Appendix N

Clean Water Act Section 404(b)(1) Evaluation

Job No. PCA20166

APPENDIX N

DRAFT
SECTION 404(B)(1) EVALUATION
FOR THE
PROPOSED CORPUS CHRISTI SHIP CHANNEL DEEPENING PROJECT

Prepared for:

U.S. Army Corps of Engineers

Prepared by:

Freese and Nichols, Inc.
10431 Morado Circle, Suite 300
Austin, Texas 78759

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Acronyms and Abbreviations

BU	beneficial use
CCSC	Corpus Christi Ship Channel
CSD	cutter suction dredge
cy	cubic yards
DEIS	Draft Environmental Impact Statement
Gulf	Gulf of Mexico
mcy	million cubic yards
MLLW	mean lower low water
MSL	mean sea level
ODMDS	Ocean Dredged Material Disposal Site
PA	placement area
PCCA or Applicant	Port of Corpus Christi Authority
Port	Port of Corpus Christi
ppt	parts per thousand
USACE	U.S. Army Corps of Engineers
VLCC	Very Large Crude Carriers

1.0 PROJECT DESCRIPTION

1.1 LOCATION

The Proposed Action is in the Gulf of Mexico (Gulf) and the Corus Christi Ship Channel (CCSC). The CCSC is in Corpus Christi Bay on the south-central portion of the Texas coast, 200 miles southwest of Galveston and 150 miles north of the mouth of the Rio Grande River. The coastal counties included within the study area are Aransas, Nueces, Refugio, and San Patricio. The CCSC provides deepwater access from the Gulf to the Port of Corpus Christi (Port), via Port Aransas, through Redfish Bay and Corpus Christi Bay. The waterway extends from deep water in the Gulf through the Port Aransas jettied entrance and connects to marine terminals along the Inner Harbor and La Quinta Channel. The Inner Harbor starts at Harbor Bridge and includes five turning basins. The La Quinta Channel extends from the CCSC near Ingleside, Texas, and runs parallel to the eastern shoreline of Corpus Christi Bay for 6.9 miles to the San Patricio Turning Basin. The Proposed Action will be completed within the limits of the CCSC from the Gulf to Harbor Island. The study area extends offshore from the San José, Mustang, and North Padre islands beyond the proposed CCSC extension, approximately 17 miles.

1.2 GENERAL DESCRIPTION

The CCSC is currently authorized by the U.S. Army Corps of Engineers (USACE) to project depths of –54 feet and –56 feet mean lower low water (MLLW) from Station 110+00 to Station –330+00 as part of the CCSC Improvement Project. The current authorized width of the CCSC is 600 feet inside the jetties and 700 feet in the entrance channel.

The Port of Corpus Christi Authority (PCCA or Applicant) proposes to deepen the channel from Station 110+00 to Station –72+50 to a maximum depth of –79 feet MLLW (–75 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge), and from Station –72+50 to Station –330+00, the channel would be deepened to a maximum depth of –81 feet MLLW (–77 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge). The Proposed Action includes a 29,000-foot extension of the CCSC from Station–330+00 to Station –620+00 to a maximum depth of –81-foot MLLW (–77 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge) to reach the –80-foot MLLW bathymetric contour in the Gulf. The Proposed Action would span approximately 13.8 miles from a location near the southeast side of Harbor Island to the –80-foot MLLW bathymetric contour in the Gulf.

The Proposed Action consists of the following:

- Deepening a portion of the CCSC from the current authorization of –54 and –56 feet MLLW to final constructed deepened channel ranging from –75 to –77 feet MLLW;
- Extending the existing terminus of the authorized channel an additional 29,000 feet into the Gulf to reach the –80-foot MLLW bathymetric contour;

- Expanding the existing Inner Basin at Harbor Island as necessary to accommodate Very Large Crude Carriers (VLCC) turning.
- Straightening the northeast channel limits of the Harbor Island Transition Flare.
- Placement of new work dredged material into an existing upland dredged material placement area at Harbor Island;
- Placement of new work dredged material within the Corpus Christi New Work Ocean Dredged Material Disposal Site (ODMDS).
- Placement intended as beneficial use (BU) at:
    - Harbor Island and Port Aransas to restore eroded shorelines adjacent the CCSC;
    - Harbor Island to restore the eroded bluff and shoreline;
    - Gulf-facing shoreline of San José Island for dune and beach restoration;
    - Gulf-facing shoreline of Mustang Island for beach restoration; and
    - Nearshore berms offshore San José and Mustang islands.

