Freeport Harbor Channel Improvement Project, Brazoria County, Texas
Final Integrated General Reevaluation Report and Environmental Assessment

Appendix J

GENERAL CONFORMITY DETERMINATION

November 2017

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

May 5, 2017

Janelle Stokes
Regional Technical Specialist
Environmental Compliance Branch
Coastal Section Regional Planning and Environmental Center
U.S. Army Corps of Engineers
2000 Fort Point Road
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Subject: General Conformity Determination Concurrence for Freeport Harbor Channel Improvement Project, Reach 2 Widening and Stabilization Component, Brazoria County

Dear Ms. Stokes:

This letter concerns the draft General Conformity Determination (GCD) for the *Freeport Harbor Channel Improvement Project, Brazoria County, Texas*, which was received April 10, 2017 from the United States Army Corps of Engineers (USACE). The Texas Commission on Environmental Quality (TCEQ) reviewed the draft GCD in accordance with requirements of 40 Code of Federal Regulations (CFR) Part 93, Subpart B. The proposed project is located in Brazoria County, which is one of eight counties comprising the Houston-Galveston-Brazoria (HGB) ozone nonattainment area (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties). The HGB 2008 ozone standard nonattainment area is currently classified by the United States Environmental Protection Agency (EPA) as moderate.

The USACE presented data determining that the proposed project would produce estimated direct and indirect emissions of nitrogen oxides (NO_X), an ozone precursor, totaling 115.12 tons per year (tpy) in 2019. These estimated emissions are above the EPA's 100 tpy *de minimis* threshold for NO_X in moderate ozone nonattainment areas; therefore, in accordance with 40 CFR §93.153(b) a general conformity analysis is required.

Title 40 CFR §93.152 specifies that project emissions be compared with emissions budgets from the most recent EPA-approved SIP revision for the area. The most recent EPA-approved SIP revision for the HGB moderate ozone nonattainment area (approved effective April 21, 2015) is the *Emissions Inventory State Implementation Plan Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard for the Houston-Galveston-Brazoria and Dallas-Fort Worth Areas* (SIP Project No. 2013-016-SIP-NR). However, this SIP revision is not the most appropriate approved SIP revision for general conformity purposes as it consists solely of emissions inventories for 2011. Through consultation with TCEQ staff, EPA staff, and project partners, it was agreed that emissions for this project be compared with emissions budgets from the *Houston-Galveston-Brazoria Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard* (SIP Project No. 2009-017-SIP-NR) and *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Standard Nonattainment Area Motor Vehicle Emissions Budgets Update State Implementation Plan Revision* (SIP Project No. 2012-002-SIP-NR). These SIP revisions were submitted to the EPA to satisfy Federal Clean Air Act requirements for severe nonattainment areas under the 1997 eight-hour ozone standard, and they were approved by the EPA effective February 3, 2014. The non-road and on-road mobile source budgets

established in these SIP revisions are more appropriate because they represent projected emissions for 2018, a year more in line with this project's construction phase. Additionally, the 2018 budgets are more conservative than the 2011 emissions inventories comprising the most recent, approved HGB area SIP revision.

The *Houston-Galveston-Brazoria Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard* estimates 2018 non-road NO_X emissions of 32.92 tons per day (tpd) and 2018 off-road NO_X emissions of 85.66 tpd. Proposed project emissions would represent 0.10% and 0.50% of those budgets, respectively. The *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Standard Nonattainment Area Motor Vehicle Emissions Budgets Update State Implementation Plan Revision* establishes a NO_X motor vehicle emissions budget (MVEB) of 49.21 tpd for on-road mobile sources, of which proposed on-road mobile source project emissions represent 0.0019%.

Based on our review, and in accordance with 40 CFR §93.158(a)(5)(A), the TCEQ concludes that the total direct and indirect emissions from the proposed project, when considered along with all other emissions in the HGB ozone nonattainment area, will not exceed the 2018 emissions budgets specified in the SIP. We concur with the USACE's determination that the project conforms to the SIP and agree that the USACE sufficiently demonstrated conformity for this project. To assure continued air quality improvement in the HGB ozone nonattainment area, we advocate that pollution prevention and/or reduction measures be adopted in conjunction with this and future projects:

- encourage construction contractors to apply for Texas Emission Reduction Plan grants;
- establish bidding conditions that give preference to contractors who proactively limit air pollutant emissions and idling of construction vehicles;
- direct construction contractors to exercise air quality best management practices such as fueling vehicles late in the day during ozone season;
- direct contractors and operators to use newer, low-emission vehicles and equipment whenever possible;
- select equipment based on lowest NO_X emissions instead of lowest price; and/or
- purchase and permanently retire surplus NO_X offsets prior to commencement of operations.

Thank you for providing TCEQ staff the information necessary to evaluate the proposed project. We appreciate any appropriate updates as the project progresses, and we look forward to working with you on upcoming projects that affect air quality. If you require further assistance on this matter, please contact Ms. Jamie Zech at 512-239-3935 or jamie.zech@tceq.texas.gov.

Sincerely,

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

cc: Jeff Riley: United States Environmental Protection Agency
Terri Rector Fann, P.E.: HDR Inc.

General Conformity Determination

Freeport Harbor Channel Improvement Project, General Reevaluation Report and Environmental Assessment, Freeport, Texas

August 2016, updated April/May 2017, and October 2017

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Job No. 10026871

GENERAL CONFORMITY DETERMINATION
FOR
FREEPORT HARBOR CHANNEL IMPROVEMENT PROJECT GENERAL REEVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT
FREEPORT, TEXAS

Prepared for:
U.S. Army Corps of Engineers
Galveston District
P.O. Box 1229
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Prepared by:

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San Antonio, TX 78216

August 2016, updated April/May 2017, and October 2017

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Professional Engineer Statement

The attached draft General Conformity Determination and estimate of NO_x emissions was prepared under the supervision of, and reviewed by Terri Rector Fann, P.E., Texas Registration No. 78064, for the purpose of evaluation and discussion. This document is not to be used for construction, bidding, or permitting purposes.

Terri Rector Fann

4/26/17

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1 Introduction

Freeport Harbor Channel provides deep-water access from the Gulf of Mexico (Gulf) to Port Freeport. 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 winding westward for approximately 3.5 miles into Freeport. See **Figure 1-1** on the following page.

The Freeport Harbor Jetty and Entrance Channels are currently maintained by the U.S. Army Corps of Engineers (USACE) to a depth of –46 feet and –48 feet mean lower low water (MLLW), respectively, at a width of 600 feet. These existing channels are approximately 6.3 miles in length. Current routine maintenance of the channel requires that shoal material be dredged from the channel during maintenance cycles and placed in the designated ocean dredged material disposal site (ODMDS A1) for the Jetty and Entrance channels.

