U.S. Army Corps
of Engineers

Galveston District
Southwestern Division

Houston Ship Channel Expansion Channel Improvement Project, Harris, Chambers, and Galveston Counties, Texas

Final Integrated Feasibility Report–Environmental Impact Statement

APPENDIX H

CLEAN WATER ACT SECTION 404(B)(1) EVALUATION

November 2019

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HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT
HARRIS, CHAMBERS, AND GALVESTON COUNTIES, TEXAS
SECTION 404(b)(1) EVALUATION

Background – This evaluation to comply with the Section 404(b)(1) Guidelines of the Clean Water Act (CWA) is provided for the Houston Ship Channel Expansion Channel Improvement Project (HSC-ECIP) feasibility study at the phase of study following the milestone of determining the National Economic Development (NED) Plan and a Locally Preferred Plan (LPP), and in order to provide a feasibility and National Environmental Policy Act (NEPA) document for technical, agency, and public review. The HSC-ECIP study is being conducted under the U.S. Army Corps of Engineers (USACE) Specific, Measurable, Attainable, Risk-Informed, Timely (SMART) planning process, and both the LPP and NED Plan are at a stage of planning where the major components have been defined, and mostly refined to address final configuration and sizes.

The dredged material placement, is highly dependent on final sizes and details of the channel modifications of the NED Plan or LPP and will vary slightly whether the NED or LPP is considered. Both the NED and LPP will propose to use existing placement areas (PA) including beneficial use (BU) sites, as much as possible, but it will be necessary to construct new placement sites, both upland confined and BU placement (marsh, bird islands, and oyster beds). This evaluation covers the NED Plan and LPP channel modifications in their current configuration and range of sizes identified, and the use of existing and proposed PAs. A specific dredged material management plan (DMMP) has been developed. Please see the beginning two paragraphs in **Chapter 7** of the Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS) for more detail on the process and planning status. This evaluation has been updated upon completion of the DMMP and is included in the Final FIFR-EIS.

I. PROJECT DESCRIPTION

a. Location

The project area for the HSC-ECIP is located on the upper Texas coast within Harris, Chambers, and Galveston Counties, Texas, in the Houston metropolitan region, and is defined as areas that would be directly affected by the implementation of the proposed NED or LPP. The NED and LPP consist of the proposed dredging footprint for channel modifications (described in Item b. below), existing PAs including BU sites identified in **Section 2.5** of the FIFR-EIS, and mitigation areas.

The LPP includes the Houston Ship Channel (HSC), Barbours Cut Channel (BCC) and Bayport Ship Channel (BSC) which pass through various communities including Houston, Jacinto City, Pasadena, Deer Park, La Porte, Morgans Point, Shoreacres, and Galveston Bay, where several other communities line the shore. These channels provide deep draft navigation from the Gulf of Mexico (Gulf) to the Port of Houston. A more detailed description of the HSC system and study area can be found in Chapters 1 and 2 of the FIFR-EIS.

b. General Description

The project is a result of the study and planning process described in the FIFR-EIS. The study area was divided into 6 segments of the HSC and its side channels, described in **Section 1.4** and shown in **Figure 1-1** of the FIFR-EIS. The NED and LPP were selected after the evaluation of 8 alternatives to improve deep draft navigation to address problems and opportunities described in **Chapter 4** of the FIFR-EIS. The LPP and NED are discussed and illustrated in detail in **Section 6.1** of the Main Report of the FIFR-EIS, and are also shown in Figure 1 of this evaluation. The LPP or NED navigation improvements for the HSC consist of the following features proposed as necessary for safe and efficient navigation in the HSC.

- Four bend easings on the main HSC channel with associated relocation of barge lanes, one of which become superfluous under the LPP (**Segment 1**);
- Widening of the HSC main channel from the existing 530-foot width to a width of 700 feet between Bolivar Roads and BE1 78+844 (under the LPP the widening would extend to the BCC) (**Segment 1**);
- The LPP removes the need for Flare expansion on the BSC (**Segment 2**) required in the NED Plan;
- Shoaling attenuation structure near the BSC Flare (**Segment 2**);
- Widen BSC from the existing 300-400 feet to 455 feet (**Segment 2**);
- Widen the BCC from existing 300 feet to 455 feet (**Segment 3**);
- Combination flare and turning basin on the BCC (**Segment 3**);
- Deepen the HSC from Boggy Bayou to Sims Bayou from the existing 41.5-foot depth up to 46.5 feet (**Segment 4**);
- Widen the HSC from Boggy Bayou to Greens Bayou from the existing 400-foot wide channel up to 530 feet (**Segment 4**);
- Deepen the HSC from Sims Bayou to the Main Turning Basin from the existing 37.5-foot depth up to 41.5 feet deep (**Segments 5 and 6**);
- Improvement of and consideration of federalizing an existing turning basin located near Brady's Landing in Segment 6 (**Segment 6)**;

<u>Recommended for Federalization</u>

Federalization of improvements already completed by the Non-Federal Sponsor (the Port of Houston Authority) to the BSC, BCC, Greens Bayou Channel, and the Jacintoport Channel will be recommended.

c. Authority and Purpose

The study is being performed under the standing authority of Section 216 of the Flood Control Act (FCA) of 1970 Public Law (P.L.) 91-611, as amended:

> "The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operations of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due [to] significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

The purpose of this feasibility study is to evaluate Federal interest in alternative plans (including the No-Action Plan) for reducing transportation costs while providing for safe, reliable navigation on the HSC system. The study will assess the effects of the alternatives on the natural system and human environment, including the economic development effects of existing inefficiencies. The study is being conducted to address the problems to deep draft navigation detailed in Chapter 4 of the FIFR-EIS. A summary of the main problems is as follows:

- Inefficient deep and shallow-draft vessel utilization of the HSC system resulting from existing channel depth, width, and configuration including
  - shallower drafts in the upper reach of the HSC
  - one-way transit restrictions throughout
  - substantial transit delays and waits due to channel and daylight restrictions
  - excessive transits to anchorage at or near the Gulf
- Safety navigation concerns for deep and shallow-draft vessel traffic
- Identifying environmentally acceptable dredged material placement (PA/BU) with the capacity to serve the system.

The overall study goal is to provide an efficient and safe navigation channel while contributing to the National Economic Development (NED) consistent with protecting the nation's environment. Specific objectives used to formulate alternatives were:

- Reduce navigation transportation costs by increasing economies of scale for vessels to and from HSC over the period of analysis (starting in the base year for 50 years).
- Increase channel efficiency, and maneuverability in the HSC system for the existing fleet and future vessels through the 50-year period of analysis.
- Develop environmentally suitable placement for dredged material and maximize the use of BU of dredged material for placement over the 50-year period of analysis.
- Increase channel safety for vessels utilizing the HSC, BSC, and BCC.
- Reduce high shoaling at BSC Flare to reduce dredging frequency.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material

Materials are expected to be predominantly new work and consist of soft silts and muds, soft, firm, hard, stiff, very stiff, silty, and sandy clays, fine to coarse sands, silty sands, calcareous nodules, shell, and rock. Maintenance sediments encountered in the HSC consist of mixtures of clay, silt, and sand of varying percentages.

Actual grain size for individual dredging operations will vary based on climate conditions such as tropical storms, drought, and floods. Results of historic particle size analyses for maintenance sediment grab samples obtained from the HSC and tributary channels shown in **Table 7.1** of **Appendix B** of the FIFR-EIS, indicate the percentage of fines (clay and silt particle sizes) ranges from about 43 percent to 91 percent. The balance of the maintenance sediment consists of sand-sized or larger particles.

