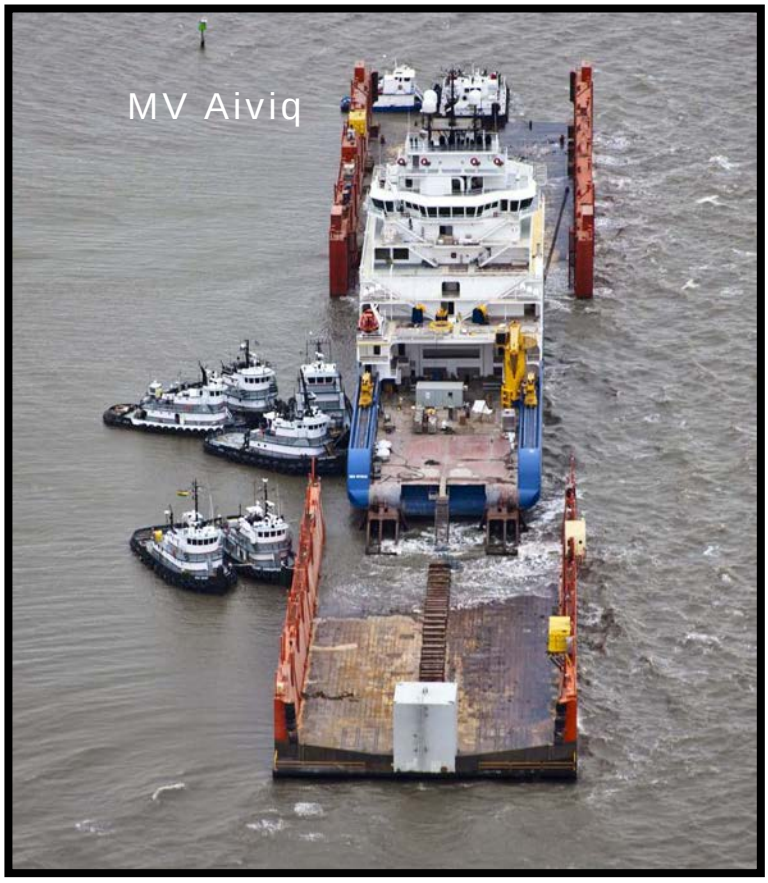
Appendix D

ECONOMIC BENEFITS

Draft Report
ECONOMIC BENEFITS OF HOUMA NAVIGATION CANAL DEEPENING



Prepared for

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and
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LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

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Draft Report

ECONOMIC BENEFITS OF HOUMA NAVIGATION CANAL DEEPENING

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EXECUTIVE SUMMARY

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This updated economic benefits report is submitted to address the economic reanalysis of benefits to deepening the Houma Navigation Canal (HNC) conducted in 2006 and previously updated in 2010 and 2012. Consequently, this 2015 update reflects existing studies and prior reports, including the results of a time series of market interviews and assessments that were conducted in relation to traditional National Economic Development (NED) benefits of waterway improvements, and fabrication benefits related to the deepwater oil & gas sector in the context of a legislated framework for evaluation. These activities have been compiled over several reports and studies both for the HNC and other deepwater offshore Gulf of Mexico (GOM) fabrication activities.

The methodology to develop benefits is largely based on personal interviews conducted with waterway users and service providers, including area fabrication firms. Owing to the extended nature of these studies with regard to updates in some instances there have been a time series of successive meetings with the same or similar individuals or firms for major users and market leaders affected by without-project conditions for the HNC. The interviews sought to identify how these firms currently used the HNC in without-project conditions and how they would likely use the HNC in with-project conditions based on changes in the sizes and sailing drafts of vessels. A concerted effort was made to have a complete set of personal interviews with the major and potential HNC users and service providers as well as update this for new entrants and changes in market conditions. Consequently, over time some users either as firms or individuals have changed businesses, bought, sold or relocated. The overall results have remained relatively constant with regard to a plethora of non-users of the HNC because of insufficient project depth as currently authorized (minus 15-ft.) with some localized maintenance issues that reduce the channel depth as opposed to proposed for with-project conditions.

There appear to be substantial benefits from deepening the HNC to different categories of vessels and users. Industry interviews indicate that there is little use of the HNC for vessels drafting more than 12 to 13 feet because of possible groundings and/or damages which is consistent with the Waterborne Commerce reports and annual vessel trips and drafts. The major shipyards at Houma and the oil & gas sector barges based there (derrick barges and pipe-laying barges) report that larger ocean tugs >3,000 horsepower cannot safely transit the HNC without risking damages. Consequently, these vessels and related barges will reroute by using a substantially longer detour via Eugene Island, the lower Atchafalya River, and the GIWW to Houma. Alternatively, some ocean barges are brought to Houma by the HNC by using inland river tugs because the ocean tug cannot transit under without-project conditions.

There are other NED benefits for deepening the HNC that are difficult to quantify but nevertheless exist. Vessels working in the Gulf of Mexico (GOM) near Houma reportedly must divert to other more distant ports for repairs and services because they cannot use the HNC. New vessels built at the Houma shipyards must use alternative routes to the GOM for sea trials as well as delivery or exit to the GOM via the HNC under special operating circumstances and risks of damages. Larger specialty offshore deepwater service vessels fabricated at Houma for domestic markets cannot be independently navigated out to GOM via the HNC but must be

conveyed on barges and or dry docks. The without-project operating drafts discourage efficient use of the HNC, resulting in light loaded vessels or bypassing the waterway and trucking to other ports and thereby incurring double handing costs in lieu of direct shipment from Houma.

There are substantial fabrication benefits for GOM deepwater oil and gas production topsides when using the gross value of contracts to the fabricator as the measure of benefit. For example, a deeper HNC would allow Gulf Island Fabrication (GIF) to ship out very large topsides for deepwater platforms. It is also possible that GIF might produce its deepwater hull design (MinDOC) at the Houma facility under with-project conditions, depending on market share developments.

The oil & gas offshore industry has waterway depth requirements that have outstripped their ability to efficiently use the HNC. An 18-foot project would only serve the periphery of these demands for both the NED and fabrication sectors of benefits. Whereas the old 180-ft. length offshore supply vessel (OSV) was the standard size a decade ago, the 2006 study encountered OSV market preferences for 250-260-ft. length. Today the OSV market is characterized by larger offshore distances to deepwater production platforms, longer offshore vessel dwell times as floating supply depots, and industry preferences to serve multiple platforms with one very large vessel. The combination of these features is reflected in strong preferences for 300-ft. or larger length OSV vessels as the new size standard. This generation of OSV vessels can only use the HNC under special circumstances ("light light" condition) to exit from Houma shipyards and can never return once fully outfitted for periodic maintenance and repair. A 20-foot channel would be able to capture most, if not all, of the identified NED and fabrication benefits including the largest OSV designs. At channel depths much less than 20 feet, either by authorized depth or operating draft, the usefulness of the HNC is substantially less.

The report reflects work done in 2006 and 2007, originally submitted as a draft in May 2007, containing the materials in chapters I through VI. The NED benefits had subsequently been updated in 2010 and 2012 the benefit cost analysis completed. The updated benefits in 2015 are contained in chapters V and VI, Benefit Analysis, and Benefits and Costs, respectively. The benefits reflect the current (FY 2016) Federal water resources discount rate and traffic forecast corresponding to the revised period for with-project conditions, 2027-2076, replacing the earlier period for with-project conditions, 2028-2076 (2014), 2024-2073 (2012) which had superseded the original time frame of 2012-2061 (2010).

The NED benefits consist of transportation cost savings and fabrication. As updated the present value of transportation cost savings are $223.933 million and $1,063.761 million for the -18-ft. and -20-ft. projects, respectively. The updated present value of the fabrication benefits is $72.044 million for the -20-ft. project. The -18-ft. project has no fabrication benefits based on the most recent very long term forecast for Gulf Of Mexico (GOM) deepwater oil/gas sea level production platforms requiring this channel depth.

The total construction costs of the project are between $163.650 million and $175.572 million for the -18-ft. and -20-ft. project depths, respectively, and adjacent disposal, to $187.092 million and $207.461 million for the -18-ft. and -20.ft project depths, respectively, and earthen retention and $224.001 million and $247.328 million for the -18-ft. and -20-ft. project depths,

respectively, and rock retention. The total construction costs of the -18-ft. and -20-ft. projects for adjacent disposal are approximately 87 and 85 percent of the total construction costs for earthen retention and 73 and 71 percent of the total construction costs for rock retention.

The total costs of the project consist of construction, interest during construction (IDC) and incremental operations and maintenance (O&M) costs. The IDC reflect a nine year construction schedule with costs ranging from $21.533 million (18-ft. adjacent disposal) to $28.735 million (20-ft. rock retention). The incremental O&M costs are nominal for the adjacent disposal alternative, $3.446 million and $15.396 million for the -18-ft. and -20-ft. projects, respectively.

However, the incremental O&M costs for the earthen and rock retention disposal alternatives are substantial, slightly less than the total construction costs for earthen retention and slightly more than the total construction costs for rock retention. The present value of the 50-year incremental O&M costs for the earthen retention alternative are $171 and $183 million for the -18-ft. and -20-ft. alternatives, respectively. The present value of the 50-year incremental O&M costs for the rock retention alternative are $239 and $265 million for the -18-ft. and -20-ft. alternatives, respectively.

Consequently, total costs, consisting of construction, IDC and present value of incremental O&M over 50-year project life, are substantially higher for the earthen and rock retention disposal alternatives. Total costs for adjacent disposal are $188 and $214 million for the -18-ft. and -20-ft. projects, respectively, compared to $381 and $416 million for earthen retention for -18-ft. and -20-ft., respectively, and $489 and $541 million for rock retention for -18-ft. and -20-ft., respectively.

The total NED benefits (transportation cost savings) of the -18-ft. project are slightly more than 20 percent of the total NED benefits for the -20-ft.project. Consequently, the benefit cost ratio (BCR) for the -20-ft. project is substantially higher than the corresponding BCR for the -18-ft. project.

The benefit cost ratios (BCR) for the -20-ft. project are 4.96/5.30 (NED benefits and NED + Fabrication benefits, respectively) for adjacent disposal alternative, 2.55/2.73 for the earthen retention alternative and 1.96/2.10 for the rock retention alternative. The benefit cost ratios (BCR) for the -18-ft. project are 1.19 for the adjacent disposal alternative, 0.59 for the earthen retention alternative and 0.46 for the rock retention alternative.[1] A seven percent discount rate used by Office of Management and Budget (OMB) results in lower BCR values. The 20-ft. project would have a BCR of 2.37 for the adjacent disposal alternative, 1.54 for the earthen retention alternative and 1.23 for the rock retention alternative. The 18-ft. project would have a BCR of 0.55 for the adjacent disposal alternative, 0.36 for the earthen retention alternative and 0.29 for the rock retention alternative.

[1] There are no fabrication benefits for the -18-ft. channel.

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ECONOMIC BENEFITS OF HOUMA NAVIGATION CANAL DEEPENING

I. INTRODUCTION

Potential benefits from the deepening of the Houma Navigation Canal (HNC) were previously considered in *The Economic Impact of Deepening the Houma Navigational Canal* prepared by Loren C. Scott & Associates in May 2000 for the Terrebonne Parish Consolidated Government and in the *Houma Navigation Canal Traffic Forecasting* report prepared by the URS Corporation in December 2002 for the New Orleans District Corps of Engineers. Information from the Scott and URS reports was incorporated into the Economic Analysis Appendix of the New Orleans District's draft March 2005 *Houma Navigation Canal Deepening Reevaluation Report*. Internal review of the draft document indicated a need for greater clarification and documentation with respect to economic benefits, which gave rise to the 2006 study.

The 2006/2007 study represented a fresh look at benefits. It included a traditional National Economic Development (NED) benefits analysis, but also a special analysis of fabrication benefits under the May 2005 Public Law 109-13 directive to incorporate the full value of project-induced contract awards in the calculation of benefits. The fabrication benefits analysis is concerned largely with the relation between channel deepening and the ability to secure deepwater oil & gas production platform fabrication contracts. The analysis is placed within the context of ongoing studies concerning the deepening of the Port of Iberia channel and the Atchafalaya River, because these projects could have an influence on the market share of fabrication contracts that might be obtained by Houma area firms.

This analysis was originally done in 2006 through shipper interviews and market assessment using primary data (Infield Systems very long term forecasts of world deepwater offshore oil/gas sea level production platform installations) and secondary data. The May 4, 2007 report was subsequently updated based on a traffic forecast for the HNC (*Houma Navigation Canal Deepening Study: Traffic Forecast Study, Final Report*, December 19, 2008). The updated report, revised March 1, 2010, reflected a change in the forecast of growth of benefitting traffic as a result of being too low in the years leading up to and slightly beyond with-project conditions then projected to exist in 2012 and too high in the later years of the project after 2016. The 2010 revision assumed a later start year for with-project conditions, 2024 as opposed to 2012 for the 2007 report. As a result benefits start much later, 2024 versus 2012 with a larger fleet owing to projected growth between 2006 and 2024.

The most recent update (2012) assumed the baseline fleet in 2010 from the 2010 update with the exception of any particular changes associated with the update. The biggest change was the inception of state of the art shipbuilding at LA Ship in Houma which was being planned at the time of the 2006 study and under development during the 2010 update but not specifically included in the benefiting fleet. LA Ship (Edison Chouest Offshore) projected in 2006 that it would fabricate special purpose offshore deepwater support vessels at LA Ship in Houma that would be too large in relation to vessel sailing draft and without-project conditions to float out via the HNC without special expensive navigation aids. None of these large vessels as projected by Edison Chouest Offshore were included in earlier investigations since the completion of LA Ship had not occurred. The delivery (November 1, 2011) of the first icebreaking anchor handling tug supply vessel, MV Aiviq, built for Shell Oil to support oil exploration in the Chukchi Sea (offshore Alaska), marks the beginning of a paradigm shift in vessel fabrication in

Houma. The MV Aiviq represents a $200 million dollar vessel touted as the "worlds' largest and most powerful anchor-handling icebreaker."[2] Edison Chouest Offshore incurred over $2.5 million of extra expenses to float the Aiviq out to the GOM using a flotilla of small tugs to move a dry dock and barge carrying the vessel. The Aiviq is the first of many specialty vessels to be fabricated at Houma that cannot be floated out via the HNC under without-project conditions without special navigation aids (a flotilla of barges and or dry docks assisted by multiple small shallow draft river tugs).

The current economics update related to benefits was initiated in late 2014, completed in 2015, and represents a refreshing of the 2012 analyses with regard to the baseline vessel fleet, fleet projections and benefits. Subsequently, the revised construction costs and schedule were completed in December 2015 resulting in the finalization of the updated economics appendix in January 2016. The updated economics since 2012 has increased benefits largely due to the more robust long term Department of Energy, Energy Outlook forecasts for deep water offshore oil production and a reduction in the federal water resources discount rate to FY 2016 (3.125%).

II. PRIOR REPORTS

NED BENEFITS

There are two prior reports that had dealt with NED benefits, and the information in these reports was incorporated into a Corps analysis of the economic feasibility of deepening the HNC.

Scott Report

The Economic Impact of Deepening the Houma Navigational Canal was prepared in May 2000 by Loren C. Scott & Associates for the Terrebonne Parish Consolidated Government. The Scott report was a regional economic benefits study based on questionnaires administered to Houma area firms and to oil & gas exploration companies to obtain their estimates of lost sales to foreign firms and costs of operation that could be reduced if the HNC was deepened to 20 feet. The questionnaire designed for Houma area firms was faxed to members of the South Central Industrial Association, a 200-member nonprofit association dedicated to regional growth and a supporter of HNC deepening. The questionnaire designed for the oil & gas exploration companies was e-mailed by the Mid-Continent Oil and Gas Association.

Questionnaires were faxed to 32 firms in the Houma area, of which 22 responded and 14 indicated benefits in the form of increased sales that would be gained through increased competitiveness with foreign firms (Table 1). Total sales increases were estimated at between $434 million and $1.3 billion. A question concerning reduced business costs with a deeper channel was also presented to the 32 firms, of which 10 responded affirmatively. Two oil and gas companies that had been e-mailed the questionnaire also responded affirmatively. The results are presented as annual cost savings of between $25 million and $44 million.

[2] Remarks made by Edison Chouest spokesman Gary Chouest.

Table 1. Direct Sales Increases and Annual Cost Savings With 20-Foot Channel in Scott Report

Company	Estimated Additional Direct Sales (Millions)	Estimated Annual Cost Savings
Cajun Cutters	$1.5	$420,000
Cenac Towing	35.0	1,300,000
Edison Chouest	200.0	2,000,000 – 10,000,000
R. B. Falcon Marine	0.5	400,000 – 600,000
Gulf Coast International Inspections	5.0	500,000
Gulf Island Fabricators	132.0	0
Hope Services	30.0	0
Mamou Heavy Lift	6.0	5,000,000
Marine One	1.0	0
Chet Morrison Contractors	5.0	2,000,000
Offshore Specialty Fabricators	10.0	3,000,000 – 5,000,000
Pride Offshore	1.0	0
Quality Shipyards	5.0	300,000 – 1,000,000
Skagit/Smatco	2.0	400,000
Conoco	0	8,334,000 – 16,667,000
Texaco	0	850,000
Totals	$434.0	$24,504,000 - $43,737,000

Sources: Loren C. Scott & Associates, May 2000, *The Economic Impact of Deepening the Houma Navigational Canal*; and G.E.C., Inc.

URS Report

The *Houma Navigation Canal Traffic Forecasting* report was prepared in December 2002 by the URS Corporation for the New Orleans District Corps of Engineers. The URS report was a traffic forecasting study based on historic usage trend analysis, supply/demand analysis of major industry products, and a survey of shipping companies and other HNC users. The study addresses non-monetarized benefits over the 50-year project life for 18-foot and 20-foot channel deepening. The surveys were faxed to businesses that utilize the HNC, which were asked to provide estimates of present annual trips and drafts for various sizes of vessels and expected annual trips and drafts under the 18-foot and 20-foot deepening scenarios.

Of the 64 firms that were faxed surveys, 34 responded; and of these, 15 indicated that they would benefit from a deeper channel. The beneficiaries are shown in Table 2 by cumulative inbound and outbound vessel trips for the existing condition and the 20-foot channel, indicating that the largest present user is Offshore Specialty Fabricators, followed by Main Iron Works, Delta Towing, Bollinger Larose, Trico, Chet Morrison, Cajun Cutters, Quality Shipyards, Offshore Shipbuilders, Gulf Island, Mammoet, and Skagit Smatco.

Table 2. Average Annual Vessel Trips Under Existing Conditions and With 20-Foot Channel in URS Report

Company	Existing Conditions		20-Foot Channel	
	Incoming	Outgoing	Incoming	Outgoing
Quality Shipyards	50	50	70	70
Four Star Marine	0	0	5	5
Mammoet	18	26	25	38
Delta Towing	262	262	345	345
Trico	80	80	75	75
Bollinger Larose	130	130	197	197
Skagit Smatco	4	10	8	20
Cajun Cutters	52	52	63	63
Gulf Island Fabrication	38	38	62.5	62.5
Offshore Specialty Fabricators	468	468	840	840
Chet Morrison	72	72	132	132
Main Iron Works	332	208	370	295
Doucet & Adams	0	0	2	2
Offshore Shipbuilders	50	50	60	60

Sources: URS Corporation, December 2002, *Houma Navigation Canal Traffic Forecasting*; and G.E.C., Inc.

Corps Report

Information from the Scott and URS reports was incorporated into the Economic Analysis Appendix of the draft March 2005 *Houma Navigation Canal Deepening Reevaluation Report*, which was prepared by the New Orleans District Corps of Engineers. Table 3 shows the NED benefits. As can be seen from the table, the primary beneficiaries are eight firms in the Scott report (excluding Cajun Cutters, R. B. Falcon Marine, and the two oil & gas companies), with the estimates of benefits derived from the lower range in the Scott report (see Table 1). The total annual savings are $14.5 million for the eight firms, which was adjusted upward on the basis of the URS report to produce $17.6 million in average annual benefits for the 20-foot channel with a B/C ratio of 1.5.

The ITR comment on the economic analysis was as follows: “There is no justification for benefits given other than that they were provided by users. More details identifying current use of the channel needs to be included. Vessel characteristics and how they are currently being used should be included. A detailed explanation of how deepening would allow for improved utilization of resources needs to be incorporated. There is a reference to transportation savings but no detail on hourly operating costs of specific vessel type and size that would benefit. How many vessels are light loaded? What are the operating procedures at the business and how would they change with a deeper channel. What is the economic impact of that change? Asking area firms how much savings they would incur and use these reported values is not an acceptable measurement technique.”

Table 3. NED Benefits from March 2005 Economic Analysis Appendix

Company	20+ Feet Deep Per Year Savings	Reasons for Savings*
Cenac Towing	$1,300,000	Transit savings
Chet Morrison Contractors	$2,000,000	Launch fully loaded vessels
Edison Chouest	$2,000,000	Consolidating of work in one facility
Gulf Coast International Inspections	$500,000	Consolidating facilities
Mamou Heavy Lift	$5,000,000	Use of larger more efficient equipment
Offshore Specialty Fabricators	$3,000,000	Use of larger more efficient equipment
Quality Shipyards	$300,000	Rigs and vessels could float in directly
Skagit/Smatco	$400,000	More efficient use of equipment
Total	$14,500,000	

*See *The Economic Impact of Deepening the Houma Navigation Canal*, prepared for Terrebonne Parish Consolidated Government Department of Planning and Economic Development by Loren C. Scott & Associates, Inc., May 2000.

Source: New Orleans District Corps of Engineers, March 2005, Economic Analysis Appendix, *Houma Navigation Canal Deepening Reevaluation Report*.

FABRICATION BENEFITS

The Atchafalaya River and the Port of Iberia channel are west of the HNC and within Louisiana. Both are being considered for channel deepening, with a large emphasis on increased opportunities for offshore platform fabrication.

Port of Iberia Report (2005)

In July 2005, G.E.C., Inc. (GEC) produced for the New Orleans District a draft report titled *Projections of Study Area Involvement in the Present and Future Petroleum Industry Activities on the OCS: Port of Iberia, Louisiana, Channel Deepening Study*, which dealt with the economic benefits of a deeper channel for the Port of Iberia (POI). This study was essentially a market allocation analysis related to what were then the Big 4 domestic deepwater offshore platform fabrication yards (Gulf Island, McDermott, Kiewit, and Technip, from which Technip has been eliminated by purchase by Gulf Island) and the then three smaller fabrication yards at POI (Omega Natchiq, Dynamic Industries, and Unifab, from which Unifab has been eliminated by purchase by Dynamic Industries). The study did not contain an analysis of any other potential users. That analysis was conducted by the Corps, which was unable to obtain documentation for additional benefits.

The study was conducted through a literature review, meetings with POI and other Gulf of Mexico fabricators, and meetings with project design/management firms and oil and gas operators in Houston to determine the competitive environment. The study analyzed the development of deepwater production platforms in the Gulf of Mexico and worldwide, the capacity and experience of the POI fabricators and other Gulf of Mexico fabricators, and public and private information on total and deepwater oil & gas worldwide and in the Gulf of Mexico.

Long-term production platform estimates for the deepwater Gulf of Mexico were obtained from the U.S. Minerals Management Service and from the English industry analyst Infield. The value of future deepwater topsides contracts was determined on the basis of contract value to the fabricator rather than total topsides value (because components are contracted to other firms). Market share estimates for POI and other Gulf of Mexico fabricators were rooted in present production capacity. Potential market shares and values for the POI fabricators are presented on the basis of a number of different scenarios for Gulf of Mexico and overseas work.

Fairly early in the study, it was determined that Gulf of Mexico fabricators faced little competition from foreign firms for Gulf of Mexico deepwater platform topsides, that there was little opportunity for Gulf of Mexico fabricators to compete with foreign firms for Gulf of Mexico deepwater platform hulls, and that there only limited opportunity for Gulf of Mexico fabricators to obtain contracts for deepwater projects in foreign lands because of local content restrictions. As a consequence, the market opportunities for POI fabricators were essentially in relation to other Gulf of Mexico fabricators and did not provide an occasion for NED benefits.

As the study was coming to a close, the May 2005 directive intervened, which (in the language of the Corps' traditional analyses) directed the Corps to count Regional Economic Development Benefits as NED benefits. This change was incorporated into the July 2005 analysis, which was itself incorporated into the New Orleans District's April 2006 Economics Appendix for the *Port of Iberia, Louisiana, Final Feasibility Report* and eventually led to a recommendation for a 16-foot channel to the Port of Iberia.

Atchafalaya Report

In May 2006, URS prepared a draft report for the Vicksburg District Corps of Engineers titled *Atchafalaya River and Bayous Chene, Boeuf, and Black Project and Proposed River Deepening Study*, which is concerned primarily with the economic benefits that would accrue to the fabricator McDermott in Morgan City under the new rule concerning the calculation of fabrication benefits. Much of the information in this report was obtained from the GEC report, but with some fundamental differences in statistical content, approaches, and conclusions.

The major difference in statistical content is the absence in the Atchafalaya report of the MMS data that were obtained late in the POI study. The major difference in approach is that the Atchafalaya report does not present any scenarios. The major difference in conclusions is that POI fabricators are assumed to have no share in the future Gulf of Mexico deepwater topsides market. The Big 3 Gulf of Mexico fabricators will capture 100 percent of the Gulf of Mexico deepwater topsides market and zero percent of the foreign topsides market. No new domestic fabricators will emerge in the next 50 years.

The Atchafalaya report calculates baseline market shares for deepwater Gulf of Mexico topsides on the basis of maximum man-hours for the Big 3 under the assumption that POI fabricators will not be able to penetrate the deepwater topsides market. The reason for the exclusion of the POI fabricators is the assumption that capacity for dockside integration by a firm (i.e., firm capacity rather than site capacity) will be totally determinative of capacity to participate in future deepwater topsides fabrication for all platform types other than SPARS (which cannot be integrated dockside). Even a 20-foot channel at POI would not provide the capacity for dockside integration.

The report does not suggest that McDermott might gain increased market share through a 35-foot channel that would provide integration capacity; rather, that a deeper channel would be the only way it could maintain its present market share. Greater than 35-foot options are excluded under the assumption that any topsides that would require more than 35 feet would be constructed by foreign yards.

Without-project benefits are calculated only in relation to SPARS under the assumption that McDermott will be able to compete only for this platform type without sufficient channel depth for dockside integration. With-project benefits are calculated using the topsides weight by type of platform and the per fabricated ton value contained in the POI report; and these numbers are used in conjunction with updated Infield projections to establish benefits as the total value of the topsides rather than the fabricator's contract value used in the POI report. Using these procedures, the Atchafalaya report calculates benefits of $50 million annually for a 35-foot channel. These are categorized as NED benefits under the new rule. Traditional NED benefits are not calculated.

Port of Iberia Report (2010)

In June 2010, G.E.C., Inc. (GEC) produced for the New Orleans District a final report titled *Port of Iberia Louisiana Channel Deepening Study: 2010 Economics Update*, which dealt with an update of the 2005 economic benefits of a deeper channel for the Port of Iberia (POI). This updated study reflected some differences from the 2005 work: (1) a current long term forecast of GOM deepwater sea level production platforms was obtained (2009) from Infield Systems (along the with rest of the world); and (2) NED benefits from channel deepening were developed from users.

The major findings of the reevaluation supported the trends and issues previously developed in the 2005 report. The general findings pertinent to deepwater oil/gas sea level production platforms (topsides) include: (1) GOM topsides continue to be dominated by GOM fabricators; (2) large hulls continue to be dominated by overseas shipyards; and (3) smaller hulls (including the MinDOC design developed by Gulf Island Fabrication) continue to be dominated by GOM fabricators.

With respect to market assessment, the findings were as follows: (1) the Big 4 GOM fabricators had become the Big 3 fabricators with the sale of a deepwater Texas facility to Gulf Island Fabrication; (2) one of the three mid-size fabricators at Port of Iberia had been eliminated and the facility acquired by another Port of Iberia mid-size fabricator, which had also acquired deepwater access at Lake Charles; and (3) hull and topsides shore side integration will be

dominated by deepwater yards in Texas, giving them competitive advantages over non-integrated yards for large topsides.

Fabrication benefits for the 50-year life of Corps navigation projects require a very long term-forecast of deepwater oil/gas sea level production platforms. Other than long term projections of production platform installations by MMS (and its successor BOEM) the oil/gas industry per se does not make long term forecasts extending beyond a few years.[3] Two sources were used for very long term GOM deepwater oil/gas production platforms, former Materials Management Service (MMS) 2006 projections and Infield Systems 2009 projections. Both MMS and Infield project a near continuous decline in the number of sea level platform installations in the GOM after 2012. The Infield 2009 GOM projections are distinctly lower than the Infield 2005 projections but track the MMS 2006 projections very closely. There is a consistent overall decline in the projected deepwater sea level GOM platforms installed after 2021 through the duration of the projections which has significant implications for the deferral of start years for with-project conditions relative to total forecasted topsides and fabrication benefits. The reversal of the significant decline in deepwater sea level platforms after 2021 would require substantial new discoveries to change the clear declining trends for the GOM as projected by MMS (2006) and Infield (2009) after 2021. The proportion of the Eastern Gulf that will likely be opened at some time for exploration and production is quite small in terms of undiscovered but assumed to exist resources compared to the existing Central and Western Gulf regions.

Using market share scenarios, the total GOM deepwater offshore oil/gas platforms projected for the period 2020 through 2069 was compared with the earlier period and prior forecasts. The GOM 2009 projections are distinctly less than the 2005 projections, primarily after year 2020. As a result, the 2009 GOM projections for the number of deepwater offshore oil/gas sea level installations are about one-half of the projected number for the 2005 forecast for the period 2020 through 2069. Therefore, using the market share approach previously developed translates into similar share of a much smaller overall projected GOM market (2020-2069).

III. INTERVIEWS

SURVEY METHODOLOGY

The 2006 study was conducted primarily on the basis of personal interviews with potential beneficiaries in the Houma area (including Dulac, Bourg, Larose, and Galliano) and New Orleans and oil and gas companies in Houston, with follow up e-mail and telephone calls to secure promised documentation.

Response results of the Scott and URS surveys were summarized to obtain an initial list of potential beneficiaries and some suggestions of the possible importance of individual firms (Table 4). The firm names were used to develop an enquiry form asking for an evaluation of the

[3] On October 1, 2011 the Bureau of Ocean Energy Management, Regulation and Enforcement, formerly Materials Management Service, was replaced by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) as part of a major reorganization.

degree of relevance to the present study and for the names of other firms that should be included. The enquiry form was submitted to Gulf Island Fabrication (GIF), Quality Shipyards, Edison Chouest Offshore, and the Port of Terrebonne/Terrebonne Economic Development Authority and was fully completed by Gulf Island Fabrication, which knows most of the relevant firms in south Louisiana and has been instrumental in the development of the South Central Industrial Association and the Port of Terrebonne.

Table 4. Potential Beneficiaries from Deeper Channel in Prior Reports

Firm	Returned		Benefits	
	Scott	URS	Scott	URS
A&M Dockside Repair Inc.	⁜	N	⁜	⁜
All South General Contractors	N	⁜	⁜	⁜
American Aero Cranes	N	N	⁜	⁜
Angel Boats Inc.	⁜	N	⁜	⁜
ASCO Logistics	⁜	N	⁜	⁜
B.J. Services	N	Y	⁜	N
Bayou Marine Corp.	⁜	Y	⁜	N
Bayou Tugs, Inc.	⁜	Y	⁜	N
BILCO	N	Y	⁜	N
Bollinger Shipyards	Y	Y	N	Y
Caillou Island Towing Company	⁜	N	⁜	⁜
Cajun Cutters	Y	Y	Y	Y
Cenac Towing	Y	N	Y	⁜
Chet Morrison Contractors	Y	Y	Y	Y
Conoco	Y	⁜	Y	⁜
Coral Marine Services Inc.	⁜	N	⁜	⁜
Cor-Val Inc.	⁜	N	⁜	⁜
Dagates Marine, Inc.	⁜	N	⁜	⁜
Danost & Curole	N	⁜	⁜	⁜
Deep Sea Development Inc.	⁜	Y	⁜	⁜
Delta Inspection Co. of Houma	⁜	Y	⁜	N
Delta Towing	Y	Y	Y	Y
Dixie Shipyard & Supply Inc.	⁜	N	⁜	⁜
Dolphin Services	N	N	⁜	⁜
Doucet & Adams	Y	Y	Y	Y
Drilling Rig Instruments Co.	⁜	Y	⁜	N
Dupre Bros. Construction Inc.	⁜	N	⁜	⁜
EBI Elevated Boat LLM	⁜	N	⁜	⁜
Edison Chouest (N. Am. Fab.)	Y	Y	Y	N
Four Star Marine	⁜	Y	⁜	Y
G&H Barge Repair and Fabrication	⁜	N	⁜	⁜
Gulf Coast International Inspection	Y	N	Y	⁜
Gulf Coast Fabrication	⁜	Y	⁜	N
Gulf Island Fabrication	Y	Y	Y	Y
Halliburton Energy Services	⁜	N	⁜	⁜
Hope Services	Y	N	Y	⁜
Hydraulic Well Control, Inc.	⁜	Y	⁜	N

Firm	Returned Scott	URS	Benefits Scott	URS
J. Ray McDermott	Y	N	N	⁎
L&L Rig Repair Service	⁎	Y	⁎	N
LeBeouf Bros. Towing Co., Inc.	⁎	Y	⁎	N
LOOP	Y	⁎	N	⁎
M. B. Barge, L.L.C.	⁎	Y	⁎	N
Mamou Heavy Lift	Y	Y	Y	Y
Marine Fab & Repair Inc.	⁎	N	⁎	⁎
	Returned		**Benefits**	
Firm	**Scott**	**URS**	**Scott**	**URS**
Main Iron Works	N	Y	⁎	Y
Marine One	Y	N	Y	⁎
McDonough Marine	N	⁎	⁎	⁎
Nabors Offshore Corp.	⁎	Y	⁎	N
Offshore Shipbuilders	⁎	Y	⁎	Y
Offshore Specialty Fabricators	Y	Y	Y	Y
Oilfield Production Contractors	⁎	N	⁎	⁎
Patco Completion Services	⁎	Y	⁎	N
Pellegrin Marine, Inc.	⁎	Y	⁎	N
Pipeline Construction & Maintenance	N	Y	⁎	N
Pride Offshore	Y	N	Y	⁎
Production Systems, Inc.	⁎	Y	⁎	N
Quality Shipyards	Y	Y	Y	Y
Setton Towing L.L.C.	⁎	Y	⁎	N
Sigma Industries	N	⁎	⁎	⁎
Skagit/SMATCO	Y	Y	Y	Y
Southern Technology & Services	⁎	Y	⁎	N
Sun Towing Corp.	⁎	N	⁎	⁎
T. Baker Smith & Sons	Y	⁎	N	⁎
Taira Lynn Marine Inc.	⁎	Y	⁎	⁎
Tetra Applied Oil and Gas Services	Y	Y	N	N
Texaco	Y	⁎	Y	⁎
TLC Marine Service Inc.	⁎	N	⁎	⁎
TRICO Marine	Y	Y	Y	Y
Williams Field Services	Y	N	N	⁎

Notes: Scott = Loren C. Scott & Associates, May 2000, *The Economic Impact of Deepening the Houma Navigational Canal.*
URS Corporation, December 2002, *Houma Navigation Canal Traffic Forecasting*.

Initial contacts with firms were made by GIF, with the assistance of Quality Shipyards and Cenac Towing, which expedited the process and insured full participation. Each interviewed firm was asked for the names of additional firms that might be included in the study, with an emphasis on similarly situated firms when a firm type proved to be particularly relevant. When shipyards/repair yards proved to be significant potential generators of NED benefits, the initial

list of firms was checked against Colton's online "Directory of U.S. Shipyards," OPL's *Offshore Shipbuilders and Fabrication Yards of the World*, and the "Ship Building and Repairing" section of the *Marine Yellow Pages*. The entire process resulted in the inclusion of only a few additional firms.

SURVEY PROCEDURES

The interviews were held primarily through six two-day trips to Houma and one three-day trip to Houston from October 2006 through April 2007. The first set, which was classified as a kickoff meeting, was organized by PBS&J and included one fabricator and two shipyards that were identified as important to the establishment of benefits, as well as a joint meeting with the Port of Terrebonne and the Terrebonne Economic Development Authority. Subsequent interview appointments were made and conducted by GEC. Three of the subsequent sets of interviews in Houma were primarily concerned with the identification of NED benefits, and two sets were primarily concerned with the identification of fabricator benefits, but included additional NED benefit interviews. The Houston interviews were also primarily concerned with fabricator benefits, but included one potential NED beneficiary.

Packets of information for each firm that was to be interviewed were prepared from online sources. Interviewees (many of whom had participated in the previous studies) were told why a restudy was being done and the criteria that were relevant to the Federal Government in the establishment of benefits and were asked to describe the nature of their operations and how their firms or customers might benefit from channel deepening, which was followed in most cases by extensive discussions of the details of potential benefits. Firms indicating that they would benefit from the project were asked to supply documentation.

Following each set of interviews, e-mails were sent to firms that indicated that they could supply documentation, with a statement of the features of the materials that had been promised. Interview notes were used to provide an account of the details of each interview.

SURVEY RESULTS

NED Benefits Surveys

The following firms were formally interviewed (2006-2007) to determine potential NED benefits:

1. Quality Shipyards, two interviews: Bobby Barthel, Executive Vice President/General Manager
2. Edison Chouest Offshore: Roger T. White, Senior Vice President
3. Chet Morrison Contractors: Chet Morrison, Chief Executive Officer
4. Hope Services: Richard Miles, President
5. Manson Gulf: Vincent Dinkler, President; Michael Mayeux, Manager Civil Construction
6. Dolphin Services: Bill Fromenthal, President and CEO
7. Trico Marine Services: Kenneth Bourgeois, Vice President
8. Seacor, telephone interview: Shull Autin, Executive Vice President

9. Oil States Skagit Smatco: Leland Robichaux, Aftermarket Sales
10. Otto Candies: O. E. Butch Monnier, Jr., Managing Director
11. Cenac Towing Company: Arlen "Benny" Cenac, Jr., President
12. Superior Energy Services: Dwayne Boudreaux, Director of Operations; David Faulkner, Vessel Superintendent
13. Elevating Boats: Walter Cure, Marine Manager
14. Crosby Tugs: Kent Fournier, General Manager; Ashton Cheramie, Offshore Operations Manager
15. Main Iron Works, two interviews: LeRoy Molaison, President
16. Pride Offshore: Chris Johnson, General Manager; Jimmy Ledet, Operations Manager; Eddie Speed, Maintenance Manager
17. Delta Towing: Ricky Guy, Inland Operations Coordinator; Jude Landry, Offshore Operations
18. Offshore Specialty Fabricators: Harlan Berlanger, Executive Vice President
19. Caillou Island Towing: Billy Cenac
20. Global International Marine: Tony Authement, Chief Executive Officer
21. Performance Energy Services: Jimmy Carlos, Chief Operating Officer
22. Mariner: Gary Stansbury
23. Bollinger, telephone interview: Craig Roussel
24. Thoma-Sea Boatbuilders: Robert Thomassie, President
25. Crossmar: Bobby Thompson, Jr., Chairman and CEO
26. Offshore Towing: Cory Kief, President
27. Allied Shipyard: Danny Toups, Production Manager
28. Intracoastal Iron Works: Raymond Vigurie
29. Mammoet: Piet Nooren, Executive Vice President, Hans van Breukelen, Director of Sales

Fabrication Benefits Surveys

The following firms were formally interviewed in 2006-2007 to determine potential fabrication benefits:

1. Gulf Island Fabrication, three interviews: Kerry Chauvin, Chairman and Chief Executive Officer; Roy Francis, Director of Government Affairs/Business Development; Bill Blanchard, Director of Operations
2. North American Fabricators/Edison Chouest Offshore: Roger T. White, Senior Vice President
3. Dolphin Services: Bill Fromenthal, President and CEO
4. Chet Morrison Contractors: Chet Morrison, Chief Executive Officer
5. Offshore Specialty Fabricators: Harlan Berlanger, Executive Vice President
6. Performance Energy Services: Jimmy Carlos, Chief Operating Officer

Of these, the latter five were also interviewed for potential NED benefits and therefore are included in the prior list.

Oil and Gas Industry Surveys

The following oil and gas firms in Houston were formally interviewed in 2006-2007 to clarify and confirm GIF's competitive position:

1. Chevron: Buddy Lang, Project Manager, Blind Faith Project
2. Anadarko: S. Michael Beattie, General Manager, International Projects; R. Don Vardeman, Vice President, Worldwide Projects; Gary Mitchell, General Manager, Production Operations
3. ATP: Robert Shivers, Vice President
4. BP: Edmond Blanchard, Construction Manager; Raymond Malone, Atlantis Project

Additional Contacts

The following additional contacts have been made in 2006-2007:

1. Port of Terrebonne and the Terrebonne Economic Development Authority -- Formal interview held to determine port plans and the overall context for channel deepening benefits.
2. T. Baker Smith -- Formal interview held to identify present channel limitations and the need for deepening.
3. Terrebonne Parish Department of Public Works -- Visited to obtain vessel traffic data for comparison to Federal data.
4. International Shipholding (New Orleans) -- Contacted by phone to obtain information on two vessel delays that were incorporated into a Corps report on the need for maintenance dredging.
5. Central Gulf Towing (referred by Doucet & Adams) -- Contacted by phone. Does not think firm would benefit directly from the project. .
6. Southern Technology & Services -- Contacted by phone for possible project benefits and as a participant in the South Central Industrial Association. No direct benefits.
7. Bilco Tools -- Contacted by GIF. Indicated no potential benefits.
8. Weeks Marine -- Contacted by GIF. Indicated no potential benefits.
9. Bourg Dry Dock/LeBoeuf Bros. Towing -- Contacted by GIF. Indicated no potential benefits.[4]
10. Rep. Gordy Dove -- Courtesy call.
11. Cajun Cutters -- Contacted by GIF. Indicated no potential benefits.
12. Tetra Applied Technologies – Contacted by GIF. Indicated no potential benefits.
13. Dulac Shipyard – Contacted by GIF. Indicated no potential benefits.
14. On-Site Marine – Shipyard on same property indicates that On-Site is not presently operational.

[4] In 2012 Bourg Dry Dock/LeBoeuf Brothers Towing has culminated a series of shipyard investments in dry docks and a fleeting area at Houma to perform repairs and new buildings for other vessel owners and operators than the LeBoeuf fleet. The firm expects to pursue ocean barge repairs and also shallow draft vessels.

15. Bourg Marine & Supply – Contacted by GIF. Indicated no potential benefits.

IV. ANALYTICAL RESULTS

The Scott and URS surveys were not used as a basis for discussion in the interviews. Retrospectively, it is obvious that the completed surveys in the Scott and URS reports contained important information; but this information was limited and largely unintelligible because of the explanatory constraints imposed by mail surveys. The key element in the 2006-2007 analysis was the personal interviews, which provided sufficient time for potential beneficiaries to describe their problems with respect to the existing HNC conditions and sufficient time for probing to clarify the issues and to obtain supporting data in a verbal form.[5] This has enabled the 2006-2007 analysis to extend well beyond the previous analyses in terms of the number and variety of potential beneficiaries identified, the variety of potential benefits, an explanation of how those benefits would be achieved, and a quantification of benefits in conformance with Corps regulations and the new directive for evaluating fabrication benefits.

NED BENEFITS

Of the 34 firms that were initially interviewed 2006-2007 to determine benefits, 29 were firms that had potential NED benefits (the exceptions being Gulf Island and the four oil & gas companies, which were interviewed only in relation to fabrication benefits). The status of the 29 firms with respect to NED benefits developed during 2006-2007 is discussed individually in the following sections, which have been divided into shipyards and nonshipyards because of the importance of the shipyards in the NED benefit picture that emerged during the course of the interviews.[6] Where the firm status has been confirmed to change as of 2015 this will be indicated. None of the changes in ownership or operations are material to the benefits of deepening as formulated in 2006-2007 and previously updated in 2010 and 2012.

Shipyards

In the following descriptions, Colton refers to Colton's online "Directory of U.S. Shipyards." Colton is a compilation of information on historic and contracted (as of September 23, 2006) new builds and does not include information on repairs, which have proven to be an important part of the benefit picture. MARAD refers to the U.S. Maritime Administration's 2004 *Report on Survey of U.S. Shipbuilding and Repair Facilities*.

Quality Shipyards

Quality Shipyards is located on the Intracoastal Waterway in Houma and is part of the New-Orleans based and internationally operating Tidewater, whose webpage indicates that

[5] The potential benefits and vessel operations related to a diverse group of users and non-users of the HNC under without and with-project conditions were sufficiently diverse such that no standardized set of survey questions would suffice or be appropriate.

[6] This descriptive material related to individual firms in 2006-2007 has not been updated to reflect changes related to 2012 and 2014 except as otherwise specifically noted.

it builds and repairs offshore supply vessels, offshore tugs, utility vessels, and specialty vessels, with the closest additional facility being a repair yard in Amelia. Colton indicates that the Houma yard has completed 124 offshore service vessels, tugs, and towboats since 1969 and has 20 underway. MARAD indicates that it has four floating dry docks and one shipway. Quality's brochure emphasizes deepwater vessel construction. It responded to the Scott survey, indicating that it was losing repairs and construction of larger deeper draft vessels to foreign firms and that vessels with drafts greater than 15 feet need to be brought in by smaller vessels. It also responded to the URS survey, indicating 50 incoming and 50 outgoing vessel trips annually at present, which would increase to 70 incoming and outgoing with a 20-foot channel.

In the interview, Quality reported issues in relation to getting new building offshore supply vessels (OSV) out of the HNC as the result of draft constraints. Vessels can be brought in for repairs, but depth is a problem as they look to other ports and countries. The current 21.5 draught OSV hulls can only be light loaded to 15 to 16 feet, so they cannot come to Houma for repairs. The repair market is substantial; about 70 percent of the yard activity is repair, and the rest is new construction. Vessels that cannot come into Houma for dry docking on the ABS two-year in five-cycle of inspections and repairs must travel to more distant ports for these services. The repair cycles average about $2 million in expenditures. Houma also repairs OSV that are part of the Mexican fleet. These vessels are normally smaller than the U.S. GOM fleet, but about one-half cannot come to Houma on the HNC without tug assistance because of draft issues. The offshore OSV fleet is viewed to be about 40 percent 180 by 40 by 14 (length overall, beam, and draught), 40 percent 220 by 50/56 by 20, and some 250/260 by 60 by 24. Most new construction will be at least 180 plus 30 feet or about 220 by 46 by 17. The bigger boats carry substantially more cargo due to larger beam and draft in addition to larger length overall (Loa).

Edison Chouest Offshore

Edison Chouest Offshore is headquartered in Galliano on Bayou Lafourche and has facilities in Houma, Larose, and Port Fourchon and has acquired property at the Port of Terrebonne. Its webpage claims that it provides "the most technologically advanced and fastest growing offshore vessel services in the world," including a fleet of new-generation offshore service vessels that currently support the majority of the U.S. Gulf of Mexico deepwater market and the largest fleet of seismic and research vessels in the world. Chouest's C-Port facility in Port Fourchon is a multi-service marine complex that has 18 slips and provides ship repair, cargo transfer, and support services. Chouest's North American Shipbuilding facility in Larose is claimed to have built "more specialized offshore vessels than any other shipyard in the world." Chouest's North American Fabricators facility in Houma was added in 1996 and builds highly specialized offshore supply vessels from 190 feet long and up for Chouest's fleet. The land was obtained at the Port of Terrebonne to establish a new yard that will be called LAShip and will be dedicated to tankers. Colton indicates that the Larose and Houma facilities combined have produced 109 supply and specialty vessels since 1974, with 13 currently underway. The Houma facility is not listed in MARAD; the Larose facility is, but no data are provided. With respect to North American Fabricators in Houma, Edison Chouest responded negatively to the URS survey but positively to the Scott survey, indicating that North American would benefit as a shipbuilding facility from a deeper channel, including the capacity to construct small Floating

Production Storage and Offloading vessels (FPSOs), which was corrected in the interview with Chouest to shuttle tankers for FPSOs.

In the interview, Chouest indicated that it plans to continue to build 280-foot Loa OSV at the North American Fabrication facility in Houma, producing one vessel every four months. The plans for LAShip are to produce small refined products (product) tankers for the domestic (Jones Act) coastal trades and shuttle vessels for FPSO GOM deepwater oil & gas production platforms. Both the OSV and the tankers will move out of the HNC in a "light light" condition under the without-project conditions.[7]

Hope Services

Hope Services is located on the HNC in Dulac (below Houma). Its webpage indicates that it builds push-boats, tugs, and offshore supply vessels and fabricates small and medium offshore structures and that it has 60 fenced acres with 3,000 feet of water frontage, but no dry dock. Colton indicates that it has constructed 33 vessels (almost all towboats) since 1985 and that it has two underway. MARAD indicates that it has 1,067 meters of berths. It did not respond to the URS survey, but did respond to the Scott survey, indicating loss of dry docking and rig repair business abroad because of channel depth limitations.

In the interview, Hope indicated that vessels drawing more than 14 feet of draft cannot come to its facility. As a result, there are repair jobs lost to other more distant yards in Texas and Alabama. Rigs working in the GOM will spend more travel time (up to $150,000 to $200,000 it is estimated) to access more distant shipyards for repairs. There is no way of knowing the extent of these repair diversions for rigs because Hope only gets calls (about six times a year) from operators who do not know the limitations of the HNC. The rest of the jobs are lost. There are about 160-180 rigs working in the GOM, and this results in about 25 to 30 rigs a year seeking yard space for ABS survey work that represents about $2 million worth of refurbishment.

Otto Candies

Otto Candies is located on the Intracoastal Canal in Houma and is part of the Des Allemands-based firm by that name, whose webpage indicates that they are in the marine transportation business and operate worldwide, with a fleet numbering 100 vessels. The yard in Houma builds vessels primarily for Candies' fleet needs. It was until recently under the ownership of the Dutch firm De Hoop and was known as Houma Fabricators. Colton indicates that it has constructed 82 tugs, towboats, and offshore service vessels since 1966. It is listed in MARAD under the name Houma Fabricators, indicating that it has one shipway. It was not included in the Scott or URS surveys.

[7] Follow up with Edison Chouest Offshore indicates that the vessel fabrication markets and strategies espoused in 2006 have remained unchanged. These specialty vessels are now being fabricated at LA Ship and represent a major new category of NED benefits because the vessel drafts cannot be accommodated by the HNC in without-project conditions, necessitating expensive alternative means of moving these vessels via other vessels (barges) or dry docks to the mouth of the HNC.

In the interview, Candies indicated that new construction is characterized by larger and more specialized offshore vessels. At this facility they cannot build 80 percent of the new-age anchor handling tug support vessels, which range from 240 to 340 feet Loa, because of draft. They cannot build 50 percent of the new-age MIR ROV support intervention vessels, which range from 260 to 340 feet Loa. They cannot build between 60 to 70 percent of the deepwater intervention vessels (frack boats), which range from 340 to 480 feet Loa. The OSV fleet is expected to converge around 260 to 280 feet Loa as a standard size compared to the 180-foot Loa standard size in the 1980s. As the industry has moved farther out on the shelf, the boats are viewed as floating warehouses. Generally, there are two rigs/platforms per boat, but the industry appears to be moving to four rigs/platforms per boat with the new-age high-capacity 280-foot Loa vessels. There will be some replacement of the smaller osv, but the norm will be 260 to 280 feet Loa. As a result, the large number of vessels that comprise the older smaller fleet that is now currently working will be laid up when the existing market cools or these vessels come out of service. The majority of the older smaller fleet will be taken out of service and scrapped or sold overseas.[8]

Main Iron Works

Main Iron Works does not have a webpage. It is located in Houma on the Intracoastal Waterway and is in the business of building and repairing ships and offshore tugs. Colton indicates that it has completed 257 tugs and towboats since 1954 and has five underway. MARAD indicates that it has five floating dry docks. It did not respond to the Scott survey, but did respond to the URS survey, indicating that it had to turn down jobs because of draft restrictions and that it has 332 incoming and 208 outgoing vessel trips annually at present, which would increase to 370 incoming and 295 outgoing with a 20-foot channel.

In the interview, Main indicated that they are engaged in repair and new construction, primarily of offshore deep-draft tugs that come to this yard via Eugene Island, taking up to 30 to 32 hours to get here. They also use this route for sea trials. They incur charges of about $30,000 to tow these vessels through the GIWW via Eugene Island to Fourchon. A substantial number of the boats they handle each year must be rerouted.[9]

Mariner[10]

Mariner is a 10-acre shipyard without a dry dock located on the HNC in Houma. Its webpage indicates that it designs, constructs, and repairs military and commercial vessels for worldwide customers and specializes in aluminum and steel construction, repairs, refurbishing, electrical and machinery overhaul, and conversion. Colton does not have a build record for

[8] Similar to Edison Chouest Offshore (LA Ship) Otto Candies anticipates that it will fabricate specialty vessels for its proprietary fleet that are too big to navigate the HNC and will require ancillary vessels (barges) and or dry docks to be floated out to the mouth of the HNC. Houma is the major domestic shipyard with respect to investment and vessel fabrication by Otto Candies.

[9] A representative for Main Iron Works indicated in 2012 follow up that the firm has had to turn away new buildings of tugs too large to be accommodated by the HNC as well as repairs) because of without-project conditions at the HNC.

[10] In 2012 this company is no longer in business.

Mariner, but indicates that it has two vessels underway. It is not listed in MARAD and was not included in the Scott or URS surveys.

In the interview, Mariner indicated that it turns away repairs on big tugs. The tugs are getting bigger, as well as the drafts of the supply boats. They have the capability to turn out four vessels per year, but lack a dry dock.

Bollinger

Bollinger is headquartered in Lockport. According to its webpage, it operates 13 shipyards in south Louisiana and Texas and engages in construction, repair, and conversion for a wide variety of offshore and inland vessels. Bollinger Shipyards Lockport is a construction yard with an adjacent repair facility that has five marine railways. Bollinger Fourchon is a repair facility at Port Fourchon. Bollinger Marine Fabricators in Amelia is a construction yard. It is joined in Amelia by two other repair facilities, Bollinger Morgan City and Bollinger Amelia Repair, both of which have three floating dry docks. Bollinger Larose is a repair facility with five floating dry docks and one marine railway. Colton indicates that Bollinger Shipyards Lockport has constructed 280 tugs, towboats, offshore service vessels, and patrol boats since 1963 and has 13 underway and that Bollinger Marine Fabricators in Amelia has constructed 44 barges and has 16 underway. MARAD indicates that Bollinger in Lockport has two shipways and five marine railways, that Bollinger in Larose has four floating dry docks and one marine railway, and that Bollinger Marine Fabricators in Amelia has one shipway. Bollinger Larose responded negatively to the Scott survey, but positively to the URS survey, indicating that it has 130 incoming and outgoing vessel trips annually at present, which would increase to 144 incoming and outgoing with a 20-foot channel.

In the interview, Bollinger indicated that it makes extensive use of the HNC in conjunction with its repair business, but it did not provide any statistics on vessel movements, diversions, tug assistance, or the like. It did indicate that vessel access time to shipyards is an important criterion for winning work, other things being equal. Most of the Bollinger work is stated to be done in Amelia, which is not directly affected by the HNC. Bollinger is of the opinion that the with-project conditions (deepening) of the HNC would have a huge impact, because the vessels are becoming too large (wider and deeper) for the HNC to handle in its current configuration. Local companies would particularly benefit from the with-project conditions, such as Chouest (North American Fabrication), Main Iron Works, and Quality. Bollinger would also use a deeper HNC, but they have been reluctant to divulge their vessel repairs and new buildings that are constrained by the HNC and need to be diverted or otherwise have tug assistance.

Thoma-Sea Boatbuilders

Thoma-Sea Boatbuilders is located on the Intracoastal Waterway in Houma and has an additional facility in Lockport and has acquired property in the Port of Terrebonne. It does not have a webpage and was not surveyed by Scott or URS. Colton describes it as a small builder of tugs since 1994, having completed 25 vessels and with one under construction. It is listed in MARAD, but without data.

In the interview, Thoma-Sea indicated that they regularly reroute large ocean tugs (new buildings) to the Mississippi River or to the Gulf via Morgan City in conjunction with sea trials. The largest supply boat they can build and get out is 220 by 54 by 19, and they can only get this out on the HNC in "light light" condition and then find fuel, stores, and supplies at another port. The sea trial diversions are expensive because they have to pick up some of the extra time-related costs for some of the agencies affected by the detour time, which is about eight hours to the Mississippi or Morgan City. Although the costs of sea trials are built into the bid price, they typically absorb the extra costs related to diversions. For some tugs, they use a submersible barge and take the tug to Fourchon for trials. About 30 percent of the sea trials movements use tug assistance to minimize damages and the use of divers and dry docks when there are groundings.[11]

Allied Shipyard

Allied Shipyard is located on the Intracoastal Waterway in Larose and has an additional facility in Golden Meadow. It does not have a webpage and was not surveyed by Scott or URS. Colton indicates that it is primarily a repair yard, that it has been in existence since 1966, and that it has constructed 37 (mostly fishing) vessels with none under construction. MARAD indicates that the facility has three floating dry docks, one shipway, and one marineway.