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 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 1970 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 (now 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 USACE, identifying a federal interest in a widening and deepening project because transportation savings in the form of National Economic Development (NED) benefits substantially exceeded 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 initiated 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, known as the Freeport Harbor Channel Improvement Project, was led by the USACE, with the cost being shared by Port Freeport. (USACE, 2011)

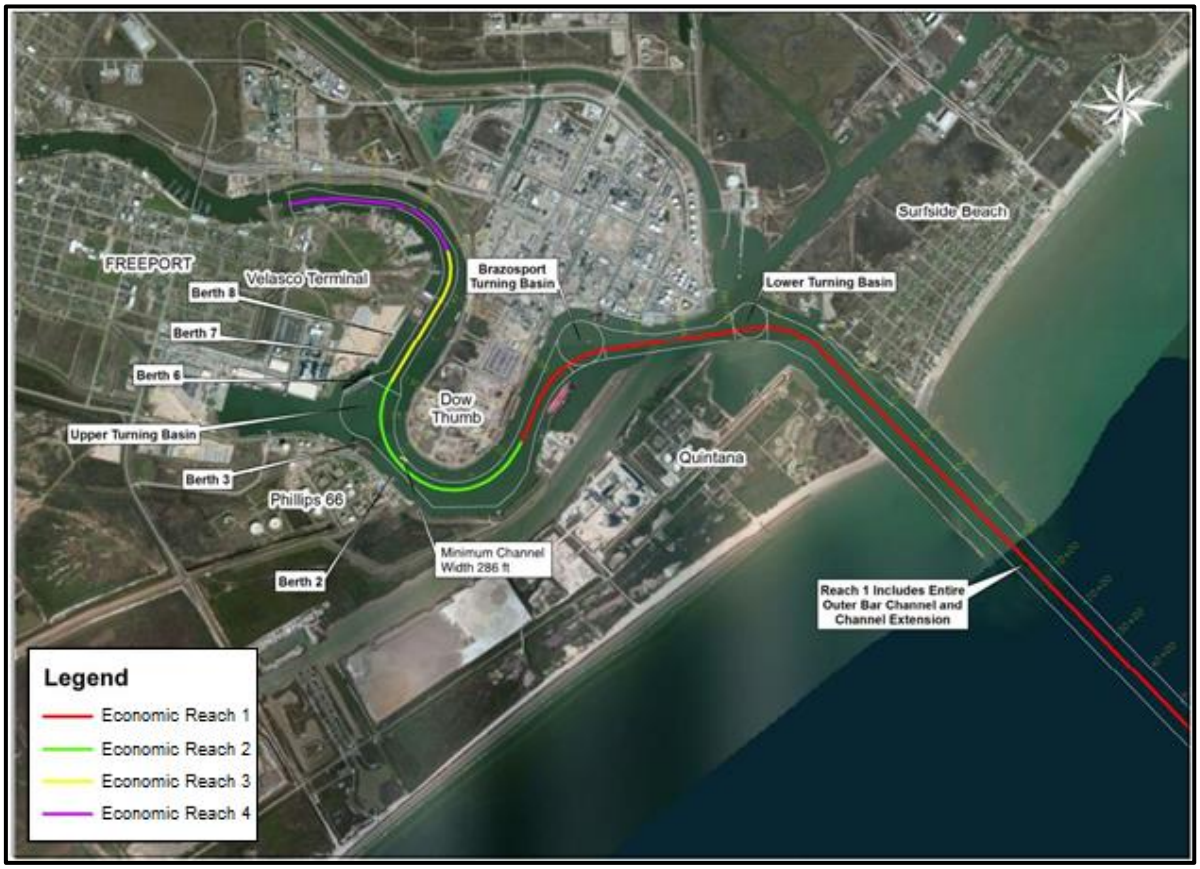


Figure 1-1 Freeport Harbor Channel Improvement Project Area

The Freeport Harbor Channel Improvement Project authorized deepening the entrance and Jetty channels to 55 feet deep, widening the Jetty channel to 600 feet wide, deepening the main channels to 55 feet, and widening and deepening the Stauffer Channel to 300 feet wide and 50 feet deep. Associated turning basins were also authorized to be deepened, and widened. Construction of the Improvement Project would generate approximately 17.4 million cubic yards (mcy) of dredged material. Maintenance of the deepened and widened channel would generate approximately 175.9 mcy of maintenance dredged material over the 50-year evaluation period.

After the General Conformity Determination and Final EIS for the Freeport Harbor Channel Improvement Project were approved, it was determined that additional widening and slope stabilization would be required in Reach 2 around the Dow Thumb area shown in **Figure 1-1** as Reach 2, beyond what was originally planned. A General Reevaluation Report (GRR), for which this General Conformity analysis is attached, is currently in process to evaluate these additional features (selective widening with removal of the underwater berm around Dow Thumb, bend easing, a turning notch, and construction of a sheet-pile system to mitigate removal of the underwater berm which is part of the Freeport Hurricane Flood Protection Project [HFPP]). From the standpoint of the air quality impacts analysis, these proposed additional features do not impact the conclusions of previous analyses because construction of the GRR features is not expected to occur concurrently with other phases of the Channel Improvement Project. Therefore, although the air quality analysis is

part of a GRR, the air quality analysis itself is not necessarily a re-evaluation as defined in 40 Code of Federal Regulations (CFR) 93.

The proposed widening effort would result in the removal of the underwater berm around the perimeter of the Dow Thumb. Removal of the underwater berm would decrease the stability of the existing Freeport HFPP Levee. To maintain levee integrity, a sheet-pile system would be installed along the bank to reinforce and stabilize the levee around the Dow Thumb. Once the sheet pile system is in place, the channel around the DOW thumb can be widened. Additionally, but unrelated to the sheet-pile system, the initial bend (Gulf side) of Reach 2 would be eased and a turning notch would be constructed northwest of the Upper Turning Basin.

1.1 Dredging

The channel bottom of cut is currently 273 feet wide at a depth of 46 feet MLLW, though the 1970 authorization would allow it to be widened to 375 feet. The GRR study is evaluating three structural alternatives. Each structural alternative involves widening the channel around the Dow Thumb to a different width (375 feet, 400 feet, and 425 feet), in addition to construction of a bend easing, and a turning notch. For the purposes of the air quality analysis, the three alternatives are distinguishable from each other by the width to which the deepest portion of the channel through the Dow Thumb section would be widened. **Table 1-1** shows the estimated dredging volumes required for each of the three structural alternatives.

Table 1-2. Structural Alternatives – Estimated New Work Dredging Volumes

Structural Alternative	Dredged (cu yd)	Total Dredged By Alternative (cu yd)
Widen to 375 feet, Bend Easing, and Turning Notch		
375 foot channel widening alternative	196,495	**1,883,040**
Bend Easing (all three alternatives)	1,555,218	
Turning Notch (all three alternatives)	131,327	
Widen to 400 feet, Bend Easing, and Turning Notch		
400 foot channel alternative	243,049	**1,929,594**
Bend Easing (all three alternatives)	1,555,218	
Turning Notch (all three alternatives)	131,327	
Widen to 425 feet, Bend Easing, and Turning Notch		
425 foot channel alternative	260,256	**1,946,801**
Bend Easing (all three alternatives)	1,555,218	
Turning Notch (all three alternatives)	131,327	
All structural alternatives would require the installation of a sheet-pile wall to mitigate for impacts to the underwater berm around Dow Thumb.		

As shown in the far right column of **Table 1-1**, the total volume of material dredged under each structural alternative scenario is nearly the same. The scenarios differ by only 3 percent. Because the schedule and equipment emissions are directly related to the volume of material to be dredged, the estimated air quality impacts for the three alternatives are virtually the same. Therefore, only the

425-foot channel alternative has been evaluated for this General Conformity Determination because it would involve the maximum dredging impacts.

Figure 1-2 shows the location of placement area 1 (PA 1). Dredging from the GRR features would be placed in PA 1.

