Petersburg Navigation Improvements

Appendix D: Economics

Petersburg, Alaska

US Army Corps of Engineers
Alaska District

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1. OVERVIEW

Figure 1. Petersburg, Alaska and Municipal Harbors, Courtesy: Wild Iris Photography

1.1 Executive Summary

The economic analysis presented in this appendix evaluates an array of four alternatives for improving navigation in Petersburg, Alaska. The alternatives include non-structural reorganization of the Petersburg harbor system, dredging South Harbor only, dredging South Harbor and developing a haul-out facility at Scow Bay, and dredging South Harbor and developing a new harbor at Scow Bay. The U.S. Army Corps of Engineers (USACE) evaluated a range of benefit scenarios based on the expected portion of commercial fishing and subsistence vessels impacted by depth constraints during low-tide cycles.

Based on the preliminary National Economic Development (NED) analysis, the recommended plan is Alternative 3, South Harbor Dredging Only, with a benefit-cost ratio (BCR) of 1.82 and average annual net benefits of approximately $481,000. Under all but the most conservative of benefit scenarios considered, the recommended plan is economically justified with a BCR ranging from 0.81 to 3.10, and net annual benefits of –$113,000 to $1.23 million. Results of the NED analysis are summarized in Table 1 and Table 2 below.

Table 1. Summary of Costs and Benefits by Alternative

Alternative	Present Value Benefits*	Average Annual Benefits	Present Value Costs	Average Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
1 No Action	N/A	N/A	N/A	N/A	N/A	N/A
2	$34,996,000	$1,328,000	$46,548,000	$1,766,000	–$438,000	0.75
3	$28,056,000	$1,065,000	$15,402,000	$584,000	$481,000	1.82
4	$67,462,000	$2,560,000	$55,456,000	$2,104,000	$456,000	1.22
5	$72,520,000	$2,752,000	$86,046,000	$3,265,000	–$513,000	0.84

*This table shows benefits for the "most likely" benefit scenario considered, which was estimated through simulations using @Risk, a Microsoft Excel Add-In. The BCR for Alternative 3 ranges from 0.81 to 3.10 based on the portion of vessels affected during low-tide cycles.

Table 2. Sensitivity Analysis for Recommended Plan (Alternative 3)

Scenario*	Present Value Benefits	Average Annual Benefits	Present Value Costs	Average Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
Low	$12,391,000	$471,000	$15,402,000	$584,000	–$113,000	0.81
Mid	$24,167,000	$916,000	$15,402,000	$584,000	$332,000	1.57
Most Likely	$28,056,000	$1,065,000	$15,402,000	$584,000	$481,000	1.82
High	$47,720,000	$1,811,000	$15,402,000	$584,000	$1,227,000	3.10

*Scenarios are based on the assumed portion of vessels impacted during low-tide cycles (low = 25%, mid = 50%, high = 100%). The most likely scenario is based on @Risk simulations. Given that most vessels run multiple gear types and essentially fish year round, it is likely that a larger portion of vessels would be affected during each low-tide cycle and would benefit from the proposed navigation improvements.

1.2 Introduction

The purpose of this economic analysis is to evaluate whether the proposed navigation improvements at Petersburg, Alaska, are economically justified. This analysis is conducted from a National Economic Development (NED) perspective where NED benefits are defined as the change in value of goods and services that accrue to the Nation as a whole as a result of constructing the project. National Economic Development costs are defined as the total economic costs of constructing and maintaining the project. The average annual economic benefits of the project are compared to the average annual economic costs to provide an estimated benefit-cost ratio (BCR). A project with a BCR greater than 1.0 is considered economically justified.

All prices listed in this appendix are reported in current dollars. Indices used to adjust prices to current dollars include the Consumer Price Index for Anchorage maintained by the State of Alaska Department of Labor and Workforce Development, and the U.S. Bureau of Labor Statistics Employment Cost Index. The appropriate index is referenced wherever prices were adjusted throughout the appendix.

Guidance is contained in USACE Engineering Regulation (ER) 1105-2-100, specifically in the appendices on economic and social considerations, the USACE Civil Works program, and the

USACE Continuing Authorities Program, as well as recent Economic Guidance Memoranda (EGMs) issued by Headquarters USACE.

1.3 Project Location and Description

Petersburg is located on the northwest end of Mitkof Island, where the Wrangell Narrows meet Frederick Sound. It lies midway between Juneau and Ketchikan, about 120 miles from either community (Figure 2 and Figure 3).

Figure 2. Location of Petersburg in Alaska

Figure 3. Petersburg's location in relation to Juneau and Ketchikan

Petersburg was founded over 100 years ago by Norwegian fishermen and is one of Alaska's major commercial fishing communities. In 2013, the City of Petersburg was dissolved and the Petersburg Borough was formed. The borough encompasses about 3,800 square miles of land and water. The majority of this land is federally owned and managed as the Tongass National Forest. The majority of borough residents live on Mitkof Island, which is not connected to any mainland road system. All people and goods move via ferry, container barge, airplane, or boat.

The formation of the borough has brought new community development, fiscal, and partnership responsibilities. These include expanding public services to new residents, considering and planning for future use of large areas of undeveloped or underdeveloped lands, and the acquisition of additional facilities including harbor facilities that support the area's fishing industry.

Figure 4. Petersburg Borough

1.4 Problems and Opportunities

The primary problem identified in this analysis is transportation inefficiency related to ocean-going vessels' ability to navigate the Petersburg harbor system; tidal ranges vary widely, and these vessels are unable to access public use facilities. Lack of sufficient depths result in vessels

anchoring offshore, occupying other than assigned moorage areas, and remaining docked until sufficient depth exists to safely navigate the harbor system and access fishing grounds.

Insufficient depths and existing marine infrastructure within the Petersburg harbor system cause transportation inefficiencies and limit access for commercial fishing and subsistence activities, creating economic inefficiencies for the region and Nation.

The following opportunities have been identified:

- Improve access for commercial and subsistence vessels
- Reduce life and human safety risks
- Increase regional economic activities
- Increase regional employment opportunities
- Reduce damage to catch and dead-loss, which is caused by delays and contamination.

Catch and dead-loss refer to fish, crab, or other species caught by commercial fishermen that may die in transit to the processing facility due to increased wait times and inability to access the facility during low tidal stages. Contamination refers to catch sitting in the cargo hold for extended periods of time in stagnant water, which can affect the quality of the product.

2. MARINE RESOURCES

2.1 Introduction

The level of economic activity in Petersburg has been closely linked to the fishing industry since the town's inception. The Petersburg harbor system primarily supports commercial fishing vessels and operations.[1] Therefore, demand for harbor facilities depends on the viability of fishery resources in the region. This section describes the fisheries in the Petersburg area including historical catch and values, fisheries management institutions and practices, and expectations for the future.

Fisheries management in the State of Alaska is divided into four large geographic regions: Southeast, Central, Westward, and Alaska-Yukon-Kuskokwim (Figure 5). Petersburg falls within the Southeast Alaska/Yakutat region (Region 1), which consists of Alaska waters between Cape Suckling to the north and Dixon Entrance to the south (Figure 6).

[1] According to the Petersburg Harbormaster, over 90 percent of vessels using Petersburg Harbor facilities are commercial vessels.

Figure 5. Alaska Commercial Fisheries Management Regions

Figure 6. Southeastern Alaska/Yakutat Region (Region I)

2.2 Commercial Fisheries Overview

Commercial use of salmon resources in Southeast Alaska began in the late 1870s. Until the early 1900s, sockeye salmon was the primary species harvested. Pink salmon began to dominate the harvest in the early 1900s and, during the past decade, have made up about 70 percent of the region's total salmon harvest. The relative order of production from highest to lowest is generally pink, chum, coho, sockeye, and Chinook salmon.

Salmon are commercially harvested in Southeast Alaska with purse seines and drift gillnets; in Yakutat with set gillnets; and in both areas with hand and power troll gear. Herring are harvested in winter bait, sac roe, spawn-on-kelp, and bait pound fisheries. Miscellaneous shellfish (sea cucumber, sea urchins, and geoduck clams) are harvested in dive fisheries in the region. The Alaska Department of Fish and Game (ADF&G) has management jurisdiction over all groundfish resources within state waters in Region I. The State also has management authority for Demersal Shelf Rockfish, ling cod, and black and blue rock fish in both state and federal waters. There are several commercially important shellfish species in Southeast Alaska. They include golden and red king crab, Dungeness crab, Tanner crab, and pandalid shrimp.

2.3 Historical Catch and Value

Petersburg is a small town but a major port. In 2017, the National Marine Fisheries Service estimated approximately 64.8 million pounds of seafood were landed in Petersburg with an ex-vessel value of $51.7 million, making Petersburg the 19th largest port by volume for total commercial fishery landings in the Nation.[2] These figures are up from 2016 when 41.0 million pounds were landed with an ex-vessel value of $37.0 million, and are consistent with the 10-year average harvest of 65.6 million pounds. Over the last decade, the record harvest occurred in 2013 when over 122 million pounds of seafood were landed in Petersburg with an ex-vessel value of $73.0 million. This made Petersburg the 12th largest port by value and 17th largest by volume in the Nation for that year. Harvest data and ex-vessel values are shown in Table 3.

Table 3. Total Commercial Fish Landings and Value for Petersburg, Alaska, 2007-2016

Year	Rank (by Value)	Millions of Pounds	Millions of Dollars	Millions of Dollars, Inflation-Adjusted*
2008	26	34.7	$26.8	$31.9
2009	22	55.4	$30.7	$36.1
2010	24	49.9	$36.3	$41.3
2011	14	101.1	$68.8	$77.0
2012	20	52.0	$50.0	$54.8
2013	12	122.6	$73.0	$77.5

[2] National Marine Fisheries Service, Total Landings by Port, 2017. https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/other-specialized-programs/total-commercial-fishery-landings-at-an-individual-u-s-port-for-all-years-after-1980/index

2014	24	64.7	$50.9	$53.2
2015	26	69.6	$39.3	$40.9
2016	29	41.0	$37.0	$38.3
2017	26	64.8	$51.7	$53.3
Average	22	65.6	$46.5	$50.4

Source: National Marine Fisheries Service
**Values updated to current dollars using the Anchorage Consumer Price Index from the State of Alaska Department of Labor and Workforce Development.*

2.4 Commercial Fisheries Outlook

The fishing industry in Petersburg and Southeast Alaska is considered strong and is expected to continue to support demand for moorage and other harbor facilities in Petersburg. Fishery activities will continue to fluctuate as resource abundance varies, regulations change, or technological breakthroughs are made. Overall, the biological stock is healthy and the presence of multiple land-based processing plants in Petersburg offers opportunities for commercial fishermen to timely deliver and process catch for shipping while the harvest is fresh. In short, Petersburg has been and will continue to be a fishing town.

3. SOCIOECONOMICS

3.1 Demographic Profiles

Petersburg is located on the northwest end of Mitkof Island, where the Wrangell Narrows meet Frederick Sound in Southeast Alaska. An estimated 3,196 residents lived in the Petersburg Borough in 2016. This represents a population increase of 8.4 percent since 2010 and a decrease of 0.9 percent since 2000. The formation of the borough in 2013 may have been a contributing factor to the population increase since 2010 but the degree to which it contributed is not explicitly known. It should be noted that Petersburg has many transient workers during the fish processing season who are not counted by the U.S. Census, so these population estimates can be considered conservative. Table 4 provides population data for the United States, Alaska, and Petersburg Borough over the last 20 years for which data is available.

Table 4. Population Comparisons: United States, Alaska, Petersburg Borough

Area	% Change 2000–2016	2016	2010	2000
United States	14.8%	323,127,513	308,745,105	281,421,906
Alaska	18.3%	741,894	710,231	626,932
Petersburg Borough	–0.9%	3,196	2,948	3,224

Source: 2000 Census, 2010 Census, 2016 Population Estimate; Census Bureau

Based on 2016 census estimates, 74.8 percent of Petersburg residents are white; 10.4 percent are Hispanic or Latino; 7.5 percent are American Indian or Alaska Native; and 4.4 percent of residents are Asian. In the state of Alaska, 65.6 percent of residents are white; 6.7 percent are Hispanic or

Latino; 14.1 percent are American Indian or Alaska Native; and 6 percent are Asian. Table 5 displays racial demographics for the Petersburg Borough, state, and Nation.

Table 5. Population by Race

	Petersburg Borough	Alaska	United States
Total	3,196	736,855	318,558,162
White alone	74.8%	65.6%	73.3%
Black or African American alone	2.3%	3.3%	12.6%
American Indian and Alaska Native alone	7.5%	14.1%	0.8%
Asian alone	4.4%	6.0%	5.2%
Native Hawaiian and Other Pacific Islander alone	0.6%	1.2%	0.2%
Two or more races	8.3%	8.5%	3.1%
Hispanic or Latino	10.4%	6.7%	17.3%
White alone, not Hispanic or Latino	67.0%	62.0%	62.0%

Source: 2012–2016 American Community Survey 5-Year Estimates, Census Bureau

3.2 Employment & Income

In 2016, approximately 79 percent of the Petersburg Borough population was 16 years old and older. Of that population, 69.2 percent was in the labor force. The unemployment rate for the borough was 9.1 percent, above both the State of Alaska rate of 7.8 percent and the United States rate of 7.4 percent. Table 6 lists occupational data for the study area.

Table 6. Civilian Labor Force by Occupation

	Petersburg Borough	Alaska	United States
Civilian employed population 16 years old and older	1,632	357,098	148,001,326
OCCUPATION			
Management, business, science, and arts occupations	471 / 28.9%	132,669 / 37.2%	54,751,318 / 37.0%
Service occupations	199 / 12.2%	62,844 / 17.6%	26,765,182 / 18.1%
Sales and office occupations	268 / 16.4%	79,782 / 22.3%	35,282,759 / 23.8%
Farming, fishing, and forestry occupations	242 / 14.8%	3,668 / 1.0%	1,062,331 / 0.7%
Construction, extraction, maintenance, and repair occupations	182 / 11.2%	37,664 / 10.5%	12,440,120 / 8.2%
Production, transportation, and material moving occupations	270 / 16.5%	40,471 / 11.3%	18,542,291 / 12.2%

Source: 2012–2016 American Community Survey 5-Year Estimates, Census Bureau

In 2016, the median household income in Petersburg was $63,940, below the State of Alaska median of $74,444 and above the National median of $55,322. The mean household income was

$82,803. Table 7 shows the number of households in Petersburg Borough, Alaska, and the United States and the percentage of each by their respective incomes.

Table 7. Family Income Comparisons

	Petersburg Borough	Alaska	United States
Total Households	1,237	250,235	117,716,237
Less than $10,000	5.0%	3.7%	7.0%
$10,000 to $14,999	6.1%	3.4%	5.1%
$15,000 to $24,999	10.1%	7.1%	10.2%
$25,000 to $34,999	7.9%	7.0%	9.9%
$35,000 to $49,999	7.8%	11.4%	13.2%
$50,000 to $74,999	21.3%	17.9%	17.8%
$75,000 to $99,999	11.9%	14.8%	12.3%
$100,000 to $149,999	15.6%	19.2%	13.5%
$150,000 to $199,999	9.8%	8.8%	5.4%
$200,000 or more	4.5%	6.8%	5.7%

Source: 2012–2016 American Community Survey 5-Year Estimates, Census Bureau

4. ECONOMIC ANALYSIS

4.1 Purpose and Scope

The purpose of this economic analysis is to evaluate alternatives to reduce transportation inefficiencies within the Petersburg harbor system. The alternatives considered would reduce delays caused by waiting for favorable tides to enter and exit the harbor as well as improve opportunities to participate in subsistence activities.

4.2 General Methodology

The basic methodology utilized in the economic analysis and compilation of this report consisted of three steps. First, the USACE reviewed published information about the history, present status, future prospects for harbor operations and vessel traffic management at Petersburg. Next, local port officials, harbor users, and maritime specialists operating in Petersburg were interviewed to gain a better understanding of the navigation problems and potential benefits that could result from a navigation improvements project. Finally, selection and description of NED benefits and related construction and life cycle costs were made for the proposed improvement alternatives that appear cost effective and achievable.

This report assesses NED benefits of the alternatives identified in the Project Alternatives section and follows the methodology for small boat harbor navigation analysis described in the Planning Guidance Notebook[3] and other relevant Corps of Engineers regulations and policy guidance. Benefits equal the difference between without- and with-project costs associated with

[3] ER 1105-2-100. https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

transportation delays, enhanced access for subsistence activities, and utilization of unemployed or underemployed labor resources during project construction.

To properly compare the benefit and cost streams associated with each proposed alternatives, benefits and costs must reflect a common time standard. This is accomplished through discounting, a procedure that adjusts the value of a stream of benefits or costs to reflect the time value of money. All cost and benefit values were calculated using Fiscal Year (FY) 2019 (October 2018) price levels and then converted to Average Annual Equivalent (AAEQ) values using the FY19 Federal discount rate of 2.875 percent, assuming a 50-year period of analysis. Costs and benefits for each alternative were discounted/indexed to the base year (2022) then compared to determine economic justification. The plan that reasonably maximizes net benefits (benefits less cost) is the NED plan.

4.3 Existing Conditions

The following sections describe current conditions at Petersburg regarding the tidal range, marine facilities in the area, and the fleet of vessels calling on Petersburg.

4.3.1 Tidal Range

Petersburg is in an area of semi-diurnal tides with two high waters and two low waters each lunar day. The tidal parameters in Table 8 were determined using National Oceanic and Atmospheric Administration published data for Turn Point (approximately 1 mile southwest of Petersburg) published June 2009 for the tidal epoch 1983-2001. There was no reported highest observed water level or lowest observed water level.

Table 8. Petersburg Tidal Parameters

Parameter	Elevation (feet)
Highest Predicted Tide	19.69
Mean Higher High Water (MHHW)	16.07
Mean Sea Level (MSL) *	8.34
Mean Tide Level (MTL) **	8.34
Mean Lower Low Water (MLLW)	0.00
Lowest Predicted Tide	–4.15

*****MSL – The arithmetic mean of hourly heights observed over the National Tidal Datum Epoch. Shorter series are specified in the name; e.g., monthly mean sea level and yearly mean sea level.
******MTL – The arithmetic mean of mean high water and mean low water.

4.3.2 Marine Facilities

As one of Alaska's major commercial fishing communities, there are multiple marine facilities around Petersburg that provide general moorage and other services to the fishing fleet. The majority of Petersburg Borough residents live on Mitkof Island and most of the commercial fish landings take place in Petersburg. This analysis focuses on facilities in the Petersburg harbors and Scow Bay where insufficient depths and marine infrastructure result in transportation inefficiencies for the commercial and subsistence vessels using these facilities. Existing marine facilities within the Petersburg harbor system have been constructed and reconstructed over a period of many years, with facilities ranging in age from nearly new to over 30 years old. Aside

from USACE dredging in North Harbor that originally occurred in 1971 and again in 2013, marine infrastructure improvements described in this section were performed by the Petersburg Borough Port and Harbor Department (or at their direction). For more information on the waterfront facilities on Mitkof Island, please see the Borough's Waterfront Master Plan.[4] Much of the information presented in this section is summarized from that plan.

Petersburg is accessed by air and water. It is on the mainline state ferry route and has ferry terminals on the north and south ends of Mitkof Island (Figure 7). The State-owned James A. Johnson Airport has a runway for scheduled jet service and small plane charter services. Lloyd R. Roundtree Seaplane Base (on the Wrangell Narrows) allows for float plane services.

Harbor facilities include a petroleum wharf, barge terminals, three boat harbors (i.e. the "Petersburg harbor system") with approximately 573 slips available for permanent and transient moorage, a boat launch, and a boat haul-out. Freight arrives by barge, ferry, or cargo plane. Remote areas of the borough are served by small state-owned boat docks at Papke's Landing in the Wrangell Narrows, on Kupreanof Island at the City of Kupreanof, and in Hobart Bay. Boat launch ramps are located on the south end of Mitkof Island at Banana Point, Blaquerie Point, and Woodpecker Cove. The State-owned Mitkof Highway carries traffic north and south and is paved or chip-sealed for 28 miles between the South Mitkof Ferry Terminal and the airport.

[4] Petersburg Borough Waterfront Master Plan, 2016.

Figure 7. Mitkof Island

4.3.2.1 Petersburg Harbor System

The Petersburg harbor system comprise three contiguous areas along the downtown waterfront: the North Harbor between Icicle Seafoods and Ocean Beauty Seafoods, the Middle Harbor located south of Ocean Beauty Seafoods, and the South Harbor that extends between Middle Harbor and the drive-down dock (Figure 8).

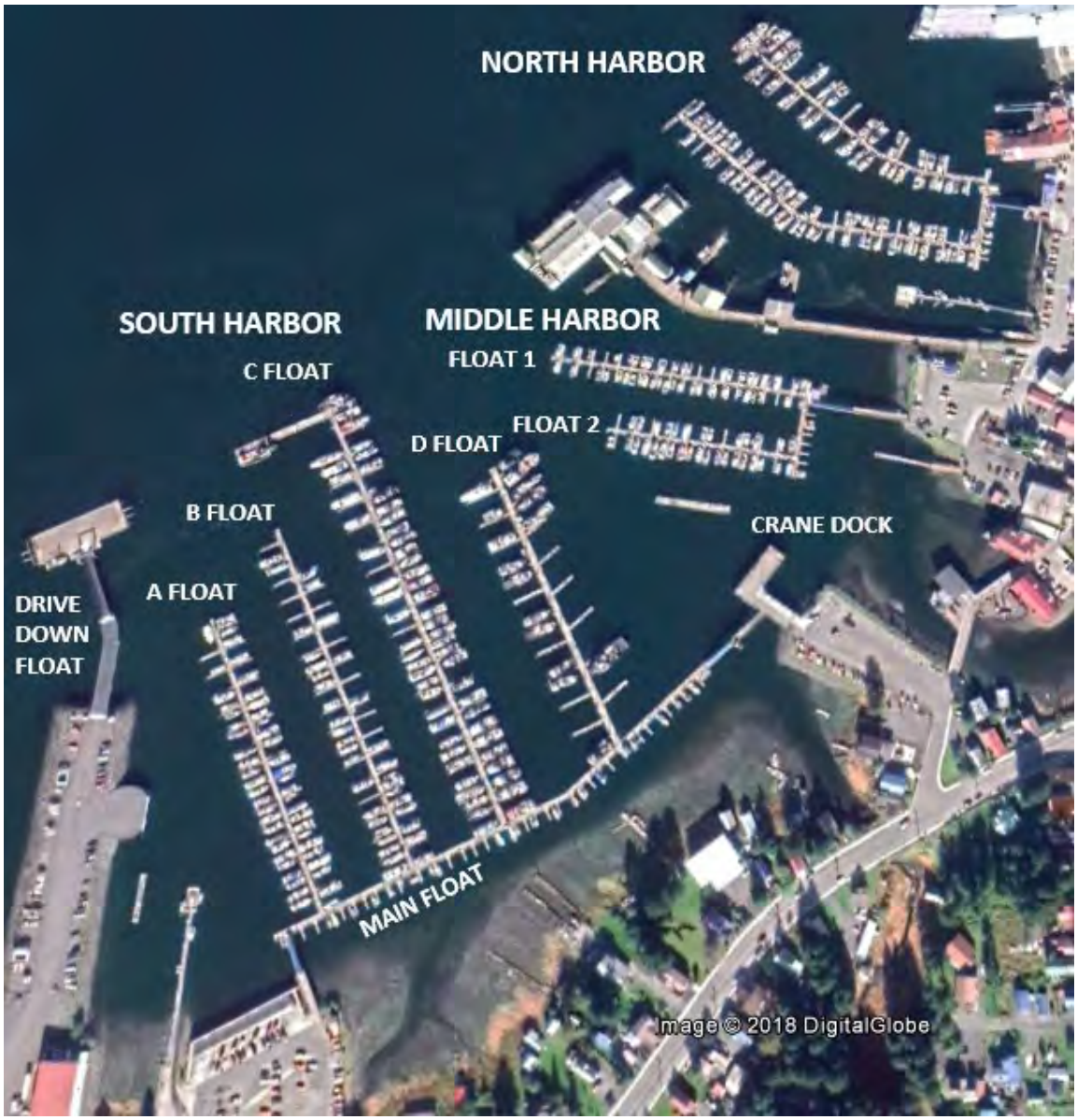

Figure 8. Petersburg Harbor System

Petersburg's harbors were primarily developed to serve the regional commercial fishing industry. In addition to the floating docks, it is home to three major fish processors and two small processors, a U.S. Coast Guard (USCG) mooring station, a seaplane base, a fuel dock, and various public and private marine services. The harbor is also home to a substantial recreational fishing fleet that generally uses slips during the summer season and hauls out during the off-season. In recent years, tourism, yachts, and mini-cruise ship calls have contributed to Petersburg harbors' activity.

North Harbor

Petersburg North Harbor is bounded to the north by the Icicle Seafoods processing plant and to the south by the Ocean Beauty Seafoods processing plant and pier (Figure 9). Trident Seafoods also

operates a small processing plant within North Harbor. The North Harbor has two main floats with a connecting float that joins them. These floats support approximately 120 berths ranging in length from 18 to 75 feet. Several longer mooring positions are used for transient vessels along the outside margin of the end floats.