The total length of the CCSC proposed for deepening is approximately 13.8 miles. The Proposed Action would generate an estimated 46.3 million cubic yards (mcy) of new work material. The newly generated material would consist of approximately 37 percent clays (17.1 mcy) and 63 percent sand (29.1 mcy). The clay portion of the new work dredged material located in the offshore reaches (Station –620+00 to –72+50) would be placed at the Corpus Christi New Work ODMDS located approximately 2.9 miles southeast of the Aransas Pass South Jetty and adjacent to the CCSC. The clay portion of new work dredged material from Stations –72+50 to Station 110+00 would be used beneficially where possible to create perimeter dikes.

The new proposed depth for the applicable sections of the channel would be approximately –79 feet to –81 feet MLLW to account for underkeel clearances and includes 2 feet of advanced maintenance and 2 feet of allowable overdredge depth. The design depth was based on a detailed review of the dimensions of VLCCs expected to call at the Port's existing and proposed crude oil export terminals; the predominant density of crude oil to be exported and associated vessel draft; environmental effects due to winds, waves, and currents; required underkeel clearances, plus 2 feet of advanced maintenance; and 2 feet of allowable overdredge depth. The Proposed Action does not include widening the channel. Deepening activities will be completed within the footprint of the authorized CCSC channel width. Incidental widening may be needed however to maintain side slope requirements and are expected to be minor.

1.3 AUTHORITY AND PURPOSE

The project purpose, as determined by the USACE after concurrence with the Cooperating Agencies, is to export safely, efficiently, and economically current and forecasted crude oil inventories via VLCC, a common vessel in the world fleet. Crude oil is delivered via pipeline from the Eagle Ford and Permian Basins to multiple locations at the Port. Crude Oil inventories exported at the Port have increased from

280,000 barrels per day in 2017 to 1,650,000 barrels in January 2020 with forecasts increasing to 4,500,000 barrels per day by 2030. Current facilities require vessel lightering to fully load a VLCC which increases cost and effects safety.

To address the purpose and need, PCCA proposes to deepen portions of the CCSC beyond the current authorized project depth of –54 feet and –56 feet MLLW, from the Gulf (approximate Station –620+00) to Harbor Island (approximate Station 110+00), to allow berthing of VLCCs which can then be fully laden, with drafts of up to 70 feet. This is a length of approximately 13.8 miles.

The purpose of the Proposed Action, as provided by the Applicant, is to construct a channel with the capability to accommodate transit of fully laden VLCCs from multiple locations on Harbor Island into the Gulf. Factors influencing the Applicant's need for the project include:

- The ability for more efficient movement of U.S. produced crude oil to meet current and forecasted demand in support of national energy security and national trade objectives,
- Enhancement of the PCCA's ability to accommodate future growth in energy production, and
- Construction of a channel project that the PCCA can readily implement to accommodate industry needs.

1.4 GENERAL DESCRIPTION OF DREDGED OR FILL MATERIAL

1.4.1 General Characteristics of Material

The sediment within the dredge template varies from very fine sand to high plasticity clays. The outer portions of the ship channel transition from a soft clay dominated Outer Channel (Station –330+00 to –620+00) to a sand dominated Approach Channel (Station –72+50 to –330+00). The interior portions of the ship channel, including the Corpus Christi Channel segment (Station 110+00 to 38+16.43), Harbor Island Junction segment (Station 38+16.43 to 20+82.07), Harbor Island Transition Flare segment (Station 20+82.07 to –20+00), and Jetties to Harbor Island Transition Flare (Station –20+00 to –72+50) are comprised of loose clay and silty sands with some clays. A summary is provided in Table 1.

Table 1
Sediment Characterization for Corpus Christi Ship Channel by Segment

Segment	Description	Begin Station	End Station	Approximate Composition
1	Outer Channel	–620+00	–330+00	82.5% Soft Clay 17.5% Sand
2	Approach Channel	–330+00	–72+50	18% Soft Clay 4% Stiff Clay 78% Sand

Segment	Description	Begin Station	End Station	Approximate Composition
3	Jetties to Harbor Island Transition Flare	–72+50	–20+00	1% Soft Clay 13% Stiff Clay 86% Sand
4	Harbor Island Transition Flare	–20+00	20+82.07	2% Soft Clay 28% Stiff Clay 70% Sand
5	Harbor Island Junction	20+82.07	38+16.43	<1% Soft Clay 27% Stiff Clay 72% Sand
6	CCSC	38+16.43	110+00	43.5% Stiff Clay 56.5% Sand

1.4.2 Quantity of Material

Although quantity estimates are still in progress, approximately 46.3 mcy of material would need to be dredged. Table 2 provides a breakdown of material volumes by dredging location.

