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April 26, 2019

Colonel Lars Zetterstrom
District Commander
Attention: Mr. Harmon Brown
Galveston District, U.S. Army Corps of Engineers
Post Office Box 1229
Galveston, Texas 77553-1229

Dear Colonel Zetterstrom:

The U.S. Fish and Wildlife Service (Service) is collaborating with the U.S. Army Corps of Engineers (Corps) on the evaluation of the “Jefferson County Ecological Restoration Feasibility Study (JCER)” located in Jefferson County, Texas. It is the Corps’ assertion that there is a critical need to improve the coastal shorelines and protect the marsh both of which provide buffers against major storm events and sea level rise for communities, businesses, infrastructure, and navigation in Jefferson County, Texas. The JCER Study area lies within a critically important landscape known for its ecological and economic significance on both local and national scales. The Study sponsors, Jefferson County and the Sabine Neches Navigation District, are in agreement with the Corps on the selection of the Tentatively Selected Plan (TSP) that will move forward for additional planning, design, and funding.

The enclosed Fish and Wildlife Coordination Act Report (FWCAR) is presented herein to provide the Service’s comments and recommendations regarding the JCER while identifying planning constraints that may influence the Service’s ability to fulfill our reporting responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This FWCAR is prepared under the authority of the FWCA; and does constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA. The Service will provide copies of the FWCAR to the National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD); if any comments are received, we will forward them under a separate cover. Comments in this letter are also provided under Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884, as amended) and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended).

The FWCA identifies and highlights key natural resources and provides avoidance and minimization measures for fish and wildlife within the Study area. The Service believes the recommendations in this letter will guide the Corps in developing an environmentally sound restoration project that eliminates or significantly reduces negative impacts to natural resources within the project area while restoring critically important fish and wildlife habitat. We look forward to working with the Corps to refine the TSP during the Planning, Engineering, and Design phase of the Study.

Please contact staff biologist, Donna Anderson (281-212-1505) or myself at 281-286-8282 with any questions.

Sincerely,

A handwritten signature in blue ink, consisting of several loops and a long horizontal stroke extending to the right.

Charles Ardizzone
Field Supervisor

Cc: Doug Head, USFWS McFaddin NWR
Rusty Swafford, NMFS
Rebecca Hensley, TPWD
Paul Kasper, EPA
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Jefferson County Ecological Restoration Feasibility Study



Fish and Wildlife Coordination Act Report

Submitted to:
Galveston District
U.S. Army Corps of Engineers

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April 30, 2019



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List of Acronyms

Act	Endangered Species Act
BMP	Best management practices
Corps	U.S. Army Corps of Engineers
FWCAR	Fish and Wildlife Coordination Act Report
GIWW	Gulf Intercoastal Water Way
GLO	Texas General Land Office
GOM	Gulf of Mexico
ICT	Interagency coordination team
IPaC	Information for Planning and Consultation
JCER	Jefferson County Ecological Restoration Study
MBTA	Migratory Bird Treaty Act
NAWMP	National American Waterfowl Management Plan
NER	National Ecosystem Restoration
NMFS	National Marine Fisheries Service
NRCS	National Resource Conservation System
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge
PED	Planning, Engineering and Design
PAL	Planning Aid Letter
RP	Recommended Plan
SNND	Sabine Neches Navigation District
SNWW	Sabine Neches Water Way
Service	U.S. Fish and Wildlife Service

TPWD	Texas Parks and Wildlife Department
TSP	Tentatively Selected Plan
TxGLO	Texas General Land Office
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment
WMA	Wildlife Management Area

Executive Summary

The upper Texas coast, historically rich in natural resources, experienced significant shoreline erosion and loss of wetlands over the last three decades. Anthropogenic changes such as agricultural practices, jetties, large navigation channel construction, smaller canal systems, oil and gas developments, and natural change such as increased frequency and amplitude of high tide events and sea level rise contribute to the ecosystem degradation experienced in Jefferson County, Texas. The Jefferson County Ecological Restoration Feasibility Study (JCER), one of four component studies for the larger Texas Coastal Study, has the specific purpose to evaluate ecosystem restoration problems and opportunities along the coast in Jefferson County, Texas. The U.S. Army Corps of Engineers (Corps) was requested to conduct the Jefferson County Ecological Restoration Feasibility Study via Resolution Docket 22620 adopted on February 16, 2000, by the U.S. House of Representatives Committee on Transportation and Infrastructure.

An Interagency Coordination Team (ICT) made up of Corps and state and federal natural resource agency staff developed a list of 14 Comprehensive Strategies with specific measures to address the ecological deficits of Jefferson County and provide opportunities for storm damage reduction and ecosystem restoration. Measures to protect and restore coastal wetlands and unique natural ecosystem features (such as cheniers) were evaluated, including the construction of shoreline protection measures along the Gulf of Mexico and navigation canals, interior lakes and bays, plus measures to re-create wetlands in shallow open water areas. Since the JCER is part of the larger Texas Coastal Protection and Restoration Study, measures not constructed will be incorporated into the Texas Comprehensive Master Plan due out in 2021. This plan seeks to identify coast-wide small and large-scale ecological restoration opportunities contributing to coastal resiliency. The initial list of potential project measures for the JCER Study was reduced to a more focused and achievable final list of measures based on criteria approved by an interagency project delivery team.

The final list of measures was assembled into four alternatives plus the “no action” alternative, all of which were evaluated for cost effectiveness and varying levels of ecosystem restoration. The Corps chose not to select the National Ecosystem Restoration (NER) plan nor the environmentally preferred plan to move forward for further evaluation. The Corps, however, selected the recommended plan (RP). The RP was selected and named as the TSP due to perceived significant implementation risks associated with the NER plan. The NER plan is a more comprehensive restoration plan involving shoreline protection on two fronts (along the beach and the Gulf Intercoastal Waterway (GIWW) and marsh restoration using dredge material with a significant amount of work on National Wildlife Refuge (NWR) lands. The NER would in fact require funding and implementation by the Service; however, the Corps would not identify additional revenue sources leaving the Service to fund all restoration occurring on federal lands. Due to uncertainties in future funding and Service restoration priorities, the NER plan was not recommended. The Corps felt that measures occurring on Service lands may not be implemented within a reasonable period or at all given Department of Interior funding constraints. These limitations could result in ecosystem restoration assumptions and benefits that may not be realized within the 50-year period of the study. Therefore, the RP was identified as the next best plan with minimal restoration occurring on Service lands while still providing some environmental benefits within Jefferson County.

The Corps asserts that implementation of the TSP would restore, enhance, and protect 8,421 acres of coastal wetlands and construct 6,592 feet of offshore breakwaters along the Gulf Intercoastal Water Way (GIWW). However, implementation of some restoration measures could result in minor adverse impacts.

The recommendations provided in this report address ways to avoid unintended impacts to and improve fish and wildlife habitat quality in the proposed restoration areas. The Service supports ecological restoration in Jefferson County when it aligns with specific management goals and objectives of land managers. Therefore, we do not object to the implementation of the TSP provided the recommendations included herein are incorporated into the project.

Introduction

Regulatory Background

The Service is mandated to provide expertise during the planning and development of major federal projects, to ensure that fish and wildlife resources are conserved, and that impacts to these resources are avoided or minimized. The Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401), requires consultation with the Service and State fish and wildlife agencies where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources." Second, The Rivers and Harbors Act of 1938 (33 U.S.C. 540, and other U.S.C. sections; Chapter 535, June 20, 1938; 52 Stat. 802), provides for wildlife conservation to be given "due regard" in planning federally authorized water resource projects.

The FWCA provides a basic procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into Federal and federally permitted or licensed water development projects. The principle provisions of the FWCA include:

1. A statement of Congressional purpose that fish and wildlife conservation shall receive equal consideration with other project features;
2. Mandatory consultation with wildlife agencies to achieve such conservation;
3. Full consideration by action agencies of the recommendations resulting from consultations;
4. Authority for action agencies to implement such recommendations as they find acceptable.

Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884, as amended) requires Federal agencies to insure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of listed species or modify critical habitat. The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended) establishes a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, at any time, or in any manner, any migratory bird (e.g. waterfowl, shorebirds, birds of prey, song birds, etc.) included in the terms of this Convention...for the protection of migratory birds...or any part, nest, or egg of any such bird."

The purpose of this FWCA report is to provide the Service's comments and recommendations regarding trust resources within the Study area while identifying planning constraints that may influence the Service's ability to fulfill our reporting responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report is prepared under the authority of the FWCA; and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA.

The Service will provide copies of this report to the National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD); if any comments are received on this report they will be forwarded under a separate cover letter. Our comments in this FWCA are focused on the specific restoration alternatives and the effects on the trust fish and wildlife resources within the overall project footprint.

