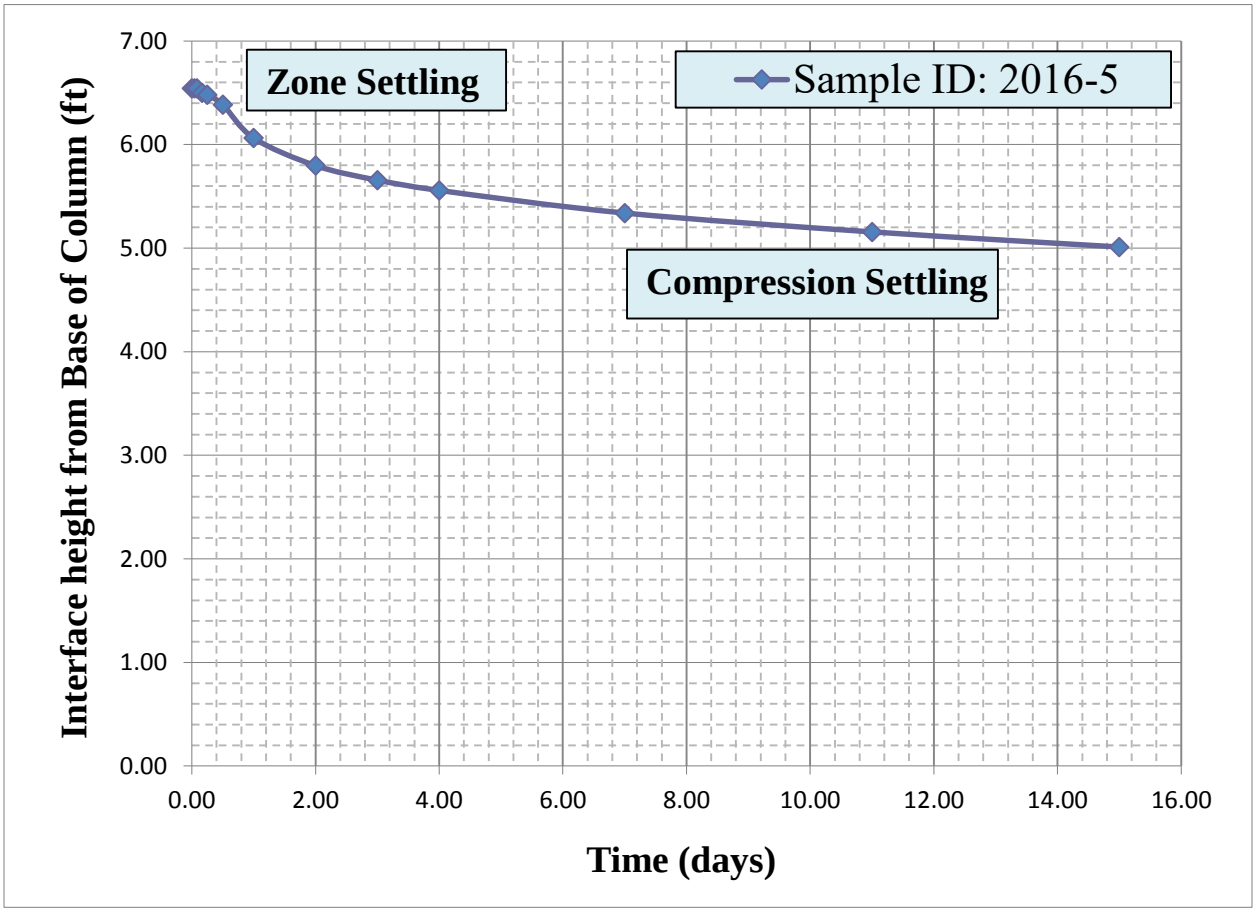


Figure 2: Sediment-water interface height as a function of time for sample 2016-5

As shown in Figure 2, zone settling was observed within 1 day from the start of the settling column test. This was followed by a region of compression settling which continued throughout the remaining duration of the test. Laboratory test data for the first 30 hours (~1.3 day) of the settling column test, during which zone settling was observed, was plotted separately in Figure 3. A linear regression was performed with the resulting equation and correlation coefficient shown on Figure 3.

The slope of the regression line, which corresponds to the zone settling velocity, was 0.33 ft/day.

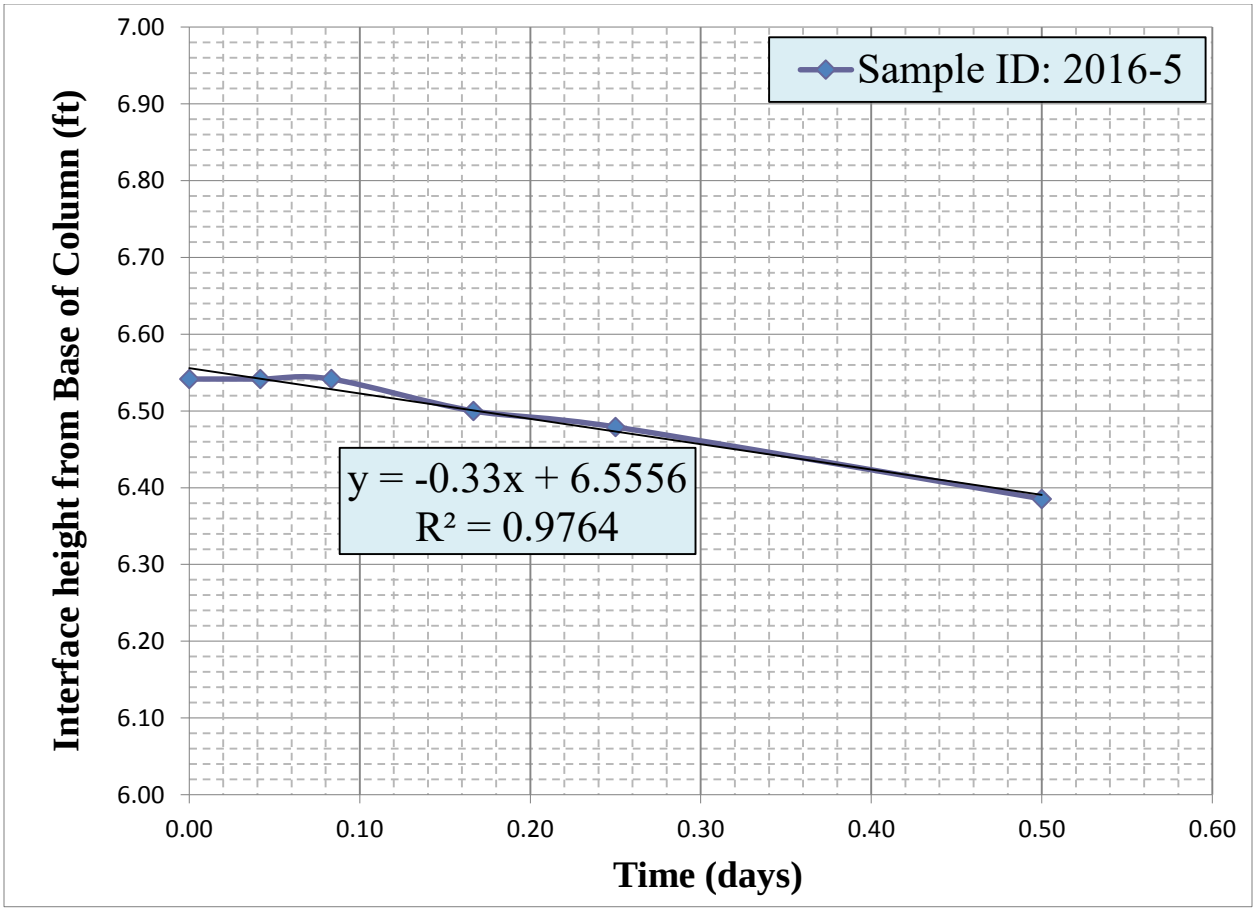


Figure 3: Sediment-water interface height as a function of time during zone settling for sample 2016-5

For the portion of the column settling test during which compression settling was observed, the concentration of sediments for various interface heights was calculated using the following formula (source: US Army Corps of Engineers Manual EM 1110-2-5027):

$$C = \frac{C_0 \ H_i}{H_t} \quad \text{.....(1)}$$

where, C = slurry concentration at time t, (g/L)
C_0 = initial slurry concentration (g/L)
H_i = initial slurry height (ft)
H_t = height of interface at time t (ft)

Figure 4 shows the variation of slurry sediment concentration as a function of time during the compression settling portion of the test.

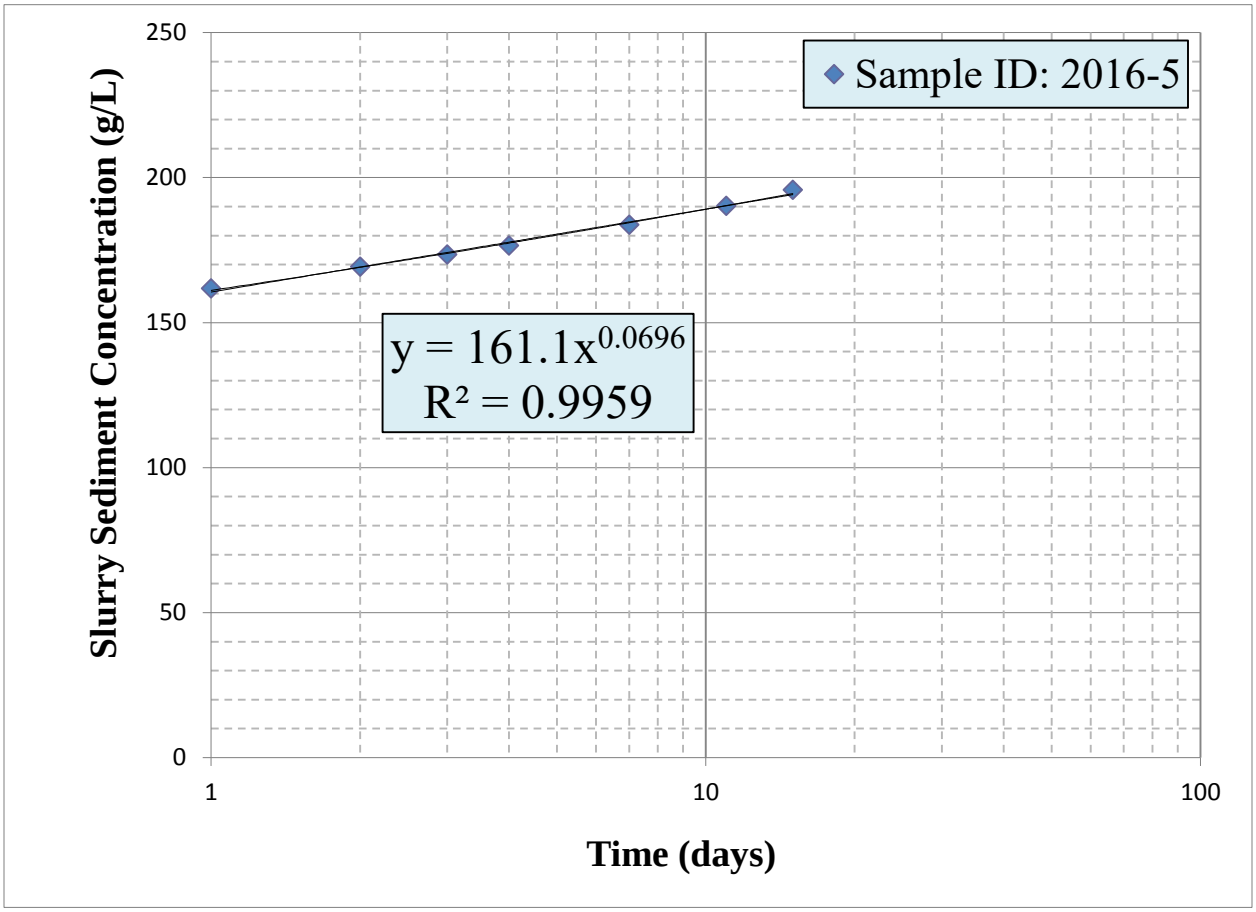


Figure 4: Slurry Sediment Concentration as a function of time during compression settling for Sample 2016-5

References:

1. US Army Corps of Engineers (1987) Engineering and Design – Confined Disposal of Dredged Material, Engineer Manual No. EM 1110-2-5027
2. American Society for Testing and Materials (2016) – Annual Book of ASTM Standards

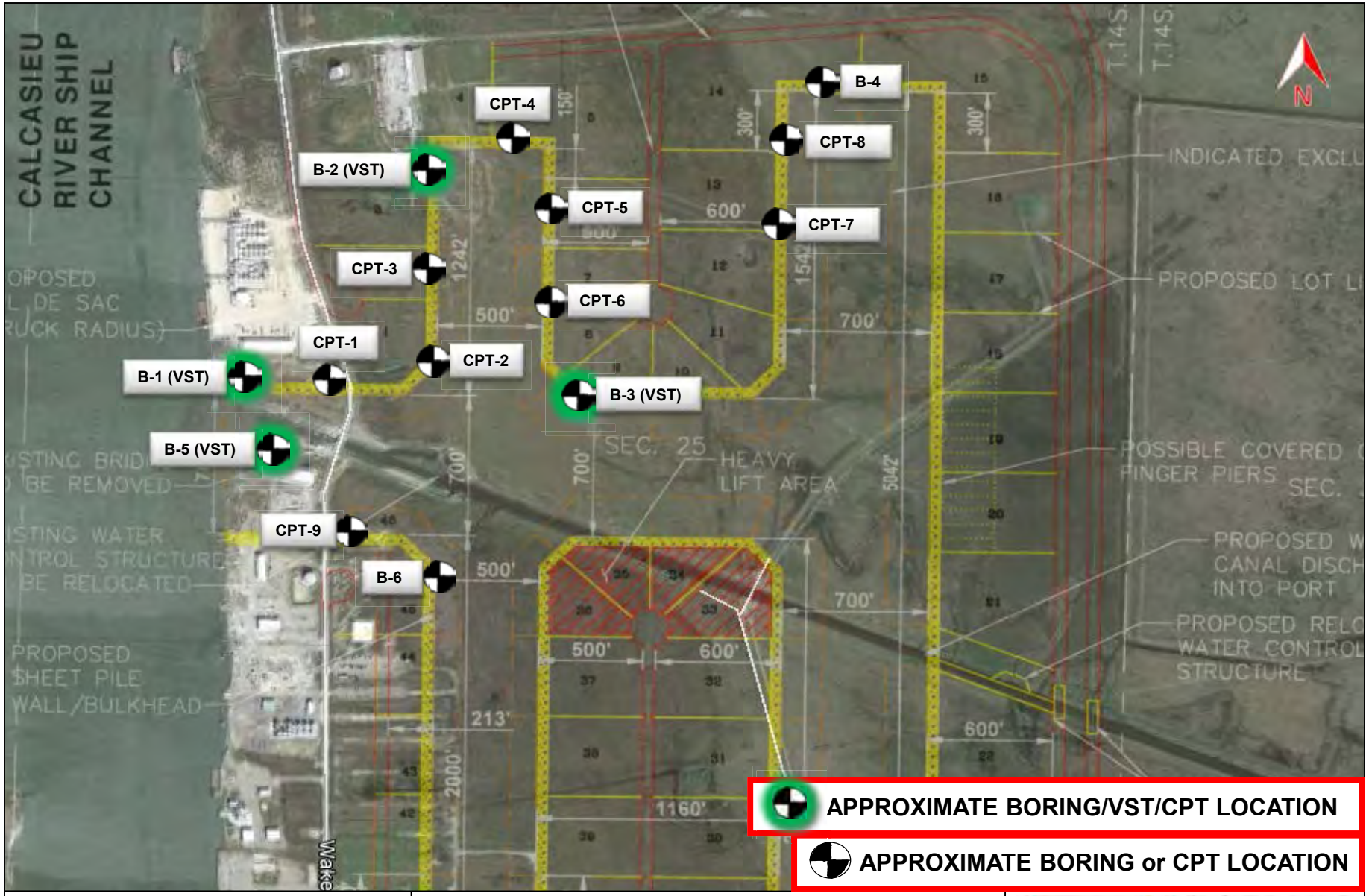
Appendices

Appendix A: Boring Location Plan for Port Cameron – Marsh Creation Project

Appendix B: Sediment-water interface height as a function of time (Sample ID: 2016-5)

Appendix C: Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-5)

Appendix A



Port Cameron
Cameron Parish, Louisiana
Plate 1

Phase I Test Location Plan

PSI Project No. 0254834-1

Google Earth Image Dated January, 2015

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Appendix B

Sediment-water interface height as a function of time (Sample ID: 2016-5)

Elapsed Time (hour)	**Interface Height (feet)**	**H/H_0**
0.00	6.54	1.000
1.00	6.54	1.000
2.00	6.54	1.000
4.00	6.50	0.994
6.00	6.48	0.991
12.00	6.39	0.976
24.00	6.06	0.927
48.00	5.80	0.886
72.00	5.66	0.865
96.00	5.56	0.850
168.00	5.34	0.816
264.00	5.16	0.788
360	5.01	0.766

Appendix C

Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-5)

Start of Settling Column Test

1 hour after start of Settling Column Test

2 hours after start of Settling Column Test

4 hours after start of Settling Column Test

6 hours after start of Settling Column Test

12 hours after start of Settling Column Test

Photographs of Sediment-water interface height as a function of time (Sample ID: 2016-5)

1 day after start of Settling Column Test

2 days after start of Settling Column Test

4 days after start of Settling Column Test

7 days after start of Settling Column Test

11 days after start of Settling Column Test

15 days after start of Settling Column Test

Bulk Factor Calculation for Dredged Fill – EM 1110-2-5027

Project Name: Port Cameron – Marsh Creation
Location: Cameron Prairie National Wildlife Refuge
PSI Project No.: 0254869-1

1.) Void ratio, e_0: $e_0 = \frac{G_s \cdot \gamma_w}{C_d} - 1$

Specific gravity, $G_s = 2.65$ (measured, PSI)

Unit weight of water, $\gamma_w = 1000\,{}^{g}\!/_{L}$

Design solids concentration, 1. $C_d = (179.94)\cdot(45 days)^{0.1072} = 270.6\,{}^{g}\!/_{L}$ (1)

2. $C_d = (161.1)\cdot(45 days)^{0.0696} = 210\,{}^{g}\!/_{L}$ (2)

$$e_0 = \frac{(2.65)\cdot(1000\,{}^{g}\!/_{L})}{270.6\,{}^{g}\!/_{L}\ or\ 210} - 1 = 8.79 or 11.62$$

(1)*Initial TSS Concentration = 98 g/L;* (2)*Initial TSS Concentration = 150 g/L*

2.) Assume 100 cy of material. Based on lab test data, assume approximately 85% fine-grained soils.

Volume of coarse-grained soils, V_{sd}: $V_{sd} = 100cy \cdot 0.15 = 15cy$

Volume of fine-grained soils, V_i: $V_i = 100cy \cdot 0.85 = 85cy$

Volume of fine-grained sediment after disposal, V_f:

$$V_f = V_i\left(\frac{e_0 - e_i}{1 + e_i} + 1\right)$$

Void ratio at beginning of consolidation, $e_i = 2.49$
(from low-pressure consolidation test (Low P-3), PSI)

$$V_f = 85cy\left(\frac{8.79 or 11.62 - 2.49}{1 + 2.49} + 1\right) = 238 or 307.4cy$$

3.) Total volume, V: $V = V_f + V_{sd}$

$$V = 238 or 307cy + 15cy = 253 or 322cy$$

Cut/Fill Ratio: $\frac{V}{100cy} = \frac{238 or 307cy}{100cy} =$ 2.4 or 3.1

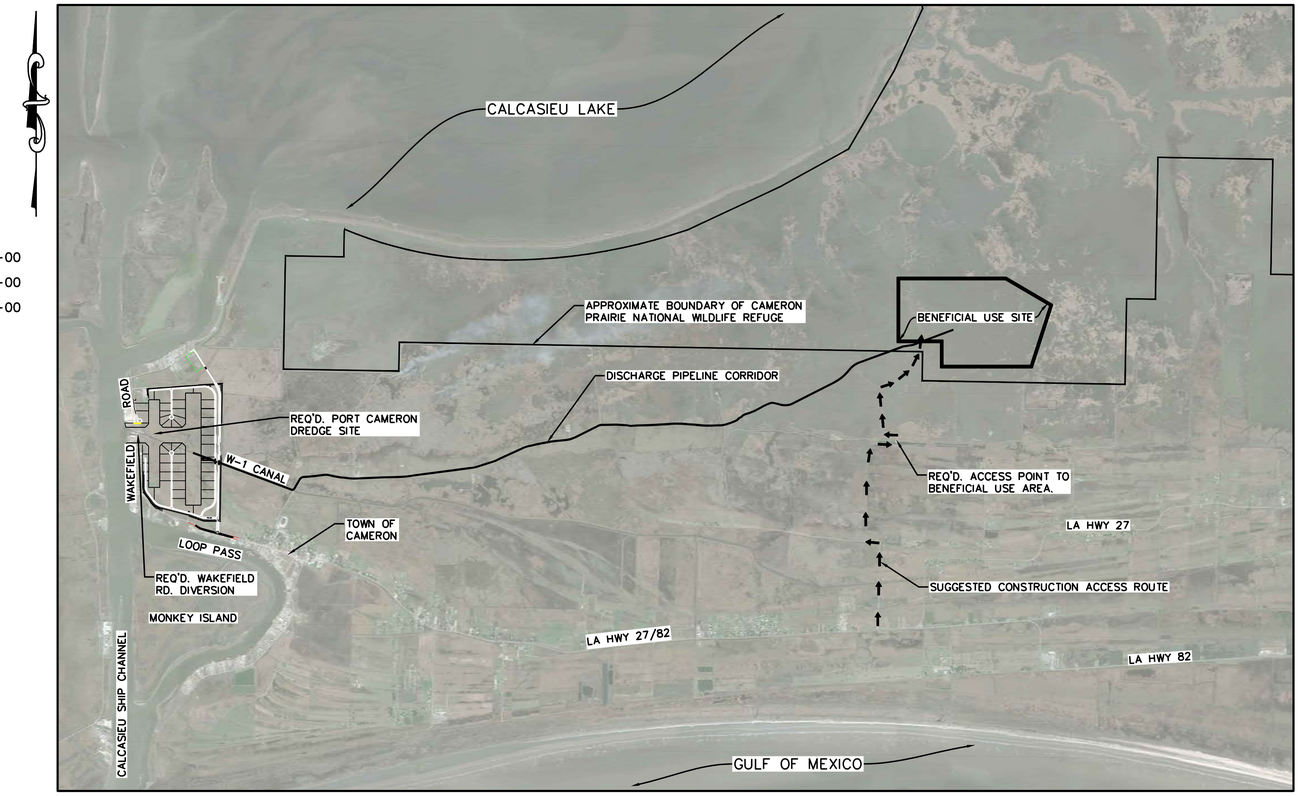
Attachment A: Marsh Creation Project Figures

PORT CAMERON DREDGING AND MARSH CREATION PROJECT

JULY 2017

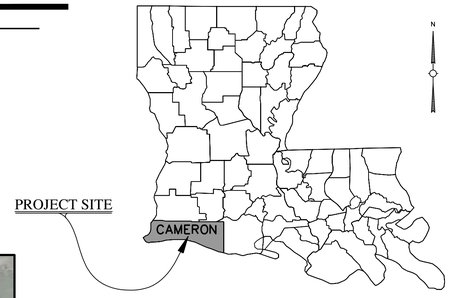
INDEX TO SHEETS

SHEET	DESCRIPTION
1	TITLE SHEET
2	SUMMARY OF ESTIMATED QUANTITIES & GENERAL NOTES
3	PROJECT LOCATION MAP
4	TEMPORARY DIVERSION AND DEMOLITION PLAN
5	OVERALL DREDGING PLAN
6	DREDGE CROSS SECTIONS A, B & C
7	DREDGE CROSS SECTIONS D, E & F
8	DREDGE CROSS SECTIONS G, H & I
9	DREDGE CROSS SECTIONS J, K & L
10	DREDGE CROSS SECTIONS M, N & O
11	DREDGE CROSS SECTION P
12	GRADING LAYOUT
13	MITIGATION AREA SITE MAP
14	MITIGATION AREA CROSS SECTIONS 20+00 – 40+00
15	MITIGATION AREA CROSS SECTIONS 45+00 – 65+00
16	MITIGATION AREA CROSS SECTIONS 70+00 – 90+00
17	OVERALL DREDGE DISCHARGE LINE CORRIDOR
18–25	ENLARGED DREDGE DISCHARGE LINE COORIDOR
26–29	SUGGESTED CONSTRUCTION ACCESS ROUTE
30	TYPICAL DETAILS
31	PLANTING DETAILS
32	BULKHEAD LOCATION PLAN



LOCATION MAP

SCALE: NOT TO SCALE



VICINITY MAP

TYPE OF CONSTRUCTION:

MAJOR CLASSIFICATION: HEAVY CONSTRUCTION
SUBCLASSIFICATION: DREDGING AND WHARFS, DOCKS, HARBOR IMPROVEMENTS, AND TERMINALS.

NO.	DATE	REVISIONS	BY

LLOYD R. ERIKSON
NAME
PRELIMINARY
7/18/17
DATE
31061
LICENSE NO.

THIS DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION CONVEYANCE, SALES OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT

PLANS PREPARED BY AND RECOMMENDED FOR APPROVAL:

EVANS-GRAVES ENGINEERS, INC.
ENGINEERING CONSULTANTS 9029 JEFFERSON HWY. BATON ROUGE, LA. 70809 (225) 926-1620

LLOYD R. ERIKSON, P.E.
CHIEF CIVIL ENGINEER
P.E. REG. No. 31061

DATE

SHEET NUMBER 1

PARISH	CAMERON	
FEDERAL PROJECT	N/A	
STATE PROJECT	N/A	
DESIGNED LRE	DRAWN LRE	DATE JULY 2017
CHECKED SEW	DETAILED CHECKED	SHEET

PRELIMINARY

NO. DATE REVISION DESCRIPTION BY

PORT CAMERON

TITLE SHEET

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call 1-800-272-3020 Call before you dig

EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\1402500_TI.dwg – Aug 17, 2017 – 2:13pm

SUMMARY OF ESTIMATED QUANTITIES

ITEM NUMBER	ITEM	UNIT	QUANTITY
001	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	1
002	PRE-CONSTRUCTION SURVEY	LUMP SUM	1
003	POST CONSTRUCTION, PROCESS, CHECK AND AS-BUILT SURVEY	LUMP SUM	1
004	REMOVAL OF EXISTING WAKEFIELD ROAD BRIDGE	LUMP SUM	1
005	BULKHEAD WALL ENGINEERING FOR PHASE 1 ONLY	LUMP SUM	1
006	BULKHEAD WALL FOR PHASE 1 ONLY (INCLUDES BACKFILL, FENDER SYSTEM, BOLLARDS, TAILWALLS, ETC.)	LINEAR FEET	11,000
007	HYDRAULIC DREDGING PLACED ON BENEFICIAL USE SITE AND LOTS	CUBIC YARD	8,773,780
008	DREDGE DISCHARGE PIPELINE (CONSTRUCTION AND MAINTENANCE)	LUMP SUM	1
009	PRIMARY CONTAINMENT DIKE CONSTRUCTION	LINEAR FEET	20,310
010	SECONDARY CONTAINMENT DIKE CONSTRUCTION	LINEAR FEET	7,500
011	MARSHHAY CORDGRASS PLANTING	EACH	273,650
012	SMOOTH CORDGRASS PLANTING	EACH	273,650
013	ENVIRONMENTAL PROTECTION PLAN (EPP) & GENERAL ENVIRONMENTAL PROTECTION PLAN PROVISIONS	LUMP SUM	1
014	WAKEFIELD ROAD DIVERSION	LUMP SUM	1
015	REMOVAL AND DISPOSAL OF FIELD PIPELINES AND OTHER OBSTRUCTIONS	LUMP SUM	1
016	STONE TOP DRESSING LOTS 1-18 (18" THICK OVER GEOTEXTILE FABRIC)(100'W)	SQUARE YARD	97,755
017	STONE TOP DRESSING LOTS 19-20 (18" THICK OVER GEOTEXTILE FABRIC)(100'W)	SQUARE YARD	8,889
018	STONE TOP DRESSING LOTS 21-40 (18" THICK OVER GEOTEXTILE FABRIC)(100'W)	SQUARE YARD	104,000
019	STONE TOP DRESSING LOTS 41-45 (18" THICK OVER GEOTEXTILE FABRIC)(100'W)	SQUARE YARD	29,492

BULKHEAD WALL NOTES:

1. THE DESIGNATED PORTION OF THE WORK FOR THE COMPLETE BULKHEAD WALL SYSTEM ("BULKHEAD WALL") IS NOT WITHIN EVANS-GRAVES' DESIGN RESPONSIBILITY. THE BULKHEAD WALL IS TO BE PROVIDED AS A DESIGN-BUILD ITEM BY THE CONTRACTOR.

2. THE CONTRACTOR SHALL PROVIDE THOSE DESIGN SERVICES AND CONSTRUCTION NECESSARY TO SATISFACTORILY COMPLETE THE BULKHEAD WALL, TO INCLUDE ALL REQUIRED PERMITS, LICENSES AND CERTIFICATIONS. BULKHEAD WALL CALCULATIONS, DRAWINGS, PLANS AND SPECIFICATIONS SHALL BE DESIGNED AND STAMPED BY A LOUISIANA LICENSED PROFESSIONAL ENGINEER IN ACCORDANCE WITH THE ENGINEERING LAW AND RULES, AND SHALL BE FOR A COMPLETE FUNCTIONAL SYSTEM TO MEET THE REQUIREMENTS OF THE PROJECT, THE OWNER'S DESIGN PARAMETERS AND SOUND ENGINEERING DESIGN.

3. THE CONTRACTOR, AND ITS DESIGN ENGINEER FOR THE BULKHEAD WALL WHERE APPROPRIATE, SHALL BE RESPONSIBLE FOR COMPLIANCES WITH ALL LAWS, CODES, REGULATIONS, DESIGN STANDARDS, ENGINEERING LICENSE REQUIREMENTS AND RULES, FEDERAL, STATE AND LOCAL JURISDICTIONAL AUTHORITIES' RULES AND REGULATIONS, AND ANY PERMITS ASSOCIATED WITH THE DESIGN AND CONSTRUCTION OF THE BULKHEAD WALL. FURTHER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SURVEYS, INVESTIGATIONS, FIELD MEASUREMENTS, AND FIELD COORDINATION WITH EXISTING AND OTHER WORK, TO INCLUDE EXISTING AND NEW UTILITIES.

4. THE DESIGN ENGINEER FOR THE BULKHEAD WALL SHALL HAVE RESPONSIBILITY FOR CONTRACT ADMINISTRATION SERVICES ASSOCIATED WITH THE BULKHEAD WALL, TO INCLUDE SHOP DRAWING REVIEW, PERIODIC SITE OBSERVATIONS TO VERIFY PAY APPLICATIONS AND CONTRACT CONFORMANCES, AS REQUESTED BY EVANS-GRAVES, FINAL SITE OBSERVATION TO VERIFY CONFORMANCE OF WORK TO PLANS AND SPECIFICATIONS, AND RESPONSE TO REQUESTS FOR INFORMATION FOR INTERPRETATION OF ITS DESIGN REQUIREMENTS.

5. SHOP DRAWINGS, TO INCLUDE ALL FABRICATIONS, ERECTION, LAYOUT, AND MANUFACTURING DRAWINGS, AND PERFORMANCE DATA SHALL BE REQUIRED FOR THE BULKHEAD WALL TO DEMONSTRATE HOW THE CONTRACTOR SHALL CONFORM TO THE DESIGN AND PROJECT REQUIREMENTS. THE CONTRACTOR SHALL SPECIFICALLY NOTE ANY DEVIATIONS FROM THE PLANS AND SPECIFICATIONS, AND SHALL REVIEW AND APPROVE SHOP DRAWINGS FOR COMPLIANCE BEFORE SUBMISSION TO THE DESIGN ENGINEER FOR THE BULKHEAD WALL, WHO SHALL BE RESPONSIBLE FOR REVIEW AND APPROVAL. THE CONTRACTOR'S APPROVAL SHALL INDICATE ITS COORDINATION OF THE WORK AND COMPLIANCES WITH THE DESIGN REQUIREMENTS. APPROVED SHOP DRAWINGS SHALL NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. EVANS-GRAVES IS ENTITLED TO RELY ON THE APPROVAL BY THE CONTRACTOR AND DESIGN ENGINEER.

6. THE COMPLETE ENGINEERED CALCULATIONS, DRAWING, PLANS AND SPECIFICATIONS SHALL BE PROVIDE TO EVANS-GRAVES FOR REVIEW PRIOR TO THE SHOP DRAWING STAGE OR START OF FABRICATION. HOWEVER, EVANS-GRAVES' REVIEW AND APPROVAL SHALL BE FOR THE LIMITED PURPOSE OF GENERAL COMPLIANCE WITH THE PROJECT REQUIREMENTS SUCH AS WALL HEIGHT, NUMBER OF MOORING BOLLARDS, DESIGN LIFE AND CATHODIC PROTECTION CONSIDERATIONS. THIS IS A GENERAL REVIEW ONLY. EVANS-GRAVES WILL NOT REVIEW CALCULATIONS AND WILL NOT BE RESPONSIBLE FOR ANY DESIGN REVIEW AND APPROVAL SHALL NOT RELIEVE THE CONTRACTOR OF ITS RESPONSIBILITY TO COMPLY WITH THE BULKHEAD WALL PLANS AND SPECIFICATIONS AND THE PROJECT REQUIREMENTS, AND SHALL NOT RELIEVE THE DESIGN ENGINEER FOR THE BULKHEAD WALL FROM ANY RESPONSIBILITY OR LIABILITY FOR BULKHEAD WALL DAMAGE.

7. IN ADDITION TO EVANS-GRAVES' REVIEW, THE CONTRACTOR MAY BE REQUIRED TO SUBMIT THE COMPLETED CALCULATIONS, DRAWINGS, PLANS AND SPECIFICATIONS TO THIRD PARTY FOR REVIEW AND APPROVAL PRIOR TO THE SHOP DRAWING STAGE OR FABRICATION. SUFFICIENT TIME SHALL BE ALLOWED FOR THIS REVIEW. THE CONTRACTOR SHALL BE REQUIRED TO RESPOND TO AND COMPLY WITH THE THIRD PARTY REVIEWER'S REQUESTS FOR INFORMATION OR MODIFICATIONS OF THE DESIGN. HOWEVER, EVANS-GRAVES IS NOT HEREBY OBLIGATED TO PROVIDE FOR A THIRD PARTY REVIEW.

8. EVANS-GRAVES SHALL HAVE THE RIGHT TO PERFORM CERTAIN CONTRACT ADMINISTRATION TASKS RELATED TO THE BULKHEAD WALL, TO INCLUDE SITE OBSERVATIONS, REVIEW OF CONTRACTOR PAY APPLICATIONS, SHOP DRAWING SUBMITTAL REVIEW, REVIEW OF CONTRACTOR REQUESTS FOR INFORMATION, AND REVIEW FOR FINAL PROJECT ACCEPTANCE. HOWEVER, EVANS-GRAVES' SERVICES ASSOCIATED WITH THE BULKHEAD WALL SHALL BE FOR THE CONTRACTOR OF ITS OBLIGATIONS TO PROVIDE THE BULKHEAD WALL IN FULL CONFORMANCE WITH THE CONTRACT AND PROJECT REQUIREMENTS.

9. EVANS-GRAVES SHALL BE ENTITLED TO RELY UPON THE ADEQUACY, COMPLETENESS, CERTIFICATIONS AND/OR APPROVALS OF THE SERVICES OR WORK PERFORMED BY THE CONTRACTOR AND ITS DESIGN ENGINEER FOR THE BULKHEAD WALL. EVANS-GRAVES SHALL NOT BE RESPONSIBLE FOR THE ACTS OR OMISSIONS OF THE CONTRACTOR OR ITS DESIGN ENGINEER FOR THE BULKHEAD WALL, OR ANY OF THEIR ASSOCIATED WITH THE BULKHEAD WALL, TO INCLUDE ANY DECISIONS OR INTERPRETATIONS MADE REGARDING THE BULKHEAD WALL DESIGN OR CONSTRUCTION.

10. THE AGREEMENT BETWEEN THE CONTRACTOR AND ITS DESIGN ENGINEER FOR THE BULKHEAD WALL SHALL NOT INCLUDE ANY LIMIT OF LIABILITY. THE CONTRACTOR AND DESIGN ENGINEER MUST OBTAIN AND MAINTAIN PROPER INSURANCE TO COVER DESIGN ERRORS AND OMISSIONS ASSOCIATED WITH THE BULKHEAD WALL DESIGN SERVICES, WITH A COVERAGE AMOUNT OF AT LEAST $AN AMOUNT EQUAL TO THE TOTAL BID COST OF THE BULKHEAD AND SUBMIT PROOF OF INSURANCE BEFORE DESIGN OF THE BULKHEAD WALL BEGINS.

11. BULKHEAD WALL DESIGN PARAMETERS:
    DESIGN LIFE ; 75 YEARS
    TYPE : OPEN CELL
    TOP OF WALL : ELEV. 6.50'
    BOTTOM OF DREDGE : ELEV. -35.00'
    DECK PRESSURE : 250 PSF MINIMUM
    DESIGN VESSEL : CHOUEST ISLAND VENTURE (ULSTEIN)
    SHEET COATING : COAL TAR EPOXY PER LATEST USACE SPECIFICATION
    CORROSION PROTECTION : SACRIFICIAL SHEET THICKNESS + CATHODIC PROTECTION
    FENDERING SYSTEM : FULL LENGTH 14" STEEL PIPE (OR SIMILAR).
    BOLLARD SYSTEM : PIPE BOLLARDS PLACED AT EVERY OTHER WYE PILE

GENERAL NOTES:

1. THE CONSTRUCTION CONTRACTOR SHALL TAKE PRE- AND POST- CONSTRUCTION SURVEYS OF THE FILL AREAS AND THE IMMEDIATELY-SURROUNDING MARSH TO ENSURE THAT TARGET ELEVATIONS HAVE BEEN MET AND THERE IS NO EXCESSIVE DEPOSITION OF FILL MATERIAL ON ADJACENT MARSH. GRADING OF DISPOSAL MATERIALS AND/OR RUN-OFF SHALL BE CONDUCTED IMMEDIATELY FOLLOWING PROJECT COMPLETION IF SPECIFIC AREAS ARE FOUND TO HAVE EXCESSIVE FILL AT UNACCEPTABLE TARGET ELEVATIONS.

2. CONTRACTOR SHALL PROVIDE ON-GROUND PRE- AND POST-CONSTRUCTION SCALED PHOTOGRAPHIC DOCUMENTATION AT A SCALE THAT CLEARLY SHOWS THE ENTIRE WORK AREA. THE PRE- AND POST-CONSTRUCTION PHOTOS SHOULD BE AT THE SAME SCALE. THE POST-CONSTRUCTION DOCUMENTATION SHALL BE ACQUIRED (PHOTOS ACTUALLY TAKEN) AND SUBMITTED WITHIN 60 DAYS OF THE END OF THE FIRST GROWING SEASON (APRIL 1-AUGUST 1) FOLLOWING COMPLETION OF THE PROJECT. IN ORDER TO INSURE THAT ACCEPTABLE TARGET ELEVATIONS AND SPECIFIED CRITERIA HAVE BEEN ACHIEVED AT THE DISPOSAL LOCATIONS.

3. NO ACTIVITY IS AUTHORIZED UNDER THIS WORK WHICH MAY ADVERSELY AFFECT SIGNIFICANT ARCHAEOLOGICAL OR CULTURAL RESOURCES LISTED OR ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES UNTIL THE REQUIREMENTS FOR SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT ARE MET. UPON DISCOVERY OF THE PRESENCE OF ANY PREVIOUSLY UNKNOWN HISTORIC AND/OR PREHISTORIC CULTURAL RESOURCES. ALL WORK MUST CEASE AND THE CONTRACTOR MUST NOTIFY THE ENGINEER, WHO WILL IN TURN WILL NOTIFY THE STATE HISTORIC PRESERVATION OFFICE AND THE CORPS OF ENGINEERS. WORK SHALL BE SUSPENDED UNTIL IT IS DETERMINED WHETHER OR NOT THE ACTIVITY WILL HAVE AN ADVERSE EFFECT ON CULTURAL RESOURCES. WORK MAY BE REACTIVATED OR MODIFIED THROUGH SPECIFIC CONDITIONS IF NECESSARY, IF IT IS DETERMINED THAT THE ACTIVITY WILL HAVE NO ADVERSE EFFECT ON THE CULTURAL RESOURCES. IF IT IS DETERMINED THAT CULTURAL RESOURCES WOULD BE ADVERSELY AFFECTED, THAT PORTION OF THE WORK MAY BE INDEFINITELY SUSPENDED.

4. IF AT ANY TIME DURING CONSTRUCTION, RARE, ENDANGERED, OR OTHERWISE SIGNIFICANT PLAN AND ANIMAL SPECIES, PLANT COMMUNITIES, OR OTHER NATURAL FEATURES ARE ENCOUNTERED WITHIN THE PROJECT AREA, CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY, WHO WILL CONTACT THE BIOLOGISTS AT THE LOUISIANA NATURAL HERITAGE PROGRAM (LNHP) FOR FURTHER DETERMINATION OF ACTION.

5. THERE SHALL BE NO UNREASONABLE INTERFERENCE WITH, OR HAZARDS TO NAVIGATION CAUSED BY THIS WORK. THE CONTRACTOR WILL, AT HIS EXPENSE, INSTALL AND MAINTAIN ANY SAFETY LIGHTS, SIGNALS AND SIGNS PRESCRIBED BY THE UNITED STATES COAST GUARD, THROUGH REGULATIONS OR OTHERWISE, OR AUTHORIZED FACILITIES OR ON EQUIPMENT USED IN PERFORMING THIS WORK.

6. ANY DISCHARGE OF POLLUTANTS INTO WATERS SHALL BE AT ALL TIMES CONSISTENT WITH APPLICABLE WATER QUALITY STANDARDS, EFFLUENT LIMITATIONS, AND STANDARDS OF PERFORMANCE PROHIBITIONS, PRETREATMENT STANDARDS AND MANAGEMENT PRACTICES ESTABLISHED PURSUANT TO THE CLEAN WATER ACT (PL 92-500: 86 STAT 816), OR PURSUANT TO APPLICABLE STATE AND LOCAL LAWS.

7. FOR ACTIVITIES RESULTING IN GENERATION OF SEWAGE AND/OR RELATED DOMESTIC WASTES ALL SEWAGE AND DISPOSAL SYSTEMS SHALL COMPLY WITH THE STATE SANITARY CODE AND THE DEPARTMENT OF HEALTH AND HOSPITALS, AND MUST BE APPROVED BY THE ENGINEER BEFORE USAGE.

8. ALL ACTIVITIES PROPOSED UNDER THIS WORK MUST COMPLY WITH ALL OTHER NECESSARY FEDERAL, STATE, AND/OR LOCAL PERMITS, LICENSES, OR APPROVAL. FAILURE TO DO SO WOULD RESULT IN A VIOLATION OF THE APPROVED PROJECT PERMIT.

9. PRIOR TO COMMENCEMENT OF ANY PROPOSED WORK OR CONSTRUCTION, THE CONTRACTOR SHALL VERIFY POSSESSION OF ANY REQUIRED PERMITS FROM CITY AND/OR PARISH AGENCIES.

10. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE STATE LAWS REGARDING THE NEED TO CONTACT THE LOUISIANA ONE CALL (LOC) SYSTEM (1-800-272-3020) TO LOCATE ANY BURIED CABLES AND PIPELINES.

11. THE CONTRACT FOR THIS WORK DOES NOT GRANT OR CONVEY ANY PROPERTY RIGHTS, MINERAL RIGHTS, OR EXCLUSIVE PRIVILEGES: NOR DOES IT AUTHORIZE INJURY TO PROPERTY OR RIGHTS OF OTHERS.

12. CONTRACTOR SHALL TAKE EFFORTS TO AVOID SUBSTANTIALLY DISRUPTING THE MOVEMENT OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATERBODY, INCLUDING THOSE SPECIES WHICH NORMALLY MIGRATE THROUGH THE AREA.

13. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IF ANY POTENTIAL COLONIAL NESTING WATER BIRDS ARE OBSERVED AT OR WITHIN 1,000 FEET OF ANY PROJECT SITES, IN ORDER TO DETERMINE ANY NECESSARY ABATEMENT TECHNIQUES OR ANY REQUIREMENTS OF THE STATES BIOLOGISTS AND THE THE U.S. FISH AND WILDLIFE SERVICE. NO PART OF THE PROJECT SHALL OCCUR WITHIN THE TIME WINDOW CORRESPONDING TO THE NESTING PERIOD OF THE PARTICULAR SPECIES OF NESTING BIRD(S) FOUND ON THE PARTICULAR SITE. FOR A RANGE UP TO 1,000 FEET FROM THE ROOKERY. AND CONSTRUCTION ACTIVITIES ASSESSED WITH 1,000 FEET OF A KNOWN NESTING WATER BIRD COLONY OR ROOKERY WILL BE RESTRICTED TO THE FOLLOWING WINDOWS OF TIME:
- ANHINGA & CORMORANT: JULY 1-MARCH 1
- GREAT BLUE HERON & GREAT EGRET: AUGUST 1-FEBRUARY 15
- SNOWY EGRET, LITTLE BLUE HERON, TRICOLORED HERON, & REDDISH EGRET: AUGUST 1-MARCH 1
- CATTLE EGRET & IBIS: SEPTEMBER 1-APRIL 1
- GREEN BACKED HERON & YELLOW CROWNED NIGHT HERON: SEPTEMBER 1-MARCH 15
- ROSEATE SPOONBILL: AUGUST 1-APRIL 1.

14. THE CONTRACTOR SHALL ALLOW THE OWNER OR HIS AUTHORIZED REPRESENTATIVE(S) AGENT(S) TO MAKE PERIODIC UNANNOUNCED INSPECTIONS OF THE PROJECT SITES(S) AT ANY TIME DEEMED NECESSARY IN ORDER TO ASSURE THAT THE WORK BEING PERFORMED IS ACCORDANCE WITH THE TERMS AND CONDITIONS OF THE APPROVED PROJECT PERMIT.

15. IF THE OWNER REQUIRES THE REMOVAL, RELOCATION, OR OTHER ALTERNATION OF THE ANY EQUIPMENT OR STRUCTURE, OR IF, IN THE OPINION OF THE OWNER OR HIS AUTHORIZED REPRESENTATIVE, SAID EQUIPMENT OR STRUCTURE SHALL CAUSE UNREASONABLE OBSTRUCTION TO THE FREE NAVIGATION OF NAVIGABLE WATERS. THE CONTRACTOR WILL BE REQUIRED, UPON DUE NOTICE FROM THE ENGINEER OR OWNER, TO REMOVE, RELOCATE, OR ALTER THE EQUIPMENT OR STRUCTURE OR OBSTRUCTIONS CAUSED THEREBY, WITHOUT EXPENSE TO THE OWNER. NO CLAIM SHALL BE MADE ON ACCOUNT OF ANY SUCH REMOVAL OR ALTERATION.

16. NO WHEELED OR TRACKED VEHICLES OR AIRBOATS ARE TO BE USED OUTSIDE OF THE DESIGNATED ACCESS AND PIPELINE CORRIDORS. VEGETATED WETLANDS AREAS SHALL BE UNDISTURBED, EXCEPT AS DEPICTED ON THE PLANS.

17. FILLING AND/OR BLOCKING OF NATURAL WATERWAYS, BAYOUS, OR TRIBUTARIES IS SPECIFICALLY DISALLOWED.

18. THE DREDGE DISCHARGE SHALL BE MONITORED FOR COMPLIANCE BY FIELD INSPECTION PERSONNEL TO ENSURE THAT EXCESSIVE ACCUMULATION OF SEDIMENTS IS PREVENTED.

19. THE CONSTRUCTION OF CONTAINMENT DIKES SHALL OCCUR WITHIN EXISTING OPEN WATER AREAS ONLY. THE PLACEMENT OF SEDIMENT ONTO WETLANDS FOR THE PURPOSES OF OF THE CREATION OF A CONTAINMENT DIKE IS SPECIFICALLY DISALLOWED. CONTAINMENT DIKES ARE ONLY ALLOWED IN OPEN WATER AREAS. AREAS OF EXISTING, HEALTHY MARSH AND/OR VEGETATED WETLANDS ADJACENT TO FILL AREAS WILL BE USED AS A CONTINUANCE OF CONTAINMENT.

20. ALL LOGS, STUMPS, AND OTHER DEBRIS ENCOUNTERED DURING DREDGING ACTIVITIES SHALL BE REMOVED FROM THE SITE DURING OR IMMEDIATELY AFTER THE ACTIVITY AND DISPOSED OF IN ACCORDANCE WITH ALL APPLICABLE LAWS AND REGULATIONS.

21. ALL FILL MATERIAL SHALL BE CLEAN AND FREE OF CONTAMINANTS AND SHALL NOT CONTAIN HAZARDOUS MATERIALS SUCH AS ASBESTOS OR ASBESTOS RESIDUE, SHINGLES, TIRES, OIL/GREASE RESIDUE, EXPOSED REBAR, PROTRUDING OBJECTS, ETC.

22. CONTRACTOR SHALL EMPLOY AND MAINTAIN AT THE THE PROJECT SITE(S) SUITABLE EROSION PROTECTION MEASURES TO THE SATISFACTION OF THE ENGINEER.

23. THE SIDES SLOPES OF CANALS OR HEALTHY MARSH WILL NOT BE BREACHED, EXCAVATED, OR OTHERWISE COMPROMISED DURING THIS PROJECT. THE CONSTRUCTION CONTRACTOR SHALL MAINTAIN THE DESIGNATED DISTANCES OFF OF EXISTING CANAL BANKS AS SHOWN ON THE PLANS. IMMEDIATE WORK STOPPAGE AND RESTORATION OF BANK LINES TO PRE-EXISTING SECURED CONDITION SHALL BE IMPLEMENTED IF ANY NOTABLE DISTURBANCE, DEGRADATION, RUTTING, SLOUGHING, OR FAILURE OCCURS.

24. ANY MARSH OUTSIDE OF THE DESIGNATED PIPELINE COORDINATOR AND ACCESS CORRIDOR THAT IS DISTURBED SHOULD BE DOCUMENTED. CONTRACTOR SHALL TAKE POST-CONSTRUCTION PHOTOGRAPHY OF DISTURBED MARSH AREAS AND SUBMIT TO THE ENGINEER TO DETERMINE WHETHER REMEDIATION OF THE DISTURBED MARSH MAY BE REQUIRED.

