

Appendix E – Dredged Material Management Plan

Matagorda Ship Channel, TX

Section 216 – Review of Completed Projects
Integrated Draft Feasibility Report and Environmental Impact Assessment

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**US Army Corps
of Engineers®**
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1 Overview

The purpose of dredging is to improve the deep-draft transport of commerce on the Matagorda Ship Channel (MSC) for its existing and future users by:

- Reducing or eliminating light loading measures;
- Allowing larger cargo vessels to begin calls; and
- Potentially allowing for two-way traffic of smaller vessels during periods of increased transits.

According to USACE policy, the dredge material associated with construction or maintenance dredging of navigation projects should be accomplished in a least costly manner consistent with sound engineering practice and meeting all Federal environmental requirements. Hence, the DMMP should be associated with the least cost plan in order to provide information regarding material characteristics, dredging activities, and material placement related to the removal of material from the planning study. The details are presented in the following sections.

2 Existing Conditions

Maintenance dredging of the existing bay reach of the MSC has generally occurred bi-yearly, and the Gulf reach and entrance channel have been maintained approximately every 4 years. The total average annual amount of dredged material is approximately 2.0 mcy (million cubic yards). Maintenance dredging is usually performed with hydraulic pipeline dredging for the bay and hopper dredging equipment for the entrance channel. The placement areas for materials dredged from each station of the channel varied slightly. Material is dredged to the closest placement area as shown in Plate D-01.

3 Dredging Template

The deepening and widening of the MSC for the proposed MSCIP will generate approximately 21.0 mcy of new work and 154.0 mcy of maintenance material over the 50-year span of the project. There are three reaches in this project:

- Lavaca Bay Reach – Station 115+502 to 75+000 including Facilities of CPA and proposed Turning Basin)
- Matagorda Bay Reach – Station 75+000 to 0+000; and
- Offshore Reach – Station 0+000 to -33+000

4 Dredged Material

4.1 Initial Dredging (New Work)

The volume calculations are based on the channel dimensions. The volume calculations include both the overdepth and advanced maintenance requirements. Table 4-1 provides the volumes of the new work dredge material:

Table 4-1. New Work Volumes

Start Station	End Station	Distance Interval (ft)	Volume w/Advanced Maintenance (CY)	Allowable Overdepth (CY)	Total Volume (CY)	PAs	Method
-33+000	-16+000	17,000	2,606,681	634,436	3,241,117	O5	Hopper
-16+000	-6+000	10,000	1,115,407	292,354	1,407,760	SE	Pipeline
-6+000	20+000	26,000	1,886,389	419,862	2,306,250	Sundown Island	Pipeline
20+000	25+000	5,000	577,757	29,262	607,019	NP1	Pipeline
25+000	55+000	30,000	3,557,723	222,288	3,780,011	NP2	Pipeline
55+000	80+000	25,000	2,918,279	228,873	3,147,152	NP3	Pipeline
80+000	85+000	5,000	525,600	71,559	597,159	NP4	Pipeline
85+000	98+400	13,400	1,534,157	66,864	1,601,021	NP5	Pipeline
98+400	113+300	14,900	2,415,745	151,401	2,567,146	NP6	Pipeline
113+300	118+502	5,202	1,519,876	188,887	1,708,763	NP7	Pipeline
				TOTAL:	20,963,397		

4.2 Maintenance Dredging

The estimated maintenance dredging volume is based on a CSAT modeling software that calculates the volume using: historic dredging records, total suspended sediment concentrations, hydrodynamics of the proposed channel, and the amount and location of material placed in unconfined placement areas. Projected annual maintenance volumes for each reach of the channel are provided in Table 4-2. All open water placement areas for maintenance material theoretically have an unlimited capacity since they are unconfined and dispersive.

Table 4-2. Projected Maintenance Volumes

Start Station	End Station	Dredge Quantities per Cycle (CY)	50 Year O&M Quantities (CY)	Placement Area	Method	Frequency (years)
-33+000	-15+000	1,433,731	17,921,632	1	Hopper	4
-15+000	-6+000	716,865	8,960,816	SE	Hopper	4
-6+000	25+000	517,783	12,944,583	Sundown Island	Pipeline	2
25+000	35+000	114,520	2,863,000	OP1	Pipeline	2
35+000	45+000	114,520	2,863,000	OP2	Pipeline	2
45+000	55+000	114,520	2,863,000	OP3	Pipeline	2
55+000	65+000	114,520	2,863,000	OP4	Pipeline	2
65+000	75+000	512,052	12,801,308	OP5	Pipeline	2
75+000	85+000	518,106	12,952,653	OP6	Pipeline	2
85+000	97+446	641,766	16,044,156	OP7	Pipeline	2
97+446	110+000	642,238	16,055,948	OP8	Pipeline	2
110+000	114+000	807,781	20,194,537	OP9	Pipeline	2
114+000	118+502	988,107	24,702,678	OP10	Pipeline	2