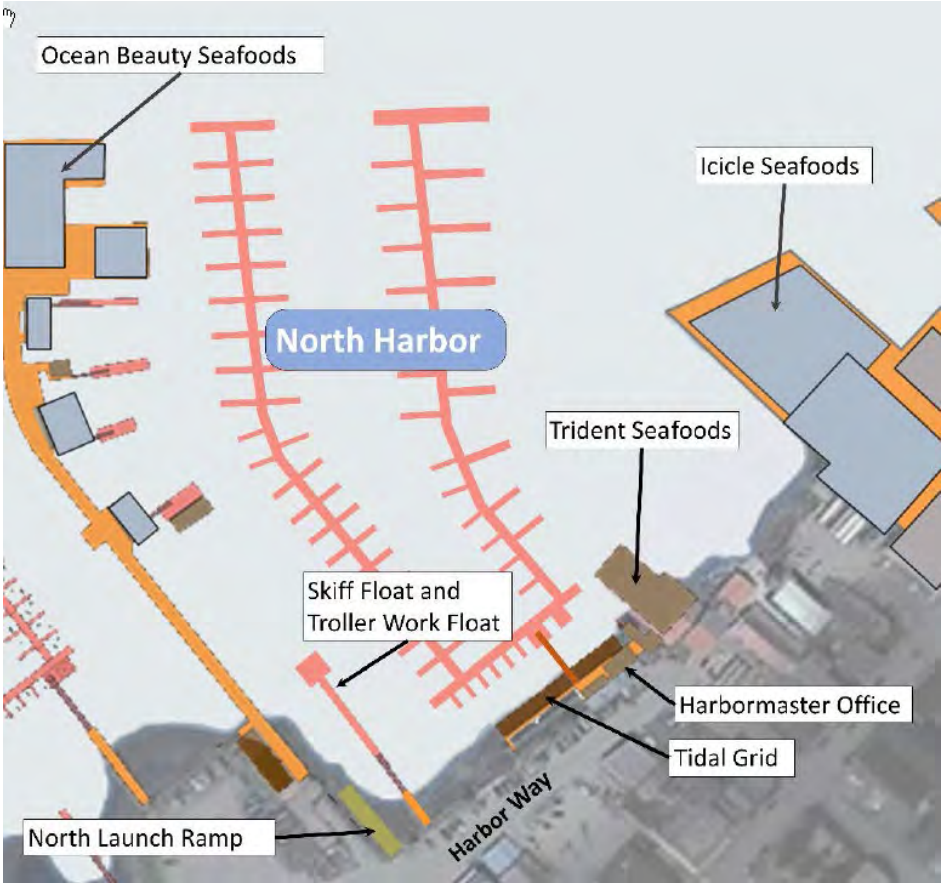

Figure 9. North Harbor

In addition to the processing plants and berths, the North Harbor has a 136-foot skiff float for Borough residents arriving by small vessels from Kupreanof Island and other surrounding communities. It also has a tidal grid of staked timbers for maintenance of commercial vessels up to 42 feet in length. The tidal grid is approximately 200 feet long and is primarily used for cleaning boat hulls below waterline. The North Harbor launch ramp, a timer ramp at the south side of the North Harbor, requires periodic maintenance. It is too short to launch boats at low tide, and there is no adjacent dedicated trailer parking.

The last major renovation of North Harbor before 2013 occurred in 1965 when more than 1,700 linear feet (LF) of log float was removed and replaced with more than 17,000 square feet of polystyrene floats. In 2013, the existing headwalk float, both mainwalk floats, all stall ("finger") floats, and the transient float were removed, along with all existing timber pile. Also demolished was an existing steel gangway, 215 LF of existing timber deck, and 37 LF of existing catwalk adjacent to the harbor office, as well as four existing boat grid sleepers and their associated support

piles. The entire slip area in North Harbor was dredged and a new approach dock, gangway, and float system was installed in a layout that increased the average north dock berth length.

Middle Harbor

Middle Harbor is bounded to the north by the Ocean Beauty Seafoods processing plant and to the south by the Petersburg Harbor crane dock (Figure 10). The Middle Harbor has two mainwalks joined by a connecting float. These floats support approximately 137 berths ranging in length from 18 to 32 feet. In addition to the processing plant and berths, Middle Harbor has a 150-foot work float for maintenance of nets and gear. An 84-foot privately owned boarding float is under lease to the ADF&G. At the south end of Middle Harbor, the Petersburg Harbor Department maintains a 120-foot public crane dock for fishing boat gear change. Hammer Slough, a tidal drainage through the center of Petersburg, empties into the harbor between the ADF&G float and the crane dock.

The last major renovation of Middle Harbor before 2005 took place around 1975 when the skiff float in the adjacent North Harbor was extended to relieve grounding issues at low tides. The area around the exiting floats in Middle Harbor was also dredged to improve accessibility. In 2005, the exiting headwalk float, both mainwalk floats, and all stall ("finger") floats were removed, along with all existing pile. Also demolished were an existing gangway, a portion of the existing timber approach dock, and associated support piles. A new gangway and float system was installed in a layout similar to that which had been demolished.

In 2012, the bulkhead at the landward end of the existing timber approach trestle suffered a partial failure. The Harbor Department executed field-expedient repairs to the bulkhead to prevent continued loss of backfill. In 2015, the Harbor Department replaced a section of the mainwalk float due to damage incurred by a vessel strike. The remaining existing element of construction of immediate concern is the timber approach trestle, which will need to be either upgraded or replaced at some point.

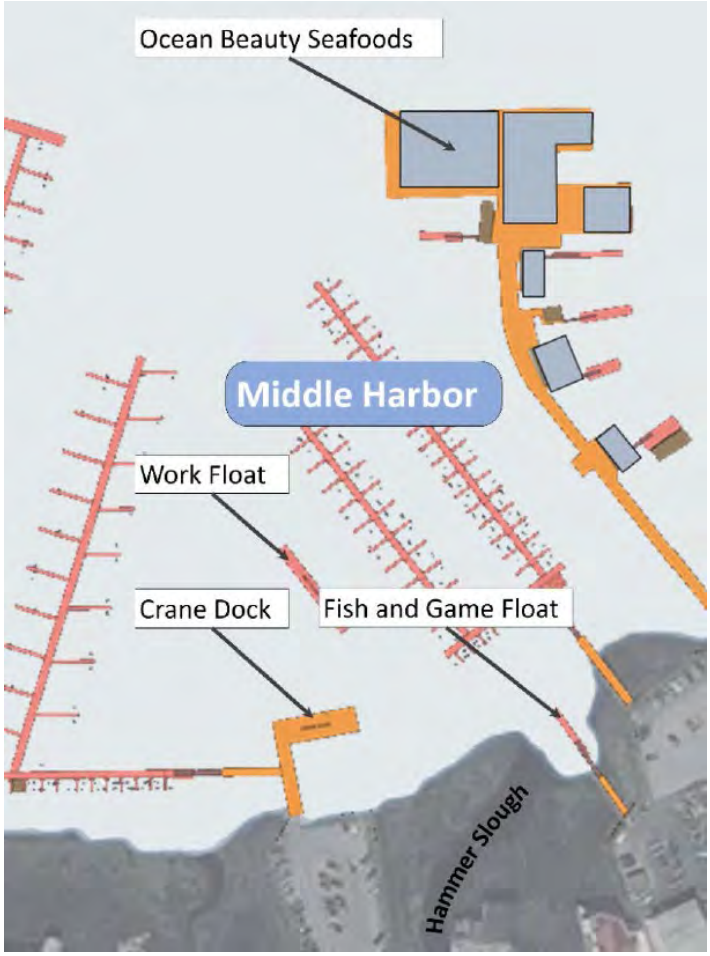

Figure 10. Middle Harbor

South Harbor

South Harbor is bounded to the north by the crane dock and to the south by the drive-down dock (Figure 11). South Harbor includes Floats A, B, C, and D with a connecting float joining them. These floats support 242 berths ranging in length from 40 to 100 feet. Several longer mooring positions for transient vessels and small cruise ships are available on the Pier C end float. On the land side of the South Harbor connecting float, 74 berths (20-foot fingers) have been constructed for skiffs and small boats on the order of 18 feet in length.

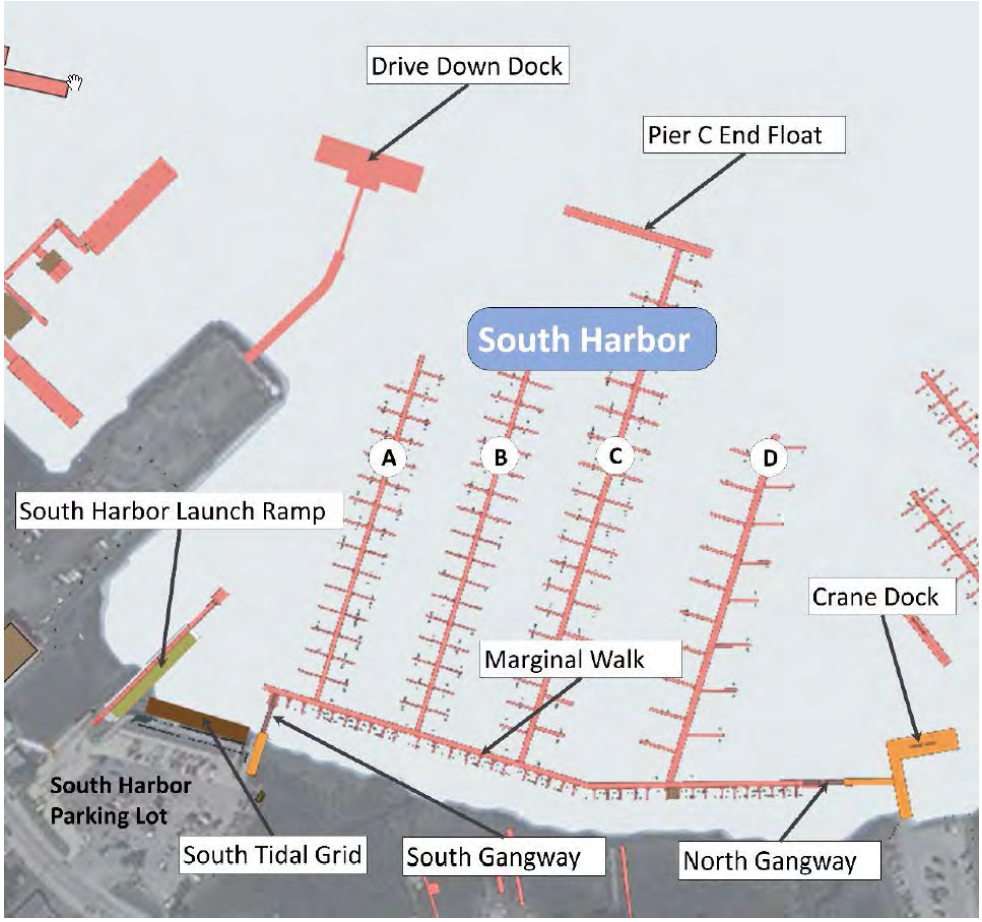

Figure 11. South Harbor

The South Harbor connecting float has two access gangways, one extending from the crane dock and one that connects to the South Harbor parking lot. Both gangways are elevated to allow small boats that berth along the back of the connecting float for egress at high tide. At the south end of the harbor, the Harbor Department maintains a single-lane concrete launch ramp and boarding float. This ramp is usable in all but the most extreme tidal conditions. There is limited trailer parking adjacent to this ramp. South Harbor also has a 195-foot steel tidal grid located parallel to the parking lot that is designed to take larger vessels up to 100 feet in length.

South Harbor improvements constructed in 1984 include the current 12-foot x 84-foot access ramp approach and a 7.5-foot x 65-foot steel access ramp, mainwalk Float A and Float D, extension of mainwalk Float B and Float C with additional finger floats, 200 feet of new vessel repair grid, and upland harbor improvements. In 1999, mainwalk Floats A, B, and C were replaced and additional finger floats added along each extension. The existing transient float was also installed at the end of mainwalk Float C. In 2000, approximately 850 LF of existing timber approach trestle and a timber dock, and approximately 400 LF of an existing fuel dock approach trestle, were demolished. Dredging occurred over an area of roughly six acres at dredge depths ranging from less than 7 feet to more than 10 feet of material, and a new approach dock was constructed for the fuel dock trestle. The western (channel side) half of Floats A, B, and C were reconstructed with new steel piles and

timbers in 2003. In 2003, a new end float was added to the existing south launch to provide space for recreational and subsistence boaters to clean fish and load gear.

Many of the older existing vessel finger floats have begun to lose freeboard, and some are experiencing significant rotational twist along their longitudinal axis. It is anticipated that replacement of these finger floats may be necessary in the near term. Remaining areas of concern include existing finger floats, mainwalk Float D, and the bearing of the existing gangway onto the existing gangway landing float. On the landside of the South Harbor connecting float, the small berths are currently restricted by sedimentation and will require dredging to remain operational throughout the full tidal range. This dredging is also necessary to prevent the connecting float from grounding at low tides and damaging the connections to the main floats. At 65 feet in length, the north and south access ramps are too short to allow them to effectively operate for the normal Petersburg Harbor tidal range.

4.3.2.2 Scow Bay

Scow Bay is an industrial district and small residential neighborhood approximately 2.5 miles south of Petersburg's downtown along the Mitkof Highway (Figure 12). It is not located within a census designated urban area and is considered a rural area (along with the entire Petersburg Borough).

The Scow Bay site was originally owned by the State of Alaska and used as an amphibious aircraft facility to serve the local population. The facility was abandoned once the State constructed a gravel airstrip in 1969 allowing wheeled planes to land in Petersburg. Currently, a portion of the site is used to store State of Alaska road maintenance equipment, but the remaining marine capital assets exceeded their life expectance many years ago and no effort was made to maintain or repurpose these assets once the facility was deemed redundant.

The existing site is constrained in many ways. The existing haul-out ramp (former seaplane ramp) has a slope that is too shallow for launch and recovery by conventional boat trailers, though it is occasionally used in this capacity by local residents. Particularly, residents from nearby island communities utilize the ramp to gain access to the road system in Petersburg for employment opportunities as well as goods and services.

The site is used occasionally to transport commercial and recreational vessels of about 30 to 40 feet in length out of the water using a commercially-operated submersible hydraulic trailer for winter storage at a yard across the highway. One vessel at a time can be accommodated on the existing site for maintenance activities. The site is exposed to wind and wave action, which limits the days when it is safe to transport vessels on the ramp. The ramp is also too short for use throughout the tidal cycle (at low tide, the bottom of the ramp is dry) so the window of opportunity for haul-outs is relatively small. Further, the site does not have infrastructure to address current federal environmental regulations restricting discharge of heavy metals, fuel, runoff, etc. into marine waters. This poses a risk to continued use of the site even at these limited levels.

In short, vessels utilizing the Scow Bay facilities are making due with transportation infrastructure that is beyond its useful life, being used in ways never envisioned by its designers, does not meet environmental standards, provides no safety improvements, and is in disrepair.

Figure 12. Scow Bay

4.3.1 Fleet Characteristics

This section provides an overview of the fleet of vessels that utilize moorage at Petersburg. While vessels with moorage throughout the Petersburg harbor system are discussed, this analysis focuses on the depth-constrained vessels utilizing moorage in South Harbor. These include 74 vessels with moorage on Float D and the north half of Float C, as well as 74 vessels primarily used for subsistence with moorage on the main float in South Harbor.

Petersburg's harbors were primarily developed to serve the regional commercial fishing industry. As such, it is important to consider vessels throughout the region that utilize Petersburg facilities for both permanent and transient moorage. According to the Commercial Fisheries Entry Commission (CFEC), there were 553 commercial fishing vessels for Petersburg residents in 2017; however, there were 1,366 commercial fishing vessels for residents in Southeast Alaska when

other communities in the region such as Wrangell, Yakutat, Skagway, and Juneau are considered.[5] Many of these vessels fish multiple permits for different species throughout the region and utilize moorage at Petersburg. To approximate the number of commercial vessels in the region, CFEC data for the census areas formerly known as the Wrangell-Petersburg, Skagway-Yakutat-Angoon, and Juneau were analyzed. Note that the names and designations of census areas have changed over time and those used by the CFEC do not necessarily reflect the most current census area names; however, they do still approximate the region. Also note that because individual vessels often hold more than one permit, are used for more than one activity, and run multiple gear types, a vessel may be counted multiple times in some of the tables below. Therefore, some totals may be inconsistent if, for example, a vessel is used as both a tender and commercial fishing vessel.

Vessel characteristics including age, hull type, use, and gear types are similar for Petersburg vessels and vessels across the region. The majority of vessels operated as commercial fishing vessels with a small portion acting as either tenders/packers or freezers/canners (Table 9). Approximately two-thirds of the vessels have diesel engines with the rest operating on gasoline. For vessel uses and vessel gear types, note that in both cases the totals exceed the number of total vessels, which indicates that vessels often run multiple gear types and are used for multiple purposes. Table 9 through Table 12 summarize vessel characteristics and statistics by area for 2017, the most recent complete year or data.

Table 9. Vessel Use by Region

	Petersburg		Region	
Use/Activity*	**Number of Vessels**	**Percentage of Total Vessels**	**Number of Vessels**	**Percentage of Total Vessels**
Freezer/Canner	9	1.7%	23	1.7%
Tender/Packer	71	13.3%	145	10.6%
Guided Sport (Charter)	0	0.0%	0	0.0%
Commercial Fishing	521	97.7%	1333	97.6%
Total Vessel Uses	**601**		**1,501**	
Total Vessels	**533**		**1,366**	

For Petersburg, vessels averaged 35 years in age and were closely split between aluminum hulls (47 percent) and fiberglass hulls (36 percent). For the region, vessels also averaged 35 years in age and were primarily split between aluminum (35 percent) and fiberglass hulls (46 percent). Average vessel length varies by hull material.

[5] Commercial Fisheries Entries Commission, Vessel Characteristics & Statistics by Year, State, Alaskan Census Area or Community. https://www.cfec.state.ak.us/index.htm

Table 10. Vessel Length by Hull Type

	Petersburg		Region	
Hull Type	**Average Vessel Length (feet)**	**Percentage of Total Vessels**	**Average Length (feet)**	**Percentage of Total Vessels**
Aluminum	22.3	46.7%	24.7	35.3%
Concrete	0.0	0.0%	26.0	0.2%
Fiberglass/Plastic	35.4	36.0%	33.2	46.2%
Iron/Steel/Alloy	64.0	8.1%	56.3	6.7%
Rubber	9.8	0.9%	6.3	0.4%
Wood	51.4	8.3%	44.9	10.9%

Table 11. Vessels by Hull Type

	Petersburg		Region	
Hull Type	**Number of Vessels**	**Percent of Vessels**	**Number of Vessels**	**Percent of Vessels**
Aluminum	249	46.7%	482	35%
Concrete	0	0.0%	3	0.2%
Fiberglass/Plastic	192	36.0%	631	46.2%
Iron/Steel/Alloy	43	8.1%	91	6.7%
Rubber	5	0.9%	6	0.4%
Wood	44	8.3%	149	10.9%
Total	**533**	**100%**	**1362**	**100%**

Gear types were varied with vessels often employing multiple gear types in order to participate in multiple seasons and fisheries. This practice is common throughout Alaska. The gear types are shown in Table 12.

Table 12. Vessels by Gear Type

	Petersburg		Region	
Gear Type	**Number of Vessels**	**Percentage of Total Vessels**	**Number of Vessels**	**Percentage of Total Vessels**
Diving Gear	25	4.7%	56	4.1%
Fish Wheel	0	0.0%	0	0.0%
Gill Net - Drift	122	22.9%	306	22.4%
Gill Net - Herring	34	6.4%	46	3.4%
Gill Net - Set	10	1.9%	45	3.3%
Longline	173	32.5%	452	33.1%
Mechanical Jig	4	0.8%	36	2.6%
Pot Gear	179	33.6%	382	28.0%
Ring Net	34	6.4%	71	5.2%
Scallop Dredge	0	0.0%	1	0.1%
Seine - Purse Seine	145	27.2%	214	15.7%
Seine - Beach Seine	5	0.9%	7	0.5%
Trawl - Beam	11	2.1%	30	2.2%
Trawl - Double Otter	0	0.0%	1	0.1%
Trawl - Otter	7	1.3%	11	0.8%
Trawl - Pair Trawl	0	0.0%	0	0.0%
Troll - Dinglebar	9	1.7%	63	4.6%
Troll - Hand	164	30.8%	434	31.8%
Troll - Power	62	11.6%	308	22.5%
Other Gear Types	47	8.8%	82	6.0%
Total Gear Types	**1,031**		**2,545**	
Total Vessels	**533**		**1,366**	

In addition to commercial fishing vessels, other types of vessels are present at Petersburg. Charter vessels provide sport fishing and sightseeing opportunities. The majority of these vessels are 28 to 45 feet in length. Subsistence vessels assist residents in performing subsistence hunting, fishing, and gathering activities. The majority of these vessels are less than 20 feet in length. Recreation vessels such as pleasure craft and yachts are also present. These vessels vary greatly in length from less than 20 feet to greater than 60 feet.

4.3.2 Moorage Demand

Additional information on the fleet which currently utilizes Petersburg harbor facilities was determined through analysis of moorage data maintained by the Petersburg Harbormaster, personal interviews, and other research. In the most general sense, demand for moorage at Petersburg exceeds supply based on the fact that the harbor office maintains a waitlist for slips. The harbors described in the Marine Facilities section already operate at or near capacity and maintain waitlists for permanent moorage.

There are approximately 573 slips available in the Petersburg harbor system with more than 80 percent of slips being filled on a permanent basis as of December 2018. Of the vessels with

permanent moorage, the majority of vessels occupy slips in the 28 to 37 foot range followed by vessels in the 46 to 60 foot range. The 74 depth-constrained vessels on the main float in South Harbor are all under 22 feet in length and currently draft less than 3 feet. However, it is worth noting that many of these slips are not usable or see limited use due to depth-constraints, but are expected to be used regularly if dredged to sufficient depth.

While the majority of vessels with permanent moorage are less than 46 feet in length (70 percent) and draft less than 10 feet (80 percent), the depth-constrained vessels on Float C and Float D in South Harbor are all longer and draft deeper than the fleet overall. Table 13 and Table 14 summarize vessel lengths and draft for vessels with permanent moorage at Petersburg, while Table 15 and Table 16 show vessel lengths and draft for vessels with permanent moorage on Float D and the north half of Float C in South Harbor.

Table 13. Vessel Length, Permanent Moorage in Petersburg

Vessel Length Range (feet)	Number of Vessels	Percent of Vessels
0–20	59	11%
21–27	67	12%
28–36	146	27%
37–45	105	19%
46–60	122	22%
>60	45	8%
Total	**544**	**100%**

Table 14. Vessel Draft, Permanent Moorage in Petersburg

Vessel Draft Range (feet)	Number of Vessels	Percent of Vessels
1–4	300	55%
5–9	135	25%
10–12	98	18%
>14	11	2%
Total	**544**	**100%**

Table 15 and Table 16 summarize vessel lengths and drafts for the 74 depth-constrained vessels with permanent moorage in South Harbor. Note that the majority of these vessels fall within the 56 to 60 foot length range and draft between 10 and 12 feet.

Table 15. Vessel Length, Permanent Moorage in South Harbor

Vessel Length Range (feet)	Number of Vessels	Percent of Vessels
0–20	0	0%
1–27	0	0%
28–36	0	0%
37–45	0	0%
46–60	**52**	**70%**
*46-52**	*6*	*9%*
*56-58**	*46*	*62%*
*60**	*3*	*4%*
>60	**22**	**30%**
Total	**74**	**100%**

*Italicized numbers are sub-totals within the 46–60 foot length range.

Table 16. Vessel Draft, Permanent Moorage in South Harbor

Vessel Draft Range (feet)	Number of Vessels	Percent of Vessels
8	8	11%
9	1	1%
10	33	45%
11	24	32%
12	8	11%
Total	**74**	**100%**

Petersburg also maintains a waitlist for vessels seeking permanent moorage. As of December 2018, there were 29 vessels on the waitlist ranging from 50 to 143 feet in length and 8 to 14 feet in draft. In addition to established demand for permanent moorage, transient vessels also use facilities at Petersburg. According to the Petersburg Harbormaster, transient moorage is based on a first come first serve basis, and vessels on the waitlist are frequent transient customers. Commercial vessels from throughout the region utilize Petersburg's facilities for months at a time during much of the fishing season, particularly during the summer salmon fishing season. While the Harbormaster does not maintain detailed data for vessels utilizing transient moorage, harbor records indicate there are between 3,000 and 4,000 stops by transient vessels each year on average. About 90 percent of these transient vessels draft 12 feet or less while the rest draft about 14 feet. The larger, deeper draft vessels are primarily tender vessels. Table 17 summarizes transient vessel calls to Petersburg by vessel length based on available data.