25. THE CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO IMMEDIATELY REMEDY ANY OVERBUILD ON ADJACENT MARSH BY REMOVING EXCESS FILL AND RESTORING THE AFFECTED MARSH TO PRE-CONSTRUCTION CONDITIONS OR BETTER, INCLUDING PLANTING OF APPROPRIATE WETLAND SPECIES WHERE VEGETATION HAS BEEN DAMAGED: AND RE-CREATING CONDITIONS CONDUCIVE TO NOURISHMENT AND/OR ENHANCEMENT OF THOSE WETLANDS. THESE ACTIVITIES WILL BE MONITORED FOR COMPLIANCE BY FIELD INSPECTION PERSONNEL.

26. ANY DAMAGE DONE TO ANY LEVEES OR OTHER FLOOD CONTROL STRUCTURES, REVETMENTS, OR SURROUNDING PROJECT AREA, RESULTING FROM THE PURPOSED WORK, MUST BE REPAIRED OR REPLACED.

27. CONTRACTOR SHALL COMPLETE AND SUBMIT AS-BUILTS DRAWINGS FOLLOWING CONSTRUCTION, WHICH SHALL HAVE WRITTEN ON THEM THE DATE OF COMPLETION OF THE WORK. DEFINED LOCATIONS AND DESCRIPTIONS OF ALL CONTAINMENT DIKES SHALL BE PROVIDED WITH THE AS-BUILT INFORMATION.

28. FILL TOLERANCES SHALL BE 0.5 FEET ABOVE THE TARGET ELEVATION FOR THE BENEFICIAL USE SITE AND LOTS. HYDRAULIC FILL MUST MEET THE TARGET EVERYWHERE WITHIN THE BENEFICIAL USE SITE AND LOT FILL AREA. THE CONTRACTOR SHALL FILL ANY DEFICIENT SEGMENT TO MEET THE TARGET EVERYWHERE WITHIN THE BENEFICIAL USE SITE AND LOT FILL AREAS. THE BENEFICIAL USE SITE AND LOT FILL AREA WILL BE INSPECTED AFTER A MINIMUM OF 30 DAYS SUBSEQUENT TO CONTRACTOR NOTIFYING ENGINEER THAT FILL PLACEMENT HAS BEEN ACCOMPLISHED ACCORDING TO THE PLANS AND SPECS. IF THE INSPECTED AREA HAS UNDERGONE SETTLEMENT IN EXCESS OF THE ALLOWABLE TOLERANCES, THE ENGINEER MAY REQUIRE THE CONTRACTOR TO PLACE ADDITIONAL MATERIAL PRIOR TO FINAL ACCEPTANCE.

SHEET NUMBER 2

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	DETAILED	DATE
LRE	DRW	JULY 2017
CHECKED	CHECKED	SHEET
SEW	LRE	

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

SUMMARY OF ESTIMATED QUANTITIES & GENERAL NOTES

PORT CAMERON - DREDGING AND MARSH CREATION

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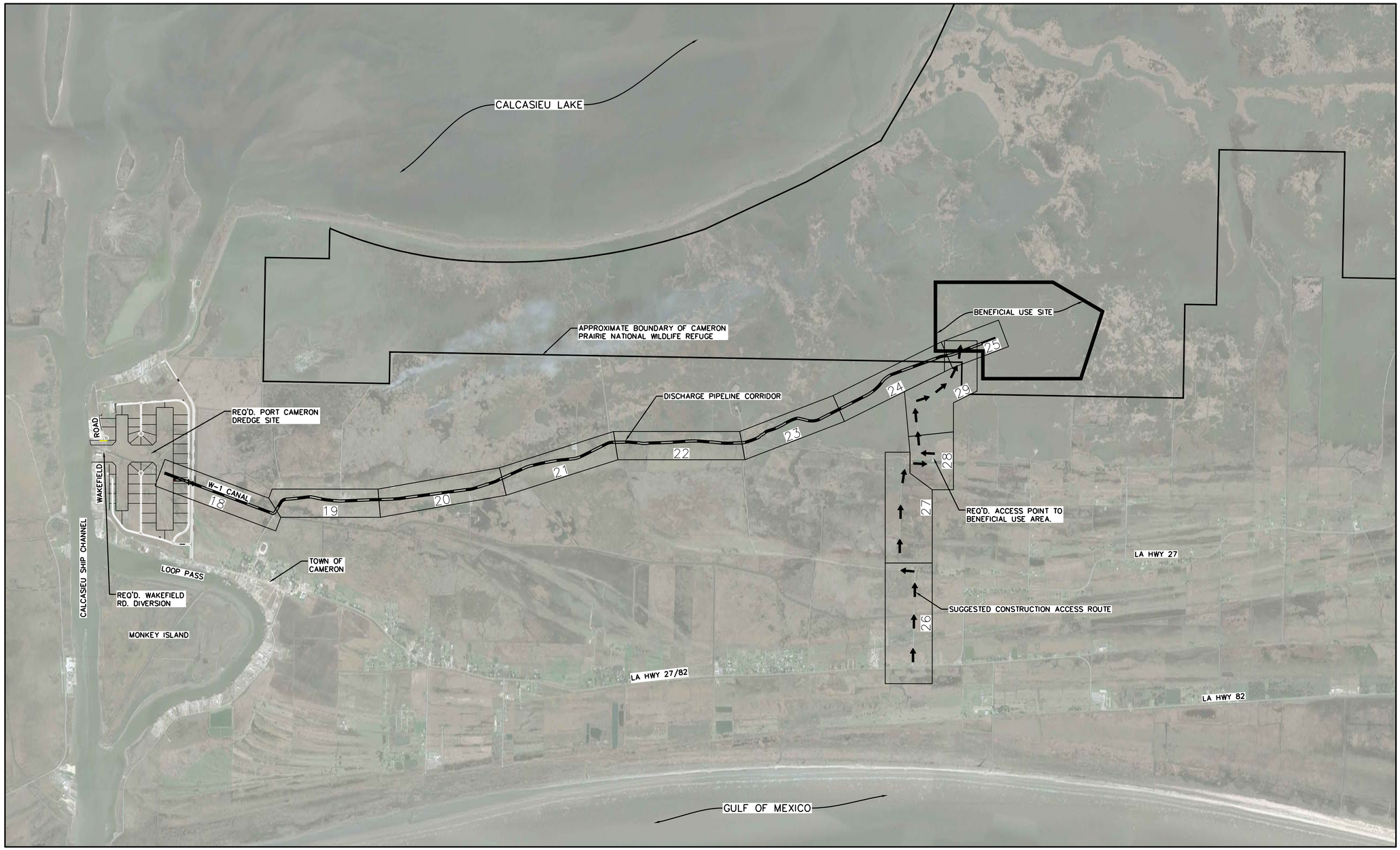

LEGEND:

26 — DENOTES PAGE NO. OF CORRESPONDING SHEET

↑ — SUGGESTED CONSTRUCTION ACCESS ROUTE

DISCHARGE PIPELINE CORRIDOR

LOCATION MAP

2000 0 2000 4000

SCALE IN FEET

SHEET NUMBER	3
PARISH	CAMERON
FEDERAL PROJECT	N/A
STATE PROJECT	N/A
DESIGNED / CHECKED	LRE / SEW
DETAILED / CHECKED	DRW / LRE
DATE / SHEET	JULY 2017

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION | BY

PORT CAMERON

PROJECT LOCATION MAP

PORT CAMERON – DREDGING AND MARSH CREATION

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EXISTING LEGEND:

- POWER POLE
- WATER METER
- TELEPHONE PEDESTAL
- SANITARY SEWER MANHOLE
- FIRE HYDRANT
- MAILBOX
- WATER VALVE
- RIGHT OF WAY MARKER
- ABANDONED GAS WELL SITE
- FENCE
- OVERHEAD ELECTRIC
- GAS PIPELINE
- 6" WATER LINE
- 10" WATER LINE
- EXISTING WATERWAY
- EXISTING ROADWAY
- EXISTING GROUND CONTOURS

PHASING LEGEND:

- PHASE 1 DREDGING (3,281,866 C.Y. TOTAL) TO COMMENCE @ N.T.P. AND WATER LINE RELOCATION
- PHASE 2 DREDGING (935,233 C.Y. TOTAL) TO COMMENCE @ ENLINK PIPELINE RELOCATION
- PHASE 3 DREDGING (1,753,888 C.Y. TOTAL) TO COMMENCE @ NEW WATER CONTROL STRUCTURE START-UP
- PHASE 4 DREDGING (2,802,793 C.Y. TOTAL) TO COMMENCE ONLY AS DIRECTED BY OWNER
- SOIL BORING LOCATION. (RE: GEOTECH REPORT FOR BORING LOGS.)

1" = 300'

CALCASIEU SHIP CHANNEL

DREDGE ACCESS (SEE SHEET 3)

CROSS SECTION BASELINE FOR SECTIONS 'A-A' THRU 'G-G'

EXIST. WAKEFIELD ROAD BRIDGE TO BE REMOVED(SEE SHEET 3)

CROSS SECTION BASELINE FOR SECTIONS 'H-H', 'I-I', 'O-O' & 'P-P'

EXIST. WAKEFIELD ROAD

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE LOWERED BY OTHERS, UNDER SEPARATE CONTRACT)

EXIST. CAPPED ABANDONED GAS WELL.

EXIST. ENLINK PIPELINE TO BE REMOVED BY OTHERS, UNDER SEPARATE CONTRACT.

EAST FORK

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

REQ'D. EXIST. TRANSCANADA & KINETICA PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

PHASE 3 DREDGING 1,753,888 C.Y.

EXIST. W-1 CANAL WATER CONTROL STRUCTURE(TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT)

PHASE 4 DREDGING 1,143,548 C.Y.

PHASE 2 DREDGING 46,004 C.Y.

EXIST. W-1 CANAL

LOOP PASS

EXIST. LA HWY 27/82

EXIST. CAPPED ABANDONED GAS WELL.

FUTURE CONSTRUCTION

PHASE 1 DREDGING 3,281,866 C.Y.

ENERGY ROAD (65' R/W)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

CROSS SECTION BASELINE FOR SECTIONS 'J-J' THRU 'N-N'

EXIST. GRAVEL ROAD

PHASE 4 DREDGING 1,659,245 C.Y.

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE REMOVED BY OTHER, UNDER SEPARATE CONTRACT)

REQ'D. EXIST. ENLINK PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

PHASE 2 DREDGING 889,229 C.Y.

EXIST. CHENIERE PIPELINE

REQ'D. RELOCATED W-1 CANAL CONTROL STRUCTURE. (BY OTHERS, UNDER SEPARATE CONTRACT)

APPROXIMATE LOCATION OF EXIST. 10" WATER LINE.(CONTRACTOR TO VERIFY LOCATION AND SIZE)(TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.)

REQ'D. BULKHEAD WALL. (SEE SHEET 19)

VEHICLE ACCESS

PORT CAMERON DRIVE

EXIST. CAPPED ABANDONED GAS WELL.

EXPLORATION ROAD (65' R/W)

VIATOR ROAD (UNDER SEPARATE CONTRACT)

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

PROPERTY LINE (TYP.)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-9 B-10 B-11

CPT-1 CPT-2 CPT-3 CPT-4 CPT-5 CPT-6 CPT-7 CPT-8 CPT-9

RB-1 RB-2 RB-3 RB-4 RB-5 RB-6 RB-7 RB-8 RB-9 RB-10 RB-11

A B C D E F G H I J K L M N O P

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

SHEET NUMBER	5
PARISH	CAMERON
FEDERAL PROJECT	N/A
STATE PROJECT	N/A
DESIGNED / CHECKED	LRE / SEW
DETAILED / CHECKED	DRW / LRE
DATE / SHEET	JULY 2017

PRELIMINARY

NO. DATE BY REVISION DESCRIPTION

PORT CAMERON

OVERALL DREDGING PLAN

PORT CAMERON – DREDGING AND MARSH CREATION

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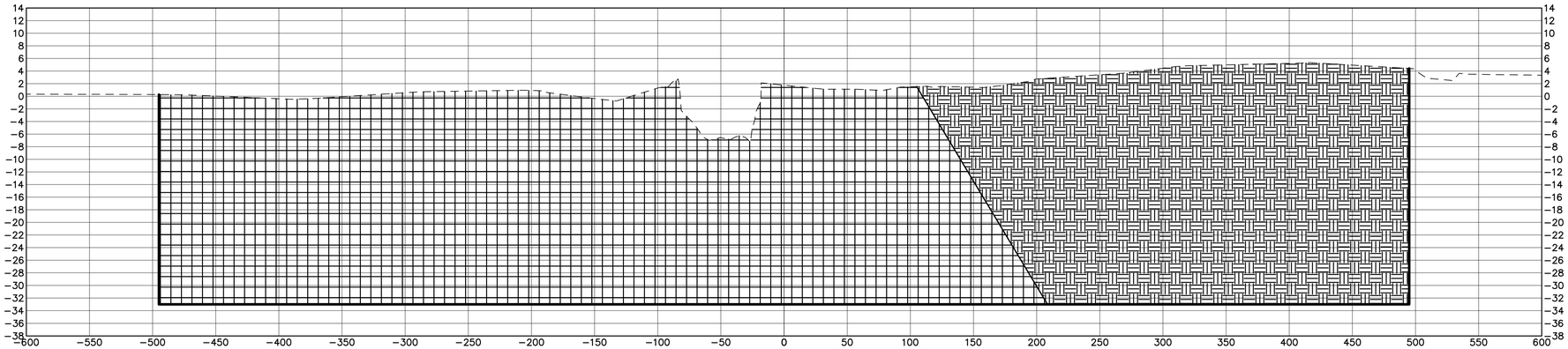
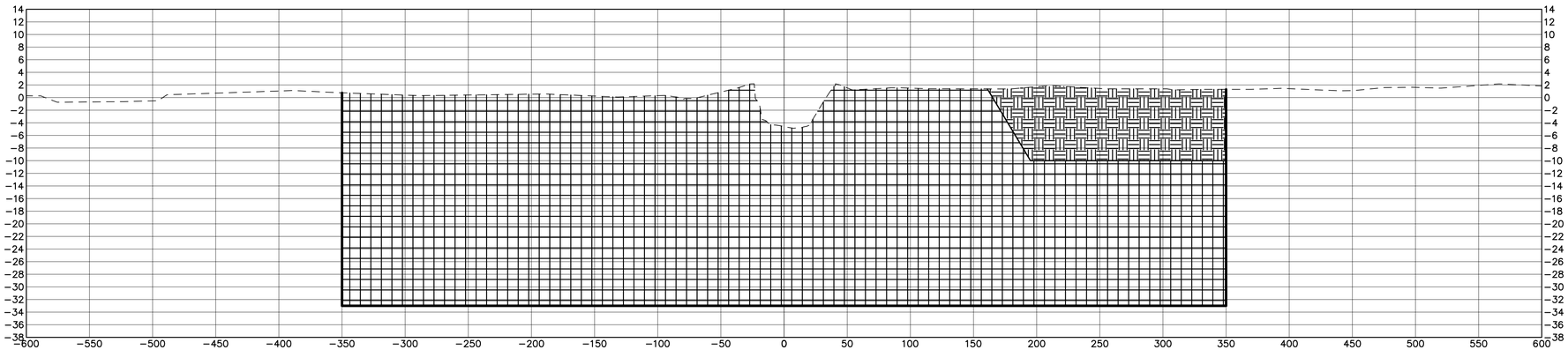
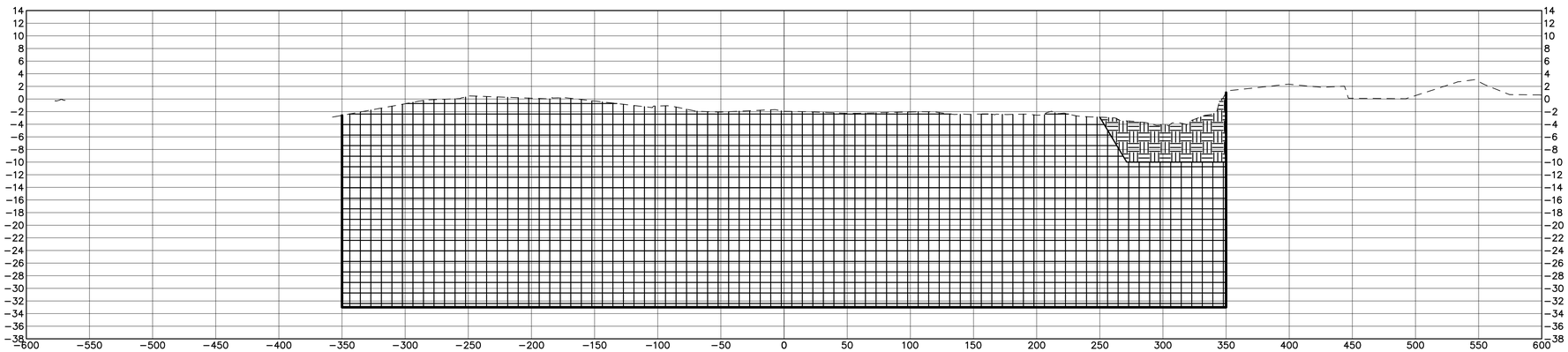


SECTION 'C–C'



SECTION 'B–B'



SECTION 'A–A'

LEGEND

PHASE 1 CUT

PHASE 3 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER	6
PARISH	CAMERON
FEDERAL PROJECT	N/A
STATE PROJECT	N/A
DESIGNED / CHECKED	LRE / SEW
DETAILED / CHECKED	DRW / LRE
DATE / SHEET	JULY 2017

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION | BY

PORT CAMERON

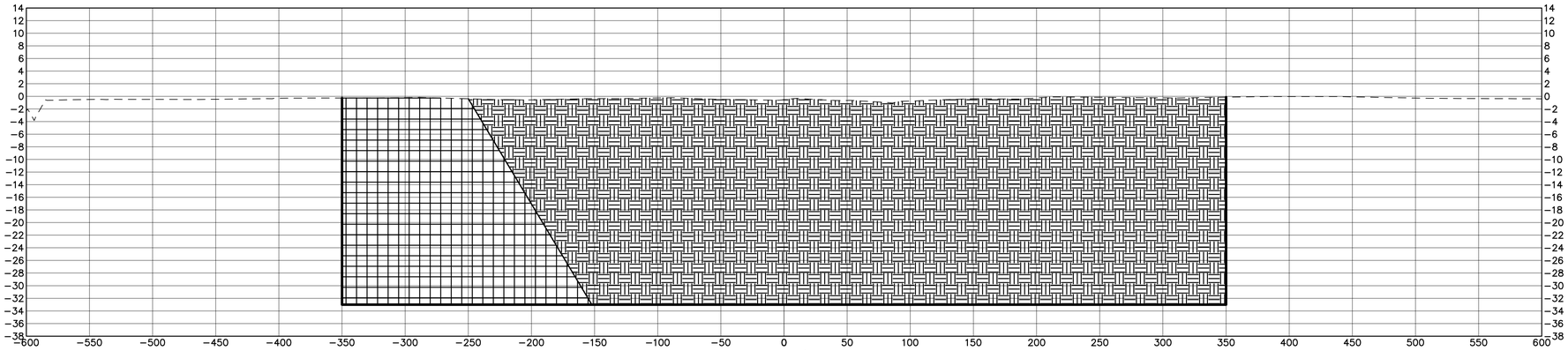
DREDGE CROSS SECTIONS A, B, & C

PORT CAMERON – DREDGING AND MARSH CREATION

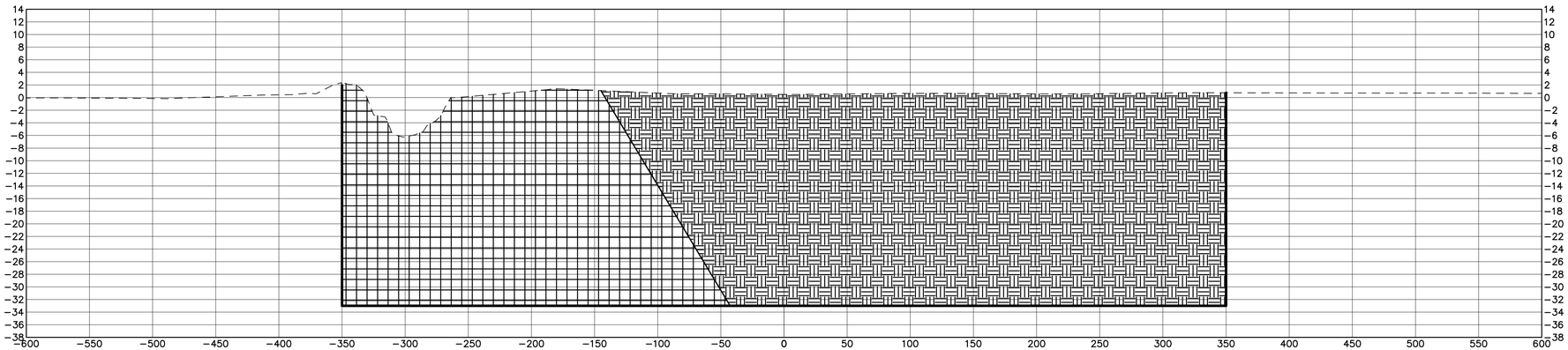
LA One Call 1-800-272-3020 Call before you dig

EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\1402500_XSEC01.dwg — Aug 17, 2017 – 2:17pm



SECTION 'F–F'



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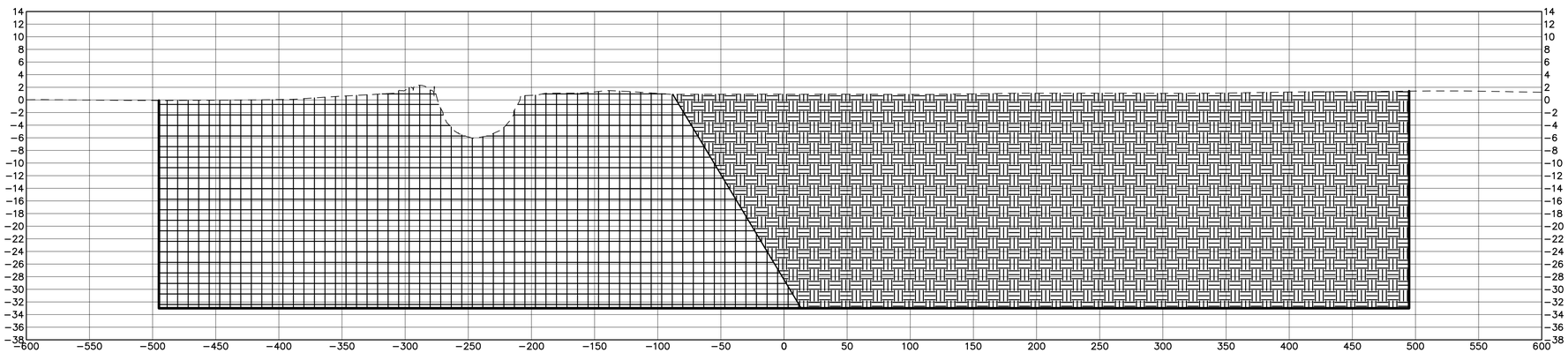

SECTION 'D–D'

LEGEND

PHASE 1 CUT

PHASE 3 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER 7

PARISH CAMERON
FEDERAL PROJECT N/A
STATE PROJECT N/A

DESIGNED LRE
CHECKED SEW
DETAILED DRW
CHECKED LRE
DATE JULY 2017
SHEET

PRELIMINARY

NO. DATE BY REVISION DESCRIPTION

PORT CAMERON

DREDGE CROSS SECTIONS D, E, & F

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call
1-800-272-3020
Call before you dig

EG

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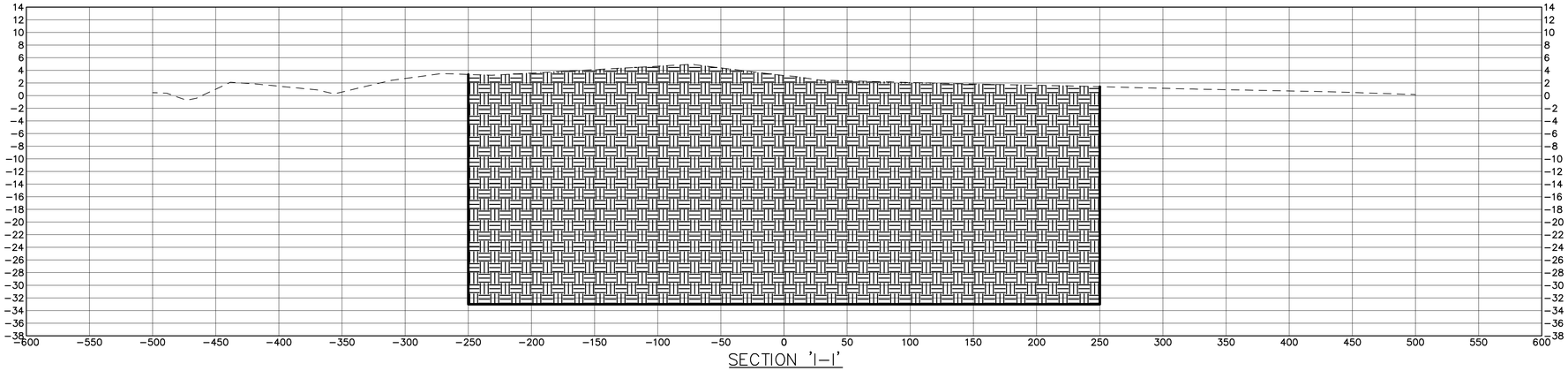
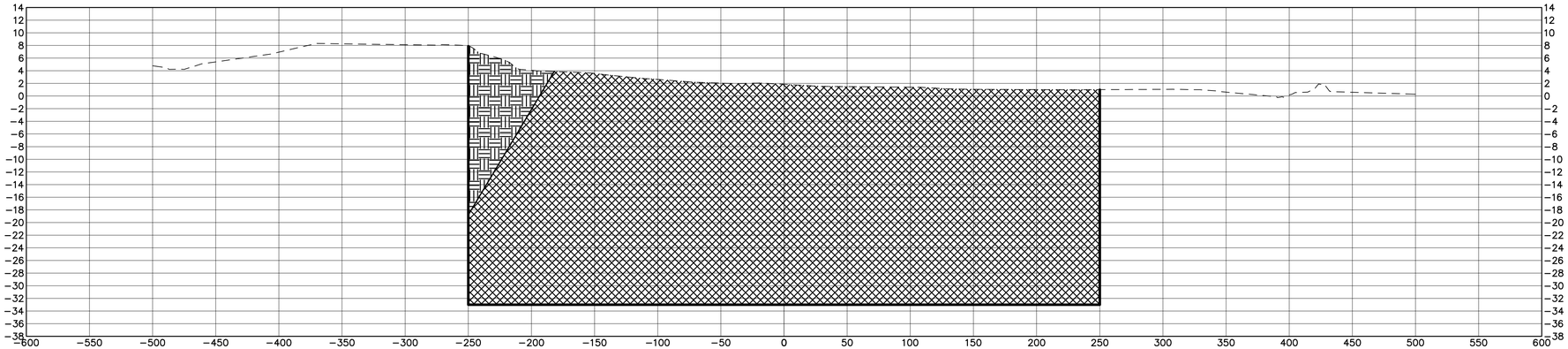
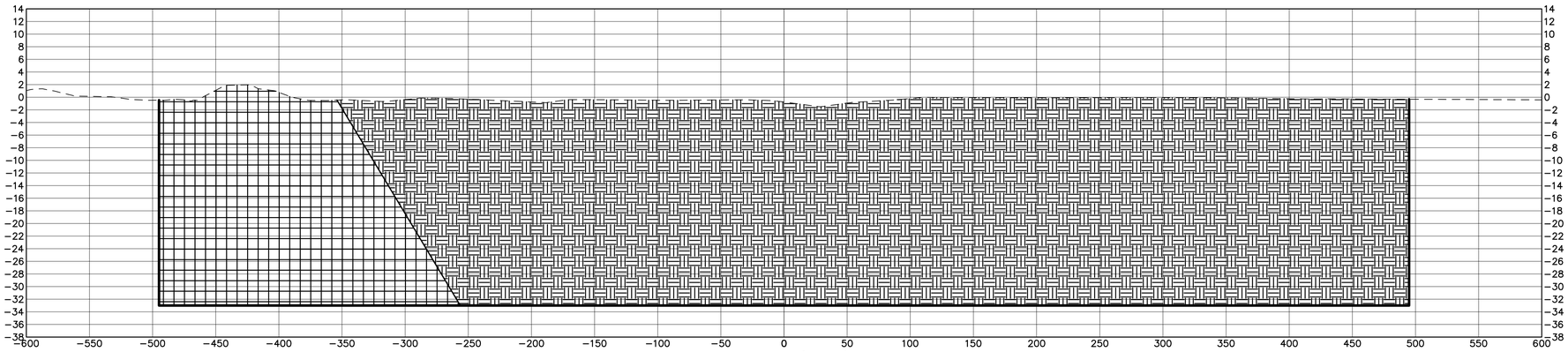


SECTION 'I–I'



SECTION 'H–H'



SECTION 'G–G'

LEGEND

- PHASE 1 CUT
- PHASE 2 CUT
- PHASE 3 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER 8

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	CHECKED	DETAILED	CHECKED	DATE	SHEET
LRE	SEW	DRW	LRE	JULY 2017	

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

DREDGE CROSS SECTIONS G, H, & I

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call 1-800-272-3020 Call before you dig

EG

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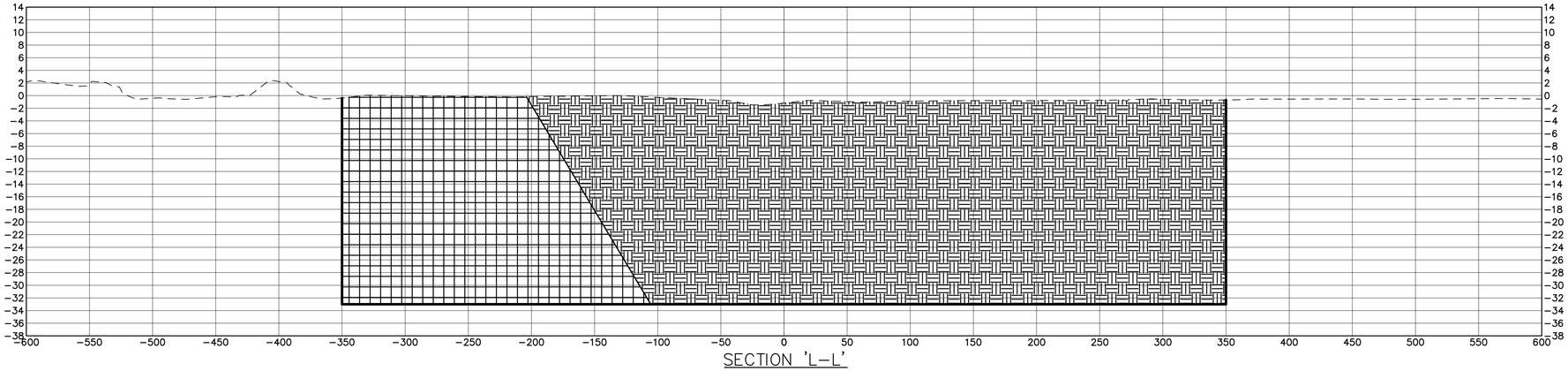

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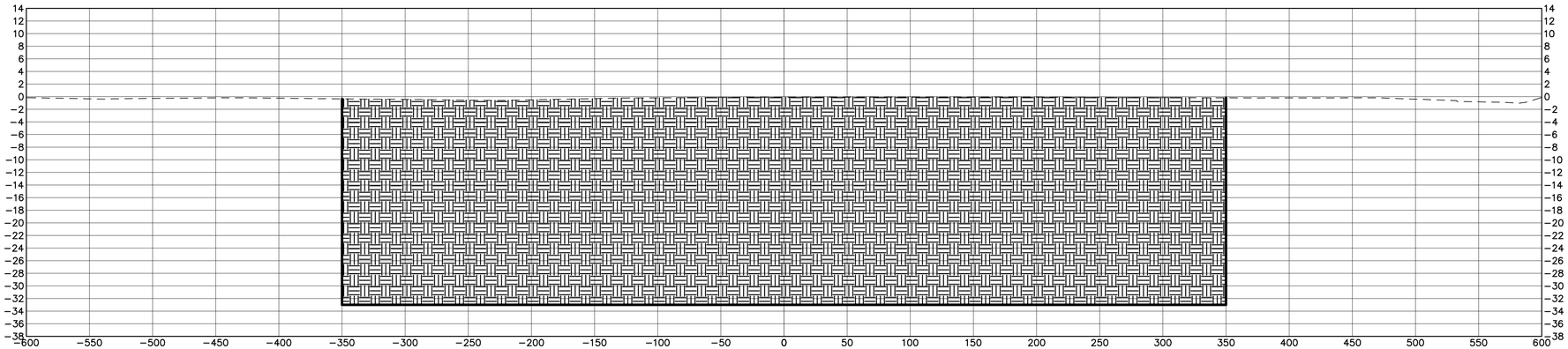
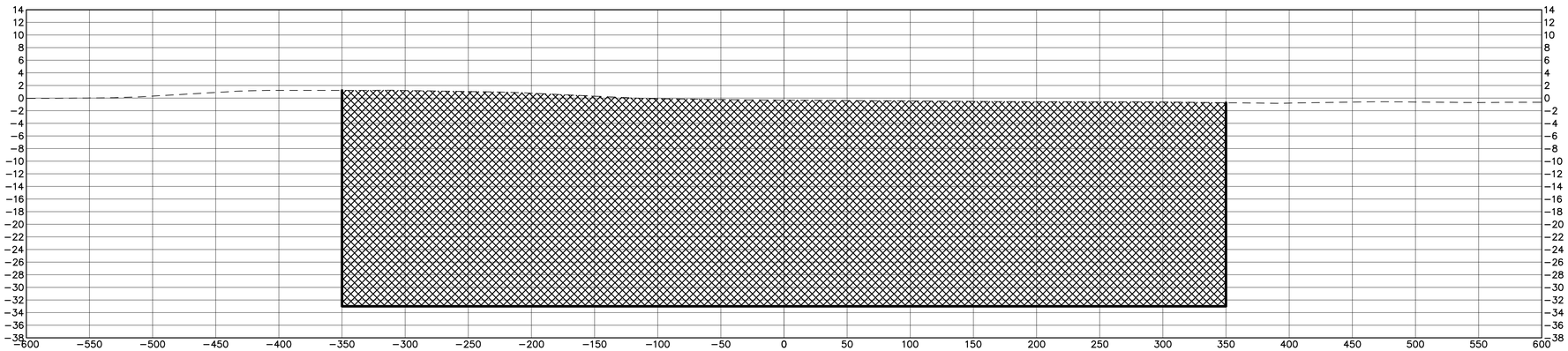


SECTION 'K–K'



SECTION 'J–J'

LEGEND

- PHASE 1 CUT
- PHASE 2 CUT
- PHASE 3 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER	9
PARISH	CAMERON
FEDERAL PROJECT	N/A
STATE PROJECT	N/A
DESIGNED	LRE
CHECKED	SEW
DETAILED	DRW
CHECKED	LRE
DATE	JULY 2017
SHEET	

PRELIMINARY

NO.	REVISION DESCRIPTION	DATE	BY

PORT CAMERON

DREDGE CROSS SECTIONS J, K, & L

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call
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Call before you dig

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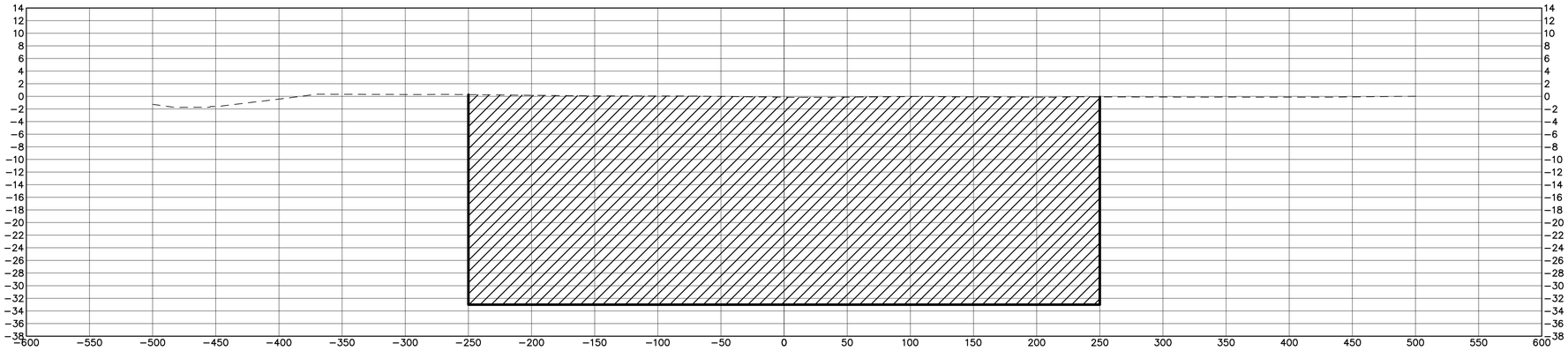
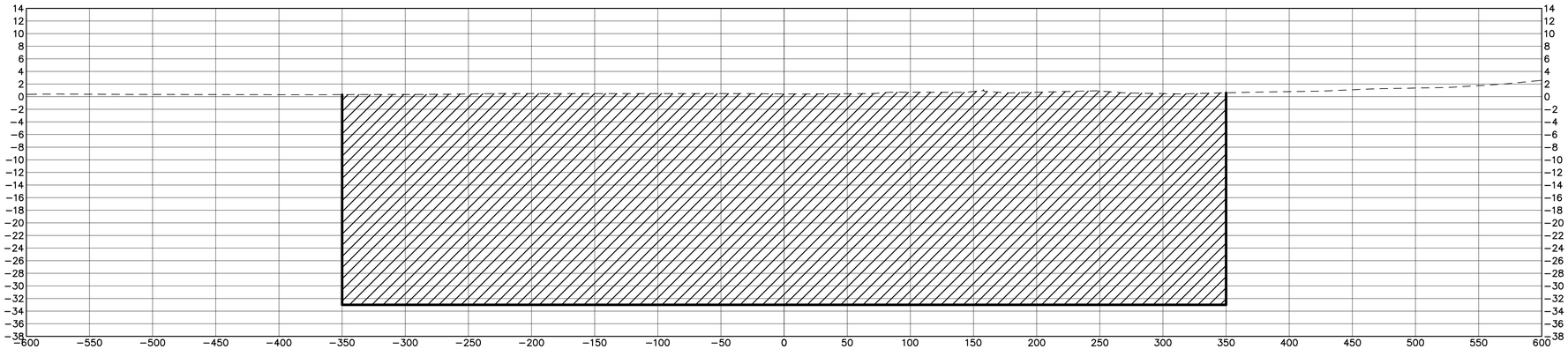
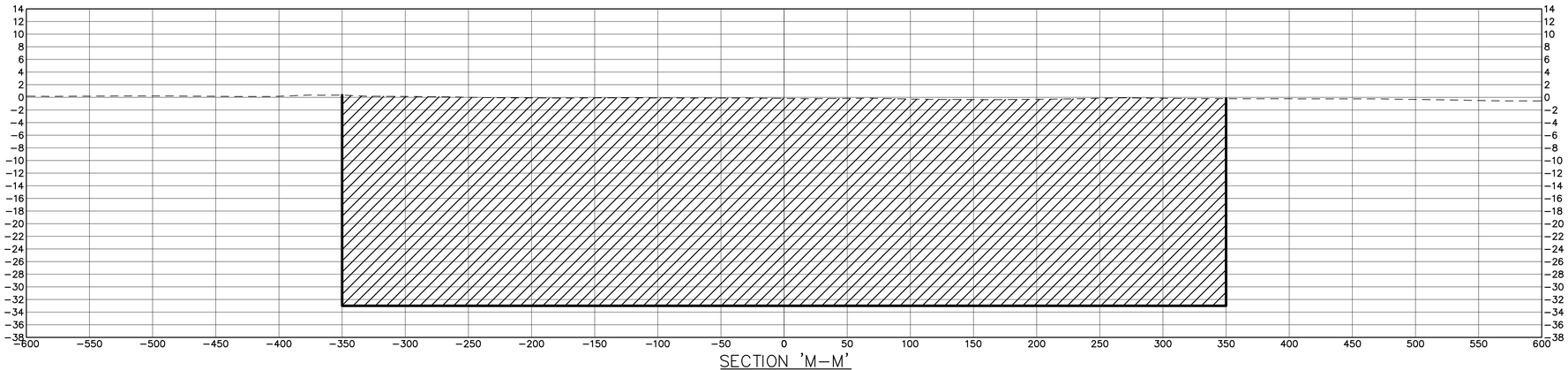


SECTION 'O–O'



SECTION 'N–N'



SECTION 'M–M'

LEGEND

PHASE 4 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER 10

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	DETAILED	DATE
LRE	DRW	JULY 2017
CHECKED	CHECKED	SHEET
SEW	LRE	

PRELIMINARY

NO.	REVISION DESCRIPTION	DATE	BY

PORT CAMERON

DREDGE CROSS SECTIONS M, N, & O

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call
1-800-272-3020
Call before you dig

EG

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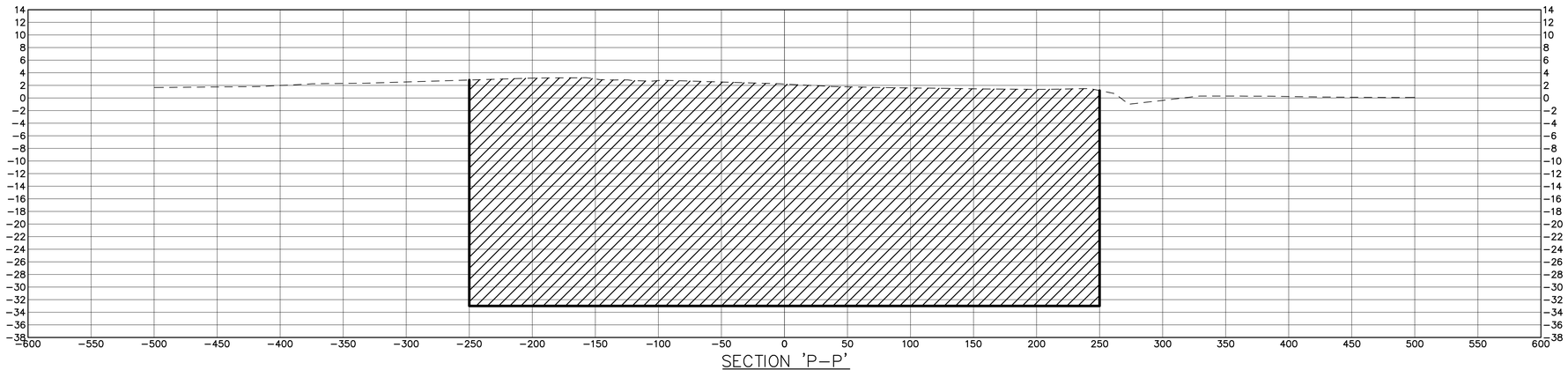


SECTION 'P–P'

LEGEND

PHASE 4 CUT

SCALE IN FEET

50 0 50 100

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

SHEET NUMBER 11

PARISH CAMERON

FEDERAL PROJECT N/A

STATE PROJECT N/A

DESIGNED LRE
CHECKED SEW

DETAILED DRW
CHECKED LRE

DATE JULY 2017
SHEET

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

DREDGE CROSS SECTION P

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call
1-800-272-3020
Call before you dig

EC

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\14025DG_XSEC01.dwg – Aug 17, 2017 – 2:17pm

EXISTING LEGEND:

- POWER POLE
- WATER METER
- TELEPHONE PEDESTAL
- SANITARY SEWER MANHOLE
- FIRE HYDRANT
- MAILBOX
- WATER VALVE
- RIGHT OF WAY MARKER
- ABANDONED GAS WELL SITE
- FENCE
- OE — OVERHEAD ELECTRIC
- G — GAS PIPELINE
- 6W — 6" WATER LINE
- 10W — 10" WATER LINE
- EXISTING WATERWAY
- EXISTING ROADWAY
- 22 — EXISTING GROUND CONTOURS

REQ'D. LEGEND:

- 18" STONE OVER GEOTEXTILE FABRIC 100' BACK FROM FACE OF WALL
- 9 — FINISHED GROUND CONTOUR AND ELEVATION
- LOT LINE
- 40 — LOT No.

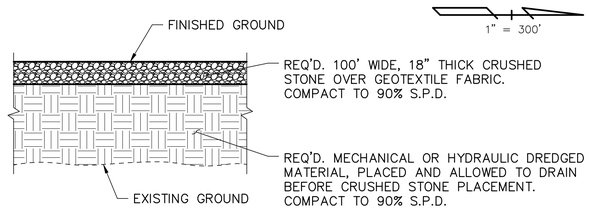
PHASING LEGEND:

PHASE 1 SHALL CONSIST OF FILLING LOTS 1–18 AS SHOWN ON GRADING LAYOUT TO COMMENCE @ N.T.P. AND WATER LINE RELOCATION

PHASE 2 SHALL CONSIST OF FILLING LOTS 19–20 AS SHOWN ON GRADING LAYOUT TO COMMENCE @ ENLINK PIPELINE RELOCATION

PHASE 3 SHALL CONSIST OF FILLING LOTS 21–40 AS SHOWN ON GRADING LAYOUT TO COMMENCE @ NEW WATER CONTROL STRUCTURE START-UP

PHASE 4 SHALL CONSIST OF FILLING LOTS 41–45 AS SHOWN ON GRADING LAYOUT TO COMMENCE ONLY AS DIRECTED BY OWNER



TYPICAL LOT FILL SECTION

1" = 300'

CALCASIEU SHIP CHANNEL

EAST FORK

LOOP PASS

EXIST. WAKEFIELD ROAD

EXIST. ENLINK PIPELINE TO BE REMOVED BY OTHERS, UNDER SEPARATE CONTRACT.

EXIST. WAKEFIELD ROAD BRIDGE TO BE REMOVED(SEE SHEET 3)

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

PH. 4

PH. 3

REQ'D. TOP OF WALL ELEV. = 6.5'
REQ'D. BOTTOM OF CHANNEL ELEV. = −33.0'

REQ'D. EXIST. TRANSCANADA & KINETICA PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

EXIST. W-1 CANAL

FUTURE CONSTRUCTION

ENERGY ROAD (ELEV. = 8.0')

100' TYP.

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

REQ'D. EXIST. ENLINK PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

REQ'D. BULKHEAD WALL. (SEE SHEET 19)

PH. 3 → PH. 2 PH. 2 → PH. 1

PORT CAMERON DRIVE (ELEV. VARIES)

EXPLORATION ROAD (ELEV. = 8.0')

VIATOR ROAD (UNDER SEPARATE CONTRACT)

PROPERTY LINE (TYP.)

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

SHEET NUMBER 12

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	CHECKED	DETAILED	CHECKED	DATE	SHEET
LRE	SEW	DRW	LRE	JULY 2017	

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

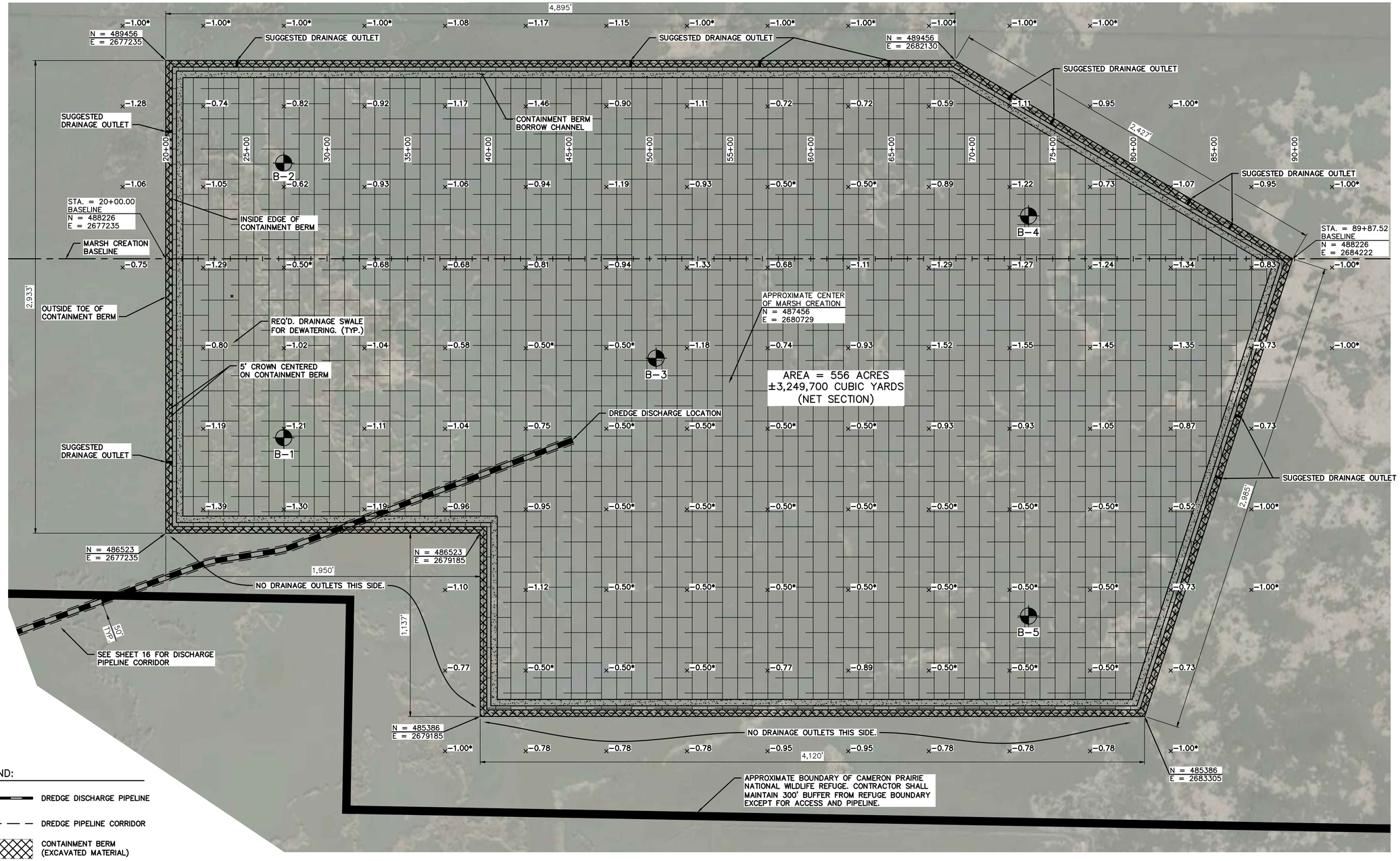
GRADING LAYOUT

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call 1-800-272-3020 Call before you dig

EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\14025DG_G801.dwg – Aug 17, 2017 – 2:18pm



LEGEND:

- DREDGE DISCHARGE PIPELINE
- DREDGE PIPELINE CORRIDOR
- CONTAINMENT BERM (EXCAVATED MATERIAL)
- CONTAINMENT BERM BORROW CHANNEL (TO BE BACKFILLED WITH DREDGED MATERIAL)
- DREDGE FILL PLACEMENT (DREDGED MATERIAL)
- SOIL BORING LOCATION. (RE: GEOTECH REPORT FOR BORING LOGS.)
- ×−0.50* ESTIMATED WATER BOTTOM ELEVATION
- ×−0.96 WATER BOTTOM ELEVATION

NOTES:

1. PROJECT BOUNDARY SHALL BE WITHIN 100' OF CONTAINMENT BERM LIMIT SHOWN.
2. ACCESS TO BENEFICIAL USE AREA MAY BE OBTAINED THROUGH PRIVATE LAUNCH. CONTACT CRAIG DUPONT AT 337-794-2494. LAUNCH IS AT THE END OF EARL STREET OFF OF LA HWY 27. (SEE LOCATION MAP SHEET 1.)
3. UP TO 3 SECONDARY CONTAINMENT BERMS MAY BE CONSTRUCTED NORTH TO SOUTH TO SUBDIVIDE ENTIRE BENEFICIAL USE AREA.

