GULFPORT HARBOR, GULFPORT, MISSISSIPPI

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APPENDIX B- ECONOMICS

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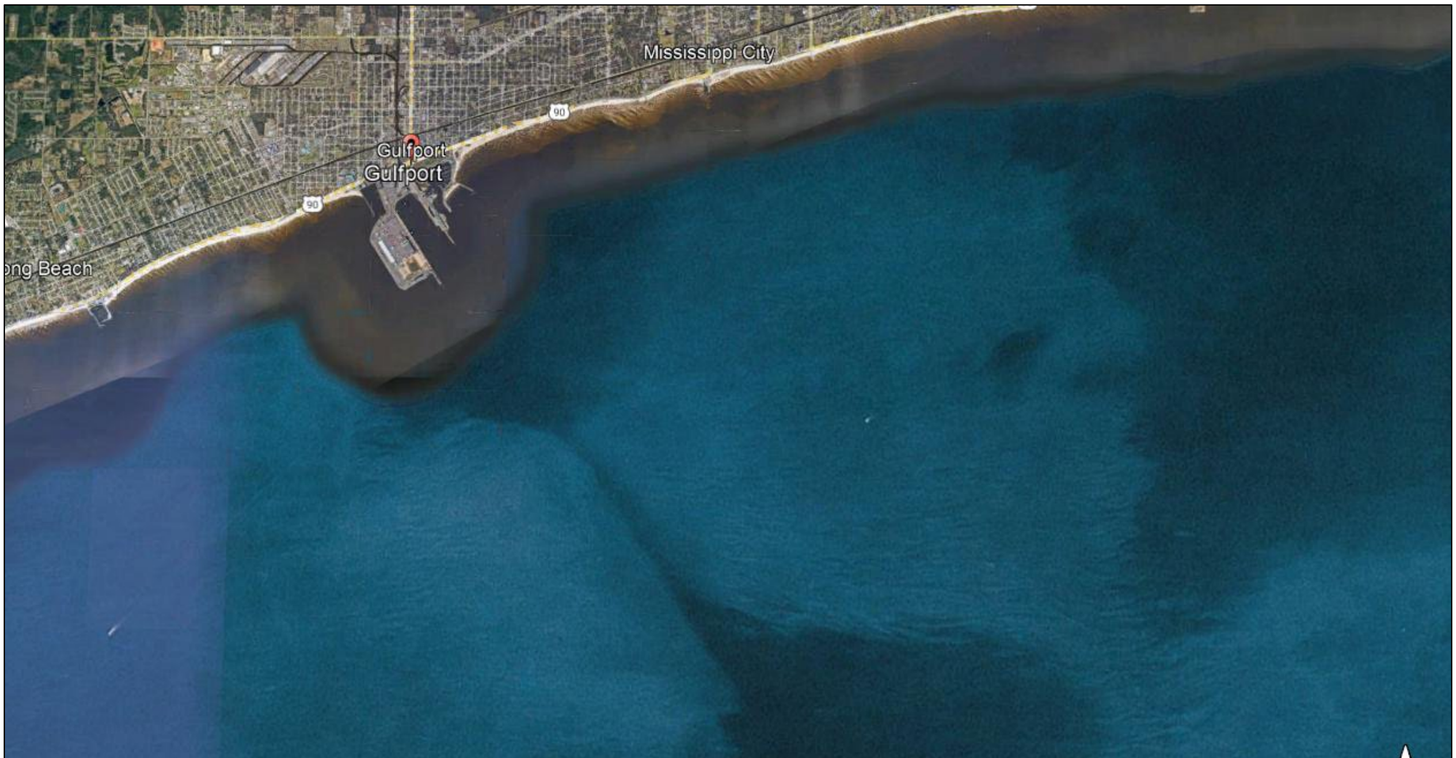


US Army Corps of Engineers
Mobile District

PORT OF GULFPORT MISSISSIPPI

TABLE OF CONTENTS

List of Tables

LIST OF FIGURES

SECTION 1.0 INTRODUCTION

1.1 Study Purpose

The role of the U.S Army Corps of Engineers (USACE) with respect to navigation is to reduce navigation hazards and enable reliable and efficient waterborne transportation systems for the movement of commerce, national security needs and recreation. The Planning Guidance Notebook (ER1105-2-100) was referenced in performing the economic analysis. National Economic Development (NED) benefits are contributions to NED that increase the value of the national output of goods and services. It is the primary basis for Federal investment in water resource projects and is measured in average annual equivalent (AAEQ) terms.

The purpose of this study is to evaluate Federal interest in alternative plans (including the No-Action Plan) for reducing transportation costs for the Port of Gulfport and assess the effects of the alternatives on the natural system and human environment, including economic development. The economic analysis focuses on the overall efficiency of the system and comparison of the cost of transportation.

The principal navigation problems are that 1) vessels with drafts in excess of ~36 feet experience draft limitations due to the existing channel dimensions, and 2) larger vessels, which are projected to call in the future with-project condition (FWPC), are not able to access the Port due to channel width and depth restrictions.

The period of analysis is 50 years, 2035 through 2084. The analysis uses the vessel operating cost from the Economic Guidance Memorandum (EGM), 17-04, Deep Draft Vessel Operating Costs FY 2019 Price Levels and the Federal discount rate from EGM, 18-01, Federal Interest Rates for Corps of Engineers Projects for Fiscal Year (FY) 2025 of 3.0 percent. The benefits in the economic analysis are derived from transportation cost savings.

1.2 Study Area Delineation

The Port of Gulfport is located on the Gulf Coast of Mississippi in Harrison County, approximately 210 nautical miles northeast of the Port of New Orleans and 90 nautical miles west of Mobile Harbor. The Gulfport Harbor Federal Navigation Channel (FNC) provides access to approximately 6,000 feet of berth space across ten berths owned and leased by the Mississippi State Port Authority (MSPA). The channel is currently 36 feet deep and 300 feet wide across the Sound Channel and 38 feet deep and 400 feet wide across the entrance and Bar Channel. The port facilities are located 18 miles from open Gulf of Mexico water and five miles from the Gulf Intracoastal Waterway. An overview of the existing Gulfport Harbor FNC is shown in Figure 1-1.

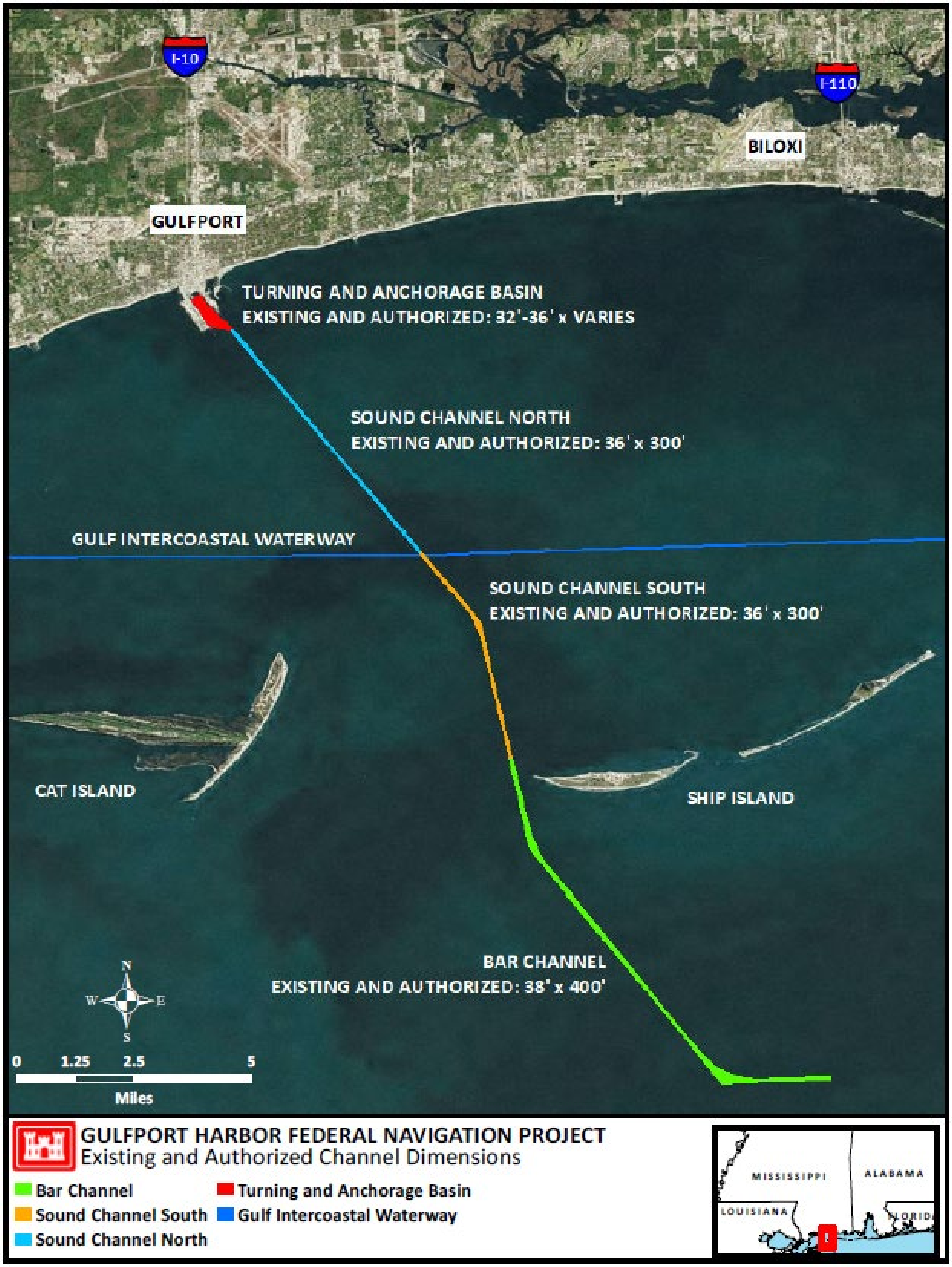


Figure 1-1: Existing Gulfport Channel

SECTION 2.0 EXISTING CONDITIONS

2.1 Economic Study Area

The Port of Gulfport is operated by the MSPA, which is an Enterprise Agency of Mississippi. All property is owned by MSPA and leased by the tenants. Figure 2-1 shows the cargo-handling terminals in the harbor. The transportation cost savings that are measured and displayed in this appendix accrue at the West Terminal. However, as indicated in the figure, both terminals (East and West) have potential to expand and benefit from a deepened channel.

Much of the Port's infrastructure was damaged beyond repair by Hurricane Katrina, one of the largest natural disasters in U.S. History, in 2005. The Port received funding from the Federal Government, Housing and Urban Development (HUD), to restore and expand the Port of Gulfport. In 2011, the state of Mississippi and the Port began a multi-year, $570 million restoration and expansion project to bring opportunities and competitiveness to the Port of Gulfport while retaining current tenants. The restoration project was largely complete by 2018.

In 2015, the Port received a Strategic Seaport Designation by the Department of Defense and the Department of Transportation (DOT) Maritime Administration (MARAD).

Land side transportation to and from Gulfport is by rail or truck based on its proximity to Interstate 10, the Kansas City Southern Railway Company (KCS), and, as of 2023, the Canadian National (CN) Railroad.

The main imports are agricultural products (mainly bananas and other fruit) and ilmenite ore while the main exports are meat, cotton, and other textile products.

2.1.1 Facilities and Infrastructure

The Port of Gulfport encompasses approximately 300 acres and has approximately 5,300 feet of berthing space for deep draft vessels. The facilities located on the water include the West Pier and East Pier. There is also a Small Craft Harbor located outside of the port area with an 11-foot draft. The Port has cargo handling and intermodal capabilities both on the West and East Piers as well as inland facilities.

Figure 2-1: Gulfport Harbor Terminals

2.1.1.1 Port Terminals

The Port is comprised of two deep water terminals, the West Pier and the East Pier. Additionally, there is a Small Craft Harbor that is located outside of the secured port area and has a draft of 11 feet.

The West Pier Terminal is the primary cargo handling pier. Area on the West Pier is leased by Dole, Chiquita, Crowley (containers) and Chemours (bulk). Additionally, the West Pier has two warehouses which are leased by Dole, Chiquita, and Crowley. The West Pier has three gantry cranes, capable of unloading container ships measuring 17 boxes across. A fourth gantry crane, capable of unloading containerships up to 19 boxes across, is on order as of 2023 and is expected to be operational by 2030. Below is a list of berths on the West Pier along with their associated length overall (LOA). Berths are maintained to a depth of 36 feet.

- Berth 1 - 700 feet LOA
- Berth 2 - 600 feet LOA
- Berth 3 - 600 feet LOA
- Berth 4 - 550 feet LOA
- Berth 5 - 550 feet LOA
- Berth 6 - 740 feet LOA
- Berth 7 (including the cat walk) - 1100 feet LOA
- RoRo Berth - 750 feet LOA

The East Pier Terminal is primarily used for breakbulk cargo. It has three berths and two warehouses. Below is the list of berths on the East Pier, each maintained to a depth of 36 feet.

- Berth 1 = 700 feet LOA
- Berth 2 = 767 feet LOA
- Berth 3 = 767 feet LOA

Additionally, Ocean Aero, a manufacturer of autonomous, surface/subsurface drones leases space on the East Pier; though most units are transported by truck when complete.

2.1.1.2 Other Infrastructure [Highway and Rail Connections]

Infrastructure at the Port allows for vessel-to-truck or vessel-to-rail connection. The Port is located off Highway 90 and 30th Avenue in Gulfport, which is approximately five miles south of Interstate 10.

The following rail services are available at the Port of Gulfport:

- Kansas City Southern Railway Company (KCS) – Class 1 rail service that provides access to the Midwest, Northern Alabama, Tennessee, and Kentucky.
- Chessie Seaboard Consolidated (CSX) – A class 1 rail that provides East/West access to New Orleans, Mobile, inland Alabama, and Georgia

- Canadian National (CN) – This new north-south intermodal railroad service began running in the Fall of 2023. It has capability to run to the U.S. Midwest (Chicago) and eventually to Canada. The train has the capacity to move 300 units per day out of Gulfport.

The Port has the following inland facilities:

- North Port Property
- Highway 90 Property
- North Port Property
- Cotton Compress
- North Port Property
- Inland Port

The West Pier has 4 rail spurs (1,070 linear feet, 1,400 linear feet, 1,300 linear feet, and 1,600 linear feet) while the North Harbor has 3 (all 800 linear feet). Monthly railcar counts in 2021 (before CN Railroad started operations at the Port) were between 600 and 1,000 per month.

The truck roads to access the Port are 30th Avenue and Highway 90. Trucks connect to I-10 using 30th Avenue, Highway 49, or Canal Road.

Initial estimates show that without additional land expansion of the Port, twenty-equivalent unit (TEU) capacity is at least 800,000 TEUs annually.

2.2 Historical Commerce

The Gulfport FNC is used to move close to two million metric tons of cargo annually. Historical commerce data was gathered from the Waterborne Commerce Statistical Center (WCSC), National Navigation Operation & Management Performance Evaluation & Assessment System (NNOMPEAS), and the Port.

The WCSC data provides overall tonnage and TEU levels as well as tonnage levels by commodity. NNOMPEAS provides data at the vessel-call level, including commodity, tonnage, and vessel specification information. For detailed analysis of the NNOMPEAS data, the most recent five years of available data at the time of the analysis was used, which was 2016 through 2020. This data captures the peak tonnage level in 2017 as well as the downturn in tonnage experienced in 2020 that was related to the COVID-19 pandemic. Therefore, these years were considered a practical representation of typical cargo movement at the Port. Though the recovery to throughput tonnage from COVID-19 impacts is not captured in this data, Figure 2-2, above, shows that tonnage levels did in fact rebound in 2021 and 2022.

As shown in Figure 2-2, the volume of cargo handled through Gulfport between 2013 and 2022 was 1.8 million metric tons. The figure also shows that the vast majority of cargo handled via the channel is moving to and from foreign countries. Domestic cargo (i.e., receipts and shipments to and from the contiguous and non-contiguous territories of the United States) accounted for approximately 10-15% of cargo between 2013 and 2016, but in recent years, it has accounted for less than 2% of total tonnage.

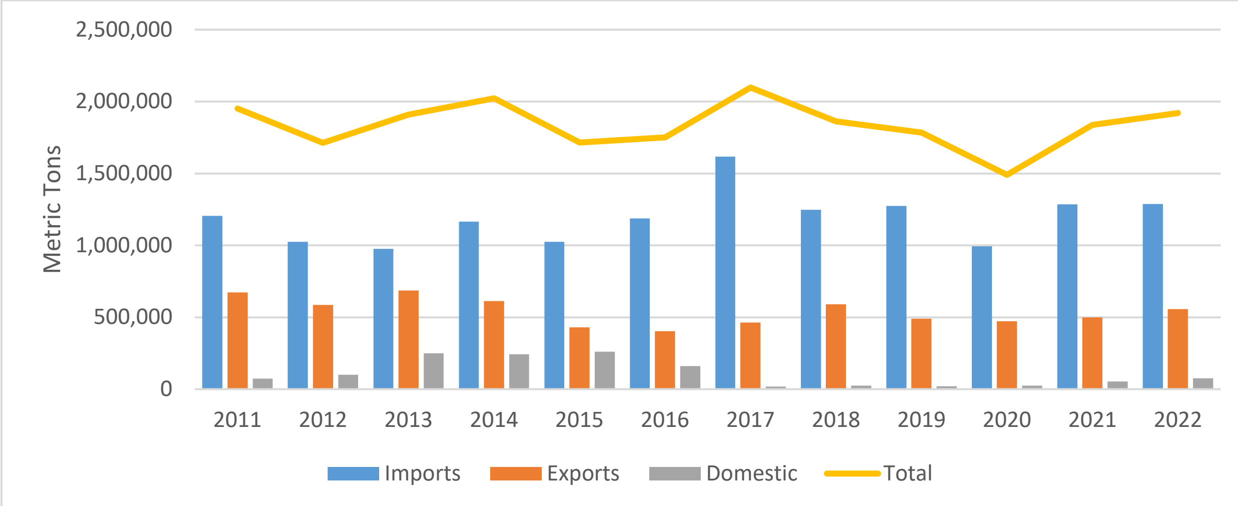


Figure 2-2: Imports, Exports, and Domestic Tonnage Totals (2011-2022)

2.2.1 Cargo Types

The cargo is carried primarily in containerships and bulk carriers with occasional barges. Figure 2-3 shows the distribution of foreign cargo by vessel type between 2016 and 2020 according to NNOMPEAS data. Approximately 60-70% of tonnage is carried on container ships while 20-30% is carried on bulk vessels. Approximately 3% of tonnage in a given year is carried on a different type of vessel.