In the interview, Allied indicated that they are geared for offshore service vessel production in the 210-215 Loa range, making about 10 vessels a year that they send out through the HNC in a light condition with tug assistance. They do about 40 tug repairs a year, of which five to six are deep-draft diverted vessels from the HNC; and they do from 100 to 200 or more vessel repairs a year and turn down about 30 repairs a year on vessels that are too large to come to their yard.

Intracoastal Iron Works

Intracoastal Iron Works is located on the Intracoastal Waterway in Bourg. It does not have a webpage and was not surveyed by Scott or URS. Colton indicates that it has three towboats under construction, but no past record is given. The facility is not listed in MARAD.

In the interview, Intracoastal indicated that they do not have a dry dock, but nevertheless concentrate on new building for about 80 percent of their business. The push boat market in which they participate is currently strong. They use the Intracoastal to Morgan City, which has its own set of difficulties, and would use the HNC if it were deeper. They can do dock trials out of their facility, but sea trials require longer runs and deeper water. Followup work from sea trials is conducted at other yards because of HNC constraints.

[11] Thoma Sea in 2012 is a major tenant at the Port of Terrebonne and has evolved into one of the largest shipbuilders at Houma engaged in constructing vessels too big to navigation the Houma Navigation Canal.

Nonshipyards

Chet Morrison Contractors

Chet Morrison Contractors was started in 1983, has traditionally operated out of facilities in Houma and Harvey, and has recently acquired facilities in Mexico and Trinidad. Its webpage indicates that the 15-acre Houma facility on the HNC constructs decks, skids, platforms, and buildings (mostly living quarters) and can accommodate material barges up to 300 feet. Chet Morrison responded affirmatively to the Scott survey (indicating that it was losing fabrication work to foreign firms) and to the URS survey (indicating significant present channel usage and enhanced usage with channel deepening). Webpage descriptions indicate that it has acquired only small-scale offshore platform fabrication contracts. This was confirmed in the context of the present study through an interview, which indicated that Chet Morrison has established a niche in offshore laying of pipe and related diving services on the shelf. The fabrication work that the company is now involved in is limited to this niche.

In the interview, Chet Morrison indicates that they work with three pipe laying barges. The HNC impedes them for dispatch to the eastern GOM, so they use the Atchafalaya to go out. They estimate that this requires about 18 days a year of barge time and cost to reroute the vessels because of the shallow channel in the HNC. It costs about $50,000 for a GIWW/HNC routing to go west on the GIWW and the Atchafalaya to head east. Most of the time they are 12 to 13 feet draft fully loaded, but there is a reluctance to use the NHC under these conditions. Part of the rerouting of the vessels is described by “insurance” wherein they are committed to time-constrained activities with detailed vessel logs supporting documentation. The pipe laying barges cost about $100,000 per day, and a dive barge is $50,000 per day. Use of the draft-constrained HNC that could affect schedule reliability is seen as a problem that they want to avoid. When they move to dynamic positioning barges in the next two years, the vessel size will increase from about 12 feet draft to 16.5 feet draft. Consequently, they will need to home port this projected equipment elsewhere, with the resulting loss of economies of scale of having just one central home port for repair, resupply, etc. Most of the HNC is navigable at 12 to 13 feet, but there are some high spots that cause them to regularly reroute to avoid getting stuck and/or damaging equipment.

Manson Gulf

Manson Gulf on the Intracoastal Waterway in Houma is part of the Seattle-based Manson Construction, which according to its webpage engages in construction of wharves and piers, dredging, heavy lift, and salvage. Additional facilities are in California. The Houma facility serves the Gulf of Mexico and the East Coast. Work in the Gulf region includes dredging using hopper dredges and offshore installation using large vessels and derrick barges for the smaller energy companies on the shelf in less than 500 feet of water. Manson Gulf was not surveyed by Scott or URS.

In the interview, Manson Gulf indicated that they operate some of the bigger derrick barges in the GOM and three hopper dredges. The HNC problem for the barges is that the loaded tugs require a 14-foot draft compared to a 12-foot draft running light. The loaded tugs

will not use the HNC and will reroute via Eugene Island. One of the derrick barges is staffed with 70 persons, and the other is staffed with 120 to 150 persons. The "day" rates for the barges, including profit and overhead, are about $100,000 for the smaller unit and $150,000 to $175,000 for the larger unit. The out-of- pocket daily barge cost to use the detour route is about $50,000 for the small barge and $75,000 for the large barge. The dredges come in to Houma every two or three years. They have to engage tug assistance on the spot market for usually two tugs. The tugs will go over to the Atchafalya to meet the vessels, which is 12 hours over and 18 to 24 hours back. This is a 2.5-day round trip, with the bigger offshore boats standing by. The escort tugs cost $400 to $500 per hour (each).

Dolphin Services

Dolphin is a subsidiary of Gulf Island Fabricators in Houma. It began in 1980 as an oilfield fabrication company, and fabrication continues to be its main line of business, with concentration on offshore platforms, caisson decks and boat landings, production skids and modules, spool piping, and stainless steel/aluminum fabrication. However, it is also engaged in offshore hookup and maintenance, inshore construction, sandblasting and coatings, and steel sales. It was included in the Scott and URS survey efforts, but did not respond. Dolphin emphasizes small-scale projects in its literature, suggesting that channel limitations would not have an important effect on its business. This was confirmed in the context of the present study through an interview with Dolphin, which indicated small-tonnage shipments with only very occasional difficulties with channel limitations.

In the interview, Dolphin indicated that most of their suppliers know their operational limitations. In addition to being a small specialty fabricator subsidiary of Gulf Island Fabrication, they are seldom asked to provide services that are outside the draft of the HNC. They have one job currently in which they are breaking down the prefabricated pieces and shipping them by truck to Fourchon where the units will be assembled to load on a supply vessel. The vessel was too deep to call directly at Houma and take the load directly to the GOM, so there will be an extra cost to truck the pieces to Fourchon.

Trico Marine Services[12]

Trico Marine Services is located on the HNC in Houma and is part of a Houston-based firm with additional facilities in Norway, the United Kingdom, and Brazil. The company webpage indicates that their worldwide fleet consists of 48 offshore supply vessels, 13 large capacity platform supply vessels, six large anchor handling, towing, and supply vessels, 11 crew boats, and six line handling vessels, all of which are equipped to work in deep water and extreme weather conditions. The 60-acre Houma facility is used for offshore supply vessel storage and topsides work. Trico responded to the Scott survey, indicating occasional vessel damages from shallow water, but was unable to identify costs. It also responded to the URS survey, indicating 80 incoming and outgoing vessel trips annually at present, which would be reduced to 75 with a 20-foot channel because of the capacity to operate larger deeper draft vessels.

[12] Trico Marine Services is not in existence in 2012.

In the interview, Trico indicated that they do not use the Houma facility to load or offload vessels, but rather for vessel storage. They are able to bring a 210-foot Loa OSV to Houma as a light vessel without any problem. The 210-foot Loa vessels are wider and deeper, with the same capacity as the 235-foot Loa vessels. The entire offshore industry is moving to 240 to 260 feet Loa vessels. The 240 to 260 foot Loa vessels are inconvenienced by the HNC depth. There will not be any more 180-foot Loa vessels constructed, and 210-foot Loa vessels will be the smallest. The 210-foot Loa vessels can be misleading, since they are proportionately wider and deeper and can carry as much cargo as the 235-foot Loa vessels.

Seacor

Seacor has an office in Houma, but not a facility. Its webpage indicates that they operate a diversified fleet of offshore support vessels and helicopters servicing oil & gas exploration, development, and production facilities worldwide; a fleet of product tankers that transport petroleum, chemicals, and crude products in the U.S.; and a fleet of inland river barges that transport grain and other bulk commodities in the U.S. They operate 165 offshore supply vessels in the Gulf of Mexico, primarily out of Fourchon. They are interested in the possibility of operating out of Houma, but are unable to do so because of channel depth restrictions. They were not contacted in the Scott or URS surveys because they were not in Houma until recently.

In the interview, Seacor indicated that they service their OSV vessels primarily out of Fourchon. The objective is to get the vessels in and out of the port quickly. About 90 percent of the GOM offshore supply fleet is serviced out of Fourchon with the remainder out of Morgan City, Intracoastal City, and Galveston. They have the potential to use Houma in terms of land, but they seldom use the HNC because of draft issues. They can get vessels out light drafted using the HNC. The transit time to get in and out via Eugene Island is too long for them to regularly use this detour. The entire offshore fleet sector is becoming larger and more specialized.

Oil States Skagit Smatco

Oil States Skagit Smatco is located in Houma at the intersection of the HNC and the Intracoastal Waterway and is part of the Arlington, Texas, based international firm Oil States Industries, whose webpage indicates that they engage in offshore and onshore oil and gas, Defence, and general industry work. The Houma facility builds heavy equipment for the oil & gas and marine industries, particularly winches, pipe handling equipment, cranes, concrete mats, and marine risers. The 40-acre facility in Houma contains 150,000 square feet of covered space, including 40-foot hook height clearance. They responded affirmatively to the Scott survey (indicating lost business to foreign firms in pipe handling equipment) and to the URS survey (indicating four incoming and 10 outgoing vessel trips annually at present, which would increase to 12 incoming and 28 outgoing with a 20-foot channel).

In the interview, Oil States indicated that they build heavy equipment (among other things) for the rigs and marine industry. One market is the anchor handling winches, which come in sets of 16, each of which weighs 450,000 pounds. They have three shipments of heavy pieces a year on average, with three barges at one time compared to about nine or 10 similar

shipments for other ports such as Mobile, Galveston, and Brownsville. The barges are 200 by 80 ocean hoppers, although a 220- foot Loa supply boat can be used. With a 20-foot channel depth they could accommodate a 250 to 280 foot Loa supply boat.

One of their major markets is the repair and conditioning of marine risers. The typical marine risers are 95 feet long and about 50 inches in diameter. Every rig in deepwater has a riser string that is represented by 6,000 to 8,000 feet of pipe. The risers can come in by barge or truck to offload for repair, reuse, and repositioning. The risers typically go to deepwater ports such as Ingleside, Brownsville, and Fourchon. Despite the lack of deep draft, they estimate that they have a 25 percent share of the rapidly growing riser market. One riser moves on one truck. If a barge or OSV is used, more risers can be handled, but they cannot be stacked on top of each other. They are expecting a 10 percent annual growth in risers. Deepwater service vessels will need from 17 to 19 feet of water depth to handle risers directly to offshore locations. The HNC at a 20-foot depth would accommodate about 90 percent of the deepwater service vessels. Four of five risers on a supply boat would require an 18 to 20 foot draft.[13]

Cenac Towing Company[14]

Cenac Towing is located on the HNC in Houma and doesn't have a webpage. Internet sources indicate that it has 500 employees and operates tugs and barges inland and offshore, with the offshore fleet located in Amelia. The newest and largest offshore tug is the 130-foot *Andrea Cenac,* which was built by Main Iron Works in Houma and is currently working in the deepwater Gulf of Mexico. Cenac Towing did not respond to the URS survey, but did respond to the Scott survey, indicating that a deeper channel would avoid the need to divert vessels to Morgan City and the Mississippi River and also that business in fuel sales (lube oil), freight transport, and industrial waste disposal is being lost abroad.

In the interview, Cenac indicated that they moved their offshore fleet home port to Amelia two years ago. However, the people are still based in Houma, which is central to the GOM. The Amelia location raises crew change issues and also vessel maintenance issues. The big cost disadvantage is the barge and tug maintenance. They have to hire inland boats to move the barges to Houma for maintenance using 1,200-horsepower tugs and 20,000 to 25,000 barrel barges. Their major offshore moves are 50,000-barrel tank barges of crude and refined products. They do not come up the HNC with this equipment. Formerly, they moved products from Lake Charles to Houma offshore via the HNC using 195 by 35 barges. The transit time was 24 hours offshore compared to 36 to 48 hours or more using the GIWW. Now they truck product from Lake Charles. They had been moving up to five million gallons a month in product but now handle two million gallons. Other producers have stepped in to fill the market. If the HNC was deepened, they would expect to get this products distribution market back and possibly expand it. They have been looking at imported rock movements for new construction as well, but it is too early to determine if they would use the HNC or the Eugene Island route to get to Houma

[13] Oil States Skagit Smatco exited the riser repair business after hurricane Katrina and has no immediate plans to re-enter this market under without-project conditions. However, with-project conditions would allow them to use more barges for oil field exports that otherwise move as large oversize over weight truck shipments to adjacent ports at New Orleans or Houston.

[14] Cenac Towing as of 2012 is owned and operated by another local towing company, Enterprise Marine.

because of the HNC draft issues. There are issues with drafts at the sea buoy where they must have an ocean tug. Usually, they will run the ocean tug to Cocodrie and then let the inland tug take over because of insurance and safety issues.

Superior Energy Services[15]

Superior Energy Services is headquartered on the Harvey Canal in Harvey and has offices throughout the world. Its webpage indicates that it is the leading provider of specialized oilfield services and equipment, focusing on serving the production-related needs of oil & gas companies in the Gulf of Mexico. The Marine Services division provides self-elevating liftboats (self-propelled jackup vessels), cranes, lodging, and accommodations to the offshore drilling industry. Superior has the most diverse fleet of liftboats in the world, with leg lengths from 145 to 250 feet and capable of working in water depths up to 180 feet. Superior was not included in the Scott or URS surveys.

In the interview, Superior indicated that they use the HNC to Dulac but cannot get to Houma. Travel time for the vessels to Houma is six hours compared to 12 to 14 hours to Amelia from the sea buoy. Liftboats less than 200 feet Loa are put into New Iberia for repairs. Liftboats more than 200 feet Loa are put into Amelia for repairs.

Elevating Boats

Elevating Boats is located on the HNC in Houma, with an additional facility in Braithwaite, Louisiana, at the intersection of the Caernarvon Canal and the Mississippi River. According to its webpage, it is the originator of liftboats and designs, builds, and operates these vessels for offshore repair and maintenance work in the shelf of the Gulf of Mexico. The liftboats are constructed at the 110-acre facility in Houma. The rental fleet of 25 certified liftboats is home ported in Braithwaite, which also manufactures pedestal cranes and hydraulic cylinders. Both facilities provide maintenance for the fleet's vessels as well as the liftboats of others. Elevating Boats was not included in the Scott survey and did not respond to the URS survey.

In the interview, Elevating Boats indicated that they operate liftboats and need a draft of only 10 feet. The HNC draft is not a problem for them, although channel width poses some issues for their vessels (their lift pads extend outward from the hull and add 20 to 28 feet on each side for clearance) passing other vessels.

Crosby Tugs

Crosby Tugs is headquartered in Galliano and bases its offshore tug fleet in Fourchon and Eugene Island near Morgan City. Crosby's webpage indicates that it has been in the marine towing business for over 25 years. Listed vessels include three 600-horsepower tugs, five 900-horsepower tugs, 16 1,000-horsepower tugs, two 1,200-horsepower tugs, 10 1,800-horsepower tugs, 10 3,000-horsepower tugs, five 3,600-horsepower tugs, one 4,200-horsepower

[15] Superior Energy Services has been acquired by Seacor.

tugs, five 6,000-horsepower tugs, two 9,000-horsepower tugs, five 10,500-horsepower tugs, two 15,000-horsepower tugs, and two barges. Crosby was not included in the Scott or URS surveys.

In the interview, Crosby indicated that they have offshore tugs based in Fourchon and also Eugene Island. They keep the bigger tugs out of the HNC because of kort nozzles. For inland operations (HNC), they turn the offshore barge over to two inland tugs to tow over to Amelia. The bigger boats draw 14 feet of water, so they cannot be used on the HNC. The HNC is only for smaller vessels. When they do an HNC transit, they bring the offshore barge inside, and the smaller boats take it depending on the weather conditions. In rough weather, the round trip HNC transit can take from 12 to 15 hours upwards to 20 to 30 hours with the use of three or four smaller tugs. The major repair yards at Houma, Larose, and Amelia all have 14 feet of draft. It can take 5 to 10 hours to go up the HNC with an offshore barge and three or four inland tugs. If they went up the HNC direct with an offshore tug (with-project conditions), they would still push with a river tug for steering purposes. They commonly move a derrick barge with two 3,600-horsepower offshore tugs and hand it over to four river tugs between 900 and 1,200-horsepower for the HNC trip.

Normally, it takes six to eight hours to traverse the HNC with light tugs to the mouth; but this has to be coordinated with the offshore vessels for an estimated arrival time at the buoy. They need one to two hours at the buoy to unhook and hook up the barge between the offshore and inland tugs. Weather is a big factor affecting the operation. They do these moves at least once a month, but it is really more like 20 to 30 times a year. They will not use the HNC for anything drafting more than 12-feet otherwise, they will reroute. Anything more than 3,000 horsepower will not use the HNC. The same is true for Eugene Island, particularly for vessels equipped with kort nozzles. They exchange the barge at the sea buoy and use smaller tugs to reach Amelia, Bollinger Larose, etc. Another major vessel operator that provides similar detour and escort services is Delta Towing, which does a lot of work for its parent, Chouest.

Pride Offshore[16]

Pride Offshore is located on the Intracoastal Canal in Houma and is part of the Houston-based Pride International, which provides contract drilling and related services to oil and gas companies worldwide, operating offshore and on land in over 25 countries. The rig fleet includes 12 jackups and nine platform rigs operating in the U.S. Gulf of Mexico. The facility in Houma services and maintains rigs. Pride did not respond to the URS survey, but did respond to the Scott survey, indicating unspecified losses because of channel depth limitations.

In the interview, Pride indicated that the rigs are modular and self erecting, but they have to come back into the base between jobs. The rigs are sent out and brought back on a component basis. They need between 10 to 11 boat trips or about three 180-foot Loa vessels for the larger rigs and six to seven loads for the smaller rigs. The jackup rigs do not use Houma, but rather Fourchon, Cameron, and Grand Isle, despite the fact that Houma is a natural market for repair and equipment for the oilfield sector for the GOM and Mexico. They get about five rigs in and out of Houma a year ranging from 90 days to six months in service. They are anticipating operating one to two more rigs in the next year or two. The work out of Houma is all shallow

[16] Pride Offshore was sold to Blake Drilling.

shelf work. Although all of their deepwater work is administered out of Houma, it is not there operationally. They see Houma as the hub of the oilfield supply sector, except for deepwater access at Fourchon, Grand Isle, and Intracoastal City. They think that if there was deepwater access to this supply base, there would be a huge boom in deployment of oil sector activity at Houma.

Delta Towing[17]

Delta Towing is located on the Intracoastal Waterway in Houma. It formerly operated under the name R&B Falcon Marine, was recently part of Edison Chouest, and is now part of the Houston-based TODCO, which maintains the largest fleet of shallow water drilling rigs along the Gulf Coast. Delta operates inland and offshore tugs. When it was owned by Chouest in 2000, it had a fleet of 34 offshore tugs, 72 inland tugs, 28 crewboats, and 66 service barges. According to the interview, the fleet contains nine offshore tugs, 37 inland tugs, and five derrick barges. TODCO's webpage does not devote any space to Delta Towing, and it does not have an independent webpage. Delta Towing was included in the Scott survey (under the name R&B Falcon Marine), indicating that the Houma facility could be used for boat repair work if the channel were deeper. It was also included in the URS survey, indicating that it was the third highest user of the HNC, with 262 incoming and outgoing vessel trips annually under existing conditions, which would increase to 345 incoming and outgoing with a 20-foot channel.

In the interview, Delta indicated that it would not benefit from HNC deepening because it has inland and offshore fleets; but their customers would benefit by the reduced costs of using bigger barges and larger loadouts. They use the Atchafalaya to bring in their big ocean tugs three to four times a year for repairs and inspections. They have a derrick barge at Dulac, but they use the Atchafalaya to bring it to Houma. They also tow out supply boats not on their own power from shipyards.

Offshore Specialty Fabricators

Offshore Specialty Fabricators is located in Houma on the HNC. Its webpage indicates that it is in the business of platform installation and removal, rig moves, heavy lifts, loadouts and offloads, new platform fabrication, and platform leasing and is divided into an offshore division and a fabrication division. The fabrication division constructs decks, jackets, and pilings in the Houma yard and process equipment in an Ingleside yard. The offshore division installs and dismantles offshore platforms in the Gulf of Mexico and operates five derrick barges in depths not much over 1,000 feet. Offshore Specialty responded affirmatively to the Scott survey (indicating vessel transport difficulties) and to the URS survey (providing information to indicate that it was the largest user of the HNC in terms of vessel movements). The interview with Offshore Specialty indicated that it used to operate crew boats, tugs, and supply boats. These vessels were sold, and the company concentrated on fabrication and the operation of derrick barges to load and demolish offshore platforms. It intends to get back into its traditional fleet.

[17] Delta Towing was acquired by Crosby Tugs.

In the interview, Offshore Specialty indicated that they would prefer to bring their derrick barges to Houma to work on them for efficiency and control; but they cannot navigate the HNC, so they usually go to a shipyard such as Mobile at a higher cost. Their ocean tugs are 8,000-horsepower and draw 18 feet of water, so they cannot come into the HNC. Although the smaller derrick barges draw 13 to 14 feet of water, the tugs cannot get to Houma on the HNC. The maintenance schedule for their three derrick barges is five to six times a year to come in for work. A deeper HNC channel would result in a 5,000- to 6,000-horsepower tug coming in with the derrick barge. The derrick barges have a daily hire rate of $30,000 to $40,000 that includes everything (except fuel). Right now, it takes four tugs to navigate the smaller derrick barges on the HNC compared to one ocean tug and a trailing shallow tug that would be used for steering purposes if there was sufficient depth. There is a substantial difference in tug costs between using four inland tugs compared to one ocean tug and an inland steering tug. The derrick barge players in Houma are Manson Gulf, Horizon, Global, and Tetra Tech. Their niche is larger derrick barges for heavy lifts.

Caillou Island Towing

Caillou Island Towing is located near the intersection of the HNC and the Intracoastal Waterway. According to its webage, it is in the oilfield-related marine towing business and maintains a fleet of one deck barge, one supply vessel, four spud barges, and seven tugs. It was not included in the Scott survey and did not respond to the URS survey

In the interview, Caillou Island indicated that they provide tug assistance trips on the HNC once every 35 to 40 days or about 10 times a year. They use 1,200- and 900-horsepower tugs (about $380 per hour) and take six to eight hours down light and then about 18 hours back up loaded. Major tug assistance players on the HNC are Delta Towing, Central Gulf at Larose, and Crosby Tugs. They also tow out new boats to avoid having them started up because of low water and possible damage to the cooling systems.

Global International Marine

Global International Marine (formerly Offshore Shipbuilders) is located in Houma near the intersection of the HNC and the Intracoastal Waterway. Their webpage indicates that they operate ocean class tugs and barges domestically and overseas. Towing services include grain, ships, barges, metals, equipment, military, commercial shipment, and government cargo. A special page on cargoes illustrates past shipments of beans, wheat, scrap metals, and soda ash. They were not included in the Scott survey, but were included in the URS survey, indicating 50 incoming and outgoing annual vessel trips under present conditions that would increase to 60 incoming and outgoing with a 20-foot channel; but this was when they were in the supply business and before shifting to the liquid bulk sector.

In the interview, Global International indicated that they operate food-grade tank barge bulk services from the U.S. Gulf to Puerto Rico and Central and South America. They load in the U.S. Gulf. The barges and tugs are based in Houma, but they cannot get into Houma during the winter and scrape bottom at other times. Consequently, they lay up the tug/barge in between jobs at other ports where they can find dockage. Their tugs draft between 14 and 15

feet. At the conclusion of every trip, the food-grade barges must be cleaned. For cleaning, they divert the barge to New Orleans and then pay dockage for the tug/barge until the next load, which is normally 5 to 10 days between trips. They would prefer to clean their barges at Houma and save $35,000 per cleaning. They make two trips a month with two barges and are expecting to soon acquire a third food-grade tank barge. If they could come to Houma for cleaning, they would save a tug/barge day compared to cleaning at New Orleans. Often their next load is not the Lower Mississippi, so they are actually diverting the barge away from where they need to be for cleaning. The tugs cost from $4,000 to $5,000 per day plus fuel. They load about 40 percent of their cargo on the Lower Mississippi, and the rest is spread around the Gulf.

Performance Energy Services

Performance Energy Services was formed in June 2000 and specializes in onshore spool pipe, structural fabrication, sandblasting and painting, and offshore installations. Yards are maintained in Houma, New Iberia, and Ingleside. The seven-acre Houma yard is located adjacent to the Intracoastal Waterway, with 12 feet of water at the bulkhead, and features a 12,000 square foot fabrication shop, three 15-ton forklifts, and two 25-ton cherry pickers. Performance Energy was not included in the Scott or URS surveys. Its webpage suggests small-scale fabrication, which was confirmed in the context of the present study through an interview.

In the interview, Performance indicated that it uses the HNC to do offshore hookups and that the present channel dimensions do not cause them any difficulties.

Crossmar

Crossmar is located near the HNC in Houma. Its webpage indicates that it is a group of companies designed to support the marine and offshore industry with a wide range of equipment, services, and support. Crossmar maintains a 500-foot dockside facility for onboard repairs, as well as 45 acres of storage area, and provides 24-hour field services, with the primary line of business being deepwater well installation and competition. Winches and deck equipment are rented, with a specialization in serving ultra deepwater project demands. Crossmar was not included in the Scott or URS surveys.

In the interview, Crossmar indicated that about 85 percent of the deepwater vessels are domiciled at Fourchon. The logistics are to support them by land. Houma has the biggest infrastructure to support the offshore sector. Vessels are getting deeper. If the HNC was deepened to 20 feet, it is conceivable that there would be shuttle vessels for transportation of supplies to Fourchon. The HNC if deepened would offer another access that is protected compared to Fourchon. If the HNC was deepened, they would be able to bring in bigger equipment (deepwater well installation and completion). Major oil companies would likely use the HNC for deepwater logistics and load 20 feet straight to the GOM. They could take a size 8,000-horsepower tug and a dynamic positioning barge 250 to 250 feet Loa or similar size OSV and load straight to the GOM. There are savings in loading direct, since many of the components are sensitive to handling and damage (such as sea fasteners). The major offshore oil sector players operating out of Fourchon are trucking from Houma versus loading vessels here.

Offshore Towing

Offshore Towing in Lockport contains four subsidiaries: Doucet & Adams, Belle Pass Towing, Global Towing Services, and Delta Towing. They occasionally use the HNC for shipyard work on their six tugs, which operate strictly on call to move drilling rigs. Doucet & Adams responded to the Scott survey (indicating vessel damages and lost time from needing to use other channels) and to the URS survey (indicating no annual trips at present and two annual incoming and outgoing with a 20-foot channel).

In the interview, Offshore Towing indicated that they use the HNC for shipyard work on the ocean tugs. They dock at Larose or Houma. There are logistical issues using other bases in terms of laying up the crew, inspecting the vessel, etc. Not all deep-draft vessels use the Eugene Island route. The problem is incurring damage to the vessel after dry docking, which can also occur using the Eugene Island route. They primarily use three shipyards -- Main Iron Works, Allied (Larose), and Bollinger -- because these are the yards that built their tugs. Vessel escorts (tug assistance) are a matter of choice. They have used two 900-horsepower tugs, but they also have their own. There is also vessel time lost going to Fourchon and heading west. They take their smaller tugs to Fourchon and pump off extra fuel and supplies to lighten the vessel for the Eugene Island route to Houma. They could run from Fourchon to Larose in less than 24 hours compared to two to three days via the Eugene Island route. The HNC at 20-foot depth would allow some tugs to come in, primarily during the summer and spring but not in the winter when the water level is lower.

Mammoet

Mammoet's webpage indicates that they operate internationally in the transport and installation of objects requiring heavy lift capacities. They indicated in the Scott survey that their clients would benefit from a deeper HNC and in the URS survey that they would increase incoming trips from 13 at present to 19 with a 20-foot channel and outgoing trips from 25 to 38.

Mammoet was interviewed in their facility south of Houston. The interview indicated that a deeper channel would not produce dramatic changes in their usage patterns, but would affect the ability of their primary customer (GIF) to ship larger pieces. Numerous large modules for the expansion of capacity at refineries and chemical plants on the Gulf Coast are being transported from China, and Mammoet is bidding on installation contracts.

FABRICATION BENEFITS

Of the 34 firms that were interviewed to determine benefits, five were interviewed to determine potential fabrication benefits as well as NED benefits, and one (Gulf Island) was interviewed three times to determine potential fabrication benefits. In addition, four oil and gas firms in Houston were interviewed to clarify and confirm the competitive status of Gulf Island. The following sections provide an overview of the competitive setting for Gulf Island in the GOM, the status of each firm interviewed for potential fabrication benefits, and the results of the Houston interviews.

Competitive Setting

Prior to 2006, the fabrication of topsides for offshore production platforms in the deepwater Gulf of Mexico was dominated by four firms: McDermott in Morgan City, Louisiana; Gulf Island in Houma, Louisiana; Kiewit in the Corpus Christi area of Texas; and Gulf Marine in the Corpus Christi area of Texas. That number was reduced in January 2006 through the acquisition by Gulf Island of the two Gulf Marine yards (at Ingleside and Aransas Pass) that were owned by the Paris-based firm Technip.

McDermott in Morgan City is part of McDermott International, which owns fabrication yards throughout the world. McDermott in Morgan City is on a 20-foot channel and was once the most important fabricator in the Gulf of Mexico. However, it became overextended in commitments, alienated a portion of its client base by providing services to a single client over an extended period of time, and has been unable to regain a footing in the deepwater topsides market. McDermott International is constructing a new yard in Mexico, which has given rise to speculation that the Morgan City yard is being abandoned. That speculation has been firmly rejected by McDermott in Morgan City, citing the allocation by McDermott International of $13 million for upgrades at the Morgan City yard (see Rick von Flatern, "Adjusting to the 'new normal,'" *Offshore Engineer*, October 26, 2006). McDermott maintains a deepwater facility in the Corpus Christi area, but it has been inactive in recent years.

The Kiewit yard at Ingleside, Texas, is part of Kiewit Offshore, which is part of the Omaha-based Peter Kiewit Sons'. Kiewit has two yards in Canada, one of which has been recently in the news in connection with the construction of the topsides for the White Rose FPSO. Kiewit had been operating in the Gulf of Mexico since the 1980s through joint ventures, but decided to build a state-of-the-art facility at Ingleside in 2001. The facility is on a deepwater (45-foot) channel and features a 13,000-ton capacity crane. It has done well since its inception in obtaining deepwater fabrication contracts, including most recently a semisubmersible hull, and is a major center for the integration of platform components.

The Gulf Marine facilities in the Corpus Christi area were established in 1991 and were acquired by Technip in 2001. Technip is an international firm whose facility in Finland has constructed most of the hulls for production platforms in the deepwater Gulf of Mexico. The yard at Ingleside is on the Intracoastal Waterway; and the yard at Aransas Pass is on the 45-foot deep Corpus Christi Ship Channel and has a 4,000-ton capacity crane. Technip was able to secure some deepwater fabrication contracts and engaged in some integration activities; but the venture was not profitable, and Technip entered into negotiations with Gulf Island in 2005 that resulted in Gulf Island's acquisition of the facilities in January 2006, along with Technip's ongoing Tahiti project.

In addition to the primary fabrication yards, there are a large number of secondary yards throughout the Gulf of Mexico region that participate in various aspects of offshore platform production. Only Dynamic Industries and Omega Natchiq at the Port of Iberia are attempting to be competitive with the primary yards. Omega Natchiq constructed the topsides for the Prince mini-TLP in the Gulf of Mexico and the rig module for the Benguela Belize project in Angola.

Dynamic Industries recently increased its capacity through purchase of Mid-Fab (formerly Unifab), another offshore platform fabrication facility at the Port of Iberia.

In the Houma area, a literature and webpage review and conversations with local study participants indicated that there were five firms in addition to Gulf Island that should probably be interviewed for potential fabrication benefits (as well as NED benefits): (1) North American Fabricators; (2) Dolphin Services; (3) Chet Morrison Contractors; (4) Offshore Specialty Fabricators; and (5) Performance Energy Services.

Benefit Status

The status of the firms in the Houma area with respect to fabrication benefits is as described in the following paragraphs.

Gulf Island Fabrication[18]

Gulf Island is located on the 15-foot deep HNC and has been in existence since 1985. It maintains two yards across from each other on the canal: the 140-acre east main yard with 185,000 square feet of covered fabrication area, 2,800 feet of water frontage, and 1,500 feet of steel bulkhead; and the 437-acre west yard with 2,350 feet of steel bulkhead. Although Gulf Island has not been able to bid on a number of projects because of channel depth limitations, it has been highly successful in obtaining deepwater platform fabrication contracts, maintaining a reputation for competitive costs, quality work, and completion of projects on time. It has been consistently profitable and is debt free. The deepwater projects obtained by Gulf Island by year of installation are as follows:

1998 Eni Morpeth mini-TLP, GOM, hull and topsides
1998 Chevron/Texaco Petronius compliant tower, GOM, topsides
1999 Eni Allegheny mini-TLP, GOM, hull and topsides
2003 Kerr McGee Gunnison truss spar, GOM, topsides
2004 Murphy Front Runner truss spar, GOM, topside
2006 McGee Constitution truss spar, GOM, topsides
2007 BHP Billiton Neptune TLP, GOM, topsides
2007 Chevron Tahiti spar, GOM, topsides
2008 Chevron Blind Faith semisubmersible, GOM, topsides
2009 Chevron Tombua Landana compliant tower, Angola, top and bottom sections (with Gulf Marine)

Gulf Island has pursued a diversification strategy based on the provision of a full range of fabrication services for the oil & gas industry. Dolphin Services was formed in 1980 and acquired by Gulf Island in 1997. The 34-acre Dolphin facility is located a short distance

[18] Gulf Island Marine Fabrication was created as a wholly owned subsidiary to diversify the company away from cyclical market conditions in the traditional offshore oil/gas fabrication sector but allow use of common (complementary) resources related to fabrication (ship building and repair). Gulf Island Marine is a major shipyard with respect to size and employment in Houma for new buildings, primarily for shallow draft towboats but also for offshore specialty vessels such as lift boats. For example, Gulf Island Marine delivered the largest lift boat via the HNC with some sailing draft issues.

from Gulf Island's yards on a 12-foot channel that enters into the HNC. Dolphin provides small-scale fabrication, offshore hookup and maintenance, inshore construction, sandblasting and coatings, and steel sales. Gulf Island acquired Southport in 1998. The 22-acre Southport facility is located on the HNC across the street from Gulf Island's main yard and specializes in the fabrication of living quarters for offshore platforms.

Gulf Island also made a partial entrance into the design business by participating in the development of the MinDOC (Minimum Deepwater Operating Concept) drilling and production system, in which it maintained a major proprietary interest. Gulf Island sold its 60 percent interest for $1 million to the other partner in January 2006 under the assumption that the partner was better suited to market the concept and that Gulf Island would be a preferred contractor should any oil & gas company decide to utilize the concept. This apparently was a wise course of action because Bluewater Industries has contracted with Gulf Island to build the first MinDOC hull at the Gulf Marine facilities.

Gulf Island had been looking into possible deepwater sites along the Gulf of Mexico when the Gulf Marine facilities became available. The Gulf Marine facilities were purchased for $80 million, including 11 percent of Gulf Island's common stock. Gulf Island assumed responsibility for Technip's 19,000-ton deck Tahiti project, with 921,000 man-hours of work remaining; and Gulf Island and Technip have entered into a cooperative agreement with respect to potential future work in the Gulf of Mexico region. Gulf Island's board has allocated $25 million for upgrades to the Gulf Marine facilities, including an increase of the crane capacity to 6,000 tons, and $6.3 million for purchase of new equipment for the Houma facilities to increase productivity and capacity.

With the purchase of the Gulf Marine facilities, Gulf Island has gained: (1) 400 new employees to add to its 1,100 employee base in Houma; (2) a heavy lift capacity of 4,000 tons that is being upgraded to 6,000; (3) dockside deepwater (45 feet) access; and (4) an 800 by 200 by 80 feet deep basin in which heavy lift ships can be submerged to load or offload their cargo. Gulf Island is now able to engage in ship and TLP module integration and to load and offload jackup drilling rigs, semisubmersible drilling rigs, TLPs, SPARs, and similar cargo.

Gulf Island now has the greatest amount of fabrication capacity along the Gulf of Mexico and has reduced its deepwater competition to Kiewit and McDermott (with five others mentioned as competitors for projects in water depths of 150-300 feet). New markets have been opened, the facilities in Houma are better positioned to secure and complete an even greater number of projects, and the company as a whole is positioned to dominate the deepwater fabrication industry in the Gulf of Mexico.

In spite of this acquisition, Gulf Island is a Houma firm and will remain so. Houma is where its primary facilities and labor base are located, and it has made large investments in its main yards and collateral facilities. Even if it wanted to move, it would be difficult for Gulf Island to do so. In an industry characterized by overcapacity, there is little incentive for new market entrants; and potential buyers from within the existing industry would have little reason to acquire a shallow-water facility. The relationship between the facilities in

Houma and the facilities in the Corpus Christi area is envisioned by Gulf Island (in their own words) to be:

1. Further enhances GIF's ability to be a "one-stop shop."
2. GIF has more pipe-spooling capacity, living quarter construction, and Dolphin Services is suited for construction of skids, modules and hook-ups.
3. GMF adds dockside integration, heavy lifts (4,000 ton lift capacity shear-leg crane), rig repair, offloading of submersible heavy lift ships and cell spar construction.
4. Allows GIF/GMF to compete for larger projects (such as deepwater and international projects) that the yards in Louisiana would not have the capacity and depth of water.
5. Increased man-hour capacity and second labor pool.
6. An example of this relationship is Chevron's Tombua Landana Tower. The job is large enough that both yards will fabricate components (9,000 tons in Houma and 30,000 tons in Texas). The integration will be done at GMF.
7. As activity continues to slow on the shelf, GMF allows for integration/topside work for FPSO or floating structures. The topside/components/modular could be constructed in Houma and transported to Texas.
8. Another example of an opportunity is MinDOC. ATP was having a spar constructed at a yard in Finland. Now, GIF has a letter of intent to construct an alternative to the spar concept. GIF is also in discussion to construct the topside -- "one-stop shop."

North American Fabricators/Edison Chouest

North American Fabricators in Houma is part of Edison Chouest Offshore, which is headquartered in Galliano and has additional facilities in Larose and Port Fourchon and has acquired property at the Port of Terrebonne. North American is in the shipbuilding business and concentrates on offshore supply vessels for Chouest's fleet. North American was addressed in the Scott and URS studies through surveys sent to Edison Chouest Offshore. The response to the Scott survey indicated that North American would benefit as a shipbuilding facility from a deeper channel. However, it also indicated that North American would get into the small FPSO business ($100 million to $500 million each) if the channel was deepened to 20 feet, which might qualify as a fabrication benefit. The response to the URS survey was negative (even though filled out by the same person). In the context of the present study, an initial meeting with Edison Chouest Offshore in Galliano confirmed that North American Fabricators was one of Chouest's shipyards, that it did not have potential fabrication benefits, and that it did not need to be interviewed independently for potential NED benefits. The FPSO issue was resolved during the interview by the statement that North American could construct shuttle tankers that would service FPSOs rather than the FPSOs themselves.

Dolphin Services

Dolphin Services has already been mentioned as one of Gulf Island's subsidiaries. It began in 1980 as an oilfield fabrication company, and fabrication continues to be its main line

of business, with concentration on offshore platforms, caisson decks and boat landings, production skids and modules, spool piping, and stainless steel/aluminum fabrication. It was included in the Scott and URS survey efforts, but did not respond. Dolphin emphasizes small modules in its literature, suggesting that channel limitations would not have an important effect on its business. This was confirmed in the context of the present study through an interview with Dolphin, which indicated small-tonnage shipments with only very occasional difficulties with channel limitations.

Chet Morrison Contractors

Chet Morrison Contractors was started in 1983, has traditionally operated out of facilities in Houma and Harvey, and has recently acquired facilities in Mexico and Trinidad. Its webpage indicates that the 15-acre Houma facility on the HNC constructs decks, skids, platforms, and buildings (mostly living quarters) and can accommodate material barges up to 300 feet. Chet Morrison responded affirmatively to the Scott survey (indicating that it was losing fabrication work to foreign firms) and to the URS survey (indicating significant present channel usage and enhanced usage with channel deepening). Webpage descriptions indicate that it has acquired only small-scale offshore platform fabrication contracts. This was confirmed in the context of the present study through an interview, which indicated that Chet Morrison has established a niche in offshore laying of pipe and related diving services on the shelf and that fabrication work is limited to this niche.

Offshore Specialty Fabricators

Offshore Specialty Fabricators is located in Houma on the HNC. Its webpage indicates that it is in the business of platform installation and removal, rig moves, heavy lifts, loadouts and offloads, new platform fabrication, and platform leasing and is divided into an offshore division and a fabrication division. The offshore division installs and dismantles offshore platforms in the Gulf of Mexico and operates five derrick barges in depths not much over 1,000 feet. The fabrication division constructs decks, jackets, and pilings in the Houma yard and process equipment in an Ingleside yard. Offshore Specialty responded affirmatively to the Scott survey (indicating vessel transport difficulties) and to the URS survey (providing information to indicate that it was the largest user of the HNC in terms of vessel movements). Its webpage indicates that both of the fabrication facilities have a loadout capacity of 2,000 tons, suggesting small fabrication projects. This was confirmed in the context of the present study through an interview, which indicated that Offshore Specialty builds shallow-water facilities for the Gulf of Mexico.

Performance Energy Services

Performance Energy Services was formed in June 2000 and specializes in onshore spool pipe, structural fabrication, sandblasting and painting, and offshore installations. Yards are maintained in Houma, New Iberia, and Ingleside. The seven-acre Houma yard is located adjacent to the Intracoastal Waterway, with 12 feet of water at the bulkhead, and features a 12,000 square foot fabrication shop, three 15-ton forklifts, and two 25-ton cherry pickers.

Performance Energy was not included in the Scott or URS surveys. Its webpage suggests small-scale fabrication, which was confirmed in the context of the present study through an interview.

Oil and Gas Industry Views

The results of interviews with oil and gas firms in Houston are described in the following paragraphs.

Chevron

Chevron decided to use Gulf Island on the Bind Faith project because of its track record and a referral by Kerr McGee. GIF had the requisite capabilities (competitive cost, schedule capabilities, skilled labor force of sufficient size). Channel depth was not an issue because the project was similar in size (6,500 tons) to one already completed by GIF. Consideration for larger projects would require a review of yard space, barge handling capacity (bulkhead and channel depth), and Pontoon Bridge restrictions. GIF will not have integration capacities at Houma even with a 20-foot channel.

Chevron would prefer to have all topsides and hulls for GOM platforms constructed by GOM fabricators. Transport of hulls from overseas is very costly, and vessel availability is an issue. An overseas production delay can give rise to circumstances in which a transport vessel is not available. Chevron prefers a competitive integrated package for topsides and hulls because there are usually problems of interfacing among different parties. MinDOC is an attractive alternative because it can be constructed entirely within the U.S.

Anadarko

They would place work in the hands of GIF at Houma if they were confident that the structure could be moved out, particularly after having problems moving a 6,000-ton structure because of HNC channel silting from a hurricane. For moving larger structures, there are channel depth issues, as well as issues with the Pontoon Bridge and the Morganza lock. They like the work force supply at GIF and the synergy between the fabrication yard, Dolphin, and Southport and see potential for similar synergies (particularly labor) with the Corpus Christi yard. Even with a 20-foot-channel, GIF at Houma would continue to experience storm-induced channel silting.

The Spar concept has proven to be robust. The MinDOC hull design will probably displace a modest percentage of the GOM Spar market. Semisubmersibles are becoming increasingly important in the deeper waters and cannot be accommodated by a 15-foot channel. The competitive advantages of keyside integration have not yet been fully realized. There is some interest in establishing an integration facility for projects in the eastern part of the GOM. It is uncertain whether GIF will make heavily lift capacity improvements in its Corpus Christi yard. McDermott in Morgan City remains viable as a fabrication yard, but it does not have significant lift capacities.

Expectations about mega-fields in the GOM are overblown. Storm-induced difficulties with large structures such as semisubmersibles are generating speculation about multiple small structures as an alternative. Investor groups will probably enter the fabrication sector for the construction of platforms on speculation, which will enable companies to monetize project with greater speed and will probably favor the smaller variety.

ATP

ATP cancelled an order for a Truss Spar from overseas and commissioned a MinDOC hull from GIF, and an order for a second hull is underway. The cost is typically much greater than if done in Southeast Asia. The weak dollar was a factor in these decisions, as well as the fact that overseas yards are operating at capacity; and scheduling of overseas transport (with its attendant problems and costs) will be avoided. GIF will fabricate components at Houma, and the units will be integrated at the new graving dock at the Gulf Marine yard, which is a deep hole with attendant dock facilities and skids similar in operation to a dry dock.

The industry is very conservative, but MinDOC may be important in the future if it can be built competitively. The lives of platforms will be extended, and platforms will be reused. MinDOC is ideal for movement in the GOM from one small field to another. Speculative building of platforms will probably concentrate on hulls rather than topsides. The big three fabricators will continue to operate, along with the smaller players such as Twin Brothers and Omega Natchiq.

BP

Nearly all of BP's offshore fleet is based at Fourchon. They attempted to establish a logistics base at Venice, but it was wiped out by the hurricane. They have made logistics facility investments in Houma because of its central location and ease of access. However, there are double handling and associated damages costs from trucking to Fourchon from Houma that could be reduced by a deeper channel, which would produce logistics benefits. Storm-induced lost production costs, service vessel disruption, and difficulties in restarting equipment after extended shutdowns are matters of national significance. Like the other oil and gas companies, BP has developed contingency plans for storm-induced disruptions. They are looking at the HNC as a potential safe harbor for their Fourchon fleet during hurricanes, which would enable offshore production to get back into operation sooner.

V. BENEFIT ANALYSIS

The Houma Navigation Canal (HNC) is part of a commercial waterway network that is primarily oriented to the support of domestic offshore oil & gas exploration and production in the Gulf of Mexico (GOM). The HNC supports commercial fishing vessels and local commerce, but most of its commercial waterway traffic is related to the offshore oil & gas sector. The following discussion of HNC trends focuses on commodity flows and vessel fleet characteristics in the context of the fundamental orientation on the offshore oil & gas sector.

The HNC is part of a larger network of navigable waterways to which it is linked and on which many of its vessels navigate. It intersects the Gulf Intracoastal Waterway (GIWW) at Houma as well as numerous other canals. There are movements between the HNC and the GIWW that are both complements and substitutes that would be impacted by deepening the HNC. Similarly, the HNC is part of the offshore oil & gas supply and logistics support system that is largely based operationally out of Port Fourchon, but also uses the HNC to some degree for major equipment supply.

The economic niche of Houma is steel fabrication for the offshore oil industry including shipbuilding of specialized offshore support vessels. Trends in these fleets include increased sizes that render the construction of these vessels not practical at Houma under without project conditions or substantial increased costs associated with delivery of vessels customarily too large to independently navigate the Houma Navigation Canal fully outfitted under without project conditions. Consequently, these vessels if constructed at Houma will leave under special circumstances such as light loaded and once fully outfitted can never return for follow up maintenance by the inaugurating shipyard.[19]

Finally, there are specialized oil & gas service providers located at Houma that would be affected by deepening. Although part of the commodity flow and vessel fleet statistics, these providers (for example, offshore shallow wells and related services) are unique to the HNC and have been identified as benefiting vessels because of the GOM base of operations extending from Houma.

COMPUTE NED BENEFITS

Determine Economic Study Area

The economic study area is the vicinity of Houma, Louisiana, as it relates to use of the HNC or other waterways and ports to access the GOM, primarily for offshore vessel services associated with oil & gas exploration and production. The Houma area has a collection of materials handling skill sets pertaining to metal fabrication and related structures and services that support offshore GOM oil & gas industries through ship building, repair, and provision of offshore supply equipment and materials such as pipe and pumps. Because of its labor supply skill sets, geography, and proximity to traditional industry supply chains domiciled at New Orleans and Fourchon, the Houma area is regarded as a central location for the provision of offshore oil & gas equipment and services.

Interviews with oil companies indicate that Houma is regarded as central to the GOM because of its proximity to major operational staging centers. Locations west of Houma are regarded less favorably because of distance and accessibility from these locations compared to offshore industry clusters at New Orleans and Fourchon.

[19] Prevailing domestic shipbuilding industry practices are to prefer to have vessels maintained at yards where they were fabricated due to familiarity with the vessels. In the case of Houma the larger offshore vessels once fully outfitted can never return to Houma under current without project conditions.

Types/Volumes of Commodity Flow

A detailed compilation of Waterborne Commerce Statistics (WCS) reported for HNC commodities and for the period 1995-2013 is contained in Table A-1 in the appendix to this report. Table 5 (updated) summarizes the major commodity groups and annual tonnages of reported cargo for the HNC for the period 1995-2013.[20] Apart from 2005, tonnages of cargo reported to WCS have fluctuated considerably over the entire time series, 1995-2013 as well as recently, 2005-2013. Total waterborne tonnage reported was 1.026 and 1.031 million total tons in 2005 and 2006, respectively, declining to 0.463 million total tons in 2011 and 0.471 million tons in 2012 before rising to 0.732 million tons in 2013. Nearly all the waterborne cargo in recent years is petroleum or crude materials related to the offshore petroleum sector. Petroleum is the largest cargo volume and fluctuates the most.

Project Waterborne Commerce

The historical trend for HNC reported cargo tons in Table 5 have been uneven to flat, for the time series between 1995 and 2004. However, beginning in 2005 and reoccurring in subsequent years through 2008 there was a relatively large increase in waterborne tonnage, primarily from increases in petroleum and to a lesser extent crude materials, with total annual cargo tonnage close to 1.0 million tons. However, as noted previously total annual commodity tonnages declined substantially after 2008 and did not rise again until 2013.

WCS cargo tons for the HNC are largely related to offshore oil & gas activity, which had been increasing through year 2008. The Port of Fourchon (Fourchon) is regarded as a reliable indicator of the strength of the offshore oil & gas sector. Fourchon currently serves half of the platforms operating in the GOM and is projected to serve 47 percent of pending future deepwater plans. Figures 1 and 2 from Fourchon's webpage depict the GOM onshore service bases for existing deepwater structures and pending deepwater plans, respectively. Fourchon is clearly the predominant port with respect to market share for these locations.

Nearly 95 percent of the total tonnage handled at Fourchon is oil & gas related. About 30 percent of the total tonnage is received by barge, comprising bulk cargoes, and the other 70 percent of the cargo is received by truck. Fourchon tonnage statistics have risen from 15 million in 2002 to over 20 million in 2005, with dramatic increases (74 percent) projected for 2006. Fourchon is projecting an expansion of 700 acres that will reportedly double the size of the port. The port indicates that the expansion underway has 5,600 feet of bulkhead completed at the end of 2006 that is under lease, another 3,600 feet of bulkhead will be developed in 2007 and available for lease, and the remaining 6,000 feet of bulkhead will be developed to meet demand.[21]

[20] As noted subsequently, there is a substantial amount of cargo moving on the HNC that is not reported to WCS and compiled because it is moving offshore to the GOM and not to a specific "port."
[21] http://www.portfourchon.com/site100-01/1001757/docs/annual_report-_pdf_copy.pdf

Table 5. Houma Navigation Canal Annual Commodities, 1995-2013
(000 tons)

Commodity	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Petroleum and petroleum products	364	462	426	383	322	319	444	302	266	442	821	844	621	823	477	411	404	382	606
Chemicals and related products	2	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	2
Crude materials, inedible except fuels	228	79	38	32	22	78	79	92	133	112	200	184	205	165	138	29	57	85	116
Primary manufactured goods	23	30	55	28	5	4	2	3	4	11	4	2	5	6	3	3	2	1	5
Food and farm products	62	28	0	19	13	2	0	2	2	1	0	0	0	0	1	0	0	0	0
All manufactured equipment, machinery, and products	8	13	6	14	34	6	6	4	0	14	1	1	14	2	1	3	0	3	3
Total waste and scrap nec	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0
Unknown or not elsewhere classified	0	0	0	0	0	0	0	0	20	20	0	0	0	0	0	0	0	0	0
Total	**687**	**612**	**525**	**476**	**396**	**412**	**531**	**404**	**426**	**600**	**1026**	**1031**	**845**	**997**	**621**	**446**	**463**	**471**	**732**

Source: Waterborne Commerce Statistics.

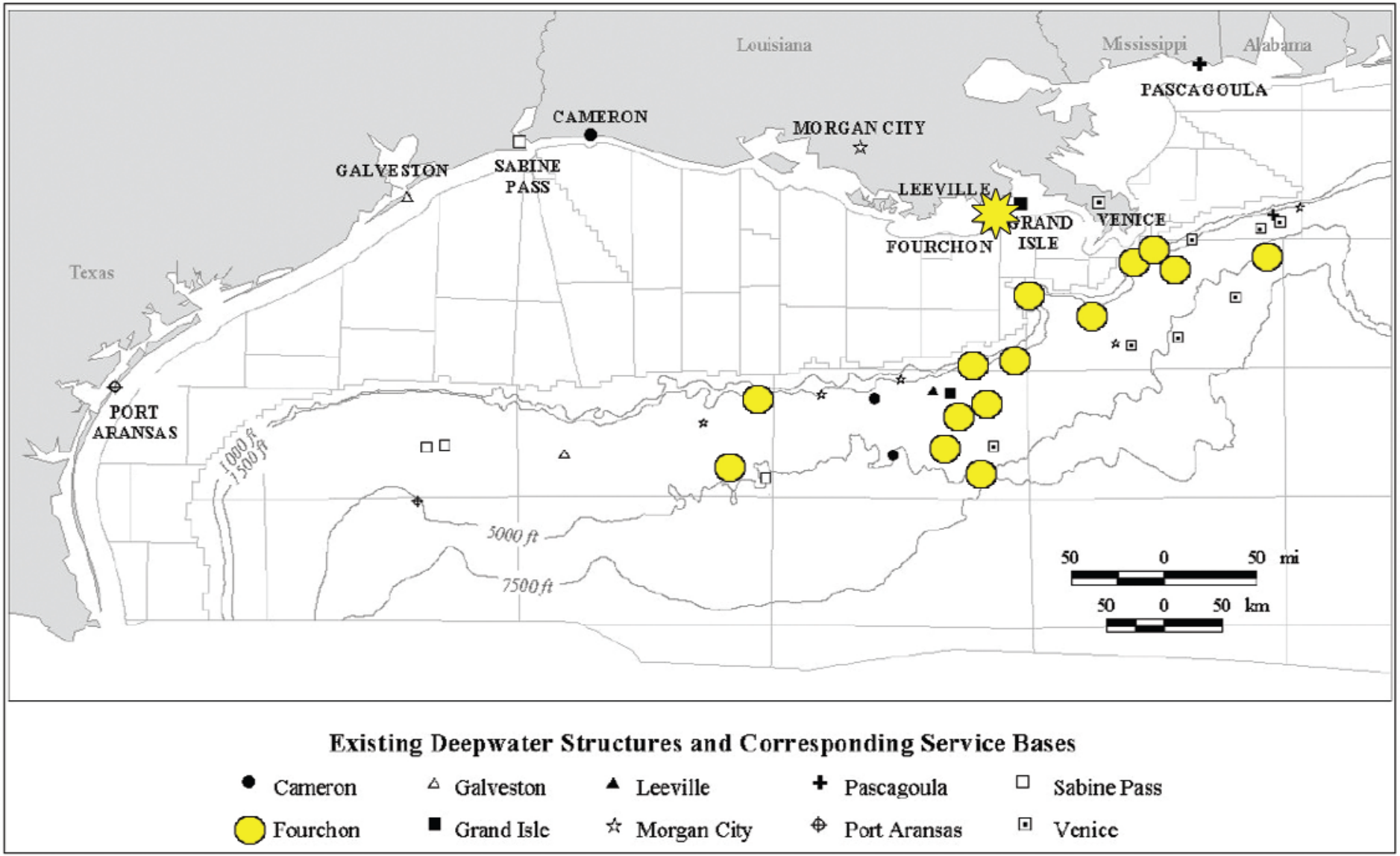
Louisiana
Mississippi
Alabama
Texas
PASCAGOULA
CAMERON
MORGAN CITY
GALVESTON
SABINE PASS
LEEVILLE
GRAND ISLE
VENICE
FOURCHON
PORT ARANSAS
1000 ft
1500 ft
5000 ft
7500 ft
50 0 50 mi
50 0 50 km
Existing Deepwater Structures and Corresponding Service Bases
Cameron
Galveston
Leeville
Pascagoula
Sabine Pass
Fourchon
Grand Isle
Morgan City
Port Aransas
Venice

Figure 1.