Project Background

The Service is collaborating with the U.S. Army Corps of Engineers (Corps) on the evaluation of the “Jefferson County Ecosystem Restoration Feasibility Study (Study)” located in Jefferson County, Texas (Figure 1). The Study will conduct a separate and independent review of the Jefferson County (Study area) coastal area including shoreline and interior wetland areas. Findings from this Study will be included in the larger and more comprehensive Texas Coastal Study, which seeks to evaluate storm surge protection and ecological restoration measures along the entire Texas coast. The assessment for this Study includes impacts from federally constructed projects and recommends solutions for ecosystem restoration opportunities. These solutions include but are not limited to the potential beneficial use of dredge material from the Sabine-Neches Waterway (SNWW), Gulf of Mexico (GOM) beach and Gulf Intercoastal Waterway (GIWW) shoreline protection, and wetland restoration in Jefferson County, TX.



Figure 1 Jefferson County Shoreline Ecosystem Restoration Feasibility Study Area

Source: USACE 2017

That Docket specifically requested the Secretary of the Army, in accordance with section 10 of the River and Harbors Act, to “...review the feasibility of providing shore protection and related improvements between Sabine Pass and the entrance to Galveston Bay, Texas in the interest of protecting and restoring environmental resources on and behind the beach, to include the 77,000 acres of freshwater wetlands and the maritime resource of east Galveston Bay and Rollover Bay, and include the feasibility of providing

shoreline erosion protection and related improvement to the Galveston Island Beach, Texas ...” Based on the findings, the Corps will recommend a selected plan to the U.S. Congress for potential authorization and implementation.

The Corps identified the following problems within the Study area:

- Land loss due to erosion and subsidence threatening geomorphic structure and hydrologic function of the coastal shoreline and inland wetland systems.
- Altered hydrologic conditions contribute to the conversion of low salinity coastal habitats to those of higher salinities or to open water.
- Longshore sediment transport is significantly reduced along this portion of the Texas coast resulting in limited sustainability of the coastal ecosystem.
- Sea level rise is expected to exacerbate the already identified problems

The Corps defined the following objectives for the Study area:

- Improve the salinity regime, sediment, and nutrient inputs into the project area.
- Increase the quality and quantity of wetland habitat to provide for ecosystem sustainability.
- Create, restore, nourish, and protect a sustainable shoreline system to protect wetlands located between the Gulf and GIWW.

The Study is authorized under Section 110 of Rivers and Harbors Act 1962 and by resolution; dated February 16, 2000 entitled “Sabine Pass to Galveston Bay, Texas.” The U.S. Senate requested the Secretary of the Army develop a comprehensive plan addressing severe erosion along coastal Texas for the purpose of shoreline erosion and coastal storm damages, providing for environmental restoration and protection, increasing natural sediment supply to the coast, restoring and preserving wetlands and wetlands, improving water quality, and other related purposes to the interrelated ecosystem along the coastal Texas area. As a result, the local sponsors, Jefferson County and Sabine Neches Navigation District (SNND), signed a cost-share agreement with the Corps in July 2016. This resulting feasibility study is conducted under the Corps 3x3x3 Rule limiting total project costs to \$3 million, must be conducted within three years, and have three concurrent levels of review. The Study began in FY17 with completion expected in late FY19.

We present this JCER Fish and Wildlife Coordination Act Report (FWCAR) to provide the U.S. Fish and Wildlife Service’s (Service) comments and recommendations while identifying planning constraints that may influence the Service’s ability to fulfill our reporting responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This FWCAR is prepared under the authority of the FWCA; and does constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA. The Service will provide copies of the FWCAR to the National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD); if any comments are received they will be forwarded under a separate cover. Comments in this letter are also provided under the Endangered Species Act (Act) of 1973 and the Migratory Bird Treaty Act (MBTA) of 1918.

The Services’ evaluation is based on the current data, modeling, and analyses made available by Corps sources and Service files. The Service understands construction of the project is subject to Congressional approval and the Tentatively Selected Plan (TSP) funding will occur sometime in the future with or

without project modifications. Additional Service involvement is necessary for subsequent detailed planning, habitat analysis, engineering, design, and construction phases of each planning effort is required to fulfill our responsibilities under the FWCA. Since there may be a significant time lag between the study and construction phases, the Service recommends the Corps reinstate coordination under a separate FWCA agreement when Planning, Engineering, and Design (PED) phase funding is made available. This will allow the Service to conduct a comprehensive review of the project footprint, impacts, and update recommendations based on environmental conditions at the time of construction.

The Service extensively described the Study's natural resources, available habitats, and recommendations for protection of those very resources and habitats in the Sabine Neches Water Way Channel Improvement Project Fish and Wildlife Coordination Act Report (U.S. Fish and Wildlife Service, 2010) and the JCER Planning Aid Letter (PAL) dated November 11, 2017 (U.S. Fish and Wildlife Service, 2017). Habitat values, fish, and wildlife resources described in those previous letters and reports remain relatively unchanged and are therefore incorporated herein by reference. The Service strongly supports the Corps and the Study sponsors in their quest to identify and implement restoration opportunities along this portion of the upper Texas coast. The Service received no comments on the PAL provided to NMFS and TPWD.

The Service participated on the Corps led team to develop strategies and identify measures to improve ecological conditions without regard for costs or financial obligations in Jefferson County. Numerous ecological restoration measures were evaluated within the Study area including protection and restoration of coastal wetlands, unique ecosystem features, and construction of shoreline protection projects (for navigation canals, interior lakes and bays, and the Gulf of Mexico) on federal and private lands. Of the 13 alternatives considered (including the no action alternative), only the beneficial use alternatives were considered cost effective and included in the TSP. The ecosystem restoration features of the proposed TSP will benefit wetlands (with benefits to migratory wading birds and waterfowl) and other aquatic habitats that support the Service's trust resources.

Just days prior to the recent Pre-TSP meeting, the Corps moved to select and modify 4A as the proposed TSP instead of 6A, removing any restoration on Service lands due to the Service's inability to commit funding at this time. 6A, as proposed, would result in a Service cost-share burden of \$654,492,000 greater than either the Corps or the non-federal sponsor shares combined. As a result, the Corps identified Alternative 6A as the National Ecosystem Restoration (NER) plan and 4A as the proposed TSP. Alternative 6A is very similar to 4A with the exception of a constructed beach berm at Texas Point NWR, marsh restoration on McFaddin NWR, and 3.1 miles of breakwater structures located on State owned lands on the GIWW. The Corps believes 4A to be "the most achievable" of the alternatives; however, the Service believes restoration of the areal loss of Service lands due to the construction and maintenance of the GIWW and SNWW channel should be appropriately addressed in the TSP.

In general, the Service supports suitable restoration opportunities in Jefferson County; however, an alternative providing the greatest amount of ecosystem benefits and lift warrants inclusion and is preferred and recommended under this Study. Unfortunately, ecological lift and ecosystem benefits are not adequately quantified or accounted for within the Corps cost analysis processes ultimately providing a TSP that provides the beneficial use of dredge material (local sponsor preferred option) with minimal shoreline protection and does little to reduce storm surge and habitat conversion within the Study area. The Service has maintained the position throughout the planning process that shoreline and

GIWW/SNWW protection is imperative for the long-term success of any marsh restoration in Jefferson County. The Gulf of Mexico shoreline/beach erosion rates in this area are among the highest along the Texas coast; and accordingly, the GIWW continues to erode and widen due to increased vessel driven wave fetch. Without suitable and consistent beach and dune ridge protection, a sufficient sediment supply, armoring of the GIWW and Sabine Lake shorelines, marsh habitat south of the GIWW will experience salinity conversion resulting in an open water habitat within the next 50 years.

Future Fish and Wildlife Resources

Sea level rise, shoreline retreat and the loss or transition of coastal wetlands remains the primary issues affecting Study area fish and wildlife resources. We expect future losses to be attributed to wave action, subsidence, saltwater intrusion, eustatic sea level rise, and insufficient sediment supply. Sediments supplies are notably deficient along the upper Texas coast, mainly due to ship channel dredging, damned upstream rivers, and the presence of jetties and this trend is expected to continue. Increasing acreages of open water and decreased wetland quality may lead to significant declines in coastal fish and shellfish production, limited carrying capacity for migratory waterfowl, wading birds, other migratory birds, alligators, furbearers, and game mammals such as white-tailed deer and swamp rabbit.

Saltwater intrusion caused by the construction and enlargement of the Sabine Neches Water Way, Salt Bayou, the GIWW sea level rise, and beach overtopping (caused by storm events) are considered causes of wetland loss in Sabine Lake (Workgroup, 2013). Deepening and widening efforts in deep-draft channels have been linked to increased salinity levels, water levels, and duration of high tides in some areas (U.S. Fish and Wildlife Service, 2010). The increased salinity stresses fresh and intermediate wetland vegetation, contributing to plant death and ultimately conversion of wetlands to shallow open water. Those hydrology changes result in the rapid conversion of interior low-salinity wetlands to open water and brackish wetlands. Once those changes have occurred, loss rates decrease as the most vulnerable areas have become open water. Further, saltwater intrusion continues to impact sensitive low-salinity wetland areas during drought-induced high salinity periods. Changes to wetland habitats stress fish and wildlife causing decreased productivity, encouraging predation, abandonment of the habitat by those species. Because of continued saltwater intrusion, habitat quantity and quality for freshwater fishes, waterfowl, alligators, and more freshwater-tolerant estuarine species (i.e., Gulf menhaden, white shrimp) will continue to decrease throughout most of this area. Habitat quantity will increase for species such as brown shrimp, spotted seatrout, and black drum, which prefer brackish and saline conditions. However, continued degradation of those brackish and saline marshes may reduce production of those fish and shellfish.