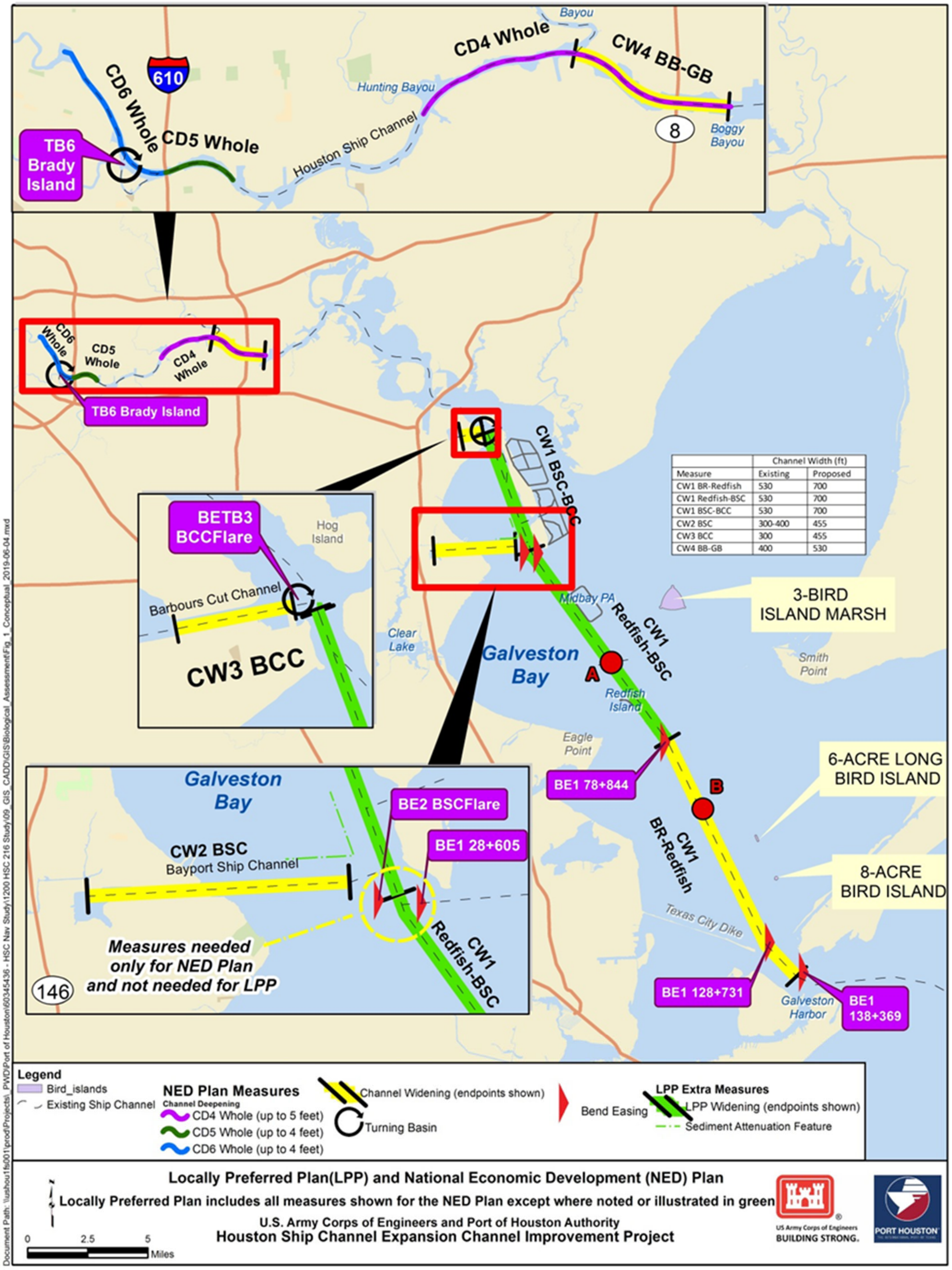
(2) Quantity of Material

Construction of the LPP would generate approximately 27.6 million cubic yards (MCY) of new work dredged material. The 50-year incremental O&M quantity would generate an approximate range of 79.3-116.9 MCY of dredged material. The estimated quantities for each measure by segment is provided in **Table 1** below. Widening volumes in the HSC Bay sections from Bolivar Roads to Morgans Point include the offset of the 235-foot barge lanes. The bold, italicized values show the measures that are identified for a size range that will be narrowed down to a selected width in the next planning phase.

Table 1 – LPP and NED New Work Dredge Quantities

Plan	Measure	Description	New Work Quantity (CY)
SEGMENT 1			
Bolivar Roads to Redfish Station 138+369.011 - 78+844.001			
NED	CW1_700_BR-RF	700-foot channel widening from Bolivar Roads to Redfish with 328-foot bend easings and transition to 530-foot existing channel at Sta. 74+119.99	5,031,403
LPP	CW1_700_BR-RF *with full channel widening from Bolivar Roads to BCC	700-foot channel widening from Bolivar Roads to Redfish with 328-foot bend easing (transition to 530-ft channel no longer applicable)	3,916,000
Redfish to BSC Station 78+844.001 - 28+605.055			
LPP	CW1_700_RF-BSC	700-foot channel widening from Redfish to BSC with 328-foot bend easings	8,794,000
BSC to BCC 28+605.055 - -0+003.944			
NED	BE1_028+605	328-foot bend on existing 530-foot channel at Sta. 28+605	425,000
LPP	CW1_700_BSC-BCC	700-foot channel widening from BSC to BCC with 328-foot bend easings	5,341,000
BCC to Exxon Station 0+05 - 295+00			

Plan	Measure	Description	New Work Quantity (CY)
SAFETY FEATURE	CW1_HOG_600	Widen HSC to 600-FT between 10+00 to 83+00	242,000
SAFETY FEATURE	BE1_153+06	Bend easing at Fred Hartman Bridge	468,000
SAFETY FEATURE	BE1_246+54	Bend easing at Alexander Island	267,000
SEGMENT 2			
NED/LPP	CW2_BSC_455	Widen BSC to 455-FT	2,108,000
NED	BE2_BSCFlare	Widen south BSC Flare to 5,375-FT radius (Includes 7 feet of Advanced Maintenance)	1,925,000
SEGMENT 3			
NED/LPP	CW3_BCC_455	Widen BCC to 455-FT	1,202,000
NED/LPP	BETB3_BCCFlare_1800NS	Widen BCC N/S flare 1,800-FT diameter TB (Includes 7 feet of Advanced Maintenance)	1,623,000
SEGMENT 4			
NED/LPP	CW4_BB-GB_530[1]	Widen (530-FT)/Deepen (5-FT) Boggy Bayou to Greens Bayou	2,412,000
NED/LPP	CD4_Whole	Deepen (5-FT) Boggy Bayou to Washburn Tunnel	1,069,000
SEGMENT 5			
NED/LPP	CD5_Whole	Deepen (4-FT) HSC Sims Bayou to I-610 Bridge	176,000
SEGMENT 6			
NED/LPP	CD6_Whole	Deepen (4-FT) HSC I-610 Bridge thru Turning Basin	706,000
NED/LPP	TB6_Brady_900	Turning Basin at Brady Island Station 1195+00	294,000
NOTES: [1]Quantity excludes approximately 418,000 CY included with CD4_Whole			



	Channel Width (ft)	
Measure	Existing	Proposed
CW1 BR-Redfish	530	700
CW1 Redfish-BSC	530	700
CW1 BSC-BCC	530	700
CW2 BSC	300-400	455
CW3 BCC	300	455
CW4 BB-GB	400	530

Figure 1 Conceptual Map of the LPP and NED Plan

e. Description of the Proposed Discharge

(1) Location

Existing and proposed PAs proposed for use for new work and maintenance placement are listed in **Table 2** below, and shown in Figure 2. The new work material would be used beneficially as much as possible to raise containment dikes to increase in capacity and extend the life of the PAs, repair dikes, or continue construction of already planned PAs and marsh cells. Maintenance material would be placed in the interiors of the PAs, which are currently used to maintain the existing HSC system. In completed marsh cells, maintenance material would be used to nourish interior marsh if they subside or erode.