BENEFICIAL USE AREA SITE MAP

300 0 300 600

SCALE IN FEET

NOTE:

THE GEOTECHNICAL INFORMATION AND ANALYSIS FOR THE BORROW AREA AND THE MARSH CREATION AREA WERE PERFORMED BY PROFESSIONAL SERVICES INDUSTRIES FROM OCTOBER 2016 TO FEBRUARY 2017. SOIL BORES ARE LOCATED IN PROJECT SPECS.

SHEET NUMBER ----

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
DETAILED: DRW LRE
CHECKED: SEW
DATE: JULY 2017
SHEET

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION | BY

PORT CAMERON

BENEFICIAL USE AREA SITE MAP

PORT CAMERON — DREDGING AND MARSH CREATION

LA One Call 1-800-272-3020 Call before you dig

EC

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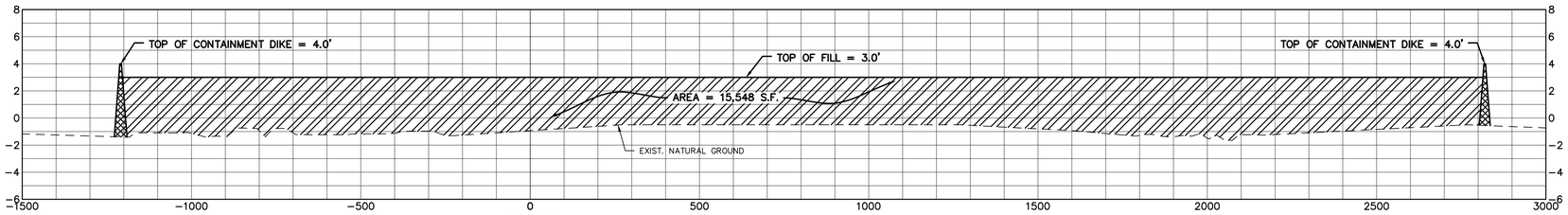

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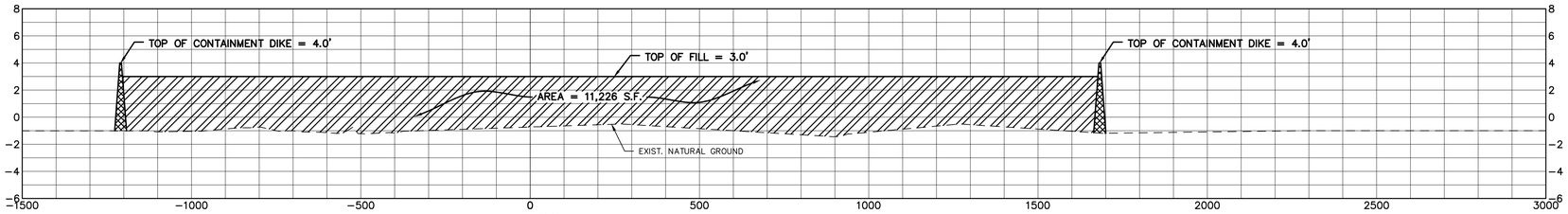

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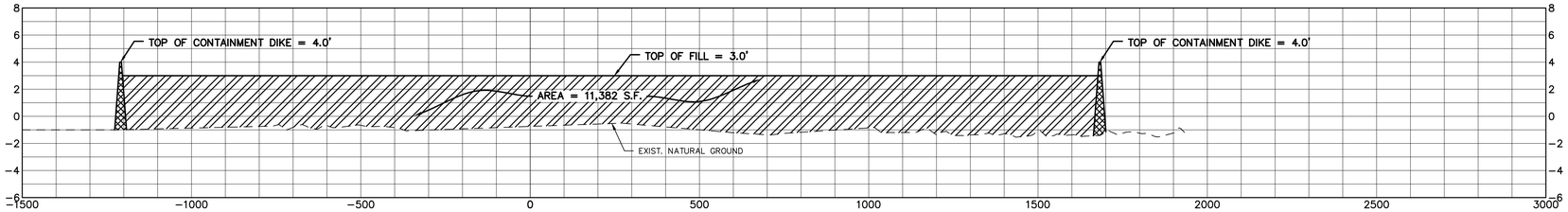

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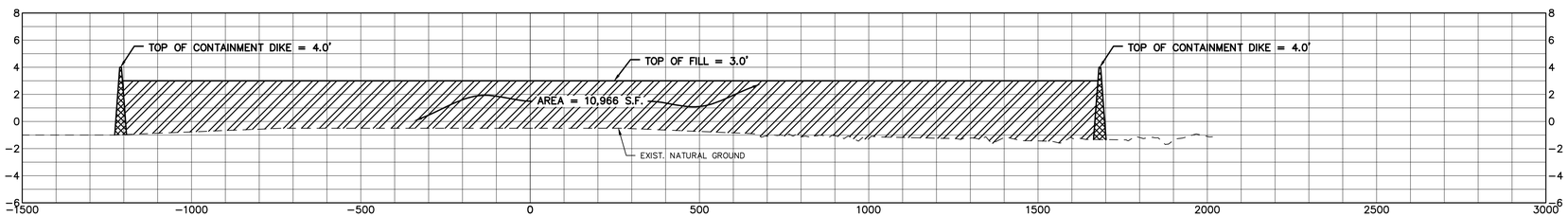

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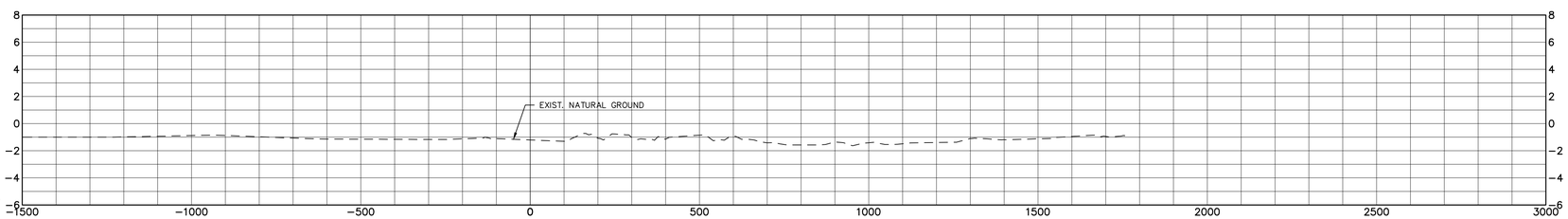


20+00

LEGEND

CONTAINMENT DIKE FILL

DREDGE DISPOSAL FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER 14

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	CHECKED	DETAILED	CHECKED	DATE	SHEET
LRE	SEW	DRW	LRE	JULY 2017	

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

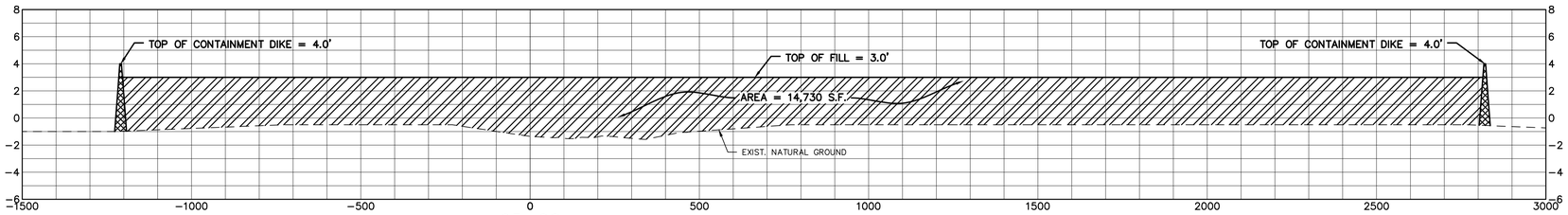
BENEFICIAL USE AREA CROSS SECTIONS
20+00 – 40+00

PORT CAMERON – DREDGING AND MARSH CREATION

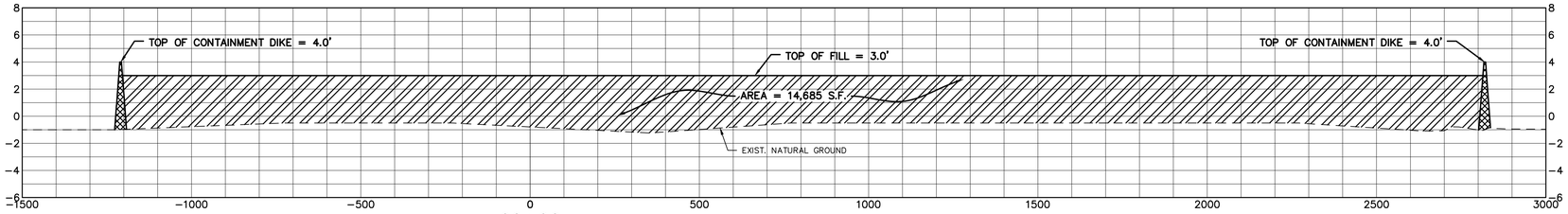
LA One Call
1-800-272-3020
Call before you dig

EG

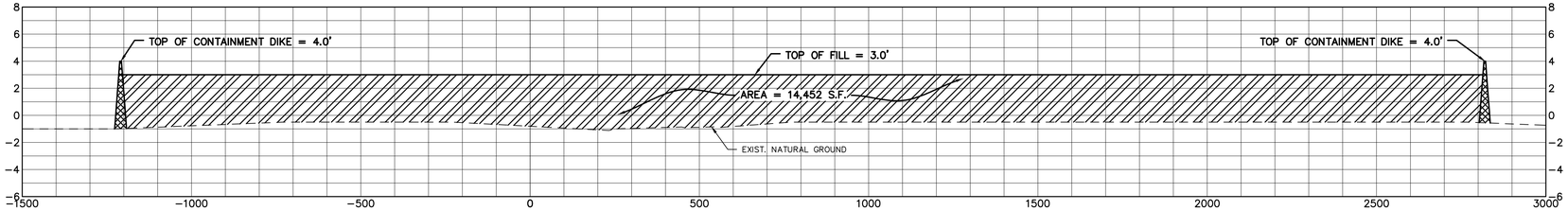
Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\14025DG_XSEC02.dwg — Aug 17, 2017 - 2:19pm



65+00



60+00



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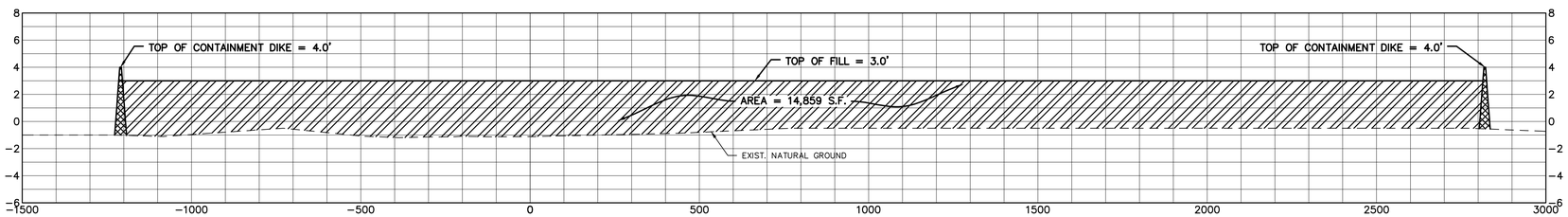
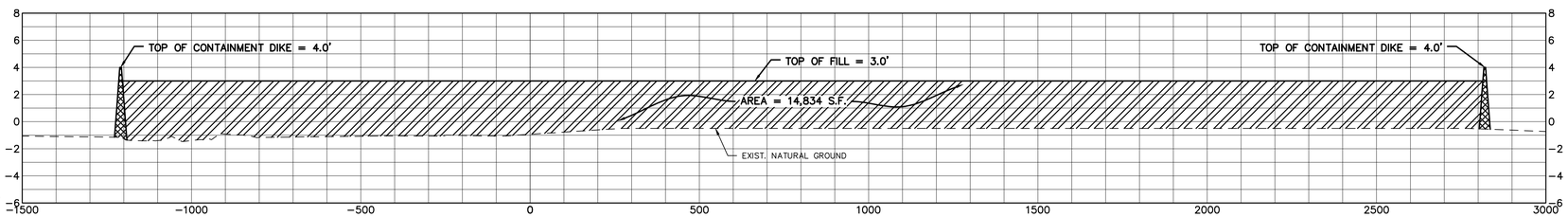


50+00



45+00

LEGEND

CONTAINMENT DIKE FILL

DREDGE DISPOSAL FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER 15

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW
CHECKED: LRE
DATE: JULY 2017
SHEET

BY

PRELIMINARY

NO. | REVISION DESCRIPTION | DATE

PORT CAMERON

BENEFICIAL USE AREA CROSS SECTIONS
45+00 – 65+00

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call
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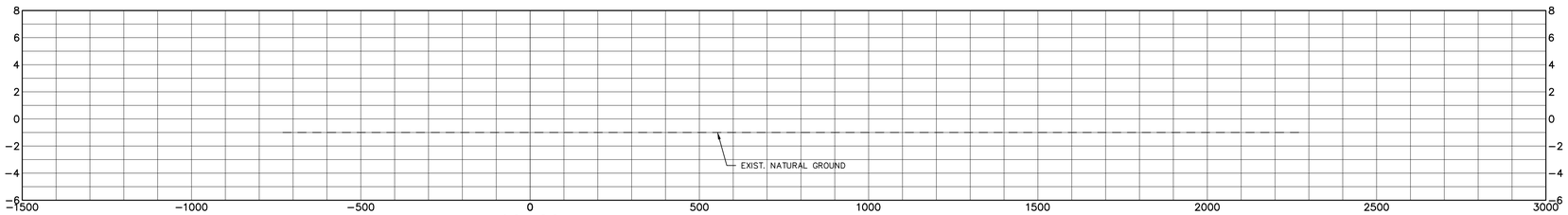
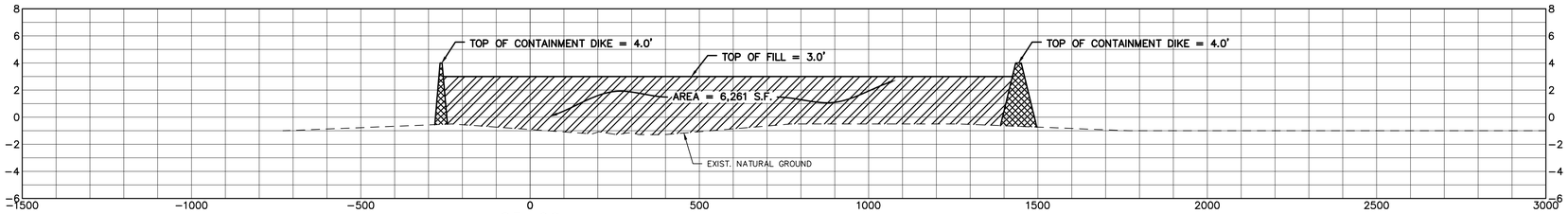
Call before you dig

EG

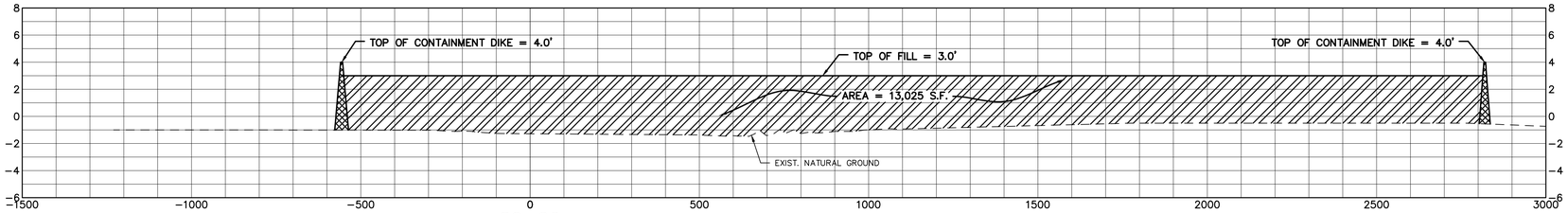
Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\14025DG_XSEC02.dwg — Aug 17, 2017 - 2:19pm



90+00



85+00



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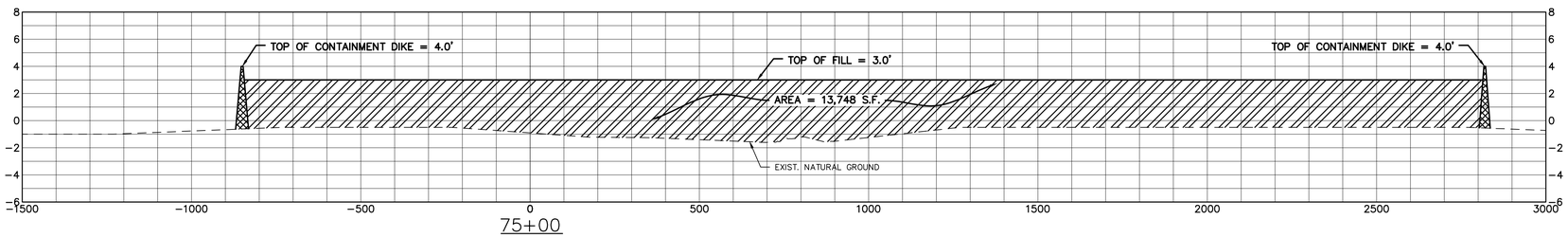
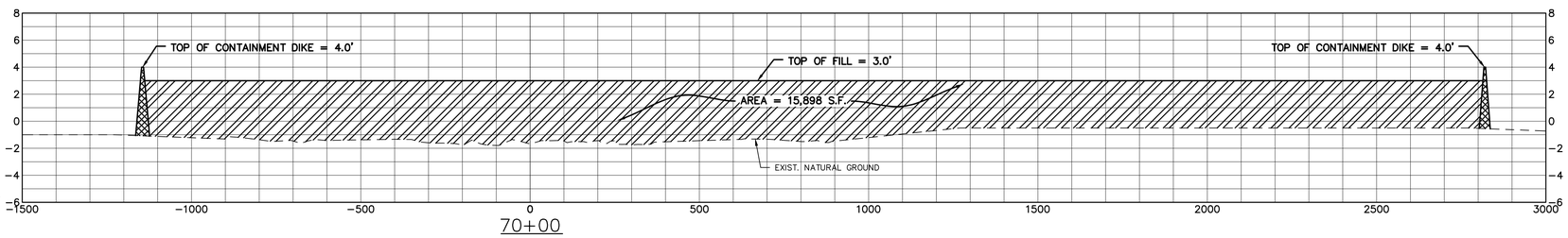


75+00



70+00

LEGEND

CONTAINMENT DIKE FILL

DREDGE DISPOSAL FILL

SCALE IN FEET

200 0 200 400

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 5'

SHEET NUMBER ----

PARISH	FEDERAL PROJECT	STATE PROJECT
CAMERON	N/A	N/A

DESIGNED	DETAILED	DATE
LRE	DRW	JULY 2017
CHECKED	LRE	SHEET
SEW		

PRELIMINARY

NO.	DATE	REVISION DESCRIPTION	BY

PORT CAMERON

BENEFICIAL USE AREA CROSS SECTIONS
70+00 - 90+00

PORT CAMERON – DREDGING AND MARSH CREATION

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EG

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\1402500_XSEC02.dwg – Aug 17, 2017 – 2:19pm

DREDGE DISCHARGE LINE CORRIDOR PI LOCATIONS

PI NUMBER	NORTHING	EASTING
1	481560	2645585
2	479895	2650041
3	479921	2650113
4	480442	2650456
5	480505	2650916
6	480561	2651378
7	480576	2651590
8	480520	2651890
9	480460	2652203
10	480438	2652421
11	480411	2652659
12	480408	2652842
13	480410	2652998
14	480463	2654155
15	480482	2654906
16	480564	2655629
17	480787	2657337
18	480880	2658042
19	480892	2658178
20	481223	2659226
21	481287	2659334
22	481830	2660555
23	481961	2661095
24	482086	2661797
25	482179	2662557
26	482806	2663879
27	482830	2664654
28	482796	2665112
29	482776	2665232
30	482775	2665368
31	482790	2665507
32	482802	2665893
33	482818	2666316
34	482875	2667453
35	482830	2668137
36	482785	2668625
37	482813	2669441
38	482930	2669799
39	483042	2670046
40	483124	2670136
41	483169	2670224
42	483256	2670322
43	483413	2670753
44	483700	2671301
45	483809	2671608
46	483769	2671830
47	483700	2672219
48	484975	2674781
49	485491	2675284
50	486343	2677505
51	486422	2677965
52	487100	2679758

DREDGE DISCHARGE LINE PIPE DETAILS

FROM PI	TO PI	LENGTH	LOCATION OF PIPELINE
1	2	4,756'	WITHIN W-1 CHANNEL
2	3	77'	WITHIN EXISTING DRAINAGE CANAL
3	4	628'	WITHIN EXIST. DRAINAGE CANAL (0.2 AC IMPACT)
4	5	467'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
5	6	466'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
6	7	212'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
7	8	306'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
8	9	319'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
9	10	219'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
10	11	239'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
11	12	183'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
12	13	156'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
13	14	1,158'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
14	15	751'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
15	16	728'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
16	17	1,722'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
17	18	711'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
18	19	137'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
19	20	1,099'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
20	21	135'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
21	22	1,327'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
22	23	556'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
23	24	712'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
24	25	767'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
25	26	1,465'	WITHIN WETLAND AREA (APPROX. 3 AC. IMPACT)
26	27	773'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
27	28	463'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
28	29	122'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
29	30	136'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
30	31	139'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
31	32	388'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
32	33	421'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
33	34	1,142'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
34	35	683'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
35	36	493'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
36	37	814'	WITHIN EXISTING UNPAVED ROADWAY CORRIDOR
37	38	380'	WITHIN DEGRADED MARSH (0.6 AC. IMPACT)
38	39	269'	WITHIN OPEN WATER

DREDGE DISCHARGE LINE PIPE DETAILS

FROM PI	TO PI	LENGTH	LOCATION OF PIPELINE
39	40	124'	WITHIN DEGRADED MARSH (0.2 AC. IMPACT)
40	41	98'	WITHIN OPEN WATER
41	42	133'	WITHIN OPEN WATER
42	43	457'	WITHIN OPEN WATER
43	44	622'	WITHIN OPEN WATER
44	45	325'	WITHIN OPEN WATER
45	46	230'	WITHIN OPEN WATER

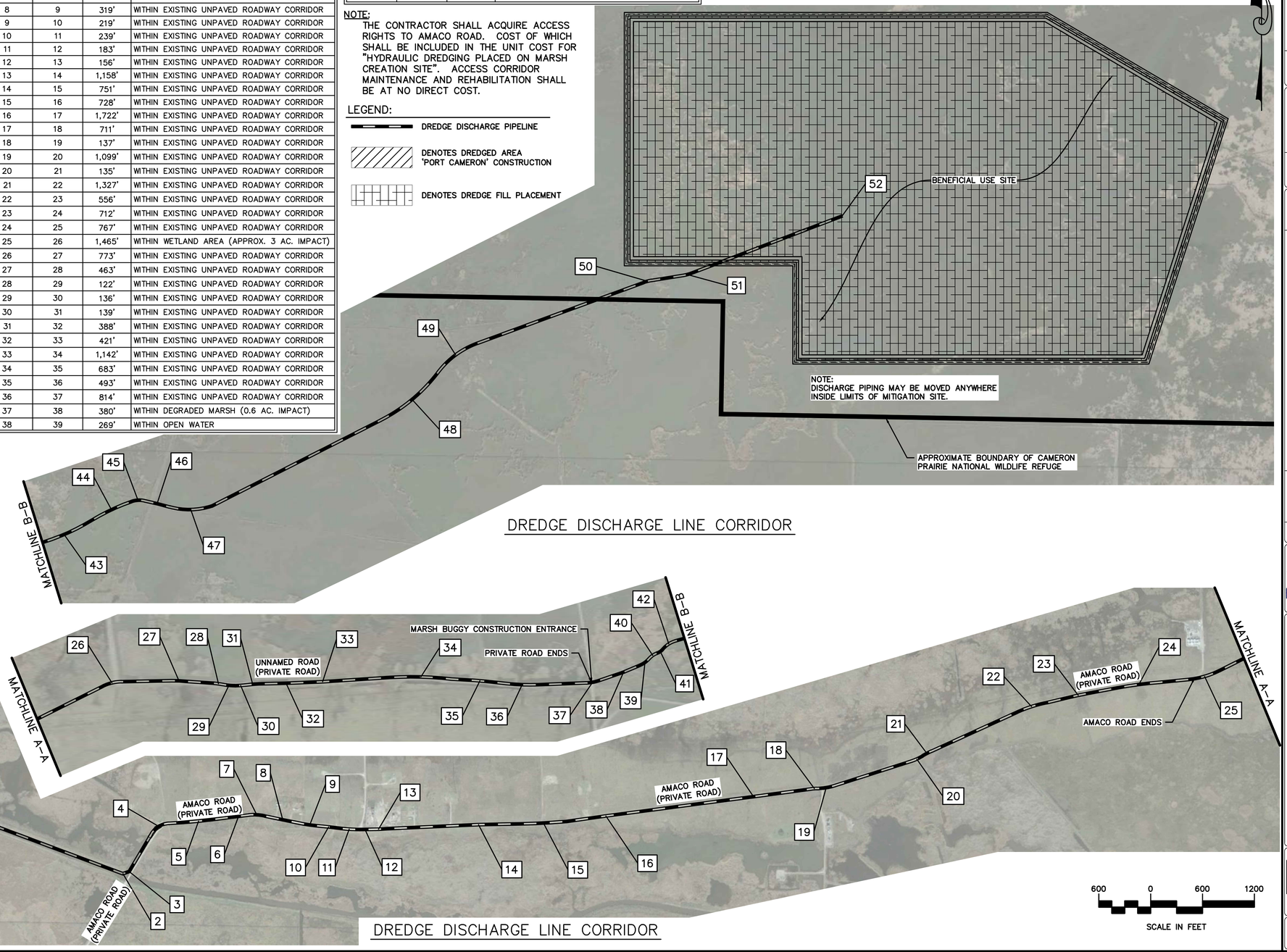
DREDGE DISCHARGE LINE PIPE DETAILS

FROM PI	TO PI	LENGTH	LOCATION OF PIPELINE
46	47	396'	WITHIN OPEN WATER
47	48	2,875'	WITHIN OPEN WATER
48	49	720'	WITHIN OPEN WATER
49	50	2,386'	WITHIN OPEN WATER
50	51	465'	WITHIN OPEN WATER
51	52	1,917'	WITHIN OPEN WATER

NOTE:
THE CONTRACTOR SHALL ACQUIRE ACCESS RIGHTS TO AMACO ROAD. COST OF WHICH SHALL BE INCLUDED IN THE UNIT COST FOR "HYDRAULIC DREDGING PLACED ON MARSH CREATION SITE". ACCESS CORRIDOR MAINTENANCE AND REHABILITATION SHALL BE AT NO DIRECT COST.

LEGEND:

- DREDGE DISCHARGE PIPELINE
- DENOTES DREDGED AREA 'PORT CAMERON' CONSTRUCTION
- DENOTES DREDGE FILL PLACEMENT



DREDGE DISCHARGE LINE CORRIDOR

DREDGE DISCHARGE LINE CORRIDOR

600 0 600 1200
SCALE IN FEET

SHEET NUMBER 17

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A

DESIGNED LRE
CHECKED SEW
DETAILED DRW
CHECKED LRE
DATE JULY 2017
SHEET

PRELIMINARY

NO. | REVISION DESCRIPTION | DATE | BY

PORT CAMERON

OVERALL DREDGE DISCHARGE LINE CORRIDOR

PORT CAMERON – DREDGING AND MARSH CREATION

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EC

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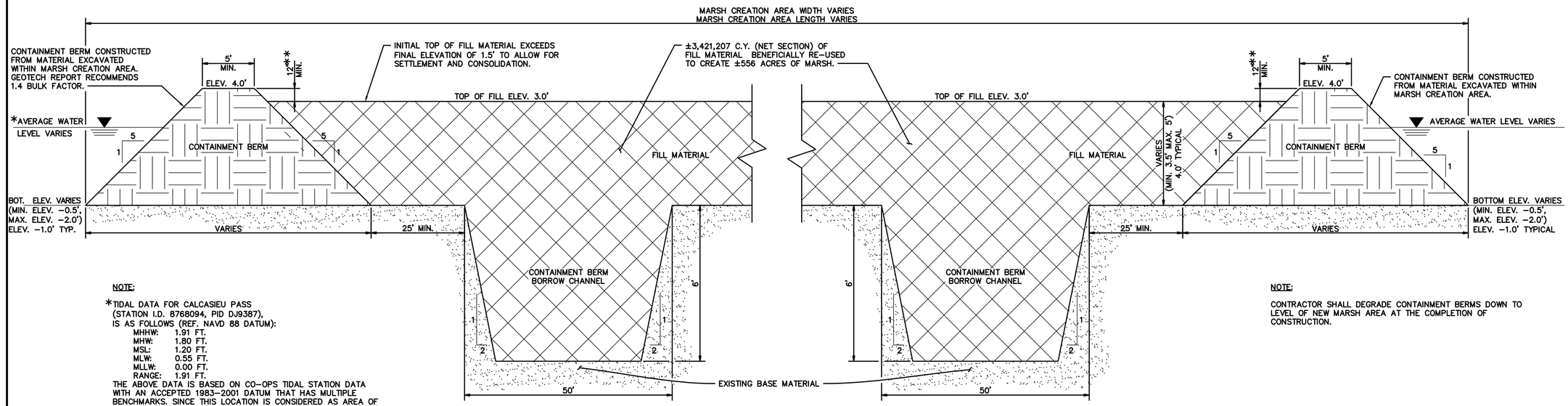


NOTE:

*TIDAL DATA FOR CALCASIEU PASS (STATION I.D. 8768094, PID DJ9387), IS AS FOLLOWS (REF. NAVD 88 DATUM):

MHHW:	1.91 FT.
MHW:	1.80 FT.
MSL:	1.20 FT.
MLW:	0.55 FT.
MLLW:	0.00 FT.
RANGE:	1.91 FT.

THE ABOVE DATA IS BASED ON CO-OPS TIDAL STATION DATA WITH AN ACCEPTED 1983-2001 DATUM THAT HAS MULTIPLE BENCHMARKS. SINCE THIS LOCATION IS CONSIDERED AS AREA OF HIGH SUBSIDENCE, THESE VALUES MAY HAVE A ±1 FT. POSSIBLE ERROR.

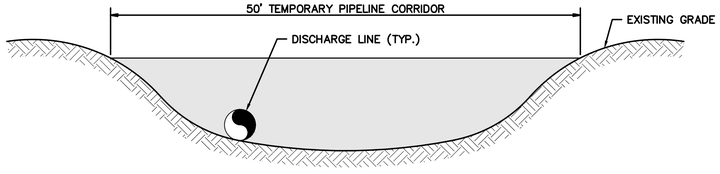
**GAPS ARE TO BE LEFT IN UPPER ELEVATION OF CONTAINMENT BERM AS REQUIRED FOR DRAINAGE OF WATER IMPOUNDED IN DREDGE FILL AREA.

NOTE:

CONTRACTOR SHALL DEGRADE CONTAINMENT BERMS DOWN TO LEVEL OF NEW MARSH AREA AT THE COMPLETION OF CONSTRUCTION.

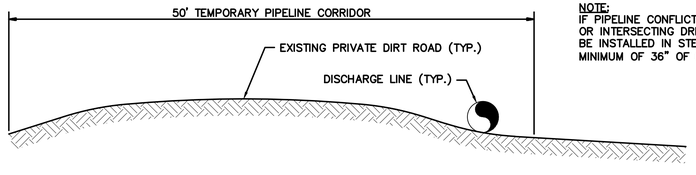
TYPICAL MARSH CREATION CROSS-SECTION

N.T.S.



TYPICAL DISCHARGE LINE CORRIDOR IN W-1 CHANNEL

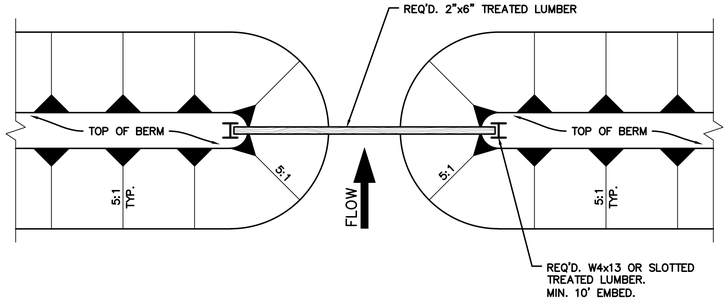
N.T.S.

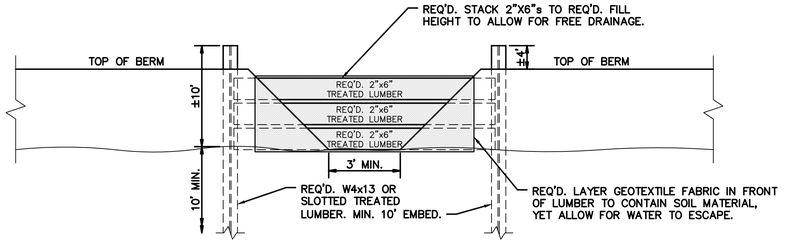


NOTE:
IF PIPELINE CONFLICTS WITH DRIVEWAY OR INTERSECTING DRIVE, PIPELINE SHALL BE INSTALLED IN STEEL CASING WITH A MINIMUM OF 36" OF COVER.

TYPICAL DISCHARGE LINE CORRIDOR ALONG PRIVATE DRIVES

N.T.S.





SUGGESTED DRAINAGE OUTLET

N.T.S.

NOTE:
TYPICAL DRAINAGE OUTLET MAY BE MODIFIED. CONTRACTOR TO SUBMIT PROPOSED DRAINAGE OUTLET FOR APPROVAL.

SHEET NUMBER 30

PARISH: CAMERON | FEDERAL PROJECT: N/A | STATE PROJECT: N/A

DESIGNED: LRE | DETAILED: DRW | DATE: JULY 2017
CHECKED: SEW | CHECKED: LRE | SHEET:

PRELIMINARY

NO. | DATE | REVISION DESCRIPTION | BY

PORT CAMERON

TYPICAL DETAILS

PORT CAMERON – DREDGING AND MARSH CREATION

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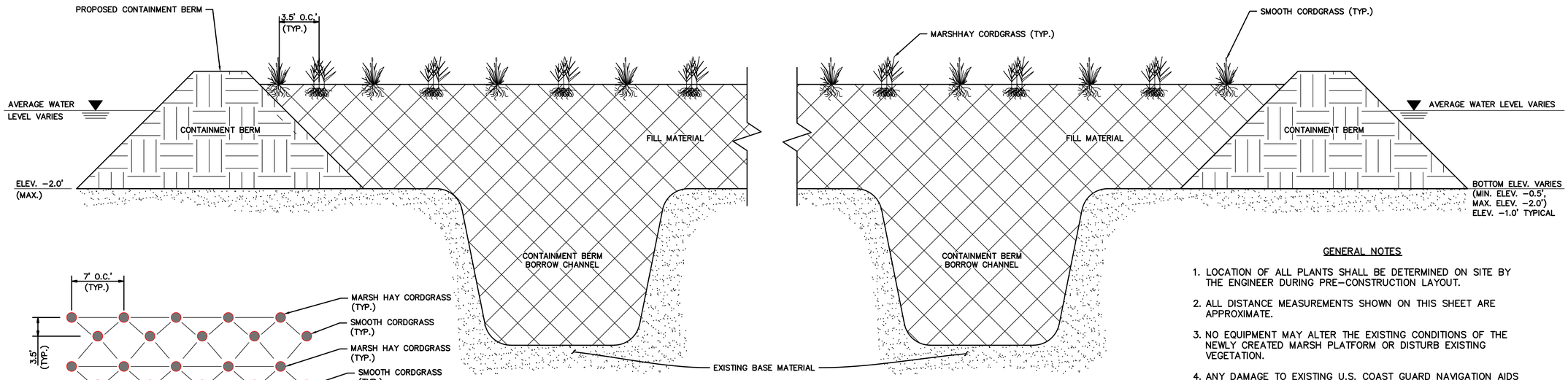
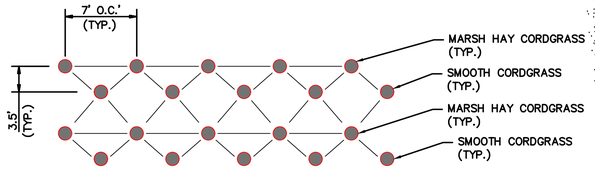




TYPICAL PLAN
PLANTING LAYOUT
N.T.S.

TYPICAL MARSH CREATION CROSS-SECTION
N.T.S.

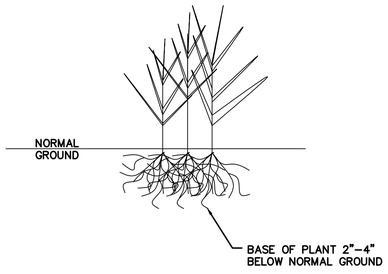
GENERAL NOTES

1. LOCATION OF ALL PLANTS SHALL BE DETERMINED ON SITE BY THE ENGINEER DURING PRE-CONSTRUCTION LAYOUT.
2. ALL DISTANCE MEASUREMENTS SHOWN ON THIS SHEET ARE APPROXIMATE.
3. NO EQUIPMENT MAY ALTER THE EXISTING CONDITIONS OF THE NEWLY CREATED MARSH PLATFORM OR DISTURB EXISTING VEGETATION.
4. ANY DAMAGE TO EXISTING U.S. COAST GUARD NAVIGATION AIDS OR PRIVATE NAVIGATION AIDS SHALL BE REPAIRED BY THE CONTRACTOR TO U.S. COAST GUARD STANDARDS AT THE EXPENSE OF THE CONTRACTOR.
5. AVERAGE MARSH LEVEL IS +1.1' AS REFERENCED TO NAVD 88, US FEET.
6. ALL EQUIPMENT SHALL BE FLOATING AT ALL TIMES DURING TRANSIT TO AND FROM THE PROJECT SITE OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.

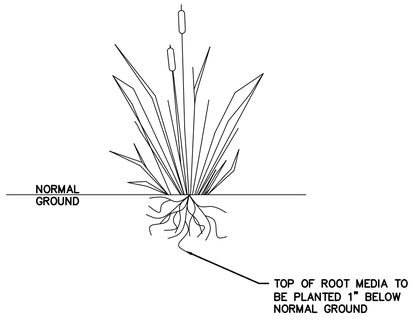
SUMMARY OF ESTIMATED QUANTITIES

REF. NO.	BOTANICAL NAME	DESCRIPTION	UNIT	SIZE	ESTIMATED QUANTITY
1.	SPARTINA PATENS "GULF COAST"	MARSHHAY CORDGRASS VEGETATIVE PLUGS	EACH	ROOT MASS NOT LESS THAN 2" ø AT ROOT CROWN WITH A MINIMUM OF 5 ACTIVELY GROWING STEMS 12" IN HEIGHT	273,650
2.	SPARTINA ALTERNIFOLIA "VERMILION"	SMOOTH CORDGRASS VEGETATIVE PLUGS	EACH	ROOT MASS NOT LESS 2" ø AT ROOT CROWN WITH A MINIMUM OF 3 ACTIVELY GROWING STEMS 10" IN HEIGHT	273,650

QUANTITIES SHOWN ARE FOR BID PURPOSES ONLY. THE OWNER RESERVES THE RIGHT TO ADJUST QUANTITIES HIGHER OR LOWER WITHOUT ADJUSTMENT TO THE UNIT PRICE.



TYPICAL PLANTING DETAIL
MARSH HAY CORDGRASS
N.T.S.



TYPICAL PLANTING DETAIL
SMOOTH CORDGRASS PLUG
N.T.S.

CONTRACTOR SHALL CHECK WITH OWNER'S REPRESENTATIVE BEFORE INITIATING ANY PLANTING ACTIVITIES. GENERALLY, PLANTINGS SHALL BE ATTEMPTED DURING MARCH 15TH THROUGH JUNE 15TH, NO LATER THAN JULY 15TH. FALL PLANTINGS SHALL NOT BE RULED OUT IF DEEMED ACCEPTABLE ON A CASE-BY-CASE BASIS.

PRIOR TO PLACING MATERIAL IN THE MARSH CREATION AREA, ALL RETENTION DIKES AND WASTE WEIRS SHALL BE CONSTRUCTED AND MAINTAINED BY THE CONTRACTOR TO CONFINE THE DREDGE MATERIAL IN THE MARSH CREATION AREA. MATERIALS NECESSARY FOR DIKE CONSTRUCTION OR MAINTENANCE SHALL BE OBTAINED FROM WITHIN THE MARSH CREATION AREA AT THE LIMITS SHOWN IN THE CONTRACT DRAWINGS.

PLANTS SHALL BE PLANTED THE SAME DAY THEY ARE DELIVERED TO THE SITE IF POSSIBLE. PLANTS SHALL NOT BECOME WATER STRESSED PRIOR TO PLANTING. PLANTS SHALL RETAIN THEIR STEM AND LEAF RIGIDITY AT ALL TIMES INDICATING ADEQUATE MOISTURE IS BEING RECEIVED. PLANTS SHALL BE WATERED WITH WATER WITHIN THE SALINITY RANGES IN WHICH THEY WERE GROWN. THE CONTRACTOR MUST TAKE THE NECESSARY PRECAUTIONS TO ENSURE THAT PLANT MATERIALS RECEIVE ADEQUATE WATER DURING ALL PHASES OF THE CONTRACT PRIOR TO ACTUAL PLANTING. TRANSPLANTS MUST STAY MOIST DURING MOBILIZATION AND WHILE ON SITE PRIOR TO PLANTING. PLANTS APPEARING DISCOLORED, SHRIVELED, DEHYDRATED, OR OTHERWISE STRESSED SHALL BE REJECTED.

THE CONTRACTOR SHALL PROVIDE OFFICIAL DOCUMENTATION THAT THE NURSERY PROVIDING PLANT MATERIAL HAS RECEIVED FOUNDATION MATERIAL FOR SPARTINA ALTERNFOLIA "VERMILION" AND SPARTINA PATENS "GULF COAST" FROM THE GOLDEN MEADOW PLANT MATERIAL CENTER. FOUNDATION MATERIAL FOR NURSERY PROPAGATION CAN BE OBTAINED FROM:

GOLDEN MEADOW PMC
438 AIRPORT ROAD
GALLIANO, LA 70354
(985) 475-5280

SHEET NUMBER 31
PARISH: CAMERON | FEDERAL PROJECT: N/A | STATE PROJECT: N/A
DESIGNED: KDN | DETAILED: LRE | CHECKED: DRW | CHECKED: LRE | DATE: JULY 2017 | SHEET
NO. | REVISION DESCRIPTION | DATE | BY
PRELIMINARY
PORT CAMERON
PLANTING DETAILS
PORT CAMERON - DREDGING AND MARSH CREATION
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EXISTING LEGEND:

- POWER POLE
- WATER METER
- TELEPHONE PEDESTAL
- SANITARY SEWER MANHOLE
- FIRE HYDRANT
- MAILBOX
- WATER VALVE
- RIGHT OF WAY MARKER
- ABANDONED GAS WELL SITE
- FENCE
- OVERHEAD ELECTRIC
- GAS PIPELINE
- 6" WATER LINE
- 10" WATER LINE
- EXISTING WATERWAY
- EXISTING ROADWAY
- EXISTING GROUND CONTOURS

PHASING LEGEND:

- PHASE 1 BULKHEAD CONSTRUCTION (10,981 LINEAR FEET) TO COMMENCE @ N.T.P. AND WATER LINE RELOCATION
- PHASE 2 (N.I.C.) BULKHEAD CONSTRUCTION (6,892 LINEAR FEET) TO COMMENCE @ TRANSCANADA & KINETICA PIPELINE RELOCATION, WATER CONTROL STRUCTURE RELOCATION, & AS DIRECTED BY OWNER.
- PHASE 3 (N.I.C.) BULKHEAD CONSTRUCTION (4,200 LINEAR FEET) TO COMMENCE ONLY AS DIRECTED BY OWNER
- BULKHEAD WALL

1" = 300'

CONTRACTOR SHALL REFER TO BULKHEAD WALL NOTES ON SHEET 2.

CALCASIEU SHIP CHANNEL

EAST FORK

LOOP PASS

CROSS SECTION BASELINE FOR SECTIONS 'A-A' THRU 'G-G'

N = 482009
E = 2642592

N = 482709
E = 2642564

EXIST. WAKEFIELD ROAD

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE LOWERED BY OTHERS, UNDER SEPARATE CONTRACT)

EXIST. WAKEFIELD ROAD BRIDGE TO BE REMOVED(SEE SHEET 3)

EXIST. CAPPED ABANDONED GAS WELL.

EXIST. ENLINK PIPELINE TO BE REMOVED BY OTHERS, UNDER SEPARATE CONTRACT.

REQ'D. EXIST. TRANSCANADA & KINETICA PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

N = 481859
E = 2643585

N = 482709
E = 2643435

N = 482009
E = 2643435

N = 482859
E = 2643585

N = 483951
E = 2643585

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

N = 480009
E = 2643585

PH. 1

PH. 3

EXIST. W-1 CANAL WATER CONTROL STRUCTURE(TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT)

N = 480009
E = 2644085

PH. 3

PH. 1

EXIST. W-1 CANAL

N = 482859
E = 2644085

N = 482709
E = 2644235

N = 481859
E = 2644085

N = 483951
E = 2644085

N = 482009
E = 2644235

EXIST. CAPPED ABANDONED GAS WELL.

FUTURE CONSTRUCTION

ENERGY ROAD (65' R/W)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

EXIST. CAPPED ABANDONED GAS WELL.

N = 482009
E = 2645095

N = 481859
E = 2645245

N = 482859
E = 2645245

N = 482709
E = 2645095

EXIST. CAPPED ABANDONED GAS WELL.

PH. 1

PH. 2

EXIST. CAPPED ABANDONED GAS WELL SITE (TO BE REMOVED BY OTHER, UNDER SEPARATE CONTRACT)

REQ'D. EXIST. ENLINK PIPELINES TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.

EXIST. CHENIERE PIPELINE

N = 479209
E = 2645245

EXIST. GRAVEL ROAD

APPROXIMATE LOCATION OF EXIST. 10" WATER LINE.(CONTRACTOR TO VERIFY LOCATION AND SIZE)(TO BE RELOCATED BY OTHERS, UNDER SEPARATE CONTRACT.)

REQ'D. BULKHEAD WALL.

N = 484251
E = 2645945

REQ'D. RELOCATED W-1 CANAL CONTROL STRUCTURE. (BY OTHERS, UNDER SEPARATE CONTRACT)

N = 479209
E = 2645945

GAS WELL.

PORT CAMERON DRIVE

PH. 2

PH. 1

N = 482751
E = 2645945

EXIST. CAPPED ABANDONED GAS WELL.

EXIST. CAPPED ABANDONED GAS WELL.

EXPLORATION ROAD (65' R/W)

VIATOR ROAD (UNDER SEPARATE CONTRACT)

REQ'D. RELOCATED TRANSCANADA & KINETICA PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

PROPERTY LINE (TYP.)

REQ'D. RELOCATED ENLINK PIPELINES (BY OTHERS, UNDER SEPARATE CONTRACT)

EXIST. LA HWY 27/82

Drawing name: F:\00_PROJECTS\14-025\Sheet_Sets\Construction\Dredging Plans_Beneficial Use\140250G_Bl01.dwg – Aug 17, 2017 – 2:26pm

SHEET NUMBER 32

PARISH: CAMERON
FEDERAL PROJECT: N/A
STATE PROJECT: N/A
DESIGNED: LRE
CHECKED: SEW
DETAILED: DRW LRE
CHECKED:
DATE: JULY 2017
SHEET:

PRELIMINARY

NO. DATE BY REVISION DESCRIPTION

PORT CAMERON

BULKHEAD LOCATION PLAN

PORT CAMERON – DREDGING AND MARSH CREATION

LA One Call 1-800-272-3020 Call before you dig

EG

From: Mayer, Martin S CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: Port Cameron Info
Date: Thursday, July 27, 2017 12:39:38 PM
Attachments: Port_Cameron_Impact_Assessment.20170427.pdf

PHASE I ENVIRONMENTAL SITE ASSESSMENT

PORT OF CAMERON PROPERTY LOCATED

IN

CAMERON, LOUISIANA

FOR

Will Belton

May 19, 2015

PREPARED BY:

SPOONER & Associates, Inc.
Post Office Box 12685
Cameron, La 70612
(337) 855-4517

Project No. 0413836

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CERTIFICATION

Spooner & Associates, Inc. prepared this report in conformance with the scope and limitations of ASTM 1527-13 concerning the approximately 500 acre section of property located in Section 25, Township 14 South, Range 10 West, of the USGS "Cameron, Louisiana", Quadrangle Map in Cameron Parish. The field inspection environmental site assessment document was performed and prepared by an Environmental Specialist and reviewed by a Licensed Geologist. The affixed signatures below signify the persons certifying the work on this project.

