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Galveston District

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VOLUME II

FINAL

ENVIRONMENTAL IMPACT STATEMENT

FREEPORT HARBOR CHANNEL
IMPROVEMENT PROJECT
BRAZORIA COUNTY, TEXAS

U.S. Army Corps of Engineers, Galveston District
2000 Fort Point Road
Galveston, Texas 77550

September 2012

Volume I Contents for Final Environmental Impact Statement

Volume II Contents for Final Environmental Impact Statement Appendices:

Appendices:

Appendix B

Ocean Dredged Material Disposal Site Analysis

Document No. 070281
Job No. 441901

OCEAN DREDGED MATERIAL DISPOSAL SITE ANALYSIS

October 2010

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Contents

Figures

Tables

1.0 INTRODUCTION

The existing Freeport Harbor Project was authorized by the River and Harbor Acts of May 1950 and July 1958, providing for an Outer Bar Channel of 38-foot depth and 300-foot width from the Gulf of Mexico to a point inside the jetties and for inside channels of 36-foot depth and 200-foot width up to and including the Upper Turning Basin. In 1970, Congress passed Section 101 of the River and Harbors Act of 1970 (PL 91-611; House Document 289, 93rd Congress – 2nd Session, December 31, 1975), and in 1974, the president authorized the relocation and deepening (Freeport Harbor Channel 45-Foot Project [45-foot Project]) of the Jetty Channel to 45-foot depth and 400-foot width and the Outer Bar Channel to 47-foot depth and 400-foot width, with an extension of approximately 4.6 miles into the Gulf of Mexico.

The Brazos River Harbor Navigation District (BRHND), or Port Freeport, of Brazoria County, Texas, submitted an application to the U.S. Army Corps of Engineers (USACE), Galveston District, for a Clean Water Act Section 404 permit and River and Harbor Act Section 10 permit for dredge and fill and other construction activities to widen portions of the Freeport Harbor Channel (the Widening Project). Proposed activities include dredging in navigable waters to widen portions of the Freeport Harbor Jetty Channel and all of the Freeport Harbor Outer Bar Channel to 600 feet, with placement of some of the new work dredged material at Quintana Beach and the remainder at the existing 45-foot Project New Work Ocean Dredged Material Disposal Site (ODMDS). The widening of the Jetty and Outer Bar channels at Freeport Harbor will generate a total of 3.2 million cubic yards (mcy) of new work dredged material, with 2.9 mcy placed at the existing 45-foot Project New Work ODMDS.

1.1 PROPOSED FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT

As a concurrent effort, USACE and Port Freeport (non-Federal sponsor) propose to improve the Widening Project navigation channels servicing Freeport Harbor as a Federal action by deepening and extending the current channel alignment, starting approximately 3 miles offshore at the 60-foot depth contour, and terminating at the Stauffer Channel Turning Basin. This proposed Freeport Harbor Channel Improvement Project (FHCIP) will also provide for the creation of two new upland confined placement areas (PAs 8 and 9), adjacent to the Brazos River. The port's Widening Project under permit would occur prior to Federal construction of the other proposed channel improvements. As such, the appropriate future to compare FHCIP alternatives to is the Widening Project, which is the logical Future without-Project Alternative (FWOP-1). The Locally Preferred Plan (LPP) has been adopted by the USACE and Port Freeport as the proposed project plan. Channel dimensions for the LPP can be found in Table 1-1. In general, the LPP Alternative proposes to widen the Entrance and Jetty channels up to 600 feet and deepen to 55 feet, to deepen the Main Channel to 55 feet from the Lower Turning Basin to

Table 1-1
Channel Dimensions for Proposed Plan (LPP)

LPP Plan					
Channel Reach and Station	**Dredged Depth**		**Dredged Over-depth[b]**	**Maximum Maintained Depth (feet)[c]**	**Width (feet)**
	Proposed	***Required Template*** [a]	***Allowable***		
Future Channel Extension Sta. −300+00 to Sta. −370+00	57	59	2	55+4+2	600
Outer Bar Channel Sta. 0+00 to Sta. −300+00	57	59	2	55+4+2	600
Jetty Channel Sta. 71+52 to Sta. 0+00	55	57	2	55+2+2	600
Lower Turning Basin Sta. 78+52 to Sta. 71+52	55	57	2	55+2+2	750-ft diam.
Channel to Brazosport Turning Basin Sta. 101+00 to Sta. 78+52	55	57	1	55+2+1	existing[1]
Brazosport Turning Basin Sta. 115+00 to Sta. 101+00	55	57	1	55+2+1	1,200-ft diam.
Channel from Brazosport Turning Basin Sta. 132+66 to Sta. 115+00	55	57	1	55+2+1	existing[1]
Channel to Upper Turning Basin Sta. 174+00 to Sta. 132+66	52	54	1	52+2+1	existing[1]
Upper Turning Basin Sta. 184+20 to Sta. 174+00	52	54	1	52+2+1	existing[2]
Stauffer Channel, Lower Reach (3,700 feet) Sta. 222+00 to Sta. 184+20	50	52	1	50+2+1	300
Stauffer Channel, Upper Reach (*includes Turning Basin*) Sta. 260+00 to 222+00	25	27	1	Redredge, 25-x-200-ft (Redredge, 25-x-500-ft diam.)	

[a]Proposed Depth + 2-foot Advanced Maintenance.
[b]Box-Cut Below Template. Overdepth is an additional 2 feet from Sta. 82+66 towards Gulf and 1 foot from 82+66 to end of Stauffer.
[c]Authorized Depth + 2-foot Advanced Maintenance + 2-foot Overdraft + 2-foot Wave (Offshore).
[1] Channel width varies between 350 and 400 feet.
[2] Upper Turning Basin diameter is 1,200 feet.

above the Brazosport Turning Basin, and to 50 feet upchannel through the Upper Turning Basin, to deepen the Lower Stauffer Channel to 50 feet and widen it to 300 feet, and to redredge Upper Stauffer Channel to a 25-foot depth. Associated turning basins would also be deepened and widened.

The USACE proposes to place new work (construction) dredged material from the present Entrance Channel and its extension into the existing 45-foot Project New Work ODMDS and future maintenance dredged material from these channels into the existing Maintenance ODMDS (Figure 1-1). It is estimated that approximately 17.3 mcy of new work material would be generated by dredging the LPP project, with 12.7 mcy of the new work material to be placed at the existing 45-foot Project New Work ODMDS, and the remainder to be placed at the existing upland PA (PA 1) and at two newly designated upland PAs (PA 8 and PA 9). Also, on the average, a total of 3.2 mcy/year of future maintenance dredged material will be placed in the existing Maintenance ODMDS, and 0.04 mcy, 0.12 mcy, and 0.19 mcy would be placed in PAs 1, 8, and 9, respectively, on a 3-year cycle.

1.1.1 Project Purpose and Need

Presently, under existing conditions, the maximum ship dimensions permitted by the Brazos Pilots Association at Freeport Harbor are 825 feet length overall (LOA), 145-foot maximum beam, and 42-foot draft. The existing channel configuration operationally constrains ship movement within the Outer Bar and Jetty channels to (a) one-way traffic, (b) daylight-only operations for larger vessels, and (c) restrictions that do not allow the larger vessels to enter the port when winds exceed 20 knots or crosscurrents exceed 0.5 knot. These problems are discussed in more detail below.

- **Lightering and Lightening.** Since the completion of the 45-foot Project, the size of the vessels navigating the waterway has steadily increased so that many vessels currently have to be light-loaded to traverse the channel. The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for navigating the channel. This lightering operation takes place in the Gulf where two ships, the mother ship and the lightering ship, come together so that a cargo transfer can occur. Lightening operations are similar except that cargo is transferred to another ship so that both ships can enter port. Although these operations have occurred frequently in the past, the possibility for a collision, oil spill, fire, or other adverse environmental and/or safety consequences is always present. Current projections indicate that crude imports will increase in the near future. As these imports increase, the number of lightering vessels and product carriers will also increase, adding to shipping delays, congestion, and the risk of collision or spill.

  LOA Restriction. The length limitation of 825 feet is enforced because crosswinds and crosscurrents force tankers to “crab” at an angle through the Entrance Channel. Ships of greater length than 825 feet are not able to clear the jetties under adverse wind and current conditions. Waivers on ship length are granted on a case-by-case basis for ships

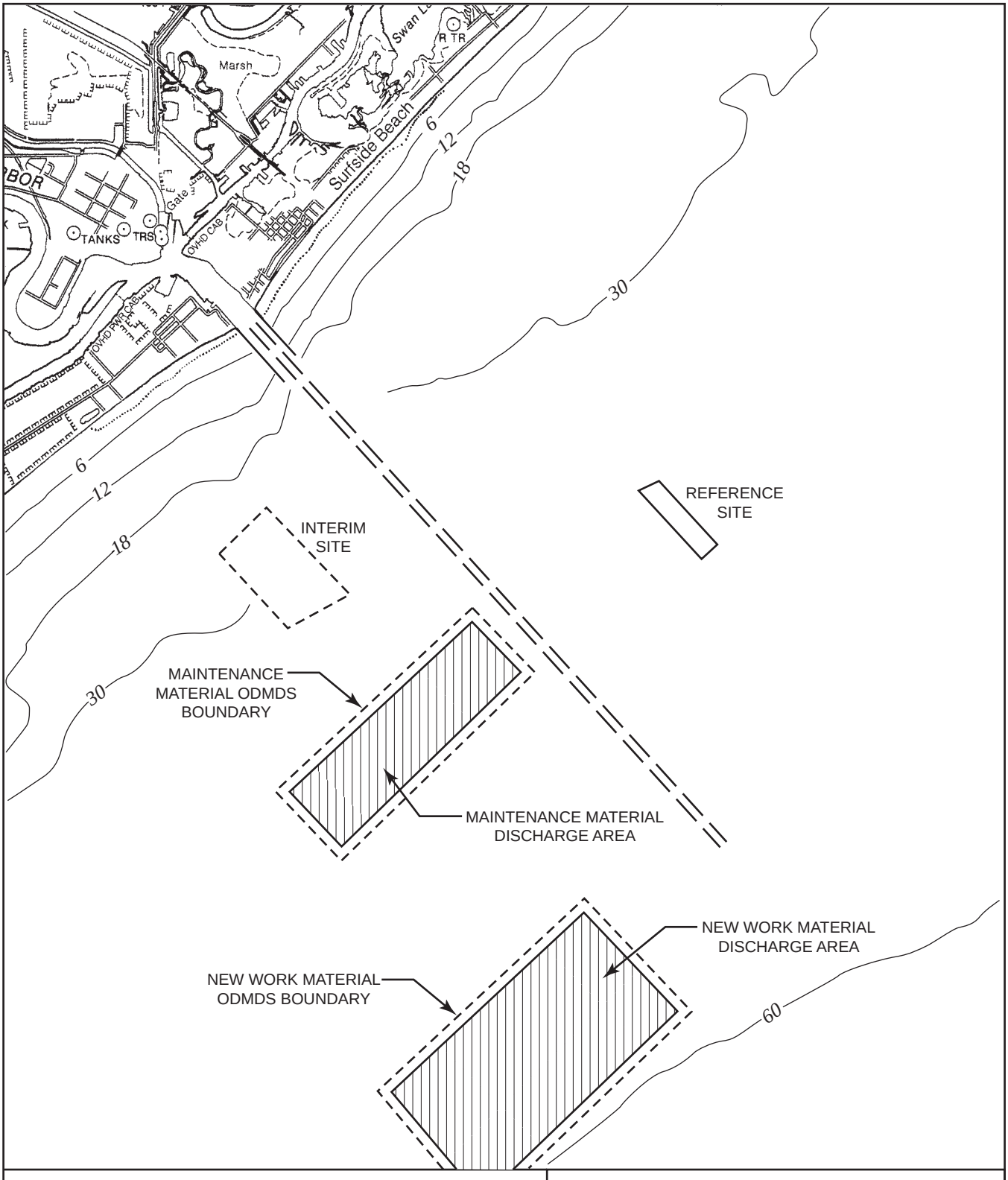

Figure 1-1

GENERAL BATHYMETRY
AND ODMDSs
PORT FREEPORT, TEXAS

Base Map: NOAA Navigation Chart 11321 (1990)

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as large as 900 feet LOA and 160-foot beam to transit the Freeport Harbor Channel, provided that winds are less than 20 knots and that there is no more than a 0.5-knot crosscurrent at the mouth of the jetties. About three to four ships per month are granted these waivers. Numerous requests have been submitted for ships in the 920- to 950-foot LOA range to transit the channel, and these requests have been denied. When denied access to Freeport Harbor, these ships normally divert to Corpus Christi or New Orleans.

- **Beam Restriction**. The maximum beam permitted under normal operations is 145 feet. Vessels with larger beams require waivers to enter port.
- **One-Way Traffic Restriction**. Because of the 400-foot width of the Entrance and Main channels, one-way ship traffic is always in effect in the Freeport Harbor Channel. This can result in delays when ship schedules coincide.
- **Daylight-Only Operation Restriction**. Because of channel dimensions as well as the nature of the cargo of ships calling at Freeport Harbor, daylight-only operation is enforced on all vessels greater than 750 feet LOA or over 107-foot beam. This can result in delays when ship schedules coincide.

Under FWOP-1, the Freeport Harbor Outer Bar and Jetty channels will be widened from 400 to 600 feet, thus eliminating many of the aforementioned operational constraints associated with vessel LOA and beam widths.

However, since the completion of the 45-foot Project, the drafts of ships using Freeport Harbor's waterway has steadily increased so that many vessels currently have to be lightered or lightened to allow for the transport of cargo through the channel. The ship lightering process at Freeport Harbor involves the ship-to-ship transfer of crude oil cargo in the Gulf from extremely large tankers, e.g., Very Large Crude Carriers (VLCC) and Ultra Large Crude Carriers (ULCC), onto one or more smaller tanker (service ship). With lightering, the VLCC or ULCC does not enter Freeport Harbor, but relies on the service ship to transport all or a portion of its crude cargo from a designated lightering zone within the Gulf (approximately 80 miles from Freeport Harbor) to a receiving facility at Port Freeport. Ship lightening is similar to the lightering process with the exception that under the lightening process only enough crude cargo is offloaded from a larger tanker to service ships to permit the larger lightened tanker to transit through a confined channel system. Although lightering and lightening operations have been going on for years at Freeport Harbor, the possibility for a collision, oil spill, fire, or other adverse environmental consequences is always present, along with adding to the costs of shipping.

Port Freeport has experienced significant tonnage growth over the past decade. Review of USACE national statistics shows Port Freeport ranking 24th in the nation in terms of total tonnage in 2002, up from 38th in the early 1990s. Although Port Freeport handles general cargo and containerized cargo, crude petroleum imports account for the majority of throughput. Current projections suggest that crude imports will increase in the future at Port Freeport. As the imports increase, the number of lightering and lightening vessels and product carriers will also increase, adding to shipping delays, congestion, and risk of collision, unless the Freeport Harbor

Channel is deepened. The proposed FHCIP entails deepening the channels at Freeport Harbor, which will provide opportunities for service ships to be more fully loaded and will also allow larger lightened tankers to transit within the channel at greater drafts. The results will be improvements to transportation safety and improvements to transportation savings in the form of reduced shipping costs, stemming from improved navigation efficiency by decreasing the number of lightering and lightening operations, which ultimately translates into economic benefits to the nation.

1.1.2 Project Alternatives

The No Action Alternative is the existing project. The 45-foot Project depth would be maintained throughout the Freeport Harbor Outer Bar and Jetty channels. The remainder of the Freeport Harbor Main Channel, turning basins, and Stauffer Channel would remain as described in Section 1.3 and Table 1.3-1 of the Final Environmental Impact Statement (FEIS). Shoal material would continue to be dredged from the channel during maintenance cycles and placed in the designated ODMDS for the Jetty and Outer Bar channels and in PA 1 for the channel inshore of the Jetty Channel.

As noted above, the Widening Project is the FWOP-1, and it is to this alternative that all FHCIP impacts will be compared, not the No Action Alternative, as is usual.

During its feasibility analysis, the USACE identified two improvement plans for Freeport Harbor. These two plans consisted of the National Economic Development (NED) Plan and the LPP, noted above. Design parameters for channel dimensions are normally based on the channel width versus the maximum vessel beam allowed to transit the channel. Studies (Fugro Consultants, Inc. [Fugro], 2005) showed that the maximum channel width should not exceed 600 feet to maintain jetty stability (550 feet inside Channel Station 38+00); therefore, the USACE did not evaluate alternative plans consisting of a channel width greater than 600 feet. An analysis of the two plans indicates the NED Plan Alternative resulted in the most economic benefits; however, Port Freeport prefers the smaller and less-costly LPP Alternative. Therefore, USACE has selected the LPP as the tentatively Recommended Plan for implementation.

The FHCIP (LPP Alternative) would generate approximately 12.7 mcy of new work dredged material from the Extension, Outer Bar, and Jetty channels that is targeted for disposal at the existing 45-foot Project New Work ODMDS. It is estimated that the new work dredged material to be placed at the existing 45-foot Project New Work ODMDS will consist of 72 percent clay, 21 percent silt, and 7 percent sand/shell.

Based on review of potential beneficial uses (BUs) of dredged material for the proposed Freeport Entrance and Jetty Channel Widening Project, which included an interagency panel review, no cost-effective BUs were identified in the project area, except beach nourishment from a shallow layer of construction material. This decision was made based on the characteristics of the

material, cost to transport the material, impacts associated with placement and manipulation of the material, and impacts to existing resources. However, beach-quality material has not been identified for the FHCIP. Thus, no BU is proposed for the FHCIP.

Following completion of the proposed project, future maintenance of the channel (from the Outer Bar Entrance Channel to the Lower Turning Basin) is expected to be performed on an annual cycle, by dredging 3.53 mcy of maintenance material per year. Since 1992, maintenance dredging has occurred on the channel an average of every 10.3 months, with an average of 1.90 mcy dredged per maintenance cycle, or equivalent to 2.21 mcy per year. The existing Maintenance ODMDS designated by the U.S. Environmental Protection Agency (EPA) for placement of maintenance material from the Freeport Harbor Channel will continue to be used for placement of future maintenance dredged material, provided the EPA concurs that the designation criteria are still being met.

1.2 ODMDS AUTHORIZATION

Ocean disposal of dredged material was not specifically regulated in the United States until passage of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA). Limited regulation was provided by the Supervisors' Act of 1888 and the Refuse Act of 1899. Under these acts, transportation and navigation factors, rather than environmental considerations, guided selection of placement locations by the USACE and the issuance of permits for ocean disposal.

Although the Fish and Wildlife Coordination Act of 1958 initially referred to inland tidal waters, it included consideration of the effects of dredged material on commercially important marine species. This Act, together with subsequent judicial decisions, empowered the USACE to refuse permits if the dredging or filling of a bay or estuary would result in significant, unavoidable damage to the marine ecosystem.

MPRSA and the Federal Water Pollution Control Act (FWPCA), later amended by the Clean Water Act of 1977, both passed in 1972 and specifically addressed waste disposal in the aquatic and the marine environment. The FWPCA and the Water Quality Improvement Act of 1970 set up specific water-quality criteria to be used as guidelines in controlling discharges into marine and aquatic environments. These water-quality criteria applied to placement of dredged material only in cases where fixed pipelines were used to transport and discharge dredged material into the environment at discrete points. MPRSA, however, specifically regulates the transport and ultimate disposal of waste materials in the ocean. Under Title I of MPRSA, the primary regulatory vehicle of the Act, a permit program for the disposal of dredged and nondredged materials, was established that mandates determination of impacts and provides for enforcement of permit conditions.

The August 1975 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Convention) is the principal international agreement governing ocean dumping. The Convention specifies that contracting nations will regulate disposal in the marine environment within their jurisdiction, disallowing all disposal without permits. The nature and quantities of all waste material and the circumstances of disposal must be periodically reported to the International Maritime Organization (formerly the Inter-Governmental Maritime Consultative Organization), which administers the Convention.

In October 1973, the EPA issued the final Ocean Dumping Regulations and Criteria (the Regulations or Ocean Dumping Regulations), revised in January 1977 (40 CFR Parts 220 to 229). These regulations established procedures and criteria for review of ocean disposal permit applications (Part 227); assessment of impacts of ocean disposal and alternative disposal methods; enforcement of permits; and designation and management of ocean disposal sites (Part 228). They also established procedures by which the EPA is authorized to designate ODMDSs and times for ocean disposal of acceptable materials under Section 102(c) of the MPRSA and the criteria for site designation, including general and specific criteria for site selection.

The EPA is mandated with the authority to regulate ocean dumping and with the responsibility for site designation, monitoring, and management by Congress as stated specifically in 40 CFR 228.4(e)(1). Site designation by the EPA does not authorize any dredging project nor does it permit disposal of any dredged material. Sites are designated in areas where a need for ocean disposal has been indicated, based on past dredging demands and/or projected demands associated with new or expanded projects. However, site designation does not in and of itself preclude the consideration of other placement options, including BU options or the No Action Alternative. Once designated as an approved ocean disposal site, the appropriateness of ocean disposal is determined on a case-by-case basis in accordance with the ocean dumping criteria.

Although the EPA is responsible for designating ocean dumping sites according to Section 102 of the MPRSA and such sites may be necessary for construction and maintenance of the proposed improvement project, the USACE may, with concurrence of the EPA, authorize a site in accordance with MPRSA 103(b). For the purpose of the proposed project, the USACE is seeking concurrence from the EPA to place the new construction material dredged from the Extension, Outer Bar, and Jetty channels within the existing 45-foot Project New Work ODMDS and placing the future maintenance dredged material in the existing Maintenance ODMDS. This placement would be implemented by the USACE under the authority of MPRSA Section 103, provided the EPA concurs that Section 102 (MPRSA) requirements continue to be met in regards to the proper evaluation of the criteria and that the approach taken to evaluate the site was appropriate.

The existing designated maintenance material ODMDS is bounded by:

28° 54′ 00″ N, 95° 15′ 49″ W; 28° 53′ 28″ N, 95° 15′ 16″ W;

28° 52′ 00″ N, 95° 16′ 59″ W; 28° 52′ 32″ N, 95° 17′ 32″ W.

Water depth ranges from 31 to 38 feet and the site is 3 miles from shore at its closest point (see Figure 1-1). The area of the site equals 2.02 square statute miles.

The existing designated new work (or construction) material ODMDS, designated for the construction material from the 45-foot Project in 1990, is bounded by:

28° 50′ 51″ N, 95° 13′ 54″ W; 28° 51′ 44″ N, 95° 14′ 49″ W;

28° 50′ 15″ N, 95° 16′ 40″ W; 28° 49′ 22″ N, 95° 15′ 45″ W.

Water depth ranges from 54 to 63 feet and the site is 6 miles from shore at its closest point (see Figure 1-1). The area of the site equals 3.50 square statute miles.

1.2.1 ODMDS Authorization Purpose and Need

The EPA's action resulting from this analysis is to concur with the USACE's proposal to place approximately 12.7 mcy of new work material dredged to improve Freeport Harbor's navigation channels at the existing 45-foot Project New Work ODMDS under the authority of MPRSA Section 103(b), and to concur with annual placement of 3.2 mcy of future maintenance dredged material at the existing Maintenance ODMDS. An FEIS for the new construction and maintenance dredging of the Freeport Harbor Channel (for the authorized 45-foot Project) was prepared by the EPA (1990). The Maintenance ODMDS was designated by the EPA for the continued placement of dredged material removed from the Freeport Harbor Channel, and the New Work ODMDS for construction material was designated for indefinite use during construction of the 45-foot Project in 1990. Offshore dredged material placement under the authority of MPRSA Section 103(b) will provide an environmentally acceptable and economically and physically feasible area for the disposal of the new construction dredged material generated from the deepening and widening of the Freeport Harbor Extension, Outer Bar, and Jetty channels, and disposal of future maintenance material from the extended Outer Bar and Jetty channels.

1.2.2 ODMDS Authorization Alternatives

The EPA (1990) examined a suite of alternatives for the location of the new work material ODMDS and the maintenance material ODMDS. These included the No Action Alternative, upland placement, and offshore. The offshore alternatives included mid-shelf, continental slope, and nearshore, including the interim-designated, historically used site. The alternative analysis concluded that only the nearshore alternative was feasible, and the most appropriate sites were selected by eliminating unfeasible areas. The New Work ODMDS and the Maintenance ODMDS

resulted from the selection process and were designated. The need to identify and evaluate new nearshore alternative sites was obviated by the fact that the previous ODMDS designation analyses (EPA, 1990) are still deemed to be valid and thorough.

2.0 PROPOSED USE OF THE ODMDSs

Predominantly southward longshore transport has caused shoaling of the existing channel at a current rate of approximately 1.90 mcy at approximately 10.3-month intervals, or 2.21 mcy/year. It is anticipated that under the improved conditions, the annual maintenance dredged material volume within the extended Outer Bar and Jetty channels will increase by 1.24 mcy/year, to a total of 3.47 mcy/year.

The proposed use of the existing maintenance material ODMDS is for future maintenance material. The existing site was sized based on a 2.1-mcy discharge (EPA, 1990); however, as discussed below, modeling was conducted to ensure that it is large enough to contain future maintenance dredged material volumes.

The existing New Work ODMDS was designated for indefinite use for the 45-foot Project (EPA, 1990), based on receiving an anticipated 5.1 mcy of construction material. It is proposed that this site be used for the placement of an additional 12.7 mcy of new work construction material from the FHCIP.

3.0 CHARACTERIZATION OF THE ODMDSs

Based on information provided by the USACE, Table 3-1 provides dredging dates and volumes dredged from the Freeport Harbor Outer Bar and Jetty channels from 1951 through 2009. However, only the dredging history in the period since deepening to 45 feet, 1992 through 2009, is included in the frequency and volume calculation. For that period, the average time between the beginnings of each dredging operation is approximately 10.3 months, and the average amount of maintenance material dredged is approximately 1.90 mcy. This does not mean that all of the Outer Bar and Jetty channels are dredged every 10.3 months, on average, but it does indicate the average frequency of use of the Maintenance ODMDS.

Chemical data have been collected on ODMDS sediments from the Maintenance ODMDS at intervals since 1974. Additionally, a study was conducted by Battelle (2004) for the EPA in 2003. The USACE and EPA/Battelle data (Battelle, 2004) are presented in Tables 3-2 and 3-3, respectively. The data as discussed in Section 3.5 of the EIS to which this document is attached, and the ODMDS and Reference Site data, as shown in Table 3-2, indicate no cause for concern. The range of concentrations is similar for the USACE and the EPA/Battelle (Battelle, 2004) data. Relative to the data in Table 3-3, Battelle (2004) states:

Table 3-1
Dredging History

Start	Finish	Dredge Work Type	Total Yards
Nov-51	Nov-51	Maintenance	474,788
Oct-71	Dec-71	Maintenance	957,085
Nov-70	May-71	Maintenance	1,614,436
Oct-71	May-72	Maintenance	1,161,215
Nov-72	May-73	Maintenance	868,540
Sep-73	Jan-74	Maintenance	1,089,540
Dec-73	Jan-74	Maintenance	743,610
Nov-74	Dec-74	Maintenance	1,010,361
Sep-75	Dec-75	Maintenance	2,095,572
Aug-78	Oct-78	Maintenance	966,648
Aug-80	Jan-81	Maintenance	1,098,920
Jun-82	Aug-82	Maintenance	1,388,226
Jun-83	Oct-83	Maintenance	1,109,789
Oct-84	Nov-84	Maintenance	1,186,135
Oct-84	Nov-84	Maintenance	212,799
Jul-86	Aug-86	Maintenance	925,709
May-87	Jul-87	Maintenance	1,241,905
Sep-87	Sep-87	Maintenance	213,773
Aug-88	Sep-88	Maintenance	843,940
Aug-89	Sep-89	Maintenance	999,961
Aug-92	Nov-92	Maintenance	2,884,532
Jul-93	Sep-93	Maintenance	1,415,742
Aug-94	Nov-94	Maintenance	2,599,267
Sep-95	Jan-96	Maintenance	2,674,026
Jul-96	Aug-96	Maintenance	579,500
Jan-97	Apr-97	Maintenance	2,489,108
Nov-97	Dec-97	Maintenance	1,053,157
Oct-98	Dec-98	Maintenance	2,334,436
Sep-99	Jan-00	Maintenance	1,555,615
Jul-00	Nov-00	Maintenance	1,859,847
Oct-00	Jan-01	Maintenance	2,202,288
Jun-01	Sep-01	Maintenance	2,479,249
May-02	Aug-02	Maintenance	1,996,354
Aug-03	Oct-03	Maintenance	1,726,186
Sep-04	Nov-04	Maintenance	1,908,831
Dec-05	Feb-06	Maintenance	1,911,091
May-06	May-06	Maintenance	200,511
Oct-06	Feb-07	Maintenance	2,516,000
Oct-07	Dec-07	Maintenance	1,415,421
Oct-08	Dec-08	Maintenance	1,577,096
Oct-09	Nov-09	Maintenance	2,420,755[a]

[a] 7,500 cy dredged in January 2010.

TOTAL					
No. years	59	years/cycle	1.44	Total cy	60,001,964
No. dredgings	41	months/cycle	17.3	cy/cycle	1,463,463
				cy/year	1,016,982
SINCE 1992					
No. years	18	years/cycle	0.86	Total cy	39,799,012
No. dredgings	21	months/cycle	10.3	cy/cycle	1,895,191
				cy/year	2,211,056

> There were no elevated concentrations of metals in sediments from the active discharge quadrants (Q1 and Q2), the inactive quadrants (Q3 and Q4), the Down Current site, or the Reference site. No measurements exceeded ER-L guidelines (Long et al., 1995) and all concentrations were similar to those reported for the earth's crust, indicating only natural input (Krauskopf, 1967).

The Battelle Sampling Plan included two stations in the discharge area of the Maintenance ODMDS (see Figure 1-1), two in the downcurrent area of the Maintenance ODMDS (where placement does not occur), a station located 1,000 feet downcurrent of the Maintenance ODMDS, and a reference station (see Reference Site, Figure 1-1). All stations were a composite of samples collected at three substations. It should be noted that sediment had recently been placed in the Maintenance ODMDS, and so there was some mounding in the actual disposal area, but none in the nonplacement areas of the Maintenance ODMDS. Battelle calculated that enough maintenance material had been placed in the site since it was designated to create a mound 33.4 feet high, had it remained in place. However, because it is a dispersive site, mounding of only 2 to 4 feet in the northeastern third of the Maintenance ODMDS, probably from the recently placed material, was observed. Battelle (2004) also found that the majority of benthic macroinfaunal indicators were negatively correlated to percent fines, which could lead to a short-term impact on the infauna since maintenance material averaged 8.9 percent (Project EIS Table 3.4-2) sand versus 24.9 percent and 17.3 percent average sand for the Maintenance ODMDS and Reference site, respectively, based on the data in Tables 3-2 and 3-3.

Conversely, USACE studies (Espey, Huston & Associates, Inc. [EH&A, now PBS&J], 1991, 1993a, 1993b, 1994) demonstrated that impacts from construction material placement at the New Work ODMDS were not detected 6 months after cessation of dredging. Sand content near the New Work ODMDS averaged 11 percent during the predredging survey in 1990 versus 38 percent for the reference sediment. Six months after placement, the sand content increased to 48 percent near the New Work ODMDS versus 54.6 percent at the reference site. In the preconstruction benthic invertebrates survey, only one of the eight monitoring stations surrounding the New Work ODMDS had a greater number of taxa than the reference station. Six months after construction, only one station had fewer. Similar results were found for total number of individuals and mean density. By 18 months after construction, the sand content at the reference site was generally higher than at the monitoring stations surrounding the New Work ODMDS, and benthic metrics were also higher, confirming the results found by Battelle (2004).

Table 3-2
Detected Parameters
Freeport Harbor Entrance Channel ODMDS and Reference Stations

		Station:				FH-88-DA1			FH-88-REF1			FH-89-DA1			FH-89-REF1		
		Date:				3/15/1988			3/15/1988			4/7/1989			4/7/1989		
		Channel Station:															
Parameter	**Liquid Media Unit**	**Solid Media Unit**	**WQC**	**TWQS**	**ERL**	**Water**	**Elutriate**	**Sediment**	**Water**	**Elutriate**	**Sediment**	**Water**	**Elutriate**	**Sediment**	**Water**	**Elutriate**	**Sediment**
Sand		%						46.8			23.6						56.2
Silt		%						34.7			64.2						40.3
Clay		%						18.5			12.2						3.5
D50		mm						0.07									0.08
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<2.0		2.27	<2.0	<2.0	3.14	<2.0		<1.0	<2.0	<2.0	<1.0
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	4.40		<0.1	2.60	2.70	<0.1	<2.0		<0.1	<2.0	<2.0	<0.1
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<10.0		8.68	<10.0	<10.0	10.11	<10.0		4.60	<10.0	<10.0	3.90
Copper	µg/L	mg/kg	4.8	13.5	34.0	4.0		4.20	<1.0	<1.0	4.79	<1.0		5.90	<1.0	<1.0	2.60
Lead	µg/L	mg/kg	210	133	46.7	<5.0		5.60	<5.0	<5.0	6.38	<5.0		1.20	<5.0	<5.0	<1.0
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.1	<0.20	<0.2	<0.1	<0.20		<0.1	<0.20	<0.2	<0.1
Nickel	µg/L	mg/kg	74	118	20.9	24.2		7.00	25.6	27.8	9.04	<5.0		7.10	<5.0	<5.0	4.90
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<1.0	<2.0	<2.0	<1.0	<2.0		<0.5	<2.0	<2.0	<0.5
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	**98.6**		27.45	39.2	<5.0	30.32	<5.0		14.8	<5.0	<5.0	18.1
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Total PCB	µg/L	µg/kg	N/A	N/A	N/A	<0.5		<5.0	<0.5	<0.5	<5.0	<0.5		<5.0	<0.5	<0.5	<5.0
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Table 3-2 (Continued)

Parameter	Liquid Media Unit	Station: / Date: / Channel Station: / Solid Media Unit	WQC	TWQS	ERL	FH-93-DA1 7/20/1993			FH-93-REF1 7/20/1993			FH-95-DA1 2/2/1995			FH-95-REF1 2/2/1995		
						Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						12.7			21.8			5.4			6.0
Silt		%						63.2			46.8			66.4			75.2
Clay		%						24.1			31.4			28.2			18.8
D50		mm						0.02			0.04			0.06			0.06
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0		<0.10	<1.0	<1.0	<0.10
Barium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.10		1.10	<0.10	<0.10	1.00	14.90		**329.10**	15.30	**42.30**	**145.50**
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		11.70	<1.0	<1.0	12.00	<1.0		<0.10	<1.0	<1.0	<0.10
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.0		4.70	<1.0	<1.0	4.60	<1.0		36.04	<1.0	<1.0	27.86
Lead	µg/L	mg/kg	210	133	46.7	<1.0		5.10	<1.0	<1.0	4.70	<1.0		15.38	<1.0	<1.0	16.04
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.02	<0.20	<0.2	<0.02	<0.20		**15.40**	<0.20	<0.2	**8.95**
Nickel	µg/L	mg/kg	74	118	20.9	<1.0		16.30	5.2	<1.0	8.10	<1.0		<0.10	<1.0	<1.0	<0.10
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.20	<2.0	<2.0	<0.20	<2.0		23.07	<2.0	<2.0	20.16
Silver	µg/L	mg/kg	1.9	2.0	1.00	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0		30.4	<1.0	52.3	29.7	<1.0		<0.10	<1.0	<1.0	<0.10
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Total PCB	µg/L	µg/kg	N/A	N/A	N/A	<0.5		<50.0	<0.5	<0.5	<50.0	<0.5		88.51	<0.5	<0.5	67.62
Ammonia	mg/L	mg/kg	Var	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Table 3-2 (Continued)

		Station:				FH-97-PA1A			FH-97-REF1			FH-97A-PA1A			FH-97A-REF1		
		Date:				1/25/1997			1/25/1997			9/30/1997			9/30/1997		
		Channel Station:															
Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment	Water	Elutriate	Sediment
Sand		%						18.1			18.7			6.7			8.8
Silt		%						24.7			33.2			48.8			38.5
Clay		%						57.2			48.1			44.5			52.7
D50		mm						0.00			0.01			0.01			0.00
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	8.0	2.96	<1.0	8.0	3.66
Barium	µg/L	mg/kg	N/A	N/A	N/A	25.7		110.0	25.1	17.4	217.0	24.7	56.0	231.0	17.6	28.0	208.0
Cadmium	µg/L	mg/kg	40	45.4	1.20	<0.1		<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10	<0.1	<0.1	<0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		33.9	<1.0	<1.0	22.1	<1.0	<1.0	16.1	<1.0	<1.0	22.9
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00		19.3	1.80	4.36	13.6	<1.00	<1.00	9.77	<1.00	<1.00	11.3
Lead	µg/L	mg/kg	210	133	46.7	<1.0		45.0	<1.0	<1.0	25.3	1.07	<1.0	3.26	<1.0	<1.0	3.23
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		<0.02	<0.20	<0.2	<0.02		<0.20	0.02		<0.20	0.02
Nickel	µg/L	mg/kg	74	118	20.9	<1.0		**23.1**	<1.0	<1.0	18.9	<1.0	1.0	15.6	<1.0	1.0	18.9
Selenium	µg/L	mg/kg	290	564	N/A	<2.0		<0.20	<2.0	<2.0	<0.20	<1.0	<1.0	<0.20	<1.0	<1.0	<0.20
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0		<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10	<1.0	<1.0	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	<1.0		62.4	<1.0	4.3	52.3	<1.0	10.3	55.4	6.1	14.4	70.0
TOC	mg/L	%	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total PCB	µg/L	µg/kg	N/A	N/A	N/A	<0.01		<1.0	<0.01	<0.01	<1.0	<0.01	<0.01	<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03		6.58	<0.03	0.64	6.74	<0.03	<0.03	4.10	<0.03	<0.03	3.84

Table 3-2 (Continued)

Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Station: FH-98-PA1A Date: 9/30/1997 Channel Station: Water	Elutriate	Sediment	FH-98-REF1 9/30/1997 Water	Elutriate	Sediment	FH-OB-00-PA1A 5/23/2000 Water	Elutriate	Sediment	FH-OB-00-REF1 5/23/2000 Water	Elutriate	Sediment
Sand		%						1.6			21.9			28.2			6.1
Silt		%						44.3			41.0			41.6			33.4
Clay		%						54.1			37.1			30.2			60.5
D50		mm						0.00			0.02			0.05			0.00
Percent Solids		%															
Arsenic	µg/L	mg/kg	69	149	8.2	<1.00		5.77	<1.00	<1.00	3.94	<1.00		3.43	<1.00	<1.00	4.92
Barium	µg/L	mg/kg	N/A	N/A	N/A	23.7		151	22.2	57.9	122	31.7		76.0	26.2	47.5	81.2
Cadmium	µg/L	mg/kg	40	45.4	1.20	0.17		0.14	<0.10	<0.10	<0.10	0.60		<0.10	0.90	0.40	0.10
Chromium	µg/L	mg/kg	1,100	1,090	81.0	<1.0		17.9	<1.0	<1.0	13.5	<1.00		6.00	<1.00	<1.00	8.91
Copper	µg/L	mg/kg	4.8	13.5	34.0	<1.00		12.10	<1.00	<1.00	9.83	<1.00		7.53	<1.00	<1.00	9.34
Lead	µg/L	mg/kg	210	133	46.7	<1.0		4.58	<1.0	<1.0	3.41	<1.00		11.1	<1.00	<1.00	16.1
Mercury	µg/L	mg/kg	1.8	2.1	0.15	<0.20		0.02	<0.20	<0.20	0.05	<0.20		0.04	<0.20	<0.20	0.04
Nickel	µg/L	mg/kg	74	118	20.9	<1.00		15.4	<1.00	<1.00	12.1	4.00		8.04	<1.00	<1.00	12.50
Selenium	µg/L	mg/kg	290	564	N/A	<1.00		<0.20	<1.00	<1.00	<0.20	<1.00		0.20	<1.00	<1.00	0.27
Silver	µg/L	mg/kg	1.9	2.0	1.00	<1.0		0.23	<1.0	<1.0	<0.10	<1.00		<0.10	<1.00	<1.00	<0.10
Thallium	µg/L	mg/kg	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Zinc	µg/L	mg/kg	90	92.7	150	20.5		51.8	10.6	1.1	44.2	10.7		31.2	47.1	5.2	34.3
TOC	mg/L	%	N/A	N/A	N/A	<1.00		7350	<1.00	<1.00	6880	<1.0		10100	<1.0	<1.0	15500
Total PCB	µg/L	µg/kg	N/A	N/A	N/A	<0.01		<1.00	<0.01	<0.01	<1.00	<0.01		<1.00	<0.01	<0.01	<1.00
Ammonia	mg/L	mg/kg	Var	N/A	N/A	<0.03		11.8	<0.03	5.70	5.70	<0.03		29.0	<0.03	0.36	3.05

Table 3-2 (Concluded)

Parameter	Liquid Media Unit	Solid Media Unit	WQC	TWQS	ERL	Station: FH-EC-04-REF Date: 4/29/2004 Channel Station: Water	Elutriate	Sediment	Station: FH-EC-05-REF Date: 6/29/2005 Channel Station: Water	Elutriate	Sediment
Sand		%						12.9			7.5
Silt		%						28.2			5.7
Clay		%						58.9			86.8
D50		mm						0.00			0.00
Percent Solids		%						47.2			47.4
Arsenic	µg/L	mg/kg	69	149	8.2			6.93			7.53
Barium	µg/L	mg/kg	N/A	N/A	N/A			N/A			N/A
Cadmium	µg/L	mg/kg	40	45.4	1.20			0.13			0.2
Chromium	µg/L	mg/kg	1,100	1,090	81.0			19.6			23.8
Copper	µg/L	mg/kg	4.8	13.5	34.0			12.2			15.4
Lead	µg/L	mg/kg	210	133	46.7			17.6			16.8
Mercury	µg/L	mg/kg	1.8	2.1	0.15			<0.20			<0.20
Nickel	µg/L	mg/kg	74	118	20.9			18.8			20.8
Selenium	µg/L	mg/kg	290	564	N/A			<0.50			<0.50
Silver	µg/L	mg/kg	1.9	2.0	1.00			<0.20			<0.20
Thallium	µg/L	mg/kg	N/A	N/A	N/A			0.21			0.38
Zinc	µg/L	mg/kg	90	92.7	150			25.4			17.9
TOC	mg/L	%	N/A	N/A	N/A			10300			13300
Total PCB	µg/L	µg/kg	N/A	N/A	N/A			N/A			N/A
Ammonia	mg/L	mg/kg	1.7	N/A	N/A			71.0			12.2

Chromium = CrIII and Total Cr

Var = varies based on pH, salinity, and temperatures

N/A means that no analyses were conducted for a particular parameter in a particular year

WQC = EPA Acute, Marine Water Quality Criterion; TWQS = Texas Acute, Marine Water Quality Standard; ERL = Effects Range Low

µg/L = micrograms per liter; µg/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; mm = millimeters

Table 3-3
Metal Concentrations in Sediments*
(mg/kg dry weight)

Metal	Site						ER-L [1]	Earth Crust [2]
	Q1	Q2	Q3	Q4	DC	Reference		
Antimony	0.025	0.025	0.025	0.025	0.025	0.06	-	0.2
Arsenic	5.1	5.1	5.4	3.8	4	5.3	8.2	1.8
Beryllium	0.83	0.84	0.54	0.54	0.59	0.97	-	2.8
Cadmium	0.064	0.083	0.039	0.046	0.043	0.116	1.2	0.2
Chromium	20.7	16.1	11.8	10.6	11.7	16.4	81	100
Copper	8.65	10	5.68	6.17	6.66	13.5	34	55
Lead	14.2	14.4	10.2	9.79	11	14.1	46.7	12.5
Mercury	0.03	0.03	0.02	0.02	0.02	0.02	0.15	0.08
Nickel	16.1	16.5	11.7	11.4	12.3	19.7	20.9	75
Selenium	0.4	0.4	0.5	0.4	0.4	0.6	-	0.05
Silver	0.04	0.05	0.03	0.03	0.03	0.04	1	0.07
Zinc	54.3	50.4	41.8	39.6	43.3	45.5	150	70

[1] = Long et al. (1995).