Table 2 – Proposed New Work Dredged Material PAs

NAME	NED	LPP	TYPE	Description	Existing or New?	Approx. Acres	Existing Environ.
8-acre Bird Island	X	X	Eco BU	Build new colonial waterbird island - longer version	New	8	bay bottom
6-acre Long Bird Island	X	X	Eco BU	Build new colonial waterbird island	New	6	bay bottom
ODMDS	X	X	Offshore Disposal	Ocean Dredged Material Disposal Site	Existing	dispersive	Gulf Bottom
3-Bird Island Marsh	X	X	Eco BU	Build marsh/bird island, and oyster wave trip complex	New	402	bay bottom
M12	X	X	Eco BU	Construct levee then partially fill new marsh cell expansion	New	273	bay bottom
East-east (E2) Clinton	X	X	Upland CDF	Use NW to construct dikes & upland CDF & place NW in interior on disturbed grazing & former borrow area property	New	76	upland
BW-8	X	X	Construction BU	Donate NW material to raise grade 5' on PH property being developed	New	385	upland
Glendale	X	X	Upland CDF	Place NW in existing PA	Existing	240	upland
Filterbed	X	X	Upland CDF	Place NW in old existing PA	Existing	110	upland
Oyster pad mitigation		X	Eco BU	BU new work to elevate oyster cultch mitigation pads	New	mitigation	bay bottom
M789 dike rehab		X	Eco BU	Use NW to repair M789 dikes	Existing	repair	eroded dike
M11		X	Eco BU	Construct levee then partially fill already planned marsh cell expansion	Previously Planned	445	bay bottom
Sediment Attenuation Feature		X	Construction BU	Construct the core of sediment attenuation feature	New	17	bay bottom

Both existing PAs and new upland confined placement or BU of dredge material have been employed where practicable in order to develop the specific DMMP which provides 50 years of maintenance material placement capacity for the LPP features. New placement areas that have been developed are within 5 miles of the HSC, BSC, and BCC. General planning considerations for constraints and impact of new PAs are discussed in **Section 7.6** of the FIFR-EIS, and **Section 13** of the **Engineering Appendix** of the FIFR-EIS.

Maintenance of the NED Plan or LPP would use existing PAs with capacity and the new BU sites that provide placement capacity for the project incremental shoaling. These are identified in Table 1Table 3 below. One BU site that would not be constructed under this project, but under the DMMP planning for the existing HSC is the Bay Aquatic

Beneficial Use Site (BABUS), which will be a series of beneficial use cells constructed from dredging in situ bay bottom material to form confining dikes that themselves would host a variety of marsh, oyster reef, and other aquatic habitat types, and the interior of the cell would be filled with HSC material over a long term to ultimately be converted to beneficial use habitat. This concept would be evaluated and designed in more detail as part of the existing HSC project DMMP. The LPP would only make use of a small portion of the capacity created by the BABUS, and O&M placement under the current ECIP DMMP which integrates ECIP requirements with anticipated future without project placement, would actually result in a small net decrease of BABUS use due to the other capacity created by LPP DMMP features. The full description of new work and O&M placement for the ECIP DMPP is provided in Appendix R of the FIFR-EIS Main Report.

Table 3 – Proposed O&M Dredged Material PAs

NAME	Existing HSC	NED	LPP	Status
ODMDS No.1	X	X	X	Existing
3-BIRD ISLAND MARSH		X	X	New
Mid Bay	X	X	X	Existing
PA15	X	X	X	Existing
PA14	X	X	X	Existing
PA14/15 Connection	X	X	X	Existing
New M12		X	X	New
Spilmans Island	X	X	X	Existing
BABUS	X	X	X	FWOP
M7,8,&9	X		X	Existing
M11	X		X	Previously Authorized, Not Built
Lost Lake	X	X	X	Existing
Rosa Allen	X	X	X	Existing
New Rosa Allen Expansion		X	X	New
East Clinton	X	X	X	Existing
West Clinton	X	X	X	Existing
House-Stimson Tract	X	X	X	Existing

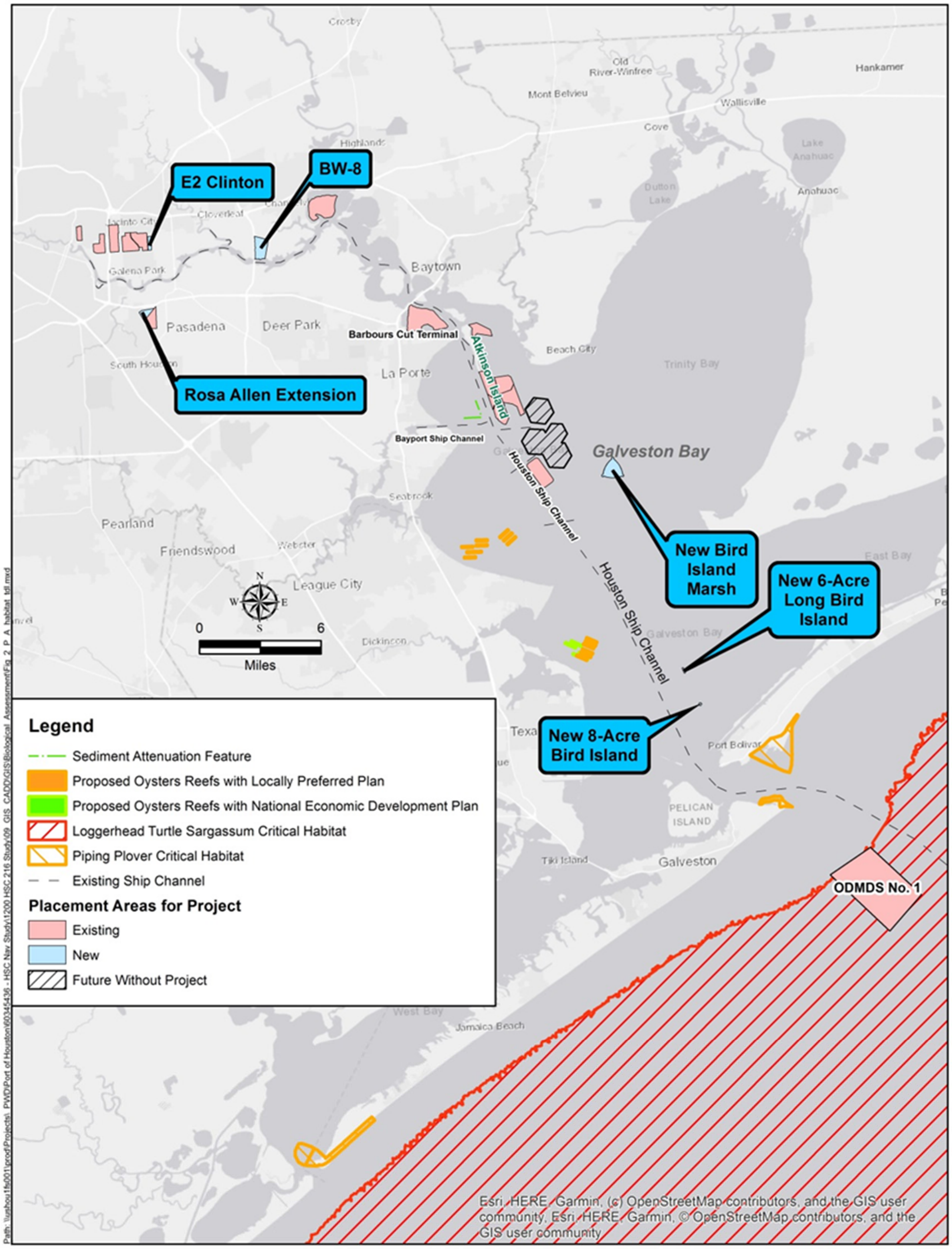


Figure 2 NED Plan and LPP, Placement Areas, and Critical Habitat

(2) Size

See acreage data under Table 2.

(3) Type of Site and Habitat

The majority of the HSC is dredged navigation channels, with permitted or authorized depths ranging from -13.5 to -46.5 MLLW (-12 to -45 feet MLT) that with advanced maintenance and allowable overdepths have maximum depths ranging from -14.5 to 50.5 feet MLLW (-13 to -49 feet MLT). The navigation channel bottoms are primarily characterized by fine-grained silt and clay, with some sand/gravel content.