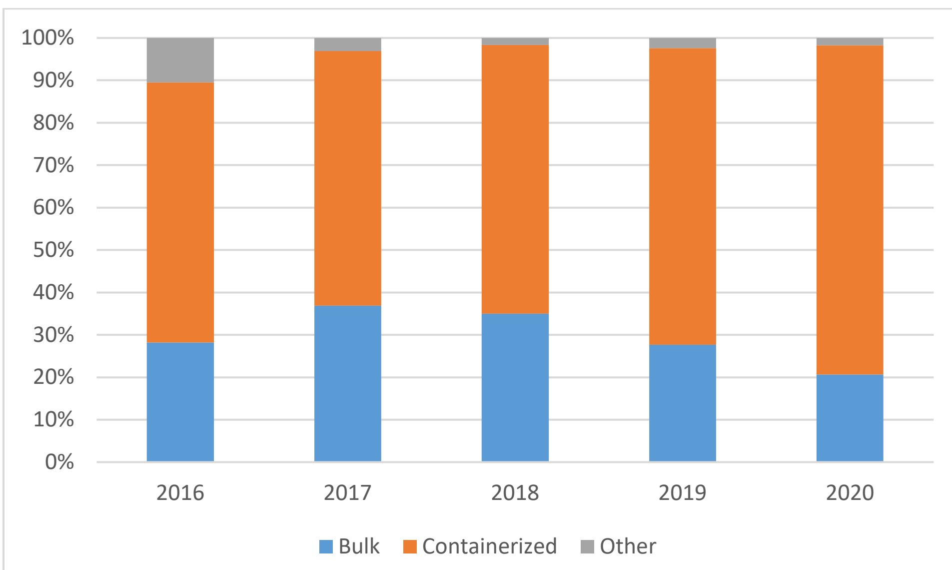


Figure 2-3: Tonnage Distribution by Cargo Type

2.2.2 Commodity Types

As discussed in the previous section, the majority of cargo is containerized and bulk.

Containerized cargo consists mainly of food products, cotton, textiles, and paper. Bananas and other fruit imported by Dole and Chiquita account for 30-40% of overall tonnage moved through Gulfport in recent years (2016-2020).

The other main commodity activity is the import of ilmenite ore for use at the Chemours' Mississippi plant to produce the final product of titanium dioxide. The finished product is trucked to New Orleans from the Mississippi plant and exported. Its main use is as a coating in paint cans. With a deeper channel, there is potential to export the final product from Gulfport via container ship. Limestone activity drove volumes of crude materials up during the Gulfport terminal restoration, but that activity ceased in 2018.

Based on data for years 2011 to 2022, food and farm products accounted for an average of 40% of total tonnage; crude materials account for 31%, Manufactured machinery and equipment accounted for 14%, and Primary manufactured goods accounted for 12%. Figure 2-4 shows the commodity distribution from 2010 to 2014 for both foreign and domestic (import and export) cargo.

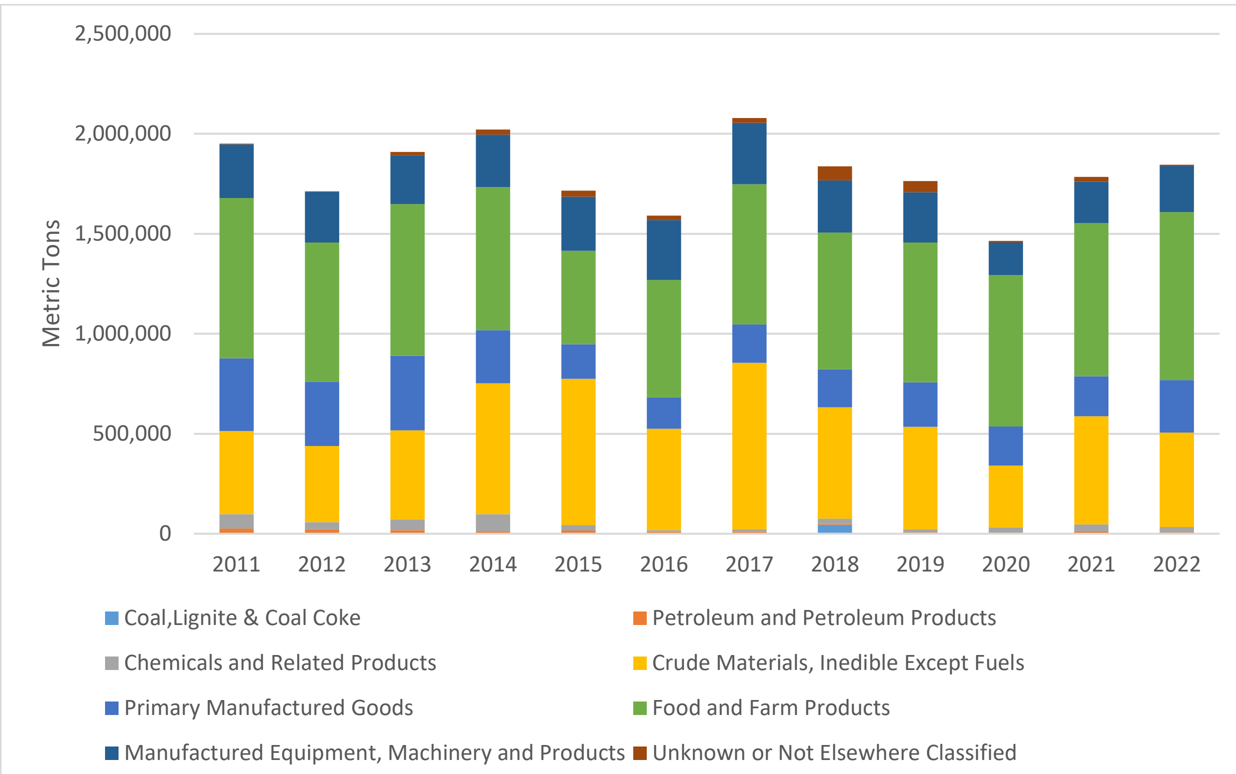


Figure 2-4: Gulfport Commodity Type Distribution (2013-2022)

2.2.3 Containerized Cargo

As of 2023, three container services were calling at Gulfport. Table 2-1 shows the operator, service, vessel TEU capacity and trade area. Current routes include services to the Central America and the Gulf.

Table 2-1: Existing Terminal Services

Operator	Vessel TEUs	Routes	Trade Areas
Dole	3,000	Central America/Caribbean	Central America • Freeport • Gulfport • Tampa
Chiquita	2,000-3,000	Central America/Caribbean	Central America • Freeport • Gulfport • Everglades
Crowley	1,000	Central America/Caribbean	Central America • Gulfport

2.2.3.1 *Container Facility and Capabilities*

Between 2019 and 2022, an average of 142,287 loaded twenty equivalent units (TEUs) were handled through Gulfport. When including empty TEUs, an average of 188,555 TEUs were handled during the same timeframe. In terms of container tonnage, imports currently account for approximately 60% of tonnage while exports account for 40%. Figure 2-5 shows import and export loaded TEUs from 2013 to 2021 according to WCSC data.

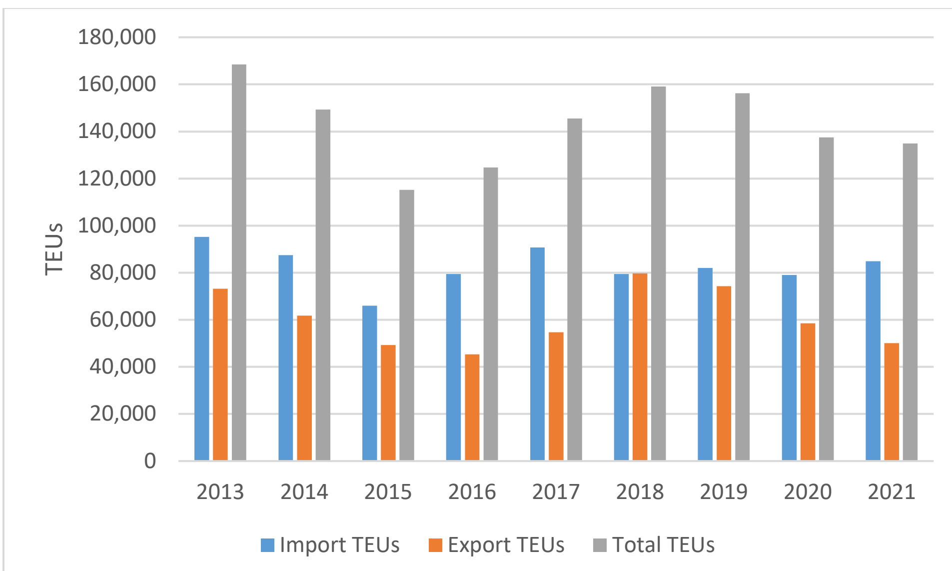


Figure 2-5: Import, Export, and Total TEUs (Loaded)

2.3 Fleet Characteristics

Vessel data was obtained from NNOMPEAS and the Port of Gulfport logs to compile vessel characteristics of the fleet calling the Port. As discussed in Section 2.2.1, approximately 60-70% of tonnage in recent years has been containerized and 30-40% of tonnage has been bulk cargo. Table 2-2 displays all vessel types that called at Gulfport between 2016 and 2020 as well as their associated minimum and maximum dimensions.

Table 2-2: Vessel Fleet Dimensions Summary

Vessel Types	Deadweight Tons (DWT)		Length Overall (ft)		Vessel Width (ft)		Design Draft (ft)	
	Min	Max	Min	Max	Min	Max	Min	Max
Bulk Carrier	30,478	66,721	576	656	91	119	32	44
Bulk Carrier, Self-discharging	46,606	73,609	615	810	106	106	37	45
Chemical/Products Tanker	22,430	22,430	492	492	81	81	33	33
Container Ship	10,831	35,465	441	695	73	100	24	38
Crane Vessel	21,550	21,550	497	497	153	153	31	31
Crew/Supply Vessel	311	1,753	194	202	32	34	7	18
General Cargo Ship	7,428	32,752	393	594	66	94	25	34
Heavy Load Carrier	7,572	45,028	329	791	69	138	24	28
Offshore Support Vessel	4,243	21,011	298	591	65	106	20	35
Open Hatch Cargo Ship	33,143	33,398	581	591	93	94	33	33
Passenger/Cruise	6,953	13,294	880	952	117	118	26	27
Platform Supply Ship	2,738	6,163	265	320	54	64	14	21
Research Survey Vessel	50	4,047	177	281	34	65	18	20
Ro-Ro Cargo Ship	25,957	25,957	738	738	106	106	31	31
Tug	327	669	86	126	30	35	13	16
Vehicles Carrier	19,670	21,233	653	656	106	106	32	33
Well Stimulation Vessel	3,117	3,117	260	260	60	60	17	17

An analysis of the existing fleet data and cargo data reveals that the only types of cargo-carrying vessels between 2016 and 2020 were bulk carriers and container ships with the occasional barge. Very rarely, an open hatch cargo ship or vehicle carrier called at the Port between 2016 and 2020.

2.3.1 Containership Fleet

The current containership fleet consists of vessels between 10,000 and 35,000 deadweight tons with a maximum TEU capacity of 2,600. Figure 2-6 provides an overview of calls by vessel size between 2016 and 2020.

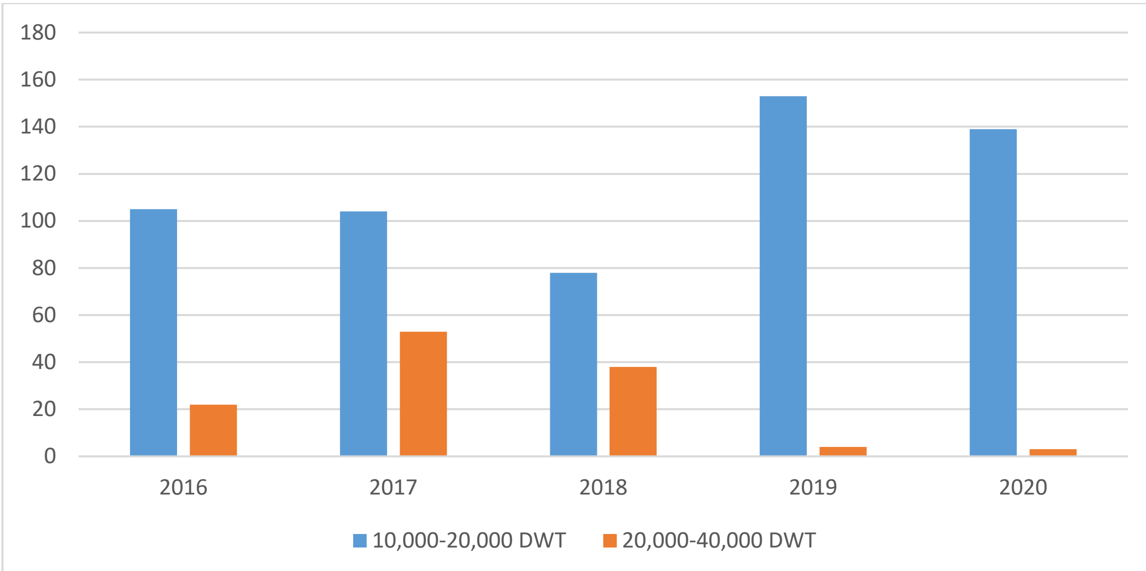


Figure 2-6: Container Vessel Call Counts by DWT Capacity

It is likely that current port users will shift to using vessels at the top of this range more often in the future. Additionally, this study assumes that terminal expansions, discussed further in Section 3.1 will lead to larger vessels calling the future. The dimensions of the largest container ship currently calling at the Port are listed in Table 2-3.

Table 2-3: Largest Gulfport Harbor Containership Characteristics

Vessel Name	Beam	Draft	LOA	DWT	TEU Capacity
Chiquita Trader	98.4	37.4	695.1	35,465	2,490

2.3.2 Bulk Fleet

The bulk fleet consists almost exclusively of dry bulk carriers. Figure 2-7 provides an overview of calls by vessel size between 2016 and 2020, according to NNOMPEAS data. Bulk vessel class names vary by source. The descriptors below are based on Marine Insight's classification, which classifies Handysize vessels as those between 25,000 and 40,000 DWT; Handymax are those between 40,000 and 60,000 DWT; and Panamax are those between 60,000 and 100,000 DWT. At Gulfport, the DWT capacity of Panamax-sized vessels is generally less than 70,000 DWT.

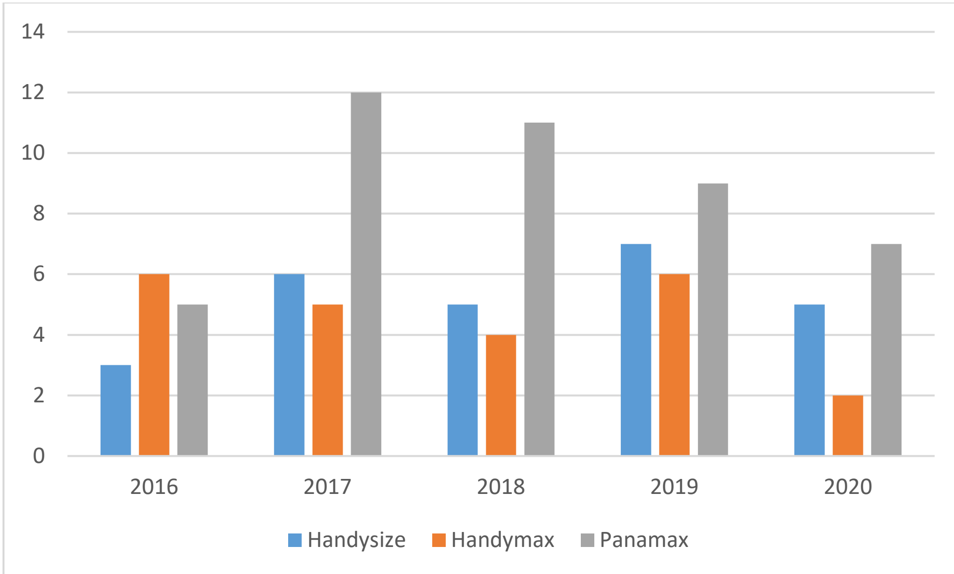


Figure 2-7: Bulk Vessel Calls Counts by Vessel Class

Between 2016 and 2020, the largest bulk vessels calling at Gulfport in terms of design draft and deadweight tonnage, respectively, were the African Leopard and the African Buzzard. Their vessel dimensions are listed in Table 2-4.

Table 2-4: Bulk Vessel Dimensions

Vessel Name	Vessel DWT	Vessel Design Draft	Vessel LOA (ft)	Vessel Beam (ft)
African Leopard	63435	44	656.1	106.4
African Buzzard	66652	42.4	656.2	118.8

2.4 Shipping Operations

The Gulfport Harbor Pilots do not have specific rules or restrictions in place for the channel that pertain to vessels that are currently calling. Based on discussions with the pilots, a large vessel calling at the Port in the past required daylight restriction and an additional pilot, so it is a reasonable assumption that larger vessels calling in the FWP and FWOP may be subject to additional restrictions.

2.4.1 Underkeel Clearance

The measure of underkeel clearance (UKC) for economic studies is applied according to ER 1105-2-100. According to this guidance, UKC is evaluated based on actual vessel operator and pilot practices within a harbor and subject to present conditions, with adjustment as appropriate or practical for with-project conditions. Discussions with the Gulfport harbor pilots indicated that there are no existing rules related to UKC established by the pilots; however, companies will frequently require a meter of UKC. It is assumed that this requirement would become more vital as vessel sizes increase. As such, a UKC of 3 feet is utilized for this analysis. This assumption is consistent with requirements at other ports along the Gulf Coast.

2.4.2 Tidal Range

The tidal variation in the Mississippi Sound and adjacent waters is diurnal with an average tide cycle of 24.8 hours. The mean diurnal tidal range near Harrison County Beaches as show in Figure 2-5 is 1.6 feet with spring tides reaching a range of 1.8 feet. According to discussions with the harbor pilots, tide does not cause discernible differences in channel depth and is not relied upon for vessels to transit the channel. It is assumed that this will remain the case in the future with-project conditions.

2.4.3 Sailing Practices

Figure 2-8 and Figure 2-9 show the vessel frequency and sailing drafts for bulk carriers and containerships between 2016 and 2020. It can be observed in these two figures that while the majority of vessels draft below 30 feet, the frequency of vessels drafting deeper increased during the last four years of available data (2016 through 2020).