[2] = Krauskopf (1967)

* Verbatim from Battelle (2004)

4.0 CHARACTERIZATION OF THE MATERIAL EXPECTED TO BE DREDGED

4.1 CONSTRUCTION (NEW WORK) MATERIAL

Throughout this document, it is assumed that information relative to the construction material dredged for the 45-foot Project and presented in EPA (1990) is valid for the proposed FHCIP, since the FHCIP is an expansion of the 45-foot Project by widening and deepening. The data included in EPA (1989, 1990) are included in this document by reference. However, the standards and criteria to which the sample concentrations are compared have changed since the New Work ODMDS was designated in 1990. Therefore, where pertinent, the data from EPA (1989) is discussed. Additionally, chemical analyses were conducted on material from core samples taken from within the proposed FHCIP (Fugro, 2005; PBS&J, 2006). Those data are included in Table 4-1.

There were six exceedances of effects range low (ERLs) in the Fugro (2005) data (see Table 4-1), all by nickel, with an ERL of 20.9 milligrams per kilogram (mg/kg). The exceedance values ranged from 23.8 mg/kg (114 percent of the ERL) to 35.3 mg/kg (170 percent of the ERL). However, for the Sabine-Neches Waterway Channel Improvement (SNWW CIP) contaminant assessment study (PBS&J, 2004), a proposed project within geographic proximity to the proposed FHCIP, concentrations in some instances had exceeded ERL, but no toxicity was exhibited by sensitive water column or benthic organisms, during bioassays conducted on the sediments according to procedures provided in EPA/USACE (1991). The results of the bioassays and several other factors lead to the conclusion that the nickel ERL exceedances do not lead to a cause for concern at Freeport Harbor and vicinity. The other factors are (1) there is no way to determine whether nickel was the causative factor in the data that led to the nickel ERL (see 45-foot Project Environmental Impact Statement (EIS) Section 3.3.1); (2) toxicity data from the SNWW CIP have demonstrated that nickel concentrations in the same range as those found in the Freeport Harbor samples did not cause toxicity; (3) the Freeport Harbor concentrations are less than a factor of two of the ERL; (4) the Port Freeport concentrations are below the Effects Range Medium (ERM) concentration (51.6 mg/kg) and well below the Apparent Effects Threshold values, of which 110.0 mg/kg (for echinoderm larvae) is the lowest value (Buchman, 1999); and (5) there are no Action Levels established by the Food and Drug Administration for poisonous or deleterious substances in human food and animal feed (which includes fish and shellfish) for nickel. Based on this information and the fact that no other ERLs were exceeded at the Freeport Harbor Outer Bar and Jetty channels, there would appear to be no cause for concern relative to placing these soils in the Gulf of Mexico.

A reexamination of the data presented in EPA (1989) determined that the concentration of no parameter in the elutriates exceeded the EPA Water Quality Criteria (WQC) (Table 4-2), except

Table 4-1
Concentrations of Detected Constituents in Soils (dry weight)
Freeport Harbor Channel Improvement Project

Date Sampled: February 2005

Parameter	Units	NOAA ERL*	B-1,E,26' 0211038	B-2,E-1,24' 0211039	B-2,E-2,46' 0211040	B-3,E-1,26' 0211041	B-3,E-2,35' 0211042	B-4,E-1,35' 0211043	B-4,E-2,40' 0211044	B-5,E-1,34' 0211045	B-5,E-2,59' 0211046	B-6,E-2,32-34' 0211047
Antimony	mg/kg	N/A	< 0.0986	< 0.0934	< 0.0971	< 0.0948	< 0.0977	< 0.0977	< 0.0971	< 0.0878	< 0.0910	< 0.0966
Arsenic	mg/kg	8.2	2.7	2.4	1.4	0.700	8.2	2.0	4.1	0.600	2.0	1.6
Beryllium	mg/kg	N/A	1.15	1.18	1.46	0.274	1.46	0.743	1.16	0.142	0.983	0.433
Chromium, Total	mg/kg	81.0	28.1	46.0	59.9	7.8	46.8	15.3	23.2	4.1	20.2	9.9
Copper	mg/kg	34.0	25.8	19.1	19.9	3.6	26.1	10.1	19.5	1.6	12.2	4.6
Lead	mg/kg	46.7	14.9	27.6	29.9	5.1	39.9	7.0	15.6	2.8	10.7	6.8
Manganese	mg/kg	N/A	257.7	184.7	214.1	130.2	723.2	157.2	489.6	85.2	290.1	311.9
Mercury	mg/kg	0.150	< 0.00794	< 0.00664	< 0.00663	< 0.00613	< 0.00647	< 0.00597	< 0.00647	< 0.00602	0.0111	0.0129
Nickel	mg/kg	20.9	**30.2**	**26.8**	**33.3**	6.0	**35.3**	17.6	**29.8**	3.3	**23.8**	10.6
Thallium	mg/kg	N/A	0.294	0.284	0.340	< 0.190	0.324	< 0.195	0.285	< 0.176	0.214	< 0.193
Zinc	mg/kg	150	61.7	63.1	73.5	38.0	64.5	34.8	58.9	10.5	50.4	40.6
Fluoranthene	ug/kg	600	< 635	< 531	< 265	534	< 259	< 239	< 259	< 241	< 237	< 259
Percent Solids	%	N/A	63.0	75.3	75.4	81.5	77.3	83.8	77.3	83.0	84.5	77.1

ERL = Effects Range Low for Marine Sediments. There are no ERLs for soils.
Bold indicates exceedance of an ERL.

perhaps copper in 1976, and nickel in one boring station (Station 12, 0–6 feet) of 19 in 1974. The concentration of copper (<10 micrograms per liter [µg/L]) may exceed the WQC, but since the detection limit (10 µg/L) was higher than the Criterion, this cannot be determined. However, the WQC for copper has been raised from 2.9 to 4.8 µg/L, so the likelihood of an exceedance is no greater than when the New Work ODMDS was designated.

Table 4-2
Range of Values for Elutriate Samples
with Channel New Work Sediment

Parameter	Water Quality Criteria[a]	1974[b]	1976[b]
Metal (µg/L)			
Arsenic	69	–	0.1–4
Cadmium	40	<1	2–3
Chromium	1,100	–	10–20
Copper	4.8	–	10
Lead	210	–	10–20
Mercury	1.8	–	0.36–0.73
Nickel	74	40–130	10–20
Selenium	290	–	0.1–1.9
Zinc	90	–	10–20

[a]EPA (2006).
[b]USACE (1978).

4.2 MAINTENANCE MATERIAL

As noted above, the characteristics of the maintenance material are discussed in Section 3.5 of the Project EIS to which this document is appended and are not repeated here.

5.0 MODELING OF DREDGED MATERIAL DISTRIBUTION

The placement of dredged material was simulated using an updated version (Multiple Dump Fate [MDFATE]; USACE/EPA, 1991) of a 1976 model, Dredged Material Fate (DMF), developed for the USACE through the Dredged Material Research Program by Tetra Tech., Inc. (Brandsma and Divoky, 1976). The modifications to this model were made under the supervision of Dr. Billy H. Johnson of the Engineer Research and Development Center (formerly the Waterways Experiment Station) of the USACE. The purpose of the modeling was to determine whether the previously designated New Work ODMDS and the existing Maintenance ODMDS were of sufficient size to contain the new work (construction) and future maintenance dredged material from the FHCIP.

This program models the initial behavior and final disposition of dredged material deposited "instantaneously" at the site of interest through the doors of a hopper dredge. The MDFATE model assumes that this procedure may be broken into three phases: (1) convective descent, during which the discharge cloud falls under the influence of gravity; (2) dynamic collapse, occurring when the descending cloud impacts the bottom or arrives at a level of neutral buoyancy, at which point the descent is retarded and horizontal spreading dominates; and (3) long-term passive dispersion, commencing when the material transport and spreading are determined more by ambient currents and turbulence than by the dynamics of the disposal operation (Johnson and Holliday, 1978). The model also includes the settling of suspended solids.

The model was run for the size of hopper dredge that is anticipated to be used for this project, a 3,600-cubic yard (cy) hopper dredge (19.5-foot loaded draft, 9.5-foot light draft, 27-inch suction pipe, 11 knots loaded, 12 knots light, 4 knots during discharge, 4 minutes to empty hoppers). Model runs were made for both the previously designated New Work ODMDS and the existing Maintenance ODMDS. Based on EPA (1989), it was anticipated that a 0.5-knot surface current and a 0.25-knot bottom current would be used in the modeling. However, the model will accept only one current velocity, so a 0.38-knot current, parallel to the long axis of the ODMDSs, was entered into the model.

5.1 NEW WORK MATERIAL

The percentage of the various soil particle types anticipated in the new work sediment to be dredged was estimated using the information from EPA (1989) and confirmed by Fugro (2005) to be 2.5 percent shell, 4.5 percent sand, 21.0 percent silt, and 72 percent clay (as clayballs).

Output from the MDFATE model simulates the results of randomly depositing the entire amount of dredged material on the ocean floor at predetermined grid points. For a dredged material volume of 10.65 mcy, MDFATE simulated the mound height at its highest peak within the New Work ODMDS as 12 feet. As can be seen in Attachment A, there are a few streaks of build up outside the New Work ODMDS boundaries, but it appears the maximum height for that build up is not more than 0.3 foot (less than the 1-foot threshold that is proposed in the ODMDS Site Management Plan). Given the upslope ambient depth at the site is 52 feet, there should not be any interference to navigation associated with formation of the new work dredged material disposal mound. Subsequent to the MDFATE modeling effort, the new work dredged material volume for offshore placement was reforecasted from 10.65 to 7.75 mcy. This change in new work volume was a result of changing the assumption that Port Freeport would implement the widening of the Outer Bar and Jetty channels prior to construction of the FHCIP. Given the new work volume for offshore disposal has been reduced, it has been safely assumed that the maximum disposal mound height within the New Work ODMDS will not exceed 12 feet, nor will the material build up more than 0.3 foot outside the boundaries of the ODMDS.

5.2 MAINTENANCE MATERIAL

The MDFATE model program was also run on the maintenance material using a 3,600-cy hopper dredge. The percentage of the grain sizes anticipated in the maintenance material to be dredged from the extended Outer Bar and Jetty channels was based on the grain size of past maintenance material, using historical information from analyses of maintenance material from the existing channel dating from 1988 through 2005 (USACE Galveston District Dredging Histories Data Base). The MDFATE simulations for future maintenance dredged material placement utilized the historic maintenance material grain-size data as input. The total volume of maintenance material modeled for placement was 3.74 mcy. As with the new work simulation, minor streaks of maintenance dredged material can be seen building up outside of the Maintenance ODMDS boundaries. However, these streaks resulted in a height of less than 1 foot; therefore, adverse impacts to the benthic community outside of the ODMDS boundaries should not be experienced (EPA/USACE, 1996). Attachment A shows the simulated maximum mound height within the boundaries of the Maintenance ODMDS is approximately 8.5 feet. Given the ambient water depths within the Maintenance ODMDS range from 31 to 38 feet, there should be sufficient clearance with the disposal mound in place for the larger supply boats (15-foot draft) that may transverse through the area.

Subsequent to the MDFATE modeling effort, the future maintenance material volume for offshore placement was reforecasted from 3.74 to 4.05 mcy/yr. However, it is anticipated that this additional 310,000 cy/yr of maintenance-dredged material will not translate in a disposal mound height exceeding 10 feet, the threshold established in the Site Management Plan.

6.0 ENVIRONMENTAL CONSEQUENCES

As required by the Ocean Dumping Regulations (40 CFR 220–229) promulgated to interpret the MPRSA, the previously designated New Work ODMDS will be examined relative to the 5 general criteria and the 11 specific factors (40 CFR 228.5 and 40 CFR 228.6(a), respectively). Since the maintenance material to be dredged from the proposed deepened and widened channel should be the same as existing maintenance material, except for volume, the existing routine Maintenance ODMDS will be examined to determine whether it is of sufficient size to receive the greater quantity of material. This information will be included in the examination relative to the 5 general criteria and the 11 specific factors, where pertinent. In the following section, the criteria and factors are presented in italics, followed by the statement indicating compliance.

Other environmental regulations, which are pertinent to ODMDS designation, are addressed in the Freeport Harbor Channel Improvement Project EIS to which this ODMDS analysis is attached: Coastal Zone Management (Project EIS Section 8.7 and Appendix J), Endangered Species Act (Project EIS Section 4.13 and Appendix I), Magnuson-Stevens Fishery Conservation and Management Act or Essential Fish Habitat (Project EIS Section 4.12), cultural and historic

resources (Project EIS Section 4.14), and Section 404(b)(1) Water Quality Certification (Project EIS Section 8.2 and Appendix G).

6.1 REGULATORY CHARACTERIZATION

6.1.1 Five General Criteria

6.1.1.1 40 CFR 228.5(a)

The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.

The New Work and Maintenance ODMDSs, like the other nonexcluded areas in EPA (1989), were selected, including appropriate buffer zones, to avoid sport and commercial fishing activities, as well as other areas of biological sensitivity. The excluded areas include a white shrimp breeding area, a sport and commercial fishing harvest area, two reef areas, and the jetties, all with buffer zones; platforms; submerged shipwrecks; and several single oil and/or gas platforms. The buffer zones were sized on the basis of the physical movement of the disposal material, since sediment analysis in EPA (1989) and PBS&J (2006) concluded that the quality of the material proposed for discharge met the criteria of 40 CFR 227. The preferred sites are outside the channel, including the navigation channel buffer zone, and they avoid known navigational obstructions.

6.1.1.2 40 CFR 228.5(b)

Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.

The results of the analyses and studies (EH&A, 1989, 1991, 1993a, 1993b, 1994; PBS&J, 2006), as discussed above, indicate that the construction material dredged for the 45-foot Project was acceptable for ocean disposal under 40 CFR 227. The biota of the area near the New Work and Maintenance ODMDSs is healthy (EH&A, 1994). While toxicity tests have not been conducted for the new work sediments, there is no evidence to suggest that they would not meet the criteria of 40 CFR 227, and chemical analysis at the Freeport Channel, as noted in Section 4.1 of this ODMDS assessment, and experience with other Texas Gulf Coast areas, including the nearby Galveston Harbor channels, support an expectation that the new work and future maintenance sediments would be acceptable for ocean disposal. The appropriate sizes for the buffer zones and

for the preferred sites are based on the sediment transport information and the physical oceanographic characterization of the Freeport area. These, combined with the information on the expected quality of the material to be dredged, as discussed above, and recent modeling with MDFATE, ensure that perturbations caused by disposal would be reduced to ambient conditions at the boundaries of the New Work and Maintenance ODMDSs.

6.1.1.3 40 CFR 228.5(c)

If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in 228.5–228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

Although included in the General Criteria, this item is not really a criterion for site designation, and, in fact, information presented in EPA (1990) was designed to answer the question raised by 40 CFR 228.5(c). A suitable alternative to the interim site was designated and extensive monitoring and surveillance programs, including bathymetric scans; water, sediment, and elutriate chemistry; bioassays; bioaccumulation studies; and benthic infaunal analyses (EH&A, 1991, 1993a, 1993b, 1994), do not indicate that any problems are apparent at the New Work ODMDS or the Maintenance ODMDS.

6.1.1.4 40 CFR 228.5(d)

The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.

The size of the New Work ODMDS was as small as possible to meet reasonably the criteria stated at 40 CFR 228.5 and 228.6(a) for the 45-foot Project. The determined size for the construction (new work) material site is 3.49 square statute miles (2.64 square nautical miles), while that for the future maintenance material site is 2.02 square statute miles (1.53 square nautical miles) versus 0.53 square statute mile for the interim-designated site. The monitoring program included in EPA (1989) determined no adverse long-range impacts. Modeling with MDFATE was conducted to determine whether the size of the New Work ODMDS and Maintenance ODMDS is sufficient for construction of the proposed FHCIP and subsequent maintenance. The size of the sites was not increased for the project, since the MDFATE modeling results suggest the existing sizes are sufficient to receive the proposed new work and future maintenance dredged material volumes.

6.1.1.5 40 CFR 228.5(e)

EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

It was determined in EPA (1989) that cost, safety, and time factors, plus difficulties with monitoring and surveillance, dictated that the distance to the edge of the continental shelf at Freeport precluded the use of any ODMDS off the shelf. Additionally, the lack of resilience of the deep-ocean benthic community and the grain-size disparity between the material to be discharged and the deep-ocean sediments off Freeport indicated that an off-shelf disposal site would cause severe impacts to the off-shelf benthic community. No advantage to an off-shelf site was noted. The New Work ODMDS was historically used for the 45-foot Project.

6.1.2 Eleven Specific Factors

40 CFR 228.6(a) states that the factors included below as sections 6.1.2.1 through 6.1.2.11 will be considered in the selection process for site designation.

6.1.2.1 40 CFR 228.6(a)(1)

Geographical position, depth of water, bottom topography, and distance from coast.

The preferred site for the construction (new work) material disposal, as determined in EPA (1990), is bounded by the following coordinates (see Figure 1-1):

28° 50′ 51″ N, 95° 13′ 54″ W; 28° 51′ 44″ N, 95° 14′ 49″ W;

28° 50′ 15″ N, 95° 16′ 40″ W; 28° 49′ 22″ N, 95° 15′ 45″ W.

The water depth at the preferred site ranges from 54 to 63 feet (see Figure 1-1), the bottom topography is flat, and the preferred New Work ODMDS is approximately 6 miles from the coast at its closest point.

The existing maintenance ODMDS, as determined in EPA (1990), is bounded by the following coordinates (see Figure 1-1):

28° 54′ 00″ N, 95° 15′ 49″ W; 28° 53′ 28″ N, 95° 15′ 16″ W;

28° 52′ 00″ N, 95° 16′ 59″ W; 28° 52′ 32″ N, 95° 17′ 32″ W.

The water depths at the maintenance ODMDS range from 31 to 38 feet, and the site is 3 miles from shore at its closest point (see Figure 1-1).

6.1.2.2 40 CFR 228.6 (a)(2)

Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.

EPA (1989) reports a white shrimp breeding area, a sport and commercial fishing harvest area, and a reef area, approximately 5 miles southwest of the New Work and Maintenance ODMDSs. EPA (1989) also reports a small collection of coral heads (reefs), approximately 5 miles east of the New Work and Maintenance ODMDSs, and the jetties are approximately 6 miles north-northeast. There appear to be no oil and/or gas platforms within 5 miles of the end of the jetties and only nine within 10 miles of the end of the jetties (National Oceanic and Atmospheric Administration, 2004), and none are in the New Work and Maintenance ODMDSs. The *George Vancouver*, a Liberty ship, which is part of the Texas Parks and Wildlife Department's artificial reef program, is located about 10.5 miles southwest of Freeport.

6.1.2.3 40 CFR 228.6(a)(3)

Location in relation to beaches or other amenity areas.

The New Work ODMDS and the Maintenance ODMDS are roughly 6 miles and 3 miles, respectively, from beaches and other amenity areas.

6.1.2.4 40 CFR 228.6(a)(4)

Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packaging the waste, if any.

Construction (new work) material (17.3 mcy) will be primarily discharged into the New Work ODMDS (12.7 mcy), with the remainder placed at two new upland PAs, PA 8 (1.9 mcy) and PA 9 (2.8 mcy). The Maintenance ODMDS will receive most future maintenance dredged material (approximately 3.2 mcy/year), but PAs 1, 8, and 9 would also receive on average 0.04 mcy, 0.12 mcy, and 0.19 mcy, respectively, on a 3-year cycle. Historically, the New Work ODMDS was designated for the 5.1 mcy of material to be removed in connection with the 45-foot Project, for an indefinite period of time. Based on chemical analyses of the new work material, which indicated no problems with the acceptability of these materials for ocean disposal, EPA (1989) concluded that no special location or precautions would be necessary for the disposal of the materials to be dredged except for grain size. The New Work and Maintenance ODMDSs were sited in the silty-clay regime, with which it was most compatible.

6.1.2.5 40 CFR 228.6(a)(5)

Feasibility of surveillance and monitoring.

Both the New Work ODMDS and Maintenance ODMDS are amenable to surveillance and monitoring, as is evidenced by EH&A (1991, 1993a, 1993b, 1994).

6.1.2.6 40 CFR 228.6(a)(6)

Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current velocity, if any.

These physical oceanographic parameters were used (1) to develop the necessary buffer zones for the exclusion analysis, and (2) to determine the minimum size of the preferred site in EPA (1989). Predominant longshore currents, and thus predominant longshore transport, is to the southwest. Steady longshore transport and occasional storms, including hurricanes, should remove the placed material from the site. The size of the ODMDSs was modeled using MDFATE, which includes vertical mixing, to ensure that it was large enough to prevent significant mounding (see Section 5.0).

6.1.2.7 40 CFR 228.6(a)(7)

Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).

The information from EH&A (1994) plus chemical analyses of water from the area concluded that there were no indications of water or sediment quality problems near the New Work ODMDS or the Maintenance ODMDS. Studies of the benthos near the New Work and Maintenance ODMDSs (EH&A, 1994) did not indicate any significant decrease or change in composition of the benthos at the ODMDSs.

6.1.2.8 40 CFR 228.6(a)(8)

Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.

The items from the above list that are pertinent to the FHCIP ODMDSs are shipping, mineral extraction, commercial and recreational fishing, recreational areas, and historic sites. The location of the ODMDSs was selected so that its use would not interfere with other legitimate uses of the ocean (EPA, 1990). Disposal operations in the past have not interfered with other uses.

6.1.2.9 40 CFR 228.6(a)(9)

Existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.

Monitoring studies have shown only short-term water column perturbations of turbidity, and perhaps chemical oxygen demand, which resulted from disposal operations. No short-term sediment quality perturbation could be directly related to disposal operations. In general, the water and sediment quality and benthic macroinvertebrate matrices are good throughout the vicinity of the ODMDSs (EH&A, 1994; EPA, 1989). This indicates that there have been no long-term impacts on water and sediment quality or on the benthos at the ODMDSs.

6.1.2.10 40 CFR 228.6(a)(10)

Potentiality for the development or recruitment of nuisance species in the disposal site.

With a disturbance to any benthic community, initial recolonization will be by opportunistic species. However, these species are not nuisance species in the sense that they would interfere with other legitimate uses of the ocean or that they are human pathogens. EH&A (1993a, 1993b, 1994) determined that the placement of new work material in the New Work ODMDS and maintenance material in the Maintenance ODMDS have not, and placement of the proposed material should not, attract or promote the development or recruitment of nuisance species.

6.1.2.11 40 CFR 228.6(a)(11)

Existence of or in close proximity to the site of significant natural or cultural features of historical importance.

The nearest site of historical importance to the ODMDSs is approximately 0.5 mile away from the edge of this site in a crosscurrent direction (EPA, 1989: Figure 6-1). Monitoring has determined no movement of material out of the ODMDSs that would impact sites of historical importance.

7.0 SITE MONITORING AND MANAGEMENT PLAN

One of the ODMDS management responsibilities cited in 40 CFR 228.3 is "developing and maintaining effective ambient monitoring programs," although this is tempered somewhat by 40 CFR 228.9(a), which states, "The monitoring program, if deemed necessary by the Regional Administrator or the District Engineer, as appropriate, may include baseline or trend assessment surveys. . . ." Since 40 CFR 229(c) states that "EPA will require the full participation of permittees . . . in the development and implementation of disposal monitoring programs," a

monitoring program and Site Monitoring and Management Plan (SMMP) are included in this ODMDS Analysis Report as Attachment B.

There are two approaches that may be applied to determining unfavorable trends. One is to conduct monitoring surveys on the ecosystem at and near the ODMDSs at regular intervals. The other approach is to determine the quality of the material to be discharged at the site, from a chemical and biological perspective, and thereby determine expected impacts. The testing requirements specified in 40 CFR 227.13, as applied by the USACE, Galveston District, satisfy parts of both of the above-mentioned approaches.

Attachment B (SMMP) details the protocol and requirements to properly monitor and manage the maintenance and construction (new work) ODMDSs for the FHCIP.

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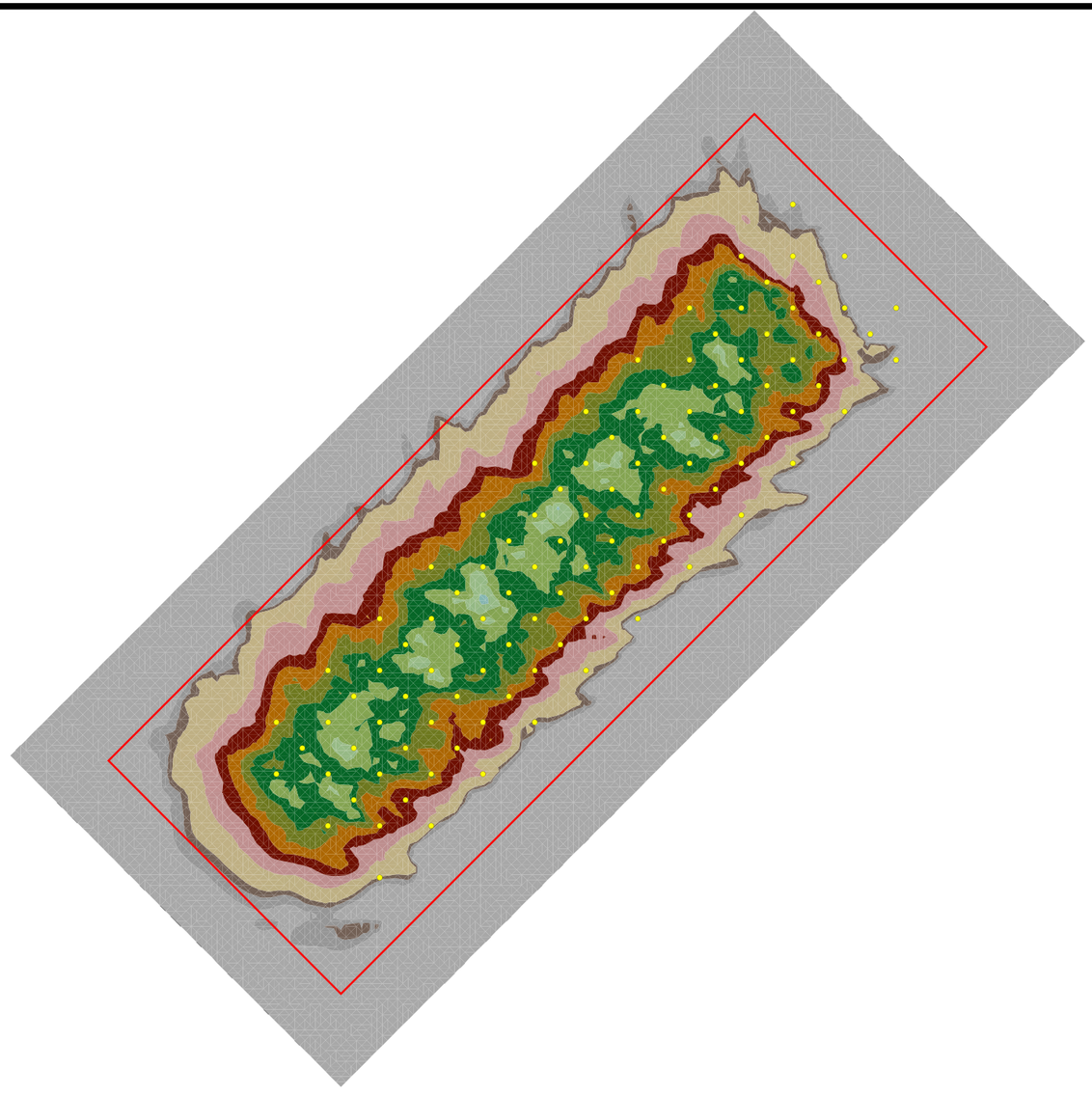
Attachment A

MDFATE Modeling Results



N

5,000 2,500 0 Feet

Legend

Discharge points

ODMDS Boundary

Mound height

8 - 9	6 - 7	3 - 4	0.3 - 1
7 - 8	5 - 6	2 - 3	0.2 - 0.3
	4 - 5	1 - 2	0.1 - 0.2
			0.004 - 0.1

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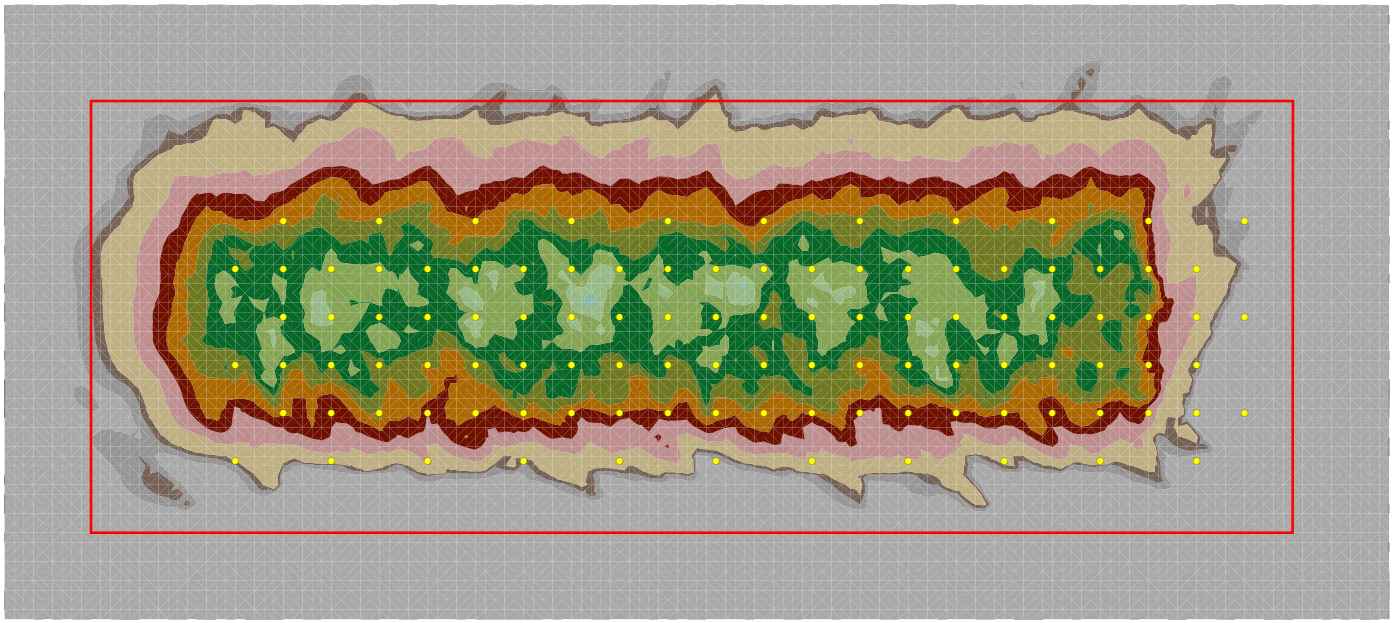
Freeport Federal Maintenenace Material ODMDS

Prepared for:	
Job No.:	Scale:
Prepared by:	Date:
File:	



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- Discharge points
- ODMDS Boundary

Mound height

6 - 7	3 - 4	0.3 - 1
8 - 9	5 - 6	2 - 3	0.2 - 0.3
7 - 8	4 - 5	1 - 2	0.1 - 0.2
			0.004 - 0.1

N

4,000 2,000 0 Feet

Freeport Federal Maintenenace Material ODMDS

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Job No.:	Scale:
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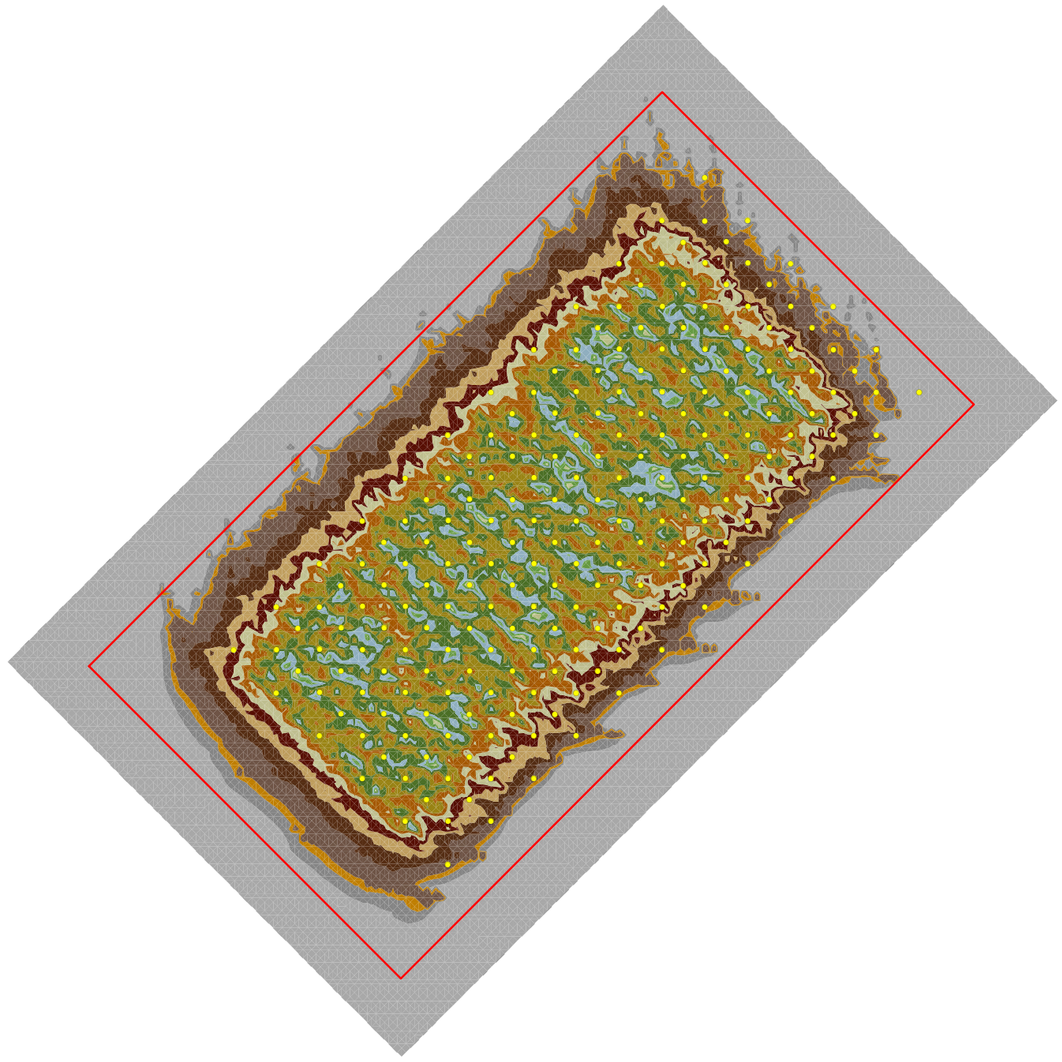

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Legend

Discharge points

ODMDS Boundary

Mound height

12 - 12.091

11 - 12

10 - 11

9 - 10

8 - 9

7 - 8

6 - 7

5 - 6

4 - 5

3 - 4

2 - 3

1 - 2

0.3 - 1

0.2 - 0.3

0.1 - 0.2

0.007 - 0.1

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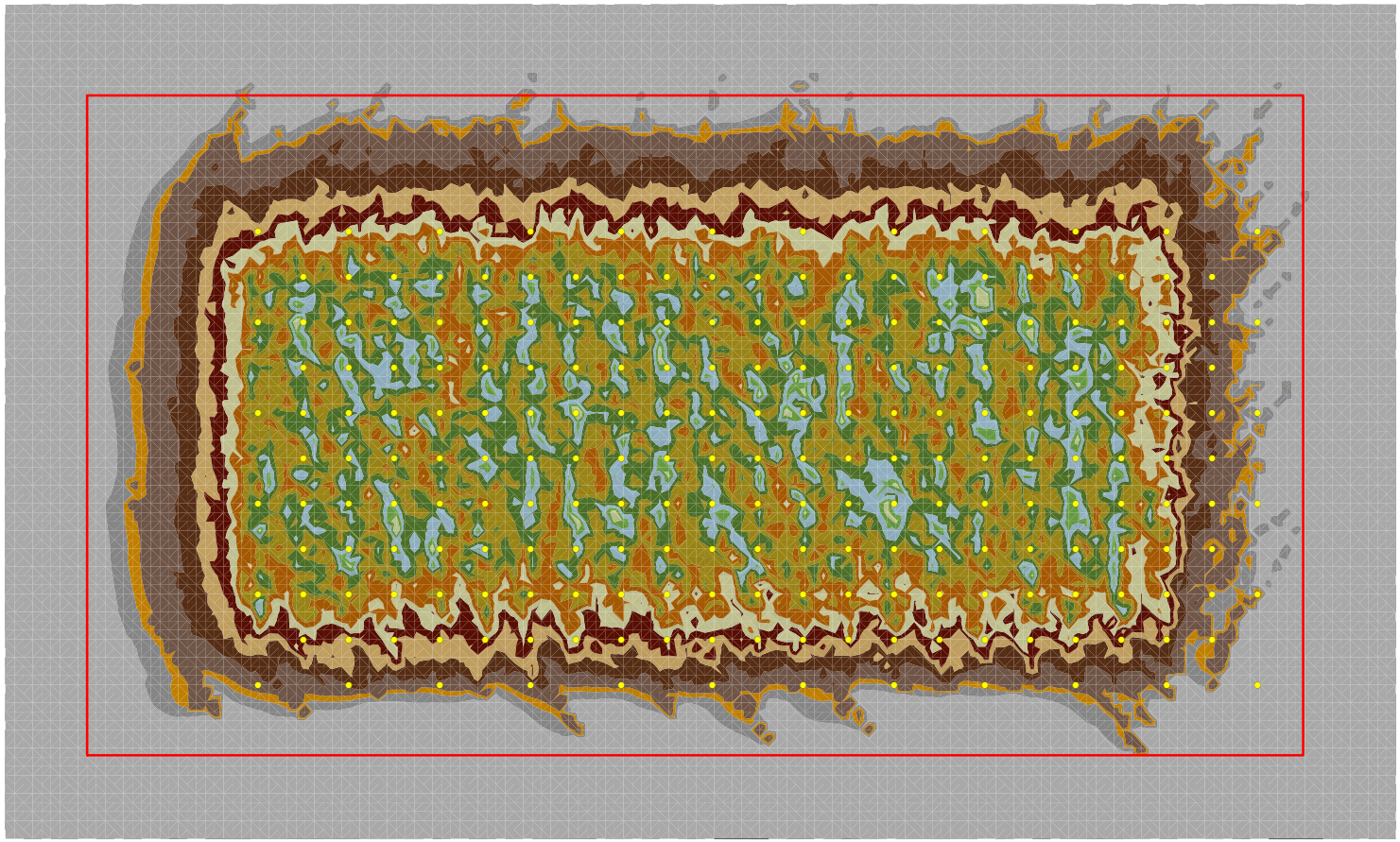
Freeport Federal New Work Material ODMDS

Prepared for:	
Job No.:	Scale:
Prepared by:	Date:
File:	



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4,000 2,000 0 Feet

Legend

- Discharge points
- ODMDS Boundary

Mound height

- 12 - 12.091
- 11 - 12
- 10 - 11
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0.3 - 1
- 0.2 - 0.3
- 0.1 - 0.2
- 0.007 - 0.1

Freeport Federal
New Work Material ODMDS

Prepared for:	
Job No.:	Scale:
Prepared by:	Date:
File:	

Attachment B

Site Management and Monitoring Plan

US Army Corps
of Engineers
Galveston District

FREEPORT HARBOR DEEPENING AND WIDENING CHANNEL IMPROVEMENT PROJECT, BRAZORIA COUNTY, TEXAS

ODMDS SITE MANAGEMENT AND MONITORING PLAN

AS REQUIRED BY

SECTION 102 OF THE

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

SITE MANAGEMENT AND MONITORING PLAN

FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT, BRAZORIA COUNTY, TEXAS OCEAN DREDGED MATERIAL DISPOSAL SITE

I. General

The Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. Section 1401, *et seq.*) is the legislative authority regulating the disposal of dredged material into ocean waters, including the territorial sea. The transportation of dredged material for the purpose of placement into ocean waters is permitted by the U.S. Army Corps of Engineers (USACE) or, in the case of Federal projects, authorized for disposal under MPRSA Section 103(e), applying environmental criteria established by the Environmental Protection Agency (EPA) in the Ocean Dumping Regulations (40 CFR Parts 220–229).

