Annova LNG Common Infrastructure, LLC
SWG-2015-00110 Appendix 1, Compensatory Mitigation Plan, Little San Martin Lake, Cameron County, Texas. Sheet 1 of 25.

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CONCEPTUAL MITIGATION PLAN

ANNOVA LNG BROWNSVILLE PROJECT
CAMERON COUNTY, TEXAS

U.S. ARMY CORPS OF ENGINEERS PROJECT NUMBER: SWG-2015-00110

PREPARED FOR

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1.0 INTRODUCTION

This Conceptual Mitigation Plan outlines Annova LNG Common Infrastructure, LLC's (Annova's) plan for mitigating wetland impacts resulting from the proposed Annova LNG Brownsville Project (Project), which will be located on the south bank of the Brownsville Ship Channel (BSC) at approximate mile marker 8.2 on the Brazos Santiago Pass, in Cameron County, Texas (**Figure 1**). This mitigation plan has been prepared in accordance with Title 33 of the Code of Federal Regulations (CFR) part 332 (33 CFR §332): *Compensatory Mitigation for Losses to Aquatic Resources* (USACE and Environmental Protection Agency [EPA] 2008).

On July 13, 2016, Annova submitted an application to the Federal Energy Regulatory Commission (FERC) for authorization under Section 3 of the Natural Gas Act to site, construct, and operate new liquefaction and export facilities under Docket Number CP16-480. Construction of the Project will permanently impact wetlands and other waters of the United States (U.S.) subject to regulation under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA). As a result, Annova has applied for a Section 404/10 Standard Permit from the U.S. Army Corps of Engineers (USACE) Galveston District (Permit Application SWG-2015-00110). In November 2018, Annova submitted a second permit application for a third-party intrastate natural gas pipeline lateral that will supply natural gas to the Project; however, the lateral pipeline is not discussed in detail in this mitigation plan because wetland impacts from pipeline construction will be temporary and are not expected to require compensatory mitigation.

1.1 Terms used to Describe the Project Area

Throughout this document, the ***Project Site*** refers to the 731-acre lease site on the south bank of the BSC where the LNG terminal will be constructed and operated. Annova will create one new main access road to the Project Site off State Highway (SH) 4 (Boca Chica Boulevard) as the principal access road for both construction and operation. Two alternative routes are currently being considered for the main access road. ***Access Road Alternative 2*** would involve the construction of the main access road entirely along an existing unpaved road and is the preferred alternative. However, either ***Access Road Alternative 1***, which diverges from the existing unpaved road into undisturbed areas, or Access Road Alternative 2 is feasible.

The term ***Project Area*** is used in this document to refer to a combined area including the Project Site, Access Road Alternative 1, and Access Road Alternative 2.

The ***Limits of Disturbance (LOD)*** for the Project are those areas within which all construction activities will occur, on both the Project Site and the main access road. The LOD does not include areas to be dredged within the BSC.

1.2 Document Format

For context, Section 2.0 of this document provides a Project overview and summarizes the Project's impacts to waters of the U.S. Sections 3.0 through 14.0 address the 12 fundamental elements that are required in permittee-responsible mitigation plans, as outlined in 33 CFR §332.4(c)(2-13). The 12 fundamental elements of a mitigation plan and their corresponding sections in this mitigation plan are:

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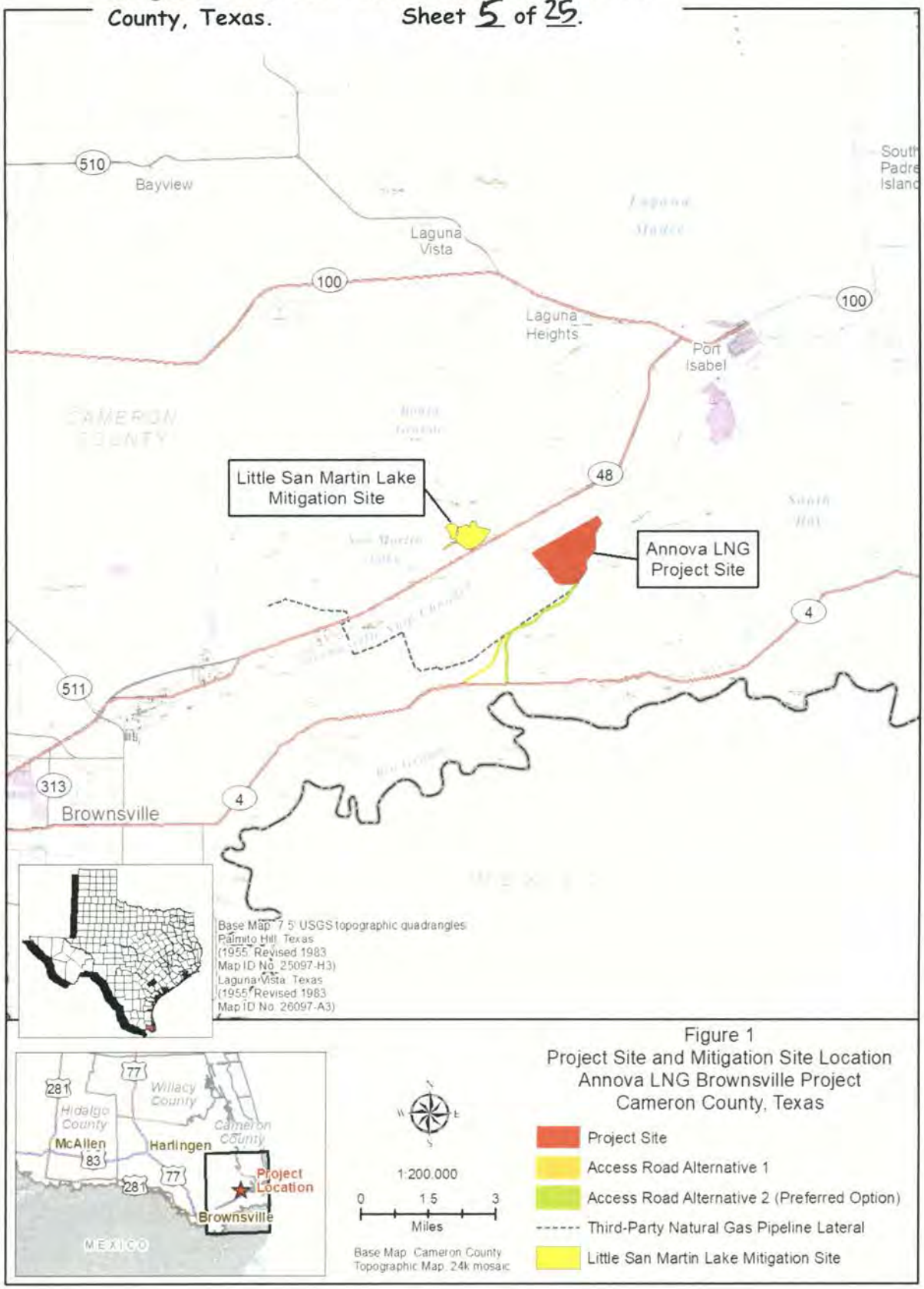

Figure 1
Project Site and Mitigation Site Location
Annova LNG Brownsville Project
Cameron County, Texas

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Mitigation Plan Section	Fundamental element of a mitigation plan at 33 CFR §332.4(c)
3.0	(2) Objectives
4.0	(3) Site Selection
5.0	(4) Site Protection Instrument
6.0	(5) Baseline Information
7.0	(6) Determination of Credits
8.0	(7) Mitigation Work Plan
9.0	(8) Maintenance Plan
10.0	(9) Performance Standards
11.0	(10) Monitoring Requirements
12.0	(11) Long-term Management Plan
13.0	(12) Adaptive Management Plan
14.0	(13) Financial Assurances

2.0 PROJECT OVERVIEW

Annova is proposing to construct the Project on approximately 731 acres of land to be obtained through a long-term lease with the Brownsville Navigation District (BND). The Project includes two principal parts: the LNG facilities and the associated marine transfer facilities. The Permit Application SWG-2015-00110 and FERC Resource Reports describe the Project in detail.