Table 17. Transient Vessel Calls at Petersburg

Vessel Length Range (feet)	Average Number of Stops Annually	Percent by Vessel Length
0–60	800	24%
60–72	500	15%
72–80	500	15%
8–85	1000	30%
85–120	500	15%
Total	**3,300**	**100%**

Based on the makeup of the existing fleet described above, as well as expectations described in the next section about the stability of the fleet going into the future, the design vessel for this study is a hybrid of the National Geographic Sea Lion vessel (164-foot length and 33-foot beam) and a commercial fishing vessel with a 12-foot draft.

4.3.3 Summary

Existing marine facilities within the Petersburg harbor system have been constructed and reconstructed over a period of many years in order to continue to meet the needs of the fleet, with facilities ranging in age from nearly new to over 30 years old.[6] While it is expected that demand for moorage and marine services in Petersburg will remain strong into the future, and that the Petersburg Borough will continue to maintain existing marine facilities to support that demand, insufficient depths within the harbor system will continue to result in transportation inefficiencies and limit access for commercial fishing and subsistence activities, creating economic inefficiencies for the region and Nation. The following section describes the expected future conditions in Petersburg in the absence of Federal investment in navigation improvements.

4.4 Without-Project Conditions

4.4.1 Assumptions

Several assumptions were made when conducting the future without-project economic analysis. Chief among them is that the existing fishery will continue to support the fleet. This is a critical assumption supported by the fact that fisheries in Alaska are regulated to assure future viability of resources. The Marine Resources section of this appendix provides a description of the viability of the commercial fisheries in Petersburg and Southeast Alaska. The continued sustainability of commercial fisheries is crucial for vessels that call on Petersburg. Available forecasts for commercial fisheries are for the relative near term in terms of this study's 50-year period of analysis. Based on available data and Alaska's historical management techniques, this analysis assumes that the commercial fisheries utilized by Petersburg boaters will remain stable. Because of the inherent uncertainty surrounding the forecast of any growth in fisheries and related marine

[6] Petersburg Borough Waterfront Master Plan, 2016.

resources, a conservative "no growth" approach was taken in determining the future fleet at Petersburg. Conversely, there is no evidence that demand for moorage at Petersburg will decrease over time. Therefore, it is assumed that the fleet identified in the Existing Conditions section will remain stable throughout the period of analysis

It is also assumed that the Petersburg harbor system will continue to be a cornerstone of the Petersburg Borough economy. However, absent Federal investment in navigation improvements, insufficient depths and existing marine infrastructure within the harbor system are expected to continue to cause transportation inefficiencies and limit access for commercial fishing and subsistence activities. Finally, it is assumed that a haul-out facility and/or harbor will not be developed in Scow Bay without Federal investment, so vessels will continue to utilize other facilities in the region, resulting in greater distance traveled and time spent to reach such facilities. The expected future levels of these inefficiencies and foregone harvesting opportunities, including their associated future without-project costs, are discussed in this section.

It is important to note that approximately 93 percent of vessels using Petersburg harbor facilities are commercial fishing vessels.[7] South Harbor is used primarily by commercial boaters, while most of the shoreline slips in the inland mooring area are used by subsistence and recreational boaters. Depth constraints are expected to continue to affect all commercial fishing vessels moored on Float D (38 vessels) and the north half of Float C (36 vessels), as well as 74 subsistence vessels moored on the main float shown in Figure 13. Based on the makeup of the existing fleet and the fleet expected to use South Harbor over the period of analysis, the design vessel for this study is a hybrid of the National Geographic Sea Lion (length and beam) and a commercial fishing vessel with a 12-foot draft.

Harbor users stated an approximate tide of –1 foot Mean Lower Low Water (MLLW) was the limit of safe navigation within these portions of South Harbor.[8] Tides lower than –1 foot MLLW are assumed to cause delays for vessels moored in these areas while entering and exiting South Harbor. While all 74 commercial fishing vessels and 74 subsistence vessels would be affected if entering or exiting the harbor during low-tide events, not all vessels use the harbor daily due to the different types of fisheries accessed from Petersburg. For example, seiners typically make two round trips per week to access fishing grounds during the summer salmon fishing season, which is the season when the harbor is typically most affected by low tides.[9] Therefore, a range of scenarios was evaluated based on the percent of commercial and subsistence vessels expected to be impacted by depth constraints during low-tide cycles. The most conservative scenario assumes 25 percent of vessels would be affected during each low-tide event, which would likely result in an underestimation of potential benefits. Given that most vessels run multiple gear types and

[7] Petersburg harbormaster.
[8] Based on discussions with Petersburg harbormaster and local fishermen.
[9] According to the Petersburg harbormaster, these vessels typically depart South Harbor on a Wednesday, fish Thursday, return Friday, then depart again Saturday, fish Sunday, and return Monday.

essentially fish year round, it is likely that a larger portion of vessels would be affected during each low-tide cycle and would therefore benefit from the proposed navigation improvements.

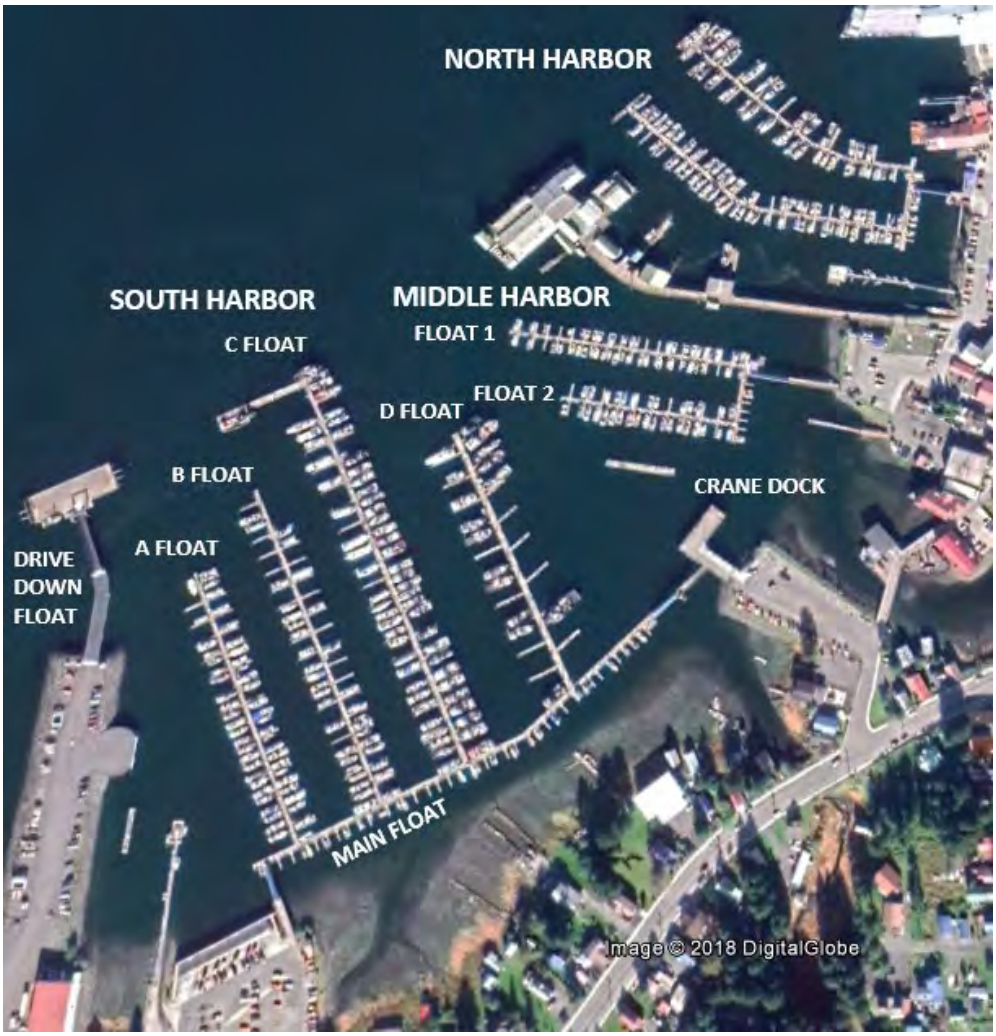

Figure 13. Petersburg Harbor System

Based on focus group interviews with harbor users, depths during lower or minus tides causing vessel delays occur approximately five times during the summer salmon fishing season and impact access to South Harbor for an average of four days at a time. Delays per commercial fishing vessel average five hours. Delays experienced by subsistence vessels range from about two to six hours depending on where vessels can exit the harbor. Delays are about two hours for vessels that can exit at the south end near the drive-down dock, whereas delays for vessels that can exit at the north end of South Harbor near Float D are more similar to the four to six hour delays experienced by the larger vessels on Floats C and D.[10] This analysis conservatively assumes an average delay of

[10] Conversation with City of Petersburg Community and Economic Development Director on 21 June 2016.

two hours for subsistence vessels. This analysis also conservatively assumes vessels would experience delays on half of the days during a low-tide cycle, resulting in approximately 50 delay hours per commercial vessel and 20 delay hours per subsistence vessel each summer.[11, 12] Although vessel delays related to low tides primarily occur during the summer months, which coincides with the commercial salmon fishing season, additional benefits may be realized by reducing delays that occur throughout the rest of the year.

In addition to the delays described above, Petersburg-based vessels must travel to other ports in the region to use haul-out facilities to access vessel work yards and storage yards. While some vessels use existing haul-out facilities at Scow Bay, these facilities have outlasted their useful life and do not meet the needs of the fleet. The closest community to Petersburg is approximately 40 miles away and travel time by boat is approximately four hours each way; however, this yard cannot accommodate all Petersburg vessels plus their own fleet so some Petersburg-based vessels travel further to access such facilities (approximately 120 miles or about 16 hours by water each way). Given the capacity of nearby ports, it is estimated that about 200 Petersburg vessels could be accommodated at the closer distance and the remainder would have to travel further.

Based on CFEC data, this analysis assumes 410 vessels would benefit from haul-out facilities at Scow Bay. Petersburg harbors have approximately 573 slips.[13] Of these, 77 are used by vessels larger than 57 feet that would exceed the capacity of the proposed haul-out facilities at Scow Bay.[14] An additional 74 slips are for vessels under 20 feet that would likely use existing recreational ramps in Petersburg. The remaining 410 vessels are expected to benefit from improved haul-out facilities in Scow Bay, as further described in the next section.

The number of vessels experiencing delays and the length of these delays are combined with the vessel operating costs described in the next section to estimate potential delay reduction benefits for commercial and subsistence vessels operating in Petersburg.

4.4.2 Vessel Operating Cost Methodology

Vessel operating costs (VOCs) for the Petersburg fleet are used to calculate future-without project delay costs and, subsequently, benefits resulting from navigation improvements. Previous Alaska District small boat harbor studies provide the basis for the methodology and assumptions used to develop these estimates. This approach has been used in several Alaska District feasibility studies including Craig, Whittier, Valdez, Homer, and Port Lions. The basic framework used in those studies is applicable to Petersburg with changes to input data as appropriate.

Vessel costs are comprised of both fixed and variable costs. Fixed costs are induced upon the owner of the vessel regardless of productive use. Variable costs occur while the vessel is in

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[11] Delay length per commercial vessel = 5 times per summer x 2 days per occurrence x 5 hours per delay = 50 hours.
[12] Delay length per subsistence vessel = 5 times per summer x 2 days per occurrence x 2 hours per delay = 20 hours.
[13] Petersburg harbormaster
[14] Alaska Commercial Fisheries Entry Commission Vessel Database, Homeport Petersburg, Alaska. http://www.cfec.state.ak.us/plook/#vessels

operation, including the costs for vessel repair and maintenance, the cost of fuel and lubricating oil, and other such costs. As such, this analysis assumes that fixed expenses for any given vessel operating out of Petersburg will be unchanged with improved navigation conditions whereas variable expenses for Petersburg vessel operators could change as a result of navigation improvements.

Vessel characteristics are used as a starting point to determine operating costs. One key aspect of vessel characteristics is the vessel investment cost. Certain vessel costs are calculated as a portion of vessel investment cost. For this analysis, vessel investment costs are based on the values used in the 2014 Craig feasibility study updated to current dollars. These are considered representative of operating costs for commercial fishing vessels in Southeast Alaska (Table 18).

Table 18. Petersburg Fleet, Average Investment Costs and Characteristics

	Vessel Length					
Description*	**0-20 feet**	**21-27 feet**	**28-36 feet**	**37-45 feet**	**46-60 feet**	**>60 feet**
Investment (2014 dollars)	$46,000	$45,000	$100,000	$147,000	$409,000	$360,000
Investment (current dollars)	$47,000	$46,000	$101,000	$149,000	$415,000	$365,000
Length x Beam (ft)	18 x 6	22 x 9	32 x 13	45 x 17	58 x 19	100 x 28
Draft (ft)	1-3	1-3	2-4	4-6	8-12	10-14
Fish hold (lb.)	N/A	N/A	12,000	30,000	60,000	300,000
Main Power Load rate "B"	Volvo penta gas IO	Volvo penta gas IO	Single Cat 3208 Turbo	Twin Cat 3208 turbo	Twin Cat 308 turbo	Twin 8V71 Detroit Diesel

*Vessel Descriptions and characteristics are based on previous Corps feasibility studies including Craig, Whittier, Valdez, Homer, and Port Lions, as well as fleet information provided by the Petersburg Harbormaster. These vessels are considered typical of commercial fishing vessels in Southeast Alaska.

4.4.2.1 Annual Operating Costs

Total annual operating expenditures, both fixed and variable, include all costs that a vessel owner would be expected to spend in a given year. The fixed expenses for any given vessel operating out of Petersburg are assumed to remain unchanged with improved navigation. However, the variable expenses for Petersburg boaters could change as a result of navigation improvements.

Total operating hours are dependent upon assumptions about fishing season length, time spent fishing, and the number of crew. Research into commercial fishing practices in Alaska suggests that the number of open fishing days per season ranges from 60 to 130 depending on vessel size. The total season hours a commercial fishing vessel may be operating is equal to the number of fishing days per season multiplied by 24 hours per day, and ranges from 1,440 to 3,120 hours. This includes time not actively spent fishing and may include time motoring between ports or fishing locations, awaiting repairs, or time when the vessel is idle but still expending resources through refrigeration, processing, ventilation, or other systems onboard. Commercial fishing vessels are assumed to spend an average of 14 hours per days actively harvesting during the fishing season. Therefore, the total harvesting hours per commercial vessel range from 840 to 1,820. Commercial fishing vessels have between 2 and 4 people on board (including the captain) depending on vessel

size. The total man hours per commercial fishing vessel ranges from 1,680 to 7,280 hours.[15] For this analysis, the calculations for subsistence vessels are the same as for commercial fishing vessels. Table 19 summarizes assumptions related to hours in operation per fishing season.

Table 19. Petersburg Fleet, Operating and Season Length Assumptions

	Vessel Length					
Description	**0-20 ft**	**21-27 ft**	**28-36 ft**	**37-45 ft**	**46-60 ft**	**>60 ft**
HP[1]	100-200	100-200	255	510	510	925
Fuel Use Rate[1]						
Low (gph @ 25% power)	6	6	5	10	10	13
Medium (gph @ 50% power)	9	9	9.5	19	19	28
High (gph @ 85% power)	12	12	14	28	28	43
Crew, Commercial Fishing & Subistence[1]	2	2	3	3	4	4
Potential number open fishing days, per season[2]	60	60	120	130	130	130
Commercial vessels, total season hours (assumes 24-hrs in operation)	1,440	1,440	2,880	3,120	3,120	3,120
Commercial vessels, total harvesting hours (14-hr days)	840	840	1,680	1,820	1,820	1,820
Commercial vessels, total man hours	1,680	1,680	5,040	7,280	7,280	7,280

Notes:

1. Vessel characteristics and number of crew members are assumptions from previous Corps feasibility reports and are representative of Alaskan commercial fishing vessels.
2. Previous Corps feasibility reports assumed an average commercial fishing length season of 130 days for larger vessels. Smaller fishing vessels fish fewer days. This is based on the typical commercial fishing season length based on searches of records from the State of Alaska Department of Fish and Game. The season lengths represent general averages without considering weather delays or other issues of individual operators, as this type of empirical data is not available.

Fixed Costs

Most fixed costs are calculated as a percentage of vessel investment cost but may also include fees associated with fishing licenses and the cost of fuel, repairs and maintenance, and hourly wages paid to crew members as applicable. It is important to note that in the case of commercial fishing vessels, the captain and crew are paid through crew shares, which vary based on the skill of the crew, the fishery, and the gross harvest value. Crew members earn a share of the harvest value

[15] 840 harvesting hours x2 crew members = 1,680 hours; 1,820 harvesting hours x 4 crew members = 7,280 hours.

after the cost of fuel, food, and other operating costs are covered. Table 20 summarizes annual fixed costs for the Petersburg fleet by vessel size category.

Table 20. Annual Fixed Operating Costs for the Petersburg Fleet

	Vessel Length					
Description	**0-20 ft**	**21-27 ft**	**28-36 ft**	**37-45 ft**	**46-60 ft**	**> 60 ft**
Hull Insurance @ 5% of investment[1]	$2,350	$2,300	$5,050	$7,450	$20,750	$18,250
P&I Insurance @2%[1]	$940	$920	$2,020	$2,980	$8,300	$7,300
License/permit fees[2]	$1,009	$1,009	$6,057	$10,094	$20,525	$24,675
Association dues[2]	$224	$224	$336	$561	$1,122	$1,122
Business Expenses @ 2%[1]	$940	$920	$2,020	$2,980	$8,300	$7,300
Return on Capital @ 2.875% over 30 years[3]	$2,359	$2,309	$5,070	$7,480	$20,832	$18,322
Food @ ($29 x # fishing days x # crew)[4]	$3,481	$3,481	$10,443	$15,085	$15,085	$15,085
Commercial fishing Crew share (1/2 total costs)[5]	$58,768	$58,518	$133,373	$260,763	$338,307	$426,408

Notes:

1. Research conducted for the Port Lions feasibility study found that some fixed vessel costs are best represented as a percent of the investment cost of the vessel. Hull insurance is estimated at 5% of vessel investment, Protection and Indemnity (P&I) Insurance at 2%, and Business Expenses at 2%. Since vessel investment costs are up-to-date, these percentages represent current estimates of these items.
2. License and permit fees and Association dues values are derived from the Valdez Feasibility economics appendix, June 2010, updated to current dollars using the Anchorage Consumer Price Index from the State of Alaska Department of Labor and Workforce Development.
3. The average annual value of return on capital of vessel investment is estimated using the current Federal discount rate (2.875 percent), and an average vessel life of 30 years.
4. The Port Lions feasibility report found that food for crew is equal to $20 per person per day. These values were based on a USACE cost estimate for False Pass from 2000. Using the CPI to update this value to current dollars results in a per person food cost of $29 per day. This is multiplied by the number of days per fishing season to estimate annual food costs.
5. Crew shares for commercial captain and crew are based on 50 percent of gross harvest value, assuming a break-even harvest value. Under this assumption, crew shares would equal half of total annual costs.

Variable Costs

Variable costs are costs which can be foregone when the vessel is not in operation. These include the cost of fuel, vessel repairs, and vessel maintenance.

Fuel expenses depend on vessel characteristics and the vessel operator's strategic and tactical fishing decisions. Fuel consumption rates vary by vessel type and range from 6 to 12 gallons per hour for 0 to 20-foot vessels to 10 to 28 gallons per hour for 46 to 60-foot vessels. For commercial

fishing vessels, this analysis assumes that each vessel operates for 8 hours per day at the high fuel use rate, 12 hours at the medium (or average) fuel use, and 4 hours per day at low fuel use (or idle but utilizing on-board systems). In this case, fuel use per vessel ranges from nearly 14,000 gallons to 95,000 gallons annually.

Quantifying the cost of this fuel use is dependent upon the price of fuel. The analysis utilizes the 5-year average price of #2 marine diesel as reported for Petersburg by the Pacific States Marine Fisheries Commission monthly fuel price survey. Fuel costs range from $42,000 to $294,000 annually for commercial fishing vessels. Vessel repair and maintenance expenses are estimated to be 11 percent of the vessel investment cost (Table 18) based on previous Corps feasibility studies in Alaska. This category includes the costs of preparing the vessel to fish at the beginning of the season, preparation for winter storage at the end of the season, in-season maintenances, and other repairs. Table 21 shows input data used to calculate annual fuel costs as well as repair and maintenance costs by vessel size category.

Table 21. Annual Variable Costs, Petersburg Fleet

	Vessel Length					
Description	**0-20 ft**	**21-27 ft**	**28-36 ft**	**37-45 ft**	**46-60 ft**	**>60 ft**
Average Fuel Price (per gallon)	$3.09	$3.09	$3.09	$3.09	$3.09	$3.09
Fuel Use (gallons)	13,680	13,680	29,520	63,960	63,960	95,160
Fuel Cost	$42,294	$42,294	$91,266	$197,744	$197,744	$294,204
Repair/Maintenance @ 11%	$5,170	$5,060	$11,110	$16,390	$45,650	$40,150

The annual variable operating costs estimated above are then divided by the estimated number of total season hours to derive hourly variable operating costs.

4.4.2.2 Hourly Operating Costs

Hourly variable operating costs are calculated as a range to address some of the uncertainty associated with vessel operating practices. The high range for vessel fuel costs is based on fuel consumption for the hours spent actively fishing. It is calculated by dividing the total fuel cost per season by the total number of vessel hours spent fishing during the season. The low range for fuel costs is based on the fuel consumption for all vessel activities, assuming the vessel is in operation in some capacity for 24 hours per day during the fishing season. The total hourly variable cost is equal to fuel costs plus repair and maintenance costs. The mid-range hourly variable cost is an average of the high and low estimates and is used throughout this analysis as the representative vessel operating cost. Table 22 shows hourly variable costs for commercial vessels.

Table 22. Hourly Variable Cost Summary for Petersburg Commercial Fishing Vessels

	Vessel Length					
Description	**0-20 ft**	**21-27 ft**	**28-36 ft**	**37-45 ft**	**46-60 ft**	**>60 ft**
Fuel Cost, averaged per hour harvesting	$50.35	$50.35	$54.33	$108.65	$108.65	$161.65
Fuel Cost, averaged per hour for all activities	$29.37	$29.37	$31.69	$63.38	$63.38	$94.30
Variable repair and maintenance Cost	$6.15	$6.02	$6.61	$9.01	$25.08	$22.06
Hourly Variable Costs						
High	$56.50	$56.37	$60.94	$117.66	$133.73	$183.71
Low	$35.53	$35.39	$38.30	$72.38	$88.46	$116.36
Average	**$46.02**	**$45.88**	**$49.62**	**$95.02**	**$111.10**	**$150.03**

The vessel operating costs used in this analysis are based on the characteristics of the vessels experiencing depth-related delays at Petersburg. Since the majority commercial fishing vessels experiencing delays are in the 46 to 60-foot length range, the hourly VOC of $111.10 is used. Since nearly all subsistence vessels experiencing delays are less than 20 feet in length, the hourly VOC of $46.02 is used for those vessels.

4.4.3 Commercial Fishing

Due to the depth constraints and delays occurring at Petersburg, commercial fishing captains and crew members incur additional VOCs and an Opportunity Cost of Time (OCT) while waiting for sufficient depths to safely enter, exit, and maneuver within the harbor system. Moreover, vessels that currently utilize haul-out facilities outside of Petersburg incur additional transportation costs that could be alleviated if haul-out facilities were located in Petersburg. Potential benefits to the commercial fishing fleet are based on the portion of the commercial fleet experiencing delays in South Harbor, the average delay length, and the hourly VOCs estimated above.

Vessel Operating Costs

Based on the assumptions described above regarding the portion of the commercial fleet experiencing delays in South Harbor, potential benefits associated with reducing VOCs have a present value of approximately $11.1 million over the period of analysis with an average annual equivalent (AAEQ) value of $423,000. Input data including the expected number of vessels that would be delayed, average delay length, and average vessel operating costs per vessel are summarized in Table 23. As noted in the General Methodology section, all potential benefit values are converted to AAEQ values using the FY19 discount rate of 2.875 percent, a 50-year period of analysis, and base year of 2022. Therefore, the potential annual VOC savings, which are not discounted/indexed to the base year, differ slightly from the AAEQ values shown in the table below.

Table 23. Potential Vessel Operating Cost Savings: South Harbor Commercial Fishing Vessels

Variable Description	South Harbor Vessels
Vessels Affected	74
Average Delay per Vessel	50
Average VOC per hour	$111.10
Potential Annual VOC Savings	$411,000
AAEQ Value	**$423,000**
Total Present Value	**$11,144,000**

In addition to these potential savings, opportunities exist for vessels that currently utilize haul-out facilities and moorage at other harbors in the region, but could call at Petersburg if facilities were built in Scow Bay. As noted in the Assumptions section, 410 vessels are expected to benefit from haul-out facilities at Scow Bay. Given the capacity of nearby ports, 200 Petersburg vessels could be accommodated at the closest port while the remaining 210 vessels would be travel to the next closest port (Table 24).