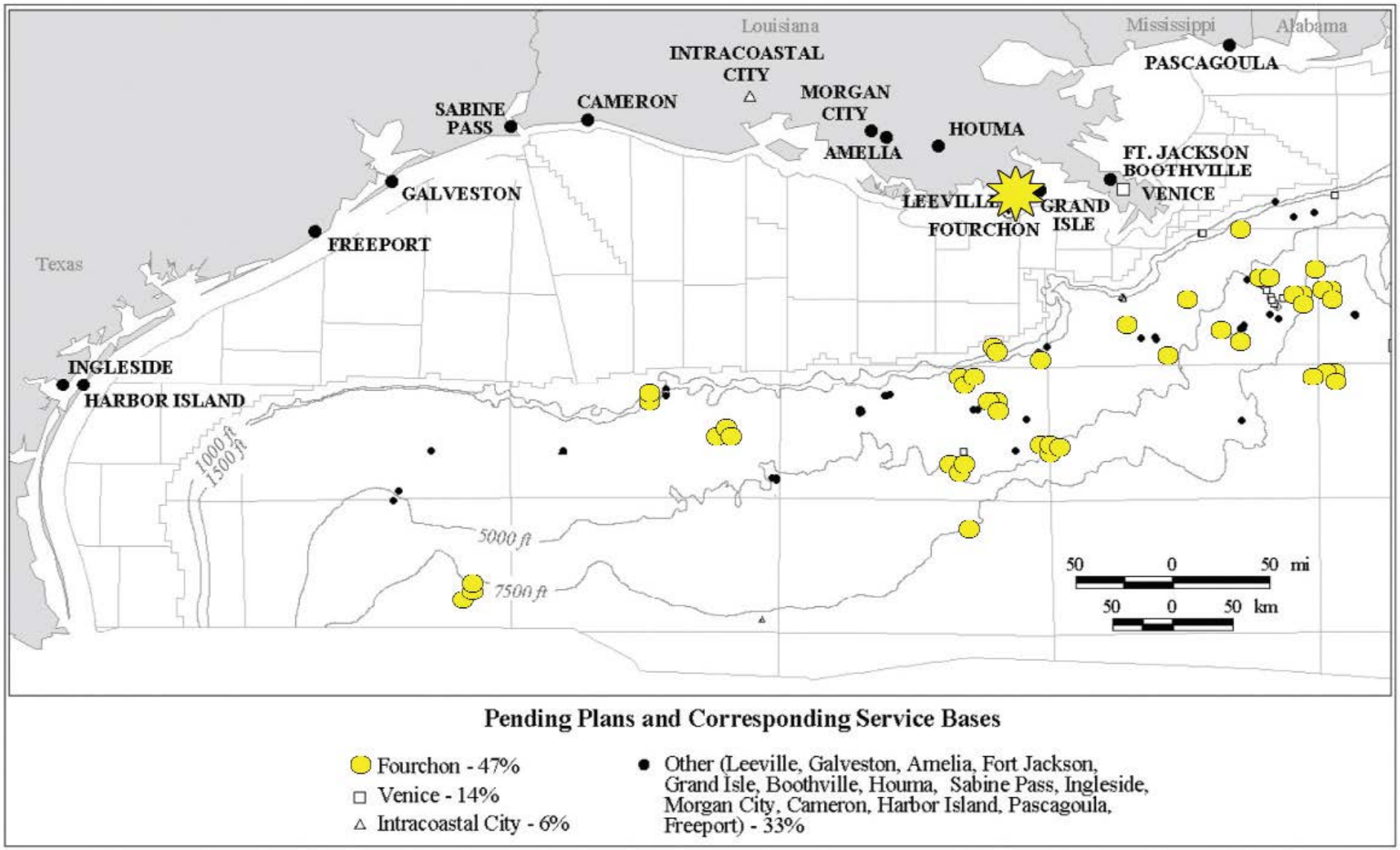
Louisiana
Mississippi
Alabama
Texas
INTRACOASTAL CITY
PASCAGOULA
SABINE PASS
CAMERON
MORGAN CITY
HOUMA
AMELIA
FT. JACKSON
BOOTHVILLE
VENICE
GALVESTON
LEEVILLE
GRAND ISLE
FOURCHON
FREEPORT
INGLESIDE
HARBOR ISLAND
1000 ft
1500 ft
5000 ft
7500 ft
50 0 50 mi
50 0 50 km
Pending Plans and Corresponding Service Bases
Fourchon - 47%
Venice - 14%
Intracoastal City - 6%
Other (Leeville, Galveston, Amelia, Fort Jackson, Grand Isle, Boothville, Houma, Sabine Pass, Ingleside, Morgan City, Cameron, Harbor Island, Pascagoula, Freeport) - 33%

Figure 2.

Projected future platforms for the deepwater GOM provide an indication of the volume of future work for regional supply centers such as Houma and Fourchon. Deepwater GOM projections by the Minerals Management Service (MMS) show a projected high total of 22 platforms (>200 meters water depth) installed for each of the two 5-year periods 2007-2011 and 2012-2016, then declining to 14 platforms for the period 2017-2021, then nearly leveling off to eight platforms for the periods 2022-2026 and 2027-2031, then seven platforms for the periods 2032-2036 and 2037-2041, then three platforms for the period 2042-2046.[22] The MMS projected activity of production platform installations in the GOM tracks closely with projected deepwater oil production for the GOM.[23] Trends for the GOM offshore oil & gas sector appear to remain robust through the end of the next decade (2020). Thereafter, some decline is envisioned in the developable deepwater in the western GOM.

Given the synergy between oil & gas offshore activity and the Houma-based major supply sector for equipment and parts, it would appear that the local oil & gas sector based economy and related activity would continue to grow and remain at historically higher levels of activity than the recent past at least for the next decade ending 2020. Expansion of GOM exploration and development as well as maintenance of existing wells beyond 2020 would appear to have a sustainable effect on use of the HNC. Although the volume of projected installations of deepwater production platforms declines after 2020, it is projected to be reasonably stable until 2040.[24]

Even though there is a relationship between GOM offshore oil & gas exploration and production (including services related to future abandonment of wells) and cargo tons on the HNC, a strict causal relationship cannot be interfered that would support a projection of cargo tons of petroleum and petroleum products and crude materials. Moreover, for this feasibility analysis the benefiting cargo is vessel movements generally not related to cargo but rather to ancillary matters as services such as repairs and home port layups. Quantitative cargo projections have not been made because they would not translate into particular benefiting vessel movements other than in a very loose manner. Rather, cargo projections are discussed qualitatively in terms of the factors (deepwater oil & gas exploration/production in the GOM) that drive continued use of the HNC for supporting infrastructure and equipment.

Determine Vessel Fleet Composition and Cost

HNC Reported Vessel Trips and Drafts Trends

Table 6 (revised and updated) summarizes the WCS total annual trips and drafts (foreign and domestic vessels) reported for the HNC for the period 2003-2013.[25] A full set of detailed HNC annual trips and drafts by direction and vessel is provided in Table A-2 in the

[22] It should not be assumed that these are entirely new and independent platforms relative to possible reuse of existing platforms on fields that are no longer efficient to produce.
[23] John Westwood and Steve Robertson, "Deep and Ultra-Deepwater Investment Trends." Refer to Draft Economics Appendix, Port of Iberia Louisiana Channel Deepening Study (February 2006), page 47, Figure 7.
[24] The 2014 Energy Outlook forecast for GOM offshore oil production affirms that production will remain robust throughout the current forecast ending in 2040 (refer to tables 12A and 12B).
[25] Waterborne Commerce revised the formatting of reporting the vessel trips and drafts from sequential foot by foot drafts to footage ranges beginning with year 2003.

appendix to this report. Total reported trips and drafts on the HNC for the period 2003 through 2013 peaked at 9,338 trips in 2007. There are substantial fluctuations in reported vessel trips similar to cargo tonnages. There were about 5,400 trips annually in years 2003 and 2004 compared to about 9,000 trips annually in years 2007 and 2008. Thereafter total annual vessel trips compiled by the Corps declined in 2009 (5,974), 2010 (4,101), 2011 (3,797), 2012 (3,780) and 2012 (4,267).

Table 6. Houma Navigation Canal Annual Trips by Vessel Flag and Draft, 2003-2013

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Domestic											
All Drafts (ft.)	5,235	5,133	7,294	7,803	8,472	8,471	5,666	4,048	3,737	3,714	4,087
0 to 5	3,085	2,432	3,710	4,361	3,996	4,587	3,277	1,881	1,783	1,736	1,781
6 to 9	1,967	2,459	3,488	3,292	4,255	3,799	2,351	2,088	1,841	1,726	2,252
10 to 12	168	238	90	149	221	66	36	78	103	245	54
13 to 14	11	2	4	0	0	1	2	1	10	7	0
15 to 17	4	1	2	1	0	18	0	0	0	0	0
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Foreign											
All Drafts (ft.)	246	303	87	414	866	502	308	53	60	66	180
0 to 5	18	60	14	20	57	7	8	3	5	2	22
6 to 9	135	132	29	155	497	322	201	25	25	28	65
10 to 12	68	87	33	208	198	120	63	13	16	24	69
13 to 14	9	16	5	20	62	27	1	6	9	5	18
15 to 17	16	8	6	11	52	25	35	5	4	4	6
18 to 20	0	0	0	0	0	1	0	1	1	3	0
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All Vessels											
All Drafts (ft.)	5,481	5,436	7,381	8,217	9,338	8,973	5,974	4,101	3,797	3,780	4,267
0 to 5	3,103	2,492	3,724	4,381	4,053	4,594	3,285	1,884	1,788	1,738	1,803
6 to 9	2,102	2,591	3,517	3,447	4,752	4,121	2,552	2,113	1,866	1,754	2,317
10 to 12	236	325	123	357	419	186	99	91	119	269	123
13 to 14	20	18	9	20	62	28	3	7	19	12	18
15 to 17	20	9	8	12	52	43	35	5	4	4	6
18 to 20	0	0	0	0	0	1	0	1	1	3	0

Source: Waterborne Commerce Statistics.

Continued concerns about the volume of commercial vessel traffic entering the HNC led the Terrebonne Port to purchase data on vessel transits (Ship Tracker) from the north and south ends of the HNC. Initial data fro the period January 31, 2012 to May 21, 2012, nearly four calendar months, show 628 vessel transits at the north end of the HNC and 2,029 vessel transits at the south end of the HNC. The data for nearly four months could be extrapolated to a full calendar year by a factor of three not allowing for seasonal traffic fluctuations. Estimated annual vessel transits would be nearly 2,000 at the north end (628*3=1,884) and 6,000 at the south end (2029*3=6,087). Total estimated annual traffic would be nearly 8,000 vessels using the HNC from the north and south junction points with other waterways.

Similar data for the first seven months of calendar year 2015, January 1, 2015 through August 2, 2015, show 939 vessel transits at the north end of the HNC and 3,554 vessel transits at the south end of the HNC. The data for seven months could be extrapolated to a full calendar year by a factor of 1.7143 (12/7 = 1.7143). Estimated annual 2015 vessel transits

would be nearly 1,600 at the north end (939*1.7143 = 1,610) and 6,000 at the south end (3,554*1.78143 = 6,093). Total estimated HNC 2015 annual traffic would be nearly 7,600 vessels using the HNC from the north and south junction point with other waterways.

A review of the sailing draft distributions indicates that there is no trend to deeper vessels transiting the HNC as the fluctuations in the deepest reported drafts seem to reflect the changes in the total volume of trips rather than shifts to deeper drafts. The reported annual total number of trips for drafts more than 12 feet is relatively low. This appears to be consistent with the vessel operator interviews, which indicated that they would not use the HNC for drafts more than 12 or 13 feet because of vessel groundings and related damages associated with prevailing lack of channel maintenance of full authorized depths. Channel survey data supplied by the Terrebonne Port Authority indicated that a section of the lower HNC near the mouth is reported to regularly and repeatedly have navigable drafts in the range of 12 to 13 feet thus supporting the contention that vessel operators are limited to not be able to use the full authorized project depth except after maintenance events that include advanced maintenance.

HNC Dulac Pontoon Bridge Vessel Transits

The WCS statistics reported for cargo and vessel trips and drafts represent a subset of the total population of cargo and vessels transiting the HNC. The WCS are reported for commercial vessels engaged in trade between ports. Commercial vessels that are sailing between the HNC and the GOM for offshore work related to oil & gas platforms, exploration, and drilling do not report cargo trips to WCS because these vessels are not calling a specific "port" offshore. Consequently, there is regarded to be underreported commerce related to the GOM that is not included in the WCS statistics for cargo and vessel transits on the HNC.

A more accurate measure of the use of the HNC is reflected in the bridge tender records of openings for transiting vessels at the Dulac pontoon bridge. Table 7 summarizes the reported monthly total number of bridge openings for vessel transits for the period 2004-2014. Table 8A displays monthly vessel trips as compiled from paper copies of daily bridge tender logs for the entire year of 2005. Table 8B displays the trip data for June 2005 by vessel type.

The annual bridge data of vessel transits in Table 8A indicate that there are about two times the number of commercial vessels passing through the bridge than are reported by the total WCS trips and drafts for 2005. Slightly more than one-half of the total HNC bridge transits are related to tug movements. Other vessels related to the offshore oil & gas sector such as offshore supply and rig jackets are not very prominent.

Table 7. Houma Navigation Canal Pontoon Bridge Annual Openings, 2004-2014

Month	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
January	911	1,135	892	674	544	595	582	726	638	701	112
February	1,057	1,016	798	530	836	585	616	455	572	564	105
March	1,190	1,392	1,045	677	978	810	736	826	767	691	714
April	1,238	1,330	1,111	1,045	860	809	906	830	869	646	652
May	1,887	1,064	1,437	1,392	1,312	1,194	919	1,080	805	796	1,006
June	1,515	1,288	1,507	1,330	1,104	1,053	575	1,095	1,044	901	786
July	1,527	1,284	1,242	1,064	1,347	1,080	748	1,116	962	436	811
August	1,597	1,255	1,673	1,288	1,481	945	1,054	1,080	1,211	920	812
September	1,770	1,004	1,537	1,284	615	853	961	949	863	849	559
October	1,449	793	1,331	1,255	1,184	904	1,031	892	964	1,031	870
November	927	1,174	1,181	1,004	885	760	859	713	630	664	847
December	1,107	850	687	793	921	577	597	584	602	645	618
Total	16,175	13,585	14,441	12,336	12,067	10,165	9,584	10,346	9,927	8,844	7,892

Source: Terrebonne Parish Consolidated Government.

Table 8A. Houma Navigation Canal Pontoon Bridge Vessel Count, 2005

Month	Actual Count	Percentages
January	967	6.38%
February	1,009	6.65%
March	1,178	7.77%
April	1,223	8.07%
May	1,497	9.87%
June	1,574	10.38%
July	1,687	11.13%
August	1,447	9.54%
September	1,305	8.61%
October	1,134	7.48%
November	1,143	7.54%
December	999	6.59%
Total	**15,163**	**100%**

Source: Terrebonne Parish Department of Public Works.

Table 8B. Houma Navigation Canal Pontoon Bridge Vessel Type Count, June 2005

Type of Vessel	Actual Count	Percentages
Tug Boat in Tow	647	41.11%
Tug Boat (Light Boat)	244	15.50%
Offshore Supply	78	4.96%
Rig Jacket	27	1.72%
Trawl Boat	57	3.62%
Oyster Boat	8	0.51%
Lafitte Skiff	42	2.67%
Crew Boat	153	9.72%
Pleasure Boat	282	17.92%
Other	36	2.29%
Total	**1,574**	**100%**

Source: Terrebonne Parish Department of Public Works.

Offshore Supply Vessel Trends

Table 9 shows the length overall (Loa) size distributions of platform supply vessels for the world fleet and the GOM fleet. The world fleet is reported to be 1,718 vessels, and the GOM fleet is reported to be 526 vessels.[26] The Loa size distributions for the world and GOM are quite similar, with nearly 30 percent of both fleets >200 feet Loa. Most of the world and GOM fleet is still constituted by comparatively small vessels <200 feet Loa. For the GOM, these smaller vessels <200 feet Loa will be replaced with larger hulls that are wider and deeper for more cargo capacity.[27]

Table 10 shows the draught and breadth statistics for the world fleet by Loa category. Vessels above 200 feet Loa are deeper and wider. There is more increase in width than depth (draught). Vessels more than 180 feet Loa cannot use the HNC other than in a light loaded condition (if at all) for some of the larger platform supply vessels.[28] From Table 10, it is clear that the emerging trend in the platform supply fleet to move to larger vessels (>200 feet Loa) cannot be sustained by the HNC under the without-project conditions.

[26] There is a smaller fleet in terms of size and number of vessels operated in Mexico by several of the U.S. firms. These vessels are not included here, but are usually brought back to the U.S. for major repairs and maintenance.
[27] The wider (beam) and deeper (draft) hulls of the larger (Loa) vessels means that the cargo carrying capacity is greater than proportional changes in Loa.
[28] The larger platform supply vessels built in Houma have to be towed out on the HNC in a "light light" condition, with minimum fuel and supplies and preferably without use of the vessel's own power that would result in deeper sailing drafts. Once fully fitted out, these vessels cannot sail back to Houma on the HNC because of draft constraints.

Table 9. Platform Supply Vessel Characteristics: Loa and Age

Length Overall (Feet)	World Fleet Count	World Fleet Avg Age (Yrs)	World Fleet Percent	GOM Count	GOM Fleet Avg Age (Yrs)	GOM Percent
Zero or Blank	6	0	0.35%	4	0	0.76%
Less Than 140	333	27	19.38%	68	23	12.93%
Between 140 and 159.99	193	24	11.23%	70	13	13.31%
Between 160 and 179.99	332	28	19.32%	124	25	23.57%
Between 180 and 199.99	312	23	18.16%	99	21	18.82%
Between 200 and 219.99	168	13	9.78%	78	7	14.83%
Between 220 and 239.99	136	11	7.92%	32	11	6.08%
Between 240 and 259.99	89	6	5.18%	26	8	4.94%
Between 260 and 279.99	84	7	4.89%	23	3	4.37%
Greater than 279.99	65	10	3.78%	2	21	0.38%
TOTAL	**1,718**		**100%**	**526**		**100%**

Note: GOM=Gulf of Mexico.

Source: Lloyd's Fairplay Register.

Table 10. Platform Supply Vessel Characteristics: Loa and Draught

	Draught Comparison		Breadth Comparison	
Length Overall (Feet)	World Fleet Count	World Fleet Average Draught	World Fleet Count	World Fleet Average Breadth
Zero or Blank	201	0	9	0
Less Than 140	224	8.9	332	28.2
Between 140 and 159.99	167	10.4	193	35.8
Between 160 and 179.99	320	11.7	332	38.4
Between 180 and 199.99	309	13.0	312	40.7
Between 200 and 219.99	157	15.6	168	47.9
Between 220 and 239.99	126	17.2	136	50.3
Between 240 and 259.99	86	18.8	89	54.1
Between 260 and 279.99	68	19.5	82	59.1
Greater than 279.99	60	20.3	65	65.0
TOTAL	**1,718**		**1,718**	

Source: Lloyd's Fairplay Register.

HNC Benefiting Vessel Fleets

The constrained depth of the HNC results in increased costs for several categories of actual or potential users as follows: (1) diversions of HNC draft-constrained vessels navigating to Houma or other ports by longer routes (rerouting); (2) use of smaller, shallower tugs for interior movements of offshore barges (tug assistance) or other vessels because large ocean tugs cannot navigate the HNC directly to Houma; and (3) other draft-related issues that constrain efficient vessel use such as smaller and/or light loaded vessels, substitutions of truck trips related to oilfield supplies in place of barges, and diversions to other ports.

The fleets affected by without-project conditions can be described under the following categories: (1) rerouting for repairs of deep-draft tugs, sea trials of new buildings, and offshore oil & gas sector barge diversion; (2) HNC tug assistance for ocean barges and new buildings; (3) diversions to other more distant ports for deep-draft barges, tugs, and jackup rigs seeking repairs; (4) deeper loadings for heavy equipment, commissioning and decommissioning offshore platforms (shallow water), receipts and shipments of risers and exports of heavy oil field equipment; and (5) new (building) vessel trips that are too large with respect to light loaded draft to navigate the HNC and must consequently use ancillary floating mechanisms such as dry docks and barges to exit via the HNC. Each will be described in the following sections and will be used as a framework to compile current cost; alternative cost, future cost, and harbor use and compute NED benefits in the remainder of this chapter.

Rerouted Fleet

Rerouting of vessels between Houma and the GOM is a commonly stated preference and practice to avoid use of the HNC for vessels with sailing drafts greater than 12-13 feet because of concerns about damages from groundings.[29] Large ocean tugs with kort nozzles will reportedly not normally transit the HNC because of draft issues. Smaller ocean tugs up to about 3,000 horsepower reportedly transit the HNC under certain conditions. New buildings that are HNC draft constrained may also be diverted to the GOM for sea trials using other routes.

Houma is a large center for shipyard work for the offshore marine sector both for new buildings and regular repairs of licensed vessels. The major shipyards include Main Iron Works, Quality, North American Fabricators (Chouest), Otto Candies, Mariner, and Intracostal Iron Works in addition to the Bollinger facilities at Larose. Many of the large offshore tugs have been constructed by these yards and are serviced there in conjunction with the ABS hull inspection and maintenance standards of two events occurring in a five-year period. The state of the art LA Ship is operational and launched its first specialty vessel, MV Aiviq, an icebreaking anchor handling tug supply vessel. Currently, Terrebonne Port has two new ship building tenants, LA Ship and Thoma Sea.

Derrick barges and pipe-laying barges in the offshore oil sector will typically not transit the HNC even with suitable drafts because of tug draft constraints. A light tug without a barge can transit the HNC with a 12-foot draft, but under a load the tug draft will typically increase up to two feet (squat) and thus be regarded as draft constrained. Consequently, nearly all of the oil sector service barges domiciled at Houma accompanied by large ocean tugs will not transit the HNC with their ocean tugs but will use other routes and/or transit the HNC with shallow-water tug assistance.

Tug Assistance Fleet

Tug assistance occurs for deep-draft vessels using the HNC such as ocean barges and new vessel buildings. In order for most ocean barges to transit the HNC, only smaller ocean tugs or inland tugs can be used. When the ocean barge has a large tug (>3,000/3,600 horse-

[29] The Waterborne Commerce Vessel Trips and Drafts data support the contention that there is little use of the HNC beyond 12 or 13 foot reported sailing drafts.

power), smaller inland tugs navigate to the mouth of the HNC to exchange the barge from the draft-constrained ocean tug. Typically, three to four 900 horsepower inland (shallow tugs) are used in place of the ocean tug to move the barge between the sea buoy and Houma.

New buildings, usually offshore supply vessels >220 feet Loa, can only navigate the HNC under a "light-light" condition and will require tug assistance.[30] Usually two tugs will be supplied for this purpose.

Diverted Fleet to Other Ports

There are vessels that would be domiciled at Houma but cannot regularly access it because of HNC draft constraints. There are also vessels that would come to Houma for repairs because of its proximity to the GOM offshore oil & gas sector, but because of HNC draft constraints they will call at more distant shipyards (as far away as Alabama and Texas) that are not subject to draft constraints.[31]

Deeper Sailing Drafts

The without-project condition at the HNC affects the drafts of vessels and results in more trips or diverted cargo. Two local firms report that loadouts of heavy offshore equipment require more barges and trips than would be used for with-project conditions. Another firm cannot efficiently load out barges to adjacent export ports of Houston and New Orleans so oversize over weight permitted highway vehicles are used, requiring multiple trucks rather than one barge. Two fleet owned/leased shipyards, Otto Candies and LA Ship, have the capability to fabricate custom order specialty deepwater oil field vessels that are larger (depth) than the without project depth dimensions of the HNC, necessitating that these vessels be floated out to sea using barges and dry docks.

Determine Current Cost of Commodity Movements

Rerouting

To avoid the HNC, large draft-constrained tugs reach the Houma area shipyards by a considerably longer detour route consisting of passage by Eugene Island, the lower Atchafalya River to Morgan City, and the GIWW to Houma.[32] Tug assistance is required to safely navigate the ocean tugs in constrained waters.[33] Normally, two shallow tugs about 900

[30] "Light-light" expression signifies that the vessel is not fully outfitted in order for it to navigation the HNC. Once fully outfitted the vessel likely cannot return to Houma because of draft.

[31] As noted previously industry practices and preferences are to have vessels serviced and repaired by the shipyard of their construction because of familiarity with the vessels. HNC draft constraints nullify this practice and preference for those vessels ("light-light") once outfitted cannot navigation the HNC under without project conditions.

[32] There are no locks on the GIWW between Morgan City and Houma. The channel depth is generally regarded as 18 feet, with some necessity to navigate in the center line and shift on necessity for two-way passages with other traffic.

[33] Although the tug will commonly navigate the center line of the channel, tug assistance is needed to safely clear the center line for other vessels.

horsepower each will accompany ocean tugs to and from Houma. The escort tugs can transit the route light loaded in about 12 hours. With the ocean tug, the escort tugs can transit the route in about 24 hours. At an hourly tug hire rate of $400, the round-trip transit tug escort cost is $28,800, excluding time for delays.[34] The ocean tug will normally have a daily hire rate of $7,500. The ocean tug transit cost will be $7,500 per trip.[35]

There are five derrick barges reportedly based in Houma that are operated by Offshore Specialty, Manson, Horizon, Global, and Tetra Tech and that are brought back for maintenance or between jobs. There are three pipe laying barges (Chet Morrison) domiciled at Houma that are also brought in for maintenance or between jobs. It is estimated that these specialty barges are brought in and out of Houma three times a year. The barges are normally powered by two small ocean tugs of about 1,200 to 1,500 horsepower that cost $500 per hour.

Usually, this equipment will not navigate the HNC because of concerns about vessel damages and related delays. The longer Eugene Island diversion route is taken with a transit time of 24 hours. A shallow tug is also employed for steering purposes. The shallow tug is deployed up to 36 hours, consisting of 12 hours to sail to the buoy and 24 hours to return with the barge and tugs. The transit time cost for the tugs, exclusive of delays, using the Eugene Island route is $38,400 for each direction.[36] The barge time is valued as the out-of-pocket costs of the equipment, which are stated to be $60,000 per day.[37] The total cost for a one-way diversion would be $98,400. The total cost of the Eugene Island diversion barge time would be $1.440 million per year (eight barges at $60,000 per day multiplied by three trips per year = $1.440 million) for each direction.[38]

There are also reroutes of new buildings for sea trials using the GIWW to the GOM via Eugene Island or to the Mississippi River. The extent of rerouting for sea trials varies, but it appears to involve an average of four big tugs and six offshore supply boats annually. The tugs would require escorts, but the supply boats would not normally require escorts. The tug costs for escorts would be $38,400 for a one-way tug movement and $7,500 for the tug. The offshore supply boat reroute costs would be about $30,000 for a 24-hour (one-day) movement on the GIWW in order to commence sea trials (without tug assistance).

HNC Tug Assistance

The transit time cost for the inland tugs (exclusive of delays) is a total of 18 round-trip hours and a total of two hours for barge hookups at the entrance to the HNC and at Houma. Total time for HNC tug assistance is 20 round-trip hours at $400 per hour or $8,000 per tug. On average, three to four tugs are used depending on weather, wind, etc. HNC tug assistance costs for an average of 3.5 tugs per barge would be $28,000 per round trip.

[34] The escort tug hire charges are for the total elapsed time from home port to home port, regardless of where the vessel is domiciled in the vicinity of the shipyards and detour route. One interviewee reported that the escort tug costs for the Eugene Island route were about $30,000 per trip.
[35] The increased tug costs do not include any trip preparation expenses such as going to a deeper port and discharging extra fuel or supplies to lighten the tug draft.
[36] These are the total tug costs to bring the equipment to or from Houma via the Eugene Island route.
[37] The equipment hire rate is stated to be $100,000 per day.
[38] These are the total barge costs to bring the equipment to or from Houma via the Eugene Island route.

For sea trials, the HNC tug assistance would most likely have two tugs. The cost would be $16,000 per round trip voyage plus $15,000 for the offshore supply vessel (one-half day).

Diversion to Other Ports

An operator of food-grade tank barges based in Houma reported that he cannot normally navigate the HNC with the ocean tugs to bring the barges to Houma for cleaning between trips. As a result, he has to divert the barges to New Orleans for cleaning after each trip, for which he pays $35,000 more than if he was able to use Houma facilities. He also has to pay for dockage between 5 to 10 days while the vessels lay at New Orleans for the next call. Dockage costs at New Orleans are computed to be $5,533 per event.[39] All of the vessel trips originate at Gulf Coast ports, but only half at the Lower Mississippi. Consequently, returning to New Orleans after every trip for cleaning is estimated to cost one tug barge day compared to cleaning at Houma.[40] Tug barge daily costs are estimated to be $10,000.

It is estimated that there is a significant amount of lost shipyard business from tugs too large to transit the HNC and reluctant to take the Eugene Island detour as well as jackup rigs that seek other more distant ports in Texas and Alabama for repairs. These vessels are estimated to travel an average of two days to reach yards in Alabama and Texas for repairs. At a tug cost of $7,500 per day, the one-way distances for repairs that cannot be made at Houma as a result of HNC draft constraints cost $15,000. It is estimated that jackup rigs that would call HNC shipyards, including Dulac, for ABS repairs annually are forced to travel to more distant ports similar to tugs in Alabama and Texas. The jackup rigs are estimated to travel for 2.0 days to reach yards in Alabama and Texas for repairs. At a rig cost of $100,000 per day and a tug assistance cost of $7,500 per day, the one-way distances for repairs that cannot be made at Houma as a result of HNC draft constraints cost $215,000.

Deeper Loadings

Prior to hurricane Katrina there were about 400 deepwater marine risers received at Houma from offshore exploration or production wells, refurbished and subsequently shipped from Houma to Fourchon each year by truck. The over size over weight trucking was expensive.[41] This market ceased after Katrina in part because of the expense of shipping by truck. It is expected to resume using ocean barges under with-project conditions. Instead of towing risers in ocean barges about 550 miles to Ingleside and Brownsville, Texas for refurbishing the risers would be moved by ocean barge to Houma. Twenty risers per barge would move at a time and 600 risers per year. Towing costs round trip between offshore locations and Ingleside/Brownsville would be $57,292 (550 miles at 8 miles per hour towing underway = 65.75 at sea hours * 2 for 137.50 round trip at sea hours/24 = 5.73 at sea days * $10,000 per day of tug/barge at sea = $57,292). Towing costs round trip between offshore

[39] The Port of New Orleans dockage tariff is $1.82 per foot Loa. Based on a 380-foot Loa tug-barge combination and an average stay of 7.5 days, the dockage for eight 24-hour days or fraction thereof would be $5,533.
[40] There are very few barge cleaning facilities in the Gulf Coast capable of processing food-grade barges, so there are very few cleaning options apart from New Orleans under without-project conditions.
[41] One riser per truck was the shipment size.

locations and Houma would be $20,883 (200 miles at 8 miles per hour towing underway = 25 at sea hours * 2 for 50 round trip at sea hours/24 = 2.08 at sea days * $10,000 per day of tug/barge at sea = $20,883).

One local Houma firm makes three offshore heavy equipment loadouts annually using three barges because of draft constraints. The tug barges are for offshore heavy lifts usually on hire for a minimum of 10 days, including mobilization, loading, GOM offshore transit, and offloadings and demobilization. Tug barge units will cost about $100,000 for 10 days each deployment. Three units would cost $300,000.

Over weight, over size oil field exports via Houston and New Orleans customarily move by truck. There are about 12 shipments per year at a cost of $130,000 per truck. Comparative barge costs are $60,000.

One local Houma firm mobilizes a current fleet of offshore shallow-water drilling rigs on average a total of five times annually. Each rig requires for setup from five to 11 offshore supply vessel trips depending on the size of the rig and the same for disassembly and return. Based on eight vessel trips per rig setup and takedown and an OSV cost (180-foot Loa) of $20,000 per day for four days per vessel trip for setup and takedown, the rig setup and takedown cost would be $640,000 (4 days * $20,000/day * 8 trips per rig setup).

New Vessel Trips

There is a clear trend of building larger, specialized vessels for the offshore market. Some of these vessels are particularly specialized such as offshore supply vessels with ice breaking capability for use in Alaska. Large specialty purpose vessels are projected to be fabricated at the state of the art shipyards in Houma such as LA Ship and Otto Candies. These vessels will be fabricated to serve their owners, Edison Chouest and Otto Candies, respectively, or for use in special offshore markets such as crude oil feeder tankers for FPSO platforms. The sizes of these vessels with respect to draft are such that they cannot be floated out via the HNC under without-project conditions even in a "light light" condition with tug assistance. For example the first offshore icebreaking anchor handling tug supply vessel built by LA Ship was the MV Aiviq launched November 1, 2011. The vessel dimensions are 360.92–ft (length), 80.08-ft (width) and 28.25-ft (draft fully loaded). Even in a "light light" condition this vessel cannot be towed out on the HNC under without-project conditions.

LA Ship (Edison Chouest Offshore) used a dry dock and a barge to float the Aiviq out to the mouth of the HNC where the vessel was separated from the supporting dry dock and barge. A flotilla of small tugs was deployed to move the dry dock and barge on which the Aiviq rested to the mouth of the HNC. LA Ship (Edison Chouest Offshore) supplied documentation of the extra expenses associated with the movement of the Aiviq to the mouth of the HNC. The costs of this movement exceeded $2.5 million exclusive of delays to other users since the navigation channel was effectively blocked during the two day movement.[42]

[42] The extra expenses associated with floating out the MV Aiviq, slightly more than $2.5 million are relatively minor when compared to the investment value of this vessel, reported to be about $200 million. The sophisticated technical design and intricate fabrication requirements are the competitive characteristics of the unique vessel

Edison Chouest Offshore projects that it will fabricate upwards of four large vessels annually at the LA Ship facility.[43] The vessels will include a fleet of anchor handling tug supply vessels with icebreaking capabilities such as the MV Aiviq as well as product tankers for domestic service in the U.S. Otto Candies is also expected to fabricate at least one vessel annually that is too large to navigate the HNC.

Determine Current Cost of Alternative Movements

Rerouting

A deeper HNC would allow ocean tugs to come directly to Houma. Tug assistance would still be required for steering purposes. Under with-project conditions, the light-loaded tugs would transit the HNC to meet the ocean tug at the sea buoy in approximately six hours and then return to Houma with the ocean tug in about 12 hours. The total tug assistance time would be nearly 18 hours, excluding delays. Estimated tug assistance costs would be $14,400, and deep-draft tug costs would be one-half day, or $3,750.

The derrick barges and specialty (pipe laying) barges would navigate the HNC using a light tug for steering assistance. The light tug costs would be $7,200 per round trip. The barge trip costs would be $12,000 for two ocean tugs ($500 per hour * 12 hours * 2 tugs = $12,000) and $30,000 for one-half day to navigate the HNC. The total cost for a one-way movement on the HNC would be $49,200. Total annual barge costs would be $0.720 million (8 barges * $30,000 * 3 trips) for each direction.

The rerouting of new buildings for sea trials away from the HNC would cease under the with-project conditions. The deep-draft new tugs would still require two tug escorts, whereas the supply boats would not require escorts (sea trials). The escort tug costs would be $14,400 plus the deep-draft tug one-half day $3,750. The offshore supply boat costs would be about $15,000 for a 12-hour (one-half day) movement to commence sea trials (without tug assistance).

HNC Tug Assistance

A deeper HNC would allow the ocean tug to transit directly to Houma with the barge. The ocean tug would require one inland tug for steering assistance. This tug would cost

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market design and fabrication niche that LA Ship (Edison Chouest Offshore) is pursuing that are sufficient to make the HNC higher costs of exit under without-project conditions tolerable in competition with shipyards not disadvantaged by the HNC depth constraint but otherwise lacking the sophisticated design and fabrication capabilities.

[43] This is a new category of benefits as a result of the completion of the LA Ship facility in Houma. The plans of Edison Chouest Offshore to fabricate large specialized vessels at LA Ship, such as icebreaking anchor handling tug supply vessels and feeder tankers for domestic offshore service, were articulated in 2006, but not included in the economic benefits of channel deepening at that time because the LA Ship facility had not been constructed. A recent meeting (2012 update) with Edison Chouest Offshore indicated that the plans articulated in 2006 to use LA Ship for fabricating specialty vessels too large to navigate the HNC have not changed. The launching of the MV Aiviq is a confirmation that these large specialty purpose vessels will be fabricated at Houma.

$7,200. The ocean tug would cost $3,750 based on a long-term charter rate of $7,500 per day. The total tug cost for a direct movement would be $10,950.

Diversion to Other Ports

The tug-barge combination moving food-grade products would come to Houma under the with-project conditions and save $35,000 cleaning, $5,533 dockage per call, and one-day tug barge costs at $10,000.

The deep-draft tugs and jackup rigs that seek more distant ports in Texas and Alabama for repairs would call Houma vicinity shipyards at an estimated travel time of 0.5 days. The travel time cost one way for tugs would be $3,750 and $53,750 for a jackup rig.

Deeper Loadings

Risers that could be directly received from offshore locations by ocean barge at Houma under with-project conditions would save considerable distance by ocean barge to alternative Texas locations of Ingleside and Brownsville for refurbishing. The barge costs between offshore locations and Houma would be about $20,883 round trip compared to $57,292 for Texas locations (round trip).

Heavy equipment offshore loadouts would be completed with two tug-barge units instead of three tug-barges units. The cost for two units would be $200,000. Heavy equipment exports by barge instead of truck to Houston/New Orleans would cost $60,000 compared to truck costs of $130,000.

Offshore rig setup for the with-project conditions would use larger vessels and disproportionately displace older smaller vessels (180-foot Loa). A total of four vessels would be used at $30,000 per day per vessel. Based on four vessel trips per rig setup and takedown and an OSV cost of $30,000 per day (>220 feet Loa) for four days per vessel, the rig setup and takedown cost would be $480,000.

New Vessel Trips

The documentation of the extra movement related activities and associated expenses for the MV Aiviq using small tugs to push and steer a flotilla of a dry dock and a barge reportedly cost in excess of $2.5 million. Under with-project conditions the vessel could be launched at Houma and move under its own power with tug assistance costing about $15,000.

Determine Future Cost of Commodity Movements

The future cost of commodity movements is estimated to be constant in real terms for all the movements (rerouting, tug assistance, diversions, and deeper loadings and new vessel trips).

Determine Use of Harbor With and Without Project

Rerouting

The baseline fleet for rerouting consists of 60 diverted deep-draft tugs annually, six derrick barges, four pipe-laying barges and six OSV trials. The baseline is forecasted to change in proportion to the forecasted changes in offshore domestic crude oil production.

HNC Tug Assistance

The 50 HNC tug assistance moves per year are expected to change in proportion to the forecasted changes in offshore domestic crude oil production.

Diversion to Other Ports

The tank barge operation is three units and will continue to make two trips per month per tug barge vessel.

The lost shipyard business, estimated to be 60 deep-draft tugs and 10 jackup rigs annually, is expected to change in proportion to the forecasted changes in offshore domestic crude petroleum production.

Deeper Loadings

The riser business is projected to return to Houma under with-project conditions for the repair and refurbishment of 600 risers annually. The heavy equipment loadouts are estimated to triple with the ability to load barges directly to offshore installations. The platform rig count is projected at six units. The exports of heavy oil field equipment via Houston and New Orleans are projected to be 12 movements annually shifting from truck to barge under with-project conditions. The deeper loadings are projected to change in proportion to the forecasted changes in offshore domestic crude petroleum.

Compute NED Benefits

Table 11 (new) contains the five benefit categories (rerouting, tug assistance, diversions, deeper loadings and new vessel trips) and the associated vessels and related trips for the base year of the project.[44] For each benefit category and vessel, the total annual without- and with-project costs as described in the sections "Determine Current Cost of Commodity Movement" and "Determine Current Cost of Alternative Movements," respectively, have been computed.

The total base year annual savings for the four benefit categories is $28.7 million, consisting of $5.331 million for rerouting, $0.988 million for tug assistance, $7.823 million for diversions, $3.352 million for deeper loadings and $11.2 million new vessel trips for specialty vessels such as ice breaking anchor handling tug supply and tankers = $8.970 million ($4.485 * 2

[44] Bold entries and values in Table 11 represent updated benefits. Otherwise the entries in Table 11 remain unchanged from the 2012 report.

Table 11. Houma Navigation Canal Base Year NED Benefits

Benefit	Vessel	Quantity	Trips per Vessel	Without Project		With Project		NED Benefits
				Trip Cost	Total Cost	Trip Cost	Total Cost	
Rerouting	Tugs	60	2	$36,300	$4,356,000	$18,150	$2,178,000	$2,178,000
	Barges	10	6	$98,400	$5,904,000	$49,200	$2,952,000	$2,952,000
	Tug trials	4	1	$45,900	$183,600	$18,150	$72,600	$111,000
	OSV trials	6	1	$30,000	$180,000	$15,000	$90,000	$90,000
	Subtotal				$10,623,600		$5,292,600	$5,331,000
Tug Assistance	Barges	50	1	$28,800	$1,440,000	$10,950	$547,500	$892,500
	OSV trials	6	1	$31,000	$186,000	$15,000	$90,000	$96,000
	Subtotal				$1,626,000		$637,500	$988,500
Diversions	Tug barges	3	24	$50,533	$3,638,376	$0	$0	$3,638,376
	Tugs	60	1	$16,000	$960,000	$0	$0	$960,000
	Jackups	10	2	$215,000	$4,300,000	$53,750	$1,075,000	$3,225,000
	Subtotal				$8,898,376		$1,075,000	$7,823,376
Deeper Loading	**Risers**	**30**	**1**	**$57,292**	**$1,718,760**	**$20,883**	**$626,490**	**$1,092,270**
	Loadouts	3	1	$100,000	$300,000	$100,000	$200,000	$100,000
	Rigs	6	8	$80,000	$3,840,000	$120,000	$2,880,000	$960,000
	Exports	**12**	**1**	**$130,000**	**$1,560,000**	**$60,000**	**$360,000**	**$1,200,000**
	Subtotal				**$5,858,760**		**$3,706,490**	**$3,352,270**
New Vessel Trips	**Ice breakers**	**2**	**1**	**$2,250,000**	**$4,500,000**	**$15,000**	**$15,000**	**$4,485,000**
	Tankers	**2**	**1**	**$2,250,000**	**$4,500,000**	**$15,000**	**$15,000**	**$4,485,000**
	Large Specialty	**1**	**1**	**$2,250,000**	**$2,250,000**	**$15,000**	**$7,500**	**$2,242,500**
	Subtotal				**$11,250,000**	**$45,000**	**$37,500**	**$11,212,500**
Total					**$27,006,736**		**$10,711,590**	**$28,707,646**

Notes: Bold entries represent 2015 updates.

Source: G.E.C., Inc.

= $8.970 million). Other large benefiting categories are tug barge diversions ($3.638 million), jackup rig diversions ($3.225 million), barge rerouting ($2.952 million), tug rerouting ($2.178 million) and riser deeper loadings ($1.092 million).

Table 12A (revised) contains the Energy Information Administration (EIA) U.S. domestic oil production forecast for the period 2014 to 2040 as contained in the 2014 Annual Energy Outlook (reference case).[45] U.S. domestic offshore oil production is nearly all from the Gulf of Mexico (GOM). Consequently, the oil production forecast for the U.S. domestic offshore is used to develop indices for the base line year, 2013. The indices (2013 = 1.00) indicate that domestic offshore oil production (Lower 48 Offshore) is projected to grow relative to 2013 thereafter. Offshore production is projected to peak in 2016 relative to 2013 and then remain relatively stable in 2017, 2018 and 2019 before declining gradually between 2020 and 2024 and then gradually increasing annually to the last year of the forecast, 2040. . The 2014 EIA offshore oil production projections represent a game-changer compared to earlier EIA forecasts ending at 2035 that consistently had shown offshore oil production to peak early in the first decade, circa 2019, and then thereafter decline nearly continuously until the last year of the forecast 2035. Consequently, the 2014 EIA offshore oil production projections now show production ratios in 2040 (1.45) to be nearly the same as production ratios in 2016 (1.47), 2017 (1.44), 2018 (1.43) and 2019 (1.44) relative to the base year, 2013 (1.00).

The principal commodities carried on the HNC are related to offshore domestic oil production such as petroleum and petroleum products and crude materials (used primarily for offshore oil/gas wells). The indices of domestic offshore oil production were used to project changes in the baseline 2013 fleet of vessels affected by HNC with-project conditions

Table 12B contains the forecasted annual domestic crude oil production (million barrels per day) for different regions of the U.S., including domestic offshore and a subset thereof, Gulf Coast Offshore. The EIA 2014 forecasts are presented for the most likely (reference) case, and high and low crude oil production forecasts. Based on the EIA annual production forecasts computations of the Average Annual Compound Growth Rates (AACGR) for forecasted annual domestic crude oil production are shown for each year of the forecast between 2013 and 2040. The AACGR between 2013 production and 2040 production is 1.629 percent (refer to "Gulf Coast Offshore"). The corresponding AACGR for the high and low production forecasts for "Gulf Coast Offshore" are 1.723 percent and 1.533 percent, respectively. The AACGR for the high (1.723%) and low (1.533%) production forecasts for the period 2013-2040 are very similar to the AACGR for the base (reference) case (1.629%).

Table 13 (revised) provides a 50-year time frame for NED benefitting vessels for the five categories and the associated vessels. The growth rates of U.S. domestic offshore oil production between 2013 and 2040 were used for long term projections (refer to Table 12B). After 2040 annual vessel growth was flat lined zero growth annually through year 2076, coinciding with year 50 of with-project conditions (2027-2076). All vessel movements in the base year, 2013,

[45] The Energy Outlook which forecasts total US energy production and consumption is updated annually for a thirty-one to thirty-five year period which is currently through 2040. Every five years the forecast is extended by a like amount, year 2040 having recently been extended from year 2035.

Table 12A. Energy Information Administration Annual Energy Outlook 2014, Oil and Gas Supply, Reference Case

Production and Supply	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Crude Oil													
Lower 48 Average Wellhead Price 1/													
(2012 dollars per barrel)	**98.12**	**94.94**	**97.54**	**98.50**	**93.15**	**89.76**	**88.23**	**88.88**	**90.82**	**92.93**	**95.30**	**97.81**	**100.25**
Production (million barrels per day) 2/													
United States Total	5.66	6.49	7.72	8.53	9.04	9.54	9.56	9.58	9.61	9.55	9.42	9.29	9.19
Lower 48 Onshore	3.66	4.60	5.84	6.57	6.94	7.07	7.12	7.14	7.18	7.21	7.21	7.19	7.15
Tight Oil 3/	1.31	2.25	3.48	4.07	4.49	4.67	4.72	4.76	4.78	4.79	4.80	4.74	4.68
Carbon Dioxide Enhanced Oil Recovery	0.28	0.28	0.28	0.28	0.29	0.29	0.31	0.32	0.34	0.36	0.38	0.40	0.42
Other	2.07	2.07	2.09	2.21	2.16	2.11	2.09	2.06	2.05	2.06	2.03	2.04	2.05
Lower 48 Offshore	**1.43**	**1.37**	**1.37**	**1.49**	**1.63**	**2.01**	**1.97**	**1.96**	**1.98**	**1.90**	**1.79**	**1.71**	**1.67**
Alaska	0.57	0.53	0.51	0.47	0.46	0.46	0.47	0.47	0.45	0.44	0.41	0.39	0.37
					1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Production Indices Relative to 2011			1.38	1.40	1.42	1.44	1.46	1.48	1.50	1.53	1.55	1.57	1.59
Production (million barrels per day) 2/													
United States Total	1.00	1.15	1.36	1.51	1.60	1.69	1.69	1.69	1.70	1.69	1.66	1.64	1.62
Lower 48 Onshore	1.00	1.26	1.60	1.79	1.90	1.93	1.94	1.95	1.96	1.97	1.97	1.96	1.95
Lower 48 Offshore	**1.00**	**0.96**	**0.96**	**1.05**	**1.14**	**1.41**	**1.38**	**1.38**	**1.39**	**1.34**	**1.26**	**1.20**	**1.17**
Alaska	1.00	0.93	0.89	0.83	0.81	0.81	0.82	0.83	0.79	0.76	0.72	0.68	0.64
Production Indices Relative to 2012													
Production (million barrels per day) 2/													
United States Total			1.00	1.10	1.17	1.24	1.24	1.24	1.24	1.24	1.22	1.20	1.19
Lower 48 Onshore			1.00	1.12	1.19	1.21	1.22	1.22	1.23	1.23	1.23	1.23	1.22
Lower 48 Offshore			**1.00**	**1.09**	**1.19**	**1.47**	**1.44**	**1.43**	**1.44**	**1.39**	**1.31**	**1.25**	**1.22**
Alaska			1.00	0.93	0.91	0.91	0.92	0.93	0.89	0.86	0.81	0.76	0.72

Table 12A (cont'd). Energy Information Administration Annual Energy Outlook 2014, Oil and Gas Supply, Reference Case

2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2012-2040
102.65	**106.84**	**131.07**	**109.28**	**111.00**	**113.00**	**114.69**	**116.70**	**118.92**	**121.29**	**123.50**	**125.59**	**127.47**	**129.33**	**131.59**	**134.45**	**137.63**	**1.3%**
9.07	9.00	8.83	8.67	8.52	8.38	8.30	8.16	8.07	8.04	7.98	7.87	7.75	7.70	7.56	7.53	7.48	0.5%
7.11	7.04	6.90	6.78	6.65	6.52	6.38	6.26	6.13	6.01	5.90	5.79	5.67	5.56	5.44	5.34	5.23	0.5%
4.61	4.54	4.47	4.42	4.34	4.26	4.17	4.08	3.98	3.88	3.79	3.69	3.58	3.49	3.39	3.29	3.20	1.3%
0.45	0.47	0.50	0.52	0.54	0.56	0.58	0.60	0.61	0.63	0.65	0.66	0.69	0.70	0.72	0.73	0.74	3.6%
2.05	2.03	1.93	1.84	1.77	1.70	1.63	1.59	1.54	1.50	1.47	1.44	1.40	1.37	1.34	1.32	1.29	-1.7%
1.62	**1.64**	**1.63**	**1.60**	**1.59**	**1.60**	**1.68**	**1.67**	**1.67**	**1.69**	**1.69**	**1.70**	**1.72**	**1.78**	**1.79**	**1.90**	**1.99**	**1.4%**
0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.27	0.34	0.39	0.38	0.37	0.36	0.32	0.29	0.26	-2.5%
1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.99
1.61	1.64	1.66	1.68	1.71	1.73	1.75	1.78	1.80	1.83	1.85	1.88	1.91	1.93	1.96	1.99	2.01	
1.60	1.59	1.56	1.53	1.51	1.48	1.47	1.44	1.43	1.42	1.41	1.39	1.37	1.36	1.34	1.33	1.32	
1.94	1.92	1.88	1.85	1.82	1.78	1.74	1.71	1.67	1.64	1.61	1.58	1.55	1.52	1.49	1.46	1.43	
1.14	**1.15**	**1.14**	**1.13**	**1.12**	**1.12**	**1.18**	**1.17**	**1.17**	**1.19**	**1.19**	**1.20**	**1.21**	**1.25**	**1.26**	**1.33**	**1.40**	
0.60	0.57	0.54	0.50	0.47	0.45	0.42	0.40	0.48	0.59	0.68	0.66	0.64	0.63	0.56	0.50	0.45	
1.17	1.17	1.14	1.12	1.10	1.09	1.08	1.06	1.05	1.04	1.03	1.02	1.00	1.00	0.98	0.98	0.97	
1.22	1.21	1.18	1.16	1.14	1.12	1.09	1.07	1.05	1.03	1.01	0.99	0.97	0.95	0.93	0.91	0.90	
1.18	**1.20**	**1.19**	**1.17**	**1.16**	**1.17**	**1.23**	**1.22**	**1.22**	**1.23**	**1.24**	**1.24**	**1.26**	**1.30**	**1.31**	**1.39**	**1.45**	
0.68	0.64	0.60	0.57	0.53	0.50	0.47	0.44	0.54	0.67	0.76	0.74	0.72	0.71	0.63	0.57	0.51	

1/ Represents lower 48 onshore and offshore supplies.

2/ Includes lease condensate.

3/ Tight oil represents resources in low-permeability reservoirs, including shale and chalk formations. The specific plays included in the tight oil category are Bakken/Three Forks/Sanish, Eagle Ford, Woodford, Austin Chalk, Spraberry, Niobrara, Avalon/Bone Springs, and Monterey.

Source: U.S. Energy Information Administration Annual Energy Outlook, 2014, Table 14 Oil and Gas Supply, Reference Case.