Annova will create one new main access road off SH 4. Consultations with the U.S. Fish and Wildlife Service (USFWS) identified the potential to construct the main access road along an existing unpaved road that crosses USFWS property, identified as Access Road Alternative 2. Annova prefers Access Road Alternative 2; however, either Access Road Alternative 1 or Access Road Alternative 2 is feasible. **Figure 2** shows the Project site and the proposed routes for Access Road Alternatives 1 and 2.

2.1 Summary of Waters of the U.S. in the Project Area

Approximately 134.4 acres of wetlands [estuarine emergent and scrub-shrub (mangrove)] and 26.9 acres of non-wetland waterbodies (open water and unvegetated tidal flats) were delineated within the Project Site. In addition, approximately 12.8 acres of estuarine emergent wetland were delineated in the Access Road Alternative 1 survey corridor, and 3.2 acres of estuarine emergent wetland were delineated in the Access Road Alternative 2 survey corridor. Section 6.0 *Baseline Information* describes the aquatic resources within the Project Area. In December 2017, the USACE issued final Preliminary Jurisdictional Determinations (PJDs) that include all water resources in the Project Area.

2.2 Summary of Waters of the U.S. Impacts

Table 1 summarizes the acreages of wetlands and non-wetland waterbodies that would be impacted by Project construction and operation. Annova's 404/10 permit application provides detailed information on waters of the U.S. impacts. **Figure 2** shows the LOD in relation to waters of the U.S. within the Project Site and along the access road routes.

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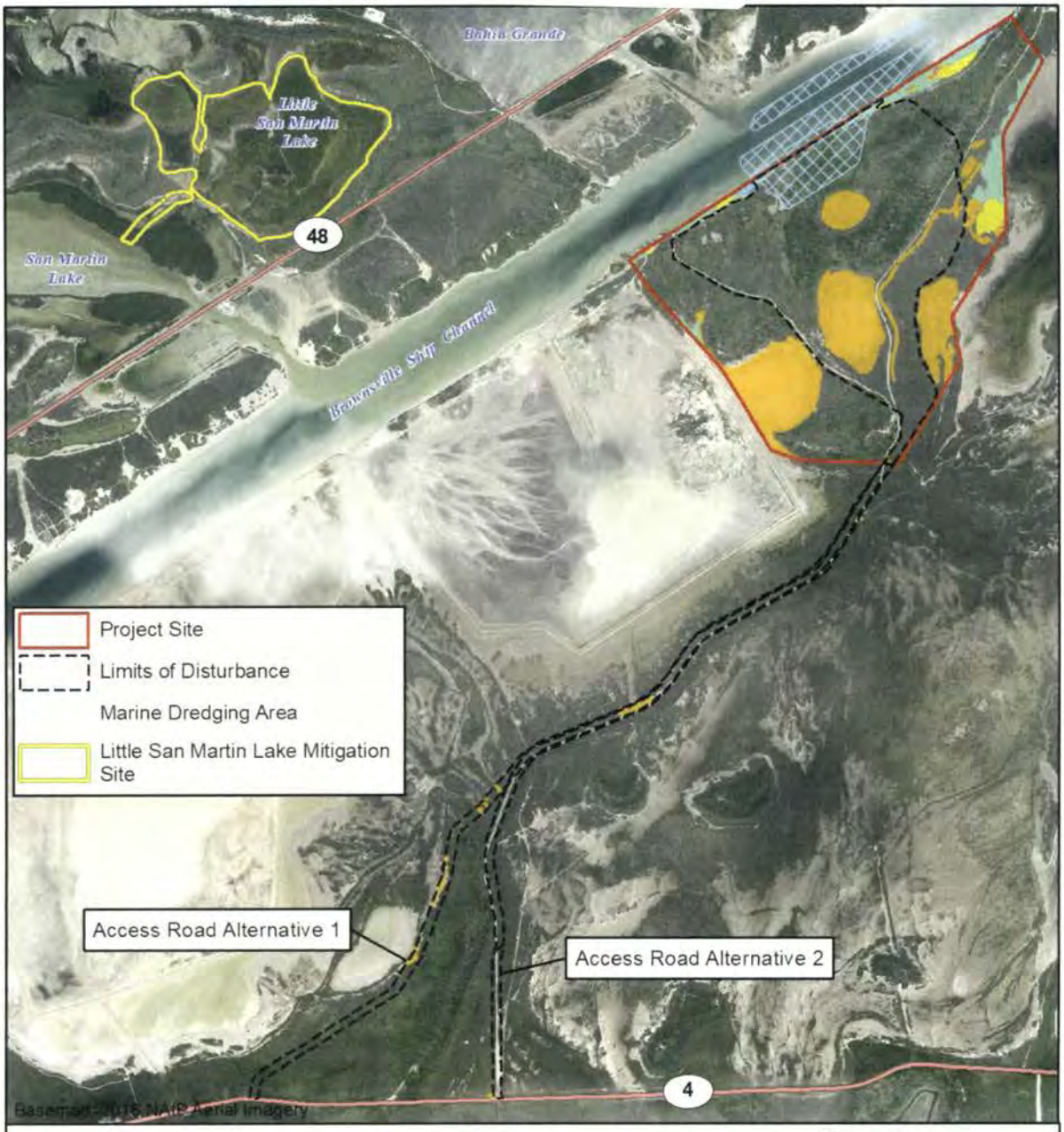

Waters of the U.S.