4.3 Without vs With Project O&M Quantities

The With Project cycle frequency of O&M dredging will remain 2 years for the main channel and 4 years for the entrance channel. The main channel width will increase from 200' to 300' and the entrance channel will increase from 300' to 550'. The quantities of maintenance dredging volumes will increase due to the increased width of the channel. The O&M quantities per cycle comparing Without Project O&M and With Project O&M quantities are presented in Table 4-3. The average annual increase in O&M cost necessary to dredge additional quantity of material in the With Project channel is approximately \$8,000,000.00 without escalation.

Table 4-3. Without vs With Project Maintenance Volumes

Stationing	Estimated		Frequency (years)
	Without Project O&M per Cycle (CY)	With Project O&M per Cycle (CY)	
-6+000 to 118+502	3,429,922	4,568,131	2
-33+000 to -6+000	1,477,710	2,668,379	4

5 Typical Dredging Equipment

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 placement area (PA), the amount of material, the distance to the disposal or PA, the wave-energy environment, and so forth. Based on these considerations, three types of dredging equipment will be utilized as follows:

- Hydraulic Pipeline Dredges in Lavaca Bay and Matagorda Bay Reaches;
- Hopper dredge or clamshell dredge with dump scows in portions of the Matagorda Bay Reach; and
- Hopper dredge and Hydraulic Pipeline Dredges in the Offshore Reach.

A detailed description of the types of dredging equipment can be found in EM 1110-2-5025, Dredging and Dredged Material Management (USACE. 1983. EM 1110-2-5025). The following sections present three typical dredging equipment.

5.1 Hydraulic Cutterhead (Pipeline)

Hydraulic cutterhead dredges are used when the MSCIP and placement area are close enough to economically pump the dredged material. Hydraulic cutterhead dredges typically are used to place material in upland-confined or bay-confined placement sites through dredge pipelines, but may place dredged material in unconfined placement areas as well. Based on the site layout, expected placement locations, and material type, a hydraulic cutterhead dredge would be suitable for this project for the Lavaca and Matagorda Bay Reaches. An ocean certified cutterhead dredge would also be suitable to dredge the entrance channel in the Gulf of Mexico.

5.2 Mechanical Clamshell

Clamshell dredges along with dump scows are generally used when the placement site is too far away to hydraulically pump dredged material and where the material cut section consists of soft clay. In these operations, dredged material is placed in the dump scows and towed to the placement area. The material may be bottom-dumped from the scow, off-loaded with a crane, or pumped from the scow with a hydraulic loader.

5.3 Hydraulic Hopper

Hopper dredges are used when long stretches of channel are available to allow for unrestricted movement within the dredge area and when the placement site is too far away to economically pump the material. Based on the proposed site layout and expected placement locations, a hopper dredge is most suitable for work in the entrance channel in the Gulf of Mexico, but ocean certified cutterhead dredge or clamshell dredge may provide an acceptable substitute.

6 Placement Plan Formulation

6.1 Previous DMMP Established in Tentatively Selected Plan

Under the new SMART planning guidance in this study, the recommended DMMP has been reviewed and analyzed with respect to pump distance to transport dredged material from the channel since the initial phase of the study because it will be a major cause in increased project costs.

In order to minimize pump distance and thereby reduce costs for placement of both new work and maintenance materials, the main idea of the plan was to utilize new unconfined placement areas located on the west side of the channel as shown in Plate D-01. In this DMMP, existing placement areas to the east of the channel will not be utilized to receive dredged material any longer.

During the establishment of the tentatively selected plan above, it was assumed that the tidal currents in this area were relatively small and were oriented parallel to the channel and placement areas. This provides good evidence that the new work placement areas should perform well as a barrier between the channel and O&M placement areas, and that the currents should not recycle material into the channel. The shoaling rates in this portion of Matagorda Bay were assumed not to have changed significantly since the construction of the channel in the 1960's. Modeling has indicated that the maintenance material is dispersed through wave action within a year of placement (URS 2006). Therefore, placement capacity into these proposed placement areas is unlimited. Table 6-1 provides a list of placement features.