Road construction and development along the cheniers has filled a number of swales or drains which during high water periods, allowed the Neches River Basin water to drain southward into the tidal marshes. Closure of those drains has nearly eliminated seasonal freshwater inputs into those brackish marshes, affecting the health of those marshes and reducing the fish and wildlife resources they once supported. Hurricanes fill in canals and ditches between cheniers, causing ponding of water and the deterioration and loss of live oak stands and associated stopover habitat for migrating songbirds.

The Study Area shorelines have a long history of coastal erosion and without intervention; we expect this trend to accelerate. Paine et. al (2014) documents shoreline erosion from 1930 to 2012 to be 10.95 feet per year and in the period of 2000 to 2012, the rate increased to 17 feet per year. TPWD's Sea Rim State

Park shoreline remains the only coastline within the Study Area to document accretion. The Corps (2018) documents the accretion to be a result of wave diffraction and as a natural remedy to the Sabine Jetties. Despite the beach accretion at Sea Rim State Park, there remains a sediment deficit along the remaining Gulf shorelines of the Study Area and natural processes will not provide the relief necessary to restore this vital frontline defense.

Future fish and wildlife resource conditions may vary greatly within the Study area from current conditions based on the Corps’ and the GLO’s proposal to construct storm surge gates across the mouth of Galveston Bay restricting ingress and egress by as much as 30%. The Corps’ own modeling predicts changes in salinities, tidal amplitudes, vegetation, and marsh loss in Galveston Bay, because of the constructed gated structure. However, the Service is not aware of any modeling or monitoring to address impacts on adjacent bay systems.

Any future Study features constructed on Service lands must prove to be appropriate and compatible with the existing uses of the Refuge and as in accordance with (603 FW 2.10D(1)) of the National Wildlife Refuge System Administration Act, as amended by the National Wildlife Refuge System Improvement Act of 1997, and 16 U.S.C. 668dd-668ee (Refuge Administration Act). A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of national wildlife refuge that, based on sound professional judgement, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose of the national wildlife refuge. This determination is seated with the refuge manager and will have Regional and national review. This process can take upwards of 180 days to complete. If project features are obtainable, funding sources are identified, and agreed upon by the Service, the Service will work with the Corps to obtain necessary permitting and NEPA compliance to construct features within a reasonable timeline to be determined by both the Corps and the Service. Close coordination with the Refuge through next phases of the Study will reduce the potential for compatibility concerns.

Alternatives under Consideration

The Corps began coordination meetings with state and federal natural resource agencies in November 2016. Early on in the coordination process, the team divided the Study Area into Zones (Table 1) to easily identify the variety of habitats, current existing conditions and possible future conditions without the project. Service staff regularly participated in monthly interagency team meetings where restoration measures were identified, refined, and combined into alternatives including a No Action Alternative.

Table 1 Study Area Zones defined

Study Zone	Existing Conditions	Future without Project Conditions
Zone 1 (Nearshore and Shoreline)	Shoreline erosion rate of up to 40 feet per year with an average loss of 11 ft per year. Severe erosion along SNWW canal entrance and further west along the shoreline.	Shoreline will continue to erode with sea level change. Allows for continued saltwater intrusion from the Gulf and open water development in the marsh over time

Zone 2 (Beaches and Dunes)	Beach/dune is less than 5-10 feet along the beaches and few areas have actual dune left. Longshore sediment transport interruptions throughout region.	Without beach and dune ridge marsh areas are susceptible to overwash, allowing for faster rates of erosion and sea level encroachment into marsh areas
Zone 3 (Ridge and Intertidal marsh)	Back ridges to dune structures are non-existent in some areas, allowing for breaching and saltwater intrusion into marsh areas.	Without back ridge and filling of sediment to raise the marsh platform, saltwater will continue to encroach into open areas
Zone 4 (High Marsh)	With saltwater intrusion, vegetation and soil subsidence have occurred so that some areas are now 1-4 feet below sea level.	Without high marsh the GIWW structure itself could be damaged with open water developing adjacent to the waterways ridges/levees and cause more saltwater to come further inland, continuing the erosion, subsidence, and habitat switching mentioned above

Once the Zones were identified, the group developed 14 Strategies (outlined below) along with a variety of measures to promote a healthy landscape and restore habitat function to the Study Area.

- **Wildlife and Fisheries Strategy 1:** restoration that targets species-specific habitat requirements; restoration that contributes to the recovery of priority species
- **Passive (Indirect) Restoration Strategy 2:** passive restoration of the area that depends on nature to rework the system with minimal human intervention beyond increasing sediment inputs; can implement quickly and cheaply but benefits are not realized immediately. This plan has two options (A/B); both include feeder berm, elevation modifications, and training berm. Option B: includes sand fencing. This plan became alternative 1 during further assessment.
- **Engineered (Direct) Restoration Strategy 3:** active restoration approach that relies on engineered solutions and human intervention to manipulate the system; expensive and time consuming but benefits realized immediately. It includes beach nourishment, breakwater, raised dune/ridges with fencing and plantings, elevation modifications, removal of invasive species, plantings, training berms, water control structures, and armoring on the south bank of the GIWW.
- **Existing ER Plans (Complimentary) Strategy 4:** incorporate measures already implemented or included in the Service's comprehensive conservation plan, WMA plans, TX Coastal Resiliency Plan, and Salt Bayou plans to create a contiguous restored area. It includes beach nourishment, elevation modifications, removal of invasive plant species, plantings, inverted siphons, and armoring on the GIWW.

- **Location Specific Strategy 5 - Keith Lake:** restoration focused in and around Keith Lake; reduce negative impacts of hydrologic modifications by reducing volume of GOM water coming through the pass. It includes elevation modifications, removal of invasive species, plantings and improved drainage.
- **Improve Hydrologic Connectivity Strategy 6:** focus on improved hydrologic flows to reduce saltwater intrusion, freshen brackish waters, improve sediment quality, and provide nutrients to interior wetlands. It includes beach nourishment, raised dune/ridge and fencing and plantings, and training berms.
- **Beneficial Use - Dredge Material Strategy 7:** all measures must utilize dredged material from the SNWW. This plan also has two options (A/B). Option A includes: beach nourishment, raised dune/ridge, fencing and plantings, elevation modification, removal of invasive species, and training berms. Option B includes feeder beach, sand fencing, elevation modifications, removal of invasive, plantings and training berms.
- **Coastal Shoreline Only Strategy 8:** restoration focuses on the shoreline. Includes beach nourishment, breakwater, raised dune/ridge, fencing with plantings, feeder berms.
- **North of GIWW Strategy 9:** restoration would only occur north of the GIWW. Includes elevation modifications, removal of invasive species, plantings, training berm, improved drainage, armoring of the GIWW.
- **South of GIWW Strategy 10:** restoration would only occur south of GIWW. Includes beach nourishment, breakwater, raise dune/ridge, fencing with planting, elevation modifications, and removal of invasive, water control structures, improved drainage, and armoring on the GIWW.
- **Wetland Accretion Strategy 11:** use of measures that promote accretion at a rate sufficient to keep up with subsidence and RSLC. Includes: elevation of wetland modifications, removal of invasive plants, native plantings, and a training berm.
- **Comprehensive Strategy 12:** all measures incorporated to maximize restoration efforts. Includes everything from all other plans, project area wide

Strategies were developed into alternatives and evaluated using economic and environmental criteria. Alternative 13 was later added as a hybrid to capture features of the engineered approach seen in 2A and the passive approach of 1B (**Table 2**), removed the breakwater and beach nourishment measures and replaced it was a sand engine to sustain shorelines further west along the Jefferson County coast. These alternatives received additional screening and the Corps selected six of the 11 alternatives to move forward for further environmental and cost analyses.