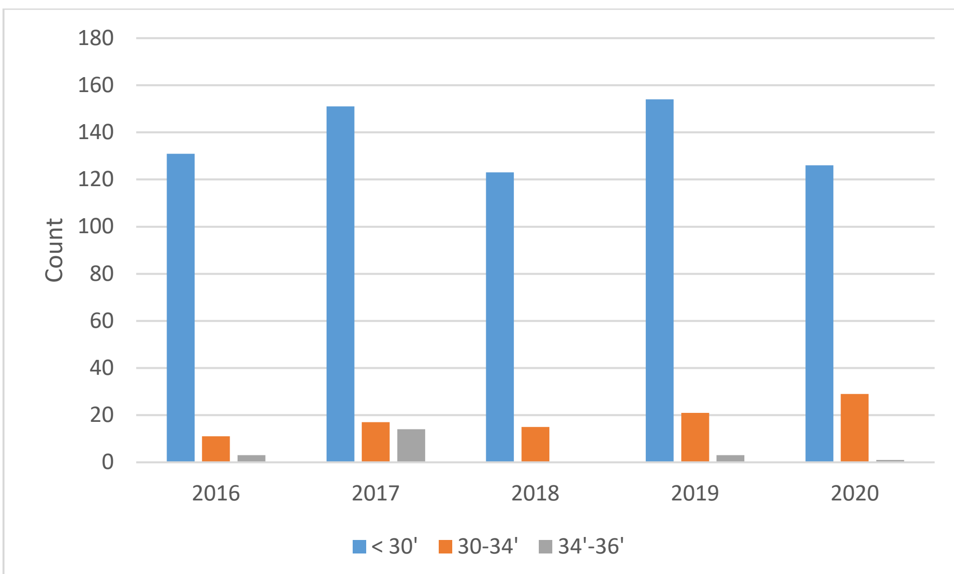


Figure 2-8: Arrival Drafts of Bulk Carriers and Containerships

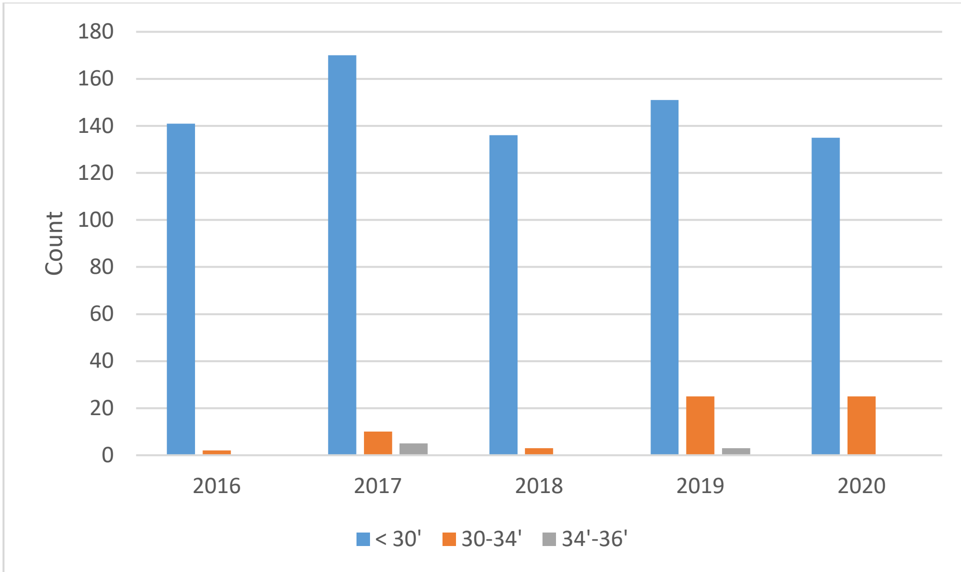


Figure 2-9: Departure Drafts of Bulk Carriers and Containerships

SECTION 3.0 FUTURE CONDITIONS

3.1 Terminal Expansions

The Port has multiple expansion/development projects planned or in progress, including the three described below that are anticipated to increase the cargo-handling capacity of the Port.

3.1.1 Terminal 4 Development

In 2024, Gulfport entered into a partnership with Ports America to develop a new cargo-handling terminal on the West Pier (Terminal 4). The partnership began with a $43 million investment by Ports America, and the build-out of Terminal 4 is expected to be complete by 2030. The area was previously an unpaved and unused area of the West Pier that had access to berthing space.

The development of Terminal 4 will result in additional containers being moved through Gulfport in the future without project (FWOP) and future with project (FWP) conditions. The projected throughput associated with this development is discussed in more detail in Section 3.3.

3.1.2 East and West Pier Expansion

An Environmental Impact Statement (EIS) was completed in 2017 for a project that would expand the East and West Piers by 197 acres. This project would extend the West Pier to the south (past Terminal 4) and would also add acreage to the East Pier. As of 2023, there were no channel users for this area whose activity would impact the cargo throughput of the Port. Thus, no additional tonnage is attributed to this expansion.

3.2 Roll-On/Roll-Off Cargo

Roll-on/Roll-Off cargo (also referred to as Ro-Ro) is cargo that can be rolled on and off a vessel at its import/export destinations. In this context, Ro-Ro refers to automobiles and equipment (e.g., farm equipment). Ro-Ro cargo has been moved via Gulfport very sporadically in the past; however, it is anticipated that it will become a more prevalent activity at Gulfport with the development of Terminal 4 with volumes up to 35,000 tons projected to be moved annually within the period of analysis.

There is potential for vehicle carriers or Ro-Ro vessels with design drafts deeper than 36 feet to call at Gulfport. However, as displayed in Table 3-1, the majority (95%) of Ro-Ro vessels in the world fleet have design drafts less than 36 feet. Thus, benefits attributed to deepening are not expected to be significant for this vessel type and were not calculated at this time.

Table 3-1: Vehicle Carrier World Fleet

Vessel Maximum Draft	Count of Vessels	Percentage of Vessels
0-29.99 ft	331	35%
30-32.99 ft	427	45%
33-35.99 ft	138	15%
36-39 ft	50	5%
40+ ft	5	1%
Total	951	100%

3.3 Commodity Forecast

An essential step when evaluating navigation improvements is to analyze the types and volumes of cargo moving through the Port. Trends in cargo history can offer insights into a Port's long-term trade forecasts and thus the estimated cargo volume upon which future vessel calls are based. Estimates of Gulfport's future commerce for the period of analysis are based on existing and historical commodity movements as well as projections for future operations at Terminal 4.

Under FWOP and FWP conditions, the Terminal 4 development is anticipated to lead to additional tonnage moving through the Port as described in Section 3.1.1. An equal volume of cargo is assumed to move through Gulfport under the FWOP and FWP conditions. However, a deepening project will allow shippers to use vessels more efficiently or take advantage of larger vessels. This efficiency translates to savings and is the main driver of NED. The Port's share of the commodity projections remains the same as existing condition. Cargo projections ultimately drive vessel fleet projections in terms of the numbers and sizes of vessels for without- and with-project conditions. Table 3-2 shows an overview of the baseline tonnage levels and forecast sources for the three main commodity groups.

Table 3-2: Baseline and Forecast Sources

Commodity Name/Type	Baseline Source	Forecast Source
Containers	• Terminal 4: Ports America Volume Projection Memo • Existing Terminals: Empirical Data	• Terminal 4: Ports America Volume Projection Memo • Existing Terminals: Martin Associates
Non-Ferrous Ore (Ilmenite)	Average 2019-2021	• Global Trade Analytic Suite (GTAS)
Breakbulk	• Existing Breakbulk: Average of 2018-2020 WCSC Data • New RoRo activity: Ports America Volume Projection Memo	• Existing Breakbulk: Average was held constant • New RoRo activity: Ports America Volume Projection Memo

3.3.1 Container TEU and Tonnage Baseline

Empirical data for container TEU and tonnage levels that included the built-out and operational Terminal 4 were unavailable at the time of the feasibility study. Although an operational Terminal 4 is considered a FWP and FWOP condition, it is not anticipated to be fully operational until 2030. Thus, projections from a variety of sources were considered to develop a container TEU and tonnage forecast that included Terminal 4.

In recent years, multiple sources created TEU forecasts for the Port that included new services calling at Terminal 4 in a future without-project condition. An overview of these projections is displayed in Table 3-3.

Table 3-3: FWOP TEU Projections Including New Container Services

Source	2041 TEU Projection	2054 TEU Projection
Jacobs (203 Report)	303,594	402,774
WSP (Master Plan)	330,000	NA
Ports America (Volume Projection)	337,656	384,284

Because Ports America is the new Terminal 4 operator and their TEU projections were in line with other sources, the Ports America volume projection was used as a baseline for the TEU forecast. Ports America also provided a forecast for Roll-On Roll-Off (Ro-Ro) cargo at the Port in the future.

3.3.2 Container TEU and Tonnage Forecast

The TEU projections provided in the Ports America Volume Projection memo mentioned in Table 3-2 is shown below.

Table 3-4: Loaded TEUs by Outyear

Commodity	2035	2045	2055	2065
Existing Terminals	**175,647**	**184,630**	**194,072**	**203,996**
Import	122,953	129,241	135,850	142,797
Export	52,694	55,389	58,221	61,199
Terminal 4	**130,149**	**166,737**	**192,691**	**224,727**
Import	52,060	66,695	77,622	89,891
Export	78,089	100,042	116,433	134,836
Total	**305,796**	**351,367**	**388,126**	**428,724**

Because the TEU forecast was provided for the entire Port, it was necessary to extrapolate import and export tonnage as well as the forecasted tonnage by route group. Based on discussions with the new terminal operator, it was assumed that Terminal 4 will handle 40% imports and 60% exports. The existing terminal tonnage stays at its historical level of approximately 70% imports and 30% exports. Terminal 4 was assumed to ship and receive cargo from the four route groups mentioned in Section 3.3 while the Existing Terminals route group continues to ship and receive cargo only to and from Central America, as it does in the existing condition.

Because the TEUs associated with Terminal 4 will be moved on to-be-determined services and routes, the methodology to obtain a forecast by trade route was different for this study. Various sources of forecasts and empirical data were consulted to serve as proxies for the container TEU forecast by route. Future services and trade lanes were grouped into four "routes," and it was assumed that all four would benefit from a channel deepening. The following are the routes used for this study:

- Central America/Caribbean to North America (CAR-CA-NCSA)
- East Coast South America to North America (ECSA-NA)
- Northern Europe and Mediterranean to North America (NEU-MED-NA)
- Far East to North America via Panama Canal (FE-NA-PAN)

To convert TEUs to tonnage, other ports along the Gulf were consulted to determine a reasonable distribution of route groups that would call at Terminal 4 in the FWOP and FWP condition. A summary of the distribution of route groups by outyear is contained in Table 3-5.

Table 3-5: Average TEU Distribution by Route Groups

Route Group	Import	Export
Existing Terminals		
Central America/Caribbean	100%	100%
Terminal 4		
Central America/Caribbean	35%	18%
East Coast South America	15%	16%
Northern Europe and Mediterranean	24%	26%
Far East	25%	41%

An average TEU weight was estimated for each route group and multiplied by the total number of forecasted TEUs. That number was then multiplied by the route group distribution percentage to obtain a tonnage forecast by route group. The TEU weight by route group that was used for the forecast is listed in Table 3-6, and the resulting TEU tonnage forecast by is displayed in Table 3-7.

Table 3-6: TEU Weight by Route Group

Route	TEU Weight
Central America/Caribbean	10.2
East Coast South America	13.0
Northern Europe and Mediterranean	11.0
Far East	10.4

Table 3-7: Container Tonnage Forecast by Outyear

Route Group	2035	2045	2055	2065
Imports				
CAR-CA-NCSA	1,308,705	1,415,257	1,514,819	1,622,306
ECSA-NA	96,258	130,155	151,478	175,422
FE-NA	128,378	168,927	196,603	227,678
NEU-MED-NA	149,488	185,780	216,217	250,393
Subtotal	1,682,830	1,900,119	2,079,117	2,275,798
Exports				
CAR-CA-NCSA	629,106	681,961	736,987	796,927
ECSA-NA	163,453	204,603	238,123	275,762
FE-NA	187,243	273,347	318,130	368,415
NEU-MED-NA	361,617	446,765	519,960	602,146
Subtotal	1,341,419	1,606,676	1,813,200	2,043,250
Total	3,024,249	3,506,794	3,892,317	4,319,048

3.3.3 Growth Rates

This subsection will summarize the growth rates that were used to forecast or that resulted from each type of commodity forecasted. Tonnage levels were held constant from 2065 through the end of the period of analysis; hence, the 0% growth rates during that time period.

3.3.3.1 Container Tonnage Growth Rates

For many studies, commodity forecasts are completed by developing a baseline tonnage level (typically an average of the most recent years of data) and applying a growth rate to the baseline. Because the new activity anticipated at Gulfport did not have a baseline upon which to forecast, existing forecasts from other sources were used and the results were reviewed for reasonableness by comparing them to other forecast sources for Gulfport as well as comparing the resulting growth rates to recent forecasts for container ports along the Gulf.

The growth rates resulting from the container forecast are listed in Table 3-8 below. Imports and exports were not forecasted separately; instead, the import/export distributions described in Section 3.3.2 were used to calculate import and export tonnage values.

3.3.3.2 Non-Ferrous Ore (Ilmenite) Import Forecast

As noted in Table 3-2, the Global Trade Analytics Suite (GTAS) forecasting tool was used to obtain a growth rate to apply to the non-ferrous ore imported into Gulfport.

The empirical tonnage levels as well as the forecasted growth (both positive and negative) from GTAS have been volatile in recent years. Due to this volatility and uncertainty of future growth at the Chemours plant in Gulfport, it was decided to average the latest three years (2019 to 2021) of empirical ilmenite tonnage at Gulfport to obtain a baseline. This baseline was held constant through 2027 when the high growth for non-ferrous ore forecasted by GTAS leveled out, as the channel users at Gulfport do not anticipate experiencing high growth in ilmenite imports in the near future. After 2028, the GTAS forecasts were applied until the last available forecast year, 2041. A growth rate of 1% was used after the latest available forecast year, and the forecast was held constant after 2055.

3.3.3.3 Breakbulk Forecast

Breakbulk activity has been sporadic at the Port over the latest years of available data, ranging from an estimated 15,000 to 30,000 metric tons annually between 2011 and 2021, per Waterborne Commerce data. As part of the Terminal 4 expansion, additional breakbulk, in the form of Ro-Ro cargo, is anticipated at the Port. Tonnage from the most recent ten years of available data was averaged to obtain a baseline breakbulk tonnage rate of 21,649 annually. This baseline was held constant, and the Ro-Ro tonnage forecast from Ports America was added to it to obtain a breakbulk forecast. This forecast was prepared for informational purposes, as breakbulk cargo is not considered benefiting from the deepening at this time.

Table 3-8: Commodity Forecast Rates of Change

Commodity Type	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Containers – Existing Terminals	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Containers – Terminal 4	4.5%	4.4%	4.3%	4.3%	4.2%	4.1%	4.0%	4.0%	3.9%	3.8%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.5%	1.5%	1.5%	1.5%
Non-ferrous ore Imports	2%	4%	3%	4%	4%	4%	3%	3%	3%	3%	3%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Breakbulk	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
(Continued)	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**	**2073**	**2074**	**2074**
Containers – Existing Terminals	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Containers – Terminal 4	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-ferrous ore Imports	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Breakbulk	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

3.4 Vessel Fleet Forecast

In addition to the commodity forecast, a forecast of the future fleet is required when evaluating navigation projects. To assist in vessel fleet forecast and benefits estimation, the containership fleet was split into “classes” by grouping vessels with similar dimensions.

Sub-Panamax (SPX) and Panamax (PX), generally 4,800 TEUs and below, refer to those vessels that fit through the Panama Canal locks prior to its redesign. Post-Panamax Generation I and II, generally 9,900 TEUs and below, refer to those vessels that were too large to fit through the original Panama Canal. Post-Panamax Generation III, generally 15,000 TEUs and below, refers to the “New Panamax” vessels that were designed to fit through the expanded Panama Canal locks, which opened in 2016. The dimensions associated with these vessel classes, for purposes of this study, are listed in Table 3-9.

Table 3-9: Containership Dimensions by Vessel Class

Vessel Fleet Subdivision (Containerships)		From	To
Sub Panamax	Beam	0	98
	Draft	8.2	38.1
	LOA	222	813.3
	TEUs	Up to	2,800
Panamax	Beam	98	106
	Draft	30.8	44.8
	LOA	572	970
	TEUs	2,801	4,800
Post-Panamax Generation I (Post-Panamax)	Beam	106	138
	Draft	35.4	47.6
	LOA	661	1045
	TEUs	4,801	6,800
Post-Panamax Generation II (Super Post-Panamax)	Beam	138	144
	Draft	39.4	49.2
	LOA	911	1,205
	TEUs	6,801	9,900
Post-Panamax Generation III (New Panamax, or Ultra Post-Panamax)	Beam	144	168
	Draft	Up to	51.2
	LOA	Up to	1220
	TEUs	9,901	15,000

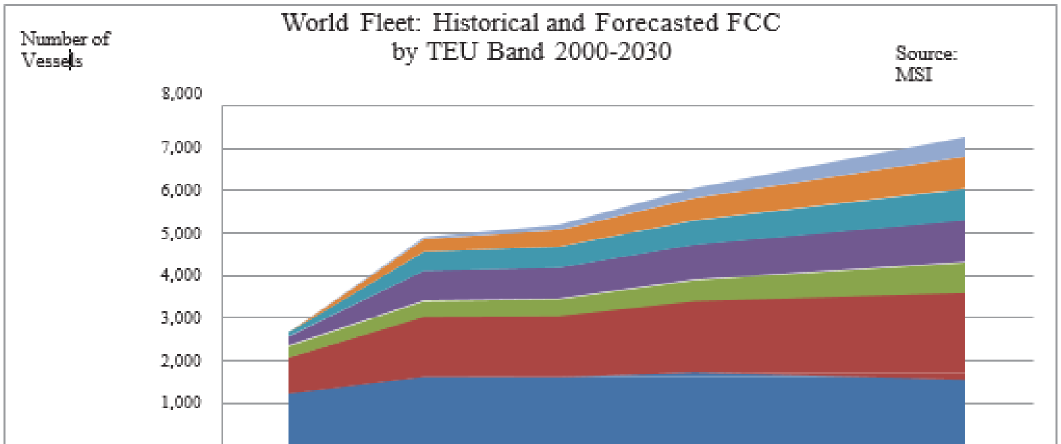
3.4.1 World Containership Fleet

To develop projections of the future containership fleet calling Gulfport Harbor, the study made use of world fleet forecasts of containerships developed by Maritime Strategies Inc (MSI) and used in recent feasibility studies for Houston, Mobile, and New Orleans.