Table 12B. Lower 48 Crude Oil Production by Supply Region, High and Low Growth Forecasts, 2012-2040

Production (million barrels per day)			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Crude Oil : Production : Lower 48 Total	TRUE		5.97	6.92	8.14	8.88	9.12	9.56	9.92	10.15	10.18	10.12	10.07	10.02	10.04
Lower 48 On Shore	TRUE		4.6	5.57	6.64	7.23	7.37	7.64	7.85	7.96	8.03	8.01	8	7.99	8.03
Gulf Coast On Shore	TRUE		1.07	1.52	1.98	2.23	2.23	2.28	2.26	2.24	2.18	2.07	1.99	1.91	1.85
Lower 48 Off Shore	TRUE		1.38	1.36	1.5	1.64	1.75	1.92	2.07	2.18	2.15	2.11	2.07	2.02	2
Gulf Coast Off Shore	TRUE		1.29	1.28	1.43	1.57	1.66	1.84	2	2.11	2.08	2.04	2.01	1.96	1.94
Shallow State Off Shore	TRUE		0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Shallow Federal Off Shore	TRUE		0.23	0.23	0.23	0.2	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.15	0.15
Deep Federal Off Shore	TRUE		1.03	1.02	1.17	1.34	1.49	1.67	1.83	1.96	1.92	1.88	1.85	1.8	1.78
High Growth Crude Oil : Production : Lower 48 Total			5.97	6.92	8.14	8.88	9.12	9.56	9.93	10.15	10.2	10.14	10.11	10.06	10.08
Lower 48 On Shore			4.6	5.57	6.64	7.23	7.38	7.65	7.86	7.97	8.05	8.03	8.02	8.02	8.07
Gulf Coast On Shore			1.07	1.52	1.98	2.24	2.24	2.28	2.26	2.24	2.19	2.08	2	1.92	1.86
Lower 48 Off Shore			1.38	1.36	1.5	1.64	1.75	1.92	2.07	2.18	2.15	2.12	2.09	2.04	2.01
Gulf Coast Off Shore			1.29	1.28	1.43	1.57	1.66	1.84	2	2.11	2.08	2.05	2.02	1.97	1.95
Shallow State Off Shore			0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Shallow Federal Off Shore			0.23	0.23	0.23	0.2	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.15	0.15
Deep Federal Off Shore			1.03	1.02	1.17	1.34	1.49	1.67	1.83	1.96	1.92	1.89	1.87	1.81	1.79
Low Growth Crude Oil : Production : Lower 48 Total			5.97	6.92	8.14	8.87	9.11	9.56	9.92	10.14	10.18	10.11	10.05	9.99	10
Lower 48 On Shore			4.6	5.57	6.64	7.23	7.36	7.64	7.85	7.95	8.03	8	7.98	7.97	8
Gulf Coast On Shore			1.07	1.52	1.98	2.23	2.23	2.27	2.25	2.24	2.18	2.06	1.99	1.91	1.85
Lower 48 Off Shore			1.38	1.36	1.5	1.64	1.75	1.92	2.07	2.18	2.15	2.11	2.07	2.02	1.99
Gulf Coast Off Shore			1.29	1.28	1.43	1.57	1.66	1.84	2	2.11	2.08	2.04	2.01	1.96	1.93
Shallow State Off Shore			0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Shallow Federal Off Shore			0.23	0.23	0.23	0.2	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.15	0.15
Deep Federal Off Shore			1.03	1.02	1.17	1.34	1.49	1.67	1.83	1.96	1.92	1.88	1.85	1.8	1.77
Source: U.S. Energy Information Administration, April 30, 2015															
Average Annual Compound Growth Rate (AACGR)			**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Production (million barrels per day)															
Crude Oil : Production : Lower 48 Total				1.015%	0.425%	0.094%	-0.014%	-0.219%	-0.396%	-0.524%	-0.565%	-0.563%	-0.567%	-0.571%	-0.619%
Lower 48 On Shore				0.807%	0.159%	-0.175%	-0.262%	-0.429%	-0.572%	-0.665%	-0.741%	-0.767%	-0.802%	-0.842%	-0.925%
Gulf Coast On Shore				-0.384%	-1.407%	-1.930%	-2.009%	-2.190%	-2.250%	-2.314%	-2.296%	-2.149%	-2.053%	-1.936%	-1.860%
Lower 48 Off Shore				1.746%	1.430%	1.126%	0.900%	0.534%	0.215%	-0.022%	0.046%	0.148%	0.262%	0.422%	0.511%
Gulf Coast Off Shore				1.629%	1.259%	0.932%	0.737%	0.319%	-0.046%	-0.302%	-0.246%	-0.157%	-0.084%	0.060%	0.128%
Shallow State Off Shore				-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%
Shallow Federal Off Shore				-2.091%	-2.171%	-1.708%	-0.594%	-0.620%	-0.648%	-0.352%	-0.370%	-0.389%	-0.411%	-0.838%	-0.890%
Deep Federal Off Shore				2.230%	1.778%	1.298%	0.906%	0.446%	0.049%	-0.275%	-0.186%	-0.085%	0.000%	0.161%	0.241%
High Growth Crude Oil : Production : Lower 48 Total				1.101%	0.514%	0.185%	0.081%	-0.120%	-0.297%	-0.416%	-0.461%	-0.454%	-0.463%	-0.461%	-0.502%
Lower 48 On Shore				0.861%	0.214%	-0.118%	-0.208%	-0.373%	-0.512%	-0.603%	-0.682%	-0.705%	-0.737%	-0.780%	-0.867%
Gulf Coast On Shore				-0.357%	-1.379%	-1.919%	-1.998%	-2.159%	-2.217%	-2.280%	-2.283%	-2.136%	-2.040%	-1.924%	-1.848%
Lower 48 Off Shore				1.932%	1.623%	1.327%	1.108%	0.750%	0.440%	0.214%	0.294%	0.384%	0.485%	0.656%	0.791%
Gulf Coast Off Shore				1.723%	1.357%	1.033%	0.842%	0.428%	0.068%	-0.184%	-0.122%	-0.052%	0.027%	0.177%	0.252%
Shallow State Off Shore				-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%
Shallow Federal Off Shore				-2.091%	-2.171%	-1.708%	-0.594%	-0.620%	-0.648%	-0.352%	-0.370%	-0.389%	-0.411%	-0.838%	-0.890%
Deep Federal Off Shore				2.331%	1.882%	1.407%	1.018%	0.563%	0.171%	-0.148%	-0.052%	0.028%	0.088%	0.286%	0.373%
Low Growth Crude Oil : Production : Lower 48 Total				0.924%	0.331%	0.000%	-0.111%	-0.325%	-0.507%	-0.635%	-0.686%	-0.686%	-0.691%	-0.697%	-0.747%
Lower 48 On Shore				0.725%	0.075%	-0.263%	-0.348%	-0.524%	-0.671%	-0.762%	-0.850%	-0.875%	-0.909%	-0.955%	-1.038%
Gulf Coast On Shore				-0.466%	-1.490%	-2.017%	-2.100%	-2.266%	-2.328%	-2.417%	-2.404%	-2.238%	-2.173%	-2.063%	-1.996%
Lower 48 Off Shore				1.622%	1.303%	0.994%	0.763%	0.390%	0.065%	-0.178%	-0.118%	-0.025%	0.080%	0.229%	0.337%
Gulf Coast Off Shore				1.533%	1.160%	0.829%	0.630%	0.208%	-0.162%	-0.424%	-0.374%	-0.291%	-0.225%	-0.091%	0.000%
Shallow State Off Shore				-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%
Shallow Federal Off Shore				-2.091%	-2.171%	-1.708%	-0.594%	-0.620%	-0.648%	-0.352%	-0.370%	-0.389%	-0.411%	-0.838%	-0.890%
Deep Federal Off Shore				2.105%	1.649%	1.165%	0.767%	0.302%	-0.100%	-0.431%	-0.350%	-0.258%	-0.183%	-0.033%	0.070%
Oil Production Ratios, 2013-2040			**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Gulf Coast On Shore				1.000	1.303	1.467	1.467	1.500	1.487	1.474	1.434	1.362	1.309	1.257	1.217
Gulf Coast Off Shore				1.000	1.117	1.227	1.297	1.438	1.563	1.648	1.625	1.594	1.570	1.531	1.516
Gulf Coast Total				1.000	1.218	1.357	1.389	1.471	1.521	1.554	1.521	1.468	1.429	1.382	1.354
High Growth Gulf Coast On Shore				1.000	1.303	1.474	1.474	1.500	1.487	1.474	1.441	1.368	1.316	1.263	1.224
High Growth Gulf Coast Off Shore				1.000	1.117	1.227	1.297	1.438	1.563	1.648	1.625	1.602	1.578	1.539	1.523
High Growth Gulf Coast Total				1.000	1.218	1.361	1.393	1.471	1.521	1.554	1.525	1.475	1.436	1.389	1.361
Low Growth Gulf Coast On Shore				1.000	1.303	1.467	1.467	1.493	1.480	1.474	1.434	1.355	1.309	1.257	1.217
Low Growth Gulf Coast Off Shore				1.000	1.117	1.227	1.297	1.438	1.563	1.648	1.625	1.594	1.570	1.531	1.508
Low Growth Gulf Coast Total				1.000	1.218	1.357	1.389	1.468	1.518	1.554	1.521	1.464	1.429	1.382	1.350

Source: Table 12A and G.E.C., Inc.

Table 12B (cont'd). Lower 48 Crude Oil Production by Supply Region, High and Low Growth Forecasts, 2012-2040

Production (million barrels per day)			**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Crude Oil : Production : Lower 48 Total	TRUE		9.96	9.81	9.8	9.87	9.83	9.8	9.57	9.36	9.25	9.19	9.2	9.16	9.1	9.08	9.03	9.09
Lower 48 On Shore	TRUE		8.01	7.86	7.81	7.77	7.68	7.6	7.36	7.18	7.09	7.06	7.07	7.04	7	6.96	6.94	6.92
Gulf Coast On Shore	TRUE		1.78	1.68	1.61	1.57	1.55	1.51	1.48	1.45	1.43	1.41	1.39	1.38	1.37	1.37	1.37	1.37
Lower 48 Off Shore	TRUE		1.95	1.95	2	2.1	2.16	2.21	2.2	2.18	2.16	2.13	2.14	2.12	2.1	2.12	2.09	2.17
Gulf Coast Off Shore	TRUE		1.89	1.89	1.94	2.03	2.08	2.08	2.05	2.03	1.98	1.92	1.92	1.91	1.9	1.93	1.91	1.98
Shallow State Off Shore	TRUE		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0
Shallow Federal Off Shore	TRUE		0.15	0.15	0.15	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13
Deep Federal Off Shore	TRUE		1.73	1.73	1.78	1.86	1.92	1.91	1.89	1.87	1.83	1.77	1.77	1.76	1.75	1.79	1.77	1.85
High Growth Crude Oil : Production : Lower 48 Total			10	9.87	9.89	9.99	9.97	9.91	9.65	9.47	9.32	9.3	9.32	9.25	9.22	9.2	9.14	9.3
Lower 48 On Shore			8.04	7.92	7.88	7.87	7.79	7.7	7.45	7.25	7.17	7.16	7.17	7.14	7.09	7.06	7.04	7.02
Gulf Coast On Shore			1.79	1.69	1.63	1.59	1.57	1.53	1.5	1.45	1.43	1.41	1.4	1.39	1.38	1.38	1.38	1.38
Lower 48 Off Shore			1.96	1.96	2.01	2.12	2.19	2.21	2.2	2.22	2.15	2.15	2.15	2.11	2.13	2.15	2.1	2.28
Gulf Coast Off Shore			1.9	1.9	1.95	2.06	2.13	2.1	2.06	2.06	1.98	1.93	1.94	1.91	1.95	1.96	1.93	2.03
Shallow State Off Shore			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0
Shallow Federal Off Shore			0.15	0.15	0.15	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13
Deep Federal Off Shore			1.73	1.73	1.79	1.89	1.96	1.93	1.9	1.9	1.82	1.78	1.79	1.76	1.8	1.82	1.79	1.9
Low Growth Crude Oil : Production : Lower 48 Total			9.94	9.75	9.73	9.76	9.75	9.67	9.46	9.27	9.11	8.96	9	8.99	8.93	8.89	8.86	8.87
Lower 48 On Shore			8	7.83	7.77	7.71	7.62	7.52	7.31	7.14	6.97	6.91	6.89	6.9	6.84	6.81	6.79	6.77
Gulf Coast On Shore			1.78	1.68	1.61	1.56	1.53	1.49	1.47	1.45	1.41	1.39	1.38	1.37	1.35	1.34	1.34	1.34
Lower 48 Off Shore			1.95	1.92	1.97	2.05	2.13	2.15	2.15	2.13	2.14	2.05	2.12	2.09	2.09	2.08	2.07	2.1
Gulf Coast Off Shore			1.88	1.86	1.91	1.98	2.05	2.06	2.01	1.98	1.97	1.87	1.9	1.87	1.88	1.89	1.88	1.93
Shallow State Off Shore			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0
Shallow Federal Off Shore			0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13
Deep Federal Off Shore			1.72	1.7	1.75	1.82	1.89	1.9	1.85	1.83	1.82	1.72	1.75	1.73	1.74	1.75	1.75	1.79
Source: U.S. Energy Information Administration, April 30, 2015																		
Average Annual Compound Growth Rate (AACGR)			**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Production (million barrels per day)																		
Crude Oil : Production : Lower 48 Total			-0.607%	-0.543%	-0.577%	-0.684%	-0.709%	-0.749%	-0.570%	-0.365%	-0.249%	-0.182%	-0.240%	-0.192%	-0.037%	0.055%	0.664%	
Lower 48 On Shore			-0.970%	-0.906%	-0.926%	-0.961%	-0.943%	-0.933%	-0.683%	-0.460%	-0.346%	-0.333%	-0.428%	-0.429%	-0.382%	-0.288%	-0.288%	
Gulf Coast On Shore			-1.730%	-1.446%	-1.234%	-1.129%	-1.116%	-0.968%	-0.854%	-0.707%	-0.610%	-0.479%	-0.289%	-0.182%	0.000%	0.000%	0.000%	
Lower 48 Off Shore			0.715%	0.766%	0.630%	0.274%	0.042%	-0.182%	-0.152%	-0.057%	0.066%	0.311%	0.279%	0.584%	1.099%	1.172%	3.828%	
Gulf Coast Off Shore			0.311%	0.333%	0.157%	-0.208%	-0.447%	-0.491%	-0.385%	-0.311%	0.000%	0.514%	0.617%	0.904%	1.384%	1.287%	3.665%	
Shallow State Off Shore			-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	#DIV/0!	#DIV/0!	
Shallow Federal Off Shore			-0.949%	-1.017%	-1.095%	-1.715%	-1.870%	-2.055%	-1.577%	-1.773%	-2.024%	-2.357%	-1.471%	-1.836%	-2.440%	-3.638%	0.000%	
Deep Federal Off Shore			0.448%	0.480%	0.297%	-0.045%	-0.337%	-0.319%	-0.237%	-0.134%	0.155%	0.739%	0.888%	1.255%	1.870%	1.662%	4.520%	
High Growth Crude Oil : Production : Lower 48 Total			-0.483%	-0.424%	-0.472%	-0.595%	-0.630%	-0.633%	-0.410%	-0.226%	-0.031%	0.000%	-0.043%	0.135%	0.288%	0.542%	1.751%	
Lower 48 On Shore			-0.900%	-0.858%	-0.885%	-0.948%	-0.942%	-0.920%	-0.658%	-0.402%	-0.302%	-0.329%	-0.422%	-0.423%	-0.330%	-0.284%	-0.284%	
Gulf Coast On Shore			-1.719%	-1.437%	-1.273%	-1.173%	-1.166%	-1.027%	-0.922%	-0.617%	-0.507%	-0.358%	-0.287%	-0.180%	0.000%	0.000%	0.000%	
Lower 48 Off Shore			1.013%	1.086%	0.974%	0.608%	0.367%	0.312%	0.398%	0.334%	0.842%	0.983%	1.181%	1.956%	2.294%	2.979%	8.571%	
Gulf Coast Off Shore			0.442%	0.474%	0.310%	-0.122%	-0.436%	-0.338%	-0.163%	-0.183%	0.357%	0.845%	0.911%	1.535%	1.349%	1.770%	5.181%	
Shallow State Off Shore			-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	#DIV/0!	#DIV/0!	
Shallow Federal Off Shore			-0.949%	-1.017%	-1.095%	-1.715%	-1.870%	-2.055%	-1.577%	-1.773%	-2.024%	-2.357%	-1.471%	-1.836%	-2.440%	-3.638%	0.000%	
Deep Federal Off Shore			0.627%	0.672%	0.460%	0.044%	-0.282%	-0.157%	0.000%	0.000%	0.616%	1.093%	1.200%	1.932%	1.819%	2.174%	6.145%	
Low Growth Crude Oil : Production : Lower 48 Total			-0.756%	-0.673%	-0.709%	-0.794%	-0.856%	-0.860%	-0.713%	-0.550%	-0.381%	-0.168%	-0.291%	-0.335%	-0.224%	-0.113%	0.113%	
Lower 48 On Shore			-1.107%	-1.034%	-1.054%	-1.078%	-1.069%	-1.045%	-0.849%	-0.663%	-0.415%	-0.341%	-0.351%	-0.474%	-0.342%	-0.294%	-0.295%	
Gulf Coast On Shore			-1.875%	-1.602%	-1.402%	-1.259%	-1.198%	-1.055%	-1.024%	-0.981%	-0.725%	-0.609%	-0.587%	-0.552%	-0.248%	0.000%	0.000%	
Lower 48 Off Shore			0.495%	0.642%	0.493%	0.201%	-0.129%	-0.235%	-0.261%	-0.177%	-0.269%	0.402%	-0.189%	0.119%	0.159%	0.480%	1.449%	
Gulf Coast Off Shore			0.175%	0.264%	0.080%	-0.213%	-0.547%	-0.650%	-0.450%	-0.319%	-0.293%	0.528%	0.314%	0.793%	0.879%	1.053%	2.660%	
Shallow State Off Shore			-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	-100.000%	#DIV/0!	#DIV/0!	
Shallow Federal Off Shore			-0.949%	-1.017%	-1.095%	-1.185%	-1.292%	-1.421%	-1.577%	-1.773%	-2.024%	-2.357%	-1.471%	-1.836%	-2.440%	-3.638%	0.000%	
Deep Federal Off Shore			0.266%	0.369%	0.174%	-0.138%	-0.493%	-0.595%	-0.366%	-0.276%	-0.237%	0.667%	0.453%	0.856%	0.949%	1.136%	2.286%	
Oil Production Ratios, 2013-2040			**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Gulf Coast On Shore			1.171	1.105	1.059	1.033	1.020	0.993	0.974	0.954	0.941	0.928	0.914	0.908	0.901	0.901	0.901	0.901
Gulf Coast Off Shore			1.477	1.477	1.516	1.586	1.625	1.625	1.602	1.586	1.547	1.500	1.500	1.492	1.484	1.508	1.492	1.547
Gulf Coast Total			1.311	1.275	1.268	1.286	1.296	1.282	1.261	1.243	1.218	1.189	1.182	1.175	1.168	1.179	1.171	1.196
High Growth Gulf Coast On Shore			1.178	1.112	1.072	1.046	1.033	1.007	0.987	0.954	0.941	0.928	0.921	0.914	0.908	0.908	0.908	0.908
High Growth Gulf Coast Off Shore			1.484	1.484	1.523	1.609	1.664	1.641	1.609	1.609	1.547	1.508	1.516	1.492	1.523	1.531	1.508	1.586
High Growth Gulf Coast Total			1.318	1.282	1.279	1.304	1.321	1.296	1.271	1.254	1.218	1.193	1.193	1.179	1.189	1.193	1.182	1.218
Low Growth Gulf Coast On Shore			1.171	1.105	1.059	1.026	1.007	0.980	0.967	0.954	0.928	0.914	0.908	0.901	0.888	0.882	0.882	0.882
Low Growth Gulf Coast Off Shore			1.469	1.453	1.492	1.547	1.602	1.609	1.570	1.547	1.539	1.461	1.484	1.461	1.469	1.477	1.469	1.508
Low Growth Gulf Coast Total			1.307	1.264	1.257	1.264	1.279	1.268	1.243	1.225	1.207	1.164	1.171	1.157	1.154	1.154	1.150	1.168

Source: Table 12A and G.E.C., Inc.

Table 13. Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category: 2014 - 2076

Year	Project Year	Activity Vessel Category Growth		Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total Trips (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trips
2013				120.0	60.0	4.0	6.0	**50.0**	**6.0**	72.0	**60.0**	20.0	**30.0**	-1.0	**-24.0**	**12.0**	**2.0**	2.0	**1.0**	420	184	161	2	56.0	5.0
2014		0.01629%	101.629%	122.0	61.0	4.1	6.1	50.8	6.1	73.2	61.0	20.3	30.5	-1.0	-24.4	12.2	2.0	2.0	1.0	427	187	164	2	56.9	5.1
2015		0.01629%	101.629%	123.9	62.0	4.1	6.2	51.6	6.2	74.4	62.0	20.7	31.0	-1.0	-24.8	12.4	2.1	2.1	1.0	434	190	166	2	57.8	5.2
2016		0.01629%	101.629%	126.0	63.0	4.2	6.3	52.5	6.3	75.6	63.0	21.0	31.5	-1.0	-25.2	12.6	2.1	2.1	1.0	441	193	169	2	58.8	5.2
2017		0.01629%	101.629%	128.0	64.0	4.3	6.4	53.3	6.4	76.8	64.0	21.3	32.0	-1.1	-25.6	12.8	2.1	2.1	1.1	448	196	172	2	59.7	5.3
2018		0.01629%	101.629%	130.1	65.0	4.3	6.5	54.2	6.5	78.1	65.0	21.7	32.5	-1.1	-26.0	13.0	2.2	2.2	1.1	455	199	175	2	60.7	5.4
2019		0.01629%	101.629%	132.2	66.1	4.4	6.6	55.1	6.6	79.3	66.1	22.0	33.1	-1.1	-26.4	13.2	2.2	2.2	1.1	463	203	177	2	61.7	5.5
2020		0.01629%	101.629%	134.4	67.2	4.5	6.7	56.0	6.7	80.6	67.2	22.4	33.6	-1.1	-26.9	13.4	2.2	2.2	1.1	470	206	180	2	62.7	5.6
2021		0.01629%	101.629%	136.6	68.3	4.6	6.8	56.9	6.8	81.9	68.3	22.8	34.1	-1.1	-27.3	13.7	2.3	2.3	1.1	478	209	183	2	63.7	5.7
2022		0.01629%	101.629%	138.8	69.4	4.6	6.9	57.8	6.9	83.3	69.4	23.1	34.7	-1.2	-27.8	13.9	2.3	2.3	1.2	486	213	186	2	64.8	5.8
2023		0.01629%	101.629%	141.0	70.5	4.7	7.1	58.8	7.1	84.6	70.5	23.5	35.3	-1.2	-28.2	14.1	2.4	2.4	1.2	494	216	189	2	65.8	5.9
2024		0.01629%	101.629%	143.3	71.7	4.8	7.2	59.7	7.2	86.0	71.7	23.9	35.8	-1.2	-28.7	14.3	2.4	2.4	1.2	502	220	192	2	66.9	6.0
2025		0.01629%	101.629%	145.7	72.8	4.9	7.3	60.7	7.3	87.4	72.8	24.3	36.4	-1.2	-29.1	14.6	2.4	2.4	1.2	510	223	195	2	68.0	6.1
2026		0.01629%	101.629%	148.1	74.0	4.9	7.4	61.7	7.4	88.8	74.0	24.7	37.0	-1.2	-29.6	14.8	2.5	2.5	1.2	518	227	199	2	69.1	6.2
2027	1	0.01629%	101.629%	150.5	75.2	5.0	7.5	62.7	7.5	90.3	75.2	25.1	37.6	-1.3	-30.1	15.0	2.5	2.5	1.3	527	231	202	3	70.2	6.3
2028	2	0.01629%	101.629%	152.9	76.5	5.1	7.6	63.7	7.6	91.7	76.5	25.5	38.2	-1.3	-30.6	15.3	2.5	2.5	1.3	535	234	205	3	71.4	6.4
2029	3	0.01629%	101.629%	155.4	77.7	5.2	7.8	64.8	7.8	93.2	77.7	25.9	38.9	-1.3	-31.1	15.5	2.6	2.6	1.3	544	238	209	3	72.5	6.5
2030	4	0.01629%	101.629%	157.9	79.0	5.3	7.9	65.8	7.9	94.8	79.0	26.3	39.5	-1.3	-31.6	15.8	2.6	2.6	1.3	553	242	212	3	73.7	6.6
2031	5	0.01629%	101.629%	160.5	80.3	5.4	8.0	66.9	8.0	96.3	80.3	26.8	40.1	-1.3	-32.1	16.1	2.7	2.7	1.3	562	246	215	3	74.9	6.7
2032	6	0.01629%	101.629%	163.1	81.6	5.4	8.2	68.0	8.2	97.9	81.6	27.2	40.8	-1.4	-32.6	16.3	2.7	2.7	1.4	571	250	219	3	76.1	6.8
2033	7	0.01629%	101.629%	165.8	82.9	5.5	8.3	69.1	8.3	99.5	82.9	27.6	41.4	-1.4	-33.2	16.6	2.8	2.8	1.4	580	254	222	3	77.4	6.9
2034	8	0.01629%	101.629%	168.5	84.2	5.6	8.4	70.2	8.4	101.1	84.2	28.1	42.1	-1.4	-33.7	16.8	2.8	2.8	1.4	590	258	226	3	78.6	7.0
2035	9	0.01629%	101.629%	171.2	85.6	5.7	8.6	71.3	8.6	102.7	85.6	28.5	42.8	-1.4	-34.2	17.1	2.9	2.9	1.4	599	263	230	3	79.9	7.1
2036	10	0.01629%	101.629%	174.0	87.0	5.8	8.7	72.5	8.7	104.4	87.0	29.0	43.5	-1.5	-34.8	17.4	2.9	2.9	1.5	609	267	233	3	81.2	7.3
2037	11	0.01629%	101.629%	176.8	88.4	5.9	8.8	73.7	8.8	106.1	88.4	29.5	44.2	-1.5	-35.4	17.7	2.9	2.9	1.5	619	271	237	3	82.5	7.4
2038	12	0.01629%	101.629%	179.7	89.9	6.0	9.0	74.9	9.0	107.8	89.9	30.0	44.9	-1.5	-35.9	18.0	3.0	3.0	1.5	629	276	241	3	83.9	7.5
2039	13	0.01629%	101.629%	182.7	91.3	6.1	9.1	76.1	9.1	109.6	91.3	30.4	45.7	-1.5	-36.5	18.3	3.0	3.0	1.5	639	280	245	3	85.2	7.6
2040	14	0.01629%	101.629%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2041	15		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2042	16		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2043	17		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2044	18		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2045	19		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2046	20		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2047	21		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2048	22		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2049	23		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2050	24		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2051	25		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2052	26		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2053	27		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2054	28		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2055	29		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2056	30		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2057	31		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2058	32		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2059	33		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2060	34		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2061	35		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2062	36		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2063	37		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2064	38		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2065	39		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2066	40		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2067	41		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2068	42		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2069	43		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2070	44		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2071	45		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2072	46		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2073	47		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2074	48		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2075	49		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
2076	50		100.000%	185.6	92.8	6.2	9.3	77.3	9.3	111.4	92.8	30.9	46.4	-1.5	-37.1	18.6	3.1	3.1	1.5	650	285	249	3	86.6	7.7
Subtotal	2013-2076			10898	5449	363	545	4541	545	6539	5449	1816	2724	-91	-2180	1090	182	182	91	38141	16710	14621	182	5086	454
Subtotal	2027-2076			9028	4514	301	451	3761	451	5417	4514	1505	2257	-75	-1806	903	150	150	75	31596	13842	12112	150	4213	376

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.
Vessel Activity Growth reflects the long term crude oil domestic off shore production projections growth rate from the 2014 Annual Energy Outlook using the period 2014 up to 2040.
Vessel Activity Growth after 2040 reflects no change of the long term crude oil domestic off-shore production from the 2014 Annual Energy Outlook forecast for the period 2014-2040.

Source: G.E.C., Inc.

were adjusted using the 2014 indices of offshore domestic oil production, except for the category "new vessel movements" which was not in existence until year 2012.

The total projected vessel movements between 2013 and 2076 time frame and for with-project conditions, 2027-2076 timeframe, indicate the degree to which the with-project conditions time period overlaps with the elapsed time from 2013 to 2076. For example, for the category "rerouting tugs light tug" there is a total of 10,898 movements projected for the period 2013 through 2076 and 9,028 movements projected for the period 2027-2076. Total trips (all benefitting vessels) is 38,141 (2013-2076) and 31,596 (2027-2076).

Table 14 (revised) provides a 50-year time frame for NED benefits for the five categories and the associated vessels. The total current value of NED benefits for the period 2027-2076 is $2.159 billion. The largest benefitting category is "New vessel trips" with a total current value of $843.5 million followed by the category "Increased vessel trips tug/barge," $585.4 million.

Table 15 (revised) provides a 50-year time frame for the present value of NED benefits for the five categories and the associated vessels. The total present value of NED benefits is $1,063.7 billion. The largest benefitting category is "New vessel trips" with a present value of $415.4 million followed by the category "Increased vessel trips tug/barge" with a present value of $288.3 million.

Sensitivity Analysis

Domestic offshore crude oil production forecasts (refer to Table 12A) suggest a relatively sustained growth forecast (2013-2040). A sensitivity analysis was conducted by adopting a flat (constant) forecast of domestic offshore crude oil production fixed at 2013 levels to assess the sensitivity of the benefits to changes as a result of a "no growth" forecast.

Table 16 contains the annual numbers of vessel trips for the benefitting fleets for a "no growth" forecast. Total trips (all benefitting vessels) is 26,460 (2013-2076) and 21,000 (2027-2076) using a "no growth" forecast. The total trips for all benefitting vessels (2013-2076) under the "no growth" forecast are substantially less than the "growth" forecast (refer to Table 13), 38,141 compared to 26,417, respectively. The total trips for all benefitting vessels for with-project conditions (2027-2076) under the "no growth" forecast are also substantially less than the "growth" forecast (refer to Table 13), 31,596 compared to 21,000, respectively. The substantial difference between total vessel trips under "growth" (Table 13) and total vessel trips under "no growth" (Table 16) will be similarly reflected in the benefits corresponding to these two forecasts.

Table 17 contains the NED benefits for the benefitting fleets for a "no growth" forecast. Total current benefits (all benefitting vessels) are $1.435 billion for the period 2027-2076 using a "no growth" forecast. The total current benefits for all benefitting vessels (2027-2076) under the "no growth" forecast are substantially less than the "growth" forecast (refer to Table 13), $2.159 billion compared to $1.438 billion, respectively. The total current benefits for with-project conditions (2027-2076) under the "no growth" forecast for the "New vessel trips" are $560.6 million compared to $843.5 million for the "growth" forecast (refer to Table 13). The substantial

Table 14. NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category: 2014 - 2076

Year	Project Year	Activity Vessel Category Growth	Annual Growth	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trips
2013		0.00%	0.000%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2014		0.01629%	101.629%	$2,213,480	$3,000,088	$112,808	$91,466	$907,039	$97,564	$3,697,645	$975,638	$3,277,535	$1,110,063	$101,629	$975,638	$1,219,548	$4,558,061	$4,558,061	$2,279,030	$29,175,294	$3,301,926	$7,909,425	$5,564,188	$1,004,603	$11,395,152
2015		0.01629%	101.629%	$2,249,537	$3,048,960	$114,646	$92,956	$921,814	$99,153	$3,757,880	$991,532	$3,330,926	$1,128,146	$103,285	$991,532	$1,239,414	$4,632,311	$4,632,311	$2,316,156	$29,650,559	$3,355,715	$8,038,270	$5,654,828	$1,020,968	$11,580,779
2016		0.01629%	101.629%	$2,286,182	$3,098,627	$116,513	$94,470	$936,831	$100,768	$3,819,096	$1,007,684	$3,385,187	$1,146,524	$104,967	$1,007,684	$1,259,604	$4,707,772	$4,707,772	$2,353,886	$30,133,567	$3,410,379	$8,169,213	$5,746,946	$1,037,599	$11,769,430
2017		0.01629%	101.629%	$2,323,424	$3,149,104	$118,411	$96,009	$952,092	$102,410	$3,881,309	$1,024,099	$3,440,332	$1,165,200	$106,677	$1,024,099	$1,280,123	$4,784,461	$4,784,461	$2,392,231	$30,624,442	$3,465,934	$8,302,290	$5,840,563	$1,054,502	$11,961,154
2018		0.01629%	101.629%	$2,361,273	$3,200,403	$120,340	$97,573	$967,601	$104,078	$3,944,535	$1,040,781	$3,496,375	$1,184,181	$108,415	$1,040,781	$1,300,977	$4,862,400	$4,862,400	$2,431,200	$31,123,315	$3,522,394	$8,437,534	$5,935,706	$1,071,680	$12,156,001
2019		0.01629%	101.629%	$2,399,738	$3,252,537	$122,301	$99,163	$983,364	$105,774	$4,008,792	$1,057,736	$3,553,331	$1,203,472	$110,181	$1,057,736	$1,322,170	$4,941,609	$4,941,609	$2,470,804	$31,630,313	$3,579,774	$8,574,981	$6,032,399	$1,089,137	$12,354,022
2020		0.01629%	101.629%	$2,438,830	$3,305,521	$124,293	$100,778	$999,383	$107,497	$4,074,095	$1,074,966	$3,611,214	$1,223,076	$111,976	$1,074,966	$1,343,708	$5,022,108	$5,022,108	$2,511,054	$32,145,571	$3,638,089	$8,714,668	$6,130,666	$1,106,879	$12,555,269
2021		0.01629%	101.629%	$2,478,558	$3,359,368	$126,318	$102,420	$1,015,663	$109,248	$4,140,462	$1,092,477	$3,670,041	$1,243,000	$113,800	$1,092,477	$1,365,597	$5,103,918	$5,103,918	$2,551,959	$32,669,223	$3,697,353	$8,856,630	$6,230,535	$1,124,910	$12,759,794
2022		0.01629%	101.629%	$2,518,934	$3,414,092	$128,375	$104,088	$1,032,208	$111,027	$4,207,910	$1,110,274	$3,729,826	$1,263,249	$115,654	$1,110,274	$1,387,842	$5,187,061	$5,187,061	$2,593,530	$33,201,404	$3,757,583	$9,000,904	$6,332,030	$1,143,235	$12,967,651
2023		0.01629%	101.629%	$2,559,967	$3,469,708	$130,467	$105,784	$1,049,022	$112,836	$4,276,457	$1,128,360	$3,790,585	$1,283,827	$117,538	$1,128,360	$1,410,450	$5,271,558	$5,271,558	$2,635,779	$33,742,255	$3,818,794	$9,147,529	$6,435,179	$1,161,858	$13,178,894
2024		0.01629%	101.629%	$2,601,669	$3,526,229	$132,592	$107,507	$1,066,111	$114,674	$4,346,120	$1,146,741	$3,852,334	$1,304,741	$119,452	$1,146,741	$1,433,426	$5,357,431	$5,357,431	$2,678,716	$34,291,916	$3,881,002	$9,296,542	$6,540,008	$1,180,785	$13,393,579
2025		0.01629%	101.629%	$2,644,050	$3,583,671	$134,752	$109,258	$1,083,478	$116,542	$4,416,919	$1,165,422	$3,915,088	$1,325,995	$121,398	$1,165,422	$1,456,777	$5,444,704	$5,444,704	$2,722,352	$34,850,532	$3,944,224	$9,447,983	$6,646,545	$1,200,020	$13,611,760
2026		0.01629%	101.629%	$2,687,122	$3,642,049	$136,947	$111,038	$1,101,128	$118,441	$4,488,870	$1,184,406	$3,978,865	$1,347,595	$123,376	$1,184,406	$1,480,508	$5,533,398	$5,533,398	$2,766,699	$35,418,247	$4,008,475	$9,601,891	$6,754,817	$1,219,568	$13,833,496
2027	1	0.01629%	101.629%	$2,730,895	$3,701,378	$139,178	$112,847	$1,119,065	$120,370	$4,561,994	$1,203,700	$4,043,681	$1,369,548	$125,385	$1,203,700	$1,504,625	$5,623,537	$5,623,537	$2,811,769	$35,995,210	$4,073,773	$9,758,305	$6,864,853	$1,239,435	$14,058,843
2028	2	0.01629%	101.629%	$2,775,381	$3,761,674	$141,445	$114,685	$1,137,295	$122,331	$4,636,309	$1,223,309	$4,109,552	$1,391,858	$127,428	$1,223,309	$1,529,136	$5,715,145	$5,715,145	$2,857,572	$36,581,572	$4,140,135	$9,917,268	$6,976,682	$1,259,626	$14,287,862
2029	3	0.01629%	101.629%	$2,820,592	$3,822,952	$143,749	$116,553	$1,155,821	$124,324	$4,711,834	$1,243,236	$4,176,497	$1,414,531	$129,504	$1,243,236	$1,554,045	$5,808,244	$5,808,244	$2,904,122	$37,177,486	$4,207,578	$10,078,821	$7,090,332	$1,280,145	$14,520,611
2030	4	0.01629%	101.629%	$2,866,540	$3,885,227	$146,091	$118,452	$1,174,650	$126,349	$4,788,590	$1,263,489	$4,244,532	$1,437,574	$131,613	$1,263,489	$1,579,361	$5,902,861	$5,902,861	$2,951,430	$37,783,107	$4,276,119	$10,243,005	$7,205,833	$1,300,998	$14,757,152
2031	5	0.01629%	101.629%	$2,913,236	$3,948,518	$148,471	$120,382	$1,193,785	$128,407	$4,866,596	$1,284,071	$4,313,675	$1,460,992	$133,757	$1,284,071	$1,605,089	$5,999,018	$5,999,018	$2,999,509	$38,398,594	$4,345,777	$10,409,863	$7,323,216	$1,322,192	$14,997,546
2032	6	0.01629%	101.629%	$2,960,692	$4,012,839	$150,889	$122,343	$1,213,231	$130,499	$4,945,873	$1,304,988	$4,383,945	$1,484,791	$135,936	$1,304,988	$1,631,235	$6,096,742	$6,096,742	$3,048,371	$39,024,107	$4,416,570	$10,579,440	$7,442,512	$1,343,730	$15,241,856
2033	7	0.01629%	101.629%	$3,008,922	$4,078,208	$153,347	$124,336	$1,232,995	$132,625	$5,026,441	$1,326,247	$4,455,360	$1,508,978	$138,151	$1,326,247	$1,657,808	$6,196,058	$6,196,058	$3,098,029	$39,659,810	$4,488,516	$10,751,779	$7,563,750	$1,365,620	$15,490,146
2034	8	0.01629%	101.629%	$3,057,937	$4,144,642	$155,845	$126,361	$1,253,080	$134,785	$5,108,322	$1,347,851	$4,527,937	$1,533,560	$140,401	$1,347,851	$1,684,814	$6,296,992	$6,296,992	$3,148,496	$40,305,868	$4,561,634	$10,926,925	$7,686,964	$1,387,865	$15,742,480
2035	9	0.01629%	101.629%	$3,107,751	$4,212,158	$158,384	$128,419	$1,273,493	$136,981	$5,191,537	$1,369,808	$4,601,698	$1,558,541	$142,688	$1,369,808	$1,712,260	$6,399,570	$6,399,570	$3,199,785	$40,962,451	$4,635,943	$11,104,925	$7,812,184	$1,410,474	$15,998,925
2036	10	0.01629%	101.629%	$3,158,376	$4,280,775	$160,964	$130,511	$1,294,238	$139,212	$5,276,107	$1,392,122	$4,676,659	$1,583,930	$145,013	$1,392,122	$1,740,152	$6,503,819	$6,503,819	$3,251,910	$41,629,729	$4,711,462	$11,285,824	$7,939,445	$1,433,450	$16,259,548
2037	11	0.01629%	101.629%	$3,209,826	$4,350,508	$163,586	$132,637	$1,315,321	$141,480	$5,362,055	$1,414,799	$4,752,842	$1,609,732	$147,375	$1,414,799	$1,768,499	$6,609,766	$6,609,766	$3,304,883	$42,307,877	$4,788,212	$11,469,670	$8,068,778	$1,456,801	$16,524,416
2038	12	0.01629%	101.629%	$3,262,114	$4,421,378	$166,251	$134,798	$1,336,748	$143,785	$5,449,402	$1,437,847	$4,830,266	$1,635,955	$149,776	$1,437,847	$1,797,308	$6,717,439	$6,717,439	$3,358,720	$42,997,073	$4,866,212	$11,656,511	$8,200,219	$1,480,533	$16,793,598
2039	13	0.01629%	101.629%	$3,315,254	$4,493,402	$168,959	$136,994	$1,358,524	$146,127	$5,538,173	$1,461,269	$4,908,951	$1,662,605	$152,216	$1,461,269	$1,826,586	$6,826,866	$6,826,866	$3,413,433	$43,697,495	$4,945,483	$11,846,396	$8,333,800	$1,504,650	$17,067,166
2040	14	0.01629%	101.629%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2041	15	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2042	16	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2043	17	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2044	18	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2045	19	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2046	20	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2047	21	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2048	22	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2049	23	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2050	24	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2051	25	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2052	26	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2053	27	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2054	28	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2055	29	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2056	30	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2057	31	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2058	32	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2059	33	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2060	34	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2061	35	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2062	36	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2063	37	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2064	38	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2065	39	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2066	40	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2067	41	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2068	42	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2069	43	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2070	44	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2071	45	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2072	46	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2073	47	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2074	48	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2075	49	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
2076	50	0.00000%	100.000%	$3,369,260	$4,566,600	$171,712	$139,226	$1,380,654	$148,507	$5,628,390	$1,485,073	$4,988,918	$1,689,688	$154,695	$1,485,073	$1,856,341	$6,938,076	$6,938,076	$3,469,038	$44,409,327	$5,026,044	$12,039,374	$8,469,558	$1,529,161	$17,345,190
	2027-2076			$163,850,126	$222,077,857	$8,350,489	$6,770,666	$67,142,442	$7,222,044	$273,713,667	$72,220,441	$242,615,545	$82,171,064	$7,522,963	$72,220,441	$90,275,552	$337,404,875	$337,404,875	$168,702,437	$2,159,665,485	$244,421,056	$585,485,551	$411,882,205	$74,364,486	$843,512,187
Subtotal	2013-2076			$195,612,890	$265,128,214	$9,969,252	$8,083,177	$80,158,174	$8,622,056	$326,773,757	$86,220,557	$289,647,185	$98,100,134	$8,981,308	$86,220,557	$107,775,697	$402,811,666	$402,811,666	$201,405,833	$2,578,322,123	$291,802,699	$698,983,412	$491,726,616	$88,780,230	$1,007,029,166

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.

Source: G.E.C., Inc.

Table 15. Present Values of NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2027-2076

Year	Project Year	Activity Vessel Category Growth	Annual Growth	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trips
2027	1	0.00016	1.63%	$2,648,141	$3,589,215	$134,960	$109,427	$1,085,154	$116,722	$4,423,752	$1,167,225	$3,921,145	$1,328,046	$121,586	$1,167,225	$1,459,031	$5,453,127	$5,453,127	$2,726,564	$34,904,446	$3,950,325	$9,462,599	$6,656,827	$1,201,877	$13,632,818
2028	2	0.00016	1.63%	$2,609,725	$3,537,148	$133,003	$107,840	$1,069,412	$115,029	$4,359,578	$1,150,292	$3,864,262	$1,308,781	$119,822	$1,150,292	$1,437,865	$5,374,020	$5,374,020	$2,687,010	$34,398,099	$3,893,019	$9,325,328	$6,560,259	$1,184,441	$13,435,051
2029	3	0.00016	1.63%	$2,571,867	$3,485,836	$131,073	$106,275	$1,053,898	$113,361	$4,296,335	$1,133,605	$3,808,205	$1,289,795	$118,084	$1,133,605	$1,417,006	$5,296,061	$5,296,061	$2,648,031	$33,899,097	$3,836,545	$9,190,049	$6,465,091	$1,167,259	$13,240,153
2030	4	0.00016	1.63%	$2,534,557	$3,435,268	$129,172	$104,734	$1,038,610	$111,716	$4,234,009	$1,117,160	$3,752,960	$1,271,084	$116,371	$1,117,160	$1,396,450	$5,219,233	$5,219,233	$2,609,617	$33,407,334	$3,780,889	$9,056,732	$6,371,305	$1,150,326	$13,048,083
2031	5	0.00016	1.63%	$2,497,789	$3,385,433	$127,298	$103,214	$1,023,543	$110,095	$4,172,588	$1,100,954	$3,698,517	$1,252,645	$114,683	$1,100,954	$1,376,192	$5,143,519	$5,143,519	$2,571,760	$32,922,705	$3,726,041	$8,925,349	$6,278,878	$1,133,639	$12,858,798
2032	6	0.00016	1.63%	$2,461,555	$3,336,322	$125,451	$101,717	$1,008,695	$108,498	$4,112,058	$1,084,983	$3,644,864	$1,234,473	$113,019	$1,084,983	$1,356,229	$5,068,904	$5,068,904	$2,534,452	$32,445,107	$3,671,989	$8,795,872	$6,187,793	$1,117,193	$12,672,260
2033	7	0.00016	1.63%	$2,425,846	$3,287,923	$123,631	$100,242	$994,062	$106,924	$4,052,405	$1,069,243	$3,591,989	$1,216,565	$111,380	$1,069,243	$1,336,554	$4,995,371	$4,995,371	$2,497,686	$31,974,436	$3,618,720	$8,668,273	$6,098,028	$1,100,986	$12,488,428
2034	8	0.00016	1.63%	$2,390,655	$3,240,226	$121,838	$98,787	$979,642	$105,373	$3,993,619	$1,053,732	$3,539,882	$1,198,917	$109,764	$1,053,732	$1,317,165	$4,922,905	$4,922,905	$2,461,452	$31,510,594	$3,566,225	$8,542,525	$6,009,566	$1,085,015	$12,307,262
2035	9	0.00016	1.63%	$2,355,974	$3,193,222	$120,070	$97,354	$965,430	$103,845	$3,935,684	$1,038,446	$3,488,530	$1,181,524	$108,171	$1,038,446	$1,298,058	$4,851,490	$4,851,490	$2,425,745	$31,053,480	$3,514,491	$8,418,602	$5,922,387	$1,069,275	$12,128,725
2036	10	0.00016	1.63%	$2,321,797	$3,146,899	$118,329	$95,942	$951,425	$102,338	$3,878,591	$1,023,382	$3,437,923	$1,164,384	$106,602	$1,023,382	$1,279,227	$4,781,111	$4,781,111	$2,390,556	$30,602,998	$3,463,507	$8,296,476	$5,836,473	$1,053,763	$11,952,778
2037	11	0.00016	1.63%	$2,288,116	$3,101,248	$116,612	$94,550	$937,623	$100,854	$3,822,325	$1,008,536	$3,388,050	$1,147,493	$105,056	$1,008,536	$1,260,670	$4,711,753	$4,711,753	$2,355,877	$30,159,050	$3,413,263	$8,176,122	$5,751,806	$1,038,477	$11,779,383
2038	12	0.00016	1.63%	$2,254,923	$3,056,259	$114,920	$93,179	$924,021	$99,391	$3,766,876	$993,905	$3,338,901	$1,130,847	$103,532	$993,905	$1,242,382	$4,643,401	$4,643,401	$2,321,701	$29,721,543	$3,363,748	$8,057,514	$5,668,366	$1,023,412	$11,608,503
2039	13	0.00016	1.63%	$2,222,211	$3,011,923	$113,253	$91,827	$910,617	$97,949	$3,712,231	$979,487	$3,290,464	$1,114,442	$102,030	$979,487	$1,224,359	$4,576,041	$4,576,041	$2,288,020	$29,290,382	$3,314,951	$7,940,626	$5,586,137	$1,008,566	$11,440,102
2040	14	0.00016	1.63%	$2,189,974	$2,968,230	$111,610	$90,495	$897,407	$96,528	$3,658,379	$965,278	$3,242,731	$1,098,275	$100,550	$965,278	$1,206,597	$4,509,658	$4,509,658	$2,254,829	$28,865,477	$3,266,863	$7,825,434	$5,505,101	$993,935	$11,274,145
2041	15	0.00016	1.63%	$2,123,611	$2,878,283	$108,228	$87,753	$870,213	$93,603	$3,547,519	$936,027	$3,144,466	$1,064,994	$97,503	$936,027	$1,170,034	$4,373,002	$4,373,002	$2,186,501	$27,990,765	$3,167,867	$7,588,300	$5,338,280	$963,815	$10,932,504
2042	16	0.00016	1.63%	$2,059,260	$2,791,063	$104,948	$85,093	$843,843	$90,766	$3,440,019	$907,663	$3,049,179	$1,032,722	$94,548	$907,663	$1,134,578	$4,240,486	$4,240,486	$2,120,243	$27,142,560	$3,071,871	$7,358,351	$5,176,513	$934,609	$10,601,216
2043	17	0.00000	0.00%	$1,996,858	$2,706,485	$101,768	$82,515	$818,272	$88,016	$3,335,776	$880,158	$2,956,780	$1,001,427	$91,683	$880,158	$1,100,197	$4,111,987	$4,111,987	$2,055,993	$26,320,058	$2,978,784	$7,135,371	$5,019,649	$906,287	$10,279,967
2044	18	0.00000	0.00%	$1,936,347	$2,624,470	$98,684	$80,014	$793,476	$85,349	$3,234,692	$853,486	$2,867,180	$971,081	$88,905	$853,486	$1,066,858	$3,987,381	$3,987,381	$1,993,691	$25,522,481	$2,888,518	$6,919,147	$4,867,539	$878,824	$9,968,453
2045	19	0.00000	0.00%	$1,877,670	$2,544,941	$95,694	$77,590	$769,431	$82,762	$3,136,671	$827,623	$2,780,296	$941,654	$86,211	$827,623	$1,034,529	$3,866,551	$3,866,551	$1,933,276	$24,749,072	$2,800,987	$6,709,476	$4,720,038	$852,193	$9,666,379
2046	20	0.00000	0.00%	$1,820,771	$2,467,821	$92,794	$75,238	$746,115	$80,254	$3,041,620	$802,544	$2,696,045	$913,119	$83,598	$802,544	$1,003,179	$3,749,383	$3,749,383	$1,874,692	$23,999,100	$2,716,108	$6,506,159	$4,577,006	$826,369	$9,373,458
2047	21	0.00000	0.00%	$1,765,596	$2,393,039	$89,982	$72,959	$723,505	$77,822	$2,949,450	$778,224	$2,614,346	$885,449	$81,065	$778,224	$972,780	$3,635,766	$3,635,766	$1,817,883	$23,271,855	$2,633,802	$6,309,002	$4,438,309	$801,328	$9,089,414
2048	22	0.00000	0.00%	$1,712,093	$2,320,523	$87,255	$70,748	$701,581	$75,464	$2,860,072	$754,642	$2,535,124	$858,617	$78,608	$754,642	$943,302	$3,525,591	$3,525,591	$1,762,795	$22,566,647	$2,553,990	$6,117,821	$4,303,815	$777,045	$8,813,977
2049	23	0.00000	0.00%	$1,660,211	$2,250,204	$84,611	$68,604	$680,321	$73,177	$2,773,404	$731,774	$2,458,302	$832,598	$76,226	$731,774	$914,717	$3,418,755	$3,418,755	$1,709,377	$21,882,809	$2,476,596	$5,932,432	$4,173,396	$753,498	$8,546,887
2050	24	0.00000	0.00%	$1,609,902	$2,182,016	$82,047	$66,525	$659,705	$70,960	$2,689,361	$709,599	$2,383,808	$807,368	$73,917	$709,599	$886,998	$3,315,156	$3,315,156	$1,657,578	$21,219,694	$2,401,548	$5,752,661	$4,046,930	$730,665	$8,287,890
2051	25	0.00000	0.00%	$1,561,117	$2,115,894	$79,561	$64,509	$639,714	$68,810	$2,607,865	$688,096	$2,311,571	$782,902	$71,677	$688,096	$860,120	$3,214,697	$3,214,697	$1,607,348	$20,576,673	$2,328,774	$5,578,338	$3,924,295	$708,523	$8,036,742
2052	26	0.00000	0.00%	$1,513,810	$2,051,776	$77,150	$62,554	$620,329	$66,724	$2,528,839	$667,244	$2,241,524	$759,178	$69,505	$667,244	$834,055	$3,117,282	$3,117,282	$1,558,641	$19,953,137	$2,258,205	$5,409,298	$3,805,377	$687,053	$7,793,204
2053	27	0.00000	0.00%	$1,467,937	$1,989,601	$74,812	$60,659	$601,531	$64,702	$2,452,208	$647,025	$2,173,599	$736,173	$67,398	$647,025	$808,781	$3,022,819	$3,022,819	$1,511,409	$19,348,497	$2,189,774	$5,245,380	$3,690,063	$666,233	$7,557,047
2054	28	0.00000	0.00%	$1,423,454	$1,929,310	$72,545	$58,820	$583,303	$62,742	$2,377,898	$627,418	$2,107,732	$713,864	$65,356	$627,418	$784,272	$2,931,218	$2,931,218	$1,465,609	$18,762,179	$2,123,418	$5,086,429	$3,578,243	$646,044	$7,328,045
2055	29	0.00000	0.00%	$1,380,319	$1,870,846	$70,347	$57,038	$565,627	$60,841	$2,305,841	$608,405	$2,043,861	$692,232	$63,376	$608,405	$760,507	$2,842,393	$2,842,393	$1,421,197	$18,193,628	$2,059,072	$4,932,295	$3,469,811	$626,467	$7,105,983
2056	30	0.00000	0.00%	$1,338,492	$1,814,154	$68,215	$55,310	$548,487	$58,997	$2,235,967	$589,969	$1,981,926	$671,255	$61,455	$589,969	$737,461	$2,756,260	$2,756,260	$1,378,130	$17,642,306	$1,996,675	$4,782,831	$3,364,665	$607,483	$6,890,650
2057	31	0.00000	0.00%	$1,297,931	$1,759,180	$66,148	$53,634	$531,866	$57,209	$2,168,210	$572,091	$1,921,868	$650,914	$59,593	$572,091	$715,114	$2,672,737	$2,672,737	$1,336,369	$17,107,691	$1,936,170	$4,637,897	$3,262,706	$589,075	$6,681,843
2058	32	0.00000	0.00%	$1,258,600	$1,705,871	$64,144	$52,008	$515,749	$55,475	$2,102,507	$554,755	$1,863,629	$631,190	$57,787	$554,755	$693,444	$2,591,745	$2,591,745	$1,295,873	$16,589,276	$1,877,498	$4,497,354	$3,163,836	$571,224	$6,479,363
2059	33	0.00000	0.00%	$1,220,461	$1,654,178	$62,200	$50,432	$500,120	$53,794	$2,038,795	$537,944	$1,807,156	$612,063	$56,036	$537,944	$672,430	$2,513,207	$2,513,207	$1,256,604	$16,086,570	$1,820,604	$4,361,071	$3,067,962	$553,914	$6,283,018
2060	34	0.00000	0.00%	$1,183,477	$1,604,051	$60,315	$48,904	$484,965	$52,164	$1,977,013	$521,643	$1,752,394	$593,515	$54,338	$521,643	$652,053	$2,437,050	$2,437,050	$1,218,525	$15,599,099	$1,765,435	$4,228,917	$2,974,994	$537,129	$6,092,624
2061	35	0.00000	0.00%	$1,147,614	$1,555,444	$58,487	$47,422	$470,269	$50,584	$1,917,103	$505,835	$1,699,291	$575,530	$52,691	$505,835	$632,294	$2,363,200	$2,363,200	$1,181,600	$15,126,399	$1,711,937	$4,100,768	$2,884,842	$520,852	$5,907,999
2062	36	0.00000	0.00%	$1,112,838	$1,508,309	$56,715	$45,985	$456,018	$49,051	$1,859,009	$490,507	$1,647,797	$558,090	$51,094	$490,507	$613,134	$2,291,587	$2,291,587	$1,145,794	$14,668,023	$1,660,060	$3,976,503	$2,797,423	$505,069	$5,728,969
2063	37	0.00000	0.00%	$1,079,115	$1,462,603	$54,996	$44,592	$442,200	$47,564	$1,802,676	$475,643	$1,597,864	$541,178	$49,546	$475,643	$594,554	$2,222,145	$2,222,145	$1,111,073	$14,223,537	$1,609,755	$3,856,003	$2,712,652	$489,764	$5,555,364
2064	38	0.00000	0.00%	$1,046,415	$1,418,281	$53,330	$43,240	$428,800	$46,123	$1,748,049	$461,230	$1,549,444	$524,779	$48,045	$461,230	$576,537	$2,154,808	$2,154,808	$1,077,404	$13,792,521	$1,560,974	$3,739,154	$2,630,451	$474,923	$5,387,019
2065	39	0.00000	0.00%	$1,014,705	$1,375,303	$51,714	$41,930	$415,806	$44,725	$1,695,078	$447,253	$1,502,491	$508,876	$46,589	$447,253	$559,066	$2,089,510	$2,089,510	$1,044,755	$13,374,566	$1,513,672	$3,625,846	$2,550,740	$460,531	$5,223,776
2066	40	0.00000	0.00%	$983,957	$1,333,627	$50,147	$40,659	$403,205	$43,370	$1,643,712	$433,700	$1,456,961	$493,456	$45,177	$433,700	$542,125	$2,026,192	$2,026,192	$1,013,096	$12,969,276	$1,467,803	$3,515,972	$2,473,445	$446,575	$5,065,480
2067	41	0.00000	0.00%	$954,140	$1,293,214	$48,627	$39,427	$390,987	$42,056	$1,593,903	$420,558	$1,412,810	$478,502	$43,808	$420,558	$525,697	$1,964,792	$1,964,792	$982,396	$12,576,268	$1,423,324	$3,409,428	$2,398,492	$433,043	$4,911,981
2068	42	0.00000	0.00%	$925,227	$1,254,026	$47,153	$38,233	$379,139	$40,781	$1,545,602	$407,813	$1,369,998	$464,002	$42,481	$407,813	$509,767	$1,905,253	$1,905,253	$952,627	$12,195,169	$1,380,193	$3,306,112	$2,325,811	$419,920	$4,763,133
2069	43	0.00000	0.00%	$897,189	$1,216,025	$45,725	$37,074	$367,650	$39,546	$1,498,766	$395,455	$1,328,483	$449,942	$41,193	$395,455	$494,319	$1,847,518	$1,847,518	$923,759	$11,825,618	$1,338,369	$3,205,926	$2,255,332	$407,195	$4,618,795
2070	44	0.00000	0.00%	$870,002	$1,179,176	$44,339	$35,950	$356,509	$38,347	$1,453,349	$383,472	$1,288,226	$436,307	$39,945	$383,472	$479,340	$1,791,533	$1,791,533	$895,766	$11,467,266	$1,297,813	$3,108,777	$2,186,988	$394,856	$4,478,832
2071	45	0.00000	0.00%	$843,638	$1,143,443	$42,995	$34,861	$345,706	$37,185	$1,409,308	$371,852	$1,249,189	$423,086	$38,735	$371,852	$464,814	$1,737,244	$1,737,244	$868,622	$11,119,773	$1,258,485	$3,014,572	$2,120,716	$382,891	$4,343,110
2072	46	0.00000	0.00%	$818,073	$1,108,794	$41,692	$33,805	$335,230	$36,058	$1,366,602	$360,583	$1,211,335	$410,265	$37,561	$360,583	$450,729	$1,684,600	$1,684,600	$842,300	$10,782,810	$1,220,349	$2,923,221	$2,056,452	$371,288	$4,211,500
2073	47	0.00000	0.00%	$793,283	$1,075,194	$40,429	$32,780	$325,071	$34,966	$1,325,190	$349,657	$1,174,627	$397,833	$36,423	$349,657	$437,071	$1,633,552	$1,633,552	$816,776	$10,456,058	$1,183,369	$2,834,639	$1,994,135	$360,037	$4,083,879
2074	48	0.00000	0.00%	$769,244	$1,042,612	$39,204	$31,787	$315,221	$33,906	$1,285,032	$339,061	$1,139,033	$385,777	$35,319	$339,061	$423,826	$1,584,050	$1,584,050	$792,025	$10,139,208	$1,147,509	$2,748,740	$1,933,707	$349,127	$3,960,125
2075	49	0.00000	0.00%	$745,934	$1,011,018	$38,016	$30,824	$305,669	$32,879	$1,246,092	$328,786	$1,104,517	$374,087	$34,249	$328,786	$410,983	$1,536,049	$1,536,049	$768,024	$9,831,959	$1,112,736	$2,665,445	$1,875,109	$338,547	$3,840,121
2076	50	0.00000	0.00%	$723,330	$980,381	$36,864	$29,890	$296,406	$31,882	$1,208,332	$318,823	$1,071,046	$362,751	$33,211	$318,823	$398,529	$1,489,502	$1,489,502	$744,751	$9,534,021	$1,079,017	$2,584,674	$1,818,288	$328,288	$3,723,754
Subtotal	2027-2076			$80,705,752	$109,386,308	$4,113,103	$3,334,948	$33,071,572	$3,557,278	$134,819,959	$35,572,783	$119,502,318	$40,474,046	$3,705,498	$35,572,783	$44,465,979	$166,191,596	$166,191,596	$83,095,798	$1,063,761,318	$120,391,638	$288,385,811	$202,876,029	$36,628,850	$415,478,990

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.