Section 102(c) of the MPRSA and 40 CFR 228.4(e)(1) authorize the EPA to designate Ocean Dredged Material Disposal Sites (ODMDSs) in accordance with requirements at 40 CFR 228.5 and 228.6. Section 103(b) of MPRSA requires that the USACE use dredged material sites designated by EPA to the maximum extent feasible. Where use of an EPA-designated site is not feasible, the USACE may, with concurrence of EPA, select an alternative site in accordance with MPRSA 103(b).

Section 228.3 of the Ocean Dumping Regulations established disposal site management responsibilities; however, the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580) included a number of amendments to the MPRSA specific to ODMDS management. Section 102(c) of MPRSA as amended by Section 506 of WRDA 92 provides that:

1. Site management and monitoring plans (SMMPs) shall be developed for each ODMDS designated pursuant to Section 102(c) of MPRSA.
2. After January 1, 1995, no ODMDS shall receive a final designation unless a SMMP has been developed.
3. For ODMDSs that received a final designation prior to January 1, 1995, SMMPs shall be developed as expeditiously as practicable, but no later than January 1, 1997, giving priority to sites with the greatest potential impact on the environment.
4. Beginning on January 1, 1997, no permit or authorization for dumping shall be issued for a site unless it has received a final designation pursuant to Section 102(c) MPRSA or it is an alternate site selected by the USACE under Section 103(b) of MPRSA.

This SMMP for the Freeport Harbor Channel Improvement Project (FHCIP), Brazoria County, Texas, Ocean Dredged Material Disposal Sites was developed jointly by EPA, Region 6 and USACE, Galveston District (USACE-SWG). In accordance with Section 102(c)(3) of the MPRSA, as amended by WRDA 92, the plan includes the following:

1. A baseline assessment of conditions at the site;
2. A program for monitoring the site;

3. Special management conditions or practices to be implemented at the site that are necessary for protection of the environment;

4. Consideration of the quantity of dredged material to be discharged at the site, and the presence, nature, and bioavailability of the contaminants in the material;

5. Consideration of the anticipated use of the site over the long term, including the anticipated closure date for the site, if applicable, and any need for management of the site after the closure; and

6. A schedule for review and revision of the plan.

II. Site Management Objectives

The purpose of ODMDS management is to ensure that placement activities do not unreasonably degrade the marine environment or interfere with other beneficial uses (e.g., navigation) of the ocean. The specific objectives of management of the FHCIP ODMDSs are as follows:

1. Ocean discharge of only that dredged material that satisfies the criteria set forth in 40 CPR Part 227 Subparts B, C, D, E, and G and Part 228.4(e) and is suitable for unrestricted placement at the ODMDS.

2. Avoidance of excessive mounding either within the site boundaries or in areas adjacent to the site, as a direct result of placement operations.

These objectives will be achieved through the following measures:

1. Regulation and administration of ocean dumping permits;

2. Development and maintenance of a site monitoring program;

3. Evaluation of permit compliance and monitoring results.

III. Roles and Responsibilities

In accordance with Section 102(c) of the MPRSA and with the Regional Memorandum of Understanding between USACE-SWG and EPA, Region 6 on Management of ODMDSs signed August 13, 1993, EPA is responsible for designation of ODMDSs. Where use of an EPA-designated site is not feasible, the USACE-SWG may, with concurrence with EPA, Region 6 select an alternative site in accordance with Section 103(b) of the MPRSA as amended by Section 506 of WRDA 92.

Development of SMMPs for ODMDSs within USACE-SWG is the joint responsibility of EPA, Region 6 and the USACE-SWG. Both agencies are responsible for assuring that all components of the SMMPs are implementable, practical, and applicable to site management decision-making.

IV. Funding

Physical, chemical, and biological effects-based testing of dredged material prior to placement at the ODMDS will be undertaken and funded by the permittee if the project is permitted or USACE-SWG for Federal projects. The permittee or USACE-SWG, as appropriate, shall also be responsible for costs associated with placement site hydrographic monitoring. Should monitoring indicate that additional studies and/or tests are needed at the ODMDSs, the cost for such work would be shared by the permittee or USACE-SWG and EPA, Region 6.

Physical, chemical, and biological effects-based testing at the ODMDS, or in the site environs after discharge that is not required as a result of hydrographic monitoring, shall be funded by EPA, Region 6. Federal funding of all aspects of the SMMP is contingent on availability of appropriated funds.

V. Baseline Assessment

A. Site Characterization (Existing Maintenance ODMDS). The Freeport Harbor Maintenance ODMDS is located approximately 3 miles offshore, and about 1,000 feet southwest of the centerline of the Outer Bar Channel. The site is rectangular in shape with corner coordinates located at:

28°54′00″N, 95°15′49″W; 28°53′28″N, 95°15′16″W;
28°52′00″N, 95°16′59″W; 28°52′32″N, 95°17′32″W.

This site occupies an area of approximately 1.53 square nautical miles (2.02 square statute miles), with depths ranging from 31 to 38 feet. The sediment reference area is located northeast of the channel with vertices at the following coordinates:

28°54′28″N, 95°13′40″W; 28°54′35″N, 95°13′28″W;
28°55′07″N, 95°14′01″W; 28°54′60″N, 95°14′13″W.

B. Site Characterization (Existing New Work ODMDS). The Freeport Harbor New Work ODMDS is located approximately 6 miles offshore, with its area bounded by the following coordinates:

28°50′51″N, 95°13′54″W; 28°51′44″N, 95°14′49″W;
28°50′15″N, 95°16′40″W; 28°49′22″N, 95°15′45″W

The site occupies an area of approximately 2.64 nautical square miles (3.49 square statute miles), with depths ranging from 54 to 63 feet.

Baseline conditions at the Freeport Harbor Maintenance and New Work ODMDSs were assessed during the site designation process. Details of baseline conditions, including descriptions of the marine environment in the site vicinity and the physical, chemical, and biological characteristics of the sediments and the water column at the site, are contained in the Final Environmental Impact Statement (EIS), Freeport Harbor 45-Foot Project (45-foot Project), Ocean Dredged Material Disposal Site Designation prepared by EPA, Region 6, in January 1990.

C. Historical Use of Site

1. Maintenance ODMDS. The Freeport Harbor Maintenance ODMDS received final designation on March 27, 1990 (55 FR 59). Historical use of the site is depicted in Table 1.

Table 1
Dredging History

Start	Finish	Dredge Work Type	Total Yards
Aug-92	Nov-92	Maintenance	2,884,532
Jul-93	Sep-93	Maintenance	1,415,742
Aug-94	Nov-94	Maintenance	2,599,267
Sep-95	Jan-96	Maintenance	2,674,026
Jul-96	Aug-96	Maintenance	579,500
Jan-97	Apr-97	Maintenance	2,489,108
Nov-97	Dec-97	Maintenance	1,053,157
Oct-98	Dec-98	Maintenance	2,334,436
Sep-99	Jan-00	Maintenance	1,555,615
Jul-00	Nov-00	Maintenance	1,859,847
Oct-00	Jan-01	Maintenance	2,202,288
Jun-01	Sep-01	Maintenance	2,479,249
May-02	Aug-02	Maintenance	1,996,354
Aug-03	Oct-03	Maintenance	1,726,186
Sep-04	Nov-04	Maintenance	1,908,831
Dec-05	Feb-06	Maintenance	1,911,091
May-06	May-06	Maintenance	200,511
Oct-06	Feb-07	Maintenance	2,516,000
Oct-07	Dec-07	Maintenance	1,415,421
Oct-08	Dec-08	Maintenance	1,577,096
Oct-09	Nov-09	Maintenance	2,420,755 [a]

[a] 7,500 cy dredged in January 2010.

SINCE 1992

No. years	18	years/cycle	0.86	Total cy	39,799,012
No. dredgings	21	months/cycle	10.3	cy/cycle	1,895,191
				cy/year	2,211,056

2. New Work ODMDS. The New Work ODMDS was designated (EPA, 1990) originally for the 45-foot Project for placement of 5.1 million cubic yards (mcy) of new work material. This site has been inactive since completion of the 45-foot Project, but has been designated for period of use for an indefinite period of time.

VI. Quantity of Material and Level of Contamination

A. Summary of information used to determine size of the site. Historically, since 1992, the dredging frequency for this navigation project is slightly less than 1 year or approximately 10.3 months, with an average of approximately 1.90 mcy of material excavated per dredging cycle placed at the Maintenance ODMDS. The excavated channel sediments can be characterized as clayey-sandy-silts. The channel sediment may contain a slightly higher percentage of sand than the placement area, and slightly less than the reference area; however, the percentage of silt is similar for all three locations. Average particle-size distribution is described in Table 2.

Table 2
Average Particle-size Distribution

Location	% Sand	% Silt	% Clay
Channel	19.6	52.0	28.4
ODMDS	5.4	66.4	28.2
Reference Area	26.9	56.6	16.5

As described in the site designation EIS, the sizes of the Maintenance ODMDS and New Work ODMDS were determined by simulations run on a computer model. These simulations assumed an average of 3.74 mcy of future maintenance dredged material to be placed during each maintenance cycle and 10.65 mcy of new work dredged material to be placed as part of the improvement project. The 10.65 mcy of new work material is greater than the 5.1 mcy of new work material originally simulated during the designation process for the historic New Work ODMDS (EPA, 1990). Both sites can be described as dispersive; therefore, the dredged material deposited there is expected to erode, especially due to the high percentage of fine-grained components.

Subsequent to the New Work ODMDS MDFATE modeling effort, the future new work material volume for offshore placement was reforecasted from 10.65 to 7.75 mcy. Given the reforecasted new work volume is less than the modeled volume, it is anticipated the disposal mound height will not exceed 15 ft, the Tier C1 threshold established in the SMMP.

Subsequent to the Maintenance ODMDS MDFATE modeling effort, the future maintenance material volume for offshore placement was reforecasted from 3.74 mcy/yr to 4.05 mcy/yr. However, it is anticipated that the additional 310,000 cy/yr of maintenance-dredged material will not translate in a disposal mound height exceeding 10 ft, the Tier M1 threshold established in this SMP.

B. Summary of testing requirements per Regional Implementation Agreement (RIA) and summary of past dredged material evaluations. On September 24, 1992, a RIA was executed between EPA Region 6 and SWG. The RIA was revised and updated, and a new RIA (EPA/USACE, 2003) issued November 3, 2003. This RIA described protocols for evaluating the quality of the dredged material and implementation of the "GREEN BOOK." These protocols describe chemical parameters to be analyzed, as well as required detection limits. It also specifies how toxicity testing and bioaccumulation assessments are to be conducted, as well as organisms to be utilized. Since that time, all sediment evaluations have been conducted in accordance with the RIA. Since the mid-1970s, before development of the RIA, dredged material from the Freeport Harbor Project had been evaluated numerous times to determine suitability for offshore

placement. This testing was performed to determine levels of metals and organic constituents, as well as toxicity and bioaccumulation assessments. Testing performed for this project is summarized in Table 3.

Table 3
Testing of Dredged Material, 1975–2006

Date	Type of Testing
September 17, 1975	Predredging Bulk Analyses
October 6, 1975	During-dredging Bulk Analyses
December 2, 1975	After-dredging Bulk Analyses
April 1978	Toxicity and Bioaccumulation Assessment*
October 1978	Toxicity and Bioaccumulation Assessment*
July 1980	Toxicity and Bioaccumulation Assessment*
January 14, 1982	Predredging Bulk Analyses
February 22, 1983	Predredging Bulk Analyses
July 3, 1984	Predredging Bulk Analyses
February 1985	Toxicity and Bioaccumulation Assessment*
May 15, 1985	Predredging Bulk Analyses
March 28, 1986	Predredging Bulk Analyses
March 18, 1987	Predredging Bulk Analyses
March 15, 1988	Predredging Bulk Analyses
April 7, 1989	Predredging Bulk Analyses
July 20, 1993	Predredging Bulk Analyses
September 1994	Toxicity and Bioaccumulation Assessment*
February 2, 1995	Predredging Bulk Analyses
January 25, 1997	Predredging Bulk Analyses
March 3, 1998	Predredging Bulk Analyses
July 8, 1998	Predredging Bulk Analyses
April 29, 1999	Toxicity and Bioaccumulation Assessment*
May 23,2000	Predredging Bulk Analyses
April 29, 2004	Toxicity and Bioaccumulation Assessment*
June 29, 2005	Toxicity and Bioaccumulation Assessment*
August 22, 2006	Predredging Bulk Analyses

*Also includes predredging bulk analyses.

The results of the above testing indicated that the material was suitable for offshore placement without special management conditions.

VII. Anticipated Site Use

The maintenance dredging frequency for the deepening and widening project is estimated to generate an average of approximately 3.19 mcy of maintenance dredge material to be placed at the existing Maintenance ODMDS. Presently, the Maintenance ODMDS receives on the average of 1.90 mcy of maintenance-dredged material at a frequency of once every 10.3 months.

The new work construction project will generate approximately 12.7 mcy of new work material from the Entrance Channel to be placed within the existing New Work ODMDS previously designated by EPA for indefinite placement of construction (new work) dredged material for the 45-foot Project.

Currently, no beneficial use of material dredged from Freeport Harbor is practiced. It is the policy of the Galveston District to require implementation of beneficial uses of dredged material, wherever practicable. Therefore, resource agencies were consulted during coordination to identify a beneficial uses plan for the FHCIP. However, it was determined that the likely beneficial use of the dredged material to create marsh or nourish adjacent shorelines would either be economically prohibitive or geotechnically incompatible. Therefore, a beneficial use plan is not proposed for the FHCIP.

VIII. Special Management Conditions or Practices

Currently, no special management conditions or practices related to placement of dredged material into the designated ODMDS have been required. As previously discussed, evaluations of sediment quality have indicated that the material from the channel is suitable for offshore placement without such requirements. However, all operations shall be conducted such that the dredged material remains within the bounds of the ODMDS immediately following descent to the ocean floor.

A seasonal restriction has been recommended by the National Marine Fisheries Service (NMFS), during formal consultation undertaken pursuant to the Endangered Species Act (NMFS, 2007) for maintenance dredging activities. This restriction was based on potential impacts of hopper dredging operations on several species of threatened and endangered sea turtles. The recommendation is to restrict hopper dredging to the period from December 1 through March 31, during which turtle abundance is at a minimum. This recommendation pertains, however, only to actual dredging operations, and not placement of the material into the ODMDSs. While it may not be practical to observe this restriction for all dredging cycles, it will be practiced when feasible. It is anticipated that a Biological Opinion addressing the proposed new work dredging will be issued by NMFS to define restrictions to avoid or minimize impacts to threatened and endangered species that may result from hopper dredging operations.

IX. Monitoring Program

The primary purpose of the Site Monitoring Program is to evaluate the impact of the placement of dredged material on the marine environment.

The evaluations will be used for making decisions, preventing unacceptable adverse effects beyond the site boundary, and ensure regulatory compliance over the life of the ODMDSs. Emphasis will be placed on determining physical impacts, since, to date, dredged material from the FHCIP and from the future maintenance of the navigation channels have been determined to be acceptable for ocean placement, without special conditions; however, consideration of contaminants will also be included.

Testing of dredged material is conducted based on "GREEN BOOK" and RIA procedures; however, it is necessary to verify the decisions made regarding suitability of the dredged material are correct and that the material is not having an adverse impact to the environment. In the event that the material persists in the ODMDSs, there may be potential for long-term contaminant effects on benthos.

The size and location of the Freeport Harbor New Work and Maintenance ODMDSs were determined pursuant to the General Criteria as listed in 40 CFR 228.5, and the Specific Criteria at 40 CFR 228.6(a). There are no significant environmental resources delineated within or immediately outside of the designated ODMDSs. Since these sites are dispersive in nature, the primary concern of the use of the sites is the potential short-term build up of dredged material, such that a hazard to navigation is presented. Another concern is whether there is significant short-term transport of the dredged material beyond the ODMDSs boundaries; specifically, the benthic community can be impacted if significant rapid movement of material off the site occurs, resulting in burial of benthic populations outside the sites. Studies have shown that benthic organisms can burrow through 6–9 inches of dredged material without significant impacts on the community (EPA/USACE, 1996).

The Site Monitoring Program is designed as a tiered program. If initial tier results fail predetermined limits, then a more complex set of tests is invoked at the next tier to determine the extent of impact. The tiers are used to facilitate rapid, accurate, and economical collection of information for use by the EPA, Region 6 and the USACE-SWG. The tiered hypothesis testing for these factors is described below.

CONSTRUCTION MATERIAL

While the literature on maintenance material disposal on the Gulf Coast indicates only minor short-term and negligible long-term mounding from placement activities, little information is available for new work material ODMDSs. Mounding from the construction material, while acceptable, is higher and of firmer material than is true for the maintenance material. Additionally, construction placement is expected to last for only a period of 2 years or less and more-frequent monitoring would be expected than would be necessary for the periodic, but short-term placement that occurs with maintenance dredging. The following monitoring and surveillance program is proposed for the FHCIP ODMDSs during construction. The monitoring is discussed in detail below.

A major consideration in the acceptability of the size of the ODMDSs was the location of the dredge when each discharge occurs. To prevent excessive mounding, it is necessary that a method be utilized to record the location of each discharge to ensure that the dredge distributes material uniformly over the ODMDS while it avoids approaching the edges of the ODMDS too closely. The following is the scheme used in the modeling to avoid excessive mounding and dispersal of material outside the ODMDS: two discharges at all exterior placement points (one should a larger dredge be used), followed by one discharge at each of the interior placement points in a given sequence until each has been utilized. Continue repeating the sequence with one discharge at each interior placement point until construction is complete.

TIER C1

Bathymetric Surveys

Routine bathymetric scans shall be conducted for the ODMDS to determine that there is no excessive mounding; e.g., to heights greater than 15 feet (threshold) above the existing bottom elevation (unless an alternate height is determined in agreement between the EPA and USACE on a case-by-case basis), and that there is no short-term transport of material beyond the limits of the ODMDS. Therefore, an accumulation of 1 foot of sedimentation along the ODMDS

boundary will be considered the threshold level for movement of material outside of the designated ODMDS. These determinations will be based on a comparison of the results with predisposal surveys.

Bathymetric surveys shall be obtained before the start of disposal operations, and monthly thereafter until operations are complete. Additional surveys shall then be performed after 6 months and 1 year.

Hydrographic surveys shall be conducted along transects within the ODMDS. These transects shall be oriented perpendicular to the channel in the direction of sediment transport (i.e., southwest). Transect intervals shall be every 1,000 feet extending 1,000 feet outside each boundary. In addition, a depth profile shall be obtained along the boundary.

Surveys shall be obtained using a USACE, or contract, survey vessel equipped with electronic surveying capabilities. The vessel must be equipped with positioning equipment with a horizontal precision of 1 foot. The fathometer, which shall display real-time depth on real-time location, must have a precision of 0.5 foot. All data shall be collected using methodology described in Engineer Manual 1110-2-1003, dated January 1, 2002.

Data Analysis

- If the surveys indicate deposited dredged material is not mounding to heights greater than the threshold elevation above the existing bottom elevation, and there is no short-term movement of material beyond the limits of the ODMDS, then the management objectives are being met. Further monitoring shall be conducted as scheduled.
- If the monthly surveys indicate movement of material outside of the designated limits, then the disposal operation will be reviewed to determine if the disposal sequence is being properly followed. The disposal sequence shall be adjusted as necessary to compensate for the movement.
- If the after-disposal surveys indicate mounding to heights greater than the threshold elevation, and/or movement of material out of the ODMDS has occurred, then the monitoring program shall proceed to Tier C2.

Sediment Chemistry

The New Work ODMDS is expected to receive most of the construction material and is selected as worst case for the monitoring described below. Monitoring stations, which consist of a control station, stations located immediately outside the ODMDS, and stations located some distance downcurrent from the site should be sampled for the items noted in the following paragraph to determine if impacts are occurring outside of the ODMDS. EPA (1989) describes two stations on each side of the ODMDS, roughly 300 feet from the ODMDS edges (stations B1 through B8), a control site located upcurrent of the ODMDS, and two stations located 10,000 feet downcurrent (southwest) of the downcurrent edge of the ODMDSs (Figure 1).

These stations shall be sampled before and at the completion of disposal operations. Postdisposal sampling shall occur 6 months and 1 year after the cessation of discharge of new work material at the site.

Samples shall be collected for (1) grain-size analysis, and (2) chemical characterization of sediments. The analytes and protocols described in the RIA shall apply to this testing. Sediment chemistry results shall be compared to the before-disposal results of samples from the sites and control sample. Data from previously collected sediments in the vicinity can also be considered. Significantly elevated sediment concentrations are defined as concentrations above the range of contaminant levels in dredged sediments that the Regional Administrator and the District Engineer found to be suitable for disposal at the ODMDS.

Data Analysis

- If contaminant concentrations are not significantly different from before-disposal data, then the management objectives are being met. Further monitoring shall be conducted as scheduled.
- If significant increases in levels of contaminants are observed, but bathymetric monitoring indicates that there is no short-term transport of material beyond the limits of the ODMDS, as determined in Bathymetric Surveys Tier C1, then this is an indication that the increase is not a result of dredged material placement. Further monitoring shall be conducted as scheduled.
- If significant increases in levels of contaminants are observed, and bathymetric monitoring indicates that there is short-term transport of material beyond the limits of the ODMDS, as determined in Bathymetric Surveys Tier C1, then bioassay/bioaccumulation testing shall be conducted to determine effects to the benthic communities. This testing is described in Tier C2.

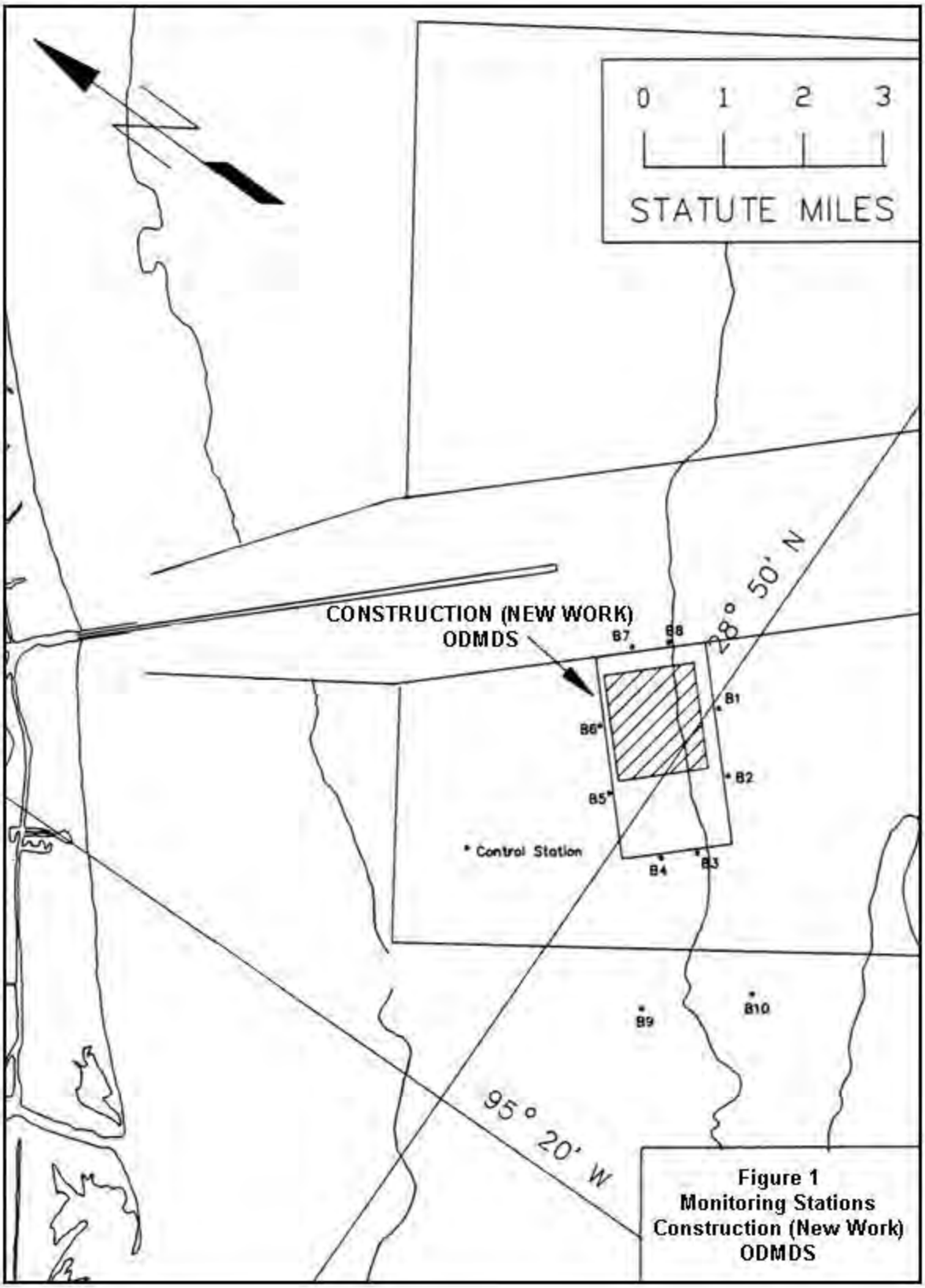

Figure 1
Monitoring Stations
Construction (New Work)
ODMDS

Benthos

Monitoring stations, which consist of a control station, stations located immediately outside the ODMDS, and stations located some distance downcurrent from the site should be sampled for the items noted in the following paragraph to determine if impacts are occurring outside of the ODMDS. EPA (1989) describes two stations on each side of the ODMDS, roughly 300 feet from the ODMDS edges (stations B1 through B8), a control site located upcurrent of the ODMDS, and two stations located 10,000 feet down current (southwest) of the downcurrent edge of the ODMDS (stations B9 and B10). These should be the same stations used for sediment chemistry (see Figure 1). Substrate elevation should also be determined at each sampling station during each sampling event.

These stations shall be sampled before and at the completion of disposal operations. Postdisposal sampling shall occur 6 months and 1 year after the cessation of discharge of new work material at the site. Samples shall be collected for macrobenthic invertebrates (in triplicate). Macrobenthic community structure during each sampling event shall be compared to the control sample to eliminate effects of potential seasonal variation. Significant changes are defined as statistically significant differences in community structure or population density.

Data Analysis

- If macrobenthic community structure is not significantly different than the control, then the management objectives are being met. Further monitoring shall be conducted as scheduled.
- If significant changes are observed, then further analysis shall be conducted under Tier C2.

TIER C2

Bathymetric Surveys

If deposited dredged material mounds to heights above the threshold value, then monitoring shall continue as scheduled, and could possibly be extended. A Notice to Mariners shall be posted as appropriate.

If transport of material from the site is occurring, hydrographic surveys shall be expanded to include the impacted areas to determine the changes in dispersion of the material. An accumulation of more than I foot of sedimentation along the ODMDS boundary will be considered the threshold level for significant movement of material outside of the designated ODMDS.

Data Analysis

- During Dredging – If deposited dredged material is mounding to heights above the threshold value, but less than 20 feet above the existing bottom elevation, and there is no significant short-term transport of material beyond the limits of the ODMDS, then monitoring shall continue as scheduled. A Notice to Mariners shall be issued as appropriate.

- During Dredging – If deposited dredged material is mounding to heights greater than 20 feet above the existing bottom elevation, and there is no significant short-term transport of material beyond the limits of the ODMDS, then bathymetric monitoring shall continue as scheduled. A Notice to Mariners shall be posted as appropriate. If mounding is considered to be excessive, alterations to the placement operations may be warranted.
- During Dredging – If significant movement of material out of the ODMDS is occurring, bathymetric monitoring shall be expanded to include the impacted areas to determine the changes in dispersion of the material. Following completion of disposal operations, surveys shall continue on a quarterly basis for 1 year, or until agreement is reached between the EPA and USACE-SWG to discontinue monitoring. Findings shall be documented for future reference.
- After Dredging – If deposited dredged material has mounded to heights above the threshold value, but less than 20 feet above the existing bottom elevation, and there is no significant short-term transport of material beyond the limits of the ODMDS, then bathymetric monitoring shall continue at predetermined 6-month intervals for 1 year, or until agreement is reached between the EPA and USACE-SWG to discontinue monitoring. Findings shall be documented for future reference, and a Notice to Mariners shall be issued as appropriate.
- After Dredging – If deposited dredged material is mounding to heights greater than 20 feet above the existing bottom elevation, and there is no significant short-term transport of material beyond the limits of the ODMDS, then bathymetric monitoring shall continue at predetermined 6-month intervals for 1 year, or until agreement is reached between the EPA and USACE-SWG to discontinue monitoring. Findings shall be documented for future reference, and a Notice to Mariners shall be issued as appropriate.
- After Dredging – If significant movement of material out of the ODMDS has occurred, bathymetric monitoring shall be expanded to include the impacted areas to determine the changes in dispersion of the material, and shall continue on a quarterly basis for a 1-year period, or until agreement is reached between the EPA and USACE-SWG to discontinue monitoring. Findings shall be documented for future reference.

Sediment Chemistry

If the results of the Tier C1 sediment chemistry evaluation indicate the need for additional testing, then solid-phase bioassay and bioaccumulation testing shall be conducted in accordance with the procedures described in the RIA. Funding for work under this Tier shall be provided by EPA, Region 6 as described in Section IV, Funding.

Data Analysis

- If significant toxicity is not found, testing shall continue as described in Tier C1. However, subsequent sampling shall continue on a quarterly basis for the 1-year period following completion of disposal operations, or until agreement is reached between the EPA and USACE-SWG to discontinue monitoring. Findings shall be documented for future reference.
- If significant toxicity is found, the USACE-SWG together with EPA Region 6 will consider various management options to rectify the situation. Because the ODMDS is a

dispersive site, potential sources of toxicity other than dredged material must also be considered. A decision must also be made whether to allow continued use of this site. Findings shall be documented for future reference.

Benthos

A significant change in community structure or population density may be an indication that the substrate has changed. This could be a result of natural redistribution of sediments or the dredged material may be moving beyond the ODMDS at a faster rate than anticipated. A change in community structure could also indicate that toxicity has occurred. Monitoring the macrobenthic community shall continue on a quarterly basis until 1 year following completion of discharge operations has elapsed, or until agreement is reached between the EPA, Region 6 and USACE-SWG to discontinue monitoring.

Data Analysis

- If significant changes are observed, but bathymetric monitoring indicates that there is no short-term transport of material beyond the limits of the ODMDS, as determined in Bathymetric Surveys Tier C1, then this is an indication that the changes are not a result of dredged material placement. Further monitoring shall be conducted as scheduled.
- If significant changes are observed, and bathymetric monitoring indicates that there is short-term transport of material beyond the limits of the ODMDS, as determined in Bathymetric Surveys Tier C1, then this is an indication that the changes may be a result of dredged material placement. Further monitoring shall be conducted as scheduled.
  - If significant changes are observed 1 year following completion of disposal operations, then the monitoring shall continue on a quarterly basis for 1 additional year. If significant changes are observed after the second year, further monitoring plans will be developed based on the degree of impact.
- If significant changes are observed, and there is an indication that the sediments are toxic, as determined in Sediment Chemistry Tier C2, then this is an indication that the changes may be a result of dredged material placement. Further monitoring shall be conducted as scheduled.
  - If significant changes are observed 1 year following completion of disposal operations, then the monitoring shall continue on a quarterly basis for 1 additional year. If significant changes are observed after the second year, further monitoring plans will be developed based on the degree of impact.

MAINTENANCE MATERIAL

TIER M1

Physical and chemical evaluations of the ODMDS material shall be conducted to characterize possible effects from the placement of dredged material occurring at the site. Physical analyses of the sediment can assist in assessing the impact of disposal practices on the benthic environment at the disposal site and determine if dredged material is migrating offsite. Chemical analyses of the sediment shall be conducted to establish whether contaminants of concern are suspected to be affecting the benthic environment at the disposal site.

Bathymetric Surveys

The ODMDS is located outside of the safety fairway for large vessel traffic; therefore, the mounding will be considered in regard to shallow-draft vessels only. Considering the grain-size characteristics of typical maintenance dredged material from this channel, significant mounding is not expected subsequent to discharge operations. The threshold elevation for mounding of dredged material within the ODMDS will be 10 feet, or other mutually agreed-upon height, above the existing bottom elevation.

Since the sites are dispersive, movement of material from the sites is expected to occur after disposal operations cease. In order to detect if short-term movement of the material out of the designated ODMDS is occurring at a significant rate, hydrographic surveys of the ODMDS shall be obtained before the start of disposal operations, and soon after completion of disposal operations. An accumulation of 1 foot of sedimentation along the ODMDS boundary will be considered the threshold level for movement of material outside of the designated ODMDS. This determination shall be based on a comparison of the results of these before and after surveys.

Hydrographic surveys shall be conducted along transects within the ODMDS. These transects shall be oriented perpendicular to the channel in the direction of sediment transport (i.e., southwest). Transect intervals shall be every 1,000 feet extending 1,000 feet outside each boundary. In addition, a depth profile shall be obtained along the boundary.

Surveys shall be obtained using a USACE or contract survey vessel equipped with electronic surveying capabilities. The vessel must be equipped with positioning equipment with a horizontal precision of 1 foot. The fathometer, which shall display real-time depth on real-time location, must have a precision of 0.5 foot. All data shall be collected using methodology described in Engineer Manual 1110-2-1003, dated January 1, 2002.

Data Analysis

- If deposited dredged material is not mounding to heights greater than the threshold height above the existing bottom elevation, and there is no short-term movement of material beyond the limits of the ODMDS, then the management objectives are met. No further postdisposal monitoring will be required.
- If mounding to heights greater than the threshold height, and/or movement of material out of the ODMDS has occurred, as determined by the postdredging survey, then the monitoring program shall proceed to Tier M2.

Sediment Chemistry

Sediment chemistry analyses shall be conducted in conjunction with the dredged material evaluations from samples collected in the navigation channel. Collecting samples from both the navigation channel and ODMDS during the same sampling event has been determined to be the most efficient use of resources. Because most ODMDSs lie directly adjacent to the navigation channels, there are relatively short distances between the two areas. As described in the RIA, sediment testing in the navigation channels generally occurs on a 5-year cycle. Sediment chemistry results from the ODMDSs should be compared to the results collected from the navigation channel. Significantly elevated sediment concentrations are defined as concentrations above the range of contaminant levels in dredged sediments that the Regional Administrator and the District Engineer found to be suitable for disposal at the ODMDS.

Data Analysis

- If contaminant concentrations are not significantly different than navigation channel concentrations then no further testing is needed.
- If significant increases in levels of contaminants are observed at the ODMDS, then a bioassay/bioaccumulation study shall be conducted to determine effects to the benthic community. The studies are described below as Biological Testing under Tier M2.

TIER M2

Bathymetric Surveys

If transport of material from the sites is occurring, hydrographic surveys shall be expanded to include the impacted areas and shall be performed on a semiannual basis to determine the changes in dispersion of the material until the impacts are no longer observed. An accumulation of more than 1 foot of sedimentation along the ODMDS boundary will be considered the threshold level for significant movement of material outside of the designated ODMDS.

Data Analysis

- If deposited dredged material is mounding to elevations above the threshold value, but less than 15 feet above the existing bottom elevation, and there is no significant short-term transport of material beyond the limits of the ODMDS, then semiannual postdisposal monitoring shall occur as described.
- If at 6 months after disposal, deposited dredged material remains mounded to elevations greater than half the postdisposal elevations, then bathymetric surveys shall be continued.
- If deposited dredged material is mounding to heights greater than 15 feet and/or significant movement of material out of the ODMDS has occurred, the USACE-SWG together with EPA, Region 6 will consider various management options to rectify the situation. Such options could include, but are not limited to, expansion of the ODMDS or relocation of the ODMDS within the zone of siting feasibility described in the designation EIS.

Biological Testing

If the results of the Tier M1 sediment chemistry evaluation indicate the need for additional testing, then solid-phase bioassay and bioaccumulation testing shall be conducted in accordance with the procedures described in the RIA. Funding for work under this Tier shall be provided by EPA, Region 6 as described in Section IV, Funding.

Data Analysis

- If toxicity is not indicated, then no further testing is needed and disposal activities can continue at the ODMDS.
- If toxicity is indicated at the ODMDS, the USACE-SWG together with EPA, Region 6 will consider various management options to rectify the situation. Because the ODMDS is a dispersive site, potential sources of toxicity other than dredged material must also be considered. If planned use of the ODMDS is imminent, a decision must also be made whether to allow continued use of this site.

X. SMMP Review and Revision

Pursuant to Section 102(c) of the MPRSA, as amended by WRDA 92, the SMMP for the FHCIP ODMDSs will be reviewed and revised, if necessary, not less frequently than 10 years after adoption and every 10 years thereafter.

Modifications or updates to the SMMP may be necessary, based on specific needs identified for specific authorized projects. Modifications or updates to the SMMP may be proposed by either the USACE-SWG or EPA, Region 6. Following a 30-day review period of the changes(s), the modifications may be incorporated into the plan by mutual consent of both agencies.