Table 2
Dredged Material Volumes per Channel Segment for the Proposed Action

Dredging Location	Dredged Material Quantity (cy) for Proposed Action
Outer Channel	9,617,390
Approach Channel	20,308,762
Jetties to Harbor Island Transition Flare	2,105,041
Harbor Island Transition Flare	2,851,897
Harbor Island Junction	2,951,614
Corpus Christi Ship Channel	8,448,886
Total	46,283,590

cy = cubic yards

1.5 DESCRIPTION OF THE PROPOSED DISCHARGE

1.5.1 Location

Discharges are proposed at several placement areas (PAs) and other locations along the CCSC, San José Island, Mustang Island, and offshore at the New Work ODMDS. The inshore locations were chosen for PA levee improvements and fill, shoreline restoration or repair, dune and beach restoration, and beach nourishment. Placement locations are outlined in Table 3.

Table 3
Placement Locations

Placement Site	Description
PA6	5-foot levee raise and fill (no environmental benefit)
SS1	Restore eroded and washed-out shoreline at Harbor Island
SS2	Restore shoreline washouts along Port Aransas Nature Preserve
SS1 Extension	Reestablish eroded shoreline and land loss in front of PA4
PA4	Upland placement
HI-E	Bluff and shoreline restoration with site fill
SJI	Dune and beach restoration San José Island
New Work ODMDS	Place New Work ODMDS
B1–B9	Nearshore berms offshore of San José Island and Mustang Island
MI	Beach Nourishment for Gulf side of Mustang Island

1.5.2 Size

Total area of discharges may cover approximately 4,663 acres. Details regarding acreage and placement capacity for each BU site is included in Table 4.

Table 4
Size and Capacity of Placement Locations

Placement Site	Placement Capacity (cy)
PA6	1,796,400
SS1	2,793,000
SS2	250,000
PA4	4,537,400
HI-E	1,825,000
SJI	4,000,000
New Work ODMDS	38,888,600
B1–B9	8,100,000
MI	2,000,000

1.5.3 Type of Site and Habitat

The sites and types of habitats that could be directly impacted are outlined in Table 5.

1.5.4 Time and Duration of Discharge

Construction is expected to occur from 2023 until 2026. Maintenance will be ongoing; estimates for the CCSC deepening include a 50-year project life. Table 6 provides a breakdown anticipated construction start and completion dates by task.

Table 5
Habitat Types of Placement Sites

Placement Site	Habitat Cover Type(s)
PA6	N/A – Existing Levee
SS1	Bare Land; Estuarine Aquatic Bed; Estuarine Emergent Wetland; Grassland/Herbaceous; Open Water; Palustrine Aquatic Bed; Unconsolidated Shore
SS2	Bare Land; Deciduous Forest; Estuarine Emergent Wetland; Grassland/Herbaceous; Open Water; Palustrine Emergent Wetland; Scrub/Shrub Wetland; Scrub/Shrub; Unconsolidated Shore
PA4 (includes SS1 Extension)	Bare Land; Deciduous Forest; Estuarine Emergent Wetland; Grassland/Herbaceous; Open Water; Palustrine Emergent Wetland; Scrub/Shrub; Unconsolidated Shore
HI-E	Bare Land; Deciduous Forest; Estuarine Emergent Wetland; Grassland/Herbaceous; Open Water; Palustrine Emergent Wetland; Scrub/Shrub Wetland; Unconsolidated Shore
SJI	Bare Land; Grassland/Herbaceous; Open Water; Palustrine Emergent Wetland; Unconsolidated Shore
New Work ODMDS	Open Water
B1–B9	Open Water
MI	Bare Land; Developed Low Intensity; Estuarine Emergent Wetland; Grassland/Herbaceous; Open Water; Palustrine Emergent Wetland; Scrub/Shrub; Unconsolidated Shore

Source: NOAA (2010).

1.5.5 Description of Disposal Method

It is anticipated that most materials would be used for PA improvements and fill, or beneficially for restoration or for beach nourishment, with the remaining materials to be placed in the Maintenance ODMDS. For placement actions targeting restoration, fill discharges may consist of thin-layer placement or confined placement, depending on the target restoration elevations. Direct placement with dredged pipeline is anticipated for larger restoration actions including beach and dune restoration. Hopper dredge would likely be used for ODMDS discharges.