Source: G.E.C., Inc.

Table 16. No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category: 2014 - 2076

Year	Project Year	Activity Vessel Category Growth	Annual Growth	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total Trips (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Line
2013		0.00000%	100.000%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184.0	161.0	2.0	56.0	5.0
2014		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2015		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2016		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2017		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2018		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2019		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2020		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2021		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2022		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2023		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2024		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2025		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2026		0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2027	1	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2028	2	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2029	3	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2030	4	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2031	5	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2032	6	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2033	7	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2034	8	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2035	9	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2036	10	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2037	11	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2038	12	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2039	13	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2040	14	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2041	15	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2042	16	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2043	17	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2044	18	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2045	19	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2046	20	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2047	21	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2048	22	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2049	23	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2050	24	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2051	25	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2052	26	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2053	27	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2054	28	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2055	29	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2056	30	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2057	31	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2058	32	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2059	33	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2060	34	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2061	35	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2062	36	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2063	37	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2064	38	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2065	39	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2066	40	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2067	41	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2068	42	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2069	43	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2070	44	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2071	45	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2072	46	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2073	47	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2074	48	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2075	49	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
2076	50	0.00000%	100.00%	120.0	60.0	4.0	6.0	50.0	6.0	72.0	60.0	20.0	30.0	-1.0	-24.0	12.0	2.0	2.0	1.0	420.0	184	161	2	56.0	5.0
Subtotal	2027-2076			6,000	3,000	200	300	2,500	300	3,600	3,000	1,000	1,500	-50	-1,200	600	100	100	50	21,000	9,200	8,050	100	2,800	250
Subtotal	2014-2076			7,560	3,780	252	378	3,150	378	4,536	3,780	1,260	1,890	-63	-1,512	756	126	126	63	26,460	11,592	10,143	126	3,528	315

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.

Source: G.E.C., Inc.

Table 17. NED Benefits Corresponding to the No Growth in Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category: 2014 - 2076

Year	Project Year	Activity Vessel Category Growth	Table 19(()) Growth	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trips
2013		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2014		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2015		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2016		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2017		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2018		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2019		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2020		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2021		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2022		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2023		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2024		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2025		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2026		0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2027	1	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2028	2	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2029	3	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2030	4	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2031	5	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2032	6	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2033	7	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2034	8	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2035	9	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2036	10	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2037	11	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2038	12	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2039	13	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2040	14	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2041	15	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2042	16	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2043	17	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2044	18	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2045	19	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2046	20	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2047	21	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2048	22	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2049	23	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2050	24	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2051	25	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2052	26	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2053	27	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2054	28	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2055	29	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2056	30	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2057	31	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2058	32	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2059	33	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2060	34	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2061	35	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2062	36	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2063	37	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2064	38	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2065	39	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2066	40	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2067	41	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2068	42	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2069	43	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2070	44	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2071	45	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2072	46	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2073	47	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2074	48	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2075	49	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
2076	50	0.00%	100.00%	$2,178,000	$2,952,000	$111,000	$90,000	$892,500	$96,000	$3,638,376	$960,000	$3,225,000	$1,092,270	$100,000	$960,000	$1,200,000	$4,485,000	$4,485,000	$2,242,500	$28,707,646	$3,249,000	$7,782,646	$5,475,000	$988,500	$11,212,500
Subtc	2027-2076			$108,900,000	$147,600,000	$5,550,000	$4,500,000	$44,625,000	$4,800,000	$181,918,800	$48,000,000	$161,250,000	$54,613,500	$5,000,000	$48,000,000	$60,000,000	$224,250,000	$224,250,000	$112,125,000	$1,435,382,300	$162,450,000	$389,132,300	$273,750,000	$49,425,000	$560,625,000

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.

Source: G.E.C., Inc.

difference between total current benefits under "growth" (Table 13) and total current benefits under "no growth" will be similarly reflected in the present value of these benefits.

Table 18 contains the present value of NED benefits for the benefitting fleets for a "no growth" forecast. Total present value of NED benefits (all benefitting vessels) is $721.4 million for the period 2027-2076 using a "no growth" forecast. The total present value of NED benefits for all benefitting vessels (2027-2076) under the "no growth" forecast is substantially less than the "growth" forecast (refer to Table 13), $1.063 billion compared to $721.4 million, respectively. The total present value of NED benefits for with-project conditions (2027-2076) under the "no growth" forecast for the "New vessel trips" is $281.7 million compared to $415.4 million for the "growth" forecast (refer to Table 13), respectively. The substantial difference between total present values of NED benefits under "growth" (Table 13) and total present value of NED benefits under "no growth" (Table 18) indicates that the "growth" or "no growth" forecasts have a distinguishable effect on the present value of these benefits.

FABRICATION BENEFITS

In May 2005, Public Law 109-13, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005 was enacted, which states the following:

> *OFFSHORE OIL AND GAS FABRICATION PORTS SEC. 6009. In determining the economic justification for navigation projects involving offshore oil & gas fabrication ports, the Secretary of the Army, acting through the Chief of Engineers, is directed to measure and include in the National Economic Development calculation the value of future energy exploration and production fabrication contracts and transportation cost savings that would result from larger navigation channels.*

The scope of work specifies that

> *Under the legislation the full monetary value of any contract awarded to Houma Navigation Canal fabricators, for the deepwater fabrication of offshore exploration and production equipment is included in the calculation of benefits. Furthermore, any benefit using Deepwater Fabrication contracts is to be counted as a benefit for project justification regardless if work was displaced from foreign or domestic yards. Note: Contracts which would be awarded under existing conditions should not be included in the benefits estimate.*

Other than the scope of work, there is little prescriptive guidance for "fabrication benefits." Two studies of these benefits at the Port of Iberia and Morgan City (see Chapter II) have produced divergent prescriptive measures of "fabrication benefits." Moreover, as the deepwater offshore industry evolves in the context of recent trends in what would appear to be real increases in world oil prices, there is more known about the offshore deepwater sector and related fabrication than at the inception of a similar analysis for the Port of Iberia in 2005.

Table 18. Present Values of NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category for No Growth: 2027 - 2076 discount rate = 3.125%

Year	Project Year	Activity Vessel Category Growth	Annual Growth	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trip
2027	1	0.00%	0.00%	$2,112,000	$2,862,545	$107,636	$87,273	$865,455	$93,091	$3,528,122	$930,909	$3,127,273	$1,059,171	$96,970	$930,909	$1,163,636	$4,349,091	$4,349,091	$2,174,545	$27,837,717	$3,150,545	$7,546,808	$5,309,091	$958,545	$10,872,727
2028	2	0.00%	0.00%	$2,048,000	$2,775,802	$104,375	$84,628	$839,229	$90,270	$3,421,209	$902,700	$3,032,507	$1,027,075	$94,031	$902,700	$1,128,375	$4,217,300	$4,217,300	$2,108,650	$26,994,150	$3,055,074	$7,318,117	$5,148,209	$929,499	$10,543,251
2029	3	0.00%	0.00%	$1,985,939	$2,691,686	$101,212	$82,064	$813,797	$87,535	$3,317,536	$875,345	$2,940,613	$995,951	$91,182	$875,345	$1,094,181	$4,089,503	$4,089,503	$2,044,752	$26,176,146	$2,962,496	$7,096,356	$4,992,203	$901,332	$10,223,758
2030	4	0.00%	0.00%	$1,925,759	$2,610,120	$98,145	$79,577	$789,137	$84,882	$3,217,005	$848,820	$2,851,503	$965,771	$88,419	$848,820	$1,061,024	$3,965,579	$3,965,579	$1,982,789	$25,382,929	$2,872,724	$6,881,315	$4,840,924	$874,019	$9,913,947
2031	5	0.00%	0.00%	$1,867,403	$2,531,026	$95,171	$77,165	$765,224	$82,310	$3,119,520	$823,098	$2,765,094	$936,505	$85,739	$823,098	$1,028,872	$3,845,410	$3,845,410	$1,922,705	$24,613,749	$2,785,672	$6,672,790	$4,694,229	$847,533	$9,613,525
2032	6	0.00%	0.00%	$1,810,815	$2,454,328	$92,287	$74,827	$742,035	$79,816	$3,024,989	$798,155	$2,681,303	$908,126	$83,141	$798,155	$997,694	$3,728,882	$3,728,882	$1,864,441	$23,867,878	$2,701,257	$6,470,584	$4,551,980	$821,851	$9,322,206
2033	7	0.00%	0.00%	$1,755,942	$2,379,954	$89,490	$72,560	$719,549	$77,397	$2,933,323	$773,969	$2,600,052	$880,607	$80,622	$773,969	$967,461	$3,615,886	$3,615,886	$1,807,943	$23,144,609	$2,619,401	$6,274,506	$4,414,041	$796,946	$9,039,715
2034	8	0.00%	0.00%	$1,702,732	$2,307,834	$86,778	$70,361	$697,745	$75,052	$2,844,434	$750,515	$2,521,262	$853,922	$78,179	$750,515	$938,144	$3,506,314	$3,506,314	$1,753,157	$22,443,257	$2,540,025	$6,084,370	$4,280,282	$772,796	$8,765,784
2035	9	0.00%	0.00%	$1,651,134	$2,237,900	$84,149	$68,229	$676,601	$72,777	$2,758,239	$727,772	$2,444,860	$828,046	$75,810	$727,772	$909,715	$3,400,062	$3,400,062	$1,700,031	$21,763,159	$2,463,055	$5,899,995	$4,150,577	$749,378	$8,500,154
2036	10	0.00%	0.00%	$1,601,099	$2,170,085	$81,599	$66,161	$656,098	$70,572	$2,674,656	$705,719	$2,370,774	$802,953	$73,512	$705,719	$882,148	$3,297,029	$3,297,029	$1,648,515	$21,103,669	$2,388,417	$5,721,207	$4,024,802	$726,670	$8,242,574
2037	11	0.00%	0.00%	$1,552,581	$2,104,325	$79,126	$64,156	$636,216	$68,433	$2,593,606	$684,333	$2,298,932	$778,622	$71,285	$684,333	$855,417	$3,197,120	$3,197,120	$1,598,560	$20,464,164	$2,316,040	$5,547,837	$3,902,838	$704,649	$7,992,799
2038	12	0.00%	0.00%	$1,505,533	$2,040,557	$76,728	$62,212	$616,937	$66,360	$2,515,012	$663,596	$2,229,267	$755,027	$69,125	$663,596	$829,495	$3,100,237	$3,100,237	$1,550,119	$19,844,038	$2,245,857	$5,379,721	$3,784,570	$683,296	$7,750,593
2039	13	0.00%	0.00%	$1,459,911	$1,978,722	$74,403	$60,327	$598,242	$64,349	$2,438,799	$643,487	$2,161,714	$732,147	$67,030	$643,487	$804,359	$3,006,291	$3,006,291	$1,503,145	$19,242,703	$2,177,801	$5,216,699	$3,669,886	$662,590	$7,515,726
2040	14	0.00%	0.00%	$1,415,671	$1,918,761	$72,149	$58,499	$580,113	$62,399	$2,364,896	$623,987	$2,096,207	$709,961	$64,999	$623,987	$779,984	$2,915,191	$2,915,191	$1,457,595	$18,659,591	$2,111,807	$5,058,617	$3,558,678	$642,512	$7,287,977
2041	15	0.00%	0.00%	$1,372,772	$1,860,617	$69,962	$56,726	$562,534	$60,508	$2,293,233	$605,079	$2,032,686	$688,447	$63,029	$605,079	$756,348	$2,826,852	$2,826,852	$1,413,426	$18,094,149	$2,047,813	$4,905,326	$3,450,839	$623,042	$7,067,129
2042	16	0.00%	0.00%	$1,331,173	$1,804,234	$67,842	$55,007	$545,488	$58,674	$2,223,741	$586,743	$1,971,089	$667,585	$61,119	$586,743	$733,429	$2,741,190	$2,741,190	$1,370,595	$17,545,841	$1,985,758	$4,756,680	$3,346,268	$604,162	$6,852,974
2043	17	0.00%	0.00%	$1,290,834	$1,749,561	$65,786	$53,340	$528,958	$56,896	$2,156,355	$568,963	$1,911,359	$647,355	$59,267	$568,963	$711,204	$2,658,123	$2,658,123	$1,329,062	$17,014,149	$1,925,584	$4,612,538	$3,244,866	$585,854	$6,645,308
2044	18	0.00%	0.00%	$1,251,718	$1,696,544	$63,793	$51,724	$512,929	$55,172	$2,091,011	$551,722	$1,853,439	$627,738	$57,471	$551,722	$689,652	$2,577,574	$2,577,574	$1,288,787	$16,498,569	$1,867,233	$4,472,764	$3,146,537	$568,101	$6,443,935
2045	19	0.00%	0.00%	$1,213,787	$1,645,133	$61,860	$50,157	$497,385	$53,500	$2,027,647	$535,003	$1,797,275	$608,716	$55,729	$535,003	$668,753	$2,499,466	$2,499,466	$1,249,733	$15,998,612	$1,810,650	$4,337,226	$3,051,187	$550,886	$6,248,664
2046	20	0.00%	0.00%	$1,177,006	$1,595,281	$59,985	$48,637	$482,313	$51,879	$1,966,203	$518,790	$1,742,812	$590,270	$54,041	$518,790	$648,488	$2,423,724	$2,423,724	$1,211,862	$15,513,806	$1,755,782	$4,205,794	$2,958,727	$534,192	$6,059,311
2047	21	0.00%	0.00%	$1,141,339	$1,546,939	$58,167	$47,163	$467,697	$50,307	$1,906,621	$503,070	$1,689,999	$572,383	$52,403	$503,070	$628,837	$2,350,278	$2,350,278	$1,175,139	$15,043,690	$1,702,576	$4,078,346	$2,869,069	$518,004	$5,875,695
2048	22	0.00%	0.00%	$1,106,753	$1,500,062	$56,405	$45,734	$453,525	$48,783	$1,848,845	$487,825	$1,638,787	$555,038	$50,815	$487,825	$609,781	$2,279,058	$2,279,058	$1,139,529	$14,587,821	$1,650,983	$3,954,760	$2,782,127	$502,307	$5,697,644
2049	23	0.00%	0.00%	$1,073,215	$1,454,606	$54,696	$44,348	$439,782	$47,304	$1,792,819	$473,042	$1,589,127	$538,219	$49,275	$473,042	$591,303	$2,209,995	$2,209,995	$1,104,998	$14,145,766	$1,600,953	$3,834,919	$2,697,820	$487,086	$5,524,988
2050	24	0.00%	0.00%	$1,040,693	$1,410,527	$53,038	$43,004	$426,455	$45,871	$1,738,491	$458,708	$1,540,972	$521,909	$47,782	$458,708	$573,385	$2,143,026	$2,143,026	$1,071,513	$13,717,106	$1,552,439	$3,718,709	$2,616,068	$472,326	$5,357,564
2051	25	0.00%	0.00%	$1,009,157	$1,367,783	$51,431	$41,701	$413,532	$44,481	$1,685,810	$444,808	$1,494,276	$506,094	$46,334	$444,808	$556,009	$2,078,085	$2,078,085	$1,039,043	$13,301,436	$1,505,396	$3,606,021	$2,536,793	$458,013	$5,195,214
2052	26	0.00%	0.00%	$978,577	$1,326,335	$49,872	$40,437	$401,001	$43,133	$1,634,725	$431,329	$1,448,994	$490,758	$44,930	$431,329	$539,161	$2,015,113	$2,015,113	$1,007,557	$12,898,363	$1,459,778	$3,496,748	$2,459,921	$444,134	$5,037,783
2053	27	0.00%	0.00%	$948,923	$1,286,143	$48,361	$39,212	$388,849	$41,826	$1,585,187	$418,258	$1,405,086	$475,886	$43,569	$418,258	$522,823	$1,954,049	$1,954,049	$977,025	$12,507,503	$1,415,542	$3,390,785	$2,385,378	$430,675	$4,885,123
2054	28	0.00%	0.00%	$920,168	$1,247,169	$46,896	$38,023	$377,066	$40,558	$1,537,151	$405,584	$1,362,507	$461,465	$42,248	$405,584	$506,979	$1,894,836	$1,894,836	$947,418	$12,128,488	$1,372,647	$3,288,034	$2,313,094	$417,624	$4,737,089
2055	29	0.00%	0.00%	$892,284	$1,209,376	$45,475	$36,871	$365,640	$39,329	$1,490,571	$393,293	$1,321,219	$447,482	$40,968	$393,293	$491,616	$1,837,416	$1,837,416	$918,708	$11,760,958	$1,331,051	$3,188,397	$2,243,000	$404,969	$4,593,541
2056	30	0.00%	0.00%	$865,245	$1,172,729	$44,097	$35,754	$354,560	$38,138	$1,445,402	$381,375	$1,281,182	$433,921	$39,727	$381,375	$476,719	$1,781,737	$1,781,737	$890,869	$11,404,565	$1,290,717	$3,091,779	$2,175,030	$392,697	$4,454,343
2057	31	0.00%	0.00%	$839,025	$1,137,191	$42,760	$34,670	$343,815	$36,982	$1,401,602	$369,818	$1,242,358	$420,772	$38,523	$369,818	$462,273	$1,727,745	$1,727,745	$863,872	$11,058,972	$1,251,604	$2,998,089	$2,109,120	$380,797	$4,319,362
2058	32	0.00%	0.00%	$813,600	$1,102,731	$41,464	$33,620	$333,397	$35,861	$1,359,129	$358,612	$1,204,711	$408,022	$37,355	$358,612	$448,265	$1,675,389	$1,675,389	$837,695	$10,723,852	$1,213,676	$2,907,237	$2,045,207	$369,258	$4,188,473
2059	33	0.00%	0.00%	$788,946	$1,069,315	$40,208	$32,601	$323,294	$34,774	$1,317,944	$347,745	$1,168,205	$395,657	$36,223	$347,745	$434,681	$1,624,620	$1,624,620	$812,310	$10,398,887	$1,176,898	$2,819,139	$1,983,231	$358,068	$4,061,549
2060	34	0.00%	0.00%	$765,038	$1,036,911	$38,990	$31,613	$313,497	$33,721	$1,278,006	$337,207	$1,132,805	$383,668	$35,126	$337,207	$421,509	$1,575,389	$1,575,389	$787,694	$10,083,769	$1,141,235	$2,733,711	$1,923,133	$347,218	$3,938,472
2061	35	0.00%	0.00%	$741,855	$1,005,490	$37,808	$30,655	$303,997	$32,699	$1,239,279	$326,989	$1,098,477	$372,041	$34,061	$326,989	$408,736	$1,527,650	$1,527,650	$763,825	$9,778,200	$1,106,652	$2,650,871	$1,864,857	$336,696	$3,819,124
2062	36	0.00%	0.00%	$719,375	$975,020	$36,662	$29,726	$294,785	$31,708	$1,201,725	$317,080	$1,065,190	$360,767	$33,029	$317,080	$396,350	$1,481,357	$1,481,357	$740,679	$9,481,891	$1,073,117	$2,570,542	$1,808,346	$326,493	$3,703,393
2063	37	0.00%	0.00%	$697,576	$945,474	$35,551	$28,825	$285,852	$30,747	$1,165,309	$307,471	$1,032,912	$349,835	$32,028	$307,471	$384,339	$1,436,468	$1,436,468	$718,234	$9,194,561	$1,040,598	$2,492,647	$1,753,548	$316,599	$3,591,169
2064	38	0.00%	0.00%	$676,437	$916,824	$34,474	$27,952	$277,190	$29,815	$1,129,996	$298,154	$1,001,611	$339,234	$31,058	$298,154	$372,693	$1,392,938	$1,392,938	$696,469	$8,915,938	$1,009,065	$2,417,112	$1,700,410	$307,005	$3,482,346
2065	39	0.00%	0.00%	$655,939	$889,041	$33,429	$27,105	$268,790	$28,912	$1,095,754	$289,119	$971,259	$328,954	$30,117	$289,119	$361,399	$1,350,728	$1,350,728	$675,364	$8,645,758	$978,487	$2,343,866	$1,648,882	$297,702	$3,376,820
2066	40	0.00%	0.00%	$636,062	$862,100	$32,416	$26,284	$260,645	$28,036	$1,062,549	$280,358	$941,827	$318,986	$29,204	$280,358	$350,447	$1,309,797	$1,309,797	$654,898	$8,383,765	$948,836	$2,272,840	$1,598,916	$288,681	$3,274,492
2067	41	0.00%	0.00%	$616,787	$835,976	$31,434	$25,487	$252,747	$27,186	$1,030,351	$271,862	$913,287	$309,320	$28,319	$271,862	$339,828	$1,270,106	$1,270,106	$635,053	$8,129,712	$920,084	$2,203,966	$1,550,464	$279,933	$3,175,265
2068	42	0.00%	0.00%	$598,097	$810,644	$30,482	$24,715	$245,088	$26,362	$999,128	$263,624	$885,612	$299,946	$27,461	$263,624	$329,530	$1,231,618	$1,231,618	$615,809	$7,883,357	$892,202	$2,137,179	$1,503,480	$271,450	$3,079,045
2069	43	0.00%	0.00%	$579,973	$786,079	$29,558	$23,966	$237,661	$25,564	$968,852	$255,635	$858,775	$290,857	$26,629	$255,635	$319,544	$1,194,296	$1,194,296	$597,148	$7,644,467	$865,166	$2,072,416	$1,457,920	$263,225	$2,985,741
2070	44	0.00%	0.00%	$562,398	$762,258	$28,662	$23,240	$230,459	$24,789	$939,492	$247,889	$832,751	$282,043	$25,822	$247,889	$309,861	$1,158,106	$1,158,106	$579,053	$7,412,817	$838,949	$2,009,615	$1,413,741	$255,248	$2,895,264
2071	45	0.00%	0.00%	$545,355	$739,159	$27,794	$22,535	$223,476	$24,038	$911,023	$240,377	$807,517	$273,496	$25,039	$240,377	$300,471	$1,123,011	$1,123,011	$561,506	$7,188,186	$813,526	$1,948,718	$1,370,900	$247,513	$2,807,529
2072	46	0.00%	0.00%	$528,829	$716,761	$26,951	$21,852	$216,704	$23,309	$883,416	$233,093	$783,046	$265,209	$24,281	$233,093	$291,366	$1,088,981	$1,088,981	$544,490	$6,970,362	$788,874	$1,889,666	$1,329,358	$240,013	$2,722,452
2073	47	0.00%	0.00%	$512,804	$695,041	$26,135	$21,190	$210,137	$22,603	$856,646	$226,029	$759,318	$257,172	$23,545	$226,029	$282,537	$1,055,981	$1,055,981	$527,991	$6,759,139	$764,968	$1,832,403	$1,289,074	$232,740	$2,639,953
2074	48	0.00%	0.00%	$497,265	$673,979	$25,343	$20,548	$203,769	$21,918	$830,687	$219,180	$736,308	$249,379	$22,831	$219,180	$273,975	$1,023,982	$1,023,982	$511,991	$6,554,317	$741,788	$1,776,876	$1,250,011	$225,687	$2,559,955
2075	49	0.00%	0.00%	$482,196	$653,555	$24,575	$19,925	$197,594	$21,254	$805,515	$212,538	$713,996	$241,822	$22,139	$212,538	$265,673	$992,952	$992,952	$496,476	$6,355,701	$719,309	$1,723,031	$1,212,132	$218,848	$2,482,380
2076	50	0.00%	0.00%	$467,584	$633,750	$23,830	$19,322	$191,606	$20,610	$781,105	$206,098	$692,359	$234,494	$21,469	$206,098	$257,622	$962,863	$962,863	$481,431	$6,163,104	$697,512	$1,670,818	$1,175,401	$212,216	$2,407,157
Subtc	2027-2076			$54,733,307	$74,183,986	$2,789,438	$2,261,707	$22,428,593	$2,412,487	$91,432,667	$24,124,873	$81,044,497	$27,448,829	$2,513,008	$24,124,873	$30,156,092	$112,708,393	$112,708,393	$56,354,197	$721,425,340	$81,647,619	$195,578,489	$137,587,169	$24,841,081	$281,770,983

Notes: Activity refers to the use of the HNC with regard to existing vessel trips characterized as rerouted, tug assisted, diverted, or deeper loading.
Vessel refers to the navigation affected such as tugs, barges, tug trials, OSV trials, tug barge, jackups, etc.
Category refers to the WCS vessel category such as light tug, tug/barge, dry cargo, etc.

Source: G.E.C., Inc.

Fabrication benefits, defined as additional gross revenues earned by fabricators of deepwater oil& gas production platforms produced in response to with-project conditions, were estimated using the framework and market data presented in the Port of Iberia analysis. The major assumptions that underlie the estimates of fabrication benefits are as follows: (1) The largest topsides under with-project conditions will be semisubmersibles with an average fabrication weight of 10,000 tons and a total shipping weight of 13,500 tons;[46] (2) The next largest topsides under with-project conditions will be for FPSOs, which will have an average fabrication weight of 8,000 tons and a total shipment weight of nearly 11,000 tons; (3) SPAR topsides will not be constrained by without-project conditions, but the production of SPAR hulls using the proprietary MinDOC design developed by Gulf Island cannot be performed at Houma in without-project conditions because of the estimated size of the hulls, about 12,000 tons; (4) Average market fabrication contract value paid to the fabricator is estimated to be $8,000 per ton for topsides and hulls, exclusive of purchased components and equipment provided by other contractors; (5) Infield GOM deepwater platform installation projections were used for the period 2012-2059 and extrapolated to 2079; (6) MMS 2006 GOM deepwater platform installation projections for the period 2007–2046 were compared with Infield projections for sensitivity testing, including more recent BOEM projections to 2051.

Deepwater Oil/Gas GOM Sea Level Platforms Update

The estimated number of deepwater sea level oil/gas production platforms (topsides) that are forecasted to be fabricated at Houma (Gulf Island Fabrication) and use the Houma Navigation Canal (HNC) was previously developed based on very long term projections of GOM deepwater oil/gas sea level production platforms by Infield Systems developed in 2005. References to the 2005 data are used as a benchmark for the revisions using more current information developed in 2009.

Table 19 contains the projected number of topsides to be installed deepwater (>500 meters) in the GOM from Infield projections in 2005 and 2009. The Infield 2005 GOM deepwater oil/gas sea level production platform (topsides) projections were 60 units for the period 2015 to 2079, 52 units for the period 2020-2079, 41 units for the period 2025-2079 and 31 units for the period 2030-2079. The more recent 2009 projections for the GOM deepwater topsides installations are distinctly lower, 34 units for the period 2015-2079, 24 units for the period 2020-2079, 17 units for the period 2025-2079, and 13 units for the period 2030-2079.

Figure 3 indicates the Infield GOM 2005 and 2009 topsides projections extrapolated to 2079. It is evident that the 2009 projections are generally distinctly lower than the 2005 projections for the same time periods between 2015 and 2079.

Figure 4 contains the Infield 2005 and 2009 GOM deepwater topsides projections for the period 2025 to 2079 (extrapolated) which is essentially congruent with the period of with project conditions, 2027-2076. The effects of the later start time for with project conditions (2027) are a sharp reduction in the total projected numbers of platforms for both forecasts, particularly the

[46] Shipment or load out weight is the total weight on the barge exclusive of ballast, consisting of the fabricated topsides (fabrication weight), weight of accessory pieces, and weight of grillage and anchoring fasteners to secure the equipment.

Table 19. Infield GOM Projections Deepwater Topside Installations, 2005 and 2009

Years	2005	2009	Change
2015-2019	8	10	-2
2020-2024	11	7	4
2025-2029	10	4	6
2030-2034	3	3	0
2035-2039	4	2	2
2040-2044	3	0	3
2045-2049	7	2	5
2050-2054	3	1	2
2055-2059	3	1	2
2060-2064	2	1	1
2065-2069	2	1	1
2070-2074	2	1	1
2075-2079	2	1	1
Subtotals			
2015-2079	60	34	26
2020-2079	52	24	28
2025-2079	41	17	24
2030-2079	31	13	18

Notes: 2005 platforms extrapolated from 2050-2079 (six periods) 2009 platforms extrapolated from 2060-2079 (four periods)

Source: Infield Systems and G.E.C., Inc.

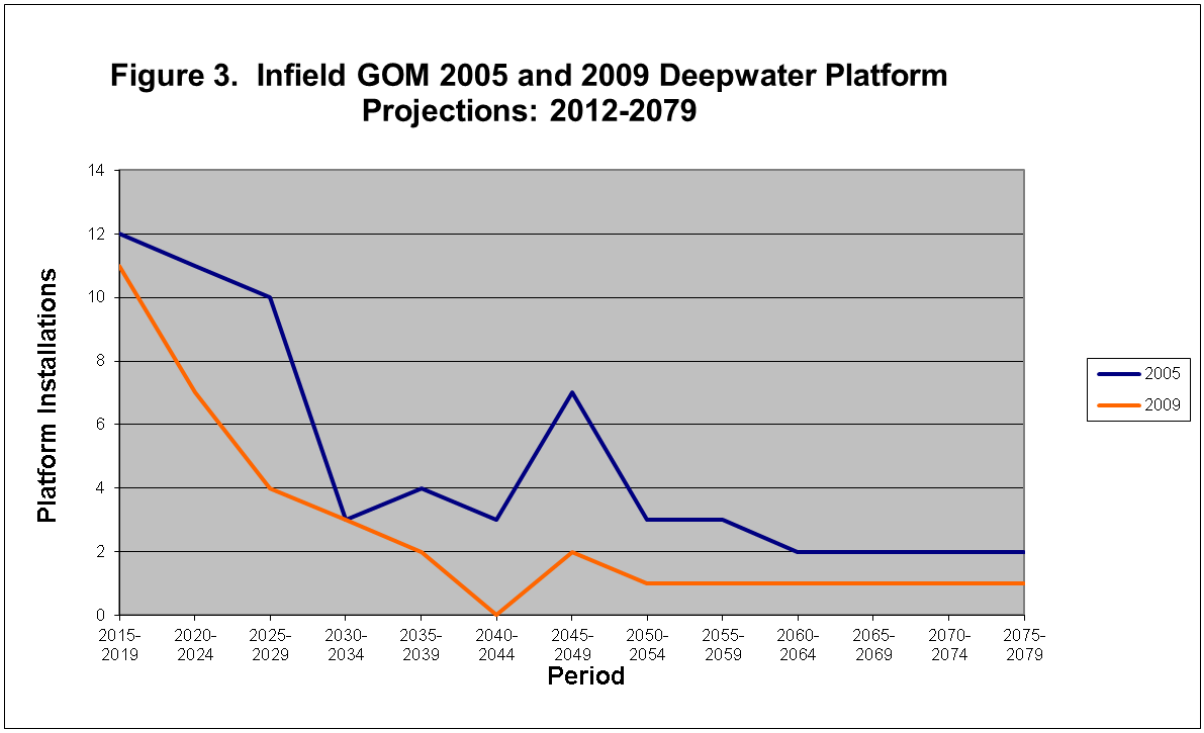
Figure 3. Infield GOM 2005 and 2009 Deepwater Platform Projections: 2012-2079
Platform Installations
14
12
10
8
6
4
2
0
2015-2019
2020-2024
2025-2029
2030-2034
2035-2039
2040-2044
2045-2049
2050-2054
2055-2059
2060-2064
2065-2069
2070-2074
2075-2079
Period
2005
2009

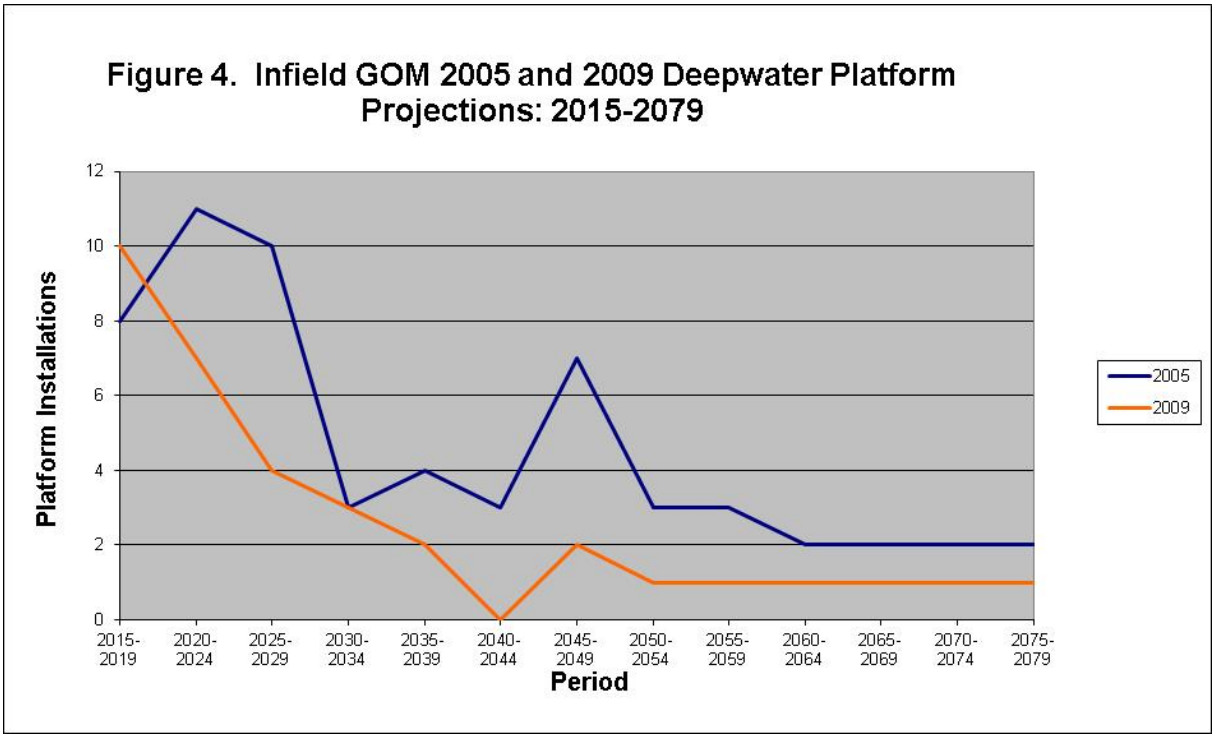
Figure 4. Infield GOM 2005 and 2009 Deepwater Platform Projections: 2015-2079
Platform Installations
12
10
8
6
4
2
0
2015-2019
2020-2024
2025-2029
2030-2034
2035-2039
2040-2044
2045-2049
2050-2054
2055-2059
2060-2064
2065-2069
2070-2074
2075-2079
Period
2005
2009

2009 projections, which is nearly reduced by 50 percent from 34 installations (2015-2079) to 17 installations (2025-2079). The reduction in topsides is more drastic using the time frame of 2030-2079 as the total installations decline to 13 compared to 34 for the entire period, 2015-2079.

Table 20 contains the expected HNC market shares of projected GOM deepwater topsides for the two Infield forecasts from 2005 and 2009. A 50 percent market share assumes that the two current leading domestic contenders for GOM topsides, Gulf Island Fabrication (GIF) and Kiewit Offshore Services (KOS), constitute the "big two" of domestic deepwater topsides fabricators. The 33 percent market share assumes that McDermott (or alternatively another domestic or foreign competitor) successfully re-enters (enters) the domestic deepwater fabrication sector for topsides. McDermott has not been an active competitor for domestic GOM deepwater topsides. The 25 percent market share assumes that there is other domestic or foreign competition for GOM topsides in addition to re-entry by McDermott (or alternatively another domestic or foreign competitor).

Table 20. HNC Market Shares of Projected GOM Deepwater Topsides, 2005 and 2009

Years	2009 Total	2005 Total	2009 at 50%	2005 at 50%	2009 at 33%	2005 at 33%	2009 at 25%	2005 at 25%
2015-2019	11	12	5.5	6	3.63	3.96	2.75	3
2020-2024	7	11	3.5	5.5	2.31	3.63	1.75	2.75
2025-2029	4	10	2	5	1.32	3.3	1	2.5
2030-2034	3	3	1.5	1.5	0.99	0.99	0.75	0.75
2035-2039	2	4	1	2	0.66	1.32	0.5	1
2040-2044	0	3	0	1.5	0	0.99	0	0.75
2045-2049	2	7	1	3.5	0.66	2.31	0.5	1.75
2050-2054	1	3	0.5	1.5	0.33	0.99	0.25	0.75
2055-2059	1	3	0.5	1.5	0.33	0.99	0.25	0.75
2060-2064	1	2	0.5	1	0.33	0.66	0.25	0.5
2065-2069	1	2	0.5	1	0.33	0.66	0.25	0.5
2070-2074	1	2	0.5	1	0.33	0.66	0.25	0.5
2075-2079	1	2	0.5	1	0.33	0.66	0.25	0.5
Subtotals								
2015-2079	35	64	17.5	32	11.55	21.12	8.75	16
2020-2079	24	52	12	26	7.92	17.16	6	13
2025-2079	17	41	8.5	20.5	5.61	13.53	4.25	10.25
2030-2079	13	31	6.5	15.5	4.29	10.23	3.25	7.75

Notes: Assumes no channel depth constraints (e.g., 20-foot authorized depth assumed for the largest topsides).
Fifty year project life projected for the period 2028 through 2077.
Fractional platforms from market share projections are totaled rather than rounded to whole units.

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Source: G.E.C., Inc.

Total projected GOM topsides for the periods 2025-2079 and 2030-2079 are 17 and 13, respectively, compared to 41 and 31 for the 2005 projections, respectively. The HNC market share (Gulf Island Fabrication) at 50 percent would be 8.5 and 6.5 topsides using 2009 projections and 20.5 and 15.5 using 2005 projections for the time periods 2025-2079 and 2030-

2079, respectively. The HNC market share (Gulf Island Fabrication) at 33 percent would be 5.61 and 4.29 topsides using 2009 projections and 13.53 and 10.23 topsides using 2005 projections for the time periods 2025-2079 and 2030-2079, respectively. The HNC market share (Gulf Island Fabrication) at 25 percent would be 4.25 and 3.25 topsides using 2009 projections and 10.25 and 7.75 topsides using 2005 projections for the time periods 2025-2079 and 2030-2079, respectively.

Market Size: Installed Platforms

Table 21 contains the Infield 2005 and 2009 projections for deepwater (>500 meters) topsides installed in the GOM by hull type (FPS, FPSO, SPAR and TLP) for the period 2000-2079 (extrapolated). The GOM has historically used SPAR hulls or smaller TLP hulls. A minority of the hulls has been larger FPS or is projected to be floating vessels (FPSO).

The 2009 projections include 35 topsides for the period 2015-2079. Nearly one-half, 19 units, are projected to be SPAR hulls and about one-third, 11, are projected to be TLP hulls. Only a minority, 5 hulls, are projected for the largest hulls, FPS (5). For the with-project conditions spanning 2025-2079 or alternatively 2030-2079 there are totals of 17 and 13 installed topsides, respectively, of which 15 and 12, respectively, are SPAR and TLP hulls.

Table 21 illustrates that the vast reduction in forecasted topsides for deepwater GOM between 2005 and 2009 forecasts is primarily reflected in fewer SPAR and TLP hulls. For the with-project conditions spanning 2025-2079 or alternatively 2030-2079 there is a total of 24 and 18 fewer topsides forecasted to be installed in GOM deepwater. A total of 21 and 14 of the forecasted reduction in 2009 compared to 2005 reflect SPAR and TLP hulls.

Table 22 assigns the forecasted topsides for deepwater GOM for hulls by required channel depth for offshore delivery via the HNC. The maximum channel depths, inclusive of underkeel clearance, are for 16-ft., 18-ft. and 20-ft. corresponding to the smaller SPAR and TLP units (up to 16-ft.), and larger FPS and FPSO units corresponding to a maximum depth of up to 20-ft. The 2009 forecast for deepwater GOM topsides market for the periods 2025-2079 and 2030-2079 includes 15 and 12 topsides, respectively, for up to 16-ft. channel depths and 2 and 1 topsides, respectively, for up to 20-ft. channel depth. As noted previously (refer to Table 21) there is a considerable reduction in the forecast for deepwater GOM topsides in Infield 2009 forecast compared to the Infield 2005 forecast. Table 22 indicates that the 2005 forecast had a total of 41 topsides for the period 2025-2079, including 36 for up to 16-ft. channel depth, 3 for 18-ft. channel depth and 2 for up to 20-ft. channel depth and the period 2030-2079 had 26 topsides (up to 16-ft. channel depth), 3 topsides (up to 18-ft. channel depth) and 2 topsides (up to 20-ft. channel depth).

Table 21. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size

	Infield 2009					Infield 2005					Infield 2009 - Infield 2005				
	FPS	FPSO	SPAR	TLP	Total	FPS	FPSO	SPAR	TLP	Total	FPS	FPSO	SPAR	TLP	Total
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	2	2	4	0	0	2	2	4	0	0	0	0	0
2002	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0
2003	1	0	3	1	5	1	0	3	1	5	0	0	0	0	0
2004	0	0	4	2	6	0	0	4	2	6	0	0	0	0	0
2005	1	0	1	0	2	1	0	0	0	1	0	0	1	0	1
2006	2	0	0	0	2	2	0	2	1	5	0	0	-2	-1	-3
2007	1	0	0	1	2	1	0	1	3	5	0	0	-1	-2	-3
2008	1	0	2	1	4	0	0	2	2	4	1	0	0	-1	0
2009	1	0	0	1	2	0	0	0	1	1	1	0	0	0	1
2010	0	1	0	0	1	0	0	2	0	2	0	1	-2	0	-1
2011	0	0	0	0	0	1	0	0	1	2	-1	0	0	-1	-2
2012	0	1	0	0	1	1	0	0	0	1	-1	1	0	0	0
2013	1	0	0	2	3	0	0	0	0	0	1	0	0	2	3
2014	0	0	2	1	3	0	0	3	0	3	0	0	-1	1	0
2015	0	0	1	1	2	0	0	3	1	4	0	0	-2	0	-2
2016	0	0	1	1	2	0	0	1	1	2	0	0	0	0	0
2017	0	0	1	1	2	1	0	2	0	3	-1	0	-1	1	-1
2018	1	0	1	1	3	0	0	2	0	2	1	0	-1	1	1
2019	0	0	1	1	2	0	0	1	0	1	0	0	0	1	1
2010-2014	1	2	2	3	8	2	0	5	1	8	-1	2	-3	2	0
2015-2019	1	0	5	5	11	1	0	9	2	12	0	0	-4	3	-1
2020-2024	2	0	3	2	7	1	3	4	3	11	1	-3	-1	-1	-4
2025-2029	1	0	2	1	4	0	0	7	3	10	1	0	-5	-2	-6
2030-2034	1	0	1	1	3	1	0	1	1	3	0	0	0	0	0
2035-2039	0	0	1	1	2	1	0	1	2	4	-1	0	0	-1	-2
2040-2044	0	0	0	0	0	0	0	2	1	3	0	0	-2	-1	-3
2045-2049	0	0	1	1	2	0	3	4	0	7	0	-3	-3	1	-5
2050-2054	0	0	1	0	1	0	0	3	0	3	0	0	-2	0	-2
2055-2059	0	0	1	0	1	0	0	3	0	3	0	0	-2	0	-2
2060-2064	0	0	1	0	1	0	0	1	1	2	0	0	0	-1	-1
2065-2069	0	0	1	0	1	0	0	1	1	2	0	0	0	-1	-1
2070-2074	0	0	1	0	1	0	0	1	1	2	0	0	0	-1	-1
2075-2079	0	0	1	0	1	0	0	1	1	2	0	0	0	-1	-1
Total	13	2	34	22	71	11	6	58	29	104	2	-4	-24	-7	-33
Subtotals															
2015-2079	5	0	19	11	35	4	6	38	16	64	1	-6	-19	-5	-29
2020-2079	4	0	14	6	24	3	6	29	14	52	1	-6	-15	-8	-28
2025-2079	2	0	11	4	17	2	3	25	11	41	0	-3	-14	-7	-24
2030-2079	1	0	9	3	13	2	3	18	8	31	-1	-3	-9	-5	-18

Source: G.E.C., Inc.

Table 22. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platforms Projected by Channel Depth Requirements

	Infield 2009 expressed in 2005 Format				Infield 2005				Infield 2009 - Infield 2005			
	20-foot	18-foot	16-foot	Total	20-foot	18-foot	16-foot	Total	20-foot	18-foot	16-foot	Total
2020-2024	2	0	5	7	1	3	7	11	1	-3	-2	-4
2025-2029	1	0	3	4	0	0	10	10	1	0	-7	-6
2030-2034	1	0	2	3	1	0	2	3	0	0	0	0
2035-2039	0	0	2	2	1	0	3	4	-1	0	-1	-2
2040-2044	0	0	0	0	0	0	3	3	0	0	-3	-3
2045-2049	0	0	2	2	0	3	4	7	0	-3	-2	-5
2050-2054	0	0	1	1	0	0	3	3	0	0	-2	-2
2055-2059	0	0	1	1	0	0	3	3	0	0	-2	-2
2060-2064	0	0	1	1	0	0	2	2	0	0	-1	-1
2065-2069	0	0	1	1	0	0	2	2	0	0	-1	-1
2070-2074	0	0	1	1	0	0	2	2	0	0	-1	-1
2075-2079	0	0	1	1	0	0	2	2	0	0	-1	-1
Total	4	0	20	24	3	6	43	52	1	-6	-23	-28
Subtotals												
2025-2079	2	0	15	17	2	3	36	41	0	-3	-21	-24
2030-2079	1	0	12	13	2	3	26	31	-1	-3	-14	-18

Source: G.E.C., Inc.

Fabrication Benefits

Table 23 contains the timing of forecasted deepwater GOM topsides for the period of with-project conditions, 2027-2076. The topsides are grouped into five year periods of delivery that span the time frames of 2027-2077 and 2032-2077. Table 23 time periods (2027-2077 and 2032-2077) contain the same forecasted numbers of GOM deepwater topsides from Table 22 (2025-2079 and 2030-2079). The topsides are grouped in five year periods to allow for uncertainty in the timing of their development. Technically, the topsides could be developed at any year in the five year periods with respect to bidding, contract award, fabrication and load out.[47]

Table 24 contains the fabrication values in current dollars for the forecasted GOM deepwater topsides by channel depth. The 2009 forecast for the time period 2027-2079 has a total of $800 million of current fabrication benefits which are $640 million for the 16-ft. maximum depth, and $160 million for the 20-ft. channel depth. The current fabrication benefits for the time period 2032-2079 are a total of $592 million of which $512 million are for the 16-ft. channel depth and $80 million for the 20-ft. channel depth. The fabrication benefits are based on a market value of $8,000 per ton with assumed average tonnages of 5,333, 8,000 and 10,000 for the 16-ft., 18-ft. and 20-ft. required maximum channel depths, respectively. Table 24 indicates that the prior 2005 GOM deepwater topsides forecast had much larger fabrication values. Total current benefits for periods 2027-2077 and 2032-2077 would be $1.902 billion and $1.472 billion, respectively.

[47] Deepwater oil/gas exploration and production typically operate on a three year cycle between exploration and production wherein there is a specific time frame (schedule) for fabrication that includes delivery and installation. Outside of the development of existing projects with contractual schedules the future timing of other projects is conjectural with respect to expected year of installation and production.

Table 23. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076

		Infield 2009				Infield 2005			
Year	Period	20-foot	18-foot	16-foot	Total	20-foot	18-foot	16-foot	Total
2020									
2021									
2022		2	0	5	7	1	3	7	11
2023									
2024									
2025									
2026									
2027	1	1	0	3	4	0	0	10	10
2028	2								
2029	3								
2030	4								
2031	5								
2032	6	1	0	2	3	1	0	2	3
2033	7								
2034	8								
2035	9								
2036	10								
2037	11	0	0	2	2	1	0	3	4
2038	12								
2039	13								
2040	14								
2041	15								
2042	16	0	0	0	0	0	0	3	3
2043	17								
2044	18								
2045	19								
2046	20								
2047	21	0	0	2	2	0	3	4	7
2048	22								
2049	23								
2050	24								
2051	25								
2052	26	0	0	1	1	0	0	3	3
2053	27								
2054	28								
2055	29								
2056	30								
2057	31	0	0	1	1	0	0	3	3
2058	32								
2059	33								
2060	34								
2061	35								
2062	36	0	0	1	1	0	0	2	2
2063	37								
2064	38								
2065	39								
2066	40								
2067	41	0	0	1	1	0	0	2	2
2068	42								
2069	43								
2070	44								
2071	45								
2072	46	0	0	1	1	0	0	2	2
2073	47								
2074	48								
2075	49								
2076	50								
2077		0	0	1	1	0	0	2	2
2027-2077		2	0	15	17	2	3	36	41
2032-2077		1	0	12	13	2	3	26	31

Source: G.E.C., Inc.

Table 24. Fabrication Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076

		Infield 2009				Infield 2005			
	Weight	10,000	8,000	5333		10,000	8,000	5385	
	Value/ton	$8,000	$8,000	$8,000		$8,000	$8,000	$8,000	
Year	Period	20-foot	18-foot	16-foot	Total	20-foot	18-foot	16-foot	Total
2020									
2021									
2022		$160,000,000	$0	$213,333,333	$373,333,333	$80,000,000	$192,000,000	$301,538,462	$573,538,462
2023									
2024									
2025									
2026									
2027	1	$80,000,000	$0	$128,000,000	$208,000,000	$0	$0	$430,769,231	$430,769,231
2028	2								
2029	3								
2030	4								
2031	5								
2032	6	$80,000,000	$0	$85,333,333	$165,333,333	$80,000,000	$0	$86,153,846	$166,153,846
2033	7								
2034	8								
2035	9								
2036	10								
2037	11	$0	$0	$85,333,333	$85,333,333	$80,000,000	$0	$129,230,769	$209,230,769
2038	12								
2039	13								
2040	14								
2041	15								
2042	16	$0	$0	$0	$0	$0	$0	$129,230,769	$129,230,769
2043	17								
2044	18								
2045	19								
2046	20								
2047	21	$0	$0	$85,333,333	$85,333,333	$0	$192,000,000	$172,307,692	$364,307,692
2048	22								
2049	23								
2050	24								
2051	25								
2052	26	$0	$0	$42,666,667	$42,666,667	$0	$0	$129,230,769	$129,230,769
2053	27								
2054	28								
2055	29								
2056	30								
2057	31	$0	$0	$42,666,667	$42,666,667	$0	$0	$129,230,769	$129,230,769
2058	32								
2059	33								
2060	34								
2061	35								
2062	36	$0	$0	$42,666,667	$42,666,667	$0	$0	$86,153,846	$86,153,846
2063	37								
2064	38								
2065	39								
2066	40								
2067	41	$0	$0	$42,666,667	$42,666,667	$0	$0	$86,153,846	$86,153,846
2068	42								
2069	43								
2070	44								
2071	45								
2072	46	$0	$0	$42,666,667	$42,666,667	$0	$0	$86,153,846	$86,153,846
2073	47								
2074	48								
2075	49								
2076	50								
2077		$0	$0	$42,666,667	$42,666,667	$0	$0	$86,153,846	$86,153,846
2027-2077		$160,000,000	$0	$640,000,000	$800,000,000	$160,000,000	$192,000,000	$1,550,769,231	$1,902,769,231
2032-2077		$80,000,000	$0	$512,000,000	$592,000,000	$160,000,000	$192,000,000	$1,120,000,000	$1,472,000,000

Source: G.E.C., Inc.

Table 25 contains the fabrication values in present values for the forecasted GOM deepwater topsides by channel depth. The 2009 forecast for the time period 2027-2077 has a total of $559.5 million present value of fabrication benefits which are $415.4 million for the 16-ft. maximum depth, and $144.0 million for the 20-ft. channel depth. The present value of fabrication benefits for the time period 2032-2077 are a total of $357 million of which $291 million are for the 16-ft. channel depth and $66 million for the 20-ft. channel depth. The fabrication benefits are based on a market value of $8,000 per ton with assumed average tonnages of 5,333, 8,000 and 10,000 for the 16-ft., 18-ft. and 20-ft. required maximum channel depths, respectively (refer to Table 24). Table 25 indicates that the prior 2005 GOM deepwater topsides forecast had much larger present values of fabrication values. Total present values of fabrication benefits for periods 2027-2077 and 2032-2077 would be $1.242 billion and $824 million, respectively.

Table 26 summarizes the fabrication benefits based on time frame of with-project conditions and forecasted topsides (2027-2077 and 2032-2077), HNC market share of GOM deepwater forecasted topsides (100 percent, 50 percent, 33 percent and 25 percent) and channel depths (16-ft. 18-ft. and 20-ft.). The 16-ft. channel depth represents the smaller topsides from a load out (shipping) weight perspective. Many if not most of these smaller topsides for TLP and SPAR hulls should be able to navigate the HNC with sufficient underkeel clearance under without-project conditions and full maintenance of authorized channel depths. Topsides for the larger hulls that require 18-ft and 20-ft. channel depths would be benefitting candidates for with-project conditions.

For the 2027-2077 time frame fabrication benefits for the 18-ft. channel would be zero for the 2009 projections. Fabrication benefits for the 20-ft. project, depending on HNC market share, would be $144.0 million (100 percent), $72.0 million (50 percent), $47.5 million (33 percent) and $36.0 million (25 percent). For the time period 2032-2077 the fabrication benefits would be lower based on market share, ranging from $66.5 million (100 percent) to $16.6 million (25 percent).

MMS Projections

It has been noted that Materials Management Service (MMS) past projections of GOM deepwater installations were slightly different from Infield Systems in terms of threshold depth for "deepwater."[48] Less overt differences are that MMS (and its successor BOEM) usually does not make long term projections of sea level deepwater oil gas production units.[49] Rather MMS (and its successor BOEM) makes deepwater GOM (>800 meters) projections for the universe of production units, which primarily reflect sub sea level units. Adjustments based on assumptions about the proliferation of sub-sea production installations compared to sea level production

[48] Infield Systems has used 500 m as the threshold depth for "deepwater. MMS/BOEM has used >800 m for "deepwater" (but has forecasted production installations for lesser depths.

[49] All references to "MMS" reflect that this agency prior to be being reorganized as BOEM supplied forecasts of GOM deepwater oil/gas production installations for use in developing fabrication benefits under previous investigations.

Table 25. Present Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076

		Infield 2009				Infield 2005			
	Weight	10,000	8,000	5333		10,000	8,000	5385	
0.03125	Value/ton	$8,000	$8,000	$8,000		$8,000	$8,000	$8,000	
Year	Period	20-foot	18-foot	16-foot	Total	20-foot	18-foot	16-foot	Total
2020									
2021									
2022									
2023									
2024									
2025									
2026									
2027	1	$77,575,758	$0	$124,121,212	$201,696,970	$0	$0	$417,715,618	$417,715,618
2028	2								
2029	3								
2030	4								
2031	5								
2032	6	$66,512,951	$0	$70,947,148	$137,460,099	$66,512,951	$0	$71,629,332	$138,142,283
2033	7								
2034	8								
2035	9								
2036	10								
2037	11	$0	$0	$60,829,624	$60,829,624	$57,027,773	$0	$92,121,787	$149,149,559
2038	12								
2039	13								
2040	14								
2041	15								
2042	16	$0	$0	$0	$0	$0	$0	$78,984,622	$78,984,622
2043	17								
2044	18								
2045	19								
2046	20								
2047	21	$0	$0	$44,717,294	$44,717,294	$0	$100,613,912	$90,294,537	$190,908,449
2048	22								
2049	23								
2050	24								
2051	25								
2052	26	$0	$0	$19,170,159	$19,170,159	$0	$0	$58,063,462	$58,063,462
2053	27								
2054	28								
2055	29								
2056	30								
2057	31	$0	$0	$16,436,370	$16,436,370	$0	$0	$49,783,236	$49,783,236
2058	32								
2059	33								
2060	34								
2061	35								
2062	36	$0	$0	$14,092,437	$14,092,437	$0	$0	$28,455,882	$28,455,882
2063	37								
2064	38								
2065	39								
2066	40								
2067	41	$0	$0	$12,082,764	$12,082,764	$0	$0	$24,397,889	$24,397,889
2068	42								
2069	43								
2070	44								
2071	45								
2072	46	$0	$0	$10,359,683	$10,359,683	$0	$0	$20,918,591	$20,918,591
2073	47								
2074	48								
2075	49								
2076	50								
2077		$0	$0	$42,666,667	$42,666,667	$0	$0	$86,153,846	$86,153,846
2027-2077		$144,088,709	$0	$415,423,358	$559,512,067	$123,540,724	$100,613,912	$1,018,518,802	$1,242,673,438
2032-2077		$66,512,951	$0	$291,302,146	$357,815,097	$123,540,724	$100,613,912	$600,803,184	$824,957,820

Notes: Deepwater oil/gas platform (topsides) weights specified in short tons.
Value per ton of deepwater oil/gas platform (topsides) is the estimated contract value received by the fabricator, exclusive of other installed equipment, etc.
Water resources discount rate for FY 2016 is 3.125 percent.