- Estuarine Emergent Marsh-Tidal (E2EM1)
- Estuarine Emergent Wetlands-Nontidal (EEM1)
- Estuarine Open Water (E1OW)
- Estuarine Scrub-Shrub (Mangrove) Marsh (E2SS3)
- Tidal Flats/Washover Areas (E2US3)

Figure 2
Waters of the U.S.
in the Project Area
Annova LNG Brownsville Project
Cameron County, Texas

1:36,000

0 1,500 3,000
Feet

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Table 1. Wetlands and Non-Wetland Waterbodies Affected by the Project

Wetland Type	Cowardin Class	Project Site (acres)		Access Road Alternative 1 (acres)		Access Road Alternative 2 (acres)		Marine Facilities (acres)	
		Const[a]	Oper[b]	Const[a]	Oper[b]	Const[a]	Oper[b]	Const[a]	Oper[b]
Non-wetland Waterbodies									
Estuarine open water (within Project property)	E1OW	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Unvegetated tidal flat	E2US3	1.7	0.0	0.0	0.0	0.0	0.0	1.0	1.0
	Subtotal[c]	2.7	0.0	0.0	0.0	0.0	0.0	2.0	2.0
Wetlands									
Estuarine emergent	EEM1	51.6	49.5	2.5	2.2	1.4	1.3	<0.1	<0.1
Estuarine scrub-shrub (mangrove) marsh	E2SS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal[c]	51.6	49.5	2.5	2.2	1.4	1.3	0.0	0.0
	Total[c]	**54.3**	**49.5**	**2.5**	**2.2**	**1.4**	**1.3**	**2.0**	**2.0**

(a) Temporary (construction) impacts include all areas that will be disturbed during construction of the Project including areas that will be maintained during operation.
(b) Permanent (operation) impacts include those areas that will be maintained during operation of the Project.
(c) Values may not exactly add up to the subtotal and total values due to rounding.

2.3 Avoidance and Minimization

The Project is water-dependent because it requires deepwater access to load LNG carriers for export; therefore, the Project cannot be sited to completely avoid aquatic resources. However, throughout Project engineering and design, Annova implemented measures to avoid wetland impacts to the extent practicable and to minimize the construction footprint within wetlands when complete avoidance was not logistically feasible. Efforts to avoid and minimize wetland impacts have included the following:

- Conducted site visits with FERC and various resource and regulatory agencies—including, but not limited to, the EPA, USACE, National Marine Fisheries Service (NMFS), USFWS, Texas Parks and Wildlife Department (TPWD), and Texas General Land Office (GLO)—to obtain the agencies' input.
- Modified the Project layout to accommodate a wildlife corridor on the west side of the Project Site ("Western Wildlife Corridor"), where existing wetlands will be avoided and preserved.
- Modified the LOD, cut/fill plan, construction laydown areas, and other disturbance areas to avoid wind-tidal flats and adjacent wetland areas along the southeast portion of the Project Site.
- Designed the marine facilities to be the minimum size while still providing a safe navigation and mooring environment.
- Consulted with the USFWS to evaluate an access road alternative that incorporates a portion of an existing dirt road on USFWS refuge property into the main access road alignment for the Project. This alternative access road alignment would maximize the use of existing disturbances associated with the existing access road and minimize impacts to wetlands.

As a result of these collaborative efforts, Annova will avoid over 100 acres of wetlands and non-wetland waterbodies within the Project Site.

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3.0 OBJECTIVES

The objective of this Conceptual Mitigation Plan is to offset the Project's impacts to wetlands and non-wetland waterbodies. To achieve this, Annova proposes to restore regular tidal flow to the Little San Martin Lake (LSML) basin, which is located on the northwest side of SH 48 between the Bahia Grande and San Martin Lake, approximately 1.2 miles northwest of the Project Site (**Figures 1 and 2**). Tidal flow to the LSML basin was cut off by construction of oil/gas access roads between 1955 and 1970. Aerial photography shows emergent marsh surrounding LSML prior to the access road construction, but the wetlands gradually disappeared (**Figure 3**). Restoring regular tidal flow to the basin will re-establish wetlands around LSML, enhance existing wetlands in the basin, and restore estuarine shallow water habitat in LSML itself.

Annova's mitigation plan entails excavating a series of channels between San Martin Lake and the LSML basin and surrounding areas to restore regular tidal flow to the basin. Currently the basin is primarily dependent on episodic rainfall events for hydrology, with tidal flow being limited to infrequent high tide events through a small breach in the access roads. During extended dry periods that are common to the region, the flats surrounding the main basin are completely dry and barren, and the basin is isolated from other aquatic resources. After the proposed channels are excavated, emergent wetland vegetation and limited mangroves will be planted along the channels, and emergent wetlands are expected to gradually establish throughout the flats surrounding the basin. In addition, the channels would allow various estuarine species to access shallow water habitat within LSML itself. The mitigation plan would enhance/restore an estimated 250 acres of estuarine wetland and shallow water habitats (**Table 2**). The final acreages will be determined based on the final mitigation needs and work plan, which will be completed through USACE coordination and permit review and subsequent development of mitigation engineering plans.

Table 2. Overview of Annova's Conceptual Mitigation Plan

Resource Types and Amounts Provided[1]	Method(s) of Compensation	Geographic Region Addressed	Manner in which Mitigation will Meet Needs of Geographic Region
Estimated benefits to 250 acres of aquatic resources: • Restore 50-71 acres of estuarine wetlands • Enhance 121 acres of estuarine wetlands • Restore 58 acres of shallow water habitat	Enhancement and restoration	Watershed	Restores tidal exchange and estuarine habitat lost when BSC and SH 48 were constructed; supplements ongoing efforts to restore estuarine habitat in the area

[1] Final resource types/amounts will be determined through USACE coordination and permit review.

Annova's proposed mitigation site, referred to as the "Little San Martin Lake Mitigation Site" or "LSML Mitigation Site," is near the Project Site and in the same watershed, and it would provide compensation through *restoration* and *enhancement*. The improvements in estuarine habitat in the basin will address watershed needs by restoring tidal exchange that was lost when the BSC was excavated in the 1930s and SH 48 was constructed in the 1950s. The mitigation project would supplement ongoing efforts to restore tidal flow and enhance estuarine habitats in the watershed, including the Bahia Grande Restoration Project. The USFWS document titled "*Final Environmental Assessment, Proposed Restoration of Bahia Grande*" (USFWS 2005) recommended excavating a channel from San Martin Lake, through LSML, and into Bahia Grande. Should future modeling by USFWS or other entity determine that continuing a channel to Bahia Grande is beneficial, Annova's LSML Mitigation Site would be a major step toward that goal.

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1955 Aerial Photograph showing Historical Conditions

1970 Aerial Photograph showing New Access Roads and Isolated LSML

1996 Aerial Photograph showing Thinning Marsh

Recent Aerial Photograph

Figure 3
Historic and Current Conditions at Little San Martin Lake
Cameron County, Texas

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The LSML Mitigation Site is located within a Perpetual Drainage Easement (PDE) controlled by the BND within the USFWS' Bahia Grande Unit of the Laguna Atascosa National Wildlife Refuge (LANWR). The BND secured the PDE prior to the USFWS acquiring the property. Annova has discussed development of the LSML Mitigation Site with both the BND and USFWS, as well as the USACE, EPA, NMFS, TPWD, and GLO. Part of the LSML Mitigation Site was previously approved as mitigation for the BND's Port of Brownsville International Crossing Project (USACE Permit Nos. SWG-1995-00115 and SWG-1998-01873, issued in July 1995 and amended in May 1999). The BND never built the International Crossing Project or implemented the mitigation plan for LSML, and the USACE permit for that project expired in December 2001. Annova is proposing a similar, but larger, mitigation project within the BND's PDE.