References

National Marine Fisheries Service (NMFS). 2007. Revision 2 to the November 19, 2003, Biological opinion concerning dredging of Gulf of Mexico navigation channels and sand mining ("borrow") areas using hopper dredges by U.S. Army Corps of Engineers, Galveston, New Orleans, Mobile, and Jacksonville districts (Consultation Number F/SER/2000/01287).

U.S. Environmental Protection Agency (EPA). 1989. Draft environmental impact statement, Freeport Harbor (45-foot Project), Ocean Dredged Material Disposal Site designation, EPA 906/01-80-003. U.S. EPA Region VI, Dallas, Texas.

———. 1990. Final environmental impact statement, Freeport Harbor (45-Foot Project), Ocean Dredged Material Disposal Site designation, EPA 906/01-90-001. U.S. EPA, Region VI, Dallas, Texas.

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1996. Guidance document for development of SMMPs for Ocean Dredged Material Disposal Sites. Office of Water (4504F), Environmental Protection Agency, Washington, D.C.

———. 2003. Regional implementation agreement for testing and reporting requirements for ocean disposal of dredged material off the Louisiana and Texas coasts under Section 103 of the Marine Protection, Research and Sanctuaries Act, July 2003. U.S. EPA Region VI, Dallas, Texas; U.S. Army Corps of Engineers, Galveston District; and U.S. Army Corps of Engineers, New Orleans District.

This SMMP complies with Section 102(c)(3) of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Sections 1401, *et seq.*) as amended by Section 506 of the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580), and has been approved by the following officials of Region 6 of the U.S. Environmental Protection Agency, and Galveston District of the U.S. Army Corps of Engineers. This plan goes into effect upon the date of the last signature:

Al Armendariz
Regional Administrator
Region 6
U.S. Environmental Protection Agency

5/6/2011
Date

Christopher W. Sallese
Colonel, Corps of Engineers
Galveston District
U.S. Army Corps of Engineers

23 MAR 11
Date

Appendix C

General Conformity Determination and Air Emissions Estimates

Document No. 070282
Job No. 441901

FINAL
GENERAL CONFORMITY DETERMINATION
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT
BRAZORIA COUNTY, TEXAS

Prepared for:

U.S. Army Corps of Engineers
Galveston District
P.O. Box 1229
Galveston, Texas 77553-1229

Prepared by:

Atkins
6504 Bridge Point Parkway
Suite 200
Austin, Texas 78730

April 2011

PROFESSIONAL ENGINEER STATEMENT

The attached Final General Conformity Determination Document and estimate of air contaminant emissions is released on August 21, 2012 under the authority of Ruben I. Velasquez, P.E., Registration No. 69126, for the purpose of evaluation and discussion. This preliminary document is not to be used for construction, bidding, or permitting purposes.

TCEQ and USACE's determination of conformity is based on the emissions information and project schedule proposed at the time. Once a final project schedule is completed, USACE will provide an update of the General Conformity documentation to TCEQ and EPA for review and concurrence that the updated emissions and schedule will still be conformant with the currently approved Houston-Galveston area State Implementation Plan.

Ruben I. Velasquez, PE
Atkins
TBPE REG. #F-474

Contents

Figures

Tables

Acronyms and Abbreviations

BPA	Brazos Pilots Association
BRHND	Brazos River Harbor Navigation District
CAA	Federal Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CY	cubic yards
FEIS	Final Environmental Impact Statement
DOT	U.S. Department of Transportation
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERDC	Engineer Research and Development Center
FHCIP	Freeport Harbor Channel Improvement Project
FEIS	Final Environmental Impact Statement
FS	Feasibility Study
HGB	Houston-Galveston-Brazoria
LOA	length overall
LPP	Locally Preferred Plan
mcy	million cubic yards
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NO_X	nitrogen oxides
ODMDS	Ocean Dredged Material Disposal Site
PA	Placement Area
PM_{10}	particulate matter with an aerodynamic diameter equal to or less than 10 microns
SIP	Texas State Implementation Plan
SO_2	sulfur oxides
TCEQ	Texas Commission on Environmental Quality
tpy	tons per year
TxLED	Texas Low-Emission Diesel
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 INTRODUCTION

The existing Freeport Harbor Project was authorized by the River and Harbors Acts of May 1950 and July 1958, providing for an Entrance Channel of 38-foot depth and 300-foot width from the Gulf of Mexico (Gulf) to inside the jetties and for interior channels of 36-foot depth and 200-foot width up to and including the Upper Turning Basin. The relocation and deepening of the Jetty Channel to a 45-foot depth and 400-foot width and the Entrance Channel to a 47-foot depth and 400-foot width, with an extension of approximately 4.6 miles into the Gulf was authorized by Congress in 1978 with the passage of Section 101 of the River and Harbors Act of 1970 (PL 91-611; House Document 289, 93rd Congress – 2nd Session, December 31, 1975) and by the president in 1974. The construction of this existing project, referred to in this document as the Freeport Harbor Channel 45-Foot Project was completed in 1998.

The Brazos River Harbor Navigation District (BRHND) (Port Freeport), the non-Federal sponsor of the existing channel system, began consideration of additional channel improvements to alleviate navigation problems experienced at the port. A 905(b) reconnaissance study was completed in 2002 by the U.S. Army Corps of Engineers (USACE), identifying a Federal interest in a widening and deepening project because transportation savings in the form of National Economic Development (NED) benefits substantially exceed the cost of project implementation. A general screening analysis was conducted to identify structural plans, which would provide safe and efficient navigation at the least cost while minimizing environmental impacts, and included a ship simulation study conducted at Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi. As a result, a Feasibility Study (FS) was begun to determine whether a Federal navigation improvements project is justified and to provide a decision document to recommend to Congress authorization and funding to construct the project. On July 7, 2003, the USACE and Port Freeport signed an agreement to conduct the FS, including an Environmental Impact Statement (EIS). The project is being led by the USACE, with the cost being shared by Port Freeport.

The District Engineer, USACE, is responsible for the overall management of this EIS. Port Freeport is the non-Federal sponsor for the study. The study is being coordinated with interested Federal, State, and local agencies and the public. There are no cooperating agencies for the Freeport Harbor Channel Improvement Project (FHCIP). In accordance with the National Environmental Policy Act (NEPA), a Draft Environmental Impact Statement (DEIS) was prepared to analyze and disclose the potential impacts of the proposed project and reasonable alternatives on the natural and human environment.

Freeport Harbor Channel provides deep-water access from the Gulf to Port Freeport (Figure 1). Specifically, the existing Freeport Harbor Channel begins approximately 4.9 miles seaward of the coastal jetty tips between Surfside and Quintana, in Brazoria County, Texas, at the 47-foot depth contour in the Gulf, continuing upstream through the Freeport Harbor Entrance and Jetty channels, and winding westward for approximately 3.5 miles into Freeport to the Stauffer Channel Turning Basin. Upland and offshore placement areas (PAs) for disposal of dredged material from the proposed improvements are also

included in the study. The Freeport Harbor Jetty and Entrance Channels are currently maintained by the USACE to a depth of –45 feet and –47 feet mean low tide, respectively, at a width of 400 feet. These existing channels are approximately 6.3 miles in length and approximately 400 feet in width.

For the preparation of the FHCIP, several alternatives were identified and suggested in the 2002 Galveston District Reconnaissance Report Section 905(b) Analysis. Based on the analysis and evaluation of these alternatives, the USACE has identified three alternatives carried through and evaluated in this EIS. The alternatives include the No-Action Alternative and the proposed action with two alternative channel configurations, as follows:

- No-Action Alternative – The No-Action Alternative is the existing project. The 45-Foot Project depth would be maintained throughout the Freeport Harbor Entrance and Jetty channels. The remainder of the Freeport Harbor Main Channel, turning basins, and Stauffer Channel would remain as described in Section 1.3 and Table 2.5-1. Shoal material would continue to be dredged from the channel during maintenance cycles and placed in the designated ocean dredged material disposal site (ODMDS) for the Jetty and Entrance channels and in PA 1 for the channel inshore of the Jetty Channel.

- Future Without Project – The FWOP is defined as the No-Action Alternative combined with permit widening. Construction of channel widening by the Port will occur before Federal construction of the FHCIP, in the event the permit is issued. Under the FWOP, the channel would be maintained at the authorized depth of 45 feet, with a permitted width of 600 feet for the Entrance and Jetty channels. The Freeport Harbor Jetty Channel from Channel Station 63+46 would be gradually widened, at the authorized depth, from 400 feet to 550 feet up to Channel Station 43+00. From that station to Channel Station 38+00, the channel width would be between 550 feet and 600 feet. The remainder of the Jetty Channel and the entire Freeport Harbor Entrance Channel (to approximately Channel Station –300+00) would be approximately 600 feet wide. The 45-Foot Project depth would be maintained throughout the Freeport Harbor Entrance and Jetty channels. The remainder of the Freeport Harbor Main Channel, turning basins, and Stauffer Channel would remain as described in Section 1.3 and Table 1.3-1. For the FHCIP, the FWOP is the condition against which all proposed project alternatives are evaluated, rather than the No-Action Alternative.

- NED Plan Alternative – In general, the NED Plan Alternative proposes to widen the Entrance and Jetty channels to 540 feet and deepen to 60 feet, to deepen the main channels to 60 feet, and to deepen the Stauffer Channel to 40 feet and widen it to 300 feet, while restoring the Upper Stauffer Channel to its authorized dimensions of 30-foot depth and 200-foot width. Associated turning basins would also be deepened and widened. Construction of the NED Plan would generate approximately 23.2 million cubic yards (mcy) of dredged material. Maintenance of the deepened and widened channel would generate a total of 190.5 mcy of maintenance dredged material over the 50-year evaluation period. Material dredged from the Entrance and Jetty

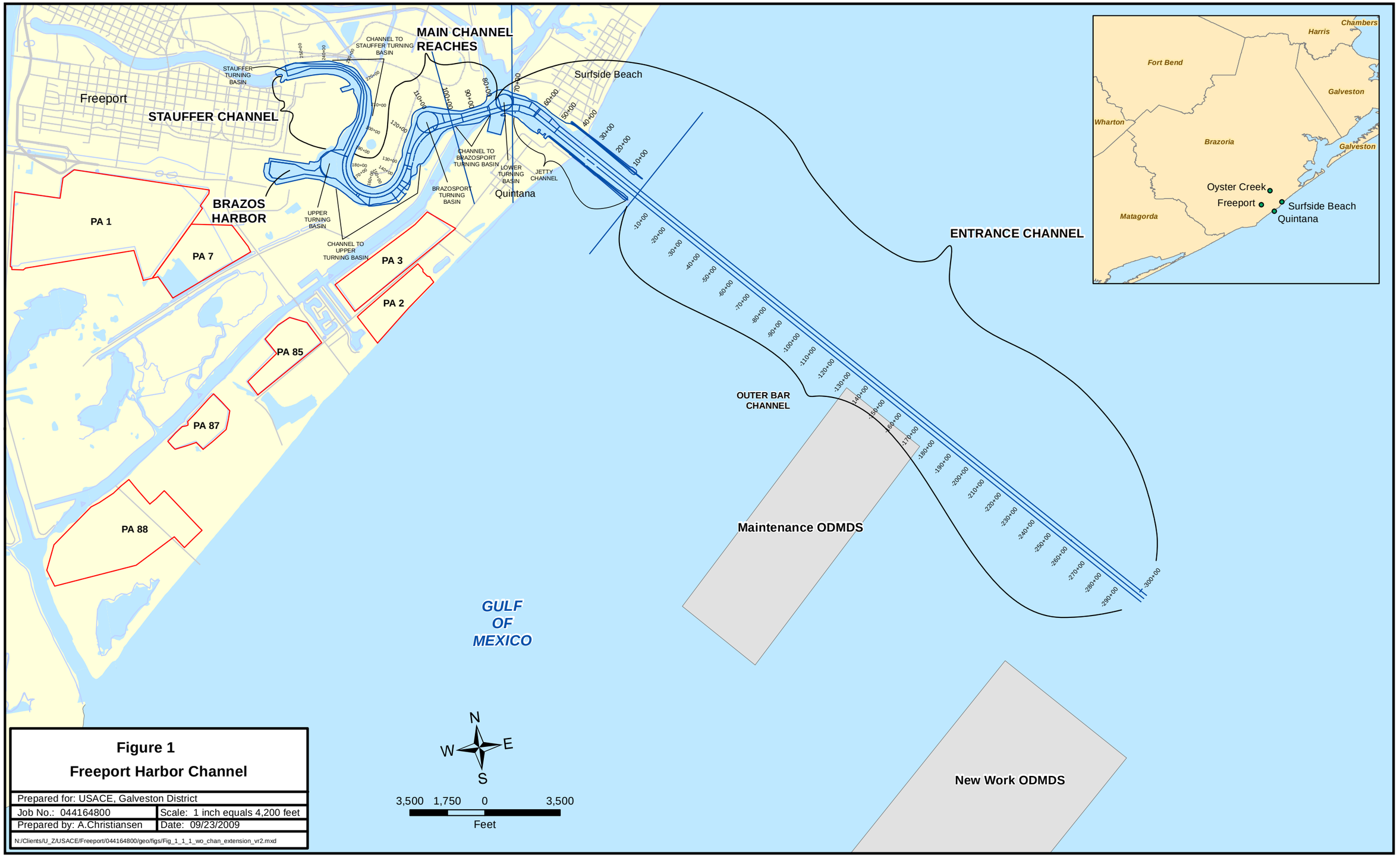

Figure 1

Freeport Harbor Channel

Prepared for: USACE, Galveston District	
Job No.: 044164800	Scale: 1 inch equals 4,200 feet
Prepared by: A.Christiansen	Date: 09/23/2009
N:/Clients/U_Z/USACE/Freeport/044164800/geo/figs/Fig_1_1_1_wo_chan_extension_vr2.mxd	

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channels during construction would be placed in the New Work ODMDS and the remainder of the new work material would be placed in upland PAs 1, 8, and 9. Material dredged from the Entrance and Jetty channels during maintenance cycles would be placed in the maintenance material ODMDS, and material from the remainder of the channel would be placed in PAs 1, 8, and 9.

- Locally Preferred Plan (LPP) Alternative – In general, the LPP Alternative proposes to widen the Entrance and Jetty channels up to 600 feet and deepen to 55 feet, to deepen the main channels to 55 feet, and to deepen the Stauffer Channel to 50 feet and widen it to 300 feet. Associated turning basins would also be deepened and widened. Construction of the LPP would generate approximately 17.4 mcy of dredged material. Maintenance of the deepened and widened channel would generate a total of 175.9 mcy of maintenance dredged material over the 50-year evaluation period. Material dredged from the Entrance and Jetty channels during construction would be placed in the New Work ODMDS, and the remainder of the new work material would be placed in PAs 1, 8, and 9. Material dredged from the Entrance and Jetty channels during maintenance cycles would be placed in the Maintenance ODMDS, and material from the remainder of the channel would be placed in PAs 1, 8, and 9.

Additional information regarding the proposed project is presented in the FEIS.

1.1 PURPOSE

Vessel operations are currently constrained by the dimensions of the Freeport Harbor Channel. The maximum ship dimensions currently permitted by the Brazos Pilots Association (BPA) at Freeport Harbor are 825-foot length overall (LOA), 145-foot maximum beam, and 42-foot draft. The channel dimension constraints include (a) lightering and lightening, (b) LOA restrictions, (c) beam restrictions, (d) one-way traffic, and (e) daylight-only operation restrictions. These problems are discussed in more detail below.

- **Lightering and Lightening.** Since the completion of the 45-foot Project, the size of the vessels navigating the waterway has steadily increased so that many vessels currently have to be light-loaded to traverse the channel. The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for navigating the channel. This lightering operation takes place in the Gulf where two ships, the mother ship and the lightering ship, come together so that a cargo transfer can occur. Lightening operations are similar except that cargo is transferred to another ship so that both ships can enter port. Although these operations have occurred frequently in the past, the possibility for a collision, oil spill, fire, or other adverse environmental consequence is always present. Current projections indicate that crude imports will increase in the near future. As these imports increase, the number of lightering vessels and product carriers will also increase, adding to shipping delays, congestion, and the potential risk of collision or spill.
- **LOA Restrictions.** The length limitation of 825 feet is enforced because crosswinds and crosscurrents force tankers to “crab” at an angle through the Entrance Channel. Ships of greater length than 825 feet are not able to clear the jetties under adverse wind and current conditions. Waivers on ship length are granted on a case-by-case basis for ships as large as

900-foot LOA and 160-foot beam to transit the Freeport Harbor Channel, provided that winds are less than 20 knots and that there is no more than a 0.5 knot crosscurrent at the mouth of the jetties. About three to four ships per month are granted these waivers. Numerous requests have been submitted for ships in the 920- to 950-foot LOA range to transit the channel, and these requests have been denied. When denied access to Freeport Harbor, these ships normally divert to Corpus Christi or New Orleans.

- **Beam Restrictions.** The maximum beam permitted under normal operations is 145 feet. Vessels with larger beams require waivers to enter the port.
- **One-Way Traffic Restriction.** Because of the 400-foot width of the Entrance and inside channels, one-way ship traffic is always in effect in the Freeport Harbor Channel. This can result in delays when ship schedules coincide.
- **Daylight-Only Operation Restriction.** Because of channel dimensions as well as the nature of the cargo, daylight-only operation is enforced on all vessels greater than 750-foot LOA or over 107-foot beam. This can result in waiting time of up to 12 hours, if ship arrival/departure occurs at dark.

Port Freeport requested that the terminus of the Federal project extend to include the Stauffer Channel. The length of the proposed channel would then extend approximately 3,700 feet from the federally authorized 45-foot Upper Turning Basin. As part of the FS, optimization of the depth for the channel extension for the Lower Stauffer Channel was determined. Depth alternatives of 30, 40, and 50 feet were initially evaluated and resulted in a more focused evaluation of a smaller range of depths. Analyses were conducted to determine any competitive advantage that Port Freeport might potentially have over competing ports. For instance, there is considerable overlap between the Houston and Freeport population centers, and a Port Freeport container terminal has the potential of capturing associated savings. In addition, Port Freeport offers an advantage over existing facilities in Houston because terminal capacity in Houston is near capacity.

The purpose of the proposed project is to improve navigation efficiency by reducing the number of lightering and lightening operations by deepening the channel, and to eliminate operational constraints by improving the channel.

1.2 NEED

The project need is the elimination of the operational constraints to allow vessels to avoid delays, thereby reducing shipping costs and logistical problems and increasing vessel safety. Freeport experienced strong tonnage growth over the past decade. Review of the USACE national statistics shows Freeport ranking 24th in the nation in terms of total tonnage in 2002, up from 38th in the early 1990s. Although Freeport handles general cargo and containerized cargo, crude petroleum imports account for the majority of throughput.

As discussed in the FEIS, the USACE has previously noted the problems mentioned above; i.e., that “the light-loading, one-way traffic, and daylight-only operation result in significantly higher costs to users of

the Port Freeport than would be experienced if the harbor were enlarged and deepened. The transportation savings that would result from improvements at Freeport Harbor would be an economic benefit to the nation." Thus the USACE has confirmed the need for the project and that the project serves the national interest.

1.3 GENERAL CONFORMITY

This project, as a Federal action, is subject to the General Conformity Rule promulgated by the U.S. Environmental Protection Agency (EPA). The rule mandates that the Federal government not engage in, support, or provide financial assistance for licensing or permitting, or approving any activity not conforming to an approved State Implementation Plan. In Texas, the applicable plan is the Texas State Implementation Plan (SIP), an EPA-approved plan for the regulation and enforcement of the National Ambient Air Quality Standards (NAAQS) in each air quality region within the state.

Based on an evaluation of air contaminant emissions associated with this project, it has been determined that a General Conformity Determination for nitrogen oxide (NO_X) emissions would be required. Emissions of volatile organic compounds (VOC) for this project are exempt from a General Conformity Determination because they are below the emissions threshold requiring such an analysis.

This document represents the Final General Conformity Determination prepared on behalf of the USACE, Galveston District, pursuant to the Clean Air Act (CAA), Section 176(c)(1), to document that emissions that would result from the proposed FHCIP are in conformity with the SIP for the HGB ozone nonattainment area.

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2.0 REGULATORY BACKGROUND – GENERAL CONFORMITY

General Conformity refers to the process of evaluating plans, programs, and projects to determine and demonstrate they meet the requirements of the CAA and the SIP. The General Conformity Rule establishes conformity in coordination with and as part of the NEPA process. The rule takes into account air pollution emissions associated with actions that are federally funded, licensed, permitted, or approved, and ensures emissions do not contribute to air quality degradation, thus preventing the achievement of State and Federal air quality goals.

This rule is designed to ensure that Federal actions do not cause or contribute to air quality violations in areas that do not meet the NAAQS. The General Conformity Rule is codified at Title 40 Code of Federal Regulations (CFR) Part 51, Subpart W, and Title 40 CFR Part 93, "Determining Conformity of Federal Actions to State or Federal Implementation Plans."

The Texas Commission on Environmental Quality (TCEQ), has promulgated its own corresponding regulations under 30 TAC §101.30, "Conformity of General Federal Actions to State Implementation Plans" (TCEQ, 1999). Unless specifically exempted, this rule applies to all Federal actions except programs and projects requiring funding or approval from the U.S. Department of Transportation (DOT), the Federal Highway Administration, the Federal Transit Administration, or the Metropolitan Planning Organization. These types of programs and projects must instead comply with the conformity provisions implemented in the Transportation Conformity Rule issued by the DOT on November 24, 1993.

The CAA defines conformity to an implementation plan as the upholding of "an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of such standards." Conforming activities or actions should not, through additional air pollutant emissions, result in the following:

- Cause or contribute to new violation of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or
- Delay timely attainment of any NAAQS or interim emission reductions or other milestones in any area.

The purpose of this General Conformity requirement is to assure Federal agencies consult with State and local air quality districts to assure these regulatory entities know about the expected impacts of a Federal action and would include expected emissions in their SIP emissions budget.

Consistent with Section 176(c)(1) of the CAA, a Federal action is generally defined as any activity engaged in or supported in any way by any department, agency, or instrumentality of the Federal government (40 CFR 51.852). Federal actions include providing Federal financial assistance or issuing a Federal license, permit, or approval. Where the Federal Action is a permit, license, or other approval for

some aspect of a non-Federal undertaking, the relevant activity is the part, portion, or phase of the non-Federal undertaking that requires the Federal permit, license, or approval.

Pursuant to the General Conformity Rule, a Federal agency; e.g., the USACE, must make a General Conformity Determination for all Federal actions in nonattainment or maintenance areas where the total of direct and indirect emissions of a nonattainment pollutant or its precursors exceeds levels established by the regulations. For the HGB nonattainment area, the threshold level is 25 tons per year (tpy) for either NO_X or VOC. In addition, even if the total of direct and indirect emissions of VOC or NO_X does not exceed the 25 tpy threshold levels, when the total of direct and indirect emissions of any pollutant from the Federal action represents 10 percent or more of a nonattainment or maintenance area's total emissions of those pollutants, then the action is defined as a regionally significant action, and a conformity determination would still be applicable.

The general conformity regulations require the inclusion of direct and indirect impacts of the Federal action in the conformity applicability analysis if those impacts are reasonably foreseeable and subject to continuing agency responsibility. Only those air emissions of NO_X and VOC related to the Federal action should be considered in this General Conformity Determination.

3.0 APPLICABILITY

The General Conformity Rule is applicable only to nonattainment and maintenance areas. The FHCIP will be located in Brazoria County, Texas. Brazoria County is included in the eight-county HGB ozone nonattainment area, which is classified as "severe" in terms of its degree of compliance with the current 1- and 8-hour ozone standards. This classification affects facilities that generate the ozone precursors, NO_X, and VOC. As such, the project is subject to the General Conformity Rule, which applies to all nonattainment and maintenance areas.

The proposed project alternatives have been evaluated in terms of the relevant direct and indirect emissions associated with each alternative such as emissions from dredging, dredge support equipment, construction equipment used in the placement of dredged material, and employee vehicles used to commute to and from the work sites. Based on this evaluation, it has been determined that a General Conformity Determination for NO_X emissions would be required for the NED and LPP alternatives as emissions of NO_X are estimated to exceed the 25 tpy applicability threshold for each of these alternatives. Emissions of VOC for the construction activities for each of these alternatives are exempt from a General Conformity Determination because they are below the 25 tpy emissions threshold requiring such an analysis. A General Conformity Determination has been prepared for the No-Action Alternative (Widening Project) and coordination with TCEQ is ongoing.

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4.0 AIR EMISSIONS INVENTORY

For the EIS and the General Conformity Determination, an air emissions inventory was prepared for project-related activities for both the NED and LPP alternatives based on the schedule and other assumptions as developed for each alternative. Air emissions estimates were calculated using techniques appropriate for a specific emissions-generating activity or source. The basis, emission factors, and summary of emissions are provided in Appendix A, NED Alternative Emissions Summary, and Appendix B, LPP Alternative Emissions Summary, of this document.

4.1 Project Emissions

The emission sources for each project alternative will consist of marine and land-based mobile sources that will be utilized as scheduled for the duration of the project. It is assumed that the marine emission sources will include two types of dredges, hydraulic and hopper, as well as support equipment such as tugboats, survey boats, and trawlers. The land-based emission sources will include both off-road equipment utilized for dredged material placement sites and on-road vehicles for employees commuting to and from the work site. The marine emission sources and off-road equipment will consist primarily of diesel-powered engines. The on-road employee vehicles will consist primarily of gas-powered vehicles.

4.1.1 Methods Used for Estimation of Air Contaminant Emissions

Emissions of NO_X and VOC were estimated in tons per year for each piece of equipment. The emissions were then categorized and totaled and broken out on an annual basis for each year for which dredging is projected to occur.

The basis for emissions included the following:

- Preliminary project description and other information, as provided for each alternative.
- Emissions from marine vessels in support of the dredging activities were estimated for the project duration; the project is expected to begin in 2011. The basis for emissions estimates consisted of the operating hours for each specific type of equipment engine, engine load factor, and engine horsepower. Emission rates (tons per hour) from dredges, dredging support equipment, and other harbor vessels were calculated for each criteria pollutant and were derived based on the following formula:

  Emission Rate = Engine Horsepower x Engine Load Factor x Emission Factor (grams per horsepower-hour) ÷ 453.59 grams per pounds ÷ 2,000 pounds per ton

  Load factors and emission factors for the different marine equipment were determined based on the EPA report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," February 2000. Emission amounts (tons per year) for each of the pollutants were then calculated based on the following formula:

Emission Amount (tons/year) = Emission Rate (tons/hr) x Working Hours (hrs/year)

Detailed emission calculations for the marine equipment can be found in Tables B-1 to B-7 and C-1 to C-12 in appendices A and B for each alternative.

- The EPA, NONROAD emission factor model, Final 2005 Version, was used to predict emissions resulting from land-side, off-road construction equipment used for construction and placement in upland PAs with inputs for assumed equipment usage developed for this alternative. This model may be used to predict air emissions for off-road construction equipment based on information including geographic location, equipment type, and fuel use for specific years that may be selected. It provides an estimate of emissions for different equipment based on equipment population, load factor, available horsepower, deterioration, and applicable standards.

  The NONROAD model was run to generate an emission factor for the criteria air contaminants resulting from the use of bulldozers in Brazoria County during the model year of 2010. These emission factors were then used to estimate the total emissions from the use of bulldozers in dredged material placement activities associated with the project. Detailed emission calculations for the off-road construction equipment can be found in Tables D-1 to D-5 in appendices A and B for each alternative.

- Mobile on-road emissions associated with employee vehicles were calculated with the use of the EPA MOBILE6.2 emission factor model. MOBILE6 is a model for predicting emission factors from motor vehicles under various conditions. The model accounts for general factors that may affect emission factors including changes in vehicle emission standards, changes in vehicle populations and activity, and variation in local conditions such as temperature, humidity, and fuel quality.

  A mix of light duty gasoline vehicles and light duty gasoline trucks was assumed for the makeup of the employee vehicles. An average commute of 25 miles each way was assumed for each vehicle. The total number of miles traveled equaled the number of miles per trip multiplied by the total number of days of activity times the number of vehicles. Detailed emission calculations for employee vehicles can be found in Tables E-1 and E-4 in appendices A and B for each alternative.

4.1.2 Dredging Activities

Air emissions directly related with the dredging equipment including generators used to drive the dredge pumps and emissions from support equipment such as tugs and runabouts were calculated on an annual basis based on the anticipated type of activity, engine use, horsepower, load factor, and anticipated hours of operation during the construction period.

For the NED Alternative, it was assumed that the FHCIP would include the use of the dredge equipment as follows.

- Hopper Dredge – A hopper dredge would be used to dredge 17,957,000 cubic yards (CY) of material for placement at ODMDSs.

- Cutterhead – A 30-inch hydraulic cutterhead would be used for pumping and onshore placement of 5,211,000 CY of material into new upland PAs.

For the LPP Alternative, it was assumed that the widening and deepening project would include the use of the dredge equipment as follows.

- Hopper Dredge – A hopper dredge would be used to dredge 12,733,000 CY of material for placement at ODMDSs.

- Cutterhead – A 24-inch hydraulic cutterhead would be used for pumping and onshore placement of 4,619,000 CY of material into new upland PAs.

When not dredging, air contaminant emissions were also estimated from dredging vessels when sailing as oceangoing vessels, e.g., during periods of mobilization to the dredging site or during transport and placement of the dredged material.

4.1.3 Land-side Dredged Material Placement – Nonroad Equipment

It is anticipated that land-side dredged material placement activities would occur primarily only in support of the mechanical dredging activities and would include working and compacting of the dredged material on-shore within a localized area of placement using nonroad construction equipment. It is expected that Texas Low-Emission Diesel (TxLED) will be available for use in nonroad equipment such as bulldozers, dump trucks, etc. during the proposed construction period pursuant to the TxLED requirements of the SIP. However, for conservatism, a reduction in NO_X emissions was not assumed in the final summary of emissions for this equipment in support of this project.

4.1.4 On-Road Mobile – Employee Commuter Vehicles

Mobile source emissions associated with the project construction would be generated from employee commuter vehicles to and from the work-site. It was assumed that commuter vehicles would include a mix of cars and light-duty trucks burning primarily gasoline. Mobile source emission factors were estimated using the EPA's mobile-source emissions model, MOBILE6.2, based on vehicle information and other input options specific to Brazoria County as previously provided by the TCEQ's Air Quality Planning and Implementation Division.

4.2 NED PLAN ALTERNATIVE – SUMMARY OF NO_X AND VOC EMISSIONS

For comparison with the thresholds defined in the General Conformity Rule, the estimated annual emissions of NO_X and VOC for the NED Plan Alternative are summarized in Tables 1 and 2 for each year of the anticipated construction activities. Emissions of carbon monoxide, sulfur dioxide, and particulate matter are not considered in the General Conformity evaluation as this area is in attainment with the NAAQS for each of those pollutants.

TABLE 1
NED PLAN ALTERNATIVE – SUMMARY OF NO_X EMISSIONS
(tons per year)

Activity	2011	2012	2013	2014	2015	2016
Dredging Activities	100.96	847.8	933.1	786.4	551.1	302.6
Land-side Dredged Material Placement	--	6.75	9.0	8.48	7.44	1.24
Employee Commuter Vehicles	0.16	3.36	2.50	3.35	1.78	0.65
Totals	101.1	857.9	944.6	798.2	560.4	304.5

As shown in Table 1, the estimate of NO_X emissions for the NED Plan Alternative would exceed the conformity threshold, i.e., greater than 25 tpy for all years of projected construction activity. Therefore, a General Conformity Determination for NO_X emissions is required for this alternative.

TABLE 2
NED PLAN ALTERNATIVE– SUMMARY OF VOC EMISSIONS
(tons per year)

Activity	2011	2012	2013	2014	2015	2016
Dredging Activities	1.16	9.61	10.78	9.08	6.41	3.48
Land-side Dredged Material Placement	--	0.48	0.65	0.62	0.58	0.10
Employee Commuter Vehicles	0.2	4.41	3.28	4.40	2.34	0.86
Totals	**1.36**	**14.51**	**14.71**	**14.11**	**9.33**	**4.43**

As shown in Table 2, the estimate of VOC emissions for the NED Plan Alternative would not exceed the conformity threshold of 25 tpy. Therefore, a General Conformity Determination for VOC emissions is not required for this alternative.

4.3 LPP ALTERNATIVE – SUMMARY OF NO_X AND VOC EMISSIONS

For comparison with the thresholds defined in the General Conformity Rule, the estimated annual emissions of NO_X and VOC for the LPP Alternative are summarized in Tables 3 and 4 for each year of the anticipated construction activities.

TABLE 3
LPP ALTERNATIVE – SUMMARY OF NO_X EMISSIONS
(tons per year)

Activity	2011	2012	2013	2014	2015
Dredging Activities	95.4	747.3	855.2	703.7	218.3
Land-side Dredged Material Placement	--	19.41	25.88	14.23	--
Employee Commuter Vehicles	0.11	5.65	2.43	2.90	0.90
Totals	95.5	772.4	883.5	720.9	219.2

As shown in Table 3, the estimate of NO_X emissions for the LPP Alternative would exceed the conformity threshold, i.e., greater than 25 tpy, for all years of projected construction activity. Therefore, a General Conformity Determination for NO_X emissions is required for this alternative.

TABLE 4
LPP ALTERNATIVE – SUMMARY OF VOC EMISSIONS
(tons per year)

Activity	2011	2012	2013	2014	2015
Dredging Activities	1.09	8.52	9.86	8.18	2.55
Land-side Dredged Material Placement	--	1.39	1.86	1.08	--
Employee Commuter Vehicles	0.15	7.42	3.19	3.81	1.18
Totals	1.24	17.33	14.91	13.08	3.73

As shown in Table 4, the estimate of VOC emissions for the LPP Alternative would not exceed the conformity threshold of 25 tpy. Therefore, a General Conformity Determination for VOC emissions is not required for this alternative.

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5.0 ISSUANCE OF DRAFT GENERAL CONFORMITY DETERMINATION AND AGENCY RESPONSE

In December 2010, the USACE, Galveston District, issued a Draft General Conformity Determination concurrently with the Draft EIS for the proposed FHCIP. Copies of these documents were provided to various Federal and State agencies including the TCEQ and the EPA, Region VI. On December 19 and 26, 2010, the USACE published the notice of availability of the Draft General Conformity Determination in "The Facts" a daily newspaper of general circulation for the Brazoria County and published in the City of Clute. A copy of this publication and publisher's affidavit are in provided in Appendix C of this document.

In response to the issuance of the Draft General Conformity Determination in December 2010, the TCEQ provided a General Conformity Concurrence letter dated March 1, 2011. A copy of this letter is provided in Appendix D.

In its letter, the TCEQ provided its General Conformity concurrence for the proposed FHCIP and a determination that emissions from the project would not exceed the emissions budgets in the most recent SIP approved by the EPA. The most recently approved SIP revision, the "HGB Reasonable Further Progress SIP BPA Rate-of-Progress," adopted by the TCEQ on May 23, 2007, was approved by the EPA on March 29, 2010. In addition, the TCEQ suggested that the USACE adopt pollution prevention and/or reduction measures in conjunction with this and future projects including the following:

- Encourage construction contractors to apply to Texas Emission Reduction Plan grants;
- Establish bidding conditions that give preference to clean contractors;
- Direct construction contractors to exercise air quality best management practices;
- Direct contractors that will use tugboats during construction to use clean fuels;
- Direct operators of the assist tugboats used in maneuvering dredge vessels to use clean fuels;
- Select assist tugs based on lowest NO_X emissions instead of lowest price; or
- Purchase and permanently retire surplus NO_X offsets prior to commencement of operations.

The EPA also provided comments with regard to the Draft General Conformity Determination by letter dated February 11, 2011, as follows:

> "The DEIS and appendices do not indicate plans for this project to use cleaner, newer equipment with lower NO_X emissions. EPA encourages the use of clean, lower-emissions equipment and technologies to reduce pollution. Further, EPA's final

Highway Diesel and Nonroad Diesel Rules mandate the use of lower-sulfur fuels in non-road and marine diesel engines beginning in 2007. Please indicate a discussion of additional measures the project will incorporate to reduce emissions and the anticipated reductions in emissions. Initiatives such as the EPA Voluntary Diesel Retrofit Program, the EPA Diesel Emission Reduction Program (DERA), and the Texas Emissions Reduction Plan (TERP on the State level offer the opportunity to apply for resources for upgrading and replacing older equipment to reduce NO_X emissions."

In response to these suggestions USACE will:

1. Encourage construction contractors to apply for Texas Emission Reduction Plan grants, the EPA's Voluntary Diesel Retrofit Program, or the EPA's Diesel Emission Reduction Plan offering the opportunity to apply for resources for upgrading or replacing older equipment to reduce NO_X emissions;

2. Encourage contractors to use cleaner, newer equipment with lower NO_X emissions;

3. Direct contractors and operators that will use non-road diesel equipment to use clean, low-sulfur fuels

4. Direct contractors that will use tugboats during construction to use clean, low-sulfur fuels

5. Direct operators of the assist tugboats used in maneuvering dredge vessels to use clean, low-sulfur fuels; and

6. Direct operators of the dredging vessels to use clean, low-sulfur fuels.

The USACE cannot, however, give preference to bidders who use cleaner, newer equipment or who apply for TERP grants. This would interfere with competition, and it would be unfair to contractors outside of Texas who cannot apply for TERP grants.

6.0 FINAL GENERAL CONFORMITY DETERMINATION

Based on the evaluation of the proposed project description, estimated air quality emissions, and with consideration of the General Conformity concurrence letter from the TCEQ, the USACE has determined that its approval of the proposed FHCIP will meet the General Conformity requirements of TCEQ Chapter 101, §101.30(h)(1)(E)(i)(I). This section of the TCEQ's General Conformity Rule applies to an ozone nonattainment area, where the EPA has approved a revision to an area's attainment demonstration after 1990, and the TCEQ makes a determination that the estimated air contaminant emissions from a proposed Federal action will not exceed the emissions budget in the SIP.

The emissions budget for General Conformity purposes is defined in the TCEQ General Air Quality Rules §101.30(8). The budget is established by the allowable emissions allocated to a subcategory of the emissions inventory in the applicable SIP revision. The applicable SIP for General Conformity purposes is the most recent revision of the SIP that has been approved by the EPA. This evaluation is based on a comparison to the 2004 Mid-Course Review SIP (TCEQ, 2004), based on attainment of the 1-hour ozone standards, and associated emissions trading programs approved by the EPA on 6 September 2006 (EPA, 2006).

6.1 NED PLAN ALTERNATIVE EMISSIONS COMPARED TO SIP EMISSIONS BUDGETS

For comparison to the SIP Area Source Emissions budget, the annual NO_X emission rates estimated for the NED Plan Alternative may be summarized in terms of tons per day and compared to the SIP emissions budget as shown on Table 5.

TABLE 5
NED PLAN ALTERNATIVE – NO_X EMISSIONS COMPARED TO SIP 2007
WEEKDAY NONROAD MOBILE SOURCE EMISSIONS BUDGET[1]

	2011	2012	2013	2014	2015	2016
Tons per Year	101.0	854.6	942.1	794.8	558.6	303.8
Tons per Day	0.39	3.29	3.62	3.06	2.15	1.17
% of Nonroad Mobile Emissions Budget (64.53 tons per day)	0.60	5.09	5.61	4.74	3.33	1.81

[1]TCEQ (2004).

As shown on Table 6, NO_X emissions for the NED Plan Alternative project nonroad mobile equipment emissions would represent about 0.6 to 5.6 percent of the SIP 2007 Nonroad Emissions Budget for NO_X.

TABLE 6
NED PLAN ALTERNATIVE – NO_X EMISSIONS COMPARED TO SIP 2008
MOBILE VEHICLE EMISSIONS BUDGET[1]

	2011	2012	2013	2014	2015	2016
Tons per Year	0.16	3.36	2.50	3.35	1.78	0.65
Tons per Day	0.0006	0.013	0.0096	0.013	0.0068	0.0025
% of Mobile Vehicle Emissions Budget (186.13 tons per day)	0.0003	0.007	0.005	0.007	0.004	0.001

[1]H-GAC (2010).

Air emissions from employee commuter vehicles would represent a maximum of about 0.007 percent of the SIP 2008 Motor Vehicle Emissions Budget.

6.2 LPP ALTERNATIVE EMISSIONS COMPARED TO SIP EMISSIONS BUDGETS

For comparison to the SIP Area Source Emissions budget, the highest annual NO_X emission rate for the LPP Alternative may be broken out as shown on Table 7.