The recommendations and professional opinions presented herein are within the limits prescribed by the client and were prepared in accordance with generally accepted professional engineering and industrial safety practices. There is no other warranty either expressed or implied.

The one original documents are signed in blue ink. This is Document One.

Brandon Spooner
Environmental Consultant

Scott Spooner, PG
Registered Professional
Geologist TN-3322

EXECUTIVE SUMMARY

In accordance with a request by Mr. Will Belton, Spooner & Associates Inc. conducted a Phase I Environmental Site Assessment (ESA) on May 6, 2015 on an approximately 500 acre section of property located in Cameron Parish, Louisiana. This ESA adhered to the scope and limitations of the American Society for Testing and Materials (ASTM) Standard Practice E-1527-13. These concerns are addressed in this report. A Title Abstract was not available for review during the preparation of this report.

The subject property is located in Cameron Parish within the city limits of Cameron, Louisiana. There is one structure located on the subject property.

This document summarizes the observations related to the environmental condition of the subject property and potential areas of Recognized Environmental Conditions (RECs). It also contains a description of the subject property, a summary of regulatory databases and records reviewed, and an opinion by Spooner & Associates with regard to existing environmental conditions at the subject property.

On the following matrix, Spooner & Associates has attempted to identify any areas that contain recognized environmental conditions (RECs) for the respective subject property. After review of all environmental information obtained by Spooner & Associates, it is the opinion of the environmental professional that this assessment has revealed **No Evidence of Recognized Environmental Conditions** in connection with this property.

The qualifications of the environmental professional conducting supervision of field work and document preparation of this ESA is as follows:

Scott Spooner, a Licensed Professional Geologist, has more than 24 years of experience dealing with environmental issues and has prepared and reviewed numerous ESAs for federal, industrial, municipal, and private entities.

PROJECT CONCLUSIONS MATRIX

Assessment Component	Acceptable	Potential Impact	Reference Section	Comments on Site
Banks Environmental Database Report	✓		3.0	See Attachment C
Historical Review	✓		3.0	Aerial Photographs, Topographic maps
Operational Activities	✓		2.0	None
Potentially Hazardous materials	✓		3.0, 4.0 & 6.0	None
Structures and Buildings	✓		2.0	None
Ground Surface Areas	✓		4.0	Marsh grass
General Safety Issues	✓		4.0	None
Environmental Conditions	✓		6.0	None
Environmental Regulatory Compliance	✓		3.0 & 4.0	No compliance issues were noted
Adjacent Properties	✓		2.0	Commercial / Industrial

1.0 INTRODUCTION

1.1 Purpose

The purpose of the Phase I ESA is to identify to the extent feasible, pursuant to the processes prescribed herein, recognized environmental conditions in connection with the subject property, in accordance with ASTM Standard Practice. The term "recognized environmental conditions" means the presence or likely presence of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, past release, or a material threat of a release of hazardous substances or petroleum products into structures on the property or onto the ground, groundwater or surface water of the subject property. A Phase I ESA is intended to reflect a commercially prudent and reasonable inquiry in order to satisfy one of the requirements under the innocent landowner's defense under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.2 Special Terms and Conditions

The findings and conclusions of this report are not scientific certainties, but rather, probabilities based on professional judgment concerning the significance of the data gathered during the course of the assessment. Spooner & Associates is not able to verify that the subject property or adjoining land contains no hazardous substances, petroleum products, or other laden condition beyond that detected or observed during the assessment. The possibility always exists for contaminants to migrate through surface water, air, soil, or groundwater. The ability to accurately address the environmental risks associated with transport in these media is beyond the scope of this assessment. The opinions expressed by Spooner & Associates with reference to the subject property only pertain to the conditions that exist at the subject property during the time the site inspection was conducted.

1.3 Limitations and Exceptions of Assessment

This report and other instruments of service were prepared for, and made available for the sole use of our client. Spooner & Associates is not responsible for damage or loss caused by any other party's reliance upon observations expressed in this report. To the fullest extent permitted by law, Spooner & Associates' total liability for any and all injuries, claims, losses, expenses, or damages whatsoever arising out of or in any way relating to the project or the site from any cause or causes including but not limited to Spooner & Associates' negligence, errors, omissions, strict liability, breach of contract, or breach of warranty shall not exceed the total amount paid by the client for the services of Spooner & Associates under this project.

1.4 Limiting Conditions and Methodology Used

Spooner & Associates' environmental professional conducted a physical inspection of the site on May 6, 2015. While at the site, Spooner & Associates recorded pertinent observations relating to the condition of the subject property in regard to potential environmental liabilities. This report was prepared to summarize observations related to the environmental conditions of the subject property and areas of potential concern. This included a description of the subject property, an abstract of findings obtained from research of regulatory databases and records, a summary of observations and interviews with pertinent parties, and an opinion by Spooner & Associates with regard to the existing environmental conditions of the subject property. The Phase I ESA is limited to the subject property as further described in Sections 2.0 - 6.0 of this report.

A Title Abstract was not available for review during the preparation of this report.

2.0 SITE DESCRIPTION

2.1 Location and Legal Description

As shown on the site location map noted as Figure 1, the subject property is located in Cameron, Louisiana. The USGS "Cameron, Louisiana", Quadrangle (Figure 3) reveals that the property is located in Section 25, Township 14 South, Range 10 West, Cameron Parish, Louisiana. Figure 1 denotes the layout of the subject property.

2.2 Site and Vicinity Characteristics

Currently, the subject site exists as pasture land containing cattle with the majority of the property consisting of marshland characteristics. The subject property boundaries are defined by the property's fence lines used to contain the livestock. Adjoining properties to the west and south are commercial sites, while adjoining the property to the north and east are vacant tracts of land.

2.3 Description of Structures, Roads, and Other Improvements on the Site

One gravel road is located near the center of the subject site running north and south. A bridge is in place where the gravel road encounters the W1 West Center Canal Gravity Drainage number 3 Right-of-Way canal that flows west towards the Calcasieu ship channel.

2.4 Environmental Liens or Specialized Knowledge or Experience

A review of the Louisiana Department of Environmental Quality (LDEQ) Electronic Document Management System (EDMS) did not reveal any documents pertaining to environmental liens affiliated with the property.

2.5 Current Uses of the Property

Presently the property is used for grazing and contains a number of cattle.

2.6 Past Uses of the Property

A review of historical aerial photographs depicts the subject site as a cleared tract of land as early as 1952. Throughout the years different areas\ of the property have been leased and utilized for agriculture use, oil and gas exploration, drainage, parking area, air strip, helicopter landing pad, and construction equipment and material storage.

2.7 Current and Past Uses of Adjoining Properties

A review of historical aerial photography indicates that the adjoining properties to the west, and south have remained as commercial sites. Adjacent properties to the north and east have remained as cleared tracts of land since 1952.

2.8 Site Plan

An aerial photograph, street map, and topographic map are included as Figures 1, 2, and 3, respectively.

3.0 STANDARD ENVIRONMENTAL RECORD SOURCES, FEDERAL, AND STATE

Spooner & Associates utilized a nationwide environmental database information system service, Banks Environmental Database Report, to access federal and state databases. The databases chosen for review were based on ASTM protocol. A copy of the Banks Environmental Database Report, which includes topographical and sites location maps from the database search, is included as Attachment B.

3.1 Standard Environmental Sources

3.1.1 National Priorities List Sites (NPL)

The National Priorities List (NPL) is the list of high priority hazardous waste sites in the United States eligible for long-termed remedial action financed under the federal Superfund program and the Comprehensive Environmental Response, Compensation, and Liability ACT (CERCLA). The Banks Environmental Database Report identified one NPL site within the 1.0-mile search radius of the investigated site. The identified site is: Hess Corp. As of 2014 the NPL site listed has a status of inactive and abandoned.

3.1.2 Delisted NPL Sites

The Delisted DNPL is a list of all sites that have been deleted from the Environmental Protection Agency's (EPA) NPL list. These sites are taken off the NPL list usually due to no further response or remedial action being required on them. The Banks Environmental Database Report did not identify any Delisted NPL sites listed within the 0.5-mile search radius of the investigated site.

3.1.3 CERCLIS Sites

Comprehensive Environment Response, Compensation, and Liability Information System (CERCLIS) sites come from the CERCLA, a federal law designed to clean up abandoned hazardous waste sites. These sites are either proposed, listed, or under review currently to be a part of the NPL. The Banks Environmental Database Report did not identify any CERCLIS site within the 0.5-mile search radius of the investigated tract.

3.1.4 No Further Remedial Action Planned Sites

CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the site being placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. No NFRAP site was found.

3.1.5 RCRA-CORRACTS Sites

These sites are registered hazardous waste generators or handlers that fall under the Resource Conservation and Recovery Act (RCRA) and subject to corrective action activity. The Banks Environmental Database Report did not identify any RCRA-CORRACTS sites within the 1.0-mile search radius of the investigated site.

3.1.6 RCRA-TSD Facilities

This database lists all treatment, storage, and disposal of hazardous material sites that fall under RCRA. The Banks Environmental Database Report did not identify any RCRA-TSD facility within the 0.5-mile search radius of the investigated site.

3.1.7 RCRA Large/Small Quantity Generators

The EPA and the Louisiana Department of Environmental Quality (LDEQ) maintain lists of registered large and small quantity generators of hazardous wastes. The Banks Environmental Database Report identified ten RCRA hazardous waste generators within the 0.25-mile search radius

of the investigated site. The sites identified are listed as: SOCO Offshore Inc., Martin LP Cameron, Halliburton Energy Services Inc., TETRA Technologies Inc. Cameron Facility, TETRA Technologies Inc., El Paso E & P Co. LP, Linder Oil West Cameron BLK, El Paso Cameron Shorebase, MI SWACO Cameron Deepwater Port, Hess Corp. The majority of these sites are located along Wakefield Road.

3.1.8 Emergency Response Notification System

The Emergency Response Notification System (ERNS) is a national database used to store information on unauthorized release of oil and hazardous substances that have been reported to the National Response Center since 2001. The Banks Environmental Database Report identified fifty-seven ERNS sites within the 0.25-mile search radius of the investigated site.

3.1.9 Engineering Control/Institutional Control Sites

This is a listing of Brownfield Management System (BMS) sites that have had Engineering Controls (ECs) or Institutional Controls (ICs) placed on them. ECs are physical methods or modifications put into place on a site to reduce or eliminate the possibility of human exposure to known contamination. ICs are administrative constraints, such as legal controls, that help minimize the potential for human exposure to known contamination by ensuring appropriate land resource use. Banks Environmental Database Report did not identify any Federal or State EC or IC sites within the 0.5-mile search radius of the investigated site.

3.1.10 Federal Brownfields Sites

This is a listing of sites that assist the EPA in collecting, tracking, and uploading information of sites in relation to the Small Business Liability Relief and Brownfields Revitalization Act. These sites are real property that is either abandoned or underutilized where redevelopment or expansion is complicated by real or perceived environmental contamination. The Banks Environmental Database Report did not identify any Brownfields sites within the 0.5-mile search radius of the investigated site.

3.1.11 Solid Waste Landfill Sites

This database contains listings of all solid waste disposal facilities or landfills registered with the Solid Waste Program for the LDEQ. The Banks Environmental Database Report did not identify any solid waste landfill sites within the 0.5-mile search radius of the investigated property.

3.1.12 Leaking Petroleum Storage Tank Sites

This database is a list of all known leaking Petroleum storage tanks (identified as LPST in the Banks Environmental Database Report) as registered with the Remediation Services Division of the LDEQ. The Banks Environmental Database Report identified one LPST site within the 0.5-mile search radius of the investigated property. The identified site is listed as: Cameron Exxon. This LPST tank has been closed since 1980.

3.1.13 Registered Petroleum Storage Tanks

This database is a list of all known Petroleum storage tanks (identified as PST in the Environmental Database Report) as registered with the Remediation Services Division of the LDEQ. The Banks Environmental Database Report identified two PST sites within the 0.25-mile search radius of the investigated property. The sites identified are listed as: Cameron Deepwater Port, and Waldon L. Doxey. Both identified PST sites have been removed.

3.1.14 Voluntary Remediation Program Sites

This database contains information about sites that have been placed in the Louisiana Voluntary Remediation Program (VRP). This is a program that provides current property owners with the opportunity to clean up contaminated properties and attain a release of liability for further cleanup of historical contamination at the site. The Banks Environmental Database Report did not identify any VRP site within the 0.25-mile search radius of the investigated property.

3.1.15 Unmapped Sites

The Banks Environmental Database Report identified one hundred and seventy-two unmapped sites. The sites are listed as: one hundred and forty-two ERNS sites, two RCRA Generating sites (Cameron Construction Co. Inc. and Chevron USA Inc.), twenty-four RCRA sites, one LPST site (Cameron Canal), three PST sites (Zapata Haynie Corp. Cameron Plant, Cameron Canal, and Saye's Grocery).

3.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

The Banks Environmental Database Report presents additional databases other than the standard ASTM required information. A description of these databases and details of the search area for the databases are listed in the Banks Environmental Database Report. The Banks Environmental Database Report did not identify any sites under the supplemental categories.

3.2.1 State Hazardous Waste Sites (CERCLIS)

The Louisiana Department of Environmental Quality (LDEQ) maintains a listing of all State Superfund sites.

There is one site listed as a State Hazardous Waste CERCLIS site. The site identified is listed as Gulf Crews.

3.2.2 State Solid Waste Division

The LDEQ maintains listings of State permitted Solid Waste Landfills.

There are no facilities within a 0.5-mile radius of the subject property.

3.2.3 State Petroleum Storage Tank (PST) Divisions

The LDEQ maintains listings of registered Petroleum storage tanks (PST) and leaking Petroleum storage tanks (LPST).

There are five PST sites and two LPST sites referenced in the database search within 0.5-mile of the subject property. The PST sites identified are: Zapata Haynie Corp., Cameron Canal, Saye's Grocery, Cameron Deepwater Port, and Waldon L. Doxey. All PST sites have been either closed or removed. The LPST sites identified are: Cameron Exxon, and Cameron Canal. Both LPST sites listed have been either closed or removed.

3.3 Physical Setting Source

The most current USGS 7.5 Minute Series Quadrangle Map, depicting the area in which the subject property is located, is the "Cameron, Louisiana", Quadrangle Map, (Figure 3).

3.4 Historical Use Information

Field investigation of the property did not indicate any evidence of any other current or past environmental concerns on the subject property however on site conditions hindered access and visibility during the investigation and total certainty cannot be determined. Interviews with persons knowledgeable of the site also did not reveal any recognized environmental conditions on the property.

3.5 Additional Record Sources

3.5.1 Aerial Photographs

Spooner & Associates reviewed aerial photographs from the years 1952, 1968, 1975, 1977, 1982, 1998, 2004, 2007, 2010, and 2013 from the

Banks Environmental Database Report. Copies of the aerial photographs are included in this report.

Spooner & Associates made the following limited observations when viewing the photographs. The environmental professional making these observations is simply reporting on what is believed as generally depicted in the photographs.

1952--Photograph shows the subject property as cleared site with a single road running north and south through the approximate center of the site. An airstrip is apparent along the southeastern section of the property.

1968-- Photographs show the subject property with minor roadways now extending off of the original road running located in the approximate center of the subject site.

1975--Photographs show the subject property as relatively unchanged from the previous historical photograph.

1977--Photographs show the subject property remains relatively unchanged. Apparent development to the west of the subject site along Wakefield Road is evident.

1982--Photograph shows the subject property remains relatively unchanged. Continued development along Wakefield Road is evident.

1998--Photographs show the subject property as relatively unchanged from the previous historical photograph.

2004--Photographs show the subject property as relatively unchanged from the previous historical photograph.

2007--Photographs show the subject property as relatively unchanged from the previous historical photograph.

2010--Photograph shows the subject property as relatively unchanged from previous historical photograph.

2013--Photograph shows the subject property as relatively unchanged from previous historical photograph.

3.5.2 Louisiana Department of Natural Resources

The Louisiana Department of Natural Resources, Office of Conservation (DNR) maintains a listing of water and oil and gas wells located in Louisiana. According to a review of the DNR website, there are eleven recorded oil and gas wells within a one-mile radius of the subject property.

4.0 INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

On May 6, 2015, Spooner & Associates representatives conducted an inspection of the subject property. The purpose of the inspection was to observe whether any visible areas of recognized environmental conditions were evident at the subject property. Selected photographs of the subject property taken during the inspection are shown in Plates 1 through 42. The boundaries and interior of the property were visually and physically examined to determine if there were any indications that the property was used to dispose of hazardous substances or petroleum products.

On May 12, 2015 an interview was conducted with Mr. Scott Henry the current owner and viable point of contact for the subject property. Mr. Henry indicated that his family has owned the subject site for nearly a century and to his knowledge there have been no significant environmental developments or areas of concerns with the subject property.

On May 12, 2015 an interview using information provided by the ASTM 1527-13 User Questionnaire was conducted with Mr. Henry. A copy of the ASTM 1527-13 User Questionnaire results is included as Attachment A in this report.

4.1 Hazardous Substances in Connection with Identified Uses

No evidence of hazardous or potentially hazardous substances was noted in conjunction with the subject property. During the site investigation the limited the field of view was severely limited due to the dense vegetation and physical terrain.

4.2 Hazardous and/or Unidentified Substance Containers

None found on site.

4.3 Storage Tanks

No storage tanks are located on the site. A single diesel tank was noted along the western limit of the subject site on property currently leased by a commercial business located in the vicinity of the Calcasieu ship channel.

4.4 Indications of PCBs

Electrical transformers providing single-phase power were observed along Highway 27 and Wakefield Road. The transformers belong to Jefferson Davis Electric Co-Op and through correspondence with company representatives, it was stated that all new transformers do not contain PCBs but also stated that all transformers are operated in compliance with all Federal and State regulatory guidelines. In case of a spill from a transformer on any site, the utility company will take the necessary appropriate action.

4.5 Indications of Solid Waste Disposal

Limited evidence of solid waste was noted on the subject property. The majority of evidence observed was likely remnants of hurricane debris.

4.6 Physical Setting Analysis

Spooner & Associates reviewed the most current USGS 7.5 Minute Series Topographical Map depicting the area in which the subject property is located. The "Cameron, Louisiana", Quadrangle Map (Figure 3) indicates that the area around the subject property is level with a contour elevation ranging from 1 to 5 feet. Stormwater runoff from the site is to the east toward drainage provided by the W1 West Center Canal, which feeds into the Calcasieu ship channel.

4.7 Miscellaneous Areas of Concern

No miscellaneous areas of concern were noted throughout the subject property.

5.0 OPINION OF IMPACTS

It is the opinion of Spooner & Associates' environmental professional who conducted the site visit and reviewed the results of the available data that there are ***No Recognized Environmental Conditions*** representing environmental impacts to the soil and water resources on the subject property.

6.0 FINDINGS AND CONCLUSIONS

Interviews and environmental database searches did not note any areas of environmental concern for the subject property. Field observation revealed *no visual evidence* of possible petroleum hydrocarbon release or other hazardous contamination.

Any additional environmental impact to subsurface soils and groundwater on site cannot always be determined by the visual investigation performed during an environmental site assessment.

Spooner & Associates has performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E-1527-13 on the subject property located in Cameron, more specifically Section 25, Township 14 South, Range 10 West, of the "Cameron, Louisiana", Quadrangle Map (Figure 3). Any exceptions to or deletions from this practice are described in Section 1.3 of this report. This assessment has revealed ***No Evidence of Recognized Environmental Conditions*** in connection with the property.

7.0 RECOMMENDATIONS

Based on the scope of work performed for this assessment, it is Spooner & Associates' professional opinion that **No Evidence of *Recognized Environmental Concerns*** has been identified in connection with the subject property.

8.0 ENVIRONMENTAL PROFESSIONAL'S STATEMENT

Spooner & Associates, Inc. declares that, to the best of its knowledge and belief, Spooner & Associates, Inc. personnel meet the definition of Environmental professional as defined in 312.10 of 40 CFR 312 and,

Spooner & Associates, Inc. personnel have specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. Spooner & Associates, Inc. personnel have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

9.0 REFERENCES

ASTM International, 2005.11, E 1527-13, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process", Pgs. 1-35. ASTM International, West Conshohocken, PA.

US Geological Survey Topographic Maps Internet at www.usgs.gov.

Banks Environmental Data, 2015, The Banks Regulatory Database Report, ES# 115173 prepared for Spooner & Associates, Inc., Cameron, Louisiana.

Historical Aerial Photography obtained from Louisiana Department of Transportation and Development, Baton Rouge, Louisiana, Louisiana Department of Natural Resources Strategic Online Natural Resources Information System (SONRIS) http://sonris.com. Baton Rouge, Louisiana and The Banks Group, Austin, TX.

Environmental Data Management System Records obtained http://edms.deq.louisiana.gov/, Louisiana Department of Environmental Quality, Baton Rouge, Louisiana.

Louisiana Department of Natural Resources Strategic Online Natural Resources Information System (SONRIS) records obtained from http://sonris.com, Louisiana Department of Natural Resources, Baton Rouge, Louisiana.

From:	Gutierrez, Raul
To:	Breaux, Brian W MVN
Cc:	Marceaux, Josh; Kyle Balkum (kbalkum@wlf.la.gov); Cheatwood, Twyla; Elizabeth Johnson (DEQ); mark.hogan@la.gov
Subject:	Port Cameron public notice; MVN-2013-02424
Date:	Thursday, July 28, 2016 1:31:00 PM
Attachments:	MVN-2013-02424-MB_PortCameron.pdf

Attached is a copy of our comments for the Port Cameron pubic notice. Hard copy is in the mail.

Raul Gutierrez, Ph.D.
Wetlands Section (6WQ-EM)
US EPA Region 6
(504) 862-2371
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From: Mayer, Martin S CIV USARMY CEMVN (US)
To: Gutierrez, Raul
Subject: Port Cameron. BU plan at Cameron Prairie NWR
Date: Thursday, July 27, 2017 12:46:46 PM
Attachments: DMMPrevised20170424.pdf

April 2017

Port Cameron, LLC **MVN-2013-02424-MB**

Port Cameron Project

Impact Assessment

Cameron Parish, Louisiana

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LIST OF APPENDICES

Appendix A: Air Emission Methodologies and Calculations

TECHNICAL ABBREVIATIONS AND ACRONYMS

ACHP	Advisory Council on Historic Preservation
APE	area of potential effects
ASTM	American Society for Testing and Materials
AQCR	Air Quality Control Region
bgs	below ground surface
BMPs	best management practices
CBRS	Coastal Barrier Resources System
CCWP	Cameron Creole Watershed Project
CEQ	Council on Environmental Quality
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPRA	Louisiana Coastal Protection and Restoration Authority
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibel
dBA	decibels on the A-weighted scale
DOTD	Louisiana Department of Transportation and Development
DPS	distinct population segment
EA	environmental assessment
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ERNS	Emergency Response Notification System
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GHG	greenhouse gas
GMFMC	Gulf of Mexico Fishery Management Council
HUD	U.S. Department of Housing and Urban Development
kg	kilograms
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LDOA	Louisiana Division of Archaeology – Office of Cultural Development
LOS	Level of Service
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration Fisheries

NO_2	nitrogen dioxide
N_2O	nitrous oxide
NO_X	nitrogen oxide
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSR	New Source Review
NWR	national wildlife refuge
OCM	Office of Coastal Management
PM	particulate matter
$PM_{2.5}$	particles with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	particles with an aerodynamic diameter less than or equal to 10 microns
ppt	parts per thousand
Project	Port Cameron Project
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental condition
SAV	submerged aquatic vegetation
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasures
SWLA	Southwest Louisiana
SWPPP	stormwater pollution prevention plan
tpy	metric tons per year
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compounds

1. IMPACT ANALYSIS

1.1 GEOLOGY

1.1.1 Existing Environment

The Project would be in the Gulf Coastal Plain physiographic province, which lies along the Atlantic seaboard and Gulf Coast, stretching approximately 100 to 400 miles inland and 100 to 200 miles offshore to the edge of the continental shelf (U. S. Geological Survey [USGS] 1998). Growth faulting associated with the subsidence of the Gulf Coast geosyncline occurs in zones throughout southern Louisiana in the Gulf Coastal Plain province. In addition, salt domes formed from the Louann salt bed are scattered throughout southern Louisiana and overlain by caprock of variable thickness (Hosman 1996).

The Project is located in the Chenier Plain, Saline Marsh geologic unit consisting of unconsolidated clay or mud and silt (USGS 2014a). The Chenier Plains are Holocene in age and consist of long, narrow, wooded beach ridges (cheniers) and intervening mudflats formed by alternating suspended sediment deposition and wave erosion of sandy mud (Owen 2008).

Geotechnical studies have been conducted on both the port and beneficial use sites. A two-phase geotechnical study is in progress to evaluate subsurface soil and groundwater conditions within the port site. Phase I of the study was conducted in previously developed areas and areas that could be accessed without crossing delineated wetlands. Additional borings are proposed in wetland areas as Phase II of the investigation and are awaiting approval of a Coastal Use Permit. The Phase I geotechnical study for the port site included:

- 6 soil borings to a depth of 120 feet below ground surface (bgs);
- 13 cone penetration tests ranging in depth from 70 to 90 feet-bgs; and
- 4 discrete in-situ vane shear testing ranging in depth from 7.5 feet to 28 feet-bgs.

The Phase I investigations indicated that the materials in the western portion of the Project site appear to be located on a mudflat and consist of very soft to soft fat clay with organics and intermittent sand and shell layers to a depth of 55 feet-bgs; deeper layers include firm to stiff fat clays with a thin sand layer at approximately 70 to 80 feet-bgs.

The eastern portion of the port site was determined to be located on the chenier ridge based on the presence of coarser sediments and increased amounts of sand and shell. Materials on the eastern portion consisted of very soft to firm fat clay or lean clay to a depth of 12 feet-bgs; deeper layers include sandy silty clay, silty clayey sand, lean clay, sandy silt, and silty sands. The investigation indicated that these soils may be suitable as structural fill pending additional bulk testing. The Phase II investigations will be used to confirm the results of the Phase I investigation, including confirming any treatment required for use of these soils as suitable fill material.

Surficial groundwater was encountered during drilling between seven and 10 feet-bgs with the exception of one boring location encountering surficial groundwater at a depth of approximately 20 feet-bgs.

The geotechnical study for the beneficial use site included five soil borings to a depth of 50 to 60 feet below the existing mudline. The investigation showed that from zero to four feet below the mudline, soils are very soft, gray and black organic clay or fat clay with organics. From four to forty feet below the mudline, soils are very soft to soft gray fat clay with organics and shells. Between forty and sixty feet below the mudline, the soils are firm to stiff reddish green/brown fat clay with sand and shells intermixed.

Settlement calculations were performed to determine the maximum construction elevation that would be required to attain the target marsh surface at about El. +1 feet over a period of 20 years after construction. Four (4) components of settlement were considered to determine the total anticipated long-term settlement in the newly-created marsh area:

1) Primary consolidation settlement of dredged fill and foundation soils;
2) Secondary compression of dredged fill and foundation soils;
3) Desiccation of the dredged fill material; and,
4) Regional geologic subsidence.

This long-term settlement analysis wias be used in the final design of the beneficial use area.

1.1.2 Discussion of Impacts

1.1.2.1 No Action Alternative

The No Action Alternative would not impact geology within the study area.

1.1.2.2 Proposed Action

Approximately 9.7 million cubic yards of material would be excavated and dredged to construct the port canals, which would convert 106.4 acres of existing land to open water. Dredging and excavation would minimally impact the local geology by redistributing clays and sediments (see Sections 1.4 and 1.5).

Port Cameron would drive sheet piles for the bulkheads and may drive concrete piles to support the relocated W-1 canal pump station. Further, Port Cameron would modify the existing topographic contours to accommodate port facilities and maintain adequate drainage from the site. The majority of the dredged and excavated material (approximately 5.7 million cubic yards) would be used to elevate portions of the site to 7.0 to 10.0 feet above sea level where land-based infrastructure would be located; changes in topography are further addressed in Section 1.3.2, below. Net changes to local or regional geology would be minimal.

Approximately 4.0 million cubic yards of dredged and excavated material would be used beneficially to create marsh habitat in the nearby East Cove Unit of the Cameron Prairie National Wildlife Refuge (NWR). Dredged materials would be pumped via a hydraulic dredge through a temporary aboveground pipeline to re-create approximately 556 acres of marsh in the NWR.

Excavation, dredging, and relocation of soils and sediments associated with construction of the port would alter the existing topography but would not markedly impact the geology of the area. Thus, no significant adverse impacts to geology are anticipated.

1.2 TOPOGRAPHY AND SOILS

1.2.1 Existing Environment

Based on USGS topographic maps and field investigations, the Port site is relatively flat with elevations ranging from 0 to 5 feet above sea level, except where cheniers in the Port site reach elevations of 9 feet. The site generally slopes toward the W-1 canal, located in the center of the site, and westward toward the Calcasieu Ship Channel.

The soils in the Port site include Aquents, dredged; Creole Mucky Clay; Hackberry-Mermentau complex, gently undulating; Mermentau clay; and Udorthents with 1 to 20 percent slopes. Aquents consist of loamy and clayey materials with less than 1 percent slopes that were hydraulically excavated from soils in marshes during the construction and maintenance of navigable waterways. Creole Mucky Clay consists of very poorly drained, very fluid, mineral soil in brackish marshes that is ponded for long periods and frequently flooded, with slopes less than 1 percent. The Hackberry-Mermentau complex, gently undulating, consists of level and gently undulating, somewhat poorly drained, and poorly drained soils, with Hackberry soils forming on low ridges (1 to 3 percent slopes) and Mermentau soils forming in depressions between the ridges (0 to 1 percent slopes). Mermentau clay consists of poorly drained soils with less than 1 percent slopes that form on low ridges near the coast and in broad areas of brackish marsh. Udorthents, 1 to 20 percent slopes, consist of sandy, loamy, and clayey soil material that was hydraulically excavated from soils in marshes during the construction and maintenance of navigable waterways (Natural Resources Conservation Service [NRCS] 1995).

1.2.1.1 Prime Farmland and Farmland of Statewide Importance

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (NRCS 2015). This designation includes cultivated land, pasture, woodland, or other land that is either used for food or fiber crops, or is available for these uses. Urbanized land, built-up land, and open water cannot be designated as prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., by drainage or irrigation). Farmland of statewide importance includes all prime farmland as identified by the Soil Conservation Service and, in addition, land that meets specific state designated criteria (NRCS 2016). No prime farmland or farmland of statewide importance was identified within the Port site.

1.2.2 Discussion of Impacts

1.2.2.1 No Action Alternative

The No Action Alternative would not alter soils or topography within the Port site.

1.2.2.2 Proposed Action

Construction activities such as grading, excavation, backfilling, and the movement of construction equipment may reduce soil quality at the Port site. Soil compaction due to equipment traffic can lower infiltration rates of water and reduce the available water-holding capacity of the soil, thus increasing runoff potential (NRCS 2000). Within the 505.4-acre permanent Port footprint, soils would be lost due to dredging and excavation to create canals (106.4 acres) or encumbered by land-based infrastructure.

As described above (see Section 1.1.2), about 9.7 million cubic yards of material would be dredged and excavated from the Port site for the creation of the open-water canals. The majority of this material (approximately 5.7 million cubic yards) would be used to elevate the portions of the site that would support land-based infrastructure to 7.0 to 10.0 feet above sea level to reduce the risk of flooding, permanently altering the topography of the Port site. Hydrologic drainage patterns would be altered, but the overall volume of runoff would decrease, as well as flooding potential. Section 1.3 below provides more detail regarding Port impacts on hydrology and drainage; Section 1.4 addresses flooding.

The remaining 4.0 million cubic yards of material would be pumped via a hydraulic dredge through a temporary aboveground pipeline to beneficially reuse the material to re-create approximately 556 acres of marsh in the East Cove Unit of the Cameron Prairie NWR. Port Cameron would coordinate with the U.S. Fish and Wildlife Service (USFWS), both Cameron Prairie National Wildlife Refuge and the Ecological Services Branch, the National Marine Fisheries Service (NMFS), the USACE, the U.S. Environmental Protection Agency (EPA), and the Louisiana Department of Natural Resources (LDNR), Office of Coastal Management (OCM) for the design and implementation of the beneficial use site. Consideration would be given to maintaining the tidal exchange of water in the beneficial use site for the benefit of fish access. Soils formed from the placement of dredged material for beneficial use would have a higher inorganic content than the naturally occurring soils typical of coastal marshes; therefore, they would likely be denser and possibly less susceptible to erosion.

To reduce the impacts of construction on soils, and to minimize the potential for contamination of nearby wetlands, waterbodies, and other sensitive resources, a stormwater pollution prevention plan (SWPPP) would be implemented during construction of the Project. The SWPPP would outline potential sources of releases at the site, measures to prevent a release to the environment, and initial responses in the event of a spill. As described in more detail in Section 1.4.2, measures would be implemented to control erosion and sedimentation during construction. Steel sheet pile bulkheads lining the proposed canals would prevent erosion or sloughing of soil into the water during construction and operation of the Port. During operation of the Port, Port Cameron would require future tenants to abide by and maintain applicable regulatory permits and associated SWPPPs and spill prevention, control, and countermeasures (SPCC) plans (see Section 1.4.2). Thus, no significant adverse impacts to topography and soils are anticipated.

1.3 FLOODING AND STORMS

1.3.1 Existing Environment

Executive Order 11988 (Floodplain Management) requires federal agencies to avoid, to the greatest extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) were reviewed for the Port site. According to the effective FIRM for the Port site (FIRM panel number 22023C0700H), the port site would be located within FEMA Flood Hazard Zone AE, with base flood elevations of 12 and 13 feet (NAVD88)(FEMA 2012). Properties located in these zones have a one percent chance of flooding up to the base flood elevation in any year.

Regional subsidence and anticipated sea level rise can exacerbate flooding. Measures of relative sea level rise integrate both eustatic (global change) sea level and subsidence factors. Including a eustatic component of 0.07 inches per year, a relative sea level rise rate of 0.50 inches per year was estimated for the port site (Moffatt & Nichol 2015). Over a 50-year period, this rate would amount to a 2.1-foot loss in elevation at the port site.

Due to its proximity to the Gulf of Mexico and the presence of the Calcasieu Ship Channel, the port site would be subject to periodic hurricanes. Hazards associated with hurricanes include storm surges, heavy rainfall, inland flooding, high winds, tornadoes, and rip currents. Hurricane intensity is measured on the Saffir-Simpson Scale and ranges from a Category 1 storm with winds from 74 to 95 miles per hour (mph) that produce some damage, to a Category 5 storm with winds greater than 157 mph that produce catastrophic damage (National Oceanic and Atmospheric Administration [NOAA] 2016). The estimated return period for a major hurricane of Category 3 and above within 50 nautical miles of Cameron Parish is about 33 years (Black and Gibney 2011).

The highest recorded water level in Cameron Parish was 16.2 feet NAVD during Hurricane Rita in 2005. This was recorded at a location 1.5 miles southeast to the proposed port site (Moffatt and Nichol 2015).

Without accounting for wave effects, storm surge water levels at the port site are anticipated to reach between 10.7 and 14.5 feet NAVD for 100- and 500-year storms, respectively (Moffatt and Nichol 2015). Wave crest elevations are anticipated to reach 12.5 feet NAVD for 100-year storms. When subsidence and sea level rise are factored in, wave crest elevations at the port site would reach 14.6 feet NAVD during 100-year storms. Wave crest elevation data for 500-year storms were not available (Moffatt and Nichol 2015).

1.3.2 Discussion of Impacts

1.3.2.1 No Action Alternative

The No Action Alternative would have no impact on floodplain management in the area.

1.3.2.2 Proposed Action

The Port would convert 106.4 acres of hydrologically managed land and existing drainage canals to open water for the proposed 700-foot wide canals that would directly connect with the Calcasieu Ship Channel. The remainder of the site would be graded and sloped to drain stormwater runoff into the open water canals and then to the Calcasieu Ship Channel. Lots along the proposed open-water canals would be filled with dredged or off-site material to increase elevations to a maximum of 10 feet (NAVD88) to support land-based infrastructure and provide tenants with reduced risk of flooding from storm surge.

In response to Hurricane Rita, Cameron Parish implemented federally mandated resiliency principles for construction. Building codes and federal permits for properties at risk of tidal storm surge and high winds are now regulated in the parish (Southwest Louisiana [SWLA] Economic Alliance 2015). Port tenants would be required to comply with parish building codes, including the parish Flood Damage Prevention Ordinance (Cameron Parish Police Jury 2016a). FEMA base flood elevations, relative sea level rise, and increased flooding during hurricane storm surges would be taken into consideration in the design of the structures by the tenants. For example, all habitable structures would be built on piles at least one foot above base flood elevation.

A Hydrologic Modification Impact Analysis (HMIA) was conducted to quantify Project impacts on hydrology on and around the port site during the 10-year and 100-year design storms and determined that volumetric runoff under with-Project conditions would be reduced as a result of the conversion of 106.4 acres of ground cover to open water. Surface water flow would increase and flooding potential would decrease on the Port site due to the replacement of the 60-foot-wide W-1 canal with the wider 700-foot-wide proposed open-water canals, which would directly flow to the Calcasieu Ship Channel. Flooding is also expected to be reduced to the east of the Port site due to the more efficient response of the W-1 canal drainage system due to the reduction of stormwater from the removal of 505.4 acres of land from the larger W-1 canal drainage area. Additionally, the Project would restore 556 acres of open water to marsh habitat in the East Cove Unit of the Cameron Prairie NWR through beneficial use of the material dredged for Port construction. The conversion of open water to marsh would enhance the flood storage capacity and decrease flood velocities during storm events in the NWR (EPA 2006). For these reasons, the Port would have little potential to adversely impact the natural function of the floodplain or result in increased flood velocities.

This project has been coordinated with the Floodplain Manager of Cameron Parish. Gravity Drainage District No. 3, which manages the drainage control structure on the proposed site, issued a letter stating no objection to the Project.

Thus, no significant adverse impacts to floodplains are anticipated.

1.4 WATER QUALITY

1.4.1 Existing Environment

1.4.1.1 Groundwater

The EPA defines a sole or principal source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. To be defined as a sole source aquifer, there cannot be an alternative drinking water source that could physically, legally, and economically supply all those who depend upon the aquifer with drinking water (EPA 2016a). The Chicot aquifer system is an EPA-designated sole source aquifer that underlies the Port site (EPA 2016b). In Cameron Parish, the Chicot aquifer system is composed of six locally named sand units (aquifers); the shallow sand, upper sand, lower sand, and "200-foot," "500-foot," and "700-foot" sands. A surficial clay confining unit restricts infiltration of precipitation into the Chicot aquifer system throughout much of the parish and is generally present from land surface to depths ranging from 120 to 360 feet-bgs. The "200-foot," "500-foot," and "700-foot" sands underlie the Port site; however, no fresh groundwater is present in these aquifers at this location (LDNR 2016a, USGS 2014b). The LDNR Strategic Online Natural Resources Information System database identified no public or private water supply wells in the Port site (LDNR 2016a).

The LDNR's Office of Conservation has the authority to regulate groundwater usage on a statewide basis through designation as an Area of Ground Water Concern or a Critical Area of Ground Water Concern (LDNR 2016b). Areas of Ground Water Concern are defined as areas where the sustainability of an aquifer is not being maintained due to either movement of a salt water front, water level decline, or subsidence. A Critical Area of Groundwater Concern is defined as an Area of Ground Water Concern in which the Office of Conservation's Commissioner of Conservation finds that the sustainability of the aquifer cannot be maintained without withdrawal restrictions. The State of Louisiana has three designated Areas of Ground Water Concern, all of which are in north Louisiana in the Sparta Aquifer, and none of which are in the Port site (LDNR 2016a, 2016b).

1.4.1.2 Surface Water

Louisiana is divided into 12 large-scale watershed basins for water quality management and assessment purposes (LDEQ 2016a). The Project is located in the Calcasieu River Basin, which drains an area of about 3,910 square miles into the Gulf of Mexico (LDEQ 2016a). States develop water quality standards to enhance or maintain water quality, protect the public health or welfare, and provide for the designated uses of the waters of the state. There are seven designated uses established for surface waters in Louisiana, including:

- primary contact recreation: any recreational or other water contact use involving prolonged or regular full-body contact with the water and in which the probability of ingesting appreciable amounts of water is considerable;

- secondary contact recreation: any recreational or other water contact activity in which prolonged or regular full-body contact with the water is either incidental or accidental,

and the probability of ingesting appreciable amounts of water is minimal;

- fish and wildlife propagation: the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment;

- drinking water supply: the use of water for human consumption and general household use;

- oyster propagation: the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected;

- agricultural: the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption; and

- outstanding natural resource waters: waterbodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes.

Surface waterbodies in the vicinity of the port and beneficial use sites include the Calcasieu Ship Channel, the Cameron Loop (both are designated as water quality subsegment LA030401), and Calcasieu Lake (water quality subsegment LA030402). Designated uses for both subsegments include primary contact recreation (swimming), secondary contact recreation (boating), fish and wildlife propagation (fishing), and oyster propagation. All three waterbodies fully support their designated uses (LDEQ 2016a); no 303 (d) listed waterways occur within the vicinity of the project sites.

1.4.2 Discussion of Impacts

1.4.2.1 No Action Alternative

Under the No Action Alternative, use of groundwater at the Port site would be unchanged and the periodic maintenance dredging and dredged material placement already performed for the Calcasieu Ship Channel, and the temporary and localized effects due to increases in turbidity associated with those actions, would continue.

1.4.2.2 Proposed Action

Groundwater

No groundwater withdrawal would be required for construction of the Project. With the exception of dredging the proposed open-water canals and installing sheet pile walls and concrete piles, Port construction would involve shallow, temporary, and localized excavation. Near-surface soil compaction caused by heavy construction vehicles could reduce the soil's ability to absorb water. During construction, local water table elevations could be affected by excavation and backfill. In areas where groundwater is near the surface, excavation may

intersect the water table in low-lying areas. Impacts would be temporary and minor.

The site of the proposed open water canals would be dredged to a depth of 33 feet-bgs. Sheet pile walls and concrete piles required for the bulkhead, bridges, water control structure, and pump station would be driven to depths no deeper than approximately 70-80 feet. These piles would be shallower than the water table of the shallowest aquifer, the 200-foot sand aquifer. Therefore, driven piles would not directly impact the underlying aquifer or result in mixing of groundwater between confining layers. Following construction of the Port, the portion of the ground surface not paved or converted to open water would be revegetated or graveled to eliminate exposed soils and to ensure restoration of overland flow and recharge patterns.

Surface Water

In a letter dated December 2, 2016, LDEQ stated the Project would be in compliance with State Water Quality Standards and applicable state water laws, rules and regulations. LDEQ issued a Section 401 Water Quality Certification for the Project.

Dredging and Dredged Material Placement

Dredging the entrance to the proposed open-water canals for the Port would occur within a small portion of the Calcasieu Ship Channel (outside of the authorized dimensions of the channel, but adjacent to the existing bank of the channel) and would cause mixing and disturbance of sediments, resulting in increased turbidity, sedimentation, and reductions in dissolved oxygen. These impacts would be temporary and consistent with impacts normally experienced along the ship channel due to regular maintenance dredging.

The placement of dredged material in the Cameron Prairie NWR for beneficial use would temporarily affect temperature, salinity, and turbidity. These impacts would be expected to be limited to the immediate vicinity of dredged material placement, and water quality would return to previous conditions following completion of pumping. Dredging and dredged material placement would not be expected to degrade the long-term water quality of the Calcasieu Ship Channel or the beneficial use placement site in the NWR.

As described in Section 1.6.2, a dredge pipeline would be used to transport material from the Port site to the beneficial use site within the Cameron Prairie NWR. The pipeline would cross approximately 23 acres of open water to the south and within the Cameron Prairie NWR. While placement and use of the pipeline could result in some disturbance of sediment, impacts would be temporary and limited to the period of construction.s

Site Modification and Stormwater Runoff

Short-term water quality impacts during construction include a possible increase in total suspended solids due to earthwork operations and stormwater runoff. An LPDES Permit for Stormwater Discharges from Construction Activities of 5 acres or greater, LAR100000, with an associated SWPPP (which requires implementation of best management practices (“BMPs”), would be implemented for Port construction to prevent discharges of inorganic nutrient compounds, suspended solids, or toxic substances into surface waters. Measures would be implemented to control erosion and fugitive dust during construction, such as:

- watering exposed soils during construction;
- equipping vehicles hauling soils with container covers;
- limiting vehicle speeds on unpaved roadways and posting speed limits at all construction site entrances;
- installing silt fencing and hay bales to manage runoff;
- constructing gravel ramps at roadway entrances and sweeping paved roadways to minimize dirt from construction equipment; and
- vegetating soils upon completion of construction.

Once tenant lots are constructed, the lots would be covered with gravel to limit sediment run-off prior to tenant construction of facilities, and all new roads would be revegetated and topped with gravel. During operation, tenants of the facility would be required to follow all applicable laws regarding stormwater pollution prevention, spill containment and solid and hazardous waste management. Because runoff would be controlled through the individual lot discharges into the open-water canals, individual water quality best management practices (BMPs) for each lot would be required. Any tenants discharging into the port canals would be required to acquire all necessary permits.

Long-term water quality impacts would be prevented or mitigated by revegetating/surfacing disturbed soil, maintaining individual BMPs and compliance with all laws and regulations applicable to stormwater discharges, as described above. Additionally, the Port Cameron canal entrance would slope longitudinally toward the ship channel to prevent possible stagnation and low dissolved oxygen levels that could otherwise impact water quality in the ship channel and canals. Thus, no significant adverse impacts to water quality are anticipated.

1.5 HYDROLOGY

1.5.1 Existing Environment

The Port site is adjacent to the Calcasieu Ship Channel about 4 miles from the Gulf of Mexico and south of the opening to Calcasieu Lake. The natural hydrology within the Port site has been significantly altered by drainage canals and water control structures, as well as cattle grazing, oil and gas exploration and other uses. The drainage system includes the 60-foot-wide W-1 canal, which connects to the Calcasieu Ship Channel and crosses the center of the site, and a water control structure located on the W-1 canal near its point of entry into the Calcasieu Ship Channel. The topography of the site generally slopes toward the W-1 canal and then westward into the Calcasieu Ship Channel. The W-1 canal water control structure, managed by Cameron Gravity Drainage District No. 3, consists of weirs, bypass culverts, and a pumping station. It drains water from the W-1 canal into the ship channel either by gravity or by pumping and is operated to prevent backflow from the ship channel during storm events. Stormwater in the Port site flows toward the W-1 canal and then westward toward the ship channel.

1.5.2 Discussion of Impacts

1.5.2.1 No Action

Hydrology in the Port site would not change under the No Action Alternative. The Port site would continue to be part of the W-1 canal drainage basin and continue to be hydrologically altered by water control structures, canals and roadways.

1.5.2.2 Proposed Action

Construction of the Port would convert 106.4 acres of land, including about 3,000 feet of the existing 60-foot-wide W-1 canal in the interior of the Port site, to open water for the proposed 700-foot wide canals. The W-1 canal water control structure would be relocated 3,000 feet upstream to the eastern end of the Port canals and would continue to operate in its current capacity, releasing water from the W-1 canal to the Calcasieu Ship Channel via the Port canals. The remainder of the site would be graded and sloped to drain stormwater runoff into the proposed open water canals, which would provide more efficient site drainage of stormwater into the Calcasieu Ship Channel than that currently provided by the W-1 canal.

As described in Section 1.3, an HMIA was conducted to quantify Port impacts on hydrology. The HMIA estimated runoff volumes associated with precipitation for the 10-year (7.8 inches) and 100-year (12.6 inches) design storms using data from 2006 to 2015. Runoff volumes were estimated for the site under existing conditions and post-construction conditions. The analysis showed that the volume of runoff at the site would decrease with-Project conditions due to the conversion of 106.4 acres of ground surface to open water. Stormwater drainage would become more efficient and flooding would be reduced because runoff would drain to the proposed 700-foot wide canals (rather than to the narrower 60-foot wide W-1 canal where it requires pumping) and then into the expansive Calcasieu Ship Channel, where impacts from the volume of stormwater under Project conditions would be negligible.

Hydraulic conditions upstream of the Port would improve due to the relocation of the

water control structure upstream of the Port site, thereby removing the 505.4-acre Port site from the W-1 canal drainage basin. The area upstream and east of the Port site is expected to benefit from more efficient and effective storm drainage under with-Project conditions. Thus, no significant adverse impacts to hydrology are anticipated.

1.6 WETLANDS AND WATERS OF THE U.S.

1.6.1 Existing Environment

Wetlands are semiaquatic lands, flooded or saturated by water for varying periods of time. For an area to be delineated as a wetland, it must exhibit appropriate hydrology, contain hydric soils, and support hydrophytic vegetation (USACE 1987). Wetlands restore and maintain water quality by removing and retaining nutrients contained in stormwater runoff that would otherwise flow directly into the water column. These ecosystems provide habitat for a diversity of plants and animals, including fish, shellfish, waterfowl, shorebirds, wading birds, songbirds, and mammals. Wetlands provide flood control by retaining water that would otherwise flood nearby residential and agricultural areas. Wetlands also act as storm buffers from highly erosive wave action to surrounding areas in the Louisiana coastal zone. Furthermore, wetlands provide many recreational and economic benefits to Louisiana and the nation.

The Port site is largely comprised of undeveloped wetlands and uplands currently used for cattle pasture and hay production. Its natural hydrology has been significantly altered by the W-1 drainage canal that dissects the interior of the site, a road which bisects the southern half of the site, as well as by exploration and production activities. A wetland and waterbody delineation was performed on January 29, 2015 to identify the extent of existing wetlands and "waters of the U.S" within the Port site and to request a USACE Jurisdictional Determination. As required under Section 404 of the Clean Water Act, wetlands were delineated using the routine method described in the USACE *Wetlands Delineation Manual* (USACE 1987) and the *USACE Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)* (USACE 2010). The Regional Supplement presents wetland indicators, delineation guidance, and other information that is specific to the Atlantic and Gulf Coast Plain Region.

Vegetation identified during the delineation included herbaceous plants, including herbaceous vines, and woody plants, except woody vines, less than 3 feet in height dominated by saltmeadow cord grass (*Spartina patens)*. Other species observed included eastern baccharis (*Baccharis halimifolia*), multiflora roase (*Rosa multiflora*), southern dewberry (*Rubus trivialis*), seashore vervain (*Verbena litoralis*), St. Andrew's-cross (*Hypericum hypericoides*), and McCartney rose (*Rosa bracteate*) (Lichvar *et al.* 2016). Other "waters of the U.S." include the W-1 canal that flows west toward the Calcasieu Ship Channel, an unnamed canal which flows north/south along the eastern boundary of the Port site, and various small open water ponds located throughout the Port site.