4.0 SITE SELECTION

In accordance with 33 CFR §332.4(c)(3), Annova evaluated multiple mitigation site alternatives considering watershed needs, on-site alternatives as applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and preservation at each potential site. Annova's mitigation site selection also considered mitigation type and location options in the hierarchy outlined in 33 CFR §332.3(b) and **Table 3**. Annova's alternative mitigation sites and plans focused on providing a combination of restoration, enhancement, establishment, and preservation. Based on Annova's coordination with the USACE and USFWS, Annova did not focus on mitigation options that would provide preservation of existing aquatic resources only. The following sections discuss Annova's site selection process in relation to the mitigation hierarchy.

Table 3. Summary of Annova's Site Selection Process

Mitigation Hierarchy	Type and Location of Mitigation	Alternatives Considered[1]	Alternative Selected
1	Mitigation Bank Credits	None Available	N/A
2	In-lieu Fee Program Credits	None Available	N/A
3	Permittee-responsible Mitigation under a Watershed Approach	Five options	**Little San Martin Lake Mitigation Site**
4	Permittee-responsible Mitigation through On-site and In-kind Mitigation	Although Annova ultimately selected a mitigation site under the higher-priority Watershed Approach, Annova considered other on-site and off-site mitigation options, which were dismissed for various reasons.	
5	Permittee-responsible Mitigation through Off-site and/or Out-of-kind Mitigation		

[1] Annova's alternative mitigation sites and plans focused on providing a combination of restoration, enhancement, establishment, and preservation. Based on Annova's coordination with USACE and USFWS, Annova did not focus on mitigation options that would provide preservation of existing aquatic resources only.

4.1 Mitigation Bank Credits and In-lieu Fee Program Credits

Based on the USACE's Regulatory In-lieu Fee and Bank Information Tracking Information System (RIBITS) website (USACE 2018) and discussions with the USACE Galveston District and mitigation bank developers, the Project Area is not within the service area of any active or pending mitigation bank or in-lieu fee program. As a result, compensatory mitigation for waters of the U.S. impacts resulting from the Project cannot be accomplished through mitigation bank or in-lieu fee program credits.

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4.2 Permittee-Responsible Mitigation under a Watershed Approach

Since the Project Area is not within the service area of an approved mitigation bank or in-lieu fee program, permittee-responsible mitigation is the only option for mitigating the Project's impacts to aquatic resources. For permittee-responsible mitigation, 33 CFR §332.3(c) states that a watershed approach must be used to the extent appropriate and practicable, considering watershed needs and existing watershed plans. Therefore, Annova first evaluated mitigation sites under a watershed approach.

4.2.1 Watershed Identification

The Project Area is located in the South Laguna Madre watershed (HUC 12110208), which encompasses 2,839 square miles (1.9 million acres) of land, including most of Cameron and Willacy Counties and over half of Hidalgo County. More locally, the Project Area is within the Bahia Grande-BSC sub-watershed (HUC 121102080900), which covers approximately 366 square miles (234,000 acres) of land in southeast Cameron County (**Figure 4**). The western and southwestern parts of the Bahia Grande-BSC sub-watershed (hereafter "the watershed") include the Brownsville urbanized area and a matrix of urban and agricultural areas west of Brownsville. Resacas and manmade drainage ditches are the dominant water features in these areas. Many of the resacas in the urban and agricultural areas have been deepened to collect runoff (e.g., Resaca de los Cuates), which reduces flooding and stores water for irrigation and recreational uses.

The eastern portion of the watershed is dominated by tidally influenced waters that include the Bahia Grande, the BSC, San Martin Lake, and South Bay. Wetlands within this portion of the watershed generally occur as large complexes associated with the Bahia Grande, San Martin Lake, and South Bay, as well as in scattered depressions and shallow resacas. Most of the wetlands in the region, including those in scattered depressions and resacas, are dominated by halophytic (salt-loving) plant species found in high salt marsh due to coastal flooding, lack of consistent rainfall or other freshwater source, and presence of saline soils.

Historic topographic maps show the Bahia Grande, San Martin Lake, and South Bay were all hydrologically connected to the Laguna Madre prior to the construction of the BSC and SH 48 (**Figure 5**). The construction of the BSC in the 1930s and SH 48 in the 1950s severed tidal connection to many areas and greatly altered the hydrology within the watershed. Restoring and enhancing tidal exchange to major waterbodies in the watershed has been an ongoing need since the BSC and SH 48 were constructed and has been an active goal of resource agencies and conservation entities for the past 30 years or more.

4.2.2 Watershed Plan

When using a watershed approach to plan mitigation, 33 CFR §332.3(c)(1) states that the approach should be based on an appropriate ***watershed plan***, if available. A watershed plan is a plan "developed by federal, tribal, state, and/or local government agencies or appropriate non-governmental organizations, in consultation with relevant stakeholders, for the specific goal of aquatic resource restoration, establishment, enhancement, and preservation" (USACE and EPA 2008). The Bahia Grande Restoration Plan, a major restoration/enhancement planning effort that has been ongoing for several decades, meets the definition of a watershed plan. The USFWS bought purchased the Bahia Grande and surrounding lands in 1999-2000, with earlier planning efforts occurring before then. The Bahia Grande Restoration Plan has involved more

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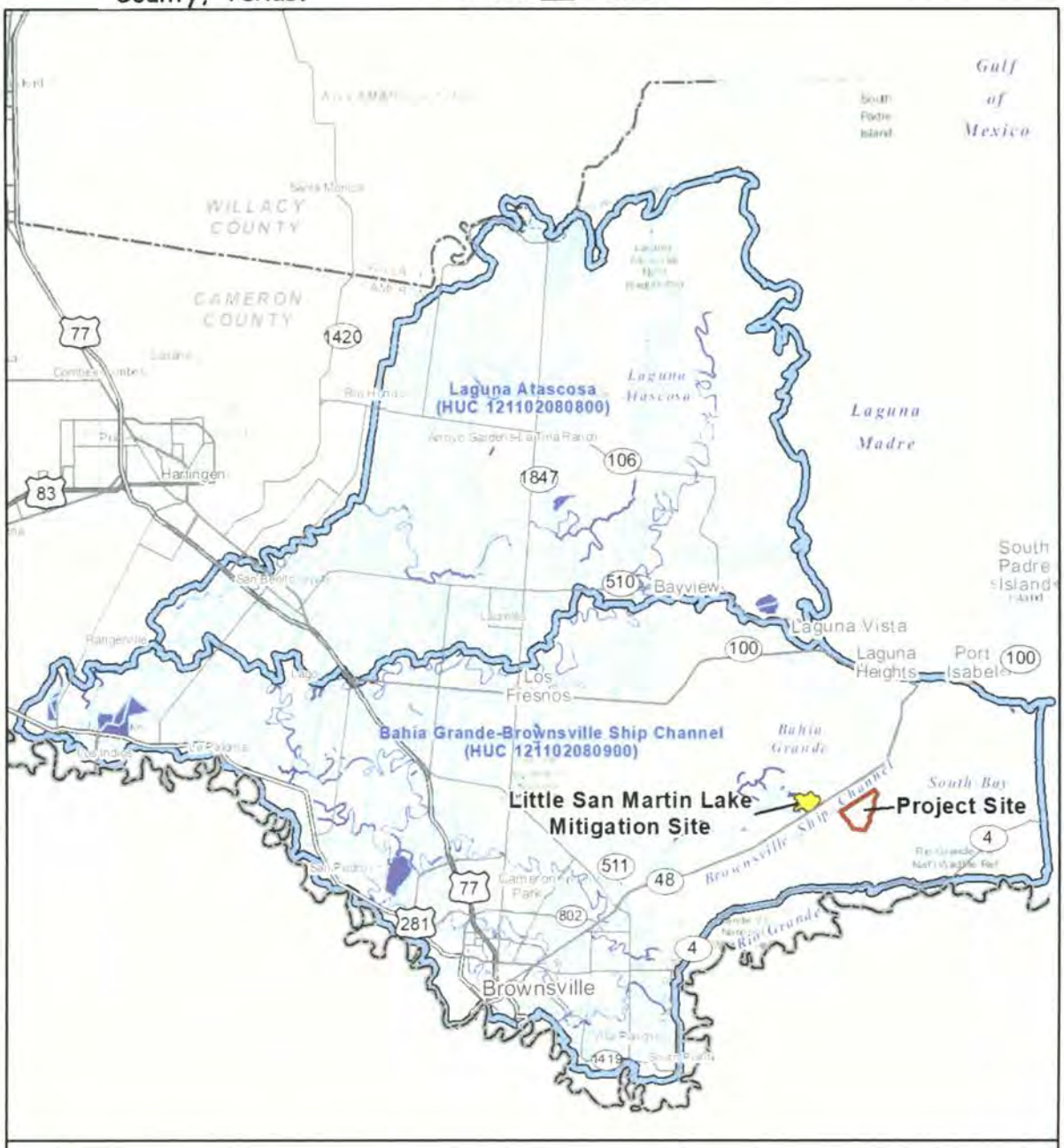