TABLE 7
LPP ALTERNATIVE – NO_X EMISSIONS COMPARED TO SIP 2007
WEEKDAY NONROAD MOBILE SOURCE EMISSIONS BUDGET[1]

	2011	2012	2013	2014	2015
Tons per Year	95.4	766.7	881.1	717.9	218.3
Tons per Day	0.37	2.95	3.39	2.76	0.84
% of Nonroad Mobile Emissions Budget (64.53 tons per day)	0.57	4.57	5.25	4.28	1.30

[1]TCEQ (2004).

As shown on Table 7, NO_X emissions for the LPP Alternative project nonroad mobile equipment emissions would represent about 0.6 to 5.3 percent of the SIP 2007 Nonroad Emissions Budget for NO_X.

TABLE 8
LPP ALTERNATIVE – NO_X EMISSIONS COMPARED TO SIP 2008
MOBILE VEHICLE EMISSIONS BUDGET[1]

	2011	2012	2013	2014	2015
Tons per Year	0.11	5.65	2.43	2.90	0.90
Tons per Day	0.0004	0.0217	0.0094	0.0112	0.0034
% of Mobile Vehicle Emissions Budget (186.13 tons per day)	0.0002	0.012	0.005	0.006	0.002

[1]H-GAC (2010).

Air emissions from employee commuter vehicles would represent a maximum of about 0.01 percent of the SIP 2008 Motor Vehicle Emissions Budget.

6.3 TCEQ CONFIRMATION OF SIP CONFORMITY

Based on an evaluation of the proposed alternative emissions, it is believed that the total of direct and indirect emissions of NO_X resulting from the selection of either alternative would result in a level of emissions that are well within the emissions budgets in the most recently approved SIP revision. The FHCIP is not unusual in scope for an area like the HGB, and it is anticipated that emissions from each year of the project will be less than an increase of 10 percent of the VOC and NO_X emissions inventories for the entire HGB nonattainment area. Therefore, emissions from the activities subject to the USACE action are not considered regionally significant for purposes of General Conformity. Because of this, it is expected that emissions from the project construction will not:

- Cause or contribute to new violation of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or
- Delay timely attainment of any NAAQS or interim emission reductions or other milestones in any area.

Based on a review of the Draft General Conformity Determination, the TCEQ has determined, pursuant to 30 TAC § 101.30(h)(1)(E)(i)(I), that emissions from the proposed project will not exceed the emissions from the applicable SIP revision, the "HGB Reasonable Further Progress SIP BPA Rate-of-Progress," adopted by the TCEQ on May 23, 2007, approved by the EPA on March 29, 2010. Therefore, the USACE has determined that the proposed project complies with the requirements of the General Conformity Rule; Section 176 of the CAA, and the State regulations promulgated pursuant to this rule, and is in conformity with the currently approved HGA SIP.

The TCEQ and USACE's determination of conformity is based on the emissions information and project schedule proposed at the time. Once a final project schedule is completed, the USACE will provide an update of the General Conformity documentation to the TCEQ and EPA for review and concurrence that the updated emissions and schedule will still be conformant with the currently approved HGA SIP.

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7.0 REFERENCES

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Appendix A

NED Alternative Emissions Summary

APPENDIX A

List of Tables
Freeport Harbor Channel Improvement Project
NED Alternative

Table A-1. Annual Project Emissions Summary
Freeport Harbor Channel Improvement Project
NED Alternative

	TONS PER YEAR					
Year 2011	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	11.37	100.96	2.29	2.41	16.73	1.16
Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Employee Vehicles	2.14	0.16	0.003	0.008	0.002	0.204
Subtotal	**13.51**	**101.12**	**2.29**	**2.42**	**16.73**	**1.36**
Year 2012	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	94.81	847.82	19.21	20.26	140.46	9.61
Construction Equipment	2.80	6.75	0.47	0.48	1.07	0.48
Employee Vehicles	46.18	3.36	0.07	0.16	0.05	4.41
Subtotal	**143.78**	**857.94**	**19.75**	**20.91**	**141.58**	**14.51**
Year 2013	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	105.45	933.05	21.15	22.31	154.67	10.78
Construction Equipment	3.74	9.00	0.62	0.64	1.42	0.65
Employee Vehicles	34.34	2.50	0.06	0.12	0.04	3.28
Subtotal	**143.53**	**944.56**	**21.82**	**23.07**	**156.13**	**14.71**
Year 2014	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	88.85	786.35	17.82	18.80	130.35	9.08
Construction Equipment	3.76	8.48	0.60	0.62	1.32	0.62
Employee Vehicles	46.05	3.35	0.07	0.16	0.05	4.40
Subtotal	**138.66**	**798.18**	**18.50**	**19.59**	**131.72**	**14.11**
Year 2015	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	62.48	551.13	12.49	13.18	91.37	6.41
Construction Equipment	3.80	7.44	0.57	0.58	1.12	0.58
Employee Vehicles	24.47	1.78	0.04	0.09	0.03	2.34
Subtotal	**90.75**	**560.35**	**13.10**	**13.85**	**92.51**	**9.33**
Year 2016	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	34.10	302.55	7.53	6.86	7.23	3.48
Construction Equipment	0.63	1.24	0.09	0.10	0.19	0.10
Employee Vehicles	8.99	0.65	0.01	0.03	0.01	0.86
Subtotal	**43.72**	**304.45**	**7.64**	**6.99**	**7.43**	**4.43**
TOTAL (ALL YEARS)						
Dredge & Support Equipment	397.05	3,521.87	80.49	83.82	540.80	40.52
Construction Equipment	14.73	32.91	2.36	2.43	5.11	2.43
Employee Vehicles	162.16	11.80	0.26	0.57	0.18	15.50
	574	**3,567**	**83**	**87**	**546**	**58**

Table A-2. Summary of Annual Project Emissions From All Sources Compared to 2001 Emissions Inventory Freeport Harbor Channel Improvement Project NED Alternative

	TONS PER YEAR					
2002 EMISSION INVENTORY	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
HGA	**1,101,693**	**357,353**	**59,155**	**325,353**	**152,017**	**214,128**
Brazoria County	**59,817**	**44,128**	**6,515**	**40,363**	**11,194**	**15,842**
ANNUAL NED ALTERNATIVE EMISSIONS	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Year 2011	**13.51**	**101.12**	**2.29**	**2.42**	**16.73**	**1.36**
% of HGA	0.00%	0.03%	0.00%	0.00%	0.01%	0.00%
% of Brazoria County	0.02%	0.23%	0.04%	0.01%	0.15%	0.01%
Year 2012	**143.78**	**857.94**	**19.75**	**20.91**	**141.58**	**14.51**
% of HGA	0.01%	0.24%	0.03%	0.01%	0.09%	0.01%
% of Brazoria County	0.24%	1.94%	0.30%	0.05%	1.26%	0.09%
Year 2013	**143.53**	**944.56**	**21.82**	**23.07**	**156.13**	**14.71**
% of HGA	0.01%	0.26%	0.04%	0.01%	0.10%	0.01%
% of Brazoria County	0.24%	2.14%	0.33%	0.06%	1.39%	0.09%
Year 2014	**138.66**	**798.18**	**18.50**	**19.59**	**131.72**	**14.11**
% of HGA	0.01%	0.22%	0.03%	0.01%	0.09%	0.01%
% of Brazoria County	0.23%	1.81%	0.28%	0.05%	1.18%	0.09%
Year 2015	**90.75**	**560.35**	**13.10**	**13.85**	**92.51**	**9.33**
% of HGA	0.01%	0.16%	0.02%	0.00%	0.06%	0.00%
% of Brazoria County	0.15%	1.27%	0.20%	0.03%	0.83%	0.06%
Year 2016	**43.72**	**304.45**	**7.64**	**6.99**	**7.43**	**4.43**
% of HGA	0.00%	0.09%	0.01%	0.00%	0.00%	0.00%
% of Brazoria County	0.07%	0.69%	0.12%	0.02%	0.07%	0.03%
Peak Annual Emissions	**144**	**945**	**22**	**23**	**156**	**15**
% of HGA	0.01%	0.26%	0.04%	0.01%	0.10%	0.01%
% of Brazoria County	0.2%	2.1%	0.3%	0.06%	1.4%	0.1%

Table A-3. General Conformity Emissions By Source
Freeport Harbor Channel Improvement Project
NED Alternative

Year	NO_X (tpy)				VOC (tpy)			
	Dredge & Support Equipment	Construction Equipment	Employee Vehicles	NO_X Total	Dredge & Support Equipment	Construction Equipment	Employee Vehicles	VOC Total
2011	100.96	0.00	0.16	**101.12**	1.16	0.00	0.20	**1.36**
2012	847.82	6.75	3.36	**857.94**	9.61	0.48	4.41	**14.51**
2013	933.05	9.00	2.50	**944.56**	10.78	0.65	3.28	**14.71**
2014	786.35	8.48	3.35	**798.18**	9.08	0.62	4.40	**14.11**
2015	551.13	7.44	1.78	**560.35**	6.41	0.58	2.34	**9.33**
2016	302.55	1.24	0.65	**304.45**	3.48	0.10	0.86	**4.43**

Table A-4. General Conformity Emissions By Engine Type
Freeport Harbor Channel Improvement Project
NED Alternative

		Tons per Year											
		NO_x						VOC					
		2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
Dredging	Hopper Dredge - Propelling	59.96	350.32	428.87	367.99	188.10	172.24	0.53	3.07	3.76	3.23	1.65	1.51
	Survey Boat - Propelling	2.11	12.34	15.10	12.96	6.62	6.07	0.05	0.30	0.36	0.31	0.16	0.15
	Trawler - Propelling	4.44	25.91	31.72	27.22	13.91	12.74	0.11	0.62	0.76	0.66	0.34	0.31
	Tug - Propelling		9.74	12.97	10.25	14.41	0.77		0.23	0.31	0.25	0.35	0.02
	Crew Boat - Propelling		0.65	0.86	0.68	0.96	0.05		0.02	0.02	0.02	0.02	0.001
	Hopper Dredge - Pumping	10.76	62.88	76.98	66.05	33.76	30.92	0.09	0.55	0.68	0.58	0.30	0.27
	Cutter Dredge - Pumping		239.65	188.87	149.31	209.88	11.24		2.10	1.66	1.31	1.84	
	Floating Booster - Pumping												
	Hopper Dredge - Generating	20.50	119.77	146.62	125.81	64.31	58.89	0.18	1.05	1.29	1.10	0.56	0.52
	Spill Barge - Generating		0.27	0.36	0.28	0.40	0.02		0.006	0.009	0.007	0.010	0.001
	Subtotal	**97.77**	**821.52**	**902.36**	**760.55**	**532.35**	**292.93**	**0.96**	**7.96**	**8.85**	**7.46**	**5.23**	**2.77**
Idling	Dredges - Idling	1.97	19.18	21.97	18.32	14.95	6.12	0.12	1.21	1.38	1.15	0.94	0.39
	Survey Boat - Idling	0.39	2.30	2.81	2.41	1.23	1.13	0.02	0.14	0.18	0.15	0.08	0.07
	Trawler - Idling	0.83	4.83	5.91	5.07	2.59	2.37	0.05	0.30	0.37	0.32	0.16	0.15
	Subtotal	**3.19**	**26.30**	**30.69**	**25.80**	**18.77**	**9.62**	**0.20**	**1.65**	**1.93**	**1.62**	**1.18**	**0.61**
Construction Equipment	Miscellaneous Equipment		6.75	9.00	8.48	7.44	1.24		0.48	0.65	0.62	0.58	0.10
	Subtotal		**6.75**	**9.00**	**8.48**	**7.44**	**1.24**		**0.48**	**0.65**	**0.62**	**0.58**	**0.10**
Vehicles	Cars	0.08	1.68	1.25	1.67	0.89	0.33	0.10	2.14	1.59	2.14	1.14	0.42
	Pickups	0.08	1.68	1.25	1.68	0.89	0.33	0.11	2.27	1.69	2.26	1.20	0.44
	Subtotal	**0.16**	**3.36**	**2.50**	**3.35**	**1.78**	**0.65**	**0.20**	**4.41**	**3.28**	**4.40**	**2.34**	**0.86**
	Total	**101.12**	**857.94**	**944.56**	**798.18**	**560.35**	**304.45**	**1.36**	**14.51**	**14.71**	**14.11**	**9.33**	**4.33**
		100.96	847.82	933.05	786.35	551.13	302.55	1.16	9.61	10.78	9.08	6.41	3.38

Nonroad	NOx						
	TPY	**101.0**	**854.6**	**942.1**	**794.8**	**558.6**	**303.8**
	TONS/DAY	0.39	3.29	3.62	3.06	2.15	1.17
	64.53 TPY Emis Budget	0.60%	5.09%	5.61%	4.74%	3.33%	1.81%

Vehicles	NOx						
	TPY	**0.16**	**3.36**	**2.50**	**3.35**	**1.78**	**0.65**
	TONS/DAY	0.0006	0.0129	0.0096	0.0129	0.0068	0.0025
	186.13 TPY Emis Budget	0.0003%	0.007%	0.005%	0.007%	0.004%	0.001%

Table B-1. Dredging Contract Schedule - Days per Year
Freeport Harbor Channel Improvement Project
NED

Contract No.	Reach	Dredging Duration Months	Dredging Duration Days	Contract Start	Contract Finish	Year 1 2011 days	Year 2 2012 days	Year 3 2013 days	Year 4 2014 days	Year 5 2015 days	Year 6 2016 days
1	New Extention and Part of Outer Bar	35.3	1,059	10/1/2011	9/30/2014	65	261	261	195		
2	Outer Bar and Jetty Channel	41.4	1,242	6/1/2012	11/30/2016		152	261	261	261	239
3	Lower TB, PA1, & Seaway Removel	2	60	4/1/2012	6/1/2012		45				
4	Real Estate	6	180	10/1/2011	3/31/2012	65	65				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	14.5	435	4/1/2012	8/31/2014		196	261	173		
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	3.4	102	9/1/2014	2/28/2016				88	261	41
7	Stauffer Channel	4.4	132	3/1/2016	7/30/2016					109	
8	Mitigation	6	180	4/1/2015	9/30/2015					131	
TOTAL		130	719	783	717	762	280				

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Type		Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 1: New Extension & Part of Entrance					
DredgingNew Extent (Duration =		**12.3**	**Quantity =**	**2,670,000**	**CY**
Generic Large Hopper	Dredging		6150	14000	
	Idle		2116		
Survey Boat	Dredging		1230	2000	
	Idle		423		
Trawlers - 2	Dredging		8610	1200	
	Idle		2962		
Dredging Part of Outer Bar (Duration =		**23**	**Quantity =**	**5,550,000**	**CY**
Generic Large Hopper	Dredging		11500	14000	
	Idle		3956		
Survey Boat	Dredging		2300	2000	
	Idle		791		
Trawlers - 2	Dredging		16100	1200	
	Idle		5538		
Total		**35.3**	**61,676**		
CONTRACT 2: Outer Bar and Jetty Ch					
Dredging Outer Bar (Duration =		**23**	**Quantity =**	**5,550,000**	**CY**
Generic Large Hopper	Dredging		11500	14000	
	Idle		3956		
Survey Boat	Dredging		2300	2000	
	Idle		791		
Trawlers - 2	Dredging		16100	1200	
	Idle		5538		
Dredging Jetty Ch (Duration =		**18.4**	**Quantity =**	**4,187,000**	**CY**
Generic Large Hopper	Dredging		9200	14000	
	Idle		3165		
Survey Boat	Dredging		1840	2000	
	Idle		633		
Trawlers - 2	Dredging		12880	1200	
	Idle		4432		
Total		**41.4**	**72,335**		

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Type		Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 3: Lower TB, PA 1 Work & Seaway Removal					
Dredging Lower TB (Duration =		**2**	**Quantity =**	**318,000**	**CY**
30" Dredge	Dredging		1000	9000	
	Idle		450	3000	
Dredging Tugs (3 @ 500hp each)	Dredging		2400	1500	
Spill Barge	Dredging		200	165	
Crewboat	Construction		200	400	
Total		**2**	**4,250**		
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8					
Dredging Cycle (Duration =		**14.5**	**Quantity =**	**2,316,000**	**CY**
30" Dredge	Dredging		7250	9000	
	Idle		3262.5	3000	
Dredging Tugs (3 @ 500hp each)	Dredging		17400	1500	
Spill Barge	Dredging		1450	165	
Crewboat	Construction		1450	400	
Total		**14.5**	**30,813**		
CONTRACT 6: Ch to UTB thr UTB & PA 9					
Dredging Cycle (Duration =		**3.4**	**Quantity =**	**1,037,000**	**CY**
30" Dredge	Dredging		1700	9000	
	Idle		765	3000	
Dredging Tugs (3 @ 500hp each)	Dredging		4080	1500	
Spill Barge	Dredging		340	165	
Crewboat	Construction		340	400	
Total		**3.4**	**7,225**		
CONTRACT 7: Stauffer Ch					
Dredging Cycle (Duration =		**4.4**	**Quantity =**	**1,540,000**	**CY**
30" Dredge	Dredging		2200	9000	
	Idle		990	3000	
Dredging Tugs (3 @ 500hp each)	Dredging		5280	1500	
Spill Barge	Dredging		440	165	
Crewboat	Construction		440	400	
Total		**4.4**	**9,350**		

Table B-3. Dredging Contract Allocation by Year
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Reach	Dredging Duration Days	Year 1 **2011** percent	Year 2 **2012** percent	Year 3 **2013** percent	Year 4 **2014** percent	Year 5 **2015** percent
1	New Extention and Part of Outer Bar	1,059	8%	33%	33%	25%	
2	Outer Bar and Jetty Channel	1,242		13%	22%	22%	22%
3	Lower TB, PA1, & Seaway Removel	60		100%			
4	Real Estate	180	50%	50%			
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	435		31%	41%	27%	
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	102				23%	67%
7	Stauffer Channel	132					100%
8	Mitigation	180					100%

Table B-4. Dredge Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Reach	Operating Hours													
		Dredge						Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
		Dredge Type	Total Dredging	Propelling	Pumping	Power Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
1	New Extension	Generic Large Hopper	6,150	3,998	2,153	6,150	2,116	1,230	423	8,610	2,962				
	Part of Outer Bar	Generic Large Hopper	11,500	7,475	4,025	11,500	3,956	2,300	791	16,100	5,538				
2	Outer Bar	Generic Large Hopper	11,500	7,475	4,025	11,500	3,956	2,300	791	16,100	5,538				
	Jetty Channel	Generic Large Hopper	9,200	5,980	3,220	9,200	3,165	1,840	633	12,880	4,432				
3	Lower TB	30" Dredge	1,000				450						2,400	200	200
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	7,250				3,263						17,400	1,450	1,450
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,700				765						4,080	340	340
7	Stauffer Channel	30" Dredge	2,200				990						5,280	440	440
8	Mitigation														

Table B-5. Typical Hopper Dredging Cycle
Freeport Harbor Channel Improvement Project
NEDAlternative

Contract No.	Reach	Dredging Cycle				
		Dredge Type	Total Dredging Hours	Propelling	Pumping	Power Generating
1	New Extension	Generic Large Hopper	6,150	65%	35%	100%
	Part of Outer Bar	Generic Large Hopper	11,500	65%	35%	100%
2	Outer Bar	Generic Large Hopper	11,500	65%	35%	100%
	Jetty Channel	Generic Large Hopper	9,200	65%	35%	100%

Table B-6. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
NED Alternative

Contract No.	Location/Disposal Site	Dredge Type	Horsepower (hp)												
			Engine Type					Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
			Total	Propulsion	Pump	Generator	Generator at Idling	Main Engine	Idling	Main Engine	Idling	Pumping	Propulsion	Main Engine	Propulsion
1	New Extension	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Part of Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
2	Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Jetty Channel	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
3	Lower TB	30" Dredge	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
4	Real Estate						3,000						500	165	400
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,000				3,000						500	165	400
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	9,000				3,000						500	165	400
7	Stauffer Channel	30" Dredge	9,000				3,000						500	165	400
8	Mitigation						3,000						500	165	400

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	511.19	332.27	178.92	511.19	175.88	102.24	35.16	715.66	246.20				
	Part of Outer Bar	Generic Large Hopper	955.88	621.32	334.56	955.88	328.82	191.18	65.75	1,338.24	460.32				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL		**1,467.07**	**953.60**	**513.48**	**1,467.07**	**504.71**	**293.41**	**100.91**	**2,053.90**	**706.52**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	2,052.62	1,334.20	718.42	2,052.62	706.24	410.52	141.18	2,873.67	988.60				
	Part of Outer Bar	Generic Large Hopper	3,838.24	2,494.85	1,343.38	3,838.24	1,320.35	767.65	264.00	5,373.53	1,848.36				
2	Outer Bar	Generic Large Hopper	1,488.93	967.80	521.12	1,488.93	512.19	297.79	102.41	2,084.50	717.02				
	Jetty Channel	Generic Large Hopper	1,191.14	774.24	416.90	1,191.14	409.78	238.23	81.96	1,667.60	573.82				
3	Lower TB	30" Dredge	1,000.00				450.00						2,400.00	200.00	200.00
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2,255.56				1,015.00						5,413.33	451.11	451.11
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**11,826.48**	**5,571.10**	**2,999.82**	**8,570.92**	**4,413.56**	**1,714.18**	**589.55**	**11,999.29**	**4,127.79**		**7,813.33**	**651.11**	**651.11**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	2,052.62	1,334.20	718.42	2,052.62	706.24	410.52	141.18	2,873.67	988.60				
	Part of Outer Bar	Generic Large Hopper	3,838.24	2,494.85	1,343.38	3,838.24	1,320.35	767.65	264.00	5,373.53	1,848.36				
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3,003.57				1,351.61						7,208.57	600.71	600.71
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**13,496.39**	**6,820.33**	**3,672.49**	**10,492.82**	**4,961.31**	**2,098.56**	**721.76**	**14,689.94**	**5,053.46**		**7,208.57**	**600.71**	**600.71**

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
NED Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	1,533.57	996.82	536.75	1,533.57	527.65	306.71	105.48	2,146.99	738.61				
	Part of Outer Bar	Generic Large Hopper	2,867.65	1,863.97	1,003.68	2,867.65	986.47	573.53	197.24	4,014.71	1,380.96				
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,990.87				895.89						4,778.10	398.17	398.17
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	383.59				172.62						920.62	76.72	76.72
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**11,377.64**	**5,852.06**	**3,151.11**	**9,003.17**	**4,165.74**	**1,800.63**	**619.30**	**12,604.44**	**4,336.06**		**5,698.71**	**474.89**	**474.89**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	2,556.64	1,661.82	894.83	2,556.64	879.49	511.33	175.85	3,579.30	1,231.19				
	Jetty Channel	Generic Large Hopper	2,045.32	1,329.45	715.86	2,045.32	703.63	409.06	140.73	2,863.44	985.31				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,137.69				511.96						2,730.46	227.54	227.54
7	Stauffer Channel	30" Dredge	2,200.00				990.00						5,280.00	440.00	440.00
8	Mitigation														
	YEAR 2015 TOTAL		**7,939.65**	**2,991.27**	**1,610.69**	**4,601.96**	**3,085.08**	**920.39**	**316.58**	**6,442.74**	**2,216.50**		**8,010.46**	**667.54**	**667.54**
YEAR 2016															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	2,341.14	1,521.74	819.40	2,341.14	805.35	468.23	161.03	3,277.60	1,127.41				
	Jetty Channel	Generic Large Hopper	1,872.91	1,217.39	655.52	1,872.91	644.32	374.58	128.86	2,622.08	902.26				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	178.72				80.42						428.92	35.74	35.74
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2016 TOTAL		**4,392.77**	**2,739.14**	**1,474.92**	**4,214.05**	**1,530.10**	**842.81**	**289.89**	**5,899.68**	**2,029.67**		**428.92**	**35.74**	**35.74**

Table C-2. Marine Engine Emission Factors and Fuel Consumption Algorithms

(in g/kW-hr, for all marine engines)

Freeport Harbor Channel Improvement Project

Statistical Parameter	Exponent (x)	Intercept (b)	Coefficient (a)
CO	1	0	0.8378
NO_X	1.5	10.4496	0.1255
PM	1.5	0.2551	0.0059
PM2.5	1.5	0.2551	0.0059
PM10	1.5	0.2551	0.0059
SO_X	n/a	0	2.3735
VOC (HC)	1.5	0	0.0667

Notes:

1.) All regressions but SO_2 are in the form of:

Emissions Rate (g/hp-hr) = (a*(Fractional Load)$^{-x}$ + b) * 0.7457

where the conversion factor of 0.7457 kW/hp is used to calculate the emission factor in g/hp-hr

2.) Fractional Load is equal to actual engine output divided by rated engine output.

3.) The SO_2 regression is the form of:

Emissions Rate (g/hp-hr) = a*(Fuel Sulfur Flow in g/hp-hr) + b

where Fuel Sulfur Flow is the Fuel Consumption times the sulfur content of the fuel;
The sulfur content for the fuel consumption regression was set to 3300 parts per million (0.33 wt%)

4.) **Fuel Consumption (g/hp-hr) = (14.12 / (Fractional Load) + 205.717) * 0.7457**

5.) n/a is not applicable, n/s is not statistically significant.

6.) All information shown above is detailed in Table 5-1 of the EPA technical report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", EPA 420-R-00-002, February 2000.

Table C-3. Marine Equipment Load Factors and Emission Factors
Freeport Harbor Channel Improvement Project

	Dredge					Crew Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
Operating Mode	Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
Load Factor	0.8	0.8	0.8	0.8	0.2	0.4	0.2	0.4	0.2	0.8	0.4	0.4	0.4
EF (Gram/hp-hr)													
CO	0.780934	0.780934	0.780934	0.780934	3.123737	1.561869	3.123737	1.561869	3.123737	0.780934	1.561869	1.561869	1.561869
NO_X	7.923056	7.923056	7.923056	7.923056	8.838583	8.162195	8.838583	8.162195	8.838583	7.923056	8.162195	8.162195	8.162195
PM	0.196377	0.196377	0.196377	0.196377	0.239417	0.207619	0.239417	0.207619	0.239417	0.196377	0.207619	0.207619	0.207619
PM2.5	0.178703	0.178703	0.178703	0.178703	0.217870	0.188933	0.217870	0.188933	0.217870	0.178703	0.188933	0.188933	0.188933
PM10	0.188522	0.188522	0.188522	0.188522	0.229841	0.199314	0.229841	0.199314	0.229841	0.188522	0.199314	0.199314	0.199314
SO_X	1.304627	1.304627	1.304627	1.304627	1.613894	1.407716	1.613894	1.407716	1.613894	1.304627	1.407716	1.407716	1.407716
VOC (HC)	0.069511	0.069511	0.069511	0.069511	0.556090	0.196607	0.556090	0.196607	0.556090	0.069511	0.196607	0.196607	0.196607

Notes:

1.) The dredge type, engine type, horsepower, and fuel type were based on information provided by project sponsors.

2.) The engine load factors for the dredges and support equipment were determined from Table 5-2 of the EPA Report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", February 2000.

A survey of dredge engine sizes along with input from project sponsors was used to determine which operating mode and hence which load factor applied to each engine. The following assumptions applied to the load factor determination:

A.) The main engines on the dredges were assumed to operate at full power (e.g. 0.8 "cruise" load factor from Table 5-2 of EPA report) for all hours of operation.

B.) The generators on the dredges were assumed to operate at 0.2 load factor during idling.

C.) The main engines or propulsion engines on the support equipment were assumed to operate at intermittent times during the dredging operations and were also determined to operate at the 0.4 "slow cruise" load factor.

D.) The auxiliary engines, if any, on the support equipment were assumed to operate sparingly during idling and were determined to operate at the 0.2 "maneuvering" load factor.

3.) The emission factors were calculated according to the algorithm table and formulas detailed on page 5-3 of the EPA report. The emissions Rate formula and algorithm table are also shown on Table A-4, "Marine Engine Emission Factor and Fuel Consumption Data", February 2000.

4.) The Emission Rate in tons/hr is based on the following formula: Emission Rate = hp*LF*EF*(0.0022046 lbs/gram)*(1 ton/2000 lbs).

Table C-4. Marine Equipment CO Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CO (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.06	0.37	0.70	0.24	0.14	0.05	0.30	0.10				
	Part of Outer Bar	Generic Large Hopper		3.85	0.69	1.32	0.45	0.26	0.09	0.55	0.19				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**5.91**	**1.06**	**2.02**	**0.70**	**0.40**	**0.14**	**0.85**	**0.29**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		8.27	1.48	2.83	0.97	0.57	0.19	1.19	0.41				
	Part of Outer Bar	Generic Large Hopper		15.46	2.78	5.29	1.82	1.06	0.36	2.22	0.76				
2	Outer Bar	Generic Large Hopper		6.00	1.08	2.05	0.71	0.41	0.14	0.86	0.30				
	Jetty Channel	Generic Large Hopper		4.80	0.86	1.64	0.56	0.33	0.11	0.69	0.24				
3	Lower TB	30" Dredge	9.64				0.62								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	13.98				2.10						1.86	0.05	0.12
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**23.62**	**34.53**	**6.20**	**11.80**	**6.78**	**2.36**	**0.81**	**4.96**	**1.71**		**1.86**	**0.05**	**0.12**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		8.27	1.48	2.83	0.97	0.57	0.19	1.19	0.41				
	Part of Outer Bar	Generic Large Hopper		15.46	2.78	5.29	1.82	1.06	0.36	2.22	0.76				
2	Outer Bar	Generic Large Hopper		10.30	1.85	3.52	1.21	0.70	0.24	1.48	0.51				
	Jetty Channel	Generic Large Hopper		8.24	1.48	2.82	0.97	0.56	0.19	1.18	0.41				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	18.62				2.79						2.48	0.07	0.17
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**18.62**	**42.27**	**7.59**	**14.45**	**7.76**	**2.89**	**0.99**	**6.07**	**2.09**		**2.48**	**0.07**	**0.17**

Table C-4. Marine Equipment CO Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

CO (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		6.18	1.11	2.11	0.73	0.42	0.15	0.89	0.31				
	Part of Outer Bar	Generic Large Hopper		11.55	2.07	3.95	1.36	0.79	0.27	1.66	0.57				
2	Outer Bar	Generic Large Hopper		10.30	1.85	3.52	1.21	0.70	0.24	1.48	0.51				
	Jetty Channel	Generic Large Hopper		8.24	1.48	2.82	0.97	0.56	0.19	1.18	0.41				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	12.34				1.85						1.65	0.05	0.11
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.38				0.36						0.32	0.01	0.02
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**14.72**	**36.27**	**6.51**	**12.40**	**6.47**	**2.48**	**0.85**	**5.21**	**1.79**		**1.96**	**0.05**	**0.13**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		10.30	1.85	3.52	1.21	0.70	0.24	1.48	0.51				
	Jetty Channel	Generic Large Hopper		8.24	1.48	2.82	0.97	0.56	0.19	1.18	0.41				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	7.05				1.06						0.94	0.03	0.06
7	Stauffer Channel	30" Dredge	13.64				2.05						1.82	0.05	0.12
8	Mitigation														
	YEAR 2015 TOTAL		**20.69**	**18.54**	**3.33**	**6.34**	**5.28**	**1.27**	**0.44**	**2.66**	**0.92**		**2.76**	**0.08**	**0.18**

Table C-5. Marine Equipment NOx Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

NO_x (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		20.89	3.75	7.14	0.69	0.74	0.14	1.55	0.29				
	Part of Outer Bar	Generic Large Hopper		39.07	7.01	13.36	1.28	1.38	0.26	2.89	0.54				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**59.96**	**10.76**	**20.50**	**1.97**	**2.11**	**0.39**	**4.44**	**0.83**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		83.90	15.06	28.68	2.75	2.95	0.55	6.21	1.16				
	Part of Outer Bar	Generic Large Hopper		156.88	28.16	53.63	5.15	5.53	1.03	11.60	2.16				
2	Outer Bar	Generic Large Hopper		60.86	10.92	20.81	2.00	2.14	0.40	4.50	0.84				
	Jetty Channel	Generic Large Hopper		48.69	8.74	16.64	1.60	1.71	0.32	3.60	0.67				
3	Lower TB	30" Dredge	97.82				1.75								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	141.83				5.93						9.74	0.27	0.65
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**239.65**	**350.32**	**62.88**	**119.77**	**19.18**	**12.34**	**2.30**	**25.91**	**4.83**		**9.74**	**0.27**	**0.65**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		83.90	15.06	28.68	2.75	2.95	0.55	6.21	1.16				
	Part of Outer Bar	Generic Large Hopper		156.88	28.16	53.63	5.15	5.53	1.03	11.60	2.16				
2	Outer Bar	Generic Large Hopper		104.50	18.76	35.73	3.43	3.68	0.69	7.73	1.44				
	Jetty Channel	Generic Large Hopper		83.60	15.00	28.58	2.74	2.94	0.55	6.18	1.15				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	188.87				7.90						12.97	0.36	0.86
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**188.87**	**428.87**	**76.98**	**146.62**	**21.97**	**15.10**	**2.81**	**31.72**	**5.91**		**12.97**	**0.36**	**0.86**

Table C-5. Marine Equipment NOx Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

NO_x (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		62.68	11.25	21.43	2.06	2.21	0.41	4.64	0.86				
	Part of Outer Bar	Generic Large Hopper		117.21	21.04	40.07	3.84	4.13	0.77	8.67	1.61				
2	Outer Bar	Generic Large Hopper		104.50	18.76	35.73	3.43	3.68	0.69	7.73	1.44				
	Jetty Channel	Generic Large Hopper		83.60	15.00	28.58	2.74	2.94	0.55	6.18	1.15				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	125.19				5.24						8.60	0.24	0.57
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	24.12				1.01						1.66	0.05	0.11
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**149.31**	**367.99**	**66.05**	**125.81**	**18.32**	**12.96**	**2.41**	**27.22**	**5.07**		**10.25**	**0.28**	**0.68**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		104.50	18.76	35.73	3.43	3.68	0.69	7.73	1.44				
	Jetty Channel	Generic Large Hopper		83.60	15.00	28.58	2.74	2.94	0.55	6.18	1.15				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	71.54				2.99						4.91	0.14	0.33
7	Stauffer Channel	30" Dredge	138.34				5.79						9.50	0.26	0.63
8	Mitigation														
	YEAR 2015 TOTAL		**209.88**	**188.10**	**33.76**	**64.31**	**14.95**	**6.62**	**1.23**	**13.91**	**2.59**		**14.41**	**0.40**	**0.96**

Table C-6. Marine Equipment PM Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

PM (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.52	0.09	0.18	0.02	0.02	0.00	0.04	0.01				
	Part of Outer Bar	Generic Large Hopper		0.97	0.17	0.33	0.03	0.04	0.01	0.07	0.01				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.49**	**0.27**	**0.51**	**0.05**	**0.05**	**0.01**	**0.11**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.08	0.37	0.71	0.07	0.08	0.01	0.16	0.03				
	Part of Outer Bar	Generic Large Hopper		3.89	0.70	1.33	0.14	0.14	0.03	0.30	0.06				
2	Outer Bar	Generic Large Hopper		1.51	0.27	0.52	0.05	0.05	0.01	0.11	0.02				
	Jetty Channel	Generic Large Hopper		1.21	0.22	0.41	0.04	0.04	0.01	0.09	0.02				
3	Lower TB	30" Dredge	2.42				0.05								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3.52				0.16						0.25	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**5.94**	**8.68**	**1.56**	**2.97**	**0.52**	**0.31**	**0.06**	**0.66**	**0.13**		**0.25**	**0.01**	**0.02**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.08	0.37	0.71	0.07	0.08	0.01	0.16	0.03				
	Part of Outer Bar	Generic Large Hopper		3.89	0.70	1.33	0.14	0.14	0.03	0.30	0.06				
2	Outer Bar	Generic Large Hopper		2.59	0.46	0.89	0.09	0.09	0.02	0.20	0.04				
	Jetty Channel	Generic Large Hopper		2.07	0.37	0.71	0.07	0.07	0.01	0.16	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4.68				0.21						0.33	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**4.68**	**10.63**	**1.91**	**3.63**	**0.60**	**0.38**	**0.08**	**0.81**	**0.16**		**0.33**	**0.01**	**0.02**

Table C-6. Marine Equipment PM Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

PM (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.55	0.28	0.53	0.06	0.06	0.01	0.12	0.02				
	Part of Outer Bar	Generic Large Hopper		2.91	0.52	0.99	0.10	0.11	0.02	0.22	0.04				
2	Outer Bar	Generic Large Hopper		2.59	0.46	0.89	0.09	0.09	0.02	0.20	0.04				
	Jetty Channel	Generic Large Hopper		2.07	0.37	0.71	0.07	0.07	0.01	0.16	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3.10				0.14						0.22	0.01	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.60				0.03						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**3.70**	**9.12**	**1.64**	**3.12**	**0.50**	**0.33**	**0.07**	**0.69**	**0.14**		**0.26**	**0.01**	**0.02**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2.59	0.46	0.89	0.09	0.09	0.02	0.20	0.04				
	Jetty Channel	Generic Large Hopper		2.07	0.37	0.71	0.07	0.07	0.01	0.16	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1.77				0.08						0.12	0.00	0.01
7	Stauffer Channel	30" Dredge	3.43				0.16						0.24	0.01	0.02
8	Mitigation														
	YEAR 2015 TOTAL		**5.20**	**4.66**	**0.84**	**1.59**	**0.40**	**0.17**	**0.03**	**0.35**	**0.07**		**0.37**	**0.01**	**0.02**

Table C-7. Marine Equipment $PM_{2.5}$ Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

$PM_{2.5}$ (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.47	0.08	0.16	0.02	0.02	0.00	0.04	0.01				
	Part of Outer Bar	Generic Large Hopper		0.88	0.16	0.30	0.03	0.03	0.01	0.07	0.01				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.35**	**0.24**	**0.46**	**0.05**	**0.05**	**0.01**	**0.10**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.89	0.34	0.65	0.07	0.07	0.01	0.14	0.03				
	Part of Outer Bar	Generic Large Hopper		3.54	0.64	1.21	0.13	0.13	0.03	0.27	0.05				
2	Outer Bar	Generic Large Hopper		1.37	0.25	0.47	0.05	0.05	0.01	0.10	0.02				
	Jetty Channel	Generic Large Hopper		1.10	0.20	0.38	0.04	0.04	0.01	0.08	0.02				
3	Lower TB	30" Dredge	2.21				0.04								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3.20				0.15						0.23	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**5.41**	**7.90**	**1.42**	**2.70**	**0.47**	**0.29**	**0.06**	**0.60**	**0.12**		**0.23**	**0.01**	**0.02**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.89	0.34	0.65	0.07	0.07	0.01	0.14	0.03				
	Part of Outer Bar	Generic Large Hopper		3.54	0.64	1.21	0.13	0.13	0.03	0.27	0.05				
2	Outer Bar	Generic Large Hopper		2.36	0.42	0.81	0.08	0.09	0.02	0.18	0.04				
	Jetty Channel	Generic Large Hopper		1.89	0.34	0.64	0.07	0.07	0.01	0.14	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4.26				0.19						0.30	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**4.26**	**9.67**	**1.74**	**3.31**	**0.54**	**0.35**	**0.07**	**0.73**	**0.15**		**0.30**	**0.01**	**0.02**

Table C-7. Marine Equipment $PM_{2.5}$ Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

$PM_{2.5}$ (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.41	0.25	0.48	0.05	0.05	0.01	0.11	0.02				
	Part of Outer Bar	Generic Large Hopper		2.64	0.47	0.90	0.09	0.10	0.02	0.20	0.04				
2	Outer Bar	Generic Large Hopper		2.36	0.42	0.81	0.08	0.09	0.02	0.18	0.04				
	Jetty Channel	Generic Large Hopper		1.89	0.34	0.64	0.07	0.07	0.01	0.14	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.82				0.13						0.20	0.01	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.54				0.02						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**3.37**	**8.30**	**1.49**	**2.84**	**0.45**	**0.30**	**0.06**	**0.63**	**0.12**		**0.24**	**0.01**	**0.02**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2.36	0.42	0.81	0.08	0.09	0.02	0.18	0.04				
	Jetty Channel	Generic Large Hopper		1.89	0.34	0.64	0.07	0.07	0.01	0.14	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1.61				0.07						0.11	0.00	0.01
7	Stauffer Channel	30" Dredge	3.12				0.14						0.22	0.01	0.01
8	Mitigation														
	YEAR 2015 TOTAL		**4.73**	**4.24**	**0.76**	**1.45**	**0.37**	**0.15**	**0.03**	**0.32**	**0.06**		**0.33**	**0.01**	**0.02**

Table C-8. Marine Equipment PM_{10} Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