Table 2 summarizes the type of existing habitat for the proposed new work PAs. The existing 12 upland confined placement areas (PAs), 7 proposed and 1 existing beneficial use (BU) marsh cells, 2 proposed oyster pad areas, one sediment attenuation feature, and one existing ocean dredged material disposal site (ODMDS) will be used for construction and maintenance disposal. The existing upland PAs are periodically disturbed by deposition of dredged material during channel maintenance cycles or earthwork to de-water and manage these PAs, where pioneer herbaceous species continually re-vegetate areas of deposition in between these activities. Previous site investigations of several of the Bay segment PAs (Spilmans Island, PA 14, and PA 15) conducted during previous USACE and Non-Federal Sponsor projects indicate the typical nature of the vegetation as invasive with species such as salt cedar (*Tamarix chinensis*) and giant cane (*Arundinaria gigantea*) as well as typical marsh plants such as saltwater cordgrass (*Spartina alterniflora*) and salt-meadow cordgrass (*Spartina patens*) that readily colonize deposited material in between periods of disturbance. All of the existing upland PAs are periodically filled with additional material from current and future maintenance dredging activities. The new upland placement PAs consist of

The new upland sites at BW-8 and E2 Clinton are disturbed terrestrial sites on which 32.6 acres of wetlands developed from past land use practice (diking, blocked ditching/drainage). The previously disturbed upland site Rosa Allen Expansion, listed in Table 3, would be used for future channel maintenance approximately 10 to 12 years after construction, and contains approximately 41 acres of predominantly forested wetlands formed by previous diking of the property. The wetlands on the proposed new work and O&M PAs are predominantly Chinese tallow (*Triadica sebifera*)-dominated forested wetlands. They are described in more detail in Appendix G, Sections 1.4.1.2 and 3.2.1.2 and mitigation for them by purchase of mitigation bank credits is described in Appendix P-2 of the FIFR-EIS. The new ecological BU sites are all currently bay bottom that would be converted to marsh or bird island.

The BU marshes are typically seeded with saltwater cordgrass that grows well at the designated elevations for the BU. However, if the designated beneficial use areas are impacted by future subsidence or sea level rise, additional dredge material could be added to maintain sediment elevations for quality marsh habitat. Similarly, if existing filled marsh cells that are impacted by future subsidence or sea level rise may also receive additional maintenance dredged material to maintain sediment elevations for quality marsh habitat.

The proposed sediment attenuation feature location has not been determined, but the general area is typical of the rest of the bay, flat with silty to clayey bottom.

The proposed oyster reef locations are to be in the general areas that have previously been oyster reef but were covered over by sediment from Hurricane Ike. The bay bottom in these locations is typically 4 to 6 inches of silty to clayey sediments over hard sediment with oyster shell.

The existing ODMDS is offshore ocean bottom composed of various levels of silts, clays, and sands. The ocean bottom in this area is similar but does not receive periodic additional material from current and future maintenance dredging activities.

(4) Time and Duration of Discharge

The phases of the LPP have been designed with efficiency and economies of scale in mind. The entirety of the project will take place over 6 years and will consist of segmented focuses to minimize the impact on the port operations and the channel traffic overall. In the first year segments 1A (Bolivar Roads to Redfish) and 4 (Greens Bayou to Sims Bayou and Boggy Bayou to Greens Bayou) will be addressed. Segment 4 will continue to be a focus into year 2 as the Boggy Bayou to Greens Bayou area is finished and segments 1B and 2 are addressed (HSC and BSC). Year 3 segments 1B and 2 (HSC and BSC) are completed and dredging begins on segments 1C and 3 (BCC and Oyster Mitigation). Work in segments 1C and 3 continues into year 4 with the sweeping of Cedar Bayou, and further dredging of the HSC. With Year 5 the dredging of segment 1 comes to a close and segments 5 and 6 are addressed. During this period the dredging from sims bayou to the turning basin and the dredging of the turning basin itself begins. These last two segments continue on into year 6 and the project draws to a close within the first half of the year.

f. Description of Disposal Method

The type of dredging equipment considered depends on the type of material, the depth of the channel, the depth of access to the disposal or PA, the amount of material, the distance to the disposal or PA, the wave-energy environment, etc. A detailed description of types of dredging equipment, which includes mechanical-clamshell, hydraulic hopper, cutter-suction pipeline dredges and cutter suction dredges with barges for the transportation of dredged material to designated disposal sites, can be found in EM 1110-2-5025, Dredging and Dredged Material Management (USACE, 2015b).

Mechanical – Clamshell Dredging

Mechanical dredges are classified by how the bucket is connected to the dredge. The three standard classifications are structurally connected (backhoe), wire rope connected (clamshell), and chain and structurally connected (bucket ladder). The advantage of mechanical dredging systems is that very little water is added to the dredged material by the dredging process and the dredging unit is not used to transport the dredged material. This is important when the disposal location is remote from the dredging site. The disadvantage is that mechanical dredges require sufficient dredge cut thickness to fill the bucket to be efficient and greater re-suspended sediment is possible when the bucket impacts the bottom and as fine-grained sediment washes from the bucket as it travels through the water column to the surface. These dredges can work in confined areas, can pick up large material, and are less sensitive to sea conditions than other dredges.

Mechanical dredging for new work is expected to be limited to softer materials in portions the middle and lower HSC segments in the Bay. Disposal method would involve the use of scows to transport these materials to the ODMDS.

Hydraulic – Hopper Dredging

There is no hopper dredging proposed to be used for new work. Hopper dredging would only be used for maintenance of the LPP, which is used for maintenance of the existing HSC. Hopper dredges include self-propelled ocean-going vessels that hydraulically lift dredged material from the nourishment projects. Since hopper dredges are self-propelled, they are more maneuverable than dredges that rely upon tug boats to move. One or more suction tubes, equipped with a drag head or other suspension apparatus are dragged along the channel bottom. A pump system sucks up a mixture of materials such as sand, gravel, silt or clay, and water and discharges it in the "hopper" or hold of the vessel. Once the vessel is fully loaded, it sails to the unloading site. The material can be deposited on the seabed through bottom doors, reclaimed using a rainbow technique, or discharged through a floating pipeline to the shore.

Hopper dredges will be used for long term maintenance of the channel along with cutter head suction dredging as needed in the Bay reaches of the HSC, BSC, and BCC as part of the programmatic DMMP. The material would be transported to the ODMDS and disposed of according to the Site Management and Monitoring Plan (SMMP) that is approved by the EPA.

Hydraulic – Cutter Suction Dredge

Hydraulic cutter suction dredging will be used for the majority of new work dredging. Large cutter suction dredges, or cutterhead dredges, are mounted on barges. The cutter suction dredge is equipped with a rotating cutterhead used for cutting and fragmenting the soils to be removed. It mobilizes the dredged material as it rotates. The mobilized material is hydraulically moved into the suction pipe for transport. The cutter suction head is located at the end of a ladder structure that raises and lowers it to and from the bottom surface. The cutter suction dredge moves by means of a series of anchors, wires, and spuds. The cutter suction dredges as it moves across the dredge area in an arc as the dredge barge swings on the anchor wires. The discharge pipeline connects the cutter suction dredge to the PA. The dredged material is hydraulically pumped from the bottom, through the dredge, and out through the discharge pipeline to the placement location. Booster pumps can also be added along the discharge pipeline to move the material greater distances. Additionally, the cutter suction dredge can pump the dredged material into a series of barges that can be transported to a PA and pumped out or bottom dumped. Three types of barges are generally used to transport dredged material to the placement sites, which include a split hull barge/scow, bottom dump barge/scow, or a flat top barge/scow. All three barge types are typically pushed or pulled to the placement site by a tug. This is the least efficient option for cutterhead dredging. Cutterhead suction dredging is the predominant dredging currently employed in the study area and this is the continued anticipated practice for construction, operation, and maintenance of the measures considered under this study.

II. FACTUAL DETERMINATIONS

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope

Section 1.d.2 above describes proposed modifications to the channels by segment.