MSI's forecasting technique begins with performing a detailed review of the current world fleet and how it is deployed on the trade routes of the world. Forecasting of the world fleet was made possible through MSI's proprietary Container Shipping Planning Service (CSPS) model, which applies historical and forecasted time series data from 1980–2030 for:

- Macroeconomic and trade variables including:
    - Annual Gross Domestic Product (GDP) growth rates by region
    - Industrial production
    - Population growth
    - Inflation and interest rates
    - Currency exchange
- Global container trade and movements in TEU lifts by region including:
    - Primary lifts
    - Transshipment lifts
    - Loaded/Empty lifts
- Sector-specific fleet dynamics including:
    - Fleet nominal capacity by vessel size and age
    - Contracting, order book, deliveries, cancellations, slippage and scrapping
    - Container fleet by size
    - Sector-specific supply/demand balances
    - Time charter rates and vessel operating costs
- Freight rates including:
    - Headhaul rates
    - Backhaul rates
    - New building, second-hand (by age) and scrap prices for standard sizes
- Data sources for the CSPS model include:
    - Macroeconomics: Oxford Economics, leading investment banks
    - World Trade: United Nations Conference of Trade and Development, Drewry Shipping Consultants, Containerization International
    - Fleet Supply: LR-Fairplay, Worldyards, Howe Robinson
    - Charter Rates, Freight Rates and Vessel Prices: Drewry Shipping Consultants, Howe Robinson, Clarksons, and various contacts at shipping lines

When evaluating data on vessel composition, vessel age, and container markets, MSI then considered the "order book" to estimate new deliveries to the fleet into the future. Vessel scrapping is accounted for based on historical scrapping rates by vessel class and age. Containerships, particularly the largest ones, are relatively new, so widespread scrapping is not expected to take place until well in the future. Likewise, when economies are strong, vessel owners are more likely to hold onto their existing vessels (or build new ones) and less likely to scrap them. Figure 3-1 provides an overview of the world containership fleet used in this study.



	2000	2011	2015	2020	2025	2030
12 k TEU +	-	47	124	232	348	458
7.6 k to 12 k TEU	-	291	388	515	632	742
5.2 k to 7.6 k TEU	104	456	498	577	654	747
3.9 k to 5.2 k TEU	203	707	735	826	905	991
2.9 k to 3.9 k TEU	272	364	393	497	600	708
1.3 k to 2.9 k TEU	850	1,420	1,446	1,684	1,869	2,051
0.1 k to 1.3k TEU	1,214	1,604	1,596	1,706	1,633	1,537

Figure 3-1: World Fleet 2000-2030

An updated breakdown of newbuild containerships in the "order book" is shown in Figure 3-2 below. Post-Panamax Generation III vessels made up 21 percent of newbuilds as of 2021, which supports the trend of the MSI forecast.

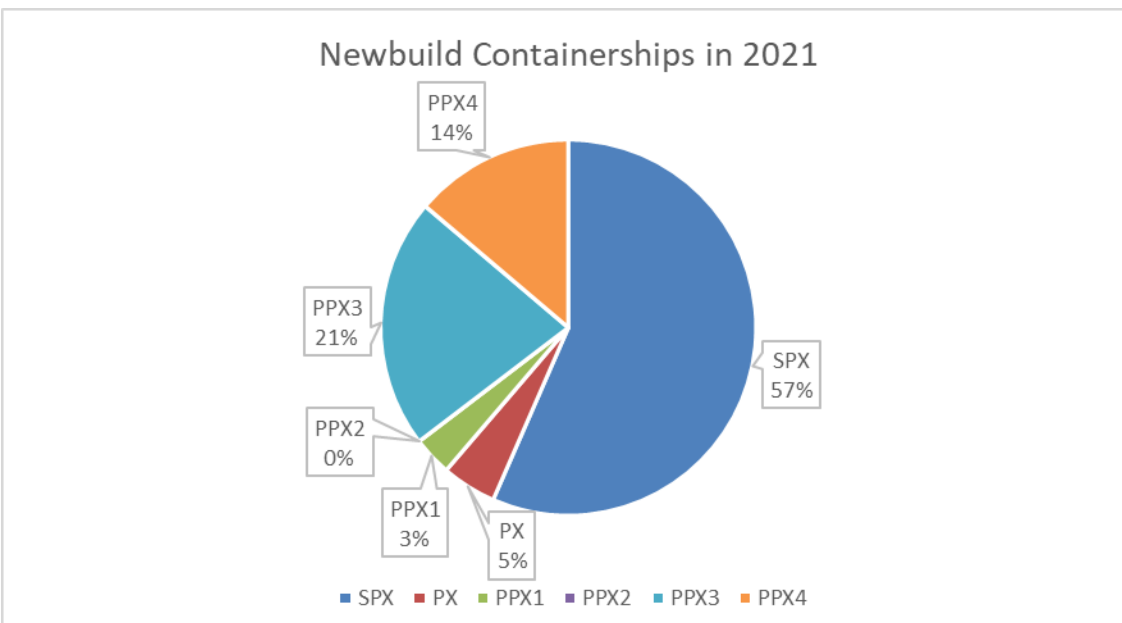


Figure 3-2: Newbuild Containerships by Vessel Class (Source: IHS SeaWeb)

3.4.2 Design Vessel

Generally, waterway improvements should be designed for optimization across the entire forecasted fleet. In the existing condition, the dimensions of the bulk carriers calling at the Port exceed the dimensions of the container vessels in terms of LOA, beam, and draft. In the future, however, larger container vessels are anticipated to call at the Port as a result of the Terminal 4 expansion.

The design vessels are defined per USACE guidance from EM 1110-2-1613 stating:

"…*the design ship or ships are selected on the basis of economic studies of the types and sizes of the ship fleet expected to use the proposed navigation channel over the project life*…" The design ship is defined by EM 1110-2-1613 as "…*the largest ship of the major commodity movers expected to use the project improvements on a frequent and continuing basis*…"

In discussions with Ports America, it was conveyed that Terminal 4 is being designed to accommodate a vessel with dimensions corresponding to that of the Post-Panamax Generation III vessel class, as defined by Table 3-9, above. Post-Panamax Generation IV vessels are being used at east and west coast ports with increased frequency, leaving PPX3 vessels to become the emergent container class on the gulf. Several recent USACE deep draft navigation studies along the Gulf Coast have selected a PPX3 vessel as their design vessel, including Houston, Mobile, and New Orleans. It is likely that vessels of these dimensions will call at Gulfport (assuming channel dimensions allow) while making other stops along the Gulf Coast. For these reasons, USACE adopted the vessel that is being used for the Terminal 4 design as the design vessel for the feasibility study and channel design. Table 3-10 displays the design vessels characteristics and dimensions.

Table 3-10: Design Vessel Characteristics

Vessel Type	DWT	Beam	LOA	Design Draft	TEU
Containership	110,000	158.5	984	47.6	10,926

3.4.3 Container Fleet Forecast for Gulfport Harbor

To develop projections of the future fleet calling at Gulfport, recent feasibility studies completed by the Deep Draft Navigation Center of Expertise (DDN PCX) were leveraged. Similar to the selection of the design vessel, it was assumed that the distribution of the container fleet in the future without- and with-project should be similar to other container ports along the Gulf given the uncertain environment in which the forecast is being developed. The study team made use of World Fleet forecasts of containerships and other vessels developed by MSI for Port Houston (2013), Port of Charleston (2015), and Port of Seattle (2016).

The MSI forecast adapted for this study used the world fleet forecast to determine the expected fleet composition at Gulfport over the study period. The forecast introduces a Post Panamax Generation 3 (PPX3) containership vessel. The MSI groups the Post

Panamax Generation 2 (PPX2) and PPX3 vessels into the same TEU band (7.6k to 12k). This study assumed a similar tonnage distribution across PPX2 and PPX3 to other Gulf Coast ports. Additionally, this study incorporated empirical vessel fleet distributions observed at the Port of Houston and Port of New Orleans to refine the original MSI forecast. Fleet forecasts were completed for four different route groups: 1) Far East to North America via Panama Canal (FE-NA-PAN), Northern Europe and Mediterranean to North America (NEU-MED-NA), East Coast South America to North America (ECSA-NA), and Central America/Caribbean to North America (CAR-CA-NCSA). The results of the fleet forecast are provided in Table 3-11. Future with-project percentages were used to inform the fleet distribution of the shallowest depth modeled (40 feet); then, the vessel calls in the class with the highest allocation priorities were held constant while vessel calls in smaller, less-efficient classes decreased as the greater depths were analyzed. This is the same approach used by the container loading tool (CLT) within the HarborSym suite of tools. Table 3-11 displays the percentage of tonnage that shifts to the new vessel classes that are able to call in the FWP condition (PPX2 and PPX3). The percentage of tonnage on the less efficient vessel classes varies, as tonnage is allocated to each vessel class in priority order, with the largest vessels being loaded first.

Table 3-11: Fleet Forecast Percentages

Route	Class	2035		2045		2055 - 2084	
		FWOP	FWP	FWOP	FWP	FWOP	FWP
Far East	SPX	0%	0%	0%	0%	0%	0%
	PX	46%	37%	38%	7%	38%	7%
	PPX1	54%	30%	62%	47%	62%	47%
	PPX2	0%	15%	0%	19%	0%	19%
	PPX3	0%	19%	0%	27%	0%	27%
Europe & Mediterranean	SPX	5%	0%	5%	0%	5%	0%
	PX	40%	22%	37%	15%	37%	16%
	PPX1	54%	44%	58%	46%	58%	45%
	PPX2	0%	14%	0%	17%	0%	17%
	PPX3	0%	20%	0%	22%	0%	22%
South America (East Coast)	SPX	11%	7%	11%	1%	11%	0%
	PX	20%	19%	20%	17%	20%	14%
	PPX1	69%	70%	69%	77%	69%	75%
	PPX2	0%	4%	0%	5%	0%	11%
	PPX3	0%	0%	0%	0%	0%	0%
Caribbean and Central America	SPX	74%	74%	74%	74%	74%	74%
	PX	26%	26%	26%	26%	26%	26%
	PPX1	0%	0%	0%	0%	0%	0%
	PPX2	0%	0%	0%	0%	0%	0%
	PPX3	0%	0%	0%	0%	0%	0%

3.4.4 Bulk Fleet Forecast - Ilmenite

The bulk fleet is described in Section 2.3.2. The average deadweight tonnage of the bulk vessels calling at Gulfport between 2016 and 2020 was 52,000 DWT. Discussions with the shippers indicated that bulk vessels calling at Gulfport would not likely shift to a larger class in the FWOP or FWP condition. It was further discussed that although a deeper channel at Gulfport would present flexibility in chartering vessels, it is not assumed that a deeper channel would result in less trips being required to meet demand. Thus, deepening benefits were not estimated. This means that a detailed load factor analysis was not completed for bulk commodities, and the fleet forecast is the same in the FWOP and FWP conditions.

Although deepening benefits were not assumed to accrue for bulk commodities, it was clear that there could be transportation efficiency gained if Gulfport were able to become the first port of call along the Gulf. The non-ferrous ore commodity forecast and the current average load size was used to develop the bulk fleet forecast shown in Table 3-12.

Transportation cost savings for the bulk fleet are described further in Section 4.2.2.

Table 3-12: Bulk Fleet Forecast (FWOP and FWP)

	Baseline	2035	2045	2055
Forecast (Metric Tons)	477,160	606,147	761,062	840,685
Average Import (Metric Tons)	26,780	26,780	26,780	26,780
Vessel Calls	18	23	28	31

3.5 Alternatives for Economic Evaluation

Alternative plans were developed to address the insufficient channel depth and width expected in the future without-project condition.

Alternatives analyzed are channel depths from 40 feet to 46 feet. Each alternative includes widening the channel by 100 feet. The widening was not analyzed separately (i.e., incrementally justified), because additional channel width is needed to accommodate the design vessel dimensions.

Analysis of existing conditions led to screening of alternatives that include the following:

- 36 through 40 feet was eliminated initially, because it was thought unlikely that net benefits would maximize at this depth, given that the design vessel in the analysis significantly exceeded this channel depth.
- The non-Federal sponsor (NFS) identified a constraint of deepening the channel greater than 46 feet. It is not required to analyze project plans greater than the plan desired by the NFS; thus, depths of 47 feet and greater were screened out.

The list of depths below are those in the focused array of alternatives. It was decided that economics would model the 40-, 42-, and 46-feet deepening alternatives and that benefits for the remaining depths could be interpolated, as there were no known break points where cost and benefits were very likely to be linear between these depths.

- 40 feet
- 41 feet
- 42 feet
- 43 feet
- 44 feet
- 45 feet
- 46 feet

SECTION 4.0 TRANSPORTATION COST SAVINGS BENEFITS ANALYSIS

The purpose of this analysis is to describe the benefits associated with the deepening and widening of the channel leading to Gulfport Harbor. NED benefits were estimated by calculating the reduction in transportation costs for each project depth.

4.1 Methodology

Channel improvement modifications result in reduced transportation cost by allowing a more efficient future fleet mix when traversing the port. With a deepened channel, carriers will be able to load vessels more efficiently and thereby reduce transiting costs. With a widened channel, carriers will be able to utilize larger vessels, as the channel will have greater beam width restrictions. In the future, these carriers are anticipated to replace smaller less efficient vessels with the larger more efficient vessels on Gulf Coast service lanes that will call on Gulfport Harbor.

There are three primary effects from channel deepening that can induce changes in the future fleet calling at Gulfport. The first is an increase in a vessel's maximum practicable loading capacity, if the vessel is depth constrained in the current channel. Channel restrictions can limit a vessels capacity by limiting its ability to load to its design draft. Deepening the channel can reduce this constraint, and the vessel's maximum practicable capacity can increase towards its design capacity if commodities are available to transit, vessel loading practices allow, and the weight of all commodities causes the vessel to draft deeper into the water. This increase in vessel capacity utilization can result in fewer vessel trips being required to transport the forecasted cargo. The second effect of increased channel depth is the increased operational reliability of water depth, which encourages the deployment of larger vessels to high volume lanes. The third effect is a consequence of the second. The increase in Post-Panamax vessels displaces the less economically efficient Panamax class vessels.

Additionally, transportation cost saving benefits result from the channel modifications aimed at reducing delays within the harbor. Currently, the Gulfport Harbor channel is one-way, but congestion delays are not present in the existing condition given the existing volume of traffic. Widening the channel is not anticipated to allow for two-way traffic. The benefits resulting from two-way traffic are not anticipated, given the projected volume of traffic in the FWOP condition, and were not measured for this analysis.

To estimate Origin-Destination (OD) cost savings benefits, a Container Loading Tool (CLT) spreadsheet was used. This CLT spreadsheet was developed to duplicate, as closely as possible, the loading process used by the HarborSym CLT. The spreadsheet's output is vessel call counts that are required to fulfill the projected TEUs (i.e., a fleet forecast). A separate spreadsheet is completed for all alternatives depths as well as each route group and out-year.

Most-likely mileage distances (by route group) and vessel operating costs (by vessel class) were then applied to the fleet forecast. The transportation costs saving benefits were then calculated from the existing 36-foot depth for each additional project depth.

Because container ship vessels typically deliver/pick up cargo at multiple ports on the same voyage, not all voyage costs (and thus cost savings) can be attributed to Gulfport. Instead, only a portion of the voyage cost is attributed to Gulfport based on the estimated share of vessel cargo that is allocated to the port. Once again, empirical data from other ports of comparable size was referenced to estimate the most likely share of cargo that would be allocated to Gulfport. These values are considered the At-Sea Allocation Fraction and were held constant between the FWOP and FWP condition.

Additionally, transportation cost savings were estimated for bulk commodities based on the opportunity to change bulk vessels' typical path along the Gulf Coast when delivering commodities to multiple Gulf Coast ports in the FWP condition.

4.1.1 Data Inputs

The data inputs to complete the deepening benefit analysis were simplified, since a HarborSym model was not built. Typical in-harbor data inputs were not used. It is assumed that the vast majority of transportation cost savings (i.e., benefits) would be realized via OD savings as opposed to in-port savings based on the objective of the study being to allow a more efficient fleet to access the channel and load deeper.

Model Parameters. The base year for the container benefits model was 2035. A model run was performed for the following years for deepening: 2035, 2040, 2055 and 2065.

General Information. Route groups were developed by evaluating the trade routes calling at Gulfport and other Gulf Coast ports. Recent USACE feasibility studies for ports along the Gulf, including Houston, New Orleans, and Mobile, utilized similar route groups for container ship benefit analysis. Due to the unknown nature of future services calling at Gulfport, this study referred to completed feasibility studies and utilized an average of the most-likely at-sea distances on each respective route. The resulting distances used to compute benefits are shown in Table 4-1.

Table 4-1: Route Group Distances

Service Type	Region	Distance (nautical mi)
Containerized Cargo	Caribbean/Central America	3,867
	East Coast South America	13,430
	Northern Europe/Mediterranean	12,297
	Far East	23,109

Vessel Operations. Hourly operating costs while in-port and at-sea were determined for all vessel classes. At-sea speeds by vessel class were also collected. The values used as the most-likely vessel operating costs (VOCs) and speeds were either the average speed/cost of the vessel class or the speed/cost of the vessel within the class that is projected to call most frequently in the FWP condition. Vessel speeds are displayed in Table 4-2. VOCs used by USACE are proprietary in nature and cannot be published.

Table 4-2: Container Ship Speeds at Sea

Vessel Type	Average Most Likely Speed at Sea
SPX	17.2
PX	21
PPX1	21.85
PPX2	20
PPX3	20

Vessels Calls. The vessel call lists are made up of forecasted vessel calls for a given year as generated by the CLT spreadsheet.

4.1.2 Containerized Vessel Call List

The containerized commodity forecast for Gulfport was allocated to the future fleet using a CLT spreadsheet. The spreadsheet produces a containership-only future vessel fleet count based on user inputs describing commodity forecasts, the available fleet, and the distribution of tonnage that should be allotted to each vessel class within the fleet. Using a user-provided synthetic fleet list, the commodity forecast demand is allocated to individual vessels from the synthetic fleet, creating a vessel call.

In addition to the commodity forecast and distribution of tonnage among the vessel classes, users provide extensive data describing containership loading patterns. The user must provide this information for each outyear and route group in the container forecast.

4.1.2.1 *Container Loading Algorithm*

The CLT spreadsheet generates a vessel call list and fleet forecast by based on user inputs. The vessels in the fleet and their associated physical characteristics are randomly selected by class from a list of vessels provided by the user.

To begin, tentative arrival draft is determined for each generated vessel based on user-provided cumulative distribution functions (CDFs). A random draw is made from that CDF and the arrival draft is initially set to that value.

The tentative arrival draft is then compared to the maximum allowable arrival draft, and set to the lesser value, that is, either the statistically estimated value or the constrained value. In this analysis, UKC requirements were taken into account when developing arrival draft curves. Also, it was assumed that prior and next port limiting depths are not a constraint, as each of the routes have ports with depths in excess of the depth at Gulfport, with the exception of Caribbean-Central America. For that route, the limiting depth was taken into account in the arrival draft curve.