PM_{10} (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.50	0.09	0.17	0.02	0.02	0.00	0.04	0.01				
	Part of Outer Bar	Generic Large Hopper		0.93	0.17	0.32	0.03	0.03	0.01	0.07	0.01				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.43**	**0.26**	**0.49**	**0.05**	**0.05**	**0.01**	**0.11**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.00	0.36	0.68	0.07	0.07	0.01	0.15	0.03				
	Part of Outer Bar	Generic Large Hopper		3.73	0.67	1.28	0.13	0.13	0.03	0.28	0.06				
2	Outer Bar	Generic Large Hopper		1.45	0.26	0.50	0.05	0.05	0.01	0.11	0.02				
	Jetty Channel	Generic Large Hopper		1.16	0.21	0.40	0.04	0.04	0.01	0.09	0.02				
3	Lower TB	30" Dredge	2.33				0.05								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	3.37				0.15						0.24	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**5.70**	**8.34**	**1.50**	**2.85**	**0.50**	**0.30**	**0.06**	**0.63**	**0.13**		**0.24**	**0.01**	**0.02**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.00	0.36	0.68	0.07	0.07	0.01	0.15	0.03				
	Part of Outer Bar	Generic Large Hopper		3.73	0.67	1.28	0.13	0.13	0.03	0.28	0.06				
2	Outer Bar	Generic Large Hopper		2.49	0.45	0.85	0.09	0.09	0.02	0.19	0.04				
	Jetty Channel	Generic Large Hopper		1.99	0.36	0.68	0.07	0.07	0.01	0.15	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4.49				0.21						0.32	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**4.49**	**10.20**	**1.83**	**3.49**	**0.57**	**0.37**	**0.07**	**0.77**	**0.15**		**0.32**	**0.01**	**0.02**

Table C-8. Marine Equipment PM_{10} Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

PM_{10} (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.49	0.27	0.51	0.05	0.05	0.01	0.11	0.02				
	Part of Outer Bar	Generic Large Hopper		2.79	0.50	0.95	0.10	0.10	0.02	0.21	0.04				
2	Outer Bar	Generic Large Hopper		2.49	0.45	0.85	0.09	0.09	0.02	0.19	0.04				
	Jetty Channel	Generic Large Hopper		1.99	0.36	0.68	0.07	0.07	0.01	0.15	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.98				0.14						0.21	0.01	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.57				0.03						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**3.55**	**8.76**	**1.57**	**2.99**	**0.48**	**0.32**	**0.06**	**0.66**	**0.13**		**0.25**	**0.01**	**0.02**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2.49	0.45	0.85	0.09	0.09	0.02	0.19	0.04				
	Jetty Channel	Generic Large Hopper		1.99	0.36	0.68	0.07	0.07	0.01	0.15	0.03				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1.70				0.08						0.12	0.00	0.01
7	Stauffer Channel	30" Dredge	3.29				0.15						0.23	0.01	0.02
8	Mitigation														
	YEAR 2015 TOTAL		**4.99**	**4.48**	**0.80**	**1.53**	**0.39**	**0.16**	**0.03**	**0.34**	**0.07**		**0.35**	**0.01**	**0.02**

Table C-9. Marine Equipment SO_2 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

SO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		3.44	0.62	1.18	0.13	0.13	0.03	0.27	0.05				
	Part of Outer Bar	Generic Large Hopper		6.43	1.15	2.20	0.23	0.24	0.05	0.50	0.10				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**9.87**	**1.77**	**3.38**	**0.36**	**0.36**	**0.07**	**0.76**	**0.15**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		13.81	2.48	4.72	0.50	0.51	0.10	1.07	0.21				
	Part of Outer Bar	Generic Large Hopper		25.83	4.64	8.83	0.94	0.95	0.19	2.00	0.39				
2	Outer Bar	Generic Large Hopper		10.02	1.80	3.43	0.36	0.37	0.07	0.78	0.15				
	Jetty Channel	Generic Large Hopper		8.02	1.44	2.74	0.29	0.30	0.06	0.62	0.12				
3	Lower TB	30" Dredge	16.11				0.32								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	23.35				1.08						1.68	0.05	0.11
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**39.46**	**57.68**	**10.35**	**19.72**	**3.50**	**2.13**	**0.42**	**4.47**	**0.88**		**1.68**	**0.05**	**0.11**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		13.81	2.48	4.72	0.50	0.51	0.10	1.07	0.21				
	Part of Outer Bar	Generic Large Hopper		25.83	4.64	8.83	0.94	0.95	0.19	2.00	0.39				
2	Outer Bar	Generic Large Hopper		17.21	3.09	5.88	0.63	0.63	0.13	1.33	0.26				
	Jetty Channel	Generic Large Hopper		13.77	2.47	4.71	0.50	0.51	0.10	1.07	0.21				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	31.10				1.44						2.24	0.06	0.15
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**31.10**	**70.62**	**12.68**	**24.14**	**4.01**	**2.61**	**0.51**	**5.47**	**1.08**		**2.24**	**0.06**	**0.15**

Table C-9. Marine Equipment SO_2 Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

SO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		10.32	1.85	3.53	0.38	0.38	0.08	0.80	0.16				
	Part of Outer Bar	Generic Large Hopper		19.30	3.46	6.60	0.70	0.71	0.14	1.50	0.29				
2	Outer Bar	Generic Large Hopper		17.21	3.09	5.88	0.63	0.63	0.13	1.33	0.26				
	Jetty Channel	Generic Large Hopper		13.77	2.47	4.71	0.50	0.51	0.10	1.07	0.21				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	20.61				0.96						1.48	0.04	0.10
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	3.97				0.18						0.29	0.01	0.02
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**24.59**	**60.59**	**10.88**	**20.72**	**3.34**	**2.24**	**0.44**	**4.69**	**0.93**		**1.77**	**0.05**	**0.12**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		17.21	3.09	5.88	0.63	0.63	0.13	1.33	0.26				
	Jetty Channel	Generic Large Hopper		13.77	2.47	4.71	0.50	0.51	0.10	1.07	0.21				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	11.78				0.55						0.85	0.02	0.06
7	Stauffer Channel	30" Dredge	22.78				1.06						1.64	0.05	0.11
8	Mitigation														
	YEAR 2015 TOTAL		**34.56**	**30.97**	**5.56**	**10.59**	**2.73**	**1.14**	**0.23**	**2.40**	**0.47**		**2.49**	**0.07**	**0.17**

Table C-10. Marine Equipment VOC Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

VOC (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.18	0.03	0.06	0.04	0.02	0.01	0.04	0.02				
	Part of Outer Bar	Generic Large Hopper		0.34	0.06	0.12	0.08	0.03	0.02	0.07	0.03				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**0.53**	**0.09**	**0.18**	**0.12**	**0.05**	**0.02**	**0.11**	**0.05**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.74	0.13	0.25	0.17	0.07	0.03	0.15	0.07				
	Part of Outer Bar	Generic Large Hopper		1.38	0.25	0.47	0.32	0.13	0.06	0.28	0.14				
2	Outer Bar	Generic Large Hopper		0.53	0.10	0.18	0.13	0.05	0.03	0.11	0.05				
	Jetty Channel	Generic Large Hopper		0.43	0.08	0.15	0.10	0.04	0.02	0.09	0.04				
3	Lower TB	30" Dredge	0.86				0.11								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.24				0.37						0.23	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**2.10**	**3.07**	**0.55**	**1.05**	**1.21**	**0.30**	**0.14**	**0.62**	**0.30**		**0.23**	**0.01**	**0.02**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.74	0.13	0.25	0.17	0.07	0.03	0.15	0.07				
	Part of Outer Bar	Generic Large Hopper		1.38	0.25	0.47	0.32	0.13	0.06	0.28	0.14				
2	Outer Bar	Generic Large Hopper		0.92	0.16	0.31	0.22	0.09	0.04	0.19	0.09				
	Jetty Channel	Generic Large Hopper		0.73	0.13	0.25	0.17	0.07	0.03	0.15	0.07				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.66				0.50						0.31	0.01	0.02
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**1.66**	**3.76**	**0.68**	**1.29**	**1.38**	**0.36**	**0.18**	**0.76**	**0.37**		**0.31**	**0.01**	**0.02**

Table C-10. Marine Equipment VOC Emissions
Freeport Harbor Channel Improvement Project
NED Alternative

VOC (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.55	0.10	0.19	0.13	0.05	0.03	0.11	0.05				
	Part of Outer Bar	Generic Large Hopper		1.03	0.18	0.35	0.24	0.10	0.05	0.21	0.10				
2	Outer Bar	Generic Large Hopper		0.92	0.16	0.31	0.22	0.09	0.04	0.19	0.09				
	Jetty Channel	Generic Large Hopper		0.73	0.13	0.25	0.17	0.07	0.03	0.15	0.07				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.10				0.33						0.21	0.01	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.21				0.06						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2014 TOTAL		**1.31**	**3.23**	**0.58**	**1.10**	**1.15**	**0.31**	**0.15**	**0.66**	**0.32**		**0.25**	**0.01**	**0.02**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.92	0.16	0.31	0.22	0.09	0.04	0.19	0.09				
	Jetty Channel	Generic Large Hopper		0.73	0.13	0.25	0.17	0.07	0.03	0.15	0.07				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.63				0.19						0.12	0.00	0.01
7	Stauffer Channel	30" Dredge	1.21				0.36						0.23	0.01	0.02
8	Mitigation														
	YEAR 2015 TOTAL		**1.84**	**1.65**	**0.30**	**0.56**	**0.94**	**0.16**	**0.08**	**0.34**	**0.16**		**0.35**	**0.01**	**0.02**

Table C-11. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	4.0	35.2	0.9	0.8	0.8	5.8	0.4
	Part of Outer Bar	Generic Large Hopper	7.4	65.8	1.6	1.5	1.6	10.9	0.8
2	Outer Bar	Generic Large Hopper							
	Jetty Channel	Generic Large Hopper							
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge							
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2011 TOTAL		**11.4**	**101.0**	**2.5**	**2.3**	**2.4**	**16.7**	**1.2**

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	15.9	141.3	3.5	3.2	3.4	23.4	1.6
	Part of Outer Bar	Generic Large Hopper	29.7	264.1	6.6	6.0	6.3	43.8	3.0
2	Outer Bar	Generic Large Hopper	11.5	102.5	2.6	2.3	2.4	17.0	1.2
	Jetty Channel	Generic Large Hopper	9.2	82.0	2.0	1.9	2.0	13.6	0.9
3	Lower TB	30" Dredge	10.3	99.6	2.5	2.2	2.4	16.4	1.0
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	18.1	158.4	3.9	3.6	3.8	26.3	1.9
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2012 TOTAL		**94.8**	**847.8**	**21.1**	**19.2**	**20.3**	**140.5**	**9.6**

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	15.9	141.3	3.5	3.2	3.4	23.4	1.6
	Part of Outer Bar	Generic Large Hopper	29.7	264.1	6.6	6.0	6.3	43.8	3.0
2	Outer Bar	Generic Large Hopper	19.8	175.9	4.4	4.0	4.2	29.2	2.0
	Jetty Channel	Generic Large Hopper	15.9	140.8	3.5	3.2	3.4	23.3	1.6
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	24.1	211.0	5.3	4.8	5.0	35.0	2.5
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2013 TOTAL		**105.4**	**933.1**	**23.2**	**21.1**	**22.3**	**154.7**	**10.8**

YEAR 2014

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	11.9	105.5	2.6	2.4	2.5	17.5	1.2
	Part of Outer Bar	Generic Large Hopper	22.2	197.3	4.9	4.5	4.7	32.7	2.3
2	Outer Bar	Generic Large Hopper	19.8	175.9	4.4	4.0	4.2	29.2	2.0
	Jetty Channel	Generic Large Hopper	15.9	140.8	3.5	3.2	3.4	23.3	1.6
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	16.0	139.8	3.5	3.2	3.3	23.2	1.7
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	3.1	26.9	0.7	0.6	0.6	4.5	0.3
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2014 TOTAL		**88.9**	**786.4**	**19.6**	**17.8**	**18.8**	**130.3**	**9.1**

Table C-11. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

YEAR 2015

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper							
	Part of Outer Bar	Generic Large Hopper							
2	Outer Bar	Generic Large Hopper	19.8	175.9	4.4	4.0	4.2	29.2	2.0
	Jetty Channel	Generic Large Hopper	15.9	140.8	3.5	3.2	3.4	23.3	1.6
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge							
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	9.1	79.9	2.0	1.8	1.9	13.3	0.9
7	Stauffer Channel	30" Dredge	17.7	154.5	3.9	3.5	3.7	25.6	1.8
8	Mitigation								
	YEAR 2015 TOTAL		**62.5**	**551.1**	**13.7**	**12.5**	**13.2**	**91.4**	**6.4**

YEAR 2016

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper							
	Part of Outer Bar	Generic Large Hopper							
2	Outer Bar	Generic Large Hopper	18.1	161.1	4.0	3.7	3.9	26.7	1.8
	Jetty Channel	Generic Large Hopper	14.5	128.9	3.2	2.9	3.1	21.4	1.5
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge							
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1.4	12.6	0.3	0.3	0.3	2.1	0.1
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2016 TOTAL		**34.1**	**302.6**	**7.5**	**6.9**	**7.2**	**50.1**	**3.5**

TOTAL

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	47.7	423.2	10.5	9.6	10.1	70.1	4.9
	Part of Outer Bar	Generic Large Hopper	89.1	791.4	19.7	17.9	18.9	131.2	9.1
2	Outer Bar	Generic Large Hopper	89.1	791.4	19.7	17.9	18.9	131.2	9.1
	Jetty Channel	Generic Large Hopper	71.3	633.1	15.8	14.3	15.1	104.9	7.3
3	Lower TB	30" Dredge	10.3	99.6	2.5	2.2	2.4	16.4	1.0
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	58.2	509.2	12.7	11.5	12.2	84.5	6.0
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	13.7	119.4	3.0	2.7	2.9	19.8	1.4
7	Stauffer Channel	30" Dredge	17.7	154.5	3.9	3.5	3.7	25.6	1.8
8	Mitigation								
	PROJECT TOTAL		**397.1**	**3,521.9**	**87.7**	**79.8**	**84.2**	**583.7**	**40.5**

Table C-12. Annual Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Year 2011	11.37	100.96	2.29	2.41	16.73	1.16
Year 2012	94.81	847.82	19.21	20.26	140.46	9.61
Year 2013	105.45	933.05	21.15	22.31	154.67	10.78
Year 2014	88.85	786.35	17.82	18.80	130.35	9.08
Year 2015	62.48	551.13	12.49	13.18	91.37	6.41
Year 2016	34.10	302.55	7.53	6.86	7.23	3.48

Table D-1. Construction Equipment Emission Factors
Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)					
					NO_x	VOC	PM_{10}	PM2.5	CO	SO_2
Contract 5: Ch to Brz thr Brzpt TB & PA 8										
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	--	0	0%	0	0	0	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	5.2085505	0.3480453	0.4103982	0.3980863	2.9595816	0.7499748
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	5.2151822	0.3655059	0.3994855	0.3875009	2.5667446	0.7499005
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	0.9099999	62.807925	9.7481978	8.968342	348.86535	0.1401917
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	173	43%	4.0891554	0.2871882	0.2397886	0.2325949	0.8792386	0.7421074
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	3.3773756	0.2664183	0.2860623	0.2774804	1.2224024	0.750322
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	6.2439293	1.0575681	0.7586622	0.7359024	4.0710716	0.8725374
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.3661478	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.3285376	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.3121903	0.3742502	0.3630227	1.4566405	0.7501273
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	135	59%	3.7592742	0.3121903	0.3742502	0.3630227	1.4566405	0.7501273
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	250	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	4.3732137	0.2389362	0.308081	0.2988385	1.9281148	0.7503568
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	4.9466203	0.2917844	0.2690519	0.2609804	1.3649245	0.7421121
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW TRUCK)	Highway Truck	Diesel	310	59%	4.3732137	0.2389362	0.308081	0.2988385	1.9281148	0.7503568

Table D-1. Construction Equipment Emission Factors
Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)					
					NO_x	VOC	PM_{10}	PM2.5	CO	SO_2
Contract 6: Ch to UTB thr UTB & PA 9										
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	Truck Trailer	--	0	0%	0	0	0	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	5.2085505	0.3480453	0.4103982	0.3980863	2.9595816	0.7499748
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	5.2151822	0.3655059	0.3994855	0.3875009	2.5667446	0.7499005
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	0.9099999	62.807925	9.7481978	8.968342	348.86535	0.1401917
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	250	43%	4.0891554	0.2871882	0.2397886	0.2325949	0.8792386	0.7421074
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	3.3773756	0.2664183	0.2860623	0.2774804	1.2224024	0.750322
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	6.2439293	1.0575681	0.7586622	0.7359024	4.0710716	0.8725374
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.3661478	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.3285376	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.3121903	0.3742502	0.3630227	1.4566405	0.7501273
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.3661478	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.3285376	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.3121903	0.3742502	0.3630227	1.4566405	0.7501273
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	4.3732137	0.2389362	0.308081	0.2988385	1.9281148	0.7503568
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	Diesel	205	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	4.9466203	0.2917844	0.2690519	0.2609804	1.3649245	0.7421121
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	Crawler Dozers/Tractor	Diesel	80	59%	4.3723798	0.4190596	0.5820331	0.5645721	3.8945662	0.8327177
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)		--	0	0%						
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.729163	0.2867895	0.3016065	0.2925583	1.2615169	0.7502354

Table D-2. Load Factors For Equipment Using Diesel or Gasoline

SCC Code	Equipment	Load Factor[1]	
		Diesel	Gasoline
22xx003010	Aerial Lifts	21%	46%
22xx005015	Agricultural Tractor	59%	62%
22xx006015	Air Compressors	43%	56%
22xx001030	All Terrain Vehicles	42%	100%
22xx002033	Bore/Drill Rigs	43%	79%
22xx002042	Cement & Motar Mixers	43%	59%
22xx004066	Chippers/Stump Grinders	43%	78%
22xx002039	Concrete/Industrial Saws	59%	78%
22xx002045	Cranes	43%	47%
22xx002066	Crawler Dozers/Tractor	59%	80%
22xx002054	Crushing/Procesing Equipment	43%	85%
22xx002078	Dumpers/Tenders	21%	41%
22xx002036	Excavators	59%	53%
22xx007015	Fellers/Bunchers/Skidders	59%	70%
22xx003020	Forklifts	59%	30%
22xx006020	Gas Compressors	43%	85%
22xx006005	Generator Sets	43%	68%
22xx002048	Graders	59%	64%
22xx005050	Hydro Power Units	43%	56%
22xx004056	Lawn and Garden Tractor	43%	44%
22xx002051	Off-Highway Truck	59%	80%
22xx002075	Off-Highway Tractor	59%	70%
22xx004056	Other Agricultural Equipment	59%	55%
22xx002081	Other Construction Equipment	59%	48%
22xx003040	Other General Industrial	43%	54%
22xx003050	Other Material Handling	21%	53%
22xx002003	Pavers	59%	66%
22xx002021	Paving Equipment	59%	59%
22xx002009	Plate Compactors	43%	55%
22xx006030	Pressure Washer	43%	85%
22xx006010	Pumps	43%	69%
22xx003060	Refrigeration/AC	43%	46%
22xx002015	Rollers	59%	62%
22xx002057	Rough Terrain Forklifts	59%	63%
22xx002063	Rubber Tire Dozer	59%	75%
22xx002060	Rubber Tire Loader	59%	71%
22xx002018	Scrapers	59%	70%
22xx002072	Skid Steer Loader	21%	58%
22xx001060	Specialty Vehicle/Carts	21%	58%
22xx002024	Surfacing Equipment	59%	49%
22xx003030	Sweepers/Scrubbers	43%	71%
22xx002006	Tampers/Rammers	43%	55%
22xx003070	Terminal Tractors	59%	78%
22xx005040	Tillers > 6 hp	59%	71%
22xx004026	Timmer/Edger/Brush Cutter	43%	91%
22xx002066	Tractor/Loader/Backhoe	21%	48%
22xx002030	Trenchers	59%	66%
22xx006025	Welders	21%	68%

1. Load Factors from Appendix A of *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*,EPA Office of Air and Radiation Report Number NR-005b, December 2002

Table D-3. Emissions Summary

Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	NOx Emissions (tons per year)					VOC Emissions (tons per year)					PM10 Emissions (tons per year)					PM2.5 Emissions (tons per year)					CO Emissions (tons per year)					SO2 Emissions (tons per year)				
				2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8			23																													
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	23	0.0066	0.0088	0.0058			0.0005	0.0007	0.0005			0.0005	0.0007	0.0005			0.0005	0.0007	0.0005			0.0023	0.0030	0.0020			0.0014	0.0018	0.0012		
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	1	24	23	-	-	-			-	-	-			-	-	-			-	-	-			-	-	-			-	-	-		
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	23	0.0052	0.0070	0.0047			0.0004	0.0005	0.0004			0.0004	0.0006	0.0004			0.0004	0.0005	0.0004			0.0018	0.0024	0.0016			0.0011	0.0014	0.0009		
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,136	23	0.2480	0.3306	0.2204			0.0191	0.0254	0.0170			0.0201	0.0267	0.0178			0.0195	0.0259	0.0173			0.0839	0.1118	0.0746			0.0499	0.0665	0.0443		
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	183	23	0.1149	0.1532	0.1021			0.0077	0.0102	0.0068			0.0091	0.0121	0.0080			0.0088	0.0117	0.0078			0.0653	0.0871	0.0580			0.0165	0.0221	0.0147		
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,651	23	3.0896	4.1194	2.7463			0.2165	0.2887	0.1925			0.2367	0.3155	0.2104			0.2296	0.3061	0.2041			1.5206	2.0274	1.3516			0.4443	0.5923	0.3949		
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	183	23	0.0003	0.0004	0.0003			0.0232	0.0309	0.0206			0.0036	0.0048	0.0032			0.0033	0.0044	0.0029			0.1289	0.1718	0.1146			0.0001	0.0001	0.0000		
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	1	24	23	0.0031	0.0042	0.0028			0.0002	0.0003	0.0002			0.0002	0.0002	0.0002			0.0002	0.0002	0.0002			0.0007	0.0009	0.0006			0.0006	0.0008	0.0005		
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	1	24	23	0.0049	0.0065	0.0044			0.0004	0.0005	0.0003			0.0004	0.0006	0.0004			0.0004	0.0005	0.0004			0.0018	0.0024	0.0016			0.0011	0.0015	0.0010		
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	314	23	0.0231	0.0308	0.0205			0.0039	0.0052	0.0035			0.0028	0.0037	0.0025			0.0027	0.0036	0.0024			0.0151	0.0201	0.0134			0.0032	0.0043	0.0029		
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	366	23	0.0493	0.0657	0.0438			0.0041	0.0054	0.0036			0.0044	0.0059	0.0040			0.0043	0.0057	0.0038			0.0190	0.0253	0.0169			0.0083	0.0111	0.0074		
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	366	23	0.0795	0.1060	0.0707			0.0061	0.0082	0.0054			0.0062	0.0083	0.0055			0.0060	0.0081	0.0054			0.0273	0.0364	0.0242			0.0140	0.0186	0.0124		
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	183	23	0.0175	0.0233	0.0156			0.0015	0.0019	0.0013			0.0017	0.0023	0.0015			0.0017	0.0023	0.0015			0.0068	0.0090	0.0060			0.0035	0.0047	0.0031		
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	1	64	23	0.0083	0.0110	0.0073			0.0007	0.0009	0.0006			0.0008	0.0011	0.0007			0.0008	0.0011	0.0007			0.0032	0.0043	0.0028			0.0016	0.0022	0.0015		
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	1	4,014	23	0.9158	1.2211	0.8140			0.0710	0.0947	0.0631			0.0752	0.1002	0.0668			0.0729	0.0972	0.0648			0.3160	0.4214	0.2809			0.1916	0.2555	0.1703		
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	1	24	23	0.0052	0.0070	0.0047			0.0004	0.0005	0.0004			0.0004	0.0006	0.0004			0.0004	0.0005	0.0004			0.0018	0.0024	0.0016			0.0011	0.0014	0.0009		
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	10	23	0.0020	0.0027	0.0018			0.0002	0.0002	0.0001			0.0002	0.0002	0.0001			0.0002	0.0002	0.0001			0.0007	0.0009	0.0006			0.0004	0.0005	0.0004		
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	85	23	0.0186	0.0247	0.0165			0.0014	0.0019	0.0013			0.0015	0.0020	0.0013			0.0015	0.0019	0.0013			0.0063	0.0084	0.0056			0.0037	0.0050	0.0033		
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	10	23	0.0035	0.0046	0.0031			0.0002	0.0003	0.0002			0.0002	0.0003	0.0002			0.0002	0.0003	0.0002			0.0015	0.0020	0.0014			0.0006	0.0008	0.0005		
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	1	6,651	23	2.1358	2.8477	1.8985			0.1260	0.1680	0.1120			0.1162	0.1549	0.1033			0.1127	0.1502	0.1002			0.5893	0.7858	0.5238			0.3204	0.4272	0.2848		
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW TRUCK)	1	61	23	0.0210	0.0281	0.0187			0.0011	0.0015	0.0010			0.0015	0.0020	0.0013			0.0014	0.0019	0.0013			0.0093	0.0124	0.0082			0.0036	0.0048	0.0032		

Table D-3. Emissions Summary

Freeport Harbor Channel Improvement Project
NED Alternative

Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	NOx Emissions (tons per year)					VOC Emissions (tons per year)					PM10 Emissions (tons per year)					PM2.5 Emissions (tons per year)					CO Emissions (tons per year)					SO2 Emissions (tons per year)				
				2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Contract 6: Ch to UTB thr UTB & PA 9			16																													
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	16			0.0042	0.0126	0.0021			0.0003	0.0010	0.0002			0.0003	0.0010	0.0002			0.0003	0.0010	0.0002			0.0014	0.0043	0.0007			0.0009	0.0026	0.0004
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	1	24	16			-	-	-			-	-	-			-	-	-			-	-	-			-	-	-			-	-	-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	16			0.0033	0.0100	0.0017			0.0003	0.0008	0.0001			0.0003	0.0008	0.0001			0.0003	0.0008	0.0001			0.0011	0.0034	0.0006			0.0007	0.0020	0.0003
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,173	16			0.1636	0.4907	0.0818			0.0126	0.0377	0.0063			0.0132	0.0397	0.0066			0.0128	0.0385	0.0064			0.0553	0.1660	0.0277			0.0329	0.0987	0.0165
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	191	16			0.0766	0.2299	0.0383			0.0051	0.0154	0.0026			0.0060	0.0181	0.0030			0.0059	0.0176	0.0029			0.0435	0.1306	0.0218			0.0110	0.0331	0.0055
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,868	16			2.0383	6.1149	1.0191			0.1429	0.4286	0.0714			0.1561	0.4684	0.0781			0.1515	0.4544	0.0757			1.0032	3.0095	0.5016			0.2931	0.8793	0.1465
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	191	16			0.0002	0.0007	0.0001			0.0155	0.0464	0.0077			0.0024	0.0072	0.0012			0.0022	0.0066	0.0011			0.0859	0.2578	0.0430			0.0000	0.0001	0.0000
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	1	24	16			0.0029	0.0087	0.0015			0.0002	0.0006	0.0001			0.0002	0.0005	0.0001			0.0002	0.0005	0.0001			0.0006	0.0019	0.0003			0.0005	0.0016	0.0003
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	1	24	16			0.0031	0.0094	0.0016			0.0002	0.0007	0.0001			0.0003	0.0008	0.0001			0.0003	0.0008	0.0001			0.0011	0.0034	0.0006			0.0007	0.0021	0.0003
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	381	16			0.0179	0.0537	0.0089			0.0030	0.0091	0.0015			0.0022	0.0065	0.0011			0.0021	0.0063	0.0011			0.0117	0.0350	0.0058			0.0025	0.0075	0.0013
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	383	16			0.0330	0.0989	0.0165			0.0027	0.0081	0.0014			0.0030	0.0089	0.0015			0.0029	0.0086	0.0014			0.0127	0.0381	0.0063			0.0056	0.0167	0.0028
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	383	16			0.0532	0.1595	0.0266			0.0041	0.0123	0.0020			0.0042	0.0125	0.0021			0.0040	0.0121	0.0020			0.0182	0.0547	0.0091			0.0093	0.0280	0.0047
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	191	16			0.0117	0.0350	0.0058			0.0010	0.0029	0.0005			0.0012	0.0035	0.0006			0.0011	0.0034	0.0006			0.0045	0.0136	0.0023			0.0023	0.0070	0.0012
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	45	16			0.0039	0.0116	0.0019			0.0003	0.0010	0.0002			0.0003	0.0010	0.0002			0.0003	0.0010	0.0002			0.0015	0.0045	0.0007			0.0007	0.0020	0.0003
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	45	16			0.0062	0.0187	0.0031			0.0005	0.0014	0.0002			0.0005	0.0015	0.0002			0.0005	0.0014	0.0002			0.0021	0.0064	0.0011			0.0011	0.0033	0.0005
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	25	16			0.0015	0.0046	0.0008			0.0001	0.0004	0.0001			0.0002	0.0005	0.0001			0.0001	0.0004	0.0001			0.0006	0.0018	0.0003			0.0003	0.0009	0.0002
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	73	16			0.0093	0.0279	0.0046			0.0007	0.0021	0.0004			0.0008	0.0023	0.0004			0.0007	0.0022	0.0004			0.0031	0.0094	0.0016			0.0019	0.0056	0.0009
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	73	16			0.0161	0.0483	0.0080			0.0009	0.0026	0.0004			0.0011	0.0034	0.0006			0.0011	0.0033	0.0005			0.0071	0.0213	0.0035			0.0028	0.0083	0.0014
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	1	120	16			0.0149	0.0447	0.0075			0.0011	0.0034	0.0006			0.0012	0.0036	0.0006			0.0012	0.0035	0.0006			0.0050	0.0151	0.0025			0.0030	0.0090	0.0015
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	1	45	16			0.0092	0.0277	0.0046			0.0005	0.0016	0.0003			0.0005	0.0015	0.0003			0.0005	0.0015	0.0002			0.0025	0.0076	0.0013			0.0014	0.0042	0.0007
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	1	80	16			0.0045	0.0136	0.0023			0.0004	0.0013	0.0002			0.0006	0.0018	0.0003			0.0006	0.0018	0.0003			0.0041	0.0122	0.0020			0.0009	0.0026	0.0004
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	1	40	16			-	-	-			-	-	-			-	-	-			-	-	-			-	-	-			-	-	-
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	1	40	16			0.0056	0.0167	0.0028			0.0004	0.0013	0.0002			0.0005	0.0014	0.0002			0.0004	0.0013	0.0002			0.0019	0.0057	0.0009			0.0011	0.0034	0.0006
			TOTALS	**6.75**	**9.00**	**8.48**	**7.44**	**1.24**	**0.48**	**0.65**	**0.62**	**0.58**	**0.10**	**0.48**	**0.64**	**0.62**	**0.58**	**0.10**	**0.47**	**0.62**	**0.60**	**0.57**	**0.09**	**2.80**	**3.74**	**3.76**	**3.80**	**0.63**	**1.07**	**1.42**	**1.32**	**1.12**	**0.19**

Table D-4. Total Estimated Project Emissions by Year of Construction Activity
Freeport Harbor Channel Improvement Project
NED Alternative

	2012	2013	2014	2015	2016
NO_x	6.75	9.00	8.48	7.44	1.24
VOC	0.48	0.65	0.62	0.58	0.10
PM_{10}	0.48	0.64	0.62	0.58	0.10
$PM_{2.5}$	0.47	0.62	0.60	0.57	0.09
CO	2.80	3.74	3.76	3.80	0.63
SO_2	1.07	1.42	1.32	1.12	0.19

Table E-1. Crew Size per Equipment
Freeport Harbor Channel Improvement Project
NED Alternative

	Hopper Dredge		Cutterhead Dredge		
	Hopper Dredge Crew	Shore Crew	Cutterhead Dredge Crew	Shore Crew	Other Construction Equipment
Employees	22	8	46	6	6

Table E-2. Emission Factors for Employee Vehicles
Freeport Harbor Channel Improvement Project

County	Type of Vehicle	EPA Category[1]	Emisson Factor (g/mile)					
			CO[2]	NOx[2]	PM2.5[3]	PM10[3]	SO2[3]	VOC[2]
Brazoria	Cars	LDGV	6.8379	0.5163	0.0114	0.0249	0.0068	0.6596
	Pickups	LDGT1	7.3724	0.5176	0.0116	0.0252	0.0088	0.6988

Notes:
1. LDGV=light duty gasoline-fueled vehicles designated for transport of up to 12 people
LDGT1=light duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6000 pounds or less
2. Emission factors for CO, NOx, and VOC are from MOBILE6.2 run using Brazoria County input file, "30aug2007brazi1a0", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/HGB/m62/2007/.
3. Emission factors for $PM_{2.5}$, PM_{10}, and SO_2 are from MOBILE6.2 run using Statewide PM1 and PM2 input files, "2007_wk_pm1_d13c5r4ihu.in" and "2007_wk_pm2_d13c5r4ihu.in", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/Statewide/m62/2007/.

Table E-3. Summary of Employee Vehicles Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

Project Year	Type of Vehicle	EPA Category	Daily Vehicles (/day)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (tpy)					
							CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
2011	Cars	LDGV	21	50.0	130	136,500	1.0289	0.0777	0.0017	0.0037	0.0010	0.0992
	Pickups	LDGT1	21	50.0	130	136,500	1.1093	0.0779	0.0017	0.0038	0.0013	0.1051
2011 Total Mobile Emission							**2.138**	**0.156**	**0.0035**	**0.0075**	**0.0023**	**0.204**
2012	Cars	LDGV	82	50.0	719	2,947,900	22.2194	1.6777	0.0370	0.0809	0.0221	2.1433
	Pickups	LDGT1	82	50.0	719	2,947,900	23.9562	1.6819	0.0377	0.0819	0.0286	2.2707
2012 Total Mobile Emission							**46.176**	**3.360**	**0.0747**	**0.1628**	**0.0507**	**4.414**
2013	Cars	LDGV	56	50.0	783	2,192,400	16.5249	1.2477	0.0276	0.0602	0.0164	1.5940
	Pickups	LDGT1	56	50.0	783	2,192,400	17.8166	1.2509	0.0280	0.0609	0.0213	1.6888
2013 Total Mobile Emission							**34.342**	**2.499**	**0.0556**	**0.1211**	**0.0377**	**3.283**
2014	Cars	LDGV	82	50.0	717	2,939,700	22.1576	1.6730	0.0369	0.0807	0.0220	2.1374
	Pickups	LDGT1	82	50.0	717	2,939,700	23.8896	1.6772	0.0376	0.0817	0.0285	2.2644
2014 Total Mobile Emission							**46.047**	**3.350**	**0.0745**	**0.1623**	**0.0506**	**4.402**
2015	Cars	LDGV	41	50.0	762	1,562,100	11.7741	0.8890	0.0196	0.0429	0.0117	1.1358
	Pickups	LDGT1	41	50.0	762	1,562,100	12.6945	0.8913	0.0200	0.0434	0.0152	1.2033
2015 Total Mobile Emission							**24.469**	**1.780**	**0.0396**	**0.0863**	**0.0269**	**2.339**
2016	Cars	LDGV	41	50.0	280	574,000	4.3264	0.3267	0.0072	0.0158	0.0043	0.4173
	Pickups	LDGT1	41	50.0	280	574,000	4.6646	0.3275	0.0073	0.0159	0.0056	0.4421
2016 Total Mobile Emission							**8.991**	**0.654**	**0.0146**	**0.0317**	**0.0099**	**0.859**

Notes:
1. Total VMT is assumed to be 50 miles/day round trip.
2. Annual travel = Daily vehicles * Total VMT * Travel days/yr.
3. Annual emissions = Emission factor * Annual travel * 1lb/453.6 grams * 1ton/2000lb

Table E-4. Annual Employee Vehicle Emissions (tpy)
Freeport Harbor Channel Improvement Project
NED Alternative

Year	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Year 2011	2.14	0.16	0.003	0.008	0.002	0.204
Year 2012	46.18	3.36	0.07	0.16	0.05	4.41
Year 2013	34.34	2.50	0.06	0.12	0.04	3.28
Year 2014	46.05	3.35	0.07	0.16	0.05	4.40
Year 2015	24.47	1.78	0.04	0.09	0.03	2.34
Year 2016	8.99	0.65	0.01	0.03	0.01	0.86

Table F-1. NED Alternative - Additional Maintenance Dredging - Assumptions for Marine Equipment Engines
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine Horsepower (hp)	Hours of Operation per Day (hrs/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Additional 1,580,000 cy/yr Maintenance Dredging	Hopper Dredge	1	14,000	Propulsion - Oceangoing	Diesel	0.8	9,000	20	65%	40	514
				Propulsion - Dredging	Diesel	0.8	9,000	20	35%	40	277
				Dredge Pump(s)	Diesel	0.8	3,000	20	35%	40	277
				Auxiliary - Oceangoing	Diesel	0.8	2,000	20	65%	40	514
				Auxiliary - Idling	Diesel	0.8	2,000	20	35%	40	277
	Survey Boat	1	2,000	Propulsion	Diesel	0.4	2,000	20	100%	8	158
				Auxiliary	Diesel	0.2	2,000	20	100%	8	158
	Shrimp Boat (Turtle Trawl)	2	600	Propulsion	Diesel	0.4	600	24	100%	28	1,330
				Auxiliary	Diesel	0.2	600	24	100%	28	1,330
Total Engine Hours											4,832

Notes:
1. Days of operation are determined assuming 40,000 CY/day production rate for a hopper dredge removing unconsolidated, predominantly silty dredged material.