(2) Sediment Type

Materials are expected to be predominantly new work and consist of soft silts and muds, soft, firm, hard, stiff, very stiff, silty, and sandy clays, fine to coarse sands, silty sands, calcareous nodules, shell, and rock. Maintenance sediments encountered in the HSC consist of mixtures of clay, silt, and sand of varying percentages.

Actual grain size for individual dredging operations will vary based on climate conditions such as tropical storms, drought, and floods. Results of historic particle size analyses for maintenance sediment grab samples obtained from the HSC and tributary channels shown in Table 7.1 of Appendix B of the FIFR-EIS, indicate the percentage of fines (clay and silt particle sizes) ranges from about 43 percent to 91 percent. The balance of the maintenance sediment consists of sand-sized or larger particles

(3) Dredged/Fill Material Movement

Surveys of the ODMDS prior to and following placement of dredged material indicate little to no accumulation within its boundaries; therefore, it is considered to be a dispersive site with unlimited future capacity. A Particle Tracking Model (PTM) was done for this site and showed that material placed in the ODMDS does move out of the area through the process of littoral drift and does not return to the channel. This site was coordinated for the Galveston Harbor and Channel project with the SMMP for the ODMDS being signed in 2008 by the EPA and USACE, Galveston. This site is currently used for placement of material from the Bolivar Roads to Redfish Reef dredging reach. Each use of the ODMDS requires sediment testing along with coordination and approval by the EPA.

Upland PAs will have containment levees to control fill movement after deposition; small amounts of suspended solids may be present in the discharge. Proper design for material dewatering, controlled outlet works (such as adjustable weirs), and BMPs will be implemented to control and reduce discharge turbidity. For constructing underwater features such as the oyster reef mitigation pads, controlled discharge techniques would be used that limits dispersal, reduces turbidity, and focuses placement of material on the intended areas. These include diffusers, downspouts, and spider barge/scow arrangments that greatly reduce discharge energy from pumped material. A submerged point of discharge reduces the turbidity impact to the water column and by minimizing the amount of the water column which is exposed to sediment dispersion. Submerged diffusers further reduce the exit velocities for hydraulic placement, allowing increased precision in placement and reduction of both resuspension and spread of the material (USEPA/USACE 2004). The controlled aquatic placement to build BU dike features is facilitated using submerged diffusers, downspouts, and tremies. The application of a submerged diffuser is a well-studied technique and has been shown to decrease the average turbidity from a discharge plume by more than 80% when employed precisely

(Costello 2019). “Multiple Tremie” diffusers have been utilized to increase the accuracy of placement and decrease turbidity concurrently with a submerged diffuser by taking advantage of sediments cohesive rheological characteristics, slowing flow velocity and turbulence. The tremie/diffuser system was used to great effect during submerged placement in lake Zevenhuizerplas, wherein it was observed that the technique brought total suspended solids down to 20-25 mg/l within 100 meters of the diffuser, compared to 150 mg/l using a common bell diffuser (Mastbergen 2004). Furthermore, in the USACE 1990 New Bedford Harbor Study a submerged diffuser was used in a very shallow bay with a tidal range of 0.43 to 1.54 meters and found to limit total suspended solids to less than 100 mg/l within a 500-foot radius of the diffuser (USACE 1990). Given the Galveston Bays’ average tidal depths of 2.33 to 3 meters and typical background total suspended solids between 20 to 25 mg/l the submerged multiple tremie/diffuser combination techniques should be an effective means of placement.

(4) Physical Effects on Benthos

Dredging would impact and temporarily remove benthic infaunal communities present in the dredged material footprint, but these communities would be expected to recover sometime after dredging ceases. The resultant turbidity and settling from dredging has the potential for smothering sessile benthic organisms and/or inhibiting filtration functions required by some organisms for respiration and nutrition. The temporary lower DO concentrations that could result from temporary suspension of organic material during dredging could cause a temporary displacement of mobile organisms and may stress or cause mortality to sessile organisms. These effects would be temporary and minor given the nature of hydraulic dredging, as suspended sediments would return to background levels within a short time frame. For soft, featureless bay bottom, rapid recolonization by benthic species would occur and this type of habitat and benthic community is ubiquitous in Galveston Bay. Impacts to oyster reef will be mitigated, as detailed in **Section 7.5** and **Appendix P** of the FIFR-EIS. These effects are described in more detail in **Section 7.2.1.3** of the FIFR-EIS. The use of existing upland PAs would not impact benthos. The use of existing BU sites would not significantly impact benthos during placement to aid dike construction or repair, and placement. Filling the interior of the existing BU site would continue the already planned and approved tidal marsh construction that would result in beneficial changes to benthic communities that would have positive aquatic ecosystem impacts. The use of the existing offshore placement site ODMDS No. 1 would be temporarily detrimental to benthic organisms in the placement footprint, but these would also be expected to quickly rebound. The proposed new BU features in the Bay would have the same temporary effects discussed at the beginning of this section, with the impact on benthic infaunal communities coming from smothering, but recovery and recolonization would also occur relatively quickly, and shift to communities more associated with the created marsh. Only a small proportion of Bay benthic habitat would be converted to upland by the containment dike and bird island portions of these sites, but would facilitate other ecologically beneficial habitat.

(5) Other Effects

The ODMDS No. 1 is located within the Sargassum Critical Habitat of the loggerhead turtle. However, current use of ODMDS would not impact nesting or non-nesting sea turtles in the LPP project area but may affect foraging loggerhead turtles in association with high densities of Sargassum within the existing loggerhead turtle Sargassum Critical Habitat area. New work dredging use of this ODMDS during construction of the LPP would involve hydraulic or mechanically dredged material transported by scow and placed into the ODMDS by gravity fall. Maintenance of the LPP would include use of hopper dredging and placement by hopper release (as is currently done with the existing HSC). The preliminary determination for this project is that dredging placement into this ODMDS may affect but not adversely affect the critical habitat, consistent with National Marine Fisheries Service (NMFS) clarification to Regional Biological Opinions. The use of hopper dredging for maintenance may affect and likely to adversely affect any foraging green, Kemp's ridley, and loggerhead sea turtle that may be within the dredged area, for maintenance of the existing HSC and modifications made to it proposed under the NED Plan or LPP. The NED Plan or LPP would only incrementally increase the area around the HSC that would be dredged.

(6) Actions Taken to Minimize Impacts

This project was fully coordinated with State and Federal resource agencies, and responses to their comments have been incorporated into the development of the dredged material PAs. Any unavoidable losses will be mitigated.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water

Dredging to construct the LPP and the use of the new and existing PAs, new and existing BU areas, and ODMDS are expected to have only minor, short-term impacts on water quality in the area. Effects on the following parameters are summarized below. For additional detail, supporting literature, and discussion see **Section 7.1.5.1 Water Quality** of the Main Report and **Section 3.1.5.1 Water Quality** of **Appendix G** of the FIFR-EIS.

(a) Salinity

Modeling results discussed from previous studies with deepening of channels extending from oceanic to estuarine conditions, and the limited deepening for the LPP that does not extend into the Bay or Gulf, the LPP would not result in significant adverse impacts to salinity. The LPP would not result in significant adverse impacts to salinity. Impacts to salinity are discussed more fully in Section 3.2 of the Appendix G of the FIFR-EIS. USACE performed hydrodynamic modeling to confirm that the proposed alterations from the LPP would not significantly alter salinity in the estuary. The modeling is detailed in Attachment 4 of Appendix C, Engineering Appendix of the FIFR-EIS.

(b) Water Chemistry

Dredging under the LPP would result in minimal impacts and would not be expected to degrade the long-term water quality within the project area. Physicochemical parameters may be temporarily affected because of water column mixing during dredging and placement activities. These patterns would return to their previous condition following completion of dredging. Any impacts to the distribution patterns for these water quality parameters from dredging would be minimal and discussed further in the FIFR-EIS.