The conversion of wetlands to open water due to subsidence, saltwater intrusion, erosion and other factors has been an issue of major concern in coastal Louisiana. The East Cove Unit of the Cameron Prairie NWR is located approximately 0.5 mile northeast of the proposed Port site. The East Cove Unit is part of a 64,000-acre marsh restoration program called the Cameron Creole Watershed Project (CCWP). The CCWP was established by the NRCS in 1989 to reduce saltwater intrusion and stimulate restoration through revegetation efforts. Approximately 14,390 acres (32 percent) of the CCWP marshes were lost to open water from 1932 to 1990 at an average rate of 248 acres per year due to subsidence and saltwater intrusion from the Calcasieu Ship Channel (Louisiana Coastal Wetlands Conservation and Restoration Task Force

[LCWCRTF] 2016). Storm surges during Hurricanes Rita and Ike in 2005 and 2008, respectively, directly destroyed areas of marsh within the NWR and inundated the Cameron area, allowing higher Calcasieu Lake salinities to enter the watershed and causing additional land loss. Restoration projects sponsored by the USFWS and the Louisiana Coastal Protection and Restoration Authority (CPRA) are underway to restore marsh in these areas (LCWCRTF 2016).

1.6.2 Discussion of Impacts

1.6.2.1 No Action Alternative

No changes to wetlands would occur in the Port site under the No Action Alternative. Drainage canals and agricultural activities would continue to alter natural hydrology and compromise wetland habitat at the Port site. Federal and state funded restoration programs in nearby Cameron Prairie NWR would continue to ameliorate wetland loss trends resulting from historic subsidence, erosion and saltwater intrusion in the area; however, the Beneficial Use of dredged material to restore marsh within the NWR associated with Port Cameron would not occur.

1.6.2.2 Proposed Action

Port Cameron proposes to excavate and dredge approximately 9.7 million cubic yards of material in the proposed 505.4-acre site for the creation of 106.4 acres of open-water canals. Approximately 5.7 million cubic yards of the excavated and dredged material would be used to fill and elevate approximately 399 acres in the site, including 322.9 acres of estuarine wetlands and 15.4 acres of "other waters."

To offset these wetland impacts, the remaining 4.0 million cubic yards of material dredged for Port construction would be beneficially used and transported via an aboveground temporary pipeline to the Cameron Prairie NWR East Cove Unit for the restoration of 556 acres of estuarine marsh. In a letter dated December 10, 2013, the USFWS indicated its support for the Project, and that the beneficial use of dredged material is a restoration technique approved by the USFWS Comprehensive Conservation Plan and Compatibility Determinations to create marsh habitat. Port Cameron would coordinate with the USFWS, NMFS, USACE, EPA, and LDNR for the design, implementation, and monitoring of the beneficial use site over a period of time necessary to ensure project performance. Therefore, although wetlands impacted by drainage canals and cattle grazing would be lost in the Port construction site, they would be replaced with estuarine emergent marsh in the adjacent Cameron Prairie NWR, which, as described in further detail in Sections 1.8, 1.9, and 1.10, would offer higher-quality habitat for vegetation communities, wildlife, and aquatic resources within an area federally protected from alteration and development.

The dredge pipeline would be routed from the proposed Port site to the beneficial use site along the W-1 canal, an unnamed canal, and Amoco Road; however, portions of the pipeline would cross 2.3 acres of emergent wetlands and 23.8 acres of open water to the south and within the Cameron Prairie NWR. The temporary pipeline could result in the loss or disturbance of wetland vegetation during placement and use; however, it is expected to cause no long term or significant adverse impacts to wetlands and open water. Once construction is complete, Port

Cameron would coordinate with LDNR-OCM to monitor wetlands impacted by the temporary pipeline after at least one full growing season to ensure vegetation returns to pre-Project conditions. Thus, no significant adverse impacts to wetlands are anticipated.

1.7 COASTAL RESOURCES

1.7.1 Existing Environment

1.7.1.1 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 authorizes the Coastal Zone Management Program (CZMP), a federal-state partnership dedicated to comprehensive management of the nation's coastal resources. By making federal funds available, the law encourages states to preserve, protect and, where possible, restore or enhance valuable natural coastal resources, such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Any federal or state agency whose activities directly affect the coastal zone must, to the maximum extent practicable, be consistent with approved state management programs. Cameron Parish lies entirely within the Louisiana Coastal Zone; the Project would be subject to the rules and regulations promulgated pursuant to the CZMA. The USACE Section 10/404 permit application hasautomatically prompted a review by the LDNR for consistency with the CZMA, and that review is underway.

1.7.1.2 Coastal Barrier Resource Act

The USFWS administers the Coastal Barrier Resource Act of 1982, which designates specific undeveloped coastal barrier lands and islands for inclusion in the Coastal Barrier Resources System (CBRS). Areas so designated are ineligible for direct or indirect federal financial assistance that supports development, including flood insurance, except for emergency life-saving activities. Two CBRS units, LA-09 and LA-10, are located in Cameron Parish approximately 2.1 miles south and 1.1 mile west of the Port site, respectively (USFWS 2016a).

1.7.2 Discussion of Impacts

1.7.2.1 No Action Alternative

No changes to coastal resources would occur in the Port or beneficial use site under the No Action Alternative. Drainage canals and agricultural activities would continue to alter natural hydrology and compromise wetland habitat at the Port site. Federal and state funded restoration programs in nearby Cameron Prairie NWR would continue to ameliorate wetland loss trends resulting from historic subsidence and saltwater intrusion in the area.

1.7.2.2 Proposed Action

In compliance with the CZMA, Port Cameron submitted a Coastal Use Permit application to the LDNR-OCM. The permit is currently under review. The Project is not located in a designated CBRS unit. Therefore, the Coastal Barrier Resource Act would not apply. These CBR units would not be affected by the Project. The creation of wetlands through the beneficial use of dredged material would have a beneficial effect on coastal zone resources. Thus, no significant adverse impacts to coastal resources are anticipated.

1.8 VEGETATION

1.8.1 Existing Environment

The Louisiana Natural Heritage Program of the Louisiana Department of Wildlife and Fisheries (LDWF) recognizes 68 natural vegetation communities in Louisiana; the Project site is found in the Coastal Prairie region which characteristically occurs along islands and ridges surrounded by marsh (LDWF 2009). The Port site is bordered by docks and wharfs utilized by the seafood industry as well as oil and gas ancillary facilities to the north, west, and south; undeveloped property utilized for agriculture and hay production is present to the east. The Port site itself consists primarily of undeveloped marsh, pasture and spoil banks utilized for agriculture and hay production.

Herbaceous species specifically identified during field surveys at the Port site include saltmeadow cordgrass and seashore vervain. The Port site also contains areas of shrub-scrub vegetation, which generally includes woody plants (excluding woody vines) that are less than 3 inches in diameter at breast height and over 1 meter tall. Shrub-scrub vegetation observed at the Port site includes species such as eastern baccharis, St. Andrew's cross, multiflora rose, and McCartney rose. Other vegetation observed in the Port site include vines such as southern dewberry.

Much of the land at the Port site, and in the adjacent Cameron Prairie NWR, includes estuarine wetlands. Wetlands, as further discussed in Section 1.6, support a variety of aquatic and avian species, and provide important ecological functions, such as water purification, shoreline stabilization, and flood protection. General habitat at the NWR is further discussed in Section 1.9.

1.8.1.1 Invasive Plant Species

Invasive species are defined as species that are non-native to an ecosystem or habitat and may cause economic, environmental, or human health harm (Federal Executive Order 13112). Invasive species can be spread by a number of different methods including, but not limited to ballast water and boat hulls, vehicles, and through manmade canals. Invasive plant communities may out-compete and displace native species, thereby adversely altering the appearance, composition, and habitat value of affected areas (National Wildlife Federation 2016).

Invasive species noted within the port site include McCartney rose (*Rosa bracteate)*, multiflora rose (*Rosa multiflora)*, Bermuda grass (*Cynodon dactylon)* and seashore vervain (*Verbena litoralis)*. Noxious and invasive plant species documented in the Cameron Prairie NWR by the USFWS include the Chinese tallow tree (*Triadica sebifera*), water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), Eurasian milfoil (Myriophyllym spicatum), frogbit (*Hydrocharis morsus-ranae*), cattail (*Typha*), maiden cane (*Panicum hemitomon*), cutgrass (*Lersia oryzoides*), California bulrush (*Schoenoplectus californicus*), and common salvinia (*Salvinia minima*). The tallow tree generally grows along elevated, undisturbed ground near fence rows and levees. Water hyacinth and common salvinia are aquatic plants which are known to obstruct canals and other waterways which reduce water flow and sources to areas. Hydrilla and Eurasian milfoil are threats to native species as they

outcompete native species and reduce native populations of vegetation communities (USFWS 2016b).

Given the proximity of the Cameron Prairie NWR, many of the invasive species discussed above would likely also occur in the proposed beneficial use site for the Port Cameron Project.

1.8.2 Discussion of Impacts

1.8.2.1 No Action Alternative

Implementation of the No Action Alternative would result in no alteration of vegetation; therefore, there would be no potential for the introduction or accelerated spread of invasive species. However, the restoration of 556 acres of native coastal marsh within the Cameron Prairie NWR would also not occur.

1.8.2.2 Proposed Action

The proposed port would affect about 505.4 acres of land, 75.0 acres of which are classified as developed lands, and 6.4 acres of which are open water (National Land Cover Database 2011). The remaining 424.1 acres of vegetation, including wetlands, upland grassland, and cropland, would be cleared during construction of the Port. Following construction, all affected vegetation would be permanently converted to open water within the canals or to industrial use associated with operation of the facility.

Dredging and excavation related to Port construction would result in a large quantity of dredged material, a considerable amount of which would be used to convert approximately 556 acres of open water to coastal marsh in the East Cove Unit of the Cameron Prairie NWR, where multiple hurricanes, subsidence, and saltwater intrusion from the Calcasieu Ship Channel have resulted in the natural conversion of wetlands to open water habitat (USFWS 2011, LCWCRTF 2016). The NWR is considered a shoreline protection area and aids in the prevention of erosion of organic soils and breaching of spoil banks in the area. The USFWS is currently attempting to restore and improve areas that contained historic coastal wetlands (CPRA 2013). In cooperation with the NWR, Port Cameron would transport approximately 4.0 million cubic yards of hydraulically dredged spoil to the beneficial use site by way of a temporary, 7.5-mile-long pipeline that would be laid on the ground surface. The dredge pipeline would follow existing disturbance for the majority of the route (a drainage canal and Amoco Road) before crossing marsh habitat and entering the NWR. Placement of the dredge pipeline, most likely between 30 and 36 inches in diameter, would not have a significant impact on vegetation.

Conversion of open water to a coastal marsh would result in the loss of aquatic habitat, which is discussed in Section 1.9.2; however, restoration of the coastal wetlands would result in an increase in vegetation cover. The additional vegetation cover would support a diversity of wildlife species and provide coastal protection from storm events, flooding, and erosion. To ensure the success of the restoration project, Port Cameron would implement temporary and

permanent erosion control measures and other BMPs, and conduct post-construction monitoring of marsh establishment.

The Project would result in both adverse and beneficial impacts on the local vegetation communities. About 424.1 acres of vegetation would be converted to non-vegetated developed land and open water at the site of the proposed port; however, these areas include low-quality wetlands and upland agricultural areas used for cattle grazing and hay production. Although loss of these lands would result in a loss of vegetative community, this loss is considered insignificant when compared to the high quality vegetation provided by the adjacent Cameron Prairie NWR. In addition, Port Cameron would also assist the USFWS in restoring 556 acres of coastal marsh vegetation within the boundaries of the East Cove Unit of the Cameron Prairie NWR, where open water currently exists. Given the quality of habitat at the proposed Port site, and the restoration of historic habitat at the nearby Cameron Prairie NWR, a refuge established as a bird sanctuary and which is managed to protect and perpetuate coastal marshes as high quality habitat for wintering migratory waterfowl and other migratory birds and wildlife, the Project would result in a net beneficial impact on local vegetation communities.

Invasive Plant Species

Existing vegetation at the site of the Port includes highly disturbed wetlands and upland agricultural areas used for cattle grazing and hay production, which may be vulnerable to invasive species success. As vegetation would not be re-established after construction, any invasive species currently present would be eradicated within the construction footprint. Heavy equipment used during construction of the port would be transported by barge or existing roads, which would not result in the transport of non-native seeds. In addition, erosion and sediment controls would be installed per the SWPPP and Port construction plans so that disturbed soils do not leave the construction area (see Section 1.2.2). During operations, all vessels calling at the port would be required to adhere to regulatory standards for ballast water discharge, which would adequately minimize the potential to introduce aquatic invasive species in the general area.

As discussed above, Port Cameron would transport dredged material from the Port site to the Cameron Prairie NWR, East Cove Unit, where it would be used to convert open water areas back to coastal marsh. Grasses and other native vegetation used during restoration of the NWR would be selected in accordance with applicable guidance from the appropriate state and local agencies to minimize risk of spread of invasive species. Port Cameron, in coordination with NWR staff, would monitor revegetation efforts until deemed successful, and would implement necessary corrective actions if populations of noxious or invasive weeds become established during that time.

Thus, no significant adverse impacts to vegetation are anticipated.

1.9 WILDLIFE

1.9.1 Terrestrial

1.9.1.1 Existing Environment

The Project is located within the Coastal Prairie region of Louisiana. The diverse vegetation and landforms in this region provide habitat for surrounding wildlife. Parcels of habitat such as vegetated streams and wetland areas intermingled with patches of forested areas provide vital breeding, dispersal, and travel corridors for wildlife (LDWF 2005). Common mammals which could occur within the vicinity of the project site include the Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus*), swamp rabbit (*Sylivagus aquaticus*), coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), common muskrat (*Ondatra zibethicus*), and common raccoon (*Procycon lotor*). Game species in the Project site may include the white-tailed deer, swamp rabbit, and eastern gray squirrel (*Sciurus carolinensis*) (LDWF 2016d). Trapping for furbearers, although decreasing in demand, is a traditional activity in southern Louisiana. Major furbearing species in the Project site include the Virginia opossum, common raccoon, nutria (*Myocastor coypus)*, and bobcat (*Lynx rufus*) (Louisiana Trappers and Alligator Hunters 2016, LDWF 2016d).

Reptiles are also known to occur within or adjacent to wetland areas, such as those in the Project site. Typical species associated with wetlands include the southern leopard frog (*Rana sphenocephala*), American bullfrog (*Rana catesbeiana*), cottonmouth snake (*Agkistrodon piscivorus*), and Mississippi mud snake (*Farancia abacura*) (LDWF 2016a, 2016e). Species such as the American alligator (*Alligator mississippiensis*) are also known to occur in coastal marsh habitats (LDWF 2016f).

Due to its geographic location, Louisiana serves as an important resource for neotropical migratory birds. Migratory birds are species that nest in the United States and Canada during the summer and then migrate to and from tropical regions of Mexico, Central and South America, and the Caribbean for the non-breeding season. Migratory birds are protected under the Migratory Bird Treaty Act ([MBTA] – 16 U.S Code 703-711). Louisiana is located within the center of the migratory path for over 2 million birds travelling to and from the Yucatan Peninsula each year (USGS 2005). In the spring, when the wind is from the south and the weather is clear, most migratory species fly over the coastal areas and land farther inland; however, during periods of inclement weather with strong winds, birds will land on the first available land along coastal islands and ridges. Generally, when birds arrive along the coast, they have diminished energy and use the available habitat provided by the Louisiana coast for resting, feeding, and protection from predators and weather (Lowery 1946).

At least 230 different bird species have been identified in the Cameron Prairie NWR, which is about 0.5 mile northeast of the proposed port location at the closest point (Audubon 2016). The NWR was created to support, protect, and provide wintering habitat for migratory waterfowl (USFWS 2015b). The NWR provides habitat for approximately 24,000 ducks, 8,000 geese, and 15,000 wading birds annually and accommodates numerous nesting colonies for species of white-faced (*Plegadis chihi*), glossy (*P. falcinellus*), and white (*Eudocimus albus*) ibis; little blue (*Egretta caerulea*), tri-colored (*E. tricolor*), green (*Butorides virescens*), great

blue (*Ardea herodias*), yellow-crowned night (*Nyctanassa violacea*), and black-crowned night (*N. nycticorax*) herons; American (*Butaurus lentiginosus*) and least (*Lxobrychus exilis*) bitterns; cattle egret (*Bubulcus ibis*); and roseate spoonbills (*Platalea ajaja*) (USFWS 2016c). The NWR also maintains a managed moist-soil area which supports shorebirds such as the common snipe (*Gallinago gallinago*), killdeer (*Charadrius vociferous*), and Forster's tern (*Sterna forsteri*) (USFWS 2016d).

The Port site is comprised of approximately 505.4 acres of land located adjacent to the lower Calcasieu River. This area consists primarily of undeveloped coastal prairie landform, and former dredge spoil banks which are utilized for agricultural purposes. Wetlands at the site are primarily estuarine wetlands which consist of herbaceous, hydrophytic vegetation such as grasses and sedges. The Port site is also bisected by a managed drainage canal (the W-1 canal). The area to the east of the Port site is undeveloped; the areas north, west, and south (along the banks of the Calcasieu River) are primarily industrial, consisting of docks and wharfs for the seafood industry and oil and gas ancillary facilities. The proposed beneficial use site is within the NWR, at a location about 5.8 miles east of the Port site. Past hurricanes, subsidence, and saltwater intrusion from the Calcasieu Ship Channel have converted this portion of the NWR from productive marsh habitat to open water habitat (CPRA 2013, LCWCRTF 2016).

1.9.1.2 Discussion of Impacts

No Action Alternative

Implementation of the No Action Alternative would result in no loss or alteration of terrestrial wildlife habitat; therefore, this alternative would have no impact on wildlife. However, as the restoration of 556 acres of marsh within the Cameron Prairie NWR would also not occur, the beneficial impact associated with its restoration would not be realized by the local wildlife.

Proposed Action

The Port would impact approximately 505.4 acres during construction of the Port facilities, 424.1 of which are classified as vegetated habitats that may provide habitat to wildlife. Construction and operation of the Port would result in various short-term and permanent impacts on wildlife. Impacts would vary based on the specific habitat requirements of a species in the area and the habitat type impacted by the Port. The greatest impact on wildlife would be the permanent conversion of vegetated land to open water and industrial developed land, which would generally be unsuitable for terrestrial wildlife. Although agricultural lands likely do not have significant habitat value for wildlife, the majority of vegetated habitat present at the port site is degraded wetland habitat, which supports an impacted ecosystem that provide reduced nutrients, cover, shelter, and water for terrestrial and aquatic species.

Impacts on wildlife resulting from the Port would include displacement of more mobile species, and stress and direct mortality for some less mobile individuals. Clearing and conversion of vegetation would potentially reduce suitable cover, nesting, and foraging habitat for some wildlife species. Mobile wildlife species such as birds and terrestrial mammals could relocate to similar, nearby habitat. However, inadvertent injury to or mortality of smaller, less

mobile species such as reptiles and amphibians could result from construction of the Port. A permanent reduction in available habitat within the Port site could result in displacement of species to adjacent areas, which would result in increases in inter- and intra-specific competition; however, the carrying capacity of the surrounding landscape is likely adequate to support such an influx of individuals. Increases in noise during construction of the port may result in fewer individuals using the habitats immediately adjacent to the port as well. Noise impacts during construction are discussed in Section 1.20.

The vegetation communities associated with the Project provide potential habitat for migratory birds. Impacts on migratory birds and their habitat associated with the Project would be similar to those associated with other terrestrial wildlife. In addition, potential impacts specific to migratory birds could include injury or disorientation due to artificial illumination. Many migratory birds use natural light from the sun, moon, and stars for navigation. Artificial lighting can hide natural light sources, having unknown effects on birds at the population level. Fatalities to avian species due to artificial light have been well documented. Avian fatalities are associated with attraction to light sources, especially in low light, fog, and where there is a low cloud ceiling (Orr *et al.* 2013). The overall increase in nighttime lighting associated with the Port would result in a permanent, but minor impact to migratory birds. To minimize the effects of artificial lighting on migratory birds, outdoor lighting associated with construction and tenant developments would be limited, shielded and downward facing to facilitate safe operations at night, or during inclement weather, to the maximum extent practicable.

Dredging related to port construction would result in a large quantity of dredged material, some of which would be used to convert approximately 556 acres of open water habitat to coastal marsh habitat in the Cameron Prairie NWR, where multiple hurricanes and other changes have resulted in the conversion of wetlands to open water habitat (USFWS 2011). The NWR is considered a shoreline protection area and aids in the prevention of erosion of organic soils and breaching of spoil banks in the area. The USFWS is currently attempting to restore and improve areas that contained historic coastal wetlands (USFWS 2011). In cooperation with the NWR, Port Cameron would transport approximately 4 million cubic yards of hydraulically dredged spoil to the beneficial use site by way of a temporary, 7.5-mile-long pipeline that would be laid on the ground surface. The dredge pipeline would follow existing disturbance for the majority of the route (a drainage canal and Amoco Road) before crossing marsh habitat and entering the NWR. Placement of the dredge pipeline would not have significant impacts on wildlife.

Conversion of the open water habitat to coastal marsh would result in the loss of aquatic habitat which is discussed in Section 1.9.2; however, creation of the coastal wetlands would support numerous avian species that historically utilized a larger area of the NWR for roosting, nesting, and migration (LDWF 2005). The conversion would also provide wetland habitat for marine organisms and provide enhanced storm protection for inland habitats (CPRA 2013).

The Project would result in both adverse and beneficial impacts on the local wildlife. About 424.1 acres of vegetated habitat would be converted to open water and developed land at the site of the proposed port; however, these areas include low-quality wetlands and upland agricultural areas used for cattle grazing and hay production with limited support of wildlife species. Although loss of these lands would result in a loss of potential stopover habitat for migratory birds, this loss is considered insignificant when compared to the quality habitat

provided by the adjacent Cameron Prairie NWR. In addition, Port Cameron would also assist the USFWS in restoring 556 acres of coastal marsh within the boundaries of the Coastal Prairie NWR, where open water currently exists. Given the low quality of habitat at the Port site, and the restoration of historic habitat at the nearby Cameron Prairie NWR, the Project would result in a net beneficial impact on local wildlife. Thus, no significant adverse impacts to terrestrial wildlife are anticipated.

1.9.2 Aquatic

Aquatic organisms in the Port site, such as fish and invertebrates, generally include marine species that occur in and around the Calcasieu Ship Channel as they travel between the Gulf of Mexico and Calcasieu Lake. Marine and estuarine species may also occur in and around the East Cove Unit of the Cameron Prairie NWR, an area of estuarine marsh. The nearshore coastal environment, Calcasieu Lake, and the East Cove Unit provide diverse habitat for aquatic resources, such as seagrass, marsh, and oyster beds. The East Cove Unit provides habitat for multiple fish species, including gar, catfish, bowfin, bluegill, bass, crappie, flounder, and redfish; it also provides nursery habitat for brown shrimp, white shrimp, and blue crab (USFWS 2007a). The Calcasieu Ship Channel, however, is regularly dredged, limiting potential habitat to open water and soft bottom habitats.

1.9.2.1 Discussion of Impacts

No Action Alternative

If the No Action Alternative were adopted, the temporary impacts associated directly with construction of the port (i.e., increased turbidity and sedimentation) would not occur. No modification of habitat at the dredge placement beneficial use site in the East Cove Unit would occur; however, the Project's planned restoration activities at that location, which are consistent with the USFWS and CPRA's goals for the East Cove Unit and the Cameron Creole Watershed, respectively, would not be realized.

Proposed Alternative

Construction of Port Cameron would be conducted mainly on land, in wetland and upland habitats. In-water activities would include dredging at the proposed entrance to the port, which would result in a localized increase in sedimentation and turbidity within the Calcasieu Ship Channel during construction. Dredging and excavation would also occur within the port boundaries to create the proposed canals. Dredging activities would affect the open water habitat of the Calcasieu Ship Channel through an increase in localized turbidity. Soft bottom habitat, which is used by benthic (bottom-dwelling) organisms, would also be affected by removal of sediments and settling of suspended sediments. Benthic organisms may experience direct mortality during these activities, while other more mobile species, such as blue crab and demersal finfish, may experience temporary displacement. Similarly, fish species using the water column (pelagic species) would be temporarily displaced by the increase in turbidity and construction noise. Maintenance dredging would continue periodically during the life of the Port; however, these activities would result in fewer impacts than initial dredging, due to the smaller amount of sediment that would be removed. The construction-related impacts would be

greatest on the benthic community within the dredging area; however, as dredging within the Calcasieu Ship Channel would be restricted to a small area at the entrance to the proposed port, impacts on both benthic and pelagic species are anticipated to be short-term and minor.

Dredging related to port construction would result in a large quantity of dredged material, some of which would be used to restore approximately 556 acres of open water habitat to coastal marsh habitat in the East Cove Unit of the Cameron Prairie NWR, where multiple hurricanes and other changes have resulted in the conversion of wetlands to open water habitat (USFWS 2011). The East Cove Unit is being managed to preserve the balance between salt and freshwater marshes and to restore historic marshes destroyed by saltwater intrusion (USFWS 2007a). In 2014, the salinity of the dredge placement/marsh restoration site was about 17 parts per thousand (ppt); restoration goals for the area would result in a final salinity closer to 12 ppt (CPRA 2014).

The USFWS, in cooperation with other agencies, is working to restore thousands of acres of freshwater marsh habitat within the Cameron Creole Watershed (which includes the East Cove Unit) as the historic freshwater and intermediate marshes were more diverse habitats than the current brackish/saltwater marshes that consist of monotypic stands of marshhay cordgrass (USFWS 2007a). In addition, NOAA Fisheries, in its 2016-2020 Habitat Enterprise Strategic Plan (NOAA Fisheries 2016a) has acknowledged that coastal wetlands are prime nurseries for many species and plan to reduce the rate of wetland loss by restoring tidal wetlands and strengthening wetland protection measures. Placement of dredged material within the East Cove Unit would change the current character of the area from a brackish, open water area supporting both pelagic and benthic species, to a coastal marsh area that would support a modified species assemblage, but would be more beneficial as a nursery habitat. Therefore, although benthic organisms within the footprint of the fill area would be lost and more mobile species would be displaced, the restored marsh would eventually support a more diverse assemblage of species, resulting in a moderate, long-term beneficial impact. Thus, no significant adverse impacts to aquatic species are anticipated.

1.10 ESSENTIAL FISH HABITAT

1.10.1 Existing Environment

The Magnuson-Stevens Fishery Conservation and Management Act, as amended, PL 104-208, addresses the authorized responsibilities for the protection of Essential Fish Habitat (EFH) by NMFS in association with regional fishery management councils. The act establishes eight regional fishery management councils responsible for the protection of marine fisheries within their respective jurisdictions. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This definition extends to habitat specific to an individual species or group of species; whichever is appropriate within each Fishery Management Plan.

The act also authorizes the designation of Habitat Areas of Particular Concern for marine fisheries. These areas are subsets of EFH that are rare, susceptible to human degradation, ecologically important or located in an ecologically stressed area. Any federal agency that proposes any action that potentially affects or disturbs any EFH must consult with the Secretary of Commerce and Fishery Management Council authority per the Magnuson-Stevens Act, as amended. Interim final rules were published on December 19, 1997, in the Federal Register (Volume 62. No. 244) to establish guidelines for the identification and description of EFH in fishery management plans. These guidelines include impacts from fishing and non-fishing activities as well as the identification of actions needed to conserve and enhance EFH. The rule was established to provide protection, conservation, and enhancement of EFH.

The estuarine and marine waters of Cameron Parish are included in the EFH managed area. EFH located at the Port site and dredge placement area are:

- estuarine emergent wetlands;
- mud/sand/shell/rock substrates; and
- estuarine water column.

Various federally managed species or species groups are potentially found within Calcasieu Lake, the ship channel, and immediately surrounding areas (Gulf of Mexico Fishery Management Council [GMFMC] 2005). EFH for each of the species and species groups listed below has been designated in the Calcasieu Ship Channel and Calcasieu Lake. No designated Habitat Areas of Particular Concern are present within the port site (GMFMC 2005).

- Shrimp Species. Shrimp species include the brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), and pink shrimp (*Farfantepenaeus duorarum*). Adult penaeids generally occupy offshore areas of higher salinity, where spawning occurs. After hatching, larvae enter estuaries and remain there throughout the juvenile stage. Estuarine habitat serves as a nursery area offering a suitable substrate, an abundant food supply, and protection from predators. Subadult shrimp consume organic matter, including marsh grasses and microorganisms found in estuarine sediments. EFH includes shallow inshore waters, marsh edge, submerged aquatic

vegetation (SAV), tidal creeks, inner marsh, mud bottoms, and sand/shell substrate (GMFMC 1998).

- Gulf Stone Crab. Gulf stone crabs (*Menippe adina*) occur throughout the Gulf of Mexico, although the majority of fishing occurs along the Gulf Coast of Florida. Stone crabs are benthic and can be found from the shoreline out to depths of 200 feet. Juveniles can be found on shell bottom, sponges, and *Sargassum* mats, as well as in channels and deep grass flats. Stone crab larvae are planktonic and require warm water and high salinity (30-35 ppt) for most rapid growth. The stone crab is a high trophic predator and is primarily carnivorous at all life stages. Juveniles feed on small molluscs, polychaetes, and crustaceans. EFH for the Gulf stone crab includes inshore waters of less than 59 feet, estuarine hard bottoms, estuarine sand/shell, estuarine SAV, nearshore hard bottoms, and nearshore sand/shell.

- Red Drum. Red drum (*Scianeops ocellatus*) is an important recreational gamefish found in coastal waters throughout the Gulf of Mexico. Adults inhabit nearshore waters, particularly areas within the surf zone or in the vicinity of inlets. Spawning occurs in nearshore areas, and eggs and larvae are transported by tides and wind currents into estuaries. Larvae and juveniles occupy estuarine environments until maturation. Red drum are predatory in all stages of life; however, the type of prey consumed varies with life stage. Subadult red drum primarily consume small marine invertebrates including mysids and copepods, while adult specimens feed on large marine invertebrates, including shrimp and crabs, and small fishes. EFH for red drum includes mud bottoms, SAV, the marsh-water interface, mangrove communities, oyster reefs, and nearshore waters with depths of less than 131 feet (GMFMC 1998).

- Reef Fish. There are 15 species of reef fish likely to be found within the study area, including species such as lane snapper (*Lutjanus synagris*) and dog snapper (*Lutjanus jocu*). Although species within this complex generally occupy similar ecological niches and exhibit similarities in behavior and life stages, a considerable variation in diet and habitat use exists among individual species. Member species of the complex are generally predatory, but the type of prey varies widely among species and ranges from small invertebrates to fishes, including other species within this complex. Larvae and juvenile specimens may be pelagic or estuarine, and adults may occupy estuarine, nearshore, or pelagic environments. EFH for the reef fish includes SAV, mangrove communities, lagoons, hard bottoms, nearshore habitat, and estuarine sands and muds. These species occupy inshore areas during their juvenile stages where they feed on estuarine dependent prey (GMFMC 1998).

- Coastal Migratory Pelagic Species. Coastal Migratory Pelagic Species are marine fishes that inhabit coastal waters of the Gulf of Mexico from the shoreline to the continental shelf edge, including such species as king mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), and bonnethead shark (*Sphyrna tiburo*). Coastal migratory pelagics are predatory and generally occupy open marine waters, but subadults may occupy tidal inlets and estuarine environments. EFH for Coastal Migratory Pelagic Species includes the estuarine water column (GMFMC 2008).

1.10.2 Discussion of Impacts

1.10.2.1 No-Action Alternative

If the No Action Alternative were adopted, there would be no impact on EFH in the vicinity of the Project. However, the net benefit on local EFH resulting from the establishment of high quality estuarine emergent marsh in an area currently consisting of open water would also not occur.

1.10.2.2 Proposed Action

EFH affected by dredging operations at the entrance to the Port site, and by dredge placement within the East Cove Unit, would include estuarine emergent wetlands, mud/sand/shell substrates, and the estuarine water column.

As discussed above, dredging at the Port site would occur within a small area adjacent to the Calcasieu Ship Channel. Although dredging would impact the water column and soft bottom sediments, those impacts (turbidity and sedimentation) are in line with impacts normally experienced along the ship channel due to regular maintenance dredging. In addition, these habitats would recover within a short period after construction has ended; therefore, the impact on EFH from dredging within the ship channel would be negligible. Although estuarine wetlands at the Port site would be converted to developed lands, the current usage of these lands (cattle grazing with altered hydrology) suggests no value as EFH.

The GMFMC has indicated that marsh loss in Louisiana is of particular concern as the marshes are largely responsible for the production of estuarine-dependent species in the north-central Gulf of Mexico (GMFMC 1998). Beneficial use of dredged material would restore about 556 acres of subsided and eroded coastal marsh (open water) to its historic state. The dredge placement area within the East Cove Unit, which includes areas of degraded marsh (presently mud/shell/sand and estuarine water column habitats), would receive dredged material to create estuarine emergent wetland habitat. Therefore, although some EFH would be lost within the East Cove Unit (soft bottom sediments and open water), it would be replaced with a more productive, high quality EFH (estuarine emergent marsh), resulting in a net beneficial effect on local EFH. Thus, no significant adverse impacts to EFH are anticipated.

1.11 THREATENED AND ENDANGERED SPECIES

Special status species are those for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Special status species include federally listed species protected under the Endangered Species Act (ESA), as amended, species proposed or candidates for listing by the USFWS, and those species that are state listed as threatened, endangered, or other special status. Section 7(a)(2) of the ESA requires appropriate regulatory officials to ensure that any actions authorized, funded, or carried out, would not jeopardize the continued existence of federally listed or proposed species, or result in the adverse modification or destruction of critical habitat for federally listed and proposed species. Species classified as candidates for listing under the ESA do not currently carry regulatory protection under the ESA but impacts are reviewed if the applicable agency indicates its potential presence in the Project sites during consultation.

An Information for Planning and Conservation assessment for the Project was conducted to determine the presence of federally listed threatened, endangered, or special status species within the Project sites (USFWS 2016e). Additionally, LDWF records identified four state-listed species that have the potential to occur in Cameron Parish (LDWF 2016a). Table 1 describes the federally and state listed species that may occur in the Project sites and our determination of effect. No designated critical habitat occurs within the Project sites (USFWS 2016e).

Table 1
Federally and State Listed Threatened and Endangered Species that May Occur in Project Sites

Common Name	Scientific Name	Federal Status	State Status	Determination of Effect and Habitat Assessment
Mammals				
West Indian manatee	*Trichechus manatus*	Endangered	Endangered	Not likely to adversely affect
Reptiles				
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	--	Not likely to adversely affect
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Endangered	--	Not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	--	Not likely to adversely affect
Loggerhead sea turtle	*Caretta caretta*	Threatened	--	Not likely to adversely affect
Birds				
Piping plover	*Charadrius melodus*	Threatened	Threatened/ endangered	No effect
Red Knot	*Calidris canutus rufa*	Threatened	--	No effect
Brown pelican	*Pelecanus occidentalis*	Delisted	Endangered	Not likely to adversely affect

Interior least tern	*Sternula antillarum athalassos*	--	Endangered	No effect
Fishes				
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	--	Not likely to adversely affect
Source: USFWS 2016e; LDWF 2016a.				

1.11.1 Federally and State Listed Species

1.11.1.1 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is federally listed as endangered and is also protected under the Marine Mammal Protection Act. This species is an herbivorous marine mammal most commonly found in coastal estuaries and rivers in Florida and Georgia, but it has been documented from Texas to Massachusetts. Manatees are sub-tropical species that are not cold-tolerant and reside in the warm waters of peninsular Florida during the winter; however, they may disperse great distances during warmer months (USFWS 2007b). Individuals feed on aquatic plants such as seagrass, water hyacinths, hydrilla, and eelgrass. Mating can occur at any time of year with adults usually giving birth to a calf every two to five years. Calves may be present throughout the year and usually remain with their mother for up to two years. The greatest threats to the manatee are collisions with boats and loss of warm water habitat. They often rest suspended just below the water's surface, making them vulnerable to being hit by vessels (USFWS 2014). Critical habitat has been designated off the coast of Florida; no critical habitat has been designated in Louisiana

1.11.1.2 Sea Turtles

Sea turtles are found throughout the tropical and subtropical seas of the world where they occur at or near the surface of the water. All species are listed as threatened or endangered under the ESA and are under the shared jurisdiction of the USFWS and NOAA Fisheries. Trade of sea turtles is restricted by the Convention on International Trade in Endangered Species; however, not all countries have ceased to harvest these species. The major threats to sea turtle populations are fisheries by-catch mortality, pollution, and coastal development of nesting beaches (NOAA Fisheries 2016b, 2016c). Four species of federally listed sea turtles could occur in the vicinity of the project, particularly within the Calcasieu Ship Channel, as described below (USFWS 2016e).

Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretomochelys imbricata*) is federally listed as endangered. This species is widely distributed throughout the Caribbean Sea and western Atlantic Ocean. They occur in shallow coastal areas, oceanic islands, rocky areas, and coral reefs (USFWS 2012a). Hawksbill sea turtles feed on sponges, other invertebrates, and algae (NOAA Fisheries 2016d). Young hawksbills are found foraging in association with *Sargassum* mats in the open ocean; as they mature, hawksbill sea turtles commonly forage over coral reefs and hard bottom substrates. They nest in low densities on scattered undisturbed deep-sand beaches in the tropics (USFWS 2012a). Critical habitat for the hawksbill sea turtle has been designated near the coast of Puerto Rico (NOAA Fisheries 1998a, 1998b). Sightings of this species have been

documented off the coast of Louisiana; however, due to the lack of nesting beaches and suitable foraging habitat, there is a low probability of this species occurring within the port or beneficial use site; any occurrences within the Calcasieu Ship Channel would likely be transient adults.

Kemp's Ridley Sea Turtle

The federally endangered Kemp's Ridley sea turtle (*Lepidochelys kempii*) inhabits primarily coastal waters in the northwestern Atlantic and the Gulf of Mexico. Adult Kemp's Ridley's inhabit shallow coastal and estuarine waters over sand or mud bottoms where they feed on crab, fish, jellyfish, and mollusks. Hatchlings and juveniles are found in ocean open habitats or in association with *Sargassum* mats, generally migrating to adult habitat at approximately two years old. Collection of eggs, capture for meat and other products, direct take for indigenous use, ingestion of man-made materials, collision with boats, and disturbance or destruction of nesting areas are all factors that have contributed to the decline of this species. Despite these factors, the population appeared to be in the early stages of recovery until 2010, when the number of nests began decreasing (NOAA Fisheries 2016e). This species is usually found in inshore and nearshore waters of Louisiana. More specifically, they prefer areas of beach which are surrounded by coastal wetlands and large open waters connected to seasonally narrow ocean nexus. Sightings of this species have been documented off the coast of Louisiana; however, due to a lack of beaches and foraging habitat, there is a low probability of this species occurring within the port or beneficial use site; any occurrences within the Calcasieu Ship Channel would likely be transient adults.

Leatherback Sea Turtle

The federally endangered leatherback (*Dermochelys coriacea*) is the largest of the sea turtles and spends more of its life in the open ocean environment than other sea turtles. Leatherback sea turtles occur globally and range farther north and south than other sea turtles, likely due to their ability to maintain warmer body temperatures. Leatherback sea turtles feed primarily on soft-bodied animals such as jellyfish and sea squirts; however, they are also known to consume sea urchins, crustaceans, fish, and floating seaweed. Females require sandy beaches with deepwater approach for nesting habitat. (USFWS 2012b; NOAA Fisheries 2016f). The largest nesting assemblages are found in northern South America and West Africa; however, within the United States, southeast Florida, the U.S. Virgin Islands, and Puerto Rico are their primary nesting locations (NOAA Fisheries 2016f). Designated critical habitat for the leatherback sea turtle in the United States is located along the coast of California and along the Virgin Islands (NOAA Fisheries 2016f). Due to the lack of suitable nesting and foraging habitat, there is a low probability of this species occurring in the port or beneficial use site.

Loggerhead Sea Turtle

The Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead sea turtle (*Caretta caretta*) is federally listed as threatened. This species occurs throughout the world in temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The loggerhead sea turtle can migrate significant distances between foraging areas, breeding areas, and nesting locations. They can be found in inshore areas such as bays, ship channels, large river mouths, and salt marshes as well as hundreds of miles offshore. Loggerhead sea turtles feed on mollusks,

crustaceans, fish, conch, and other marine animals (USFWS 2012c, NOAA Fisheries 2016g). Young loggerheads occur in the open ocean and are often found in association with *Sargassum* mats, while juveniles and adults reside in coastal areas in between reproductive migrations where females return to their natal beach to nest. In the United States, loggerheads can generally be found nesting from Texas to Virginia, though the major nesting concentrations occur in Florida, Georgia, South Carolina, and North Carolina (USFWS 2012c).

Critical habitat for the Northwest Atlantic Ocean DPS was designated in 2014 to protect both marine and terrestrial habitats. While the terrestrial critical habitat is restricted to the Florida coast, critical habitat in the marine environment includes *Sargassum* habitats for the protection of post-hatchlings and juveniles. Due to a lack of critical habitat within the port and beneficial use site, the unlikely occurrence of *Sargassum* in the port and beneficial use site and a lack of suitable nesting and foraging habitat, there is a low probability of this species occurring in the port and beneficial use site.

1.11.1.3 Red Knot

The red knot (*Calidrus canutus rufa*), a shorebird, was federally listed as threatened in 2015. It breeds and nests in arctic tundra habitats located as far north as the Canadian Artic; however, it utilizes sandy coast habitats, from the United States Gulf Coast and into South America for migration and wintering (Cornell Lab of Ornithology 2013, USFWS 2013). The red knot generally migrates into the south between July and October and returns to the northern breeding grounds between April and June (USFWS 2013). It feeds on clams, mussels, and other invertebrates. In addition, the red knot generally roosts along sandy beaches and feed along intertidal sandy mud areas. Primary threats to this species include coastal development, shoreline stabilization, dredging, and anthropogenic disturbances which may impact availability of food sources (USFWS 2016c). No critical habitat for this species has been designated. It has been known to winter along the Louisiana coast; however, suitable beach habitat is not present within or adjacent to the port and beneficial use site.

1.11.1.4 Piping Plover

The piping plover (*Charadrius melodus*) is a small shorebird that migrates from northern breeding grounds to southern and eastern wintering grounds. The piping plover is listed as endangered in its breeding grounds, which are located on the northern Great Plains, in the Great Lakes, and along the Atlantic coast of the United States and Canada. Wintering habitat for each of the breeding populations is shared and stretches from the coast of North Carolina to Texas, and into Mexico; the Bahamas, and the West Indies; the piping plover is listed as threatened in all non-breeding habitat, including in the Project sites. During the winter, individuals use a mosaic of habitat patches, including sand spits, small islands, tidal flats, ephemeral pools, and seasonally emergent seagrass beds. Critical habitat has been designated for two of the three breeding grounds (excluding the Atlantic Coast population) and for 141 units of wintering habitat from North Carolina to Texas. Critical wintering habitat supports roosting, foraging, and sheltering activities (USFWS 2015a). In Louisiana, this species is generally found along beaches, mudflats, and barrier islands (LDWF 2016b); designated critical habitat and suitable wintering habitat are not present at or adjacent to the port and beneficial use site.

1.11.1.5 Brown Pelican

The brown pelican is state listed as endangered and may occur within Cameron Parish. The brown pelican was federally delisted in 2009, but is still federally protected by the Migratory Bird Treaty Act, which prohibits the "taking" of brown pelicans, including their parts, nests, or eggs. In Louisiana, the brown pelican occurs along the coasts in bays and tidal estuaries; nesting occurs primarily in southeastern coastal areas on barrier islands within dune shrub thickets. Brown pelicans primarily forage on fish and some marine invertebrates. Current threats to this species include loss of nesting habitat due to barrier island erosion, loss of coastal land, and the illegal take of eggs (LDWF 2016c).

1.11.1.6 Interior Least Tern

The interior least tern *(Sternula antillarum athalassos)* is a federally and state listed endangered migratory shorebird that breeds, nests, and rears its young on sparsely or non-vegetated portions of sand or gravel bars located mid-stream or along the shoreline in the Mississippi, Missouri, Arkansas, Ohio, Red and Rio Grande river systems and the rivers of central Texas. In Louisiana, the interior least tern historically occurred along the Mississippi River north of Baton Rouge, but few birds have been observed in recent surveys (USFWS 2016e). Interior least tern nesting colonies are known to occur along the Red River in northwestern and Central Louisiana. Major threats to this species include habitat loss, human disturbance at nesting colonies, and altered water flow patterns. Due to the lack of suitable habitat, there is a low probability of this species occurring in the port or beneficial use site.

1.11.1.7 Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is federally listed as threatened. This species is an anadromous fish observed in coastal rivers, estuaries, bays, and the Gulf of Mexico from Louisiana to Florida (USFWS 2003). In general, Gulf sturgeon are benthic feeders and feed on aquatic invertebrates such as crustaceans, worms, and mollusks. Adults spawn in freshwater sources in the warmer months of spring and early summer after which they migrate into estuarine waters where they spend the majority of their lives. The greatest threats to this species include habitat impediments such as dams, dredging, groundwater extraction, irrigation, flow alterations, poor water quality and contamination (NOAA Fisheries 2016h). Critical habitat for the species has been designated within waterways along the gulf coast, but within Louisiana, critical habitat is limited to southeast Louisiana (NOAA Fisheries 2016i). There is a low probability of this species occurring within the port or beneficial use site as hydrologic connectivity in these areas is limited; any occurrences would be within the Calcasieu Ship Channel.

1.11.2 Discussion of Impacts

1.11.2.1 No-Action Alternative

Implementation of the No Action Alternative would result in no effect on threatened, endangered, or special status species as no construction activities would occur.

1.11.2.2 Proposed Action

Federally threatened or endangered marine species could be affected by increased vessel traffic, increases in anthropogenic noise, material spills, and dredging if the species were present in the port or beneficial use site during active construction; however, these species would only be expected in the Calcasieu Ship Channel, within which limited dredging along the bank would occur. Manatees and sea turtles are often found near the surface of the water, where they may be vulnerable to vessel strikes, especially if the turtles are cold-stunned from cold weather events. To help reduce the risk of strikes or other potential disturbances associated with marine traffic, Port Cameron tenants would be required to include NOAA Fisheries' Vessel Strike Avoidance Measures and Reporting for Mariners in its training materials, which includes measures for vessel operators to watch for marine mammals and sea turtles and implement avoidance techniques if sighted (NOAA Fisheries 2008). Increases in underwater noise from construction activities could result in avoidance of the area; however, as in-water pile-driving is not proposed and the Port site is adjacent to an active shipping channel and wharfs, underwater noise impacts from the port are not anticipated to be significant. If a hazardous material spill were to occur in water, marine species could be affected directly (fouling) or indirectly (decreased water quality). To address the potential impacts associated with marine spills of fuel, lubricants, or other hazardous materials, Port Cameron tenants would implement their SPCC Plan and their SWPPP. There are also plans to have an emergency response unit based within the port site to respond to spills within the Gulf of Mexico which would also be equipped to quickly respond to any occurrences within the port facility.

Dredging activities during construction would be temporary and local in nature because dredging and excavation would be confined to the proposed port area, predominantly in areas that are currently terrestrial or wetland habitats which are currently hydrologically disconnected from the Calcasieu Ship Channel. Activities at the dredge spoil placement area would not likely affect marine species since the habitat is brackish to intermediate marsh (USFWS 2007). As the majority of the Project would affect terrestrial or wetland habitats that are unsuitable for marine species, and because of the avoidance and mitigation measures that would be implemented by Port Cameron, construction of the Project is not likely to adversely affect marine species.

The federally listed red knot and piping plover are unlikely to occur in Port or beneficial use sites given the lack of suitable beach habitat; therefore, construction and operation of the port would have no effect on the species. Nesting of the state and federally listed interior least tern in Louisiana have been restricted to the Red and Mississippi Rivers; this species has not been observed near the Port or beneficial use site. Therefore, construction and operation of the Project would have no effect on this species.

While no suitable nesting habitat is present in the proposed port area, the Calcasieu Ship

Channel and the Cameron Prairie NWR may provide suitable foraging and loafing habitat for the state listed brown pelican. While elevated noise during construction could result in individual brown pelicans avoiding areas of active construction, individuals are mobile and would likely move to nearby suitable habitat. Vessel traffic associated with the Port would be consistent with the current use of the Calcasieu Ship Channel and Port vicinity; and therefore brown pelicans would not be further impacted by vessels calling on the proposed port during operation of the Port. The placement of material for beneficial use in the NWR would reduce open water habitat by converting it to marsh, thereby reducing available foraging habitat. However, the reduction in the amount of open water is negligible compared to the amount of available habitat. Brown pelicans are mobile and operations involving the placement of dredged material are unlikely to harm or interfere with their activities. It is concluded that the Proposed Alternative may affect but is not likely to adversely affect the brown pelican.

Thus, no significant adverse impacts to threatened or endangered species are anticipated.

1.12 LAND USE

1.12.1 Existing Environment

Port Cameron would be located on 505.4 acres of uplands and hydrologically managed wetlands currently used primarily for cattle grazing and hay production. According to the National Land Cover Database (2011), approximately 79 percent of the site is wetlands, 15 percent is developed land, 4 percent is grassland, and the remaining 2 percent of the site is open water and cultivated crops. Land use at the site is not zoned, as Cameron Parish does not have zoning ordinances. The area immediately west and south of the site along the eastern shore of the Calcasieu Ship Channel and the northern shore of the Cameron Loop is comprised of docks and wharves that primarily support the seafood industry, as well as ancillary oil and gas facilities to the north. The town of Cameron is located approximately 0.4 mile southeast of the proposed site on the Cameron Loop. The property to the east is primarily undeveloped, hydrologically managed coastal prairie landform impacted by cattle grazing and hay production, oil and gas exploration and other uses. Approximately 0.5 mile to the northeast of the Port site is the southwestern boundary of the Cameron Prairie NWR, which consists predominantly of marsh and open water habitat.

The Parish sustained significant damage during Hurricanes Katrina and Ike in 2005 and 2008, respectively, resulting in the loss of a substantial number of residents and businesses (SWLA Economic Alliance 2015). In 2009, Cameron Parish established a Planning and Development Department with the goal of revitalizing the parish to attract new residents and businesses. According to the department's program design document (Cameron Parish and West Cameron Port Authority 2011), the parish's two main strategies for achieving this goal are:

- nurturing the historical industries of the community, commercial fisheries, and oil and gas exploration; and

- capitalizing on maritime services, particularly with regard to deep and ultra-deep water exploration on both the offshore and onshore sides of the oil and gas exploration industry.