Table 6
Preliminary Construction Schedule Plan*

Task ID	Task Description	Start Date	End Date	Duration (Days)
1	CSD via Scow to ODMDS (7,213,043 cy)	7/1/2023	9/11/2024	438
2	CSD via Pipe to ODMDS (2,404,347 cy)	9/11/2024	12/28/2024	108
3	CSD via Pipe to ODMDS (4,182,610 cy)	12/28/2024	7/4/2025	188
4	CSD via Scow to B9 (1,200,000 cy)	7/4/2025	9/7/2025	65
5	CSD via Scow to B8 (1,200,00 cy)	9/7/2025	11/11/2025	65
6	CSD via Pipe to B7 (1,200,000 cy)	11/11/2025	1/4/2026	54
7	CSD via Pipe to B1 (750,000 cy)	1/4/2026	2/7/2026	34
8	CSD via Pipe to B2 (750,000 cy)	2/7/2026	3/12/2026	34
9	CSD via Pipe to B3 (750,000 cy)	3/12/2026	4/15/2026	34
10	CSD via Pipe to B4 (750,000 cy)	4/15/2026	5/20/2026	35
11	CSD via Scow to B5 (750,000 cy)	5/20/2026	6/30/2026	41
12	CSD via Scow to B6 (750,000 cy)	6/30/2026	8/9/2026	41
13	CSD via Pipe to SJI Shore (2,000,000 cy)	7/1/2023	10/4/2023	95
	CSD via Pipe to SJI Dune (2,000,000 cy)	10/4/2023	1/2/2024	90
14	CSD via Pipe to MI (2,000,000 cy)	1/2/2024	4/1/2024	90
15	CSD via Pipe to PA4 (2,026,152 cy)	4/1/2024	7/1/2024	91
16	CSD via Pipe to PA4 (993,848 cy)	7/1/2024	8/15/2024	45
17	CSD via Pipe to SS1 (1,111,193 cy)	8/15/2024	10/4/2024	50
18	CSD via Pipe to SS1 (2,851,897 cy)	10/4/2024	2/9/2025	128
19	CSD via Pipe to SS1 (836,910 cy)	2/9/2025	3/19/2025	38
20	CSD via Pipe to M10 (2,114,704 cy)	3/19/2025	6/22/2025	95
21	CSD via Pipe to M10 (4,020,764 cy)	6/22/2025	12/20/2025	181

* This table represents a preliminary construction schedule from 08/17/2020; since this time the PAs have changed. Assumptions also include that the timeframe assumes the use of two cutter suction dredges (CSD) during the duration of the contract. Tasks 1 to 12 will be performed by one CSD while tasks 13 to 21 will be performed by another working simultaneously, and one dredge will do the majority of the offshore portion of work with open water disposal while the second dredge will perform the majority of the inshore work with beach and upland placement area disposal.

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2.0 FACTUAL DETERMINATIONS

2.1 PHYSICAL SUBSTRATE DETERMINATIONS

2.1.1 Substrate Elevation and Slope

Marsh and restoration actions target elevations ranging from below mean sea level (MSL) to about +2 feet MSL with generally flat slopes. For beach nourishment and dune restoration, dune elevations typically range from +4 to +12 feet (top of dune), with a common slope of 1:3; beach nourishment could range from –4 to +4 feet, and slopes can range from 1:50 for subaerial portions and 1:25 for intertidal portions.

At SS2, the Proposed Action involves restoration of approximately 1,085 linear feet of an eroded shoreline by an armored berm constructed with approximately 250,000 cy of dredge material hydraulically pumped to the site. Berm elevation design is +7 feet MLLW at a 4:1 slope with a crest width of approximately 20 feet. Construction of the interior levee, via hydraulic pumping and mechanical placement, at a 10:1 slope will meet the existing sand flats and wetlands at an elevation of approximately +1.5 feet MLLW. Some portions will include a bulkhead built to up to +9.5 feet MLLW.

At PA4 and SS1, a levee would be constructed via hydraulic pumping. Mechanically placed stiff clay will provide incremental exterior levee raising for dredge material placed between the proposed SS1 Extension levee and the existing PA4 levee to an approximate elevation of +20 feet MLLW; other parts of PA4 include a levee up to +12 feet MLLW, with incremental fills indicated up to +24 feet MLLW. The backside containment levee may be up to +5 feet MLLW.

At HI-E, exterior shoreline levee design will raise the existing elevation to +15 feet MLLW at a 4:1 slope and a crest width of 15 feet. Mechanical placement of approximately 23,400 cy of riprap at a 4:1 slope to +7 feet MLLW will armor the exterior shoreline levee and provide erosion control. The exterior upland levee design is to a +3 feet over grade at a 4:1 slope.

2.1.2 Sediment Type

It is assumed that stiffer clays would be used for containment levees and sands would be used for beach nourishment and other fills targeting restoration.