Figure 1-2. GRR Structural Features and Placement Area 1

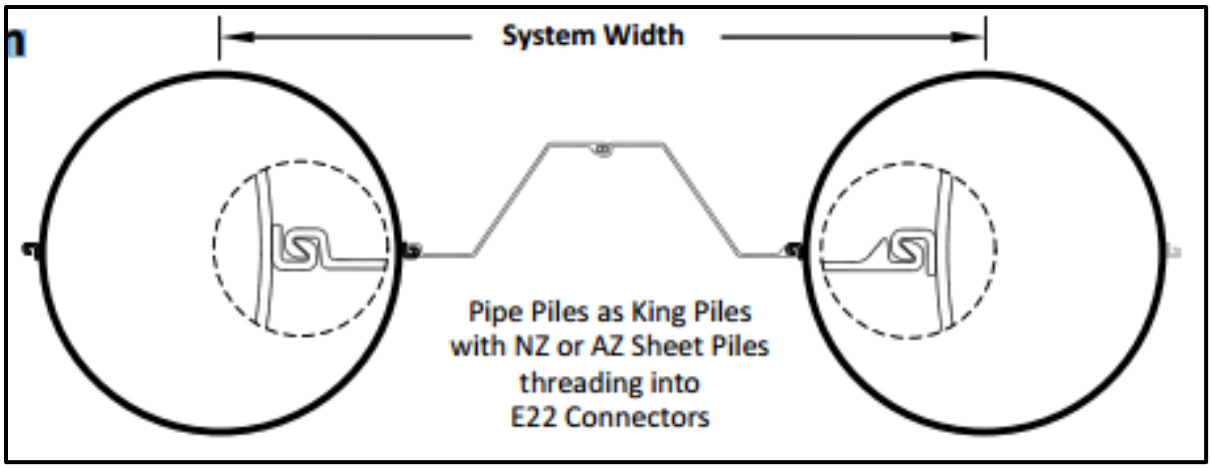
1.2 Stabilization of the Channel Slope

Each of the alternatives described in the previous section would require the removal of the existing underwater berm situated around the perimeter of the Dow Thumb in order to widen the channel. This necessitates the installation of a sheet-pile structure along the bank along on the inside of the curve to stabilize the slope of the channel. A channel cross section at the narrowest point at Dow Thumb was evaluated as a representative area of concern where channel widening is being evaluated. The analysis of the current conditions (Without-Project Condition) of the levee and channel slope, drained and undrained stability, calculated a Factor of Safety (FOS) for drained condition of 1.426 and for undrained condition of 1.219.

If the channel were to be widened by removing the underwater berm, the calculated undrained stability FOS decreased to 1.057. This is an unacceptable FOS. Therefore, removing the underwater berm would negatively impact the integrity of the levee and thus would require mechanical stabilization of the foundation to mitigate for the decreased FOS.

To maintain levee integrity with widening (and removal of the underwater berm), the Project Delivery Team (PDT), of which the non-Federal Sponsor is a member, considered alternatives and proposed a solution that would satisfy channel widening and provide satisfactory FOS of the levee, regardless of which width is selected. The proposed solution consists of foundation reinforcing utilizing a pipe-AZ, or similar, sheet-pile system. Due to foundation soil variations along Dow Thumb, the required depths of proposed reinforcement vary from 50 to 60 feet and deeper in some areas. The PDT also considered and disregarded soil mixing, due to high clay deposits in most of the foundation stratum.

Sheet piling consists of large pipes (piles) measuring 24 inches to 30 inches in diameter and approximately 55 feet long. These piles are driven vertically down into the terrestrial portion of the DOW thumb near the toe of the levee. Then sheets of steel approximately 3/8 inch thick are driven down between the pipes, interlocking with a channel on the sides of the pipes. The sheets are formed into a channel shape to increase their stiffness and to afford flexibility in the fit between the pipes. See **Figure 1-3** for a sketch of a typical section of sheet piling.



Ref: (Skyline Steel 2016)

Figure 1-3. Typical Sheet Piling Section

The schedule and equipment requirements, and hence the air emissions, from installation of the sheet piling wall are functions of the length of wall required. The sheet piling wall requirement is a maximum of approximately 4300 feet long under any of the widening alternatives. Therefore, only one air emission estimate is required for analysis of the sheet piling installation.

1.3 Purpose

The purpose of the Freeport Channel Improvement Project authorized under the Water Resource Reform and Development Act of 2014 (WRRDA 2014) was 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. Currently, vessel operations are 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.

The purpose of the proposed features being evaluated under the GRR is to allow for the safe and efficient transit of Panamax vessels through the Dow Thumb section of the Freeport Harbor Channel. A Panamax-class vessel is a vessel designed to be as large as possible while still being able to utilize the original Panama Canal. The maximum allowable dimensions for a Panamax vessel are 965-foot length and 106-foot beam, and a maximum draft of 39.5 feet.

1.4 Need

The current channel configuration is very limiting for future growth. The channel was designed and authorized in the 1970s to accommodate 800-foot length Aframax (Average Freight Rate Assessment) vessels. Traffic above the Upper Turning Basin was not an economic consideration at the time of the WRRDA 2014 Project. The Aframax-class vessels utilize the existing Berths 2 and 3 hauling petroleum and petroleum products.

Existing and future vessels can enter Berth 7 (see **Figure 1-1**) only from the Upper Turning Basin and must either back in or back out using only the 300 foot wide berth space since Reach 3 has an existing depth of 19 feet. Berth 6 accommodates general cargo/aggregate. Berth 6 is adjacent to Berth 7 and blocks Berth 7 if a vessel is docked at Berth 6. With Reach 3 dredged, a vessel at Berth 6 will no longer block Berth 7.

Berth 2 and Berth 3 are located across the channel from Dow Thumb. Phillips is converting Berth 2 to an LPG facility, which poses a safety concern for pilots utilizing the channel. Under existing conditions, any vessel longer than 600 feet poses a concern for the pilots. Therefore, the GRR structural features would greatly help alleviate pilot concerns.

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.

1.5 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 (NOx) 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 de minimis emissions threshold requiring such an analysis.

This General Conformity Determination has been 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 GRR structural features project are in conformity with the SIP for the Houston-Galveston-Brazoria (HGB) ozone nonattainment area.

1.6 Recent CEQ Guidance on Greenhouse Gases

On August 1, 2016, the Council on Environmental Quality (CEQ) issued guidance related to including potential greenhouse gas emission qualification and in some cases quantification for National Environmental Policy Act (NEPA) analyses for proposed action Environmental Assessments (EA). The CEQ guidance was rescinded in Executive Order 13783 on March 28, 2017. Greenhouse gas emission estimates, in any case, are provided in this document for information..

2 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 ensuring that the proposed actions to not prevent 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 CFR Part 51, Subpart W, and at Title 40 CFR Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." Effective 16 September 2014, the Texas General Conformity Rule was removed from the Texas SIP. Since that time, the federal General Conformity Rules govern conformity of general federal actions in Texas.

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. On December 30, 2015, EPA published a final determination of attainment for the 1997 eight-hour ozone standard for the HGB area which includes Brazoria County (80 FR 81466). Brazoria County is currently classified, however, as moderate nonattainment for the 2008 eight-hour ozone standard (81 FR 26697). The threshold level under the

1997 eight-hour ozone NAAQS was 25 tons per year (tpy) for either NOx or VOC. Today, under the 2008 ozone NAAQS for which the most of HGB including Brazoria County is currently designated moderate nonattainment, the threshold levels for NOx and VOC are 100 tpy (40 CFR 93.153 (b) and 40 CFR 81).

Because the current proposed actions occur in separate years from previously assessed project actions, it is our assumption that the air emissions will be reviewed separately for General Conformity and will be evaluated under the 2008 ozone NAAQS nonattainment criteria.

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 NOx and VOC related to the federal action should be considered in this General Conformity Determination.

3 Applicability

The General Conformity Rule is applicable only to nonattainment and maintenance areas. The proposed structural alternatives, which are associated with the Freeport Harbor Channel Improvement Project, will be located in Brazoria County, Texas. Brazoria County is included in the eight-county HGB ozone nonattainment area, which is moderate in terms of its degree of compliance with the 2008 8-hour ozone standard. This classification affects facilities that generate the ozone precursors, NOx, and VOC. As such, the project is subject to the General Conformity Rule, which applies to all nonattainment and maintenance areas.