Source: G.E.C., Inc.

Table 26. Present Value of Fabrication Benefits for HNC by GOM Deepwater Topsides Market Share and Channel Depth for 2027-2076 and 2032-2076

	Infield 2009 Projections				Infield 2005 Projections			
Channel (ft.)	**16-foot**	**18-foot**	**20-foot**	**Total (18+20)**	**16-foot**	**18-foot**	**20-foot**	**Total (18+20)**
2027-2077	$415,423,358	$0	$144,088,709	$144,088,709	$1,018,518,802	$100,613,912	$123,540,724	$224,154,636
100% HNC	$415,423,358	$0	$144,088,709	$144,088,709	$1,018,518,802	$100,613,912	$123,540,724	$224,154,636
50% HNC	$207,711,679	$0	$72,044,354	$72,044,354	$509,259,401	$50,306,956	$61,770,362	$112,077,318
33% HNC	$137,089,708	$0	$47,549,274	$47,549,274	$336,111,205	$33,202,591	$40,768,439	$73,971,030
25% HNC	$103,855,840	$0	$36,022,177	$36,022,177	$254,629,700	$25,153,478	$30,885,181	$56,038,659

	Infield 2009 Projections				Infield 2005 Projections			
Channel (ft.)	**16-foot**	**18-foot**	**20-foot**	**Total (18+20)**	**16-foot**	**18-foot**	**20-foot**	**Total (18+20)**
2032-2077	$291,302,146	$0	$66,512,951	$66,512,951	$600,803,184	$100,613,912	$123,540,724	$224,154,636
100% HNC	$291,302,146	$0	$66,512,951	$66,512,951	$600,803,184	$100,613,912	$123,540,724	$224,154,636
50% HNC	$145,651,073	$0	$33,256,476	$33,256,476	$300,401,592	$50,306,956	$61,770,362	$112,077,318
33% HNC	$96,129,708	$0	$21,949,274	$21,949,274	$198,265,051	$33,202,591	$40,768,439	$73,971,030
25% HNC	$72,825,537	$0	$16,628,238	$16,628,238	$150,200,796	$25,153,478	$30,885,181	$56,038,659

Notes: PV GOM = Present value of the projected stream of total deepwater topsides projected to be installed in the GOM for the periods 2027-2077 and 2032-2077.
100% HNCI = Present value of 100% market share under with-project conditions based on the total value of the projected stream of deepwater topsides to be installed in the GOM for the period of with-project conditions.
50% HNC = Present value of 50% market share under with-project conditions based on the total value of the projected stream of deepwater topsides to be installed in the GOM for the period of with-project conditions.
33% HNC = Present value of 33% market share under with-project conditions based on the total value of the projected stream of deepwater topsides to be installed in the GOM for the period of with-project conditions.
25% HNC = Present value of 25% market share under with-project conditions based on the total value of the projected stream of deepwater topsides to be installed in the GOM for the period of with-project conditions.

Source: G.E.C., Inc.

installations have to be made to infer the minority proportion of production units that are sea level installations in the MMS projections.[50]

Previous assumptions about the proliferation of sub sea production installations in the MMS forecasts of GOM deepwater (>800 m) production installations for GOM used 67 percent sub-sea units of total MMS projected GOM deepwater installations to reflect the residual of sea level production platforms.[51] Table 27 reflects that assumption (MMS total deepwater GOM production units are multiplied by 33 percent to arrive at forecasted sea level units) comparing MMS deepwater (>800 meters) production units (sea level) with Infield deepwater (>500 meters) sea level units. The correlations between MMS 2006 "low" and MMS 2006 "high" forecasts of GOM deepwater sea level production units and Infield 2005 and 2009 sea level GOM deepwater (>500 meters) indicate that there is a better statistical fit between MMS 2006 and Infield 2009 than MMS 2006 and Infield 2005 forecast.

Table 27. Comparison of MMS and Infield GOM Deepwater Topsides Projections

	Infield 2005 and MMS >800 2006 Low	Infield 2009 and MMS >800 2006 Low	Infield 2005 and MMS >800 2006 High	Infield 2009 and MMS >800 2006 High
Correlation	0.756	0.937	0.809	0.956
RSQ	0.571	0.877	0.655	0.914
ST DEV	3.502	3.555	4.969	5.608

Notes: Correlation between Infield and MMS forecasts is "perfect" with a value of 1.00.
RSQ = R-squared coefficient representing the percentage of the changes in the dependent variable reflected by changes in the independent variable.
ST DEV = the standard deviation of the R-square coefficient.

Source: G.E.C., Inc.

Not only is the statistical correlation ("fit") between MMS 2006 and Infield 2009 better than 2005 forecast (0.937 for 2009 versus 0.756 for 2005 for MMS 2006 low and 0.956 for 2009 versus 0.809 for 2005 for MMS 2006 high) but there is a fairly high degree of similarity between the two forecasts. The R-squared coefficient (expressing the degree to which changes in the dependent variable are reflected by changes in the independent variable) is 0.937 and 0.956 for MMS low (>800 meters) and Infield 2009 (>500 meters), indicating that about 94 percent and 95 percent of the changes in the Infield forecasts for the same time frame are reflected by the changes in the MMS forecast for the corresponding time frame (and slightly different water depths).[52] Basically, the very high R-squared coefficients between MMS low (0.937) and high (0.956) and Infield 2009 approach a value of "1.0" indicative of a perfect fit between the two forecasts.

[50] Sea level production installations are elsewhere commonly referred to as the constituent components of "hulls" and "topsides".
[51] There is an undocumented concern that the percentage of deepwater production installations that are subsea would likely increase over time as opposed to decrease.
[52] A perfect correlation would be 1.0 and the R-square equivalent would likewise be "1.0."

Bureau of Ocean Energy Management (BOEM), successor to MMS, has issued an *Environmental Impact Statement and an Opportunity for Scoping Comments for Proposed Gulf of Mexico OCS Oil and Gas Western Planning Area Lease Sale 233 and Central Planning Area Lease Sale 231,* July 9, 2012.[53] The BOEM long term projections for all GOM deepwater production installations ("Production Structures") are provided for water depths of 0 to 60 m, 60 – 200 m, 200 – 800 m, 800 – 1600 m, 1600 – 2400 m and >2400 m. Total production structures to be installed in the GOM (Western Planning Area, Central Planning Area and Eastern Planning Area) are between 89 and 101 units for the period 2012-2051 for water depths >800 meters. At first glance these BOEM production structure installations for the period 2012-2051 appear much greater than GOM sea level units (topsides) projected by Infield Systems for similar time frames. Infield 2005 projections for the period 2012-2049 were for 54 sea level installations and for 2009 36 sea level units for the same period.

Adjusting the BOEM "production structures" to exclude estimated sub sea units results in between 29 and 33 sea level installations for the period 2012-2051 for deepwater (>800 m) GOM.[54] This is very close to the 2009 Infield sea level projections (>500 m) of "36" installations in GOM deepwater (>500 m). The most recent BOEM projections of deepwater GOM sea level production structures remain on par with Infield Systems projections after adjusting for estimated share of sub sea units. [55]

Summary of Deepening Benefits by Project Depth

Table 28 presents the sailing draft distributions for the benefitting vessels. The sailing drafts do not include underkeel clearance or tidal effects. Underkeel clearance is assumed to be two feet. Consequently, each sailing draft in Table 28 requires two additional feet of channel depth. The 15-ft. sailing draft would require a 17-ft. channel depth and the 18-ft. sailing draft would require a 20-ft. channel depth. Depending on the time of the year HNC tidal effects can range from minimal, including negative tidal conditions during winter, to slightly more than one foot near the mouth of the HNC that diminishes upstream to Houma.

Table 29 contains the present values of the NED benefits for the fleet stratified by sailing draft (exclusive of underkeel clearance). The incremental NED benefits for all vessels by sailing draft are $30.9 million for 15-ft. sailing draft (17-ft. channel), $193.0 million for 16-ft. sailing draft (18-ft. channel), $500.9 million for 17-ft. sailing draft (19-ft. channel) and $338.8 million for 18-ft. sailing draft (20-ft. channel).[56] The cumulative (total) NED benefits by sailing draft/channel depth are $223.9 million for up to 16-ft. sailing draft (18-ft. channel), $724.8 million for up to 17-ft. sailing draft (19-ft. channel) and $1,063.7 million for up to 18-ft. sailing draft (20-ft. channel).

[53] http://www.boem.gov/Environmental-Stewardship/Environmental-Assessment/NEPA/nepaprocess.aspx>

[54] It was assumed that the proportion of subsea units was unchanged from prior forecasts. Accordingly, the total number of forecasted production structures was multiplied by 0.33 to arrive at estimated number of sea level production structures.

[55] Personal communication, July 26, 2012, between Dr. Kevin Horn, G.E.C., Inc. and Mr. Goeke at BOEM , New Orleans, affirmed that the recent release of forecasted "production installations" in the July 2012 EIS included sub sea level units.

[56] A two foot underkeel clearance is assumed.

Table 28. Houma Navigation Canal Benefiting Vessel Fleet Sailing Draft Distributions

Benefit	Vessel	Quantity	Trips per Vessel	15	16	17	18	Total
Rerouting	Tugs	60	2	25%	50%	25%		100%
	Barges	10	6		25%	50%	25%	100%
	Tug trials	4	1	25%	50%	25%		100%
	OSV trials	6	1	25%	50%	25%		100%
Tug Assistance	Barges	50	1		25%	50%	25%	100%
	OSV trials	6	1		25%	50%	25%	100%
Diversions	Tug barges	3	24		25%	50%	25%	100%
	Tugs	60	1	25%	50%	25%		100%
	Jackups	10	2		25%	50%	25%	100%
Deeper Loading	Risers	30	1		25%	50%	25%	100%
	Loadouts	3	1		25%	50%	25%	100%
	Rigs	6	8		25%	50%	25%	100%
	Exports	12	1		25%	50%	25%	100%
New Vessel Trips	Ice breakers	2	1			50%	50%	100%
	Tankers	2	1			50%	50%	100%
	Large Specialty	1	1			50%	50%	100%

Source: G.E.C., Inc.

Table 29. Present Values of NED Benefits Corresponding to Sailing Drafts of Number of Vessel Trips in With-Project Conditions by Activity, Vessel, and Category: 2027 - 2076 discount rate = 3.125%

Year	Project Year	Rerouting Tugs Light Tug	Rerouting Barges Tug/Barge	Rerouting Tug Trials Light Tug	Rerouting OSV Trials Dry Cargo	Tug Assist Barges Tug/Barge	Tug Assist OSV Trials Dry Cargo	Diversions Barge Tug/Barge	Diversions Tugs Light Tug	Diversions Jackups Dry Cargo	Deeper Loading Barges - Risers Tug/Barge	Deeper Loading Barge - Loadouts Tug/Barge	Deeper Loading OSV - Rigs Dry Cargo	Deeper Loading Barges - Exports	New Vessel Trips Ice Breakers	New Vessel Trips Tankers	New Vessel Trips Large Specialty	Total (all vessels)	Increased Trips Light Tug	Increased Trips Tug/Barge	Increased Trips Dry Cargo	Tug Assist	New Vessel Trips
Subtotal	2027-2076	$80,705,752	$109,386,308	$4,113,103	$3,334,948	$33,071,572	$3,557,278	$134,819,959	$35,572,783	$119,502,318	$40,474,046	$3,705,498	$35,572,783	$44,465,979	$166,191,596	$166,191,596	$83,095,798	$1,063,761,318	$120,391,638	$288,385,811	$202,876,029	$36,628,850	$415,478,990
15-ft.		$20,176,438	$0	$1,028,276	$833,737	$0	$0	$0	$8,893,196	$0	$0	$0	$0	$0	$0	$0	$0	$30,931,647	$30,097,909	$0	$833,737	$0	$0
16-ft.		$40,352,876	$27,346,577	$2,056,552	$1,667,474	$8,267,893	$889,320	$33,704,990	$17,786,392	$29,875,580	$10,118,511	$926,375	$8,893,196	$11,116,495	$0	$0	$0	$193,002,228	$60,195,819	$72,096,453	$51,552,744	$9,157,213	$0
17.ft		$20,176,438	$54,693,154	$1,028,276	$833,737	$16,535,786	$1,778,639	$67,409,979	$8,893,196	$59,751,159	$20,237,023	$1,852,749	$17,786,392	$22,232,989	$83,095,798	$83,095,798	$41,547,899	$500,949,012	$30,097,909	$144,192,905	$100,604,277	$18,314,425	$207,739,495
18.ft		$0	$27,346,577	$0	$0	$8,267,893	$889,320	$33,704,990	$0	$29,875,580	$10,118,511	$926,375	$8,893,196	$11,116,495	$83,095,798	$83,095,798	$41,547,899	$338,878,431	$0	$72,096,453	$49,885,270	$9,157,213	$207,739,495
Subtotal	2027-2076	$80,705,752	$109,386,308	$4,113,103	$3,334,948	$33,071,572	$3,557,278	$134,819,959	$35,572,783	$119,502,318	$40,474,046	$3,705,498	$35,572,783	$44,465,979	$166,191,596	$166,191,596	$83,095,798	$1,063,761,318	$120,391,638	$288,385,811	$202,876,029	$36,628,850	$415,478,990
15-16-ft.		$60,529,314	$27,346,577	$3,084,827	$2,501,211	$8,267,893	$889,320	$33,704,990	$26,679,587	$29,875,580	$10,118,511	$926,375	$8,893,196	$11,116,495	$0	$0	$0	$223,933,875	$90,293,728	$72,096,453	$52,386,481	$9,157,213	$0
15-17-ft.		$80,705,752	$82,039,731	$4,113,103	$3,334,948	$24,803,679	$2,667,959	$101,114,969	$35,572,783	$89,626,739	$30,355,534	$2,779,124	$26,679,587	$33,349,484	$83,095,798	$83,095,798	$41,547,899	$724,882,888	$120,391,638	$216,289,358	$152,990,759	$27,471,638	$207,739,495
15-18-ft.		$80,705,752	$109,386,308	$4,113,103	$3,334,948	$33,071,572	$3,557,278	$134,819,959	$35,572,783	$119,502,318	$40,474,046	$3,705,498	$35,572,783	$44,465,979	$166,191,596	$166,191,596	$83,095,798	$1,063,761,318	$120,391,638	$288,385,811	$202,876,029	$36,628,850	$415,478,990

Notes: 15-16-ft. reflects 18-ft. channel depth
15-18-ft. reflects 20-ft. channel depth

Source: G.E.C., Inc.

Table 30 contains a summary of the present values of the NED and fabrication benefits by channel depth. The NED benefits for the 15-16-ft. sailing drafts corresponding to an 18-ft. project are $223.9 million. There are no fabrication benefits for 18-ft. channel. The NED benefits for the 20-ft. channel corresponding to sailing drafts between 15 and 18-ft. are $1,063.7 million. The fabrication benefits for the 20-ft. channel range from $144.0 million to $36.0 million, depending on market share. The most likely HNC market share is 50 percent which corresponds to fabrication benefits of $72.0 million.[57]

Table 30. Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027 - 2076 discount rate = 3.125%

Sailing Draft (feet)	NED Benefits	Fabrication Benefits 100% Market Share	Fabrication Benefits 50% Market Share	Fabrication Benefits 33% Market Share	Fabrication Benefits 25% Market Share
15-16-ft.	$223,933,875	$0	$0	$0	$0
17-18-ft.	$724,882,888	$144,088,709	$72,044,354	$47,549,274	$36,022,177
15-18-ft.	$1,063,761,318	$144,088,709	$72,044,354	$47,549,274	$36,022,177
Channel Depth	**Fabrication + NED**	**100% Market Share**	**50% Market Share**	**33% Market Share**	**25% Market Share**
18-ft		$223,933,875	$223,933,875	$223,933,875	$223,933,875
20-ft.		$1,207,850,027	$1,135,805,672	$1,111,310,592	$1,099,783,495

Source: G.E.C., Inc.

The present values of total benefits, NED and fabrication, are compiled in Table 30. The 18-ft. project has only NED present value benefits of $223.9 million. The 20-ft. project has NED and fabrication benefits ranging from $1,207.8 million (100 percent market share) to $1,099.7 million (25 percent market share). The total present value benefits (NED and fabrication) for the 50 percent market share would be $1,135.8 million.

VI. BENEFITS AND COSTS

INTRODUCTION

The purpose of this chapter is to present the benefits and costs for a comparative evaluation of the project. The benefits and costs will be summarized. Readers interested in more details about the derivation of these values should consult prior chapters for the benefits or the costs summary (engineering appendix).

CONSTRUCTION AND RELATED CAPITAL COSTS

Table 31 presents a summary of the construction costs of the project, which has two alternatives (-18-ft. and -20-ft. depths) and three disposal alternatives (adjacent, earthen retention and rock retention). The total construction costs for the -18-ft. and -20-ft. projects are nearly the same across the same disposal options. The total construction costs rounded to the nearest million

[57] The most likely market share, 50 percent, assumes that Gulf Island Fabrication and Kiewit Offshore Services will remain the leading two contenders (duopolistic market structure) for GOM topsides with little other successful sustained competition from prospective domestic or foreign entrants.

range from $163 million (-18-ft. project, adjacent disposal) to $175 million (-20-ft. project adjacent disposal; 187 million (-18-ft. project earthen retention) to $207 million (-20-ft. earthen retention); and $224 million (-18-ft. rock retention) to $247 million (-20-ft. rock retention).[58]

Table 31. Houma Navigation Canal Deepening Construction Expenditure Schedule

Annual Expenditures	2A - 20 ft. Adjacent Disposal	1A - 18 ft. Adjacent Disposal	2B - 20 ft. Earthen Retention	1B - 18 ft. Earthen Retention	2C - 20 ft. Rock Retention	1C - 18 ft. Rock Retention
Year 1	$8,507,916	$7,486,502	$8,507,916	$7,507,514	$8,507,916	$7,507,514
Year 2	$9,321,245	$8,094,883	$9,321,245	$8,122,226	$9,321,245	$8,122,226
Year 3	$8,758,322	$7,449,315	$8,758,322	$7,481,321	$8,758,322	$7,481,321
Year 4	$6,508,435	$5,521,423	$6,508,435	$5,558,480	$6,508,435	$5,558,480
Year 5	$7,919,862	$7,122,958	$7,908,586	$7,170,763	$7,919,862	$7,170,763
Year 6	$43,529,728	$41,357,447	$43,308,774	$41,638,836	$43,529,728	$41,638,836
Year 7	$62,644,325	$59,870,548	$72,986,042	$69,054,187	$87,589,966	$82,580,046
Year 8	$24,699,705	$23,199,031	$41,825,575	$35,517,053	$66,856,168	$58,899,812
Year 9	$3,682,559	$3,548,688	$8,336,907	$5,042,366	$8,336,907	$5,042,366
Total	$175,572,096	$163,650,795	$207,461,802	$187,092,747	$247,328,548	$224,001,363

Source: G.E.C., Inc.

Interest during construction (IDC) is the economic (opportunity) cost of resources expended before the project is completed and ensuing benefits (resource savings) are able to commence.[59] IDC was computed based on a nine-year project construction schedule as developed by GEC from data supplied by the New Orleans District. The construction expenditures schedule is contained in Table 32 which shows the percentage of total construction expended in each of the nine years (2018-2026).

Table 33 displays the IDC based on using the FY 2016 Federal water resources discount rate of 3.125 percent.[60] IDC costs (rounded) range from $21.5 million (18-ft. project, adjacent disposal) to $23.5 million (-20-ft. adjacent disposal); $23.3 million (-18-ft. earthen retention) to $25.7 million (-20-ft. earthen retention); and $26.1 million (-18-ft. rock retention) to $28.7 million (-20-ft. project rock retention).

[58] These costs, rounded to the nearest million, are based on updates developed by GEC in November 2015 as revised in December 2015.
[59] Interest during construction reflects that there is opportunity cost to resources expended but not yet used until completion of the project.
[60] The IDC costs based on the current federal water resources discount rate, 3.125 percent, and a nine-year construction schedule are less than the 2012 IDC based on a 4.0 federal water resources discount rate and a ten year construction schedule.

. Table 32. Houma Navigation Canal Annual Construction Expenditure Percentages, 2018-2026

Annual Percentages	2A - 20 ft. Adjacent Disposal	1A - 18 ft. Adjacent Disposal	2B - 20 ft. Earthen Retention	2B - 18 ft. Earthen Retention	2C - 20 ft. Rock Retention	2C - 18 ft. Rock Retention
Year 1 (2018)	4.85%	4.57%	4.10%	4.01%	3.44%	3.35%
Year 2 (2019)	5.31%	4.95%	4.49%	4.34%	3.77%	3.63%
Year 3 (2020)	4.99%	4.55%	4.22%	4.00%	3.54%	3.34%
Year 4 (2021)	3.71%	3.37%	3.14%	2.97%	2.63%	2.48%
Year 5 (2022)	4.51%	4.35%	3.81%	3.83%	3.20%	3.20%
Year 6 (2023)	24.79%	25.27%	20.88%	22.26%	17.60%	18.59%
Year 7 (2024)	35.68%	36.58%	35.18%	36.91%	35.41%	36.87%
Year 8 (2025)	14.07%	14.18%	20.16%	18.98%	27.03%	26.29%
Year 9 (2026)	2.10%	2.17%	4.02%	2.70%	3.37%	2.25%
Total Construction	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: G.E.C., Inc.

Table 33. Houma Navigation Canal Annual Construction Expenditure Schedule and Interest during Construction

Item	2A - 20 ft. Adjacent Disposal	1A - 18 ft. Adjacent Disposal	2B - 20 ft. Earthen Retention	2B - 18 ft. Earthen Retention	2C - 20 ft. Rock Retention	2C - 18 ft. Rock Retention
Year 1 (2018)	$8,507,916	$7,486,502	$8,507,916	$7,507,514	$8,507,916	$7,507,514
Year 2 (2019)	$9,321,245	$8,094,883	$9,321,245	$8,122,226	$9,321,245	$8,122,226
Year 3 (2020)	$8,758,322	$7,449,315	$8,758,322	$7,481,321	$8,758,322	$7,481,321
Year 4 (2021)	$6,508,435	$5,521,423	$6,508,435	$5,558,480	$6,508,435	$5,558,480
Year 5 (2022)	$7,919,862	$7,122,958	$7,908,586	$7,170,763	$7,919,862	$7,170,763
Year 6 (2023)	$43,529,728	$41,357,447	$43,308,774	$41,638,836	$43,529,728	$41,638,836
Year 7 (2024)	$62,644,325	$59,870,548	$72,986,042	$69,054,187	$87,589,966	$82,580,046
Year 8 (2025)	$24,699,705	$23,199,031	$41,825,575	$35,517,053	$66,856,168	$58,899,812
Year 9 (2026)	$3,682,559	$3,548,688	$8,336,907	$5,042,366	$8,336,907	$5,042,366
Total Construction	$175,572,096	$163,650,795	$207,461,802	$187,092,747	$247,328,548	$224,001,363
Interest During Con. (IDC)	$23,501,647	$21,533,875	$25,703,520	$23,324,962	$28,735,541	$26,117,308

Notes: Interest During Construction (IDC) based on FY 2016 water resources discount rate of 3.125%.

Source: G.E.C., Inc.

INCREMENTAL OPERATIONS AND MAINTENANCE (O&M) COSTS

Table 34 displays the annual operations and maintenance costs for the six alternative projects compared to the existing project for the 50-year period, 2027-2076. Total annual operations and maintenance costs for the existing project are $726.0 million. Total annual operations and maintenance costs for the alternatives during the 50-year project (2027-2076) are $733.5 (-18-ft. adjacent disposal), $758.9 million (-20-ft. adjacent disposal), $1,068.8 million (-18-ft. earthen

Table 34. Houma Navigation Canal Annual Maintenance Cost Summary of Project Alternatives

Item	No Action Adj Disposal -15	Maint Alt. 1A Adj Disposal -18'	Maint Alt 1B Earthen Disposal -18'	Maint Alt 1C Rock Disposal -18'	Maint Alt 2A Adj Disposal -20'	Maint Alt 2B Earthen Disposal -20'	Maint Alt 2C Rock Disposal -20'
Maintenance, Year 1	$14,235,912	$14,545,149	$20,025,049	$25,483,379	$14,078,041	$19,894,718	$26,263,943
Maintenance, Year 2	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 3	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 4	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 5	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 6	$31,138,490	$30,906,503	$38,625,646	$38,353,634	$32,693,032	$39,496,778	$39,835,178
Maintenance, Year 7	$32,391,755	$32,571,653	$37,647,368	$42,901,354	$31,943,736	$37,423,759	$43,703,905
Maintenance, Year 8	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 9	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 10	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 11	$14,235,912	$14,545,149	$20,025,049	$25,483,379	$13,877,843	$19,888,699	$26,257,925
Maintenance, Year 12	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 13	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 14	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 15	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 16	$31,138,490	$31,002,554	$38,721,026	$38,448,342	$32,635,054	$39,439,609	$39,778,009
Maintenance, Year 17	$32,391,755	$32,571,653	$37,647,368	$42,901,354	$32,037,118	$37,515,835	$43,795,980
Maintenance, Year 18	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 19	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 20	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 21	$14,301,427	$14,641,201	$20,121,772	$25,579,431	$13,877,843	$19,888,699	$26,257,925
Maintenance, Year 22	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 23	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 24	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 25	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 26	$31,105,715	$30,460,258	$38,182,522	$37,913,631	$33,519,929	$40,312,110	$40,650,510
Maintenance, Year 27	$32,485,153	$32,848,025	$37,921,807	$43,173,860	$32,192,056	$37,668,605	$43,948,751
Maintenance, Year 28	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 29	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 30	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 31	$14,301,427	$14,641,201	$20,121,772	$25,579,431	$14,762,719	$20,773,576	$27,142,801
Maintenance, Year 32	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 33	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 34	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 35	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 36	$30,685,962	$31,273,261	$38,989,839	$38,715,263	$33,519,929	$40,312,110	$40,650,510
Maintenance, Year 37	$32,676,897	$32,848,025	$37,921,807	$43,173,860	$32,192,056	$37,668,605	$43,948,751
Maintenance, Year 38	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 39	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 40	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 41	$14,301,427	$15,454,203	$20,940,460	$26,392,433	$14,966,354	$20,977,211	$27,346,436
Maintenance, Year 42	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 43	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 44	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 45	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 46	$31,504,953	$31,273,261	$38,989,839	$38,715,263	$33,723,566	$40,512,897	$40,851,297
Maintenance, Year 47	$32,676,897	$33,167,765	$38,239,311	$43,489,128	$32,544,468	$38,016,089	$44,296,234
Maintenance, Year 48	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,304,382	$19,005,547	$19,005,547
Maintenance, Year 49	$9,386,513	$9,671,978	$15,117,800	$20,610,208	$8,944,278	$14,955,134	$21,324,360
Maintenance, Year 50	$9,784,246	$9,784,246	$17,899,704	$17,775,401	$11,462,485	$19,005,547	$19,005,547
TOTAL	**$726,054,784**	**$733,514,450**	**$1,068,881,710**	**$1,200,964,875**	**$758,973,652**	**$1,094,227,247**	**$1,254,704,490**

Source: G.E.C., Inc.

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retention), $1,094.2 million (-20-ft. earthen retention), $1,200.9 million (-18-ft. rock retention), and $1,254.7 million (-20-ft. rock retention).

Table 35 displays the incremental operations and maintenance (O&M) costs for the six alternative projects compared to the existing project. The total incremental O&M costs for the project alternatives during the 50 year life are $7.4 million for -18-ft. project adjacent disposal, $32.9 million for -20-ft. project adjacent disposal, $342.8 million for -18-ft. project earthen retention; $368.1 million for -20-ft. project earthen retention, $474.9 million for -18-ft. project rock retention and $528.6 million for -20-ft. project rock retention.

Table 36 displays the present values of the annual incremental operations and maintenance (O&M) costs for the two alternative project depths and three disposal alternatives compared to the existing project. The discount rate used to derive the present values of the future stream of incremental O&M costs is 3.125 percent (FY 2016). The total incremental O&M costs for the project alternatives during the 50-year life are $3.4 million for -18-ft. project adjacent disposal, $15.3 million for -20-ft. project adjacent disposal, $171.5 million for -18-ft. project earthen retention; $183.6 million for -20-ft. project earthen retention, $239.0 million for -18-ft. project rock retention and $265.5 million for -20-ft. project rock retention.

TOTAL COSTS (CONSTRUCTION AND RELATED CAPITAL COSTS AND INCREMENTAL OPERATIONS AND MAINTENANCE COSTS)

Table 37 contains the total construction costs, interest during construction costs and incremental O&M costs for the two alternative project depths and three disposal alternatives. For the adjacent disposal alternatives the incremental O&M costs for the -18-ft. and -20-ft. projects are relatively minor compared to the construction costs. Consequently, the total costs (construction, interest during construction and incremental O&M) for the -18-ft. and -20-ft. projects (adjacent disposal) are $188.6 and $214.4 million, respectively.

The incremental O&M costs for the -18-ft. and -20-ft. projects for the earthen retention and rock retention disposal alternatives are significantly more than adjacent disposal and are nearly equal to or exceed the respective total construction costs for earthen retention and rock retention disposals, respectively. Consequently, the total costs of the -18-ft. and -20-ft. projects are significantly higher because of the substantial incremental O&M costs for these disposal alternatives. Total costs for the -18-ft. and -20-ft. projects for earthen retention are $381.9 million and $416.8 million, respectively, compared to $188.6 and $214.4 million for adjacent disposal, respectively. Total costs for the -18-ft. and -20-ft. projects for rock retention are $489.1 and $541.5 million, respectively, significantly higher than earthen retention and an order of magnitude higher than adjacent disposal because of the substantially higher incremental maintenance costs (present values from Table 36).

Table 35. Houma Navigation Canal Annual Incremental Maintenance Costs Summary for Project Alternatives: Nominal Dollars

Item	No Action Adj Disposal -15	Maint Alt. 1A Adj Disposal -18'	Maint Alt 1B Earthen Disposal -18'	Maint Alt 1C Rock Disposal -18'	Maint Alt 2A Adj Disposal -20'	Maint Alt 2B Earthen Disposal -20'	Maint Alt 2C Rock Disposal -20'
Maintenance, Year 1	$14,235,912	$309,238	$5,789,137	$11,247,468	($157,870)	$5,658,806	$12,028,032
Maintenance, Year 2	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 3	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 4	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 5	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 6	$31,138,490	($231,987)	$7,487,156	$7,215,144	$1,554,542	$8,358,287	$8,696,687
Maintenance, Year 7	$32,391,755	$179,898	$5,255,613	$10,509,599	($448,019)	$5,032,004	$11,312,149
Maintenance, Year 8	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 9	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 10	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 11	$14,235,912	$309,238	$5,789,137	$11,247,468	($358,069)	$5,652,787	$12,022,013
Maintenance, Year 12	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 13	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 14	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 15	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 16	$31,138,490	($135,936)	$7,582,536	$7,309,852	$1,496,564	$8,301,119	$8,639,519
Maintenance, Year 17	$32,391,755	$179,898	$5,255,613	$10,509,599	($354,637)	$5,124,080	$11,404,225
Maintenance, Year 18	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 19	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 20	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 21	$14,301,427	$339,774	$5,820,345	$11,278,004	($423,585)	$5,587,272	$11,956,497
Maintenance, Year 22	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 23	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 24	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 25	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 26	$31,105,715	($645,456)	$7,076,807	$6,807,916	$2,414,215	$9,206,395	$9,544,795
Maintenance, Year 27	$32,485,153	$362,873	$5,436,654	$10,688,707	($293,097)	$5,183,453	$11,463,598
Maintenance, Year 28	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 29	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 30	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 31	$14,301,427	$339,774	$5,820,345	$11,278,004	$461,292	$6,472,149	$12,841,374
Maintenance, Year 32	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 33	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 34	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 35	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 36	$30,685,962	$587,298	$8,303,876	$8,029,300	$2,833,967	$9,626,148	$9,964,548
Maintenance, Year 37	$32,676,897	$171,128	$5,244,910	$10,496,963	($484,842)	$4,991,708	$11,271,854
Maintenance, Year 38	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 39	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 40	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 41	$14,301,427	$1,152,776	$6,639,033	$12,091,006	$664,927	$6,675,783	$13,045,009
Maintenance, Year 42	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 43	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 44	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 45	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 46	$31,504,953	($231,693)	$7,484,885	$7,210,309	$2,218,612	$9,007,943	$9,346,343
Maintenance, Year 47	$32,676,897	$490,868	$5,562,414	$10,812,231	($132,429)	$5,339,192	$11,619,337
Maintenance, Year 48	$9,784,246	$0	$8,115,458	$7,991,155	$1,520,136	$9,221,301	$9,221,301
Maintenance, Year 49	$9,386,513	$285,465	$5,731,287	$11,223,695	($442,235)	$5,568,622	$11,937,847
Maintenance, Year 50	$9,784,246	$0	$8,115,458	$7,991,155	$1,678,239	$9,221,301	$9,221,301
TOTAL	**$726,054,784**	**$7,459,666**	**$342,826,926**	**$474,910,091**	**$32,918,869**	**$368,172,463**	**$528,649,706**

Source: G.E.C., Inc.

Table 36. Houma Navigation Canal Present Value of Annual Incremental Maintenance Costs for Deepening Alternatives (discount rate = 3.125%)

Item	Year	No Action Adj Disposal -15	Maint Alt. 1A Adj Disposal -18'	Maint Alt 1B Earthen Disposal -18'	Maint Alt 1C Rock Disposal -18'	Maint Alt 2A Adj Disposal -20'	Maint Alt 2B Earthen Disposal -20'	Maint Alt 2C Rock Disposal -20'
Maintenance, Year 1	1	$13,804,520	$299,867	$5,613,709	$10,906,635	($153,086)	$5,487,327	$11,663,546
Maintenance, Year 2	2	$9,200,246	$0	$7,631,064	$7,514,180	$1,429,402	$8,670,902	$8,670,902
Maintenance, Year 3	3	$8,558,790	$260,292	$5,225,890	$10,233,966	($403,237)	$5,077,569	$10,885,143
Maintenance, Year 4	4	$8,651,104	$0	$7,175,583	$7,065,675	$1,344,084	$8,153,355	$8,153,355
Maintenance, Year 5	5	$8,047,935	$244,756	$4,913,968	$9,623,124	($379,169)	$4,774,500	$10,235,433
Maintenance, Year 6	6	$25,888,911	($192,877)	$6,224,910	$5,998,756	$1,292,464	$6,949,179	$7,230,529
Maintenance, Year 7	7	$26,114,803	$145,037	$4,237,168	$8,473,023	($361,201)	$4,056,890	$9,120,054
Maintenance, Year 8	8	$7,649,194	$0	$6,344,558	$6,247,379	$1,188,422	$7,209,091	$7,209,091
Maintenance, Year 9	9	$7,115,880	$216,410	$4,344,867	$8,508,641	($335,256)	$4,221,551	$9,050,037
Maintenance, Year 10	10	$7,192,630	$0	$5,965,865	$5,874,487	$1,117,488	$6,778,796	$6,778,796
Maintenance, Year 11	11	$10,148,029	$220,439	$4,126,770	$8,017,725	($255,249)	$4,029,573	$8,569,858
Maintenance, Year 12	12	$6,763,318	$0	$5,609,776	$5,523,851	$1,050,787	$6,374,185	$6,374,185
Maintenance, Year 13	13	$6,291,769	$191,347	$3,841,675	$7,523,231	($296,429)	$3,732,641	$8,001,926
Maintenance, Year 14	14	$6,359,631	$0	$5,274,941	$5,194,145	$988,068	$5,993,724	$5,993,724
Maintenance, Year 15	15	$5,916,227	$179,926	$3,612,374	$7,074,186	($278,736)	$3,509,848	$7,524,309
Maintenance, Year 16	16	$19,031,550	($83,083)	$4,634,374	$4,467,712	$914,686	$5,073,565	$5,280,392
Maintenance, Year 17	17	$19,197,609	$106,620	$3,114,842	$6,228,720	($210,183)	$3,036,886	$6,758,938
Maintenance, Year 18	18	$5,623,103	$0	$4,664,034	$4,592,596	$873,637	$5,299,573	$5,299,573
Maintenance, Year 19	19	$5,231,052	$159,088	$3,194,014	$6,254,903	($246,455)	$3,103,362	$6,652,896
Maintenance, Year 20	20	$5,287,473	$0	$4,385,648	$4,318,474	$821,492	$4,983,253	$4,983,253
Maintenance, Year 21	21	$7,494,388	$178,052	$3,050,040	$5,910,021	($221,971)	$2,927,902	$6,265,573
Maintenance, Year 22	22	$4,971,875	$0	$4,123,879	$4,060,714	$772,459	$4,685,814	$4,685,814
Maintenance, Year 23	23	$4,625,228	$140,664	$2,824,106	$5,530,505	($217,912)	$2,743,953	$5,882,405
Maintenance, Year 24	24	$4,675,115	$0	$3,877,734	$3,818,339	$726,352	$4,406,128	$4,406,128
Maintenance, Year 25	25	$4,349,159	$132,268	$2,655,542	$5,200,401	($204,906)	$2,580,172	$5,531,297
Maintenance, Year 26	26	$13,975,816	($290,004)	$3,179,614	$3,058,801	$1,084,708	$4,136,439	$4,288,482
Maintenance, Year 27	27	$14,153,308	$158,098	$2,368,671	$4,656,914	($127,698)	$2,258,355	$4,994,523
Maintenance, Year 28	28	$4,133,676	$0	$3,428,642	$3,376,126	$642,231	$3,895,841	$3,895,841
Maintenance, Year 29	29	$3,845,470	$116,949	$2,347,995	$4,598,127	($181,175)	$2,281,355	$4,890,701
Maintenance, Year 30	30	$3,886,946	$0	$3,223,994	$3,174,612	$603,898	$3,663,307	$3,663,307
Maintenance, Year 31	31	$5,509,302	$130,890	$2,242,157	$4,344,596	$177,702	$2,493,249	$4,946,849
Maintenance, Year 32	32	$3,654,943	$0	$3,031,561	$2,985,127	$567,853	$3,444,652	$3,444,652
Maintenance, Year 33	33	$3,400,115	$103,405	$2,076,067	$4,065,605	($160,192)	$2,017,144	$4,324,295
Maintenance, Year 34	34	$3,436,787	$0	$2,850,614	$2,806,951	$533,959	$3,239,049	$3,239,049
Maintenance, Year 35	35	$3,197,169	$97,233	$1,952,151	$3,822,938	($150,631)	$1,896,745	$4,066,187
Maintenance, Year 36	36	$10,135,312	$193,980	$2,742,700	$2,652,009	$936,035	$3,179,435	$3,291,205
Maintenance, Year 37	37	$10,465,843	$54,809	$1,679,854	$3,361,995	($155,286)	$1,598,758	$3,610,179
Maintenance, Year 38	38	$3,038,763	$0	$2,520,476	$2,481,870	$472,119	$2,863,925	$2,863,925
Maintenance, Year 39	39	$2,826,896	$85,972	$1,726,067	$3,380,192	($133,186)	$1,677,078	$3,595,270
Maintenance, Year 40	40	$2,857,386	$0	$2,370,034	$2,333,732	$443,940	$2,692,984	$2,692,984
Maintenance, Year 41	41	$4,050,018	$326,454	$1,880,106	$3,424,049	$188,301	$1,890,514	$3,694,213
Maintenance, Year 42	42	$2,686,835	$0	$2,228,572	$2,194,437	$417,442	$2,532,245	$2,532,245
Maintenance, Year 43	43	$2,499,505	$76,016	$1,526,166	$2,988,722	($117,761)	$1,482,850	$3,178,891
Maintenance, Year 44	44	$2,526,464	$0	$2,095,553	$2,063,456	$392,526	$2,381,101	$2,381,101
Maintenance, Year 45	45	$2,350,315	$71,478	$1,435,073	$2,810,332	($110,732)	$1,394,342	$2,989,150
Maintenance, Year 46	46	$7,649,563	($56,256)	$1,817,368	$1,750,700	$538,690	$2,187,174	$2,269,340
Maintenance, Year 47	47	$7,693,689	$115,573	$1,309,656	$2,545,711	($31,180)	$1,257,098	$2,735,742
Maintenance, Year 48	48	$2,233,866	$0	$1,852,861	$1,824,481	$347,066	$2,105,339	$2,105,339
Maintenance, Year 49	49	$2,078,118	$63,200	$1,268,873	$2,484,859	($97,908)	$1,232,860	$2,642,968
Maintenance, Year 50	50	$2,100,532	$0	$1,742,268	$1,715,582	$360,293	$1,979,676	$1,979,676
TOTAL		**$362,576,175**	**$3,446,606**	**$171,564,422**	**$239,063,314**	**$15,396,562**	**$183,641,255**	**$265,523,271**

Source: G.E.C., Inc.

Table 37. Summary of Project NED Benefits (Transportation Cost Savings) and Costs by Channel Depth and Disposal Alternative (discount rate = 3.125%)

	2A - 20 ft Adjacent Disposal	1A - 18 ft Adjacent Disposal	2B - 20 ft Earthen Retention	1B - 18 ft Earthen Retention	2C - 20 ft Rock Retention	1C - 18 ft Rock Retention
Total Construction	$175,572,097	$163,650,795	$207,461,803	$187,092,748	$247,328,549	$224,001,365
Interest During Construction	$23,501,647	$21,533,875	$25,703,520	$23,324,962	$28,735,541	$26,117,308
Incremental O&M	$15,396,562	$3,446,606	$183,641,255	$171,564,422	$265,523,271	$239,063,314
Total Cost	$214,470,307	$188,631,276	$416,806,579	$381,982,132	$541,587,362	$489,181,987
NED Benefits	$1,063,761,318	$223,933,875	$1,063,761,318	$223,933,875	$1,063,761,318	$223,933,875
AAEC	$8,534,407	$7,506,196	$16,585,965	$15,200,198	$21,551,361	$19,465,997
AAEB	$42,330,206	$8,910,991	$42,330,206	$8,910,991	$42,330,206	$8,910,991
Net Benefits	$33,795,799	$1,404,795	$25,744,241	-$6,289,207	$20,778,845	-$10,555,006
BCR	4.96	1.19	2.55	0.59	1.96	0.46

Notes: Total Construction Costs furnished by New Orleans District for channel depths and disposal alternatives.
Interest During Construction based on nine-year schedule and current Federal water resources discount rate, 3.125 percent.
Present value of Incremental Operation and Maintenance expenditures for each project alternative is calculated from Table 36.
Total Cost is the sum of Total Construction Cost, Interest During Construction, and Incremental O&M.
NED Benefits (transportation cost savings) is the present value of a 50-year stream from 2028 through 2077 at 3.125 percent discount rate.
Average Annual Equivalent Cost, AAEC, is computed based on 0.0397929549 percent (50 years at 3.125 percent) capital recovery factor.
Average Annual Equivalent Benefits, AAEB, is computed based on 0.0397929549 percent (fifty years at 3.125 percent) capital recovery factor
Net Benefits is the difference between AAEB and AAEC (AAEB-AAEC = Net Benefits).
Benefit to Cost Ratio, BCR, is the ratio of AAEB to AAEC (AAEB/AAEC = BCR).

Source: G.E.C., Inc., except as noted.

SUMMARY OF NED TRANSPORTATION COST SAVINGS BENEFITS

Previously it was shown that the total benefits (transportation cost savings) for the -20-ft. project are nearly four times greater than the total benefits (transportation cost savings) for the -18-ft. project ($1,063 million versus $223 million). The present values of total benefits (transportation cost savings) for the -20-ft. and -18-ft. projects for the 50 year period using the federal water resources discount rate of 3.125 percent are displayed in Table 37. For the -20-ft. project the total NED benefits (exclusive of fabrication) are $1,063.7 million. The -18-ft. project total NED benefits (exclusive of fabrication) are $223.9 million based on reductions in the numbers of benefiting vessel trips that cannot be made without a -20-ft. channel (refer to Table 28). The benefits for the -20-ft. and -18-ft. projects do not change across the three disposal alternatives.

The benefit/cost ratio (BCR) for transportation cost savings is 4.96 for the -20-ft. project with adjacent disposal, 2.55 for the -20-ft. project for earthen retention, and 1.96 for the -20-ft. project for rock retention. The BCR for the corresponding -18-ft. project is slightly great than 1.0--1.19 for adjacent disposal and then less 1.0 for earthen retention (0.59) and rock retention (0.46).

SUMMARY OF NED TRANSPORTATION COST SAVINGS AND FABRICATION BENEFITS AND TOTAL COSTS

Table 38 presents the total costs and total benefits (transportation cost savings and fabrication) for the -18-ft. and -20-ft. projects and the three disposal alternatives. Table 38 has the same format as Table 37 except that the -20-ft. project benefits include both NED (transportation cost savings) and fabrication benefits which reflect the two-firm scenario (50 percent HNC market share of GOM projected deepwater platforms) requiring a -20-ft. channel, 2027-2076 (refer to Table 30). The 2009 Infield projections for the GOM indicate that the two-firm fabrication benefits scenario which results in a 50 percent HNC market share of the GOM projected platforms, 2027-2076, would be $72.044 million. As noted previously, there are no fabrication benefits projected for the -18-ft. channel using the updated 2009 Infield GOM platform projections because of no projected platforms that would require this channel depth.

Table 38. Summary of Project NED Benefits (Transportation Cost Savings and Fabrication Market Valuations) and Costs by Channel Depth and Disposal Alternative (discount rate = 3.125%)

	2A - 20 ft Adjacent Disposal	1A - 18 ft Adjacent Disposal	2B - 20 ft Earthen Retention	1B - 18 ft Earthen Retention	2C - 20 ft Rock Retention	1C - 18 ft Rock Retention
Total Construction	$175,572,097	$163,650,795	$207,461,803	$187,092,748	$247,328,549	$224,001,365
Interest During Construction	$23,501,647	$21,533,875	$25,703,520	$23,324,962	$28,735,541	$26,117,308
Incremental O&M	$15,396,562	$3,446,606	$183,641,255	$171,564,422	$265,523,271	$239,063,314
Total Cost	$214,470,307	$188,631,276	$416,806,579	$381,982,132	$541,587,362	$489,181,987
NED Benefits	$1,063,761,318	$223,933,875	$1,063,761,318	$223,933,875	$1,063,761,318	$223,933,875
Fabrication Benefits - 50%	$72,044,354	$0	$72,044,354	$0	$72,044,354	$0
Total Benefits	$1,135,805,672	$223,933,875	$1,135,805,672	$223,933,875	$1,135,805,672	$223,933,875
AAEC	$8,534,407	$7,506,196	$16,585,965	$15,200,198	$21,551,361	$19,465,997
AAEB	$45,197,064	$8,910,991	$45,197,064	$8,910,991	$45,197,064	$8,910,991
Net Benefits	$36,662,657	$1,404,795	$28,611,099	-$6,289,207	$23,645,702	-$10,555,006
BCR	5.30	1.19	2.73	0.59	2.10	0.46

Notes: Total Construction Costs furnished by New Orleans District for channel depths and disposal alternatives.

Interest During Construction based on nine-year schedule and current Federal water resources discount rate, 3.125 percent.

Present value of Incremental Operation and Maintenance expenditures for each project alternative is calculated from Table 36.

Total Cost is the sum of Total Construction Cost, Interest During Construction, and Incremental O&M.

NED Benefits (transportation cost savings) is the present value of a 50-year stream from 2028 through 2077 at 3.125 percent discount rate.

Average Annual Equivalent Cost, AAEC, is computed based on 0.0397929549 percent (50 years at 3.125 percent) capital recovery factor.

Average Annual Equivalent Benefits, AAEB, is computed based on 0.0397929549 percent (fifty years at 3.125 percent) capital recovery factor

Net Benefits is the difference between AAEB and AAEC (AAEB-AAEC = Net Benefits).

Benefit to Cost Ratio, BCR, is the ratio of AAEB to AAEC (AAEB/AAEC = BCR).

Source: G.E.C., Inc., except as noted.

Including fabrication benefits the BCR values for the 20-ft. project are 5.30 (adjacent disposal), 2.73 (earthen retention) and 2.10 (rock retention). The corresponding BCR values for the 18-ft. project which are unchanged, 1.19 for adjacent disposal and then less than 1.0 for earthen retention (0.59) and rock retention (0.46), respectively

Tables 39, 40, and 41 express the costs and benefits from tables 36, 37 and 38 using a discount rate of seven percent (7%) to reflect practices of the Office of Management and Budget (OMB). The higher seven percent discount rate will approximately double the IDC but significantly decrease the present value of the incremental O&M costs over the life of the projects. For example the IDC for the 20-ft. project alternatives are $57.0, $62.1 and $69.0 million for adjacent disposal, earthen retention and rock retention, respectively, from Table 40 compared to the 3.125 percent discount rate in tables 37 and 38 yielding IDC of $23.6, $25.7 and $28.7 million for the 20-ft. project adjacent disposal, earthen and rock retentions, respectively.

However, the higher seven percent discount rate will result in a reduction in the present value of the future incremental O&M costs. In Table 39 the present value of the future incremental O&M costs using a seven percent discount rate for the 20-ft. projects are $7.8, $100.0 and $145.8 million for the adjacent disposal, earthen retention and rock retention alternatives, respectively, compared to $15.3, $183.6, and $265.5 million for the 20-ft. project and a 3.125 percent discount rate in Table 36 for adjacent disposal, earthen retention and rock retention, respectively.

Using a seven percent discount rate (Table 40) will decrease the benefits. The NED (transportation cost savings) benefits are about 50 percent less using a seven percent discount rate compared to a 3.125 percent discount rate (tables 38 and 39). The fabrication benefits are about 10 percent less using a seven percent discount rate compared to a 3.125 percent discount rate. The BCR values in Table 40 are lower because of lower present value of benefits. Total costs are higher for the adjacent disposal for both alternatives for the seven percent discount rate. However, total costs are lower because of reduction in incremental O&M for the seven percent discount rate for earthen retention and rock retention for both alternatives.

Overall, the BCR values for the seven percent discount rate are less than the BCR values for the 3.125 percent discount rate. The NED benefits (Table 40) displays BCR values for transportation cost savings of 2.37 for the -20-ft. project with adjacent disposal, 1.54 for the -20-ft. project for earthen retention, and 1.23 for the -20-ft. project for rock retention. The BCR for the corresponding -18-ft. project are less than 1.0--0.55 for adjacent disposal, 0.36 for earthen retention and 0.29 for rock retention.

The BCR values for transportation cost savings and fabrication benefits in Table 41 are slightly higher for the -20-ft. projects. Compared to BCR values of 2.37, 1.54 and 1.23 for the seven percent discount rate for transportation cost savings (Table 40) the BCR in Table 41 are 2.63, 1.71 and 1.37 for the -200-ft. projects for adjacent disposal, earthen retention and rock retention, respectively.

Table 39. Houma Navigation Canal Present Value of Annual Incremental Maintenance Costs for Deepening Alternatives (discount rate = 7.00%)

Item	Year	No Action Adj Disposal -15	Maint Alt. 1A Adj Disposal -18'	Maint Alt 1B Earthen Disposal -18'	Maint Alt 1C Rock Disposal -18'	Maint Alt 2A Adj Disposal -20'	Maint Alt 2B Earthen Disposal -20'	Maint Alt 2C Rock Disposal -20'
Maintenance, Year 1	1	$13,304,590	$289,007	$5,410,409	$10,511,652	($147,542)	$5,288,604	$11,241,151
Maintenance, Year 2	2	$8,545,939	$0	$7,088,355	$6,979,784	$1,327,745	$8,054,241	$8,054,241
Maintenance, Year 3	3	$7,662,191	$233,025	$4,678,437	$9,161,879	($360,995)	$4,545,654	$9,744,839
Maintenance, Year 4	4	$7,464,354	$0	$6,191,244	$6,096,414	$1,159,704	$7,034,886	$7,034,886
Maintenance, Year 5	5	$6,692,454	$203,533	$4,086,328	$8,002,340	($315,307)	$3,970,350	$8,511,520
Maintenance, Year 6	6	$20,748,891	($154,583)	$4,989,008	$4,807,755	$1,035,857	$5,569,480	$5,794,970
Maintenance, Year 7	7	$20,171,957	$112,032	$3,272,932	$6,544,850	($279,004)	$3,133,679	$7,044,638
Maintenance, Year 8	8	$5,694,520	$0	$4,723,271	$4,650,925	$884,733	$5,366,881	$5,366,881
Maintenance, Year 9	9	$5,105,641	$155,274	$3,117,440	$6,104,947	($240,546)	$3,028,961	$6,493,398
Maintenance, Year 10	10	$4,973,814	$0	$4,125,487	$4,062,298	$772,760	$4,687,642	$4,687,642
Maintenance, Year 11	11	$6,763,379	$146,917	$2,750,377	$5,343,591	($170,116)	$2,685,598	$5,711,572
Maintenance, Year 12	12	$4,344,322	$0	$3,603,360	$3,548,168	$674,958	$4,094,368	$4,094,368
Maintenance, Year 13	13	$3,895,069	$118,458	$2,378,280	$4,657,435	($183,512)	$2,310,780	$4,953,782
Maintenance, Year 14	14	$3,794,499	$0	$3,147,315	$3,099,108	$589,535	$3,576,179	$3,576,179
Maintenance, Year 15	15	$3,402,104	$103,466	$2,077,282	$4,067,984	($160,286)	$2,018,325	$4,326,825
Maintenance, Year 16	16	$10,547,684	($46,046)	$2,568,467	$2,476,100	$506,938	$2,811,876	$2,926,504
Maintenance, Year 17	17	$10,254,400	$56,951	$1,663,792	$3,327,070	($112,269)	$1,622,152	$3,610,286
Maintenance, Year 18	18	$2,894,805	$0	$2,401,071	$2,364,294	$449,753	$2,728,250	$2,728,250
Maintenance, Year 19	19	$2,595,449	$78,934	$1,584,749	$3,103,445	($122,282)	$1,539,770	$3,300,914
Maintenance, Year 20	20	$2,528,435	$0	$2,097,189	$2,065,066	$392,832	$2,382,959	$2,382,959
Maintenance, Year 21	21	$3,453,982	$82,060	$1,405,690	$2,723,786	($102,301)	$1,349,399	$2,887,651
Maintenance, Year 22	22	$2,208,433	$0	$1,831,766	$1,803,709	$343,115	$2,081,369	$2,081,369
Maintenance, Year 23	23	$1,980,056	$60,218	$1,208,997	$2,367,604	($93,288)	$1,174,683	$2,518,252
Maintenance, Year 24	24	$1,928,931	$0	$1,599,935	$1,575,429	$299,690	$1,817,948	$1,817,948
Maintenance, Year 25	25	$1,729,457	$52,597	$1,055,985	$2,067,957	($81,481)	$1,026,014	$2,199,539
Maintenance, Year 26	26	$5,356,264	($111,145)	$1,218,594	$1,172,293	$415,717	$1,585,300	$1,643,571
Maintenance, Year 27	27	$5,227,848	$58,397	$874,923	$1,720,138	($47,168)	$834,175	$1,844,841
Maintenance, Year 28	28	$1,471,572	$0	$1,220,583	$1,201,887	$228,632	$1,386,904	$1,386,904
Maintenance, Year 29	29	$1,319,395	$40,126	$805,606	$1,577,634	($62,162)	$782,741	$1,678,017
Maintenance, Year 30	30	$1,285,328	$0	$1,066,104	$1,049,775	$199,696	$1,211,376	$1,211,376
Maintenance, Year 31	31	$1,755,829	$41,715	$714,581	$1,384,634	$56,634	$794,605	$1,576,574
Maintenance, Year 32	32	$1,122,655	$0	$931,177	$916,914	$174,422	$1,058,062	$1,058,062
Maintenance, Year 33	33	$1,006,560	$30,612	$614,593	$1,203,570	($47,423)	$597,149	$1,280,151
Maintenance, Year 34	34	$980,571	$0	$813,326	$800,868	$152,347	$924,153	$924,153
Maintenance, Year 35	35	$879,168	$26,738	$536,809	$1,051,244	($41,421)	$521,573	$1,118,134
Maintenance, Year 36	36	$2,686,110	$51,409	$726,884	$702,848	$248,073	$842,629	$872,251
Maintenance, Year 37	37	$2,673,259	$14,000	$429,080	$858,744	($39,664)	$408,366	$922,137
Maintenance, Year 38	38	$748,073	$0	$620,482	$610,979	$116,225	$705,032	$705,032
Maintenance, Year 39	39	$670,713	$20,398	$409,529	$801,989	($31,600)	$397,906	$853,019
Maintenance, Year 40	40	$653,396	$0	$541,953	$533,652	$101,515	$615,802	$615,802
Maintenance, Year 41	41	$892,575	$71,947	$414,352	$754,619	$41,499	$416,646	$814,160
Maintenance, Year 42	42	$570,701	$0	$473,363	$466,113	$88,667	$537,865	$537,865
Maintenance, Year 43	43	$511,684	$15,561	$312,428	$611,834	($24,107)	$303,561	$650,764
Maintenance, Year 44	44	$498,472	$0	$413,454	$407,121	$77,445	$469,792	$469,792
Maintenance, Year 45	45	$446,925	$13,592	$272,887	$534,399	($21,056)	$265,142	$568,403
Maintenance, Year 46	46	$1,401,926	($10,310)	$333,067	$320,849	$98,725	$400,841	$415,899
Maintenance, Year 47	47	$1,358,949	$20,414	$231,327	$449,653	($5,507)	$222,043	$483,219
Maintenance, Year 48	48	$380,282	$0	$315,422	$310,591	$59,083	$358,402	$358,402
Maintenance, Year 49	49	$340,957	$10,369	$208,184	$407,691	($16,064)	$202,275	$433,632
Maintenance, Year 50	50	$332,153	$0	$275,502	$271,282	$56,972	$313,042	$313,042
TOTAL		**$197,256,723**	**$1,785,663**	**$93,831,376**	**$131,634,906**	**$7,848,170**	**$100,055,434**	**$145,825,767**

Source: G.E.C., Inc.