Table 2 Alternatives developed from Strategies

Plan	Description
No Action	
	No ecosystem restoration activities would be undertaken in the future, beyond those already being implemented or those that have been authorized through other means
Alternative 1: Passive Restoration	
Both	<ul style="list-style-type: none"> • Restoration occurring on USFWS, TPWD, GLO, and Private lands • Restore 15,009 acres of wetland in 14 restoration units using a passive approach • No invasive species removal or native plantings would occur • Sediment needs would utilize borrow from SNWW, Upland PAs, and offshore sources
1A/1Abu	<ul style="list-style-type: none"> • 71,818 linear feet (13.6 miles) of nearshore berm would be constructed south of McFaddin and Texas Point NWRs
1B	<ul style="list-style-type: none"> • Construct sand engine in swash zone south of McFaddin and Texas Point NWRs
Alternative 2: Engineered Restoration	
Both	<ul style="list-style-type: none"> • Construct 71,818 linear feet (13.6 miles) of beach and dune at McFaddin and Texas Point NWRs • Construct 56,455 linear feet (10.7 miles) of shoreline armoring and segmented breakwaters along the north and south shorelines of the GIWW •
2A	<ul style="list-style-type: none"> • Restoration would occur on USFWS, TPWD, GLO and Private Lands • Focuses on all areas within the focused study area • Restore 15,009 acres of wetland habitat in 14 restoration units including invasive species removal, and native species plantings • Construct 71,818 linear feet (13.6 miles) of offshore segmented breakwaters with a 1 (length):3 (spacing) design ratio
2B	<ul style="list-style-type: none"> • Restoration would occur on USFWS and GLO
Alternative 3: Complementary restoration	
	<ul style="list-style-type: none"> • Restoration would occur on USFWS, TPWD, GLO and Private Lands • Focuses on measures that are already being implemented or have been planned at locations that are contiguous to existing or future restoration efforts. • Restore 12,915 acres of wetland habitat in 12 restoration units including invasive species removal, and native species plantings • Construct 55,413 linear feet (10.5 miles) of beach and dune at McFaddin NWR • Construct 56,455 linear feet (10.7 miles) of armoring and segmented breakwaters along the north and south shorelines of the GIWW • Sediment needs would utilize borrow from SNWW, Upland PAs, and offshore sources
Alternative 4: Keith Lake Area Focused Restoration	
Both	<ul style="list-style-type: none"> • Focuses on the areas in and around Keith Lake • Construct 6,592 linear feet (1.25 miles) of armoring and segmented breakwaters along the southern bankline of the GIWW would be constructed • Sediment needs would utilize borrow material primarily from the SNWW or identified upland disposal sites as sediment becomes available

Plan	Description
4A	<ul style="list-style-type: none"> Restoration would occur on USFWS, TPWD, USACE and Private Lands Restore 8,421 acres of wetland habitat in 6 restoration units including invasive species removal and native species plantings
4B	<ul style="list-style-type: none"> Restoration would occur on USFWS and GLO Construct 16,400 linear feet (3.1 miles) of beach and dune at Texas Point NWR
Alternative 6: Beneficial Use of Dredge Material Alternative	
Both	<ul style="list-style-type: none"> Restoration would occur on USFWS, TPWD, GLO and Private Lands Focuses on the eastern half of the focused study area Restore 11,596 acres of wetland habitat in 9 restoration units including invasive species removal and native species plantings Sediment needs would utilize borrow material from the SNWW beneficial use material
6A	<ul style="list-style-type: none"> Construct 16,400 linear feet (3.1 miles) of beach and dune at Texas Point NWR
6B	<ul style="list-style-type: none"> Construct sand engine in swash zone south of Texas Point NWR
10: South of GIWW Restoration	
	<ul style="list-style-type: none"> Restoration would occur on USFWS, TPWD, USACE, GLO and Private Lands Focuses on areas south of the GIWW within the focused study area Restore 12,560 acres of wetland habitat in 11 restoration units including invasive species removal, and native species plantings Construct 71,818 linear feet (13.6 miles) of beach and dune at McFaddin and Texas Point NWRs Construct 38,237 linear feet (7.24 miles) of armoring and segmented breakwaters along south shorelines of the GIWW Construct 71,818 linear feet (13.6 miles) of offshore segmented breakwaters with a 1 (length):3 (spacing) design ratio Sediment needs would utilize borrow material from SNWW, Upland PAs, and offshore sources
13: Hybrid Restoration	
	<ul style="list-style-type: none"> Restoration would occur on USFWS, TPWD, USACE, GLO and Private Lands Focuses on all areas within the focused study area Restore 15,009 acres of wetland habitat in 14 restoration units including invasive species removal, and native species plantings Construct 55,413 linear feet (10.5 miles) of beach and dune at McFaddin NWR Construct 56,455 linear feet (10.7 miles) of armoring and segmented breakwaters along the north and south shorelines of the GIWW Construct 55,413 linear feet (10.5 miles) of offshore segmented breakwaters with a 1 (length):3 (spacing) design ratio Construct sand engine in swash zone south of Texas Point NWR Sediment needs would utilize borrow material from SNWW, Upland PAs, and offshore sources

Selection of the TSP

Initially, the Corps selected Alternative 6A as the TSP to move forward for further evaluation and funding. This was by far the most comprehensive alternative restoring 11,965 acres of wetland, non-native species removal and favorable species plantings, restoring 3.1 miles of beach and dune habitat, and

include recurring maintenance for all features. The Corp requested reassurances from the Service to secure funding for 20% of the estimated restoration costs occurring on Service lands. However, due to congressional and regulatory budget constraints, the Service does not have the ability to allocate funding in this manner. As a result, the Corps selected Alternative 4ABU as the RP, eliminating all Service lands from any restoration associated with this Study. Alternatives including Service lands were considered “not implementable” and excluded from further consideration for the remainder of the Study.

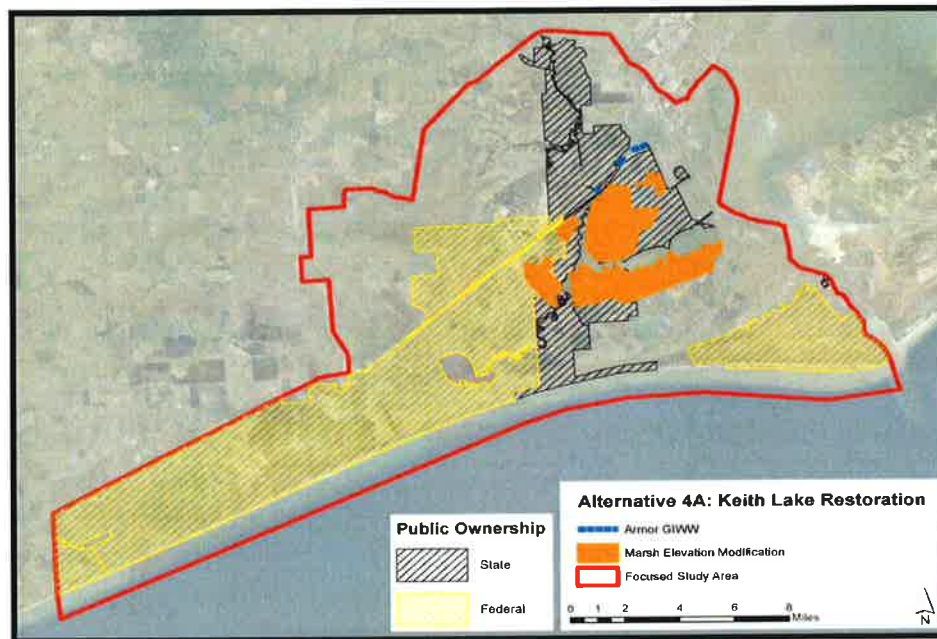


Figure 2 Alternative 4ABU Keith Lake Restoration

Source: Corps (2018)

The currently proposed TSP (4ABU) (**Figure 2**) focuses on areas in and around Keith Lake. Wetland deterioration, mostly due to subsidence, salinity variations, and changes in historic hydrological flows is well documented within the Keith Lake area and warrants restoration. The Salt Bayou Plan, (Workgroup, 2013) (Plan) is a culmination of partnership efforts involving state and federal natural resource agencies and non-governmental organizations. The Plan identified specific ecological needs and made recommendations, some of which are already implemented affecting positive change in the ecosystem. The Corps and the non-federal sponsors will cost share 1.25 miles of armoring and segmented breakwaters along the southern bankline of the GIWW, restore 8,421 acres of wetland habitat by beneficially using dredge material from the GIWW and the SNWW, and includes invasive species removal and native species plantings. The beneficial use of dredge material outlined in the TSP does address at least one goal in the Plan and provides synergy with other local efforts to restore wetland habitat. **Table 3** outlines land ownership within the TSP.

Table 3 Scale and scope of 4ABU measures in comparison to land ownership

Ownership	Marsh Measures (acres)	Shoreline Measures (linear feet)
JD Murphree WMA	5,365	6,592
McFaddin NWR	683	0

Private	2,373	0
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The Corps asserts the TSP will provide ecological benefits to both fish and wildlife that utilize the area over the 50-year lifetime of the project. The Corps removed out-year marsh nourishment at Year 30 from the TSP resulting in reduced overall project benefits and creating a need to assess future marsh nourishment in light of the assumed intermediate sea rise level used during the Study. We urge the Corps to incorporate future re-nourishments into the TSP or provide a mechanism assuring that these project features will be maintained through the 50-year life of the project.