The proposed GRR structural features (widening, bend easing, and turning notch) have been evaluated in terms of the relevant direct and indirect emissions associated with each structural alternative such as emissions from setting the sheet-pile structure, dredging, support equipment, land-based 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 NOx emissions would be required for GRR project structural features as emissions of NOx are estimated to exceed the 100 tpy applicability threshold.

Emissions of VOC for the construction activities for the GRR features are exempt from a General Conformity Determination because they are below the 100 tpy applicability threshold.

As mentioned, this document also includes GHG emission estimates for information.

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4 Air Emissions Inventory

For the General Conformity Determination, an air emissions inventory was prepared for project-related activities for the GRR based on the schedule and other assumptions as developed for the proposed action. Air emissions estimates were calculated using techniques appropriate for a specific emissions-generating activity or source. These methodologies are patterned closely after the methodologies used for the EIS and General Conformity Determination prepared in 2011 for the Channel Improvement Project. Emission factors for on-road and off-road equipment have been updated to reflect fleet turnover to later model equipment. The basis, emission factors, and summary of emissions are provided in Appendix B.

For information, emissions from GHG were estimated for the construction of the GRR structures and features.

4.1 Project Emissions

The emission sources for construction of the GRR features 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 a 30-inch hydraulic cutterhead dredge, a 250-ton crane with a vibratory driver for setting sheet piles, and support equipment such as tugboats, a spill barge, and crew boats. The land-based emission sources will include off-road equipment utilized for constructing levees and placing dredged material in the 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 NOx and VOC were estimated in tons per year for each piece of equipment. The emissions were then categorized, 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 each piece of equipment required for the GRR structural features for the project duration. The basis for emissions estimates consisted of the operating hours for each specific type of equipment, engine load factor, and engine horsepower. Emission rates for each device (tons per year) were calculated for each criteria pollutant and were estimated based on the following formula:

$$Emission\ Rate\ \left(\frac{ton}{yr}\right) = \frac{\text{Horsepower} * \text{Load Factor} * \text{Emission factor}\ \left(\frac{gram}{HP-hr}\right) * \frac{hr}{yr}}{453.6\frac{gram}{lb} * 2000\ \frac{lb}{ton}}$$

Emissions of GHG were estimated in similar fashion and then converted to metric tons (tonnes) of carbon dioxide equivalents (CO_2e) per year.

4.1.2 Marine Equipment for Sheet Pile Installation and Dredging Activities

Air emissions directly related with the pile driving and 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.

It was assumed that a 30-inch hydraulic cutterhead dredge would be used for pumping and onshore placement of 1,946,801 CY of material into upland PAs for the GRR structural features.

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.

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. These emission factors are obviously dated, and conservatively reflect a fleet of nearly all Tier 0 marine engines, but they are the most current emissions data found that is applicable.

The marine equipment NOx emission factors were adjusted, however, to reflect Texas Low-Emission Diesel (TxLED), which is required in Brazoria County for nonroad and marine diesels pursuant to the TxLED requirements of the SIP. TAC Title 30 RULE §114.318 indicates that TxLED is expected to result in a 6.2% reduction in NOx from nonroad engines. Therefore marine equipment NOx emission factors from the February 2000 EPA report were reduced by 6.2%. Even with this adjustment, the resulting estimates are expected to be conservatively high.

Detailed emission calculations for the marine equipment can be found in Tables C-1 to C-5 in Appendix B.

4.1.3 Land-Side Dredged Material Placement – Non-Road 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.

The EPA NONROAD 2008a emission factor model, 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 2008a model was run to generate emission factors and load factors for the criteria air contaminants resulting from the use of bulldozers and other non-road equipment in Brazoria County during the calendar year 2019. These emission factors reflect the age of the off-road equipment fleet expected in Brazoria County in 2019. The emission factors, in units of grams per horsepower hours, were then used to estimate the total emissions from the use of non-road

equipment dredged material placement activities associated with the project. Detailed emission calculations for the off-road construction equipment can be found in Tables D-1 and D-2 in Appendix B.

TxLED is required in Brazoria County and will be used in nonroad equipment such as bulldozers, dump trucks, etc. during the proposed construction period. However, no adjustment for NOx due to the use of TxLED fuel was made. NONROAD 2008a emission factors for CY2019 reflect significant penetration of Tier 3 and Tier 4 engines into the fleet. A February 2003 EPA report entitled "The Effect of Cetane Number Increases Due to Additives on NOx Emissions from Heavy-Duty Highway Engines" EPA 420-R-03-002 stated that EGR-equipped engines are expected to exhibit no discernable NOx response to cetane, so TxLED fuel is not expected to effect NOx emissions from late model engines.

4.1.4 On-Road 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.

Mobile on-road emissions associated with employee vehicles were calculated with the use of the EPA MOVES2014a emission factor model.

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 through E-3 in Appendix B.

4.2 Summary of NOx and VOC Emissions

For comparison with the thresholds defined in the General Conformity Rule, the estimated annual emissions of NOx and VOC for the GRR structural features are summarized in **Tables 4-1** and **4-2**. Emissions of carbon monoxide, sulfur dioxide, and particulate matter were estimated (see Appendix B), but are not considered in the General Conformity evaluation as the HGB area is in attainment with the NAAQS for each of those pollutants.

The schedule for the GRR structural features is currently projected to commence early in 2019, and is projected to be completed within that calendar year. The various other phases of the WRRDA 2014 Project were originally projected to occur during 2011 through 2016. However, the other phases have not yet begun, and are not expected to commence until 2020. Therefore, the GRR structural features construction is not expected to occur concurrently with any of the other phases of the Channel Improvement.

Table 4-1. GRR Structural Features – Summary of Estimated NOx Emissions

Activity	2019 Project NOx Emissions (tpy)	(tpd)[1]
Sheet Pile Placement and Dredging	106.83	0.4273
Land Side Dredged Material Placement	8.07	0.0323
Employee Commuter Vehicles	0.23	0.0009
Total[1]	115.12	0.4605

[1] Number of significant digits shown implies more precision than is possible, but additional digits are shown so that calculated totals and percentages will align with values shown.

As shown in **Table 4-1**, the estimate of NOx emissions for the GRR Structural Features would exceed the General Conformity de minimis threshold, (i.e., equal to or greater than 100 tpy) during 2019, the year of construction activity. Therefore, a General Conformity Determination for NOx emissions is required for the GRR Structural Features.

Table 4-2. GRR Structural Features – Summary of Estimated VOC Emissions

Activity	2019 Project VOC Emissions (tpy)	(tpd)[1]
Sheet Pile Placement and Dredging	1.41	0.0057
Land Side Dredged Material Placement	0.76	0.0030
Employee Commuter Vehicles	0.07	0.0003
Total[1]	2.24	0.0090

[1] Number of significant digits shown implies more precision than is possible, but additional digits are shown so that calculated totals and percentages will align with values shown.

As shown in **Table 4-2**, the estimate of VOC emissions for the GRR Structural Features would not equal or exceed the General Conformity de minimis threshold of 100 tpy. Therefore, a General Conformity Determination for VOC emissions is not required for the GRR Structural Features.

5 Mitigation Measures Proposed

In response to the issuance of the Draft General Conformity Determination for the Freeport Harbor Channel Improvement Project in December 2010, the TCEQ provided a General Conformity Concurrence letter dated March 1, 2011. In its letter, 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 NOx emissions instead of lowest price; or
- Purchase and permanently retire surplus NOx 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 quoted in (USACE 2011) EPA suggested that USACE:

> Include 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 NOx 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 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.

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 Final General Conformity Determination

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 GRR Structural Features will meet the General Conformity requirements of 40 CFR 51 Subpart W and 40 CFR 93 Subpart B.

The emissions budget for General Conformity purposes 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.