Little San Martin Lake Mitigation Site
Project Site
Watershed (12-digit HUC)
Drainage Ditch/Irrigation Canal
Stream/Resaca
Reservoirs
Waterbody

Base Map: ESRI World Topographic Map

Figure 4
Watersheds
Annova LNG Brownsville Project
Cameron County, Texas

1:400,000

0 2.5 5 10
Miles

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Base Map
East Brownsville Topographic Map 1930.
Laguna Vista Topographic Map 1929.
Mouth of the Rio Grange Topographic Map 1929.
Los Frenos Topographic Map 1930.
Palmito Hill Topographic Map 1929.
Port Isabel Topographic Map 1929

Project Site
Access Road Alternative 1 LOD
Access Road Alternative 2 LOD
Brownsville Ship Channel
Little San Martin Lake Mitigation Site
SH 48

Figure 5
1929 - 1930 Topographic Maps
Annova LNG Brownsville Project
Cameron County, Texas

1:200,000
0 2.5 5
Miles

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than 65 local, state, and federal agencies and groups (USFWS 2017), and proposes restoration of healthy tidal exchange to Bahia Grande and surrounding water features, to restore and enhance estuarine habitat and wetlands within the Bahia Grande watershed. Initial restoration of tidal flow into the Bahia Grande was achieved by excavation of a pilot channel between the BSC and the bahia in 2005, and additional channels were subsequently excavated between the bahia and surrounding water features. In addition, a wider, deeper main channel was designed, and received a USACE 404/10 permit in 2016, to increase tidal exchange in the Bahia Grande and enhance and expand estuarine habitats. The USFWS and other resource agencies and conservation entities continue to work to restore and enhance the Bahia Grande and surrounding areas. Annova considers the Bahia Grande Restoration Plan to be an appropriate watershed plan for evaluating and developing mitigation projects. Annova looked for opportunities to restore and/or enhance tidal flow and wetlands to the Bahia Grande and surrounding areas.

4.2.3 Potential Mitigation Projects Evaluated under the Watershed Approach

Under the watershed approach, Annova evaluated five potential mitigation options that would restore and/or enhance tidal flow to the Bahia Grande and/or surrounding areas where tidal flow appears to have been reduced or eliminated by construction of the BSC and SH 48. These options are listed in **Table 4** and included the Bahia Grande Main Channel Project, the proposed LSML Mitigation Site located immediately west of the Bahia Grande, two options that would restore and/or enhance tidal flow to areas adjacent to and east of the Bahia Grande (Paso Corvinas and Vadia Ancha), and an option that would enhance tidal flow to the unvegetated flats located west of South Bay.

Table 4. Mitigation Options Evaluated under the Watershed Approach

Potential Mitigation Project	Previously Studied and Permitted?	Mitigation Concept	Alternative Selected
Bahia Grande Main Channel	Yes	Widen and deepen the existing Pilot Channel to increase tidal exchange, reduce salinities, and enhance/expand wetlands, oysters, seagrasses, and estuarine habitat	No
Little San Martin Lake Mitigation Site	Yes	Cut channel(s) from San Martin Lake to restore tidal flow to LSML and surrounding area, creating/enhancing wetlands and estuarine habitat	**Yes**
Paso Corvinas	No	Cut channel(s) from BSC to flood flats, create/enhance wetlands, and aid in additional tidal flow to Bahia Grande	No
Vadia Ancha	No	Cut channel(s) from BSC to flood flats, create/enhance wetlands, and aid in additional tidal flow to Bahia Grande	No
South Bay Flats	No	Cut channel(s) from BSC or extend channel(s) from South Bay into flats west of South Bay to increase tidal exchange and create/enhance wetlands and estuarine habitat	No

Annova evaluated the five options by reviewing previous plans, permits, studies, and available maps, and discussing the options with the BND, who either owns or holds easements on the lands affected by the mitigation options. Based on the initial evaluation, Annova selected the Bahia Grande Main Channel Project and the LSML Mitigation Site to evaluate in more detail because (1) both the Bahia Grande and LSML are former subunits of the Laguna Madre that were cut off from tidal influence by construction of the BSC and SH 48; (2) both areas have been acquired by the USFWS and identified as restoration projects in USFWS documents; (3) both have been previously studied, developed, and permitted as mitigation or restoration projects; and (4) the BND indicated they would make these two areas available for mitigation purposes.

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Annova further evaluated the Bahia Grande Main Channel and LSML Mitigation Site, and in March 2017 presented them as mitigation options for the Project at a Joint Evaluation Meeting with representatives from the USACE, USFWS, EPA, NMFS, TPWD, and GLO. Overall, the agencies indicated that both mitigation options may meet the Project's mitigation needs. Subsequently, in June 2017, the BND signed a Memorandum of Understanding with another Port of Brownsville tenant to construct the Bahia Grande Main Channel Project; therefore, it was no longer available to Annova as a mitigation site.

Based on the above analysis, Annova selected the LSML Mitigation Site for development of a mitigation plan to offset the Project's impacts to aquatic resources. The LSML Mitigation Site is close to the Project Area and offers an opportunity to provide in-kind mitigation. Restoration and enhancement of tidal flow and wetland function in LSML and the surrounding area would benefit the health of the Bahia Grande-BSC watershed and would be a valuable component to the overall Bahia Grande Restoration Plan. Annova also determined that LSML and the surrounding area within BND's PDE provide sufficient opportunity to develop a mitigation plan that will offset the Project's impacts to aquatic resources.