Table F-2. NED Alternative - Additional Mainenance Dredging - Marine Equipment Hours of Operation
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging

			Dredge								
			Generic Large Hopper Dredge					Crew/Survey Boat (Runabout)		Shrimp Boats (Total of Two)	
Contract No.	**Additional Volume/Disposal Site**	**Dredge**	Propulsion Ocean Going	Propulsion Dredging	Dredge Pump(s)	Auxillary Oceangoing	Auxiliary Idling	Propulsion	Secondary	Propulsion	Secondary
Additional Maintenance Dredging	1,580,000 CY of Additional Maintenance Material to ODMS	Hopper	514	277	277	514	277	158	158	1,330	1,330

Table F-3. NED Alternative - Additional Maintenance Dredging - Marine Equipment Estimated Emissions
Freeport Harbor Channel Improvement Project
Additional 1,580,000 cy/yr Maintenance Dredging
(Tons per Year)

Phase No.	Pollutant	Dredge	Dredge									**Total Emissions Per Year**
			Generic Large Hopper Dredge					Crew/Survey Boat		Shrimp Boat		
			Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxillary - Dredging	Propulsion	Auxiliary	Propulsion	Auxiliary	
Additional 1,580,000 cy/yr Maintenance Dredging	CO	Hopper	3.18	1.71	0.57	0.71	0.38	0.22	0.22	0.55	0.55	**8.09**
	NOX	Hopper	32.29	17.39	5.80	7.18	1.08	1.14	0.62	2.87	1.55	**69.90**
	PM	Hopper	0.80	0.43	0.14	0.18	0.03	0.03	0.02	0.07	0.04	**1.74**
	PM2.5	Hopper	0.73	0.39	0.13	0.16	0.03	0.03	0.02	0.07	0.04	**1.59**
	PM10	Hopper	0.77	0.41	0.14	0.17	0.03	0.03	0.02	0.07	0.04	**1.67**
	SOX	Hopper	5.32	2.86	0.95	1.18	0.20	0.20	0.11	0.50	0.28	**11.60**
	VOC	Hopper	0.28	0.15	0.05	0.06	0.07	0.03	0.04	0.07	0.10	**0.85**

Appendix B

LPP Alternative Emissions Summary

APPENDIX B

List of Tables
Freeport Harbor Channel Improvement Project
LPP Alternative

Table A-1. Annual Project Emissions Summary
Freeport Harbor Channel Improvement Project
LPP Alternative

	TONS PER YEAR					
Year 2011	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	10.74	95.38	2.16	2.28	15.81	1.09
Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Employee Vehicles	1.53	0.11	0.002	0.005	0.002	0.146
Subtotal	**12.27**	**95.49**	**2.16**	**2.29**	**15.81**	**1.24**
Year 2012	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	83.82	747.30	16.93	17.86	123.83	8.52
Construction Equipment	8.05	19.41	1.34	1.39	3.07	1.39
Employee Vehicles	77.60	5.65	0.13	0.27	0.09	7.42
Subtotal	**169.48**	**772.36**	**18.40**	**19.52**	**126.98**	**17.33**
Year 2013	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	96.54	855.17	19.38	20.44	141.75	9.86
Construction Equipment	10.74	25.88	1.79	1.85	4.09	1.86
Employee Vehicles	33.42	2.43	0.05	0.12	0.04	3.19
Subtotal	**140.70**	**883.48**	**21.23**	**22.41**	**145.87**	**14.91**
Year 2014	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	79.77	703.71	15.95	16.83	116.67	8.18
Construction Equipment	6.86	14.23	1.05	1.09	2.17	1.08
Employee Vehicles	39.88	2.90	0.06	0.14	0.04	3.81
Subtotal	**126.51**	**720.85**	**17.07**	**18.05**	**118.88**	**13.08**
Year 2015	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Dredge & Support Equipment	24.79	218.29	4.95	5.22	36.19	2.55
Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Employee Vehicles	12.32	0.90	0.02	0.04	0.01	1.18
Subtotal	**37.11**	**219.18**	**4.97**	**5.26**	**36.21**	**3.73**
TOTAL (ALL YEARS)						
Dredge & Support Equipment	295.67	2,619.85	59.37	62.63	434.24	30.20
Construction Equipment	25.65	59.53	4.19	4.32	9.33	4.33
Employee Vehicles	164.75	11.99	0.27	0.58	0.18	15.75
	486	**2,691**	**64**	**68**	**444**	**50**

Table A-2. Summary of Annual Project Emissions From All Sources Compared to 2001 Emissions Inventory Freeport Harbor Channel Improvement Project LPP Alternative

	TONS PER YEAR					
2002 EMISSION INVENTORY	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
HGA	**1,101,693**	**357,353**	**59,155**	**325,353**	**152,017**	**214,128**
Brazoria County	**59,817**	**44,128**	**6,515**	**40,363**	**11,194**	**15,842**
ANNUAL LPP ALTERNATIVE EMISSIONS	**CO**	**NO_X**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**VOC**
Year 2011	**12.27**	**95.49**	**2.16**	**2.29**	**15.81**	**1.24**
% of HGA	0.00%	0.03%	0.00%	0.00%	0.01%	0.00%
% of Brazoria County	0.02%	0.22%	0.03%	0.01%	0.14%	0.01%
Year 2012	**169.48**	**772.36**	**18.40**	**19.52**	**126.98**	**17.33**
% of HGA	0.02%	0.22%	0.03%	0.01%	0.08%	0.01%
% of Brazoria County	0.28%	1.75%	0.28%	0.05%	1.13%	0.11%
Year 2013	**140.70**	**883.48**	**21.23**	**22.41**	**145.87**	**14.91**
% of HGA	0.01%	0.25%	0.04%	0.01%	0.10%	0.01%
% of Brazoria County	0.24%	2.00%	0.33%	0.06%	1.30%	0.09%
Year 2014	**126.51**	**720.85**	**17.07**	**18.05**	**118.88**	**13.08**
% of HGA	0.01%	0.20%	0.03%	0.01%	0.08%	0.01%
% of Brazoria County	0.21%	1.63%	0.26%	0.04%	1.06%	0.08%
Year 2015	**37.11**	**219.18**	**4.97**	**5.26**	**36.21**	**3.73**
% of HGA	0.00%	0.06%	0.01%	0.00%	0.02%	0.00%
% of Brazoria County	0.06%	0.50%	0.08%	0.01%	0.32%	0.02%
Peak Annual Emissions	**169**	**883**	**21**	**22**	**146**	**17**
% of HGA	0.02%	0.25%	0.04%	0.01%	0.10%	0.01%
% of Brazoria County	0.3%	2.0%	0.3%	0.06%	1.3%	0.1%

Table A-3. General Conformity Emissions By Source
Freeport Harbor Channel Improvement Project
LPP Alternative

Year	NO_X (tpy)				VOC (tpy)			
	Dredge & Support Equipment	Construction Equipment	Employee Vehicles	NO_X Total	Dredge & Support Equipment	Construction Equipment	Employee Vehicles	VOC Total
2011	95.38	0.00	0.11	**95.49**	1.09	0.00	0.15	**1.24**
2012	747.30	19.41	5.65	**772.36**	8.52	1.39	7.42	**17.33**
2013	855.17	25.88	2.43	**883.48**	9.86	1.86	3.19	**14.91**
2014	703.71	14.23	2.90	**720.85**	8.18	1.08	3.81	**13.08**
2015	218.29	0.00	0.90	**219.18**	2.55	0.00	1.18	**3.73**

Table A-4. General Conformity Emissions By Engine Type
Freeport Harbor Channel Improvement Project
LPP Alternative

		Tons per Year									
		NO_x					VOC				
		2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Dredging	Hopper Dredge - Propelling	56.65	367.22	429.96	239.96	58.84	0.50	3.22	3.77	2.11	0.52
	Survey Boat - Propelling	2.00	12.93	15.14	8.45	2.07	0.05	0.31	0.36	0.20	0.05
	Trawler - Propelling	4.19	27.16	31.80	17.75	4.35	0.10	0.65	0.77	0.43	0.10
	Tug - Propelling		4.87	8.07	18.43	7.33		0.12	0.19	0.44	0.18
	Crew Boat - Propelling		0.32	0.54	1.23	0.49		0.01	0.01	0.03	0.01
	Hopper Dredge - Pumping	10.17	65.91	77.17	43.07	10.56	0.09	0.58	0.68	0.38	0.09
	Cutter Dredge - Pumping		119.84	117.52	268.32	106.73		1.05	1.03	2.35	0.94
	Floating Booster - Pumping										
	Hopper Dredge - Generating	19.37	125.55	146.99	82.04	20.12	0.17	1.10	1.29	0.72	0.18
	Spill Barge - Generating		0.13	0.22	0.51	0.20		0.00	0.01	0.01	0.00
	Subtotal	**92.37**	**723.95**	**827.41**	**679.74**	**210.70**	**0.91**	**7.05**	**8.11**	**6.67**	**2.07**
Idling	Dredges - Generating	1.86	15.89	19.02	19.09	6.39	0.12	1.00	1.20	1.20	0.40
	Survey Boat - Generating	0.37	2.41	2.82	1.57	0.39	0.02	0.15	0.18	0.10	0.02
	Trawler - Generating	0.78	5.06	5.92	3.31	0.81	0.05	0.32	0.37	0.21	0.05
	Subtotal	**3.01**	**23.35**	**27.76**	**23.97**	**7.59**	**0.19**	**1.47**	**1.75**	**1.51**	**0.48**
Construction Equipment	Miscellaneous Equipment		19.41	25.88	14.23			1.39	1.86	1.08	
	Subtotal		**19.41**	**25.88**	**14.23**			**1.39**	**1.86**	**1.08**	
Vehicles	Cars	0.06	2.82	1.21	1.45	0.45	0.07	3.60	1.55	1.85	0.57
	Pickups	0.06	2.83	1.22	1.45	0.45	0.08	3.82	1.64	1.96	0.61
	Subtotal	**0.11**	**5.65**	**2.43**	**2.90**	**0.90**	**0.15**	**7.42**	**3.19**	**3.81**	**1.18**
	Total	**95.49**	**772.36**	**883.48**	**720.85**	**219.18**	**1.24**	**17.33**	**14.91**	**13.08**	**3.73**
		95.38	747.30	855.17	703.71	218.29	1.09	8.52	9.86	8.18	2.55

Nonroad

	NOx				
TPY	**95.4**	**766.7**	**881.1**	**717.9**	**218.3**
TONS/DAY	0.37	2.95	3.39	2.76	0.84
64.53 TPY Emis Budget	0.57%	4.57%	5.25%	4.28%	1.30%

Vehicles

	NOx				
TPY	**0.11**	**5.65**	**2.43**	**2.90**	**0.90**
TONS/DAY	0.0004	0.0217	0.0094	0.0112	0.0034
186.13 TPY Emis Budget	0.0002%	0.012%	0.005%	0.006%	0.002%

Table B-1. Dredging Contract Schedule - Days per Year
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Duration Months	Dredging Duration Days	Contract Start	Contract Finish	Year 1 2011 days	Year 2 2012 days	Year 3 2013 days	Year 4 2014 days	Year 5 2015 days	Year 6 2016 days
1	New Extention and Part of Outer Bar	23.2	696	10/1/2011	10/31/2013	65	261	218			
2	Outer Bar and Jetty Channel	33.2	996	6/1/2012	3/31/2015		152	261	261	64	
3	Lower TB, PA1, & Seaway Removel	1	30	4/1/2012	5/31/2012		44				
4	Real Estate	6	180	10/1/2011	3/31/2012	65	65				
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	8	240	4/1/2012	11/30/2014		196	261	238		
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	4	120	12/1/2013	9/30/2014			22	195		
7	Stauffer Channel	6	180	10/1/2014	4/30/2015				66	86	
8	Mitigation	6	180	4/1/2015	9/30/2015					131	
	TOTAL	130	718	762	760	281	0				

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Type		Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 1: New Extension & Part of Entrance					
DredgingNew Extent (Duration =		**6**	**Quantity =**	**795,000**	**CY**
Generic Large Hopper	Dredging		3000	14000	
	Idle		1032		
Survey Boat	Dredging		600	2000	
	Idle		206		
Trawlers - 2	Dredging		4200	1200	
	Idle		1444		
Dredging Part of Outer Bar (Duration =		**17.2**	**Quantity =**	**4,145,000**	**CY**
Generic Large Hopper	Dredging		8600	14000	
	Idle		2958		
Survey Boat	Dredging		1720	2000	
	Idle		592		
Trawlers - 2	Dredging		12040	1200	
	Idle		4142		
Total		**23.2**	**40,534**		
CONTRACT 2: Outer Bar and Jetty Ch					
Dredging Outer Bar (Duration =		**17.2**	**Quantity =**	**4,145,000**	**CY**
Generic Large Hopper	Dredging		8600	14000	
	Idle		2958		
Survey Boat	Dredging		1720	2000	
	Idle		592		
Trawlers - 2	Dredging		12040	1200	
	Idle		4142		
Dredging Jetty Ch (Duration =		**16**	**Quantity =**	**3,648,000**	**CY**
Generic Large Hopper	Dredging		8000	14000	
	Idle		2752		
Survey Boat	Dredging		1600	2000	
	Idle		550		
Trawlers - 2	Dredging		11200	1200	
	Idle		3852		
Total		**33.2**	**58,006**		

Table B-2. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Type	Activity (month)	Hours of Operation	Horse power (HP)	
CONTRACT 3: Lower TB, PA 1 Work & Seaway Removal				
Dredging Lower TB (Duration =	**1**	**Quantity =**	**208,000**	**CY**
30" Dredge	Dredging	500	9000	
	Idle	225	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	1200	1500	
Spill Barge	Dredging	100	165	
Crewboat	Construction	100	400	
Total	**1**	**2,125**		
CONTRACT 5: Ch to Brz thr Brzpt TB & PA 8				
Dredging Cycle (Duration =	**8**	**Quantity =**	**1,716,000**	**CY**
30" Dredge	Dredging	4000	9000	
	Idle	1800	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	9600	1500	
Spill Barge	Dredging	800	165	
Crewboat	Construction	800	400	
Total	**8**	**17,000**		
CONTRACT 6: Ch to UTB thr UTB & PA 9				
Dredging Cycle (Duration =	**4**	**Quantity =**	**881,000**	**CY**
30" Dredge	Dredging	2000	9000	
	Idle	900	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	4800	1500	
Spill Barge	Dredging	400	165	
Crewboat	Construction	400	400	
Total	**4**	**8,500**		
CONTRACT 7: Stauffer Ch				
Dredging Cycle (Duration =	**6**	**Quantity =**	**1,814,000**	**CY**
30" Dredge	Dredging	3000	9000	
	Idle	1350	3000	
Dredging Tugs (3 @ 500hp each)	Dredging	7200	1500	
Spill Barge	Dredging	600	165	
Crewboat	Construction	600	400	
Total	**6**	**12,750**		

Table B-3. Dredging Contract Allocation by Year
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Duration Days	Year 1 **2011** percent	Year 2 **2012** percent	Year 3 **2013** percent	Year 4 **2014** percent	Year 5 **2015** percent
1	New Extention and Part of Outer Bar	696	12%	48%	40%		
2	Outer Bar and Jetty Channel	996		21%	35%	35%	9%
3	Lower TB, PA1, & Seaway Removel	30		100%			
4	Real Estate	180	50%	50%			
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	240		28%	38%	34%	
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	120			18%	90%	
7	Stauffer Channel	180				37%	57%
8	Mitigation	180					100%

Table B-4. Dredge Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Operating Hours													
		Dredge						Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
		Dredge Type	Total Dredging	Propelling	Pumping	Power Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
1	New Extension	Generic Large Hopper	3,000	1,950	1,050	3,000	1,032	600	206	4,200	1,444				
	Part of Outer Bar	Generic Large Hopper	8,600	5,590	3,010	8,600	2,958	1,720	592	12,040	4,142				
2	Outer Bar	Generic Large Hopper	8,600	5,590	3,010	8,600	2,958	1,720	592	12,040	4,142				
	Jetty Channel	Generic Large Hopper	8,000	5,200	2,800	8,000	2,752	1,600	550	11,200	3,852				
3	Lower TB	30" Dredge	500				225						1,200	100	100
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	4,000				1,800						9,600	800	800
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2,000				900						4,800	400	400
7	Stauffer Channel	30" Dredge	3,000				1,350						7,200	600	600
8	Mitigation														

Table B-5. Typical Hopper Dredging Cycle
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Reach	Dredging Cycle				
		Dredge Type	Total Dredging Hours	Propelling	Pumping	Power Generating
1	New Extension	Generic Large Hopper	3,000	65%	35%	100%
	Part of Outer Bar	Generic Large Hopper	8,600	65%	35%	100%
2	Outer Bar	Generic Large Hopper	8,600	65%	35%	100%
	Jetty Channel	Generic Large Hopper	8,000	65%	35%	100%

Table B-6. Dredge Equipment Engine Horsepower Break-down
Freeport Harbor Channel Improvement Project
LPP Alternative

Contract No.	Location/Disposal Site	Dredge Type	Horsepower (hp)												
			Engine Type					Survey Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
			Total	Propulsion	Pump	Generator	Generator at Idling	Main Engine	Idling	Main Engine	Idling	Pumping	Propulsion	Main Engine	Propulsion
1	New Extension	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Part of Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
2	Outer Bar	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
	Jetty Channel	Generic Large Hopper	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
3	Lower TB	30" Dredge	14,000	9,000	3,000	2,000	2,000	2,000	2,000	600	600				
4	Real Estate						3,000						500	165	400
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9,000				3,000						500	165	400
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	9,000				3,000						500	165	400
7	Stauffer Channel	30" Dredge	9,000				3,000						500	165	400
8	Mitigation						3,000						500	165	400

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	358.46	233.00	125.46	358.46	123.31	71.69	24.61	501.84	172.54				
	Part of Outer Bar	Generic Large Hopper	1,027.57	667.92	359.65	1,027.57	353.44	205.51	70.74	1,438.60	494.91				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL		**1,386.03**	**900.92**	**485.11**	**1,386.03**	**476.75**	**277.21**	**95.35**	**1,940.44**	**667.44**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	1,439.34	935.57	503.77	1,439.34	495.13	287.87	98.83	2,015.07	692.80				
	Part of Outer Bar	Generic Large Hopper	4,126.10	2,681.97	1,444.14	4,126.10	1,419.19	825.22	284.03	5,776.54	1,987.25				
2	Outer Bar	Generic Large Hopper	1,771.27	1,151.33	619.95	1,771.27	609.24	354.25	121.93	2,479.78	853.09				
	Jetty Channel	Generic Large Hopper	1,647.70	1,071.00	576.69	1,647.70	566.81	329.54	113.28	2,306.78	793.37				
3	Lower TB	30" Dredge	500.00				225.00						1,200.00	100.00	100.00
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,128.06				507.63						2,707.34	225.61	225.61
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**10,612.47**	**5,839.87**	**3,144.54**	**8,984.41**	**3,822.99**	**1,796.88**	**618.07**	**12,578.18**	**4,326.51**		**3,907.34**	**325.61**	**325.61**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper	1,202.21	781.43	420.77	1,202.21	413.56	240.44	82.55	1,683.09	578.66				
	Part of Outer Bar	Generic Large Hopper	3,446.32	2,240.11	1,206.21	3,446.32	1,185.38	689.26	237.24	4,824.85	1,659.85				
2	Outer Bar	Generic Large Hopper	3,041.46	1,976.95	1,064.51	3,041.46	1,046.12	608.29	209.37	4,258.05	1,464.85				
	Jetty Channel	Generic Large Hopper	2,829.27	1,839.02	990.24	2,829.27	973.27	565.85	194.51	3,960.98	1,362.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,502.16				675.97						3,605.18	300.43	300.43
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	366.67				165.00						880.00	73.33	73.33
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**12,388.09**	**6,837.52**	**3,681.74**	**10,519.26**	**4,459.30**	**2,103.85**	**723.66**	**14,726.97**	**5,065.65**		**4,485.18**	**373.76**	**373.76**

Table C-1. Marine Equipment Operating Hours
Freeport Harbor Channel Improvement Project
LPP Alternative

Operating Hours			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	3,041.46	1,976.95	1,064.51	3,041.46	1,046.12	608.29	209.37	4,258.05	1,464.85				
	Jetty Channel	Generic Large Hopper	2,829.27	1,839.02	990.24	2,829.27	973.27	565.85	194.51	3,960.98	1,362.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1,369.78				616.40						3,287.48	273.96	273.96
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	1,797.24				808.76						4,313.36	359.45	359.45
7	Stauffer Channel	30" Dredge	1,100.00				495.00						2,640.00	220.00	220.00
8	Mitigation														
	YEAR 2014 TOTAL		**10,137.75**	**3,815.98**	**2,054.76**	**5,870.73**	**3,939.55**	**1,174.15**	**403.88**	**8,219.02**	**2,827.15**		**10,240.85**	**853.40**	**853.40**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper	745.80	484.77	261.03	745.80	256.52	149.16	51.34	1,044.12	359.20				
	Jetty Channel	Generic Large Hopper	693.77	450.95	242.82	693.77	238.66	138.75	47.70	971.27	334.05				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	1,697.37				763.82						4,073.68	339.47	339.47
8	Mitigation														
	YEAR 2015 TOTAL		**3,136.93**	**935.72**	**503.85**	**1,439.57**	**1,258.99**	**287.91**	**99.04**	**2,015.39**	**693.25**		**4,073.68**	**339.47**	**339.47**

Table C-2. Marine Engine Emission Factors and Fuel Consumption Algorithms

(in g/kW-hr, for all marine engines)

Freeport Harbor Channel Improvement Project

Statistical Parameter	Exponent (x)	Intercept (b)	Coefficient (a)
CO	1	0	0.8378
NO_X	1.5	10.4496	0.1255
PM	1.5	0.2551	0.0059
PM2.5	1.5	0.2551	0.0059
PM10	1.5	0.2551	0.0059
SO_X	n/a	0	2.3735
VOC (HC)	1.5	0	0.0667

Notes:

1.) All regressions but SO_2 are in the form of:

Emissions Rate (g/hp-hr) = (a*(Fractional Load)$^{-x}$ + b) * 0.7457

where the conversion factor of 0.7457 kW/hp is used to calculate the emission factor in g/hp-hr

2.) Fractional Load is equal to actual engine output divided by rated engine output.

3.) The SO_2 regression is the form of:

Emissions Rate (g/hp-hr) = a*(Fuel Sulfur Flow in g/hp-hr) + b

where Fuel Sulfur Flow is the Fuel Consumption times the sulfur content of the fuel;
The sulfur content for the fuel consumption regression was set to 3300 parts per million (0.33 wt%)

4.) **Fuel Consumption (g/hp-hr) = (14.12 / (Fractional Load) + 205.717) * 0.7457**

5.) n/a is not applicable, n/s is not statistically significant.

6.) All information shown above is detailed in Table 5-1 of the EPA technical report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", EPA 420-R-00-002, February 2000.

Table C-3. Marine Equipment Load Factors and Emission Factors
Freeport Harbor Channel Improvement Project

	Dredge					Crew Boat		Trawler		Floating Booster	Tug	Spill Barge	Crew Boat
Operating Mode	Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
Load Factor	0.8	0.8	0.8	0.8	0.2	0.4	0.2	0.4	0.2	0.8	0.4	0.4	0.4
EF (Gram/hp-hr)													
CO	0.780934	0.780934	0.780934	0.780934	3.123737	1.561869	3.123737	1.561869	3.123737	0.780934	1.561869	1.561869	1.561869
NO_X	7.923056	7.923056	7.923056	7.923056	8.838583	8.162195	8.838583	8.162195	8.838583	7.923056	8.162195	8.162195	8.162195
PM	0.196377	0.196377	0.196377	0.196377	0.239417	0.207619	0.239417	0.207619	0.239417	0.196377	0.207619	0.207619	0.207619
PM2.5	0.178703	0.178703	0.178703	0.178703	0.217870	0.188933	0.217870	0.188933	0.217870	0.178703	0.188933	0.188933	0.188933
PM10	0.188522	0.188522	0.188522	0.188522	0.229841	0.199314	0.229841	0.199314	0.229841	0.188522	0.199314	0.199314	0.199314
SO_X	1.304627	1.304627	1.304627	1.304627	1.613894	1.407716	1.613894	1.407716	1.613894	1.304627	1.407716	1.407716	1.407716
VOC (HC)	0.069511	0.069511	0.069511	0.069511	0.556090	0.196607	0.556090	0.196607	0.556090	0.069511	0.196607	0.196607	0.196607

Notes:

1.) The dredge type, engine type, horsepower, and fuel type were based on information provided by project sponsors.

2.) The engine load factors for the dredges and support equipment were determined from Table 5-2 of the EPA Report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", February 2000.

A survey of dredge engine sizes along with input from project sponsors was used to determine which operating mode and hence which load factor applied to each engine. The following assumptions applied to the load factor determination:

A.) The main engines on the dredges were assumed to operate at full power (e.g. 0.8 "cruise" load factor from Table 5-2 of EPA report) for all hours of operation.

B.) The generators on the dredges were assumed to operate at 0.2 load factor during idling.

C.) The main engines or propulsion engines on the support equipment were assumed to operate at intermittent times during the dredging operations and were also determined to operate at the 0.4 "slow cruise" load factor.

D.) The auxiliary engines, if any, on the support equipment were assumed to operate sparingly during idling and were determined to operate at the 0.2 "maneuvering" load factor.

3.) The emission factors were calculated according to the algorithm table and formulas detailed on page 5-3 of the EPA report. The emissions Rate formula and algorithm table are also shown on Table A-4, "Marine Engine Emission Factor and Fuel Consumption Data", February 2000.

4.) The Emission Rate in tons/hr is based on the following formula: Emission Rate = hp*LF*EF*(0.0022046 lbs/gram)*(1 ton/2000 lbs).

Table C-4. Marine Equipment CO Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CO (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.44	0.26	0.49	0.17	0.10	0.03	0.21	0.07				
	Part of Outer Bar	Generic Large Hopper		4.14	0.74	1.42	0.49	0.28	0.10	0.59	0.20				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2011 TOTAL				**5.58**	**1.00**	**1.91**	**0.66**	**0.38**	**0.13**	**0.80**	**0.28**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		5.80	1.04	1.98	0.68	0.40	0.14	0.83	0.29				
	Part of Outer Bar	Generic Large Hopper		16.62	2.98	5.68	1.95	1.14	0.39	2.39	0.82				
2	Outer Bar	Generic Large Hopper		7.14	1.28	2.44	0.84	0.49	0.17	1.02	0.35				
	Jetty Channel	Generic Large Hopper		6.64	1.19	2.27	0.78	0.45	0.16	0.95	0.33				
3	Lower TB	30" Dredge	4.82				0.31								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	6.99				1.05						0.93	0.03	0.06
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2012 TOTAL			**11.81**	**36.20**	**6.50**	**12.37**	**5.62**	**2.47**	**0.85**	**5.20**	**1.79**		**0.93**	**0.03**	**0.06**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		4.84	0.87	1.66	0.57	0.33	0.11	0.70	0.24				
	Part of Outer Bar	Generic Large Hopper		13.88	2.49	4.75	1.63	0.95	0.33	1.99	0.69				
2	Outer Bar	Generic Large Hopper		12.25	2.20	4.19	1.44	0.84	0.29	1.76	0.61				
	Jetty Channel	Generic Large Hopper		11.40	2.05	3.90	1.34	0.78	0.27	1.64	0.56				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9.31				1.40						1.24	0.03	0.08
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.27				0.34						0.30	0.01	0.02
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2013 TOTAL			**11.58**	**42.38**	**7.61**	**14.49**	**6.72**	**2.90**	**1.00**	**6.09**	**2.09**		**1.54**	**0.04**	**0.10**

Table C-4. Marine Equipment CO Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

CO (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		12.25	2.20	4.19	1.44	0.84	0.29	1.76	0.61				
	Jetty Channel	Generic Large Hopper		11.40	2.05	3.90	1.34	0.78	0.27	1.64	0.56				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	8.49				1.27						1.13	0.03	0.08
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	11.14				1.67						1.49	0.04	0.10
7	Stauffer Channel	30" Dredge	6.82				1.02						0.91	0.02	0.06
8	Mitigation														
	YEAR 2014 TOTAL		**26.45**	**23.65**	**4.25**	**8.09**	**6.75**	**1.62**	**0.56**	**3.40**	**1.17**		**3.53**	**0.10**	**0.24**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		3.00	0.54	1.03	0.35	0.21	0.07	0.43	0.15				
	Jetty Channel	Generic Large Hopper		2.79	0.50	0.96	0.33	0.19	0.07	0.40	0.14				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	10.52				1.58						1.40	0.04	0.09
8	Mitigation														
	YEAR 2015 TOTAL		**10.52**	**5.80**	**1.04**	**1.98**	**2.26**	**0.40**	**0.14**	**0.83**	**0.29**		**1.40**	**0.04**	**0.09**

Table C-5. Marine Equipment NOx Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

NO_x (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		14.65	2.63	5.01	0.48	0.52	0.10	1.08	0.20				
	Part of Outer Bar	Generic Large Hopper		42.00	7.54	14.36	1.38	1.48	0.28	3.11	0.58				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2011 TOTAL				**56.65**	**10.17**	**19.37**	**1.86**	**2.00**	**0.37**	**4.19**	**0.78**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		58.83	10.56	20.11	1.93	2.07	0.39	4.35	0.81				
	Part of Outer Bar	Generic Large Hopper		168.65	30.27	57.66	5.53	5.94	1.11	12.47	2.32				
2	Outer Bar	Generic Large Hopper		72.40	12.99	24.75	2.37	2.55	0.48	5.35	1.00				
	Jetty Channel	Generic Large Hopper		67.35	12.09	23.02	2.21	2.37	0.44	4.98	0.93				
3	Lower TB	30" Dredge	48.91				0.88								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	70.93				2.97						4.87	0.13	0.32
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2012 TOTAL			**119.84**	**367.22**	**65.91**	**125.55**	**15.89**	**12.93**	**2.41**	**27.16**	**5.06**		**4.87**	**0.13**	**0.32**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		49.14	8.82	16.80	1.61	1.73	0.32	3.63	0.68				
	Part of Outer Bar	Generic Large Hopper		140.86	25.28	48.16	4.62	4.96	0.92	10.42	1.94				
2	Outer Bar	Generic Large Hopper		124.31	22.31	42.50	4.08	4.38	0.82	9.19	1.71				
	Jetty Channel	Generic Large Hopper		115.64	20.76	39.54	3.79	4.07	0.76	8.55	1.59				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	94.46				3.95						6.49	0.18	0.43
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	23.06				0.96						1.58	0.04	0.11
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2013 TOTAL			**117.52**	**429.96**	**77.17**	**146.99**	**19.02**	**15.14**	**2.82**	**31.80**	**5.92**		**8.07**	**0.22**	**0.54**

Table C-5. Marine Equipment NOx Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

NO_x (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		124.31	22.31	42.50	4.08	4.38	0.82	9.19	1.71				
	Jetty Channel	Generic Large Hopper		115.64	20.76	39.54	3.79	4.07	0.76	8.55	1.59				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	86.13				3.60						5.92	0.16	0.39
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	113.01				4.73						7.76	0.21	0.52
7	Stauffer Channel	30" Dredge	69.17				2.89						4.75	0.13	0.32
8	Mitigation														
	YEAR 2014 TOTAL		**268.32**	**239.96**	**43.07**	**82.04**	**19.09**	**8.45**	**1.57**	**17.75**	**3.31**		**18.43**	**0.51**	**1.23**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		30.48	5.47	10.42	1.00	1.07	0.20	2.25	0.42				
	Jetty Channel	Generic Large Hopper		28.36	5.09	9.69	0.93	1.00	0.19	2.10	0.39				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	106.73				4.47						7.33	0.20	0.49
8	Mitigation														
	YEAR 2015 TOTAL		**106.73**	**58.84**	**10.56**	**20.12**	**6.39**	**2.07**	**0.39**	**4.35**	**0.81**		**7.33**	**0.20**	**0.49**

Table C-6. Marine Equipment PM Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

PM (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.36	0.07	0.12	0.01	0.01	0.00	0.03	0.01				
	Part of Outer Bar	Generic Large Hopper		1.04	0.19	0.36	0.04	0.04	0.01	0.08	0.02				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.40**	**0.25**	**0.48**	**0.05**	**0.05**	**0.01**	**0.11**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.46	0.26	0.50	0.05	0.05	0.01	0.11	0.02				
	Part of Outer Bar	Generic Large Hopper		4.18	0.75	1.43	0.15	0.15	0.03	0.32	0.06				
2	Outer Bar	Generic Large Hopper		1.79	0.32	0.61	0.06	0.06	0.01	0.14	0.03				
	Jetty Channel	Generic Large Hopper		1.67	0.30	0.57	0.06	0.06	0.01	0.13	0.03				
3	Lower TB	30" Dredge	1.21				0.02								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.76				0.08						0.12	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**2.97**	**9.10**	**1.63**	**3.11**	**0.43**	**0.33**	**0.07**	**0.69**	**0.14**		**0.12**	**0.00**	**0.01**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.22	0.22	0.42	0.04	0.04	0.01	0.09	0.02				
	Part of Outer Bar	Generic Large Hopper		3.49	0.63	1.19	0.13	0.13	0.03	0.27	0.05				
2	Outer Bar	Generic Large Hopper		3.08	0.55	1.05	0.11	0.11	0.02	0.23	0.05				
	Jetty Channel	Generic Large Hopper		2.87	0.51	0.98	0.10	0.10	0.02	0.22	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.34				0.11						0.17	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.57				0.03						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**2.91**	**10.66**	**1.91**	**3.64**	**0.52**	**0.39**	**0.08**	**0.81**	**0.16**		**0.21**	**0.01**	**0.01**

Table C-6. Marine Equipment PM Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

PM (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		3.08	0.55	1.05	0.11	0.11	0.02	0.23	0.05				
	Jetty Channel	Generic Large Hopper		2.87	0.51	0.98	0.10	0.10	0.02	0.22	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.13				0.10						0.15	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.80				0.13						0.20	0.01	0.01
7	Stauffer Channel	30" Dredge	1.71				0.08						0.12	0.00	0.01
8	Mitigation														
	YEAR 2014 TOTAL		**6.65**	**5.95**	**1.07**	**2.03**	**0.52**	**0.21**	**0.04**	**0.45**	**0.09**		**0.47**	**0.01**	**0.03**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.76	0.14	0.26	0.03	0.03	0.01	0.06	0.01				
	Jetty Channel	Generic Large Hopper		0.70	0.13	0.24	0.03	0.03	0.01	0.05	0.01				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	2.65				0.12						0.19	0.01	0.01
8	Mitigation														
	YEAR 2015 TOTAL		**2.65**	**1.46**	**0.26**	**0.50**	**0.17**	**0.05**	**0.01**	**0.11**	**0.02**		**0.19**	**0.01**	**0.01**

Table C-7. Marine Equipment $PM_{2.5}$ Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

$PM_{2.5}$ (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.33	0.06	0.11	0.01	0.01	0.00	0.03	0.00				
	Part of Outer Bar	Generic Large Hopper		0.95	0.17	0.32	0.03	0.03	0.01	0.07	0.01				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.28**	**0.23**	**0.44**	**0.05**	**0.05**	**0.01**	**0.10**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.33	0.24	0.45	0.05	0.05	0.01	0.10	0.02				
	Part of Outer Bar	Generic Large Hopper		3.80	0.68	1.30	0.14	0.14	0.03	0.29	0.06				
2	Outer Bar	Generic Large Hopper		1.63	0.29	0.56	0.06	0.06	0.01	0.12	0.02				
	Jetty Channel	Generic Large Hopper		1.52	0.27	0.52	0.05	0.05	0.01	0.12	0.02				
3	Lower TB	30" Dredge	1.10				0.02								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.60				0.07						0.11	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**2.70**	**8.28**	**1.49**	**2.83**	**0.39**	**0.30**	**0.06**	**0.63**	**0.12**		**0.11**	**0.00**	**0.01**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.11	0.20	0.38	0.04	0.04	0.01	0.08	0.02				
	Part of Outer Bar	Generic Large Hopper		3.18	0.57	1.09	0.11	0.11	0.02	0.24	0.05				
2	Outer Bar	Generic Large Hopper		2.80	0.50	0.96	0.10	0.10	0.02	0.21	0.04				
	Jetty Channel	Generic Large Hopper		2.61	0.47	0.89	0.09	0.09	0.02	0.20	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.13				0.10						0.15	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.52				0.02						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**2.65**	**9.70**	**1.74**	**3.32**	**0.47**	**0.35**	**0.07**	**0.74**	**0.15**		**0.19**	**0.01**	**0.01**

Table C-7. Marine Equipment $PM_{2.5}$ Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

$PM_{2.5}$ (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2.80	0.50	0.96	0.10	0.10	0.02	0.21	0.04				
	Jetty Channel	Generic Large Hopper		2.61	0.47	0.89	0.09	0.09	0.02	0.20	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.94				0.09						0.14	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.55				0.12						0.18	0.00	0.01
7	Stauffer Channel	30" Dredge	1.56				0.07						0.11	0.00	0.01
8	Mitigation														
	YEAR 2014 TOTAL		**6.05**	**5.41**	**0.97**	**1.85**	**0.47**	**0.20**	**0.04**	**0.41**	**0.08**		**0.43**	**0.01**	**0.03**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.69	0.12	0.24	0.02	0.02	0.00	0.05	0.01				
	Jetty Channel	Generic Large Hopper		0.64	0.11	0.22	0.02	0.02	0.00	0.05	0.01				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	2.41				0.11						0.17	0.00	0.01
8	Mitigation														
	YEAR 2015 TOTAL		**2.41**	**1.33**	**0.24**	**0.45**	**0.16**	**0.05**	**0.01**	**0.10**	**0.02**		**0.17**	**0.00**	**0.01**

Table C-8. Marine Equipment PM_{10} Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

PM_{10} (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.35	0.06	0.12	0.01	0.01	0.00	0.03	0.01				
	Part of Outer Bar	Generic Large Hopper		1.00	0.18	0.34	0.04	0.04	0.01	0.08	0.02				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**1.35**	**0.24**	**0.46**	**0.05**	**0.05**	**0.01**	**0.10**	**0.02**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.40	0.25	0.48	0.05	0.05	0.01	0.11	0.02				
	Part of Outer Bar	Generic Large Hopper		4.01	0.72	1.37	0.14	0.15	0.03	0.30	0.06				
2	Outer Bar	Generic Large Hopper		1.72	0.31	0.59	0.06	0.06	0.01	0.13	0.03				
	Jetty Channel	Generic Large Hopper		1.60	0.29	0.55	0.06	0.06	0.01	0.12	0.02				
3	Lower TB	30" Dredge	1.16				0.02								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	1.69				0.08						0.12	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**2.85**	**8.74**	**1.57**	**2.99**	**0.41**	**0.32**	**0.06**	**0.66**	**0.13**		**0.12**	**0.00**	**0.01**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		1.17	0.21	0.40	0.04	0.04	0.01	0.09	0.02				
	Part of Outer Bar	Generic Large Hopper		3.35	0.60	1.15	0.12	0.12	0.02	0.25	0.05				
2	Outer Bar	Generic Large Hopper		2.96	0.53	1.01	0.11	0.11	0.02	0.22	0.04				
	Jetty Channel	Generic Large Hopper		2.75	0.49	0.94	0.10	0.10	0.02	0.21	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.25				0.10						0.16	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.55				0.03						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**2.80**	**10.23**	**1.84**	**3.50**	**0.49**	**0.37**	**0.07**	**0.78**	**0.15**		**0.20**	**0.01**	**0.01**

Table C-8. Marine Equipment PM_{10} Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

PM_{10} (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		2.96	0.53	1.01	0.11	0.11	0.02	0.22	0.04				
	Jetty Channel	Generic Large Hopper		2.75	0.49	0.94	0.10	0.10	0.02	0.21	0.04				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	2.05				0.09						0.14	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.69				0.12						0.19	0.01	0.01
7	Stauffer Channel	30" Dredge	1.65				0.08						0.12	0.00	0.01
8	Mitigation														
	YEAR 2014 TOTAL		**6.38**	**5.71**	**1.02**	**1.95**	**0.50**	**0.21**	**0.04**	**0.43**	**0.09**		**0.45**	**0.01**	**0.03**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.73	0.13	0.25	0.03	0.03	0.01	0.06	0.01				
	Jetty Channel	Generic Large Hopper		0.67	0.12	0.23	0.02	0.02	0.00	0.05	0.01				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	2.54				0.12						0.18	0.00	0.01
8	Mitigation														
	YEAR 2015 TOTAL		**2.54**	**1.40**	**0.25**	**0.48**	**0.17**	**0.05**	**0.01**	**0.11**	**0.02**		**0.18**	**0.00**	**0.01**

Table C-9. Marine Equipment SO_2 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

SO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		2.41	0.43	0.82	0.09	0.09	0.02	0.19	0.04				
	Part of Outer Bar	Generic Large Hopper		6.92	1.24	2.36	0.25	0.26	0.05	0.54	0.11				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2011 TOTAL				**9.33**	**1.67**	**3.19**	**0.34**	**0.34**	**0.07**	**0.72**	**0.14**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		9.69	1.74	3.31	0.35	0.36	0.07	0.75	0.15				
	Part of Outer Bar	Generic Large Hopper		27.77	4.98	9.49	1.01	1.02	0.20	2.15	0.42				
2	Outer Bar	Generic Large Hopper		11.92	2.14	4.08	0.43	0.44	0.09	0.92	0.18				
	Jetty Channel	Generic Large Hopper		11.09	1.99	3.79	0.40	0.41	0.08	0.86	0.17				
3	Lower TB	30" Dredge	8.05				0.16								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	11.68				0.54						0.84	0.02	0.06
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2012 TOTAL			**19.73**	**60.47**	**10.85**	**20.67**	**2.90**	**2.23**	**0.44**	**4.68**	**0.92**		**0.84**	**0.02**	**0.06**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		8.09	1.45	2.77	0.29	0.30	0.06	0.63	0.12				
	Part of Outer Bar	Generic Large Hopper		23.19	4.16	7.93	0.84	0.86	0.17	1.80	0.35				
2	Outer Bar	Generic Large Hopper		20.47	3.67	7.00	0.74	0.76	0.15	1.59	0.31				
	Jetty Channel	Generic Large Hopper		19.04	3.42	6.51	0.69	0.70	0.14	1.48	0.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	15.55				0.72						1.12	0.03	0.07
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	3.80				0.18						0.27	0.01	0.02
7	Stauffer Channel	30" Dredge													
8	Mitigation														
YEAR 2013 TOTAL			**19.35**	**70.80**	**12.71**	**24.20**	**3.47**	**2.61**	**0.51**	**5.48**	**1.08**		**1.39**	**0.04**	**0.09**

Table C-9. Marine Equipment SO_2 Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

SO_2 (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		20.47	3.67	7.00	0.74	0.76	0.15	1.59	0.31				
	Jetty Channel	Generic Large Hopper		19.04	3.42	6.51	0.69	0.70	0.14	1.48	0.29				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	14.18				0.66						1.02	0.03	0.07
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	18.61				0.86						1.34	0.04	0.09
7	Stauffer Channel	30" Dredge	11.39				0.53						0.82	0.02	0.05
8	Mitigation														
	YEAR 2014 TOTAL		**44.18**	**39.51**	**7.09**	**13.51**	**3.49**	**1.46**	**0.29**	**3.06**	**0.60**		**3.18**	**0.09**	**0.21**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		5.02	0.90	1.72	0.18	0.19	0.04	0.39	0.08				
	Jetty Channel	Generic Large Hopper		4.67	0.84	1.60	0.17	0.17	0.03	0.36	0.07				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	17.57				0.82						1.26	0.03	0.08
8	Mitigation														
	YEAR 2015 TOTAL		**17.57**	**9.69**	**1.74**	**3.31**	**1.17**	**0.36**	**0.07**	**0.75**	**0.15**		**1.26**	**0.03**	**0.08**