Table 24. Travel Times to Nearby Ports

Port Facility	Travel Time, Roundtrip (hours) from Petersburg	Vessels	Time Saved, Roundtrip (hours)
Scow Bay	1		
Wrangell (closest port)	8	200	7
Juneau/Hoonah (next closest ports)	32	210	31

Potential VOC savings were evaluated for five user groups using the equation: Number of Trips x Time Saved per Trip x Hourly Vessel Operating Cost = Annual Savings. The five groups are:

1. Vessels able to travel to Wrangell during the off season (180 vessels)
2. Vessels able to travel to Wrangell during the fishing (20 vessels)
3. Vessels required to travel to Juneau or Hoonah during the off season (189 vessels)
4. Vessels required to travel to Juneau or Hoonah during the fishing season
5. Additional vessels that could use Scow Bay haul-out facilities (Substitute (0.50*Time Saved) for the Time Saved in calculations 1–4.

These additional potential savings have a present value $35.7 million over the period of analysis with an AAEQ value of $1.36 million. Table 25 summarizes input data and calculations for these savings.

Table 25. Potential Vessel Operating Cost Savings: Scow Bay Haul-Out Facility

User Group	Number of Trips (assumes 1 trip per vessel annually)	Time Savings Per Vessel Per Trip (hours)	Vessel Operating Cost (hourly)	Annual VOC Potential Savings
1	180	7	$111.10	$140,000
2	20	7	$111.10	$16,000
3	189	31	$111.10	$651,000
4	21	31	$111.10	$72,000
5	410	3.5 or 15.5	$111.10	$439,000
Total				**$1,318,000**
AAEQ Value				**$1,356,000**

Note that for user group 5, potential VOC savings are estimated by substituting one-half of the time savings values used for groups 1 through 4 as follows:

- User Group 5.1: 180 vessels x 3.5 hours saved x $111.10 hourly VOC = $70,000
- User Group 5.2: 20 vessels x 3.5 hours saved x $111.10 hourly VOC = $8,000
- User Group 5.3: 189 vessels x 15.5 hours saved x $111.10 hourly VOC = $325,000
- User Group 5.4: 21 vessels x 15.5 hours saved x $111.10 hourly VOC = $36,000
- User Group 5 Total: $70,000 + $8,000 + $325,000 + $36,000 = $439,000

When these additional opportunities are considered, total potential VOC savings have a present value of $46.9 million over the period of analysis with an AAEQ value of $1.78 million. Table 26 shows potential VOC savings by area of use.

Table 26. Total Potential Vessel Operating Cost Savings: Commercial Fishing Vessels

Potential Benefit by Area	Present Value	AAEQ Value	% of Total
South Harbor Only	$11,144,000	$423,000	24%
Scow Bay Only	$35,735,000	$1,356,000	76%
Total	**$46,879,000**	**$1,779,000**	**100%**

Opportunity Cost of Time

Opportunity cost of time is the value of time which could otherwise be spent pursuing additional work or leisure activities. The value of time saved is based on methodology described in the Planning Guidance Notebook.[16] For commercial fishing captains and crew members, OCT rates are calculated based on data from the report *Value of Time Commercial Fishermen in Alaska Could Save with Improved Harbor Facilities*, conducted by the Cornell University Human Dimensions Research Unit for USACE Alaska District, in September 2006. According to that report, 70 percent

[16] ER 1105-2-100. https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

of Alaska salmon fishers would use that added time to conduct more fishing activity while 30 percent said they would use that time for leisure activity. Table 27 summarizes the wage and leisure rates used.

Table 27. Wage Rates for Opportunity Cost of Time Calculations

Description	Captain	Crew	Total
Wage Rate	$90.45	$72.61	$163.05
Leisure Rate	$30.15	$24.20	$54.35

Considering that commercial fishing is the primary industry in Petersburg and local fishermen indicated they would rather spend time fishing if not delayed, this analysis assumes that captains and crews in Petersburg would elect to use these saved hours as work time. According to the Cornell report, the hourly wage rate for salmon fishermen is $90.45 for the captain and $72.61 for crew members, updated to current dollars. Average crew size is assumed to be four members (including the captain) based on fleet composition and types of permits fished.[17] Assuming four crew members per vessel, the hourly OCT per vessel is about $300. Based on delay hours and OCT, the total annual OCT value per vessel is approximately $15,000. With 74 commercial fishing vessels impacted, this equates to a potential OCT savings of $30.9 million over the period of analysis with an AAEQ value of $1.17 million.

As with VOCs, additional opportunities exist for vessels that currently use haul-out facilities and moorage at other harbors in the region but could call at Petersburg if facilities were built in Scow Bay. For this analysis, the same 410 vessels that would experience VOC savings would experience OCT savings. To calculate these OCT savings, USACE assumes that 90 percent of the use of the Scow Bay haul-out facilities would occur during the off-season, so the leisure rate for vessel captains was applied, and 10 percent of the use would occur during the fishing season so the wage rates for captain and crew were used.

These additional potential savings have a present value of $14.0 million over the period of analysis with an AAEQ value of $530,000. Table 28 summarizes input data and calculations for these potential savings.

[17] Based on Petersburg harbor office records of slip assignments and fishing permits by vessel.

Table 28. Potential Opportunity Cost of Time Savings: Scow Bay Haul-Out Facility

User Group	Number of Trips (assumes 1 trip per vessel annually)	Time Savings Per Vessel Per Trip (hours)	OCT Rate (hourly)	Annual OCT Potential Savings
1	180	7	$30.15	$38,000
2	20	7	$163.05	$23,000
3	189	31	$30.15	$177,000
4	21	31	$163.05	$106,000
5	410	3.5 or 15.5	$30.15 or $163.15	$172,000
Total				**$515,000**
AAEQ Value				**$530,000**

Note that for user group 5, potential OCT savings are estimated by substituting one-half of the time savings values used for groups 1 through4 as follows:

- User Group 5.1: 180 vessels x 3.5 hours saved x $30.15 hourly OCT rate = $19,000
- User Group 5.2: 20 vessels x 3.5 hours saved x $163.05 hourly OCT rate = $11,000
- User Group 5.3: 189 vessels x 15.5 hours saved x $30.15 hourly OCT rate = $88,000
- User Group 5.4: 21 vessels x 15.5 hours saved x $163.05 hourly OCT rate = $53,000
- User Group 5 Total: $19,000 + $11,000 + $88,000 + $53,000 = $171,000

When these additional opportunities are considered, potential OCT savings have a present value of $44.9 million over the period of analysis with an AAEQ value of $1.70 million. Table 29 shows potential OCT savings by area of use.

Table 29. Total Potential Opportunity Cost of Time Savings: Commercial Fishing Vessels

Potential Benefit by Area	Present Value	AAEQ Value	% of Total
South Harbor Only	$30,920,000	$1,173,000	69%
Scow Bay Only	$13,973,000	$530,000	31%
Total	**$44,893,000**	**$1,703,000**	**100%**

4.4.4 Subsistence

Depth constraints during low-tide cycles also cause delays for subsistence users and inhibit access to subsistence resources. Reducing delays and improving access for these users is expected to result in VOC and OCT savings as well as an increase in subsistence harvests.

Calculations of VOC and OCT savings follow the same methodology used to estimate savings to commercial fishing vessels described above with the notable exception that leisure rates (instead of wage rates) are used to estimate OCT savings for subsistence users. Leisure rates are one-third of the wage rates used for commercial fishermen, which are based on wages detailed in the *Value of Time Commercial Fishermen in Alaska Could Save with Improved Harbor Facilities*, conducted

by the Cornell University in 2006. Wage and leisure rates were updated to current dollars using the U.S. Bureau of Labor Statistics Employment Cost Index. This analysis assumes an average crew size of two people per subsistence vessel, so the leisure rates for captain and crew are combined to estimate the total hourly OCT per vessel.

The VOC and OCT savings are based on the number of subsistence vessels experiencing delays, the total delay hours per vessel each summer, and the respective hourly VOC or OCT rate. Average annual VOC savings equal the number of affected vessels, multiplied by total delay hours, multiplied by the hourly VOC per vessel (74 vessels x 20 delay hours per vessel x $46.02 hourly rate per vessel = $68,000 potential VOC savings). The same equation is used to estimate OCT savings using the hourly OCT leisure rate. As described in the General Methodology section, all benefit values are converted to average annual equivalent (AAEQ) values using the FY19 Federal discount rate of 2.875 percent, a 50-year period of analysis, and base year of 2022. Therefore, the potential savings noted above differ slightly from the AAEQ values shown in the table below. Table 30 summarizes these data and the potential OCT and VOC savings.

Table 30. Potential Vessel Operating Cost and Opportunity Cost of Time Savings: Subsistence Vessels

Variable Description	Value
Number of Subsistence Vessels Affected	74
Total Delay Hours Per Vessel	20
OCT per vessel (hourly leisure rate)	$54.35
VOC per vessel (hourly leisure rate)	$46.02
AAEQ OCT Savings	**$83,000**
AAEQ VOC Savings	**$70,000**

In addition to these VOC and OCT savings, an opportunity exists to increase subsistence harvests by improving access to these resources. The valuation of subsistence harvests is based on assumed replacement values and production cost values for these resources. A study conducted by the ADF&G Division of Subsistence found that the replacement value of subsistence resources ranged from $4.00 to $8.00 per pound in 2012, or $4.25 to $8.50 in current dollars.[18] A study conducted for the Alaska District about subsistence harvest values on Little Diomede found maximum harvest values of $24.86 per pound, updated to current dollars.[19] The values from the Little Diomede study are higher than those reported by ADF&G, in part, because they represent the total production costs of acquiring subsistence resources rather than a replacement value. Replacement values only consider the cost of purchasing proteins whereas the production cost method used for Little Diomede considers all of the resources utilized to harvest subsistence resources. The intent of this method is to better quantify the value of subsistence beyond a simple replacement value of protein.

[18] Subsistence in Alaska, A Year 2012 Update. Alaska Department of Fish and Game. Updated to current dollars using the Anchorage Consumer Price Index from the State of Alaska Department of Labor and Workforce Development.

[19] Economic Value of Subsistence Activity, Little Diomede, Alaska, 2011. Survey by Tetra Tech, Inc. Updated to current dollars using the Anchorage Consumer Price Index from the State of Alaska Department of Labor and Workforce Development.

The values calculated for Little Diomede are specific to that community and do not necessarily represent the costs to harvest subsistence resources in Petersburg. However, including this cost on the distribution of possible subsistence valuations is appropriate for this analysis to address the range of methodologies for valuing subsistence. The method used for the Little Diomede feasibility study is a production cost method which considers that subsistence resources are worth at least as much as the harvesters invest in them through expenditures of cash and labor. This is thought to be a more comprehensive approach than simply considering the grocery story (or equivalent) replacement value of these resources. The subsistence data presented in the Little Diomede feasibility study is based on comprehensive surveys to estimate subsistence production time and costs. The level of data needed to conduct a detailed update of this method is not available for Petersburg. As such, updating the value from the Little Diomede study using an economic index is an appropriate method to utilize this data for Petersburg. This value is used as one point on the distribution of subsistence values to represent the uncertainty in quantifying these resources.

Subsistence harvest values used in this analysis are based on the ADF&G and USACE studies previously mentioned and using @Risk, a Microsoft Excel add-in. To address variation and uncertainty in harvest values, this analysis uses an @Risk triangular distribution with the following parameters: $4.25 (minimum), $8.50 (most likely), and $24.86 (maximum). Given uncertainty and lack of historical data about production costs for subsistence resources in Alaska, a triangular distribution with these parameters is considered appropriate for this analysis. This analysis uses the mean value of $12.54 per pound from the distribution for further calculations.

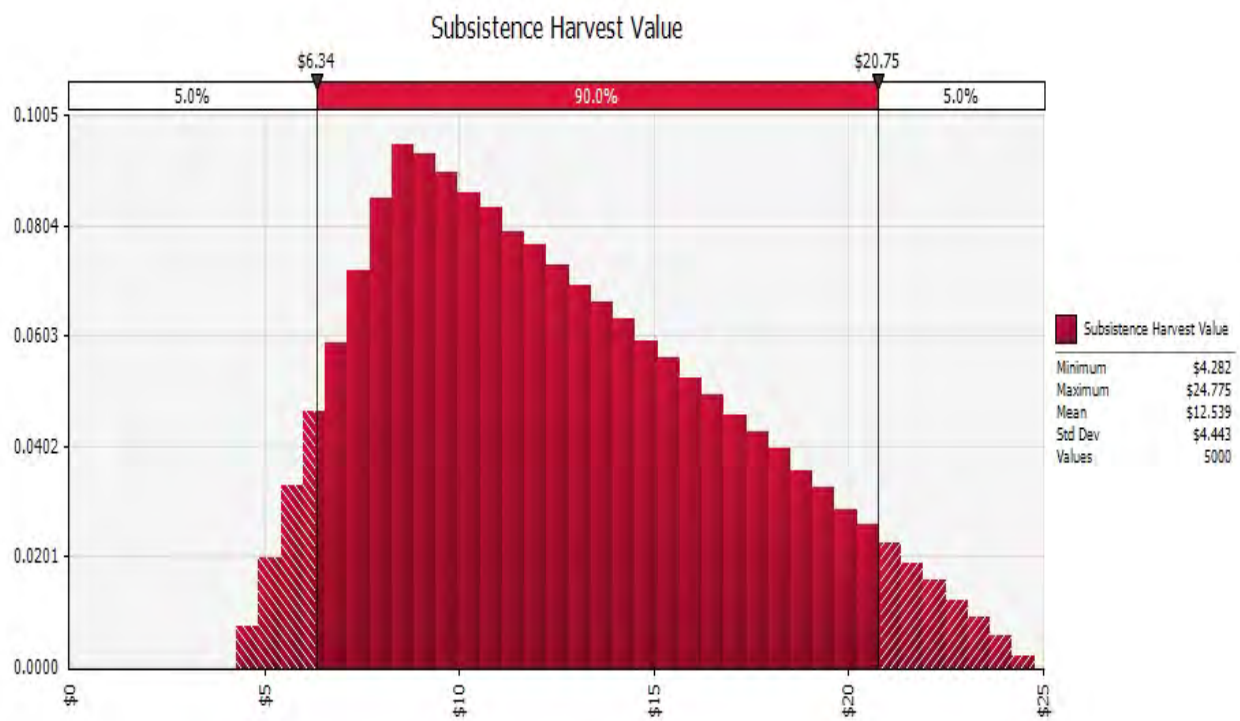

Figure 14. Subsistence harvest value, @Risk simulation results

The value of foregone subsistence harvest is based on the mean harvest value of $12.54 per pound and the estimated increase in subsistence harvest. Absent Federal action, it is assumed that subsistence harvests would be 23,890 pounds, which is the per capital subsistence harvest for Petersburg based on ADF&G subsistence data[20] multiplied by the estimated number of participants (161 pounds per person x 74 subsistence vessels x 2 subsistence participants per vessel = 23,890 pounds). With navigation improvements, subsistence harvests are assumed to increase 10 to 15 percent from what would occur without a project, equating to a net increase of about 3,000 pounds per year on average. This assumption about increased subsistence activity is based on similar USACE studies involving navigation improvements and access to subsistence resources for Valdez and Craig, Alaska. Based on the mean harvest value of $12.54 per pound and the estimated increase in subsistence harvest, the value of foregone subsistence harvest is $37,000 annually. Table 31 summarizes input data used to estimate the value of the foregone subsistence harvest.

Table 31. Foregone Subsistence Harvest Value

Variable Description	Value
Number of Subsistence Vessels Affected	74
Average Crew Size (includes captain)	2
Total Crew Members, All Vessels	148
Per Capita Annual Subsistence Harvest (pounds)	161.42
Total Annual Subsistence Harvest (pounds)	23,890
Expected Increase in Harvest (%)	12.5
Total Annual Expected Future Harvest (pounds)	26,876
Expected Harvest Increase (pounds)	2,986
Average Price per Pound	$12.54
Annual Forgone Subsistence Harvest Value	**$37,000**
AAEQ Value	**$39,000**

In consideration of the analysis presented above, potential benefits associated with reducing delays for subsistence vessels and improving subsistence harvesting opportunities have a present value of $5.0 million over the period of analysis with an AAEQ value of $191,000 (Table 32).

Table 32. Total Potential Subsistence Benefits

Potential Benefits	Present Value	AAEQ Value	% of Total
Opportunity Cost of Time	$2,181,000	$83,000	46%
Vessel Operating Costs	$1,846,000	$70,000	40%
Foregone Subsistence Harvest	$1,015,000	$39,000	14%
Total	**$5,042,000**	**$191,000**	

[20] Alaska Department of Fish and Game Subsistence Harvest Data for Petersburg, Alaska. http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=harvInfo.harvest

4.4.5 Labor Resource Underutilization

Given socioeconomic and employment characteristics in the Petersburg Borough, an opportunity exists to utilize unemployed or underemployed labor resources during project construction. Corps policy provides guidance on the NED benefit evaluation procedure for unemployed or underemployed labor resources, which are defined as …"*the economic effects of the direct use of otherwise unemployed or underemployed labor resources during project construction or installation.*"[21]

This guidance further defines the criteria required for benefit inclusion:

> *"Benefits from use of otherwise unemployed or underemployed labor resources may be recognized as a project benefit if the area has substantial and persistent unemployment at the time the plan is submitted for authorization and for appropriations to begin construction. Substantial and persistent unemployment exists in an area when:*
>
> *(a) The current rate of unemployment, as determined by appropriate annual statistics for the most recent 12 consecutive months, is 6 percent or more and has averaged at least 6 percent for the qualifying time periods specified in subparagraph (b) below and:*
>
> *(b) The annual average rate of unemployment has been at least: (a) 50 percent above the national average for three of the preceding four calendar years, or (b) 75 percent above the national average for two of the preceding three calendar years, or (c) 100 percent above the national average for one of the preceding two calendar years".*

Given the criteria above, and recent unemployment trends in the Petersburg Borough determined by the U.S. Bureau of Labor Statistics, construction of the proposed navigation improvements qualifies for labor resource benefits (Table 33).

[21] ER 1105-2-100, Appendix D, Page D-31

Table 33. Unemployment Statistics

Year	Unemployment Rate by Area			% Above National Average for Petersburg Borough
	United States	Alaska	Petersburg Borough	
2013	7.4%	7.1%	8.7%	18%
2014	6.2%	6.9%	9.5%	53%
2015	5.3%	6.4%	9.0%	70%
2016	4.9%	6.6%	9.1%	86%
2017	4.4%	7.2%	9.3%	111%
Average	5.6%	6.8%	9.1%	62%

Sources: U.S. Bureau of Labor Statistics; Alaska Department of Labor & Workforce Development

Corps policy details a 5-step evaluation procedure for estimating labor resource benefits.[22] The first step is to determine if the proposed project is located in an eligible area. The proposed project is in Petersburg, which is an eligible area based on the unemployment rates shown above. It is expected that currently unemployed labor from the Petersburg Borough would be utilized during project construction. The initial investment would support new jobs, thereby directly reducing unemployment. There would be demands for both labor and construction materials required for the project, and incomes of individuals in associated industries would be increased indirectly due to the interrelationship and interdependence of these industries. These conditions would stimulate the economy and raise the general level of income.

The second step is to estimate the number of skilled and unskilled unemployed construction workers in the labor area. Employment data for the Petersburg Borough indicate there are about 450 workers in construction and transportation occupations who could be employed to construct the project. This analysis assumes average unemployment rates shown in Table 33 are representative of unemployment in these occupations, which results in an unemployed labor pool of 41 construction workers in the Petersburg Borough and 5,344 construction workers in Alaska. These includes workers from the construction, extraction, maintenance and repair occupations and the production, transportation, and material moving occupations (Table 34).

[22] ER 1105-2-100, Paragraph D-7.d(1)–d(5). Evaluation Procedure.

Table 34. Civilian Labor Force by Occupation

Occupation Category	Petersburg Borough	Alaska	United States
Civilian employed population 16 years old and older	1,632	357,098	148,001,326
OCCUPATION			
Management, business, science, and arts occupations	471	132,669	54,751,318
Service occupations	199	62,844	26,765,182
Sales and office occupations	268	79,782	35,282,759
Farming, fishing, and forestry occupations	242	3,668	1,062,331
Construction, extraction, maintenance, and repair occupations	182	37,664	12,440,120
Production, transportation, and material moving occupations	270	40,471	18,542,291

Source: 2012–2016 American Community Survey 5-Year Estimates, Census Bureau

The labor force above was further refined by cross-referencing State of Alaska employment data with applicable occupation categories referenced in USACE planning guidance.[23] Occupation categories listed in this guidance include jobs such as heavy equipment operators, mechanics, construction laborers, and riggers, all of which would be employed by the proposed project. This analysis yielded a narrower labor pool of about 200 total workers, or 18 unemployed workers, based on the average unemployment rate for the Petersburg Borough.

The third step is to determine the labor requirements for plan implementation, which include the estimated labor cost and manpower requirements of the proposed project. Labor costs were estimated by USACE Alaska District cost engineers while manpower requirements were estimated based on input from the cost engineers, Hydraulics & Hydrology engineers, and knowledge of similar navigation projects in Alaska. For the proposed navigation improvements, the construction work force and schedule was analyzed to determine manpower requirements over the construction period. The proposed project is expected to employ 10 to 20 workers during construction depending on the scale of the project. Table 35 shows typical occupations, number of workers, and the corresponding occupations from planning guidance expected to be employed for a navigation project. Note that smaller scale projects such as a non-structural reorganization of harbor floats or a dredging project are assumed to employ about half as many workers as a larger scale harbor improvements project.

[23] ER 1105-2-100 Table D-7: Occupation Tables

Table 35. Manpower Requirements of Proposed Navigation Improvements Project

Worker category	Number of Workers	Planning Guidance Occupation Categories
Site Foreman	1	General Foreman
Operators	2	Equipment Operator
Site Safety Officer	1	
Crane Operator	1	Crane Operator
Excavator Operator	1	Heavy Equipment Operator
Heavy Equipment Operator	1	Heavy Equipment Operator
Riggers	2	Rigger Foreman
Barge crew members	2-3	Equipment Operator
Mechanic	1	Mechanic
Rock barge crew members	3	Equipment Operator
Flaggers/Traffic Control	3-4	Flag Person
Total	**18-20**	

The final two steps are to compare the manpower requirements of the project to the size of the unemployed labor pool, then calculate potential benefits. Direct labor costs are allocated between three categories of workers: skilled (40%), semi-skilled (50%), and administrative/supervisory (10%) based on the manpower requirements estimated above, input from Alaska District cost engineers, and the USACE Soo Locks feasibility study which also evaluated labor resource benefits. The portion of locally hired labor for these categories is based on USACE guidance for calculating labor resource benefits.[24] Given that labor availability in the project area is similar to labor requirements (18 available workers versus 10 to 20 workers required), the "no local hire rule" is used to calculate potential benefits. In other words, this analysis assumes that because the labor availability and manpower requirements are so similar, some workers could be drawn from outside of Petersburg for the project.

These potential benefits would accrue during the construction period and are compounded to the base year. They are allocated on a percent of cost basis based on the expected breakdown of construction expenditures in each of the construction seasons. For example, alternatives 2 and 3 are expected to be completed within one year so all labor resource benefits would be realized during the first year of construction. For alternative 4 and 5, this analysis assumes that labor costs associated with mobilization and demobilization, dredging in South Harbor, and construction of a confined disposal facility for dredged material would occur during the first year of construction so benefits would be realized in that year. Construction of the boat ramp and breakwater in Scow Bay would occur in the second year, so labor resource benefits associated with those construction expenditures would occur in the second year. Also note that the construction costs used to estimate these potential benefits are not compounded to the base year but the benefits are compounded to

[24] ER 1105-2-100, Paragraph D-7.d(5)

the base year. This essentially means that the benefits are not compounded twice, which would overstate benefits.

Absent Federal investment, these potential labor resource benefits are considered a foregone opportunity and have a present value of approximately $6.2 million over the period of analysis with an AAEQ value of $235,000. Table 36 through Table 39 display potential benefits for each proposed alternative.