2.2 DREDGED/FILL MATERIAL MOVEMENT

In most instances, project actions would use a containment structure to hold materials in situ; in other instances, thin layer placement would be performed where some material movement throughout the marsh is intended. Last, any beach and dune nourishments would result in erosion into the surf zone over time. Modeling of beach nourishment (W.F. Baird and Associates, 2022) indicated up to a 5 percent loss of sediment from Mustang Island and up to a 2 percent loss from San José Island; negligible to no movement of nearshore berms are expected. ODMDS modeling indicated a relatively stable bathymetry following discharges, but channel sedimentation in the outer channel is 2.25 times greater when comparing the Proposed Action condition versus the No-Action condition (W.F. Baird and Associates, 2022).

2.3 PHYSICAL EFFECTS ON BENTHOS

There would be direct impacts to benthic organisms, which would be buried or removed during construction. Excavation of sediments removes and buries benthic organisms, whereas placement of dredged material and structures smothers or buries benthic communities. Dredging and placement activities may cause ecological damage to benthic organisms due to physical disturbance, mobilization of sediment contaminants, and increasing concentrations of suspended sediments (Montagna et al., 1998). Placement, however, can also release nutrients that can enhance species diversity and population densities of benthic organisms outside the immediate dredge placement area as long as the dredged material is not contaminated (Newell et al., 1998).

Recolonization of areas impacted by dredging and dredged material placement occurs through vertical migration of buried organisms through the dredged material, immigration of organisms from the surrounding area, recruitment from the water column, and/or sediments slumping from the side of the dredged area (Bolam and Rees, 2003; Newell et al., 1998). The response and recovery of the benthic community from dredged material placement is affected by many factors, including environmental (e.g., water quality, water stratification), sediment type and frequency, and timing of disposal. Communities in these dynamic ecosystems are dominated by opportunistic species tolerant of a wide range of conditions (Bolam et al., 2010; Bolam and Rees; 2003, Newell et al., 2004; Newell et al., 1998). Although changes in community structure, species composition, and guild function may occur, these impacts would be temporary in some dredging and disposal areas (Bolam and Rees, 2003). Shallower, higher energy estuarine habitats can recover as fast as 1 to 10 months from perturbation, while deeper, more-stable habitats can take up to 8 years to recover (Bolam et al., 2010; Bolam and Rees, 2003; Newell et al., 1998; Sheridan, 1999, 2004; VanDerWal et al., 2011; Wilber et al., 2006).

2.3.1 Other Effects

Construction activities, particularly beach and dune restoration and offshore sediment source dredging, may affect, but are unlikely to adversely affect, Federally listed sea turtles. Beach and dune restoration actions are anticipated to benefit sea turtles by increasing available nesting habitat. Beach and dune restoration activities may also have temporary and localized disturbances to the Federally listed Piping Plover (*Charadrius melodus*) and Rufa Red Knot (*Calidris canutus rufa*); however, long-term benefits to these species are anticipated due to beach nourishment and tidal habitat restoration.

2.3.2 Actions Taken to Minimize Impacts

Some of the project features were developed as a result of stakeholder coordination and placement discharges will take place on existing PAs, eroding shorelines, storm-damaged shorelines, or eroding beach.

Best management practices will be in place to avoid and minimize impacts during discharge such as use of turbidity curtains to protect seagrass.

2.4 WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

2.4.1 Water

2.4.1.1 Salinity

Short-term modeling indicates that construction of the Proposed Action could slightly decrease bay salinities, less than 1 part per thousand (ppt) on average in the Corpus Christi Bay system. Some localized changes in salinity of less than ±3 ppt in the proposed dredge area and connected navigation channels may occur. Secondary long-term modeling also showed that channel deepening would not cause significant salinity change on average, but it may cause short-term changes in the range of ±3 ppt in the proposed dredge area and connected navigation channels (W.F. Baird and Associates, 2022).

2.4.1.2 Water Chemistry

Dredging and placement actions would result in short-term and localized impacts and would not be expected to degrade the long-term water quality within the project area. These patterns would return to their previous condition following completion of discharges. Temporary changes to dissolved oxygen, nutrients, and turbidity may occur due to sediment disturbance and mixing during construction.

2.4.1.3 Clarity

There would 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.

2.4.1.4 Color

Water immediately surrounding the construction area would become discolored temporarily due to disturbance of the sediment during dredging and placement actions but would be expected to return to normal after operations cease.

2.4.1.5 Odor

Negligible amounts of hydrogen sulfide may be expected during excavation and placement activities, which would be temporary and localized.

2.4.1.6 Taste

It is anticipated that no drinking water sources would be impacted by the Proposed Action; no effects to taste are anticipated.