Next, the CLT spreadsheet conducts a load factor analysis (LFA) given the physical characteristics of each generated vessel. The LFA explores the relationships between a ship's physical attributes, considerations for operations and attributes of the trade route cargo to evaluate the operating efficiencies of vessel classes at alternative sailing drafts. Several intermediate calculations are required. The CLT spreadsheet uses the same variables as the CLT in HarborSym, which are:

- The allocation of vessel space to vacant slots, empty and loaded containers is calculated by adding the cargo weight per box plus the box weight plus an allowance for the empty
- Total weight per loaded container = Average Lading Weight per Loaded TEU by Route (tonnes) + Average Container (Box only) Weight per TEU (tonnes) + (Average Container (Box only) Weight per TEU (tonnes)*(Percent Empty TEUs))
- Shares of vessel capacity are then calculated as:
- Cargo Share = Average Lading Weight per Loaded TEU by Route (tonnes)
- Total weight per loaded container in tonnes
- Laden Container Share = Average Container (Box only) Weight per TEU (tonnes)
- Total weight per loaded container in tonnes
- Empty Container Share = ((Average Container (Box only) Weight per TEU (tonnes))*(Percent Empty TEUs)) Total weight per loaded container in tonnes)
- Volume capacity limits are calculated as follows:
- Number of vacant slots = Nominal TEU Rating * Percent vacant slots
- Max Occupied Slots = Nominal TEU Rating - Number of vacant slots
- Max Laden TEUs = Occupied Slots/(1+Percent Empties)
- Max Empty TEUs = Occupied Slots - Laden TEUs
- Maximum Volume Restricted Tonnage is then calculated as:
- Max weight for cargo (tonnes) = Max Laden TEUs * Average Lading Weight per Loaded TEU by Route (tonnes)
- Max weight for laden boxes (tonnes) = Max Laden TEUs * Average Container (Box only) Weight per TEU (tonnes)
- Max weight for empties(tonnes) = Max Empty TEUs * Average Container (Box only) Weight per TEU (tonnes)
- Total volume restricted tonnage (cubed out tonnage)(tonnes) = Max weight for cargo + Max weight for laden boxes + Max weight for empties

The LFA proceeds similarly to the LFA in the HarborSym CLT, which is as follows:

- The initial draft is varied from the vessels maximum (loaded) to minimum (empty).
- At each sailing draft the total tonnage that can be carried is calculated using the Tons Per Inch Immersion (TPI) rating for the vessel.
- Deadweight Tonnage (DWT) Available for Vessel Draft = DWT Rating (tonnes) – [(Aggregate Maximum Summer Load Line Draft – Sailing Draft)*12 inches*TPI]
- This capacity is then allocated, first to ballast and operations to yield capacity available for cargo.
- Approximate Variable Ballast = DWT Available for Vessel Draft * Percent Assumption for Variable Ballast
- Allowance for Operations in tonnes = DWT Rating (tonnes) * Percent Allowance for Operations
- Available for Cargo = (DWT Available for Vessel Draft) - (Approximate Variable Ballast) - (Allowance for Operations)
- The capacity available for cargo is restricted if the vessel has “cubed” or “volumed” out:
- Available for Cargo adjusted for volume restriction if any (tonnes) = the lesser of Available for Cargo and Total volume restricted tonnage (cubed out tonnage)
- The tonnage available for cargo is then allocated to cargo, laden and empty containers based on the shares of vessel capacity:
- Distribution of Space Available for Cargo (tonnes) = Available for Cargo adjusted for volume restriction if any in tonnes * Cargo Share in percent
- Distribution of Space Available for Laden TEUs (tones) = Available for Cargo adjusted for volume restriction if any in tonnes * Laden Container Share in percent
- Distribution of Space Available for Empty TEUs (tonnes) = Available for Cargo adjusted for volume restriction if any * Empty Container Share
- The number of TEUs is then estimated for each share use:
- Number of Laden TEUs = Distribution of Space Available for Cargo/Average Lading Weight per Loaded TEU by Route (tonnes)
- Number Empty TEUs = Distribution of Space Available for Empty TEUs /Average Container (Box only) Weight per TEU (tonnes)
- Occupied TEU Slots on Vessel = Number of Laden TEUs + Number Empty TEUs
- Vacant Slots = Nominal TEU Rating − Occupied TEU Slots
- The CLT then calculates the ETTC (estimate of total trip cargo) for each vessel call as the cargo on board the vessel at arrival plus the cargo on board the vessel at departure, in tons.

The CLT spreadsheet refers to the user-provided distribution of tonnage by vessel class for each route and loads the specified percentage of tonnage onto each class (by user-provided allocation priority) until the forecast is satisfied.

4.1.2.2 *CLT Data for Gulfport Harbor*

A critical factor in determining benefits resulting from channel depth increases is a vessel sailing draft distribution for existing and with-project alternative depths. These vessel distributions help determine how much cargo a vessel will carry and thus how many trips are required to satisfy a commodity forecast.

Figure 4-1 through Figure 4-5 provide the arrival draft cumulative distribution functions (CDF) for containerized vessels by channel depth. The CDFs were developed by referring to arrival draft CDFs utilized in Mobile Harbor, a Gulf container port that moved a comparable amount of container tonnage at the time of the feasibility study. Vessel calls are separated into a container vessel class (SPX, PX, PPX1, PPX2, or PPX3) using the characteristics described in Table 3-9.

The arrival draft curves for Mobile Harbor were developed with the assistance of the USACE Institute for Water Resources (IWR). The assumption was made that for each additional foot of channel depth available to carriers the average Post-Panamax container vessel would use approximately 0.6 to 0.8 feet of that depth. Therefore, for the Mobile Harbor analysis, it was assumed that each Post-Panamax container vessel would sail with an additional 0.7 feet for each one-foot increment of channel depth evaluated. The analysis for Gulfport utilized the arrival draft curve for a 47-foot channel at Mobile as a proxy. Arrival drafts for depths from 40 feet to 46 feet at Gulfport were extrapolated from Mobile’s 47-foot curve. For SPX and Panamax vessels, much of the arrival draft distribution was held constant in the future with-project condition, except for those that exceeded the available channel depth plus UKC requirement. For all vessel classes, once a vessel class reaches its design draft on the curve, the class no longer shifts regardless of the channel depth.

