FINAL ENVIRONMENTAL ASSESSMENT
BAY AQUATIC BENEFICIAL USE SITES
GALVESTON BAY, TEXAS

U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TEXAS 77550

US Army Corps
of Engineers®

July 2025

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ACRONYMS, ABBREVIATIONS & INITIALISMS

A&M	Agricultural and Mechanical
AMSL	annual mean sea level
BABUS	Bay Aquatic Beneficial Use Sites
BMP	best management practice
BU	beneficial use
BUG	Beneficial Use Group
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Information Act
CFR	Code of Federal Regulations
cy	cubic yards
CZMA	Coastal Zone Management Act
DMMP	Dredged Material Management Plan
DoD	Department of Defense
EA	Environmental Assessment
ECIP	Expansion Channel Improvements Project
EFH	essential fish habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FIFR	Final Integrated Feasibility Report
GBEP	Galveston Bay Estuary Program
GMFMC	Gulf of Mexico Fishery Management Council
GMSLR	global mean sea level rise
GRBO	Gulf of Mexico Regional Biological Opinion
HSC	Houston Ship Channel
HTRW	hazardous, toxic, and radioactive waste
km	kilometer(s)
m	Meter(s)
MLLW	mean lower low water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NHPA	National Historic Preservation Act
NEPA	National Environmental Policy Act of 1969
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODMDS	ocean dredged material disposal site
O&M	operations and maintenance (dredged material)
PA	Placement Area
RLR	relative sea level rise
RRC	(Texas) Railroad Commission
SAV	submerged aquatic vegetation
SHPO	(Texas) State Historic Preservation Office

TOC	total organic carbon
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Area

1 INTRODUCTION

The U.S. Army Corps of Engineers, Galveston District (USACE) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), Public Law 91–190, regulations for implementing the procedural provisions of the NEPA, 40 Code of Federal Regulations 1500–1508, and USACE NEPA implementing regulation ER 200-2-2 in USACE (1988). This EA evaluates potential impacts associated with the Bay Aquatic Beneficial Use Sites (BABUS) project construction and operation. This EA evaluates practicable alternative locations for the BABUS, assesses effects anticipated from the proposed project, and recommends best management practices (BMPs) and measures to avoid and minimize adverse effects resulting from the proposed action.

1.1 Background

The existing Houston Ship Channel (HSC) spans 52 miles of federal navigation channels through three counties. This important series of navigation channels have been modified, starting at least as far back as 1905, to better accommodate vessel traffic. Several additional modifications to these channels have taken place since this time (USACE 2019). The latest modification project, titled the HSC Expansion Channel Improvements Project (ECIP), is the planned deepening, widening, and re-configuration of several portions of these channels. These proposed changes are planned to address existing inefficiencies in accommodating current and projected container and bulk freighter vessel size and fleet size. See the *Final Integrated Feasibility Report and Environmental Impact Statement* (FIFR-EIS) for the HSC ECIP by USACE (2019) for more information. There are several placement areas (PAs) and beneficial use (BU) areas adjacent to the HSC for placement of some of the HSC dredged material. New work and maintenance-dredged (operations and maintenance [O&M]) material from several areas of the HSC is also planned to be disposed of at the Galveston Ocean Dredged Material Disposal Site (ODMDS). However, the planned improvements to the HSC will increase the volume of O&M material from the HSC. Due to the limited capacity of the PAs and BU areas for the increased volume of dredged material, there is a need for a new placement area for this material for the next 50 years of dredging (USACE 2019).

The BABUS project was outlined in the HSC Dredged Material Management Plan (DMMP [Appendix R of the FIFR-EIS by USACE 2019]) as a PA for primarily HSC O&M material into the future. The construction of BABUS within Galveston Bay and the beneficial use of dredged material from the HSC was outlined and discussed beginning with the FIFR-EIS for the HSC ECIP by USACE (2019) as a Future Without-Project condition. It was projected that the BABUS project would have the capacity for placement of dredged material for a 50-year period beginning in 2029. This capacity is needed to help address the placement of an estimated 236.4 million cubic yard (cy) surplus of dredged material beyond the remaining capacity of the existing PAs and BU areas. Thus, the BABUS project was also identified as an alternate PA for long-term use in the DMMP (Appendix R of the FIFR-EIS by USACE 2019).

1.2 Purpose of & Need for Action

The purpose and need of the proposed action is to establish a PA in close proximity to, and for the placement of, future O&M material from the HSC primarily above Morgan's Point, as well as material from modifications to areas adjacent to the HSC, over a 50-year period. Existing placement areas in the Houston-Galveston region are expected to reach maximum capacity starting in 2034 with the last one reaching capacity by 2066 (USACE 2022), leaving a surplus that must be accounted for (FIFR-EIS by USACE 2019). The BU objective of the project is prompted by the federal goal to utilize dredged material beneficially. On 25 Jan 2023, the USACE was tasked with adopting the goal of increasing the BU of dredged material to at least 70% of all dredged material, by 2030 (USACE 2023). The proposed action would aid greatly for the USACE Galveston District to reach or exceed this goal.

Development of the BABUS project is intended to provide management strategies for placement and BU of material from dredging projects to alleviate critical capacity issues along the HSC. This BU PA would allow the development of a plan for BU of dredged material in the area, allow for competitive bidding and thus minimize cost for the dredging of the HSC generally above Morgans Point (mile 26.2) into the future. The area would also be used to create multiple habitat types within areas of the BABUS project.

2 PROPOSED ACTION & PROJECT AREA

The proposed action is the construction of the BABUS for the placement of primarily O&M dredged material (Figure 2-1). Since the BABUS project is in the conceptual stage, the exact configuration of the BABUS, and position within the project footprint, has not yet been determined. The current design of the BABUS project has a footprint that does not exceed approximately 4,500 acres. The project area is in upper Galveston Bay, southeast of Atkinson Island (and its associated BU PAs), north of the Mid Bay Placement Area (Blue Water Atoll), and east of the HSC. Upper Galveston Bay is bordered by Chambers and Harris counties, Texas. The project area is submerged land in Chambers County owned by the State of Texas and managed by the Texas General Land Office. The project area is subtidal and has an average bottom elevation of -8 feet (-2.4 m) mean lower low water (MLLW) (USACE 2022). The area is transected by two recreational boating channels: Five Mile Cut Channel and North Boaters Cut. One or both channels may require dredging to a width and depth sufficient to accommodate bottom-dump scows and (or) hopper dredges for delivery of dredged material to the BABUS.

The project will consist of two types of PAs. The first type is an excavated BU PA created by excavating the bay bottom and using that material to construct confining dikes. These dikes would serve as the outer perimeter of the PA and may be reinforced with riprap or other similar materials as needed to prevent erosion. The current design has the crests of the confining dikes having a elevation between 4 and 8 feet (2.4 m) MLLW. The second type of PA will be marsh fill areas for beneficial use of dredged material. The interiors of the BABUS PAs would be filled gradually with material dredged from areas of the HSC north of Morgans Point (mile 26.2) (DMMP [Appendix R of the FIFR-EIS by USACE 2019]). The placement of the material would occur over the projected 50-year period or until the estimated capacity of approximately 100 million cy is reached.

The beneficial use PA (shown in the center of the project area in Figure 2-1) is anticipated to be excavated to a depth of -70 feet (-21.3 m) MLLW, dependent on the results of further engineering and design work, to maximize dredged material capacity. Following initial excavation, the interior of this PA would temporarily be a deep basin accessible via North Boaters Cut or Five Mile Cut Channel. A gap in the exterior dike will be provided to allow passage of the scows/dredges. Upon completion of the construction of the exterior containment dike and bay bottom excavation to the maximum depth and extent practicable, the excavated area will be filled with dredged material using dump scows until the depth prevents scows from entering the area. After this point, the dike will be closed and the material will be placed using a pipeline dredge. The containment dikes have the potential to host a variety of aquatic and emergent habitats, including oyster reef. The types of habitats and their placement along these dikes will be decided based on further engineering and design work.

The marsh fill areas are anticipated to be filled with dredged material. The containment dikes around these areas will be constructed of bay bottom material excavated from within the dredged material PA. The outer slopes of these containment dikes are anticipated to provide habitat benefits, such as intertidal marsh and oyster reef, that are similar to those to be created on the dikes of the dredged material PA. The details for how the dikes are to be constructed, and the habitats they will support, are dependent on the results of further engineering and design efforts. The elevation of the interior of the marsh fill areas would be raised from the existing bay bottom elevation (averaging -8 feet [2.4 m] MLLW) to intertidal elevations of 0 to +3.5 feet (0–1.07 m) MLLW for the potential to create beneficial use intertidal marsh and bird island habitats. Once the interior of the marsh fill areas have reached the desired elevation, the dike will be cut at strategic locations to allow for tidal exchange of bay water in and out while continuing to provide erosion protection.

Once the excavated beneficial use PA and the marsh fill areas are filled to their desired elevations and the 100 million cy capacity is reached, it is anticipated that new marsh habitat and (or) upland habitats could be created on the upper surface of the BABUS. The habitats would be designed to accommodate various desirable wetland and aquatic species. The BABUS would also be expected to provide refuge for migratory birds along the northern Gulf coast during migrations, and to add to the productivity of bird islands along the Galveston Bay migratory corridor. Thus, the proposed action is intended to aid in the USACE's requirements and directives for increasing BU of dredged material to at least 70% of all dredged material by 2030 (USACE 2023).

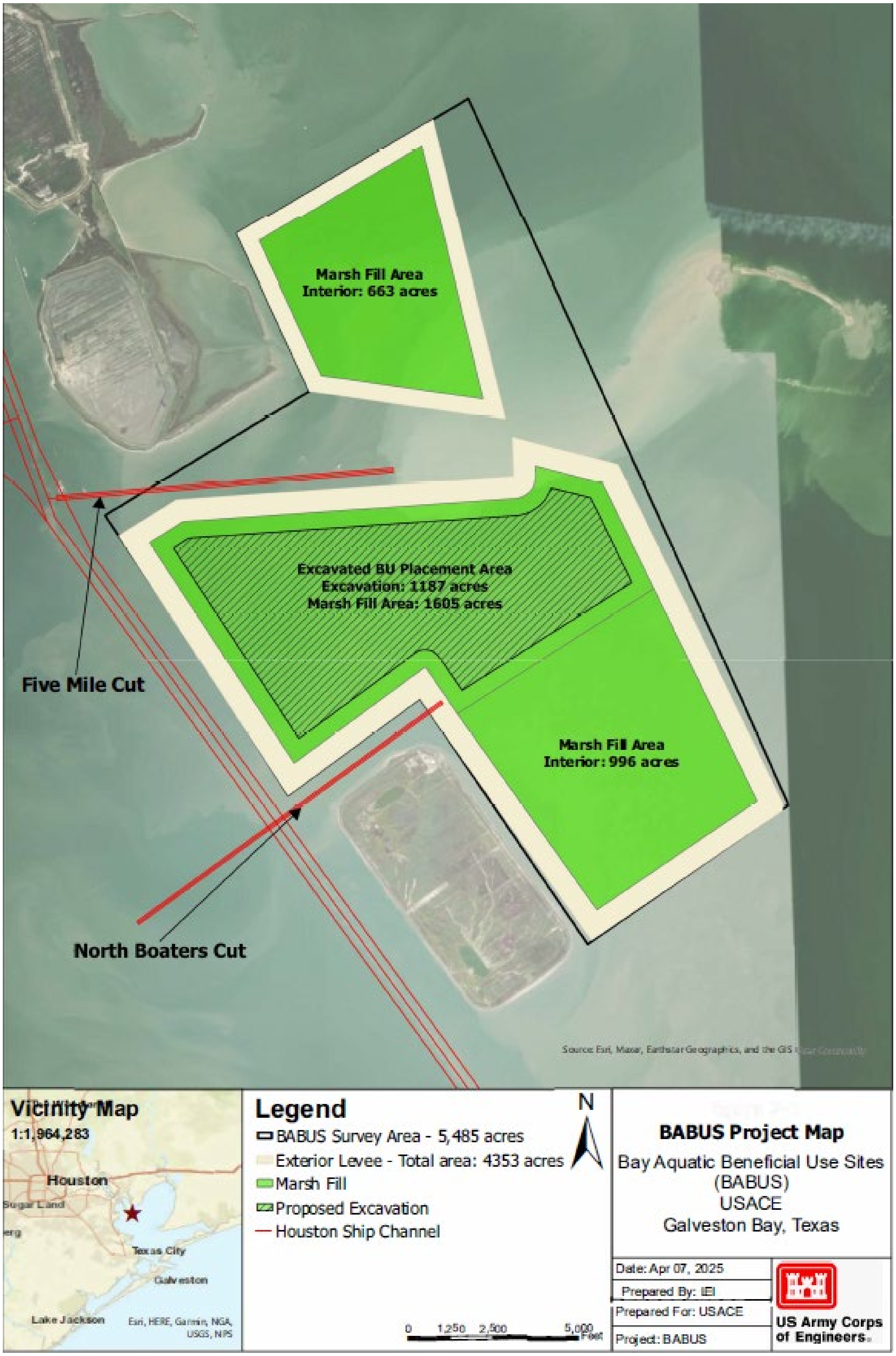

Figure 2-1. Proposed Action: Bay Aquatic Beneficial Use Sites in Upper Galveston Bay

3 ALTERNATIVES ANALYSIS

3.1 Background of Beneficial Use Placement Area Alternatives Analysis

The proposed action is derived from an earlier version of the BABUS concept design that was considered as a possible future BU PA in Subsection 2.6 of the HSC ECIP DMMP (Appendix R of the FIFR-EIS by USACE 2019). This, and another conceptual PA called the Lynchburg PA, were considered in the FIFR-EIS to potentially accommodate future surplus dredged material over a 50-year period. These concepts were evaluated alongside multiple other BU PA proposals including Long Bird Island (also known as measure B18a), 8-acre Bird Island (B18b), Three Bird Island Marsh PA (B18c), and Atkinson Island Marsh Cells M11 and M12. See Subsection 5.8 of the DMMP for descriptions of these proposed BU PAs.

The Lynchburg PA conceptual design was to construct a new upland confined PA six miles north-northeast of the existing Lost Lake PA. This concept was considered and evaluated starting at least as far back as 2017 (when it was referred to as the Farm Tract), during a preliminary assessment of current and future dredged-material PAs. It was again briefly considered as a possible component of the HSC ECIP in the 2019 FIFR-EIS. In both evaluations, the Lynchburg PA was eliminated from further consideration due to a combination of cost and logistical considerations. See Subsection 2.6 of the DMMP for a description of the Lynchburg PA concept.

These BU PA concepts were considered in the FIFR-EIS as part of the HSC ECIP (termed the Locally Preferred Plan in the EIS) along with two alternatives: the National Economic Development plan and a no-action alternative to the HSC ECIP called the Future Without Project. The Locally Preferred Plan, and the National Economic Development plan, each proposed specified BU PAs that correspond with each channel segment of the HSC. Some BU PAs were proposed for all three alternatives explored in the FIFR-EIS. The BU PA concepts were designed for either new work dredged material or O&M dredged material. The Locally Preferred Plan in the FIFR-EIS included the placement of primarily O&M dredged material at the BABUS.

An earlier version of the BABUS concept was preferred over other BU PAs based on a combination of the results of a cost-to-benefit analysis, volume capacity for dredged material placement, and environmental factors. This concept was authorized in the HSC ECIP FIFR-EIS by USACE (2019). It was also planned for construction in the National Economic Development plan, and the no-action alternative to the HSC ECIP, to accommodate and accept dredged material from portions of the HSC above Morgans Point (mile 26.2). It was determined impractical to dispose of such material from above Morgans Point to the Galveston ODMDS due to a combination of inefficiency of transport over such a long distance and logistical constraints (USACE 2019).

The existing federal PAs have limited capacity for dredged material from the existing HSC and tributary channels. This capacity limitation of existing PAs necessitates non-federal service facilities adjacent to the HSC needing to modify and (or) maintain their berths to identify other dredged material placement opportunities. If the proposed action were chosen and constructed, it would offer non-federal users a possibility for placement of dredged material. Such users would be charged a fee to help offset federal costs of planning, engineering, construction, and maintenance of the BABUS.

3.2 Beneficial Uses Under Consideration

The USACE aims to continue to provide environmentally responsible and cost-effective ways to utilize dredged material to the benefit of local communities. The *Beneficial Use Planning Manual* by U.S. Environmental Protection Agency (EPA) and USACE (2007) defines BU as using dredged material 'in a manner that will benefit society and the natural environment'. BU was similarly defined in the *Dredging and Dredged Material Management Engineering Manual* by USACE (2015). Dredged material can be used beneficially for engineered uses such as construction and agricultural, product uses such as for aquaculture or topsoil, and environmental enhancement purposes such as wildlife habitat or wetland restoration (EPA and USACE 2007). More recently, a memorandum by USACE (2023) distributed across all USACE districts categorized the BU of dredged material in USACE projects as:

- For use by agriculture, horticulture, forestry, and aquaculture industries
  - Examples include use in livestock pastures, cattle bedding, and amending marginal soils with dredged material to improve crop production
- To improve aquatic habitats including habitats in marine, estuarine, rivers, and lakes
  - Examples include tidal flats, oyster beds, seagrass meadows, fishing reefs, clam flats, and freshwater aquatic plant beds
- Placement onto a beach or river shoreline, or into the littoral zone, nearshore, or shallow water with the intent to expand, stabilize, or nourish the beach or shoreline
- To improve or construct harbor and port facilities, residential and urban areas, airports, levees, dikes, and containment facilities, roads, and island and historic preservation areas
  - This category of BU includes the re-handling of material from confined disposal facilities for construction uses
- Placement on islands and (or) upper zone wetland habitats to construct, improve, or maintain these areas
- Use in a combination of aquatic and land-based projects
  - An example of this is the use of dredged material as a cap over an existing solid waste landfill to create a park or recreational development
- Open-water placement with overlying volumes of water in rivers, lakes, estuaries, or marine environments
  - Beneficial use versions of open-water placement include to subsidize the sediment in aquatic habitats, for beach nourishment, or for multiple purposes
- Placement to help develop recreational areas
  - Such uses range from simply providing fill to allow access to recreation, or more complex uses such as to support public and private recreation facilities (either commercial or non-commercial recreational activities)

The Port of Houston Authority has established a Beneficial Uses Group (BUG) consisting of personnel of Port of Houston Authority, USACE Galveston District, EPA Region 6, National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries), National Resources Conservation Service, U.S. Fish and Wildlife Service (USFWS), Texas Parks & Wildlife Department, and the Texas General Land Office. The group was created to better define local needs for BU, collaborate on BU projects, and identify BU opportunities in the USACE Galveston District area.

The USACE evaluated seven potential types of BUs for dredged material as defined in the USACE guidance documents mentioned above. Not all forms of BU were assessed, but a reasonable array of practical uses were considered based on their relevance to local needs and stakeholder input from the BUG. Each of the uses described below were evaluated for their ability to meet the environmental and public needs within the Galveston Bay system and future projected HSC O&M material volumes. The types of BU were determined by stakeholders to be either ‘preferred’, meaning the type would provide an overall benefit to the HSC and Galveston Bay area, or ‘not preferred’, meaning the use is either not applicable to the project area or there is not an immediate need for the beneficial use type in the area.

3.2.1 Establishment, Nourishment & Restoration of Shallow Aquatic Habitats

The establishment of various shallow aquatic and intertidal habitat types, and the nourishment or restoration of existing habitats, are all preferred alternative uses over conventional placement options (USACE 2015). A single BU site may include several distinct biological communities or habitats. For example, the creation of a dredged material island may result in benefits to shallow aquatic habitats, wetlands, and even upland habitats depending on the final elevation of the dredged material placement. Desirable habitats include the creation or enhancement of oyster reef habitat and marsh habitat. The creation of dredged material islands adds environmentally important transitional habitats to the Galveston Bay area and can extend the lengths of shoreline habitats where such habitats are limited or isolated. The environmental impact of most habitat BU projects may be expressed as a loss of open-water habitat or subtidal systems and a gain in intertidal and terrestrial habitats. There may also be associated changes in local hydrology related to this conversion. In general, the need for more of certain types of habitats is considered particularly important in areas such as Galveston Bay, because such habitats have been reduced and (or) are being further reduced (USACE 2015) due to a variety of causes such as subsidence. Marsh habitat creation or nourishment is often the most desirable form of BU of dredged material in coastal areas, such as in the Galveston Bay area, as this habitat type is vulnerable and experiences the most loss due to dynamic coastal changes and processes.