4.3 Permittee-Responsible Mitigation through On-site and/or Off-site Mitigation

Although Annova ultimately identified and selected a mitigation site under the higher-priority Watershed Approach (hierarchy #3 in **Table 3**), Annova had considered on-site and off-site mitigation options (hierarchy #4 and #5 in **Table 3**) during Project development, knowing that mitigation opportunities in the area may be limited. The following summarizes the on-site and off-site mitigation options considered.

- On-site Mitigation – On-site mitigation opportunities considered included (1) establishing wetlands in a proposed borrow area along the BSC and (2) excavation to enlarge existing wetlands that would be avoided within the Western Wildlife Corridor and in the southeastern portion of the Project Site. Annova dismissed these options because (1) the BND owns the land and indicated they would not allow a perpetual easement for mitigation purposes at this location, (2) USACE and EPA representatives indicated that excavating natural upland habitats to create wetlands should be avoided if possible, and (3) Annova eliminated the proposed borrow area to reduce impacts to native thornshrub habitats.

- Off-site Mitigation – In addition to the five potential mitigation sites evaluated under the Watershed Approach, Annova evaluated 16 properties encompassing nearly 28,000 acres within the South Laguna Madre watershed, in coordination with an active conservation organization in the region and the BND as a major landowner. Annova dismissed the properties for various reasons, including (1) there was less opportunity to restore/enhance wetlands or successfully establish new wetlands than the opportunity provided at LSML, (2) the lands were purchased by others or otherwise became unavailable based on further discussions with the conservation organization and the BND, and/or (3) mitigation on the property would not benefit the Bahia Grande-BSC watershed, for which Annova has a viable mitigation option. Although opportunities for preservation exist in the area, Annova focused its efforts on a combination of restoration, enhancement, establishment, and preservation because Annova believes the benefits would far surpass those of preservation alone. Input from the USACE, USFWS, EPA, NMFS, TPWD, and GLO during Joint Evaluation Meetings and other coordination efforts confirmed that restoration and enhancement are preferred over preservation alone.

5.0 SITE PROTECTION INSTRUMENT

The LSML Mitigation Site is within a BND PDE located on USFWS-owned land that is part of the Bahia Grande Unit of the LANWR. As such, the mitigation site would be protected through a combination of USFWS-owned land and a legal instrument that would protect the mitigation area from future disturbance by BND under the PDE. Annova will work with the BND to create and execute a legal instrument that will further protect the mitigation site.

6.0 BASELINE INFORMATION

6.1 Project Area – Existing Wetlands/Waterbodies

Wetlands and non-wetland waterbodies present in the Project Area include open water, unvegetated tidal flats, estuarine emergent and scrub-shrub (mangrove) wetlands associated with the BSC and South Bay, and other estuarine emergent wetlands scattered throughout the Project Area. **Table 5** summarizes the amounts of wetlands/waterbodies present in different portions of the Project Area. **Figure 2** shows the locations of wetlands and non-wetland waterbodies within the Project Area.

Table 5. Wetlands and Non-Wetland Waterbodies on the Project Site and Access Road Alternatives

Wetland Type	Cowardin Classification	Project Site		Access Road Alternative 1[a]		Access Road Alternative 2[a]	
		Number	Acreage	Number	Acreage	Number	Acreage
Non-Wetland Waterbodies							
Estuarine open water	E1OW	2	5.5	0	0.0	0	0.0
Unvegetated tidal flat	E2US3	9	21.5	0	0.0	0	0.0
Non-Wetland Waterbody Total[b]		**11**	**26.9**	**0**	**0.0**	**0**	**0.0**
Wetlands							
Estuarine emergent	E2EM1	31	132.7	46	12.8	38	3.2
Estuarine scrub-shrub (mangrove)	E2SS3	3	1.7	0	0.0	0	0.0
Wetlands Total[b]		**34**	**134.4**	**46**	**12.8**	**38**	**3.2**

(a) A portion of Access Road Alternative 1 and Access Road Alternative 2 overlap each other. Number and acres of wetlands are reported for each road alternative; therefore, there is overlap between the values. The overlap area includes 37 wetlands totaling 3.0 acres.

(b) Values may not exactly add up to the subtotal and total values due to rounding.

6.2 Little San Martin Lake Mitigation Site – Existing Wetlands/Waterbodies

The LSML basin consists of shallow open water habitat within LSML itself (dependent on local rainfall and high tides), with mostly unvegetated flats to the east and south. Small emergent wetlands are scattered in portions of the flats, and larger emergent wetlands are present to the west and north of LSML. Due to the old oil/gas access roads on the south and west sides, the LSML basin primarily collects and stores rainwater runoff, though during very high tide events, tidal water enters the basin through one or two narrow and shallow areas that have eroded through the south road. During extended dry periods, the surrounding flats are dry and barren, and the deeper LSML basin becomes isolated from other aquatic resources. Outside the south road, mangrove marsh lines the San Martin Lake shoreline. **Figure 6** shows the existing aquatic habitats in the LSML Mitigation Site, and **Table 6** summarizes the amount of each habitat.

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Little San Martin Lake Mitigation Site

Current Aquatic Resources

Ephemeral Waterbody - Subject to Local Rainfall/High Tides

Estuarine Emergent Wetland

Estuarine Scrub-shrub (Mangrove) Wetland

Unvegetated Flat

Base Map: 2016 NAIP Aerial Imagery

Figure 6
Baseline Conditions
Little San Martin Lake Mitigation Site
Cameron County, Texas

1:15,000

0 625 1,250 2,500
Feet

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Table 6. Wetlands and Non-Wetland Waterbodies within the LSML Mitigation Site

Wetland/Waterbody Type	Acreage
Ephemeral Waterbody (subject to local rainfall and high tides)	56
Unvegetated Flats	89
Estuarine Emergent Wetland	61
Estuarine Scrub-shrub (Mangrove) Wetland	3

The proposed mitigation site is adjacent to the Bahia Grande (to the east) and San Martin Lake (to the west), which both receive tidal flow from the BSC. San Martin Lake also receives freshwater from major drainage ditches that converge and drain into the upper end of the lake.

7.0 DETERMINATION OF CREDITS

In consultation with the USACE, Annova assessed wetland functions in the Project Area and mitigation site using a hydrogeomorphic (HGM) model for tidal fringe wetlands (Shafer et al. 2002). USACE staff verified that the Tidal Fringe HGM model would apply to the wetlands in the Project Area because they are adjacent to tidal waters (e.g., abut tidal waters or are within the coastal floodplain associated with the BSC and South Bay). USACE staff also recommended using the "full" Tidal Fringe HGM model (Shafer et al. 2002) rather than the interim HGM model. The HGM model was determined to be not suitable for assessing unvegetated tidal flats or other non-wetland waterbodies.

The Tidal Fringe HGM model (Shafer et al. 2002) assesses nine functions that are performed by tidal fringe wetlands along the northwest Gulf of Mexico. To estimate the nine functions, data are collected for several variables related to hydrologic regime; habitat types, size, and connectivity; vegetation coverage, structure, and species composition; slope and topography; and soil texture, which are then incorporated into formulas that calculate Functional Capacity Indices for each of the nine functions (FCIs). The FCIs each range from 0 to 1, with a higher FCI indicating higher function. The FCIs are then multiplied by the acreage of the respective wetland assessment area (WAA) to obtain the Functional Capacity Unit (FCU) for each function.