In addition to parish strategies, Louisiana's CPRA 2012 Coastal Master Plan included criterion for assessing benefits of activities proposed for coastal Louisiana in the master plan (CPRA 2012). Two criterion included in the plan are: (1) flood protection of strategic assets, including ports, refineries, and airports, and (2) the support of navigation, including maintaining the international competitiveness of the port and navigation industry.

In response to Hurricane Rita, Cameron Parish implemented federally mandated resiliency principles for construction. Properties at risk of tidal storm surge and high winds are now subject to building codes and federal permits (SWLA Economic Alliance 2015). The Coastal Use Permit process is part of the Louisiana Coastal Resources Program, which is an effort among state, federal, and local advisory and regulatory agencies to preserve, restore, and enhance Louisiana's valuable coastal resources. The purpose of the Coastal Use Permit process is to ensure that any activity affecting the Coastal Zone, such as a project that involves either dredging or filling, is performed in accordance with guidelines established in the Louisiana

Coastal Resources Program. As addressed in Section 1.7, Cameron Parish is entirely within the Coastal Zone (LDNR 2016c).

1.12.2 Discussion of Impacts

1.12.2.1 No Action Alternative

The No Action Alternative would have no effect on land use in the Port or beneficial use site. The port site could continue to be largely undeveloped, hydrologically managed wetlands used primarily for cattle grazing and hay production, or it could be developed in the future for another industry or purpose. The Cameron Prairie NWR would be expected continue to operate in its current capacity. This alternative would not contribute to the parish's economic development goals.

1.12.2.2 Proposed Action

Construction of the port facilities would affect a total of 505.4 acres of land comprised predominantly of hydrologically managed wetlands, as well as limited acres of developed land, and 6.4 acres of open water (National Land Cover Database 2011). Of this, 106.4 acres would be converted to open water canals. The remaining land would be graded to drain stormwater to the open water canals and then vegetated to control erosion. As lots are leased, vegetated lands may be paved or graveled as necessary for use by tenants. Each tenant would be required to follow individual stormwater management plans as a condition of occupancy, including obtaining applicable regulatory permits and preparing and implementing SWPPPs and SPCC Plans. Any tenant-developed facilities, such as warehouses and office structures, would be required to comply with resiliency building codes, including requirements for elevating structures.

Construction and operation of the Port would fulfill the parish's goal of expanding maritime services for the offshore oil and gas industry as an economic development strategy. The Port would also be consistent with Louisiana's 2012 Coastal Master Plan by supporting Louisiana's port and navigation industries. The Project is being designed and developed in consultation with LDNR and in compliance with Louisiana Coastal Zone consistency guidelines. A Coastal Use Permit application is currently under review by the LDNR-OCM. Section 1.7 provides for more details regarding the Coastal Use Permit process. The creation of wetlands in the Cameron Prairie NWR through the beneficial use of dredged material would have a beneficial effect on coastal zone resources including wetlands, wildlife habitat, and EFH (see Sections 1.6, 1.7, and 1.10). Thus, no significant adverse impacts to land use are anticipated.

1.13 SOCIOECONOMICS

The socioeconomic analysis for the proposed Port Cameron examines data from Calcasieu and Cameron Parishes. Of these, the greatest socioeconomic impacts would occur in Cameron Parish, where the port would be located. None of the port facilities would be located in Calcasieu Parish, but it is included in the socioeconomic analysis because Calcasieu Parish would likely experience similar employment and economic impacts as Cameron Parish due to its proximity to the Project. For the purposes of our socioeconomic analysis, these two parishes are defined as the "Study Area."

Construction and operation of the port would have short-term, long-term, and permanent impacts. As discussed throughout this section, short-term impacts are defined as lasting a few years, long-term impacts would eventually recover, but would require several years, and permanent impacts would persist throughout the life of the Project.

1.13.1 Existing Environment

1.13.1.1 Population

Table 2 provides a summary of selected population and demographic information for the Study Area.

Table 2
Existing Socioeconomic Conditions in the Study Area

State/Parish	2010 Population[a]	2015 Population (est.)[a]	2010 Population Density (per square mile)[a]	Per Capita Income (2014 Dollars)[a]	Civilian Labor Force (percent)[a]	2016 Unemployment Rate (percent)	Top Industries[c]
Louisiana	4,533,372	4,670,724	104.9	24,775	60.7	5.9	R, P, H
Calcasieu	192,768	198,788	181.2	24,521	61.4	4.7	R, H, P
Cameron	6,839	6,817	5.3	29,450	63.3	4.4	T, R, W

H = Health care and social assistance; P + Professional, scientific, and technical services; R = Retail trade; T = Transportation and warehousing; W = Wholesale trade

[a] U.S. Census Bureau 2016a.

[b] Louisiana Workforce Commission 2016.

[c] U.S. Census Bureau 2016b.

According to the U.S. Census Bureau (2016a), Cameron Parish had a population of 6,839 with a population density of 5.3 persons per square mile in 2010. Calcasieu Parish, anchored by the cities of Lake Charles and Sulphur, had a population of 192,768 and a population density of 181.2 persons per square mile. The U.S. Census Bureau's estimated 2015 population statistics show similar populations as the 2010 census, with Cameron Parish typifying a rural community (6,817) and Calcasieu Parish an urban area (198,788). In comparison, the estimated 2015 population of the State of Louisiana was approximately 4,670,724 residents.

Historically, Cameron Parish has been one of the least populated parishes in the state, but since 2000, it has experienced a decrease in population due to the effects of Hurricanes Rita and

Ike (SWLA Economic Alliance 2015). According to the SWLA Housing Study, Strategic Plan, and Implementation Strategy (SWLA Housing Study), the lack of basic services and utilities were the initial impediments, but over time other factors have kept residents from returning to the area such as building restrictions and employment. Conversely, Calcasieu Parish has seen continued population growth, and the SWLA Housing Study projects that by 2024 the parish will gain over 10,000 residents.

1.13.1.2 Economy and Employment

Table 3 provides selected employment and income statistics for the Study Area. The top industries in the two parishes include:

- health care and social assistance;
- professional, scientific, and technical services;
- retail trade;
- transportation and warehousing; and
- wholesale trade (U.S. Census Bureau, 2016c).

The civilian labor force is defined as the population, ages 16 and older, who are employed persons and those actively searching and available for work (U.S. Census Bureau, 2016a). Over a four-year period (2010-2014), 61.5 and 63.3 percent of the population in Calcasieu and Cameron Parishes, respectively, were employed or actively searching for work. These percentages are slightly higher than the state (60.7 percent). The average per capita income in Calcasieu Parish ($24,521) was below the State of Louisiana's average per capita income of $24,775, while Cameron Parish had a per capita income that was higher than the state ($29,450). Both parishes had a lower unemployment rate than the State of Louisiana, which was 5.9 percent.

1.13.1.3 Housing

Table 3 provides selected housing statistics for the affected area. According to the U.S. Census Bureau (2017), there are 88,478 total housing units in Cameron and Calcasieu Parishes, of which 10,545 are vacant units and 1,503 units are available for seasonal, recreational, or occasional use. In addition, there are also 92 hotels/motels in these parishes that could be used by any of the short-term workforce (HotelMotels 2017). Recreational vehicle parks and campgrounds in the two parishes could also be utilized by the workforce.

TABLE 3
Available Housing for Non-Local Construction Workers during Construction of the Project

State/Parish	Total Housing Units (number)	Vacant Housing Units	Rental Vacancy Rate (percent)	Hotel / Motels (number)[a]	For Seasonal, Recreation, or Occasional Use (number)[b]
Louisiana	1,999,855	271,936	8.1	1,875	42,253
Cameron	3,524	916	13.1	7	779
Calcasieu	84,954	9,629	9.0	85	724
Parish Total	**88,478**	**10,545**	**NA**	**92**	**1,503**

Sources: U.S. Census Bureau 2017, unless otherwise noted.
[a] HotelMotels.info.com.
[b] U.S. Census 2010, DP-1, Census Summary File 1.

1.13.2 Discussion of Impacts

1.13.2.1 No Action Alternative

Under the No Action Alternative, Calcasieu and Cameron Parishes, as well as other communities within or near the Project, would continue to have the same population trends. The parish's existing industry and unemployment trends would be expected to continue into the future.

1.13.2.2 Proposed Action

The Preferred Alternative would likely have a positive effect on population growth trends within the Study Area. Further, as discussed in Section 1.12, the development of such a port is consistent with goals to revitalize the area as established in the Cameron Parish Planning and Development Department's program design document (Cameron Parish and West Cameron Port Authority 2011). The Project would also be consistent with Louisiana's 2012 Coastal Master Plan by supporting Louisiana's port and navigation industries.

Project construction of the port would create direct and indirect benefits from economic activity in the Study Area over the anticipated four-year construction period. According to the 2013 economic impact study conducted by Loren C. Scott & Associates, Inc., the bulk of these benefits would occur during the second and third years of construction.

It is anticipated that a mixed use of local and non-local workforce would be required for construction and operation of the port. The hiring of locals would temporarily decrease the unemployment rate, which would result in a short-term, but positive impact on employment. In addition to direct hires, a number of temporary short-term indirect jobs could result from the purchases that are made by non-local workers during the construction phase on items such as food, clothing, lodging, gasoline, and entertainment. In the Study Area, an estimated yearly-average of 1,290 temporary jobs would be created during the construction period, of which 646 would occur in Cameron Parish (Scott 2013). These temporary jobs would have a short-term, stimulatory effect on the local economies.

Construction of the port would stimulate the economy through the $413.4 million estimated to be spent on port infrastructure (Scott 2013), a portion of which would be spent on locally sourced construction materials (e.g., concrete, miscellaneous consumables, and fuel supply). Additionally, a percentage of the construction payroll would be spent locally by both local and non-local workers for the purchase of housing, food, gasoline, and other goods, services, and entertainment in the Study Area. Typically, construction activities increase economic activity within an area in several ways:

- direct effects – hiring of local construction workers and purchases of goods and services from local businesses;

- indirect effects – the additional demand for goods and services, such as replacing inventory from the firms that sell goods and services directly to the project or to workers and their families; and

- induced effects – the spending of disposable income by the construction workers at local businesses, which in turn order new inventory from their suppliers.

The increase in economic activity during the construction period resulting from direct, indirect, and induced effects would result in a short-term positive economic impact in the Study Area.

As stated previously, local residents would comprise a portion of the construction workforce. These workers would commute daily from their homes to the port site. However, a portion of the construction workforce would consist of non-local workers that would require short-term housing during construction of the Project, which could temporarily decrease the availability of housing in Cameron and Calcasieu Parishes. The construction contractor intends to house a large portion of any non-local workforce on temporary "quarter barges" which would be docked near the Port site, possibly within Loop Pass, East Pass, or the Ship Channel. It is estimated that no more than 200 workers would require temporary, land-based housing at a given time. The Project could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy.

To accommodate the anticipated influx of construction workers for projects planned throughout southwest Louisiana, seven worker housing developments in Sulfur, Mossville, Vinton, and Westlake in Calcasieu Parish with a total of 13,688 units have been planned for construction (SWLA Economic Development Alliance 2016b). One of these, the 2,500-unit Moss Lake Village in Sulfur, was recently completed.

Temporary housing availability varies seasonally and geographically within the two parishes. The demand for temporary housing is generally greatest during the summer months when tourism is at its highest. While some of the construction activity would be conducted during the peak tourism season, sufficient temporary housing in the parishes is still likely to be available, but may be more difficult to find and/or more expensive to secure.

Operation of Port Cameron would require a nominal workforce, which could include non-local workers who would relocate to the affected area. Based on the number of housing

units available in the affected area and planned housing development in Calcasieu Parish, operation of the Port would have a minor but permanent impact on the local housing market.

In general, operation of the port is not expected to have long-term adverse economic effects. Rather, operations and maintenance activities associated with the port are likely to result in a small, ongoing annual increase in local revenues. The expenditures and permanent workforce associated with operation of Port Cameron would result in a minor, but positive permanent impact on the local economy. Thus, no significant adverse impacts to socioeconomics are anticipated.

1.14 ENVIRONMENTAL JUSTICE

Executive Order 12898 on environmental justice recognizes the importance of using the NEPA process to identify and address, as appropriate, any disproportionately high and adverse health or environmental effects of federal programs, policies, or activities on minority populations and low-income groups. The provisions of Executive Order 12898 apply equally to Native American programs. Consistent with Executive Order 12898, the Council on Environmental Quality (CEQ) has called on federal agencies to actively scrutinize the following issues with respect to environmental justice (CEQ 1997):

- the racial and economic composition of affected communities;
- health-related issues that may amplify effects to minority or low-income individuals; and
- public participation strategies, including community or tribal participation in the NEPA process.

The EPA provides guidance on determining whether there is a minority or low-income community to be addressed in a NEPA analysis. According to this guidance, minority population issues must be addressed when minorities comprise over 50 percent of an affected area or when the minority population percentage of the affected area is substantially greater than the minority percentage in the larger area of the general population. According to 15 USC § 689, low-income populations are defined as a geographic area represented by a census tract or equivalent county/parish division where the poverty rate is 20 percent or greater, among other indicators.

In accordance with these guidelines, an environmental justice analysis for the Project was prepared. To develop an accurate understanding of the racial and ethnic characteristics of the communities in the immediate vicinity of the Project, census block data were used, as opposed to the larger geographic areas included in parish level data. In this analysis, the minority and low-income population percentages in the State of Louisiana and Cameron Parish were compared to the respective percentages for the census block groups in which Port Cameron would be located (Census Tract 9701, Block Group 1 and Census Tract 9702.01, Block Group 3). These block groups comprise the affected community based on the potential environmental impact of the Project. Table 4 identifies the racial composition for these census block groups; Cameron Parish; and the State of Louisiana. Table 5 provides an overview of the general economic status of these areas.

1.14.1 Existing Environment

Neither of the census block groups analyzed have minority populations greater than the general EPA guideline of 50 percent. However, one census block group has a poverty rate that exceeds 20 percent, indicating a low-income community (Census Tract 9701, Block Group 1). According to the EPA guidelines stated above, this is an environmental justice population.

Table 4
Demographics in the Vicinity of Port Cameron

State/Parish/ Block Group	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races
Louisiana	2,890,570	1,477,781	28,807	75,209	1,671	49,002	77,809
Cameron Parish	6,481	207	0	0	0	0	25
Census Tract 9701							
Block Group 1	231	198	0	0	0	0	0
Census Tract 9702.01							
Block Group 1	343	1	0	0	0	0	2

Source: U.S. Census Bureau 2016b.

Table 5
Economic Statistics in the Vicinity of Port Cameron

State/Parish/Block Group	Median Household Income (dollars)	Households Below Poverty Level (percent)
Louisiana	44,991[a]	18.8
Cameron	64,129[a]	8.7
Census Tract 9701		
Block Group 1	41,964[b]	21.9[c]
Census Tract 9702.01		
Block Group 3	69,375[b]	7.3 [c]

[a] U.S. Census Bureau 2016c.
[b] U.S. Census Bureau 2016d.
[c] U.S. Census Bureau 2016e.

1.14.2 Discussion of Impacts

1.14.2.1 No Action Alternative

No impacts to environmental justice communities in the Port Cameron Project site are anticipated to occur under the No Action Alternative.

1.14.2.2 Proposed Alternative

The construction and operation of Port Cameron would affect a mix of racial/ethnic and socioeconomic areas in the vicinity of the Project. Impacts on residential areas, such as dust, noise, hazardous waste or surface or ground water impacts associated with construction of the port are not expected as the closest populated area is 0.4 mile from the Port site. Potential emissions of air pollutants from construction and operation of the port would be below the threshold for unhealthy air quality over the Study Area as addressed in Section 1.19. Area residents may be affected by traffic delays and noise during construction due to material truck deliveries. However, as shown in the traffic and noise analyses (see Sections 1.17 and 1.20,

respectively), impacts would be minor and short-term. Likewise, water quality impacts are expected to be minimal as best management practices would be employed to minimize the risk of stormwater runoff pollution of surface water, chemical spills into area waterways. Therefore, the Project would not have significant or disproportionate adverse air quality, noise, dust, hazardous waste or water quality impacts on low-income or minority populations in the vicinity of the Project site.

The Cameron Parish Police Jury holds monthly public meetings where parish residents are invited to attend and learn about upcoming projects and permits in the parish, including the Port Cameron Project. Accommodations are provided for attendees requesting special assistance, such as handicap assistance. The Police Jury would continue to keep the public informed of upcoming construction and progress on the Project. Contractors working on the Project would be required to comply with applicable equal opportunity and non-discrimination laws and policies. The criteria for all positions would be based upon qualifications and in accordance with applicable, federal, state, and local employment laws and policies.

The Project is expected to provide a beneficial economic impact on local communities through employment opportunities, construction payroll expenditures, purchases of construction goods and materials, and local expenditures by workers, regardless of race or income group. The limited minor temporary impacts expected from construction and operation of the port, including temporary traffic delays and noise disturbance, would be experienced in both the low-income census block and the non-low-income census block present in the project area. Therefore, the port is not expected to have disproportionate, adverse effects on low-income residents in the area.

1.15 COMMUNITY AND RECREATIONAL RESOURCES

1.15.1 Existing Environment

1.15.1.1 Community Facilities

Public Services

Cameron Parish is served by the Cameron Parish Sheriff's Office (Cameron Parish Sheriff's Office 2016). While this office is the sole provider of law enforcement for the parish, the LDWF assists the sheriff's office with enforcement of water-based activities such as hunting and fishing regulations and safe boating requirements and rescue operations.

Fire protection within the parish is provided by the Cameron and District No. 10 Holly Beach/Johnson Bayou Volunteer Fire Departments (Government Gateway 2016). The South Cameron Memorial Hospital, located approximately 13 miles east of the Port site, is the only hospital located in the parish and has a total of 25 licensed beds (Louisiana Hospital Association 2016). Two ambulance districts provide emergency medical service to Cameron Parish, with District I serving the Port site. Schools in Cameron Parish include Grand Lake School, Hackberry School, Johnson Bayou School, and South Cameron School (Cameron Parish School Board 2016).

Cemeteries and Places of Worship

There are numerous places of worship in the communities surrounding the Port site. The two closest cemeteries to the Port site are Our Lady Star of The Sea Cemetery and St. Rose of Lima Cemetery (Louisiana Cemeteries 2016).

1.15.1.2 Recreational Facilities

Public recreation in Cameron Parish consists of outdoor activities such as fishing, hunting, boating, and bird watching. The parish provides opportunities for both saltwater and freshwater fishing with 619 square miles of water and 6 public boat launches (Tourist Commission 2016, Cameron Parish Police Jury 2016b). According to the Tourist Commission (2016), the parish is known for setting state records for boat fishing. Public fishing opportunities near the Port site include the Cameron Jetty Pier and Davis Road Boat Launch (Cameron Parish Police Jury 2016b). The pier site also provides beach access and includes a pavilion, R/V park, public restrooms, rinse stations, a playground, and a bird observation tower.

The Town of Cameron is proposing a revitalization project called Cameron Square, a multi-building civic complex extending from the existing Courthouse to the Cameron Loop. A key component of the development plan is to expand waterfront facilities including the wharf and pier to attract tourists and to support local commercial and recreational fishing (Cameron Parish Police Jury 2016b).

State Highway 27/82, including the portion that passes along the southern boundary of the proposed Port site, is a national scenic byway called the Creole Nature Trail. This 180-mile scenic byway was one of the first designated by the U.S. Secretary of Transportation in the Gulf

South, and that designation was upgraded in 2002 to the category "All-American Road" (Visit Lake Charles.org 2016).

Designated natural and recreational areas in the vicinity of the Project include the Sabine NWR (about 5.4 miles west of the Project), the Cameron Prairie NWR (about 0.5 mile northeast of the Project) and the Rockefeller NWR (about 45 miles east of the Project). The Cameron Prairie NWR consists of two separate and distinct units. The Gibbstown Unit, with 9,621 acres of fresh marsh, coastal prairie, and old rice fields, provides food for wintering waterfowl and other water birds. The 14,927-acre East Cove Unit, which is closest to the Project site, has water control structures that are managed to maintain salinity levels similar to those of historic marshes and optimal for wildlife habitat. The NWR's mission is to "manage, protect, and perpetuate coastal marshes to provide high-quality food and habitat for wintering migratory waterfowl, and other migratory birds and native wildlife." Popular activities on the refuge include fishing, boating, birding, nature photography, and wildlife viewing (USFWS 2015b).

1.15.2 Discussion of Impacts

1.15.2.1 No Action Alternative

Under the No Action Alternative, no impacts would occur to community and recreational resources from new construction, and the same existing conditions and pattern of use of these resources would continue to occur. Permitting and construction of planned projects such as the Cameron Square Development would continue into the future.

1.15.2.2 Proposed Action

Construction of the port would have little or no short-term impact on the availability of local community facilities and services such as police, fire, and medical because the non-local workforce is expected to be small relative to the current population. The local communities in Cameron and Calcasieu Parishes have adequate infrastructure and community services to meet the needs of the workers that would be required for construction and operation of the facility. Therefore, impacts on public services during construction of the Port Cameron Project would be temporary and minor. Operational impacts on public services would be permanent, but minor.

Recreational boating and fishing activities occurring within and near the port and beneficial use site could be affected by construction and operation of the port due to increased noise and marine traffic. Increased noise associated with construction activities, such as pile-driving and dredging/excavation, would likely deter recreational users from fishing in the immediate vicinity of Project activities. However, there is extensive similar habitat near the port and the surrounding waters for displaced recreational users; therefore, impacts are expected to be minor. Impacts associated with increased marine traffic would be minor due to the limited number and size of vessels expected to call on the port; recreational boaters would be permitted to pass these vessels in the ship channel. Temporary quarter barges used to house a portion of the non-local construction work force would be docked as to not interfere with marine vessel traffic on the Ship Channel. Further, increased marine traffic associated with the Project would be limited to the Calcasieu Ship Channel between the Project site and the jetties, where the channel width does not constrain vessel traffic. North of Calcasieu Lake, the ship channel is

narrower and does limit certain vessel activity. Impacts of the Project on marine traffic are discussed in Section 1.17.

State Highway 27/82, a Louisiana State Scenic Byway, would provide the primary road access to the Project site for workers and truck deliveries; recreationists and tourists traveling the highway during peak traffic times could experience temporary traffic delays. However, as discussed in more detail in Section 1.17, traffic impacts would be minor and limited to the duration of construction. Visual impacts to the scenic byway are addressed in Section 1.16.

Dredged material pumping operations in the East Cove Unit of the Cameron Prairie NWR would likely cause short-term disruptions to recreational fishing and wildlife viewing in the vicinity of pumping operations. However, restoration would also enhance habitats for numerous aquatic and marsh-dwelling organisms, which would, in turn, improve recreational activities such as fishing, birding, and wildlife viewing. The restoration of 556 acres of wetlands in the Cameron Prairie NWR would assist in the USFWS' mission to "manage, protect, and perpetuate coastal marshes" within the NWR (USFWS 2015b). Thus, no significant adverse impacts to community or recreational resources are anticipated.

1.16 VISUAL AND AESTHETIC RESOURCES

1.16.1 Existing Environment

The Project site is undeveloped, hydrologically altered marshland currently used for hay farming and cattle grazing. Given the mostly flat terrain and sparse tree cover of the area, viewsheds are extensive. The site is visible to recreationists traveling State Highway 27/82 (the Creole Nature Trail national scenic byway), users of the Calcasieu Ship Channel and the Cameron Ferry Terminal, and employees of the existing commercial and industrial businesses along Wakefield Road, Parish Road 3154, and State Highway 27/82. These existing commercial and industrial operations include aboveground storage tanks, metal office buildings, temporary office trailers, berthing areas, dock loading arms/cranes, and large graveled parking and laydown areas. Views west of the Project site across the Calcasieu Ship Channel consist of undeveloped marshland. Monkey Island, between the Calcasieu Ship Channel and Cameron Loop, is also characterized by marshland.

The location of the proposed beneficial use site in the East Cove Unit of the Cameron Prairie NWR is only accessible by boat. The terrain consists of open water and marsh habitat, providing expansive, scenic views of natural areas and wildlife.

1.16.2 Discussion of Impacts

1.16.2.1 No Action Alternative

This alternative would have no effect on aesthetic resources in the Project site. Large-scale, industrial facilities are currently being proposed for construction within the general Project site (see Section 1.22 for more information about planned projects in the area). Under the No Action Alternative, the viewshed surrounding the port site, in particular along the ship channel, may become increasingly industrialized, causing viewsheds to become less rural and more industrial.

1.16.2.2 Proposed Action

Construction and operation activities at the proposed port site would be visible to users of the Calcasieu Ship Channel and the Cameron Ferry Terminal, employees at the existing commercial and industrial businesses along Wakefield Road and State Highway 27/82, and recreationists traveling State Highway 27/82 (the Creole Nature Trail Scenic Byway). In the short term, construction activities such as dredging, excavation, and pile-driving would be visible to these viewers.

In the long-term, construction of this Project is not expected to change surrounding land use and viewshed characteristics. The construction of the port and associated maritime facilities would be consistent with existing and proposed commercial and industrial facilities in the immediate area. Employees and operators of commercial and industrial facilities along Wakefield Road, Parish Road 3154, and State Highway 27/82 are likely acclimated to the industrial components of the area, and construction and operation of the proposed port is expected to have little or no effect on local businesses from a visual resources perspective. Residents would see an increase in construction traffic along State Highway 27/82. The nearest

residences to the proposed port site are approximately 0.4 mile east. While this distance would provide a buffer for visual impacts, the flat topography of the Project site may allow some construction activities to be visible from local residences, depending on the location and perspective of the viewing point. Project construction and operation would also be visible to tourists travelling along State Highway 27/82; however, the Project facilities would be consistent with other development in the vicinity and the Project would not result in a significant change in the character of the surrounding landscape. During operation of the proposed port, visual impacts may be associated with various features, including heavy lift cranes, exterior lighting, and offshore support vessels calling at the port. These industrial and maritime activities would be consistent with current land use in area of the Port site.

The proposed action includes the beneficial use of dredged material to create marsh habitat in the East Cove Unit of the Cameron Prairie NWR. Pumping activities to restore marsh in this area may be visible to people visiting the NWR by boat. Once the newly created marsh has become established, the marsh is expected to provide additional habitat for waterfowl, which would increase opportunities for wildlife viewing. Thus, no significant adverse impacts to visual resources are anticipated.

1.17 TRANSPORTATION

1.17.1 Road Transportation

1.17.1.1 Existing Environment

The Project site is bordered by several existing roads. Parish Road 3154 traverses in a generally east-west direction about 700 feet north of the northern boundary of the Project site. This road connects with Wakefield Road, a two-lane paved roadway running north-south, parallel to the Calcasieu Ship Channel, on the west side of the Project site. Wakefield Road includes a concrete bridge that crosses the W-1 canal. This road provides direct access to State Highway 27/82, which traverses along the southern boundary of the Project site. From State Highway 27/82, a gravel road crosses north through the interior of the property and includes a one-lane bridge that crosses the W-1 canal.

1.17.1.2 Discussion of Impacts

No Action Alternative

Under the No Action Alternative, no impact is anticipated to road transportation.

Proposed Action

Approximately 800 feet of Wakefield Road where it crosses the W-1 canal would be removed for construction of the proposed port canal entrance, eliminating vehicular access between Parish Road 3154 and State Highway 27/82. Vehicular access between these two roadways would be replaced by the construction of a two-lane, paved public road within the project footprint along the eastern edge of the Port site from Parish Road 3154 to State Highway 27/82 that would include construction of a bridge crossing the W-1 canal. Thus, access to Project-area roadways would be maintained, but traffic patterns would be altered. Port Cameron would coordinate with the Louisiana Department of Transportation and Development (DOTD) and comply with all applicable permitting requirements in the design and construction of the new road, which would also provide driveway access to the proposed port facilities. A private roadway would be constructed encircling the interior boundary of the Project site to provide vehicular access to tenant lots and port offices.

During construction of the port, traffic levels on area roadways would increase due to the presence of worker vehicles, construction vehicles, and trucks delivering material to the site. Roadway truck deliveries would be minimized, however, because material would be delivered to the Project site daily by barge via the Calcasieu Ship Channel. Because existing roadways have a low-volume of traffic and excess capacity, impacts should be temporary and minor.

A traffic impact study (Gresham Smith and Partners 2016) was conducted in 2016 to determine the existing Level of Service (LOS) of State Highway 27/82 and the forecasted LOS under with-Project conditions during operations. LOS is a measurement system of operational conditions for roadways using six letter grades (Federal Highway Administration 2016):

- LOS A: free-flow traffic;

- LOS B: reasonably free-flow traffic;
- LOS C: stable flow, at or near free flow;
- LOS D: approaching unstable flow. Speeds slightly decrease as traffic volumes slightly increase;
- LOS E: unstable flow, operating at capacity; and
- LOS F: operational failure due to excess traffic.

Traffic counts were conducted during peak travel times at two intersections on State Highway 27/82 at Wakefield Road and at Davis Road (located about 0.7 mile east of the Project just east of the town of Cameron). The study found that under existing conditions at peak travel times, the roadway at these intersections operates at LOS A due to low traffic volumes. Under the with-Project scenario, the roadway at these intersections would continue to operate at a LOS A, with two exceptions:

- traffic traveling southbound from State Highway 27/82 to Davis Road would have LOS B; and
- at the proposed new intersection of State Highway 27/82 and the new public road providing access to the proposed port, traffic entering the state highway would experience LOS C. A stop sign would be installed on the proposed road for traffic entering the state highway; no traffic controls would be installed on the state highway itself.

While operations would result in an increase in traffic in the Project vicinity, the proposed traffic controls and new roadway from Parish Road 3154 to State Highway 27/82 would minimize impacts and ensure access is maintained to nearby businesses and residences. Thus, no significant adverse impacts to road transportation are anticipated.

1.17.2 Air Transportation

1.17.2.1 Existing Environment

A private, unpaved airplane landing strip is located on the southeast corner of the Project site. The landing strip is no longer in use. Private heliports at Cameron Shore Base and Cameron Midstream East are located on Parish Road 3154 north of the Project site and on Wakefield Road adjacent to the western boundary of the proposed site, respectively. The nearest public airport is the Lake Charles Regional Airport, about 40 miles north of the Project.

1.17.2.2 Discussion of Impacts

No Action Alternative

Under the No Action scenario, the use of private helicopter pads and thus, helicopter traffic, would likely increase due to anticipated growth in large-scale oil and gas facilities being

planned in Cameron and Calcasieu Parishes.

Proposed Action

The unused, unpaved landing strip located on the southeast portion of the Project site would be filled, graded, and developed as part of the Project facilities. No impact on air travel would occur because the air strip is no longer in use. A potential future tenant of the proposed port may include an offshore disaster response unit that may include a heliport. Tenants would be required to follow all aviation regulations and protocols so that existing air transportation operations in the area, including the Cameron Shore Base Heliport and the Lake Charles Regional Airport, would not be adversely impacted. Thus, no significant adverse impacts to air transportation are anticipated.

1.17.3 Marine Transportation

1.17.3.1 Existing Environment

State Highway 27/82 approaches the Cameron-Holly Beach Ferry about 350 feet west of the Project site on the east side of the Calcasieu Ship Channel. This ferry has a 50-car capacity and provides access across the Calcasieu Ship Channel 24 hours a day, seven days a week. The ferry is scheduled to depart every 15 minutes from either bank of the ship channel, completing two round trips per hour. Ridership counts maintained by the DOTD show that the majority (88 percent) of the time the ferry is in operation, it operates below 20 percent capacity, with 10 or fewer vehicles (Gresham Smith and Partners 2016).

A vessel traffic study was recently completed for the Port of Lake Charles to estimate existing and forecasted commercial vessel traffic on the Calcasieu Ship Channel (Ausenco 2015). The study was restricted to vessels exceeding a certain weight-carrying capacity requiring pilotage by a Lake Charles Pilot. Non-piloted vessels can be maneuvered between the piloted vessels and do not impact the capacity of the channel (Ausenco 2015).

The study reported that in 2013, commercial vessel traffic requiring pilotage in the Calcasieu Ship Channel numbered approximately 1,022 vessels per year (Ausenco 2015). These piloted vessels called on 13 existing terminals on the ship channel. An additional six terminals are anticipated to be constructed in the next 10 years on the channel that would require at least one piloted vessel call yearly. As a result of both the increased operations of present terminals and new traffic from proposed terminals, large commercial vessel traffic in the channel is forecasted to increase to 2,249 annual vessel calls by 2028, representing an increase of 120% from the 2013 traffic levels (Ausenco 2015).

1.17.3.2 Discussion of Impacts

No Action Alternative

Under the No Action Alternative, the Cameron-Holly Beach ferry would continue to operate as it currently does. Vessel traffic on the Calcasieu Ship Channel is expected to increase significantly by 2028 as a result of new liquified natural gas terminals proposed for construction on the channel.

Proposed Action

During construction, it is anticipated that configurations of two to six barges would bring supplies such as aggregate, fill material, sheet pile to the site two to four times per month. During construction of the port canal entrance, dredge vessels and equipment would be largely operating outside of the active shipping lane. Therefore, construction would not result in a significant impact on marine traffic in the ship channel.

The 2016 Traffic Impact Study for the Project (Gresham Smith and Partners 2016) estimates that ferry usage would increase under with-Project conditions, but would continue at less-than-full capacity. Existing ferry operations would not be adversely impacted by the Project.

A Navigation Impact Study was completed to determine how the proposed Port Cameron Project would impact navigation in the Calcasieu Ship Channel (Moffatt & Nichol 2015). The vessels expected to call at Port Cameron once in operation include offshore supply vessels, such as platform supply vessels, anchor handling towing supply vessels, mini supply vessels, and fast support vessels. All vessels calling at the port would be expected to have a maximum draft of 23 feet and a deadweight tonnage, a measure of a vessel's weight carrying capacity, below 16,000. Based on guidance from the Lake Charles Pilot Association for the study, vessels of this size would not require pilotage (Moffatt & Nichol 2015).

Assuming a 70 percent berth occupancy rate and an occupancy period of two days at the port, the study estimated that approximately 5,000 vessels would call at the port annually. Because non-piloted vessels are subject to fewer restrictions and can be maneuvered between other vessels using the channel, this increase in supply vessels would not impact the capacity of the channel. Further, the proposed port is located near the entrance jetties, where ship channel capacity is less restricted than upstream of Calcasieu Lake. Thus, no significant adverse impacts to marine transportation are anticipated.

1.18 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

1.18.1 Existing Environment

1.18.1.1 Oil and Gas Infrastructure

Six pipelines are located within the vicinity of the Project. The Creole Trail Pipeline crosses adjacent to the northern boundary of the Project site. Two pipelines owned by Bridgeline Holdings traverse the northern half of the Project site. The Transcanada/ANR and Kinetica pipelines traverse the southern half of the Project site. A Gulfsouth pipeline crosses the southern boundary of the Project site.

There are 12 natural gas wells within the Project site. All are plugged and abandoned (Banks Environmental Data 2016).

1.18.1.2 Hazardous, Toxic, and Radioactive Waste Assessment

A Hazardous, Toxic, and Radioactive Waste assessment was conducted for the Project site to identify any potential recognized environmental conditions (RECs) located in or adjacent to the Project site that have, or may have in the past, adversely impacted environmental conditions. As defined in the American Society for Testing and Materials (ASTM) E1527-13 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, a REC indicates "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property" (ASTM 2013). A search of federal, state, and local government environmental databases to identify RECs in or near the Project site was conducted by Banks Environmental Data.

A total of 79 RECs at 19 sites and facilities were listed in the Banks Report (see Table 6). Of these, 62 of the listings were listed in the Emergency Response Notification System (ERNS) database. The ERNS database is used to store information associated with the release of petroleum and hazardous substances that allows for documentation of releases and other incidents (EPA 1989). According to the Banks report, the ERNS listings generally were a result of equipment malfunctions, over-filling of tanks, or spills from marine vessels that impacted the Calcasieu Ship Channel. The release dates ranged from 1997 to 2014. Of the 62 reported releases, approximately 97 percent were releases to water; however, 12 percent of these were recorded facility emergency response exercises and were not actual releases. The remaining three percent of releases occurred on land. Due to the nature of the ERNS system, limited information is available for these releases; however, according to the Banks Environmental Data report, spills to water generally occurred in the Calcasieu Ship Channel outside of the Project site.

A total of three facilities in the vicinity of the Project site were identified in the Resource Conservation and Recovery Act (RCRA) database (see Table 6). The RCRA database includes federally regulated facilities that generate, store, dispose of, or handle hazardous wastes, and facilities that may be subject to corrective action. The RCRA facilities listed in the Banks Report included facilities that previously handled RCRA wastes associated with the oil and/or

gas exploration industry and marine freight transportation. Each of these facilities are currently listed as inactive facilities that no longer generate RCRA waste. In addition, a total of nine RCRA Generators facilities were identified by Banks, one of which (Soco Offshore Inc.) was located in the Project site (see Table 6). These include federally regulated facilities that generate an amount of hazardous waste each month that exceeds the federal reporting threshold, requiring a registration as a generator of RCRA waste. As seen in the Banks Report, these facilities include small quantity generators that generate over 100 kilograms (kg) but less than 1,000 kg of waste each month, and conditionally exempt small quantity generators of waste that generate less than 100 kg of waste each month.

Table 6
Potential REC Sites Identified in Federal and State Databases

Database	Search Radius from Project Site (miles)	Number of RECs
Federal Databases		
National Priorities List	1.0	0
Delisted National Priorities List	0.5	0
Superfund Enterprise Management System	0.5	0
Superfund Enterprise Management System - No Further Remedial Action Planned	0.5	0
RCRA Corrective Action Sites	1.0	0
RCRA Non- Corrective Action Sites	0.5	0
RCRA Generators	0.25	9
Federal Brownfields	0.5	0
Federal Institutional Controls	0.5	0
Federal Engineering Controls	0.5	0
Emergency Response Notification System. List	0.25	62
State Databases		
State/Tribal Equivalent National Priorities List	1.0	1
State/Tribal Equivalent CERCLIS	0.5	0
State/Tribal Disposal or Landfill	0.5	0
State/Tribal Leaking Petroleum Storage Tank	0.25	1
State /Tribal Petroleum Storage Tank	0.25	2
State/Tribal Institutional Controls	0.5	0
State/Tribal Engineering Controls	0.5	0
State/Tribal Voluntary Cleanup	0.5	0
State/Tribal Brownfield	0.5	0
State/Tribal Hazardous Waste	0.25	1
Non-ASTM Databases		
RCRA	0.25	3
Dry Cleaners	0.25	0
Total RECs in vicinity of Project site	--	79

RECs = recognized environmental conditions; RCRA = Resource Conservation and Recovery Act; CERCLIS = Comprehensive Environmental Response, Compensation and Liability Information System; ASTM = American Society for Testing Materials.

Source: Banks Environmental Data, November 28, 2016

Two petroleum storage tank facilities were identified within 0.25 mile of the Project that include facilities that previously contained underground storage tanks (USTs). According to the Banks Report, these USTs were installed between 1960 and 1980 and have been permanently removed from the ground at their respective facilities. Additionally, one reported leaking petroleum storage tanks facility is located 0.4 miles east of the Project site. According to the Banks Environmental Data report, this facility reported a release of petroleum hydrocarbons in January 1992. LDEQ records indicate impacts to groundwater in the vicinity of the facility; however, a pump-and-treat system was implemented onsite to remediate contamination and after a two-year period of treatment and subsequent monitoring, this facility received site concurrence (regulatory closure) from the LDEQ in May 2000 (LDEQ 1997, 2000). Further, this facility reportedly contained nine USTs that were installed between 1978 and 1980. Six of these tanks were permanently removed from the ground; the remaining three USTs have a status of closed.

One state hazardous waste facility was reported approximately 158 feet west of the Project site. According to the Banks Environmental Data report, this facility is an active transporter of hazardous waste. No violations or compliance issues have been reported at this facility (EPA 2016c).

One national priorities list facility was reported approximately 0.2 mile northeast of the Project site. National priorities list facilities are those that have known or threatened released of hazardous substances or pollutants (EPA 2016c). According to available LDEQ records, this facility was investigated by LDEQ after it was reported as abandoned in 1993 due to concern regarding with air emissions and hazardous waste associated with an onsite Heater Treater near a well head location. LDEQ's investigation determined that no records suggest any waste has been spilled or disposed of at the facility. Therefore, LDEQ issued this facility site concurrence in October 2014 and recommended no further action be taken (LDEQ 2014).

A Phase I Environmental Site Assessment was conducted on the Port site in May 2015 to identify RECs and historic RECs on or adjacent to the Project site. According to the Phase I Environmental Site Assessment, no RECs or HRECs were found associated with the Port site.

1.18.2 Discussion of Impacts

1.18.2.1 No Action Alternative

The No Action Alternative would have no effect on hazardous materials or waste. Under the No Action Alternative, no impact is anticipated to existing infrastructure.

1.18.2.2 Proposed Action

Four of the pipelines that cross the Project site would require relocation within the Project boundaries for construction of the proposed open-water canal system. The portion of the two Bridgeline Holdings pipelines that would cross the proposed canals would be relocated adjacent to and north of the proposed canals. The portion of the Transcanada/ANR and Kinetica pipelines that would cross the proposed canals would be relocated adjacent to and south of the proposed canals. Coordination is ongoing with the owners of these pipelines for the proposed relocations.

The abandoned wells located within the channel footprint will be cut and removed below the design grade of -33.0 at approximately Elev. -80.0 and additional plugs will be installed if necessary. The abandoned wells on the Port Cameron project footprint, but not within the channel footprint will remain undisturbed, covered with fill, and properly identified to potential tenants.

According to the Banks Report, there have been no reports of onsite contamination or nearby contamination that would impact soils in the Project site during excavation and dredging. During construction of the Project, liquid materials and chemicals such as fuels, lubricants, and paints would be stored on site in accordance with all applicable regulations and requirements. The site contractor would be required to take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. If hazardous constituents are unexpectedly encountered in the Project site during construction, parish authorities would be immediately notified, and appropriate measures for the proper assessment, remediation, and management of the contamination would be initiated in accordance with applicable federal, state, and local regulations.

Once in operation, the Project would include vessel support activities such as marine vessel loading and unloading, repair services, and fuel supply. Potential impacts to water could include leaks from cranes, accidental spills from marine fleet refueling, and releases from marine vessels. To mitigate for these impacts, Port Cameron would require tenants to obtain and maintain applicable regulatory permits and to develop and implement associated SPCC plans, which would identify preventative measures to reduce the likelihood of a spill and measures for clean up if a spill occurs. In addition, these plans would address storage and transportation of hazardous materials. Thus, the likelihood of impacts from hazardous, toxic or radioactive waste is not significant.

1.19 AIR QUALITY

1.19.1 Existing Environment

Regional Climate

The Project is located in Cameron Parish, Louisiana, where the climate is humid and subtropical with long, hot, summers and short, mild winters (EPA 2014a). Wind direction in the area is primarily either north or south depending on the time of year. Spring and summer months experience winds originating from the south whereas wind direction is typically from the north or northeast during the fall and winter months.

The Project site receives an annual average of 63.4 inches of rain. April is typically the driest month of the year with a monthly average of 3.8 inches, whereas June tends to be the wettest month with a monthly average of 7.5 inches. Snow events are rare, with an annual average of 0.3 inch of snow, which is likely to occur in January or February. Average daily temperatures peak at 83.0 degrees in August, and average daily temperatures are typically lowest in February at 51.8 degrees (Southern Regional Climate Center 2016).

Ambient Air Quality Standards

Ambient air quality is protected by federal and state air quality standards. The EPA establishes National Ambient Air Quality Standards (NAAQS) for seven air contaminants designated "criteria air pollutants," including nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, sulfur dioxide (SO_2), lead, inhalable particulate matter (PM) with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and PM with an aerodynamic diameter less than or equal to 10 microns (PM_{10}). The NAAQS include primary standards to protect human health, including sensitive populations such as children, the elderly, and asthmatics, and secondary standards to protect public welfare, including protection against reduced visibility and damage to crops, vegetation, animals, and buildings.

Under the Clean Air Act, each state prepares a State Implementation Plan (SIP) to demonstrate the state's air quality management program to attain or maintain the primary and secondary NAAQS. The SIP may also include stricter standards than the NAAQS. Louisiana has not adopted more stringent criteria pollutant ambient air quality standards.

Air Quality Control Regions and Classifications

The EPA has established Air Quality Control Regions (AQCR), defined as contiguous areas considered to have relatively uniform ambient air quality, and treated as single geographical units for reducing emissions and determining compliance with the NAAQS. The AQCRs are intra- and interstate regions, such as large metropolitan areas, where improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. Each AQCR, or portion thereof, is designated based on compliance with the NAAQS, for each pollutant. Designations fall under three main categories as follows: "attainment" (areas in compliance with the NAAQS); "nonattainment" (areas not in compliance with the NAAQS); or "unclassifiable" (areas lacking data to determine attainment). Areas formerly designated as nonattainment that have since demonstrated compliance with the NAAQS are considered

"maintenance areas". Maintenance areas may be subject to more stringent regulatory requirements similar to nonattainment areas, to ensure continued attainment of the NAAQS. The SIP must include measures identifying how applicable air quality standards are achieved as well as maintained in each AQCR.

Cameron Parish is located in the Southern Louisiana-Southeast Texas Interstate AQCR. Cameron Parish is designated as unclassifiable for ozone, $PM_{2.5}$, and NO_2 and in attainment for all other criteria pollutants. Within AQCRs, Federal Class I areas are designated as pristine natural areas or areas of natural significance and receive special protections under the CAA based on good air quality. If a new source or major modification of an existing source is subject to the Prevention of Significant Deterioration (PSD) program requirements and is within 62 miles (100 kilometers of a Class I area), the facility is required to notify the appropriate federal officials and assess the impacts of the Project on the Class I area. The Project is not subject to PSD program requirements and the closest designated Class I area to the Project is the Breton NWR, which is more than 200 miles from the Project site, and therefore a PSD Class I analysis is not required (EPA 2016d).

General Conformity

General Conformity ensures that the actions taken by federal agencies do not interfere with a state's plans to attain and maintain national standards for air quality. Established under the Clean Air Act (Section 176(c)(4)), the General Conformity rule requires federal agencies to work with state, tribal and local governments in a nonattainment or maintenance area to ensure that federal actions conform to the air quality plans established in the applicable state or tribal implementation plan. A General Conformity Determination must be completed when the total direct and indirect emissions of a project would equal or exceed specified pollutant thresholds on a calendar year basis for each nonattainment or maintenance area. If the total annual emissions of the federal action are below the specified thresholds, the action is exempt (EPA 2016e).

Greenhouse Gases

In December 2009, EPA updated the definition of air pollution to include six greenhouse gases (GHGs) after determining that GHGs in the atmosphere can endanger public health and welfare. The GHGs include carbon dioxide (CO2), methane, nitrous oxide (N2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. There is no NAAQS or General Conformity threshold for GHGs. GHGs can be ranked by their global warming potential (GWP), which is a relative measure of the ability of a GHG to absorb solar radiation and its residence time in the atmosphere in comparison to that of CO2. Accordingly, CO2 has a GWP of 1 while methane has a GWP of 25, and nitrous oxide has a GWP of 298.

The EPA's current rules require that a new stationary source that is major source for a non-GHG regulated New Source Review (NSR) pollutant must also obtain a GHG PSD permit prior to beginning construction with mass-based GHG emissions equal to or greater than 100,000 metric tons per year (tpy) of carbon dioxide equivalent (CO2e) (EPA 2016f).

The Council on Environmental Quality (CEQ) issued draft guidance to Federal agencies in December 2014 to provide agencies direction on when and how to consider the effects of

GHG emissions and climate change in their evaluation of all proposed Federal actions in accordance with NEPA and CEQ regulations. In this guidance, the CEQ provided a reference point for when a quantitative analysis of GHG emissions is warranted. This reference point is 25,000 metric tons of CO2e emissions on an annual basis unless quantification below that reference point is easily accomplished. Final guidance to Federal agencies was issued on August 1, 2016 to provide direction on when and how to consider the effects of GHG emissions and climate change and the evaluation of proposed Federal actions in accordance with NEPA and CEQ regulations. In this guidance, the CEQ states that when data inputs are reasonably available to support calculations, agencies should conduct a GHG analysis and disclose quantitative estimates of GHG emissions in their NEPA reviews (CEQ 2016).

1.19.2 Discussion of Impacts

1.19.2.1 No Action Alternative

Under the no action alternative, there would be no potential for direct, indirect or cumulative effects on air quality because construction of the Project would not occur, and the status of attainment of air quality for Cameron Parish is not anticipated to change from current conditions.

1.19.2.2 Proposed Action

Construction Emissions

The air emissions from construction of the Project would be short-term, occurring over a 54-month period and ceasing once construction is complete. Construction air emissions would include fugitive dust from soil disruption and combustion emissions from dredging and construction equipment, including non-road mobile sources and minor stationery sources such as generators. Minor amounts of air toxics would be generated during normal construction operations. Additionally, construction workers, delivery/supply trucks, and tugboats/barges would temporarily increase combustion emissions during trips to and from the Project site.

Direct construction emissions would occur from the following major activities and durations:

- drainage structure relocation – 12 months;
- roadway and bridge improvements – 12 months;
- excavation, dredging, and bulkhead construction – 48 months;
- utility improvements – 33 months;
- existing bridge demolition – 7 months;
- pipeline relocations – 12 months; and
- construction of the beneficial use area – 12 months.

Emissions performance standards are applicable to both road and non-road source manufacturers regulated under the Clean Air Act. The LDEQ does not require an air permit from temporary, non-stationary emission sources such as those associated with construction activities (LDEQ 2016b). Construction emission estimates from the Project were calculated using the air emission calculations, methodologies, and assumptions provided in Appendix A.

The total annual air emissions from direct and indirect sources during construction are summarized in Table 7. As the table shows, the highest level of emissions would occur during the second year of construction. The estimated annual GHG emissions (CO_2e) from construction activities would be less than the CEQ guidelines threshold of 25,000 tons per year, signifying that further quantitative assessment of GHG emissions is not warranted (CEQ 2014).

Table 7
Estimated Air Emissions from Construction Activities

Construction Year	Criteria Pollutants (tons per year)						Greenhouse Gases (metric tons per year)
	VOC	CO	NOx	SO_2	PM2.5	PM10	CO2e
General Conformity *de minimis* thresholds for Cameron Parish (tpy)	100	100	100	100	100	100	NA
Year 1	9.8	48.2	78.7	0.1	12.7	67.0	16,333
Year 2	11.8	56.1	95.1	0.1	12.0	43.7	20,457
Year 3	8.9	43.1	71.8	0.1	8.4	24.6	16,810
Year 4	4.7	24.1	44.7	0.1	3.5	7.6	11,676
Year 5 (6 months)	2.1	10.8	20.5	0.0	1.2	1.3	5,394
Total Air Emissions	**37.2**	**182.3**	**310.8**	**0.4**	**37.9**	**144.3**	**70,670**

NA = Not applicable; tpy = tons per year.