6.1 Comparison of GRR Structural Features Emissions to SIP Emissions Budgets

As noted in **Section 4.2** only emissions of NOx are projected to exceed the applicable General Conformity de minimis threshold. Therefore, this section addresses NOx emissions with respect to General Conformity requirements. To determine whether project construction NOx emissions can be accommodated in the HGB SIP emissions budgets, the most recent EPA approved ozone SIP demonstration documents were reviewed for emissions inventory information.

A recent approved revision to the SIP is the *Emissions Inventory State Implementation Plan Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard for the Houston-Galveston-Brazoria and Dallas-Fort Worth Areas*, approved on April 21, 2015. This revision contains emission budgets for the Year 2011. However, a previous approved revision contained an emission budget for the Year 2018, which is temporally closer to the projected structural features construction Year - 2019. As would be expected, the 2018 budgets are generally more restrictive (i.e. conservative) for purposes of this comparison, because they are lower, reflecting the expected phase-in of better mandatory emissions reduction technology in future years. Therefore, the 2018 budget provides a more appropriate and conservative comparison for demonstration purposes. The previous approved revision used for this demonstration is the *Houston-Galveston-Brazoria Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard*, adopted March 10, 2010, and approved by EPA on January 2, 2014.

The SIP demonstration was reviewed to determine the various activity categories of emissions in which the proposed project's construction activities will fall. While the SIP evaluates NOx emissions from all sources, including biogenic (non-human-caused) emission sources, this evaluation focuses on the categories most relevant to the proposed project construction emissions, specifically the Non-Road and Off-Road categories. Related employee commuting emissions have been compared with the SIP's On-Road mobile source emissions budget. The emissions budgets for the Non-Road, Off-Road, and On-Road Mobile Sources emission budgets in the SIP are presented in **Table 6-1**. The SIP budget projections for 2018 are presented and used for the demonstration because they are the SIP Budget year projections closest to the GRR Structural Features scheduled work. The GRR Structural Features Project is anticipated to be completed in 2019.

Table 6-1. Applicable SIP NOx Emission Budgets for 2018

Category	2018 Emissions Budget NOx ton/day[1]
Non-Road Emission Sources[2]	32.92
Off-Road Emission Sources[3]	85.66
On-Road Mobile Sources[4]	49.21

1 Source: TCEQ, 2010.
2 Non-road emission sources include equipment used for construction, agriculture, transportation, recreation.
3 Off-road emission sources include airport, locomotive, and marine emissions.
4 On-road emission sources include automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways.

Table 6-2 presents the proposed project construction emissions in average tons per day and compares these estimates with the off-road, non-road and on-road 2018 emissions budgets from the SIP demonstration.

Table 6-2. Comparison of Off-Road Project Emissions with SIP Emissions Budgets (ton/day)

Project Categories	SIP Inventory Categories	2019 Project NOx Emissions		HGB SIP 2018 NOx Emissions Budget	
		(tpy)	(tpd)	(tpd)	% of Budget
Marine Activities (dredge, sheet pile driver, support vessels)	Off-Road Emission Sources	106.83	0.4273	85.66	0.50%
Land-side Activities (levee building and dredged material placement)	Non-Road Emission Sources	8.07	0.0323	32.92	0.10%
On-Road Vehicles (employee commuting)	On-Road Mobile Sources	0.23	0.0009	49.21	0.0019%

As shown above in **Table 6-2**, the proposed project construction emissions of NOx represent only 0.5 percent of off-road emissions sources, 0.1 percent of non-road emissions sources, and only 0.002 percent of on-road emissions from on-road sources for the emissions modeled in the SIP for 2018. USACE will seek TCEQ concurrence that the NOx emissions representing these low percentages would not hinder timely attainment of the 2008 8–hour ozone standard.

6.2 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 NOx 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. 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 that emissions from the proposed project will not exceed the emissions from the applicable SIP revision. Therefore, the USACE has determined that the proposed project complies with the requirements of the General Conformity Rule; Section 176 of the CAA, and is in conformity with the currently approved 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 SIP.

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7 References

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Appendix A.
Acronyms and Abbreviations

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AAQS	Ambient Air Quality Standard
BPA	Brazos Pilots Association
BRHND	Brazos River Harbor Navigation District
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CY	Cubic Yards
DOT	(U.S.) Department of Transportation
EA	Environmental Assessment
EPA	(U.S.) Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FHCIP	Freeport Harbor Channel Improvement Project
FOS	Factor of Safety
GHG	Greenhouse Gas
GRR	General Reevaluation Report
HGB	Houston-Galveston-Brazoria
hp	horsepower
lb	pound
mcy	million cubic yards
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
O_3	Ozone
PM_{10}	Particulate matter less than 10 microns
ppm	parts per million
PSD	Prevention of Significant Deterioration
RMP	Risk Management Program
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TCEQ	Texas Commission on Environmental Quality
TxLED	Texas Low-Emission Diesel
tpy	tons per year
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
WRRDA	Water Resource Reform and Development Act of 2014
yr	year
$\mu g/m^3$	micrograms per cubic meter

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B

Appendix B.
Emission Estimates

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Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

Estimates of Air Emissions for 2019, the planned project year.

The Bend Easing dredging for channel widening and turning notch will be done with 30" dredge. Crew and support equipment for a 30" dredge are identical to what was assumed for the previous analysis.

425 ft Channel Alternative

Sheet Piling to be Installed	4,300	feet
Sheet Piling Duration	8	months
Quantity to be Dredged.	1,946,801	cubic yards
Dredging Duration	4	months

Emission Summary by Year - All Source Categories

Table A-1. Annual Project Emissions Summary

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

		CO ton	NOx ton	PM2.5 ton	PM10 ton	SO2 ton	VOC ton	CO2e Tonne
2019	Marine Equipment	13.11	106.83	2.59	2.67	0.08	1.41	6,566
	NonRoad Equipment	2.89	8.07	0.35	0.36	0.02	0.76	2,141
	Employee Vehicles	3.56	0.23	0.01	0.04	0.00	0.07	396
	2019 Total	**19.55**	**115.12**	**2.94**	**3.06**	**0.10**	**2.24**	**9,103**

Ton/Day Values Represented in Text Tables

NOx SIP Budgets	% of NOx Budget	Assuming 250 working days per year. NOx (tpd)	VOC (tpd)
85.66	0.50%	0.4273	0.0057
32.92	0.10%	0.0323	0.0030
49.21	0.0019%	0.0009	0.0003
From Table 6-1	For Table 6-2	0.4605	0.0090

Marine Vehicles Schedule and Operating Parameters

Table B-1. Dredging Contract Schedule and Allocation by Year

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

	Duration					
	Duration Months	Total Days	Contract Start	Contract Finish	2019 Weekdays	2019 %
Sheet Pile Installation	8	240	1/1/2019	8/31/2019	171	100%
Port Freeport Bend Easing	4	120	9/1/2019	12/31/2019	85	100%

Notes: Estimates include weekend days, and 8 months and 4 months are conservative, maximizing commute trips but keeping all off-road work estimates in one calendar year.

Table B-2. Dredge Equipment Engine Hour and Horsepower Break-down

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

	Duration	Sheet Pile Length	250 ton Crane				Tug		Diesel Hammer		Power Pack for Vibratory Driver		Crew Boat Construction	
			Moving Equipment		Idle (driving piles)									
	Months	ft	(hr)	HP	(hr)	HP	(hr)	HP	(hr)	HP	(hr)	HP	(hr)	HP
Sheet Pile Driving	8	4,300	1,843	365	1,843	100	3,686	500	1,720	105	860	420	800	400

	Duration	Dredging Volume	30" Dredge				Tugs 3 units		Spill Barge Dredging		Crew Boat Construction	
			Dredging		Idle							
	Months	CY	(hr)	HP	(hr)	HP	(hr)	HP	(hr)	HP	(hr)	HP
Dredging	4	1,946,801	1,298	9000	649	3000	3,232	500	400	165	400	400

Notes: Hours are round-the-clock hours. Crane will mostly hold a driver and slowly spool it down as it drives the piles, so it will idle much of the time. Diesel hammer and power pack would normally be considered non-road equipment rather than off-road, but because they are on a barge, they are being clustered with other on-the-water sources. Tug hours are total hours for three tugs.