The use of dredged material for marsh habitat establishment in the Galveston Bay area is considered a preferred BU type. This is because Galveston Bay has experienced significant wetland loss and degradation over the last century due to land development, restriction of freshwater and sediment inflows, saltwater intrusion, subsidence, extreme shifts in salinity regimes, and erosion.

3.2.2 Bird Island Creation & Restoration

Along the Texas Gulf coast, island-based colonial waterbird rookeries offer protection to wading and ground-nesting birds from predators, human disturbance, and other environmental threats. Island-based rookeries also offer foraging opportunities adjacent to the island and proper nesting substrate/vegetation. Approximately 25 species of waterbirds use the Texas coast as colonial-nesting and roosting habitat, and over half of those are in decline (Texas Parks and Wildlife Department [TPWD] 2019). Colonial waterbirds and their nests, eggs, and chicks are protected under the federal Migratory Bird Treaty Act. Some of these birds are also protected under Title 31 of the Texas Administrative Code. Colonial-nesting birds are vulnerable while nesting, during which they concentrate for several months in colonies, and remain to tend to their chicks until they have fledged. Island creation using dredged material is considered a BU of material in coastal habitats where the islands would be utilized by birds and other wildlife of conservation interest. Outside of the nesting season of these birds, such islands may be used for recreation by local citizens (USACE 2015). The construction of new bird islands is considered a BU of material where there is a need for nesting and roosting habitat in an area lacking suitable islands, and if the benefits for the birds exceed any environmental drawbacks to the construction of the islands.

Restoration or enhancement of existing islands is also considered beneficial where there is a demonstrated use of the islands by colonial or shorebird species and the islands have been degraded. Restoration or enhancement of existing rookery islands often involves the use of dredged material to restore or increase the land area of the island. Such activities often include increasing the elevation of the available nesting area to reduce the threat of inundation by waves and tides. Eroded shorelines of islands can be reinforced with dredged material of suitable grain size to ameliorate or prevent further erosion from occurring.

Galveston Bay contains islands constructed from dredged material that provide important colonial bird nesting and roosting sites. This is true of Evia Island, as well as new or planned beneficial use islands to be created specifically for birds (e.g., Three Bird Island Marsh PA, Long Bird Island). The use of dredged material to create bird islands is a desirable and BU of what would otherwise be devoid of benefit if disposed of offshore. However, such islands as Three Bird Island Marsh and Long Bird Island already address this BU type in the bay and have somewhat decreased the immediate need for new habitats of similar function. However, given the overall decline in several species of colonial water birds in Texas and elsewhere in the United States, colonial-nesting bird island creation was brought forward as a preferred use for this project.

3.2.3 Beach Nourishment

A desirable, cost-effective alternative to combat shoreline erosion and degradation is beach nourishment. Beach nourishment is the use of dredged material composed of beach-compatible sand. The sand is transported by split-hull hopper dredge, hydraulic pipeline, or truck to an eroded and (or) eroding beach. Beach nourishment results in immediate changes in the topography or bathymetry of the amended areas.

USACE generally recommends a sand fraction of at least 80 percent for potential use as beach nourishment, but such sediment may be subject to additional analytical requirements based on the beach slated for nourishment. Sediment containing excess silt and clay fraction typically disqualifies the material for beach nourishment. Previous sampling and analysis of O&M material from the HSC generally indicate that this material is unsuitable for this application based on grain size distribution and carbon content. Additionally, the nearest beaches to the upper and middle sections of the HSC are over 25 miles away, along the Gulf shore of Galveston Island, and would require transport of material by barge over this long distance. Since this material is not generally beach compatible and is a far distance from the nearest Gulf beach, beach nourishment was not considered a feasible use for this project.

3.2.4 Erosion Protection

Erosion protection is a BU for dredged material as some types of sediment are appropriate for preventing or reducing erosion along riverbanks, streambeds, and shorelines. For long-term erosion control, dredged material may be transferred by hydraulic pipeline from the dredging area to the area in need of erosion control. Uses of dredged material to combat erosion include the establishment of underwater berms, to stabilize riverbanks, and to construct dikes or levees.

Similar to beach nourishment, dredged material placed along or in front of shoreline protection structures can help stabilize the shoreline. Several state agencies, local municipalities, and private owners in the Galveston Bay area have constructed dikes and levees by pumping dredged material onsite and dewatering the material (USACE 2015). This method is used to combat erosion. Such methods can be relatively economical compared to other methods. However, the conditions at the project site should be considered when designing erosion protection as a BU of dredged material. These considerations may include the bathymetry of the placement area, wave activity or energy, navigation proximity, and sediment characteristics such as grain size distribution and total organic carbon (TOC) content.

The use of dredged material from the HSC as erosion protection is not considered a preferred BU type in the Galveston Bay area due to the high percentage of silts and clays. Such small grain size is not suitable for erosion protection levees or structures but could be used to support other erosion control structures if secondary containment was provided.

3.2.5 Parks & Recreation

One of the more common BUs for dredged material is to establish multipurpose public recreational areas, especially in urban areas. Such land may support fishing amenities, nature trails, picnic tables or pavilions, sports fields, and other recreational spaces for community members to enjoy. The land may also support native plants and wildlife habitat as a secondary benefit.

The use of dredged material for the foundation of parks and recreational facilities serves the public interest if the area may otherwise be unsuitable, or of only limited use, for recreation. However, not all dredged material is suitable for use in parks and recreation facilities, such as if the material has high levels of chemical contaminants (USACE 2015).

The use of dredged material for parks and recreation areas in the Galveston Bay area is considered a preferred BU type. Although given the available area for BU placement, and the limited compatibility of recreational use with other preferred BU uses, recreational use could only be of secondary use. There are significant limitations to the area available within the bay for BU as recreational and park areas and there are also limitations associated with the dredged material itself. The area within the bay available for land creation is not easily accessible for recreational use. Also, the fine-grained dredged material is not well suited for recreational use. Given the prioritization of bird island habitat as a priority BU, human usage of a bird island must be limited to the non-nesting season. Lastly, other BU land uses within the Galveston Bay area, such as habitat creation, are prioritized by stakeholders over recreational projects.

3.2.6 Industrial Development

This BU category is defined by the *Beneficial Use Planning Manual* (EPA and USACE 2007) as the use of dredged material that would otherwise be placed in a confined placement area to expand or raise the height of the land base, primarily near waterways, to support commercial and industrial activities. The *Dredging and Dredged Material Management Engineer Manual* (USACE 2015) states that it is important 'to identify how, when, and where dredged material from a navigation project can fulfill an economic need while not overlooking biological beneficial uses and environmental considerations and limitations'. Many industrial harbor and port development projects are built upon a foundation of dredged material. Such projects have occurred from Oregon to Texas and other states where shipping terminals, barge-fleeting areas, and storage facilities were established (USACE 2015).

The use of hydraulic equipment to collect and disburse fill material within the same general vicinity is a cost-effective method. It reduces transportation expenses and offsets the need to locate a dredged material placement area. Potential material could be dredged from the HSC and placed on adjacent land in Galveston Bay to expand available usable land. However, when considered alongside other potential uses such as habitat creation, industrial development is not a preferred BU use for this project.

3.2.7 Combination of Beneficial Use Types (Preferred)

An evaluation of the different BU types above resulted in two types of BU being identified as preferred. These types are aquatic habitat establishment and bird island creation. These two types would help address priority needs in the Galveston Bay area and were selected for further analysis. The BUG selected the development of a project based on these preferred BU types. Aquatic habitat establishment and bird island creation were carried forward for further analysis.

3.3 No-Action Alternative

The no-action alternative consists of disposing of the O&M dredged material from the planned HSC ECIP at the Galveston ODMDS. The placement of approximately 100 million cy of dredged material that would otherwise be placed at the BU PA (under the proposed action) would instead be shipped by bottom-dump scow offshore to the ODMDS for disposal. This process would occur over a 50-year period.

The Galveston ODMDS is an 8.7-square-mile (5,550-acre) trapezoid that is approximately 4.2 miles offshore of Galveston Beach in 33 to 51 feet (10–15.5 m) of water (EPA and USACE 2016). This ODMDS is a dispersive site, having a high-energy erosional zone based on past studies (EPA 1984, EPA and USACE 2016). The ODMDS is thought to have unlimited future capacity (DMMP [Appendix R of the FIFR-EIS by USACE 2019]). It is assumed that the unlimited capacity would allow all the surplus dredged material from the HSC ECIP to be disposed of there under this no-action alternative.

The approximately 100 million cy of dredged material would be transported and disposed of at the Galveston ODMDS by hopper dredge or bottom-dump scow. The added travel distance between the project area of the proposed action and the Galveston ODMDS is approximately 29 miles (58 miles round trip). The maximum capacity per load for hopper/cutter dredging is 14,800 cy based on the largest available hopper dredge, the *Ellis Island*, owned by Great Lakes Dredge & Dock Co., LLC. This equates to over 6,700 transits to and from the ODMDS over a 50-year period. Mechanically dredged material would generally require a smaller scow maximum load size (9,000 cy), equating to over 11,000 trips to and from the ODMDS to dispose of this volume.

This alternative would exclude the construction of a new BU PA in upper Galveston Bay. The project area of the proposed action would continue to provide the same habitat as most of the area within the 1,456-square-kilometer Galveston Bay.

3.4 Selection Criteria

The desired project is one that would beneficially use primarily O&M material dredged from the upper HSC and best satisfy the selection criteria listed below. The alternatives analysis considered several criteria to determine which action best achieves the project objective while meeting the selection criteria. Additionally, the alternative chosen would need to be consistent with the goals and recommendations within the HSC ECIP as described in the FIFR-EIS by USACE (2019), including the DMMP. The following selection criteria were used in the analysis:

1. The project would provide capacity for approximately 100 million cy of dredged material.
2. The project would allow for the beneficial use of dredged sediment through the creation and establishment of aquatic habitat and (or) bird island habitat.
3. The project encourages competitive bidding of dredging contracts, and minimizes dredging costs, by allowing the use of a variety of equipment types for dredge material transport and placement.

4. The project would minimize the transport distance for dredged material placement to within 10 miles of Morgans Point (mile 26.2 of the HSC).
5. The project uses an area with sediment composition that is comparable with dredged material proposed for placement and is suitable for dike construction.
6. The project would utilize an area of the bay that is available for construction and would be compatible with surrounding land use(s).
7. The project would minimize impacts to existing resources to the extent practicable.
8. The project would minimize impacts to other federal projects and navigation.
9. The project would minimize risk of interference with major active oil and gas related infrastructure.

These criteria are described below and are discussed within the context of the project design that would best satisfy the criteria described.

3.4.1 Capacity

The need for a BU PA with sufficient capacity for approximately 100 million cy was identified in the DMMP (Appendix R of the FIFR-EIS by USACE 2019) to make up for a deficiency of capacity at existing PAs. A predicted 89,472,000 cy would be placed at the new BU PA over a 50-year period under the HSC ECIP scenario according to Table 7-6 of the DMMP. The need for this capacity over a 50-year period was recognized for the HSC ECIP scenario as well as if the HSC ECIP was not chosen (termed the 'Future Without-Project' condition in the FIFR-EIS by USACE [2019]). USACE determined that even if the HSC ECIP was not chosen, a predicted 97,543,000 cy of O&M material beyond the capacity of existing placement areas would require placement at a new site (Table 7-6 of the DMMP, Table 6-15 and Section 3 of the FIFR-EIS [USACE 2019]). The capacity volume needed is rounded up to 100 million cy for the purposes of this EA to address the uncertainty of predicting dredging volumes over such a long period.

3.4.2 Beneficial Use for Aquatic Habitat & Bird Island Habitat

The combination of beneficial uses (from Subsection 3.2) selected for future consideration for the BU PA is a combination of aquatic habitat establishment and bird island habitat creation. Maximum benefit would result from the creation of large contiguous wetland or marsh areas, inclusion of multiple habitat types for increased diversity, and one or more large areas for bird island habitat that are protected from predators and human disturbance. Ideally, such a project would maximize the amount of new habitat area while minimizing the volume of dredged material placed that does not directly contribute to the creation of desirable habitats. The ideal project design would also incorporate features that promote an increase in oyster reef and intertidal marsh habitats within Galveston Bay.

3.4.3 Dredging Equipment Compatibility & Competitive Bidding

The design that would best satisfy this criterion is one constructed with accessible points of entry for various types of dredging equipment into the PA while allowing for the competitive bidding of dredging contractors based on their available equipment and cost estimates. The project design should not limit the ability to choose from dredging equipment best suited for the conditions within Galveston Bay or from providing the most economical cost possible.

Each type of dredging equipment has its own set of advantages and disadvantages based on the needs of project design. Mechanical dredges, such as clamshell/bucket equipment, are more efficient for transport of material over long distances but are relatively slow and unproductive compared to the speed and volumes of material moved by hydraulic pipeline dredging. Hydraulic pipeline dredging, such as cutterheads, can dredge and transport more material for a cheaper cost when near the PA but is less cost effective over longer distances, relative to mechanical dredging. Hopper/suction dredges are better suited for medium-haul distances and rough open water but do not facilitate the continuous dredging and placement offered by hydraulic pipeline dredging (U.S. Army Engineer Research and Development Center 2013).

3.4.4 Minimize Transport Distance

The project location should be within a 10-mile radius of the area to be dredged to further minimize transport costs. Dredging to be addressed by this project is expected to occur primarily upstream of Morgans Point (HSC mile 26.2), and so the location should be within 10 miles of this point (see Figure 3-1 below). As indicated in Subsection 3.1, and in the FIFR-EIS by USACE (2019), it was determined impractical to dispose of such material from above Morgans Point to the Galveston ODMDS due to a combination of inefficiency of transport over the significantly long distance and logistical constraints. In the criterion for competitive bidding and various dredging equipment, the most economical project design is one that will allow for the least accrued cost of transport of the dredged material.

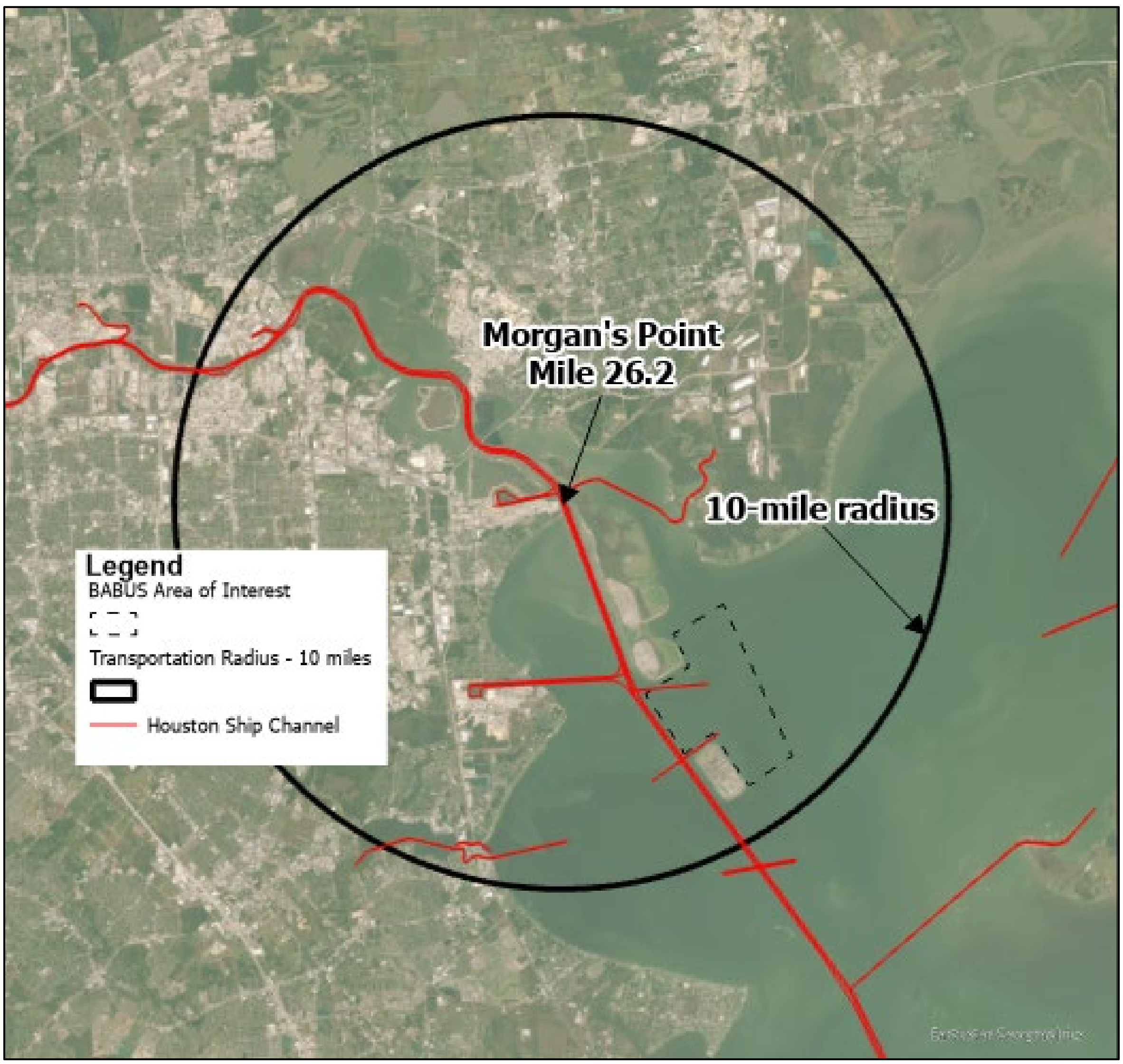

Figure 3-1. The Project Location Should be Within 10 Miles of Morgans Point (Mile 26.2 of the Houston Ship Channel)

3.4.5 Compatibility of Bay Bottom for Dredged Material Placement & Dike Construction

The bay bottom at the project footprint should have a grain size distribution that is comparable to that of the dredged material to be placed there. Choosing a site with similar sediment characteristics to those of the dredged material will help minimize environmental perturbations resulting from placement and ensure optimal re-colonization by benthic and epibenthic organisms in the project area in-between placement events.

Sediment samples representing O&M material from seven dredging units of the HSC above Morgans Point were collected and analyzed in 2024 (ANAMAR 2024). The seven composited samples were composed predominately of silt (49.3% to 93.0%), with varying amounts of clay (0.2% to 48.4%), and sand (1.0% to 32.0%). These composites shared the Unified Soil Classification System class of ML (silt of low plasticity). The project area chosen should have similar characteristics to these.

Long-term side-slope stability and erosion-resistance of the proposed dikes require certain qualities in terms of grain size distribution of the sediment used. Sediment composition for use in dike construction, obtained from the bay bottom within the project area, should include enough silt and clay composition to meet engineering demands. This should ensure the strength and integrity of the dredged material PA and the marsh fill areas. This should also minimize turbidity and sloughing or migration of the sediment into the nearby HSC and recreational channels.

3.4.6 Availability of Area & Compatibility with Surrounding Land Use(s)

The availability of bay area for the proposed BU PA is very limited due to the active presence of vibrant local industries, especially the oil and gas industry, along with important shipping and navigation functions provided by the HSC. Areas adjacent to the HSC that are accessible to dredging equipment and scows are even more limited. This represents a considerable challenge in siting a project area of sufficient size and positioned within reach of dredging equipment.

Additionally, the project area must be in a location where the proposed use (BU of dredged material) of the new landform must be compatible with the surrounding existing land use. For instance, an area where PAs are already established nearby would suggest that additional PAs, including BU PAs, would also be compatible, and even preferable, over other land uses.

3.4.7 Minimize Resource Impacts

The project area may contain existing natural and cultural resources. Any project proposed should avoid or minimize direct and indirect impacts to these resources to the maximum extent practicable. This selection criterion aims to identify the project design that would have the least negative impacts to existing aquatic vegetation, oyster reef, wetlands, essential fish habitat, federal and state protected species, and cultural resources. Surveying is used to identify, quantify, and delineate the resources existing within the project area.