Site-specific construction emissions would be temporary, lasting the duration of the construction period. Emissions from diesel- and gasoline-fired construction equipment would be minimized by maintaining the equipment in accordance with the manufacturer's recommendations and, to the extent practicable, by minimizing the idling time of engines. Additionally, fugitive emissions of particulate matter (dust) during construction would be controlled in accordance with Louisiana Administrative Code Title 33, Part III, Chapter 13. Specific precautions that would be implemented to reduce dust include:

- use of water or chemicals for control of dust inconstruction operations, the grading of roads, or the clearing of land;
- application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces that can give rise to airborne dusts;
- covering of open-bodied trucks in the process of transporting materials likely to give rise to airborne dust; and

- paving of roadways and maintenance of roadways in a clean condition.

Operation

Port Cameron would not build or permit stationary sources, but would lease space to tenants and provide basic utilities to each leased site. Tenants would be responsible for all improvements and related permits. It is anticipated that future tenants would be offshore-related oil and gas service entities and would not generate significant annual air emissions as stationary sources. Any tenant that would have annual emissions of five tons or greater of any criteria air pollutant would require an air permit to be issued by LDEQ prior to any construction or operation.

Potential Climate Change Impacts

The regional climate of the Gulf of Mexico is projected to change over the course of the 21st century. Expected increases in GHGs could alter temperature, precipitation, tropical cyclones or hurricanes, and sea level trends, exacerbating existing coastal problems such as shoreline erosion, flooding, and water pollution (EPA 2016g). According to a report published by Columbia University for the United Nations Cancun Climate Summit, "the most certain and well-understood threat to the Gulf of Mexico region from climate change is simply the increase in temperature. By the end of the 21st century, the typical summer would be warmer than any summer, even the most extreme, experienced in the past" (Biasutti *et al.* 2012). Additionally, tropical cyclones are expected to become less frequent, but more intense.

Sea level rise has been identified as the greatest threat to the coasts and islands of the Gulf of Mexico (Biasutti *et al.* 2012). Sea level rise could erode and inundate ecosystems and eliminate wetlands, as well as increase the salinity of ground water and push salt water further upstream (EPA 2016g).

The environmental effects of anticipated climate change described above would not be affected by the proposed Port Cameron Project. These changes are predicted to occur regardless of whether or not the Project is constructed and operated, as the Port is not an oil or natural gas production facility, nor will it spurn additional fossil fuel extraction. The most likely effects on climate from construction and operation of the Project are:

- The Project would temporarily increase annual GHG emissions in the region from the construction activities; however, annual GHG emissions from construction are estimated to be less than 25,000 metric tons per year, CEQ's reference point for when a quantitative analysis of GHG emissions is warranted; and

- While 322.9 acres of marsh will be lost due to construction of the project, approximately 556 acres of new marsh are anticipated to be created through the beneficial use of dredged material for the Project. The growth of marsh vegetation and related photosynthesis would likely increase the amount of carbon intake as compared to open water, a net carbon sink. Though not quantified, this conversion from open water to marsh vegetation could potentially offset some of the GHGs emitted during the construction period of the Project. The new marsh would continue to be a net

carbon sink after construction is completed and potentially act as a natural barrier to tropical cyclones in the future.

Thus, no significant adverse impacts to air quality are anticipated.

1.20 NOISE

1.20.1 Noise Principles and Regulations

Sound is a sequence of pressure waves that propagates through compressible media such as air or water. Noise is defined as unwanted sound and, in the context of protecting public health and welfare, implies potential effects on the human and natural environment. The ambient sound level of a region is defined by the total noise generated within the specific environment and usually comprises natural and man-made sounds. At any location, both the magnitude and frequency of ambient sound may vary considerably over the course of a day and throughout the week. This variation may be caused in part by changing weather conditions and the effect of seasonal changes in vegetative cover.

Decibels (dB) are the units of measurement used to quantify the intensity of noise. To account for the human ear's sensitivity to low level noises the decibel values are corrected to weighted values known as decibels on the A-weighted scale (dBA). The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies.

Noise is administered under the Noise Control Act of 1972, as amended. The EPA has also established guidelines recommending noise limits for indoor and outdoor noise activities. Under these guidelines, an average noise level over a 24-hour period of 70 dBA is listed as the threshold for hearing loss. EPA determined that noise levels should not exceed 55 dBA, which is the level that protects the public from indoor and outdoor activity interference. This noise level has been useful for state and federal agencies to establish noise limitations for various noise sources (EPA 1974).

Additionally, the U.S. Department of Housing and Urban Development (HUD) has also developed a noise abatement and control policy codified in 24 CFR Part 51. According to HUD policy, noise at or below 65 dBA is acceptable, noise between 65 and 75 dBA is generally acceptable, and noise exceeding 75 dBA is unacceptable.

Neither the State of Louisiana nor Cameron Parish has adopted noise regulations applicable to construction and operation of the Project. Cameron Parish does not have a numerical noise ordinance; however, the Cameron Parish Code of Ordinances has a general prohibition on excessive noise, and states, "No person shall make, continue, or cause to be made or continued any loud, unnecessary or excessive noise which unreasonably interferes with the comfort and repose of others within the parish" (Cameron Parish Police Jury 2016a).

1.20.2 Existing Ambient Noise Levels

The Project site is located in a mixed industrial and rural area. The noise sources in the area include industrial facilities, marine traffic, traffic on local roads, wind, birds, and insects. There are several residential areas about 0.4 mile east of the Project site in the community of Cameron, which could contribute to ambient noise levels.

No ambient noise monitoring appears to have been conducted within the Project site; consequently, no quantitative data on existing noise levels within the Project site are available

for analysis.

1.20.3 Discussion of Impacts

1.20.3.1 No Action Alternative

Under the No Action Alternative, impacts on the ambient noise environment are not expected to change from existing conditions.

1.20.3.2 Proposed Action

Construction of the Project would result in temporary increases in ambient sound levels. It is assumed that equipment would be operating up to 10 hours per day, six days a week; however, construction sound could be highly variable due to intermittent equipment operation. The total construction period would last approximately 4.5 years, with the type of equipment operating at any location changing with each construction phase. Sound level impacts on residents in the town of Cameron would depend upon the duration of use for each piece of equipment, the number of construction vehicles and equipment used simultaneously, and the distance between the sound source and receptor. Table 8 presents noise emission levels for construction equipment expected to be used during the proposed construction activities.

Noise receptors within 500 feet of the Project site include industrial complexes along Wakefield Road and State Highway 27/82, including the Cameron Ferry Complex and oil and gas support facilities for storage, load-out, and drilling operations along the ship channel. Noise receptors located within 1,000 feet of the Project site include industrial facilities along Parish Road 3154, docks, wharves, and shops that support the seafood industry on the western edge of the town of Cameron. People at these facilities could experience noise levels of 75 dBA or greater during pile-driving operations. However, noise generated from pile-driving is intermittent. The noise levels near the Project site could intermittently and temporarily exceed acceptable noise levels as defined by HUD and EPA. Noise levels would likely peak in the second year of construction, when many of the construction activities would be occurring simultaneously. The closest residences to the Project are located in the town of Cameron approximately 2,000 feet east of the site and 3,000 feet from the nearest pile-driving activity. Noise levels at this distance are not expected to exceed the EPA and HUD recommended residential noise level threshold of 55 dBA and 65 dBA, respectively (see Table 8).

Noise would also be generated during construction by truck traffic delivering material to the site. It is estimated that 32,300 cubic yards of concrete and 785,000 cubic yards of aggregate/rock and 1,103, 155 cubic yards of select fill would be required at the site. Approximately 90 percent of this bulk material would be transported by barge via the Calcasieu Ship Channel. The remaining 10 percent of the required material would be delivered by trucks traveling on State Highway 27/82 through the town of Cameron. Assuming 20 cubic yards per load, about 9,600 truckloads of material would be required. Truck traffic generates sound levels of about 75 dBA at a distance of 50 feet (Federal Highway Administration 2006). Residences located 200 feet from State Highway 27/82 in Cameron would experience noise levels of up to 65 dBA. Noise would be reduced by about 10 dBA indoors with windows open, and 30 to 35 dBA with windows closed (EPA 1974). The noise level from truck traffic would not damage

hearing; however, the noise levels and traffic-induced vibrations could be an annoyance to some residents. The noise generated by the truck traffic during construction activities would be consistent with current uses of Project site roadways, and would be intermittent over an approximately 3- to 5-year period, after which noise would be expected to return to ambient levels.

Table 8
A-Weighted (dBA) Sound Levels of Typical Construction Equipment and Modeled Attenuation at Various Distances[a]

Noise Source	Distance from Source				
	50 feet	100 feet	200 feet	500 feet	1,000 feet
Auger drill rig	84	78	72	64	58
Backhoe	78	72	66	58	52
Booster pump (skid mounted)	81	75	69	61	55
Bull dozer	82	76	70	62	56
Compactor (ground)	80	74	68	60	54
Concrete batch plant	83	77	71	63	57
Concrete mixing truck	79	73	67	59	53
Concrete pump truck	81	75	69	61	55
Concrete saw	90	84	78	70	64
Crane	81	75	69	61	55
Dump truck	76	70	64	56	50
Excavator, barge mounted	81	75	69	61	55
Front-end loader	79	73	67	59	53
Generator	81	75	69	61	55
Grader	85	79	73	65	59
Horizontal boring (hydraulic jack)	82	76	70	62	56
Hydraulic dredge (barge mounted)	82	76	70	62	56
Impact or vibratory pile driver	101	95	89	81	75
Marsh buggy	79	73	67	59	53
Pneumatic tools	85	79	73	65	59
Pumps	77	70	64	56	50
Roller	80	74	68	60	54
Truck (pickup)	75	69	63	55	49
Truck (flat-bed)	74	68	62	54	48
Warning horn	83	77	71	63	57

[a] The dBA at 50 feet is a measured noise emission. The 100- to 1,000-foot sound levels are modeled estimates.
Source: Federal Highway Administration 2006; Bauer and Babich 2007

Construction noise would be controlled or reduced by maintaining equipment in good

working order or using newer equipment, using sound aprons and dampeners where practicable, and muffling the internal combustion engines on the equipment. Other techniques include operating noisy equipment only when necessary and turning off equipment when not in use. The community would be informed regularly about planned construction activities, likely at monthly Cameron Parish Police Jury public meetings. Also, a complaint and feedback mechanism may be instituted to identify and resolve concern.

During operation of the Project, smaller specialized equipment, tools, or supplies necessary to supply and maintain operations of the port would likely arrive via local truck deliveries. While Project operation would result in increased traffic, noise levels are not expected to be louder than those experienced during current conditions. Section 1.17 provides more details on Project impacts on traffic.

Thus, no significant adverse impacts from noise are anticipated.

1.21 CULTURAL RESOURCES

A Phase I Cultural Resources Survey of the port property was completed in April 2017, and a draft report was provided to the State Historic Preservation Office (SHPO). A total of 375 shovel tests were excavated and another 938 either filled with water as they were being dug or were unable to be dug due to standing water. One archaeological site was discovered—BC-1 (16CM174). The authors of the survey report suggest that this site does not possess the qualities of significance and is not eligible for National Register of Historic Places under Criterion D. As a result, no further work is recommended for the surveyed area.

1.22 CUMULATIVE IMPACTS

NEPA requires the lead federal agency to consider the potential cumulative impacts of proposals under its review. Cumulative effects are defined in 40 CFR 1508.7 as those effects that result from:

> ...the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The Project-specific impacts of the Port Cameron Project are discussed in detail in other sections of this EA. The purpose of this section is to identify and describe cumulative impacts that would potentially result from implementation of the proposed Project along with other projects in the vicinity that could affect the same resources in the same approximate timeframe.

To ensure that this analysis focuses on relevant projects and potentially significant impacts, the actions included in the cumulative impact analysis include projects that:

- impact a resource potentially affected by the proposed Project;
- impact that resource within all or part of the time span encompassed by the proposed or reasonably expected construction and operation schedule of the proposed Project; and
- impact that resource within all or part of the same geographic area affected by the proposed Project. The geographic area considered varies depending on the resource being discussed.

1.22.1 Projects and Activities Considered

With respect to past actions, CEQ guidance (2005) allows agencies to adopt a broad, aggregated approach without "delving into the historical details of individual past actions," an approach taken here. The current regional landscape in Cameron Parish, which is a mix of agricultural land, marsh and open-water areas, national wildlife refuges, and an assortment of commercial and industrial facilities, forms the environmental baseline described in other sections of this EA and against which the impacts of reasonably foreseeable future actions were considered. Recently completed projects are included with past projects as part of the

environmental baseline.

Reasonably foreseeable projects that might cause cumulative impacts in combination with the proposed Port Cameron Project include projects that are under construction or planned. These projects were identified through publicly available information from the Southwest Louisiana (SWLA) Economic Development Alliance (SWLA Economic Development Alliance 2016), press releases, internet searches, and planned and proposed oil and gas projects listed on the Federal Energy Regulatory Commission (FERC) website (FERC 2016).

Table 9 lists the projects and activities considered in the cumulative impact analysis, including the location, distance from the project, and project timeframe. Project locations are depicted in figure 2. Descriptions of potential cumulative impacts by resource category are discussed in section 1.22.3.

Several proposed new liquid natural gas (LNG) projects regulated by FERC were identified through the sources mentioned above as possibly being planned for the future, but project sponsors have not yet initiated the pre-filing or application process with FERC due to changing market trends, financing constraints, or other reasons. These projects are not considered reasonably foreseeable and were not included in the cumulative impact analysis. They include:

- SCT&E LNG (0.8 mile south of the proposed Port Cameron Project on Monkey Island);
- Waller Marine LNG Project (2.4 miles south of the proposed Port Cameron Project on the Calcasieu Ship Channel); and
- Live Oak LNG (19.8 miles north of the proposed Port Cameron Project on the Calcasieu Ship Channel).

Additionally, the 2016 SWLA Economic Development Alliance's project report identified a number of small projects being proposed in the Lake Charles area, such as energy and transportation improvement projects; housing, hospital, casino, and hotel developments; and other minor projects typical of ongoing urban development. These projects would not occur in close vicinity of the Port Cameron Project and would have minimal impacts on resources affected by the Project. For those reasons, they are not included in the cumulative impact analysis.

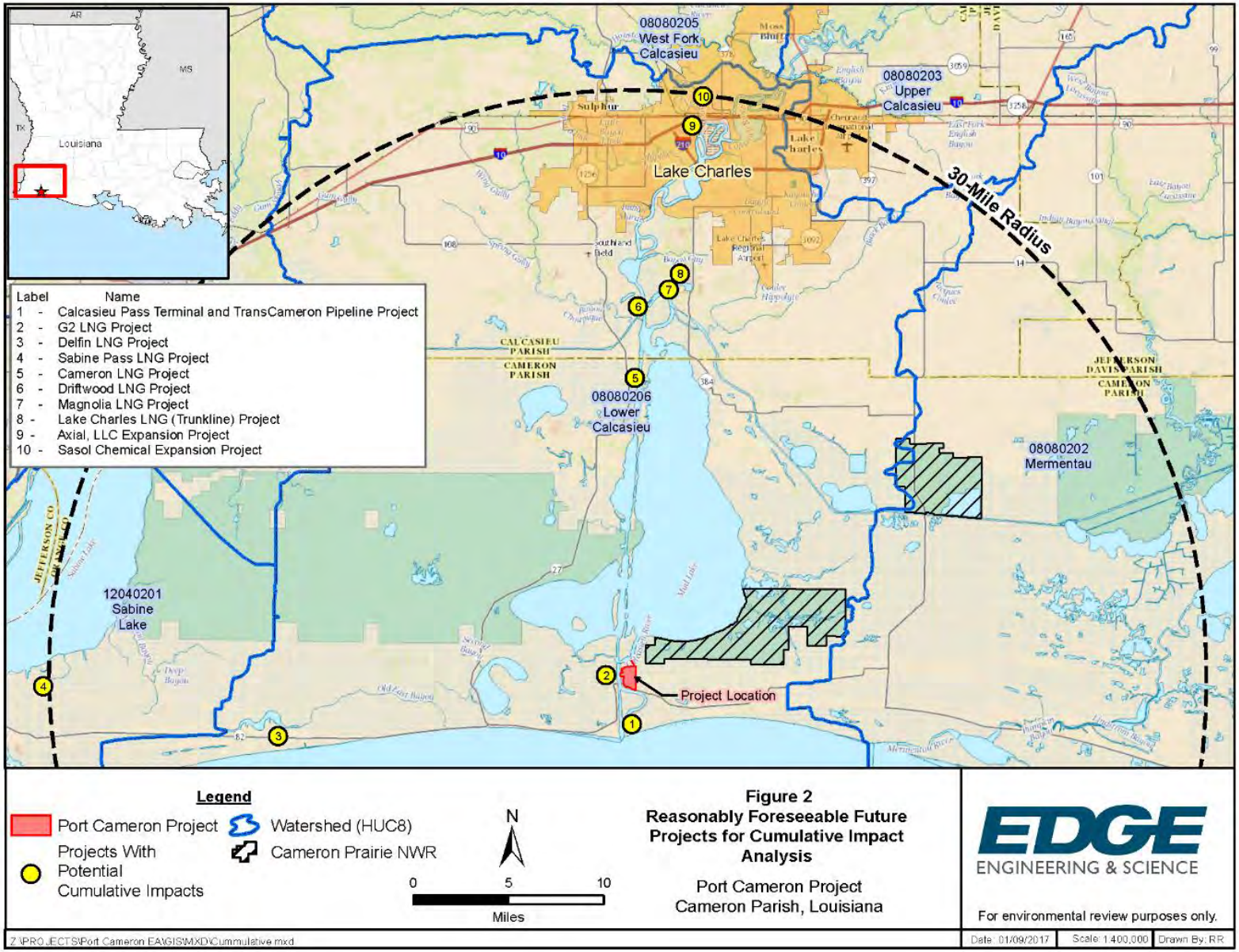
AR
MS
TX
Louisiana
08080205
West Fork
Calcasieu
08080203
Upper
Calcasieu
Sulphur
Lake Charles
30-Mile Radius
Label Name
1 - Calcasieu Pass Terminal and TransCameron Pipeline Project
2 - G2 LNG Project
3 - Delfin LNG Project
4 - Sabine Pass LNG Project
5 - Cameron LNG Project
6 - Driftwood LNG Project
7 - Magnolia LNG Project
8 - Lake Charles LNG (Trunkline) Project
9 - Axial, LLC Expansion Project
10 - Sasol Chemical Expansion Project
CALCASIEU PARISH
CAMERON PARISH
08080206
Lower
Calcasieu
JEFFERSON DAVIS PARISH
08080202
Mermentau
JEFFERSON CO
12040201
Sabine
Lake
Project Location
Legend
Port Cameron Project
Projects With Potential Cumulative Impacts
Watershed (HUC8)
Cameron Prairie NWR
N
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Figure 2
Reasonably Foreseeable Future Projects for Cumulative Impact Analysis
Port Cameron Project
Cameron Parish, Louisiana
EDGE
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For environmental review purposes only.
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Table 9
Reasonably Foreseeable Projects Included in the Cumulative Impact Analysis

Project/ Activity (Mapped #)	Project Description	Estimated Timeframe (Construction/ Operation)	Closest Distance from Facilities
Liquid Natural Gas (LNG) Projects			
Calcasieu Pass Terminal and TransCameron Pipeline Project ("Calcasieu Pass Project") (#1)	Proposed new LNG Terminal on 506-acre site	Unknown/2019	1.2 miles
G2 LNG Project (#2)	Proposed new LNG Terminal on 500-acre site	2017/2022	0.4 mile
Delfin LNG Project (#3)	Proposed onshore aboveground facilities to be constructed on existing industrial land and 1.1-mile pipeline to support an offshore (43 miles off the coast of Cameron Parish) deepwater port	2018/2022	18.2 miles (onshore facilities)
Sabine Pass LNG (#4)	Expansion of an Existing LNG Export Facility	Current	30.3 miles
Cameron LNG Project (#5)	Expansion of the existing Cameron LNG Import Terminal to allow Bi-directional distribution	Current/2018	14.9 miles
Driftwood LNG Project (#6)	Proposed new LNG Export Facility	2018/2022	18.6 miles
Magnolia LNG Project (#7)	Proposed new LNG Export Facility with local distribution	Current/2018	19.6 miles
Lake Charles LNG (formerly Trunkline) Project (#8)	Expansion of an existing LNG Export Facility	Current/2019	20.5 miles
Ethane Projects			
Axiall/Lotte Chemical Project (#9)	Construction of Ethane Cracker for Ethane Production	Unknown/2018	28.3 miles
Sasol Chemical Expansion Project (#10)	Expansion of an existing Ethane Production Facility	Current/2017	29.9 miles
State and Federal Projects			

Table 9
Reasonably Foreseeable Projects Included in the Cumulative Impact Analysis

Project/ Activity (Mapped #)	Project Description	Estimated Timeframe (Construction/ Operation)	Closest Distance from Facilities
USACE and Lake Charles Harbor and Terminal District's Maintenance Dredging of the Calcasieu Ship Channel	Maintenance dredging along the Calcasieu Ship Channel	Ongoing	0.0 feet (adjacent to Port Cameron entrance)
Marsh restoration and enhancement projects in the Cameron Prairie NWR	Restoration projects planned or under construction through funding from the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) including, for exampole, the Cameron-Creole Watershed Grand Bayou Marsh Creation Project and the Cameron-Creole Freshwater Introduction Project	Ongoing	0.5 (in Cameron Prairie NWR)

Sources: FERC 2016 docket nos. CP14-347, CP15-490, CP14-517, CP15-550, CP15-560, PF16-2, PF16-6; SWLA 2016; Federal Register 2016

1.22.2 Potential Cumulative Impacts by Resource

The following sections address the potential cumulative impacts of the Port Cameron Project and the other reasonably foreseeable projects identified within the cumulative impact area on specific environmental resources. The geographic impact area for each of the resources affected by the proposed Project is defined for each. The other projects considered in each section are those for which impacts on the resource discussed would be within the same geographic impact assessment area as those that would result from the proposed Port Cameron Project and would occur within the same timeframe.

1.22.2.1 Geology, Soils, and Topography

The cumulative impact area for geological resources, soils, and topography was defined as the area within, or immediately adjacent to, the construction boundary of the proposed port site as well as the proposed beneficial use site in the Cameron Prairie NWR. The other projects encompassed by this area include maintenance dredging of the Calcasieu Ship Channel near the proposed entrance to the port site and marsh restoration projects in the Cameron Prairie NWR near the beneficial use site.

At the proposed port site, approximately 9.7 million cubic yards of material would be excavated and dredged to construct the port canals, which would convert 106.4 acres of existing land to open water. Dredging and excavation would minimally impact the local geology by redistributing clays and sediments. The majority of the dredged and excavated material (approximately 5.7 million cubic yards) would be used to elevate portions of the site to 7.0 to 10.0 feet above sea level where land-based infrastructure would be located. Excavation,

dredging, and relocation of soils and sediments associated with construction of the port would alter the existing topography but would not markedly impact the geology of the area.

Construction activities associated with the Port, such as grading, excavation, backfilling, and the movement of construction equipment may affect soil resources. These activities can compact soil, reducing porosity and increasing runoff potential. To protect soil resources and minimize impacts on soils, Port Cameron would implement its SWPPP, which would include applying measures to control erosion and sedimentation during construction and ensuring proper restoration and revegetation of disturbed areas. As a result, most impacts on soils would be short term.

In order to maintain a constant channel depth, maintenance dredging by the USACE is scheduled to occur regularly within the Calcasieu Ship Channel. Because an increase in channel depth does not occur and disposal sites already exist, maintenance dredging does not change the topography or geology; therefore, no cumulative impacts on topography or geologic resources would occur.

Approximately 4.0 million cubic yards of dredged and excavated material would be used beneficially to create marsh habitat in the nearby East Cove Unit of the Cameron Prairie NWR. Dredged materials would be pumped via a hydraulic dredge through a temporary aboveground pipeline to re-create approximately 556 acres of marsh in the NWR. Soils formed from the placement of dredged material for beneficial use would have a higher inorganic content than the naturally occurring soils typical of coastal marshes; therefore, they would likely be denser and possibly less susceptible to erosion.

Other marsh creation projects expected to occur in the Cameron Prairie NWR would result in soil impacts similar to the Port Cameron beneficial use site. However, the combined impacts resulting from both the Port Cameron marsh creation and other marsh creation projects would provide a net benefit to soils in the Cameron Prairie NWR by possibly reducing susceptibility to erosion.

1.22.2.2 Floodplains and Hydrology

The cumulative impact area for floodplains was considered to be the construction limits of the proposed port site and the Cameron Prairie NWR for beneficial use of dredged material. A Hydrologic Modification Impact Analysis (HMIA) was conducted to quantify Project impacts on hydrology at the port site during the 10-year and 100-year design storms and determined that volumetric runoff under with-Project conditions would be reduced as a result of the conversion of 106.4 acres of ground cover to open water. Surface water flow would increase and flooding potential would decrease on the Project site due to the replacement of the 60-foot-wide W-1 canal with the wider 700-foot-wide proposed open-water canals, which would flow directly to the Calcasieu Ship Channel. Flooding is also expected to be reduced upstream of the Project due to the more efficient response of the W-1 canal drainage system and the reduction of stormwater from the removal of 505.4 acres of land from the larger W-1 canal drainage area. For these reasons, the Project would have little potential to adversely impact the natural function of the floodplain or result in increased flood velocities. As such, no adverse cumulative impact is expected from the addition of Port Cameron to other planned projects in the vicinity.

In the proposed beneficial use site, the conversion of open water to marsh would help to restore historic hydrologic conditions, enhance flood storage capacity, and decrease flood velocities during storm events in the NWR. Other reasonably foreseeable marsh creation projects in the NWR funded through CWPPRA would result in similar benefits to floodplains through the conversion of open water to marsh, thereby adding a net cumulative beneficial impact to hydrologic and floodplain functioning in the NWR.

1.22.2.3 Water Quality

Ground Water

The cumulative impact area established for groundwater resources includes the Chicot Aquifer, which underlies the proposed Port Cameron Project. The other projects encompassed by the impact area that may have impacts on groundwater resources include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- Delfin LNG Project;
- Sabine Pass LNG;
- Cameron LNG Project;
- Driftwood LNG Project;
- Magnolia LNG Project;
- Lake Charles LNG (formerly Trunkline) Project;
- Axiall/Lotte Chemical Project; and
- Sasol Chemical Expansion Project.

During construction and operation of the projects listed above, groundwater withdrawal from the Chicot Aquifer may cause lowered water levels and saltwater encroachment. The proposed Port Cameron Project would not add cumulative impacts to withdrawal rates and associated saltwater encroachment because no groundwater withdrawal would be required.

With the exception of dredging the proposed open-water canals and installing sheet pile walls and concrete piles, construction of the Port Cameron Project would involve shallow, temporary, and localized excavation. Impacts would be temporary and minor. The site of the proposed open water canals would be dredged to a depth of 33 feet-bgs. Sheet pile walls and concrete piles required for the bulkhead, bridges, water control structure, and pump station would be driven to depths no lower than approximately 70 to 80 feet. These piles would be shallower than the water table of the shallowest aquifer of the Chiquot Aquifer System, the 200-foot sand aquifer. Therefore, driven piles would not directly impact the underlying aquifer or

result in mixing of groundwater between confining layers, and thus would not cause a cumulative impact in combination with other projects above the aquifer.

Surface Water

The cumulative impact area associated with surface water resources affected by construction and operation of the proposed Port Cameron Project includes the Calcasieu River in close vicinity of the entrance to the proposed port canals and the Cameron Prairie NWR in vicinity of the proposed beneficial use site. The other projects encompassed by the impact area for surface water at the proposed port site include the following:

- G2 LNG;
- Calcasieu Pass Project; and
- maintenance dredging of the Calcasieu Ship Channel.

The activity with the greatest potential impacts on surface waters would be dredging the 106.4-acre port canals. A combination of onshore excavation and dredging would be used to construct the open-water canals. Potential impacts on water quality in the Calcasieu Ship Channel near the entrance to the port canals would include temporary increases in suspended solids and turbidity levels due to dredging. Impacts on water quality due to dredging would be minimized through the use of a hydraulic cutterhead dredge, which minimizes turbidity from resuspension of the sediment in the water column.

If dredging at Port Cameron's proposed canals were to occur at the same time as dredging for the G2 LNG and the Calcasieu Pass Projects, and/or maintenance dredging of the Calcasieu Ship Channel, the adverse impacts on water quality (e.g., increased turbidity and total suspended solids) could be exacerbated in the vicinity of the proposed port. However, dredging impacts tend to be localized (i.e., generally confined to the areas close to the dredging activity) and limited primarily to the time when the dredging is taking place (i.e., the effects cease soon after the dredging stops).

Before any dredging would occur, Port Cameron and the proponents of the other projects would be required to obtain authorization under sections 10 and 404 of the Clean Water Act from the USACE and corresponding section 401 Water Quality Certification from the state. In addition to the USACE permits and section 401 water quality certification, Port Cameron and the proponents of the other projects listed above would be required to comply with the LDEQ LPDES regulations for discharge of pollutants in stormwater or point source discharges. These authorizations would be contingent on the companies' use of best management practices to ensure that state water quality standards are not violated. Compliance by the proponents of the other projects with these regulations and project-specific best management practices would minimize cumulative effects on surface waters and thus would not cause a cumulative impact in combination with other projects above the aquifer.

1.22.2.4 Wetlands

The cumulative impact area for wetlands was considered to be the Lower Calcasieu

Watershed. The other projects encompassed by this impact area that could contribute to cumulative impacts on wetlands include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- Delfin LNG Project;
- Cameron LNG Project;
- Driftwood LNG Project;
- Magnolia LNG Project;
- Lake Charles LNG (formerly Trunkline)Project;
- Axiall/Lotte Chemical Project;
- Sasol Chemical Expansion Project;
- maintenance dredging of the Calcasieu Ship Channel; and
- marsh restoration and enhancement projects in the Cameron Prairie NWR.

As described in section 1.6, construction of the Port Cameron facilities would result in the permanent loss of 322.9 acres of wetlands. The natural hydrology of these wetlands has been disrupted by maintained drainage canals, water control structures, and roads. Natural wetland functions have been degraded by current land use at the site, including cattle grazing and hay production, which have diminished benefits to wildlife and aquatic resources. Although loss of these lands would result in a loss of potential stopover habitat for migratory birds, this loss is minor when compared to the quality habitat provided by the adjacent 14,927- acre East Cove Unit of the Cameron Prairie NWR, located 0.5 mile east of the Project site.

Port Cameron would also restore 556 acres of coastal marsh within the boundaries of the East Cove Unit where open water currently exists. This beneficial use plan would offset the proposed wetland impacts at the port site and result in long-term benefits to wetlands within the Lower Calcasieu Watershed. Given the low quality of habitat at the proposed Port Cameron site, and the restoration of historic habitat at the nearby Cameron Prairie NWR, adoption of the Proposed Action would not result in a net loss of wetlands in the area and thus would not cause a cumulative net adverse impact to wetlands.

Construction of the projects listed above in the Lower Calcasieu Watershed would permanently convert estuarine, emergent, scrub-shrub, and forested wetlands to uplands, water control structures, and other features of industrial and commercial facilities. Dredging of the Calcasieu Ship Channel would have negligible, if any, cumulative impacts on wetlands.

The proponents of each of these identified projects would need to obtain applicable permits from the USACE. Therefore, although construction of the Port Cameron Project and the other projects in the impact area could result in the conversion or reduction in the amount of existing wetlands in the vicinity, the creation of new wetlands and restoration or enhancement of existing wetlands, as required by the USACE, are expected to appropriately mitigate for impacts on wetland resources and minimize any cumulative wetland effects. CWPPRA marsh creation and enhancement projects in the watershed are expected to have beneficial impacts on wetlands in the Lower Calcasieu Watershed. Therefore, no net adverse cumulative impact on wetlands from the combination of the identified projects would be expected.

1.22.2.5 Coastal Resources

The cumulative impact area established for coastal resources includes Louisiana's 2012 Coastal Zone, which encompasses the proposed Port Cameron Project. The other projects that would be located in the Coastal Zone include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- Delfin LNG Project;
- Sabine Pass LNG Project;
- Cameron LNG Project;
- Driftwood LNG Project;
- Magnolia LNG Project (beneficial use of dredged material component);
- maintenance dredging of the Calcasieu Ship Channel; and
- marsh restoration and enhancement projects in the Cameron Prairie NWR.

In compliance with the CZMA, Port Cameron and the projects listed above must obtain a Coastal Use Permit from the LDNR-OCM before beginning construction to ensure that these projects are consistent with the rules and regulations of the CZMA. The creation of wetlands through the beneficial use of dredged material and other restoration projects would have a beneficial effect on coastal zone resources.

1.22.2.6 Vegetation

No other projects are expected to add cumulative impacts to vegetation within the construction limits of the proposed port site or the beneficial use site. Construction of the proposed port site would affect about 505.4 acres of land of the majority of which contains wetland and grassland vegetation. This vegetation would be cleared during construction of the Project. Following construction, all affected vegetation would be permanently converted to open water within the canals, to industrial use associated with operation of the facility, or re-vegetated

to become an upland herbaceous community.

In cooperation with the Cameron Prairie NWR, Port Cameron would transport approximately 4.0 million cubic yards of hydraulically dredged spoil to the proposed beneficial use site by way of a temporary, 6.6-mile-long pipeline that would be laid on the ground surface. Placement of the dredge pipeline would not have a significant impact on vegetation. Conversion of open water to a coastal marsh would result in an increase in vegetation cover. The additional vegetation cover would support a diversity of wildlife species and provide coastal protection from storm events, flooding, and erosion. CWPPRA marsh creation and enhancement projects in the NWR are expected to have cumulative beneficial impacts on vegetation in the NWR. As more acreage of marsh would be created at the beneficial use site than would be removed from the Port site, the project would not contribute net vegetative cover loss to the cumulative loss of vegetation in Cameron and Calcasieu Parish due to other developments in the area.

1.22.2.7 Terrestrial Wildlife, including Threatened and Endangered Species

The cumulative impact area for wildlife was considered to be areas within 5 miles of the construction limits of the port site to account for a typical range of wildlife movements off the site. The other projects encompassed by the impact area that may have a cumulative impact on terrestrial wildlife include the following:

- Calcasieu Pass Project;
- G2 LNG Project; and
- marsh restoration and enhancement projects in the Cameron Prairie NWR.

Cumulative impacts on wildlife from construction of the Port, the Calcasieu Pass Project, and the G2 LNG Project would include displacement, stress, and direct mortality of some individuals. Clearing and conversion of vegetation would potentially reduce suitable cover, nesting, and foraging habitat for some wildlife species. Mobile wildlife species such as birds and terrestrial mammals could relocate to similar, nearby habitat. However, inadvertent injury to or mortality of smaller, less mobile species such as reptiles and amphibians could result from construction of the Project. To the extent that construction periods overlap, these impacts may be exacerbated. Operation of the facilities would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities adjacent to the Calcasieu Ship Channel, most wildlife in the area is acclimated to these conditions.

Although the loss of vegetation due to construction of these projects would result in a loss of potential stopover habitat for migratory birds, this loss would be considered insignificant when compared to the quality habitat provided by the nearby Sabine NWR and the Cameron Prairie NWR. In addition, Port Cameron would assist the USFWS in restoring 556 acres of coastal marsh within the boundaries of the Coastal Prairie NWR, where open water currently exists. This restoration, coupled with reasonably foreseeable CWPPRA projects in the Sabine and Cameron Prairie NWRs, would beneficially impact local wildlife. Therefore, cumulative impacts due to noise, light, and human activity during operation of the facilities would be

negligible.

1.22.2.8 Aquatic Wildlife, including Threatened and Endangered Species and EFH

The cumulative impact area associated with aquatic resources and EFH affected by the proposed Port Cameron Project includes bodies of water within 1.5 miles of the port site, including the Calcasieu Ship Channel and open water in the Cameron Prairie NWR, to account for impacts from construction and operation activities such as turbidity and noise. The other projects encompassed by this impact area that could contribute to cumulative turbidity and noise impacts on aquatic resources, including EFH, include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- maintenance dredging of the Calcasieu Ship Channel; and
- CWPPRA restoration projects in the Cameron Prairie NWR.

Potential impacts on aquatic resources from construction of the port would be dredging at the proposed Port Cameron entrance, which would result in a localized increase in sedimentation and turbidity within the Calcasieu Ship Channel during construction. Soft bottom habitat, which is used by benthic (bottom-dwelling) organisms, would also be affected by removal of sediments and settling of suspended sediments. Benthic organisms may experience direct mortality during these activities, while other more mobile species, such as blue crab and demersal finfish, may experience temporary displacement. Similarly, fish species using the water column (pelagic species) would be temporarily displaced by the increase in turbidity and construction noise.

Although dredging would impact the water column and soft bottom sediments, those impacts (turbidity and sedimentation) are in line with impacts normally experienced along the ship channel due to regular maintenance dredging. In addition, these habitats would recover within a short period after construction has ended; therefore, the impact on EFH from dredging within the ship channel would be negligible. Although estuarine wetlands at the Project site would be converted to developed lands, the current usage of these lands (cattle grazing with altered hydrology) suggests little to no value as EFH.

Manatees and sea turtles are often found near the surface of the water, where they may be vulnerable to vessel strikes, especially if the turtles are cold-stunned from cold weather events. To help reduce the risk of strikes or other potential disturbances associated with marine traffic, Port Cameron would include NOAA Fisheries' Vessel Strike Avoidance Measures and Reporting for Mariners in its training materials, which includes measures for vessel operators to watch for marine mammals and sea turtles and implement avoidance techniques if sighted (NOAA Fisheries 2008). Increases in underwater noise from construction activities could result in avoidance of the area; however, as in-water pile-driving is not proposed and the Project is adjacent to an active shipping channel and wharfs, underwater noise impacts are not anticipated to be significant.

If dredging and pile driving activities required for the Calcasieu Pass Project and the G2

LNG Project occur concurrently with dredging required for the Port Cameron Project, impacts on aquatic resources are likely to be exacerbated as a direct result of each of the projects' dredge activities and as sediments resettle following construction. However, these impacts would occur within the Calcasieu Ship Channel, which is maintained (including periodic maintenance dredging) to support shipping for industrial activity. Additionally, benthos in soft bottom habitats recover rapidly through various reproductive and recolonization mechanisms. Impacts on estuarine fisheries, including those related to changes in benthic forage, should be temporary, with habitat use reverting to normal conditions following completion of construction.

Each of the projects listed above (including the Calcasieu Pass Project, the G2 LNG Project, and maintenance dredging of the Calcasieu Ship Channel) would be required to comply with section 7 of the ESA. As a result of the section 7 consultation process, the FWS and NOAA Fisheries would review each project's potential impacts on federally listed species and either provide concurrence that the project would not adversely affect listed species or issue a Biological Opinion as to whether the project would likely jeopardize the continued existence of listed species. Therefore, cumulative impacts on threatened and endangered species would be less than significant.

Beneficial use of dredged material for the Port Cameron Project would restore about 556 acres of eroded coastal marsh (open water) to its historic state. The dredge placement area within the East Cove Unit, which includes areas of degraded marsh (presently mud/shell/sand and estuarine water column habitats), would receive dredged material to create estuarine emergent wetland habitat. Therefore, although some EFH would be lost within the East Cove Unit (soft bottom sediments and open water), it would be replaced with a more productive, high quality EFH (estuarine emergent marsh), resulting in a net beneficial effect on local EFH. Reasonably foreseeable marsh creation and enhancement CWPPRA projects in the Cameron Prairie NWR would contribute cumulative beneficial impacts on EFH.

1.22.2.9 Land Use

The cumulative impact area for land use was considered to be the area within 1 mile of the proposed port site. The other project encompassed by this impact area that would affect land use includes the G2 LNG Project.

Construction of the port facilities would affect a total of 505.4 acres of land comprised predominantly of hydraulically managed wetlands (National Land Cover Database 2011). Of this, 106.4 acres would be converted to open water canals. However, the proposed port site is surrounded by commercial and industrial facilities along the Calcasieu Ship Channel and the Cameron Loop. The proposed port site would be consistent with these land uses. Additionally, construction and operation of the Project would fulfill the parish's goal of expanding maritime services for the offshore oil and gas industry as an economic development strategy (see Section 1.12 for more details regarding the parish's economic development goals with regard to land use). The Project would also be consistent with Louisiana's 2012 Coastal Master Plan by supporting Louisiana's port and navigation industries. The Project is being designed and developed in consultation with LDNR and in compliance with Louisiana Coastal Zone consistency guidelines.

If the G2 LNG Project is permitted and constructed, the facility would convert approximately 770 acres of upland and wetland habitats to industrial uses. This would contribute permanent cumulative impacts to land use in the study area. However, because this industrial project and the proposed Port Cameron Project are consistent with the parish's economic development goals and because these projects would be required to comply with Louisiana Coastal Zone consistency guidelines and beneficial use and wetland mitigation requirements, cumulative impacts to land use would not be significant.

1.22.2.10 Socioeconomics and Community Resources

The cumulative impact area for socioeconomics includes Cameron and Calcasieu Parishes. All of the LNG and ethane projects identified in Table 9 are included in the analysis because non-local workers would likely relocate to these parishes during construction and operation of the projects. Because the number of facilities that will actually be built or expanded, as well as the timing of their construction is uncertain, the socioeconomic impacts discussed could vary depending on these variables.

Employment

During construction of the Port Cameron facility, an estimated yearly-average of 1,290 direct and indirect temporary jobs would be created, of which 646 would occur in Cameron Parish (Scott 2013). The LNG and Ethane projects listed in Table 9 would also require construction workers during the same time period as Port Cameron. These projects would employ thousands of construction workers during peak construction years. Following the completion of construction, collectively, the projects are expected to result in the addition of a smaller number of more permanent jobs due to direct and induced economic growth.

Due to forecasted long-term industrial growth in the region, area leaders and educational institutions have coordinated efforts to help the region meet future workforce requirements in a way that can stabilize long-term employment in the region. For example, the SWLA Economic Development Alliance has collaborated with education facilities and industry to develop a Workforce Resource Guide, which provides residents with step-by-step instructions for finding employment and includes a description of the types of training required for each profession, as well as the training centers in Southwest Louisiana that offer the relevant certifications (SWLA Economic Development Alliance 2016). The cumulative effect of the projects on employment would be a reduction in unemployment in the parishes and potentially the need to train and hire construction workers from outside Southwest Louisiana.

Housing

The influx of non-local workers would affect the availability of housing in Calcasieu and Cameron Parishes. The cumulative impact on local housing may result in increased rental rates and housing shortages for lodging if all of the proposed and planned projects are constructed within the same timeframe. This would benefit the local housing market, but would adversely affect those seeking housing. Some members of the workforce may be forced to commute longer distances to obtain housing in adjacent parishes or Texas.

To accommodate the anticipated influx of construction workers for the proposed projects

in the area, seven worker housing developments in Sulfur, Mossville, Vinton, and Westlake in Calcasieu Parish with a total of 13,688 units have been planned for construction (SWLA Economic Development Alliance 2016b). One of these, the 2,500-unit Moss Lake Village in Sulfur, has already been constructed. Additionally, proposed LNG facilities in the cumulative impact assessment area plan to provide on-site housing for construction workers, including, but not limited to, the G2 LNG Project (FERC 2016 docket number PF16-2-000). As a result, it is expected that cumulative impacts on housing in the two parishes would be moderate and short-term during construction of the projects. Cumulative impacts on housing during operation of the projects would be minor and permanent due to the comparatively smaller number of operation personnel expected to be hired for the projects.

Community Resources

The combined construction workforces of the projects would increase the need for some public services, such as police, medical services, and schools. The need for these services would be spread throughout Cameron and Calcasieu Parishes, where the construction workers are expected to be housed. With the increase in local taxes and government revenue associated with the proposed projects, which could provide funding for expansion and/or improvement of community resources, the overall cumulative impact on public services would be expected to be minor.

Because construction of the LNG and ethane projects identified in Table 9 would last several years, it is likely that some construction workers would bring their families, including school-age children. This would increase the population in some schools in Cameron and Calcasieu Parishes. However, it is likely that those families would be housed throughout multiple school districts. As a result, it is expected that the cumulative impact on schools would be minor.

1.22.2.11 Recreational Resources

The cumulative impact area for recreational facilities was considered to be the area within 1.5 miles of the proposed port site. The other projects encompassed by this area include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- maintenance dredging of the Calcasieu Ship Channel; and
- CWPPRA restoration projects in the Cameron Prairie NWR.

Increased noise associated with construction activities at the port site, such as pile-driving, dredging, and excavation, would likely deter recreational users from fishing in the immediate vicinity of Project activities. Recreationists and tourists traveling State Highway 27/82 (a Louisiana State Scenic Byway) during peak traffic times could experience temporary traffic delays during construction. However, as discussed in more detail in Section 1.17, traffic impacts would be minor and limited to the duration of construction. Dredged material pumping

operations in the East Cove Unit of the Cameron Prairie NWR would likely cause short-term disruptions to recreational fishing and wildlife viewing in the vicinity of pumping operations.

The cumulative impact on recreational users of the Calcasieu Ship Channel would be greatest if pile driving and dredging for the Port Cameron, Calcasieu Pass Project, G2 LNG Project, and maintenance dredging of the Calcasieu Ship Channel were all to occur at the same time. Additionally, a moderate increase in barge traffic would occur on the ship channel due to construction deliveries to the port site, the Calcasieu Pass Project, and the G2 LNG Project. However, because barges do not have moving security zones, impacts on recreational boaters would be intermittent, minor, and consistent with existing uses of the waterway.

During construction of the Port Cameron Project, the Calcasieu Pass Project, and the G2 LNG Project, the State Highway 27/82 Scenic Byway would experience an increase in daily vehicle trips as a result of material and equipment deliveries and commuting of construction personnel to and from the project sites. Cumulative impacts may be mitigated somewhat because worker commuting would avoid peak traffic times on this road way, and a portion of the construction materials would be delivered by barge on the ship channel. Cumulative impacts on users of the roadway would be temporary and limited to the duration of construction.

The cumulative impacts on recreational users of the East Cove Unit of the Cameron Prairie NWR would be greatest if dredged material pumping operations for Port Cameron were to occur simultaneously with other restoration activities for CWPPRA projects in the NWR. It is likely that recreational users would avoid the area during these activities and relocate to other areas in the NWR.

1.22.2.12 Visual and Aesthetic Resources

The cumulative impact area for visual resources was considered to be the area within the viewsheds of the port site and the beneficial use site. The other projects that may have cumulative impacts on visual resources encompassed by this impact area include the Calcasieu Pass Project and the G2 LNG Project.

The landscape surrounding the Port Cameron Project is relatively flat with expansive views. Construction and operation activities at the proposed port site would be visible to users of the Calcasieu Ship Channel and the Cameron Ferry Terminal, employees at the existing commercial and industrial businesses along Wakefield Road and State Highway 27/82, and recreationists traveling the State Highway 27/82 Scenic Byway. Dredging, pile driving, and excavation would likely be visible to these viewers during construction. The nearest residences to the proposed port site are approximately 0.4 mile east. While this distance would provide a buffer for visual impacts, the flat topography of the Project site may allow some construction activities to be visible from local residences, depending on the location and perspective of the viewing point. During operation of the proposed port, visual impacts may be associated with various features, including heavy lift cranes, exterior lighting, and offshore support vessels calling at the port. These industrial and maritime activities would be consistent with current land use in the area of surrounding port site.

If permitted and constructed, the Calcasieu Pass and G2 LNG Projects may result in

permanent cumulative impacts within the viewshed of the port site. Depending on the viewer's location, the primary visual impacts on the viewshed would be the LNG storage tanks and flare stacks that would likely be constructed at these LNG facilities. The proposed port site would provide a permanent but minor incremental cumulative impact to visual resources.

1.22.2.13 Transportation

Road Transportation

The cumulative impact area for road transportation was considered to be Cameron and Calcasieu Parishes. Calcasieu Parish is included in the roadway traffic analysis due to the number of construction workers potentially residing in and commuting from areas in that parish to the proposed Project site, as well as the other proposed and planned projects in the area. All of the LNG and ethane projects identified in Table 9 were included in this analysis due to their potential to impact roadway traffic in the two parishes.

Simultaneous construction of the proposed projects could result in an increase in daily vehicle trips on roadways in the parishes as a result of material and equipment deliveries to the project sites. Due to the distance between these project sites, cumulative impacts on traffic from the projects could be moderate at times, but are expected to be intermittent, short-term, and localized.

Cumulative impacts on roadways associated with construction personnel commuting from the Lake Charles Region to the various projects under construction could also contribute to cumulative regional traffic congestion. However, any cumulative traffic impacts would be temporary and short-term. Workers associated with these types of projects would generally commute to and from the project sites during off-peak traffic hours (e.g., before 7:00 AM and after 6:00 PM). In some cases, project proponents may develop off-site parking lots so that workers could be bussed to the project site, which would reduce the amount of traffic during construction. This is proposed for the Calcasieu Pass Project (FERC 2016), for example, which has an estimated construction workforce of 1,810 workers. Additionally, the proponents of some of the projects, including but not limited to the Port Cameron and Calcasieu Pass Projects, propose to use barges for the majority of construction material deliveries (FERC 2016). Overall, cumulative impacts on local users of the roadways if construction of the projects occurs simultaneously is expected to be moderate but temporary.

Port Cameron commissioned a traffic impact study to assess potential impacts of vehicular traffic associated with operation of the Port Cameron Project (Gresham Smith and Partners 2016). The study found that the existing roadway network has more than sufficient capacity to accommodate the expected peak hour traffic volumes associated with operation of the port facility. The study concluded that during operation of Port Cameron, State Highway 27/82 intersections would operate with peak hour LOS A, B, or C, indicating that traffic would be flowing freely, or nearly flowing freely (Gresham Smith and Partners 2016). The number of workers employed for operation of the proposed Calcasieu LNG facility is expected to be 130 workers. As such, impacts on local users of the roadway due to increased traffic during operation of the projects would be negligible and thus would not add significantly to the cumulative impact of increased industry in the project area.

Marine Transportation

The cumulative impact area for marine traffic was considered to be the Calcasieu Ship Channel, which includes the Industrial Canal. The other projects encompassed by the impact area with the potential to impact marine traffic include the following:

- Calcasieu Pass Project;
- G2 LNG Project;
- Cameron LNG Project;
- Driftwood LNG Project;
- Magnolia LNG Project; and
- Lake Charles LNG (formerly Trunkline) Project.