Table 7 summarizes Pre-Project and anticipated Post-Project FCUs in the Project Area. The assessment indicates that Project Area wetlands, on average, score highest for the following three functions: Maintain Characteristic Plant Community Composition, Provide Wildlife Habitat, and Shoreline Stabilization.

Table 7. Summary of FCUs in the Project Area (Pre- and Post-Project)

Function	Pre-Project FCU	Post-Project FCU	Net Change FCU
Sediment Deposition	45.8	29.8	-16.0
Resident Nekton Utilization	39.8	25.5	-14.3
Non-resident Nekton Utilization	38.5	24.3	-14.2
Maintain Invertebrate Prey Pool	69.6	47.0	-22.6
Nutrient and Organic Carbon Exchange	30.8	18.4	-12.4
Maintain Characteristic Plant Community Composition	118.1	83.2	-34.9
Plant Biomass Production	42.0	24.5	-17.5
Provide Wildlife Habitat	117.8	78.6	-39.2
Shoreline Stabilization	122.1	82.2	-39.9

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In comparison, **Table 8** summarizes Pre-Mitigation and estimated Post-Mitigation FCUs in the LSML Mitigation Site. The Post-Mitigation FCUs are based on a conservative estimate, using the Tidal Fringe HGM model, of anticipated functional lift gained by (1) providing regular tidal flow to the LSML basin and (2) re-establishment of estuarine wetlands in the unvegetated flats. Other benefits may also occur. Based on the mitigation plan, the estimated maximum acreage of wetlands that may re-establish in unvegetated flats along LSML is approximately 71 acres. However, based on the functional assessment, approximately 50 acres of wetland re-establishment, in combination with the enhanced hydrology to existing wetlands, would replace the functions that will be impacted by the proposed Annova LNG Project. Based on discussions with the USACE and resource agencies during Joint Evaluation Meetings, Annova recognizes that the unvegetated flats sometimes support algal mats and provide important habitat for the threatened and endangered piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*), as well as other resident and migratory shore birds. Therefore, during detailed design of the mitigation plan, Annova will work to maximize the potential for preserving some of the unvegetated flats in the basin.

Table 8. Summary of FCUs in the LSML Mitigation Site (Pre- and Post-Mitigation)

Function	Pre-Mitigation FCU	Post-Mitigation FCU		Net Change FCU	
		71-acre Wetland Establishment	50-acre Wetland Establishment	71-acre Wetland Establishment	50-acre Wetland Establishment
Sediment Deposition	105.9	163.6	151.3	57.7	45.4
Resident Nekton Utilization	113.5	173.2	160.3	59.7	46.8
Non-resident Nekton Utilization	119.9	173.9	160.1	54.0	40.2
Maintain Invertebrate Prey Pool	119.6	178.7	164.0	59.1	44.4
Nutrient and Organic Carbon Exchange	77.2	112.0	104.1	34.8	26.9
Maintain Characteristic Plant Community Composition	122.2	179.0	162.2	56.8	40.0
Plant Biomass Production	67.0	84.0	79.0	17.0	12.0
Provide Wildlife Habitat	138.5	197.1	179.8	58.6	41.3
Shoreline Stabilization	151.8	211.7	194.0	59.9	42.2

The one function that may not be fully replaced by 50 acres of wetland re-establishment is the Plant Biomass Production function, which is dependent on vegetation cover *and* vegetation height. The projected Post-Mitigation FCUs in **Table 8** assume minimal establishment of mangrove wetlands. Although mangrove wetlands would provide increased Plant Biomass Production, discussions with the USACE and resource agencies at Joint Evaluation Meetings indicated that Annova's mitigation plan should minimize mangrove planting and establishment because mangrove marshes in the region are encroaching on emergent marshes and other estuarine habitats due to an overall trend of rising temperatures and absences of freezes that would normally cause mangroves to die back periodically. Therefore, during detailed design of the mitigation plan, Annova will work to minimize the potential for mangrove establishment in the mitigation site.

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7.1 Summary of Mitigation Plan Values/Benefits

Annova's LSML Mitigation Plan would enhance and restore an estimated 250 acres of wetlands/waters by providing regular tidal flow to the LSML basin and adjacent areas and re-establishing estuarine wetlands in the basin. As described in the work plan provided in Section 8.0, approximately 7 acres of open water channel would be excavated to allow for this enhancement and restoration project. In addition, up to 71 acres of estuarine marsh would be established adjacent to the channels and in the tidal flats, an estimated 94 acres of existing wetlands would be enhanced, and approximately 58 acres of shallow open water habitat would become accessible to estuarine species on a regular basis. **Figure 7** shows a conceptual image of the aquatic resources that are expected in the LSML Mitigation Site after the mitigation plan is implemented.

8.0 MITIGATION WORK PLAN

The conceptual work plan involves excavating a series of channels between San Martin Lake and LSML that would restore tidal flow to LSML, two adjoining basins, and the surrounding flats (**Figure 7**). Based on the previous work done for Permit No. SWG-1995-00115, the new channels are expected to be around 40 feet wide at the bottom, 60 to 200 feet wide at the top, and excavated down to an elevation of 0.0 (that is, down to mean sea level) (**Figure 8**). The final channel width and bottom elevation, however, will be determined based on detailed survey of existing elevations and hydraulic design to provide adequate exchange between San Martin Lake and the LSML basin.

In addition to the channels, hydrologic conditions necessary for wetland formation would be enhanced and/or restored, by excavation and/or filling, in the basins and surrounding flats. The volume of material to be excavated during channel construction would depend on final channel plans. Depending on the dredging method used, dredged material would be deposited in an appropriate upland site, existing dredged material placement areas (DMPAs), or on-site to establish appropriate elevations for marsh establishment.

Locally adapted wetland species such as sea ox-eye daisy, glassworts, seepweeds, shoregrass, and saltgrass will be planted in shallow excavated areas (excavated areas less than 1 foot deep), while black mangrove would be planted in deeper locations at the margins of the excavated channels to stabilize the channels. The locations and extent of emergent and mangrove marsh would be determined by evaluating final elevations and the elevations of existing emergent and mangrove marsh in the vicinity. Based on discussions with the USACE and resource agencies, Annova will work to minimize the amount of mangroves wetland that is established in the mitigation site.

9.0 MAINTENANCE PLAN

The width and bottom elevation of the proposed channels between San Martin Lake and LSML will be designed by hydraulic engineers and are not expected to require maintenance dredging to prevent silting in and closing. During the monitoring period, Annova will ensure successful establishment of planted areas and tidal flow between San Martin Lake and LSML. During the monitoring period, Annova will replant vegetation and maintain the channels as needed to meet the success criteria outlined in the Performance Standards section. After the mitigation site achieves the success criteria, it will be managed and protected by the USFWS refuge system in accordance with their goals and management plan.