3.4.8 Minimize Impacts to Navigation & Other Federal Projects

The project area for the proposed action is adjacent to the HSC and existing federal dredged material PAs and intersects Five Mile Cut Channel and (or) North Boaters Cut. This selection criterion favors a design with the least negative impacts to existing navigation uses at the HSC and recreational channels of the area. Such a preferred design concept is one having a project footprint that minimizes intersection of existing navigation channels and does not negatively impact the operation of nearby PAs and other existing or planned federal projects.

3.4.9 Minimize Interference with Active Oil & Gas Infrastructure

The project area contains active and abandoned oil and gas infrastructure such as pipelines, plugged wells, and dry holes (plugged wells that never produced oil or gas). Of these, the infrastructure of greatest concern to the project design are the active wells and pipelines currently in use. Avoiding or minimizing impacts to active infrastructure would meet this criterion. Subsection 4.15 has a discussion of active pipeline features within the project area and best management practices that related to these pipelines.

3.5 Alternatives Carried Forward for Environmental Analysis

3.5.1 Proposed Action

The proposed action was designed as the alternative to best meet the selection criteria listed above. The proposed action is carried forward for further environmental analysis using the current design. The proposed action design best satisfies the selection criteria in Subsection 3.4 (Table 3-1). It fulfills selection *criterion 1* by providing capacity for 100 million cy of dredged material as set forth in the FIFR-EIS by USACE (2019). Selection *criterion 2* (maximize BU) is satisfied with the proposed action by allowing the establishment of protected bird rookery habitat, encouraging oyster reef colonization, and providing sheltered intertidal habitat that benefits desirable fishes and other aquatic species. Selection *criterion 3* (encouraging competitive bidding through compatibility with dredging equipment) and *criterion 4* (minimize transport distance) would also be satisfied by the project area of the proposed action. The BABUS design, sited within upper Galveston Bay adjacent to the HSC, allows optimal access by dredging equipment and a short transit distance from the dredging area. The ease of access and the relatively short transit distance (and reduced fuel costs) would allow competitive bidding amongst contractors and encourage cost-effectiveness for construction and long-term placement. The proposed action will also fulfill *criterion 5* (sediment suitability for construction and BU and compatibility with land use) as excavated bay bottom material will allow for the construction of dikes while having a grain size distribution comparable to that of dredged material from the HSC. All these objectives would be met while reducing vessel traffic along approximately half of the 52-mile-long HSC, meeting *criterion 8* (minimize impacts to navigation).

While the proposed action has greater potential for impacts to environmental resources (*criterion 7*), relocation and (or) mitigation strategies, coupled with the subsequent potential for BU, would help ameliorate impacts and produce important intertidal habitat for aquatic species along with providing bird island habitat along the Galveston migratory corridor. Any potential impacts to navigation at Five Mile Cut or North Boaters Cut (*criterion* 8) would be minimized where possible through further engineering and design along with stakeholder engagement with recreational fishermen. Any potential impacts to active oil/gas pipelines (*criterion 9*) within the BABUS footprint would be avoided thorough analysis/implementation of BMPs and stakeholder engagement with local Port authorities. The proposed action described in Section 2 is carried forward for analysis in Section 4.

3.5.2 No-Action Alternative

The no-action alternative is insufficient in meeting the purpose and need for the project. It also falls short of meeting certain selection criteria in Subsection 3.4 (Table 3-1). Specifically, it does not maximize BU of dredged sediment (*criterion 2*), encourage competitive bidding by compatibility with a variety of dredge equipment (*criterion 3*), minimize transport distance to within 10 miles of Morgans Point (*criterion 4*), or minimize impacts to navigation (*criterion 8*). According to the FIFR-EIS by USACE (2019), it is impractical to dispose of dredged material from above Morgans Point to the Galveston ODMDS due to a combination of inefficiency of transport over such a long distance and logistical constraints (USACE 2019). Although the no-action alternative is not considered a practicable alternative, it must still be fully considered during NEPA analysis, as required by the Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) 1502.14(d). For most portions of the Affected Environment (Section 4), the no-action alternative does not depart notably from current conditions and in these cases the no-action alternative is synonymous with such conditions. Environmental impacts of the no-action placement alternatives (such as the use of the ODMDS) were evaluated in the FIFR-EIS and therefore are not described or evaluated in this EA.

Table 3-1. Selection Criteria Addressed by the Proposed Action Versus the No-Action Alternative

Selection Criterion	Does the Proposed Action (BABUS) Meet the Following Criteria?	Does the No-Action Alternative (ODMDS) Meet the Following Criteria?
(1) Capacity for approximately 100 million cy of dredged material	Yes	Yes
(2) Maximize BU of dredged material	Yes	No
(3) Encourage competitive bidding by allowing compatibility with various dredge equipment	Yes	No
(4) Minimize travel distance (≤10 miles of Morgans Point)	Yes	No
(5) Compatibility of sediment with dredged material	Yes	Yes
(6) Availability of area and compatibility with land uses	Yes	Yes
(7) Minimize impacts to existing resources	Yes (assuming mitigation / relocation)	Yes
(8) Minimize impacts to navigation and other federal projects	Yes (assuming avoidance)	No
(9) Minimize interference with active oil and gas pipelines	Yes (assuming avoidance)	Yes
MEETS ALL SELECTION CRITERIA?	**Yes**	**No**

4 AFFECTED ENVIRONMENT & POTENTIAL IMPACTS

This section establishes and describes the affected environment and the potential environmental impacts of the proposed action. This EA was conducted in accordance with Public Law 91-190 NEPA of 1969. It also follows CEQ regulations 40 CFR parts 1500 through 1508. The level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact. The scope of the affected environment considered for this EA for the proposed action consists of the ≤4,500-acre project area of the proposed BABUS. The project area is defined as an area within upper Galveston Bay that is southeast of Atkinson Island, north of Mid Bay Placement Area, and east of the HSC. The Galveston Bay complex is bordered by Chambers, Harris, and Galveston counties, Texas.

Resource areas addressed include historic and cultural resources, wetlands and special aquatic sites, water and sediment quality, wildlife and fish resources, federally protected species, freshwater inflows, sediment resources, recreation and land use, and socioeconomics. The affected environment discussions presented below describe the existing conditions of the environment and include existing effects to the environment by current and historic projects in the vicinity. Cumulative impacts will be evaluated in a subsequent section at the end of this document.

4.1 General Environmental Setting

The Galveston Bay complex includes Trinity Bay, Galveston Bay, East Bay, and West Bay. Galveston Bay receives 11 million acre-feet of freshwater inflow annually from the Trinity River and the San Jacinto River in addition to runoff from surrounding land (TWDB 2023). The Galveston Bay complex has a total combined area of approximately 384,000 acres (155,400 hectares) (Galveston Bay Estuary Program [GBEP] 2023) and has an average water depth of 1.8 m (5.9 feet) MLLW (Kim 2021). Galveston Bay is the largest estuary in Texas (GBEP 2023).

Galveston Bay is a shallow micro-tidal impoundment heavily influenced by wind and freshwater inflows from the Trinity and San Jacinto rivers and surrounding bayous. There are two tidal inlets to the bay. Bolivar roads is Galveston Bay's primary connection with the Gulf of Mexico. This, and San Luis Pass, provide tidal exchange with the Gulf (State of the Bay 2024). Galveston Bay is shallow with habitats including marshes, mud and sand flats, seagrass beds (submerged aquatic vegetation), oyster reefs, and open-bay bottom (State of the Bay 2024). The majority of Galveston Bay is mud-bottomed; some small islands exist in the interior of the bay and some of these support bird rookeries and oyster reefs.

The western edge of Galveston Bay is densely packed with municipal, industrial, and urban development supported by the HSC and associated water-based infrastructure. The eastern edge of Galveston Bay is primarily agricultural and undeveloped lands. Approximately 5.4 million people live in the four counties surrounding Galveston Bay (GBEP 2018).

4.2 Existing Threats to Environment

Current threats to the environment of the project area include subsidence resulting from industrial activities, specifically oil and gas, and groundwater extraction. Other threats include sea level rise and severe tropical storms and hurricanes.

The Trinity and San Jacinto rivers historically contributed freshwater and sediment inflows into Galveston Bay, nourishing the bay's estuarine marshes and wetlands. Impoundments and diversions of these rivers to support development and freshwater supply have drastically altered the freshwater and sediment inflow regimes to Galveston Bay (GBEP 2024).

Sea level continues to rise along the Texas coast and the rate of change has increased in recent years. Sea level rise is a byproduct of the melting glaciers and ice sheets, and the expansion of ocean water as it warms with increasing temperatures. Add to this subsidence of coastal land around Galveston Bay due to soil compaction and withdrawal of groundwater (EPA and USACE 2016). Sea level rise along the mid-Texas coast has increased more than 0.2 inches per year from 1937 to 2020. The relative sea level trend for the project study area was measured as 0.21 ± 0.04 inches per year, with 95% confidence, based on mean sea level data from 1983 to 2020 according to data from NOAA tide station #775870. This is equivalent to a change of 1.78 feet (0.5 m) over the course of 100 years (NOAA 2021).

Galveston Bay complex, along the northern edge of the Gulf of Mexico, is subject to occasional tropical storms and hurricanes. Hurricanes make landfall on any 50-mile portion of the Texas coast an average of once every six years (Roth 2010). Texas has been affected by several hurricanes and severe storms during the last century with the top five costliest for Texas having occurred since 2000 (NOAA 2021). Storm surge is a dangerous effect of tropical storms in the Gulf of Mexico that threatens the coastal environment with each storm or hurricane. Storm surge is the abnormal rise of water level over and above the predicted astronomical tides resulting from winds of tropical storms and hurricanes. Storm surge can be seen to affect even inland waters such as tidal rivers and the Galveston Bay complex as it moves through bays. The coastal environment can be dramatically affected by surges from extreme hurricane events which can cause significant structural changes to barrier islands, destruction of low-lying lands, destruction of critical infrastructure, inundation of coastal shorelines with salt water, and severe damages to essential wildlife habitat (Needham and Keim 2012).

4.3 Resources Eliminated from Further Analysis

The proposed action is submerged land isolated from the nearest farmland by open water. The project would not affect prime or unique farmlands, as defined by the Farmland Protection Policy Act, or floodplains, a resource requiring consideration per Executive Order 1988 (Floodplain Management). Cumulative impacts will be evaluated in Section 5. Climate related impacts are evaluated in the cumulative impacts section regarding the project; however, greenhouse gas emissions are not specifically addressed as the proposed action does not include any new sources of emissions.

4.4 Water & Sediment Quality

Water Profile & Water Quality

Water column profile—A literature search found no evidence of thermoclines, haloclines, or hypoxic zones in the project area. These attributes appear unlikely to occur in the project area because of its shallow depth (-8 feet MLLW) and landscape position. Although low dissolved oxygen zones have been documented in Galveston Bay, resulting in fish kills, such areas are generally associated with areas of poor water circulation such as dead-end canals (Thronson and Quigg 2008). Galveston Bay is subjected to water currents caused by tides, riverine input of freshwater, and wind-driven currents. The bay is estuarine with a varying salinity gradient that is influenced by tide, rain events, and river flow. River flow entering the bay averages 24,279,600 m^3/day according to Engle et al. (2007). These authors also reported that salinity in summer averages 18 parts per thousand in the bay and the average annual water temperature is 29.5°C. The hurricane barrier constructed to protect Galveston Island and Texas City is thought to cause a reduction in salinity within the Galveston Bay estuary by retaining freshwater for longer periods than if the barrier had not been built (Stickney 1984).

Nutrient loading—The levels of nitrogen and phosphorus within Galveston Bay were acceptable in 2023 according to the Galveston Bay Report Card (2024), although no numerical values or details were given as supporting evidence.

The water and sediment parameters summarized below were taken in accordance with the requirements and procedures defined in the EPA ocean dumping regulations (40 CFR Parts 220, 225, 227, and 228).

Water sample H-MR-24-04B was collected 3 feet above the -49.3 feet MLLW sediment surface by submergible pump in May 2024 from a near Morgans Point Cut, adjacent and west of the project area, and was analyzed for water chemistry parameters (ANAMAR 2024). An elutriate sample was also generated by mixing the water sample with sediment collected by grab sampler from the same area, and the elutriate was analyzed for chemistry and toxicity parameters. The following summary is taken from the ANAMAR (2024) report. These results are comparable to the results of water, elutriate, and sediment analysis of samples collected in June 2019 from the same stations and reported by ANAMAR (2019).

Salinity, turbidity and TOC—The water sample had a salinity of 2.3 parts per thousand and was collected during high-incoming tide. Turbidity was measured at 170.0 Nephelometric Turbidity Units. Total suspended solids was 7.69 mg/L. TOC was 7.69 mg/L and 10.8 mg/L in the water and elutriate, respectively (ANAMAR 2024)

Contaminant levels in water and elutriates—The water sample and elutriates generated from this water sample were analyzed for 15 metals, ammonia (as nitrogen), total cyanide, total petroleum hydrocarbons, 21 pesticides, total polychlorinated biphenyls, 15 polynuclear aromatic hydrocarbons, and 41 semivolatile organic compounds (ANAMAR 2024). Most of these contaminants were either not detected above the method detection limit, or were detected in concentrations that did not exceed the available criteria maximum concentration in EPA (2006, 2024), or Texas acute water quality standard values in Texas Commission on Environmental Quality (2022). The only exception was total cyanide, which was detected at 0.00500 mg/L in the water sample and 0.00230 mg/L in the elutriate, and both concentrations exceeded the criteria maximum concentration of 0.001 mg/L (ANAMAR 2024).

Petroleum Spills in Galveston Bay

The Galveston Bay estuary is home to one of the world's largest petroleum refining centers. Many of the local refineries utilize the HSC. Petroleum product pipelines are present in many areas of the bay (FIFR-EIS by USACE 2019). Galveston Bay has been subjected to repeated petroleum exposure. For instance, ship groundings and outright spillage in 1987 resulted in over 80,000 gallons of oil, hydrocarbons, and other hazardous materials entering the water (Gore 1992). Approximately 30% of the spilled oil occurred within the HSC alone. More recently, in 1989, another spill of an estimated 250,000 gallons of oil entered the HSC and Galveston Bay. In 1990, two oil barges collided with a Greek oil tanker, resulting in approximately 500,000 gallons of heavy crude entering the Galveston Bay estuary (Gore 1992). In 1991, the rupture of a pipeline transferring oil from onshore storage to a barge ruptured and spilled 40,000 gallons of light crude oil into Galveston Bay. The slick from the pipeline rupture was determined to be over four miles long (Gore 1992). It is apparent that the Galveston Bay estuary must periodically contend with exposure to petroleum products.

Sediment Profile & Sediment Quality

Sediment profile—Sediment borings to -70 to -80 feet MLLW along the HSC reach adjacent to, and south of, the BABUS project area found variable percentages of sands, silts, and clays within the profile (USACE 2022). Sediment was collected by grab sampler in May 2024 from two stations between Beacon 76 and the southern portion of Morgans Point Cut, west and adjacent to the project area, in depths of -49.3 to -47.3 feet MLLW (ANAMAR 2024). The sediment represents O&M material. The sediment was composited (composite ID H-MR-24-04) and analyzed for physical, chemical, toxicological, and bioaccumulation parameters. The following is a summary of analysis results from the ANAMAR (2024) sediment evaluation report.

Grain size, TOC and total solids—The sediment composite sample was predominantly silt (77.8%) with clay (10.3%) and some sand (11.9%). TOC measured 0.80% and total solids measured 45.1%.

Contaminant levels in sediment—The sediment was analyzed for 13 metals, ammonia (as nitrogen), total cyanide, total petroleum hydrocarbons, 21 pesticides, 15 polynuclear aromatic hydrocarbons, and 41 semivolatile organic compounds. Most of these contaminants were not detected in concentrations above the method detection limit, and none of them exceeded the threshold effects level or the effects range low from the Green Book by EPA and USACE (1991) or the Regional Implementation Agreement by EPA and USACE (2003).

Dredged Material Proposed for Beneficial Use

The dredged material that is proposed for BU in the project area would be subjected to the sampling, analysis, and reporting requirements of the EPA Inland Testing Manual under Section 404 of the CWA and the dredging regulations in 33 CFR 335–338. Such testing is generally conducted approximately every five years. This process ensures that dredged material does not have the potential for significant undesirable effects due to the presence of contaminants.

The most recent (2019, 2024) sampling, chemical analysis, and bioassessment of O&M dredged material from the HSC above Morgans Point demonstrated that the material could be disposed of without restrictions (ANAMAR 2019, 2024).

Hazardous, Toxic & Radioactive Waste

The proposed action would not be considered appropriate for hazardous, toxic, and radioactive waste (HTRW) screening. Engineer Regulation 1165-2-132 (HTRW Guidance for Civil Works Projects [USACE 1992]) instructs that dredged material placement sites are not considered HTRW sites unless such wastes are 'located within project boundaries or may affect or be affected by Corps Civil Works projects'. Regulation 1165-2-132 further instructs that material proposed for dredging qualify as HTRW 'only if they are within the boundaries of a site designated by the EPA or a state for a response action (either a removal action or a remedial action) under CERCLA [Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S. Code (U.S.C.) 9601 et seq], or if they are part of a National Priority List site under CERCLA'.

4.4.1 Consequences of the Proposed Action

The dredged material proposed for placement at the BABUS project area would have undergone sediment, water, and elutriate testing and approval prior to placement at the BABUS. The material to be placed at the BABUS will most likely have physical, chemical, and toxicity properties comparable to what currently exists in and around the project area. No significant long-term changes are expected for water quality and sediment quality from the placement of material.

Turbidity at the project area would increase beyond ambient levels during, and immediately following, construction of the containment dikes, dredging of the central portion of the PA, and dredged material placement. Dissolved oxygen levels are likely to decrease during construction and placement activities. This increase in turbidity and decrease in dissolved oxygen levels would dissipate within hours following completion of each placement episode. Estuarine organisms within the bay are generally evolutionarily prepared for such stressors and have mechanisms that allow them to survive such ephemeral perturbations successfully. The incorporation of oyster beds into the project may help reduce turbidity over time, once established.

Additionally, there is potential for decreased dissolved oxygen or anoxic conditions to develop in the deepest waters of the excavated BU area, prior to the complete filling of the marsh fill area. During the time that the excavated area is open for construction, fish and other aquatic species would be discouraged from entering the BU area through the narrow opening of the levee and the active vessel usage during construction. It is anticipated that the high level of vessel activity within the excavated area during construction would encourage water column mixing and introduction of dissolved oxygen into the system and limit the development of an anoxic area. The excavated BU area would be a temporary condition as it would gradually be filled with maintenance material over time. Therefore, impacts to water and sediment quality due to the project are anticipated to be temporary and minor.

4.5 Sediment Topography & Bathymetry, Shoreline Erosion & Accretion

Sediment Topography & Bay Depth

The bay bottom averages -1.8 m (-5.9 feet) MLLW (Kim 2021). The bottom elevation within the project area averages -8 feet (-2.4 m) MLLW (USACE 2022).

Shoreline Erosion & Accretion

Tidal amplitudes are narrow in Galveston Bay, ranging from 0.76 to 1.81 feet (0.23–0.55 m), with a mean of approximately 1 foot (0.3 m). However, wind-driven tides can be as much as 3-to-4 feet (0.9–1.2 m) below or above normal tide amplitude in the bay (Lankford and Rogers 1969). Such wind-induced extreme tides can cause erosion or accretion along portions of the bay margin and contribute to erosion around dredge material islands or bird islands. Northerly winds from cold fronts may lead to water level differences as high as 1.0 m (3.3 feet) between eastern and western portions of Galveston Bay (Lester et al. 2002). Sediment transport from wind and tidal currents is further exacerbated by ship-wakes, shrimp trawling, and dredged material placement activities within the bay (Tate et al. 2014).