The 2016 Traffic Impact Study for the Project (Gresham Smith and Partners 2016) estimates that usage of the Cameron-Holly Beach Ferry would increase during construction and operation of the Port Cameron Project, but would continue at less-than-full capacity. Existing ferry operations would not be adversely impacted by the Project.

Simultaneous construction of the proposed projects listed above could result in an increase in daily usage of the ferry as a result of workers commuting to and from project sites, although the ferry capacity may not be exceeded given the limited use the ferry currently experiences. The ferry operates 24 hours daily and the ferry is scheduled to complete two round trips every hour. Workers associated with the types of projects listed above would generally commute to and from the project sites during off-peak traffic hours (e.g., before 7:00 AM and after 6:00 PM), which would stagger the timing of ridership demands and mitigate wait times for current users of the ferry. In some cases, project proponents may house workers on site, which would reduce the number of vehicles using the ferry.

Port Cameron estimates that configurations of two to six marine deliveries would occur monthly during construction of the port. When combined with deliveries associated with construction of the projects listed above, cumulative impacts on vessel traffic within the Calcasieu Ship Channel would noticeably increase the number of barges transiting the channel. However, because barges do not have moving security zones, impacts on the other users of the waterway would be temporary, minor, and consistent with existing use of the waterway.

A Navigation Impact Study was completed to determine how the proposed Port Cameron Project would impact navigation in the Calcasieu Ship Channel (Moffatt & Nichol 2015). The vessels expected to call at Port Cameron once in operation include offshore supply vessels, such as platform supply vessels, anchor handling towing supply vessels, mini supply vessels, and fast support vessels. All vessels calling at the port would be expected to have a maximum draft of 23 feet and a deadweight tonnage, a measure of a vessel's weight carrying capacity, below 16,000. Based on guidance from the Lake Charles Pilot Association for the study, vessels of this size would not require pilotage (Moffatt & Nichol 2015). Because non-piloted vessels are

subject to fewer restrictions and can be maneuvered between other vessels using the channel, this increase in supply vessels would not impact the capacity of the channel.

As discussed in Section 1.17.3, the Port of Lake Charles commissioned a simulation to investigate the impact of forecasted increased traffic on the operations of the Calcasieu Ship Channel and to assess the need for changes to channel infrastructure and regulations (Ausenco 2015). The study evaluated the cumulative impact of expanded operations by existing channel users and the construction of six additional LNG terminals. The results of the simulation indicate that although the ship channel has the capacity to accommodate the cumulative increase in vessel traffic, the median wait time is expected to increase between 2013 and 2023 by 4.5 hours per vessel (Ausenco 2015). The study further notes that LNG carriers would experience the highest increase in median wait time. Due to the expected increase in median wait time, the cumulative impacts on marine traffic within the Calcasieu Ship Cannel and Industrial Canal during operation of the proposed projects listed above would be permanent and moderate. However, because the vessels expected to call at Port Cameron would not require pilotage or moving security zones, operation of the Port Cameron Project would add a negligible incremental impact to these cumulative impacts.

1.22.2.14 HTRW

No direct impacts on HTRW sites would be expected during construction and operation of the Port Cameron Project, and no indirect impacts are expected. The probability of encountering contaminated sites or toxic substances during project construction is considered low. For these reasons, HTRW was not included in the cumulative impact assessment.

1.22.2.15 Air Quality

The cumulative impact area for air quality during construction of the proposed Port Cameron Project is the area within 0.5 mile of the proposed port site. The other project encompassed by this impact area that may impact air quality is the G2 LNG Project.

Construction of the Port would affect air quality due to emissions from the combustion engines used to power construction equipment, vehicle emissions traveling to and from the port site, marine deliveries of construction materials, and from fugitive dust emissions resulting from earth disturbing activities and equipment movement on dirt roads. The potential for cumulative construction emissions impacts would be greatest if both Port Cameron and the G2 LNG Project undertook site preparation simultaneously, at which time fugitive dust production would likely be at its peak. Emissions from equipment engines and vehicles operating concurrently for the two projects would also result in cumulative air quality impacts in the local area. Port Cameron and G2 LNG would implement mitigation measures to minimize construction impacts on air quality, including application of water to minimize fugitive dust, compliance with applicable EPA mobile source emission performance standards, and use of equipment manufactured to meet air quality standards. Based on the duration of construction and the implementation of appropriate mitigation measures, the cumulative impacts on air quality due to construction of these facilities would not be significant.

The region in the vicinity of the proposed port is currently in attainment with air quality

standards; however, increases in industrial point sources could affect local and regional air quality. If constructed and operated, the G2 LNG Project may be a major source of air emissions in the area. However, it is anticipated that future tenants of Port Cameron would be offshore-related oil and gas service entities and would not generate significant annual air emissions as stationary sources. As such, the proposed Project is not anticipated to add cumulative impacts to air quality during operations.

1.22.2.16 Noise

The cumulative impact area for noise was conservatively estimated to be the area within 1.5 miles of the Port Cameron Project site. The other projects encompassed by this impact area that could contribute to cumulative noise impacts include the following:

- Calcasieu Pass Project;
- G2 LNG Project; and
- maintenance dredging of the Calcasieu Ship Channel.

The greatest potential for cumulative noise impacts associated with the Port Cameron Project would be during construction from pile driving activities. Pile driving activities have the potential to produce sound levels of up to 81 dBA at receptors located within 500-1,000 feet of the project, including workers at nearby commercial and industrial facilities and users of the Cameron-Holly Beach Ferry. The closest residences to the Project are located in the town of Cameron approximately 2,000 feet east of the site and 3,000 feet from the nearest pile driving activity. Noise levels at this distance are not expected to exceed the EPA and HUD recommended residential noise level thresholds of 55 dBA and 65 dBA, respectively.

Construction of the G2 LNG Project, which would also include pile driving, could overlap with the construction of Port Cameron and contribute to noise levels in the area. The G2 LNG Project is located approximately 1,300 feet from the nearest Port Cameron noise receptors, which include workers at the commercial and industrial facilities located along the east bank of the Calcasieu Ship Channel. Noise generated by pile driving at the G2 LNG facility is expected to be about 65 dBA at these receptors (based on estimated noise attenuation factors at this distance—see section 1.20); if pile driving at Port Cameron were to occur simultaneously, noise impacts on these receptors could be significant, but temporary. These receptors are located in an industrial area where increased noise levels occur during daily operations; the closest noise sensitive areas, including residences, schools, and community buildings, are located in the town of Cameron, approximately 1.5 miles east of the proposed G2 LNG Project, where noise impacts would be minor.

Although construction, including pile driving, of the Calcasieu Pass Project could overlap with the construction of Port Cameron and the G2 LNG Project, it is farther (1.1-mile) from the nearest Port Cameron noise receptors (residences and businesses in the town of Cameron). At this distance, pile driving noise generated during construction of the Calcasieu Pass Project would be significantly less than EPA and HUD recommended noise level thresholds.

The bi-annual maintenance dredging of the Calcasieu Ship Channel could contribute to the cumulative noise impact of receptors near the Port Cameron Project along the ship channel, but the effect would be temporary and limited to when dredging is occurring very close by. However, if nearby dredging activities on the Calcasieu Ship Channel were to coincide with pile driving activities at Port Cameron, the G2 LNG terminal site, and/or the Calcasieu Pass Project, cumulative noise impacts for nearby noise receptors could occur but would be temporary.

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APPENDIX A

Air Emission Methodologies and Calculations

Appendix C

Air Emission Methodologies and Calculations

Construction Emission Methodologies, Assumptions, and Calculations for the Proposed Port Cameron Project

Construction emission estimates from the Project were calculated using the following air emission calculation methodologies and assumptions. The details of the estimated emission calculations are provided in the tables below.

Non-Road Construction Equipment (Direct Emissions)

Emission factors associated with non-road construction equipment were generated using the EPA's MOtor Vehicle Emission Simulator (MOVES) 2014a software. The model was generated on a national domain scale, using a time span that covered all months in 2017 through 2020; with the calculation type set to inventory. Both weekends and weekdays were considered for the model. All pollutants and processes were analyzed in the model, with the most important being the criteria pollutants and CO_2 / Methane. As N_2O and CO_2e were not listed as pollutants for calculation, the greenhouse gas emissions inventory guidance document titled "Direct Emissions from Mobile Combustion Sources" was used in order to find a ratio of N_2O with CH_4 in fuel for diesel fired construction engines. This ratio was then applied to the N_2O factor, and CO_2e was calculated using methane, N_2O, and CO_2 along with adjustments due to global warming potential. The general "Other Construction Equipment" code was used for sources that lacked an appropriate shipping container (SCC) code in the model. Tugboats trips were also calculated using this SCC code and an assumed diesel horsepower engine of 1200 per tug. Hours of operation were assumed to be equivalent to 15 hours of operation per construction day total among the three expected barge deliveries (six of the seven days per week). A load factor of 75% was applied to all sources, under the conservative assumption that the equipment would be operating under this load capacity on average each year.

On-Road Vehicles (Indirect Emissions)

Emission factors for on-road emission sources were also generated using the MOVES 2014a software using the same setting for scale, time span, and calculation type as described above. Both weekends and weekdays were set based on the construction schedule of six days a week and 10 hour days. Diesel and gasoline combination long haul trucks, short haul trucks, commercial trucks, passenger cars, and passenger trucks were included, as well as all road types. The final emission factors were chosen from gasoline fired passenger trucks for commuter traffic, as well as combination long haul trucks for construction traffic and delivery trucks. Each vehicle was assumed to travel 106 miles per day of construction. GHG emissions (CO_2e) were calculated in the model, and no additional adjustments were made.

Land Clearing and Fugitive Dust Emissions (Direct Emissions)

Construction emissions associated with the yard area and loading area were calculated using emission factors and methodology from the Western Regional Air Partnership's (WRAP) Fugitive Dust Handbook, Countess Environmental, September 2006. The emission factor associated with land clearing PM10 in ton/acre-month was sourced from Table 3-2, under level 2 information known and average conditions. The full Project area was assumed disturbed for each month of expected construction. A 50 percent control factor was applied in order to account for moisture in both the environment and dust control techniques that would be employed. A PM2.5/PM10 ratio of 0.15 was applied to calculate PM2.5, based on the WRAP Fugitive Dust Handbook, 7-2.

Road Construction (Direct Emissions)

Project road construction emissions were calculated using the road construction equation from the WRAPS Fugitive Dust Handbook, 2006. A mile(s) to acre conversion factor was taken from the handbook for affected acreage for a two lane road (group 4). The PM2.5/PM10 ratio was assumed to be 0.1, also from guidance given by the WRAPS Fugitive Dust Handbook for fugitive dust from construction and demolition activities. The duration of activity was assumed to be only three months for 2017 and one month for 2018, based on the expected time frame that the roadway would actually be generating PM emissions from construction.

Construction Emission Summary

	Criteria Pollutants (tons per year)						Greenhouse Gases (metric tons per year)
Construction Year	**VOC**	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO_2e**
Year 1 (2017)	9.8	48.2	78.7	0.1	67.0	12.7	16,333.0
Year 2 (2018)	12.5	60.8	102.7	0.1	44.5	12.8	20,455.8
Year 3 (2019)	10.1	50.1	83.3	0.1	25.8	9.5	16,808.8
Year 4 (2020)	5.5	29.5	55.8	0.1	8.5	4.4	11,674.2
Year 5 (2021, 6 months)	2.4	13.1	25.6	0.0	1.6	1.6	5,393.6
Total Air Emissions	**40.4**	**201.7**	**346.0**	**0.4**	**147.4**	**40.9**	**70,665.4**
De Minimis Threshold	100	100	100	100	100	100	25,000

Project Construction Schedule

Activity	**2017**	**2018**	**2019**	**2020**	**2021**
Drainage Structure Relocation	100.0%	0.0%	0.0%	0.0%	0.0%
Excavation, Dredging, Bulkhead	12.5%	25.0%	25.0%	25.0%	12.5%
Roadway & Bridge Improvements	66.67%	33.33%	0.00%	0.00%	0.00%

Utility Improvements	18.18%	36.36%	36.36%	9.09%	0.00%
Bridge Demolition	0.00%	28.57%	71.43%	0.00%	0.00%
Pipeline Relocation	0.00%	66.67%	33.33%	0.00%	0.00%
Beneficial Use	0.00%	100.00%	0.00%	0.00%	0.00%

Port Cameron
NONROAD Construction Calculations

2017 Calendar Year

Actual Description	Equipment Type	SCC Code	Fuel	Engine Rating (hp)	Load Factor[2]	Adjusted Horsepower[2]	Equipment Operating Hours/Year	Emission Factors (g/hp-hr)[1]										Tons per year (tpy)						
								VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O[3]	CO_2e[4]	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Compactor (Ground)	Plate Compactors	2270002009	Diesel	130	75%	97.5	1818	0.6308	3.7838	4.5865	0.0040	0.0477	588.5594	0.0218	596.7614	0.4021	0.3900	0.12	0.74	0.90	0.00	116.61	0.08	0.08
Roller	Rollers	2270002015	Diesel	130	75%	97.5	1600	0.2155	1.1111	2.1460	0.0032	0.0168	559.1340	0.0077	562.0229	0.1740	0.1688	0.04	0.19	0.37	0.00	96.65	0.03	0.03
Horizontal Boring (Hydro Jack)	Bore/Drill Rigs	2270002033	Diesel	2000	75%	1500	0	0.3378	1.2519	3.9955	0.0033	0.0132	539.3990	0.0060	541.6642	0.2178	0.2113	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator, Barge Mounted	Excavators	2270002036	Diesel	360	75%	270	1600	0.1770	0.5429	1.3632	0.0029	0.0147	541.4699	0.0067	543.9978	0.0921	0.0894	0.08	0.26	0.65	0.00	259.05	0.04	0.04
Hydro Dredge (Barge Mounted)	Bore/Drill Rigs	2270002033	Diesel	1200	75%	900	1600	0.3378	1.2519	3.9955	0.0033	0.0132	539.3990	0.0060	541.6642	0.2178	0.2113	0.54	1.99	6.34	0.01	859.80	0.35	0.34
Concrete Saw	Concrete / Industrial Saws	2270002039	Diesel	60	75%	45	8055	0.2751	1.7661	3.2174	0.0034	0.0198	591.3859	0.0090	594.7872	0.2355	0.2284	0.11	0.71	1.29	0.00	237.64	0.09	0.09
Crane, All Terrain	Cranes	2270002045	Diesel	500	75%	375	5118	0.2002	0.5635	2.1156	0.0031	0.0147	532.7934	0.0067	535.3279	0.0996	0.0966	0.42	1.19	4.48	0.01	1,132.59	0.21	0.20
Road Grader	Graders	2270002048	Diesel	240	75%	180	1818	0.1792	0.5173	1.3618	0.0029	0.0148	537.2231	0.0067	539.7666	0.0950	0.0922	0.06	0.19	0.49	0.00	194.72	0.03	0.03
Concrete Mixing Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	4982	0.2115	0.6740	2.0298	0.0028	0.0174	536.2544	0.0079	539.2470	0.0710	0.0689	0.30	0.97	2.93	0.00	777.34	0.10	0.10
Concrete Pump Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	4836	0.2115	0.6740	2.0298	0.0028	0.0174	536.2544	0.0079	539.2470	0.0710	0.0689	0.30	0.94	2.84	0.00	754.64	0.10	0.10
Truck (Flat-bed)	Off-Highway Trucks	2270002051	Diesel	220	75%	165	11712	0.2115	0.6740	2.0298	0.0028	0.0174	536.2544	0.0079	539.2470	0.0710	0.0689	0.45	1.44	4.32	0.01	1,148.70	0.15	0.15
Backhoe	Tractors / Loaders / Backhoes	2270002066	Diesel	160	75%	120	14012	0.7391	3.6106	3.8818	0.0040	0.0309	663.9150	0.0141	669.2347	0.5674	0.5504	1.37	6.69	7.19	0.01	1,240.41	1.05	1.02
Front-End Loader	Tractors / Loaders / Backhoes	2270002066	Diesel	95	75%	71.25	16312	0.7391	3.6106	3.8818	0.0040	0.0309	663.9150	0.0141	669.2347	0.5674	0.5504	0.95	4.63	4.97	0.01	857.38	0.73	0.71
Dump Truck	Dumpers/Tenders	2270002078	Diesel	280	75%	210	9487	1.1685	5.0761	5.0182	0.0043	0.0326	682.5228	0.0149	688.1312	0.7613	0.7385	2.57	11.15	11.02	0.01	1,511.13	1.67	1.62
Marsh Buggy	Other Construction Equipment	2270002081	Diesel	80	75%	60	0	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bull Dozer	Other Construction Equipment	2270002081	Diesel	460	75%	345	1818	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	0.16	0.87	1.97	0.00	373.06	0.12	0.12
Concrete Batch Plant	Other Construction Equipment	2270002081	Diesel	260	75%	195	1265	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	0.06	0.34	0.77	0.00	146.76	0.05	0.05
Impact Pile Driver	Other Construction Equipment	2270002081	Diesel	385	75%	288.75	1653	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	0.12	0.66	1.50	0.00	283.92	0.09	0.09
Pneumatic Tools Compressor	Other Construction Equipment	2270002081	Diesel	80	75%	60	7676	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	0.12	0.64	1.44	0.00	273.91	0.09	0.09
Generator	Generator Sets	2270006005	Diesel	20	75%	15	17562	0.4425	1.8033	4.1569	0.0035	0.0174	568.0064	0.0079	570.9932	0.3040	0.2949	0.13	0.52	1.21	0.00	165.81	0.09	0.09
Barge Deliveries	Tugboat	2270002081	Diesel	1200	75%	900	4693	0.2307	1.2571	2.8445	0.0032	0.0136	537.1832	0.0062	539.5286	0.1744	0.1692	1.07	5.85	13.24	0.01	2,511.88	0.81	0.79
Pumps	Pumps	2270006010	Diesel	50	75%	37.5	6332	0.4414	1.8866	4.1164	0.0035	0.0173	567.6122	0.0079	570.5780	0.3204	0.3108	0.12	0.49	1.08	0.00	149.35	0.08	0.08
																	Totals:	9.09	40.46	69.00	0.08	13,091.33	5.97	5.79

2018 Calendar Year

Actual Description[1]	Equipment Type	SCC Code	Fuel	Engine Rating (hp)	Load Factor[2]	Adjusted Horsepower[2]	Equipment Operating Hours/Year	Emission Factors (g/hp-hr)[1]										Tons per year (tpy)						
								VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O[3]	CO_2e[4]	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Compactor (Ground)	Plate Compactors	2270002009	Diesel	130	75%	97.5	1236	0.6166	3.7719	4.5248	0.0040	0.0485	588.5993	0.0221	596.9394	0.3870	0.3754	0.08	0.50	0.60	0.00	79.32	0.05	0.05
Roller	Rollers	2270002015	Diesel	130	75%	97.5	6176	0.2022	0.9604	1.8959	0.0031	0.0161	559.1733	0.0073	561.9384	0.1484	0.1440	0.13	0.64	1.26	0.00	373.00	0.10	0.10
Horizontal Boring (Hydro Jack)	Bore/Drill Rigs	2270002033	Diesel	2000	75%	1500	107	0.3177	1.1474	3.7241	0.0033	0.0133	539.4589	0.0061	541.7510	0.2000	0.1940	0.06	0.20	0.66	0.00	95.55	0.04	0.03
Excavator, Barge Mounted	Excavators	2270002036	Diesel	360	75%	270	6095	0.1701	0.4212	1.1215	0.0028	0.0141	541.4900	0.0065	543.9228	0.0659	0.0639	0.31	0.76	2.03	0.01	986.72	0.12	0.12
Hydro Dredge (Barge Mounted)	Bore/Drill Rigs	2270002033	Diesel	1200	75%	900	4400	0.3177	1.1474	3.7241	0.0033	0.0133	539.4589	0.0061	541.7510	0.2000	0.1940	1.39	5.01	16.26	0.01	2,364.83	0.87	0.85
Concrete Saw	Concrete / Industrial Saws	2270002039	Diesel	60	75%	45	4429	0.2540	1.5724	3.0061	0.0034	0.0188	591.4474	0.0086	594.6846	0.2057	0.1996	0.06	0.35	0.66	0.00	130.65	0.05	0.04
Crane, All Terrain	Cranes	2270002045	Diesel	500	75%	375	5951	0.1916	0.4971	1.8545	0.0030	0.0145	532.8189	0.0066	535.3099	0.0870	0.0844	0.47	1.22	4.56	0.01	1,316.76	0.21	0.21
Road Grader	Graders	2270002048	Diesel	240	75%	180	1236	0.1719	0.4113	1.1139	0.0028	0.0143	537.2439	0.0065	539.6970	0.0717	0.0696	0.04	0.10	0.27	0.00	132.40	0.02	0.02
Concrete Mixing Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	2364	0.2032	0.5471	1.8532	0.0027	0.0168	536.2787	0.0077	539.1656	0.0555	0.0539	0.14	0.37	1.27	0.00	368.75	0.04	0.04
Concrete Pump Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	2073	0.2032	0.5471	1.8532	0.0027	0.0168	536.2787	0.0077	539.1656	0.0555	0.0539	0.12	0.33	1.11	0.00	323.37	0.03	0.03
Truck (Flat-bed)	Off-Highway Trucks	2270002051	Diesel	220	75%	165	13888	0.2032	0.5471	1.8532	0.0027	0.0168	536.2787	0.0077	539.1656	0.0555	0.0539	0.51	1.38	4.68	0.01	1,361.91	0.14	0.14
Backhoe	Tractors / Loaders / Backhoes	2270002066	Diesel	160	75%	120	26621	0.6799	3.3457	3.5827	0.0040	0.0302	664.0886	0.0138	669.2726	0.5215	0.5059	2.39	11.78	12.62	0.01	2,356.71	1.84	1.78
Front-End Loader	Tractors / Loaders / Backhoes	2270002066	Diesel	95	75%	71.25	25755	0.6799	3.3457	3.5827	0.0040	0.0302	664.0886	0.0138	669.2726	0.5215	0.5059	1.38	6.77	7.25	0.01	1,353.78	1.05	1.02
Dump Truck	Dumpers/Tenders	2270002078	Diesel	280	75%	210	7957	1.0707	4.7219	4.7834	0.0043	0.0325	682.8128	0.0148	688.3954	0.7035	0.6824	1.97	8.70	8.81	0.01	1,267.93	1.30	1.26
Marsh Buggy	Other Construction Equipment	2270002081	Diesel	80	75%	60	9216	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	0.13	0.70	1.57	0.00	328.88	0.10	0.09
Bull Dozer	Other Construction Equipment	2270002081	Diesel	460	75%	345	1351	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	0.11	0.59	1.33	0.00	277.15	0.08	0.08
Concrete Batch Plant	Other Construction Equipment	2270002081	Diesel	260	75%	195	691	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	0.03	0.17	0.38	0.00	80.13	0.02	0.02
Impact Pile Driver	Other Construction Equipment	2270002081	Diesel	385	75%	288.75	3227	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	0.23	1.17	2.65	0.00	554.15	0.16	0.16
Pneumatic Tools Compressor	Other Construction Equipment	2270002081	Diesel	80	75%	60	15992	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	0.23	1.21	2.73	0.00	570.70	0.17	0.16
Generator	Generator Sets	2270006005	Diesel	20	75%	15	28788	0.4160	1.6903	3.9517	0.0035	0.0176	568.0860	0.0080	571.1129	0.2829	0.2744	0.20	0.80	1.88	0.00	271.85	0.13	0.13
Barge Deliveries	Tugboat	2270002081	Diesel	1200	75%	900	4693	0.2199	1.1403	2.5806	0.0031	0.0137	537.2159	0.0062	539.5678	0.1582	0.1535	1.02	5.31	12.01	0.01	2,512.06	0.74	0.71
Pumps	Pumps	2270006010	Diesel	50	75%	37.5	4600	0.4162	1.7738	3.9017	0.0035	0.0175	567.6857	0.0080	570.6876	0.2984	0.2894	0.08	0.34	0.74	0.00	108.52	0.06	0.06
																	Totals:	11.09	48.39	85.33	0.10	17,215.11	7.31	7.09

Notes:

1. All emission factors were calculated using MOVES 2014a NONROAD for construction, with factors for construction occurring in the 2017 and 2018 calendar year(s), respectively.
2. Equipment is assumed to operate on an annual average at 75% of the full horsepower load.
3. N2O was not calculated using the NONROAD Model. In order to estimate N2O emissions, the g/hp-hr factor for CH4 was multiplied by a ratio of 0.57 (g CH4/gal fuel) / 0.26 (g N2O/gal fuel). The g/gallon of fuel factors were sourced from diesel construction/mining equipment in the Greenhouse Gas Inventory Guidance document titled "Direct Emissions from Mobile Combustion Sources", January 2016.
4. CO2e was calculated by summing the emission factors for CO2, N2O, and CH4. N2O and CH4 were both multiplied by their relative global warming potential factor first. N2O has a global warming potential factor equivalent to 298 times that of CO2, while CH4 has a global warming potential equivalent to 36 times CO2.

Port Cameron
NONROAD Construction Calculations
2019 Calendar Year

Actual Description[1]	Equipment Type	SCC Code	Fuel	Engine Rating (hp)	Load Factor[2]	Adjusted Horsepower[2]	Equipment Operating Hours/Year	Emission Factors (g/hp-hr)[1]										Tons per year (tpy)						
								VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O[3]	CO_2e[4]	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Compactor (Ground)	Plate Compactors	2270002009	Diesel	130	75%	97.5	436	0.6065	3.7667	4.4818	0.0040	0.0491	588.6297	0.0224	597.0689	0.3746	0.3634	0.03	0.18	0.21	0.00	28.00	0.02	0.02
Roller	Rollers	2270002015	Diesel	130	75%	97.5	0	0.1928	0.8262	1.6827	0.0030	0.0156	559.2010	0.0071	561.8845	0.1237	0.1200	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horizontal Boring (Hydro Jack)	Bore/Drill Rigs	2270002033	Diesel	2000	75%	1500	53	0.2988	1.0488	3.4646	0.0032	0.0135	539.5152	0.0061	541.8322	0.1830	0.1775	0.03	0.09	0.31	0.00	47.78	0.02	0.02
Excavator, Barge Mounted	Excavators	2270002036	Diesel	360	75%	270	4305	0.1655	0.3329	0.9261	0.0027	0.0138	541.5043	0.0063	543.8731	0.0467	0.0453	0.21	0.43	1.19	0.00	696.81	0.06	0.06
Hydro Dredge (Barge Mounted)	Bore/Drill Rigs	2270002033	Diesel	1200	75%	900	3200	0.2988	1.0488	3.4646	0.0032	0.0135	539.5152	0.0061	541.8322	0.1830	0.1775	0.95	3.33	11.00	0.01	1,720.13	0.58	0.56
Concrete Saw	Concrete / Industrial Saws	2270002039	Diesel	60	75%	45	6109	0.2349	1.3904	2.8101	0.0033	0.0179	591.5047	0.0081	594.5759	0.1783	0.1729	0.07	0.42	0.85	0.00	180.18	0.05	0.05
Crane, All Terrain	Cranes	2270002045	Diesel	500	75%	375	5322	0.1845	0.4346	1.6174	0.0029	0.0143	532.8406	0.0065	535.2940	0.0748	0.0726	0.41	0.96	3.56	0.01	1,177.63	0.16	0.16
Road Grader	Graders	2270002048	Diesel	240	75%	180	436	0.1659	0.3177	0.8978	0.0027	0.0138	537.2613	0.0063	539.6319	0.0507	0.04922	0.01	0.03	0.08	0.00	46.72	0.00	0.00
Concrete Mixing Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	1164	0.1926	0.4509	1.7550	0.0026	0.0160	536.3079	0.0073	539.0550	0.0471	0.0457	0.06	0.15	0.59	0.00	181.50	0.02	0.02
Concrete Pump Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	873	0.1926	0.4509	1.7550	0.0026	0.0160	536.3079	0.0073	539.0550	0.0471	0.0457	0.05	0.11	0.44	0.00	136.13	0.01	0.01
Truck (Flat-bed)	Off-Highway Trucks	2270002051	Diesel	220	75%	165	13056	0.1926	0.4509	1.7550	0.0026	0.0160	536.3079	0.0073	539.0550	0.0471	0.0457	0.46	1.07	4.17	0.01	1,280.06	0.11	0.11
Backhoe	Tractors / Loaders / Backhoes	2270002066	Diesel	160	75%	120	20699	0.6250	3.0980	3.2981	0.0039	0.0293	664.2505	0.0134	669.2966	0.4778	0.4634	1.71	8.48	9.03	0.01	1,832.58	1.31	1.27
Front-End Loader	Tractors / Loaders / Backhoes	2270002066	Diesel	95	75%	71.25	24389	0.6250	3.0980	3.2981	0.0039	0.0293	664.2505	0.0134	669.2966	0.4778	0.4634	1.20	5.93	6.32	0.01	1,282.06	0.92	0.89
Dump Truck	Dumpers/Tenders	2270002078	Diesel	280	75%	210	6261	0.9774	4.3804	4.5582	0.0043	0.0323	683.0898	0.0147	688.6450	0.6476	0.6281	1.42	6.35	6.61	0.01	998.15	0.94	0.91
Marsh Buggy	Other Construction Equipment	2270002081	Diesel	80	75%	60	0	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bull Dozer	Other Construction Equipment	2270002081	Diesel	460	75%	345	722	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.06	0.28	0.64	0.00	148.18	0.04	0.04
Concrete Batch Plant	Other Construction Equipment	2270002081	Diesel	260	75%	195	291	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.01	0.06	0.15	0.00	33.74	0.01	0.01
Impact Pile Driver	Other Construction Equipment	2270002081	Diesel	385	75%	288.75	3200	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.21	1.05	2.38	0.00	549.60	0.15	0.14
Pneumatic Tools Compressor	Other Construction Equipment	2270002081	Diesel	80	75%	60	12024	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.17	0.82	1.85	0.00	429.12	0.11	0.11
Generator	Generator Sets	2270006005	Diesel	20	75%	15	18996	0.3917	1.5842	3.7562	0.0035	0.0178	568.1582	0.0081	571.2229	0.2628	0.2549	0.12	0.50	1.18	0.00	179.42	0.08	0.08
Barge Deliveries	Tugboat	2270002081	Diesel	1200	75%	900	4693	0.2102	1.0309	2.3319	0.0031	0.0137	537.2462	0.0063	539.6027	0.1428	0.1385	0.98	4.80	10.86	0.01	2,512.22	0.66	0.65
Pumps	Pumps	2270006010	Diesel	50	75%	37.5	4600	0.3923	1.6662	3.6960	0.0034	0.0176	567.7571	0.0080	570.7868	0.2771	0.2688	0.07	0.32	0.70	0.00	108.53	0.05	0.05
																	Totals:	8.23	35.36	62.10	0.08	13,568.55	5.31	5.15

2020 Calendar Year

Actual Description[1]	Equipment Type	SCC Code	Fuel	Engine Rating (hp)	Load Factor[2]	Adjusted Horsepower[2]	Equipment Operating Hours/Year	Emission Factors (g/hp-hr)[1]										Tons per year (tpy)						
								VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O[3]	CO_2e[4]	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Compactor (Ground)	Plate Compactors	2270002009	Diesel	130	75%	97.5	109	0.5986	3.7627	4.4482	0.0040	0.0496	588.6514	0.0226	597.1710	0.3655	0.3545	0.01	0.04	0.05	0.00	7.00	0.00	0.00
Roller	Rollers	2270002015	Diesel	130	75%	97.5	0	0.1851	0.7005	1.4920	0.0029	0.0152	559.2238	0.0069	561.8334	0.0999	0.0969	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horizontal Boring (Hydro Jack)	Bore/Drill Rigs	2270002033	Diesel	2000	75%	1500	0	0.2820	0.9604	3.2222	0.0032	0.0136	539.5667	0.0062	541.9056	0.1672	0.1622	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator, Barge Mounted	Excavators	2270002036	Diesel	360	75%	270	3200	0.1628	0.2818	0.7739	0.0027	0.0136	541.5116	0.0062	543.8444	0.0363	0.0352	0.16	0.27	0.74	0.00	517.96	0.03	0.03
Hydro Dredge (Barge Mounted)	Bore/Drill Rigs	2270002033	Diesel	1200	75%	900	3200	0.2820	0.9604	3.2222	0.0032	0.0136	539.5667	0.0062	541.9056	0.1672	0.1622	0.90	3.05	10.23	0.01	1,720.36	0.53	0.51
Concrete Saw	Concrete / Industrial Saws	2270002039	Diesel	60	75%	45	327	0.2181	1.2230	2.6320	0.0032	0.0169	591.5527	0.0077	594.4660	0.1536	0.1490	0.00	0.02	0.04	0.00	9.65	0.00	0.00
Crane, All Terrain	Cranes	2270002045	Diesel	500	75%	375	4709	0.1786	0.3757	1.4026	0.0029	0.0140	532.8586	0.0064	535.2741	0.0633	0.0614	0.35	0.73	2.73	0.01	1,041.95	0.12	0.12
Road Grader	Graders	2270002048	Diesel	240	75%	180	109	0.1622	0.2602	0.7320	0.0027	0.0135	537.2746	0.0062	539.5947	0.0377	0.0366	0.00	0.01	0.02	0.00	11.68	0.00	0.00
Concrete Mixing Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	291	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.02	0.03	0.14	0.00	45.37	0.00	0.00
Concrete Pump Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	218	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.01	0.02	0.11	0.00	34.02	0.00	0.00
Truck (Flat-bed)	Off-Highway Trucks	2270002051	Diesel	220	75%	165	2304	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.08	0.15	0.70	0.00	225.85	0.02	0.02
Backhoe	Tractors / Loaders / Backhoes	2270002066	Diesel	160	75%	120	6904	0.5735	2.8637	3.0267	0.0039	0.0285	664.3992	0.0130	669.3049	0.4357	0.4226	0.52	2.62	2.76	0.00	611.24	0.40	0.39
Front-End Loader	Tractors / Loaders / Backhoes	2270002066	Diesel	95	75%	71.25	11504	0.5735	2.8637	3.0267	0.0039	0.0285	664.3992	0.0130	669.3049	0.4357	0.4226	0.52	2.59	2.73	0.00	604.73	0.39	0.38
Dump Truck	Dumpers/Tenders	2270002078	Diesel	280	75%	210	727	0.8911	4.0597	4.3439	0.0042	0.0322	683.3445	0.0147	688.8720	0.5945	0.5767	0.15	0.68	0.73	0.00	115.97	0.10	0.10
Marsh Buggy	Other Construction Equipment	2270002081	Diesel	80	75%	60	0	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bull Dozer	Other Construction Equipment	2270002081	Diesel	460	75%	345	109	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.01	0.04	0.09	0.00	22.39	0.01	0.01
Concrete Batch Plant	Other Construction Equipment	2270002081	Diesel	260	75%	195	73	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.00	0.01	0.03	0.00	8.44	0.00	0.00
Impact Pile Driver	Other Construction Equipment	2270002081	Diesel	385	75%	288.75	3200	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.21	0.95	2.14	0.00	549.64	0.13	0.13
Pneumatic Tools Compressor	Other Construction Equipment	2270002081	Diesel	80	75%	60	5752	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.08	0.35	0.80	0.00	205.29	0.05	0.05
Generator	Generator Sets	2270006005	Diesel	20	75%	15	8628	0.3691	1.4840	3.5696	0.0034	0.0180	568.2256	0.0082	571.3246	0.2438	0.2364	0.05	0.21	0.51	0.00	81.51	0.03	0.03
Barge Deliveries	Tugboat	2270002081	Diesel	1200	75%	900	4693	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.94	4.33	9.78	0.01	2,512.37	0.60	0.58
Pumps	Pumps	2270006010	Diesel	50	75%	37.5	4600	0.3702	1.5640	3.4998	0.0034	0.0177	567.8242	0.0081	570.8702	0.2566	0.2489	0.07	0.30	0.67	0.00	108.55	0.05	0.05
																	Totals:	4.06	16.40	35.00	0.05	8,433.96	2.48	2.40

Notes:

1. All emission factors were calculated using MOVES 2014a NONROAD for construction, with factors for construction occurring in the 2019 and 2020 calendar year(s), respectively.
2. Equipment is assumed to operate on an annual average at 75% of the full horsepower load.
3. N2O was not calculated using the NONROAD Model. In order to estimate N2O emissions, the g/hp-hr factor for CH4 was multiplied by a ratio of 0.57 (g CH4/gal fuel) / 0.26 (g N2O/gal fuel). The g/gallon of fuel factors were sourced from diesel construction/mining equipment in the Greenhouse Gas Inventory Guidance document titled "Direct Emissions from Mobile Combustion Sources", January 2016.
4. CO2e was calculated by summing the emission factors for CO2, N2O, and CH4. N2O and CH4 were both multiplied by their relative global warming potential factor first. N2O has a global warming potential factor equivalent to 298 times that of CO2, while CH4 has a global warming potential equivalent to 36 times CO2.

Port Cameron
NONROAD Construction Calculations
2021 Calendar Year, six month period

Actual Description[1]	Equipment Type	SCC Code	Fuel	Engine Rating (hp)	Load Factor[2]	Adjusted Horsepower[2]	Equipment Operating Hours/Year	Emission Factors (g/hp-hr)[1]										Tons per year (tpy)						
								VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O[3]	CO_2e[4]	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Compactor (Ground)	Plate Compactors	2270002009	Diesel	130	75%	97.5	0	0.5986	3.7627	4.4482	0.0040	0.0496	588.6514	0.0226	597.1710	0.3655	0.3545	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roller	Rollers	2270002015	Diesel	130	75%	97.5	0	0.1851	0.7005	1.4920	0.0029	0.0152	559.2238	0.0069	561.8334	0.0999	0.0969	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horizontal Boring (Hydro Jack)	Bore/Drill Rigs	2270002033	Diesel	2000	75%	1500	0	0.2820	0.9604	3.2222	0.0032	0.0136	539.5667	0.0062	541.9056	0.1672	0.1622	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excavator, Barge Mounted	Excavators	2270002036	Diesel	360	75%	270	1600	0.1628	0.2818	0.7739	0.0027	0.0136	541.5116	0.0062	543.8444	0.0363	0.0352	0.08	0.13	0.37	0.00	258.98	0.02	0.02
Hydro Dredge (Barge Mounted)	Bore/Drill Rigs	2270002033	Diesel	1200	75%	900	1600	0.2820	0.9604	3.2222	0.0032	0.0136	539.5667	0.0062	541.9056	0.1672	0.1622	0.45	1.52	5.11	0.01	860.18	0.27	0.26
Concrete Saw	Concrete / Industrial Saws	2270002039	Diesel	60	75%	45	0	0.2181	1.2230	2.6320	0.0032	0.0169	591.5527	0.0077	594.4660	0.1536	0.1490	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crane, All Terrain	Cranes	2270002045	Diesel	500	75%	375	2300	0.1786	0.3757	1.4026	0.0029	0.0140	532.8586	0.0064	535.2741	0.0633	0.0614	0.17	0.36	1.33	0.00	508.91	0.06	0.06
Road Grader	Graders	2270002048	Diesel	240	75%	180	0	0.1622	0.2602	0.7320	0.0027	0.0135	537.2746	0.0062	539.5947	0.0377	0.0366	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Mixing Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	0	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Pump Truck	Off-Highway Trucks	2270002051	Diesel	350	75%	262.5	0	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck (Flat-bed)	Off-Highway Trucks	2270002051	Diesel	220	75%	165	0	0.1824	0.3641	1.6801	0.0026	0.0152	536.3360	0.0069	538.9435	0.0402	0.0390	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe	Tractors / Loaders / Backhoes	2270002066	Diesel	160	75%	120	2300	0.5735	2.8637	3.0267	0.0039	0.0285	664.3992	0.0130	669.3049	0.4357	0.4226	0.17	0.87	0.92	0.00	203.63	0.13	0.13
Front-End Loader	Tractors / Loaders / Backhoes	2270002066	Diesel	95	75%	71.25	4600	0.5735	2.8637	3.0267	0.0039	0.0285	664.3992	0.0130	669.3049	0.4357	0.4226	0.21	1.03	1.09	0.00	241.81	0.16	0.15
Dump Truck	Dumpers/Tenders	2270002078	Diesel	280	75%	210	0	0.8911	4.0597	4.3439	0.0042	0.0322	683.3445	0.0147	688.8720	0.5945	0.5767	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marsh Buggy	Other Construction Equipment	2270002081	Diesel	80	75%	60	0	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bull Dozer	Other Construction Equipment	2270002081	Diesel	460	75%	345	0	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Batch Plant	Other Construction Equipment	2270002081	Diesel	260	75%	195	0	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impact Pile Driver	Other Construction Equipment	2270002081	Diesel	385	75%	288.75	1600	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.10	0.47	1.07	0.00	274.82	0.07	0.06
Pneumatic Tools Compressor	Other Construction Equipment	2270002081	Diesel	80	75%	60	2300	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.03	0.14	0.32	0.00	82.09	0.02	0.02
Generator	Generator Sets	2270006005	Diesel	20	75%	15	3450	0.3691	1.4840	3.5696	0.0034	0.0180	568.2256	0.0082	571.3246	0.2438	0.2364	0.02	0.08	0.20	0.00	32.59	0.01	0.01
Barge Deliveries	Tugboat	2270002081	Diesel	1200	75%	900	2346	0.2019	0.9291	2.1005	0.0030	0.0137	537.2712	0.0063	539.6342	0.1281	0.1243	0.47	2.16	4.89	0.01	1,256.18	0.30	0.29
Pumps	Pumps	2270006010	Diesel	50	75%	37.5	2300	0.3702	1.5640	3.4998	0.0034	0.0177	567.8242	0.0081	570.8702	0.2566	0.2489	0.04	0.15	0.33	0.00	54.28	0.02	0.02
																	Totals:	1.74	6.93	15.65	0.02	3,773.46	1.05	1.02

Notes:

1. All emission factors were conservatively calculated using MOVES 2014a NONROAD for construction, with factors for construction conservatively based on factors from the 2020 calendar year.
2. Equipment is assumed to operate on an annual average at 75% of the full horsepower load.
3. N2O was not calculated using the NONROAD Model. In order to estimate N2O emissions, the g/hp-hr factor for CH4 was multiplied by a ratio of 0.57 (g CH4/gal fuel) / 0.26 (g N2O/gal fuel). The g/gallon of fuel factors were sourced from diesel construction/mining equipment in the Greenhouse Gas Inventory Guidance document titled "Direct Emissions from Mobile Combustion Sources", January 2016.
4. CO2e was calculated by summing the emission factors for CO2, N2O, and CH4. N2O and CH4 were both multiplied by their relative global warming potential factor first. N2O has a global warming potential factor equivalent to 298 times that of CO2, while CH4 has a global warming potential equivalent to 36 times CO2.

Port Cameron
ONROAD Construction Calculations

Year 2017

Equipment Type	Fuel	Count	Total mileage/trip	Total Miles/Year	Source Category	Emission Factors (kg/mile)[1]										Emissions (tons/yr)						
						VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Passenger Truck	Gasoline	30	106	994,886	Passenger Truck	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.12	5.06	0.43	0.00	540.14	0.01	0.01
Construction Traffic	Diesel	25	106	829,071	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.40	1.90	6.64	0.02	1,929.63	0.30	0.28
Delivery Trucks	Diesel	10	106	331,629	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.16	0.76	2.66	0.01	771.85	0.12	0.11
															Total:	0.67	7.73	9.73	0.03	3,241.62	0.43	0.39

Year 2018

Equipment Type	Fuel	Count	Total mileage/trip	Total Miles/Year	Source Category	Emission Factors (kg/mile)[1]										Emissions (tons/yr)						
						VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Passenger Truck	Gasoline	30	106	994,886	Passenger Truck	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.12	5.06	0.43	0.00	540.14	0.01	0.01
Construction Traffic	Diesel	25	106	829,071	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.40	1.90	6.64	0.02	1,929.63	0.30	0.28
Delivery Trucks	Diesel	10	106	331,629	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.16	0.76	2.66	0.01	771.85	0.12	0.11
															Total:	0.67	7.73	9.73	0.03	3,241.62	0.43	0.39

Year 2019

Equipment Type	Fuel	Count	Total mileage/trip	Total Miles/Year	Source Category	Emission Factors (kg/mile)[1]										Emissions (tons/yr)						
						VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Passenger Truck	Gasoline	30	106	994,886	Passenger Truck	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.12	5.06	0.43	0.00	540.14	0.01	0.01
Construction Traffic	Diesel	25	106	829,071	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.40	1.90	6.64	0.02	1,929.63	0.30	0.28
Delivery Trucks	Diesel	10	106	331,629	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.16	0.76	2.66	0.01	771.85	0.12	0.11
															Total:	0.67	7.73	9.73	0.03	3,241.62	0.43	0.39

Year 2020

Equipment Type	Fuel	Count	Total mileage/trip	Total Miles/Year	Source Category	Emission Factors (kg/mile)[1]										Emissions (tons/yr)						
						VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Passenger Truck	Gasoline	30	106	994,886	Passenger Truck	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.12	5.06	0.43	0.00	540.14	0.01	0.01
Construction Traffic	Diesel	25	106	829,071	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.40	1.90	6.64	0.02	1,929.63	0.30	0.28
Delivery Trucks	Diesel	10	106	331,629	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.16	0.76	2.66	0.01	771.85	0.12	0.11
															Total:	0.67	7.73	9.73	0.03	3,241.62	0.43	0.39

Year 2021, six month period

Equipment Type	Fuel	Count	Total mileage/trip	Total Miles/Year	Source Category	Emission Factors (kg/mile)[1]										Emissions (tons/yr)						
						VOC	CO	NO_X	SO_2	CH_4	CO_2	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	VOC	CO	NO_X	SO_2	CO_2e	PM_{10}	$PM_{2.5}$
Passenger Truck	Gasoline	30	106	497,443	Passenger Truck	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.49	0.00	0.00	0.06	2.53	0.21	0.00	270.07	0.00	0.00
Construction Traffic	Diesel	25	106	414,536	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.20	0.95	3.32	0.01	964.81	0.15	0.14
Delivery Trucks	Diesel	10	106	165,814	Combination Long-Haul Truck	0.00	0.00	0.01	0.00	2.11	0.00	0.00	2.11	0.00	0.00	0.08	0.38	1.33	0.00	385.93	0.06	0.06
															Total:	0.33	3.86	4.86	0.01	1,620.81	0.21	0.20

Notes:

1. Urban, unrestricted road type emission factors were used for each source category. All emission factors were conservatively based on factors associated with construction occurring in 2017. Mileage is based on a 106 mile round trip from Lake Charles to Cameron for each vehicle, with a schedule of six days a week.

Port Cameron

Fugitive Dust from Development of Yard Area and Landing Area Adjacent to Bulkheads

2017 Calendar Year (Half of year)	Area (ft^2)	Months	Land Affected During Construction (acres)	Land Clearing PM_{10} Emission Factor [1] (ton/acre-month)	Emission Control Efficiency [2] (%)	PM_{10} Emissions - Controlled (tons)[3]	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Port Sites / Yards							
Yard Area	11,373,846.0	6	261.1	1.10E-02	50.0%	8.6	1.3
Loading Area (Adjacent to Bulkhead)	1,098,250.0	6	25.2	1.10E-02	50.0%	0.8	0.1
Total			**286.32**			**9.4**	**1.4**

2018 Calendar Year	Area (ft^2)	Months	Land Affected During Construction (acres)	Land Clearing PM_{10} Emission Factor [1] (ton/acre-month)	Emission Control Efficiency [2] (%)	PM_{10} Emissions - Controlled (tons)[3]	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Port Sites / Yards							
Yard Area	11,373,846.0	12	261.1	1.10E-02	50.0%	17.2	2.6
Loading Area (Adjacent to Bulkhead)	1,098,250.0	12	25.2	1.10E-02	50.0%	1.7	0.2
Total			**286.32**			**18.9**	**2.8**

2019 Calendar Year	Area (ft^2)	Months	Land Affected During Construction (acres)	Land Clearing PM_{10} Emission Factor [1] (ton/acre-month)	Emission Control Efficiency [2] (%)	PM_{10} Emissions - Controlled (tons)[3]	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Port Sites / Yards							
Yard Area	11,373,846.0	12	261.1	1.10E-02	50.0%	17.2	2.6
Loading Area (Adjacent to Bulkhead)	1,098,250.0	12	25.2	1.10E-02	50.0%	1.7	0.2
Total			**286.32**			**18.9**	**2.8**

2020 Calendar Year (Quarter of Year)	Area (ft^2)	Months	Land Affected During Construction (acres)	Land Clearing PM_{10} Emission Factor [1] (ton/acre-month)	Emission Control Efficiency [2] (%)	PM_{10} Emissions - Controlled (tons)[3]	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Port Sites / Yards							
Yard Area	11,373,846.0	3	261.1	1.10E-02	50.0%	4.3	0.6
Loading Area (Adjacent to Bulkhead)	1,098,250.0	3	25.2	1.10E-02	50.0%	0.4	0.1
Total			**286.32**			**4.7**	**0.7**

Notes:

1. Emission factor from WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 2, average conditions.
2. Estimated control efficiency based on the wet and humid environment and dust control.
3. PM2.5/PM10 = 0.15, WRAP Fugitive Dust Handbook 7-2

Port Cameron

Roadway Construction Calculations

2017 Calendar Year (Three quarters of year)[1]	Feet of Roadway	Miles of Roadway	Miles to Acres Conversion Factor[2]	PM_{10} Emission Factor (ton/acre-month)	Duration of Activity (Months)	PM_{10} Emissions - Controlled (tons)	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Roadway Construction	27,156.0	5.1	7.9	0.42	3.0	51.2	5.1

2018 Calendar Year (One quarter of year)[1]	Feet of Roadway	Miles of Roadway	Miles to Acres Conversion Factor[2]	PM_{10} Emission Factor (ton/acre-month)	Duration of Activity (Months)	PM_{10} Emissions - Controlled (tons)	$PM_{2.5}$ Emissions - Controlled (tons)[3]
Roadway Construction	27,156.0	5.1	7.9	0.42	1.0	17.1	1.7

Notes:

1. Emissions were calculated using the following equation (taken from WRAPS Fugitive Dust Handbook, 2006 for Roadway Construction):
   PM10 Emissions = (0.42 tons PM10/acre-month) x Miles of New Roadway x Miles to Acre Conversion Factor x Duration of Activity (months)
2. Miles to Acre Conversion Factor from WRAPS Fugitive Dust Handbook, for affected acreage for a 2 lane road (group 4).
3. PM2.5/PM10 ratio was assumed to be 0.1, taken from WRAPS Fugitive Dust Handbook for fugitive dust from construction and demolition activities.