The Service identifies the following generalities associated with the TSP:

Benefits:

- The Service supports desirable restoration projects on private, state, and federal lands of all habitat types within Jefferson County.
- The proposed TSP addresses a critical need of diminished sediment outlined in the Plan.
- The proposed TSP addresses a critical need for shoreline protection along the GIWW along state owned property.
- The ecosystems restoration features will benefit wetlands (with benefits to migratory song birds), and other aquatic habitats that support the Service’s trust resources.
- Measures included in the TSP, regardless of funding, will avoid delays in NEPA compliance and Clean Water Act Section 404 permitting for the Service.
- The Service is willing to work

Limitations:

- The proposed TSP limits shoreline protection along the GIWW and does not address other critical areas (state and private lands) in need. While portions of the McFaddin NWR shoreline has constructed breakwater structures along both north and south sides of the GIWW within the Study area, large portions of privately owned lands (in excess of 5.0 miles on either side) continue to erode form vessel transport and remain unprotected.
- The proposed TSP does not address shoreline protection along Sabine Lake nor the Gulf of Mexico.
- The proposed TSP does not address critical conservation needs on Federal lands leaving much of Jefferson County exposed to further ecological deterioration.
- Alternatives with greater ecological benefits are less likely to be implementable by the Corps and the non-federal sponsor.
- It is foreseeable that Alternative 4A has the potential to create an island effect without other protective measures in place as sea level rise increases within the Study area. While elevated marsh areas may provide some habitat, it does nothing to promote the wellness of the ecosystem as a whole possibly promoting fragmentation.
- While portions of the GIWW in Jefferson County are protected by Federal and State lands, current conditions (land loss, sea level rise, storm intensity and frequency) persist; and land loss rates may accelerate potentially jeopardizing the protection of vessel transports within the federally authorized waterways (GIWW and SNWW) impacting the national economy.

Given the Service's limited time (less than 4 months) and inability to provide a commitment to construct any features on Service lands, the Corps believes there is a higher probability of implementation of project features on lands outside of the Service. This move resulted in the Corps removing all project features from Service lands.

Fish and Wildlife Concerns in the Study Area

Fish and wildlife resource concerns in the study area include ecosystem-wide hydrologic alterations associated with construction of major navigation channels within the study area, the continued loss of coastal fresh and brackish marsh, and loss of beach habitat. The Service remains concerned over water-quality degradation from agricultural and urban run-off, and industrial discharges into upper Sabine-Neches Basin waterbodies. Additionally, Study area chenier ridges were historically present and forested. Residential and agricultural development resulted in the clearing of most of the formerly forested areas. In addition to impeding storm surges, forested cheniers provide important stopover habitat for trans-Gulf neotropical migratory songbirds, many of which have experienced population declines in recent decades. Decades of large-scale storm events have eroded the chenier ridges leaving little protection for interior marsh.

The continued eroding Gulf of Mexico shoreline solidifies concerns centering on deteriorating interior marshes caused by shoreline breaches. If successful, breached shorelines can create tidal passes, resulting in harmful salinity increases. Depending upon the location of such shoreline breaches, the resulting impacts could have ecosystem scale impacts. To avoid such impacts, shoreline protection and marsh creation/restoration measures have been proposed in strategic locations where such scenarios appear more likely.

The Service continues to pursue shoreline restoration on McFaddin NWR independent of the JCER Study and hopes that a 22-mile beach and dune nourishment project will be constructed in the near future. However, there are no out-year nourishment plans attached to the current project. The Service understands the benefit of beach restoration and nourishment and would like to see a TSP that incorporates shoreline restoration for the protection of interior marsh habitat. We strongly believe the first line of defense against storm surge protection along GOM beaches in Jefferson County is a robust beach dune system. Unfortunately, sediment transport along this portion of the coast is significantly restricted due to the presence of man-made structures permitted by the Corps. We welcome the opportunity for future discussions during the PED phase with the Corps to address shoreline and dune nourishment opportunities.

Texas Point NWR shoreline experiences some of the highest erosion rates in Texas. This NWR will benefit from the deepening efforts to the SNWW. BU of dredged material (to coincide with dredging efforts of the channel) will be deposited along a three-mile stretch of Texas Point NWR beach every six years. Upper portions of the Texas coast continue to be sediment starved most likely resulting from the presence of the Sabine Jetties. Recognizing the severe erosion issues at Texas Point NWR; the Corps initiated a WRDA Section 204 Continuing Authorities Program project in 2004. Dredged material hydraulically pumped onto the beach in the nearshore waters dissipated quickly during the placement event, with 60 percent of the sediment remaining following initial disposal. From this demonstration, the Service estimated that 50 percent of the remaining material after each placement episode will erode away by the end of each 6-year cycle accumulating approximately 300 acres over the life of the project (U.S.

Fish and Wildlife Service, 2010). While the BU from the SNWW expansion project will benefit Texas Point NWR shorelines, there is little doubt that the shoreline will continue to erode without substantial BU and shoreline protection measures placing national resources interests and local infrastructure at great risk.

The coastal marshes of the Calcasieu-Sabine Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture, as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. Aside from being a key waterfowl wintering area, the Chenier Plain provides important year round habitat for over 90 % of the continental population of mottled ducks *Anas fulvigula* and serves as a key breeding area for whistling ducks *Dendrocygna autumnalis*. The goal of the NAWMP, Chenier Plain Initiative is to provide wintering and migration habitat for significant numbers of dabbling ducks, diving ducks, and geese (especially lesser snow and greater white-fronted), as well as year-round habitat for mottled ducks. Because wintering waterfowl prefer fresh and intermediate marshes, and because navigation projects have contributed to substantial reductions in those preferred waterfowl habitats, measures to reduce salinity levels would have a positive impact on waterfowl habitat quantity, quality, and usage.

The mottled duck, a non-migratory waterfowl species and a Regional Conservation Priority species for the Service, is dependent upon coastal marsh systems, including that on the TCP NWR Complex. The species require a variety of habitats for different stages of reproduction i.e.: upland nesting habitat, brood-rearing marsh, and pair-ponds for adults. Beilefeld et al. 2010 (Bielefeld, Brasher, Moorman, & Gray, 2010) describes the Texas population as steeply declining. While the population declines are not well understood, the cornerstone of mottled duck management must be the maintenance of trio of habitats necessary for their life cycle. The Service and its partners are committed to restoring coastal marsh habitats for the benefit of mottled ducks and other wildlife species, however funding constraints, erosion, salt-water intrusion, and subsidence may limit restoration efforts.

Tidally influenced mud flats and shallow ponds create estuarine environments critical for the life stages of many commercial and recreationally important wildlife species. Fish, shrimp, crab, and other invertebrates are common in tidal mudflats with other species higher on the food chain preying on these organisms. Piping plovers, great blue herons, great egrets, snowy egret, cattle egrets, rosette spoonbills, black necked stilts, white ibis, king rails, and a variety of duck species rely on a mosaic of exposed mudflats, ponded, open, and marsh habitats within the project area. Recreational waterfowl hunting, on McFaddin NWR, J.D. Murphree Wildlife Management Area, and on private lands within the Study area are important opportunities for recreational hunters during the fall and winter months. Creation, restoration, and maintenance of tidally influenced mudflats and small pond complexes are critical components to the ecological health of the Jefferson County landscape. However, we expect the mud flats to become submerged because of sea level rise.

Evaluation Methodology

The Corps utilized the Wetlands Value Assessment Coastal Marsh (Version [V] 2.0) and Barrier Headland (V 1.0) models to calculate the future without project (FWOP) and future with project (FWP) conditions. The FWOP condition of the restoration units assumes no action is taken. The Wetland Value Assessment (WVA) model operates under the assumption that optimal conditions for general fish and

wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of:

- 1) List of variables that are considered important in characterizing fish and wildlife habitat,
- 2) Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and
- 3) Mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index (HSI).

The WVA model for marsh habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no project efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The HSI is combined with the acres of habitat to get a number that is referred to as "habitat units".

Expected project benefits are estimated as the difference in habitat units between the future with- project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs). The change (increase or decrease) in AAHUs for FWP scenario, compared to FWOP conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type. The Corps conducted the WVA modeling and thoroughly describes the assumptions and results in the Draft Integrated Feasibility Report (U.S. Army Corps of Engineers, 2018). The habitat variable-habitat suitability relationships within these WVA models were conducted via desktop analysis and were not verified by field data collection or validated through any rigorous scientific processes.

The barrier headland model used (V1.0) quantifies the wetland benefits of headland restoration projects and was developed to evaluate barrier headland habitats (surf zone, beach, dune, supratidal marsh, woody areas, and unvegetated flats or wash-over areas) along the Louisiana coast. This model should only be applied to shorelines along the coast consisting of beach, dune, and supratidal habitats, which naturally decrease in elevation to intertidal marsh. The model quantifies and defines "optimal combination" of habitat conditions for all fish and wildlife utilizing barrier headlands.

Actual conditions may vary and field validation for assumptions made under this WVA model should be verified during the PED phase. For the purpose of this report, the Service agrees with the assumptions and results obtained by the Corps' modeling efforts (see **Table 4**).