Table B-3. Dredge Equipment Engine Horsepower Only

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

	30" Dredge		250 ton Crane		Tug (ea)	Spill Barge	Crew Boat	Diesel	Power
	Dredging	Idling	Moving	Idling	Propelling	Main Eng.	Propelling	Hammer	Pack
	9,000	3,000	365	100	500	165	400	105	420

Marine Vehicle Emissions

Table C-1. Marine Equipment Operating Hours

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

Activity	Dredge		250 ton Crane		Tug	Spill Barge	Crew Boat	Diesel	Power
	Dredging	Idling	Moving	Idling	Propelling	Main Eng.	Propelling	Hammer	Pack
Sheet Piles			1,843	1,843	3,686		800	1,720	860
Dredging	1,298	649			3,232	400	400		
2019 Totals	1,298	649	1,843	1,843	6,917	400	1200	1,720	860

Notes: Hours in this table are the product of the annual percents in Table B-1 times the hours in Table B-2.

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

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

	Exponent (x)	Intercept (b)	Coefficient (a)
CO	1	0	0.8378
NOX	1.5	10.4496	0.1255
PM	1.5	0.2551	0.0059
SOX	n/a	0	2.3735
VOC (HC)	1.5	0	0.0667
CO2	1	648.6	44.1

Notes:

1.) All regressions excepting SO2 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 SO2 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 15 parts per million (marine diesel specification since 2012)

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. Note that Table 5-1 in the reference does not give values for PM10 and PM2.5. Only PM.

Table C-3. Marine Equipment Calculated Emission Factors

	Dredge		Crane		Tug	Spill Barge	Crew Boat	Diesel	Power
	Dredging	Idling	Moving	Idling	Propelling	Main Eng.	Propelling	Hammer	Pack
Load Factor	0.8	0.2	0.8	0.2	0.4	0.4	0.4	0.4	0.4
Emission Factors in grams per horsepower-hour									
CO	0.7809	3.1237	0.7809	3.1237	1.5619	1.5619	1.5619	1.5619	1.5619
NOX	7.9231	8.8386	7.9231	8.8386	8.1622	8.1622	8.1622	8.1622	8.1622
PM	0.1964	0.2394	0.1964	0.2394	0.2076	0.2076	0.2076	0.2076	0.2076
PM2.5	0.1905	0.2322	0.1905	0.2322	0.2014	0.2014	0.2014	0.2014	0.2014
PM10	0.1964	0.2394	0.1964	0.2394	0.2076	0.2076	0.2076	0.2076	0.2076
SOX	0.0059	0.0073	0.0059	0.0073	0.0064	0.0064	0.0064	0.0064	0.0064
VOC (HC)	0.0695	0.5561	0.0695	0.5561	0.1966	0.1966	0.1966	0.1966	0.1966
Fuel	166.56	206.05	166.56	206.05	179.73	179.73	179.73	179.73	179.73
CO2	524.77	648.09	524.77	648.09	565.87	565.87	565.87	565.87	565.87
CH4	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
N2O	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

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).

5.) CH4 and N2O emission factors were obtained from "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (ICF International, 2009)

6.) NONROAD 2008a assumes that all diesel particulate is PM10, and 97% of diesel PM10 is PM2.5. (ref: "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition" - EPA-420-R-10-018, NR-009d, July 2010. That ratio was used to estimate fine particulate from marine engines.

7.) Note that the calculated emission factors in g/hp-hr are higher at lower loads (idle).

Table C-4. Marine Equipment Emissions by Calendar Year (TPY)

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

Pollutant		Dredge		Crane		Tug	Spill Barge	Crew Boat	Diesel	Power
		Dredging	Idling	Moving	Idling	Propelling	Main Eng.	Propelling	Hammer	Pack
CO		8.044	1.341	0.4632	0.1269	2.3819	0.0455	0.3306	0.1244	0.2487
NOx		81.612	3.793	4.6996	0.3591	12.4474	0.2375	1.7274	0.6500	1.2999
PM		2.02	0.1028	0.1165	0.0097	0.3166	0.0060	0.0439	0.0165	0.0331
PM2.5		1.96	0.0997	0.1130	0.0094	0.3071	0.0059	0.0426	0.0160	0.0321
PM10		2.02	0.1028	0.1165	0.0097	0.3166	0.0060	0.0439	0.0165	0.0331
SO2		0.0611	0.0031	0.0035	0.00030	0.0098	0.00019	0.0014	0.00051	0.0010
VOC		0.72	0.2387	0.0412	0.0226	0.2998	0.0057	0.0416	0.0157	0.0313
CO2		5,405.39	278.15	311.27	26.33	862.96	16.47	119.76	45.06	90.12
CH4		0.69	0.0288	0.0397	0.0027	0.1022	0.0019	0.0142	0.0053	0.0107
N2O		0.1545	0.0064	0.0089	0.0006	0.0229	0.00044	0.0032	0.0012	0.0024

Notes: This table multiplies the (g/HP-hr emission factors in Table C-3) * (load factor from Table C-3) * (hours in Table C-1) * (horsepower in Table B-3) / (453.6 g/lb * 2000 lb/ton)

Table C-5. Marine Equipment Emissions by Calendar Year (TPY) (all criteria pollutants)

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

CO (tpy)	NOx (tpy)	PM (tpy)	PM2.5 (tpy)	PM10 (tpy)	SO2 (tpy)	VOC (tpy)	CO2e (tpy)
13.11	106.83	2.67	2.59	2.67	0.081	1.41	7237.66

Notes: This table represents totals for each pollutant in Table C-4.

Marine Vehicles Additional Maintenance Dredging Note

Emissions from additional maintenance dredging were not estimated as part of this analysis. A deeper, wider channel is expected to result in incremental maintenance dredging volumes relative to historical dredging. This is more of an issue for placement area planning than for air quality analysis. Out-year air emissions from the increased maintenance dredging were estimated for the previous General Conformity Determination, but were found to be much lower than construction year emissions, and were therefore not evaluated further.

Nonroad Equipment Parameters and Emissions

Table D-1. Construction Equipment Emission Factors

On-Land equipment used to construct levee around placement area and place dredged material.