Table 36. Potential Labor Resource Benefits: Alternative 2

Alternative 2 Labor Resource Benefit Calculations			
1. Estimate On-Site Labor Cost			
Total Project Cost*:			$36,521,845
Percent Allocated to Labor:			23%
On Site Labor Cost:			$8,352,546
2. Allocation of On-Site labor Cost			
Labor Classification	On Site Labor Cost	Percent Allocation	Wages
Skilled	$8,352,546	40%	$3,341,018
Semiskilled and Unskilled	$8,352,546	50%	$4,176,273
Administrative and Supervisory	$8,352,546	10%	$835,255
TOTAL:			$8,352,546
3. Allocation of Wages to Locally Unemployed or Underemployed Labor			
Labor Classification	Wages	Percent of Locally Hired Labor	Wages Paid to Local Hired Unemployed or Underemployed Labor
Skilled	$3,341,018	30%	$1,002,306
Semiskilled and Unskilled	$4,176,273	47%	$1,962,848
Administrative and Supervisory	$835,255	35%	$292,339
TOTAL:			$3,257,493
4. Potential Labor Resource Benefits			
AAEQ Potential Benefits:			**$123,616**

** Only remaining costs are applicable. This does not include costs for design and implementation (D&I); Supervision, Inspection, and Overhead (SIOH), or land.*

Table 37. Potential Labor Resource Benefits: Alternative 3

Alternative 3 Labor Resource Benefit Calculations			
1. Estimate On-Site Labor Cost			
Total Project Cost*:			$9,101,314
Percent Allocated to Labor:			17%
On Site Labor Cost:			$1,574,706
2. Allocation of On-Site labor Cost			
Labor Classification	On Site Labor Cost	Percent Allocation	Wages
Skilled	$1,574,706	40%	$629,882
Semiskilled and Unskilled	$1,574,706	50%	$787,353
Administrative and Supervisory	$1,574,706	10%	$157,471
TOTAL:			$1,574,706
3. Allocation of Wages to Locally Unemployed or Underemployed Labor			
Labor Classification	Wages	Percent of Locally Hired Labor	Wages Paid to Local Hired Unemployed or Underemployed Labor
Skilled	$629,882	30%	$188,965
Semiskilled and Unskilled	$787,353	47%	$370,056
Administrative and Supervisory	$157,471	35%	$55,115
TOTAL:			$614,135
4. Potential Labor Resource Benefits			
AAEQ Potential Benefits:			**$23,305**

** Only remaining costs are applicable. This does not include costs for design and implementation (D&I); Supervision, Inspection, and Overhead (SIOH), or land.*

Table 38. Potential Labor Resource Benefits: Alternative 4

Alternative 4 Labor Resource Benefit Calculations			
1. Estimate On-Site Labor Cost			
Total Project Cost*:			$39,155,481
Percent Allocated to Labor:			9%
On Site Labor Cost:			$3,338,624
2. Allocation of On-Site labor Cost			
Labor Classification	On Site Labor Cost	Percent Allocation	Wages
Skilled	$3,338,624	40%	$1,335,449
Semiskilled and Unskilled	$3,338,624	50%	$1,669,312
Administrative and Supervisory	$3,338,624	10%	$333,862
TOTAL:			$3,338,624
3. Allocation of Wages to Locally Unemployed or Underemployed Labor			
Labor Classification	Wages	Percent of Locally Hired Labor	Wages Paid to Local Hired Unemployed or Underemployed Labor
Skilled	$1,335,449	30%	$400,635
Semiskilled and Unskilled	$1,669,312	47%	$784,577
Administrative and Supervisory	$333,862	35%	$116,852
TOTAL:			$1,302,063
4. Potential Labor Resource Benefits			
AAEQ Potential Benefits:			**$126,228**

** Only remaining costs are applicable. This does not include costs for design and implementation (D&I); Supervision, Inspection, and Overhead (SIOH), or land.*

Table 39. Potential Labor Resource Benefits: Alternative 5

Alternative 5 Labor Resource Benefit Calculations			
1. Estimate On-Site Labor Cost			
Total Project Cost*:			$58,638,207
Percent Allocated to Labor:			11%
On Site Labor Cost:			$6,225,737
2. Allocation of On-Site labor Cost			
Labor Classification	On Site Labor Cost	Percent Allocation	Wages
Skilled	$6,225,737	40%	$2,490,295
Semiskilled and Unskilled	$6,225,737	50%	$3,112,869
Administrative and Supervisory	$6,225,737	10%	$622,574
TOTAL:			$6,225,737
3. Allocation of Wages to Locally Unemployed or Underemployed Labor			
Labor Classification	Wages	Percent of Locally Hired Labor	Wages Paid to Local Hired Unemployed or Underemployed Labor
Skilled	$2,490,295	30%	$747,088
Semiskilled and Unskilled	$3,112,869	47%	$1,463,048
Administrative and Supervisory	$622,574	35%	$217,901
TOTAL:			$2,428,037
5. Potential Labor Resource Benefits			
AAEQ Potential Benefits:			**$235,384**

** Only remaining costs are applicable. This does not include costs for design and implementation (D&I); Supervision, Inspection, and Overhead (SIOH), or land.*

4.4.6 Summary of Future Without-Project Conditions

Absent Federal action to provide navigation improvements at Petersburg, the transportation inefficiencies, forgone harvest opportunities, and underutilization of labor resources described above are expected to continue throughout the period of analysis. These adverse impacts incurred as a result of current and expected future conditions have a total present value of approximately $103 million over the period of analysis with an AAEQ value of $3.91 million (Table 40). The values shown in this table are the sum of the values estimated for each potential benefit category detailed in the without-project conditions section.

Table 40. Summary of Future Without-Project Conditions

Category	Present Value	AAEQ Value	Percent of Total
Commercial Fishing Delays/Effects	**$91,772,000**	**$3,483,000**	**90%**
Opportunity Cost of Time	$44,893,000	$1,704,000	44%
Vessel Operating Costs	$46,879,000	$1,779,000	46%
Subsistence Delays/Effects	**$5,042,000**	**$191,000**	**5%**
Opportunity Cost of Time	$2,181,000	$83,000	2%
Vessel Operating Costs	$1,846,000	$70,000	2%
Foregone Subsistence Harvest	$1,015,000	$39,000	1%
Labor Resource Inefficiencies	**$6,203,000**	**$235,000**	**5%**
Total	**$103,017,000**	**$3,910,000**	**100%**

4.5 With-Project Conditions

The following section describes anticipated conditions at Petersburg assuming that a project has been constructed. The anticipated changes in the operating procedures at the harbor are the basis for the economic analysis.

4.5.1 Assumptions

The NED benefits of small boat harbor projects result from enhanced access to commercial fishing activities and recreational boating and sport fishing opportunities.[25] Project benefits at Petersburg are expected to result from transportation costs savings accruing to commercial and subsistence vessel operators, enhanced access for subsistence activities, and utilization of unemployed or underemployed labor resources during project construction. Commercial fishing and subsistence vessels are expected to experience a time savings with-project in the form of the reduction in transit time delays, resulting in time savings and reduced vessel operating cost benefits. The proposed navigation improvements are also expected to enhance access for harvesting subsistence resources, which translates to an increase in harvest value based on the replacement cost analysis described in the Without-Project Conditions section.[26] Other costs and practices, such as land side costs, would not change as a result of the project and are assumed to remain constant.

The period of analysis is 50 years beginning with the base year of 2022, the project effective date, to 2073. The FY19 Federal discount rate of 2.875 percent is used to discount benefits and costs.[27] The report uses methodology for small boat harbor navigation analysis described in the Planning Guidance Notebook[28] with specific guidance found in the appendices on economic and social considerations, the USACE Civil Works program, and the USACE Continuing Authorities Program.

[25] https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf
[26] Increase in subsistence activity is based on similar USACE studies involving navigation improvements and access to subsistence resources for Valdez (2011) and Craig, Alaska (2014).
[27] Per EGM 19-01 Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2019
[28] ER 1105-2-100. https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

4.5.2 Project Alternatives

Four alternatives were evaluated along with the future without-project conditions (No Action).

Table 41. Alternative Descriptions

Alternative	Description
1	No Action
2	Non-Structural Reorganization of Petersburg Harbor System
3	South Harbor Dredging Only
4	South Harbor Dredging with Haul-out Area at Scow Bay
5	South Harbor Dredging and New Harbor at Scow Bay

1. No Action. The harbor depth will remain the same and all vessels in the Petersburg harbor system will remain in their assigned slips. If no action is taken, insufficient depths within the harbor system will continue to cause transportation delays and limit access for commercial fishing and subsistence activities, creating economic inefficiencies to the region and Nation. The study objectives would not be met and no project benefits or opportunities would be realized.

2. Non-Structural Reorganization of Petersburg Harbor System. This non-structural alternative would result in removal of all boats in the harbor system. The float layout and depth in each slip would be evaluated and boats drafting less water would be assigned to shallower slips. Larger vessels with deeper drafts would be moved to slips with deeper depths. This alternative would not address depth in the entrance channel or maneuvering basin, which is a study objective, so some vessel delays would still occur during low tides.

3. South Harbor Dredging Only. Dredging in South Harbor will take place to address vessel delays due to insufficient depth within the harbor system. The assumed project depths are –19.25 feet MLLW in the maneuvering channel, –18 feet MLLW in between Floats C and D, –10 feet MLLW landward of the main float, and –9 feet MLLW behind Floats 1 and 2 (Figure 13). A 1-foot-over-dredge allowance will be added to these depths. Disposal of dredge spoils will be evaluated to determine the least cost alternative in accordance with current guidance. This alternative assumes in-water disposal in either Thomas Bay or Frederick Sound. Optimization of disposal locations will take place in the design and implementation phase after environmental sampling is completed summer 2019. This alternative meets the study objectives of improving access to the Petersburg harbor system and reducing vessel delays due to insufficient depths within the harbor system.

4. South Harbor Dredging with Haul-out Area at Scow Bay. This alternative includes all features of Alternative 3 plus the creation of a dredged material disposal area and installation of a vessel haul-out area at Scow Bay. This alternative would provide the infrastructure (a concrete ramp) for hydraulic trailers (provided by private sector) to transport commercial and recreational vessels from the water onto the uplands to access services at adjacent work and storage yards. This alternative meets the study objectives and provides additional opportunities for development of marine infrastructure in Scow Bay. In addition to providing the benefits estimated for Alternative

3, this alternative would result in additional transportation cost savings to vessels that currently utilize haul-out facilities at other harbors in the region.

5. South Harbor Dredging with Haul-out Area and New Harbor at Scow Bay. This alternative includes all features of Alternative 4 plus the installation of a new harbor at Scow Bay to accommodate excess demand for vessels seeking permanent and transient moorage at Petersburg. The existing 400-foot breakwater would be extended out to 800-foot total length to protect the float system and harbor entrance from wave action. Three rows of stalls supporting up to 32-foot, 42-foot, and 60-foot vessels, respectively, would be constructed along with an outer slip area for transient moorage. As with Alternative 4, this alternative also meets the study objectives and provides additional opportunities to vessels that currently utilize haul-out facilities and moorage at other harbors in the region. However, additional benefits beyond those estimated for Alternative 4, such as benefits associated with installing moorage in Scow Bay, were not evaluated in this analysis since they were considered to exceed the scope of this study.

4.5.3 Summary of Future With-Project Conditions

Each alternative provides a varying degree of reduction to the inefficiencies described in the Without-Project Conditions section. All structural alternatives that involve dredging in South Harbor (Alternatives 3, 4, and 5) are expected to provide the same level of benefits in terms of transportation cost savings (measured as time and vessel operating cost savings) and increases in subsistence harvests. For these alternatives, a range of benefit scenarios is considered based on the percent of commercial fishing and subsistence vessels expected to benefit from reduced depth constraints and delays. All potential benefits estimated for each scenario in the Without-Project Conditions section are expected to be realized for Alternatives 3, 4, and 5. It is important to note that the non-structural alternative (Alternative 2) would not address depth constraints in the entrance channel or maneuvering basin, so only a portion of the potential benefits identified in the Without-Project Conditions section would be realized. As such, the “low” benefit scenario is considered most appropriate for Alternative 2.

Alternatives 4 and 5, which involve developing new marine facilities at Scow Bay, are expected to produce additional transportation savings to vessels that currently utilize haul-out facilities at other harbors in the region but would shift to Scow Bay with a project. While these additional benefits are considered in this analysis, any additional benefits that would result from adding moorage at Scow Bay were considered beyond the scope of this study.

4.5.4 Total Project Benefits

Each alternative provides a certain amount of relief from existing and expected future inefficiencies. The differences between the expected level of inefficiencies absent Federal action (without-project conditions) and those that will occur under the various with-project conditions are benefits that accrue to the project and form the basis for selecting a recommended plan.

Total annual project benefits were determined at FY19 price levels by calculating the average annual reduction in transportation costs and increase in subsistence harvests. Benefits realized through the use of otherwise unemployed or underemployed labor resources during project

construction were also calculated. Benefits are discounted to the FY19 price level using the Federal discount rate of 2.875 percent over a 50-year period of analysis.

Table 42 and Table 43 show the present value and average annual equivalent value of benefits for each alternative. Note that these tables summarize benefits for the "most likely" scenario considered, and that numbers may differ slightly from those shown in subsequent tables due to variations in @Risk simulation results. The "most likely" scenario is based on mean values from the @Risk simulation. Given uncertainty and the limited amount of data available, using mean values from triangular distributions is considered appropriate for this analysis. Benefits for the other scenarios are presented in the Risk and Sensitivity section of this appendix.

Table 42. Present Value of Benefits by Alternative

Category:	Alt 2	Alt 3	Alt 4	Alt 5
Commercial Fishing	**$31,548,000**	**$31,548,000**	**$72,971,000**	**$72,971,000**
Opportunity Cost of Time	$23,190,000	$23,190,000	$34,834,000	$34,834,000
Vessel Operating Costs	$8,358,000	$8,358,000	$38,137,000	$38,137,000
Subsistence	**$3,782,000**	**$3,782,000**	**$3,782,000**	**$3,782,000**
Opportunity Cost of Time	$1,635,000	$1,635,000	$1,635,000	$1,636,000
Vessel Operating Costs	$1,385,000	$1,385,000	$1,385,000	$1,385,000
Increased Subsistence Harvest	$762,000	$762,000	$762,000	$761,000
Labor Resources	**$3,257,000**	**$614,000**	**$3,326,000**	**$6,203,000**
Total	**$38,587,000**	**$35,944,000**	**$80,079,000**	**$82,956,000**
Total, @Risk Simulation	**$34,996,000**	**$28,056,000**	**$67,462,000**	**$72,520,000**

Table 43. Annual Benefits by Alternative

Category:	Alt 2	Alt 3	Alt 4	Alt 5
Commercial Fishing	**$1,197,000**	**$1,197,000**	**$2,769,000**	**$2,769,000**
Opportunity Cost of Time	$880,000	$880,000	$1,322,000	$1,322,000
Vessel Operating Costs	$317,000	$317,000	$1,447,000	$1,447,000
Subsistence	**$144,000**	**$144,000**	**$144,000**	**$144,000**
Opportunity Cost of Time	$62,000	$62,000	$62,000	$62,000
Vessel Operating Costs	$53,000	$53,000	$53,000	$53,000
Increased Subsistence Harvest	$29,000	$29,000	$29,000	$29,000
Labor Resources	**$124,000**	**$23,000**	**$126,000**	**$235,000**
Total	**$1,465,000**	**$1,364,000**	**$3,039,000**	**$3,148,000**
Total, @Risk Simulation	**$1,328,000**	**$1,065,000**	**$2,560,000**	**$2,752,000**

4.5.5 Project Costs

USACE Alaska District cost engineers developed Rough Order of Magnitude (ROM) cost estimates for the alternatives, including those to construct and maintain facilities. The Cost Engineering Appendix details the procedures and assumptions used to calculate the estimates. Cost

risk contingencies were included to account for uncertain items such as sediment characterization and dredged material disposal methods. Project costs were developed without escalation and are in 2019 dollars. Table 44 displays the ROM costs for each alternative.

Table 44. Rough Order of Magnitude Project First Costs by Alternative

Cost Description	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Lands, Easements, Rights-of-Way, and Relocations (LERR)	N/A	N/A	N/A	$24,000
Mobilization & Demobilization	N/A	$3,707,378	$2,279,133	$2,024,219
Float Reorganization	$36,521,845	N/A	N/A	N/A
Breakwater & Slope Protection	N/A	N/A	$593,721	$1,791,278
South Harbor Dredging & Disposal		$5,393,936	$8,638,778	$5,466,084
Haul-Out Ramp	N/A	N/A	$3,182,070	$3,133,880
Navigation Aids	N/A	N/A	N/A	$59,171
Dredge Material Confined Disposal Facility	N/A	N/A	$24,461,779	$24,149,228
Scow Bay Harbor Facilities & Utilities	N/A	N/A	N/A	$19,874,190
Remaining Construction Items	N/A	N/A	N/A	$2,140,157
Design & Implementation (D&I)	$519,725	$1,220,198	$4,946,560	$7,372,412
Supervision, Inspection, and Overhead (SIOH)	$2,766,089	$681,410	$2,635,469	$3,927,867
Project First Cost*	**$44,479,658**	**$11,002,922**	**$46,737,510**	**$69,962,486**

*Project first costs used in the benefit-cost analysis are discounted/indexed to a base year and amortized for comparison against the average annual benefits, so these costs will differ slightly from those presented in the Cost Engineering Appendix.

As with benefit cash flows, costs are discounted/indexed to a base year and amortized for comparison against the average annual benefits. As such, the project first costs shown above and detailed in the Cost Engineering appendix differ slightly from those used in the benefit-cost analysis. Costs used in the benefit-cost analysis include the project first cost compounded to the base year using the FY19 discount rate, interest during construction, and estimated operations and maintenance costs greater than the without-project condition.

For the interest during construction calculations, a one-year construction window is used for alternatives 2 and 3, and a two-year construction window is used for alternatives 4 and 5. Alternatives 2 and 3 are expected to be completed within one year so all costs would occur during the first year of construction. For alternative 4 and 5, this analysis assumes that costs associated with mobilization and demobilization, dredging in South Harbor, and construction of a confined disposal facility for dredged material would occur during the first year of construction, while construction of the boat ramp and breakwater in Scow Bay would occur in the second year.

Operations and maintenance costs are based on the cost of the 2013 North Harbor dredging effort at Petersburg and the estimated volume of dredged material for South Harbor. Maintenance

dredging is assumed to occur in 30 years from project construction. For alternatives that include a breakwater and/or moorage floats (Alternatives 4 and 5), it is assumed the floats and 15 percent of breakwater armor rock would be replaced in 30 years. Table 45 displays costs used in the benefit-cost analysis.

Table 45. Project Costs for Benefit-Cost Analysis

Cost Description	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Project First Cost (compounded to base year)	$45,912,001	$11,355,345	$48,043,192	$71,303,530
Interest During Construction	$636,364	$157,417	$1,350,131	$2,021,043
Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R)	$0	$3,888,738	$6,062,581	$12,721,319
Total Economic Cost	**$46,548,365**	**$15,401,500**	**$55,455,904**	**$86,045,891**
AAEQ Economic Cost	**$1,766,421**	**$584,457**	**$2,104,445**	**$3,265,277**

4.5.6 Net Benefits and Benefit-Cost Ratio

Net benefits and the benefit-cost ratio are determined using the average annual benefits and average annual costs for each alternative. Net benefits are determined by subtracting the average annual equivalent costs from the average annual benefits for each alternative; the BCR is determined by dividing average annual benefits by average annual costs. Table 46 summarizes project costs, benefits, and the benefit-cost ratio by alternative. The plan that reasonably maximizes net benefits is Alternative 3, the South Harbor Dredging Only alternative.

Table 46. Summary of Costs and Benefits by Alternative

Alternative	Present Value Benefits*	Average Annual Benefits	Present Value Costs	Average Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
1 No Action	N/A	N/A	N/A	N/A	N/A	N/A
2	$34,996,000	$1,328,000	$46,548,000	$1,766,000	–$438,000	0.75
3	$28,056,000	$1,065,000	$15,402,000	$584,000	$481,000	1.82
4	$67,462,000	$2,560,000	$55,456,000	$2,104,000	$456,000	1.22
5	$72,520,000	$2,752,000	$86,046,000	$3,265,000	–$513,000	0.84

*This table shows benefits for the "most likely" benefit scenario considered, which was estimated through @Risk simulations. The BCR for Alternative 3 ranges from 0.81 to 3.10 based on the portion of vessels affected during low-tide cycles.

4.6 Risk and Sensitivity

In the interest of further testing the sensitivity of project justification to uncertainty in parameters, future scenarios must be assessed. The analysis of these scenarios is intended to illustrate the effect of changes in different assumptions on project benefits and project justification.

4.6.1 Fleet and Marine Resources

Because of the inherent uncertainty surrounding the forecast of any growth in fisheries and related marine resources, a conservative "no growth" approach was taken in determining the future fleet in Petersburg. As discussed in the marine resources section of this appendix, the fishing industry in Petersburg is considered strong and is expected to continue to support demand for moorage and other harbor facilities at Petersburg. Fishery activities will continue to fluctuate as resource abundance varies, regulations change, or technological breakthroughs are made. Possible regulatory actions likely would result in an easing of catch regulations given the stability of the fisheries in the Southeast Alaska/Yakutat region, leading to an increase in fish harvests and demand for harbor facilities at Petersburg. The impact of growing foreign fisheries on the domestic fish export industry may cause prices for some exports to fall but, more likely, this would result in an overall increase in global demand for fish exports, also leading to an increase in harvests and demand for harbor facilities. At this time, however, not enough information is known to assign probabilities to any of these scenarios. They are simply intended to provide information to better understand the economic risks associated with the recommended plan.

4.6.2 Project Benefits

Alaska District economists conducted a sensitivity analysis regarding expected project benefits based on the assumed percent of commercial fishing and subsistence vessels impacted by depth constraints during low-tide cycles. This resulted in a range of benefit scenarios for each alternative. The most conservative scenario assumes 25 percent of vessels would be affected during each cycle, which likely results in an underestimation of benefits. Given that most vessels run multiple gear types and essentially fish year round, it is likely that a larger portion of vessels would be affected during each low-tide cycle, and would therefore benefit from the proposed navigation improvements. The "mid" and "high" scenarios assume 50 percent and 100 percent of vessels would be impacted by depth constraints during low-tide cycles. The "most likely" scenario is based on simulations using @Risk, a Microsoft Excel add-in. To address variation and uncertainty in project benefits, the three scenarios noted above were used to create an @Risk triangular distribution, which yielded the "most likely" scenario for each alternative.

Under all but the most conservative benefit scenario considered, Alternative 3 is economically justified and reasonably maximizes net benefits, with a BCR ranging from 0.81 to 3.10 and net annual benefits of –$113,000 to $1.23 million. Table 47 through Table 54 summarize results of the sensitivity analysis for each alternative. Two tables are presented for each alternative: a detailed breakdown of project benefits by scenario, and a summary of costs and benefits by scenario.

Alternative 2 has a BCR ranging from 0.32 to 1.08. Given the depth constraints remaining in the entrance channel and maneuvering basin, the "low" scenario is considered most applicable for Alternative 2 so this alternative is not economically justified.

Table 47. Sensitivity Analysis: Present Value Benefits, Alternative 2

Category:	Low	Mid	Most Likely	High
Commercial Fishing	**$10,516,000**	**$21,032,000**	**$31,548,000**	**$42,064,000**
Opportunity Cost of Time	$7,730,000	$15,460,000	$23,190,000	$30,920,000
Vessel Operating Costs	$2,786,000	$5,572,000	$8,358,000	$11,144,000
Subsistence	**$1,260,000**	**$2,521,000**	**$3,782,000**	**$5,042,000**
Opportunity Cost of Time	$545,000	$1,090,000	$1,635,000	$2,181,000
Vessel Operating Costs	$462,000	$923,000	$1,385,000	$1,846,000
Increased Subsistence Harvest	$254,000	$508,000	$762,000	$1,015,000
Labor Resources	**$3,257,000**	**$3,257,000**	**$3,257,000**	**$3,257,000**
Total	**$15,034,000**	**$26,810,000**	**$38,587,000**	**$50,363,000**
Total, @Risk Simulation	**$19,942,000**	**N/A**	**$34,996,000**	**$53,677,000**

Table 48. Sensitivity Analysis: Summary for Alternative 2

Scenario	PV Benefits	AAEQ Benefits	PV Costs	AAEQ Costs	Net Annual Benefits	BCR
Low	$15,034,000	$572,000	$46,548,000	$1,766,000	–$1,194,000	0.32
Mid	$26,810,000	$1,017,000	$46,548,000	$1,766,000	–$749,000	0.58
Most Likely	$34,996,000	$1,328,000	$46,548,000	$1,766,000	–$438,000	0.75
High	$50,363,000	$1,912,000	$46,548,000	$1,766,000	$146,000	1.08

Alternative 3 is economically justified under all but the most conservative benefit scenario considered with a BCR ranging from 0.81 to 3.10.

Table 49. Sensitivity Analysis: Present Value Benefits, Alternative 3

Category:	Low	Mid	Most Likely	High
Commercial Fishing	**$10,516,000**	**$21,032,000**	**$31,548,000**	**$42,064,000**
Opportunity Cost of Time	$7,730,000	$15,460,000	$23,190,000	$30,920,000
Vessel Operating Costs	$2,786,000	$5,572,000	$8,358,000	$11,144,000
Subsistence	**$1,260,000**	**$2,521,000**	**$3,782,000**	**$5,042,000**
Opportunity Cost of Time	$545,000	$1,090,000	$1,635,000	$2,181,000
Vessel Operating Costs	$462,000	$923,000	$1,385,000	$1,846,000
Increased Subsistence Harvest	$254,000	$508,000	$762,000	$1,015,000
Labor Resources	**$614,000**	**$614,000**	**$614,000**	**$614,000**
Total	**$12,391,000**	**$24,167,000**	**$35,944,000**	**$47,720,000**
Total, @Risk Simulation	**$12,960,000**	**N/A**	**$28,056,000**	**$46,625,000**

Table 50. Sensitivity Analysis: Summary for Alternative 3

Scenario	PV Benefits	AAEQ Benefits	PV Costs	AAEQ Costs	Net Annual Benefits	BCR
Low	$12,391,000	$471,000	$15,402,000	$584,000	–$113,000	0.81
Mid	$24,167,000	$916,000	$15,402,000	$584,000	$332,000	1.57
Most Likely	$28,056,000	$1,065,000	$15,402,000	$584,000	$481,000	1.82
High	$47,720,000	$1,811,000	$15,402,000	$584,000	$1,227,000	3.10

Alternative 4 is economically justified under all but the most conservative scenario considered with a BCR ranging from 0.57 to 1.81.