Short-term changes in dissolved oxygen (DO), nutrients, turbidity, and contaminant levels could occur due to mixing and disturbance of sediments into the water column during dredging and dredged material placement. Temporary decreases in DO concentration may occur during and immediately after dredging due to the movement of anoxic water and sediments through the water column. Temporary DO decreases may occur due to the aerobic decomposition from short-term increases in organic matter suspended within the water column. These minimal impacts would be expected to be limited to the immediate vicinity of dredging and dredged material placement. Contaminants present in the surface sediments would be temporarily suspended during dredging and placement activity. However, once the dredging activities stop, disturbed material would settle, and the physicochemical parameters temporarily affected would return to pre-disturbance levels. The vast majority of re-suspended sediments resettle close to the dredge within an hour. These impacts would be minimal and discussed further in the FIFR-EIS. Effects at the discharge end where material is being placed for proposed new PA features would be similar to those from the dredging in terms of temporary effects from suspended material. These would not result in permanent water quality impacts. For use of existing PAs, water chemistry would not be expected to be significantly adversely impacted, as these are contained areas designed to maintain water quality in return water decanted from placed materials.

(c) Clarity

There will be some temporary increase in local turbidity during dredging and placement operations. Water clarity is expected to return to normal background levels shortly after operations are completed, as discussed further in the FIFR-EIS.

(d) Color

Water immediately surrounding the construction area will become discolored temporarily due to disturbance of the sediment during dredging but would be expected to return to normal after dredging operations cease, as discussed in the FIFR-EIS.

(e) Odor

The new work material is not expected to be anoxic, so there should be no odors associated with dredging and placement, nor are any expected from ODMDS placement.

Negligible amounts of hydrogen sulfide may be expected. There should be no change in the maintenance material.

(f) Taste

The water bodies receiving discharge from existing PAs are not drinking water sources. No detectable impacts in the marine environment.

(g) Dissolved Gas Levels

Negligible amounts of hydrogen sulfide (H_2S) may be expected. H_2S and other gases like methane are associated with high amounts of decaying organic matter which are not expected in the new work material which is expected to be predominantly clay. This type of material is very low in total organic carbon, an indicator of organic content, with recent new results from the BSC and BCC indicating values <1 percent, and with the vast majority of samples having no detected sulfides. Dissolved gases have not been identified as a problem with maintenance material of the current channels and would not change in character with the maintenance of the LPP improvements in these channels.

(h) Nutrients

Nutrient levels may be slightly and temporarily elevated during dredging and near the PAs since new work material is low in organics. Some maintenance material will be dredged along with the new work material. There should be no change in the maintenance material.

(i) Eutrophication

Nutrients are not expected to reach levels high enough for periods long enough to lead to eutrophication of the surrounding waters. Temporary increases in nutrients during dredging is short lived at less than a few hours and is discussed further in the FIFR-EIS.

(j) Others as Appropriate

None known.

(2) Current Patterns and Circulation

A hydrodynamic model was developed by the U.S. Army Engineer Research and Development Center (ERDC) to evaluate those hydrodynamic effects of the LPP against the future without project condition. Recent studies involving hydrodynamic modeling of these effects for similar channel modification projects found minimal increases to currents, surge levels, tidal variation, and small changes to salinity because of channel modifications. Therefore, no major changes in the circulation pattern and current magnitude are expected under. USACE performed hydrodynamic modeling to confirm that the proposed channel alterations from the LPP would not significantly alter current patterns, circulation, and velocity in the Bay. The modeling is detailed in Attachment 4 of Appendix C, Engineering Appendix of the FIFR-EIS.

(a) Current Patterns and Flow

No substantial impacts are expected.

(b) Velocity

No substantial impacts are expected.

(c) Stratification

No impacts are expected. The LPP channel modifications only include minor deepening in the upper HSC and would not cause stratification of Galveston Bay's waters.

(d) Hydrologic Regime

No impacts are expected. Navigation channel modification would not alter the volume of streamflow or precipitation patterns.

(3) Normal Water Level Fluctuations

Channel deepening has the potential to affect surge and tidal variations by lowering the bay bottom relative to existing conditions and reducing hydraulic resistance. Considering the minimal impacts shown in recent hydrodynamic modeling for channel modification projects involving deepening, the limited deepening proposed in the LPP constrained to the upper reaches, and the existing deep bathymetry in those reaches, significant adverse effects would not occur due to the LPP. These conditions would be minimally changed compared to the No Action Alternative. More information is available in Section 3.1.4.1 of Appendix G of the DFIR-EIS. USACE performed hydrodynamic modeling to confirm that the proposed channel alterations from the LPP would not significantly impact tidal range in the Bay. The modeling is detailed in Attachment 4 of Appendix C, Engineering Appendix of the FIFR-EIS.

(4) Salinity Gradients

The LPP would not result in significant adverse impacts on salinity. Impacts to salinity are discussed more fully in Section 4.2 and Appendix B of the DFIR-EIS and Section II.b.1.a above.

(5) Actions That Will Be Taken to Minimize Impacts

In addition to alternatives analyses, the selected dredged material placement areas avoid impacts on various resources such as threatened and endangered sea turtles, cultural resources, and essential fish habitat. BMPs will be implemented during construction and maintenance activities.

The new PA features in Galveston Bay are classified as beneficial use and will create tidal marsh (3-bird Island, M11, M12), bird rookeries (3-bird Island, long bird island, 8-acre island), and submerged habitat (oyster pad mitigation). This method of dredged material placement assists in limiting the net impact to the local ecology. The newly created PA's will provide much needed capacity for dredged material while creating habitat beneficial to the aquatic environment and other estuarine ecological functions. The conversion of featureless bay bottom to oyster reef, seagrass or wetland would provide ecological restoration, with the benthic communities regenerating within 1-2 years of impact.

c. Suspended Particulate/Turbidity Determination

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

An increase in suspended particulates and the concomitant turbidity levels is expected during dredging and placement operations of new work and maintenance material (**Section 7.1.5.1 Water Quality** of the Main Report and **Section 3.1.5.1 Water Quality** of **Appendix G** of the FIFR-EIS). These are temporary and localized events. Existing PAs proposed for use are designed to control suspended solids in return water.

(2) Effects on Chemical and Physical Properties of the Water Column

(a) Light Penetration

Turbidity levels will be temporarily increased during dredging and placement operations of new work and maintenance material but will return to normal following completion of dredging and placement operations. No long term effects to light penetration would occur, and there is no submerged aquatic vegetation in the vicinity of dredging or existing placement areas.

(b) Dissolved Oxygen

No significant adverse impacts to dissolved oxygen are expected (**Section 7.1.5.1 Water Quality** of the Main Report and **Section 3.1.5.1 Water Quality** of **Appendix G** of the FIFR-EIS).

(c) Toxic metals and organics

A full chemical analysis for site water, as well as sediment and modified elutriate samples, were conducted in September through December 2018 as described in item d. below. Full details of the sediment testing is summarized in Appendix G, Section 3.1.5.2 of the FIFR-EIS Main Report,.

For modified elutriate chemistry screening criteria was not exceeded by any of the samples for VOCs and PCBs. Region 6 screening criteria was exceeded by all samples for 2 compounds, hexachlorobutadiene and hexachlorocyclopentadiene, however the samples were qualified, "U" meaning the levels were both below the MDL. There were no exceedances of TSWQS, EPA WQC, or NOAA screening criteria for any PAH samples. HSCNew-NMP-05-EL was the only sample to have a detection for pesticides with a detection for gamma-BHC. Region 6 screening criteria was exceeded by 7 compounds, 4,4'-DDT, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide and toxaphene, in all samples which were qualified "U". Screening criteria for toxaphene for TSWQS, USEPA WQC, and NOAA was exceeded by all samples which were qualified "U". In summary for the aforementioned compounds exceeding screening criteria not because they were detected, but because the detection limit was above the screening criteria (i.e. the analysis method was not sensitive enough for the criteria). These compounds may or may not be present. These outcomes were similar to the site water results which characterize the ambient water quality to give an indication of whether contaminant issues are more associated with ambient water quality than local sediment quality. Dioxins and furans were detected in 8 samples. Total Toxic Equivalence (TEQ) was calculated using results from non "U" qualified data and ranged from 0.00035 pg/L to 10 pg/L. There are no screening criteria for dioxins and furans. Region 6 screening criteria was exceeded by 9 samples for copper, 1 sample for lead, and 3 samples for zinc. NOAA screening criteria was exceeded by 9 samples for copper, all samples for silver, and 3 samples for zinc. USEPA WQC was exceeded by 9 samples for copper, 9 samples for silver and 3 samples for zinc. TSWQS screening criteria was exceeded by 8 samples for silver and 3 samples for zinc.