Equipment Detail	Equipment Description	Fuel	HP	Load (%)	CO (g/HP-hr)	NOx (g/HP-hr)	PM2.5 (g/HP-hr)	PM10 (g/HP-hr)	SOx (g/HP-hr)	VOC (g/HP-hr)	CO2 (g/HP-hr)	CH4 (g/HP-hr)	N20 (g/HP-hr)
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	Diesel	300	59%	0.2401	0.8232	0.0371	0.0382	0.0037	0.1480	536.3826	0.0391	0.0137
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	--	0	0%	-	-	-	-	-	-	-	-	-
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	0.1255	0.3647	0.0127	0.0131	0.0035	0.1395	536.4083	0.0375	0.0132
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	Diesel	230	59%	0.1255	0.3647	0.0127	0.0131	0.0035	0.1395	536.4083	0.0375	0.0132
TRAILER MOUNTED	Chippers/Stump Grinders	Diesel	650	43%	1.0612	2.9924	0.1350	0.1391	0.0043	0.2217	530.3716	0.0375	0.0132
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT	Dragline (crane)	Diesel	350	59%	0.5412	2.0602	0.0852	0.0878	0.0041	0.1727	530.5201	0.0375	0.0132
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	Gasoline	6	78%	298.2889	1.7366	0.1246	0.1354	0.2151	5.0413	1,044.17	0.0358	0.0123
(36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	Diesel	250	43%	0.2648	1.2118	0.0515	0.0531	0.0038	0.1603	530.5573	0.0375	0.0132
CY (1.2 M3) BUCKET, 23.3' (7.1M) MAX DIGGING DEPTH	Excavators	Diesel	238	59%	0.1936	0.6676	0.0272	0.0281	0.0036	0.1437	536.3956	0.0375	0.0132
BUCKET, 4X4,	Tractor/Loader/Backhoe	Diesel	130	21%	1.7986	3.0467	0.3609	0.3720	0.0050	0.5047	625.0150	0.0375	0.0132
AND BLADE, WHEEL, 4X4	Log Skidder (see note)	Diesel	119	59%	0.4240	1.0574	0.0911	0.0939	0.0038	0.1547	536.3622	0.0375	0.0132
SAW CUTTER, WHEEL, 4X4	Log Skidder (see note)	Diesel	200	59%	0.2446	0.9263	0.0382	0.0393	0.0037	0.1470	536.3857	0.0375	0.0132
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	1.0383	1.0775	0.1119	0.1153	0.0042	0.1599	595.6731	0.0375	0.0132
AND BLADE, WHEEL, 4X4	Log Skidder (see note)	Diesel	119	59%	0.4240	1.0574	0.0911	0.0939	0.0038	0.1547	536.3622	0.0375	0.0132
SAW CUTTER, WHEEL, 4X4	Log Skidder (see note)	Diesel	200	59%	0.2446	0.9263	0.0382	0.0393	0.0037	0.1470	536.3857	0.0375	0.0132
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	Diesel	100	59%	1.0383	1.0775	0.1119	0.1153	0.0042	0.1599	595.6731	0.0375	0.0132
50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	Diesel	210	59%	0.1255	0.3647	0.0127	0.0131	0.0035	0.1395	536.4083	0.0375	0.0132
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE	Highway Truck	Diesel	310	59%	0.2247	0.6616	0.0269	0.0277	0.0036	0.1418	536.4013	0.0375	0.0132
35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	Diesel	205	59%	0.1255	0.3647	0.0127	0.0131	0.0035	0.1395	536.4083	0.0375	0.0132
DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM	Cranes	Diesel	350	43%	0.5412	2.0602	0.0852	0.0878	0.0041	0.1727	530.5201	0.0375	0.0132
UPB T15CA004 DOZER,CWLR, D-4H,PS	Crawler Dozers/Tractor	Diesel	80	59%	1.0383	1.0775	0.1119	0.1153	0.0042	0.1599	595.6731	0.0375	0.0132
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	Truck Trailer	-	0	0%									
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	Diesel	230	59%	0.1255	0.3647	0.0127	0.0131	0.0035	0.1395	536.4083	0.0391	0.0137

Notes:
NONROAD 2008a Emission Factors by Horsepower, SCC, and Pollutant
Texas Brazoria County 2019
Date of Model Run: Jul 11 12:18:46: 2016
Core Model ver 2008a, 07/06/09. NONROAD Reporting Utility, Version 2005c

NONROAD 2008a did not generate an emission factor for a log skidder for Brazoria County 2019, so it was necessary to use a USA Average NONROAD Model output to find an emission factor for the log skidder.

Although it is expected that Texas Low Emission Diesel (TxLED) crawlers and off-road trucks will be used, it is not clear that NONROAD 2008a emission factors for Texas adjust for TxLED. No adjustment was made to NONROAD factors.

Placement Area equipment fleet and hours of use are patterned after estimates done for the Port Freeport Channel Improvement Conformity Determination and EIS.

Load Factors are taken 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. These are generally identical to those used by the NONROAD model.

N2O and CH4 emission factors published for diesel equipment in the Federal Facilities GHG Inventory Guidance, Technical Support Document dated 6 October 2010. Table D-6 Non-Highway Vehicles

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

Equipment Detail	Equipment Description	HP	Load (%)	Number of Units	Previous Contract #6 Total Eqpt Hours	Bend Easing 2019 Hours	2019 CO (ton)	2019 NOx (ton)	2019 PM2.5 (ton)	2019 PM10 (ton)	2019 SOx (ton)	2019 VOC (ton)
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	300	59%	1	24	53	0.0025	0.0085	0.0004	0.0004	0.0000	0.0015
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	0	0%	1	24	53	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	230	59%	1	24	53	0.0010	0.0029	0.0001	0.0001	0.0000	0.0011
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	230	59%	2	1173	2592	0.0487	0.1414	0.0049	0.0051	0.0014	0.0541
TRAILER MOUNTED	Chippers/Stump Grinders	650	43%	1	191	422	0.1380	0.3891	0.0175	0.0181	0.0006	0.0288
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT	Dragline (crane)	350	59%	8	6868	15177	1.8695	7.1170	0.2942	0.3033	0.0142	0.5964
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	6	78%	1	191	422	0.6495	0.0038	0.0003	0.0003	0.0005	0.0110
(36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	250	43%	1	24	53	0.0017	0.0076	0.0003	0.0003	0.0000	0.0010
CY (1.2 M3) BUCKET, 23.3' (7.1M) MAX DIGGING DEPTH	Excavators	238	59%	1	24	53	0.0016	0.0055	0.0002	0.0002	0.0000	0.0012
BUCKET, 4X4,	Tractor/Loader/Backhoe	130	21%	1	381	842	0.0456	0.0772	0.0091	0.0094	0.0001	0.0128
AND BLADE, WHEEL, 4X4	Log Skidder	119	59%	1	383	846	0.0278	0.0693	0.0060	0.0062	0.0002	0.0101
SAW CUTTER, WHEEL, 4X4	Log Skidder	200	59%	1	383	846	0.0269	0.1020	0.0042	0.0043	0.0004	0.0162
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	100	59%	1	191	422	0.0285	0.0296	0.0031	0.0032	0.0001	0.0044
AND BLADE, WHEEL, 4X4	Log Skidder	119	59%	1	45	99	0.0033	0.0081	0.0007	0.0007	0.0000	0.0012
SAW CUTTER, WHEEL, 4X4	Log Skidder	200	59%	1	45	99	0.0032	0.0120	0.0005	0.0005	0.0000	0.0019
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	100	59%	1	25	55	0.0037	0.0039	0.0004	0.0004	0.0000	0.0006
50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	210	59%	1	73	161	0.0028	0.0080	0.0003	0.0003	0.0001	0.0031
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE	Highway Truck	310	59%	1	73	161	0.0073	0.0215	0.0009	0.0009	0.0001	0.0046
35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	205	59%	1	120	265	0.0044	0.0129	0.0004	0.0005	0.0001	0.0049
DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM	Cranes	350	43%	1	45	99	0.0089	0.0340	0.0014	0.0014	0.0001	0.0028
UPB T15CA004 DOZER,CWLR, D-4H,PS	Crawler Dozers/Tractor	80	59%	1	80	177	0.0095	0.0099	0.0010	0.0011	0.0000	0.0015
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	Truck Trailer	0	0%	1	40	88	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	230	59%	1	40	88	0.0017	0.0048	0.0002	0.0002	0.0000	0.0018
Totals							2.8859	8.0690	0.3462	0.3569	0.0182	0.7611