2.4.1.7 Dissolved Gas Levels

Negligible amounts of hydrogen sulfide may be expected. Hydrogen sulfide and other gases like methane are associated with high amounts of decaying organic matter, which are not expected to be present in excavated and placed materials. Offshore sediments may be very low in total organic carbon, an indicator of organic content. Dissolved gases have not been identified as a problem with maintenance material of the current channels. Temporary dissolved oxygen decreases associated with extended periods of construction and dredged material placement may also happen from aerobic decomposition from short-term increases in organic matter suspended within the water column.

2.4.1.8 Nutrients

Temporary changes to nutrient levels may occur due to sediment disturbance and mixing during construction. Changes in ratios of nitrogen and phosphorus may change plankton communities in the bay, particularly in areas with oysters that rely on plankton as their primary food source.

2.4.1.9 Eutrophication

Nutrients are not expected to reach levels high enough for periods long enough to lead to eutrophication of the surrounding waters.

2.4.1.10 Others as Appropriate

No other potential impacts to water quality have been identified; additional information can be found in the Draft Environmental Impact Statement (DEIS).

2.4.2 Current Patterns and Circulation

2.4.2.1 Current Patterns and Flow Velocity

Discharges associated with placement would not alter typical current patterns and flow velocities. Since some of the PAs will include levees (including some armored levees of heights up to +20 feet MLLW or more), storm surges could be altered.

Channel deepening would not result in significant impacts on currents in Corpus Christi Bay, Redfish Bay, and Nueces Bay. Modeling predicted that the Proposed Action would reduce current speeds through the deepened navigation channel. The mean current speed at Aransas Pass is reduced by about 0.213 feet per second and the maximum current speed is reduced up to 0.614 feet per second. The current speed increases in the CCSC from Port Aransas to Ingleside where the water depth remains unchanged. The current speed at the Inner Channel near Port Aransas increases about 0.09 to 0.13 feet per second, up to 0.36 feet per second (W.F. Baird and Associates, 2022).

Secondary long-term modeling also demonstrates no significant impact on currents in Corpus Christi Bay, Redfish Bay, and Nueces Bay. Channel deepening would reduce current speeds through the proposed dredge area and increase the current speed in the Corpus Christi Channel from Port Aransas to Port Ingleside where the water depth remains unchanged. (W.F. Baird and Associates, 2022).

2.4.2.2 Stratification

Relatively minor amounts of vertical salinity stratification may result from the Proposed Action.

2.4.2.3 Hydrologic Regime

Deepening of navigation channels can alter circulation patterns and increase the tidal range and tidal prism within bay systems (USACE, 1987). Alternative 1 would result in these types of local bathymetric changes within and adjacent to the existing CCSC. These changes would be small compared to the scale of regional bathymetry.

2.4.3 Normal Water Level Fluctuations

Short-term modeling indicates that channel deepening is unlikely to change mean water levels in the bay. However, the model predicted that high tide would increase by less than 0.79 inches in Corpus Christi and Redfish Bay. The maximum increase of high tide occurs at Humble Basin which is about 1.57 inches. The model predicted that low tide would drop by less than 1.57 inches in Corpus Christi and Redfish Bay. The maximum drop of low tide occurs in the Inner Channel near Humble Basin which is 3.94 inches (W.F. Baird and Associates, 2022).

Short-term modeling predicted tidal amplitude increases of about 11 percent in Redfish Bay, 8 percent in Corpus Christi Bay, 7 percent in Nueces Bay, and 3 percent at Rockport. The tidal amplitude at the Inner Channel near Port Aransas has the largest increase, which is about 17 percent. There is no major change in tidal amplitudes in Aransas Pass and the Outer Channel. The model predicted that the average tidal range increase is about 1.57 inches at the Inner Channel near Port Aransas, ranging from 0.12 to 0.35 inches. The average tidal range increase at Corpus Christi Bay and Redfish Bay is less than 0.79 inches, ranging from –0.04 to 1.57 inches. A noticeable impact on the tidal range is limited to the Navigation Channel from Point Mustang to the inner basin (W.F. Baird and Associates, 2022).

Secondary long-term modeling indicates similar impacts to mean water levels as predicted by the short-term model. The model predicted that the tidal amplitude at the Inner Channel near Port Aransas had the largest increase of about 15 percent. The increase in tidal amplitudes were found to be approximately 10 percent in Redfish Bay, 9 precent in Corpus Christi Bay, 7 percent in Nueces Bay, and 3 percent in Rockport. The model predicted that the average increase in tidal range is approximately 1.38 inches at the inner channel near Port Aransas, and the average tidal range increase at Corpus Christi Bay and Redfish Bay is less than 0.79 inches. These were consistent with the short-term model (W.F. Baird and Associates, 2022).