Table 6-1. Placement Features (2017 Tentatively Selected Plan)

Applicant's Preferred Alternative		New Work (mcy)	Maintenance (mcy)
Feature Identity	Feature Description		
ER3/D	Clay Cap on Mercury-Impacted Sediment	2.5	39.5
P1	Onshore Upland	1.1	21.1
PA 14 to PA 16	Potential Placement Areas as Existing Sites		
NP 4 to NP 6	Potential Placement Areas as only for New Work		
NP 2 and NP 3	New Unconfined Area only for New Work	15.7	0.0
Sundown Island	Existing Unconfined Area along GIWW	3.3	4.4
NP 7	Potential Placement Areas only for New Work		
O5	Offshore Dispersive Site	7.6	0.0
A1	In-Bay Upland only for Maintenance	0.0	70.0
OP 8 to OP 10	Potential Placement Areas as only for Maintenance		
OP 2 to OP 7	New Unconfined Area only for Maintenance	0.0	108.9
OP 11	Potential Placement Areas only for Maintenance		
PA 1	Existing Offshore Dispersive Site	0.0	13.6
TOTAL	New Work and Maintenance Material	30.2	257.5

6.2 New Least Cost Placement Plan

The Tentatively Selected Plan was revised to reduce cost with the support of newly acquired information. An Abbreviated Ship Simulation indicated that a majority of planned channel width could be reduced by 50 ft greatly reducing quantities.

Redundant placement areas have been removed from the placement plan to reduce costs due to cutting construction costs and less material required to be dredged at longer distances. PA ER3/D was determined to be unnecessary to construct since sheet pilings would have to be placed along the entire perimeter of the newly constructed portion of the placement area to contain existing contaminated material that may be stirred up while dumping new material. The construction of PA P1 has been determined to be unnecessary unless additional placement capacity is needed for new work dredge material. Sand Engine was added to the placement plan under advisement of Galveston Hydraulics and Hydrology Branch to reduce erosion at the southwest jetty. Most placement areas will remain on the west side of the channel with exception of NP7, OP10 and Sundown Island on the east side of the channel. Updated placement plan is illustrated in Plate D-01.

Shoaling rates were generated by the Galveston Hydraulics and Hydrology Branch utilizing the CSAT shoaling modeling software. With this data, maintenance material quantities were able to be updated from previous DMMP. It was confirmed that the shoaling rates in Matagorda Bay have not changed significantly since the construction of the channel in the 1960's. Table 6-2 provides a list of revised placement features from Table 6-1.

Table 6-2. Revised Placement Features for New Least Cost Plan

Applicant's Preferred Alternative		New Work	Maintenance
Feature Identity	Feature Description	(mcy)	(mcy)
O5	Offshore Dispersive Site	3.2	0.0
Sand Engine	New Unconfined Area for Work and Maintenance Material	1.4	9.0
Sundown Island	Existing Unconfined Area along GIWW	2.3	12.9
NP1 to NP7	New Unconfined Area only for New Work Material	14.0	0.0
OP 1 to OP 10	New Unconfined Area only for Maintenance Material	0.0	114.2
PA 1	Existing Offshore Dispersive Site	0.0	17.9
TOTAL	New Work and Maintenance Material	21.0	154.0

7 Description of Placement Areas

The new least cost plan requires the creation of numerous in-bay placement areas, and potentially an upland placement area. Plate D-01 shows the locations of the placement areas for the new least cost plan. PA capacities will be revised in PED once additional surveys and borings are completed.

Placement area footprints have been assessed for reefs and anomalies. Low cost plan has been finalized regarding the inclusion of these potential unconfined placement areas through cooperation with Galveston District Operations Division. The unconfined placement areas in Plate D-01 were proposed to accept new work and maintenance material corresponding to the

deepening and widening of the channel. These potential unconfined placement areas consist of O5, SE, Sundown Island, NP1, NP2, NP3, NP4, NP5, NP6, and NP7 for new work materials and PA 1, SE, Sundown Island, OP1, OP2, OP3, OP4, OP5, OP6, OP7, OP8, OP9, and OP10 for maintenance materials, respectively. Placement Area P1 will only be constructed and utilized if additional placement capacity is needed for new work dredge material. If Placement Area P1 is constructed and the 1.5 acres of farmed wetlands within footprint is impacted then marsh cells will be constructed as environmental mitigation.

As noted in Plate D-01 for new work material, the distance between the newly proposed unconfined PAs on the west side of the channel is to be located at least 1,500 feet from the channel toe. This distance was selected because the optimum distance from the channel would be the distance at which material from the PA is reasonably prevented from recycling. In most cases, that is between 500 and 2,000 feet. In order to obtain a reliable answer to this question, it was required to review any sediment budgets or transport models created under recent RSM studies. The maximum height of the new work open water unconfined PAs (NP 1 to NP 7) is 2 feet below mean lower low water datum. The design heights of the PAs were estimated utilizing NOAA Sounding Chart as a reference for bathymetry. There is a potential block by entrance Powderhorn Lake if NP 2 and NP 3 are combined into one single PA, the new low cost plan intentionally leaves some open space by separation of the PAs.