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

Equipment Detail	Equipment Description	HP	Load (%)	Number of Units	Previous Contract #6 Total Eqpt Hours	Bend Easing 2019 Hours	2019 CO2 (ton)	2019 CH4 (ton)	2019 N20 (ton)	2019 CO2e (ton)
EP H25HU005 HYD EXCAV, CRWLR, 97,870 LBS, 3.14 CY BKT	Crawler Tractor/Dozers	300	59%	1	24	53	5.5501	0.0004	0.0001	5.6026
EP T45XX021 TRUCK TRAILER, LOWBOY, 90 TON, 4 AXLE	Truck Trailer	0	0%	1	24	53				
EP T50FO019 TRK,HWY, 43,000 GVW, 6X4, 3 AXLE	Highway Truck	230	59%	1	24	53	4.2553	0.0003	0.0001	4.2939
EP T50XX011 TRUCK, HIGHWAY, CREW, 3/4 TON PICKUP, 4X4	Highway Truck	230	59%	2	1173	2592	207.9773	0.0146	0.0051	209.8650
TRAILER MOUNTED	Chippers/Stump Grinders	650	43%	1	191	422	68.9665	0.0049	0.0017	69.5996
GEN B35Z1140 BUCKET, DRAGLINE, 3.0 CY (2.3 M3) MEDIUM WEIGHT	Dragline (crane)	350	59%	8	6868	15177	1832.7143	0.1297	0.0456	1849.5330
GEN C05Z1210 CHAINSAW, 24" - 42" (610-1,067 MM) BAR	Concrete/Industrial Saws	6	78%	1	191	422	2.2735	0.0001	0.0000	2.2834
(36 MT), 84' (25.6 M) BOOM, 4X4	Cranes	250	43%	1	24	53	3.3342	0.0002	0.0001	3.3648
CY (1.2 M3) BUCKET, 23.3' (7.1M) MAX DIGGING DEPTH	Excavators	238	59%	1	24	53	4.4032	0.0003	0.0001	4.4432
BUCKET, 4X4,	Tractor/Loader/Backhoe	130	21%	1	381	842	15.8351	0.0010	0.0003	15.9584
AND BLADE, WHEEL, 4X4	Log Skidder	119	59%	1	383	846	35.1316	0.0025	0.0009	35.4505
SAW CUTTER, WHEEL, 4X4	Log Skidder	200	59%	1	383	846	59.0474	0.0041	0.0015	59.5833
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	100	59%	1	191	422	16.3507	0.0010	0.0004	16.4843
AND BLADE, WHEEL, 4X4	Log Skidder	119	59%	1	45	99	4.1277	0.0003	0.0001	4.1652
SAW CUTTER, WHEEL, 4X4	Log Skidder	200	59%	1	45	99	6.9377	0.0005	0.0002	7.0007
POWERSHIFT, W/UNIVERSAL BLADE	Crawler Tractor/Dozers	100	59%	1	25	55	2.1401	0.0001	0.0000	2.1576
50,000 LB (22,680 KG) GVW TRUCK)	Highway Truck	210	59%	1	73	161	11.8177	0.0008	0.0003	11.9249
GEN T50Z7520 TRUCK, HIGHWAY, 55,000 LB (24,948 KG) GVW, 6X4, 3 AXLE	Highway Truck	310	59%	1	73	161	17.4449	0.0012	0.0004	17.6033
35,000 LBS (15,900 KG) GVW, 2 AXLE, 4X2	Highway Truck	205	59%	1	120	265	18.9638	0.0013	0.0005	19.1359
DRAGLINE/CLAMSHELL, 3.5 CY, 80' BOOM	Cranes	350	43%	1	45	99	8.7517	0.0006	0.0002	8.8320
UPB T15CA004 DOZER,CWLR, D-4H,PS	Crawler Dozers/Tractor	80	59%	1	80	177	5.4788	0.0003	0.0001	5.5235
UPB T40XX008 REAR DUMP BODY, 8.0CY (ADD 30,000 GVW TRUCK)	Truck Trailer	0	0%	1	40	88	0.0000	0.0000	0.0000	0.0000
UPB T50KE003 TRK,HWY, 46,000 GVW, 6X4, 3 AXLE	Highway Truck	230	59%	1	40	88	7.0922	0.0005	0.0002	7.1592
Totals							2338.59	0.16	0.058	2359.96

Notes:

Hours of operation scaled from the 2011 Channel Improvement Project estimate, scaling the total CY to be dredged for this project to Contract #6 from the previous Conformity Determination.

Although this bend easing will dredge 2.2 times as much material as Contract #6 of the Improvement Project, estimated emissions are lower because 2019 emission factors are lower than 2010 emission factors used in the previous analysis.

Contract Number	Reach	Duration Months	Volume CY
6	Channel to Upper Turning Basin through Upper Turning Basin and PA 9	4	881,000
	Bend Easing	4	1,946,801

Onroad Vehicles Parameters and Emissions

Table E-1. Crew Size per Equipment, per Shift

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

	Floating Crew	Shore Crew	Other Laborers	3 shift Total Weekday
Sheet Pile Driving	3	4	4	33
Bend Easing Dredging and Landfilling	46	12	12	210

Notes: Bend Easing estimate assumes the same crew size for a 30" dredge as was assumed for Conformity Determination and FEIS for the Channel Improvement Project. Shore crew was doubled relative to previous analysis because material flow will be greater.

Table E-2. Emission Factors for Employee Vehicles (g/mi)

MOVES 2014a	MOVES2014a Source ID		CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2	CH_4	N_2O
2019 National Average	Cars	21	2.108	0.110	0.007	0.028	0.002	0.048	290.4	0.0023	0.0011
	Trucks	31	3.379	0.241	0.009	0.031	0.003	0.062	382.8	0.0039	0.0019

Notes:

1. Source ID 21= passenger cars (gasoline-fueled); Source ID 31 = passenger trucks (gasoline-fueled).
2. Emission factors for CO, NO_x, $PM_{2.5}$, PM_{10}, SO_2, VOC, CO_2, CH_4, and N_2O are from MOVES2014a commuter vehicles run for the calendar year 2019 National Average Fleet, using Brazoria County, Texas conditions and worst-case hour for the first month in each quarter.
3. Based on expected commute speeds of 30-60 mph, emission factors were averaged for 27.5-72.5 mph in order to conservatively utilize higher emission rates at lower and upper end of expected range.
4. Based on the project area, urban and rural, restricted and unrestricted road types were averaged in determining emission factors.

Table E-3. Summary of Employee Vehicles Emissions (tpy)

Sheet Pile Installation, Bend Easing, Turning Notch, and Channel Widening

		MOVES Category	Vehicles per Day	Vehicle VMT/day	Travel day/yr	Annual VMT	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
Sheet Pile Driving	Cars	21	16	50	171	136,800	0.3179	0.0166	0.0010	0.0042	0.0003	0.0072	43.8	0.0004	0.0002	43.84
	Trucks	31	17	50	171	145,350	0.5415	0.0386	0.0014	0.0049	0.0004	0.0099	61.3	0.0006	0.0003	61.44
Bend Easing	Cars	21	105	50	85	446,250	1.0370	0.0541	0.0034	0.0136	0.0009	0.0234	142.8	0.0012	0.0005	143.02
	Trucks	31	105	50	85	446,250	1.6624	0.1184	0.0042	0.0151	0.0013	0.0304	188.3	0.0019	0.0009	188.64
					2019 Total		**3.5587**	**0.2276**	**0.0101**	**0.0378**	**0.0029**	**0.0709**	**436.3**	**0.0041**	**0.0019**	**436.9**

Notes: The vehicles per day estimate conservatively assumes no carpooling at all. Construction workers often arrive in crew pickups so this is conservative.
The previous Conformity Determination for the Channel Improvement Project assumed between two and three workers per vehicle.

25 miles each way was assumed for the commute.

A mix of 50/50 gasoline vehicles and gasoline light trucks was assumed for commuting which is more conservative than the MOVES 2014a pre-populated vehicle mix.