2.4.4 Salinity Gradients

Short-term modeling was conducted to assess the impact of channel deepening on salinity by comparing the salinity predicted for the Proposed Action to existing conditions. The results indicate that channel deepening would increase average salinity by less than 1 ppt along the navigation channel. Channel deepening may result in small instantaneous changes in salinity (about ±3 ppt) in proposed dredge area and connected navigation channels. Channel deepening may also cause some small change in salinity (about ±3 ppt) at the outlet of Nueces Bay during high flow periods from the Nueces River (W.F. Baird and Associates, 2022).

Secondary long-term modeling also showed that channel deepening would not cause significant salinity change on average, but it may cause short-term changes in the range of ±3 ppt in the proposed dredge area and the connected navigation channels (W.F. Baird and Associates, 2022).

Activities associated with offshore placement and the BU of dredged material are not anticipated to impact salinity levels in the project area. Localized impacts may occur in areas where new work material is used to develop or expand bird islands in Corpus Christi Bay. These impacts would be limited to short-term changes in salinity resulting from freshwater runoff during rain events.

2.4.5 Actions that Will Be Taken to Minimize Impacts

Some of the project features were developed because of stakeholder coordination and placement discharges will take place on existing PAs, eroding shorelines, storm-damaged shorelines, or eroding beach. Best management practices will be in place to avoid and minimize impacts during discharge such as use of turbidity curtains to protect seagrass.

2.5 SUSPENDED PARTICULATE/TURBIDITY DETERMINATION

2.5.1 Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site

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. Turbidity increases also may occur during dewatering.

2.5.2 Effects on Chemical and Physical Properties of the Water Column

2.5.2.1 Light Penetration

The temporary and localized turbidity increases during dredging and placement actions would also have temporary and localized impacts to light penetration. Conditions are anticipated to return to normal levels of light penetration following construction.

2.5.2.2 Dissolved Oxygen

Temporary dissolved oxygen decreases associated with extended periods of construction and dredged material placement may happen from aerobic decomposition from short-term increases in organic matter suspended within the water column. Additional information can be found in Section 4.1.4 of the DEIS.

2.5.2.3 Toxic Metals and Organics

Sediments are not expected to contain toxic metals and organics.

2.5.2.4 Pathogens

Sediments are not expected to contain or influence pathogens.

2.5.2.5 Aesthetics

Placement areas that target restoration or beach nourishment may improve aesthetics. Placement areas with levee improvement and fill may detract from aesthetics.

2.5.2.6 Others as Appropriate

No other potential impacts to water quality have been identified; additional information can be found in the DEIS.

2.5.3 Effects on Biota

Long-term effects to biota are expected to be beneficial due to restoration actions; negative effects to biota are expected to be temporary and localized.

2.5.4 Actions Taken to Minimize Impacts

Some of the project features were developed because of stakeholder coordination and placement discharges will take place on existing PAs, eroding shorelines, storm-damaged shorelines, or eroding beach. Best management practices will be in place to avoid and minimize impacts during discharge such as use of turbidity curtains to protect seagrass.

2.6 CONTAMINANT DETERMINATIONS

Although additional sediment sampling is pending, prior sampling for the –54 foot authorized depth did not indicate any concern for contaminants. A Sampling Analysis Plan for the Marine Protection, Research and Sanctuaries Act Section 103 evaluation of sediment was developed to determine if the new work material sediments proposed to be dredged are acceptable for disposal in the New Work ODMDS. Included in that plan is the biological testing of sediment, including sediment toxicity and bioaccumulation (Freese and Nichols, Inc., 2021). This testing is currently being conducted by PCCA.

Measurable impacts from chemical contaminants such as heavy metals, synthetic organic compounds, and nutrients are not expected to present in sediments. This conclusion is based on pre-dredging bulk analyses and toxicity and bioaccumulation assessments conducted from 1980 to 2002, whose results show that no extensive or severe contamination occurs in the sediments within the CCSC, and that dredged material was suitable for offshore placement without special management conditions (EPA and USACE, 2008; USACE, 2003). Most of the material to be dredged will be new work material, which is unlikely to have been exposed to contaminants or pollution.

2.7 AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

2.7.1 Effects on Plankton

During construction of the Proposed Action, temporary disturbances and impacts to plankton assemblages would occur. Turbidity from total suspended solids tends to reduce light penetration and thus reduce photosynthetic activity by phytoplankton (Wilber and Clarke, 2001). Such reductions in primary productivity would be localized around the immediate area of the dredging and placement operations. This reduced productivity may be offset by an increase in nutrients released into the water column during dredging activities that can increase productivity in the area surrounding the dredging activities (Newell et al., 1998; Wilber and Clarke, 2001). In past studies of impacts of dredged material placement from turbidity and nutrient release, the effects are both localized and temporary (May 1973). Due to the capacity and natural variation in phytoplankton populations, the impacts to phytoplankton from project construction, dredging within the project area, and dredged material placement of material would be temporary.