The cumulative effects of these actions create erosion and accretion. Shoreline erosion claimed an estimated 0.7% of the marshes annually from 1979 to 2002 (White et al. 2004), which is higher than the 0.5% of wetlands lost annually in the period 1975–1985 nationwide (Dahl and Johnson 1991). From 2006 to 2011, a total of 5.1% of the wetlands within Galveston County have been eroded in terms of surface area (Entwistle et al. 2018). Most of the loss of marshes, and other wetlands, are due to a combination of subsidence, sea level rise, wave action, sediment deficit, dredging, and filling (Moulton et al. 1997, Ravens et al. 2009). Erosion has been photo-documented along the HSC-facing side of the Mid Bay PA (USACE 2022). A portion of the dredged material eroded from the bank probably remained in suspension within the water column long enough to travel into the HSC and adjacent area, eventually settling in lower-energy areas and contributing to shoaling.

The Galveston Bay estuary complex has a history of rapid and dramatic changes in response to sea-level rise, and these changes historically regulated sediment supply to the estuary (Anderson et al. 2008). Nearly all wetlands along the western shore of the bay have been lost due to development (Anderson et al. 2008). The Trinity River and the San Jacinto River have been dammed and this has caused a decrease in the sediment supply into the estuary (Phillips et al. 2004, White et al. 2002).

The Galveston Bay estuarine complex has experienced high rates of subsidence within the last century caused by extraction of groundwater and petroleum (Paine et al. 1986, Paine 1993, Morton et al. 2006, Anderson et al. 2008). The impacts of increased subsidence include more flooding at rates that approach those that occurred during the prior flooding events summarized above. The current subsidence is believed to mainly impact the Trinity Bay area and low-lying areas around this delta (Anderson et al. 2008). Subsidence and sea level rise was estimated at Galveston Pier 21 to have been 3.53 mm/year during 1909–1937, 6.08 mm/year during 1937–1983, and 3.51 mm/year since 1983 (Liu et al. 2020). As much as 85 percent % of the 0.7-m relative sea level rise since 1909 is attributed to subsidence from aquifer-system compaction and groundwater extraction. An additional 1.9 m (6.2 feet) of relative sea level rise (subsidence plus other forms of sea level rise) is projected for the Galveston Island area by 2100 according to Liu et al. (2020) (Figure 4-1).

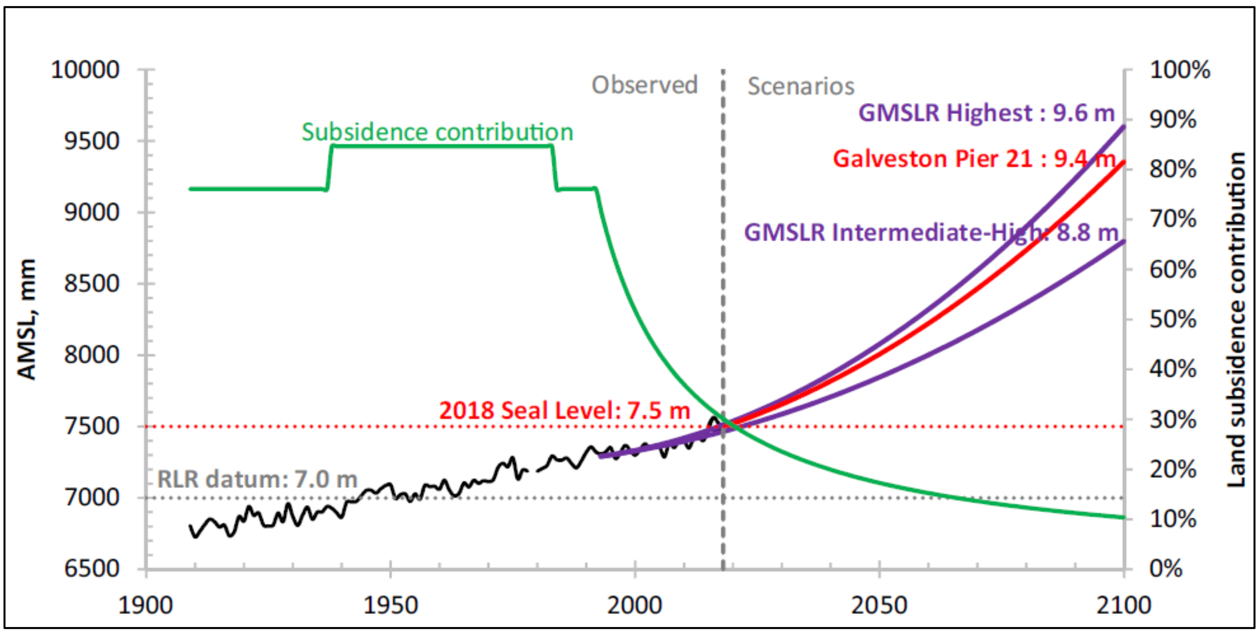

Figure 4-1. Projected Annual Mean Sea Level (AMSL) and Estimated Land Subsidence Contributions to Relative Sea Level Rise at Galveston Pier 21

Notes: GMSLR = global mean sea level rise, RLR = relative sea level rise.

Source: Modified from Figure 6 of Liu et al. (2020)

4.5.1 Consequences of the Proposed Action

The placement of dredged material within the project area would change the bathymetry of the area from an average bottom elevation of -8 feet MLLW to a variety of sediment elevations from as deep as -70 feet (21 m) MLLW, to intertidal habitats, and upland habitat having a maximum elevation of +8 feet (2.4 m) MLLW.

Subsidence and sea level rise would continue, and the predicted 1.9 m (6.2 feet) of increased sea level by 2100 has the power to convert portions of the upland areas of the BABUS project into intertidal habitat if the design elevation (to +8 feet [2.4 m] MLLW) remains static. The combined actions of waves, tidal flux, and ship-wakes may instead cause net erosion of the shoreline of the BABUS dikes, potentially threatening to reduce the amount of upland habitat. Alternatively, the planned planted vegetation may encourage flocculants to settle out, resulting in net accretion within vegetated intertidal areas, potentially reducing the impacts of continued sea level rise on the BABUS. This may also potentially reduce sediment transport such as that induced by ship-wakes and wind-driven waves.

During advance project engineering, specific attention will be given to potential for wave and wake impacts against the levees as well as wake impacts in any newly created narrow channel areas, such as Five Mile Cut, due to changes in local bathymetry. Concerns raised during the public comment period elucidate the need for specific engineering of the channel-facing levee area to ensure stability of the outer containment of the BU cell. Negative effects to the bathymetry and shoreline impact due to the project will be negligible considering mitigation of potential issues will take place with specific engineering. Overall, impacts to bathymetry from the project will be beneficial, permanent and substantial due to the creation of new habitats.

4.6 Wetlands & Special Aquatic Sites

Wetlands and special aquatic sites identified in 40 CFR 230 Subpart E consist of sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes. The sections below discuss each of these habitats as applicable to the project area. Refer to Appendix A for the Oyster Resources Survey Report.

4.6.1 Wetlands

The project area is subtidal and has an average bottom elevation of -8 feet (-2.4 m) MLLW (USACE 2022). The depth, lack of intertidal habitats, and open-water characteristics of the project area prevent the establishment of wetland habitats. Surveys of the project area in October and November 2024 further indicate a lack of wetland habitats within the project area (Appendix A).

Wetland habitats elsewhere within Galveston Bay include emergent, estuarine, and marsh wetlands. Wetlands provide important water quality regulation functions, nurseries/habitat to desirable species such as spotted seatrout, snowy egret, roseate spoonbill, great blue heron, and shoreline stabilization (GBEP 2024). Closer to the shorelines of the bay are estuarine wetlands, or fringing marshes. These regions of wetlands typically are comprised of smooth cordgrass (*Spartina alterniflora*) and black mangrove (*Avicennia germinans*).

Studies during 1950–1989 that used aerial imagery to classify and analyze wetland distribution and trends found an approximately 17% decline in vegetated wetlands in the bay during this time frame (White et al. 1993). NOAA developed the Coastal Change and Analysis Program in 1996 to establish a consistent methodology for wetland monitoring using Landsat satellite over five-year intervals (GBEP 2024). The Coastal Change and Analysis Program found the rate of estuarine wetlands loss in lower Galveston Bay to have slowed considerably since 1989, while the rate of freshwater marshes has experienced a faster rate of loss, resulting in a greater proportional loss of freshwater marshes relative to other types of wetlands. A study by Moulton et al. (1997) in (GBEP 2024) estimated that wetlands collectively had been declining across the Galveston Bay complex since the 1990s at an annual rate of 3% due to the combined effects of rising sea level, agricultural and industrial development, dredging activities, and the settling of unconsolidated sediments over longer periods of time.

To combat the loss of wetlands in the bay, the Galveston Bay Foundation and coordinating stakeholders are attempting to restore these wetlands and have restored over 950 acres of wetland habitat so far (Galveston Bay Foundation 2024). These grassroots restoration efforts, alongside new (relative to 1989) federal protections of estuarine wetlands with permitting under Clean Water Act Sections 10 and 404, have shifted focus to better protect the greater loss of freshwater/palustrine wetlands across Galveston Bay (GBEP 2024). Restoration efforts are hampered somewhat by invasive plants, such as Chinese tallow tree (*Triadica sebifera*), that continue to dominate wetland communities and slowly transition herbaceous freshwater wetlands to forested wetlands (GBEP 2024).

4.6.2 Submerged Aquatic Vegetation

Seagrasses and other submerged aquatic vegetation (SAV) are marine flowering plants that live in shallow coastal waters with adequate sunlight penetration, often in 3–9 feet (0.9–2.7 m) of water (Smithsonian 2018). The root systems of seagrasses help to stabilize sediments against erosional forces, provide food and habitat for many juvenile fishes and waterfowl and are very productive habitats. Five species of seagrasses occur in Texas, all of which were historically present in Galveston Bay (TPWD 2024c).

The cumulative effects of subsidence, industrial and municipal growth, and extreme weather events have caused a sharp decline in SAV in Galveston Bay. Fisher et al. (1972 in Pulich et al. 1990) suggested that seagrasses such as shoal grass (*Halodule wrightii*), widgeon grass (*Ruppia maritima*), and turtle grass (*Thalassia testudinum*) covered approximately 5,120 acres of the bay in 1956. TPWD has since documented a nearly 90% decline in SAV, attributing this loss to turbidity, extreme weather events, and proximity to industrial development (Pulich et al. 1990). Analysis of aerial imagery in a portion of Galveston Bay near the project area indicated a drop in aerial coverage of SAV from a combined 212 acres in 1956 to a combined 148 acres by 1987 (Pulich et al. 1990). Continued disturbance led to the complete degradation of SAV before any significant seagrass monitoring or mitigation was put into effect (Pulich 2006).

Except for selected zones in Christmas Bay, seagrasses have largely disappeared from all other regions of Galveston Bay. In fact, roughly 80% of Texas's current seagrass habitat is confined to Laguna Madre and further southward (TPWD 2024b). These impacts led the Galveston Bay Foundation and state agencies to attempt restoration of seagrass habitat within a 1,400-acre area of the bay during 1996–2006. The efforts also included greater monitoring and research and seagrass mitigation (Galveston Bay Foundation 2015). Such efforts have resulted in only limited success relative to established goals.

Surveys of the project area found no evidence of SAV, including seagrasses, in the project area (see the survey report in Appendix A).

4.6.3 Oyster Reef

Oyster reefs occur in subtidal and intertidal areas wherever there is a hard substrate and adequate currents to bring plankton and remove wastes. Oyster reefs provide ecologically important functions including maintaining or improving water quality and providing productive habitats for a wide variety of organisms, including species of commercial and recreational importance (TPWD 2019).

The eastern oyster (*Crassostrea virginica*) is present throughout the Texas coast although at substantially reduced numbers than historically recorded (Ybarra 2021). Oyster reefs and beds have historically been abundant in Galveston Bay but have been negatively affected by various modifications to the bay that have resulted in increased salinity levels beyond the tolerance range for the eastern oyster (Butler 1954).

In 2008, Hurricane Ike made landfall in Galveston and is thought to have destroyed a large percentage of the remaining oyster reefs in Galveston Bay. The severe sediment deposition caused by this hurricane smothered many of the oyster reefs across the bay and buried the hard substrate that is required for oyster development. Additionally, Hurricane Harvey made landfall in Texas and Louisiana in 2017 and generated a massive rainfall event, resulting in a large influx of freshwater into Galveston Bay. The reduced influence of the calcium carbonate-buffered saltwater from the Gulf allowed the low-salinity bay water to have increased acidity for about three weeks, bringing damage to the oyster shells in the estuary (Hicks and Shamberger 2023). These environmental factors and the history of extreme weather suggest minimal viable oyster habitat exists within the project area.

The entire BABUS project footprint was surveyed for oyster habitat and SAV (including seagrasses) using side-scan sonar in December 2023 and October 2024. An oyster habitat ground-truthing field effort took place in April, October, and November 2024. Data from these efforts were supplemented with 2018 side-scan survey data collected by Texas A&M University. These efforts resulted in 88.2 acres of oyster resources observed and recorded, amounting to 1.6% of the 5,485 acres of area surveyed. Scattered oysters over mud bottom (brown habitat) accounted for 23.9 acres, which was 0.4% of the survey area and 27.1% of the aerial coverage of all oyster resources. Viable oyster habitat totaled 64.3 acres, which was 1.2% of the survey area and 72.9% of the aerial coverage of all oyster resources. No buried shell (black habitat) was observed during the survey. The remaining 5,396.8 acres of bay bottom within the survey area was considered mud bottom devoid of shell. Areas of contiguous viable oyster habitat ranged from 0.04 to 38.9 acres, with a mean size of 1.9 acres (Figure 4-2). Most consolidated reefs appeared to be associated with oil and gas well infrastructure or remnant drilling drill cuttings from past oil and gas well drilling. These associations were also observed in side-scan sonar survey results by BOB Hydrographics (2025). Other areas of oyster reef were associated with locations of side casted clay sediment from dredging activities conducted prior to current regulations. Lloyd Engineering (2025) concluded that there are viable and active oyster habitats within the survey area but that the rarity of suitable hardbottom habitat limits expansion of these habitats. These oyster habitats have the potential to grow and expand beyond their current areas if suitable hard structure is provided (see the survey report in Appendix A).

Pits created from historical extraction/mining of oyster beds, referred to as oyster pits, may be present within the project area (USACE 2022). Recent studies through Texas A&M University are aiming to identify the current presence of oyster mining pits and their potential impacts on the project's execution, as past studies have historically found pits up to 80 feet (24 m) deep in shallow water estuaries that pose risks to water quality from low dissolved oxygen levels and potential release of hydrogen sulfide (Hensen 1993). However, no evidence of such pits was found in the project area based on their survey results (see the survey report in Appendix A).

Oyster reefs were also considered with regard to the Texas Department of State Health Services Classification of Shellfish Harvesting Areas of Galveston Bay current harvestable areas maps. The data indicates that a 1.2 acre consolidated reef and a 0.19 acre consolidated reef intersect the boundary of TX-5 harvest area, an approved shellfish harvest area. TX-4, a conditionally approved shellfish harvest area, intersects approximately 51.9 acres of consolidated reef and 1.3 acres of scattered reef area. The remaining 22.6 acres of scattered reef and 11.01 acres of consolidated oyster reef are in Restricted Area. Both TX-4 and TX-5 areas are noted as closed for public harvest (TDSHS 2023).

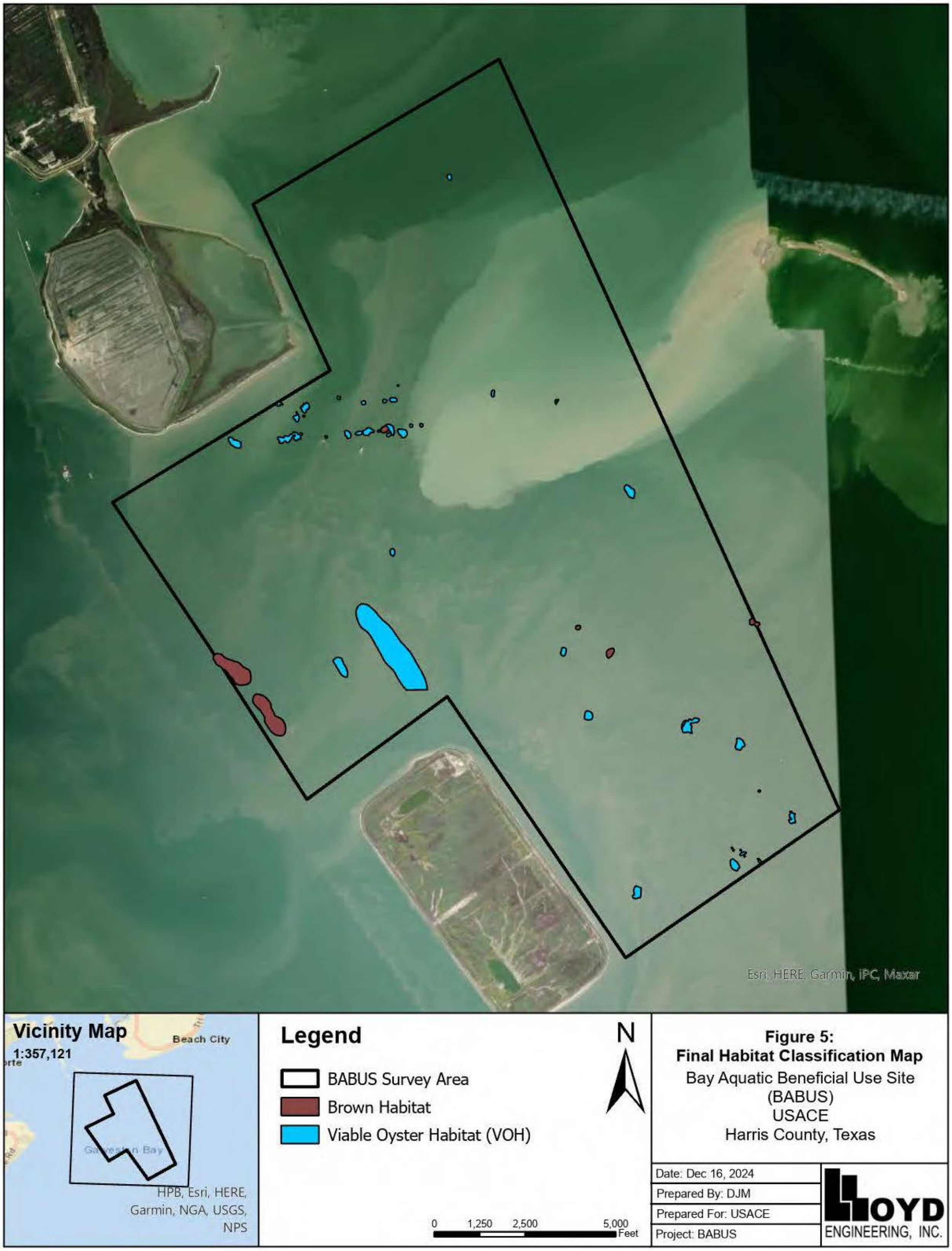

Figure 4-2a. Oyster Habitats Delineated Within a 5,485-acre Survey Area that Includes the Project Area of the Proposed Action

Source: Modified from Figure 5 of the oyster resources survey report by Lloyd Engineering (2025)

4.6.4 Consequences of the Proposed Action

No negative effects to wetlands or seagrasses (or other SAV) are expected as no evidence of such resources were found during the recent survey (Appendix A).

The proposed action would provide long-term environmental benefits through the construction of new subtidal and intertidal marsh habitats. The creation of such habitats with placed dredge material, alongside collaboration with participating stakeholders, would lead to a net gain in estuarine wetland habitat in the project area. Additionally, portions of the BABUS marsh fill areas are proposed to include intertidal habitats within shallow depths that may support and encourage seagrass establishment, potentially helping to contribute to the goals established by the Galveston Bay Foundation for seagrass restoration in the bay.