Table 40. Summary of Project Total Benefits (Transportation Cost Savings) and Costs by Channel Depth and Disposal Alternative (discount rate = 7.0%)

	2A - 20 ft Adjacent Disposal	1A - 18 ft Adjacent Disposal	2B - 20 ft Earthen Retention	1B - 18 ft Earthen Retention	2C - 20 ft Rock Retention	1C - 18 ft Rock Retention
Total Construction	$175,572,097	$163,650,795	$207,461,803	$187,092,748	$247,328,549	$224,001,365
Interest During Construction	$57,043,982	$52,172,645	$62,105,446	$56,310,696	$69,092,100	$62,742,757
Incremental O&M	$7,848,170	$1,785,663	$100,055,434	$93,831,376	$145,825,767	$131,634,906
Total Cost	$240,464,249	$217,609,103	$369,622,683	$337,234,819	$462,246,417	$418,379,028
NED Benefits	$568,793,998	$119,737,616	$568,793,998	$119,737,616	$568,793,998	$119,737,616
AAEC	$17,424,003	$15,767,923	$26,782,804	$24,435,984	$33,494,306	$30,315,681
AAEB	$41,214,728	$8,676,170	$41,214,728	$8,676,170	$41,214,728	$8,676,170
Net Benefits	$23,790,724	-$7,091,753	$14,431,924	-$15,759,815	$7,720,422	-$21,639,512
BCR	2.37	0.55	1.54	0.36	1.23	0.29

Notes: Total Construction Costs furnished by New Orleans District for channel depths and disposal alternatives.

Interest During Construction based on nine-year schedule and OMB discount rate, 7.0 percent.

Present value of Incremental Operation and Maintenance expenditures for each project alternative is calculated from Table 37.

Total Cost is the sum of Total Construction Cost, Interest During Construction, and Incremental O&M.

NED Benefits (transportation cost savings) is the present value of a 50-year stream from 2028 through 2077 at 7.0 percent discount rate.

Average Annual Equivalent Cost, AAEC, is computed based on 0.0724598495 percent (50 years at 7.0 percent) capital recovery factor.

Average Annual Equivalent Benefits, AAEB, is computed based on 0.0724598495 percent (fifty years at 7.0 percent) capital recovery factor

Net Benefits is the difference between AAEB and AAEC (AAEB-AAEC = Net Benefits).

Benefit to Cost Ratio, BCR, is the ratio of AAEB to AAEC (AAEB/AAEC = BCR).

Source: G.E.C., Inc., except as noted.

Table 41. Summary of Project Total Benefits (Transportation Cost Savings and Fabrication Market Values) and Costs by Channel Depth and Disposal Alternative (discount rate = 7.0%)

	2A - 20 ft Adjacent Disposal	1A - 18 ft Adjacent Disposal	2B - 20 ft Earthen Retention	1B - 18 ft Earthen Retention	2C - 20 ft Rock Retention	1C - 18 ft Rock Retention
Total Construction	$175,572,097	$163,650,795	$207,461,803	$187,092,748	$247,328,549	$224,001,365
Interest During Construction	$57,043,982	$52,172,645	$62,105,446	$56,310,696	$69,092,100	$62,742,757
Incremental O&M	$7,848,170	$1,785,663	$100,055,434	$93,831,376	$145,825,767	$131,634,906
Total Cost	$240,464,249	$217,609,103	$369,622,683	$337,234,819	$462,246,417	$418,379,028
NED Benefits	$568,793,998	$119,737,616	$568,793,998	$119,737,616	$568,793,998	$119,737,616
Fabrication Benefits - 50%	$64,036,867	$0	$64,036,867	$0	$64,036,867	$0
Total Benefits	$632,830,865	$119,737,616	$632,830,865	$119,737,616	$632,830,865	$119,737,616
AAEC	$17,424,003	$15,767,923	$26,782,804	$24,435,984	$33,494,306	$30,315,681
AAEB	$45,854,829	$8,676,170	$45,854,829	$8,676,170	$45,854,829	$8,676,170
Net Benefits	$28,430,826	-$7,091,753	$19,072,025	-$15,759,815	$12,360,523	-$21,639,512
BCR	2.63	0.55	1.71	0.36	1.37	0.29

Notes: Total Construction Costs furnished by New Orleans District for channel depths and disposal alternatives.

Interest During Construction based on nine-year schedule and OMB discount rate, 7.0 percent.

Present value of Incremental Operation and Maintenance expenditures for each project alternative is calculated from Table 37.

Total Cost is the sum of Total Construction Cost, Interest During Construction, and Incremental O&M.

NED Benefits (transportation cost savings) is the present value of a 50-year stream from 2028 through 2077 at 7.0 percent discount rate.

Average Annual Equivalent Cost, AAEC, is computed based on 0.0724598495 percent (50 years at 7.0 percent) capital recovery factor.

Average Annual Equivalent Benefits, AAEB, is computed based on 0.0724598495 percent (fifty years at 7.0 percent) capital recovery factor

Net Benefits is the difference between AAEB and AAEC (AAEB-AAEC = Net Benefits).

Benefit to Cost Ratio, BCR, is the ratio of AAEB to AAEC (AAEB/AAEC = BCR).

Source: G.E.C., Inc., except as noted.

APPENDIX

Table A-1. Houma Navigation Canal Commodities, 2009-2013 tons (000)

Commodity	2013 Total	2013 Receipts	2013 Shipments	2013 Through	2012 Total	2012 Receipts	2012 Shipments	2012 Through	2011 Total	2011 Receipts
Total petroleum and petroleum products	606	8	8	590	382	36	17	329	404	29
Total chemicals and related products	2	0	0	2	0	0	0	0	0	0
Total crude materials, inedible except fuels	116	0	0	116	85	0	3	82	57	20
Total primary manufactured products	5	5	0	0	1	1	0	0	2	2
Total food and farm products	0	0	0	0	0	0	0	0	0	0
Total all manufactured equipment, machinery and products	3	1	2	0	3	3	0	0	0	0
Total waste and scrap	0	0	0	0	0	0	0	0	0	0
Total unknown or not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Total	732	14	10	708	471	40	20	411	463	51

Commodity	2011 Shipments	2011 Through	2010 Total	2010 Receipts	2010 Shipments	2010 Through	2009 Total	2009 Receipts	2009 Shipments	2009 Through
Total petroleum and petroleum products	6	369	411	33	28	350	477	1	0	476
Total chemicals and related products	0	0	0	0	0	0	0	0	0	0
Total crude materials, inedible except fuels	0	37	29	9	4	16	138	0	24	114
Total primary manufactured products	0	0	3	2	0	1	3	3	0	0
Total food and farm products	0	0	0	0	0	0	1	0	0	1
Total all manufactured equipment, machinery and products	0	0	3	2	1	0	1	1	0	0
Total waste and scrap	0	0	0	0	0	0	1	1	0	0
Total unknown or not elsewhere classified	0	0	0	0	0	0	0	0	0	0
Total	6	406	446	46	33	367	621	6	24	591

Source: Waterborne Commerce Statistics.

Table A-2. Houma Navigation Canal Commodities, 1995-2008 tons (000)

2008	Internal							Foreign	
Commodity	Total	Inbound		Outbound		Through			Through
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Reciepts	Upbound
Total petroleum and petroleum products	824	0	19	32	0	771	2	0	0
Total chemicals and related products	0	0	0	0	0	0	0	0	0
Total crude materials, inedible except fuels	165	0	0	48	0	74	43	0	0
Total primary manufactured goods	5	0	0	3	0	2	0	0	0
Total food and farm products	0	0	0	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	1	0	0	1	0	0	0	0	0
Total unknown or not elsewhere classified	0	0	0	0	0	0	0	0	0
Total	995	0	19	84	0	847	45	0	0

Source: Waterborne Commerce Statistics.

2007	Internal							Foreign	
Commodity	Total	Inbound		Outbound		Through			Through
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Reciepts	Upbound
Total petroleum and petroleum products	621	0	7	7	0	605	1		1
Total chemicals and related products	0	0	0	0	0	0	0	0	0
Total crude materials, inedible except fuels	205	0	28	45	0	91	41	0	0
Total primary manufactured goods	4	0	3	0	0	1	0	0	0
Total food and farm products	0	0	0	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	14	3	1	1	6	0	2	0	1
Total unknown or not elsewhere classified	0	0	0	0	0	0	0	0	0
Total	844	3	39	53	6	697	44	0	2

Source: Waterborne Commerce Statistics.

2006	Internal							Foreign	
Commodity	Total	Inbound		Outbound		Through			Through
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Reciepts	Upbound
Total petroleum and petroleum products	844	0	5	5	0	776	1	0	57
Total chemicals and related products	0	0	0	0	0	0	0	0	0
Total crude materials, inedible except fuels	183	0	22	39	0	120	2	0	0
Total primary manufactured goods	2	0	0	0	1	1	0	0	0
Total food and farm products	0	0	0	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	0	0	0	0	0	0	0	0	0
Total unknown or not elsewhere classified	0	0	0	0	0	0	0	0	0
Total	1029	0	27	44	1	897	3	0	57

Source: Waterborne Commerce Statistics.

2005	Internal							Coastwise	
Commodity	**Total**	**Inbound**		**Outbound**		**Through**			**Through**
		Upbound	**Downbound**	**Upbound**	**Downbound**	**Upbound**	**Downbound**	**Reciepts**	**Downbound**
Total petroleum and petroleum products	**821**	2	3	17		797	2	0	0
Total chemicals and related products	**0**	0	0	0	0	0	0	0	0
Total crude materials, inedible except fuels	**200**	0	31	44	0	124	1	0	0
Total primary manufactured goods	**5**	0	2	0	1	2	0	0	0
Total food and farm products	**0**	0	0	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	**1**	0	0	0	1	0	0	0	0
Total unknown or not elsewhere classified	**0**	0	0	0	0	0	0	0	0
Total	**1027**	**2**	**36**	**61**	**2**	**923**	**3**	**0**	**0**

Source: Waterborne Commerce Statistics

2004	Internal							Coastwise	
Commodity	**Total**	**Inbound**		**Outbound**		**Through**			**Through**
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Reciepts	Downbound
Total petroleum and petroleum products	**442**	0	6	0	0	435	1	0	0
Total chemicals and related products	**0**	0	0	0	0	0	0		
Total crude materials, inedible except fuels	**112**	0	1	35	3	35	10	0	28
Total primary manufactured goods	**11**	0	11	0	0	0	0		
Total food and farm products	**1**	0	1	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	**14**	0	1	1	12	0	0		
Total unknown or not elsewhere classified	**20**							20	0
Total	**600**	**0**	**20**	**36**	**15**	**470**	**11**	**20**	**28**

Source: Waterborne Commerce Statistics

2003	Internal							Coastwise	
Commodity	**Total**	Inbound		Outbound		Through			Through
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Reciepts	Downbound
Total petroleum and petroleum products	**266**	0	10	0	0	254	2	0	0
Total chemicals and related products	**0**	0	0	0	0	0	0		
Total crude materials, inedible except fuels	**133**	0	2	37	0	55	11	0	28
Total primary manufactured goods	**4**	0	1	0	0	3	0		
Total food and farm products	**2**	0	0	0	0	1	1	0	0
Total waste and scrap nec	**1**	0	0	0	0	1	0		
Total unknown or not elsewhere classified	**20**							20	0
Total	**426**	**0**	**13**	**37**	**0**	**314**	**14**	**20**	**28**

Source: Waterborne Commerce Statistics

2002	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**302**	0	2	0	0	292	8
Total chemicals and related products	**0**	0	0	0	0	0	0
Total crude materials, inedible except fuels	**92**	0	23	55	0	7	7
Total primary manufactured goods	**3**	0	1	0	0	1	1
Total food and farm products	**2**	0	0	0	0	0	2
Total all manufactored equipment, machinery, and products	**4**	0	0	0	0	3	1
Total waste and scrap nec	**1**	0	0	0	0	1	0
Total unknown or not elsewhere classified							
Total	**404**	**0**	**26**	**55**	**0**	**304**	**19**

Source: Waterborne Commerce Statistics

2001	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**444**	0	1	0	0	435	8
Total chemicals and related products	**0**	0	0	0	0	0	0
Total crude materials, inedible except fuels	**79**	0	12	62	0	3	2
Total primary manufactured goods	**2**	0	1	0	0	0	1
Total food and farm products	**0**	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	**6**	1	0	0	2	2	1
Total unknown or not elsewhere classified							
Total	**531**	**1**	**14**	**62**	**2**	**440**	**12**

Source: Waterborne Commerce Statistics

2000	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**319**	1	1	1	1	313	2
Total chemicals and related products	**3**	0	0	0	0	3	0
Total crude materials, inedible except fuels	**78**	1	19	57	0	0	1
Total primary manufactured goods	**4**	0	1	0	0	1	2
Total food and farm products	**2**	1	0	1	0	0	0
Total all manufactored equipment, machinery, and products	**6**	1	0	1	1	1	2
Total unknown or not elsewhere classified							
Total	**412**	**4**	**21**	**60**	**2**	**318**	**7**

Source: Waterborne Commerce Statistics

1999	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**322**	1	0	1	0	308	12
Total chemicals and related products	**0**	0	0	0	0	0	0
Total crude materials, inedible except fuels	**22**	1	1	13	0	5	2
Total primary manufactured goods	**5**	0	0	0	3	1	1
Total food and farm products	**13**	6	0	0	0	7	0
Total all manufactored equipment, machinery, and products	**34**	11	1	1	17	3	1
Total unknown or not elsewhere classified							
Total	**396**	**19**	**2**	**15**	**20**	**324**	**16**

Source: Waterborne Commerce Statistics

1998	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**383**	0	0	0	0	382	1
Total chemicals and related products	**0**	0	0	0	0	0	0
Total crude materials, inedible except fuels	**32**	0	2	1	0	14	15
Total primary manufactured goods	**28**	3	0	1	22	2	0
Total food and farm products	**19**	7	0	0	0	12	0
Total all manufactored equipment, machinery, and products	**14**	0	0	0	10	3	1
Total waste and scrap nec	**0**						
Total unknown or not elsewhere classified							
Total	**476**	**10**	**2**	**2**	**32**	**413**	**17**

Source: Waterborne Commerce Statistics

1997	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**426**	0	0	0	0	426	0
Total chemicals and related products	**0**						
Total crude materials, inedible except fuels	**38**	0	0	0	0	30	8
Total primary manufactured goods	**55**	6	7	2	28	1	11
Total food and farm products	**0**	0	0	0	0	0	0
Total all manufactored equipment, machinery, and products	**6**	0	1	1	2	2	0
Total waste and scrap nec	**0**						
Total unknown or not elsewhere classified							
Total	**525**	**6**	**8**	**3**	**30**	**459**	**19**

Source: Waterborne Commerce Statistics

1996	Internal								
Commodity	Total	Inbound		Outbound		Through		Intra	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound	Upbound	Downbnd
Total petroleum and petroleum products	**462**	0	0	0	0	461	1		
Total chemicals and related products	**0**								
Total crude materials, inedible except fuels	**79**	0	3	3	6	8	59	0	0
Total primary manufactured goods	**30**	3	1	0	21	1	2	1	1
Total food and farm products	**28**	10	0	0	0	18	0	0	0
Total all manufactored equipment, machinery, and products	**13**	1	0	1	1	8	1	0	1
Total waste and scrap nec	**0**								
Total unknown or not elsewhere classified									
Total	**612**	**14**	**4**	**4**	**28**	**496**	**63**	**1**	**2**

Source: Waterborne Commerce Statistics

1995	Internal						
Commodity	Total	Inbound		Outbound		Through	
		Upbound	Downbound	Upbound	Downbound	Upbound	Downbound
Total petroleum and petroleum products	**364**	0	0	0	0	361	3
Total chemicals and related products	**2**	0	2	0	0	0	0
Total crude materials, inedible except fuels	**228**	0	42	17	4	5	160
Total primary manufactured goods	**23**	2	0	2	18	1	0
Total food and farm products	**62**	22	0	0	1	39	0
Total all manufactored equipment, machinery, and products	**8**	1	1	1	3	2	0
Total waste and scrap nec	**0**	0	0	0	0	0	0
Total unknown or not elsewhere classified							
Total	**687**	**25**	**45**	**20**	**26**	**408**	**163**

Source: Waterborne Commerce Statistics

Table A-3. Houma Navigation Canal Vessel Trips and Sailing Drafts, 2009-2013

Draft (ft.)	2013 All	2013 Up	2013 Down	2012 All	2012 Up	2012 Down	2011 All	2011 Up	2011 Down	2010 All	2010 Up	2010 Down	2009 All	2009 Up	2009 Down
0 to 5	1,803	942	861	1,738	860	878	1,788	845	943	1,884	957	927	3,285	1,593	1,692
6 to 9	2,317	840	1,477	1,754	776	978	1,866	786	1,080	2,113	971	1,142	2,552	1,067	1,485
10 to 12	123	39	84	269	200	69	119	60	59	91	32	59	99	40	59
13 to 14	18	9	9	12	4	8	19	9	10	7	4	3	3	1	2
15 to 17	6	3	3	4	0	4	4	2	2	5	4	1	35	12	23
18 to 20	0	0	0	3	2	1	1	1	0	1	0	1	0	0	0
Total	4,267	1,833	2,434	3,780	1,842	1,938	3,797	1,703	2,094	4,101	1,968	2,133	5,974	2,713	3,261

Source: Waterborne Commerce Statistics.

Table A-4. Houma Navigation Canal Vessel Trips and Sailing Drafts, 1995-2008

2008												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**4,936**	**1,016**	**0**	**2,214**	**153**	**1,553**	**4,037**	**442**	**0**	**1,879**	**134**	**1,582**
Foreign												
18							1	1				
17							1	1				
16							1	1				
15	15	15					8	7			1	
14	11	10			1		1	1				
13	10	9		1			5	4		1		
12	49	44		2	3		46	46				
11	3	3					3	2		1		
10	15	9		3	3		4	2		1	1	
9	75	68		6	1		50	48		1	1	
8	67	60		5	2		46	41		1	4	
7	40	35		5			29	25		3	1	
≤6	17	14			3		5	5				
Total	**302**	**267**	**0**	**22**	**13**	**0**	**200**	**184**	**0**	**8**	**8**	**0**
Domestic												
18												
15	9			9			9			9		
14												
13							1	2		1		
12	3	2				1	2					
11							1				1	
10	31	3		24		4	29	1		24	2	2
9	187	4		177	2	4	175	5		159	11	
8	84	2		43	1	38	57	3		41	11	2
7	655	248		332		75	352	86		260	6	
≤6	3,665	490		1,607	137	1,431	3,211	161		1,377	95	1,578
Total	**4,634**	**749**	**0**	**2,192**	**140**	**1,553**	**3,837**	**258**	**0**	**1,871**	**126**	**1,582**

Source: Waterborne Commerce Statistics

2007												
Upbound							Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**5,086**	**1,689**	**0**	**1,926**	**260**	**1,211**	**4,251**	**1,152**	**1**	**1,733**	**191**	**1,174**
Foreign												
17	5	5										
16	4	4										
15	28	24		3	1		15	13			1	1
14	25	4		2	19		16	1			15	
13	15	9		5		1	6	5		1		
12	68	59		5	4		23	21	1		1	
11	38	25		6	7		12	6		3	3	
10	42	25		11	6		15	10		3	2	
9	142	131		7	4		109	100		3	6	
8	87	76		6	5		31	28		2	1	
7	76	64		8	4		24	21		1	2	
≤6	63	27		1	35		22	12			10	
Total	**593**	**453**	**0**	**54**	**85**	**1**	**273**	**217**	**1**	**13**	**41**	**1**
Domestic												
18												
15												
14												
13												
12	1			1								
11	22					22	3			2		1
10	147	105		39		3	48	5		38	5	
9	115	5		100		10	107	3		90	13	1
8	266	7		193	2	64	159	8		128	23	
7	1,106	540		481		85	960	457		491	10	2
≤6	2,836	579		1,058	173	1,026	2,701	462		971	99	1,169
Total	**4,493**	**1,236**	**0**	**1,872**	**175**	**1,210**	**3,978**	**935**	**0**	**1,720**	**150**	**1,173**

Source: Waterborne Commerce Statistics

2006												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**4,214**	**673**	**0**	**1,987**	**141**	**1,413**	**4,003**	**499**	**0**	**1,973**	**118**	**1,413**
Foreign												
16	3	2			1							
15	5	2		1	2		3	1		1	1	
14	9	7		2			2	1		1		
13	8	5		3			1	1				
12	91	86		4	1		66	65			1	
11	32	30		1	1							
10	15	14			1		4	4				
9	18	17		1			13	13				
8	32	28		2	2		3	3				
7	19	19					7	5			2	
≤6	75	60		2	13		8	4			4	
Total	**307**	**270**	**0**	**16**	**21**	**0**	**107**	**97**	**0**	**2**	**8**	**0**
Domestic												
18												
15	1			1								
14												
13												
12	4	1		2		1	2				2	
11	23			1		22	6			1	5	
10	100	66		25		9	14			14		
9	162			129		33	102			97	5	
8	120	2		61		57	51	2		48	1	
7	572	79		396		97	317	1		316		
≤6	2,925	255		1,356	120	1,194	3,404	399		1,495	97	1,413
Total	**3,907**	**403**	**0**	**1,971**	**120**	**1,413**	**3,896**	**402**	**0**	**1,971**	**110**	**1,413**

Source: Waterborne Commerce Statistics

2005												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**3,732**	**258**	**0**	**1,900**	**118**	**1,456**	**3,648**	**236**	**0**	**1,892**	**102**	**1,418**
Foreign												
16	1	1	0	0	0	0	0	0	0	0	0	0
15	3	2	0	1	0	0	2	1	0	1	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
13	3	2	0	1	0	0	2	2	0	0	0	0
12	9	4	0	4	0	1	4	4	0	0	0	0
11	3	3	0	0	0	0	1	0	0	1	0	0
10	10	6	0	4	0	0	6	3	0	2	1	0
9	1	0	0	1	0	0	1	0	0	1	0	0
8	7	3	0	3	1	0	1	1	0	0	0	0
7	9	8	0	0	1	0	4	3	0	1	0	0
≤6	17	0	0	0	16	1	3	0	0	0	3	0
Total	**62**	**28**	**0**	**14**	**18**	**2**	**24**	**14**	**0**	**6**	**4**	**0**
Domestic												
18	0	0	0	0	0	0	0	0	0	0	0	0
15	2	0	0	0	0	2	0	0	0	0	0	0
14	2	2	0	0	0	0	2	2	0	0	0	0
13	2	1	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	1	0	0	0	0	0	0
11	9	5	0	0	0	9	1	1	0	0	0	0
10	48	0	0	26	0	17	30	3	0	25	2	0
9	177	1	0	111	1	64	114	0	0	107	7	0
8	204	0	0	106	0	98	103	0	0	93	8	2
7	476	4	0	339	0	133	307	3	0	299	4	1
≤6	2,750	217	0	1,304	99	1,130	3,067	213	0	1,362	77	1,415
Total	**3,670**	**230**	**0**	**1,886**	**100**	**1,454**	**3,624**	**222**	**0**	**1,886**	**98**	**1,418**

Source: Waterborne Commerce Statistics

2004												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**
Grand Total	**2,828**	**268**	**0**	**1,530**	**227**	**803**	**2,608**	**151**	**0**	**1,485**	**171**	**801**
Foreign												
15	8	6	0	1	1	0	0	0	0	0	0	0
14	1	1	0	0	0	0	3	3	0	0	0	0
13	10	3	0	6	1	0	2	2	0	0	0	0
12	23	9	0	9	5	0	4	4	0	0	0	0
11	14	4	0	10	0	0	5	3	0	1	1	0
10	33	27	0	6	0	0	8	5	0	1	2	0
9	14	8	0	1	5	0	3	3	0	0	0	0
8	32	13	0	4	14	1	6	5	0	1	0	0
7	25	13	0	6	6	0	1	1	0	0	0	0
<6	102	65	0	6	30	1	9	6	0	0	3	0
Total	**262**	**149**	**0**	**49**	**62**	**2**	**41**	**32**	**0**	**3**	**6**	**0**
Domestic												
18	0	0	0	0	0	0	1	0	0	0	1	0
15	0	0	0	0	0	0	1	1	0	0	0	0
14	1	0	0	0	0	1	0	0	0	0	0	0
13	1	0	0	0	0	1	0	0	0	0	0	0
12	2	1	0	0	0	1	3	0	0	0	0	3
11	3	0	0	0	0	3	90	0	0	90	0	0
10	78	39	0	32	1	6	62	41	0	21	0	0
9	144	2	0	116	1	25	107	0	0	99	8	0
8	272	3	0	212	3	54	193	1	0	175	17	0
7	253	9	0	204	1	39	191	11	0	162	3	15
<6	1,812	65	0	917	159	671	1,919	65	0	935	136	783
Total	**2,566**	**119**	**0**	**1,481**	**165**	**801**	**2,567**	**119**	**0**	**1,482**	**165**	**801**

Source: Waterborne Commerce Statistics

2003												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**2,936**	**452**	**0**	**1,682**	**262**	**540**	**2,545**	**377**	**0**	**1,403**	**260**	**505**
Foreign												
17	4	0	0	0	4	0	0	0	0	0	0	0
16	6	4	0	1	1	0	1	0	0	1	0	0
15	3	0	0	3	0	0	2	1	0	1	0	0
14	3	3	0	0	0	0	1	1	0	0	0	0
13	3	0	0	3	0	0	2	1	0	1	0	0
12	15	9	0	4	2	0	6	5	0	0	1	0
11	20	7	0	12	1	0	1	1	0	0	0	0
10	19	15	0	3	1	0	7	6	0	1	0	0
9	17	7	0	8	2	0	6	4	0	2	0	0
8	48	16	0	5	27	0	9	8	0	0	1	0
7	8	6	0	0	2	0	3	2	0	0	1	0
<6	47	31	0	1	15	0	15	7	0	0	8	0
Total	**193**	**98**	**0**	**40**	**55**	**0**	**53**	**36**	**0**	**6**	**11**	**0**
Domestic												
16	0	0	0	0	0	0	1	1	0	0	0	0
15	1	1	0	0	0	0	2	2	0	0	0	0
14	4	4	0	0	0	0	6	5	0	1	0	0
13	0	0	0	0	0	0	1	1	0	0	0	0
12	13	3	0	10	0	0	18	9	0	8	1	0
11	4	4	0	0	0	0	4	2	0	0	2	0
10	54	33	0	15	0	6	75	61	0	14	0	0
9	165	46	0	94	0	25	84	15	0	67	2	0
8	122	7	0	84	0	31	63	4	0	59	0	0
7	217	3	0	193	2	19	166	2	0	161	0	3
<6	2,163	253		1,246	205	459	2,072	239	0	1,087	244	502
Total	**2,743**	**354**	**0**	**1,642**	**207**	**540**	**2,492**	**341**	**0**	**1,397**	**249**	**505**

Source: Waterborne Commerce Statistics

2002												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**2,130**	**185**	**0**	**1,351**	**334**	**260**	**1,924**	**145**	**0**	**1,225**	**270**	**284**
Foreign												
15	9	1	0	2	6	0	1	1	0	0	0	0
14	3	2	0	1	0	0	1	0	0	1	0	0
13	3	3	0	0	0	0	2	2	0	0	0	0
12	16	7	0	8	1	0	8	5	0	2	1	0
11	27	6	0	18	3	0	2	0	0	2	0	0
10	21	9	0	11	1	0	7	3	0	4	0	0
9	44	17	0	26	1	0	3	1	0	2	0	0
8	27	7	0	10	10	0	2	2	0	0	0	0
7	48	9	0	29	10	0	12	3	0	4	5	0
<6	57	4	0	25	28	0	10	3	0	4	3	0
Total	**255**	**65**	**0**	**130**	**60**	**0**	**48**	**20**	**0**	**19**	**9**	**0**
Domestic												
15	1	0	0	0	0	1	0	0	0	0	0	0
14	4	2	0	1	0	1	2	2	0	0	0	0
13	1	0	0	0	0	1	0	0	0	0	0	0
12	2	1	0	1	0	0	21	5	0	4	0	12
11	1	0	0	1	0	0	7	1	0	0	0	6
10	10	7	0	3	0	0	51	4	0	34	1	12
9	181	6	0	148	2	25	156	5	0	138	11	2
8	87	6	0	80	1	0	101	4	0	69	5	23
7	226	5	0	199	0	22	189	2	0	179	1	7
<6	1,362	93	0	788	271	210	1,349	102	0	782	243	222
Total	**1,875**	**120**	**0**	**1,221**	**274**	**260**	**1,876**	**125**	**0**	**1,206**	**261**	**284**

Source: Waterborne Commerce Statistics

2001												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**
Grand Total	**2,219**	**653**	**0**	**883**	**367**	**316**	**1,726**	**508**	**0**	**739**	**188**	**291**
Foreign												
15	6	4	0	1	1	0	4	4	0	0	0	0
14	9	7	0	2	0	0	6	4	0	2	0	0
13	4	2	0	2	0	0	1	0	0	0	1	0
12	17	7	0	7	3	0	7	6	0	1	0	0
11	21	16	0	4	1	0	1	1	0	0	0	0
10	37	20	0	11	6	0	9	5	0	4	0	0
9	42	22	0	17	3	0	6	5	0	1	0	0
8	46	24	0	7	15	0	5	2	0	0	3	0
7	48	23	0	6	19	0	5	1	0	0	4	0
<6	85	28	0	0	57	0	5	1	0	0	4	0
Total	**315**	**153**	**0**	**57**	**105**	**0**	**49**	**29**	**0**	**8**	**12**	**0**
Domestic												
15	0	0	0	0	0	0	1	0	0	1	0	0
14	2	2	0	0	0	0	1	1	0	0	0	0
12	4	0	0	1	0	3	1	0	0	1	0	0
11	12	5	0	0	0	7	13	9	0	0	4	0
10	119	97	0	8	0	14	98	87	0	11	0	0
9	160	1	0	133	3	23	140	7	0	127	6	0
8	166	8	0	90	0	68	88	8	0	79	0	1
7	160	21	0	91	0	48	109	16	0	89	0	4
<6	1281	366	0	503	259	153	1226	351	0	423	166	286
Total	**1,904**	**500**	**0**	**826**	**262**	**316**	**1,677**	**479**	**0**	**731**	**176**	**291**

Source: Waterborne Commerce Statistics

2000												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**1,699**	**479**	**0**	**744**	**233**	**243**	**1,366**	**169**	**0**	**619**	**364**	**214**
Foreign												
18	0	0	0	0	0	0	1	0	0	1	0	0
17	0	0	0	0	0	0	1	1	0	0	0	0
16	2	1	0	0	1	0	2	2	0	0	0	0
15	10	4	0	5	1	0	6	4	0	2	0	0
14	4	2	0	1	1	0	8	4	0	2	2	0
13	15	14	0	1	0	0	8	6	0	2	0	0
12	24	21	0	2	1	0	10	8	0	2	0	0
11	104	102	0	1	1	0	6	5	0	0	1	0
10	30	22	0	5	3	0	16	11	0	5	0	0
9	13	12	0	1	0	0	8	2	0	3	2	1
8	28	21	0	0	7	0	5	4	0	1	0	0
7	57	54	0	0	3	0	6	3	0	0	3	0
<6	107	75	0	0	29	3	14	5	0	0	9	0
Total	**392**	**327**	**0**	**16**	**46**	**3**	**87**	**52**	**0**	**17**	**17**	**1**
Domestic												
15	1	0	0	0	0	1	2	2	0	0	0	0
14	8	6	0	2	0	0	5	5	0	0	0	0
13	2	2	0	0	0	0	1	1	0	0	0	0
12	22	22	0	0	0	0	27	27	0	0	0	0
11	1	0	0	0	0	1	0	0	0	0	0	0
10	34	0	0	11	0	23	11	1	0	10	0	0
9	116	1	0	94	0	21	108	1	0	97	10	0
8	108	4	0	71	1	32	66	4	0	60	2	0
7	240	25	0	138	0	77	162	23	0	136	1	2
<6	775	92	0	412	186	85	897	53	0	299	334	211
Total	**1,307**	**152**	**0**	**728**	**187**	**240**	**1,279**	**117**	**0**	**602**	**347**	**213**

Source: Waterborne Commerce Statistics

1999												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**1,421**	**471**	**2**	**572**	**204**	**172**	**1,226**	**370**	**3**	**570**	**116**	**167**
Foreign												
15	8	5	0	1	2	0	9	4	0	1	4	0
14	3	1	0	0	2	0	2	1	0	1	0	0
13	5	3	0	1	1	0	1	1	0	0	0	0
12	20	14	1	3	2	0	18	13	3	2	0	0
11	22	19	0	2	1	0	11	11	0	0	0	0
10	23	20	0	1	2	0	22	18	0	2	2	0
9	6	6	0	0	0	0	9	9	0	0	0	0
8	26	19	0	0	7	0	15	11	0	0	4	0
7	32	28	0	0	4	0	6	6	0	0	0	0
<6	71	52	0	0	19	0	38	22	0	0	16	0
Total	**216**	**167**	**1**	**8**	**40**	**0**	**131**	**96**	**3**	**6**	**26**	**0**
Domestic												
14	8	8	0	0	0	0	6	4	0	2	0	0
13	28	27	0	0	0	1	27	27	0	0	0	0
12	15	7	0	4	0	4	8	5	0	3	0	0
11	10	4	0	0	0	6	5	3	0	2	0	0
10	35	14	0	5	0	16	10	3	0	5	1	1
9	72	6	0	32	0	34	17	6	0	8	1	2
8	133	39	0	79	0	15	78	35	0	43	0	0
7	230	21	0	182	1	26	129	17	0	111	0	1
<6	674	178	1	262	163	70	815	174	0	390	88	163
Total	**1,205**	**304**	**1**	**564**	**164**	**172**	**1,095**	**274**	**0**	**564**	**90**	**167**

Source: Waterborne Commerce Statistics

1998												
Upbound							Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**2,281**	**964**	**69**	**705**	**339**	**204**	**2,158**	**884**	**32**	**715**	**291**	**236**
Foreign												
18	0	0	0	0	0	0	3	1	0	1	1	0
16	0	0	0	0	0	0	2	2	0	0	0	0
15	60	41	9	3	6	1	59	39	7	5	8	0
14	50	34	2	10	4	0	48	38	1	5	4	0
13	55	45	2	6	2	0	63	53	1	4	5	0
12	153	112	27	9	5	0	135	103	7	13	11	1
11	89	65	8	7	9	0	81	53	3	17	8	0
10	171	110	7	15	39	0	150	105	6	14	25	0
9	157	117	4	9	26	1	116	72	1	11	32	0
8	99	74	1	6	18	0	76	61	0	6	9	0
7	117	102	2	2	11	0	116	97	2	5	12	0
<6	197	84	7	10	95	1	147	83	4	7	53	0
Total	**1148**	**784**	**69**	**77**	**215**	**3**	**991**	**704**	**32**	**87**	**167**	**1**
Domestic												
14	1	1	0	0	0	0	1	1	0	0	0	0
13	3	3	0	0	0	0	15	14	0	0	1	0
12	19	10	0	8	0	1	9	8	0	0	1	0
11	3	0	0	0	1	2	1	0	0	0	1	0
10	22	8	0	5	1	8	14	4	0	6	3	1
9	75	9	0	18	0	48	34	0	0	27	4	3
8	151	3	0	111	3	34	106	2	0	89	6	9
7	234	72	0	117	5	40	203	82	0	106	0	15
<6	625	74	0	369	114	68	784	69	0	400	108	207
Total	**1,133**	**180**	**0**	**628**	**124**	**201**	**1,167**	**180**	**0**	**628**	**124**	**235**

Source: Waterborne Commerce Statistics

1997												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**2,224**	**752**	**1**	**983**	**260**	**228**	**2,325**	**764**	**0**	**977**	**275**	**309**
Foreign												
18	7	5	0	0	2	0	3	3	0	0	0	0
17	14	1	0	1	12	0	1	1	0	0	0	0
16	5	1	0	1	3	0	3	0	0	1	2	0
15	10	5	0	1	4	0	6	3	0	1	2	0
14	7	5	0	1	1	0	1	1	0	0	0	0
13	15	8	0	1	6	0	7	3	0	1	3	0
12	23	13	0	0	10	0	11	10	0	0	1	0
11	39	33	1	5	0	0	109	104	0	1	4	0
10	24	23	0	1	0	0	118	113	0	1	4	0
9	89	87	0	2	0	0	46	15	0	2	28	1
8	119	88	0	2	29	0	35	7	0	0	28	0
7	41	21	0	0	20	0	29	2	0	0	27	0
<6	111	86	0	0	25	0	114	100	0	1	13	0
Total	**478**	**369**	**1**	**13**	**95**	**0**	**476**	**358**	**0**	**7**	**110**	**1**
Domestic												
12	6	1	0	4	1	0	5	2	0	2	1	0
11	27	4	0	1	0	22	21	20	0	1	0	0
10	28	3	0	3	1	21	18	2	0	15	1	0
9	63	0	0	29	0	34	17	1	0	15	1	0
8	128	6	0	81	1	40	249	5	0	237	7	0
7	150	53	0	86	0	11	336	45	0	246	11	34
<6	1344	316	0	766	162	100	1203	331	0	454	144	274
Total	**1,746**	**383**	**0**	**970**	**165**	**228**	**1,849**	**406**	**0**	**970**	**165**	**308**

Source: Waterborne Commerce Statistics

1996												
	Upbound						Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**	**Total**	**Dry Cargo**	**Tanker**	**Tow or Tug**	**Dry Cargo**	**Tanker**
Grand Total	**2,722**	**772**	**0**	**1,397**	**315**	**238**	**2,430**	**630**	**0**	**1,308**	**220**	**272**
Foreign												
18	2	0	0	1	1	0	1	1	0	0	0	0
17	28	2	0	3	23	0	0	0	0	0	0	0
16	19	2	0	1	16	0	2	1	0	0	1	0
15	14	4	0	2	8	0	7	3	0	2	2	0
14	4	3	0	1	0	0	2	1	0	1	0	0
13	23	14	0	2	7	0	4	3	0	0	1	0
12	26	10	0	0	16	0	15	8	0	3	4	0
11	34	22	0	3	9	0	23	21	0	2	0	0
10	60	41	0	5	14	0	16	12	0	1	3	0
9	32	31	0	0	1	0	15	10	0	3	2	0
8	65	51	0	3	11	0	13	6	0	4	3	0
7	37	29	0	3	5	0	8	5	0	0	3	0
<6	90	42	0	1	47	0	24	14	0	2	8	0
Total	**385**	**247**	**0**	**20**	**118**	**0**	**127**	**83**	**0**	**18**	**26**	**0**
Domestic												
12	14	1	0	6	1	6	9	1	0	6	2	0
11	16	0	0	4	0	12	0	0	0	0	0	0
10	41	3	0	17	0	21	38	0	0	33	2	3
9	74	2	0	21	2	49	59	2	0	24	33	0
8	132	1	0	90	3	38	126	13	0	103	10	0
7	421	72	0	323	1	25	423	61	0	323	5	34
<6	1639	446	0	916	190	87	1648	470	0	801	142	235
Total	**2,337**	**525**	**0**	**1,377**	**197**	**238**	**2,303**	**547**	**0**	**1,290**	**194**	**272**

Source: Waterborne Commerce Statistics

1995												
Upbound							Downbound					
	Self Propelled Vessels				Non-Self Propelled		Self Propelled Vessels				Non-Self Propelled	
Draft	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
Grand Total	**2,630**	**542**	**0**	**1,504**	**353**	**231**	**2,586**	**538**	**0**	**1,492**	**333**	**223**
Foreign												
18	1	0	0	1	0	0	1	0	0	1	0	0
17	2	0	0	0	2	0	6	0	0	0	6	0
16	11	2	0	3	6	0	2	0	0	1	1	0
15	3	1	0	0	2	0	5	3	0	2	0	0
14	12	2	0	7	3	0	2	1	0	0	1	0
13	11	6	0	1	4	0	3	3	0	0	0	0
12	22	15	0	4	3	0	23	9	0	3	11	0
11	9	1	0	5	3	0	24	18	0	2	4	0
10	30	17	0	3	10	0	28	19	0	7	2	0
9	10	7	0	1	2	0	7	4	0	2	1	0
8	17	10	0	5	2	0	11	5	0	3	3	0
7	7	5	0	1	1	0	5	2	0	1	2	0
<6	50	18	0	5	26	1	49	15	0	1	32	1
Total	**171**	**82**	**0**	**32**	**56**	**1**	**157**	**79**	**0**	**21**	**56**	**1**
Domestic												
14	1	1	0	0	0	0	0	0	0	0	0	0
13	8	0	0	8	0	0	2	0	0	2	0	0
12	35	8	0	2	2	23	32	29	0	0	3	0
11	13	5	0	1	0	7	6	5	0	1	0	0
10	30	0	0	18	3	9	41	1	0	27	13	0
9	67	2	0	37	8	20	107	1	0	25	79	2
8	334	32	0	262	3	37	297	29	0	240	28	0
7	345	9	0	323	1	12	381	12	0	328	16	25
<6	1626	403	0	821	280	122	1563	382	0	848	138	195
Total	**2,459**	**460**	**0**	**1,472**	**297**	**230**	**2,429**	**459**	**0**	**1,471**	**277**	**222**

Source: Waterborne Commerce Statistics

MODEL CERTIFICATION

Description of Houma Navigation Economic Benefits Worksheets (Models)

I. Introduction

This paper is intended to obtain Economic approval for a set of standards and protocols for development of Corps spreadsheet economic models. HQUSACE Office of Water Project Review is now charged with approving planning models for use, as well as for certification of planning models (see EC 1105-2-412).

The Houma Navigation Canal economic benefits spreadsheet model is computed for two categories, NED benefits and fabrication benefits. The computations for each benefit category are contained in a series of worksheets which appear in the economic appendix as tables.

I.1 NED Benefits

NED benefits have been developed from different categories of present and or prospective users (vessels) of the HNC.

The NED benefits tables numbers from the economics appendix (in bold) are as follows (worksheet tabs in parenthesis): (1) **Table 11** (Table 11), Houma Navigation Canal Base Year NED Benefits; (2) **Table 12B** (Table 5-2), Lower 48 Crude Oil Production by Supply Region, High and Low Growth Forecasts, 2013-2040; (3) **Table 13** (Table 19(4)), Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel, and Category: 2014-2076; (4) **Table 14** (Table 19(5)), NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076; (5) **Table 15** (Table 19(6)), Present Values of NED Benefits Corresponding to the Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2027-2076 discount rate = 3.125%; (6) **Table 16** (Table 19(8)), No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076; (7) **Table 17** (Table 19(9)), NED Benefits Corresponding to the No Growth in Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076; (8) **Table 18** (Table 19(7)), Present Values of NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category for No Growth : 2027-2076 discount rate = 3.125%; (9) **Table 28** (Table 28), Houma Navigation Canal Benefiting Vessel Fleet Sailing Draft Distributions; (10) **Table 29** (Table 29(2)), Present Values of NED Benefits Corresponding to Sailing Drafts of Number of Vessel Trips in With-Project Conditions by Activity, Vessel and Category: 2027-2076: discount rate = 3.125%; and (11) **Table 30** (Table 30(2)), Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027-2076

I.2 Fabrication Benefits

Fabrication benefits, corresponding to the market values of deepwater oil/gas structures that would be constructed at Houma and shipped via the HNC, have been developed.

The fabrication benefits tables from the economics appendix (in bold) are as follows (worksheet tabs in parenthesis): (1) **Table 19** (RTable 9(2)), Infield GOM Projections Deepwater Topside Installations, 2005 and 2009; (2) **Table 21** (RTable 11), Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size; (3) **Table 22** (RTable 12), Infield GOM 2005 and 2009 Deepwater Oil/Gas Platforms Projected by Channel Depth Requirements; (4) **Table 23** (RTable 13(2)), Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods, 2027-2076; (5) **Table 24** (RTable 14(2)), Fabrication Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076; (6) **Table 25** (RTable 15-Table 25(2)), Present Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076; (7) **Table 26** (RTable 17(4)), Present Value of Fabrication Benefits for HNC by GOM Deepwater Topsides Market Share and Channel Depth for 2027-2076 and 2032-2076; (8) **Table 20** (RTable 10(2)), HNC Market Shares of Projected GOM Deepwater Topsides, 2005 and 2009; and (9) **Table 30** (Table 30(2)), Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027-2076

II. Description of Benefits Worksheets

II.1 NED Benefits

NED benefits are based on efficiencies of the current or prospective vessel fleets calling the HNC in with-project conditions.

II.1.1 Table 11. Houma Navigation Canal Base Year NED Benefits

The purpose of this table as described in the economics appendix is to establish the different categories of NED benefits that arise from a deeper navigation channel for the Houma Navigation Canal (HNC). Currently, in without-project conditions and existing maintenance vessels are usually restricted to a maximum sailing draft of 13 feet (refer to Table 6 for a time series of vessel sailing drafts reported for the HNC). Consequently, there are a number of issues that arise from insufficient channel depth that affect larger vessels that would use the HNC in with-project conditions. As described in the economics appendix the potential users of the HNC are affected by rerouting (using alternative waterways with greater distances and costs), tug assistance (because of difficulty navigating with the vessels own power), diversions (to other ports and longer distances) deeper loadings (more efficient use of existing vessels and the attraction of deeper loaded vessels and cost savings) and new vessel trips (special handling circumstances for new vessels fabricated in Houma that are too large to be floated out to the Gulf of Mexico via the HNC under power and instead have to be transshipped via barges and tugs to be offloaded in deeper water.

For each vessel benefit category, rerouting, tug assistance, diversions, deeper loading and new vessel trips, there are subcategories with regard to particular applications. The base line quantity of annual affected vessels and trips per vessel are specified. Without-project conditions trip costs and total annual costs are computed. Similarly with-project trip cost and total annual costs

are computed (refer to economic appendix for the detailed compilations of the costs for without-project and with-project conditions). The NED benefits for the base year are computed from subtracting the total with-project cost from the total without-project cost, for each category and category.

II.1.2 Table 12B. Lower 48 Crude Oil Production by Supply Region, High and Low Growth Forecasts, 2013-2040

The purpose of this table is to present the very long range annual crude petroleum production forecasts for Gulf of Mexico offshore oil and gas production which is the primary market served by the HNC. The annual oil production forecast, 2015 through 2040, is developed annually by the U.S. Department of Energy (DOE) Energy Information Administration (EIA) for the Annual Energy Outlook (AEO). The AEO is updated annually and the duration of the forecast is extended every five years. The 2015 AEO covers the span of twenty-six years out through 2040.

The forecasts of annual oil production expressed as millions of barrels per day, are computed in terms of the Average Annual Compound Growth Rates (AACGR) between the base year, 2013, and the duration of the forecast, 2040. The AACGR for the Gulf Coast that covers "off shore", including shallow and deep, is 1.629% between 2013 and 2040. This is the growth rate used for the benefiting vessel trips (Table 11) for the HNC.

II.1.3 Table 13. Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

The purpose of this table is to forecast the base year number of benefiting vessel trips from Table 11 for the period of with-project conditions, 2027 through 2076, based on the current construction schedule. The base year vessel trips in 2013 are forecasted for the period 2014 through 2076. The AACGR is used from Table 12B for the Gulf Coast "off shore" oil production growth of 1.629% per year for the period 2014 through 2040. After 2040 there is no further growth forecasted for Gulf Coast "off shore" oil production.

Table 13 presents the annual benefitting vessel trips for each category (rerouting, tug assistance, diversions, deep loading, and new vessel trips) and subcategory. The negative numbers for deeper loadings of barges for risers and OSV rigs are for vessel movements saved from with-project conditions. Total trips of all vessels are summed and expressed for the vessel categories of increased trips for light tugs, tug/barge, dry cargo barge, tug assistance and new vessel trips.

II.1.4 Table 14. NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

The purpose of this table is to quantify the NED benefits for the categories and subcategories in Table 11 with the forecasted numbers of benefiting vessel trips from Table 13. The NED annual benefits values in Table 11 are used to multiply the annual number of vessel trips to arrive at the annual benefits in Table 14. Table 14 displays the annual benefits for the period 2014-2076. The total benefits (all vessels) are compiled in the column "Total (all vessels)". Total annual savings are compiled for different benefit categories in columns, "Increased Trips Light Tug",

"Increased Trips Tug/Barge", "Increased Trips Dry Cargo", "Tug Assist", and "New Vessel Trips".

II.1.5 Table 15. Present Values of NED Benefits Corresponding to the Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2027-2076 discount rate = 3.125%.

The purpose of this table is to transform the gross NED benefits in Table 14 to a discounted present value, using the current water resources discount rate, 3.125% (FY 2016). The fifty year time frame for with-project conditions, 2027-2076, is used to arrive at a present value of the categories and subcategories of NED benefits as previously presented in Tables 13 and 14.

II.1.6 Table 16. No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

The purpose of this table is to present a "no growth" forecast of the annual benefiting vessels for the with-project conditions (20-ft. project) and ultimately in subsequent tables the NED benefits and present values thereof that correspond to a "no growth" forecast. Accordingly, the base year benefitting vessel trips from Table 11 remain constant throughout the time frame 2014-2076. Table 16 with an annual growth rate of "0.00%" (2014-2076) is identical in structure to Table 13 with annual growth rates of 1.629% (2014-2040) and 0.00% (2041-2076).

II.1.7 Table 17. NED Benefits Corresponding to the No Growth in Forecasted Number of Vessel Trips in With-Project Conditions(20-ft. Project) by Activity, Vessel and Category: 2014- 2076

The purpose of this table is to quantify the NED benefits for the categories and subcategories in Table 11 with the numbers of benefiting vessel trips from Table 13 under a "no growth" forecast (Table 16). Similar to Table 14 the NED annual benefits values in Table 11 are used to multiply the annual number of vessel trips under "no growth" (Table 16) to arrive at the annual benefits in Table 17. Table 17 displays the annual benefits for "no growth" for the baseline fleet in 2013 for period 2014-2076. The total benefits (all vessels) are compiled in the column "Total (all vessels)". Total annual savings are compiled for different benefit categories in columns, "Increased Trips Light Tug", "Increased Trips Tug/Barge", "Increased Trips Dry Cargo", "Tug Assist", and "New Vessel Trips".

II.1.8 Table 18

Present Values of NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category for No Growth: 2027-2076 discount rate = 3.125%.

The purpose of this table is to transform the gross NED benefits in Table 17 to a discounted present value, using the current water resources discount rate, 3.125% (FY 2016). The fifty year time frame for with-project conditions, 2027-2076, is used to arrive at a present value of the categories and subcategories of NED benefits as previously presented in Tables 16 and 17.

II.1.9 Table 28. Houma Navigation Canal Benefiting Vessel Fleet Sailing Draft Distributions

The purpose of this table is to define the sailing draft distributions for the categories of benefiting vessels in Table 11. The expected sailing drafts for each benefiting vessel category, rerouting, tug assistance, diversions, deeper loading and new vessel trips, are defined for subcategories for drafts of 15, 16, 17 and 18 feet. The sailing drafts do not include under keel clearance which is expected to be two feet. Therefore the 15-ft. and 16-ft. drafts would utilize the 18-ft. project and the 17-ft. and 18-ft. drafts would utilize the 20-ft. Project. As such Table 28 is the basis to distribute the benefitting vessel trips based on sailing drafts among the different project depths under with-project conditions (18-ft. and 20-ft.).

II.1.10 Table 29. Present Values of NED Benefits Corresponding to Sailing Drafts of Number of Vessel Trips in With-Project Conditions by Activity, Vessel and Category: 2027-2076 discount rate = 3.125%

The purpose of this table is to parse the total present values of the different categories and subcategories of benefiting vessels in Table 15 to the vessel sailing draft distributions (Table 28). Accordingly, the total present values for each benefitting vessel category (subcategory) in Table 15 are multiplied by the corresponding vessel sailing draft distribution percentages (Table 28) to distribute the total present values between drafts of 15, 16, 17, and 18 feet. The cumulative sailing draft benefits are compiled for 15-16, 15-17 and 15-18-ft. drafts corresponding to 18-ft. and 20-ft. with-project depths (assumes prevailing practice of two feet under keel clearance).

II.1.11 Table 30. Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027-2076, discount rate = 3.125%

The purpose of this table as it pertains to NED benefits is to summarize the NED benefits by sailing draft (Table 29) and channel depth.

II.2 Fabrication Benefits

Fabrication benefits, defined as the market values of the deepwater oil/gas production facilities, are presented and quantified for the HNC based on Gulf Island Fabrication participation in these markets under with-project conditions.

II.2.1 Table 19. Infield GOM Projections Deepwater Topside Installations, 2005 and 2009

The purpose of this table is to present the very long run forecasts of oil/gas deepwater production platforms (topsides) done by Infield Systems in 2005 and updated in 2009. The projected numbers of topsides installations, expressed in five year periods, becomes that basis for estimating fabrication benefits for the HNC under without and with-project conditions in subsequent tables.

II.2.2 Table 21. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/ Size.

The purpose of this table is to disaggregate the total numbers of projected topsides in Table 19 to different types and sizes of oil/gas deepwater production platforms that would require different project depths for the HNC in order to be fabricated at Houma and then floated out via the HNC to the Gulf of Mexico.

II.2.3 Table 22. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platforms Projected by Channel Depth Requirements.

The purpose of this table is to express the forecasted numbers of topsides size and types from Table 21 with respect to project depth necessary to be fabricated at Houma and towed to the GOM via HNC.

II.2.4 Table 23. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size by Midpoints of Five Year Periods, 2027-2076

The purpose of this table is to present the forecasted numbers of topsides by project depth from Table 22 for a fifty year period of with-project conditions, 2027-2076.

II.2.5 Table 24. Fabrication Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods, 2027-2076.

The purpose of this table is to present the market values (fabrication benefits) of the forecasted numbers of topsides to be fabricated by type and size with respect to project depth from Table 23.

II.2.6 Table 25. Present Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076.

The purpose of this table is to present the present values of the discounted gross fabrication benefits from Table 24 using the current (FY 2015) water resources discount rate, 3.125%. The discounted benefits are presented for the period of with-project conditions that corresponds to the project depth that would be utilized by the type and size of deepwater fabrications forecasted in five year periods between 2027 and 2076. The total present values are compiled by project depth for the period 2027-2077 and 2032-2077.

II.2.7 Table 26. Present Value of Fabrication Benefits for HNC by GOM Deepwater Topsides Market Share and Channel Depth for 2027-2079 and 2032-2079.

The purpose of this table is to display the total present values of HNC fabrication benefits (Table 25) by project depth and market share of the total GOM forecasted market for deepwater oil/gas production units. The fabrication present values are displayed for the two Infield forecasts (2005 and 2009) and then by project depth, 16-ft., 18-ft., and 20-ft.) and then by HNC market shares of

total GOM production during the period of with-project conditions and forecasted GOM time periods, 2027-2077.

II.2.8 Table 20. HNC Market Shares of Projected GOM Deepwater Topsides, 2005 and 2009.

The purpose of this table is to show expected market shares for GOM deepwater oil/gas production platforms for the major fabricators under different numbers of competitive fabricators using two, three or four alternative suppliers that would correspond the existing two leading firms (50%), a third possible U.S. entrant (33%) or a fourth foreign entrant (25%).

II.2.9 Table 30. Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027-2076, discount rate = 3.125%. (Same as II.1.11)

The purpose of this table is to summarize the fabrication values from Table 26 with respect to market share of the HNC of GOM deepwater production units and project depth.