For sediment chemistry screening criteria was not exceeded by any of the samples for VOCs. Region 6 screening criteria was exceeded by 8 samples for bis(2-ethylhexyl) phthalate however it was below the Reporting Limit (Limit of Quantitation); therefore, the result is only an estimated concentration. NOAA ERL and Region 6 screening criteria were exceeded by 1 or more samples for all analytes except, benzo(b)fluoranthene, benzo(e)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene which do not have screening criteria. NOAA ERM screening criteria was exceeded by 1 or more samples for acenaphthene, fluorine, and phenanthrene. All PAHs were detected in 1 or more samples. NOAA ERL and Region 6 screening criteria were exceeded by 1 or more samples for 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin. In addition, Region 6 screening criteria was exceeded for gamma-BHC (lindane) in 1 or more samples. NOAA ERM screening criteria was exceeded for 4,4'-DDT for one or more samples. NOAA ERL and Region 6 screening criteria for total PCB congeners was exceeded by 7 samples. NOAA ERM screening criteria was not exceeded by any samples for total PCB congeners. NOAA ERL and Region 6 screening criteria were exceeded by 1 or more samples for cadmium, copper, lead, mercury, nickel and zinc.

A determination of the suitability for placement using these results is discussed in item d. below.

(d) Pathogens

None expected or found.

(e) Aesthetics

No expected effects from underwater channel improvements or from use of existing PAs.

(f) Others as Appropriate

None known.

(3) Effects on Biota

No impacts are expected on photosynthesis, suspension/filter feeders, and sight feeders, except for temporary impacts from dredging (e.g., temporary increases in local turbidity levels) or placement operations (e.g., the burial of benthos). Refer to **Section 7.2.1.3** of the Main Report and **Section 3.2.1.3** of **Appendix G** of the FIFR-EIS for more detail on effects to aquatic fauna.

(4) Actions Taken to Minimize Impacts

Construction and placement plans for the materials have been closely coordinated with the resource agencies to assure minimal impacts. BMPs will be applied to reduce and control turbidity and sediment discharge and impacts to threatened and endangered sea turtles.

d. Contaminant Determinations

Dredging at the site of channel improvements for the LPP will not introduce or increase contaminants. Chemical constituents in bottom sediments to be dredged are already subject to relocation and redistribution through tides, currents, and other natural climatic and weather-related forces in Galveston Bay. Hydraulic cutterhead dredging, the primary construction method anticipated, and trailing suction hopper dredging, the other method anticipated for use in the LPP, tend to limit the size of turbidity plumes due to the suction nature of the dredging. Only short term and localized increases in turbidity will be temporary and limited in size as explained in **Section 7.1.5** of the FIFR-EIS. The main effect at the dredge site will be the removal of sediments with relocation to proposed dredged material placement sites. For use of existing placement areas (PA), the material would be placed to raise or repair existing dikes, or otherwise placed within dikes. See response to c.(2)(c) above. As previously discussed, all previous sediment testing results for the HSC, BSC, and BCC were reviewed to establish reasons to believe contaminants would not be present to have the potential to cause unacceptable adverse impacts. This was done to identify additional testing requirements for which sampling and analysis was conducted in September through December 2018. Previous recent extensive testing for the BSC and BCC did not indicate construction material would be a concern, and testing will be identified as necessary to be conducted during or prior to the PED phase to verify no concerns would be present with HSC new work material in the Bay. Past periodic testing results have indicated that quality of maintenance sediments has been suitable for placement in the upland confined PAs, and BU marsh cells in the system. The results of the 2018 testing are detailed in Appendices S and T of the FIFR-EIS Main Rreport. The testing was broken up into two segments, South of Morgans Point, and North of Morgans Point, and indicated the following.

The South of Morgans Point (SMP) analysis indicated sediments are suitable for open water placement. Elutriate testing indicated the need for offshore placement dilution modeling using STFATE at the ODMDS No. 1. STFATE results indicate initial conservative modeling of large hopper volume placement will need to be refined during Preconstruction Engineering Design (PED) for the now-current proposed technique of placement of mechanically dredged new work material by substantially smaller scow. The North of Morgans Point (NMP) results exhibit exceedances of lower NOAA and EPA Region 6 screening criteria for PAHs, pesticides, PCBs, and metals. Initial mixing zone calculations also indicate the need for refined calculations and design of placement dewatering and effluent. Full details of the sediment testing are summarized in Appendix G, Section 3.1.5 of the FIFR-EIS.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton

Construction and placement operations are expected to have only minor temporary, local impacts on plankton from increased turbidity levels. Refer to **Section 7.2.2.2** of the Main Report and **Section 3.2.2.2** of **Appendix G** of the FIFR-EIS for more detail on effects to aquatic fauna.

(2) Effects on Benthos

There would be permanent impacts to oyster reef that will be mitigated. These impacts are discussed in **Section 7.2.2.3** and mitigation detailed in **Section 7.5** and **Appendix P** of the FIFR-EIS. Impacts to other benthic organisms and bay bottom habitat would occur; however, benthic organisms are expected to quickly rebound from the short-term impacts of channel dredging, the use of existing BU areas, and use of the offshore ODMDS and no significant adverse impacts are expected (**Section 7.2.1.3** of the Main Report and **Section 3.2.1.3** of **Appendix G** of the FIFR-EIS). Use of existing upland PAs would have no appreciable effect on benthos communities.

(3) Effects on Nekton

Impacts to free-floating or limited-mobility nekton would be temporary during construction, and minor. These impacts, such as entrainment into cutterheads or vessel cooling water intakes and discharges would be temporary and minor, because the amount of water exchange involved is volumetrically insignificant compared to the Bay, and the ubiquity and high turnover in populations of these types of fauna would quickly replace any impacted organisms. Finfish would readily be able to avoid impacts given their mobility. No permanent or long-term impacts on nekton would result from implementing the LPP and use of dredged material in the BU and marsh areas and from the placement of maintenance material. Refer to **Section 7.2.2.2** of the Main Report and **Section 3.2.2.2** of **Appendix G** of the FIFR-EIS for more detail.

(4) Effects on Aquatic Food Web

The effects on benthic biota (such as infauna) and nekton (e.g. plankton) that form the base of the aquatic food web would be localized, temporary, and not result in significant adverse impacts to populations as discussed in the responses above to c.(3) and e.(1), (2), and (3). No significant impacts to finfish populations are expected. (**Section 7.2.2.2** of the Main Report and **Section 3.2.2.2** of **Appendix G** of the FIFR-EIS)

(5) Effects on Special Aquatic Sites

Construction of the LPP would not impact any wetlands because the few wetlands that exist along the shoreline surrounding the proposed channel improvements will be avoided. No submerged aquatic vegetation or tidal or mudflats are located within the LPP footprint. Use of the existing PAs, BU sites, and offshore placement site would not impact any special aquatic sites. The proposed new upland PAs at BW8 and E2 Clinton would impact approximately 32.6 acres of wetlands, and a future PA expansion for maintenance of the LPP would impact approximately 41 acres, but would be mitigated as previously discussed in item e.(3) above. The proposed new BU sites would create approximately 1,120 acres of special aquatic sites.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination

Past maintenance sediment elutriate testing has not indicated a discharge quality problem that would require mixing zones at existing PAs or the ODMDS. This will be confirmed with a detailed review of previous sediment testing results for the HSC, BSC, and BCC. Recent results for the BSC and BCC did not indicate discharge quality problems would be expected with the new work material. Past testing results for the HSC is being reviewed to identify if any further testing is needing for HSC new work material. As discussed in response to c.(2)(c) above, testing would be performed during or prior to the PED phase. If identified for further testing, the dredged material would be tested for contaminants, to include elutriate testing, in accordance with the USACE or joint USACE/EPA Upland, Inland or Ocean Testing Manuals as appropriate for the specific disposal methods selected during the development of the DMMP in the next planning phase. Elutriate results would be reviewed to ensure placement will not cause or contribute, after considering dilution and dispersion, to violation of any applicable surface water quality standards. After reviewing results, any necessary mixing zone calculations would be performed and the placement method evaluated in accordance with Engineer Manual (EM) 1105-2-5025, *Dredging and Dredged Material Management*.