Table 4 WVA and barrier headland model results

Alternatives	Barrier Headland	Net AAHUs		Acres	
		Brackish Marsh	Total	Direct	Indirect
1A/1Abu	6	10,970	10,976	15,009	0
1B/1Bbu	3	10,970	10,973	15,009	0
2A/2Abu	52	11,090	11,142	15,009	26,015
2B/2Bbu	52	1,630	1,682	0	26,015
3/3bu	52	10,270	10,322	12,915	22,127
4A/4Abu	0	6,897	6,897	8,421	0
4B/4Bbu	52	871	923	0	3,888
6A	52	8,842	8,894	11,596	3,888
6B	8	8,842	8,850	11,596	0
10	52	9,925	9,977	12,560	26,015
13	51	11,090	11,141	15,009	22,127

The Corps selected the 4A/4Abu alternative as the TSP. This alternative provides the least amount of direct benefits and no indirect benefits for adjacent habitats, least amount of construction duration, was the least cost, is located entirely on the eastern portion of Jefferson County and closets to the SNWW, had the least amount of acres restored, and has the smallest footprint. The Corps identifies the sediment source as coming entirely from the SNWW. The Service does not object to the selection of the TSP. However, this exercise could have been accomplished under the development of or amendment to the SNWW DMMP if the Corps and sponsor wished to select the least cost and the least environmentally beneficial alternative.

Impact Analysis

The Service has reviewed all Corps supplied documents and Service files relevant to the JCER Study and the identified TSP measures. Because the project footprint has not been finalized, staging and construction areas have not been identified, we recommend that all construction and staging areas be limited to right-of-ways or previously impacted areas to avoid and minimize impacts to terrestrial wildlife species.

Review of Service and other federal and state natural resource agency publically available data suggests the aquatic environment within the immediate project area does support fish species of both commercial and recreation importance. Potential environmental effects of dredging on aquatic species include

removal/burial of organisms, turbidity/siltation effects, contaminant release and uptake (including nutrients, metals, and organics), release of oxygen consuming substances, entrainment, noise disturbances, and alteration to hydrodynamic regimes and physical habitat (ECOPR, 2009). Exposure to these environmental effects may result in exposure of fish to various stimuli that may result in positive, negative, or neutral behavioral response (ECORP, 2009). Germano and Cary (2005) believe the majority of fish behavioral effects from dredging activities are associated with the re-suspension of sediments and the resulting physical and chemical alterations within the water column. Migrating behaviors of fish can be disrupted when encountering dredging activity or localized dredge plumes; however, most migration patterns return to normal after the dredging is completed. While the majority of the construction will occur within shallow open water areas, we believe any migratory or resident fish species will quickly move away from any dredging activities. Once construction is complete, we expect aquatic species to once again occupy this area.

Environmental contaminants closely associated with oil and chemical processing are commonly managed through the refineries located along the waterways of the upper Texas coast. Occasional spills release contaminants into local waterways and can pose immediate and long term threats to aquatic species. During dredge operations for new work and maintenance materials, contaminants may be re-suspended into the water column harming fish species.

Due to the transient nature of fish and wildlife more commonly found in the immediate project area, it does not appear that the construction and dredging activities outlined in the Study area will have a noticeable long-term negative impact on any fish or wildlife species if Best Management Practices (BMPs) are implemented. We expect the dredging impacts will remain the same for all alternatives and no noticeable long-term impacts to fish and wildlife is anticipated from the proposed restoration measures. However, continued coordination during the refinement process to further eliminate possible impacts to fish and wildlife species and habitats is recommended.

Wetlands

BU of dredge material will restore and nourish approximately 8,421 acres of marsh habitat around Keith Lake and will likely include five marsh restoration units. The TSP called for initial target elevations of +1.2 feet Mean Sea Level (MSL) with a 30-yr renourishment cycle hydraulically pumped to +2.2 MSL (based on the intermediate sea level rise curve). The Corps removed the out-year nourishment cycle from the TSP and at this time, we are uncertain of the what the pumped elevation will be during construction. We recommend continue coordination during the PED phase as target elevations may impact adjacent habitats.

Future staging areas, temporary access channels, and floatation dock locations will be identified during PED. To the greatest extent possible, staging would be placed outside of environmentally sensitive areas and all ground disturbance and staging areas should be temporary and fully restored resulting in no permanent loss. The Service is fully aware that dredge schedules may be unpredictable, however we recommend construction occur outside of the growing season to reduce submerged aquatic and landward vegetation impacts. We likely will have additional recommendations to reduce wetland impacts during the PED phase.

The Corps (2018) claims there will be no direct impacts to wetlands from TSP construction and associated future maintenance. Overall, wetland loss (whether direct or indirect) results in increasing acreages of open water, reduces storm surge protection of developed lands, and will likely contribute to water quality degradation associated with excessive nutrient inputs. Continued wetland losses are expected to cause significant declines in coastal fish and shellfish production and a decline in the Study area's carrying capacity for migratory waterfowl, wading birds, other migratory birds, alligators, furbearers, and game mammals such as white-tailed deer and swamp rabbit. We encourage the Corps to coordinate with state and federal natural resource agencies for recommendations to avoid and minimize impacts to fish, wildlife, and habitats within the Study area during the PED and construction phases. Full compensation for any wetland impacts during restoration construction is recommended.

We believe that without out-year nourishments identified as part of the construction funding, the benefits of the restoration measures outlined in the TSP will be temporary in nature.

Climate Change and Sea Level Rise

Climate change and sea level rise continues to be a concern along the upper Texas coast. The Corps references use of the NOAA sea level rise mapper for use in this study to delineate. Due to projected climate change by the mid-21st century and beyond, global marine species redistribution and marine biodiversity reduction in sensitive regions will challenge the sustained provision of fisheries productivity and other ecosystem services (high confidence). Approaches for managing climate change risk- Maintaining wetlands & urban green spaces; Coastal afforestation; Watershed & reservoir management; Reduction of other stressors on ecosystems & of habitat fragmentation; Maintenance of genetic diversity; Manipulation of disturbance regimes; Community-based natural resource management (IPCC, 2014).

The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8-14, 18-19). Changes in temperature and/or precipitation patterns will influence the status of the Chenier Plains landscape. These changes may contribute to threats that have already been identified and discussed for the Jefferson County listed species.

The Corps identified sea level rise as a contributing factor to habitat degradation in the JCER Study area. Consistent with the IPCC, the Corps adopted the intermediate sea level rise curve to assess impacts within the study area. The Service agrees with and accepts the Corps' assumptions and evaluations, as described in the Main Report (U.S. Army Corps of Engineers, 2018) regarding sea level rise and climate change impacts over the entire project areas.

Mitigation

The Service does not agree with the Corps' assumption that mitigation is not necessary with the implementation of the TSP at this stage in the planning process. While the overall goal of the Study remains restoration with a net increase in aquatic habitat anticipated, the Service does not have enough information regarding staging areas, best management practices, ingress and egress routes, construction methods, etc. to support the Corps assertion. We recommend the Corps seek the Service's technical expertise during the PED and construction phases to avoid and minimize impacts to aquatic habitats. Should the Corps identify long-term or permanent impacts during the PED or construction phases, we recommend full compensation of functions and values of impacted habitats and request coordination with the resource agencies regarding any such proposals to ensure adequate compensation is achieved.

Monitoring

The Corps will implement an Adaptive Monitoring Team (AMT) during the PED phase of the Study focused on reviewing, interpreting, and will recommend actions that reflect the goals of the Study consistent with the species and habitat needs in the area. This team will be comprised of Corps, TPWD, Service, local sponsors, and federal resource agency staff.

Success criteria should include measures to limit the establishment of herbaceous invasive plant species colonization at the BU sites. The Corps will assume management responsibility through construction and the SNND will assume responsibility for the remainder of the life of the project; however monitoring is only proposed, "Until the trajectory of the ecological change and/or other measures of the project success are determined as defined by project specific objectives" (Corps, 2018). Monitoring can be cost shared for up to ten years post-construction as defined by Section 2039 of WRDA 2007. If ecological success is not realized during the initial ten-year period, the sponsor is responsible for any additional required monitoring. The Service has concerns regarding the sponsor's ability to commit funding for initial and additional (if needed) monitoring given their reluctance to funding a TSP during the Study phase and asks for funding assurances.

We propose extended monitoring beyond the ten-year post construction period given the uncertainty of coastal and climatic conditions along this portion of the upper Texas coast. Due to the national significance of the natural resources in the Study area and the importance of project success to navigation and local infrastructure, an extended monitoring period is warranted. Data obtained from this monitoring effort will provide valuable information to meet current and future habitat management goals on a landscape level for managers and landowners in Jefferson County, address restoration uncertainties, and fill information gaps.

Marsh restoration benefits include reducing salinities and wind fetch in open water areas. Reduction in wind fetch would reduce shoreline erosion and turbidity and stimulate the production of submerged aquatic vegetation. On average, we would expect a minimum of 75 percent of the open water be restored to intermediate marshes, and existing fringe marsh would be nourished by sorting fine-grained suspended solids during material placement. Invasive species should be managed to reflect no more than two percent occurrence on the restored lands. Coordinated management actions with adjacent owners or land managers is necessary to minimize invasive vegetative species in the restoration units and achieve landscape level long-term success.

Overall, the monitoring regime and quantitative analysis outlined in the Monitoring Plan (U.S. Army Corps of Engineers, 2018), in general, would be acceptable to the Service if an Adaptive Management Team (including resource agencies) is convened, has oversight of the monitoring process, and is capable of recommending adaptive measures that would be implemented to rectify any deficiencies. Encouraging sufficient tidal flows and sediment supplies in restoration marshes are imperative to achieve long-term ecological function. Restricted flows can trap higher salinity waters restricting vegetation growth, encourages open water instead of fringed habitat and limits wildlife usage.