2.7.2 Effects on Benthos

Impacts to benthos would be localized and temporary; however, benthic organisms are expected to quickly rebound following construction activities since the majority of the project is in shallower, high energy estuarine habitats (Bolam et al., 2010; Bolam and Rees, 2003; Newell et al., 1998; Sheridan, 1999, 2004; VanDerWal et al., 2011; Wilber et al., 2006). There would be direct impacts to benthic organisms, which would be buried or removed during construction of the Proposed Action. Excavation of sediments removes and buries benthic organisms, whereas placement of dredged material and structures smothers or buries benthic communities. Dredging and placement activities may cause ecological damage to benthic organisms due to ecosystem physical disturbance, mobilization of sediment contaminants making them more bio-available, and increasing concentrations of suspended sediments (Montagna et al., 1998).

2.7.3 Effects on Nekton

During construction of the Proposed Action, temporary disturbances and impacts to nekton assemblages would occur. Although there may be temporary and localized effects to nekton due to dredging and placement operations, long-term benefits may result from restoration actions.

2.7.4 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 substantial adverse impacts to populations. Long-term benefits to ecological functions, including trophic dynamics, may result from restoration actions that benefit biota.

2.7.5 Effects on Special Aquatic Sites

Direct impacts to Special Aquatic Sites are anticipated, but the overall action is intended to restore Special Aquatic Sites. The Port Aransas Nature Preserve should benefit from placement of sediment at proposed placement site SS2. Placement of dredged material for BU should restore two shoreline breaches and land at the Port Aransas Nature Preserve.

2.8 PROPOSED DISPOSAL SITE DETERMINATIONS

2.8.1 Mixing Zone Determination

It is assumed that there would be no discharge quality concerns and that no mixing zones would be required.

2.8.2 Determination of Compliance with Applicable Water Quality Standards

Project actions would be performed in compliance with State and Federal regulations and would adhere to applicable water quality standards.

2.8.3 Potential Effects on Human Use Characteristics

2.8.3.1 Municipal and Private Water Supply

There are municipal and private water supplies located within the project area, but water quality of water supplies and drinking water would not be impacted.

2.8.3.2 Recreational and Commercial Fisheries

Although the Proposed Action is anticipated to have minor impacts on salinity, tidal amplitude, tidal velocities, freshwater retention time, and tidal prism (all of which may result in effects to recreational and commercial fisheries), some placement actions targeting restoration may result in the provision of additional habitats for recreational and commercial fisheries.

2.8.3.3 Water-related Recreation

Some placement actions targeting restoration may result in the provision of additional habitats for recreational and commercial fisheries. Bird watching opportunities may also be enhanced with some of the placement actions.

2.8.3.4 Aesthetics

Placement areas that target restoration or beach nourishment may improve aesthetics by restoring natural habitat features. Placement areas with levee improvement and fill may detract from aesthetics.

2.8.3.5 Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

No Federal lands would be affected by the Proposed Action. The Port Aransas Nature Preserve should benefit from placement of sediment at proposed placement site SS2. Placement of dredged material for BU should restore two shoreline breaches and land at the Port Aransas Nature Preserve. State-owned lands include beaches, and beach nourishment may benefit those areas on Mustang and San José islands.

2.9 DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

The Proposed Action is expected to contribute to cumulative effects on tidal amplitude. For example, with the Proposed Action, the tidal amplitude at the Inner Channel near Port Aransas may experience up to a 15 percent increase. When considering the impacts of tidal amplitude of the No-Action condition (–54 feet MLLW authorized depth) over previous condition (–48 feet MLLW authorized depth), modeling indicates that the –54 feet depth also increased the tidal amplitude over the –48 feet depth, by up to 18 percent at the Inner Channel. These modeling results indicate that the CDP would result in a direct cumulative impact to tidal range, particularly at the Inner Channel near Port Aransas where cumulative increases of tidal amplitude approach 36 percent (W.F. Baird and Associates, 2022).

The Proposed Action would result in temporary and localized increases in turbidity which can affect the aquatic ecosystem. The impacts are expected to be minor. Where past, present, or reasonably foreseeable actions may have simultaneous construction and similar impacts, there could be a chance of cumulative effects (although they would be minor, localized, and temporary). Beneficial cumulative effects may result from placement actions that target restoration in conjunction with other ecosystem restoration actions in the region.

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