The 23.9 acres of scattered oysters over mud bottom and the 64.3 acres of viable oyster habitat within the project area would be either directly or indirectly impacted by the project. The oysters are likely to be dredged up or buried in dredged material during construction of the BABUS, exposed to turbidity, or experience changes in flow patterns resulting from the proposed action. It is possible for some or all the oysters to be relocated elsewhere within the 4,500-acre project area but outside of the PA and marsh fill areas. It is also possible that the oysters may be relocated to portions of hard structure, where feasible, on the exterior dikes, following construction of the outer perimeter of the PA. The project concept includes hard structure such as riprap or other armoring of the exterior containment dikes in combination with a shallow sloping living shoreline which may be suitable for oyster reef colonization.

Figure 4-3b. Oyster Harvest Areas and Oyster Impacts
Source: TDSHS 2023

Mitigation for oyster impacts is expected to be at a 1:1 ratio of acres impacted to acres relocated or created. The onsite relocation approach is currently being considered for the oyster resources of the project area. Alternatively, candidate sites for oyster reef mitigation from Appendix P-1 of the FIFR-EIS by USACE (2019) may be explored as potential relocation areas elsewhere within Galveston Bay. TPWD recommends a 1:1 mitigation ratio of viable oysters in harvestable areas. With proposed relocation and/or habitat creation as mitigation, as approved by TPWD and NMFS EFH assessment, negative effects of the project to oysters would be temporary and minor.

4.7 Fish & Wildlife

Relevant species other than those federally protected, and those having NOAA-designated Essential Fish Habitat, are identified and discussed here. See Subsection 4.7 (Federally Protected Species) and 4.8 (Essential Fish Habitat) for these latter groups of species.

While most of the fish and wildlife discussed in this subsection are not state-listed in Texas by TPWD, such species and state protections are briefly discussed here. A query of the TPWD spatial database (https://tpwd.texas.gov/gis/rtest/) on 24 March 2025 revealed the following state-listed species in Chamber County, Texas: 3 fishes (all sharks), 7 reptiles (1 lizards, 6 turtles), 9 birds (migratory and non-migratory), and 19 mammals (marine/aquatic and bats). Texas categorizes the above species as either 'state-threatened' or 'state-endangered'. Protections afforded to these species by TPWD focus on direct impacts. State threatened and endangered animal species are protected from capture, trapping, taking, or killing, or attempting to do any of these actions (Title 31 of the Texas Administrative Code).

Atkinson Island wildlife—Atkinson Island, and its associated BU PAs is within a half mile north of the project area. This island supports wildlife such as rattlesnakes (presumably the western diamondback [*Crotalus atrox*] based on its range), shorebirds, wading birds, and raccoons (*Procyon lotor*) (FIFR-EIS by USACE 2019). The northern portion of this island is a wildlife management area managed by TPWD. TPWD (2024a) notes that waterbirds, waterfowl, and rails utilize the Atkinson Island Wildlife Management Area (WMA). Migrating raptors and passerines stop at the WMA during spring and fall migrations. Hummingbirds visit the island in large numbers in September. Bird species reported to use this WMA include clapper rail (*Rallus crepitans*), horned lark (*Eremophila alpestris*), Nelson's sparrow (*Ammospiza nelson*), white-tailed kite (*Elanus leucurus*), and gray catbird (*Dumetella carolinensis*) (TPWD 2024a). Dominant vegetation of the WMA include hackberry (*Celtis occidentalis*) and yaupon holly (*Ilex vomitoria*).

Shellfish and finfishes—Hundreds of species of shellfish and finfishes utilize Galveston Bay, and many of these likely utilize or pass through the project area at least occasionally. Some of the most common species of the bay include brown shrimp (*Penaeus aztecus*), white shrimp (*Penaeus setiferus*), blue crab (*Callinectes sapidus*), Gulf menhaden, Atlantic croaker (*Micropogonias undulatus*), spotted seatrout (*Cynoscion nebulosus*), gafftopsail catfish (*Bagre marinus*), gray snapper (*Lutjanus griseus*), and southern flounder (*Paralichthys lethostigma*) (GBEP 2024). The eastern oyster (*Crassostrea virginica*) was once an abundant natural resource in the bay. Oysters are discussed under Subsection 4.6 (Wetlands and Special Aquatic Sites).

Amphibians—Few amphibians have adapted to the osmotic challenges of life in estuarine waters. Southern leopard frogs (*Lithobates sphenocephalus*) are known to utilize brackish waters in Chambers County sloughs for shelter and reproduction and utilize grassy meadows adjacent to Galveston Bay (Tennant 1984). A search of the iNaturalist spatial database (https://www.inaturalist.org/observations) shows photo-documented observations of this species along most shores of the bay but not associated with Atkinson Island or Mid Bay PA. All life stages of leopard frogs are preyed upon by a host of fishes, reptiles, birds, and mammals. Cuban treefrogs (*Osteopilus septentrionalis*) are also well known to utilize estuaries for reproduction but no records of this species were found closer than Galveston Island and Houston.

Reptiles—Notable reptiles that utilize Galveston Bay include the Texas diamondback terrapin (*Malaclemys terrapin littoralis*) (Brennessel 2006) and the Gulf saltmarsh snake (*Nerodia clarkii clarkii*) (Tennant 1984). Historical records of terrapins in the Galveston Bay area suggest a formerly robust population. A once-active commercial fishery for terrapins in a bayou within this estuary was a matter of public record according to Brennessel (2006). An estimated 95% of the marshes that once supported terrapins and the Gulf saltmarsh snake in the Galveston Bay estuary have disappeared. Oyster reefs, considered very important for foraging and sheltering habitat for the Texas terrapins, have also largely disappeared from this estuary (Brennessel 2006). Gulf saltmarsh snake habitat in the bay area has decreased greatly since the early 1960s due to the draining of tidal wetlands in the area (Tennant 1984). Local populations of this snake are thought to have been impacted further by the presence of petrochemicals and sewage effluent from refineries, tankers, and commercial development (Tennant 1984). Terrapins and saltmarsh snakes have experienced declines in population in the Galveston Bay area (Tennant 1984, Brennessel 2006).

Many other reptiles utilize terrestrial habitats that border the bay or utilize islands within the bay. Species that typically inhabit freshwater habitats also occasionally utilize the bay, especially during times of low salinity (Tennant 1984, Brennessel 2006). Recent studies by Gordon et al. (2023) have shed light on populations of the alligator snapping turtle (*Macrochelys temminckii*, state-threatened, with federal protection proposed) in upstream areas of the bay watershed. Such populations are found in Buffalo Bayou in Houston, Turtle Bayou near the mouth of the Trinity River, and upstream in the Trinity River, but this reclusive and structure-oriented species is unlikely to be found in open water such as in the project area. Sea turtles may use the bay for foraging and are addressed in Subsection 4.7 (Federally Protected Species).

Birds—The northern portion of Galveston Bay is surrounded on most sides by hotspots for observing birds. The nearest bird-observation hotspot to the project area is El Jardin Beach Park, less than 3.5 miles west of the project area. Amateur naturalists have logged observations of 197 species of birds from this park according to searches of the Avian Knowledge Network (https://avianknowledge.net/index.php/observations-map/) and the eBird bird observation database (https://ebird.org/explore). Bird species having particularly high numbers observed (≥100 per observation) at this park are summarized in Table 4-1 below, along with associated information.

Several bird species nest in or around Galveston Bay. Tree-nesting birds (egrets, herons, ibis, and the roseate spoonbill [*Platalea ajaja*]) appear to have local populations that are either stable or moderately decreasing numbers (Galveston Bay Report Card 2024). Ground-nesting species of the bay, such as the black skimmer (*Rynchops niger*) and the least tern (*Sternula antillarum*), generally show no major trend. The exception is the laughing gull (*Leucophaeus atricilla*) which shows a moderately declining local population (Galveston Bay Report Card 2024).

Table 4-1. Bird Species Observed and Reported at Abundances of at least 100 Individuals at El Jardin Beach Park, Near the Project Area

Common Name	Scientific Name	Number Observed (Date of Observation)	Status
Franklin's gull	*Leucophaeus pipixcan*	700 (15 Oct 2022)	(not listed)
Laughing gull	*Leucophaeus atricilla*	400 (25 Oct 2022)	(not listed)
Neotropic cormorant	*Phalacrocorax brasilianus*	250 (17 Dec 2022)	(not listed)
Red-winged blackbird	*Agelaius phoeniceus*	250 (15 Apr 2023)	(not listed)
Black-bellied whistling duck	*Dendrocygna autumnalis*	200 (01 Dec 2023)	(not listed)
Ring-billed gull	*Larus delawarensis*	200 (25 Dec 2007)	(not listed)
Cedar waxwing	*Bombycilla cedrorum*	200 (17 Dec 2022)	(not listed)

Brown-headed cowbird	*Molothrus ater*	150 (01 Mar 2023)	(not listed)
Common grackle	*Quiscalus quiscula*	150 (25 Nov 2012)	(not listed)
Sanderling	*Calidris alba*	125 (28 Dec 2022)	(not listed)
American white pelican	*Pelecanus erythrorhynchos*	125 (07 Oct 2023)	(not listed)
White ibis	*Eudocimus albus*	110 (03 Apr 2023)	(not listed)
Rock pigeon	*Columba livia*	100 (11 Sep 2016)	Introduced, non-native
Brown pelican	*Pelecanus occidentalis*	100 (11 May 2020)	(not listed)
European starling	*Sturnus vulgaris*	100 (25 Nov 2012)	Introduced, non-native

Sources: Queries of the Avian Knowledge Network (https://avianknowledge.net/index.php/observations-map/) and the eBird bird observation database (https://ebird.org/explore) on 29–30 Jan 2024. TPWD Species of Greatest Conservation Need (https://tpwd.texas.gov/landwater/land/tcap/sgcn.phtml) query on 30 Jan 2024.

4.7.1 Consequences of the Proposed Action

The creation of intertidal habitats such as marsh and oyster reef, along with upland habitat, would result in the loss of sub-tidal open-water habitat in much of the project area. However, open-water habitat is by far the most dominant habitat within the 1,456-square-kilometer Galveston Bay (Engle et al. 2007), where the average water depth is 1.8 m (5.9 feet) MLLW (Kim 2021). For this reason, open-water habitat does not appear to be a limiting factor for many species that utilize the bay. Therefore, the addition of limiting habitats, as proposed in Section 2, is expected to benefit species that require such habitat for vital life history activities, such as reproduction, sheltering, and (or) foraging.

Larger more mobile aquatic species currently utilizing this open-water habitat would be expected to actively relocate and avoid the area during construction, as there are no major physical barriers preventing such movements. The placement of dredged material in the project area would have adverse direct, short-term, and minor impacts on smaller, less mobile demersal fishes and epifaunal and infaunal invertebrates within the project area. However, impacted species would be expected to recolonize living shoreline areas and adjacent open-water areas following construction. The direct, short-term loss of individuals within the spatially discrete project area (only 0.6% of the 1,456-square-km bay) is not expected to substantially impact the overall species richness or abundance in Galveston Bay as a whole. The bay population of spotted seatrout is expected to benefit from the presence of marsh habitat and oyster reef habitats as the presence and amount of these habitats are limiting factors to recruitment of this species in other Gulf of Mexico estuaries as studied by Whaley et al. (2023).

It is possible that the diamondback terrapin may utilize the upland areas of the BABUS for nesting, the intertidal marsh for basking, and the subtidal habitats for foraging and shelter. Given the known importance of the presence of oyster reefs adjacent to marsh habitats for foraging and sheltering of terrapins, and upland areas for nesting (Brennessel 2006), the proposed action may result in ideal habitat for this species-in-decline. It is logical to assume that terrapins would utilize new nesting areas provided that the population of terrapins within the bay occasionally visit the project area. Diamondback terrapins have successfully nested on a similar BU PA site in Chesapeake Bay called Poplar Island in Talbot County, Maryland (Roosenburg 2018). Dispersal of this species is aided by occasional storm events and high riverine flows, allowing new habitat to be colonized by stray individuals during and following such stochastic events.

The Gulf saltmarsh snake may also utilize the proposed constructed intertidal and upland habitats once such habitats are created and established. Although the species has experienced a drastic reduction in numbers in the bay area (Tennant 1984), mainly due to loss of marsh habitat, the species continues to be observed and photo-documented in low numbers along most edges of Galveston Bay (iNaturalist [https://www.inaturalist.org/observations]). The species is known to easily cross open estuarine waters (Tennant 1984) and it is likely that individuals may occasionally be swept across the bay during storm events, facilitating the colonization of newly available habitat. These snakes commonly utilize fiddler crab (Ocypodidae) burrows as shelters (Tennant 1984) and such shelters may be available to this snake in the future, if these crabs eventually establish a population in the proposed BABUS.

The proposed action is anticipated to include the conversion of open water to intertidal and upland habitats with native plant species that are appropriate for each habitat type. The project would create new areas of habitat for use by wildlife species for a wide variety of life history uses including sheltering, foraging, and reproductive processes. Considering that many species of birds and aquatic life within the bay area have experienced at least some degree of population-reduction due, in part, to habitat modification or reduction at the hands of humans, it is expected that these proposed new habitats may benefit such local species and aid in their long-term population trends in the area. A nearby example is the dredged-material-created six-acre Evia Island along the HSC (Port Houston 2020) in the southern part of Galveston Bay. Nearly 10,000 bird nests have been recorded on this island including the American white pelican, brown pelican, great blue heron (*Ardea herodias*), egrets (Ardeidae), and the roseate spoonbill (Port Houston 2020). Similar to Evia Island but much larger in scope, the proposed action is expected to provide an overall long-term and major beneficial effect to colonial birds and other wildlife in the area.

4.8 Federally Protected Species

An assessment of federally protected species was conducted that fully addresses federally protected species of relevance to this EA, potential effects of the proposed action, and avoidance and minimization measures. The assessment includes a summary of the federal regulatory framework, discusses and addresses relevant federally protected species, summarizes potential impacts of the proposed action as well as avoidance and minimization measures to reduce these impacts. Refer to Appendix B for the Federally Protected Species Assessment. A summary of findings is offered below.

Federally protected species that may potentially occur within the project area include the insects, fishes, reptiles, birds, and mammals listed in Table 4-2 below. Bird species protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712) and state-listed species may also occur within the project area. The project area is within proposed critical habitat for the green sea turtle (*Chelonia mydas*) but is otherwise devoid of designated critical habitat. This subsection summarizes the federally protected species, their critical habitat (if any), and potential effects of the proposed action to these species. See the Federally Protected Species Assessment in Appendix B for a thorough discussion and evaluation of possible effects of the proposed action compared to the no-action alternative.

Informal consultations with USFWS and NOAA Fisheries (NMFS) are summarized in Subsection 7.1 (Interagency Coordination and Consultations) for federally listed species under their jurisdiction that may be present within the project area. These consultations ensure compliance with the Endangered Species Act (ESA) of 1973. Appendix E contains the consultation correspondence.

Table 4-2. Summary of Federally Protected Species That May Occur In Galveston Bay

Common Name (Scientific Name)	Federal Status	State (TPWD) Status
INSECTS		
Monarch butterfly (*Danaus plexippus*)	Candidate (USFWS) (88 FR 41560, 06/27/2023) (no critical habitat designated)	(not listed)
FISHES		
Giant manta ray (*Mobula birostris*)	Threatened (NOAA Fisheries) (83 FR 2916, 01/22/2018) (no critical habitat designated)	(not listed)
REPTILES		
Green sea turtle (*Chelonia mydas*)	Threatened (co-managed) (43 FR 32800, 07/28/1978) Critical habitat is designated with more proposed (63 FR 46693, 09/02/1998 88 FR 46572, 07/19/2023)	Threatened
Loggerhead sea turtle (*Caretta caretta*)	Threatened (co-managed) (43 FR 32800, 07/28/1978) Critical habitat is designated (79 FR 39856, 07/10/2014)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*	Endangered (co-managed) (35 FR 18319, 12/02/1970) Critical habitat is proposed (43 FR 45905, 11/29/1978)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered (co-managed) (35 FR 8491, 06/02/1970) Critical habitat is designated (63 FR 46693, 09/02/1998)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered (co-managed) (35 FR 18319, 12/02/1970) Critical habitat is designated (77 FR 4170, 01/26/2012)	Endangered
BIRDS		
Bald eagle (*Haliaeetus leucocephalus*)	Protected under Bald and Golden Eagle Protection Act (USFWS) (no critical habitat designated)	(not listed)
Eastern black rail (*Laterallus jamaicensis jamaicensis*)	Threatened (USFWS) (85 FR 63764, 10/08/2020) (no critical habitat designated)	Threatened
Piping plover (*Charadrius melodus*)	Threatened (USFWS) (50 FR 50726, 12/11/1985) (Atlantic coast and northern Great Plains populations) Critical habitat is designated (74 FR 23476, 05/19/2009)	Threatened
Rufa red knot (*Calidris canutus rufa*)	Threatened (USFWS) (79 FR 73705, 12/11/2014) Critical habitat is proposed (88 FR 22530, 04/13/2023)	Threatened
MAMMALS		

Common Name (Scientific Name)	Federal Status	State (TPWD) Status
Bottlenose dolphin (*Tursiops truncatus*)	Protected under the Marine Mammal Protection Act (NOAA Fisheries)	(not listed)
West Indian manatee (Florida manatee) (*Trichechus manatus* [*T. m. latirostris*])	Threatened (USFWS) (82 FR 16668, 04/05/2017) Critical habitat is designated (42 FR 47840, 09/22/1977) Also protected by the Marine Mammal Protection Act (NOAA Fisheries)	Endangered

Sources: National Marine Fisheries Service ([NMFS] 2018), USFWS IPaC (https://ipac.ecosphere.fws.gov/) and ESA species (https://www.fws.gov/species) queries on 13 September 2023 and 21 March 2025, TPWD Species of Greatest Conservation Need (https://tpwd.texas.gov/landwater/land/tcap/sgcn.phtml) queries on 14 September 2023 and 21 March 2025.

4.8.1 Consequences of the Proposed Action

Based on all available data and the discussion and evaluation in the Federally Protected Species Assessment in Appendix B, the proposed action is predicted to have **no effect** on the monarch butterfly, bald eagle, eastern black rail, piping plover, rufa red knot, hawksbill sea turtle, leatherback sea turtle, or bottlenose dolphin. The proposed action **may affect, but is not likely to adversely affect** the giant manta ray, green sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle, and West Indian manatee and their applicable critical habitat. See the Federally Protected Species Assessment in Appendix B for a thorough discussion of effects to federally protected species and applicable critical habitat.

Avoidance and Minimization Measures

Many of the measures designed to avoid or minimize impacts to federally protected species are included in Subsection 6.1 (Construction BMPs).

Dredging interactions are well known sources of mortality to sea turtles via entrainment (Dickerson et al. 1990, Dickerson 2011). Vessels also present potential sources of injury or death to sea turtles due to impact with the hull, lower unit, and (or) propeller of the vessel (Hazel and Gyuris 2006, Witherington and Witherington 2015). Pre-construction briefs will be given to construction/dredging crews to inform them of appropriate procedures should a sea turtle be observed. Guidance and recommendations from the USACE Waterways Experiment Station's *Alternative Dredging Equipment and Operational Methods to Minimize Sea Turtle Mortalities* (Dickerson et al. 1990) may be used to help avoid impacts to sea turtles during construction. USACE will comply with applicable dredging windows and protective measures for protection of sea turtles as stated in the Gulf of Mexico Regional Biological Opinion (GRBO) by NOAA Fisheries (2003) through revision 2 of NMFS (2007) (or more recent revision). All BMPs will be adhered to during construction to ensure avoidance of impacts to sea turtles.

As with sea turtle avoidance measures, the USACE will also comply with the construction conditions for protected species outlined in NOAA Fisheries (2021), and manatee conservation measures outlined by USWFS. See the Federally Protected Species Assessment in Appendix B for a complete list of the measures to be used during construction and dredged material placement at the BABUS.

Consultation with the USFWS resulted in concurrence that the project is not likely to adversely affect west Indian manatee, with the implementation of the species-specific protective measures included in the concurrence letter. Refer to Appendix E for records of agency consultations and concurrences.

4.8.2 Consequences of the No-Action Alternative

There are aspects of the no-action alternative, such as the more frequent use of the ODMDS where there is presence of protected pelagic species and marine mammals, that make this alternative somewhat more likely to cause negative effects to federally protected species relative to the proposed action. Refer to Appendix K of the FIFR-EIS for the Biological Assessment which discusses the proposed impacts of the no-action alternatives.