Table 51. Sensitivity Analysis: Present Value Benefits, Alternative 4

Category:	Low	Mid	Most Likely	High
Commercial Fishing	**$27,086,000**	**$54,170,000**	**$72,971,000**	**$91,772,000**
Opportunity Cost of Time	$12,388,000	$24,775,000	$34,834,000	$44,893,000
Vessel Operating Costs	$14,698,000	$29,395,000	$38,137,000	$46,879,000
Subsistence	**$1,260,000**	**$2,521,000**	**$3,782,000**	**$5,042,000**
Opportunity Cost of Time	$545,000	$1,090,000	$1,635,000	$2,181,000
Vessel Operating Costs	$462,000	$923,000	$1,385,000	$1,846,000
Increased Subsistence Harvest	$254,000	$508,000	$762,000	$1,015,000
Labor Resources	**$3,326,000**	**$3,326,000**	**$3,326,000**	**$3,326,000**
Total	**$31,673,000**	**$60,017,000**	**$80,079,000**	**$100,140,000**
Total, @Risk Simulation	**$36,716,000**	**N/A**	**$67,462,000**	**$101,807,000**

Table 52. Sensitivity Analysis: Summary for Alternative 4

Scenario	PV Benefits	AAEQ Benefits	PV Costs	AAEQ Costs	Net Annual Benefits	BCR
Low	$31,673,000	$1,203,000	$55,456,000	$2,104,000	–$901,000	0.57
Mid	$60,017,000	$2,276,000	$55,456,000	$2,104,000	$172,000	1.08
Most Likely	$67,462,000	$2,560,000	$55,456,000	$2,104,000	$456,000	1.22
High	$100,140,000	$3,801,000	$55,456,000	$2,104,000	$1,697,000	1.81

Although Alternative 5 is not justified based on the benefits evaluated in this study, it is important to note that benefits associated with installing moorage in Scow Bay were considered beyond the scope of this analysis and were therefore not quantified. As such, this analysis underestimates benefits for Alternative 5; further analysis would be required to better quantify the benefits of installing a new harbor at Scow Bay.

Table 53. Sensitivity Analysis: Present Value Benefits, Alternative 5

Category:	Low	Mid	Most Likely	High
Commercial Fishing	**$27,086,000**	**$54,170,000**	**$72,971,000**	**$91,772,000**
Opportunity Cost of Time	$12,388,000	$24,775,000	$34,834,000	$44,893,000
Vessel Operating Costs	$14,698,000	$29,395,000	$38,137,000	$46,879,000
Subsistence	**$1,260,000**	**$2,521,000**	**$3,782,000**	**$5,042,000**
Opportunity Cost of Time	$545,000	$1,090,000	$1,636,000	$2,181,000
Vessel Operating Costs	$462,000	$923,000	$1,385,000	$1,846,000
Increased Subsistence Harvest	$254,000	$508,000	$761,000	$1,015,000
Labor Resources	**$6,203,000**	**$6,203,000**	**$6,203,000**	**$6,203,000**
Total	**$34,549,000**	**$62,894,000**	**$82,956,000**	**$103,017,000**
Total, @Risk Simulation	**$41,897,000**	**N/A**	**$72,520,000**	**$106,837,000**

Table 54. Sensitivity Analysis: Summary for Alternative 5

Scenario	PV Benefits	AAEQ Benefits	PV Costs	AAEQ Costs	Net Annual Benefits	BCR
Low	$34,549,000	$1,312,000	$86,046,000	$3,265,000	–$1,953,000	0.40
Mid	$62,894,000	$2,385,000	$86,046,000	$3,265,000	–$880,000	0.73
Most Likely	$72,520,000	$2,752,000	$86,046,000	$3,265,000	–$513,000	0.84
High	$103,017,000	$3,910,000	$86,046,000	$3,265,000	$645,000	1.20

4.6.3 Project Depth

Finally, an optimization of project depths for the recommended plan (Alternative 3) was performed to determine the dredge depth with the highest net benefits. This analysis confirmed that Alternative 3 with a project depth of –19.25 feet MLLW in the maneuvering channel maximizes net benefits and is the recommended plan (Table 55).

Table 55. Project Depth Sensitivity Analysis: Recommended Plan

Dredge Depth	PV Benefits	AAEQ Benefits	PV Costs	AAEQ Costs	Net Annual Benefits	BCR
-19.25 feet MLLW	$28,056,000	$1,065,000	$15,402,000	$584,000	$481,000	1.82
-18 feet MLLW	$22,699,000	$861,000	$15,348,000	$582,000	$279,000	1.48

Project costs and benefits were evaluated for dredge depths of –18 feet MLLW and –19.25 feet MLLW in the South Harbor maneuvering channel. These depths were chosen based on vessel characteristics and draft requirements (including under-keel clearance) for vessels utilizing permanent and transient moorage at Petersburg. About 80 percent of vessels with permanent moorage at Petersburg draft 11 feet or less and could access South Harbor if the maneuvering basin were dredged to –18 feet MLLW. However, roughly 20 percent of permanently moored vessels

draft 12 feet or more and would still experience depth restrictions. Additionally, many transient vessels draft 12 feet or more and would continue to experience depth-related delays if the maneuvering basin were dredged to only –18 feet MLLW. While some transient vessels that use South Harbor draft more than 12 feet and would benefit from a dredge depth greater than –19.25 feet MLLW, about 98 percent of vessels with permanent moorage in South Harbor draft 12 feet or less and could access the harbor at that depth. Therefore, depths beyond –19.25 feet MLLW were not considered.

Project costs do not increase substantially by dredge depth but benefits do, so dredging to –19.25 feet MLLW is expected to produce the most benefits for the cost. Decreasing the dredge depth from –19.25 to –18 feet is expected to decrease vessel access, which would result in a decrease in VOC and OCT savings benefits for commercial fishing vessels. Labor resource benefits would also decrease slightly due to the lower labor costs/requirements of dredging to a shallower depth. Neither the benefits estimated for subsistence users nor the additional benefits associated with navigation improvements in Scow Bay are expected to change if the dredge depth in South Harbor changes. Based on this analysis, Alternative 3 with a project depth of –19.25 feet MLLW in the maneuvering channel maximizes net benefits and is the recommended plan.

4.7 Regional Economic Development Analysis

The regional economic development (RED) account measures changes in the distribution of regional economic activity that would result from each alternative plan. Evaluations of regional effects are measured using nationally consistent projections of income, employment, output and population.

4.7.1 Regional Analysis

The USACE certified Regional Economic System (RECONS) was developed to provide estimates of regional, state, and national contributions of Federal spending associated with Civil Works and American Recovery and Reinvestment Act (ARRA) Projects. It also provides a means for estimating the forward linked benefits (stemming from effects) associated with non-Federal expenditures sustained, enabled, or generated by USACE Recreation, Navigation, and Formerly Utilized Sites Remedial Action Program (FUSRAP). Contributions are measured in terms of economic output, jobs, earnings, and/or value added. The system was used to perform the following regional analysis for the Petersburg Navigation Improvements Project.

4.7.2 Summary

The USACE Institute for Water Resources (IWR), the Louis Berger Group, and Michigan University developed the RECONS model to provide estimates of regional and National job creation and retention and other economic measures such as income, value added, and sales. This modeling tool automates calculations and generates estimates of jobs and other economic measures such as income and sales associated with USACE's ARRA spending and annual Civil Works program spending. This is done by extracting multipliers and other economic measures from more than 1,500 regional economic models that were built specifically for USACE's project locations. These multipliers were then imported to a database, and the tool matches various spending profiles

to the appropriate industry sectors by location to produce economic impact estimates. The tool will be used as a means to document the performance of direct investment spending of the USACE as directed by the ARRA. The tool also allows the USACE to evaluate project and program expenditures associated with USACE's annual expenditure.

4.7.3 Results of Economic Impact Analysis

Alaska District economists evaluated the RED impact using ROM costs for Alternative 3 at three geographical levels: local, state, and National. The local represents the Petersburg Borough impact area. The state-level includes the State of Alaska. The National level includes the 48 contiguous United States.

The following table displays the breakdown of overall spending of the total project construction costs among the major industry sectors. The spending profile also identifies the geographical capture rate, also called Local Purchase Coefficient (LPC) in RECONS, of the cost components. The geographic capture rate is the portion of USACE spending on industries (sales) captured by industries located within the impact area. RECONS utilizes the Impact on Planning (IMPLAN) software and data system, provided by the Minnesota IMPLAN Group, to estimate the economic impacts of Federal spending. In many cases, IMPLAN's trade flows Regional Purchase Coefficients are utilized as a proxy to estimate where the money flows for each of the receiving industry sectors of the cost components within each of the impact areas. For Petersburg, Regional Purchase Coefficients were not changed from their default values for navigation projects.

Table 56. Input Assumptions (Spending and LPCs)

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$671,178	32%	80%	90%
Metals and Steel Materials	4%	$473,126	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$231,061	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$572,152	12%	35%	100%
Aggregate Materials	3%	$319,085	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$33,009	7%	8%	80%
Hopper Equipment and Repairs	2%	$209,055	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$1,496,397	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$803,213	28%	82%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$506,134	37%	63%	100%
USACE Overhead	7%	$726,193	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$451,120	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$1,155,307	64%	95%	100%
USACE Wages and Benefits	13%	$1,463,388	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$1,683,447	100%	100%	100%
All Other Food Manufacturing	2%	$209,055	9%	20%	90%

Total	**100%**	**$11,002,920**	**-**	**-**	**-**

The table below displays the geographical capture amounts for each of the three geographical impact analyses, which is that portion of spending that is captured in each impact area. It measures $5,765,096 at the regional impact level, $8,185,137 at the state level, and $10,759,987 at the National level. The labor income represents all forms of employment earnings. In IMPLAN's regional economic model, it is the sum of employee compensation and proprietor income. The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues) less its intermediate inputs (i.e., the consumption of goods and services purchased from other U.S. industries or imported). The number of jobs equates to the labor income.

Table 57. Overall Summary of Economic Impacts

Impacts	Impact Areas	Regional	State	National
Total Spending		$11,002,920	$11,002,920	$11,002,920
Direct Impact				
	Output	$5,765,096	$8,185,137	$10,759,987
	Job	115.43	133.09	154.90
	Labor Income	$3,762,312	$4,843,006	$5,927,438
	GRP	$4,275,780	$5,710,058	$7,079,294
Total Impact				
	Output	$7,803,142	$13,893,704	$28,641,685
	Job	134.06	172.05	262.64
	Labor Income	$4,343,167	$6,745,434	$11,763,033
	GRP	$5,465,707	$9,140,494	$17,186,858

The next three tables present the economic impacts by Industry Sector for each geographical region. Impacts at the National level show a tremendous expansion attributable to the multiple turnovers of money that ripple throughout the National economy.

Table 58. Economic Impact at Regional Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$161,734	0.02	$3,723	$22,917
171	Steel product manufacturing from purchased steel	$3,358	0.01	$511	$634
198	Valve and fittings other than plumbing manufacturing	$1,694	0.01	$369	$742
201	Fabricated pipe and pipe fitting manufacturing	$15,495	0.06	$3,065	$6,117

26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$55,925	0.39	$23,630	$28,441
268	Switchgear and switchboard apparatus manufacturing	$77	0.00	$14	$32
290	Ship building and repairing	$110	0.00	$39	$45
319	Wholesale trade businesses	$100,570	0.69	$35,151	$74,616
322	Retail Stores - Electronics and appliances	$430	0.01	$150	$212
323	Retail Stores - Building material and garden supply	$50,425	0.65	$21,967	$33,367
324	Retail Stores - Food and beverage	$1,276	0.02	$597	$907
326	Retail Stores - Gasoline stations	$17,713	0.25	$7,124	$12,314
332	Transport by air	$149	0.00	$15	$42
333	Transport by rail	$5,805	0.02	$1,838	$3,107
334	Transport by water	$1,733	0.00	$309	$511
335	Transport by truck	$108,508	0.91	$43,401	$54,192
337	Transport by pipeline	$2,554	0.00	$693	$656
36	Construction of other new nonresidential structures	$750,982	5.97	$207,475	$270,860
365	Commercial and industrial machinery and equipment rental and leasing	$228,836	0.87	$47,621	$116,995
375	Environmental and other technical consulting services	$189,547	2.30	$109,043	$109,701
386	Business support services	$376,604	9.63	$166,895	$163,644
39	Maintenance and repair construction of nonresidential structures	$165,491	1.50	$52,020	$69,843
417	Commercial and industrial machinery and equipment repair and maintenance	$738,991	7.83	$410,842	$523,530
439	* Employment and payroll only (federal govt, non-military)	$1,097,541	14.18	$941,614	$1,097,541
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$6,101	0.02	$759	$1,368
	Total Direct Effects	$5,765,096	115.43	$3,762,312	$4,275,780
	Secondary Effects	$2,038,046	18.63	$580,855	$1,189,927
	Total Effects	**$7,803,142**	**134.06**	**$4,343,167**	**$5,465,707**

Table 59. Economic Impact at State Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$474,120	0.06	$13,053	$67,182
171	Steel product manufacturing from purchased steel	$49,808	0.10	$16,286	$19,706
198	Valve and fittings other than plumbing manufacturing	$1,694	0.01	$369	$742
201	Fabricated pipe and pipe fitting manufacturing	$143,240	0.56	$29,822	$56,546

26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$146,017	1.10	$61,697	$74,259
268	Switchgear and switchboard apparatus manufacturing	$77	0.00	$14	$32
290	Ship building and repairing	$649	0.00	$229	$262
319	Wholesale trade businesses	$109,165	0.75	$38,900	$81,309
322	Retail Stores - Electronics and appliances	$608	0.01	$227	$313
323	Retail Stores - Building material and garden supply	$59,075	0.76	$26,130	$39,392
324	Retail Stores - Food and beverage	$1,446	0.03	$684	$1,032
326	Retail Stores - Gasoline stations	$17,974	0.26	$7,232	$12,497
332	Transport by air	$640	0.00	$144	$269
333	Transport by rail	$5,805	0.02	$1,838	$3,107
334	Transport by water	$3,666	0.01	$673	$1,307
335	Transport by truck	$148,213	1.24	$62,050	$76,699
337	Transport by pipeline	$7,173	0.01	$2,493	$2,386
36	Construction of other new nonresidential structures	$1,024,099	8.14	$331,691	$416,032
365	Commercial and industrial machinery and equipment rental and leasing	$658,990	2.51	$155,215	$364,754
375	Environmental and other technical consulting services	$320,873	3.89	$198,997	$199,989
386	Business support services	$376,604	9.63	$166,895	$163,644
39	Maintenance and repair construction of nonresidential structures	$369,755	3.34	$149,002	$190,641
417	Commercial and industrial machinery and equipment repair and maintenance	$1,093,165	11.58	$619,637	$786,555
439	* Employment and payroll only (federal govt, non-military)	$1,461,923	18.89	$1,272,937	$1,461,923
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$26,909	0.08	$3,345	$6,033
	Total Direct Effects	$8,185,137	133.09	$4,843,006	$5,710,058
	Secondary Effects	$5,708,567	38.96	$1,902,428	$3,430,435
	Total Effects	**$13,893,704**	**172.05**	**$6,745,434**	**$9,140,494**

Table 60. Economic Impact at National Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$502,543	0.06	$17,483	$85,304
171	Steel product manufacturing from purchased steel	$342,720	0.71	$115,759	$139,978
198	Valve and fittings other than plumbing manufacturing	$118,487	0.41	$29,379	$57,050
201	Fabricated pipe and pipe fitting manufacturing	$451,857	1.77	$108,342	$189,385
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$157,615	1.20	$70,475	$85,160
268	Switchgear and switchboard apparatus manufacturing	$20,638	0.07	$4,884	$10,073
290	Ship building and repairing	$199,996	0.94	$70,540	$81,622
319	Wholesale trade businesses	$255,779	1.75	$103,202	$195,469
322	Retail Stores - Electronics and appliances	$1,056	0.01	$439	$590
323	Retail Stores - Building material and garden supply	$59,075	0.76	$26,130	$39,392
324	Retail Stores - Food and beverage	$1,463	0.03	$693	$1,045
326	Retail Stores - Gasoline stations	$18,121	0.26	$7,293	$12,600
332	Transport by air	$640	0.00	$153	$284
333	Transport by rail	$13,051	0.06	$4,151	$7,021
334	Transport by water	$3,674	0.01	$707	$1,381
335	Transport by truck	$164,874	1.38	$69,875	$86,144
337	Transport by pipeline	$7,380	0.01	$2,824	$2,705
36	Construction of other new nonresidential structures	$1,496,397	11.90	$546,496	$667,077
365	Commercial and industrial machinery and equipment rental and leasing	$802,040	3.05	$197,805	$447,148
375	Environmental and other technical consulting services	$506,067	6.13	$328,583	$330,062
386	Business support services	$725,963	18.56	$388,288	$382,740
39	Maintenance and repair construction of nonresidential structures	$450,991	4.08	$187,572	$238,682
417	Commercial and industrial machinery and equipment repair and maintenance	$1,154,915	12.24	$666,264	$832,413
439	* Employment and payroll only (federal govt, non-military)	$1,463,388	18.91	$1,274,269	$1,463,388
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$157,809	0.50	$22,386	$39,135
	Total Direct Effects	$10,759,987	154.90	$5,927,438	$7,079,294
	Secondary Effects	$17,881,698	107.74	$5,835,595	$10,107,563
	Total Effects	**$28,641,685**	**262.64**	**$11,763,033**	**$17,186,858**

The total Petersburg Navigation Improvements Project Economic Impact for the State of Alaska geographical area, as displayed above, is composed of $28,641,685 in sales, 262 jobs, $11,763,033 in labor income, and a contribution of $17,186,858 to GRP.

4.8 Summary of Accounts and Plan Comparison

Plan formulation for this study focused on contributing to NED with consideration of all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies, 10 March 1983. Plan selection was based on a weighting of the projected effects of each alternative on the four evaluation accounts. The PDT reviewed qualitative and quantitative information for major project effects and for major potential effect categories.

4.8.1 National Economic Development

The results of the NED analysis were discussed in the previous sections with Alternative 3 maximizing net annual benefits to the Nation. Under all but the most conservative benefit scenarios considered, Alternative 3 is economically justified with a benefit-cost ratio ranging from 0.81 to 3.10, and net annual benefits of –$113,000 to $1.23 million. The most likely BCR is 1.82 with net annual benefits of $481,000.

4.8.2 Regional Economic Development

Economic benefits that accrue to the region but not necessarily the Nation include increased income and employment associated with the construction of a project as well as the shifting of vessels from outside the region to Petersburg. Regarding construction spending, further analysis of regional economic benefits is detailed in the RED analysis section and RECONS attachment to this appendix. The RED analysis includes the use of the RECONS model to provide estimates of regional job creation, retention, and other economic measures such as sales, or value added. Each alternative has a positive effect on RED commensurate with its construction expenditure.

Improving the navigation conditions at Petersburg increases opportunities for vessels to use the harbor. Vessels seeking permanent and transient moorage, many of which are on the current waitlist for moorage, would bring revenue to the region in the form of moorage fees, additional sales tax revenues on purchases of fuel and groceries for the vessel, additional corporate income taxes to the State of Alaska, crew patronage of local businesses, and fares on local air carriers between Petersburg and the crews' homes.

4.8.3 Environmental Quality

Environmental Quality (EQ) displays the non-monetary effects of the alternatives on natural resources and is described more fully in the environmental assessment sections of the draft feasibility report. Qualitative enhancements to the environment include a reduction in fossil fuel usage and emissions due to decreased delays for vessels using the Petersburg harbor system as well as decreased travel for vessels that may relocate to Petersburg from other ports. For alternative 2 and alternative 3 (the recommended plan), decreased delays drive the qualitative environmental effects. For alternatives 4 and 5 that provide additional navigation improvements at Scow Bay,

additional environmental benefits would be gained through decreased travel for vessels expected to use the proposed haul-out facility and moorage.

4.8.4 Other Social Effects

The categories of effects in the Other Social Effects (OSE) account include urban and community effects; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation. The OSE can be either beneficial or adverse (positive/negative) depending on the standard being measured.

Construction of this project in Petersburg supports the local economy and provides income to a small community. This injection of income to the Petersburg Borough allows for the provision of social services to the community, increasing community resilience and quality of life. Enhanced revenue to local businesses provides incentive to hire additional personnel, providing income stability to more of the local citizenry.

4.8.5 Four Accounts Evaluation Summary

Based on this analysis of the four accounts, each alternative has positive effects for the RED and OSE accounts, and temporary negative effects for the EQ account. Based on its preference in the NED account, the recommended plan for this study is Alternative 3. Table 61 shows a summary of the four accounts for all alternatives, with the recommended plan highlighted in yellow.

Table 61. Four Accounts Evaluation Summary

Alternative	Net Annual Benefits & BCR*	EQ	RED	OSE
2	–$438,000 0.75	Negative (temporary)	Increased employment and income for the region and state	Beneficial
3	$481,000 1.82	Negative (temporary)	Increased employment and income for the region and state	Beneficial
4	$456,000 1.22	Negative (temporary)	Increased employment and income for the region and state	Beneficial
5	–$513,000 0.84	Negative (temporary)	Increased employment and income for the region and state	Beneficial

*This table shows net benefits and benefit-cost ratios for the "most likely" benefit scenario considered, which was estimated through @Risk simulations. The BCR for Alternative 3 ranges from 0.81 to 3.10 based on the portion of vessels affected during low-tide cycles, with a most likely BCR of 1.82. See the Risk and Sensitivity section for details.

ATTACHMENT: RECONS RESULTS BY ALTERNATIVE

This attachment shows model outputs of the RECONS analysis. Note that the results for the recommended plan (Alternative 3) are also presented in the body of the appendix and are shown again here for continuity and ease of comparison to the other alternatives. Also note that RECONS outputs are reported in FY15 dollars as the model will not run using FY19 dollars. The economic impact regions and type of analysis performed in RECONS are the same for all alternatives (Table 62 and Table 63).

Table 62. Project Information

Project Name:	Petersburg CAP 107 Navigation Improvements Project
Project ID:	
Division:	
District:	
Type of Analysis:	Civil Works Budget Analysis
Business Line:	Navigation
Work Activity:	CWB - Navigation

Table 63. Economic Impact Regions

Regional Impact Area:	Rural Area Generic Model
Regional Impact Area ID:	RURAL
Counties included	
State Impact Area:	Alaska
National Impact:	Yes

4.9 Alternative 1

There are no RED benefits to No Action. If no action is taken, insufficient depths within the harbor system will continue to cause transportation delays and limit access for commercial fishing and subsistence activities, creating economic inefficiencies to the region and Nation. The study objectives would not be met and no project benefits or opportunities would be realized. Since there is no Federal spending under the No Action plan, RECONS analysis was not performed.

4.10 Alternative 2

The following table displays the breakdown of overall spending of the total project construction costs among the major industry sectors. The spending profile also identifies the geographical capture rate, also called Local Purchase Coefficient (LPC) in RECONS, of the cost components. The geographic capture rate is the portion of USACE spending on industries (sales) captured by industries located within the impact area. RECONS utilizes the Impact on Planning (IMPLAN) software and data system, provided by the Minnesota IMPLAN Group, to estimate the economic impacts of Federal spending. In many cases, IMPLAN's trade flows Regional Purchase Coefficients are utilized as a proxy to estimate where the money flows for each of the receiving industry sectors of the cost components within each of the impact areas. For Petersburg, Regional Purchase Coefficients were not changed from their default values for navigation projects.

Table 64. Input Assumptions (Spending and LPCs), Alternative 2

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$2,713,259	32%	80%	90%
Metals and Steel Materials	4%	$1,912,625	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$934,073	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$2,312,942	12%	35%	100%
Aggregate Materials	3%	$1,289,910	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$133,439	7%	8%	80%
Hopper Equipment and Repairs	2%	$845,114	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$6,049,234	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$3,247,015	28%	82%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$2,046,064	37%	63%	100%
USACE Overhead	7%	$2,935,658	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$1,823,666	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$4,670,364	64%	95%	100%
USACE Wages and Benefits	13%	$5,915,795	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$6,805,388	100%	100%	100%
All Other Food Manufacturing	2%	$845,114	9%	20%	90%
Total	**100%**	**$44,479,660**	**-**	**-**	**-**

The USACE is planning on expending $44,479,660 on this plan. Of this total project expenditure $23,305,588 will be captured within the regional impact area. The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation. Table 65 is the overall economic impacts for this analysis.

Table 65. Overall Summary of Economic Impacts, Alternative 2

Impacts	Impact Areas	Regional	State	National
Total Spending		$44,479,660	$44,479,660	$44,479,660
Direct Impact				
	Output	$23,305,588	$33,088,681	$43,497,596
	Job	466.63	538.02	626.21
	Labor Income	$15,209,268	$19,578,006	$23,961,859
	GRP	$17,284,981	$23,083,095	$28,618,276
Total Impact				
	Output	$31,544,454	$56,165,747	$115,784,939
	Job	541.92	695.51	1,061.75
	Labor Income	$17,557,392	$27,268,635	$47,552,442
	GRP	$22,095,298	$36,950,741	$69,478,428

The next three tables present the economic impacts by Industry Sector for each geographical region. Impacts at the National level show an expansion attributable to the multiple turnovers of money that ripple throughout the National economy.