Table C-10. Marine Equipment VOC Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

VOC (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2011															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.13	0.02	0.04	0.03	0.01	0.01	0.03	0.01				
	Part of Outer Bar	Generic Large Hopper		0.37	0.07	0.13	0.09	0.04	0.02	0.07	0.04				
2	Outer Bar	Generic Large Hopper													
	Jetty Channel	Generic Large Hopper													
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2011 TOTAL			**0.50**	**0.09**	**0.17**	**0.12**	**0.05**	**0.02**	**0.10**	**0.05**				
YEAR 2012															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.52	0.09	0.18	0.12	0.05	0.02	0.10	0.05				
	Part of Outer Bar	Generic Large Hopper		1.48	0.27	0.51	0.35	0.14	0.07	0.30	0.15				
2	Outer Bar	Generic Large Hopper		0.64	0.11	0.22	0.15	0.06	0.03	0.13	0.06				
	Jetty Channel	Generic Large Hopper		0.59	0.11	0.20	0.14	0.06	0.03	0.12	0.06				
3	Lower TB	30" Dredge	0.43				0.06								
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.62				0.19						0.12	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2012 TOTAL		**1.05**	**3.22**	**0.58**	**1.10**	**1.00**	**0.31**	**0.15**	**0.65**	**0.32**		**0.12**	**0.00**	**0.01**
YEAR 2013															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper		0.43	0.08	0.15	0.10	0.04	0.02	0.09	0.04				
	Part of Outer Bar	Generic Large Hopper		1.24	0.22	0.42	0.29	0.12	0.06	0.25	0.12				
2	Outer Bar	Generic Large Hopper		1.09	0.20	0.37	0.26	0.11	0.05	0.22	0.11				
	Jetty Channel	Generic Large Hopper		1.01	0.18	0.35	0.24	0.10	0.05	0.21	0.10				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.83				0.25						0.16	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.20				0.06						0.04	0.00	0.00
7	Stauffer Channel	30" Dredge													
8	Mitigation														
	YEAR 2013 TOTAL		**1.03**	**3.77**	**0.68**	**1.29**	**1.20**	**0.36**	**0.18**	**0.77**	**0.37**		**0.19**	**0.01**	**0.01**

Table C-10. Marine Equipment VOC Emissions
Freeport Harbor Channel Improvement Project
LPP Alternative

VOC (tpy)			Dredge					Survey Boat		Trawler		Floating	Tug	Spill Barge	Crew Boat
			Dredging	Propelling	Pumping	Generating	Idling	Propelling	Idling	Propelling	Idling	Pumping	Propelling	Main Engine	Propelling
YEAR 2014															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		1.09	0.20	0.37	0.26	0.11	0.05	0.22	0.11				
	Jetty Channel	Generic Large Hopper		1.01	0.18	0.35	0.24	0.10	0.05	0.21	0.10				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	0.76				0.23						0.14	0.00	0.01
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	0.99				0.30						0.19	0.01	0.01
7	Stauffer Channel	30" Dredge	0.61				0.18						0.11	0.00	0.01
8	Mitigation														
	YEAR 2014 TOTAL		**2.35**	**2.11**	**0.38**	**0.72**	**1.20**	**0.20**	**0.10**	**0.43**	**0.21**		**0.44**	**0.01**	**0.03**
YEAR 2015															
Contract No.	**Location/Disposal Site**	**Dredge**													
1	New Extension	Generic Large Hopper													
	Part of Outer Bar	Generic Large Hopper													
2	Outer Bar	Generic Large Hopper		0.27	0.05	0.09	0.06	0.03	0.01	0.05	0.03				
	Jetty Channel	Generic Large Hopper		0.25	0.04	0.09	0.06	0.02	0.01	0.05	0.02				
3	Lower TB	30" Dredge													
4	Real Estate														
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge													
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge													
7	Stauffer Channel	30" Dredge	0.94				0.28						0.18	0.00	0.01
8	Mitigation														
	YEAR 2015 TOTAL		**0.94**	**0.52**	**0.09**	**0.18**	**0.40**	**0.05**	**0.02**	**0.10**	**0.05**		**0.18**	**0.00**	**0.01**

Table C-11. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

YEAR 2011

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	2.8	24.7	0.6	0.6	0.6	4.1	0.3
	Part of Outer Bar	Generic Large Hopper	8.0	70.7	1.8	1.6	1.7	11.7	0.8
2	Outer Bar	Generic Large Hopper							
	Jetty Channel	Generic Large Hopper							
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge							
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2011 TOTAL		**10.7**	**95.4**	**2.4**	**2.2**	**2.3**	**15.8**	**1.1**

YEAR 2012

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	11.2	99.1	2.5	2.2	2.4	16.4	1.1
	Part of Outer Bar	Generic Large Hopper	32.0	283.9	7.1	6.4	6.8	47.1	3.3
2	Outer Bar	Generic Large Hopper	13.7	121.9	3.0	2.8	2.9	20.2	1.4
	Jetty Channel	Generic Large Hopper	12.8	113.4	2.8	2.6	2.7	18.8	1.3
3	Lower TB	30" Dredge	5.1	49.8	1.2	1.1	1.2	8.2	0.5
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	9.1	79.2	2.0	1.8	1.9	13.1	0.9
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2012 TOTAL		**83.8**	**747.3**	**18.6**	**16.9**	**17.9**	**123.8**	**8.5**

YEAR 2013

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	9.3	82.7	2.1	1.9	2.0	13.7	0.9
	Part of Outer Bar	Generic Large Hopper	26.7	237.2	5.9	5.4	5.7	39.3	2.7
2	Outer Bar	Generic Large Hopper	23.6	209.3	5.2	4.7	5.0	34.7	2.4
	Jetty Channel	Generic Large Hopper	21.9	194.7	4.8	4.4	4.7	32.3	2.2
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	12.1	105.5	2.6	2.4	2.5	17.5	1.2
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	2.9	25.8	0.6	0.6	0.6	4.3	0.3
7	Stauffer Channel	30" Dredge							
8	Mitigation								
	YEAR 2013 TOTAL		**96.5**	**855.2**	**21.3**	**19.4**	**20.4**	**141.7**	**9.9**

Table C-11. Summary of Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

YEAR 2014

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper							
	Part of Outer Bar	Generic Large Hopper							
2	Outer Bar	Generic Large Hopper	23.6	209.3	5.2	4.7	5.0	34.7	2.4
	Jetty Channel	Generic Large Hopper	21.9	194.7	4.8	4.4	4.7	32.3	2.2
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	11.0	96.2	2.4	2.2	2.3	16.0	1.1
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	14.4	126.2	3.1	2.9	3.0	20.9	1.5
7	Stauffer Channel	30" Dredge	8.8	77.3	1.9	1.8	1.8	12.8	0.9
8	Mitigation								
	YEAR 2014 TOTAL		**79.8**	**703.7**	**17.5**	**15.9**	**16.8**	**116.7**	**8.2**

YEAR 2015

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper							
	Part of Outer Bar	Generic Large Hopper							
2	Outer Bar	Generic Large Hopper	5.8	51.3	1.3	1.2	1.2	8.5	0.6
	Jetty Channel	Generic Large Hopper	5.4	47.7	1.2	1.1	1.1	7.9	0.5
3	Lower TB	30" Dredge							
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge							
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge							
7	Stauffer Channel	30" Dredge	13.6	119.2	3.0	2.7	2.9	19.8	1.4
8	Mitigation								
	YEAR 2015 TOTAL		**24.8**	**218.3**	**5.4**	**4.9**	**5.2**	**36.2**	**2.5**

TOTAL

Contract No.	Location/Disposal Site	Dredge	CO	NO_x	PM	$PM_{2.5}$	PM_{10}	SO_2	VOC
1	New Extension	Generic Large Hopper	23.3	206.5	5.1	4.7	4.9	34.2	2.4
	Part of Outer Bar	Generic Large Hopper	66.7	591.8	14.7	13.4	14.1	98.1	6.8
2	Outer Bar	Generic Large Hopper	66.7	591.8	14.7	13.4	14.1	98.1	6.8
	Jetty Channel	Generic Large Hopper	62.0	550.5	13.7	12.5	13.2	91.2	6.3
3	Lower TB	30" Dredge	5.1	49.8	1.2	1.1	1.2	8.2	0.5
4	Real Estate								
5	Channel to Brazosport through Brazosport Turning Basin and PA 8	30" Dredge	32.1	281.0	7.0	6.4	6.7	46.6	3.3
6	Channel to Upper Turning Basin through Upper Turning Basis and PA 9	30" Dredge	17.4	152.0	3.8	3.4	3.6	25.2	1.8
7	Stauffer Channel	30" Dredge	22.5	196.5	4.9	4.5	4.7	32.6	2.3
8	Mitigation								
	PROJECT TOTAL		**295.7**	**2,619.9**	**65.2**	**59.4**	**62.6**	**434.2**	**30.2**

Table C-12. Annual Marine Equipment Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Year 2011	10.74	95.38	2.16	2.28	15.81	1.09
Year 2012	83.82	747.30	16.93	17.86	123.83	8.52
Year 2013	96.54	855.17	19.38	20.44	141.75	9.86
Year 2014	79.77	703.71	15.95	16.83	116.67	8.18
Year 2015	24.79	218.29	4.95	5.22	36.19	2.55

Table D-1. Total Estimated Project Emissions by Year of Construction Activity

Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)					
					NO_x	VOC	PM_{10}	PM2.5	CO	SO_2
Contract 5: Ch to Brz thr Brzpt TB & PA 8										
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	--	0	0%	0	0	0	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	5.2085505	0.34804529	0.4103982	0.3980863	2.9595816	0.7499748
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	5.21518222	0.36550586	0.3994855	0.3875009	2.5667446	0.7499005
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	0.90999985	62.8079254	9.74819783	8.968342	348.86535	0.14019169
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	173	43%	4.08915543	0.28718822	0.23978859	0.23259494	0.87923862	0.7421074
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	3.37737562	0.26641835	0.28606228	0.27748042	1.22240239	0.75032198
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	6.2439293	1.05756813	0.7586622	0.7359024	4.0710716	0.8725374
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.36614778	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.32853763	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.31219032	0.3742502	0.3630227	1.4566405	0.7501273
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	135	59%	3.7592742	0.31219032	0.3742502	0.3630227	1.4566405	0.7501273
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	250	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	4.3732137	0.23893621	0.308081	0.2988385	1.9281148	0.7503568
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	4.94662027	0.29178438	0.26905192	0.26098036	1.36492453	0.74211209
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW TRUCK)	Highway Truck	Diesel	310	59%	4.3732137	0.23893621	0.308081	0.2988385	1.9281148	0.7503568

Table D-1. Total Estimated Project Emissions by Year of Construction Activity

Construction Equipment Emission Factors
Freeport Harbor Channel Improvement Project
LPP Alternative

Equipment Type	Description	Fuel Type1	HP	Typical Load Factor	Emission Factors[1] (g/hp-hr)					
					NO_x	VOC	PM_{10}	PM2.5	CO	SO_2
Contract 6: Ch to UTB thr UTB & PA 9										
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	3.585981	0.2781069	0.2942914	0.2854627	1.2374105	0.7502724
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	Truck Trailer	--	0	0%	0	0	0	0	0	0
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	5.20855052	0.34804529	0.4103982	0.3980863	2.9595816	0.7499748
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	Dragline	Diesel	350	59%	5.21518222	0.36550586	0.3994855	0.3875009	2.5667446	0.7499005
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	GASOLINE	6	78%	0.90999985	62.8079254	9.74819783	8.968342	348.86535	0.14019169
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	250	43%	4.08915543	0.28718822	0.23978859	0.23259494	0.87923862	0.7421074
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	3.37737562	0.26641835	0.28606228	0.27748042	1.22240239	0.75032198
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	6.2439293	1.05756813	0.7586622	0.7359024	4.0710716	0.8725374
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.36614778	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.32853763	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.31219032	0.3742502	0.3630227	1.4566405	0.7501273
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	Log Skidder	Diesel	119	59%	4.4487882	0.36614778	0.4010053	0.3889752	1.7124951	0.7498978
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	Log Skidder	Diesel	200	59%	4.2682812	0.32853763	0.334577	0.3245397	1.4639283	0.7500579
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	3.7592742	0.31219032	0.3742502	0.3630227	1.4566405	0.7501273
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	Highway Truck	Diesel	310	59%	4.3732137	0.23893621	0.308081	0.2988385	1.9281148	0.7503568
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	Diesel	205	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM (ADD BUCKET)	Cranes	Diesel	350	43%	4.94662027	0.29178438	0.26905192	0.26098036	1.36492453	0.74211209
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	Crawler Dozers/Tractor	Diesel	80	59%	4.3723798	0.41905964	0.5820331	0.5645721	3.8945662	0.8327177
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)		--	0	0%						
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	3.72916299	0.28678955	0.3016065	0.2925583	1.2615169	0.7502354

Table D-2. Total Estimated Project Emissions by Year of Construction Activity

SCC Code	Equipment	Load Factor[1]	
		Diesel	Gasoline
22xx003010	Aerial Lifts	21%	46%
22xx005015	Agricultural Tractor	59%	62%
22xx006015	Air Compressors	43%	56%
22xx001030	All Terrain Vehicles	42%	100%
22xx002033	Bore/Drill Rigs	43%	79%
22xx002042	Cement & Motar Mixers	43%	59%
22xx004066	Chippers/Stump Grinders	43%	78%
22xx002039	Concrete/Industrial Saws	59%	78%
22xx002045	Cranes	43%	47%
22xx002066	Crawler Dozers/Tractor	59%	80%
22xx002054	Crushing/Procesing Equipment	43%	85%
22xx002078	Dumpers/Tenders	21%	41%
22xx002036	Excavators	59%	53%
22xx007015	Fellers/Bunchers/Skidders	59%	70%
22xx003020	Forklifts	59%	30%
22xx006020	Gas Compressors	43%	85%
22xx006005	Generator Sets	43%	68%
22xx002048	Graders	59%	64%
22xx005050	Hydro Power Units	43%	56%
22xx004056	Lawn and Garden Tractor	43%	44%
22xx002051	Off-Highway Truck	59%	80%
22xx002075	Off-Highway Tractor	59%	70%
22xx004056	Other Agricultural Equipment	59%	55%
22xx002081	Other Construction Equipment	59%	48%
22xx003040	Other General Industrial	43%	54%
22xx003050	Other Material Handling	21%	53%
22xx002003	Pavers	59%	66%
22xx002021	Paving Equipment	59%	59%
22xx002009	Plate Compactors	43%	55%
22xx006030	Pressure Washer	43%	85%
22xx006010	Pumps	43%	69%
22xx003060	Refrigeration/AC	43%	46%
22xx002015	Rollers	59%	62%
22xx002057	Rough Terrain Forklifts	59%	63%
22xx002063	Rubber Tire Dozer	59%	75%
22xx002060	Rubber Tire Loader	59%	71%
22xx002018	Scrapers	59%	70%
22xx002072	Skid Steer Loader	21%	58%
22xx001060	Specialty Vehicle/Carts	21%	58%
22xx002024	Surfacing Equipment	59%	49%
22xx003030	Sweepers/Scrubbers	43%	71%
22xx002006	Tampers/Rammers	43%	55%
22xx003070	Terminal Tractors	59%	78%
22xx005040	Tillers > 6 hp	59%	71%
22xx004026	Timmer/Edger/Brush Cutter	43%	91%
22xx002066	Tractor/Loader/Backhoe	21%	48%
22xx002030	Trenchers	59%	66%
22xx006025	Welders	21%	68%

1. Load Factors from Appendix A of *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling,*EPA Office of Air and Radiation Report Number NR-005b, December 2002

Table D-3. Total Estimated Project Emissions by Year of Construction Activity

Freeport Harbor Channel Improvement Project
LPP Alternative

																		Hrs/Day:	10		
																		Day/Week:	5		
																		Week/Mon	4.5		
																		Month/Yea	12		
																		Hours/Yea	2500		
Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	NOx Emissions (tons per year)			VOC Emissions (tons per year)			PM10 Emissions (tons per year)			PM2.5 Emissions (tons per year)			CO Emissions (tons per year)			SO2 Emissions (tons per year)		
				2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
Contract 5: Ch to Brz thr Brzpt TB & PA 8			8																		
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	8	0.0189	0.0252	0.0042	0.0015	0.0020	0.0003	0.0016	0.0021	0.0003	0.0015	0.0020	0.0003	0.0065	0.0087	0.0014	0.0040	0.0053	0.0009
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	1	24	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	8	0.0151	0.0201	0.0033	0.0012	0.0015	0.0003	0.0012	0.0016	0.0003	0.0012	0.0016	0.0003	0.0051	0.0068	0.0011	0.0030	0.0040	0.0007
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,136	8	0.7129	0.9505	0.1584	0.0548	0.0731	0.0122	0.0577	0.0769	0.0128	0.0559	0.0746	0.0124	0.2412	0.3216	0.0536	0.1434	0.1912	0.0319
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	183	8	0.3304	0.4405	0.0734	0.0221	0.0294	0.0049	0.0260	0.0347	0.0058	0.0253	0.0337	0.0056	0.1877	0.2503	0.0417	0.0476	0.0634	0.0106
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,651	8	8.8825	11.8433	1.9739	0.6225	0.8300	0.1383	0.6804	0.9072	0.1512	0.6600	0.8800	0.1467	4.3717	5.8289	0.9715	1.2772	1.7030	0.2838
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	183	8	0.0010	0.0013	0.0002	0.0667	0.0889	0.0148	0.0104	0.0138	0.0023	0.0095	0.0127	0.0021	0.3705	0.4940	0.0823	0.0001	0.0002	0.0000
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM,	1	24	8	0.0091	0.0121	0.0020	0.0006	0.0008	0.0001	0.0005	0.0007	0.0001	0.0005	0.0007	0.0001	0.0019	0.0026	0.0004	0.0016	0.0022	0.0004
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	1	24	8	0.0141	0.0188	0.0031	0.0011	0.0015	0.0002	0.0012	0.0016	0.0003	0.0012	0.0015	0.0003	0.0051	0.0068	0.0011	0.0031	0.0042	0.0007
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	314	8	0.0664	0.0885	0.0148	0.0112	0.0150	0.0025	0.0081	0.0108	0.0018	0.0078	0.0104	0.0017	0.0433	0.0577	0.0096	0.0093	0.0124	0.0021
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	366	8	0.1418	0.1890	0.0315	0.0117	0.0156	0.0026	0.0128	0.0170	0.0028	0.0124	0.0165	0.0028	0.0546	0.0728	0.0121	0.0239	0.0319	0.0053
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	366	8	0.2286	0.3048	0.0508	0.0176	0.0235	0.0039	0.0179	0.0239	0.0040	0.0174	0.0232	0.0039	0.0784	0.1045	0.0174	0.0402	0.0536	0.0089
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	183	8	0.0503	0.0671	0.0112	0.0042	0.0056	0.0009	0.0050	0.0067	0.0011	0.0049	0.0065	0.0011	0.0195	0.0260	0.0043	0.0100	0.0134	0.0022
GEN T15Z6480 TRACTOR, CRAWLER (DOZER), 101-135 HP (75-101 KW), POWERSHIFT, W/ UNIVERSAL BLADE	1	64	8	0.0238	0.0317	0.0053	0.0020	0.0026	0.0004	0.0024	0.0032	0.0005	0.0023	0.0031	0.0005	0.0092	0.0123	0.0020	0.0047	0.0063	0.0011
GEN T15Z6520 TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL	1	4,014	8	2.6329	3.5106	0.5851	0.2042	0.2723	0.0454	0.2161	0.2881	0.0480	0.2096	0.2795	0.0466	0.9085	1.2114	0.2019	0.5509	0.7345	0.1224
GEN T40Z7090 TRUCK OPTION, DUMP BODY, REAR, 12 CY (9.2 M3) (ADD 45,000 LB (20,412 KG) GVW TRUCK)	1	24	8	0.0151	0.0201	0.0033	0.0012	0.0015	0.0003	0.0012	0.0016	0.0003	0.0012	0.0016	0.0003	0.0051	0.0068	0.0011	0.0030	0.0040	0.0007
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	10	8	0.0057	0.0076	0.0013	0.0004	0.0006	0.0001	0.0005	0.0006	0.0001	0.0004	0.0006	0.0001	0.0019	0.0026	0.0004	0.0012	0.0015	0.0003
GEN T50Z7420 TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	85	8	0.0533	0.0711	0.0119	0.0041	0.0055	0.0009	0.0043	0.0058	0.0010	0.0042	0.0056	0.0009	0.0180	0.0241	0.0040	0.0107	0.0143	0.0024
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	10	8	0.0099	0.0132	0.0022	0.0005	0.0007	0.0001	0.0007	0.0009	0.0002	0.0007	0.0009	0.0002	0.0044	0.0058	0.0010	0.0017	0.0023	0.0004
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM	1	6,651	8	6.1403	8.1871	1.3645	0.3622	0.4829	0.0805	0.3340	0.4453	0.0742	0.3240	0.4319	0.0720	1.6943	2.2591	0.3765	0.9212	1.2283	0.2047
MAP L15FG001 LANDSCAPING EQUIPMENT, 3,000 GAL, HYDROSEEDER, TRUCK MTD (INCLUDES 56,000 GVW	1	61	8	0.0605	0.0807	0.0134	0.0033	0.0044	0.0007	0.0043	0.0057	0.0009	0.0041	0.0055	0.0009	0.0267	0.0356	0.0059	0.0104	0.0138	0.0023

Table D-3. Total Estimated Project Emissions by Year of Construction Activity

Freeport Harbor Channel Improvement Project
LPP Alternative

																				Hrs/Day:	10
																				Day/Week:	5
																				Week/Mon	4.5
																				Month/Yea	12
																				Hours/Yea	2500
Equipment Type	Number of Units	Total Equipment Hours of Operation	Contract Duration (months)	NOx Emissions (tons per year)			VOC Emissions (tons per year)			PM10 Emissions (tons per year)			PM2.5 Emissions (tons per year)			CO Emissions (tons per year)			SO2 Emissions (tons per year)		
				2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
Contract 6: Ch to UTB thr UTB & PA 9			4																		
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	1	24	4			0.0168			0.0013			0.0014			0.0013			0.0058			0.0035
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE (ADD TOWING TRUCK)	1	24	4			-			-			-			-			-			-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	1	24	4			0.0134			0.0010			0.0011			0.0011			0.0045			0.0027
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	1	1,173	4			0.6543			0.0503			0.0529			0.0513			0.2213			0.1316
GEN B20Z1000 BRUSH CHIPPER, 22" (559 MM) DIA LOG DISC TYPE CUTTER, TRAILER MOUNTED	1	191	4			0.3065			0.0205			0.0242			0.0234			0.1742			0.0441
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT (ADD TEETH WEAR COST)	1	6,868	4			8.1532			0.5714			0.6245			0.6058			4.0127			1.1724
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	1	191	4			0.0009			0.0619			0.0096			0.0088			0.3438			0.0001
GEN C75Z2200 CRANE, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 40 TON (36 MT), 84' (25.6 M) BOOM,	1	24	4			0.0116			0.0008			0.0007			0.0007			0.0025			0.0021
GEN H25Z3185 HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1	1	24	4			0.0125			0.0010			0.0011			0.0010			0.0045			0.0028
GEN L40Z4395 LOADER, FRONT END, WHEEL, ARTICULATED, 2.75 CY (2.1 M3) BUCKET, 4X4,	1	381	4			0.0716			0.0121			0.0087			0.0084			0.0467			0.0100
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	383	4			0.1319			0.0109			0.0119			0.0115			0.0508			0.0222
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	383	4			0.2126			0.0164			0.0167			0.0162			0.0729			0.0374
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	191	4			0.0467			0.0039			0.0046			0.0045			0.0181			0.0093
GEN L60Z4760 LOG SKIDDER, CABLE, 26,700 LB (12,111 KG) LINE-PULL, WINCH AND BLADE, WHEEL, 4X4	1	45	4			0.0155			0.0013			0.0014			0.0014			0.0060			0.0026
GEN L60Z4800 LOG SKIDDER, LOG FELLER/BUNCHER, 20" (508 MM) DIA TREE SAW CUTTER, WHEEL, 4X4	1	45	4			0.0250			0.0019			0.0020			0.0019			0.0086			0.0044
GEN T15Z6440 TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1	25	4			0.0061			0.0005			0.0006			0.0006			0.0024			0.0012
GEN T45Z7280 TRUCK TRAILER, WATER TANKER, 5,000 GAL (18,927 L) (ADD 50,000 LB (22,680 KG) GVW TRUCK)	1	73	4			0.0372			0.0029			0.0030			0.0029			0.0126			0.0075
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1	73	4			0.0644			0.0035			0.0045			0.0044			0.0284			0.0110
GEN T50Z7700 DUMP TRUCK, HIGHWAY, 10 - 13 CY (7.6 - 9.9 M3) DUMP BODY, 35,000 LBS (15,900 KG) GVW, 2	1	120	4			0.0597			0.0046			0.0048			0.0047			0.0202			0.0120
MAP C85MA001 CRANES, MECHANICAL, LATTICE BOOM, CRAWLER, DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM	1	45	4			0.0369			0.0022			0.0020			0.0019			0.0102			0.0055
UPB T15CA004 DOZER,CWLR, D-4H,PS (ADD BLADE)	1	80	4			0.0182			0.0017			0.0024			0.0023			0.0162			0.0035
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	1	40	4			-			-			-			-			-			-
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	1	40	4			0.0223			0.0017			0.0018			0.0018			0.0075			0.0045
TOTALS				**19.41**	**25.88**	**14.23**	**1.39**	**1.86**	**1.08**	**1.39**	**1.85**	**1.09**	**1.34**	**1.79**	**1.05**	**8.05**	**10.74**	**6.86**	**3.07**	**4.09**	**2.17**

Table D-4. Total Estimated Project Emissions by Year of Construction Activity
Freeport Harbor Channel Improvement Project
LPP Alternative

	2012	2013	2014
NO_x	19.41	25.88	14.23
VOC	1.39	1.86	1.08
PM_{10}	1.39	1.85	1.09
$PM_{2.5}$	1.34	1.79	1.05
CO	8.05	10.74	6.86
SO_2	3.07	4.09	2.17

Table E-1. Crew Size per Equipment
Freeport Harbor Channel Improvement Project
LPP Alternative

	Hopper Dredge		Cutterhead Dredge		
	Hopper Dredge Crew	Shore Crew	Cutterhead Dredge Crew	Shore Crew	Other Construction Equipment
Employees	22	8	46	6	6

Table E-2. Emission Factors for Employee Vehicles
Freeport Harbor Channel Improvement Project

County	Type of Vehicle	EPA Category[1]	Emisson Factor (g/mile)					
			CO[2]	NOx[2]	PM2.5[3]	PM10[3]	SO2[3]	VOC[2]
Brazoria	Cars	LDGV	6.8379	0.5163	0.0114	0.0249	0.0068	0.6596
	Pickups	LDGT1	7.3724	0.5176	0.0116	0.0252	0.0088	0.6988

Notes:
1. LDGV=light duty gasoline-fueled vehicles designated for transport of up to 12 people
LDGT1=light duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6000 pounds or less
2. Emission factors for CO, NOx, and VOC are from MOBILE6.2 run using Brazoria County input file, "30aug2007brazi1a0", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/HGB/m62/2007/.
3. Emission factors for $PM_{2.5}$, PM_{10}, and SO_2 are from MOBILE6.2 run using Statewide PM1 and PM2 input files, "2007_wk_pm1_d13c5r4ihu.in" and "2007_wk_pm2_d13c5r4ihu.in", which can be found on the TCEQ FTP site: ftp://ftp.tnrcc.state.tx.us/pub/OEPAA/TAD/Modeling/Mobile_EI/Statewide/m62/2007/.

Table E-3. Summary of Employee Vehicles Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

Project Year	Type of Vehicle	EPA Category	Daily Vehicles (/day)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (tpy)					
							CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
2011	Cars	LDGV	15	50.0	130	97,500	0.7349	0.0555	0.0012	0.0027	0.0007	0.0709
	Pickups	LDGT1	15	50.0	130	97,500	0.7923	0.0556	0.0012	0.0027	0.0009	0.0751
2011 Total Mobile Emission							**1.527**	**0.111**	**0.0025**	**0.0054**	**0.0017**	**0.146**
2012	Cars	LDGV	138	50.0	718	4,954,200	37.3416	2.8195	0.0623	0.1360	0.0371	3.6021
	Pickups	LDGT1	138	50.0	718	4,954,200	40.2605	2.8266	0.0633	0.1376	0.0481	3.8161
2012 Total Mobile Emission							**77.602**	**5.646**	**0.1256**	**0.2736**	**0.0852**	**7.418**
2013	Cars	LDGV	56	50.0	762	2,133,600	16.0817	1.2143	0.0268	0.0586	0.0160	1.5513
	Pickups	LDGT1	56	50.0	762	2,133,600	17.3388	1.2173	0.0273	0.0593	0.0207	1.6435
2013 Total Mobile Emission							**33.421**	**2.432**	**0.0541**	**0.1178**	**0.0367**	**3.195**
2014	Cars	LDGV	67	50.0	760	2,546,000	19.1901	1.4490	0.0320	0.0699	0.0191	1.8511
	Pickups	LDGT1	67	50.0	760	2,546,000	20.6902	1.4526	0.0326	0.0707	0.0247	1.9611
2014 Total Mobile Emission							**39.880**	**2.902**	**0.0645**	**0.1406**	**0.0438**	**3.812**
2015	Cars	LDGV	56	50.0	281	786,800	5.9304	0.4478	0.0099	0.0216	0.0059	0.5721
	Pickups	LDGT1	56	50.0	281	786,800	6.3940	0.4489	0.0101	0.0219	0.0076	0.6061
2015 Total Mobile Emission							**12.324**	**0.897**	**0.0199**	**0.0435**	**0.0135**	**1.178**

Notes:
1. Total VMT is assumed to be 50 miles/day round trip.
2. Annual travel = Daily vehicles * Total VMT * Travel days/yr.
3. Annual emissions = Emission factor * Annual travel * 1lb/453.6 grams * 1ton/2000lb

Table E-4. Annual Employee Vehicle Emissions (tpy)
Freeport Harbor Channel Improvement Project
LPP Alternative

Year	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC
Year 2011	1.53	0.11	0.002	0.005	0.002	0.146
Year 2012	77.60	5.65	0.13	0.27	0.09	7.42
Year 2013	33.42	2.43	0.05	0.12	0.04	3.19
Year 2014	39.88	2.90	0.06	0.14	0.04	3.81
Year 2015	12.32	0.90	0.02	0.04	0.01	1.18

Table F-1. LPP Alternative - Additional Maintenance Dredging - Assumptions for Marine Equipment Engines
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging

Activity	Equipment Type	Quantity	Total Installed Power (hp)	Engine Type	Engine Fuel Type	Engine Load Factor	Engine Horsepower (hp)	Hours of Operation per Day (hrs/day)	Daily Engine Usage (%)	Total Days of Operation (days)	Total Engine Hours of Operation (hrs)
Additional 1,280,000 cy/yr Maintenance Dredging	Hopper Dredge	1	14,000	Propulsion - Oceangoing	Diesel	0.8	9,000	20	65%	32	416
				Propulsion - Dredging	Diesel	0.8	9,000	20	35%	32	224
				Dredge Pump(s)	Diesel	0.8	3,000	20	35%	32	224
				Auxiliary - Oceangoing	Diesel	0.8	2,000	20	65%	32	416
				Auxiliary - Idling	Diesel	0.8	2,000	20	35%	32	224
	Survey Boat	1	2,000	Propulsion	Diesel	0.4	2,000	20	100%	6	128
				Auxiliary	Diesel	0.2	2,000	20	100%	6	128
	Shrimp Boat (Turtle Trawl)	2	600	Propulsion	Diesel	0.4	600	24	100%	22	1,075
				Auxiliary	Diesel	0.2	600	24	100%	22	1,075
Total Engine Hours											3,910

Notes:
1. Days of operation are determined assuming 40,000 CY/day production rate for a hopper dredge removing unconsolidated, predominantly silty dredged material.

Table F-2. LPP Alternative - Additional Mainenance Dredging - Marine Equipment Hours of Operation
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging

			Dredge								
			Generic Large Hopper Dredge					Crew/Survey Boat (Runabout)		Shrimp Boats (Total of Two)	
Contract No.	**Additional Volume/Disposal Site**	**Dredge**	Propulsion Ocean Going	Propulsion Dredging	Dredge Pump(s)	Auxillary Oceangoing	Auxiliary Idling	Propulsion	Secondary	Propulsion	Secondary
Additional Maintenance Dredging	1,280,000 CY of Additional Maintenance Material to ODMS	Hopper	416	224	224	416	224	128	128	1,075	1,075

Table F-3. LPP Alternative - Additional Maintenance Dredging - Marine Equipment Estimated Emissions
Freeport Harbor Channel Improvement Project
Additional 1,280,000 cy/yr Maintenance Dredging
(Tons per Year)

Phase No.	Pollutant	Dredge	Dredge									**Total Emissions Per Year**
			Generic Large Hopper Dredge					Crew/Survey Boat		Shrimp Boat		
			Propulsion Oceangoing	Propulsion - Dredging	Dredge Pump(s)	Auxiliary - Oceangoing	Auxillary - Dredging	Propulsion	Auxiliary	Propulsion	Auxiliary	
Additional 1,280,000 cy/yr Maintenance Dredging	CO	Hopper	2.58	1.39	0.46	0.57	0.31	0.18	0.18	0.44	0.44	**6.55**
	NOX	Hopper	26.16	14.09	4.70	5.81	0.87	0.92	0.50	2.32	1.26	**56.63**
	PM	Hopper	0.65	0.35	0.12	0.14	0.02	0.02	0.01	0.06	0.03	**1.41**
	PM2.5	Hopper	0.59	0.32	0.11	0.13	0.02	0.02	0.01	0.05	0.03	**1.28**
	PM10	Hopper	0.62	0.34	0.11	0.14	0.02	0.02	0.01	0.06	0.03	**1.36**
	SOX	Hopper	4.31	2.32	0.77	0.96	0.16	0.16	0.09	0.40	0.23	**9.40**
	VOC	Hopper	0.23	0.12	0.04	0.05	0.05	0.02	0.03	0.06	0.08	**0.69**

Appendix C

Public Notice and Publisher's Affidavit

RECEIVED

JAN 0 6 2011

PORT FREEPORT
ENGINEERING DEPT

THE STATE OF TEXAS
COUNTY OF BRAZORIA

Before me, the undersigned authority, on this day personally appeared

Deana Lesco

who, after being duly sworn, did depose and say:

My name is Deana Lesco

Advertising Director of The Facts, a daily newspaper as that term is defined by Art. 28 a R.C.S. of Texas 1925, as amended, having a general circulation in Brazoria County and published in the City of Clute, County of Brazoria, State of Texas.

The attached printed matter is a true and correct copy of the publication of

NOTICE OF PUBLIC MEETING

which was published and appeared in said newspaper, with publication being on the following date(s): December 19, 26, 2010

My fee is 640.00

Deana Lesco

Deana Lesco

Given under my hand and seal of office on this 3rd day of January, A.D. 2011.

JOANNE WASSON
NOTARY PUBLIC
STATE OF TEXAS
EXPIRES
11-20-2014

Joanne Wasson
Notary Public in and for
Brazoria County, Texas.
My commission expires 11/20/14

VERIFIED & APPROVED
BY: _____

The facts
Sunday, Dec. 19, 2010

of the Village of Surf- | The majority of the pipeline is located in | bids will not be accepted. Piano and | is the Buyer's responsibility.

NOTICE OF PUBLIC MEETING AND AVAILABILITY OF DRAFT ENVIRONMENTAL IMPACT STATEMENT FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT AND DRAFT GENERAL CONFORMITY DETERMINATION

Interested parties are hereby notified of and invited to attend an open house and public meeting to be conducted by the U. S. Army Corps of Engineers and the Brazos River Harbor Navigation District (Port Freeport) on:

THURSDAY, JANUARY 13, 2011
OPEN HOUSE 5:30-7:00 PM
PUBLIC MEETING 7:00-8:30 PM
(REGISTRATION BEGINS AT 5:30 PM)

FREEPORT COMMUNITY HOUSE
1300 WEST SECOND STREET,
FREEPORT, TEXAS 77541

The meeting will provide an opportunity for all persons to comment on the Draft Environmental Impact Statement (DEIS), and the Draft General Conformity Determination (DGCD). Those unable to attend may find the draft DEIS, and the DGCD at http://www.swg.usace.army.mil/pao/HotTopic.asp. Written comments must be postmarked by February 5, 2011.

Comments may be mailed or emailed to:
GALVESTON DISTRICT,
CORPS OF ENGINEERS
ATTN: MS. JANELLE STOKES
P. O. BOX 1229
GALVESTON, TEXAS 77553
or
Janelle.S.Stokes@usace.army.mil

Appendix D

TCEQ General Conformity Concurrence Letter

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 1, 2011

Ms. Janelle Stokes
Regional Environmental Specialist
United States Army Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, Texas 77553-1229

Re: General Conformity Concurrence for the Freeport Harbor Channel Improvement Project

Dear Ms. Stokes:

This letter provides general conformity concurrence for the proposed Freeport Harbor Channel Improvement Project. The Texas Commission on Environmental Quality (TCEQ) reviewed the project in accordance with Title 40 Code of Federal Regulations Part 93, and Title 30 Texas Administrative Code (TAC) § 101.30. The proposed project is located in the Houston-Galveston-Brazoria (HGB) area, which is classified as severe nonattainment for the 1997 eight-hour ozone standard, and emissions are expected to be above the 25 tons per year *de minimis* threshold. This threshold amount is specified in the table found in § 101.30(c)(2)(A). Therefore, a general conformity analysis is required. 1

The TCEQ has determined, pursuant to 30 TAC §101.30(h)(1)(E)(i)(I), that emissions from the proposed project will not exceed the emissions budgets specified in the most recent state implementation plan (SIP) revision approved by the United States Environmental Protection Agency (EPA). The most recently approved SIP revision, the HGB Reasonable Further Progress SIP adopted by the Commission on May 23, 2007, was approved by the EPA on March 29, 2010. This general conformity determination is based upon information provided in a December 2010 Draft General Conformity Determination prepared for the United States Army Corps of Engineers (USACE).

In support of the ozone National Ambient Air Quality Standard, the TCEQ suggests the USACE adopt pollution prevention and/or reduction measures in conjunction with this and future projects, such as the following: 2

- encourage construction contractors to apply for Texas Emission Reduction Plan grants;
- establish bidding conditions that give preference to clean contractors;
- direct construction contractors to exercise air quality best management practices;
- direct contractors that will use tugboats during construction to use clean fuels;
- direct operators of the assist tugboats used in maneuvering dredge vessels to use clean fuels;
- select assist tugs based on lowest nitrogen oxides (NO_X) emissions instead of lowest price; or
- purchase and permanently retire surplus NO_X offsets prior to commencement of operations.

Thank you for providing the necessary information and staff assistance for our review. We would also appreciate update(s), as appropriate, as this project moves forward. I look forward to working with you in the future on any upcoming projects you may have that affect air quality in your district. If you require further assistance on this matter, please contact Mrs. Amy Muttoni at (512) 239-6351 or Amy.Muttoni@tceq.texas.gov.

Sincerely,

David Brymer, Director
Air Quality Division
Texas Commission on Environmental Quality

DB/KH/kb

David Brymer, Director
Air Quality Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

RESPONSE TO COMMENTS

Comment No.	Response
1	By this letter, USACE notes that TCEQ has provided general conformity concurrence for the proposed FHCIP, and that TCEQ has determined that emissions will not exceed the emissions budgets specified in the most recent state implementation plan.
2	TCEQ recommended that USACE adopt pollution prevention and/reduction measures in conjunction with this project. USACE will: 1) encourage construction contractors to apply for Texas Emission Reduction Plan grants, the EPA's Voluntary Diesel Retrofit Program, or the EPA's Diesel Emission Reduction Plan offering the opportunity to apply for resources for upgrading or replacing older equipment to reduce NOx emissions, 2)encourage contractors to use cleaner, newer equipment with lower NOx emissions), 3) direct contractors and operators that will use non-road diesel equipment to use clean, low-sulfur fuels, 4) direct contractors that will use tugboats during construction to use clean, low-sulfur fuels, 5) direct operators of the assist tugboats used in maneuvering dredge vessels to use clean, low-sulfur fuels, and 6) direct operators of the dredging vessels to use clean, low-sulfur fuels.