4.9 Essential Fish Habitat

An EFH Assessment was prepared for the proposed BABUS project and is included in Appendix C. The EFH Assessment was written in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (MSA 16 U.S.C. 1855 (b)), including the Sustainable Fisheries Act (16 U.S.C. 1801) amendment of 1996. EFH is defined by the NMFS (2004) and approved by the Secretary of Commerce acting through NMFS (50 CFR § 600.10) as '…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity' (MSA § 3[10]).

The EFH Assessment elucidates all EFH, including any Habitat Areas of Particular Concern of relevance to the proposed action, specifies and discusses potential impacts to EFH (broadly, turbidity and water quality and sedimentation), potential impacts, mitigation measures, and summarizes conclusions. The following is a summary of EFH of relevance to this EA. No Habitat Areas of Particular Concern were identified within Galveston Bay based on a literature search.

Of the fishery-managed taxa having EFH in the region, the following species have EFH that are applicable to the proposed action based on a list of species-specific information provided in Gulf of Mexico Fishery Management Council (GMFMC) and NMFS (2016), NMFS (2017), and NOAA Fisheries (2023):

- Brown shrimp (*Penaeus aztecus*) post-larval, juvenile, and subadult EFH
- Pink shrimp (*Penaeus duorarum*) juvenile and subadult EFH
- White shrimp (*Penaeus setiferus*) post-larval, juvenile, subadult, adult, and spawning adult EFH
- Red drum (*Sciaenops ocellatus*) eggs, larvae, post-larvae, juvenile, and adult EFH
- Spanish mackerel (*Scomberomorus maculatus*) juvenile and adult EFH
- Gray snapper (*Lutjanus griseus*) adult EFH
- Lane snapper (*Lutjanus synagris*) larvae, post-larvae, and juvenile EFH
- Red grouper (*Epinephelus morio*) early juvenile EFH
- Cobia (*Rachycentron canadum*) eggs and larvae EFH
- Blacktip shark (*Carcharhinus limbatus*) neonate and young-of-year EFH
- Bull shark (*C. leucas*) neonate, young-of-year, juvenile, and adult EFH
- Spinner shark (*C. brevipinna*) neonate and young-of-year EFH
- Bonnethead (*Sphyrna tiburo*) neonate and young-of-year EFH

Oyster reef habitat also fits the definition of EFH in MSA § 3(10), is discussed and described as-such by Coen et al. (1999), and is present within the project area based on recent surveys by Lloyd Engineering (2025). Oyster reef habitat is addressed as a component of EFH for federally managed species in Eco-region 4 (eastern Texas [including Galveston Bay] to western Louisiana) by the GMFMC (2004, 2005). Oysters and oyster reef habitat is discussed and addressed under Wetlands and Special Aquatic Sites in Subsection 4.6. Estuarine water column and estuarine mud substrate occur within the project area and are considered EFH for federally managed species under MSA § 3(10). These habitats are described in Subsections 4.4 and 4.5 and impacts of the proposed action are discussed there. Mitigation of those impacts are described and discussed in Section 6. See the EFH Assessment in Appendix C for a thorough discussion of EFH, including oysters, water column, and mud substrate as EFH for federally managed species.

4.9.1 Consequences of the Proposed Action

In general, the construction and use of the BABUS could potentially produce the following adverse environmental effects:

- Temporary water column perturbations (turbidity plumes, release of chemical contaminants, lowering dissolved oxygen concentrations)
- Mortality of benthic organisms
- Changing the bathymetry of the site
- Altering the sediment composition of the site

Potential Effects to Larval Invertebrates and Fishes—Short-term impacts to zooplankton, including planktonic larvae of federally managed invertebrates and fishes, resulting from dredged material placement may include mortality due to entrainment in the sediment plume and interference with filter-feeding caused by a temporary increase in suspended sediments. Pelagic eggs of fish can be smothered by re-suspended sediment (Suedel 2011). These impacts are expected to be short-term and localized and are not expected to significantly affect planktonic conditions in the region, especially considering that steps are taken in Tier II of the above-mentioned testing procedure to evaluate and prevent deleterious effects on zooplankton and other organisms of the water column before the dredged material is deemed suitable for ocean disposal or open water placement.

Potential Effects to Pelagic Fishes—Placement activities at the site are expected to minimally affect pelagic fishes. Only a localized area will be affected by disposal operations, and fish populations are not geographically limited to the placement area or marsh fill areas of the BABUS; therefore, the presence of such species within the affected area during construction and placement operations is expected to be minimal. Pelagic fishes traveling through the immediate area may modify their route during discharge operations. Adult fishes within and immediately adjacent to the disposal area may experience a temporary reduction in the oxygen exchange capacity of their gills due to clogging and physical abrasion (Suedel 2011). A minor decrease in dissolved oxygen can occur due to increased biological oxygen demand associated with the dredged material. Additional stress in adult fishes can occur due to avoidance reactions (EPA 1995). Reproductive behavior of fishes has also been suggested to be impacted during placement activities (Suedel 2011). However, conditions that could impact pelagic fishes are expected to be short-term (measurable in hours) and localized (limited to the placement area), and the effects on adults and larger juveniles living within the water column are not expected to be significant given their ability to quickly avoid the localized area of placement activities.

Potential Impacts to Demersal Fishes and Shrimp— Placement of dredged material at the BABUS may affect demersal fishes and other epifaunal populations in the short term. The immediate local effect of dredged material placement would be the burial of taxa such as penaeid shrimp, sea robins (*Prionotus* spp.), sand flounders (Paralichthyidae), and the blackcheek tonguefish (*Symphorosa plagiusa*) as well as their epifaunal and infaunal prey. After dredged material is placed, much of the fine-grained sediment remains suspended near the ocean floor (Hirsch et al.

1978). This can cause stress in fishes in part due to the reduction of oxygen exchange capacity in the gills due to clogging and physical abrasion (EPA 1995, Suedel 2011). Larger juveniles and adults can avoid the suspended material by moving out of the area, but smaller juveniles are more vulnerable and susceptible to stress (Science Applications International Corp. 1986). Post-placement recovery of the local demersal fish populations may take 14 to 22 months, and recovery of the epibenthic invertebrate populations may take over two years, based on a dredge recolonization study in San Diego Bay conducted by Mooney (2010).

Dredged material placement at the BABUS may result in a short-term localized decrease in demersal fish species diversity and abundance. These reductions could be caused, in part, by reduced food availability (EPA 1995). Benthic infaunal and epifaunal populations, which are the main food sources for demersal fishes, decline when placement occurs frequently if these prey items are unable to re-establish themselves (Science Applications International Corp. 1986). Some recovery of the benthic community occurs within months, but complete recovery of the original benthic communities requires about 1 to 3 years according to studies by Germano and Rhoads (1984), Dillon (1984), and Scott et al. (1987), although recovery times vary widely between studies (Wilber and Clarke 2007). When placement occurs more often than yearly, the benthic community will likely experience reduced diversity and will support a more limited demersal fish community (EPA 1995).

Potential Impacts to Oyster Reefs—The 23.9 acres of scattered oysters over mud bottom and the 64.3 acres of viable oyster habitat within the project area would be either directly or indirectly impacted. Such impacts are predicted to include being dredged up or buried in dredged material during construction of the BABUS, exposed to turbidity, or experience changes in flow patterns resulting from the proposed action. Construction of sections of hard structure on portions of the exterior dike(s) of the BABUS would provide for future oyster colonization habitat and (or) to relocate existing oysters there. An onsite relocation or habitat creation approach will be formulated during final design, with the goal of mitigating the loss of oyster habitat within the project footprint at least at a 1:1 area ratio.

4.10 Cultural Resources

Cultural resources were investigated in the project area to determine the presence of cultural resources. The survey was conducted by BOB Hydrographics, LLC during 8–26 October 2024 and 11–26 March 2025 using a combination of side-scan sonar and magnetometer remote sensing. The survey area extended over the entire project area and included a 50-meter (164-foot) buffer around the project area, for a total surveyed area of 5,362 acres (BOB Hydrographics 2025).

The results of the cultural resources/archaeology survey by BOB Hydrographics found no evidence of any cultural resources within the 5,362-acre survey area. A total of 28 magnetic anomalies were detected in the magnetometer data (BOB Hydrographics 2025). All 28 anomalies were subsequently cleared from further concern by probing the bay bottom under an amendment to permit # 31570 (see the survey report in Appendix D-2). The probing of 28 magnetic anomalies resulted in only negative results for cultural resources (i.e., no shipwrecks or other cultural resources were observed) (BOB Hydrographics 2025). Metallic objects were contacted by the probe at two anomalies (11 and 23). The remaining anomaly sources are presumed to be smaller as they were not detected during probing (BOB Hydrographics 2025). None of the 28 anomalies meet the criteria for the State Antiquities Landmark or the National Register of Historic Places based on the results of this study (see survey report in Appendix D-2).

The cultural resources/archaeological study by BOB Hydrographics was completed in compliance with Section 106 of the National Historic Preservation Act (NHPA) Public Law 89-665; 16 U.S.C. 470) and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). The minimum reporting and survey requirements for marine archaeological studies conducted under a Texas Antiquities Permit are mandated by Texas Administrative Code Title 13, Part 2, Chapters 26 and 28. Archaeological project records will be curated by the Texas Archeological Research Laboratory at the University of Texas in Austin, Texas (BOB Hydrographics 2025).

4.10.1 Consequences of the Proposed Action

No direct impacts to cultural resources are expected as no evidence of any such resources were found during a thorough survey of the project area (see survey report in Appendix D-2). Refer to Appendix E for record of Texas Historic Commission concurrence with the report findings.

4.11 Recreation, Aesthetics & Land Use

Current land use of the project area is limited to aquatic uses as the area is wholly comprised of submerged bay bottom. The area has a history of oil and gas usage, as discussed in Subsection 4.15.

Recreational opportunities include fishing, although the area is devoid of obvious fish-attracting structures. Oyster reefs discussed in Subsection 4.6 provide uncommon hard-bottom habitats in the area that could be utilized as nursery habitat and foraging habitat by recreational fish species such as redfish, bass, and flounder. Aesthetics and recreation offered in the project area include views and photography of the horizon during sunrise and sunset, and of wildlife (bird watching, dolphin watching). Boating, kayaking, canoeing, and perhaps other water sports may be conducted in the project area on occasion.

The Houston Yacht Club boat ramp is less than four miles west of the project area, with two other boat ramps within seven miles of the site. There are several thousand registered water vessels within the Galveston Bay area (5,951 registered vessels in Chambers and Harris counties alone [BoatInfoWorld 2024]). Many citizens of bayside counties utilize Galveston Bay at least occasionally, for recreation.

4.11.1 Consequences of the Proposed Action

The proposed BABUS and its planned oyster reefs and marsh habitat are expected to enhance future fishing opportunities for recreational fishers targeting such species as red drum, black drum, and spotted seatrout. The siting of the BABUS may also provide opportunities for recreational kayakers and canoeists, particularly those interested in fishing or birdwatching. It is planned for at least one of the recreational boating channels to remain unimpeded for boat traffic from the HSC to access Trinity Bay.

Comments received from the Public Notice comment period of the Draft EA included several local yacht clubs concerned over a potential closure of access to the eastern bay areas through Five Mile Cut. The project does not include the closure of Five Mile Cut. The project will include specific engineering and design to ensure the Five Mile Cut remains open to ensure recreational boat access through the area.

The BABUS landforms, once constructed, may be visible from the nearest shoreline (Morgans Point to the south or Baytown to the north). However, they are not expected to impede views from land, given the low elevation and purpose of creating intertidal marsh habitat. It is not likely to negatively affect views from land.

The use of the BABUS would conceivably reduce the number of miles that dredge scows must travel within the HSC before dumping their dredged material, as it would take over 20 more miles of the HSC before a scow left the bay for disposal at the Galveston ODMDS. The use of the (relatively close-by) BABUS could decrease vessel traffic farther downstream during dredging activities. Therefore, for the reasons indicated above, it is expected that there will be an overall beneficial, indirect, long-term effect of the project on the communities in the region.

4.12 Socioeconomics

The project area is located within Galveston Bay and is over three miles from the nearest residential area (within the City of Seabrook). Although the project area is within Chambers County, the nearest city (Seabrook) is in nearby Harris County. If a half-mile buffer is used for project area community resources, as it was used for the FIFR-EIS by USACE (2019), then no such community resources would be found.

The population of Harris County (4,731,145) is about 100 times greater than that of nearby Chambers County (46,571) (U.S. Census Bureau 2024). The median ages for these areas are within 1 year of one another. Percent employment is slightly higher for the City of Seabrook (67.5%) compared to Chambers (61.7%) or Harris (63.8%) counties, or Texas (62.1%) (U.S. Census Bureau 2024). Chambers County had a higher median household income ($106,103) compared to Seabrook ($96,223) and much higher than Harris County ($68,706). This is in contrast with the relatively lower median education in Chambers County (only 22.8% with at least a bachelor degree) compared to Seabrook (40.1%) and Harris County (34.1%) (U.S. Census Bureau 2024). Percentages of population in Harris County that were ethnic minority was greater than in Chambers County. Harris County also had greater percentages of non-English speaking households than in Chambers County (U.S. Census Bureau 2024). Population statistics for the City of Seabrook and Chambers and Harris counties are compared to those of Texas in Table 4-3. Socioeconomic indicators are compared between these areas in Table 4-4 and visually compared in Figure 4-2. Overall, it appears that Harris County has a disproportionately high percentage of susceptible individuals within its population. However, Harris County is outside of the project area and its nearest residential area (Seabrook) is over three miles from the project area.

Table 4-3. Population Statistics for the City of Seabrook, Chambers County, and Harris County, Compared to the State of Texas, 2020–2022

Population Statistic	City of Seabrook	Chambers County	Harris County	Texas
Total population	13,618	46,571	4,731,145	29,145,505
Total households	6,424	15,744	1,842,683	11,087,708
Median age	34.8 ± 4.0	35.4 ± 0.4	34.5 ± 0.1	35.6 ± 0.1
% employment	67.5%	61.7%	63.8%	62.1%
Median household income	$96,223	$106,103	$68,706	$72,284
% education of ≥bachelor degree	40.1%	22.8%	34.1%	33.9%
% without health care coverage	14.8%	15.9%	20.4%	16.6%
Race and Ethnicity				
Native American	<1% (88)	<1% (337)	1.2% (55,011)	1.0% (278,948)
Asian	4.0% (539)	1.4% (640)	7.4% (349,268)	5.4% (1,585,480)
African American	5.2% (714)	6.9% (3,227)	19.2% (907,063)	12.2% (3,552,997)
Hispanic or Latino	18.4% (2,511)	23.5% (10,952)	43.0% (2,034,709)	39.3% (11,441,717)
Hawaiian or other Pacific islander	<1% (6)	<1% (1)	<1% (4,141)	<1% (33,611)
White	72.1% (9,823)	70.0% (32,614)	36.4% (1,720,356)	50.1% (14,609,365)
Other race	4.5% (617)	9.3% (4,339)	18.9% (895,151)	13.6% (3,951,366)
Two or more races	13.4% (1,831)	11.6% (5,413)	16.9% (800,155)	17.6% (5,133,738)
Language spoken at home				
% English	79.9%	79.4%	54.6%	64.9%
% Spanish	15.1%	19.1%	35.9%	28.3%
% other Indo-European languages	1.1%	0.4%	3.4%	2.6%
% Asian or Pacific islander	2.7%	1.0%	4.5%	3.1%
% other languages	1.2%	0.1%	1.5%	1.1%

Source: U.S. Census Bureau (2024), searched online on 23 Jan 2024. Census data from 2020–2022.

Table 4-4. Socioeconomic Indicator Indices for the City of Seabrook, Chambers County, and Harris County, Compared to the State of Texas

Socioeconomic Indicator	City of Seabrook	Chambers County	Harris County	Texas
Demographic index	22%	30%	53%	46%
Supplemental demographic index	9%	13%	19%	17%
People of color	28%	35%	72%	58%
Low income	15%	24%	35%	34%
Unemployment rate	4%	8%	6%	5%
Limited English-speaking households	1%	2%	11%	8%
< High school education	7%	11%	18%	16%
< 5 years old	7%	7%	7%	6%
> 64 years old	14%	12%	11%	14%
Low life expectancy	17%	20%	18%	20%

Source: EPA Screen Community Report (https://www.epa.gov/ejscreen) accessed 23 Jan 2024. Census year not stated.

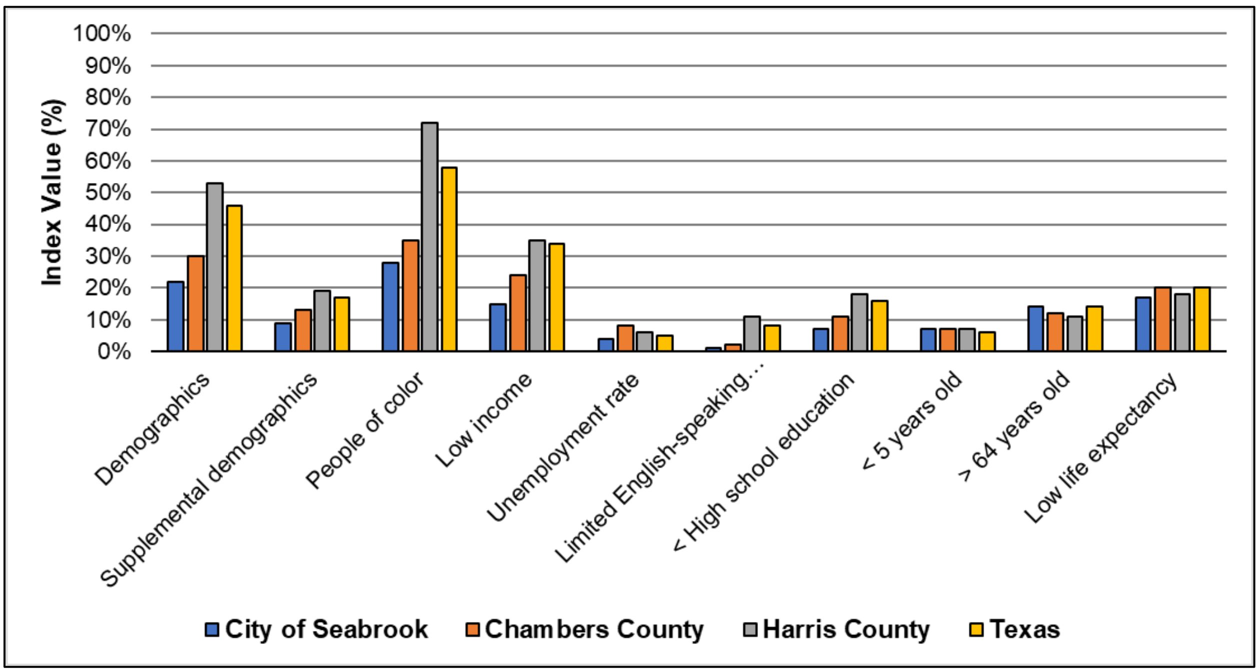

Figure 4-4. Socioeconomic Indicator Values for the City of Seabrook, Chambers County, and Harris County Compared to the State of Texas

Source: EPA Screen Community Report (https://www.epa.gov/ejscreen) accessed 23 Jan 2024. Census year not stated.

4.12.1 Consequences of the Proposed Action

The project area for the proposed action is outside of any residential area and is physically removed from the nearest landform (Mid Bay PA and marsh PAs associated with Atkinson Island). The recreational boating community of the Galveston Bay area may be impacted by the placement of dikes that would likely impede boating traffic using Five Mile Cut and (or) North Boat Cut to access Trinity Bay. However, potential impacts to navigation at Five Mile Cut or North Boaters Cut would be minimized where possible through further engineering and design along with stakeholder engagement with recreational fishermen.

The future enhancement of recreational fishing opportunities through the creation of oyster beds and marshes may also extend to enhanced charter fishing opportunities, benefiting charter boat captains and their families in Chambers and Harris counties. This may result in a slight economic benefit to the region by attracting more charter customers to stay in the area during vacations, and for previous vacationers to prolong their stay in these counties for this new fishing opportunity. The presence of oyster beds and intertidal riparian vegetation at the BABUS may also enhance commercial fisheries, to some degree, by encouraging recruitment of some species of fishes and crustaceans.