Table 66. Economic Impact at Regional Level, Alternative 2

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$653,816	0.08	$15,049	$92,644
171	Steel product manufacturing from purchased steel	$13,576	0.03	$2,066	$2,562
198	Valve and fittings other than plumbing manufacturing	$6,849	0.02	$1,492	$2,999
201	Fabricated pipe and pipe fitting manufacturing	$62,638	0.22	$12,391	$24,728
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$226,079	1.56	$95,525	$114,975
268	Switchgear and switchboard apparatus manufacturing	$311	0.00	$57	$129
290	Ship building and repairing	$446	0.00	$157	$180
319	Wholesale trade businesses	$406,557	2.78	$142,099	$301,640
322	Retail Stores - Electronics and appliances	$1,738	0.02	$606	$859
323	Retail Stores - Building material and garden supply	$203,846	2.62	$88,802	$134,887
324	Retail Stores - Food and beverage	$5,157	0.10	$2,414	$3,668
326	Retail Stores - Gasoline stations	$71,605	1.02	$28,801	$49,781
332	Transport by air	$603	0.00	$59	$168
333	Transport by rail	$23,469	0.07	$7,429	$12,559
334	Transport by water	$7,004	0.02	$1,250	$2,066
335	Transport by truck	$438,647	3.68	$175,450	$219,071
337	Transport by pipeline	$10,326	0.02	$2,802	$2,652
36	Construction of other new nonresidential structures	$3,035,868	24.14	$838,726	$1,094,959
365	Commercial and industrial machinery and equipment rental and leasing	$925,078	3.52	$192,508	$472,955
375	Environmental and other technical consulting services	$766,248	9.29	$440,810	$443,469
386	Business support services	$1,522,434	38.93	$674,678	$661,536
39	Maintenance and repair construction of nonresidential structures	$669,002	6.05	$210,293	$282,341
417	Commercial and industrial machinery and equipment repair and maintenance	$2,987,393	31.65	$1,660,843	$2,116,389
439	* Employment and payroll only (federal govt, non-military)	$4,436,846	57.33	$3,806,505	$4,436,846
5001	Labor	$6,805,388	283.43	$6,805,388	$6,805,388
69	All other food manufacturing	$24,664	0.07	$3,066	$5,529
	Total Direct Effects	$23,305,588	466.63	$15,209,268	$17,284,981
	Secondary Effects	$8,238,866	75.29	$2,348,124	$4,810,317
	Total Effects	**$31,544,454**	**541.92**	**$17,557,392**	**$22,095,298**

Table 67. Economic Impact at State Level, Alternative 2

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$1,916,645	0.23	$52,768	$271,584
171	Steel product manufacturing from purchased steel	$201,351	0.42	$65,835	$79,664
198	Valve and fittings other than plumbing manufacturing	$6,849	0.02	$1,492	$2,999
201	Fabricated pipe and pipe fitting manufacturing	$579,051	2.25	$120,555	$228,590
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$590,280	4.47	$249,411	$300,194
268	Switchgear and switchboard apparatus manufacturing	$311	0.00	$57	$129
290	Ship building and repairing	$2,622	0.01	$925	$1,059
319	Wholesale trade businesses	$441,303	3.02	$157,253	$328,694
322	Retail Stores - Electronics and appliances	$2,458	0.03	$917	$1,264
323	Retail Stores - Building material and garden supply	$238,811	3.07	$105,630	$159,242
324	Retail Stores - Food and beverage	$5,845	0.11	$2,764	$4,173
326	Retail Stores - Gasoline stations	$72,662	1.03	$29,237	$50,521
332	Transport by air	$2,586	0.01	$584	$1,087
333	Transport by rail	$23,469	0.07	$7,429	$12,559
334	Transport by water	$14,821	0.04	$2,719	$5,284
335	Transport by truck	$599,155	5.02	$250,838	$310,060
337	Transport by pipeline	$28,998	0.05	$10,080	$9,646
36	Construction of other new nonresidential structures	$4,139,955	32.92	$1,340,873	$1,681,824
365	Commercial and industrial machinery and equipment rental and leasing	$2,663,990	10.15	$627,461	$1,474,531
375	Environmental and other technical consulting services	$1,297,141	15.72	$804,450	$808,462
386	Business support services	$1,522,434	38.93	$674,678	$661,536
39	Maintenance and repair construction of nonresidential structures	$1,494,748	13.51	$602,346	$770,671
417	Commercial and industrial machinery and equipment repair and maintenance	$4,419,156	46.82	$2,504,902	$3,179,673
439	* Employment and payroll only (federal govt, non-military)	$5,909,872	76.36	$5,145,889	$5,909,872
5001	Labor	$6,805,388	283.43	$6,805,388	$6,805,388
69	All other food manufacturing	$108,780	0.34	$13,524	$24,387
	Total Direct Effects	$33,088,681	538.02	$19,578,006	$23,083,095
	Secondary Effects	$23,077,066	157.49	$7,690,629	$13,867,646
	Total Effects	**$56,165,747**	**695.51**	**$27,268,635**	**$36,950,741**

Table 68. Economic Impact at National Level, Alternative 2

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$2,031,544	0.24	$70,676	$344,845
171	Steel product manufacturing from purchased steel	$1,385,455	2.88	$467,962	$565,866
198	Valve and fittings other than plumbing manufacturing	$478,987	1.66	$118,767	$230,626
201	Fabricated pipe and pipe fitting manufacturing	$1,826,646	7.15	$437,978	$765,597
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$637,165	4.84	$284,897	$344,260
268	Switchgear and switchboard apparatus manufacturing	$83,431	0.27	$19,742	$40,720
290	Ship building and repairing	$808,490	3.80	$285,159	$329,960
319	Wholesale trade businesses	$1,033,996	7.07	$417,198	$790,191
322	Retail Stores - Electronics and appliances	$4,270	0.05	$1,773	$2,384
323	Retail Stores - Building material and garden supply	$238,811	3.07	$105,630	$159,242
324	Retail Stores - Food and beverage	$5,916	0.11	$2,800	$4,225
326	Retail Stores - Gasoline stations	$73,256	1.04	$29,482	$50,937
332	Transport by air	$2,586	0.01	$618	$1,147
333	Transport by rail	$52,758	0.23	$16,780	$28,383
334	Transport by water	$14,854	0.04	$2,858	$5,584
335	Transport by truck	$666,507	5.59	$282,471	$348,241
337	Transport by pipeline	$29,836	0.06	$11,414	$10,935
36	Construction of other new nonresidential structures	$6,049,234	48.09	$2,209,229	$2,696,681
365	Commercial and industrial machinery and equipment rental and leasing	$3,242,272	12.35	$799,632	$1,807,609
375	Environmental and other technical consulting services	$2,045,793	24.80	$1,328,308	$1,334,286
386	Business support services	$2,934,731	75.04	$1,569,668	$1,547,237
39	Maintenance and repair construction of nonresidential structures	$1,823,146	16.48	$758,265	$964,879
417	Commercial and industrial machinery and equipment repair and maintenance	$4,668,783	49.46	$2,693,396	$3,365,056
439	* Employment and payroll only (federal govt, non-military)	$5,915,794	76.44	$5,151,274	$5,915,794
5001	Labor	$6,805,388	283.43	$6,805,388	$6,805,388
69	All other food manufacturing	$637,947	2.01	$90,494	$158,203
	Total Direct Effects	$43,497,596	626.21	$23,961,859	$28,618,276
	Secondary Effects	$72,287,342	435.54	$23,590,583	$40,860,152
	Total Effects	**$115,784,939**	**1,061.75**	**$47,552,442**	**$69,478,428**

The following table shows the top ten industries that typically benefit from the types of expenditures made for this project by the USACE. This analysis was conducted at the national level and thus it cannot be guaranteed that these industries would be present in the regional impact area as analyzed.

Table 69. Top Ten Industries Affected by Work Activity, Alternative 2

Rank	Industry (millions)	IMPLAN No.	% of Total Employment
1	* Employment and payroll only (federal govt, non-military)	439	8 %
2	Business support services	386	7 %
3	Construction of other new nonresidential structures	36	6 %
4	Food services and drinking places	413	5 %
5	Commercial and industrial machinery and equipment repair and maintenance	417	4 %
6	Real estate establishments	360	3 %
7	Wholesale trade businesses	319	3 %
8	Employment services	382	3 %
9	Maintenance and repair construction of nonresidential structures	39	3 %
10	Offices of physicians, dentists, and other health practitioners	394	2 %
			43 %

Table 70. CO_2 Emission Intensities, Alternative 2

Industry	Industry Name	Output Direct	CO_2 Emission Intensity Direct	Output Indirect	CO_2 Emission Intensity Indirect Domestic	CO_2 Emission Intensity Indirect Imported	CO_2 Emission Intensity Indirect Total	CO_2 Emission Intensity Total
115	Petroleum refineries	$2,031,544	8,185.35	$1,199,239	963.45	1,061.48	2,024.94	10,210.29
171	Steel product manufacturing from purchased steel	$1,385,455	3,220.89	$1,546,958	2,486.73	967.03	3,453.76	6,674.65
198	Valve and fittings other than plumbing manufacturing	$478,987	71.79	$361,700	112.38	58.19	170.57	242.36
201	Fabricated pipe and pipe fitting manufacturing	$1,826,646	545.55	$1,650,184	971.54	471.81	1,443.35	1,988.90
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$637,165	3,206.55	$461,932	286.48	64.63	351.11	3,557.66
268	Switchgear and switchboard apparatus manufacturing	$83,431	15.71	$58,738	16.22	10.18	26.40	42.11
290	Ship building and repairing	$808,490	213.26	$689,998	324.15	150.49	474.63	687.89
319	Wholesale trade businesses	$1,033,996	110.38	$323,801	28.38	6.14	34.52	144.90
322	Retail Stores - Electronics and appliances	$4,270	1.07	$2,439	0.27	0.05	0.32	1.39
323	Retail Stores - Building material and garden supply	$238,811	59.61	$107,333	12.08	2.09	14.16	73.78
324	Retail Stores - Food and beverage	$5,916	1.48	$2,266	0.25	0.04	0.30	1.78
326	Retail Stores - Gasoline stations	$73,256	18.29	$31,556	3.55	0.61	4.16	22.45
332	Transport by air	$2,586	6.99	$1,653	0.62	0.17	0.79	7.78
333	Transport by rail	$52,758	54.97	$38,795	7.74	2.11	9.86	64.83
334	Transport by water	$14,854	72.44	$9,821	1.70	0.41	2.11	74.55

335	Transport by truck	$666,507	1,529.13	$429,738	252.90	38.65	291.55	1,820.69
337	Transport by pipeline	$29,836	71.65	$23,578	11.25	4.03	15.28	86.92
36	Construction of other new nonresidential structures	$6,049,234	2,157.81	$5,070,966	2,698.67	973.26	3,671.93	5,829.74
365	Commercial and industrial machinery and equipment rental and leasing	$3,242,272	1,330.41	$2,131,894	286.21	48.78	334.99	1,665.40
375	Environmental and other technical consulting services	$2,045,793	40.65	$903,985	113.21	24.98	138.18	178.84
386	Business support services	$2,934,731	117.61	$1,580,273	355.31	73.86	429.18	546.79
39	Maintenance and repair construction of nonresidential structures	$1,823,146	776.82	$1,361,898	979.46	314.24	1,293.70	2,070.52
417	Commercial and industrial machinery and equipment repair and maintenance	$4,668,783	99.37	$1,605,610	581.47	303.30	884.76	984.13
439	* Employment and payroll only (federal govt, non-military)	$5,915,794	0.00	$0	0.00	0.00	0.00	0.00
69	All other food manufacturing	$637,947	153.96	$826,977	409.40	108.10	517.50	671.46
	Total	**$36,692,208**	**22,061.72**	**$20,421,329**	**10,903.44**	**4,684.62**	**15,588.06**	**37,649.78**

4.11 Alternative 3

The following table displays the breakdown of overall spending of the total project construction costs among the major industry sectors.

Table 71. Input Assumptions (Spending and LPCs), Alternative 3

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$671,178	32%	80%	90%
Metals and Steel Materials	4%	$473,126	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$231,061	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$572,152	12%	35%	100%
Aggregate Materials	3%	$319,085	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$33,009	7%	8%	80%
Hopper Equipment and Repairs	2%	$209,055	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$1,496,397	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$803,213	28%	82%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$506,134	37%	63%	100%
USACE Overhead	7%	$726,193	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$451,120	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$1,155,307	64%	95%	100%
USACE Wages and Benefits	13%	$1,463,388	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$1,683,447	100%	100%	100%
All Other Food Manufacturing	2%	$209,055	9%	20%	90%
Total	**100%**	**$11,002,920**	**-**	**-**	**-**

The USACE is planning on expending $11,002,920 on the project. Of this total project expenditure $5,765,096 will be captured within the regional impact area. The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation. Table 72 is the overall economic impacts for this analysis.

Table 72. Overall Summary of Economic Impacts, Alternative 3

Impacts	Impact Areas	Regional	State	National
Total Spending		$11,002,920	$11,002,920	$11,002,920
Direct Impact				
	Output	$5,765,096	$8,185,137	$10,759,987
	Job	115.43	133.09	154.90
	Labor Income	$3,762,312	$4,843,006	$5,927,438
	GRP	$4,275,780	$5,710,058	$7,079,294
Total Impact				
	Output	$7,803,142	$13,893,704	$28,641,685
	Job	134.06	172.05	262.64
	Labor Income	$4,343,167	$6,745,434	$11,763,033
	GRP	$5,465,707	$9,140,494	$17,186,858

The next three tables present the economic impacts by Industry Sector for each geographical region. Impacts at the National level show an expansion attributable to the multiple turnovers of money that ripple throughout the National economy.

Table 73. Economic Impact at Regional Level, Alternative 3

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$161,734	0.02	$3,723	$22,917
171	Steel product manufacturing from purchased steel	$3,358	0.01	$511	$634
198	Valve and fittings other than plumbing manufacturing	$1,694	0.01	$369	$742
201	Fabricated pipe and pipe fitting manufacturing	$15,495	0.06	$3,065	$6,117
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$55,925	0.39	$23,630	$28,441
268	Switchgear and switchboard apparatus manufacturing	$77	0.00	$14	$32
290	Ship building and repairing	$110	0.00	$39	$45
319	Wholesale trade businesses	$100,570	0.69	$35,151	$74,616
322	Retail Stores - Electronics and appliances	$430	0.01	$150	$212
323	Retail Stores - Building material and garden supply	$50,425	0.65	$21,967	$33,367
324	Retail Stores - Food and beverage	$1,276	0.02	$597	$907
326	Retail Stores - Gasoline stations	$17,713	0.25	$7,124	$12,314
332	Transport by air	$149	0.00	$15	$42
333	Transport by rail	$5,805	0.02	$1,838	$3,107
334	Transport by water	$1,733	0.00	$309	$511
335	Transport by truck	$108,508	0.91	$43,401	$54,192
337	Transport by pipeline	$2,554	0.00	$693	$656
36	Construction of other new nonresidential structures	$750,982	5.97	$207,475	$270,860
365	Commercial and industrial machinery and equipment rental and leasing	$228,836	0.87	$47,621	$116,995
375	Environmental and other technical consulting services	$189,547	2.30	$109,043	$109,701
386	Business support services	$376,604	9.63	$166,895	$163,644
39	Maintenance and repair construction of nonresidential structures	$165,491	1.50	$52,020	$69,843
417	Commercial and industrial machinery and equipment repair and maintenance	$738,991	7.83	$410,842	$523,530
439	* Employment and payroll only (federal govt, non-military)	$1,097,541	14.18	$941,614	$1,097,541
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$6,101	0.02	$759	$1,368
	Total Direct Effects	$5,765,096	115.43	$3,762,312	$4,275,780
	Secondary Effects	$2,038,046	18.63	$580,855	$1,189,927
	Total Effects	**$7,803,142**	**134.06**	**$4,343,167**	**$5,465,707**

Table 74. Economic Impact at State Level, Alternative 3

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$474,120	0.06	$13,053	$67,182
171	Steel product manufacturing from purchased steel	$49,808	0.10	$16,286	$19,706
198	Valve and fittings other than plumbing manufacturing	$1,694	0.01	$369	$742
201	Fabricated pipe and pipe fitting manufacturing	$143,240	0.56	$29,822	$56,546
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$146,017	1.10	$61,697	$74,259
268	Switchgear and switchboard apparatus manufacturing	$77	0.00	$14	$32
290	Ship building and repairing	$649	0.00	$229	$262
319	Wholesale trade businesses	$109,165	0.75	$38,900	$81,309
322	Retail Stores - Electronics and appliances	$608	0.01	$227	$313
323	Retail Stores - Building material and garden supply	$59,075	0.76	$26,130	$39,392
324	Retail Stores - Food and beverage	$1,446	0.03	$684	$1,032
326	Retail Stores - Gasoline stations	$17,974	0.26	$7,232	$12,497
332	Transport by air	$640	0.00	$144	$269
333	Transport by rail	$5,805	0.02	$1,838	$3,107
334	Transport by water	$3,666	0.01	$673	$1,307
335	Transport by truck	$148,213	1.24	$62,050	$76,699
337	Transport by pipeline	$7,173	0.01	$2,493	$2,386
36	Construction of other new nonresidential structures	$1,024,099	8.14	$331,691	$416,032
365	Commercial and industrial machinery and equipment rental and leasing	$658,990	2.51	$155,215	$364,754
375	Environmental and other technical consulting services	$320,873	3.89	$198,997	$199,989
386	Business support services	$376,604	9.63	$166,895	$163,644
39	Maintenance and repair construction of nonresidential structures	$369,755	3.34	$149,002	$190,641
417	Commercial and industrial machinery and equipment repair and maintenance	$1,093,165	11.58	$619,637	$786,555
439	* Employment and payroll only (federal govt, non-military)	$1,461,923	18.89	$1,272,937	$1,461,923
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$26,909	0.08	$3,345	$6,033
	Total Direct Effects	$8,185,137	133.09	$4,843,006	$5,710,058
	Secondary Effects	$5,708,567	38.96	$1,902,428	$3,430,435
	Total Effects	**$13,893,704**	**172.05**	**$6,745,434**	**$9,140,494**

Table 75. Economic Impact at National Level, Alternative 3

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$502,543	0.06	$17,483	$85,304
171	Steel product manufacturing from purchased steel	$342,720	0.71	$115,759	$139,978
198	Valve and fittings other than plumbing manufacturing	$118,487	0.41	$29,379	$57,050
201	Fabricated pipe and pipe fitting manufacturing	$451,857	1.77	$108,342	$189,385
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$157,615	1.20	$70,475	$85,160
268	Switchgear and switchboard apparatus manufacturing	$20,638	0.07	$4,884	$10,073
290	Ship building and repairing	$199,996	0.94	$70,540	$81,622
319	Wholesale trade businesses	$255,779	1.75	$103,202	$195,469
322	Retail Stores - Electronics and appliances	$1,056	0.01	$439	$590
323	Retail Stores - Building material and garden supply	$59,075	0.76	$26,130	$39,392
324	Retail Stores - Food and beverage	$1,463	0.03	$693	$1,045
326	Retail Stores - Gasoline stations	$18,121	0.26	$7,293	$12,600
332	Transport by air	$640	0.00	$153	$284
333	Transport by rail	$13,051	0.06	$4,151	$7,021
334	Transport by water	$3,674	0.01	$707	$1,381
335	Transport by truck	$164,874	1.38	$69,875	$86,144
337	Transport by pipeline	$7,380	0.01	$2,824	$2,705
36	Construction of other new nonresidential structures	$1,496,397	11.90	$546,496	$667,077
365	Commercial and industrial machinery and equipment rental and leasing	$802,040	3.05	$197,805	$447,148
375	Environmental and other technical consulting services	$506,067	6.13	$328,583	$330,062
386	Business support services	$725,963	18.56	$388,288	$382,740
39	Maintenance and repair construction of nonresidential structures	$450,991	4.08	$187,572	$238,682
417	Commercial and industrial machinery and equipment repair and maintenance	$1,154,915	12.24	$666,264	$832,413
439	* Employment and payroll only (federal govt, non-military)	$1,463,388	18.91	$1,274,269	$1,463,388
5001	Labor	$1,683,447	70.11	$1,683,447	$1,683,447
69	All other food manufacturing	$157,809	0.50	$22,386	$39,135
	Total Direct Effects	$10,759,987	154.90	$5,927,438	$7,079,294
	Secondary Effects	$17,881,698	107.74	$5,835,595	$10,107,563
	Total Effects	**$28,641,685**	**262.64**	**$11,763,033**	**$17,186,858**

The following table shows the top ten industries that typically benefit from the types of expenditures made for this project by the USACE. This analysis was conducted at the national level and thus it cannot be guaranteed that these industries would be present in the regional impact area as analyzed.

Table 76. Top Ten Industries Affected by Work Activity, Alternative 3

Rank	Industry (millions)	IMPLAN No.	% of Total Employment
1	* Employment and payroll only (federal govt, non-military)	439	8 %
2	Business support services	386	7 %
3	Construction of other new nonresidential structures	36	6 %
4	Food services and drinking places	413	5 %
5	Commercial and industrial machinery and equipment repair and maintenance	417	4 %
6	Real estate establishments	360	3 %
7	Wholesale trade businesses	319	3 %
8	Employment services	382	3 %
9	Maintenance and repair construction of nonresidential structures	39	3 %
10	Offices of physicians, dentists, and other health practitioners	394	2 %
			43 %

Table 77. CO_2 Emission Intensities, Alternative 3

Industry	Industry Name	Output Direct	CO_2 Emission Intensity Direct	Output Indirect	CO_2 Emission Intensity Indirect Domestic	CO_2 Emission Intensity Indirect Imported	CO_2 Emission Intensity Indirect Total	CO_2 Emission Intensity Total
115	Petroleum refineries	$502,543	2,024.81	$296,655	238.33	262.58	500.91	2,525.72
171	Steel product manufacturing from purchased steel	$342,720	796.75	$382,670	615.14	239.21	854.36	1,651.11
198	Valve and fittings other than plumbing manufacturing	$118,487	17.76	$89,474	27.80	14.39	42.19	59.95
201	Fabricated pipe and pipe fitting manufacturing	$451,857	134.95	$408,205	240.33	116.71	357.04	491.99
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$157,615	793.20	$114,268	70.87	15.99	86.86	880.06
268	Switchgear and switchboard apparatus manufacturing	$20,638	3.89	$14,530	4.01	2.52	6.53	10.42
290	Ship building and repairing	$199,996	52.75	$170,685	80.18	37.23	117.41	170.16
319	Wholesale trade businesses	$255,779	27.30	$80,098	7.02	1.52	8.54	35.84
322	Retail Stores - Electronics and appliances	$1,056	0.26	$603	0.07	0.01	0.08	0.34
323	Retail Stores - Building material and garden supply	$59,075	14.75	$26,551	2.99	0.52	3.50	18.25
324	Retail Stores - Food and beverage	$1,463	0.37	$560	0.06	0.01	0.07	0.44
326	Retail Stores - Gasoline stations	$18,121	4.52	$7,806	0.88	0.15	1.03	5.55
332	Transport by air	$640	1.73	$409	0.15	0.04	0.20	1.92
333	Transport by rail	$13,051	13.60	$9,597	1.92	0.52	2.44	16.04
334	Transport by water	$3,674	17.92	$2,429	0.42	0.10	0.52	18.44

335	Transport by truck	$164,874	378.26	$106,304	62.56	9.56	72.12	450.38
337	Transport by pipeline	$7,380	17.72	$5,832	2.78	1.00	3.78	21.50
36	Construction of other new nonresidential structures	$1,496,397	533.78	$1,254,403	667.57	240.75	908.33	1,442.10
365	Commercial and industrial machinery and equipment rental and leasing	$802,040	329.10	$527,366	70.80	12.07	82.87	411.97
375	Environmental and other technical consulting services	$506,067	10.06	$223,618	28.00	6.18	34.18	44.24
386	Business support services	$725,963	29.09	$390,912	87.89	18.27	106.17	135.26
39	Maintenance and repair construction of nonresidential structures	$450,991	192.16	$336,892	242.29	77.73	320.02	512.18
417	Commercial and industrial machinery and equipment repair and maintenance	$1,154,915	24.58	$397,179	143.84	75.03	218.86	243.44
439	* Employment and payroll only (federal govt, non-military)	$1,463,388	0.00	$0	0.00	0.00	0.00	0.00
69	All other food manufacturing	$157,809	38.08	$204,569	101.27	26.74	128.01	166.10
	Total	**$9,076,540**	**5,457.40**	**$5,051,618**	**2,697.18**	**1,158.83**	**3,856.01**	**9,313.42**

4.12 Alternative 4

The following table displays the breakdown of overall spending of the total project construction costs among the major industry sectors.