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Little San Martin Lake Mitigation Site

Wetland Type (Projected)

- Estuarine Wetland
- Open Water Channel
- Tidal Pond
- Unvegetated Flat

Figure 7
Little San Martin Lake Mitigation Site Work Plan
Cameron County, Texas

1:15,000

0 625 1,250 2,500
Feet

Base Map: 2016 NAIP Aerial Imagery

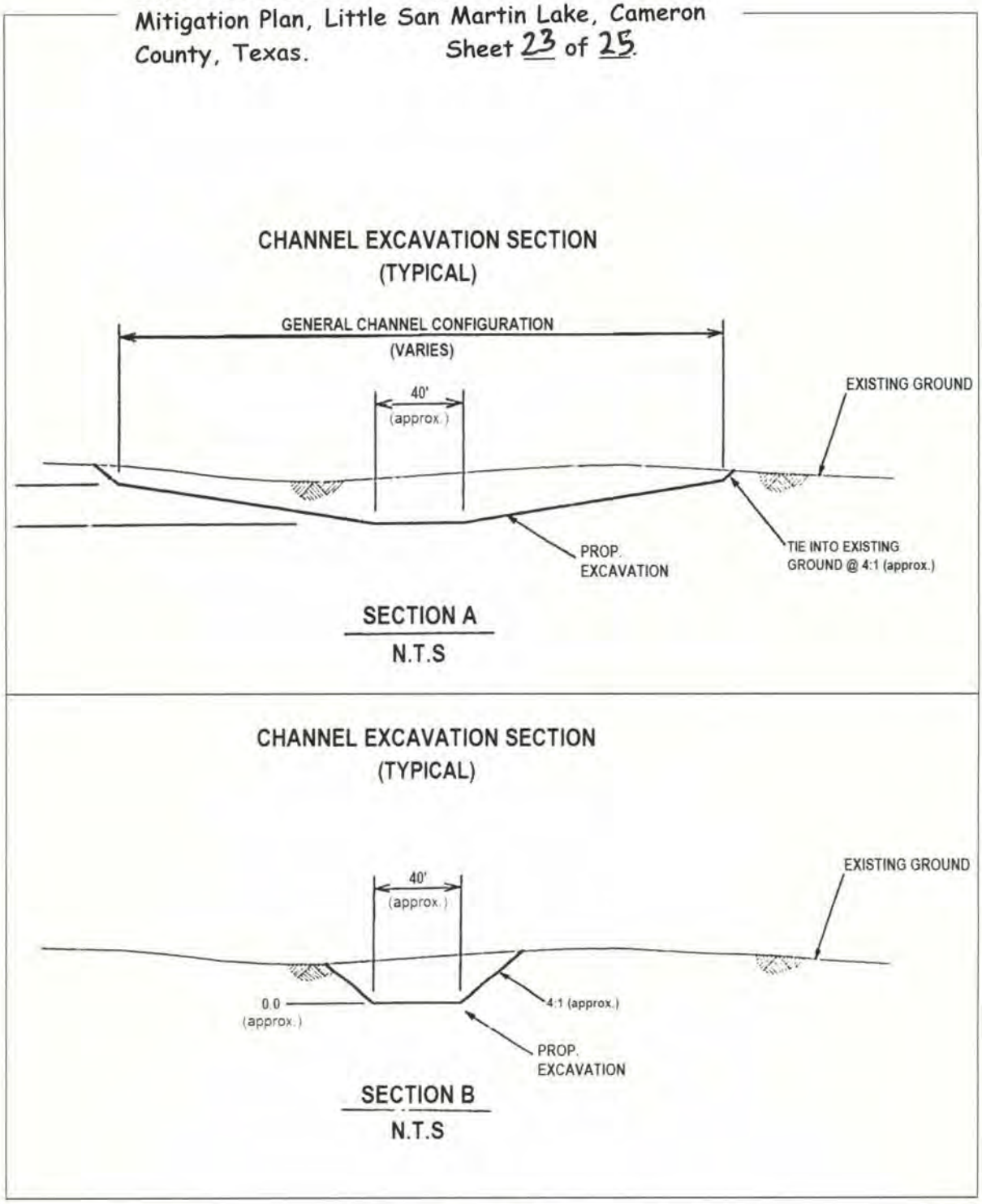

Figure 8
Typical Sections
Little San Martin Lake Mitigation Site
Cameron County, Texas

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10.0 PERFORMANCE STANDARDS

Annova will work toward performance standards regarding hydrological modifications and revegetation efforts. The performance standard for hydrologic modifications will be to ensure that the channels remain open and tidal flow to LSML is maintained during the monitoring period. The performance standard for revegetation efforts will be that wetland plant communities are present in the planted areas, and wetland vegetation is naturally establishing in unplanted flats at the end of the five-year monitoring period. Based on vegetation cover in existing wetlands, at least 40% cover by native wetland species should be present in the planted areas by the end of the monitoring period. Although not expected, nuisance, invasive, noxious, or exotic plant species will be limited to less than 15% aerial coverage.

11.0 MONITORING REQUIREMENTS

Annova will monitor the success of proposed hydrological modifications and revegetation efforts. Initial monitoring will occur within 6 months of the initial planting and any subsequent plantings to monitor survival. Following the initial survey, monitoring will occur annually for up to five years.

Hydrologic modifications will be monitored to ensure that tidal flow to LSML is maintained; if tidal flow is impeded by sedimentation or natural channel modifications, Annova will conduct minor mechanical modifications to reestablish flow.

Revegetation efforts will be monitored to ensure that wetland plant communities with at least 40% cover by native species are present in the planted areas at the end of the five-year monitoring period and that wetland vegetation is naturally establishing in unplanted flats.

After each monitoring period, Annova will submit a report to the USACE documenting the progress of the mitigation site and success criteria.

12.0 LONG-TERM MANAGEMENT PLAN

The LSML Mitigation Site is within the Bahia Grande Unit of the LANWR, which is owned and managed by the USFWS, a federal resource agency. After the mitigation work plan and monitoring are completed and the mitigation plan has achieved the success criteria outlined in the Performance Standards section, the site will be managed and protected by the USFWS in accordance with their goals and management plan. The legal instrument that will be tied to the portion of the BND's PDE surrounding the mitigation site will also protect the mitigation site.

13.0 ADAPTIVE MANAGEMENT PLAN

In the event that the proposed mitigation cannot be achieved, or success criteria are not being met as anticipated due to unforeseen changes in site conditions or other factors, Annova will consult with the USACE and USFWS to identify strategies for meeting Annova's mitigation obligations. Adaptive management strategies may include supplemental planting of estuarine wetland vegetation along the proposed channels and within other portions of the mitigation area and/or deepening, maintenance dredging, or reconfiguration of the proposed channels to maintain tidal flow.

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After the success criteria outlined in the Performance Standards section are met, the mitigation will be considered successful, and the site will be managed and protected by the USFWS refuge system in accordance with their goals and management plan.

14.0 FINANCIAL ASSURANCES

The initial mitigation work plan will be conducted within the same timeframe as construction of the proposed Project infrastructure, so the initial work plan will be part of the overall Project budget. To ensure funding is in place beyond the initial construction period to address annual monitoring, maintenance, and contingency specifically for the mitigation project, Annova will create and implement an appropriate instrument, including but not limited to a performance bond, escrow account, casualty insurance, or letter of credit, subject to USACE approval. The amount of the financial assurances will be based on the estimated cost needed for the proposed monitoring and maintenance activities, as well as a contingency for additional efforts needed to meet the performance standards.

15.0 REFERENCES

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