4.13 Air Quality

The region of interest for the air quality subsection is Chambers County, Texas. This county, including the project area, is contained within the HSC ECIP study area (FIFR-EIS by USACE 2019). The air quality in this area was described in the FIFR-EIS by USACE (2019). The Houston-Galveston-Brazoria non-attainment area (including the project area within Chambers County) currently meets all EPA National Ambient Air Quality Standards except for ozone, which is designated as being in moderate non-attainment (FIFR-EIS by USACE 2019). The nitrogen oxide (NOx) and volatile organic compounds are produced from power generation, construction activity, oil and gas extraction, refining and other industrial processes, vehicles, recreation equipment, lawn and garden equipment, and transportation and shipping. Transportation and shipping refers to aircraft, truck, rail, and marine cargo (FIFR-EIS by USACE 2019).

4.13.1 Consequences of the Proposed Action

No changes to air quality are expected resulting from the construction of the BABUS and the placement of dredged material into the PA and marsh fill areas beyond the expected future conditions or no-action alternative. This is because the HSC would need to undergo periodic O&M dredging and the dredged material would need to either be placed in a PA, or disposed of at the Galveston ODMDS, regardless of if the BABUS is constructed.

Temporary impacts to air quality would result from emissions from construction equipment and dredging vessels would be comparable regardless of where the dredged material was placed. Air emissions would be generated over the short-term resulting from construction activities, but not to levels significantly higher than what presently occur under the No-Action Alternative (as discussed in the EIS), and air emissions would not be outside the normal range of emissions from other like construction activities for Harris or Chambers County.

A general Clean Air Act conformity determination was included for the HSC ECIP as Appendix J of the FIFR-EIS by USACE (2019). The conformity determination addresses all aspects of the HSC ECIP construction emissions. The emissions addressed include those of dredging equipment and supporting vessel emissions, dredged material placement site work, and employee vehicle commuting. The conformity determined that more than 90 percent of the nitrogen oxide emissions from the proposed HSC project would be from commercial marine vessels.

4.14 Noise

Noise within the project area is largely generated by the following anthropogenic and natural sources:

- Commercial shipping traffic, including tugboats, associated with the nearby HSC and Bayport Ship Channel;
- Recreational boating traffic associated with the HSC, Five Mile Cut Channel, North Boaters Cut, and elsewhere in Galveston Bay;
- Dredging equipment associated with new work dredging, and regular O&M dredging, of HSC and Bayport Ship Channel;
- Scows and barges associated with transport of dredged material from upstream portions of the HSC;
- Dredged material placement activities at the nearby Atkinson Island BU PAs and Mid Bay PA; and
- Natural background sounds such as bird calls and sounds generated by wind and wave action.

Most of the noise within Galveston Bay is produced from anthropogenic sources associated with vessel traffic and dredged material activities (dredging and dredged material transport). Above-water noise emitted from motorboats typically range from 85 to 102 dB, ships of over 60,000 tons have been measured at 107.7 dB, noise from tugboats have been measured at 92.5 dB, and commercial fishing vessels were measured at 88–100 dB as reported by Berger et al. (2015).

4.14.1 Consequences of the Proposed Action

Noise would be generated during construction of the BABUS dikes and during the subsequent dredged material placement at the BABUS. Such equipment as dredge scows and hydraulic dredges and lift pumps would be among the sources of noise associated with the BABUS construction and use. These noises would be in addition to the current level of noise generated by the sources summarized above.

Once the dikes are installed, further noise-emitting equipment would be used for soil/sediment contouring and towards the creation of habitats. Such equipment that may be used for soil/sediment contouring and habitat-creation includes the operation of vessels (for transporting equipment and material) and mechanical equipment such as plows, front-end loaders, and hydraulic pumps. The activities associated with contouring and habitat creation are of short duration and the types of noise generated are not unusual to everyday activities and, therefore, not anticipated to greatly impact receptors in Galveston Bay. Minor noise impacts to aquatic organisms and birds within the immediate area of the BABUS would be expected.

The effects of noise would be short-term, minor to negligible, and adverse impacts to resources from noise would be limited to effects of construction, material placement, and habitat creation activities. With the proposed mitigation measures, including BMPs, in place including avoiding placement during the breeding season of migratory birds, noise impacts from the project would be considered temporary and minor.

4.15 Oil & Gas Infrastructure

WELLS

Data from the Texas Railroad Commission's (RRC's) GIS Viewer indicate that the project area contains approximately 81 targets that resemble wells and associated pipelines of varying classifications (Figure 4-4). These targets consist of the following classifications: 24 dry holes, 16 directional surface locations, 10 unplugged oil wells, 10 plugged oil wells, 5 unplugged gas wells, 5 unplugged oil/gas wells, 4 permitted locations, 2 plugged gas wells, 3 canceled/abandoned locations, 1 plugged oil/gas well, and 1 shut-in gas location. Vetting of duplicate data and non-wells revealed that at least 12 targets in the RRC's GIS Viewer appear to be active wells and 36 locations are assumed to be abandoned inactive or plugged oil, gas, and oil/gas wells.

PIPELINES

Data from RRC's GIS Viewer (Figure 4-4) indicate that the project area contains 7 pipeline systems with a total of 21 defined sections. These pipeline systems are or were predominantly transporting crude oil and natural gas and are of 2.3–4.5 inches in diameter. A portion of the active ME-85-021 Pipeline System, operated by Claron Corporation, appears to be within the project area with additional active pipelines outside/further north of the project area, The remaining pipeline systems and sections within the project area are abandoned (Figure 4-4).

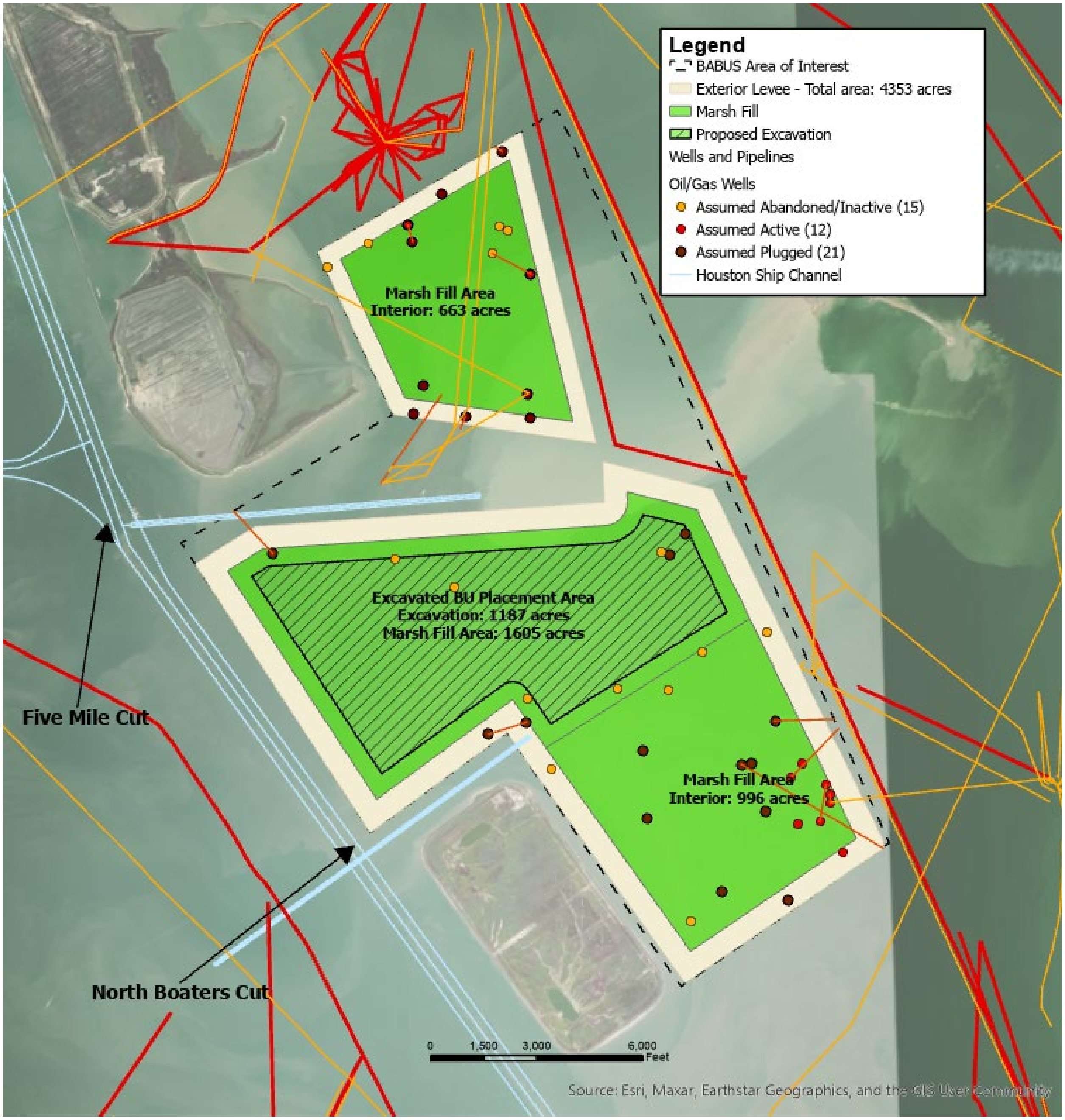

Figure 4-4. Oil and Gas Infrastructure in the BABUS Project Area

4.15.1 Consequences of the Proposed Action

The project extent has been created to avoid active infrastructure per selection criterion 9 (Section 3.4.9). Where not able to be avoided by the project layout, the active and plugged inactive wells within the footprint of the Excavated BU PA would require decommissioning and (or) removal prior to dredging to -70 feet (21.3 m) MLLW. In the marsh fill areas where decommissioned, abandoned, or plugged wells would be covered with dredge material for marsh creation and excavation will not occur, removal of subsurface infrastructure is not necessary.

The responsibility of decommissioning oil and gas wells lies with the operator of the well/pipeline. Following the plugging process, operators are then expected to remove all surface equipment and restore the surrounding well pad. This process typically costs the operator within the United States a minimum of $24,000 (Raimi et al. 2021). In the project area, most of the wells and directional lines date back to the mid-20th century, prior to robust regulation and tracking of ownership and liabilities. In cases where the operator has not removed the infrastructure and the operator no longer exists or otherwise cannot be contacted, the responsibility of removal passes to the local Port authority or federal government.

Abandoned oil pipelines left in place by prior operators (even with government approval) can corrode and slowly release hazardous chemicals into the surrounding environment (Giltz 2021). Such a scenario may lack a liable party or process for monitoring and inhibit coastal restoration as obstacles to construction. The removal of such pipelines may be funded by government organizations if the company owning the pipeline is out of reach, out of business, or liquidated (Giltz 2021). To combat these challenges, BMPs outlined in the Council for Dredging and Marine Construction Safety (2020) manual would be followed for each pipeline needing to be removed from the project area.

Due to the potential for pipeline damage caused by dredging activities, environmental risks such as oil leaks, explosions, and the contamination of water sources for public health and wildlife will be considered in BABUS construction (NOAA 2020. All state and local applicable regulations, protocols, and BMPs would be followed for removing abandoned pipelines or wells and during dredging and construction.

Therefore, it is anticipated that with proper BMPs and construction engineering, all oil and gas infrastructure within the project area will be avoided or removed within acceptable clearances resulting in no impacts to infrastructure. Further project engineering will determine which wells and pipelines will be removed and removal methods.

5 CUMULATIVE IMPACTS

Cumulative impacts or effects are defined by the CEQ under 40 CFR § 1508.1 as the '…incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.'

Past, present, and future actions considered here are those within a five-mile radius of the area of the proposed action. This therefore includes projects within Bayport Ship Channel, portions of the HSC adjacent to the project area, Mid Bay PA, PAs associated with Atkinson Island, and the proposed Three Bird Island Marsh PA. Projects beyond five miles in any direction from the project area have impact areas that are unlikely to spatially overlap with that of the proposed action. Projects beyond the five-mile radius of the project area, that are excluded from this cumulative impacts analysis, include those associated with Barbours Cut Channel, Cedar Bayou Channel, Clear Lake Channel, Texas City Channel, Galveston Ship Channel.

Such actions include federal and non-federal (private) actions. The timeline of cumulative impacts is based on the duration of the impact. Impacted resources of consideration are those identified within Section 4 (Affected Environment). These environmental resources or parameters consist of:

- Water and Sediment Quality
- Sediment Topography and Bathymetry, Shoreline Erosion and Accretion
- Fish and Wildlife including Federally Protected Species and EFH
- Wetlands and Special Aquatic Sites
- Cultural Resources
- Recreation, Aesthetics and Land Use
- Socioeconomics
- Air Quality and Noise
- Oil and Gas Infrastructure

This section investigates the overall expected impact if the impacts from all past, present, and future actions were allowed to accumulate.

Most actions were identified primarily through a comprehensive review of the USACE regulatory permit database for permits within the study area of Galveston, Harris, and Chambers counties and located in waters of Galveston Bay or land adjacent to Galveston Bay. Individual project documents, such as public notices, draft and final EA and EISs, Records of Decision, newspaper articles, planning documents, and project websites or fact sheets, were also reviewed for impacts to the resource areas. No attempts were made to verify or update those documents, and no field data were collected to verify the impacts described in the above documents.

Note that detailed information regarding past, present, and reasonably foreseeable actions were limited, especially regarding cumulative impacts. In these cases, qualitative assessments were completed when possible. There is also a level of uncertainty involved in assessing impacts of projects that are either proposed or in progress. Most of the reasonably foreseeable projects are planned, but do not have definitive implementation schedules due to a variety of factors including funding constraints and permitting. Furthermore, projects are often delayed or altered between the time they are announced and when they are completed or sometimes abandoned.

5.1 Projects Assessed for Cumulative Impacts

The projects assessed for cumulative impacts are listed below. Most of these were taken from Appendix G (Environmental Supporting Document) of the FIFR-EIS by USACE (2019). Additional projects were added that have come to light since the FIFR-EIS was completed in 2019. Such documentation originated from publicly available NEPA documents (EAs and EISs), federal feasibility studies, and related documents. The Bayport Ship Channel Container Terminal has been partially constructed and will continue to expand as the demand for container cargo continues to grow as projected. In most cases, the future impacts of these projects would be from dredging and dredged-material placement.

- **Three Bird Island Marsh Placement Area Construction**
    - The construction of Three Bird Island Marsh PA is planned for the near future and would occur less than one mile east of the BABUS project area. Subtidal bay bottom habitat would be converted to three 2-acre upland islands surrounding a saltmarsh of approximately 240 acres. The three islands would be positioned at each corner of an equilateral triangle and would be connected to one another by an approximately 3,850-acre-long dike that contains the saltmarsh. Approximately 5.4 acres of oyster reef habitat are planned along the outer edges of the islands (HDR Engineering 2020). The islands and saltmarsh are planned to be constructed using BU of dredged material (FIFR-EIS by USACE 2019). The upland portions of the islands are intended to benefit colonial-nesting birds while the saltmarsh habitat is intended to benefit shorebird species as well as an assortment of estuarine invertebrate and fish species.
- **Expansion of Placement Areas 14 and 15 associated with Atkinson Island**
    - PAs 14 and 15 are east of the HSC within the northern portion of Galveston Bay, near the project area of the proposed action. These PAs were expanded by filling the gap between them with an upland PA connection and creating adjacent BU marsh cell M10 and future cells M11 and M12. The intention is to create or enhance beneficial habitats for wildlife, especially avian and aquatic species. Impacts to the marsh and tidal flats within the connection were mitigated by constructing 88 acres of marsh habitat at the Bolivar BU Marsh site along the Bolivar Peninsula.
- **Mid Bay Placement Area**
    - Mid Bay PA is east of the HSC and south and adjacent to the project area of the proposed action. This PA is proposed for upland placement of O&M material from the HSC ECIP.
- **Dredging and Improvements at Houston Ship Channel Reaches from Beacon 76 to Morgans Point Cut and Bayport Ship Channel**
    - The deepening and widening of the 52-mile-long HSC and deepening of the two-mile-long Galveston Ship Channel was completed in 2010. Maintenance-dredged material from Beacon 76 to Morgans Point Cut and from Bayport Ship Channel are hydraulically dredged and have historically been pumped into diked upland confined PAs (USACE 2024). However, a change in logistics resulting from the effects of Hurricane Harvey and other recent storm events have reinforced the need for disposal at the Galveston ODMDS (USACE 2024). These reaches are maintenance-dredged an average of every 1.5 to 3 years, and such O&M dredging is forecasted for the next 50 years.
    - The Bayport Ship Channel was first dredged in the mid-1960s and was deepened in the 1970s. Improvements to the Bayport Ship Channel, completed in 2017,

included deepening the channel by 5 feet (1.5 m) and widening it by 50 feet (15.2 m) within the land cut, and widening it by 100 feet (30.5 m) outside of the land cut. The project also included the raising of the dikes at PA 15, effectively increasing its capacity for dredged material. This project included 4.6 acres of oyster reef habitat impacts and these impacts were mitigated (FIFR-EIS by USACE 2019).

- **Bayport Ship Channel Container Terminal**
  - This ongoing project is to build a container terminal and a cruise ship terminal along the southern shore of the Bayport Ship Channel. This channel is northwest of the area of the proposed action. The first phase of this project was completed in 2007 and involved the construction of five berths/wharves. Capital improvements during 2023–2027 involve the construction of two additional berths/wharves and ship-to-shore cranes (Port Houston 2024).
- **LBC Bulk Liquid Terminal**
  - This completed project of the LBC Tank Terminals Group constructed three large vessel wharves, and five smaller barge slips, to service vessels transporting bulk petrochemical liquids on the Bayport Ship Channel Turning Basin, west of the Bayport Ship Channel Container Terminal. Some of these facilities were originally built by Celanese and sold, in 2000, to the LBC Tank Terminals Group.
- **Cedar Port Navigation District Channel Deepening Project**
  - USACE intends to prepare an EIS for the Cedar Port Navigation and Improvement District Channel Deepening Project, accompanied by a feasibility report prepared by Cedar Port Navigation and Improvement District (CPNID) under authority granted by section 203 of WRDA 1986. The study will identify and evaluate the feasibility of providing a deep-water connection between the HSC and a planned future deepwater terminal facility at Cedar Port Industrial Park while enhancing efficient, safe, and reliable navigation in the Cedar Bayou Navigation Channel and HSC to existing stakeholder terminals.

5.2 Cumulative Effects Assessment

The cumulative impact of the proposed BABUS project for BU of dredged material is expected to result in positive long-term impacts to the project area and Galveston Bay. Based on information in Section 4.0 (Affected Environment), key resources are evaluated for cumulative effects as discussed above. The following subsections discuss each of these key resources.

5.2.1 Water & Sediment Quality

The dredged material proposed for placement at the BABUS would have undergone sediment, water, and elutriate testing in accordance with the requirements and procedures defined in the EPA ocean dumping regulations (40 CFR Parts 220, 225, 227, and 228) and Inland Testing Manual because the material would be tested for offshore suitability regardless of placement at the BABUS. The dredged material will most likely have physical, chemical, and toxicity properties comparable to what currently exists in and around the project area. No significant long-term changes are expected for water quality and sediment quality.

Turbidity at the project area would increase beyond ambient levels during and immediately following construction and dredged material placement. Dissolved oxygen levels are likely to decrease during construction and placement activities. This increase in turbidity and decrease in dissolved oxygen levels would dissipate within hours following completion of each placement episode. These effects would be further lessened using turbidity screens during such activities.

These same changes to turbidity and dissolved oxygen levels would also be associated with dredged material placement activities at the existing PAs, at the future Three Bird Island Marsh PA, and during dredging at nearby reaches of the HSC and terminals such as Cedar Port.

Estuarine organisms within the bay are generally evolutionarily prepared for such stressors and would have physiological and (or) behavioral adaptations allowing them to survive such ephemeral perturbations successfully. The establishment of oyster beds at the BABUS may help slightly improve turbidity from ambient levels due to their filter-feeding activities.