Fish and Wildlife Conservation Measures

The President’s Council on Environmental Quality defined the term mitigation in the National Environmental Policy Act regulations to include:

- a) avoiding the impacts altogether by not taking a certain action or parts of an action;
- b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- c) rectifying the impacts by repairing, rehabilitating, or restoring the affected environment;
- d) reducing or eliminating the impacts over time by preservation and maintenance operations during the life of the action; and,
- e) compensation for the impacts by replacing or providing substitute resources or environments.

The Service’s mitigation policy (FR, Volume 46, Number 15, pages 7656-7663, January 23, 1981) provides guidance to help ensure that the level of compensatory mitigation recommended by the Service is consistent with the value and scarcity of the fish and wildlife resources involved. In keeping with that policy, the Service usually recommends that losses of high-value habitats, which are becoming scarce be avoided or minimized to the greatest extent possible. Unavoidable losses of such habitats should be fully compensated by replacement of the same kind of habitat value; this is called in-kind mitigation. The mitigation planning goals and associated Service recommendations should be based on the four categories, as shown in **Table 5**.

Table 5 Service resource categories

<p><u>Resource Category 1</u> - Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section. The mitigation goal for this Resource Category is that there should be no loss of existing habitat value.</p> <p><u>Resource Category 2</u> - Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat placed in this category is that there should be no net loss of in-kind habitat value.</p> <p><u>Resource Category 3</u> - Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis. FWS’s mitigation goal here is that there be no net loss of habitat value while minimizing loss of in-kind habitat value.</p>

Resource Category 4 - Habitat to be impacted is of medium to low value for evaluation species. The mitigation goal is to minimize loss of habitat value.

Bottomland hardwood forests, bald cypress swamps, and coastal marshes are considered by the Service to be aquatic resources of conservation importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and inter-jurisdictional fisheries). Therefore, the Service recommends the unavoidable losses of those habitats.

Based on current project plans, the Corps claims there would be no net adverse impacts to the above-mentioned aquatic resources of conservation importance and hence, no need to mitigate for adverse impacts. The proposed ecosystem restoration measures would instead, increase the quantity of those valuable habitats however we remained concerned regarding possible impacts to marsh habitat during the restoration process. While we support the Corps on providing a net benefit to fish and wildlife resources as a result of the restoration measures, we ask the Corps to provide assurances that all wetland impacts will be avoided or minimized to the greatest extent possible then restored upon completion of construction.

Recommendations

The Texas Gulf coast is among the most dynamic environments in Texas. Paine et al. (2011) reports on average, the Gulf shoreline in Jefferson County is retreating 9.2 ft/year and land loss rates have averaged 35.7 acres/year. This land loss combined with the lack of consistent sediment supply, relative sea level rise, local circulation patterns, and increase frequency of high intensity storms puts Jefferson County, its residents, commercial industry, and natural resources at risk of a natural disaster. Dune systems, usually a first line defense from storm surge, are almost non-existent possibly leading to an eventual collapse of the marsh and compromise of the GIWW should current conditions persist.

Providing freshwater inflows and restricting saltwater intrusion are critical to maintaining the Chenier Plain's historic continuum of fresh, intermediate, and brackish saline marshes. Given the Service's mission and focus on migratory bird species and the habitat values for waterfowl, shorebirds and many wading bird species are greatly enhanced in intermediate marsh settings. We appreciate the Corps' efforts to identify opportunities for ecological restoration on private, state and federal lands in Jefferson County. However, an effective restoration plan needs to include out-year nourishment to rival sea level rise along with recurring beach and shoreline protective measures. The Corps and the local sponsors have an opportunity to safeguard much of the remaining contiguous freshwater wetland systems within the Texas Chenier Plains, secure nationally important navigation channels, and protect local development and infrastructure by creating and pursuing a strategic restoration plan that will provide security for the 50-year life span of the Study.

Given the high level of anthropogenic and natural changes influencing much of the landscape, we highly encourage the use of proven technologies and restoration methods to maximize results. We understand this study is developed at a cursory level; however, we believe that specifics for each measure under the RP or the NER will require further modeling and design efforts, and coordination with the land manager to be successful. The Service recommends the Corps fund the Service during the PED phase to continue

coordination efforts aimed at minimizing impacts during construction during will continue close coordination with the Corps into the PED phase to further refine the TSP.

The recommendations provided below address ways to avoid such unintended impacts and to improve fish and wildlife habitat quality in restoration areas. In general, the Service supports ecological restoration in Jefferson County when it aligns with specific management goals and objectives of land managers. We do not object to the implementation of the TSP provided the following recommendations be included as part of the plan:

1. The No Action Alternative assumes the Service will restore 20 miles of heavily degraded beach shoreline along the McFaddin NWR (Corps 2018). The Service is actively working with partner agencies to complete permitting requirements, final engineering designs, and solidify funding sources for this one time project. The Corps states (Corps 2018) “A systems approach is useful given that marsh restoration alone does not address all study problems, does not meet study objectives, and does not provide inland habitats with sustainable restoration or protection against coastal processes. Shoreline restoration alone would provide a buffer for the adjacent marsh areas, but it does not address stagnation, accretion, and subsidence experienced in the area. Therefore, shoreline restoration in conjunction with marsh restoration is necessary for optimal shoreline protection and sustainable ecosystem restoration.” The Service continues to question the Corps TSP selection knowing the plan will accomplish little to restore landscape level degradation of marsh and beach habitat. The Corps own economic and environmental analysis demonstrate minimal benefits from the TSP. The Service appreciates the Corps acknowledgment of the continued anthropogenic landscape level changes that plague Jefferson County caused by the Corps’ own permitted projects. We recommend the Corps fund a more comprehensive alternative in the JCER plan aimed at restoring additional habitats affected by these permitted projects. A future study aimed at evaluating effects from the Corps permitted projects along the Texas coast is warranted given the economic and environmental resources affected. We continue to recommend the Corps seek additional funding opportunities for a comprehensive restoration plan that will accomplish the objectives of the Study.
2. Under the Environmental Consequences section of the DEIS, the Corps states, “If, for some reason, the BMPs, are not implemented, the impacts of any of the action alternatives would only minimally increase from those described in this chapter. The increased impacts would not be substantial enough to cause an adverse insignificant impact to become significant.” The Service disagrees with this assumption since wetland impacts scar the landscape and can typically take years to recover. “The die off of wetland vegetation caused by impaction can change the tidal flow patterns through wetlands affecting valuable wetland functions such as shoreline erosion, attenuation of storm surges, and sedimentation in response to sea level” (Stijn, Moonen, P., Schoelynck, Govers, & Bouma, 2012). We request the Corps fully compensate for all impacts to wetlands resulting from construction of any measures associated with the TSP or NER on state, federal, or private lands. The Service and other natural resource agencies are willing to work with the Corps to provide suitable compensation recommendations.
3. The TSP should include out-year nourishments of dredge material or sand to combat the effects of sea level rise, shoreline retreat, and wetland fragmentation. We recommend additional

- nourishment be conducted at a minimum of 10 year intervals (or at intervals determined by the ADT) during the 50-year life of the project for marsh and beach measures.
4. When enhancing and protecting interior marsh habitat within the Study area, we recommend the TSP **include some type of Gulf shoreline protection** (beach nourishment, berms, breakwaters etc.) **as a first line of defense against storm surge events and sea level rise**. Any beach features will need to be closely coordinated with Service and TPWD staff during the PED phase of the Study.
 5. TSP features should complement existing Refuge and State restoration plans and management objectives and should be closely coordinated with NWR and TPWD managers.
 6. Evaluate the cumulative effects from past Corps funded construction projects as related to this project such as upstream river damming, SNWW and GIWW navigation, and the Sabine Jetties that contribute to the decreased sediment availability and the ecological degradation experienced in Jefferson County. Additionally, we request the Corps identify a funding mechanism to support restoration on federal, state and private lands for the good of Jefferson County.
 7. The TSP should aim to restore historic hydrologic connections, improve wetland salinities, restore historic wet prairies, and remove invasive species across the landscape to enhance habitats for wetland dependent species.
 8. Identification of federal and state boundaries with regard to GOM and GIWW shorelines should be identified during the planning phases. The Service remains concerned that the Corps may ignore restoration measures due to internal guidelines restricting funding on federal lands. The Service reminds the Corps of the extensive erosion and degradation to the GOM shorelines within the Study area, the keen interest of the Study's sponsor, potential implications to human and commercial interests including transportation (rail, road, and navigation), and the significant natural resources at risk. As such, the Service is willing to work with the Corps at both the local and national levels to address possible restoration opportunities on federal lands.
 9. Actively engage the Texas General Land Office (GLO) in the JCER coordination process. The GLO has responsibility for coastal shorelines seaward of the mean high tide line and state, federal and private landholders landward of this line. This distinction can provide for federal funding opportunities to the GLO and others not normally available to the Service; however, the GLO has not been engaged during any of the planning processes or discussions to define measures or funding opportunities that may be available.
 10. Dredged material can combat changes in water levels, erosion, and subsidence in most marsh habitats found in Jefferson County through thin layer deposition, open pipe placement, terrace features, and training berms. Pumping distance should not be a limitation and we urge the Corps to evaluate transporting material (new work and maintenance material) to areas outside of the typical 6-mile pump distance to areas along the shoreline and along the GIWW if necessary. All new work (should it become available for use) and maintenance material should be thoroughly tested for contaminants using the standards outlined in the EPA's Inland Testing and Ocean Dumping Manuals prior to being used in any beneficial use projects. Should data suggest toxic levels of contaminants are present, the Service recommends disposal of the material in accordance with EPA guidelines and within an approved landfill site.
 11. The Service supports the use of Corps' disposal areas to obtain material for beneficial use as long as the material is appropriately tested for contaminants. This material must meet certain criteria (to include but not limited to grain size, silt and clay contents, and contaminants) with respect to