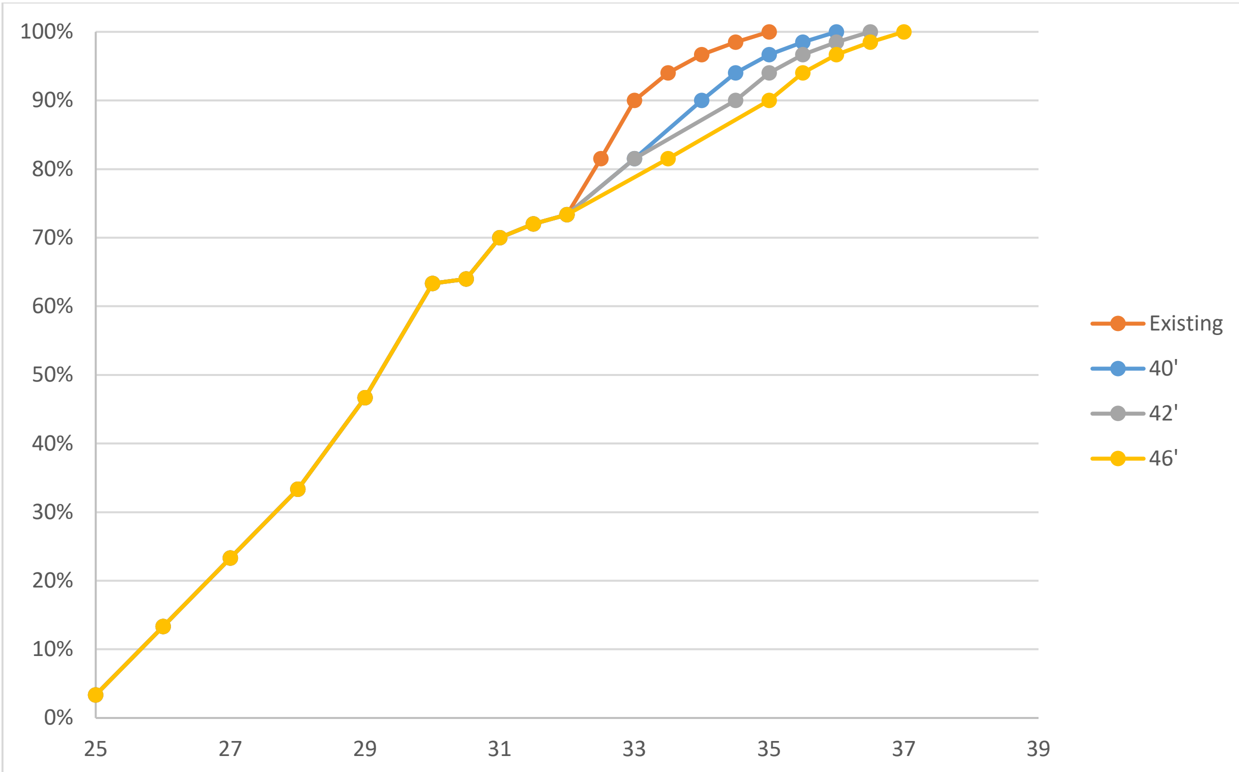


Figure 4-1: SubPanamax Arrival Draft by Channel Depth

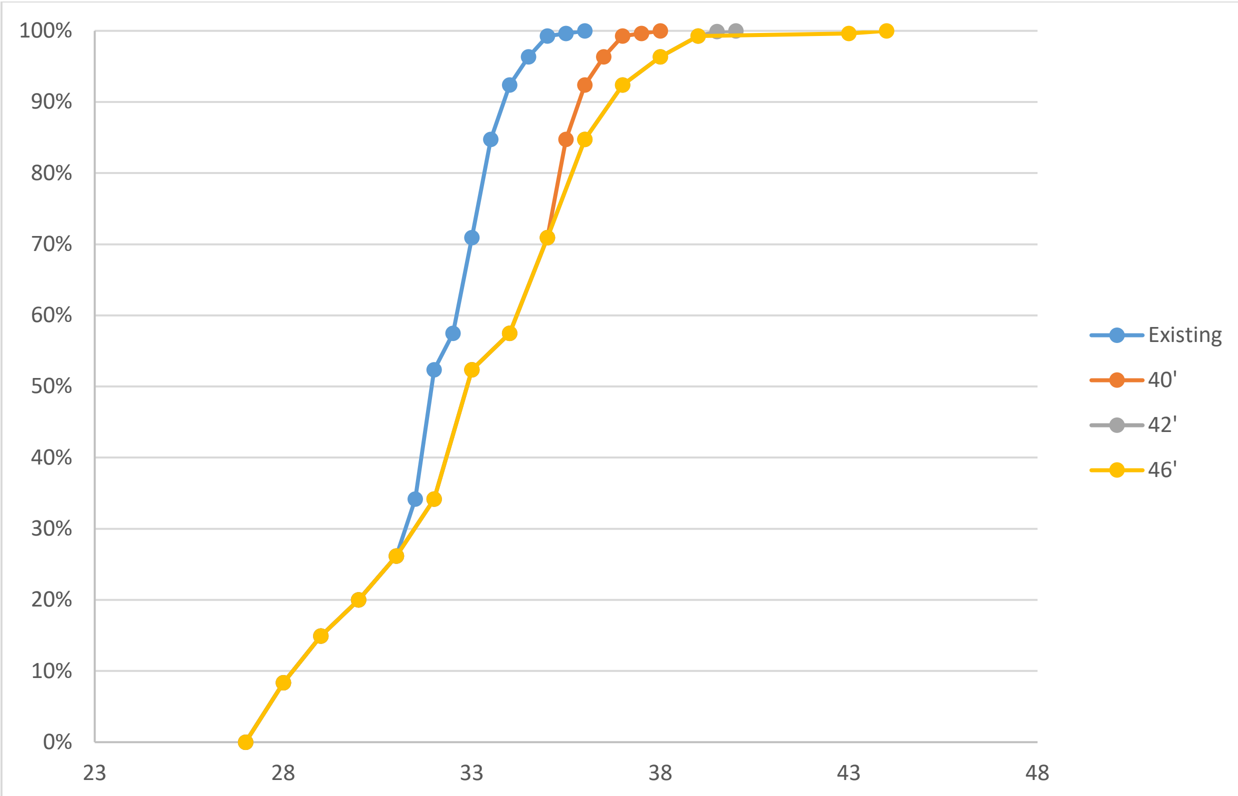


Figure 4-2: Panamax Arrival Draft by Channel Depth

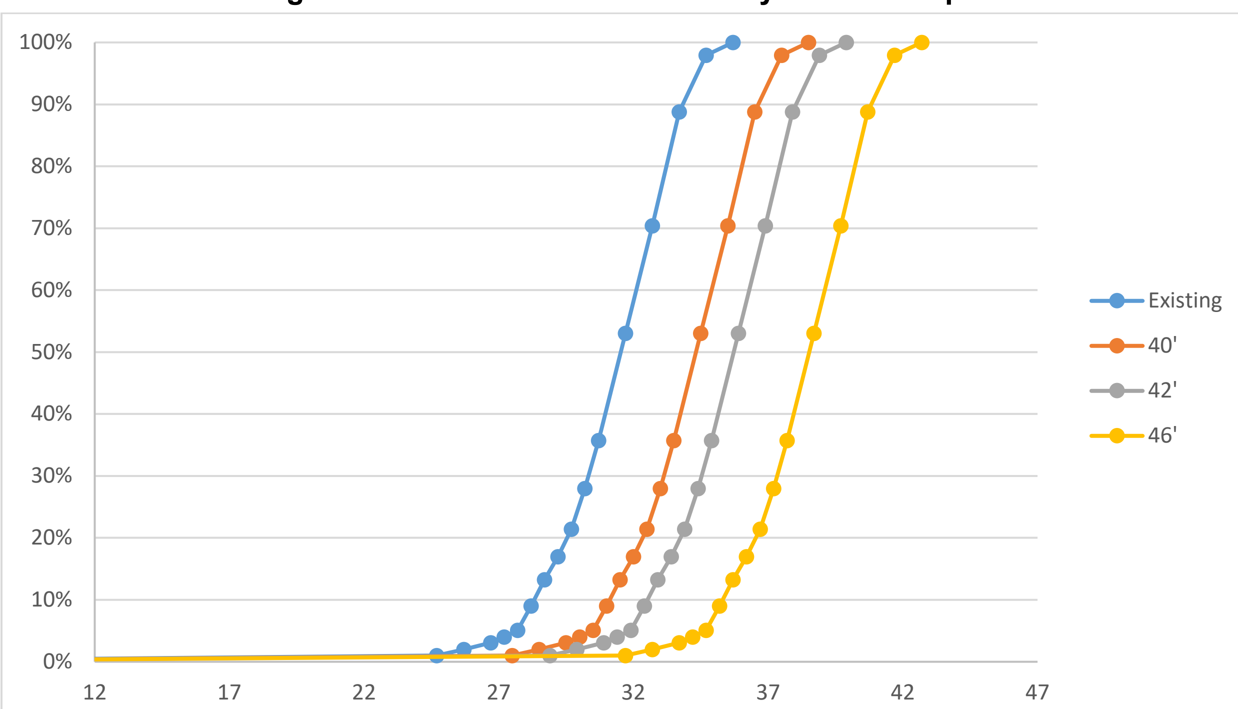


Figure 4-3: Post Panamax Generation 1 Arrival Draft by Channel Depth

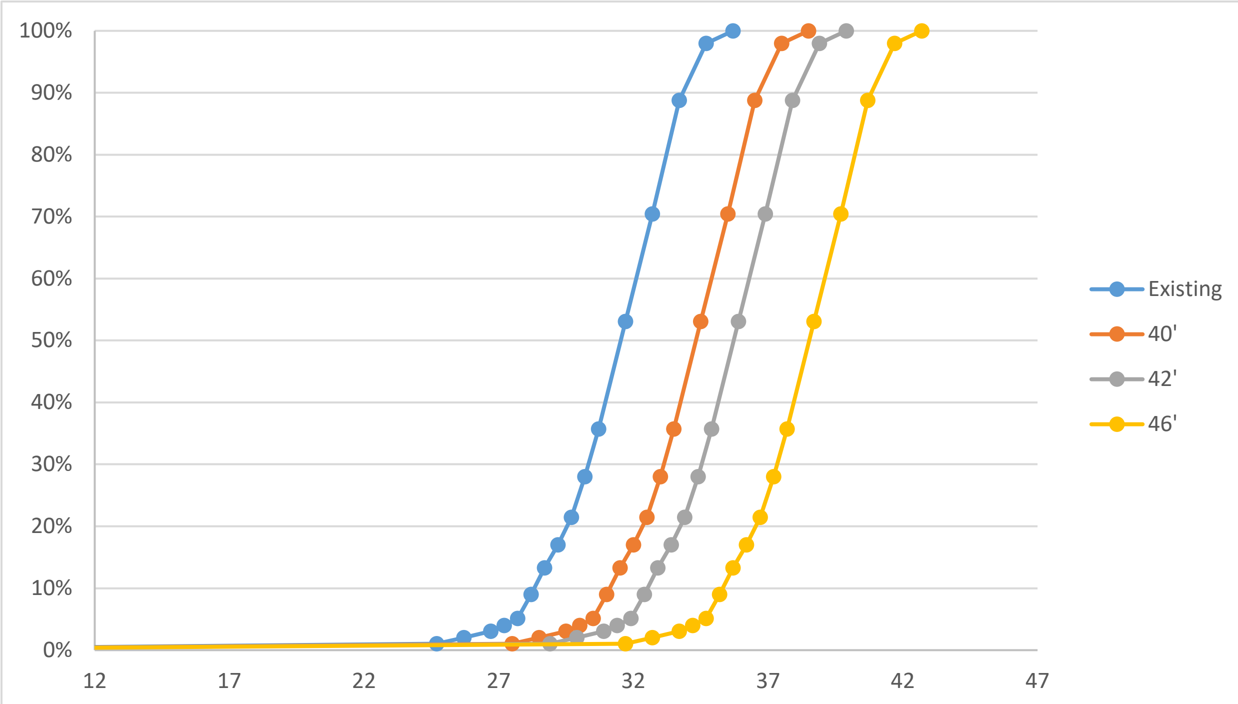


Figure 4-4: Post Panamax Generation 2 Arrival Draft by Channel Depth

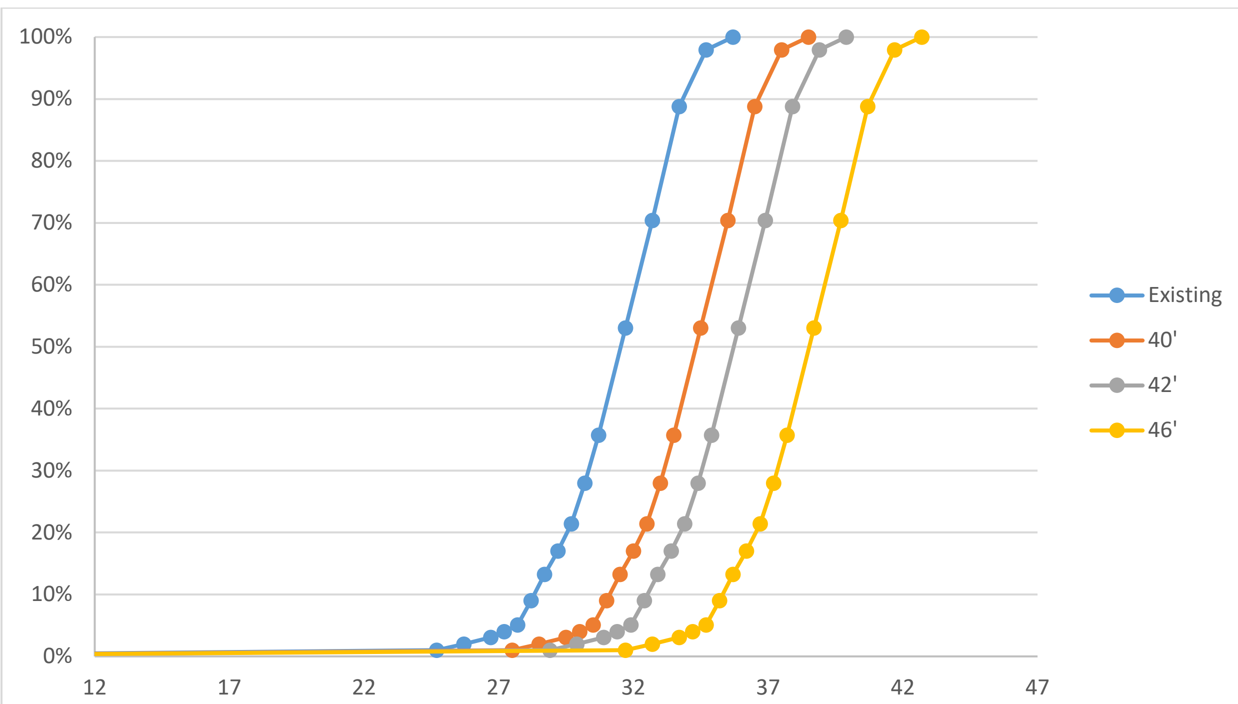


Figure 4-5: Post Panamax Sailing Draft Generation 3

Table 4-3 provides the vessel class assumptions used in the LFA, such as average lading weight per TEU, container weight, vacant slot allotment, variable ballast, import/export fraction (cargo share), etc. These inputs were developed using empirical data from other container ports that handle a similar number of TEUs as Gulfport is anticipated to handle in the FWOP condition. The inputs for the following fields was provided for these studies by IWR and utilized once more for this study: Lading Weight per Loaded TEU, Empty TEU and Vacant Slot allotment, Operations Allowance, and Variable Ballast by trade lane. The operations allowance represents tonnage used for bunkerage (fuel) and ships stores. The import/export fractions, which is the fraction of imported/exported tons to ship capacity, were estimated by evaluating the estimated import and export fractions at comparable ports as well as the cargo fractions for the existing routes at Gulfport. Often, these fractions were similar amongst ports that handle a similar number of TEUs, indicating that these percentages can be extrapolated and used for estimation purposes for Gulfport's future with- and without-project conditions.

Table 4-3: CLT Inputs and Assumptions

Route Group	Vessel Class	Avg. lading weight per TEU	Avg. Tare Weight per TEU	Empty TEU allotment	Vacant Slot Allotment	Operations Allowance (% DWT)	Variable Ballast	Import Fraction	Export Fraction
CAR-CA	SPX	10.2	2.2	21	7.9	6.7	11	0.48	0.44
CAR-CA	PX	10.2	2.2	21	7.9	6.7	11	0.48	0.44
CAR-CA	PPX1	10.2	2.2	21	7.9	6.7	11	0.48	0.44
CAR-CA	PPX2	10.2	2.2	21	7.9	6.7	11	0.48	0.44
ECSA	SPX	13.0	2.2	24	7.9	6.7	11	0.16	0.23
ECSA	PX	13.0	2.2	24	7.9	6.7	11	0.16	0.23
ECSA	PPX1	13.0	2.2	24	7.9	6.7	11	0.16	0.23
ECSA	PPX2	13.0	2.2	24	7.9	6.7	11	0.16	0.23
ECSA	PPX2	13.0	2.2	24	7.9	6.7	11	0.16	0.23
NEU-MED	SPX	11.0	2.2	15	7.9	6.7	11	0.10	0.15
NEU-MED	PX	11.0	2.2	15	7.9	6.7	11	0.10	0.15
NEU-MED	PPX1	11.0	2.2	15	7.9	6.7	11	0.10	0.17
NEU-MED	PPX2	11.0	2.2	15	7.9	6.7	11	0.10	0.15
NEU-MED	PPX3	11.0	2.2	15	7.9	6.7	11	0.10	0.15
FE-PAN	PX	10.4	2.2	27	7.9	6.7	11	0.12	0.20
FE-PAN	PPX1	10.4	2.2	27	7.9	6.7	11	0.12	0.20
FE-PAN	PPX2	10.4	2.2	27	7.9	6.7	11	0.12	0.20
FE-PAN	PPX3	10.4	2.2	27	7.9	6.7	11	0.12	0.20

Table 4-4 provides details on the vessel subclasses that is used by the CLT spreadsheet to create vessels to satisfy the commodity forecast.

Table 4-4: Vessel Subclass Details

Vessel Class ID	LOA	Beam	Max SLLD	Capacity	TEU Rating	TPI Factor	Sinkage Adjustment	% of Class
SPX	466.44	72.89	26.23	11,726	907.3	59.2	0.7	0.1
SPX	499.19	79.36	28.93	14,924	1090.3	68.8	0.8	0.1
SPX	534.64	84.96	30.35	18,438	1388.1	78.5	0.8	0.1
SPX	570.65	87.03	31.28	20,643	1447	87.1	0.8	0.1
SPX	576.4	84.24	32.49	22,184	1529.2	87.2	0.9	0.1
SPX	585.46	89.72	33.46	24,283	1618.4	93.6	0.9	0.1
SPX	596.1	91.57	34.57	24,812	1778.2	96.3	0.9	0.1
SPX	603.19	91.64	35.56	25,370	1894.5	97.1	0.9	0.1
SPX	657.08	97.69	36.21	31,139	2267.6	113.8	1	0.1
SPX	675.57	98.84	37.58	33,887	2469.9	117.7	1	0.1
PX	901	105.01	38.46	42,183	3083.9	146	1	0.1
PX	901	103.87	39.41	43,311	3188	142.8	1	0.1
PX	901	105.57	40.34	44,991	3389	150.2	1.1	0.1
PX	901	105.67	41.22	50,070	3841.1	162.7	1.1	0.1
PX	901	105.67	42.53	56,792	4125.2	176.7	1.1	0.2
PX	901	104.2	43.41	54,885	3992.5	170.4	1.2	0.2
PX	959.01	105.6	44.39	64,956	4729.4	192.7	1.2	0.2
PPX1	1013.63	131.6	39.37	74,070	5918	240.9	1	0.1
PPX1	928.08	131.47	41.44	75,623	5534.3	214.7	1.1	0.1
PPX1	972.01	123.45	42.81	77,149	4857.5	219	1.1	0.1
PPX1	899.88	130.32	44.36	78,284	4912.1	208	1.2	0.1
PPX1	934.79	131.44	46.01	78,618	5792.7	215.1	1.2	0.1
PPX1	949.07	131.78	46.02	79,891	6050	221.6	1.2	0.1
PPX1	953.76	131.75	46.05	80,651	6185.8	222.3	1.2	0.05
PPX1	964.84	131.69	46.07	80,504	6294.9	225.4	1.2	0.05
PPX1	974.7	131.73	46.09	81,237	6387	228.7	1.2	0.05
PPX1	981.28	131.74	46.1	110,448	6441.2	230.7	1.2	0.05
PPX1	984.04	131.77	46.13	75,898	6505.2	230.9	1.2	0.05
PPX1	988.83	131.8	46.17	86,060	6549.3	233.1	1.2	0.05
PPX1	991.62	131.85	46.23	102,179	6599.8	233.7	1.2	0.05
PPX1	991.57	131.91	46.34	102,871	6662.3	233.5	1.2	0.03
PPX1	969.88	131.7	47.6	103,817	6328.9	229.4	1.3	0.02

PPX2	1101.16	146.37	42.65	104,549	9148.2	290.3	1.1	0.1
PPX2	984.3	140.99	44.29	104,104	6332	244.6	1.2	0.1
PPX2	1017.74	142.79	46.13	103,865	7200	260.3	1.2	0.1
PPX2	1089.65	142.26	47.61	104,657	8212	284.9	1.3	0.1
PPX2	1099.37	142.89	47.63	105,458	8527.7	289.2	1.3	0.05
PPX2	1106.31	142.86	47.64	106,737	8669.6	291.5	1.3	0.05
PPX2	1108.61	143.35	47.65	108,348	8786.9	292	1.3	0.05
PPX2	1112.32	143.63	47.67	92,498	8874.1	292.6	1.3	0.05
PPX2	1114.13	143.78	47.66	92,875	8916.1	293.5	1.3	0.05
PPX2	1117.73	144.44	47.66	93,905	9018	295.3	1.3	0.05
PPX2	1122.37	144.96	47.67	95,169	9144.7	297.7	1.3	0.1
PPX2	1138.59	145.16	47.6	98,893	9513.2	303.4	1.3	0.1
PPX3	1000	158	48	110,000	11000	340	1.3	1

4.1.2.3 *Containerized Vessel Calls*

For containerships, cargo is often loaded and unloaded simultaneously before calling at a string of other ports. As previously mentioned, the weight of cargo can vary greatly by trade route, whereas vessel operators can also carry large number of empty containers or sail with vacant slots.

A vessel loading analysis helps to capture valid relationships and parameters for estimating the disposition of cargo and non-cargo components of vessel loading which in turn helps to better estimate the amount of cargo on a ship at a given time. The basic methodology and logic of the LFA is based on long-established practices that have been historically applied to USACE economic evaluations of deep-draft waterway improvements. Cargo components of an LFA include carried tonnages, containers that store the cargo and empty containers. Some of the non-cargo components that are considered in an LFA include allowances for ballast, bunkerage, and vacant slots.

Given the uncertainty of vessels and cargo that will be calling at Gulfport in the FWP and FWOP condition, load factor analyses from previous USACE feasibility studies were consulted to aid with the assumptions for the future of Gulfport.

The number of calls for each class was calculated using the distribution of capacity by vessel class provided in Table 3-11. The forecast of containerized vessels through year 2065 is shown in Table 4-5.

Table 4-5. Containership Calls by Route and Vessel Class

Route	Class	2035				2045				2055				2065			
		FWOP	40ft	42ft	46ft	FWOP	40ft	42ft	46ft	FWOP	40ft	42ft	46ft	FWOP	40ft	42ft	46ft
Caribbean and Central America	SPX	198	190	190	190	231	221	221	221	255	243	243	243	272	257	257	257
	PX	24	24	24	24	29	29	29	29	30	30	30	30	34	34	34	34
South America (East Coast)	SPX	12	4	1	0	18	1	0	0	18	0	0	0	21	0	0	0
	PX	9	9	8	4	10	10	5	3	13	10	4	1	16	12	7	3
	PPX1	14	14	14	14	17	17	17	17	20	20	20	20	22	22	22	22
	PPX2	0	1	1	1	0	2	2	2	0	3	3	3	0	3	3	3
	PPX3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Europe & Mediterranean	SPX	16	0	0	0	22	0	0	0	23	0	0	0	25	0	0	0
	PX	64	31	26	12	77	29	22	0	88	37	28	6	104	42	32	5
	PPX1	29	29	29	29	39	39	39	39	44	44	44	44	51	51	51	51
	PPX2	0	6	6	6	0	11	11	11	0	12	12	12	0	13	13	13
	PPX3	0	11	11	11	0	13	13	13	0	15	15	15	0	18	18	18
Far East	SPX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PX	25	7	1	0	41	7	0	0	47	8	0	0	54	10	0	0
	PPX1	14	14	14	13	22	22	22	17	25	25	24	18	31	29	29	23
	PPX2	0	3	3	3	0	8	8	8	0	7	7	7	0	9	9	9
	PPX3	0	5	5	5	0	7	7	7	0	11	11	11	0	13	13	13
Total		405	348	333	312	506	416	396	367	563	465	441	410	630	513	488	451

4.2 Transportation Cost Savings

The objective of USACE deep draft navigation projects is to lower transportation costs, which is usually done through better utilization of present vessels, or by use of larger, more efficient vessels. Future cost of commodity movements, given the projected vessel fleet composition for each commodity and the vessel operating costs, are estimated using price levels at a common point in time. The efficiencies will improve because vessels can carry more goods.

Transportation costs were estimated for the years 2035, 2045, 2055 and 2065. The transportation costs were held constant beyond 2065. The present value was estimated by interpolating between the modeled years and discounting at the FY 2024 Federal Discount rate of 3.0 percent for the 50-year period of analysis, 2035 through 2084. Estimates were calculated for each alternative project depth.

Transportation cost savings (benefits) were estimated by calculating a total voyage cost for the FWOP fleet and each of the future with-project fleets. Then, the voyage costs were isolated (reduced) to only those that should be attributed to Gulfport. This was achieved by reviewing the cargo share of containership vessels at ports handling a similar number of TEUs and applying the same cargo share to the Gulfport analysis. The FWP voyage costs were subtracted from the FWOP voyage costs to obtain the benefits of each alternative depth for each modeled outyear.

The benefits and costs were both annualized to obtain AAEQ benefits and costs.

4.2.1 Origin Destination Transportation Cost Savings

The analysis includes summaries of total transportation costs, transportation cost savings, and AAEQ transportation cost and cost savings. The overall reduction in total number of container calls is the driving force behind origin-destination benefits.

Table 4-6 provides the annual transportation costs for the out-years that were modeled (2035, 2045, 2055, and 2065). The deepening alternatives that were modeled were: future without-project condition, 40 feet, 42 feet and 46 feet. The values for the increments in between were interpolated. The transportation cost reductions by year are provided in Table 4-7.

Table 4-6: Total Transportation Cost Allocated to Port (Containerships)

Year	2035	2045	2055	2065
FWOP	$107,172,000	$141,970,000	$160,124,000	$183,805,000
40 feet	$99,571,000	$128,930,000	$146,880,000	$167,328,000
42 feet	$93,126,000	$119,951,000	$135,601,000	$155,741,000
46 feet	$85,570,000	$108,388,000	$122,756,000	$140,996,000

Table 4-7: Annual Transportation Cost Reduction Benefit by Alternative (Containerships)

Year	40FT Deepening	42FT Deepening	46FT Deepening
2035	**$7,601,000**	**$14,046,000**	**$21,602,000**
2036	*$8,145,000*	*$14,844,000*	*$22,146,000*
2037	*$8,689,000*	*$15,641,000*	*$22,690,000*
2038	*$9,233,000*	*$16,438,000*	*$23,234,000*
2039	*$9,777,000*	*$17,235,000*	*$23,778,000*
2040	*$10,321,000*	*$18,033,000*	*$24,322,000*
2041	*$10,865,000*	*$18,830,000*	*$24,866,000*
2042	*$11,408,000*	*$19,627,000*	*$25,410,000*
2043	*$11,952,000*	*$20,425,000*	*$25,954,000*
2044	*$12,496,000*	*$21,222,000*	*$26,498,000*
2045	**$13,040,000**	**$22,019,000**	**$33,582,000**
2046	*$13,061,000*	*$22,270,000*	*$33,961,000*
2047	*$13,081,000*	*$22,520,000*	*$34,339,000*
2048	*$13,101,000*	*$22,770,000*	*$34,718,000*
2049	*$13,122,000*	*$23,021,000*	*$35,096,000*
2050	*$13,142,000*	*$23,271,000*	*$35,475,000*
2051	*$13,163,000*	*$23,521,000*	*$35,854,000*
2052	*$13,183,000*	*$23,772,000*	*$36,232,000*
2053	*$13,204,000*	*$24,022,000*	*$36,611,000*
2054	*$13,224,000*	*$24,272,000*	*$36,989,000*
2055	**$13,244,000**	**$24,523,000**	**$37,368,000**
2056	*$13,568,000*	*$24,877,000*	*$37,912,000*
2057	*$13,891,000*	*$25,231,000*	*$38,456,000*
2058	*$14,214,000*	*$25,585,000*	*$39,000,000*
2059	*$14,537,000*	*$25,939,000*	*$39,544,000*
2060	*$14,860,000*	*$26,293,000*	*$40,088,000*
2061	*$15,184,000*	*$26,647,000*	*$40,632,000*
2062	*$15,507,000*	*$27,001,000*	*$41,176,000*
2063	*$15,830,000*	*$27,355,000*	*$41,720,000*
2064	*$16,153,000*	*$27,709,000*	*$42,265,000*
2065-2084	**$16,476,000**	**$28,063,000**	**$42,809,000**
Note: Benefits for italicized rows were interpolated.			

4.2.2 Non-containerized Transportation Cost Savings

The future fleet forecast of bulk vessels carrying non-ferrous ore (Ilmenite) is described in Table 3-12. For the fleet forecast, it was assumed that the loading practices and vessel call counts would be the same in the FWOP and FWP conditions.

The channel users indicated that there are occasionally opportunities to build up and load more commodities to achieve better freight rates, but there was not an indication that vessels would regularly load deeper in the FWP condition. Thus, deepening (Origin-Destination) benefits were not calculated for bulk commodities. However, the channel users indicated that a deeper channel at Gulfport would allow flexibility in planning and chartering vessels, including the ability for Gulfport to become the first port of call along the Gulf Coast.

Ilmenite shipments typically call first to New Orleans, then to Mexico followed by Gulfport, and then they return to New Orleans to pick up an export before making their return voyage. It is assumed that with a deepened channel, Gulfport could become the first port of call for many of the ilmenite shipments, eliminating the need for the vessels to make the return leg back to the Mississippi River (New Orleans).

The depth at which Gulfport could become the first port of call was assumed to be 45 feet, the depth at which Gulfport's channel depth would equal or exceed that of the others in the rotation. As such, transportation efficiency benefits were assumed to begin accruing for the depth at 45 feet; these benefits were held constant at 46 feet.

To identify the vessels that would benefit from eliminating the return leg, the prior and next ports from NNOMPEAS were analyzed, and it was determined that approximately 70% of calls were likely to benefit from a more efficient Gulf coast route. The mileage to the Port of New Orleans from Gulfport and the FY 2019 vessel operating costs were used to develop a savings per trip for vessels taking advantage of a more linear route along the Gulf. The savings per trip was estimated to be $17,132. This savings was applied to 70% of the vessel calls as described in Table 3-12. The savings by outyear are displayed in Table 4-8. Benefits were held constant after 2055.