Overall, the cumulative effects of this proposed action, combined with the predicted effects of the planned Three Bird Island Marsh PA, would have temporary minor negative impacts. Future combined actions are expected to provide beneficial effects to water and sediment quality due to the functioning of marsh and oyster reef habitats within this region of the bay.

5.2.2 Sediment Topography & Bathymetry, Shoreline Erosion & Accretion

The construction and dredged material placement activities associated with the proposed action would radically change the bathymetry and topography of the project area. These activities would potentially also affect sediment transport processes within and adjacent to the project area. However, sediment transport processes may be partially ameliorated by the wave-dampening effects of the sloped dike margins. Additionally, the vegetated intertidal marsh habitat should allow flocculants to settle out and accrete within the vegetated intertidal areas.

Dredged material placement and construction activities associated with the planned Three Bird Island Marsh PA project would increase sediment transport east and adjacent to the project area, at least during construction and placement. However, following these activities, the constructed sloped islands and intertidal marsh habitat are likely to provide additional wave-dampening effects and allow flocculants to settle out and accrete within the vegetated areas. These effects would be most pronounced during high tides, storm events, and following heavy rain events. Similar processes may be associated with the expansion of PAs 14 and 15 and with the continued placement of dredged material at the Mid Bay PA. The eroded bank along the HSC-facing side of the Mid Bay PA should be reinforced with riprap and should be monitored to prevent further erosion and sediment suspension and transport.

The effects of dredging of the nearby HSC reaches and associated terminals are expected to add little to existing sediment transport, erosion, and accretion associated with the proposed action. The cumulative effects would be mainly short-term, associated with construction and placement activities of the proposed action. Long-term effects are expected to be beneficial due to the natural processes associated with the vegetated intertidal marsh habitat and, to a lesser extent, the filtering qualities of the planned oyster reef habitat.

5.2.3 Fish & Wildlife Including Federally Protected Species & Essential Fish Habitat

The proposed action would directly affect the estuarine habitats and fauna in the study area by the conversion of relatively flat subtidal bay bottom to oyster reef habitat, intertidal habitat, and upland vegetated habitat as constructed using dredged material placed there. Short-term disturbance effects are anticipated. However, the addition of limiting habitats is expected to benefit species that require such habitat for vital life history activities, such as reproduction, sheltering, and (or) foraging. The project would create new areas of otherwise very limited habitat for use by wildlife species for a wide variety of life history uses including sheltering, foraging, and reproductive processes. A portion of the hundreds of estuarine invertebrate and fish species are expected to benefit by the long-term management and creation of oyster reef and marsh habitat.

The future addition of the Three Bird Island Marsh PA may add additional valuable habitat that aquatic or semi-terrestrial species can utilize. It is predicted that colonial-nesting and roosting bird species will also benefit from the proposed action. Local populations of some of these species may improve due to the cumulative addition of valuable limiting habitats.

Placement activities at the site are expected to minimally affect pelagic fishes and other highly mobile EFH-related species. Small demersal invertebrate and fish species will likely experience short-term local population decline but will eventually re-establish themselves over the long term.

No measurable effects to wildlife are expected by the dredging of the nearby HSC reaches, Bayport Ship Channel, and associated terminals.

The proposed action, and the future Three Bird Islands Marsh PA, are likely to have a measurable positive long-term benefit to fish and wildlife within Galveston Bay. The addition of limiting resources will likely be utilized by a variety of aquatic and avian species. The effects are expected to include increased fecundity and (or) recruitment with the addition of suitable nesting or nursery habitat. The availability of several groups of intertidal and upland habitats nearby (Atkinson Island, Mid Bay PA, future BABUS, future Three Bird Island Marsh PA) will also allow wildlife to actively avoid equipment and construction and placement activities.

5.2.4 Wetlands & Special Aquatic Sites

The project area is currently devoid of wetlands, SAV, and most other special aquatic sites as it is composed entirely of relatively flat subtidal bay bottom. The exception is that the project area was found to have a total of 88.2 acres of oyster resources (including one contiguous 38.9-acre oyster reef). Mitigation or relocation of oyster habitat will occur at 1:1 area ratio.

In addition to mitigation of existing oyster habitat, new oyster reef habitat is planned to be constructed as part of the proposed action. The addition of the new oyster reef habitat, along with wetland habitat in the form of marsh, is expected to have a measurable positive impact of the proposed action. Additional acreage of oyster reef habitat is also planned to be created as part of the future Three Bird Island Marsh PA. Thus, the proposed action, combined with other planned projects, is expected to have a net positive benefit to the aerial coverage of these desirable resources within the bay. The addition of these valuable and limiting resources is expected to benefit fish and wildlife as well as provide valuable ecosystem services in the form of improved water quality through filtering, allowing flocculants to settle out, and nutrient uptake by the smooth cordgrass. Overall, positive long-term effects are therefore expected compared to the no-action alternative, although the Three Bird Island Marsh PA would provide new acreages of such resources if the proposed action was not chosen.

5.2.5 Cultural Resources

No impacts to cultural resources are expected for the proposed action. When the proposed action is considered in conjunction with past, present, and reasonably foreseeable actions, no significant cumulative impacts would be expected for any such resource.

5.2.6 Recreation, Aesthetics & Land Use

The proposed action is predicted to have a slight benefit to recreational fishers by providing structure in the form of oyster reef and marsh habitat that certain sport fish species favor. The construction of the BABUS may also gain the interest of kayakers and canoeists, especially those that fish and (or) bird watch. The future addition of the Three Bird Island Marsh PA may add additional recreational opportunities and may enhance and attract more fishers and wildlifeviewers for an enjoyable day on the water within a relatively short distance from boat ramps west of the project area.

5.2.7 Socioeconomics

The proposed action, combined with other current and future actions, are not expected to have disproportionately high or adverse effects are expected for communities, including minority and low-income communities. The project area, nearby PAs, and the planned Three Bird Island Marsh PA are physically separated from residential communities by miles of open bay.

No significant differences were found when comparing the cumulative impacts with baseline conditions.

5.2.8 Air Quality & Noise

No changes to air quality are expected resulting from the construction of the BABUS and the placement of dredged material into the PA and marsh fill areas. The HSC needs to undergo periodic dredging and the resultant material needs to be placed or disposed of. The proposed action, nearby PAs, and future Bird Island Marsh PA do not affect this need for dredging. The dredging and transport equipment used would be the same, or comparable, regardless of where the material is placed. Air quality and noise impacts from dredging and transport would therefore not be greatly affected. No significant impacts are expected.

5.2.9 Oil & Gas Infrastructure

The Project will minorly impact oil and gas infrastructure if decommissioning or removal is required prior to construction. No long term operational impacts to active oil and gas is anticipated. It is assumed that other current or future projects will also avoid oil and gas wells and pipelines to the maximum extent possible, or conduct their own remediation of abandoned infrastructure. When the proposed action is considered in conjunction with past, present, or reasonably foreseeable actions, no significant cumulative impacts would be expected for oil and gas infrastructure within the Galveston Bay area.

6 MITIGATION

This assessment of the potential environmental impacts to important resources finds that the proposed action would have negligible and insignificant adverse impacts to open-water habitat and fisheries resources, except for the displacement of existing oyster resources. Additional impacts would be related to the loss of open-water habitat and any associated loss of slow moving or sessile benthic organisms due to the placement of dredged material. The abundance of similar habitat available elsewhere in the bay is expected to minimize the loss by providing refuge for displaced organisms. The long-term, positive, indirect impacts via the creation and establishment of functional intertidal and upland habitat, along with oyster mitigation, are expected to outweigh the adverse direct impacts caused by activities associated with the proposed action. Aside from the oyster impacts, no other impacts have been identified that would require compensatory mitigation.

6.1 Construction Best Management Practices

BMPs would be adhered to during BABUS construction and dredged-material placement activities to minimize adverse effects. When considering impacts, it was assumed that, at a minimum, BMPs identified throughout this section would apply during project construction. These BMPs are based primarily on widely accepted federal, state, and industry standards for relevant construction activities. The discussion below sets the minimum protective conditions for the proposed action. Environmental effects from the proposed action would be minimized to the extent possible through implementation of the following BMPs:

- Refueling and maintenance of vehicles and equipment in designated areas to prevent accidental spills and potential contamination of water sources and the surrounding soils.
- Limiting idling of vehicles and equipment to reduce emissions.
- Limiting ground disturbance necessary for staging areas, access routes, pipeline routes, etc. to the smallest area necessary to safely operate during construction and restoring staging area and access routes to result in no permanent loss.
- Minimizing project equipment and vehicles transiting between the staging area and restoration site to the greatest extent practicable, including but not limited to using designated routes, confining vehicle access to the immediate needs of the project, and coordinating and sequencing work to minimize the frequency and density of vehicular traffic.
- Utilizing specialized project vehicles and mats when feasible to further minimize temporary disturbance to aquatic areas within the transportation.
- Minimizing use of construction lighting at night and when in use, directing lighting toward the construction activity area and shielding from view outside of the project area to the maximum extent practicable.

Stakeholder involvement through agency coordination during project development aided in the development of BMPs that would be implemented in the specific BABUS placement areas to protect valuable resources as discussed below.

Wetlands & Special Aquatic Sites

- Material would be placed within the BABUS until target elevations are reached with natural gradual sloping to existing grade and effluent channels naturally form to create the marsh area(s) desired.

- Placement of material will avoid covering existing consolidated vegetated marsh areas to the best extent practicable.
- Temporary impacts from the hydraulic pipeline, or vehicles, used within vegetated wetland areas would be restored as closely as practicable to pre-project elevations utilizing dredged material following the removal of the temporary pipeline from the placement area.

Water & Sediment Quality

- Placement of dredged material will adhere to the standards of the Texas Council on Environmental Quality's Water Quality Certification.

Fish & Wildlife Resources Including Protected Species & Essential Fish Habitat

- Project equipment and vehicles transiting between the dredging area and the BABUS will be minimized to the extent practicable, including but not limited to using designated routes and confining vehicle access to the immediate needs of the project.
- Use of construction lighting at night shall be minimized, directed toward the construction activity area, and shielded from view outside of the project area to the maximum extent practicable.
- All recommendations and requirements for avoidance of protected species from USFWS and/or NOAA Fisheries will be incorporated where feasible for applicable species located in the project area.
- Crews should avoid working in important shorebird habitats when winter winds above 20 miles per hour co-occur with temperatures below 40 degrees. These conditions can cause the birds to roost for energy conservation, often in available ruts. If placement is not able to be avoided during nesting season, all efforts will be made to avoid placement of material within emergent shell hash areas along the shoreline to the best extent practicable.
- Material will be placed from the back of the marsh area first, working towards the bay, to allow for fish and wildlife to seek refuge or vacate the area prior to dredged material placement within the open-water area. Coordination with TPWD Kills and Spills team will be conducted to avoid, minimize, or report fish kills that may occur during material placement.

Recreation Aesthetics and Land Use

- Where feasible, access to Trinity Bay, Galveston Bay, Tabbs Bay, and other major tributaries and bayous commonly used by recreational boaters, including fishers, will be maintained throughout the project lifespan and following the placement of material. It is anticipated that one of the two recreational boating channels (Five Mile Cut or North Boaters Cut) would be left open for such traffic where possible through further engineering and design along with stakeholder engagement with recreational fishermen.

Cultural Resources

Due to the potential presence of buried paleontological resources within archaic river valley sediments, it is recommended by the THC that archeological monitoring occur for levee construction that uses material sourced from the San Jacinto or Trinity River paleo-valleys.

6.2 Wildlife Management

Once habitats are established within the BABUS, it is suggested that a wildlife management plan be implemented for the long-term benefit and conservation of the created habitats and their associated wildlife. Towards this goal of long-term management, it may be appropriate for the

USACE to partner with non-profit environmental organizations such as the Houston chapter of the National Audubon Society (Houston Audubon Society), the Galveston Bay Foundation, or local universities such as Texas A&M University. Below are some suggested management techniques for use at the BABUS:

- Survey the marsh fill areas on foot for the presence of invasive plants. The surveys could occur annually or more often, if deemed necessary.
    - If invasive plants are discovered, control efforts should be undertaken with the goal of either eradication of the species from the marshes, or if that is impractical, the species should be controlled to minimize its impact on the native plant species and the wildlife that utilize the native plants. Invasive five-stamen tamarisk (*Tamarix chinensis*) has been documented on nearby PA 14 and may eventually invade upland portions of the BABUS in the future.

The constructed natural areas are proposed, in part, as nesting areas for ground-nesting birds with the aim of enhancing their local populations. Texas diamondback terrapins may also nest on the resultant upland habitats once these habitats are established. Many of these ground-nesting species have experienced local or range-wide population decline. The eggs and young of ground-nesting birds and reptiles are vulnerable to terrestrial predators such as raccoons, feral pigs (*Sus scrofa*), Norway rats (*Rattus norvegicus*), and other mammals. Hatchling birds and reptiles are also vulnerable to predation by domestic cats (*Felis catus*) and the invasive imported red fire ant (*Solenopsis invicta*). To conserve and protect vulnerable species during their most vulnerable life-stages, the following management actions would be incorporated wherever feasible to reduce nest depredation:

- Prevent raccoons and other major terrestrial predators from entering the BABUS from nearby Atkinson Island, Mid Bay, and associated BU PAs
    - Ensure that a minimum of several hundred yards of open water separate the BABUS from the nearest predator-occupied island or PA.
    - Ensure that construction equipment does not provide a bridge for predators to cross onto the BABUS.
- Pedestrian transect survey, on at least an annual basis, to detect any terrestrial predators of eggs and young that may be present on the BABUS.
    - Surveys can be supplemented by using live traps or motion-detecting cameras within the BABUS.
        - If indirect (e.g., tracks, scat, signs of nest depredation) or direct evidence suggests the presence of one or more terrestrial predators in the marshes, a trapping program should be undertaken and the predators removed.
- If colonies of fire ants are detected within the BABUS, efforts should be made to destroy them. Such colonies are often easily detected as dome-shaped or flat patches of disturbed soil in open, sunlit locations.
    - These colonies should be eliminated or controlled on the BABUS using methods appropriate for use in natural areas/wildlife areas.
        - Such methods may include, but may not be limited to, those suggested by Texas A&M AgriLife Extension Service’s *Managing Red Imported Fire Ants in Wildlife Areas* (Drees 2014)

6.3 Oyster Mitigation

The 23.9 acres of scattered oysters over mud bottom and the 64.3 acres of viable oyster habitat within the project area would be either directly or indirectly impacted by the project at the current extent and layout. The oysters are likely to be dredged up or buried in dredged material during construction of the BABUS, exposed to turbidity, or experience changes in flow patterns resulting from the proposed action.

Mitigation for impacts to the consolidated oyster reef habitat and scattered shell habitat is proposed at a minimum of 1:1 area ratio. Where feasible, single oyster reefs and consolidated hard structure will be relocated to preserve the integrity of the reef. It is possible for some or all the oysters to be relocated elsewhere within the 4,500-acre project area but outside of the PA and marsh fill areas. It is also possible that the oysters may be relocated to hard structure on portions of the exterior dikes, following construction of the outer perimeter of the PA. The project concept includes hard structure such as riprap or other armoring of the exterior containment dikes in combination with a shallow sloping living shoreline which may be suitable for oyster reef colonization.

Temporal impacts to oyster reefs due to relocation or construction impacts will be avoided or minimized through the use of protected stock-piling locations that are sheltered from turbidity impacts and burial. The location of stock-piling and ultimate relocations are still to be determined following detailed project design of the site and coordination with local experts. The project design includes ample area of exterior shallow slope levee and placed hard structures for oysters to colonize; any oysters that are unable to be relocated will be replaced with new oyster habitat to meet the 1:1 mitigation commitment. Alternatively, candidate sites for oyster reef mitigation from Appendix P-1 of the FIFR-EIS by USACE (2019) may be explored as potential relocation areas elsewhere within Galveston Bay.

Continued coordination with TPWD and NMFS regarding implementation of mitigation will occur throughout the engineering and construction of the project. Relocation or other habitat creation as mitigation would follow recommendations from TPWD and NMFS. Survivability monitoring will occur after relocation or habitat creation to ensure the successful completion of required 1:1 area ratio mitigation.

6.4 Conclusions

The proposed project and other past, present, and reasonably foreseeable actions are expected to have overall beneficial cumulative impacts for the area as most projects include an aspect of mitigation, restoration, or habitat enhancement. Development projects that have adverse impacts to the resources discussed above are localized within the HSC and Galveston Bay complex and provide mitigation for adverse impacts. The adverse impacts of the proposed action, in combination with other potential projects, include temporary and minor impacts to water quality due to turbidity increases during placement and sediment transport of placed material. Therefore, the proposed action’s negative contribution to cumulative impacts is anticipated to be minimal or insignificant.

7 COMPLIANCE WITH ENVIRONMENTAL LAWS & REGULATIONS

7.1 Interagency Coordination & Consultations

Scoping is an early and open process for developing the breadth of issues to be addressed in the EA and for identifying significant concerns related to a proposed action. Per the requirements of Intergovernmental Cooperation Act of 1968 (42 U.S.C. 4231[a]) and Executive Order 12372, federal, state, and local agencies with jurisdiction that could be affected by the proposed action were notified during the development of this EA. Scoping with agency representatives occurred at BUG meeting held on 12 December 2024, and 27 March 2025.

The regulations of Section 106 of the NHPA and implementing regulations (36 CFR Part 800), Section 7 of the ESA and implementing regulations, Coastal Zone Management Act, findings of effect and request for concurrence were transmitted to the Texas State Historic Preservation Office at the Texas Historical Commission, USFWS, and NMFS.

Informal consultations for affected protected species under the ESA between USACE and NMFS and USFWS were initiated concurrently with the publication of the Draft EA. USFWS issued concurrence with the USACE's determinations regarding the projects impacts. Concurrence from the NMFS is pending.

Request for concurrence indicating a finding that the proposed action is unlikely to adversely affect historic properties listed, or eligible for listing, in the National Register of Historic Places was submitted to Texas SHPO. THC concurred with the findings of the investigation report and Correspondence regarding this concurrence is in Appendix E.

Water Quality Certification has been received from the TCEQ.

A CZMA consistency determination was issued from the Texas General Land Office, indicating that the implementation of the proposed action would be consistent with the Texas Coastal Management Program. Determination that the project is consistent with the CZMA and CMP from the Texas General Land Office was received.

Correspondence regarding all agency coordination and all received determinations or concurrences are in Appendix E.

7.2 Government to Government Consultations

NHPA § 106 (54 U.S.C. 306101), and implementing regulations at 36 CFR Part 800, direct federal agencies to coordinate and consult with federally recognized Native American tribes historically affiliated with the land underlying a project area. Consistent with these regulations, Department of Defense Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*, and DAFI 90-2002, *Interactions with Federally Recognized Tribes*, federally recognized tribes that are historically affiliated with the Galveston Bay area are invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations.

The *Presidential Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships*, dated 26 Jan 2021, emphasizes the recognition of tribal sovereignty and self-governance and the commitment to fulfilling federal trust and treaty responsibilities to tribal nations. This memorandum prioritizes the regular, meaningful, and robust consultation with tribal nations and honors the promises made between the U.S. Government and tribal nations for more than two centuries.

Relevant Native American tribal representatives were contacted via email to notify them of the posted public notice and invite them to comment. The following Native American tribes were consulted, and they were given 30 days to review and comment on the proposed action:

- Coushatta Tribe of Louisiana
- Alabama-Coushatta Tribe of Texas
- Kiowa Indian Tribe of Oklahoma
- The Comanche Nation
- Mescalero Apache Tribe
- Tonkawa Tribe of Oklahoma

No response to the public notice was received from the tribes contacted. Correspondence regarding these consultations is in Appendix E.

7.3 Public Review of the Environmental Assessment

A notice of availability of the Draft EA and request for public review and comment was published in the USACE Galveston District: Planning and Environmental Documents for Public Review. Comments were received by the USACE. A response to comments letter from the USACE that addresses each comment received during the public comment period is included as Appendix H. Additionally, some comments resulted in changes to the proposed project or additional information about project impacts which are included in the Final EA.

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