- the receiving habitats on NWR lands. Specific requirements for BU placement on NWR lands will be determined and coordinated with the Service during the PED phases of the project.
12. Hard structures (if incorporated as design features) such as reef domes, revetments, breakwaters, riprap, and concrete matting shall be constructed to maximize aquatic access. Design and engineering of hard structures should be coordinated with NWR and TPWD staff if constructed on Service or State lands.
 13. The protection and restoration of prairie habitat remains a high-level priority for the Service. Therefore, we recommend the sponsor work with local, state, and federal partners to develop a strategy focused on the preservation of prairie habitat throughout Jefferson County. This is achieved through the recovery of historic pothole and mound complexes, the re-introduction of native prairie species on former agricultural (rice) lands to support pollinators, grassland and wetland dependent species like the mottled duck, bobwhite quail, wintering waterfowl, waterbirds, and shorebirds, and the permanent preservation of prairie habitat through conservation easements.
 14. Incorporate success criteria, monitoring, and adaptive management into all selected features to ensure project success.
 15. Invasive native and non-native terrestrial and aquatic plants continues to spread across the Study Area. To combat this growing issue, any alternative moving forward should include treatment/removal and monitoring of invasive species.
 16. Initiate modeling of future vessel impacts along the GIWW, Sabine Neches Waterway, and the GOM shorelines. This would include, sediment transport, future sediment deposition along Jefferson County shorelines, sea level rise, sand source identification, beach dune restoration and profiling as part of the ongoing study to scientifically identify, select, and support restoration measures.
 17. Manage non-native species, reintroduce native plants, restore natural drainage features and use frequent prescribed fire to restore grasslands and prairie habitat.
 18. The Corps should obtain a right-of-way from the Service prior to conducting any work on McFaddin or Texas Point National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.
 19. Whooping cranes are known to frequent marsh habitat in Jefferson County. We have the following general recommendations with respect to whooping cranes: project equipment that may be a collision hazard (guy wires that support dredging equipment, telecommunication towers on dredges, antenna or similar items located on dredges) will be marked using red plastic balls or other suitable marking devices sized and spaced, and lighted during inclement weather conditions when low light and/or fog is present and implemented from October 1 through April 30. These recommendations are consistent with the Avian Protection Plan Guidelines used in conjunction with the Avian Power Line Interaction Committee. An Avian Protection Plan will be prepared, submitted to the Service for review and comment prior to the onset of construction activities. These actions do not alleviate the Corps responsibility of evaluating project actions and initiating formal Section 7 consultation and should not be construed as such.
 20. The Service requests that the Corps initiate coordination with the Service during the design phases of the project and prior to the commencement of any restoration activities so site-specific best management practices (BMPs) can be developed for construction activities. Measures should

- be implemented to avoid or minimize the adverse effects of pollution, sedimentation, and erosion by limiting soil disturbances, scheduling work when the fewest number of fish are likely to be present, managing likely pollutants, and limiting the harm that may be caused by accidental discharges of pollutants and sediments. BMPs attempt to minimize impacts to fish and wildlife species within the immediate construction and nearby areas and may consist of floating turbidity curtains, limiting certain construction activities to daylight hours, limiting the use of or shielding lights at night, no vegetation removal or soil disturbance should be allowed outside of the project area, removal of mature trees providing soil or bank stabilization should be coordinated with the Service and TPWD, erosive banks should be stabilized using bioengineering solutions minimizing the use of riprap, and using monitors in open water areas to identify sensitive species.
21. Construction of any study features shall occur at least 1,000 feet away from a colonial waterbird rookery site during the breeding season of February 1 through September 1.
 22. Plant restoration sites within the next growing season after project completion to minimize erosion. Plant species and planting schedules should be fully vetted and coordinated with the Service and the ICT. In some instances, the Service may recommend delayed plantings to allow for natural vegetative recruitment and threatened and endangered species utilization when possible.
 23. If sand mounding proves to be a viable alternative, we recommend mound projects be placed in low energy wave environments, include wave protection measures (e.g. temporary erodible berms), and be constructed to mitigate wave fetch.
 24. Restoration efforts may negatively affect marsh habitat i.e. moving equipment necessary for restoration activities. If these impacts are deemed unavoidable and of a permanent nature, the Service recommends mitigation for any direct or indirect wetland impacts with full compensation.
 25. The Corps shall initiate coordination with NMFS regarding Essential Fish Habitat (EFH), sea turtle impacts, and mitigation issues within the project area.
 26. Cumulative effects from this and the Texas Coastal Study project must be considered when developing project features and mitigation plans. We recommend the sponsor along with the Corps work with the Texas Coastal Study to develop complimentary project features and geographically consistent mitigation and monitoring plans.
 27. The Service supports acquisition, restoration and preservation of natural resources within the project area and is willing to assist the Corps in identifying suitable areas in need.
 28. Should this project move to the design and construction phases, we recommend the Corps evaluate the project's effects on threatened and endangered species and other natural resources. We also recommend that the Corps utilize the IPaC system at <http://ecos.fws.gov/ipac/> and initiate any necessary consultation procedures pursuant to Section 7 of the Act.
 29. The Service understands that inclusion of restoration features on the Service lands in the proposed Study report does not obligate the Service to actively pursue construction or finance of those features. We also understand that the Corps is not seeking authorization or funding to construct those features because of policy constraints regarding construction of restoration features on Federal land not owned by the Corps. The marsh and beach features located on Service lands are projected to cost more than what is typically provided to the National Wildlife Refuge System for restoration. Therefore, we look forward to partnering with the Corps to find a solution that would allow the most comprehensive measures to be completed, including those on Service lands.
 30. All planning, design, or other construction-related activities (e.g., surveys, geotechnical borings, etc.) conducted on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special

Use Permit from the Refuge Managers of the McFaddin and Texas Point National Wildlife Refuges. Please contact the Refuge Managers Doug Head and Ernie Crenwelge at 409/971-2909 or by email at douglas_head@fws.gov and ernie_crenwelge@fws.gov.

31. Work directly with TPWD managers for any restoration measures located within TPWD state parks or WMAs. For Sea Rim State Park, contact Nathan Londenberg, Park Superintendent at 409-971-2559 and for JD Murphree WMA, contact Michael Rezsutek, Project Leader, at 409-736-2551.
32. We recommend the Corps evaluate TSP measures with respect to the Coastal Barrier Resource Act of 1982 and coordinate as necessary.
33. We continue to encourage the Corps to pursue funding of restoration projects on NWR lands due to the extreme importance of protecting the beach and marsh habitats of Jefferson County.
34. Borrow pits for construction of wetland creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Borrow pit construction should also avoid the following:
 - avoid inducing wave refraction/diffraction erosion of existing shorelines
 - avoid inducing slope failure of existing shorelines
 - avoid submerged aquatic vegetation
 - avoid increased saltwater intrusion
 - avoid excessive disturbance to area water bottoms
 - avoid inducing hypoxia
 - Avoid effects to threatened and endangered species and their habitats
35. Wetland creation measures should avoid areas of dense submerged aquatic vegetation.
36. The Corps should monitor ecosystem restoration features to document the degree of success achieved. We recommend the Service and other interested natural resource agencies be included in developing those monitoring criteria and in the review of subsequent monitoring information and reports.
37. We recommend the Corps coordinate with the Service, TPWD, and other interested natural resource agencies during the PED and construction phases to evaluate and minimize impacts associated with construction traffic ingress and egress, and staging areas, spill plan etc.
38. Conduct sediment pumping during the non-growing season periods to reduce possible salinity impacts on adjoining vegetation.

Service recommendations regarding specific ecosystem restoration measures are provided below:

1. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.
2. To pump into eastern and western extremes of the designated fill area, the pipeline route should depart from that designated route only within the proposed fill area, and routed through unvegetated open water areas, to avoid affecting existing wetlands.
3. If funding is provided to the Service to construct restoration measures (marsh, beach, or breakwater) located on NWR lands outlined in the Study, the funding should be sufficient to cover the necessary administration, engineering, and design work for each restoration measure.

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