Table 4-8. Bulk Fleet Transportation Cost Savings (45' and 46')

	2035	2045	2055
Vessel Calls	23	28	31
Benefiting Vessel Calls	16	20	22
Savings	$271,445	$340,820	$376,477

4.2.3 In-Harbor Transportation Cost Savings

In-harbor transportation costs are typically calculated for port improvement studies where congestion or other obstacles to efficient vessel maneuvering will be eased by a study's alternative plan(s). However, no such obstacles exist for Gulfport; thus, in-harbor transportation cost savings were not estimated.

4.3 Initial Project Costs of Deepening

In the evaluation and comparison of project depth alternatives, which is necessary to arrive at the selected plan, NED costs play a critical role. NED costs include both the financial and economic costs associated with a project throughout its lifecycle. Each of these types of costs and their sources are discussed in this section of the report. Additionally, the NED costs for the depth and width alternatives being considered in this analysis will be identified.

4.3.1 NED Cost – Financial

Financial costs of the proposed project consist of the construction accrued during construction of the project and over its lifecycle. More specifically, these costs include:

- Land Construction Costs
- Dredging Costs
- Planning, Engineering, and Design Costs (PED)
- Construction Management Costs (CM)
- Contingency Costs

Mobile District Cost Engineering prepared the cost estimate for the proposed deepening and widening alternatives for use in the economic analysis. The sum of these costs is used to determine Interest During Construction (IDC), which represents the economic cost of building a project. The next section defines IDC and provides an explanation as to how it is calculated and included in the analysis. Together, these costs represent the economic cost of construction.

Another financial cost not included above is the annual cost accrued over the life of a project due to Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities that represent an increase over the current OMRR&R costs to maintain the channel. OMRR&R was excluded from the list of financial costs above because it is not included in the calculation of IDC. IDC takes into account only those costs incurred during construction.

4.3.2 NED Cost – Economic

Interest During Construction represents an economic cost of building a project that is considered in the selection of the recommended plan but does not factor in as a paid cost. Interest During Construction is the cost of the foregone opportunity to invest the money required to construct a project for another use. The hypothetical return on another investment, measured as IDC, is counted as an NED cost. As an economic, rather than a financial cost, IDC is not considered in the determination of cost-sharing responsibilities.

Interest During Construction reflects that project construction costs are not incurred in one lump sum, but as a flow over the construction period. This analysis assumes that construction expenditures are incurred at a constant rate over the period of construction, an assumption which is supported by the *NED Manual for Deep Draft Navigation*.

4.3.3 NED Channel Deepening Cost by Alternative

Table 4-9 contains the project costs associated with each project depth evaluated in this analysis. The costs were annualized at the FY25 discount rate of 3.0 percent. A period of analysis of 50 years was used to annualize costs.

Costs analyses for USACE deep draft projects include associated costs which are components of the direct construction costs of the recommended Federal project but are a necessary non-Federal responsibility or U.S. Coast Guard (USCG) responsibility due to the channel modifications. These costs are not typically cost-shared. Associated costs include items like Aids to Navigation (ATONs), local service facilities (LSF), and sometimes mitigation efforts. In this case, Associated Costs include ATONs and berth dredging.

Table 4-9: Project Cost for Deepening (costs in thousands)

Project Depth	Project First Cost	Associated Cost	Months for IDC	IDC	AAEQ Project Cost	Annualized O&M	Total AAEQ Cost
40'	$184,225	$2,965	30	$6,947	$7,545	$11,186	$18,731
41'	$212,094	$3,237	35	$9,439	$8,736	$10,556	$20,833
42'	$239,963	$3,508	39	$11,930	$9,926	$9,926	$22,934
43'	$269,061	$3,777	45	$15,602	$11,210	$11,210	$25,251
44'	$298,159	$4,045	50	$19,273	$12,494	$12,494	$27,568
45'	$332,412	$4,315	57	$24,782	$14,050	$14,831	$30,171
46'	$366,664	$4,585	63	$30,291	$15,606	$17,167	$32,773

4.4 Benefit Cost Analysis

Net NED benefits are NED benefits minus NED costs. NED costs are essentially the costs to the Nation for a specific project implementation. The comparison of NED benefits and costs is generally expressed as a ratio of benefits to costs. Economic justification requires that benefits exceed costs and therefore the benefit/cost ratio must exceed 1.0. The most efficient use of resources is when benefits exceed costs by the maximum amount. Therefore, maximum net NED benefits are uses as the primary determinant of the most efficient plan. However, for this study, there was a constraint identified by the NFS at 46 feet deep, so benefits were not analyzed beyond this depth.

Table 4-10 displays the AAEQ benefits and AAEQ costs for each of the deepening alternatives.

Table 4-10: Channel Deepening Benefits and Costs

Project Depth	AAEQ Benefits	AAEQ Costs	Net AAEQ Benefits	BCR

40'	$13,135,000	$18,731,000	-$5,597,000	0.70
41'	$18,037,000	$20,832,000	-$2,795,000	0.87
42'	$22,940,000	$22,934,000	$6,000	1.00
43'	$25,728,000	$25,251,000	$477,000	1.02
44'	$28,517,000	$27,568,000	$949,000	1.03
45'	$31,653,000	$30,171,000	$1,483,000	1.05
46'	$34,442,000	$32,773,000	$1,669,000	1.05

The 46-foot deepening alternative has the highest net benefits. Therefore, the Tentatively Selected Plan (TSP) includes deepening to 46 feet MLLW and widening by 100 feet to accommodate the design vessel. Table 4-11 displays the TSP benefits, costs, net benefits, and benefit-to-cost ratio (BCR) at the time of plan selection (FY 2024).

Table 4-11: TSP Benefit Cost Analysis

Total Deepening and Widening Cost and Benefits	
AAEQ Benefits	$34,442,000
Project First Cost	$366,664,000
Interest During Construction	$30,291,000
Associated Cost	$4,585,000
Total Economic Cost	$401,540,000
Annualized O&M	$17,167,000
Total AAEQ Cost	$32,773,000
Net Benefits	$1,669,000
Benefit-to-Cost Ratio	1.05

SECTION 5.0 COMPREHENSIVE BENEFITS

In accordance with the 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), each alternative has been evaluated based on its effects to the following four accounts:

- National Economic Development (NED)
- Regional Economic Development (RED)
- Other Social Effects (OSE)
- Environmental Quality (EQ)

In accordance with the January 2021 Comprehensive Benefits Memorandum, additional benefits derived by the project have been analyzed across each of the accounts: NED, RED, OSE, and EQ.

5.1 National Economic Development Account

National Economic Development (NED) benefits are contributions to NED that increase the value of the national output of goods and services. It is the primary basis for Federal investment in water resource projects and is measured in average annual equivalent (AAEQ) terms.

NED benefits for deep draft navigation projects are primarily quantified via transportation cost savings. These cost savings benefits were summarized in Sections 4.2 through 4.4.

5.2 Regional Economic Development Account

RED benefits can be accrued a variety of ways when a water resources project is constructed. This study focuses on the impacts (i.e., benefits) that will result from construction and O&M spending that are directly related to the deepening project. These benefits by alternative plan are discussed in detail in SECTION 9.0 of this document.

5.3 Environmental Quality Account

Effects associated with the EQ account are fully described in Chapter 5 of the main report. In summary, short-term negative EQ effects (e.g., air quality, noise) are anticipated during construction. EQ benefits are derived primarily from the beneficial use of dredged material at the Cat Island North placement site.

In addition to being the least cost placement option, utilization of the Cat Island beneficial use site creates EQ benefits. Beneficial use of dredge material for marsh creation can support biodiversity by creating new habitat for breeding, nesting, and foraging areas for fish, crustaceans, waterfowl, and shorebirds. It also assists in reducing the atmospheric carbon dioxide since marches store carbon in sediments and plant biomass.

Additionally, transportation efficiencies gained from a deeper FNC are likely to result in decreased emissions required to transport the same amount of cargo. The benefits of decreased emissions were not quantified.

5.4 Other Social Effects Account

OSE refers to effects impacting things like social connectedness and communal identity. OSE impacts resulting from a construction project can be positive or negative. Through public engagement meetings that have occurred throughout this study, it was evident that there was community concern about negative impacts of the project, such as traffic.

This study assumed that the amount of tonnage moved via the Port would be equal in the FWOP and FWP conditions. Thus, the assumption is that road traffic levels will not change as a result of deepening and widening the channel. Other negative impacts of construction (e.g., air quality, noise) are expected to be temporary in nature, and as such, the conclusion of the OSE analysis was that there will be no change to the OSE account. It is likely, however, that the positive impacts to the RED account (e.g., job creation, economic output) could result in increases to qualitative metrics of OSE such as: citizens regarding the community as a good place to live, community outlook for the future, and quality of life.

Additionally, the beneficial use of dredged material that this project is anticipated to facilitate will result in coastal storm resiliency. These benefits have not been quantified as either OSE or NED but would be a positive result of the construction and O&M material resulting from this project.

5.5 Comprehensive Benefits Summary

A summary of the comprehensive benefits analysis by alternative plan is show in Table 5-1.

Table 5-1. Comprehensive Benefits Summary

Alternative Plans (MLLW)	NED (Annual Net Benefits)	RED		EQ	OSE
		Economic Output of Construction Spending	Economic Output of O&M (Annual)		
No Action	$0	$0	$0	No Change	No Change
Alt 8: -40 ft	-$5,597,000	$205,602,000	$12,000,000	Acreage of Habitat: 185	No Change
Alt 9: -41 ft	-$2,795,000	$236,787,000	$12,945,000	Acreage of Habitat: 215	No Change
Alt 10: -42 ft	$6,000	$267,971,000	$13,890,000	Acreage of Habitat: 245	No Change
Alt 11: -43 ft	$477,000	$301,036,000	$14,993,000	Acreage of Habitat: 275	No Change
Alt 12: -44 ft	$949,000	$334,100,000	$16,096,000	Acreage of Habitat: 305	No Change
Alt 13: -45 ft	$1,483,000	$373,215,000	$17,214,000	Acreage of Habitat: 340	No Change
Alt 14: -46 ft	$1,669,000	$412,330,000	$18,331,000	Acreage of Habitat: 370	No Change

SECTION 6.0 SENSITIVITY ANALYSIS

The Principles and Guidelines and subsequent ER 1105-2-100 recognize the inherent variability to water resources planning. Therefore, a sensitivity analysis in which key quantitative assumptions and computations are changed is required to assess the effect on the outcome. To capture the uncertainty of the projected commodity volumes or fleet changes, sensitivity scenarios will be analyzed to display the variance in project benefits. This section will be updated after review of the draft report.

SECTION 7.0 MULTIPORT ANALYSIS

Multiport competition was assessed qualitatively for this study as it relates to shifting of cargo from one port to another port based on factors such a deepening or widening a ship channel. The recommended plan includes a deeper and wider channel to allow the efficient use of larger vessels. Larger vessels alone do not drive growth for the harbor. Many factors may influence the growth of a particular harbor, landside development and infrastructure, location of distribution centers for imports, source locations for exports, population and income growth and location, port logistics and fees, business climate and taxes, carrier preferences, labor stability and volatility, and business relationships. Harbor depth is just one of many factors involved in determining growth and market share for a particular port. The economic analysis was conducted with the historical Gulfport cargo share remaining the same in both the future without-project and future with-project conditions.

Between 2000 and 2017, the coastline along the Gulf of Mexico grew at a rate of 26.1%, more than any other Coastline Region in the United States and 15.7% higher than the country as a whole. In recent years (2020-2024), congestion and delays have plagued ports along the West Coast. Simultaneously, global supply chains have been reducing their reliance on China and shifting to other countries, such as Vietnam, India, Europe, and Mexico. These countries often favor the Gulf and East coasts as trading partners, leading the Port of Gulfport positioned to experience growth from a variety of factors.

To restate the multiport considerations in another way, justification of the recommendation for this study is not based on the assumption that cargo will shift to Gulfport with deepening alone. The analysis assumes Gulfport receives the same share of regional cargo volumes with or without the deepening of the channel.

SECTION 8.0 SOCIOECONOMIC ANALYSIS

The socioeconomics of the community surrounding the study area are summarized in this section. This section will describe the social and demographic characteristics of the city of Gulfport, Harrison County, and the state of Mississippi. The parameters used to describe the demographic and socioeconomic environment of the study areas include population trends, private sector employment and wage earnings. Other social characteristics such as race composition, age distribution, and poverty issues will be examined within the city of Gulfport and Harrison County whose residents have the greatest potential to be directly impacted by the channel deepening.

8.1 Population and Demographics

As shown in Table 8-1, Mississippi had a resident population of 2,844,658 as of 2022. Between the years of 2000 and 2022, Mississippi’s population increased by 24 percent, from 2.8 million to 2.9 million persons, which translates to an annual growth rate of

0.2%. During the same time period, Harrison County experienced an annual growth rate of 0.5%, and the city of Gulfport experienced a 0.1% annual growth rate. Population projections obtained for 2050 indicate that the state will experience moderate growth of 0.1% between 2022 and 2050 while Harrison County experiences negative growth of 0.2% annually.

Table 8-1: Population Estimates and Projections (2000-2050)

Geographic Area	2000 Population Estimate	2010 Population Estimate	2022 Population Estimate	2050 Population Projection
Mississippi	2,844,658	2,967,297	2,940,057	3,064,588
Harrison County	189,601	187,105	211,044	201,068
Gulfport	70,986	67,793	72,228	NA
Source: U.S. Census Bureau, Population Division (2000, 2010 Estimates); U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates (2022 Estimate); University of Mississippi (2050 Projections)				

8.1.1 Race and Ethnicity Distribution

Table 8-2 displays race and ethnicity for the comparative geographies. Within Harrison County, approximately 62% of the population is White, 21% is Black, 6% is Hispanic or Latino, 2% is Asian, and 8% is two or more races. In Gulfport, 51% of the population is White, 32% is Black, 5% is Hispanic or Latino, 2% is Asian, and 9% is two or more races. By comparison, within the state of Mississippi, 55% of the population is White, 36% is Black, 3% is Hispanic or Latino, 1% is Asian, and 3% is two or more races. In general, Harrison County has a larger minority population than that of Mississippi while Gulfport has a slightly smaller minority population compared to the state.

Table 8-2. Population by Race and Hispanic Origin

Race/Ethnicity	Mississippi		Harrison County		Gulfport	
	Number	Percent	Number	Percent	Number	Percent
White	1,625,979	55%	129,901	62%	36,665	51%
Black	1,072,962	36%	43,850	21%	23,392	32%
American Indian and Alaskan Native	12,457	0%	1,182	1%	463	1%
Asian	25,217	1%	3,760	2%	1,056	2%
Native Hawaiian or Pacific Islander	397	0%	50	0%	0	0%
Some other race alone	9,501	0%	2,537	1%	348	1%

Two or More Races	96,367	3%	17,511	8%	6,812	9%
Hispanic or Latino	97,177	3%	12,253	6%	3,492	5%
Total	2,940,057	100%	211,044	100%	72,228	100%
Source: U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates						

8.1.2 Age Distribution
The distribution of population by age group is displayed in Figure 8-1 for the areas of interest. The age distribution in Harrison County is similar to that of the state of Mississippi. In Gulfport, the 25 to 34 age group is slightly larger when compared to the county or state.

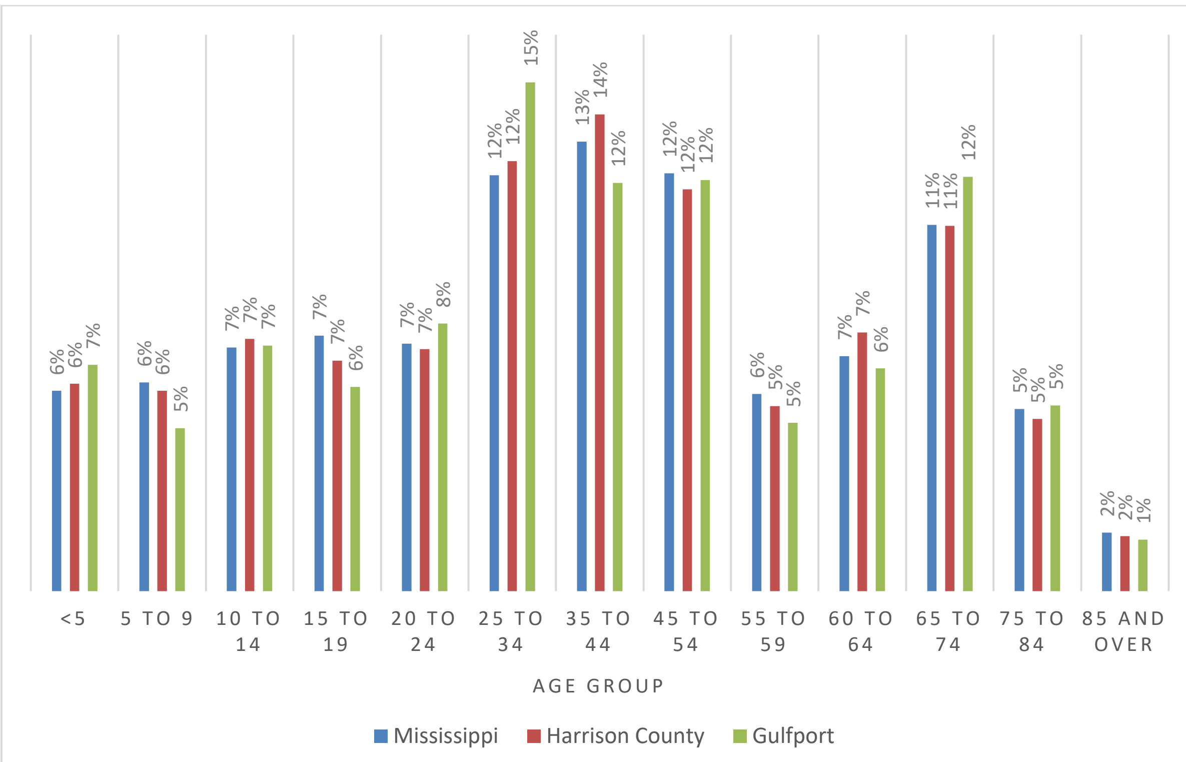


Figure 8-1. Population by Age Group (2022)

8.2 Socioeconomic Characteristics
This section compiles various socioeconomic indicators, such as wages, labor force data, educational attainment, and income and poverty levels, for the geographies of interest.

8.2.1 Wage Earnings by Sector
As of 2022, employment totaled approximately 1.1 million in the state of Mississippi. Of those, approximately 86,700 were employed in Harrison County. Employees in the state of Mississippi earned an average annual wage of $42,428 in 2022 while employees in Harrison County earned an average of $53,934 annually as shown in Table 8-3.

Statewide, the largest employment sector is Manufacturing. In Harrison County, the largest industry is Accommodation and Food Service followed by Retail Trade.