Placement Area O5 – New ODMDS as Open-Water Unconfined Placement Area

PA O5 is a 2,663-acre rectangular open-water placement area located approximately 3 miles offshore and 1,200 feet south of the channel centerline. The ODMDS will be used for the placement of approximately 3.2 mcy of new work dredged material from Entrance Channel.

Placement Area 1 – Existing ODMDS as Open-Water Unconfined Placement Area

PA 1 is a 457-acre rectangular open-water placement area located approximately 2 miles offshore and 1,000 feet south of the channel centerline. PA 1 will be used for the placement of approximately 17.9 mcy of maintenance material from the Entrance Channel over a 50-year period.

Sand Engine (SE)

Sand Engine (SE) is an approximate 165-acre, rectangular shaped site located at the entrance channel southwest of the jetties. The Sand Engine was not in previous DMMPs, but deemed as a necessity to reduce erosion at the southwest jetty. Assessment by the USACE Hydraulics and Hydrology Branch concluded that if the land surrounding jetty continues to erode the southwest jetty will fail and likely cause closure of the entrance channel. The Sand Engine will accept both new work and maintenance materials in the 50-year DMMP. The material in the Sand Engine will also nourish the beach as dredge material is carried west by virtue of longshore drift. Sand Engine will be used to contain approximately 1.4 mcy of new work material and 9.0 mcy of future maintenance material over a 50-year period.

Sundown Island as Open-Water Unconfined Placement Area (BU Site as Bird Island)

Sundown Island periodically had received material from maintenance dredging of the Gulf Intracoastal Waterway and Matagorda Ship Channel, but was not previously used to develop the 50-year DMMP. Sundown Island is approximately 442-acres and located southeast of the GIWW. This Island periodically receives material from maintenance dredging of the GIWW and Matagorda Ship Channel. This island will expand to accept both new work and maintenance materials in the 50-year DMMP.

This PA will be used to contain approximately 2.3 mcy of new work material and 12.9 mcy of future maintenance material. Any material placed on this PA will be done in accordance with the current placement limitations followed by the USACE, and utilize the existing authorized footprints. Local coordination, if necessary, will be done prior to placing material on the island to determine the Resource Agency's preferred timeframe for placement. Current guidelines dictate that material will be placed on Sundown Island only between September and February in order to avoid disturbing nesting birds.

New Unconfined Open-Water Placement Areas (NP 1, NP 2, NP 3, NP 4, NP 5, NP 6, and NP7)

These new PAs are located southwest of the ship channel in Matagorda Bay. Regarding the island height and water depth of the new PAs, the top surface of the new PAs is 2 feet below the water (mean lower low water) and the height is estimated utilizing NOAA Sounding Chart as a reference for bathymetry. The areas of NP1, NP6 and NP7 is estimated at 331 acres. The areas of NP 2 and NP 3 are estimated at 1,433 acres and 661 acres. The areas of NP4, NP5, are estimated at 248 acres. Capacity of these open-water placement areas utilizes a retention rate of 50 percent for dredge materials forming new work berms. Retention rate will have to be revised in PED when additional borings and surveys are taken. These seven areas will be used for the placement of approximately 14.0 mcy of new work material.

O&M Unconfined Open-Water Placement Areas (OP 1, OP 2, OP 3, OP 4, OP 5, OP 6, OP7, OP8, OP9, and OP10)

The MSC is currently maintained by placing dredged material in unconfined placement areas along the length of the channel, both in the bay and offshore. The current PAs are located northeast of the ship channel in Matagorda Bay. The proposed placement areas are southwest of the ship channel in Matagorda Bay. These placement areas are unconfined and dispersive and therefore have a theoretical unlimited placement capacity. The areas of OP1, OP2, OP3, OP4, OP5, OP6, OP7, OP9, and OP10 are estimated 331 acres. The area of OP8 is estimated 248 acres. These ten placement areas will be used for the placement of approximately 114.2 mcy of maintenance material over a 50-year period. It should be noted that OP1 to OP10 are located further away from the channel than New Work PAs to avoid maintenance material from shoaling back into channel.

Placement Area P1 – Terrestrial Upland

Placement Area P1 will only be constructed and placed into if additional placement capacity is determined necessary in PED to accommodate new work dredge material. Placement Area P1 will be created south of Alamo Beach on existing agricultural land. The placement area will be designed and scaled to contain quantity of material needed. The containment dike will be constructed utilizing existing material within the placement area. The maximum footprint of this placement area would be 248-acres and could impact a maximum of 1.5 acres of farmed wetland. If impacted, marsh cells will be constructed as environmental mitigation.

8 Hazardous Substances

The Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination as stated in the Project Partnership Agreement (PPA). Such costs shall be paid solely by the Non-Federal Sponsor without reimbursement or credit by the Government.

9 Reference

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