Houma Navigation Canal Model Documentation

February 10, 2016

Table 11. Houma Navigation Canal Base Year NED Benefits

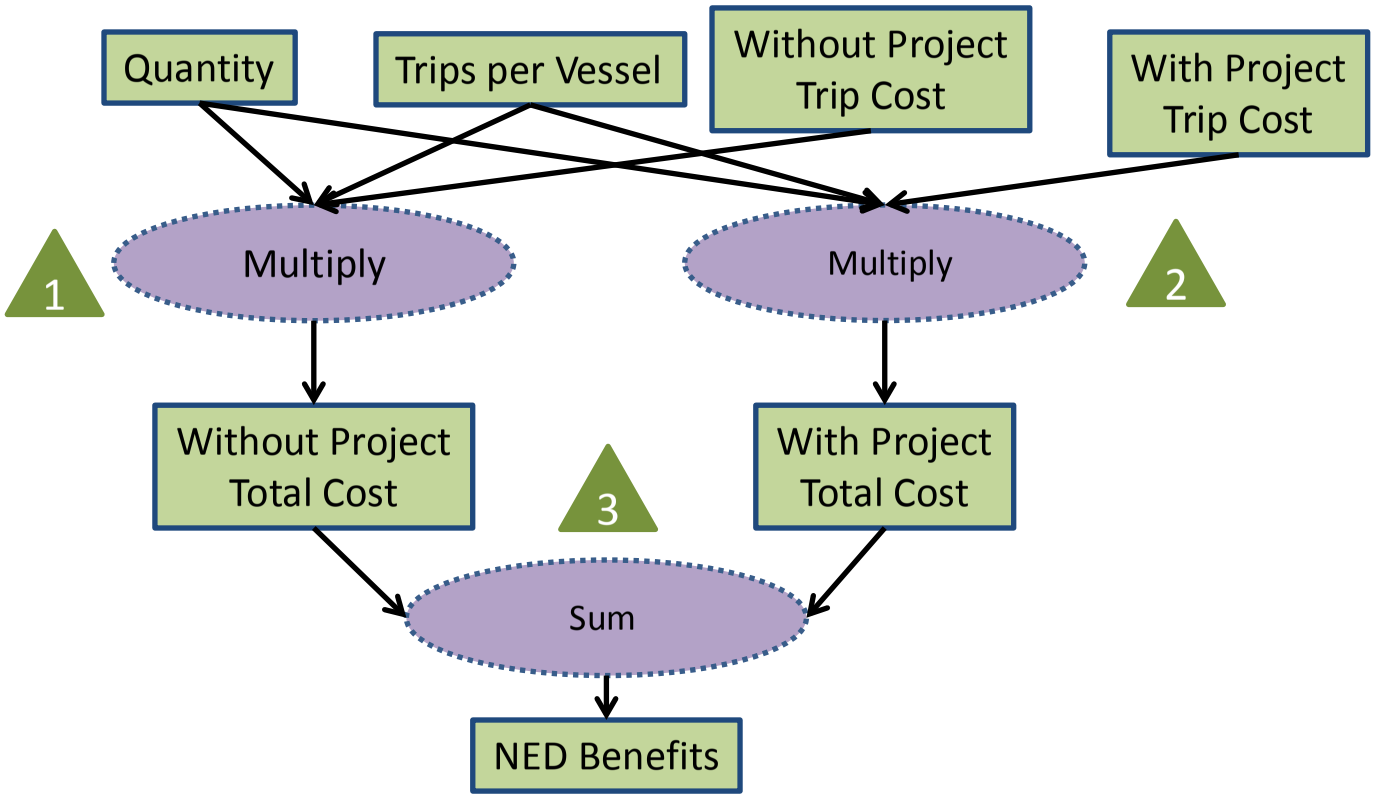

Table 12B. Lower 48 Crude Oil Production by Supply Region, High and Low Growth Forecast, 2013-2040

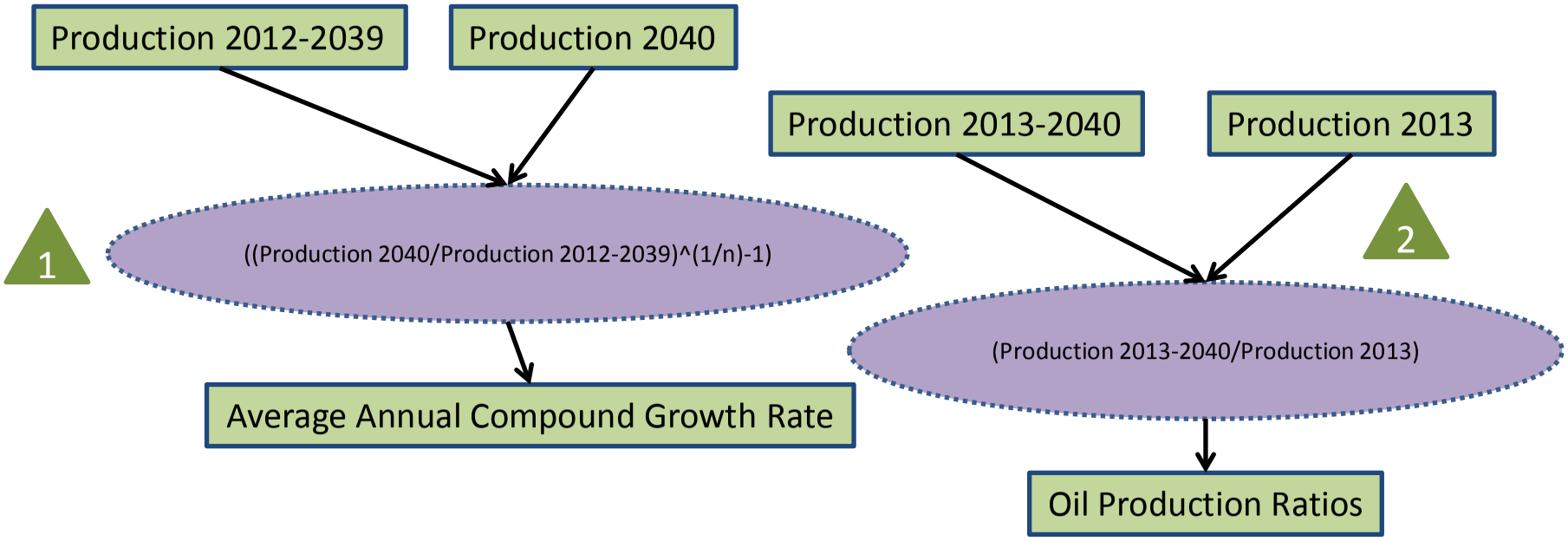

Table 13. Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

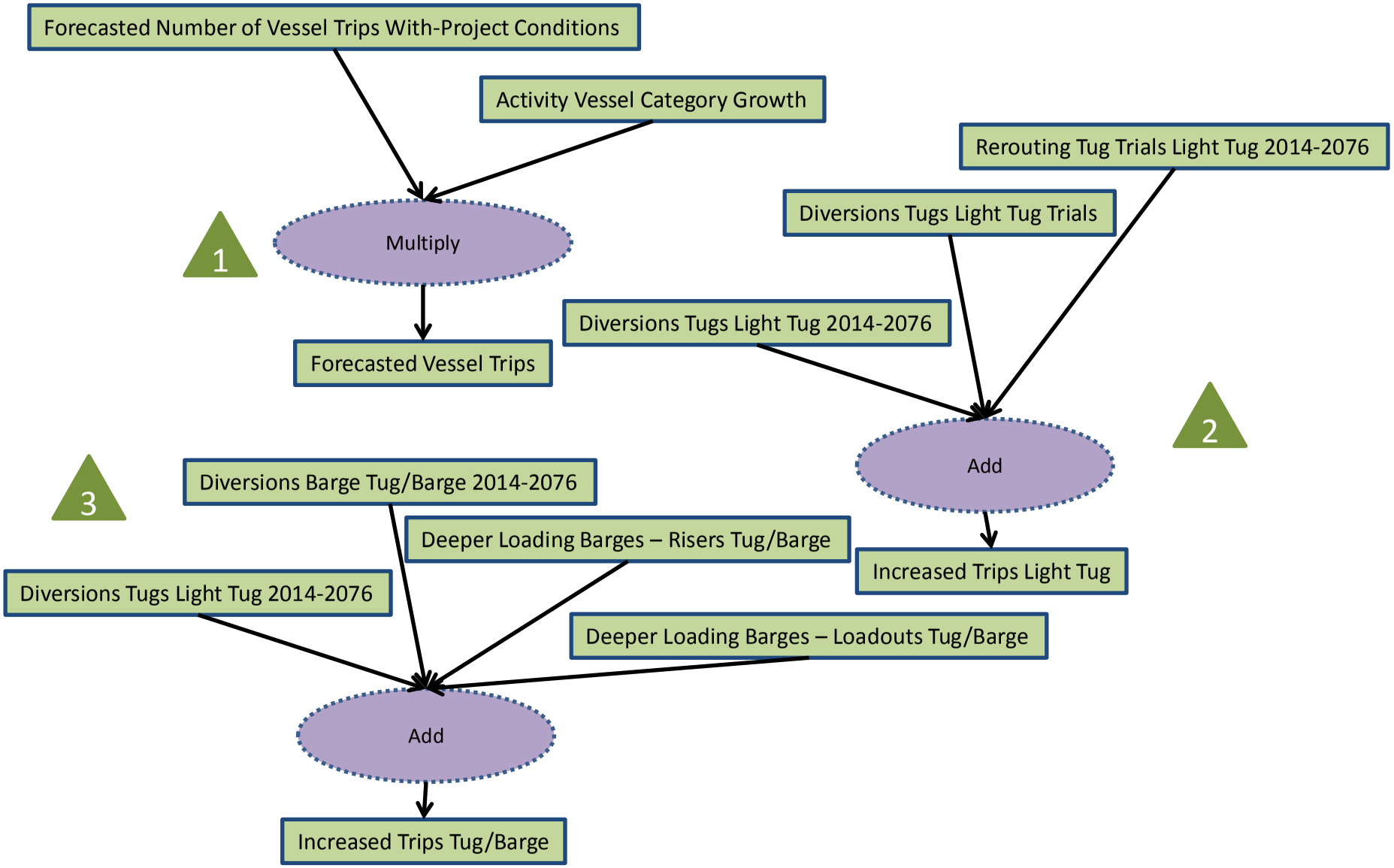

Table 13 Continued. Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

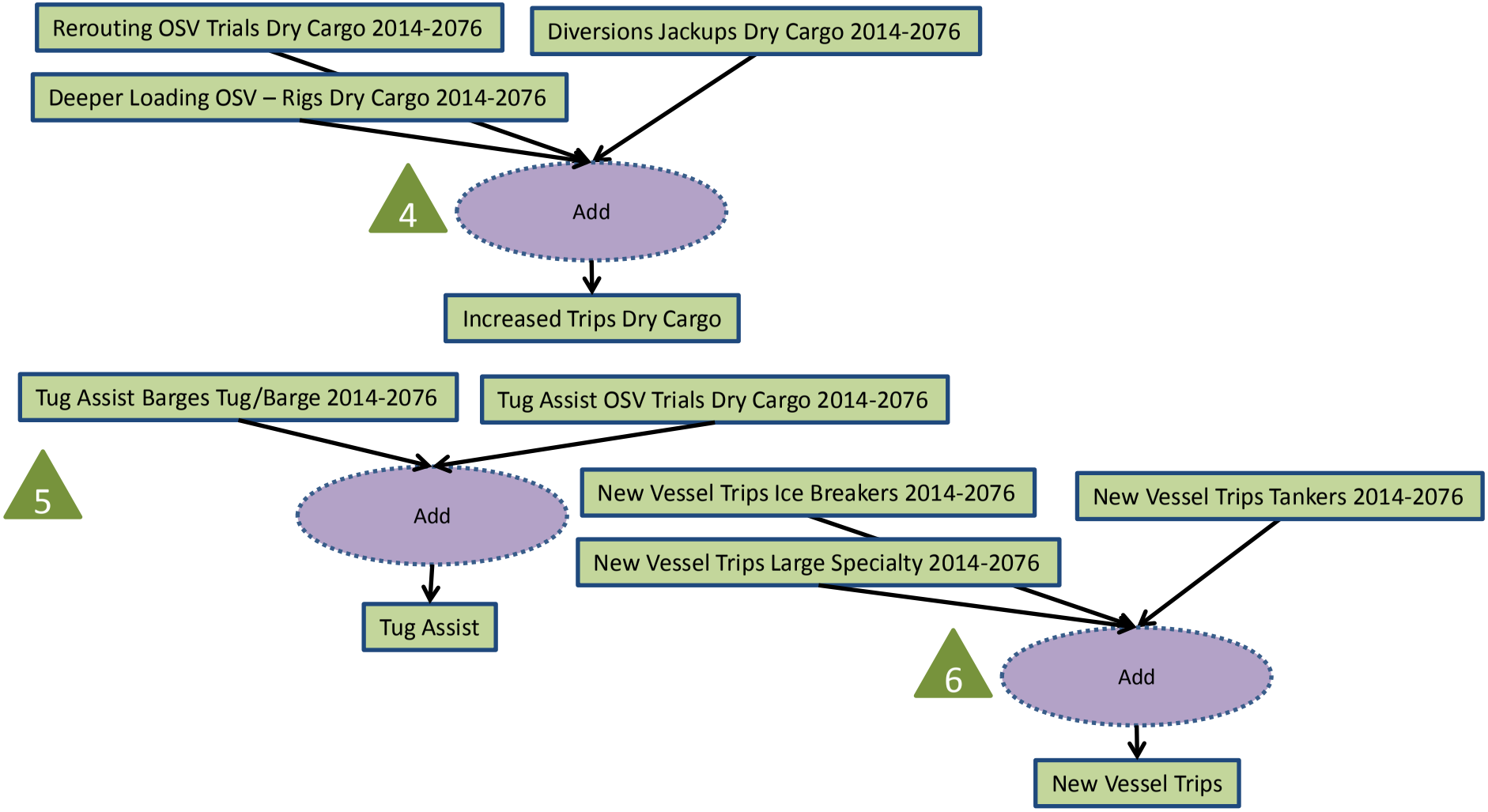

Table 14. NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

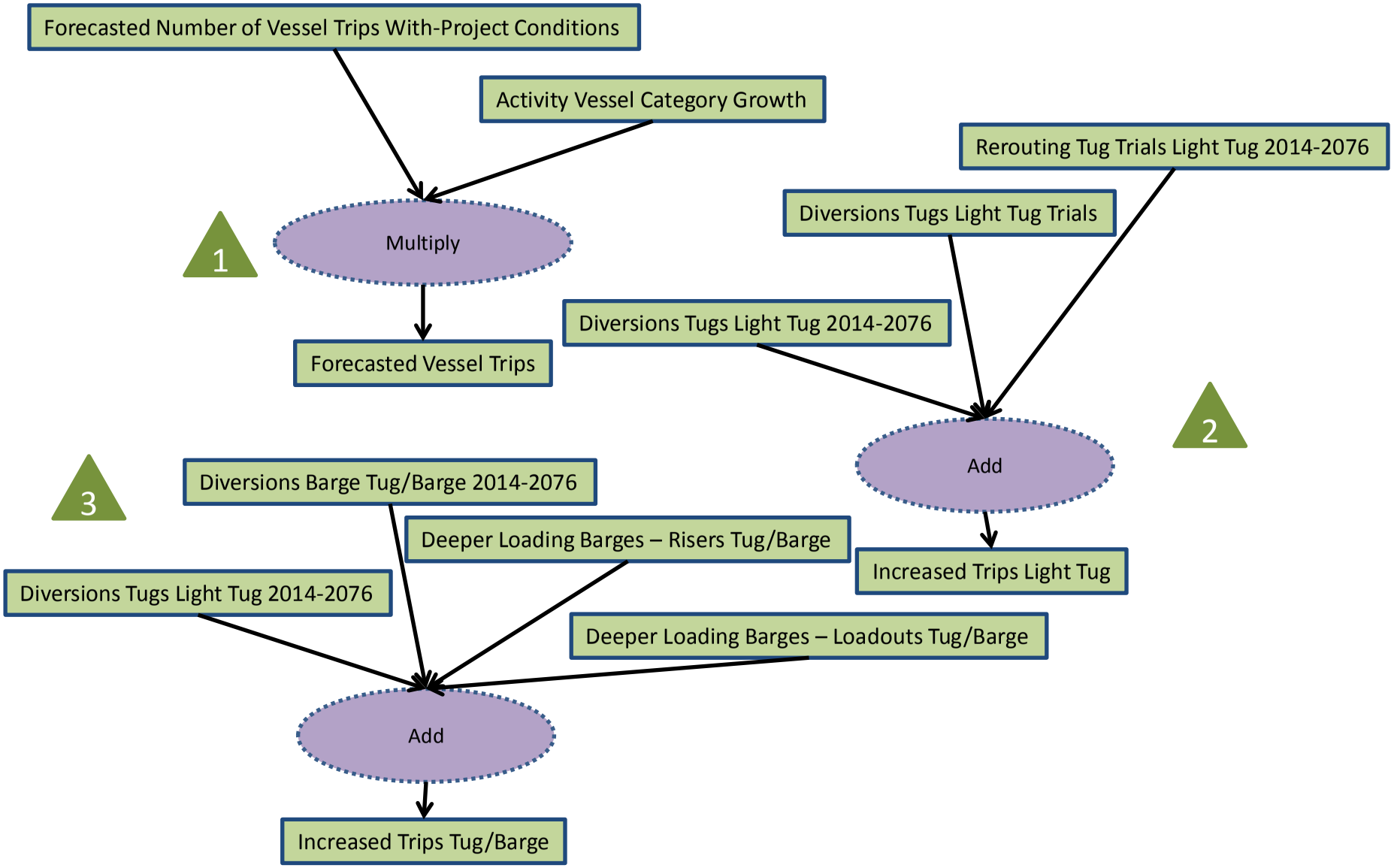

Table 14 Continued. NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

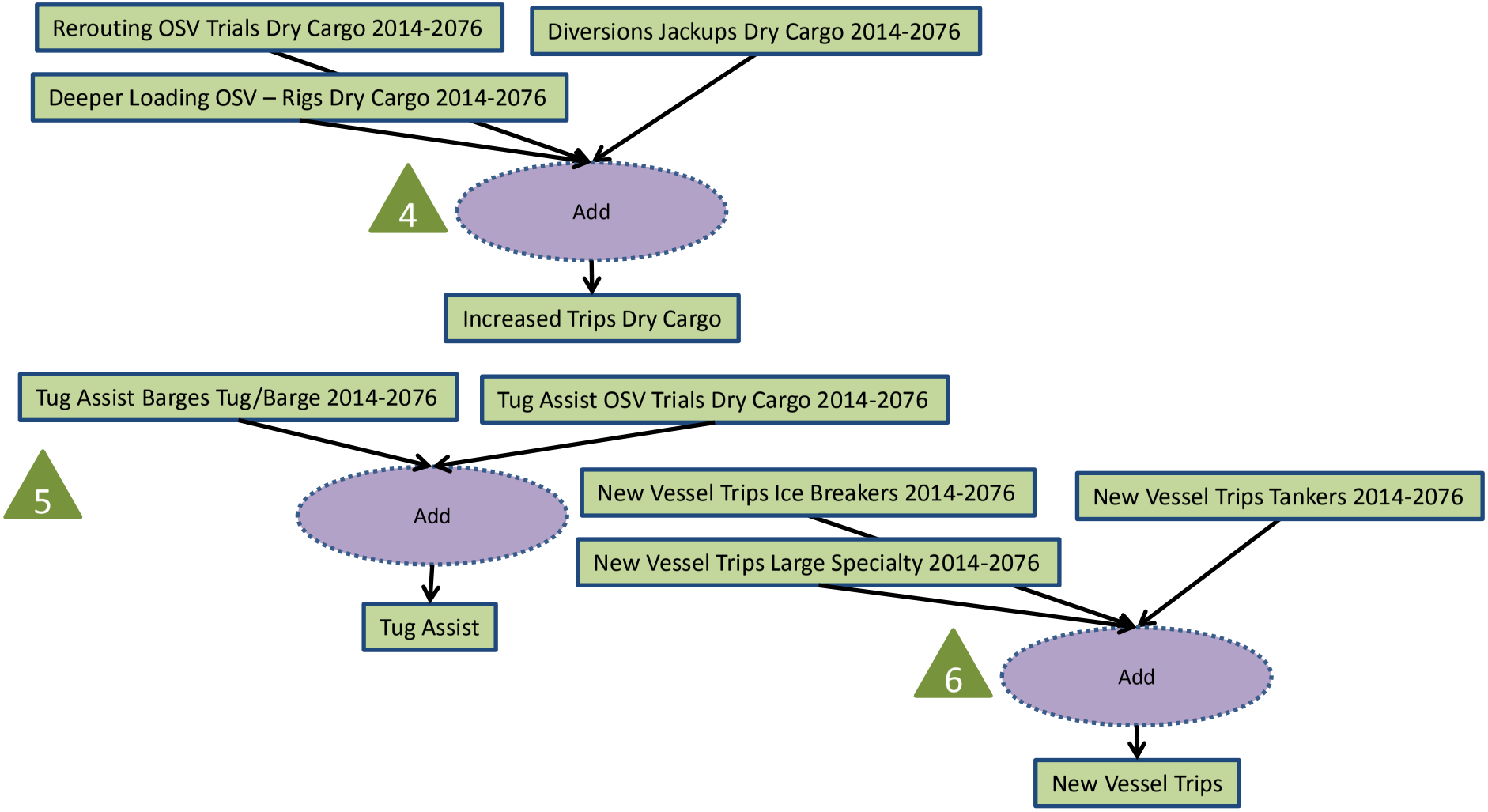

Table 15. Present Values of NED Benefits Corresponding to Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076 Discount Rate = 3.125%

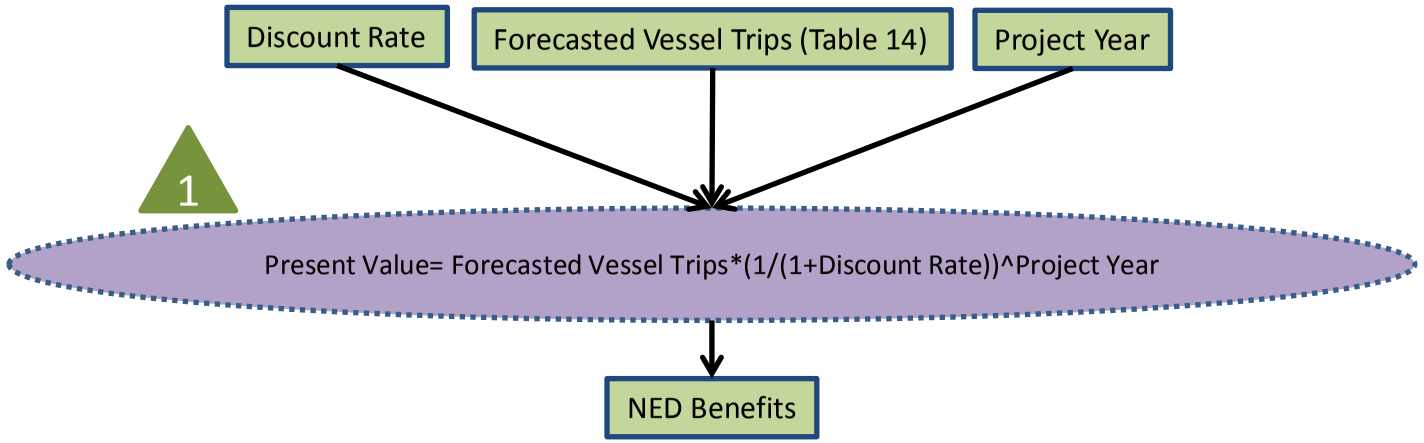

Table 16. No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

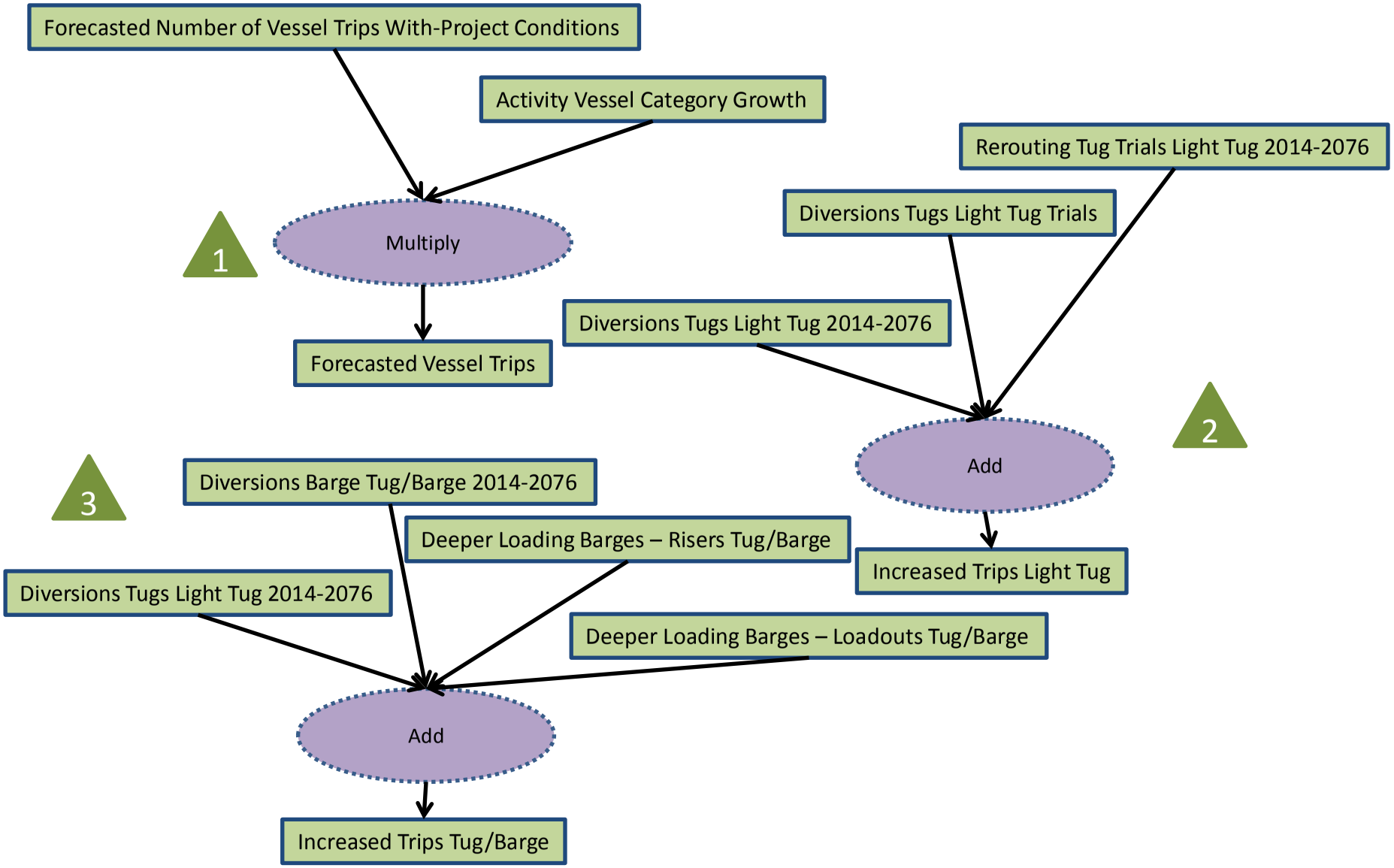

Table 16 Continued. No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

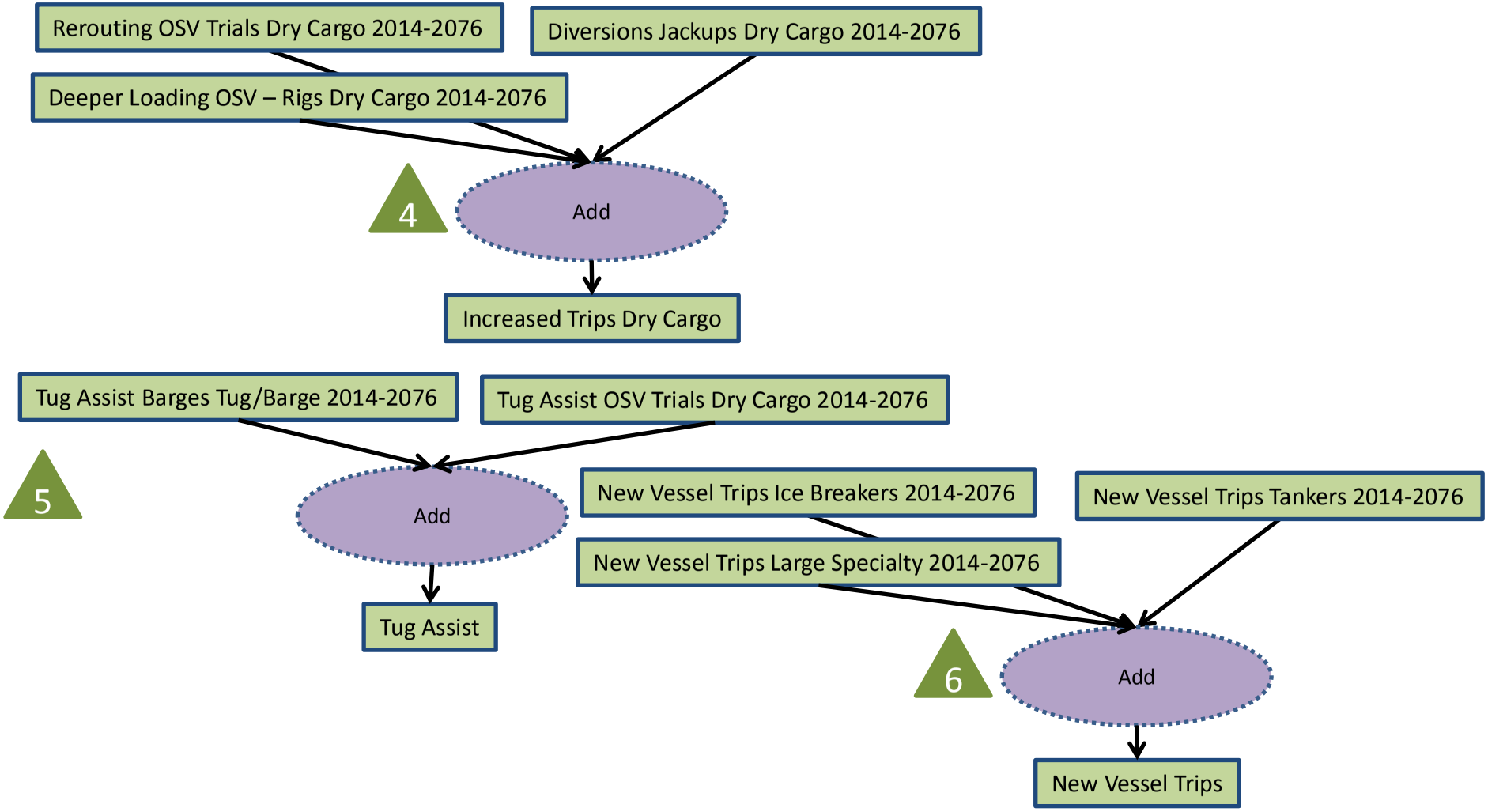

Table 17. NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

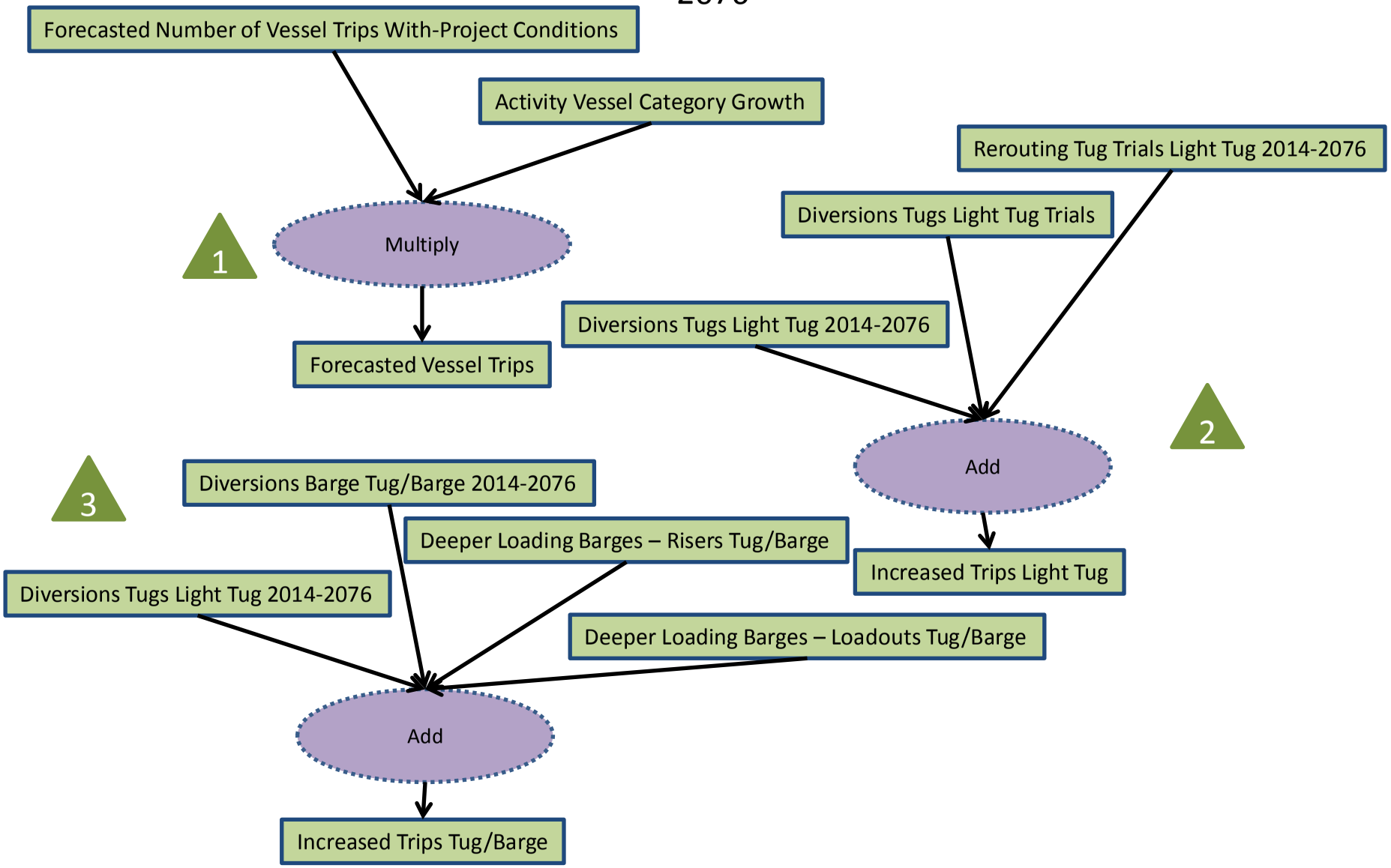

Table 17 Continued. NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076

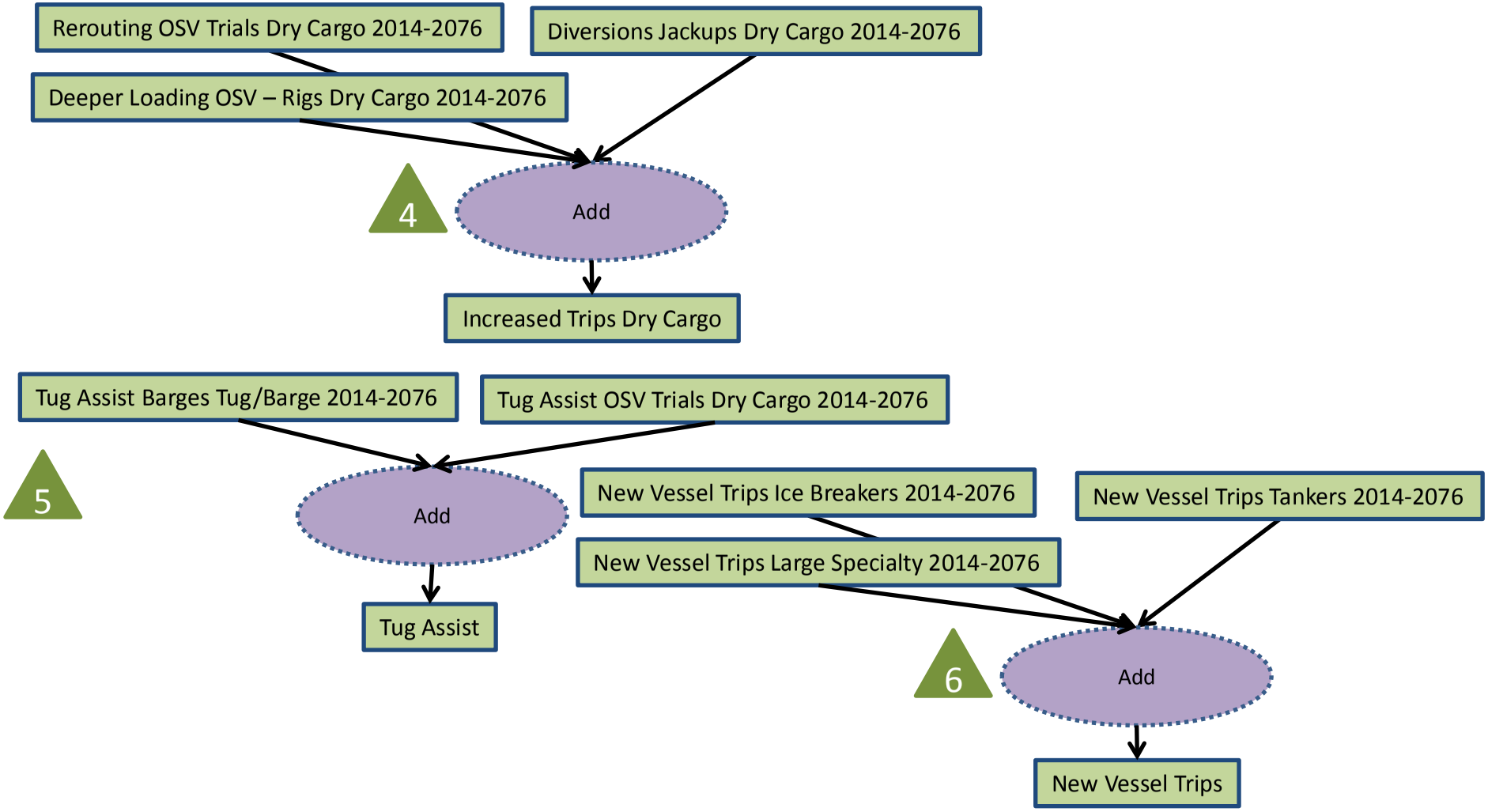

Table 18. Present Values of NED Benefits Corresponding to the No Growth Forecasted Number of Vessel Trips in With-Project Conditions (20-ft. Project) by Activity, Vessel and Category: 2014-2076 Discount Rate = 3.125%

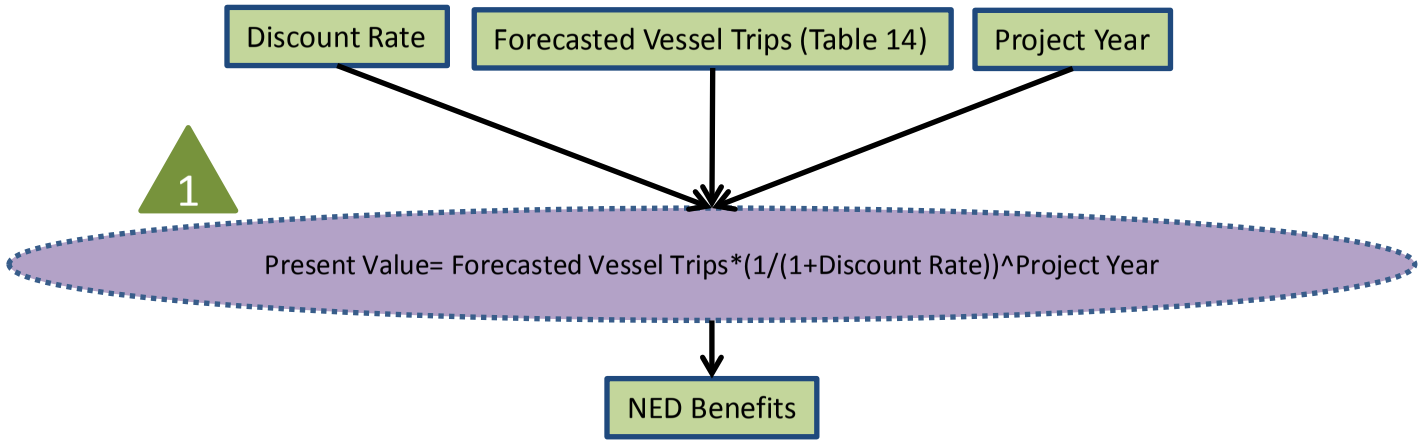

Table 28. Houma Navigation Canal Benefiting Vessel Fleet Sailing Draft Distributions

Table 29. Present Values of NED Benefits Corresponding to Sailing Drafts of Number of Vessel Trips in With-Project Conditions by Activity, Vessel, and Category: 2027-2076 Discount Rate= 3.125%

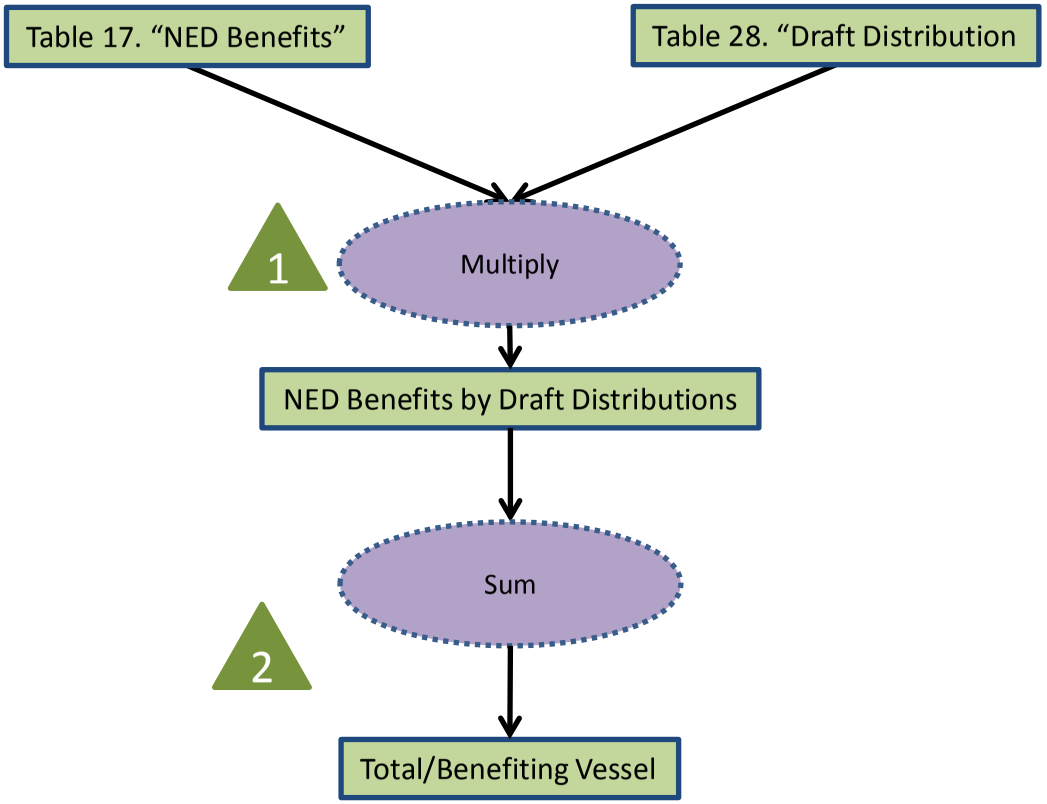

Table 30. Present Values of NED and Fabrication Benefits Corresponding to Sailing Drafts of Number of Vessel Trips and Market Share of GOM Deepwater Topsides in With-Project Conditions: 2027-2076 Discount Rate= 3.125%

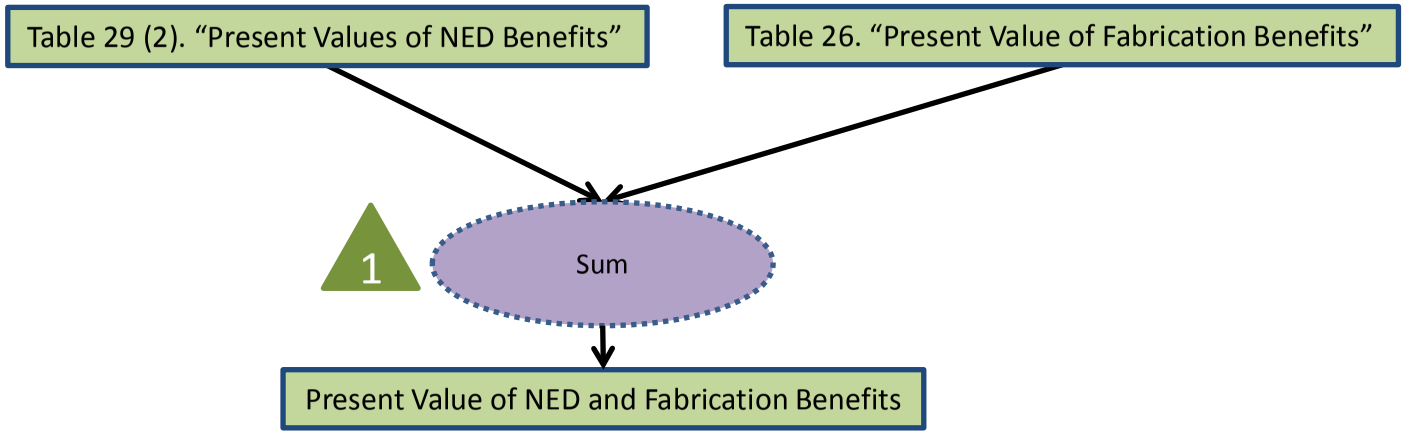

Table 19. Infield GOM Projections Deepwater Topside Installations, 2005 and 2009

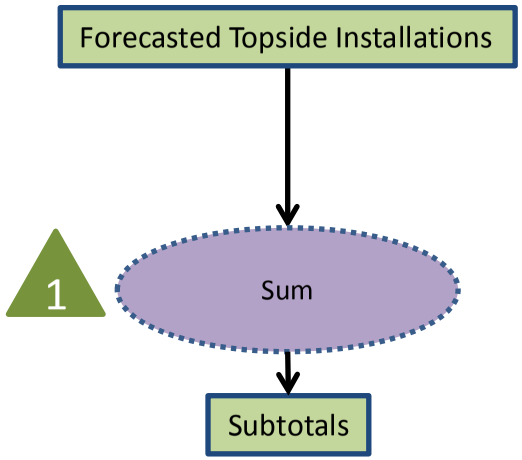

Table 21. Infield GOM 2005 and 2009 Deepwater Oil/Gas Projections by Type and Size

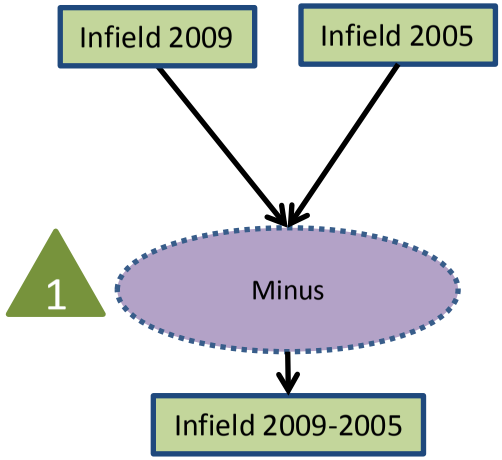

Table 21. Infield GOM 2005 and 2009 Deepwater Oil/Gas Projections by Type and Size

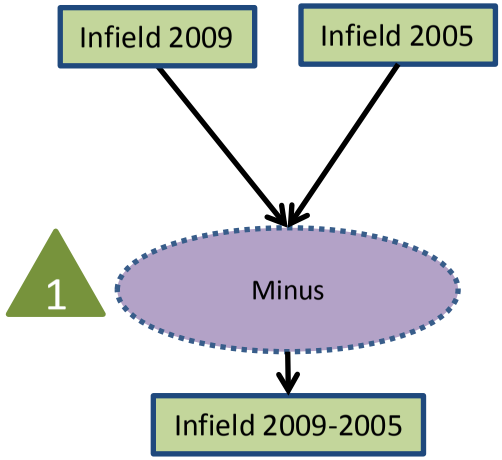

Table 22. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platforms Projected by Channel Depth

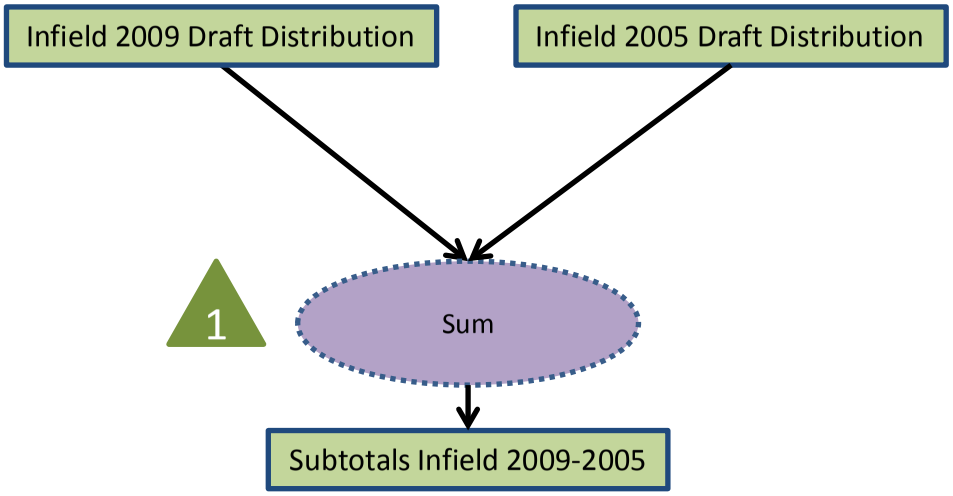

Table 23. Infield GOM 2005 and 2009 Deepwater Oil/Gas Platforms Projected by Channel Depth

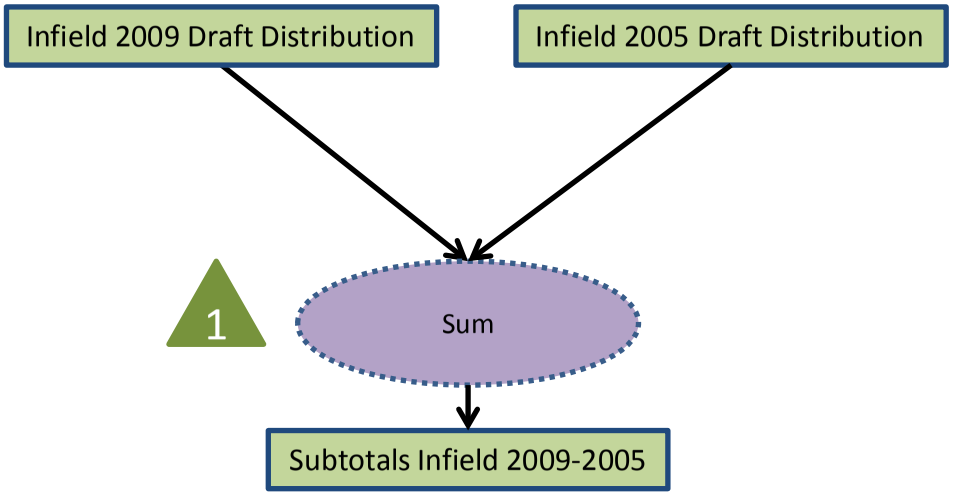

Table 24. Fabrication Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076

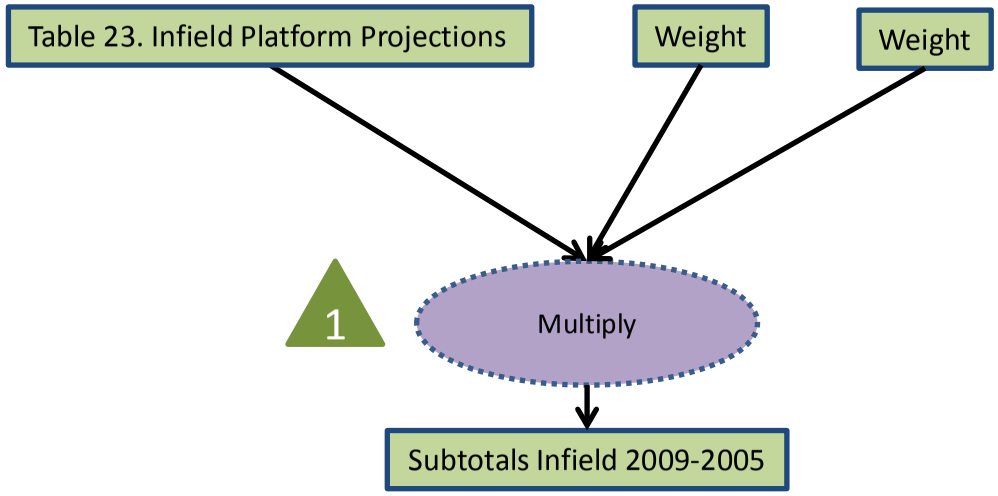

Table 25. Present Values for Infield GOM 2005 and 2009 Deepwater Oil/Gas Platform Projections by Type/Size for Midpoints of Five Year Periods: 2027-2076

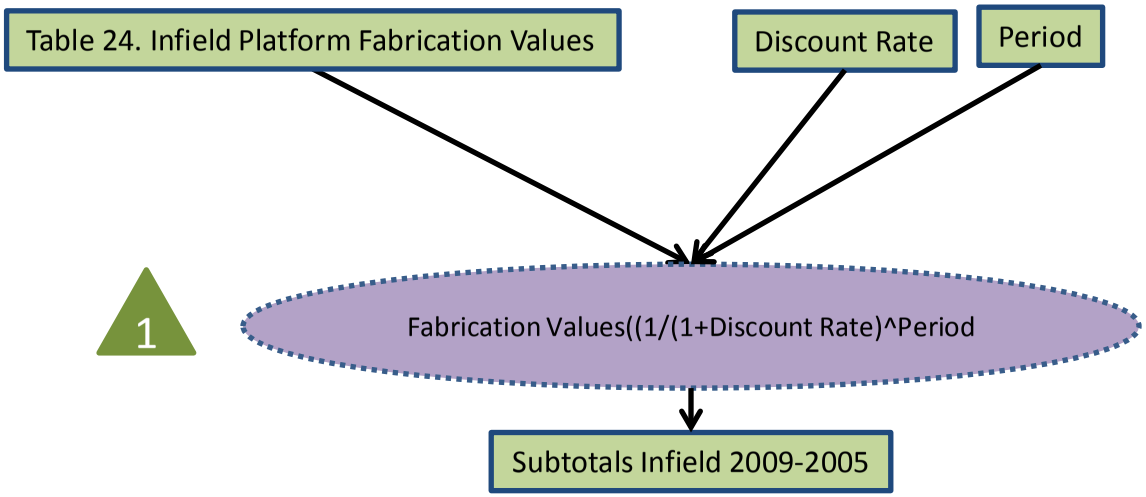

Table 26. Present Values of Fabrication Benefits for HNC by GOM Deepwater Topsides Market Share and Channel Depth for 2027-2076 and 2032-2076

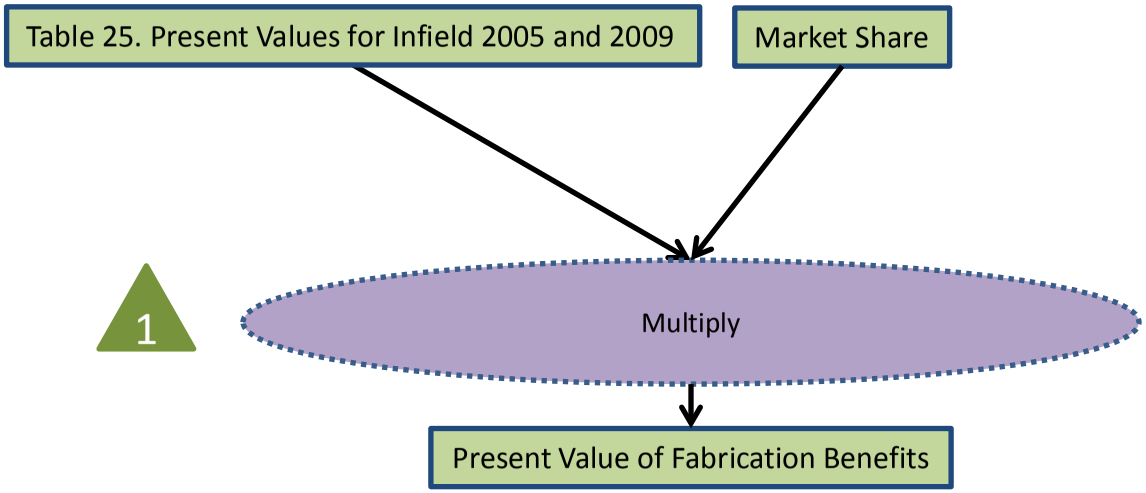

Table 20. HNC Market Share of Projected GOM Deepwater Topsides, 2005 and 2009