Table 8-3: Employment by Sector (2022 Annual Averages)

North American Industry Classification System (NAICS) Sector		Mississippi		Harrison County	
		Annual Average Employment	Annual Wages Per Employee	Annual Average Employment	Annual Wages Per Employee
11	Agriculture, forestry, fishing and hunting	11,078	$46,157	NA	NA
21	Mining, quarrying, and oil and gas extraction	3,315	$84,383	NA	NA
22	Utilities	7,891	$89,549	613	$127,490
23	Construction	46,179	$59,364	3,593	$56,147
31-33	Manufacturing	148,027	$57,068	3,088	$67,127
42	Wholesale trade	35,203	$70,727	1,660	$62,435
44-45	Retail trade	139,129	$32,008	12,014	$33,620
48-49	Transportation and warehousing	59,525	$51,335	2,037	$50,231
51	Information	10,206	$59,647	592	$56,061
52	Finance and insurance	32,148	$69,243	1,890	$61,912
53	Real estate and rental and leasing	11,471	$45,904	1,182	$46,476
54	Professional, scientific, and technical services	37,136	$65,948	2,078	$66,101
55	Management of companies and enterprises	10,962	$109,611	918	$92,493
56	Administrative and support and waste management and remediation services	70,079	$34,802	4,823	$31,423
61	Educational services	11,547	$40,731	525	$47,679

62	Health care and social assistance	132,197	$50,969	6,890	$47,257
71	Arts, entertainment, and recreation	9,251	$22,697	1,462	$25,279
72	Accommodation and food services	123,213	$21,292	2,1546	$28,716
81	Other services (except public administration)	21,299	$43,211	1,832	$39,023
All	Federal Government	25,711	$78,735	5,903	$72,478
All	State Government	51,975	$56,314	1,528	$46,485
All	Local Government	147,910	$42,428	12,505	$53,934
	Total	1,145,452	NA	86,679	NA

Source: U. S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW)

8.2.2 Labor Force and Employment

Details on the labor force and unemployment rates are displayed in Table 8-4 below. The 2022 annual average unemployment rate in Mississippi was 3.8%. The annual unemployment rate in Harrison County was similar at 3.7%.

Table 8-4. Labor Force and Unemployment Rates (2022 Annual Averages)

Geographic Area	Civilian Labor Force	Number Employed	Number Unemployed	Unemployment Rate
Mississippi	1,248,093	1,200,234	47,859	3.8%
Harrison County	87,323	84,104	3,219	3.7%
Source: Bureau of Labor Statistics, Current Population Survey (State estimate, 2022), LAUS (County estimates, 2022)				

8.2.3 Educational Attainment

Geographic Area	Highest Level of Educational Attainment							
	Population 25 years and over	Less than 9th grade	9th to 12th grade, no diploma	High school graduate (includes equivalency)	Some college, no degree	Associate degree	Bachelor's degree	Graduate or professional degree
Mississippi	1,963,322	83,604	159,922	604,163	419,570	209,877	297,480	188,706
Harrison County	142,325	4,140	9,609	43,180	32,023	16,117	23,199	14,057
Gulfport	49,235	1,453	3,236	15,376	11,840	5,173	8,216	3,941
Source: U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates								

8.2.4 Income and Poverty

Median household and per capita income for the areas of interest as of 2022 are shown in Table 8-5. The table also displays the percentage of families and individuals with income below the poverty level. In general, poverty rates were similar in the state of Mississippi and Harrison County, but poverty was more prevalent in the city of Gulfport in 2022.

Table 8-5: Median Income, Per Capita Income, and Poverty

Geographic Area	Median Household Income	% of Families with Incomes Below Poverty Level (Last 12 months)	Per Capita Income	% of People with Incomes Below Poverty Level (Last 12 months)
Mississippi	$52,719	14.2%	$29,045	19.1%
Harrison County	$56,041	14.9%	30,467	19.5%
Gulfport	$43,047	19.6%	27,319	25.1%
Source: U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates				

SECTION 9.0 REGIONAL ECONOMIC DEVELOPMENT

The USACE Institute for Water Resources, Louis Berger, and Michigan State University have developed a regional economic impact modeling tool, RECONS (Regional ECONomic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through the use of IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure. The impacts are considered Regional Economic Development (RED) benefits of each respective plan. The construction costs cited in this section to describe the RED benefits are in FY 24 price level and may differ slightly from those in previous sections of this document.

9.1 Regional Economic Development Benefits of Alternative Plans

RECONS was used to calculate RED benefits for each alternative plan. A summary of the benefits for each plan is included in Table 9-1. The Civil Works expenditures result in a range of $205,602,000 to $412,330,000 in economic output in the local impact area; the expenditures result in between 1,640 to 3,289 jobs, between $105,363,000 and $211,304,000 in labor income, and between $119,171,000 and $238,996,000 in gross regional product.

Table 9-1. RED Benefits (Local Impact) by Alternative

Alternative	Output ($000)	Jobs*	Labor Income ($000)	Value Added ($000)
No Action	**$0**	**0**	**$0**	**$0**
Alt 8: -40 feet	$205,602	1,640	$105,363	$119,171
Alt 9: -41 feet	$236,786	1,889	$121,344	$137,247

Alt 10: -42 feet	$267,971	2,137	$137,325	$155,322
Alt 11: -43 feet	$301,035	2,401	$154,269	$174,487
Alt 12: -44 feet	$334,100	2,665	$171,213	$193,652
Alt 13: -45 feet	$373,215	2,977	$191,258	$216,324
Alt 14: -46 feet	$412,330	3,289	$211,304	$238,996

9.2 Regional Economic Development Benefits of Tentatively Selected Plan

This section details the RED benefits attributed to the tentatively selected plan for Gulfport Harbor, i.e., the 46-foot deepening. The expenditures associated with the improvement of Gulfport Harbor were estimated to be $368,526,213 as of September 2024. Of this total expenditure, $257,154,279 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in the following tables. The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures $368,526,213 support a total of 3,288.9 full-time equivalent jobs, $211,303,571 in labor income, $238,996,158 in the gross regional product, and $412,330,456 in economic output in the local impact area. More broadly, these expenditures support 5,927.2 full-time equivalent jobs, $429,426,236 in labor income, $565,673,019 in the gross regional product, and $983,933,252 in economic output in the nation.

Table 9-2: Project Information

Project Name	**GULFPORT HARBOR, MS (SAM)**
Project ID	96646149
Type of Analysis	All Work Activities, with Ability to Customize Impact Area and Work Activity
Year of Expenditure	2030

Table 9-3: Project Expenditure

Business Line	**Navigation**
Work Activity	NAV - CWB - Construction
Year of Expenditure	2030
Current Expenditure	$368,526,213

Table 9-4: Spending Profile

	Spending Category	**Percentage (%)**	**Amount**
	Dredging Fuel	6%	$22,111,573
	Metals and Steel Materials	5%	$18,426,311
	Dredging Consumables -- Textiles, Lubricants, and Metal Valves and Parts	2%	$7,370,524

	Machinery Materials	1%	$3,685,262
	Electrical Materials	4%	$14,741,049
	Dredge Equipment (Depreciation and Capital Expenses)	6%	$22,111,573
	Insurance (bond) and Workman's Comp	2%	$7,370,524
	Construction of Other Nonresidential Structures	23%	$84,761,029
	Cement Materials	3%	$11,055,786
	Architectural, Design, and Engineering Services	1%	$3,685,262
	Environmental Compliance, Planning, and Technical Services	1%	$3,685,262
	Industrial Machinery and Equipment Repair and Maintenance	10%	$36,852,621
	Dredging Consumables -- Food and Beverages	2%	$7,370,524
	USACE Overhead	4%	$14,741,049
	USACE Wages and Benefits	7%	$25,796,835
	Private Sector Labor or Staff Augmentation	23%	$84,761,029
	Total	**100%**	**$368,526,213**

Table 9-5: Local Purchase Coefficients

IMPLAN Code	Industry	Expenditure	Local Purchase Coefficients		
			Local	State	US
56	Construction of other new nonresidential structures	$84,761,029	99%	100%	100%
103	All other food manufacturing	$4,626,351	0%	3%	90%
154	Petroleum refineries	$18,264,159	75%	75%	89%
203	Cement manufacturing	$8,689,848	0%	3%	89%
215	Iron and steel mills and ferroalloy manufacturing	$15,202,676	0%	9%	74%
252	Valve and fittings, other than plumbing, manufacturing	$6,295,397	1%	2%	54%
269	All other industrial machinery manufacturing	$3,338,847	0%	0%	66%
331	Switchgear and switchboard apparatus manufacturing	$12,574,114	0%	2%	51%
360	Ship building and repairing	$21,691,453	96%	96%	98%
392	Wholesale - Motor vehicle and motor vehicle parts and supplies	$110,558	38%	46%	100%
395	Wholesale - Machinery, equipment, and supplies	$1,227,447	27%	70%	100%
398	Wholesale - Grocery and related product wholesalers	$1,320,439	83%	90%	100%
399	Wholesale - Petroleum and petroleum products	$2,741,835	7%	67%	100%
400	Wholesale - Other nondurable goods merchant wholesalers	$3,634,796	30%	47%	100%
401	Wholesale - Wholesale electronic markets and agents and brokers	$1,975,301	33%	43%	100%
405	Retail - Building material and garden equipment and supplies stores	$1,320,439	98%	99%	100%

414	Air transportation	$175,348	7%	12%	78%
415	Rail transportation	$707,059	40%	72%	100%
416	Water transportation	$187,207	81%	81%	100%
417	Truck transportation	$2,391,320	44%	93%	100%
419	Pipeline transportation	$398,008	7%	43%	100%
444	Insurance carriers, except direct life	$7,370,524	4%	38%	90%
457	Architectural, engineering, and related services	$3,685,262	73%	73%	91%
463	Environmental and other technical consulting services	$3,685,262	61%	78%	100%
470	Office administrative services	$14,741,049	59%	59%	100%
515	Commercial and industrial machinery and equipment repair and maintenance	$36,852,621	97%	97%	100%
544	* Employment and payroll of federal govt, non-military	$25,796,835	75%	100%	100%
5001	Private Labor	$84,761,029	75%	75%	100%
	Total	**$368,526,213**			

Table 9-6: Overall Summary

Area	Local Capture ($000)	Output ($000)	Jobs*	Labor Income ($000)	Value Added ($000)
Local					
Direct Impact		$257,154	2,473.2	$165,699	$153,954
Secondary Impact		$155,176	815.6	$45,604	$85,042
Total Impact	$257,154	$412,330	3,288.9	$211,304	$238,996
State		$0		$0	$0
Direct Impact		$274,641	2,667.2	$174,770	$168,783
Secondary Impact		$205,387	1,072.3	$58,530	$108,725
Total Impact	$274,641	$480,028	3,739.5	$233,300	$277,508
US		$0		$0	$0
Direct Impact		$349,293	3,335.6	$231,361	$222,554
Secondary Impact		$634,641	2,591.6	$198,066	$343,119
Total Impact	$349,293	$983,933	5,927.2	$429,426	$565,673
*** Jobs are presented in full-time equivalence (FTE)**					

Table 9-7: Local Impacts

IMPLAN Sectors	Industries	Output ($000)	Jobs*	Labor Income ($000)	Value Added ($000)
	Direct Impacts				
56	Construction of other new nonresidential structures	$83,609	943.9	$54,868	$28,322
103	All other food manufacturing	$0	0.0	$0	$0
154	Petroleum refineries	$13,730	1.1	$391	$2,542
203	Cement manufacturing	$0	0.0	$0	$0
215	Iron and steel mills and ferroalloy manufacturing	$0	0.0	$0	$0
252	Valve and fittings, other than plumbing, manufacturing	$72	0.2	$17	$23
269	All other industrial machinery manufacturing	$0	0.0	$0	$0
331	Switchgear and switchboard apparatus manufacturing	$11	0.0	$2	$4
360	Ship building and repairing	$20,911	63.3	$6,917	$8,698
392	Wholesale - Motor vehicle and motor vehicle parts and supplies	$42	0.1	$7	$18
395	Wholesale - Machinery, equipment, and supplies	$336	1.1	$94	$186
398	Wholesale - Grocery and related product wholesalers	$1,096	4.9	$385	$557
399	Wholesale - Petroleum and petroleum products	$190	0.1	$14	$169
400	Wholesale - Other nondurable goods merchant wholesalers	$1,084	3.4	$224	$536
401	Wholesale - Wholesale electronic markets and agents and brokers	$643	11.5	$1,041	$533
405	Retail - Building material and garden equipment and supplies stores	$1,289	8.7	$394	$892
414	Air transportation	$12	0.0	$3	$7

415	Rail transportation	$286	0.4	$71	$157
416	Water transportation	$151	0.2	$17	$28
417	Truck transportation	$1,064	6.7	$251	$329
419	Pipeline transportation	$29	0.1	$9	$20
444	Insurance carriers, except direct life	$302	0.3	$30	$152
457	Architectural, engineering, and related services	$2,684	11.3	$1,301	$1,476
463	Environmental and other technical consulting services	$2,241	14.9	$1,783	$1,599
470	Office administrative services	$8,638	135.1	$3,666	$1,722
515	Commercial and industrial machinery and equipment repair and maintenance	$35,817	189.9	$17,485	$23,066
544	* Employment and payroll of federal govt, non-military	$19,348	91.1	$13,159	$19,348
5001	Private Labor	$63,571	984.9	$63,571	$63,571
	Direct Impact	**$257,154**	**2473.2**	**$165,699**	**$153,954**
	Secondary Impact	**$155,176**	**815.6**	**$45,604**	**$85,042**
	Total Impact	**$412,330**	**3288.9**	**$211,304**	**$238,996**
	* Jobs are presented in full-time equivalence (FTE)				

Table 9-8: State Impact Results

IMPLAN Sectors	Industries	Output ($000)	Jobs*	Labor Income ($000)	Value Added ($000)
	Direct Impacts				
56	Construction of other new nonresidential structures	$84,761	956.9	$55,624	$30,806
103	All other food manufacturing	$122	0.3	$18	$23
154	Petroleum refineries	$13,730	1.2	$391	$2,542
203	Cement manufacturing	$275	0.4	$32	$87
215	Iron and steel mills and ferroalloy manufacturing	$1,388	1.1	$139	$328
252	Valve and fittings, other than plumbing, manufacturing	$143	0.4	$37	$49
269	All other industrial machinery manufacturing	$11	0.0	$3	$4
331	Switchgear and switchboard apparatus manufacturing	$259	0.5	$57	$96
360	Ship building and repairing	$20,911	63.4	$6,917	$8,698
392	Wholesale - Motor vehicle and motor vehicle parts and supplies	$51	0.1	$9	$23
395	Wholesale - Machinery, equipment, and supplies	$859	2.9	$242	$475
398	Wholesale - Grocery and related product wholesalers	$1,184	5.6	$416	$602
399	Wholesale - Petroleum and petroleum products	$1,828	1.1	$137	$1,630
400	Wholesale - Other nondurable goods merchant wholesalers	$1,711	5.4	$356	$846
401	Wholesale - Wholesale electronic markets and agents and brokers	$858	15.3	$1,388	$714

405	Retail - Building material and garden equipment and supplies stores	$1,311	8.8	$417	$917
414	Air transportation	$20	0.1	$7	$13
415	Rail transportation	$510	0.7	$126	$281
416	Water transportation	$151	0.2	$24	$37
417	Truck transportation	$2,213	13.9	$680	$877
419	Pipeline transportation	$172	0.3	$55	$117
444	Insurance carriers, except direct life	$2,787	3.2	$311	$1,516
457	Architectural, engineering, and related services	$2,684	12.6	$1,301	$1,476
463	Environmental and other technical consulting services	$2,880	27.9	$2,292	$2,055
470	Office administrative services	$8,638	135.1	$5,190	$2,134
515	Commercial and industrial machinery and equipment repair and maintenance	$35,817	211.8	$17,485	$23,066
544	* Employment and payroll of federal govt, non-military	$25,797	121.4	$17,545	$25,797
5001	Private Labor	$63,571	1076.6	$63,571	$63,571
	Direct Impact	**$274,641**	**2667.2**	**$174,770**	**$168,783**
	Secondary Impact	**$205,387**	**1072.3**	**$58,530**	**$108,725**
	Total Impact	**$480,028**	**3739.5**	**$233,300**	**$277,508**
	* Jobs are presented in full-time equivalence (FTE)				

Table 9-9: US Impacts

IMPLAN Sectors	Industries	Output ($000)	Jobs*	Labor Income ($000)	Value Added ($000)
	Direct Impacts				
56	Construction of other new nonresidential structures	$84,761	956.9	$65,602	$38,211
103	All other food manufacturing	$4,178	10.0	$677	$912
154	Petroleum refineries	$16,308	1.4	$465	$3,669
203	Cement manufacturing	$7,737	10.3	$1,125	$2,905
215	Iron and steel mills and ferroalloy manufacturing	$11,218	9.1	$1,287	$2,651
252	Valve and fittings, other than plumbing, manufacturing	$3,418	9.2	$880	$1,445
269	All other industrial machinery manufacturing	$2,214	8.6	$647	$890
331	Switchgear and switchboard apparatus manufacturing	$6,354	12.6	$1,545	$2,348
360	Ship building and repairing	$21,161	64.2	$7,214	$9,166
392	Wholesale - Motor vehicle and motor vehicle parts and supplies	$111	0.3	$21	$53
395	Wholesale - Machinery, equipment, and supplies	$1,227	4.2	$386	$734
398	Wholesale - Grocery and related product wholesalers	$1,320	6.3	$485	$694
399	Wholesale - Petroleum and petroleum products	$2,742	1.6	$206	$2,445
400	Wholesale - Other nondurable goods merchant wholesalers	$3,635	11.4	$931	$2,059
401	Wholesale - Wholesale electronic markets and agents and brokers	$1,975	35.3	$3,196	$1,736

405	Retail - Building material and garden equipment and supplies stores	$1,320	8.9	$488	$923
414	Air transportation	$138	0.3	$49	$93
415	Rail transportation	$707	1.1	$188	$389
416	Water transportation	$187	0.2	$29	$53
417	Truck transportation	$2,391	15.0	$955	$1,112
419	Pipeline transportation	$398	0.7	$336	$346
444	Insurance carriers, except direct life	$6,661	8.2	$1,047	$3,624
457	Architectural, engineering, and related services	$3,364	15.8	$1,666	$2,014
463	Environmental and other technical consulting services	$3,681	35.6	$2,930	$2,627
470	Office administrative services	$14,673	229.5	$15,621	$6,667
515	Commercial and industrial machinery and equipment repair and maintenance	$36,853	218.0	$20,138	$24,231
544	* Employment and payroll of federal govt, non-military	$25,797	121.4	$18,486	$25,797
5001	Private Labor	$84,761	1539.5	$84,761	$84,761
	Direct Impact	**$349,293**	**3335**	**$231,361**	**$222,554**
	Secondary Impact	**$634,641**	**2591**	**$198,066**	**$343,119**
	Total Impact	**$983,933**	**5927**	**$429,426**	**$565,673**
	* Jobs are presented in full-time equivalence (FTE)				

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