The South of Morgans Point (SMP) analysis indicated sediments are suitable for open water placement. Elutriate testing indicated the need for offshore placement dilution modeling using STFATE at the ODMDS No. 1. STFATE results indicate initial conservative modeling of large hopper volume placement will need to be refined during Preconstruction Engineering Design (PED) for the now-current proposed technique of placement of mechanically dredged new work material by substantially smaller scow. The North of Morgans Point (NMP) results exhibit exceedances of lower NOAA and EPA Region 6 screening criteria for PAHs, pesticides, PCBs, and metals. Initial mixing zone calculations also indicate the need for refined calculations and design of placement dewatering and effluent. Full details of the dilution and mixing zone analyses is summarized in Appendix G, Section 3.1.5 of the FIFR-EIS.

(1) Factors in determining the acceptability of a proposed mixing zone.

Past maintenance sediment elutriate testing has not indicated a discharge quality problem that would require mixing zones at existing PAs or the ODMDS. This will be confirmed with a detailed review of previous sediment testing results for the HSC, BSC, and BCC. Recent results for the BSC and BCC did not indicate discharge quality problems would be expected with the new work material. Past testing results for the HSC is being reviewed to identify if any further testing is needing for HSC new work material. As discussed in response to c.(2)(c) above, testing would be performed during or prior to the PED phase. If identified for further testing, the dredged material would be tested for contaminants, to include elutriate testing, in accordance with the USACE or joint USACE/EPA Upland, Inland or Ocean Testing Manuals as appropriate for the specific disposal methods selected during the development of the DMMP in the next planning phase. Elutriate results would be reviewed to ensure placement will not cause or contribute, after considering dilution and dispersion, to violation of any applicable surface water quality standards. After reviewing results, any necessary mixing zone calculations would be performed and the placement method evaluated in accordance with Engineer Manual (EM) 1105-2-5025, *Dredging and Dredged Material Management*.

(2) Potential Effects on Human Use Characteristics

(a) Municipal and Private Water Supply

No apparent private, public, or industrial water wells registered with the Texas Water Development Board (2017) would be destroyed and/or affected based on their proximal distances and completed depths below surface grade.

(b) Recreational and Commercial Fisheries

Oyster reef impacts will be mitigated as discussed above in e.(2). No significant adverse or long-term effects to other recreational or commercial fisheries are anticipated as a result of the LPP. See **Section 7.2.4** of the Main Report and **Section 3.2.4** of **Appendix G** of the FIFR-EIS for more detail.

(c) Water-related Recreation

The LPP will not have significant adverse effects on waterborne recreation, either through impeding use, or effects on water-quality dependent recreational uses such as fishing or aesthetics. See **Section 7.2.4**, and **7.4.1.4** of the Main Report and **Section 3.2.4** and **3.4.1.4** of **Appendix G** of the FIFR-EIS for more detail.

(d) Aesthetics

The LPP is not expected to change land use in the area. The majority of the new placement areas/beneficial use sites are on existing sites and will include the addition of six to nine feet dikes. The majority of these existing sites have trees and plantings, as well as berms, where the new material would not be seen from the existing viewsheds. The majority of the sites in the water are not seen from any neighborhoods.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

No parks, national or historic monuments, national seashores, wilderness areas, or research sites will be negatively impacted by the project.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

The LPP channel modifications are not expected to result in significant adverse cumulative impacts to the aquatic ecosystem, as discussed in **Section 7.7** of the FIFR-EIS. Use of existing PAs (including BU sites) would not result in significant adverse cumulative impacts to the aquatic ecosystem either, as these sites are already used for dredged material placement. These PAs have been used for the long term operations and maintenance (O&M) of the HSC system without impairment of the water quality of the receiving waters in Galveston Bay or Buffalo Bayou /San Jacinto River, and without interfering with the productivity of the existing aquatic ecosystems. Use of the material for the BU sites would produce benefits to the productivity of aquatic ecosystems by helping in the continued restoration of tidal marsh.

h. Determination of Secondary Effects on the Aquatic Ecosystem

No significant adverse secondary effects on the aquatic ecosystem should occur as a result of implementing the LPP or use of existing PAs. The existing PAs would remain in use for long term O&M of the Federal channels, and are not planned for development into other land uses other than their current upland or BU placement.

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

November 21, 2019

Dr. Harmon Brown
Environmental Branch
Regional Planning & Environmental Center
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229

Re: Houston Ship Channel Improvement Project EIS

Dear Dr. Brown:

This letter is in response to the Draft Final Integrated Feasibility Report – Environmental Impact Statement dated September 2019, and the U.S. Army Corps of Engineers' request for certification on the Notice of Availability dated August 18, 2017 for the draft feasibility study and integrated environmental impact statement (EIS) for the proposed Houston Ship Channel (HSC) 45-foot Expansion Channel Improvement Project where different reaches of the channel will be widened and deepened to accommodate larger vessels and traffic volume. The project is located in Harris and Galveston Counties, Texas.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the Draft EIS. Based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards.

The purpose of the proposed project is to reduce transportation costs while providing for safe, reliable navigation on the HSC system.

The preferred action includes widening 11 miles of lower bay channel from 530 feet to 700 feet (Bolivar Roads to Redfish Reef) with associated barge lane relocations, widening approximately 10 miles of channel from 530 feet to 700 feet (Redfish Reef to Bayport Ship Channel) with associated barge lane relocations, widening approximately 5 miles of channel from 530 feet to 700 feet (Bayport Ship Channel to Barbours Cut Channel) with associated barge lane relocations, easing bends in four locations with associated barge lane relocations, widening the Bayport Ship Channel from existing 300-400 feet to 455 feet, widening Barbour Cut Channel from existing 300 feet to 455 feet, deepening the HSC from Boggy Bayou to Hunting Turning Basin from the existing 41.5-foot depth up to 46.5 feet, widening the HSC from Boggy Bayou to Greens Bayou from the existing 400-foot wide channel up to 530 feet, making improvements to Hunting Turning Basin, deepening the HSC from Sims Bayou to I-610 Bridge from the existing 37.5-foot depth up to 41.5 feet, deepening the HSC from I-610 Bridge to Main Turning Basin from existing 37.5-foot depth up to 41.5 feet deep, and making improvements to Brady Island Turning Basin.

Dredged material (sand) would be placed in beneficial use and dredged material placement areas in accordance with the Dredge Material Management Plan (DMMP). Selection of placement areas will be further refined during feasibility-level analysis, with the final design in the Preconstruction Engineering and Design (PED). Sediment testing will continue to be conducted in accordance with the joint EPA/USACE Inland Testing Manual. A portion of the HSC near its confluence with the San Jacinto River lies within the southern boundary of the Area of Concern for the EPA-designated superfund site known as the San Jacinto River Waste Pits. The results of the routine water quality and sediment testing of dredged material from this segment of the HSC are evaluated in accordance with the requirements established by the EPA, TCEQ and USACE (2009) to ensure that maintenance dredging within this area would not have an impact on the EPA's investigation and cleanup of this superfund site.

Lost wetland functions will be mitigated at appropriate mitigation banks when they become available.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact Mr. Jeff Paull of the Water Quality Division MC-150, P.O. Box 13087, Austin, Texas 78711-3087. Mr. Paull may also be contacted by e-mail at jeff.paull@*tceq.texas.gov*, or by telephone at (512) 239-1649.

Sincerely,

David W. Galindo, Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/JP/fc