Table 78. Input Assumptions (Spending and LPCs), Alternative 4

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$2,850,988	32%	80%	90%
Metals and Steel Materials	4%	$2,009,713	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$981,488	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$2,430,351	12%	35%	100%
Aggregate Materials	3%	$1,355,388	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$140,213	7%	8%	80%
Hopper Equipment and Repairs	2%	$888,013	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$6,356,301	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$3,411,838	28%	82%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$2,149,925	37%	63%	100%
USACE Overhead	7%	$3,084,676	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$1,916,238	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$4,907,439	64%	95%	100%
USACE Wages and Benefits	13%	$6,216,089	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$7,150,839	100%	100%	100%
All Other Food Manufacturing	2%	$888,013	9%	20%	90%
Total	**100%**	**$46,737,510**	**-**	**-**	**-**

The USACE is planning on expending $46,737,510 on the project. Of this total project expenditure $24,488,612 will be captured within the regional impact area. The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation. Table 79 shows the overall economic impacts for this analysis.

Table 79. Overall Summary of Economic Impacts, Alternative 4

Impacts	Impact Areas	Regional	State	National
Total Spending		$46,737,510	$46,737,510	$46,737,510
Direct Impact				
	Output	$24,488,612	$34,768,309	$45,705,595
	Job	490.32	565.33	657.99
	Labor Income	$15,981,312	$20,571,814	$25,178,197
	GRP	$18,162,391	$24,254,825	$30,070,980
Total Impact				
	Output	$33,145,694	$59,016,799	$121,662,345
	Job	569.43	730.81	1,115.64
	Labor Income	$18,448,630	$28,652,829	$49,966,271
	GRP	$23,216,886	$38,826,412	$73,005,251

The next three tables present the economic impacts by Industry Sector for each geographical region. Impacts at the National level show an expansion attributable to the multiple turnovers of money that ripple throughout the National economy.

Table 80. Economic Impact at Regional Level, Alternative 4

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$687,004	0.08	$15,813	$97,347
171	Steel product manufacturing from purchased steel	$14,265	0.03	$2,171	$2,692
198	Valve and fittings other than plumbing manufacturing	$7,197	0.02	$1,568	$3,151
201	Fabricated pipe and pipe fitting manufacturing	$65,818	0.23	$13,020	$25,983
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$237,555	1.64	$100,374	$120,811
268	Switchgear and switchboard apparatus manufacturing	$327	0.00	$60	$136
290	Ship building and repairing	$469	0.00	$165	$189
319	Wholesale trade businesses	$427,194	2.92	$149,312	$316,951
322	Retail Stores - Electronics and appliances	$1,826	0.02	$637	$902
323	Retail Stores - Building material and garden supply	$214,193	2.75	$93,309	$141,734
324	Retail Stores - Food and beverage	$5,419	0.10	$2,537	$3,855
326	Retail Stores - Gasoline stations	$75,239	1.07	$30,263	$52,307
332	Transport by air	$634	0.00	$62	$177
333	Transport by rail	$24,660	0.07	$7,806	$13,197
334	Transport by water	$7,360	0.02	$1,314	$2,171
335	Transport by truck	$460,913	3.86	$184,356	$230,192
337	Transport by pipeline	$10,850	0.02	$2,945	$2,787
36	Construction of other new nonresidential structures	$3,189,973	25.36	$881,301	$1,150,541
365	Commercial and industrial machinery and equipment rental and leasing	$972,036	3.70	$202,280	$496,963
375	Environmental and other technical consulting services	$805,144	9.76	$463,186	$465,980
386	Business support services	$1,599,715	40.91	$708,926	$695,116
39	Maintenance and repair construction of nonresidential structures	$702,961	6.35	$220,968	$296,673
417	Commercial and industrial machinery and equipment repair and maintenance	$3,139,038	33.26	$1,745,149	$2,223,820
439	* Employment and payroll only (federal govt, non-military)	$4,662,067	60.24	$3,999,728	$4,662,067
5001	Labor	$7,150,839	297.81	$7,150,839	$7,150,839
69	All other food manufacturing	$25,916	0.07	$3,222	$5,810
	Total Direct Effects	$24,488,612	490.32	$15,981,312	$18,162,391
	Secondary Effects	$8,657,082	79.11	$2,467,318	$5,054,495
	Total Effects	**$33,145,694**	**569.43**	**$18,448,630**	**$23,216,886**

Table 81. Economic Impact at State Level, Alternative 4

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$2,013,937	0.24	$55,447	$285,370
171	Steel product manufacturing from purchased steel	$211,572	0.44	$69,177	$83,708
198	Valve and fittings other than plumbing manufacturing	$7,197	0.02	$1,568	$3,151
201	Fabricated pipe and pipe fitting manufacturing	$608,445	2.36	$126,675	$240,194
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$620,243	4.69	$262,072	$315,432
268	Switchgear and switchboard apparatus manufacturing	$327	0.00	$60	$136
290	Ship building and repairing	$2,755	0.01	$972	$1,113
319	Wholesale trade businesses	$463,704	3.17	$165,235	$345,379
322	Retail Stores - Electronics and appliances	$2,583	0.03	$964	$1,328
323	Retail Stores - Building material and garden supply	$250,934	3.22	$110,992	$167,325
324	Retail Stores - Food and beverage	$6,141	0.11	$2,904	$4,384
326	Retail Stores - Gasoline stations	$76,350	1.09	$30,721	$53,085
332	Transport by air	$2,717	0.01	$614	$1,142
333	Transport by rail	$24,660	0.07	$7,806	$13,197
334	Transport by water	$15,573	0.04	$2,857	$5,552
335	Transport by truck	$629,569	5.28	$263,570	$325,799
337	Transport by pipeline	$30,470	0.06	$10,591	$10,136
36	Construction of other new nonresidential structures	$4,350,105	34.59	$1,408,938	$1,767,196
365	Commercial and industrial machinery and equipment rental and leasing	$2,799,218	10.66	$659,312	$1,549,381
375	Environmental and other technical consulting services	$1,362,986	16.52	$845,285	$849,501
386	Business support services	$1,599,715	40.91	$708,926	$695,116
39	Maintenance and repair construction of nonresidential structures	$1,570,623	14.20	$632,922	$809,791
417	Commercial and industrial machinery and equipment repair and maintenance	$4,643,478	49.19	$2,632,055	$3,341,078
439	* Employment and payroll only (federal govt, non-military)	$6,209,866	80.24	$5,407,102	$6,209,866
5001	Labor	$7,150,839	297.81	$7,150,839	$7,150,839
69	All other food manufacturing	$114,302	0.35	$14,211	$25,625
	Total Direct Effects	$34,768,309	565.33	$20,571,814	$24,254,825
	Secondary Effects	$24,248,490	165.48	$8,081,016	$14,571,587
	Total Effects	**$59,016,799**	**730.81**	**$28,652,829**	**$38,826,412**

Table 82. Economic Impact at National Level, Alternative 4

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$2,134,668	0.26	$74,264	$362,350
171	Steel product manufacturing from purchased steel	$1,455,783	3.03	$491,716	$594,590
198	Valve and fittings other than plumbing manufacturing	$503,301	1.75	$124,796	$242,333
201	Fabricated pipe and pipe fitting manufacturing	$1,919,369	7.51	$460,210	$804,459
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$669,509	5.08	$299,359	$361,735
268	Switchgear and switchboard apparatus manufacturing	$87,666	0.28	$20,744	$42,787
290	Ship building and repairing	$849,531	3.99	$299,634	$346,709
319	Wholesale trade businesses	$1,086,483	7.43	$438,375	$830,302
322	Retail Stores - Electronics and appliances	$4,487	0.05	$1,863	$2,505
323	Retail Stores - Building material and garden supply	$250,934	3.22	$110,992	$167,325
324	Retail Stores - Food and beverage	$6,216	0.12	$2,942	$4,439
326	Retail Stores - Gasoline stations	$76,975	1.10	$30,978	$53,522
332	Transport by air	$2,717	0.01	$650	$1,206
333	Transport by rail	$55,436	0.24	$17,631	$29,824
334	Transport by water	$15,608	0.04	$3,003	$5,868
335	Transport by truck	$700,340	5.87	$296,810	$365,918
337	Transport by pipeline	$31,350	0.06	$11,994	$11,490
36	Construction of other new nonresidential structures	$6,356,301	50.54	$2,321,372	$2,833,568
365	Commercial and industrial machinery and equipment rental and leasing	$3,406,854	12.98	$840,222	$1,899,366
375	Environmental and other technical consulting services	$2,149,640	26.06	$1,395,735	$1,402,016
386	Business support services	$3,083,702	78.85	$1,649,347	$1,625,777
39	Maintenance and repair construction of nonresidential structures	$1,915,692	17.32	$796,756	$1,013,858
417	Commercial and industrial machinery and equipment repair and maintenance	$4,905,777	51.97	$2,830,116	$3,535,871
439	* Employment and payroll only (federal govt, non-military)	$6,216,088	80.32	$5,412,760	$6,216,088
5001	Labor	$7,150,839	297.81	$7,150,839	$7,150,839
69	All other food manufacturing	$670,330	2.11	$95,088	$166,233
	Total Direct Effects	$45,705,595	657.99	$25,178,197	$30,070,980
	Secondary Effects	$75,956,749	457.65	$24,788,074	$42,934,271
	Total Effects	**$121,662,345**	**1,115.64**	**$49,966,271**	**$73,005,251**

The following table shows the top ten industries that typically benefit from the types of expenditures made for this project by the USACE. This analysis was conducted at the national level and thus it cannot be guaranteed that these industries would be present in the regional impact area as analyzed.

Table 83. Top Ten Industries Affected by Work Activity, Alternative 4

Rank	Industry (millions)	IMPLAN No.	% of Total Employment
1	* Employment and payroll only (federal govt, non-military)	439	8 %
2	Business support services	386	7 %
3	Construction of other new nonresidential structures	36	6 %
4	Food services and drinking places	413	5 %
5	Commercial and industrial machinery and equipment repair and maintenance	417	4 %
6	Real estate establishments	360	3 %
7	Wholesale trade businesses	319	3 %
8	Employment services	382	3 %
9	Maintenance and repair construction of nonresidential structures	39	3 %
10	Offices of physicians, dentists, and other health practitioners	394	2 %
			43 %

Table 84. CO_2 Emission Intensities, Alternative 4

Industry	Industry Name	Output Direct	CO_2 Emission Intensity Direct	Output Indirect	CO_2 Emission Intensity Indirect Domestic	CO_2 Emission Intensity Indirect Imported	CO_2 Emission Intensity Indirect Total	CO_2 Emission Intensity Total
115	Petroleum refineries	$2,134,668	8,600.85	$1,260,114	1,012.36	1,115.36	2,127.72	10,728.58
171	Steel product manufacturing from purchased steel	$1,455,783	3,384.39	$1,625,483	2,612.96	1,016.12	3,629.08	7,013.47
198	Valve and fittings other than plumbing manufacturing	$503,301	75.44	$380,060	118.09	61.14	179.23	254.66
201	Fabricated pipe and pipe fitting manufacturing	$1,919,369	573.24	$1,733,950	1,020.86	495.76	1,516.62	2,089.86
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$669,509	3,369.32	$485,381	301.03	67.91	368.94	3,738.26
268	Switchgear and switchboard apparatus manufacturing	$87,666	16.50	$61,720	17.04	10.70	27.74	44.25
290	Ship building and repairing	$849,531	224.08	$725,023	340.60	158.13	498.73	722.81
319	Wholesale trade businesses	$1,086,483	115.98	$340,237	29.82	6.45	36.27	152.25
322	Retail Stores - Electronics and appliances	$4,487	1.12	$2,562	0.29	0.05	0.34	1.46
323	Retail Stores - Building material and garden supply	$250,934	62.64	$112,782	12.69	2.19	14.88	77.52
324	Retail Stores - Food and beverage	$6,216	1.55	$2,381	0.27	0.05	0.31	1.87
326	Retail Stores - Gasoline stations	$76,975	19.21	$33,157	3.73	0.65	4.38	23.59
332	Transport by air	$2,717	7.35	$1,737	0.65	0.17	0.83	8.18
333	Transport by rail	$55,436	57.76	$40,764	8.14	2.22	10.36	68.12
334	Transport by water	$15,608	76.12	$10,319	1.79	0.43	2.22	78.34

335	Transport by truck	$700,340	1,606.75	$451,552	265.74	40.61	306.35	1,913.11
337	Transport by pipeline	$31,350	75.28	$24,775	11.82	4.24	16.05	91.34
36	Construction of other new nonresidential structures	$6,356,301	2,267.34	$5,328,375	2,835.66	1,022.66	3,858.33	6,125.66
365	Commercial and industrial machinery and equipment rental and leasing	$3,406,854	1,397.94	$2,240,112	300.74	51.25	351.99	1,749.93
375	Environmental and other technical consulting services	$2,149,640	42.72	$949,872	118.95	26.25	145.20	187.92
386	Business support services	$3,083,702	123.58	$1,660,490	373.35	77.61	450.96	574.54
39	Maintenance and repair construction of nonresidential structures	$1,915,692	816.25	$1,431,030	1,029.18	330.19	1,359.37	2,175.62
417	Commercial and industrial machinery and equipment repair and maintenance	$4,905,777	104.41	$1,687,113	610.98	318.69	929.68	1,034.09
439	* Employment and payroll only (federal govt, non-military)	$6,216,088	0.00	$0	0.00	0.00	0.00	0.00
69	All other food manufacturing	$670,330	161.77	$868,955	430.18	113.59	543.77	705.54
	Total	**$38,554,756**	**23,181.61**	**$21,457,944**	**11,456.91**	**4,922.42**	**16,379.33**	**39,560.94**

4.13 Alternative 5

The following table displays the breakdown of overall spending of the total project construction costs among the major industry sectors.

Table 85. Input Assumptions (Spending and LPCs), Alternative 5

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$4,267,712	32%	80%	90%
Metals and Steel Materials	4%	$3,008,387	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$1,469,212	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$3,638,049	12%	35%	100%
Aggregate Materials	3%	$2,028,912	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$209,887	7%	8%	80%
Hopper Equipment and Repairs	2%	$1,329,287	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$9,514,899	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$5,107,262	28%	82%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$3,218,275	37%	63%	100%
USACE Overhead	7%	$4,617,524	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$2,868,462	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$7,346,061	64%	95%	100%
USACE Wages and Benefits	13%	$9,305,011	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$10,704,261	100%	100%	100%
All Other Food Manufacturing	2%	$1,329,287	9%	20%	90%
Total	**100%**	**$69,962,490**	**-**	**-**	**-**

The USACE is planning on expending $69,962,490 on the project. Of this total project expenditure $36,657,586 will be captured within the regional impact area. The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation. Table 86 is the overall economic impacts for this analysis.

Table 86. Overall Summary of Economic Impacts, Alternative 5

Impacts	Impact Areas	Regional	State	National
Total Spending		$69,962,490	$69,962,490	$69,962,490
Direct Impact				
	Output	$36,657,586	$52,045,509	$68,417,793
	Job	733.97	846.25	984.97
	Labor Income	$23,922,806	$30,794,437	$37,689,842
	GRP	$27,187,715	$36,307,625	$45,013,964
Total Impact				
	Output	$49,616,578	$88,343,650	$182,119,257
	Job	852.40	1,093.97	1,670.03
	Labor Income	$27,616,193	$42,891,102	$74,795,699
	GRP	$34,753,909	$58,120,180	$109,283,295

The next three tables present the economic impacts by Industry Sector for each geographical region. Impacts at the National level show an expansion attributable to the multiple turnovers of money that ripple throughout the National economy.

Table 87. Economic Impact at Regional Level, Alternative 5

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$1,028,393	0.12	$23,670	$145,721
171	Steel product manufacturing from purchased steel	$21,354	0.04	$3,250	$4,030
198	Valve and fittings other than plumbing manufacturing	$10,773	0.04	$2,347	$4,717
201	Fabricated pipe and pipe fitting manufacturing	$98,525	0.35	$19,490	$38,894
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$355,601	2.45	$150,252	$180,845
268	Switchgear and switchboard apparatus manufacturing	$490	0.00	$90	$203
290	Ship building and repairing	$702	0.00	$248	$284
319	Wholesale trade businesses	$639,477	4.38	$223,509	$474,452
322	Retail Stores - Electronics and appliances	$2,734	0.03	$954	$1,351
323	Retail Stores - Building material and garden supply	$320,631	4.12	$139,677	$212,166
324	Retail Stores - Food and beverage	$8,111	0.15	$3,798	$5,770
326	Retail Stores - Gasoline stations	$112,628	1.60	$45,301	$78,300
332	Transport by air	$949	0.00	$92	$265
333	Transport by rail	$36,914	0.11	$11,686	$19,754
334	Transport by water	$11,017	0.03	$1,966	$3,249
335	Transport by truck	$689,952	5.78	$275,967	$344,580
337	Transport by pipeline	$16,241	0.03	$4,408	$4,171
36	Construction of other new nonresidential structures	$4,775,147	37.97	$1,319,240	$1,722,272
365	Commercial and industrial machinery and equipment rental and leasing	$1,455,064	5.54	$302,797	$743,916
375	Environmental and other technical consulting services	$1,205,239	14.61	$693,354	$697,537
386	Business support services	$2,394,651	61.23	$1,061,208	$1,040,536
39	Maintenance and repair construction of nonresidential structures	$1,052,279	9.51	$330,772	$444,097
417	Commercial and industrial machinery and equipment repair and maintenance	$4,698,900	49.78	$2,612,355	$3,328,889
439	* Employment and payroll only (federal govt, non-military)	$6,978,758	90.17	$5,987,289	$6,978,758
5001	Labor	$10,704,261	445.80	$10,704,261	$10,704,261
69	All other food manufacturing	$38,795	0.11	$4,823	$8,697
	Total Direct Effects	$36,657,586	733.97	$23,922,806	$27,187,715
	Secondary Effects	$12,958,992	118.43	$3,693,387	$7,566,194
	Total Effects	**$49,616,578**	**852.40**	**$27,616,193**	**$34,753,909**

Table 88. Economic Impact at State Level, Alternative 5

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$3,014,710	0.36	$82,999	$427,177
171	Steel product manufacturing from purchased steel	$316,707	0.66	$103,553	$125,304
198	Valve and fittings other than plumbing manufacturing	$10,773	0.04	$2,347	$4,717
201	Fabricated pipe and pipe fitting manufacturing	$910,796	3.54	$189,623	$359,552
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$928,457	7.02	$392,301	$472,178
268	Switchgear and switchboard apparatus manufacturing	$490	0.00	$90	$203
290	Ship building and repairing	$4,125	0.02	$1,455	$1,666
319	Wholesale trade businesses	$694,129	4.75	$247,344	$517,007
322	Retail Stores - Electronics and appliances	$3,866	0.05	$1,442	$1,988
323	Retail Stores - Building material and garden supply	$375,629	4.82	$166,146	$250,473
324	Retail Stores - Food and beverage	$9,193	0.17	$4,347	$6,563
326	Retail Stores - Gasoline stations	$114,291	1.63	$45,987	$79,465
332	Transport by air	$4,068	0.02	$918	$1,710
333	Transport by rail	$36,914	0.11	$11,686	$19,754
334	Transport by water	$23,311	0.06	$4,277	$8,311
335	Transport by truck	$942,417	7.90	$394,545	$487,697
337	Transport by pipeline	$45,612	0.08	$15,854	$15,173
36	Construction of other new nonresidential structures	$6,511,775	51.77	$2,109,073	$2,645,358
365	Commercial and industrial machinery and equipment rental and leasing	$4,190,216	15.96	$986,939	$2,319,305
375	Environmental and other technical consulting services	$2,040,286	24.73	$1,265,328	$1,271,638
386	Business support services	$2,394,651	61.23	$1,061,208	$1,040,536
39	Maintenance and repair construction of nonresidential structures	$2,351,103	21.25	$947,436	$1,212,196
417	Commercial and industrial machinery and equipment repair and maintenance	$6,950,933	73.64	$3,939,985	$5,001,339
439	* Employment and payroll only (federal govt, non-military)	$9,295,696	120.11	$8,094,020	$9,295,696
5001	Labor	$10,704,261	445.80	$10,704,261	$10,704,261
69	All other food manufacturing	$171,102	0.53	$21,272	$38,359
	Total Direct Effects	$52,045,509	846.25	$30,794,437	$36,307,625
	Secondary Effects	$36,298,141	247.72	$12,096,665	$21,812,555
	Total Effects	**$88,343,650**	**1,093.97**	**$42,891,102**	**$58,120,180**

Table 89. Economic Impact at National Level, Alternative 5

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$3,195,436	0.38	$111,168	$542,410
171	Steel product manufacturing from purchased steel	$2,179,196	4.53	$736,061	$890,056
198	Valve and fittings other than plumbing manufacturing	$753,403	2.61	$186,810	$362,754
201	Fabricated pipe and pipe fitting manufacturing	$2,873,149	11.25	$688,900	$1,204,215
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$1,002,204	7.61	$448,118	$541,490
268	Switchgear and switchboard apparatus manufacturing	$131,230	0.42	$31,052	$64,049
290	Ship building and repairing	$1,271,683	5.98	$448,529	$518,997
319	Wholesale trade businesses	$1,626,383	11.13	$656,215	$1,242,899
322	Retail Stores - Electronics and appliances	$6,716	0.08	$2,789	$3,750
323	Retail Stores - Building material and garden supply	$375,629	4.82	$166,146	$250,473
324	Retail Stores - Food and beverage	$9,305	0.17	$4,404	$6,645
326	Retail Stores - Gasoline stations	$115,226	1.64	$46,372	$80,119
332	Transport by air	$4,068	0.02	$973	$1,805
333	Transport by rail	$82,983	0.36	$26,393	$44,644
334	Transport by water	$23,364	0.06	$4,495	$8,783
335	Transport by truck	$1,048,356	8.79	$444,302	$547,751
337	Transport by pipeline	$46,929	0.09	$17,954	$17,199
36	Construction of other new nonresidential structures	$9,514,899	75.65	$3,474,917	$4,241,635
365	Commercial and industrial machinery and equipment rental and leasing	$5,099,801	19.42	$1,257,749	$2,843,206
375	Environmental and other technical consulting services	$3,217,848	39.01	$2,089,309	$2,098,711
386	Business support services	$4,616,067	118.04	$2,468,947	$2,433,664
39	Maintenance and repair construction of nonresidential structures	$2,867,644	25.92	$1,192,682	$1,517,668
417	Commercial and industrial machinery and equipment repair and maintenance	$7,343,574	77.80	$4,236,468	$5,292,930
439	* Employment and payroll only (federal govt, non-military)	$9,305,010	120.23	$8,102,489	$9,305,010
5001	Labor	$10,704,261	445.80	$10,704,261	$10,704,261
69	All other food manufacturing	$1,003,432	3.16	$142,340	$248,839
	Total Direct Effects	$68,417,793	984.97	$37,689,842	$45,013,964
	Secondary Effects	$113,701,464	685.06	$37,105,858	$64,269,331
	Total Effects	**$182,119,257**	**1,670.03**	**$74,795,699**	**$109,283,295**

The following table shows the top ten industries that typically benefit from the types of expenditures made for this project by the USACE. This analysis was conducted at the national level and thus it cannot be guaranteed that these industries would be present in the regional impact area as analyzed.

Table 90. Top Ten Industries Affected by Work Activity, Alternative 5

Rank	Industry (millions)	IMPLAN No.	% of Total Employment
1	* Employment and payroll only (federal govt, non-military)	439	8 %
2	Business support services	386	7 %
3	Construction of other new nonresidential structures	36	6 %
4	Food services and drinking places	413	5 %
5	Commercial and industrial machinery and equipment repair and maintenance	417	4 %
6	Real estate establishments	360	3 %
7	Wholesale trade businesses	319	3 %
8	Employment services	382	3 %
9	Maintenance and repair construction of nonresidential structures	39	3 %
10	Offices of physicians, dentists, and other health practitioners	394	2 %
			43 %

Table 91. CO_2 Emission Intensities, Alternative 5

Industry	Industry Name	Output Direct	CO_2 Emission Intensity Direct	Output Indirect	CO_2 Emission Intensity Indirect Domestic	CO_2 Emission Intensity Indirect Imported	CO_2 Emission Intensity Indirect Total	CO_2 Emission Intensity Total
115	Petroleum refineries	$3,195,436	12,874.82	$1,886,295	1,515.43	1,669.61	3,185.04	16,059.86
171	Steel product manufacturing from purchased steel	$2,179,196	5,066.17	$2,433,225	3,911.40	1,521.05	5,432.45	10,498.62
198	Valve and fittings other than plumbing manufacturing	$753,403	112.93	$568,921	176.77	91.52	268.29	381.21
201	Fabricated pipe and pipe fitting manufacturing	$2,873,149	858.10	$2,595,590	1,528.15	742.11	2,270.26	3,128.36
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$1,002,204	5,043.61	$726,578	450.61	101.66	552.27	5,595.88
268	Switchgear and switchboard apparatus manufacturing	$131,230	24.70	$92,390	25.51	16.01	41.53	66.23
290	Ship building and repairing	$1,271,683	335.43	$1,085,305	509.85	236.70	746.56	1,081.99
319	Wholesale trade businesses	$1,626,383	173.61	$509,309	44.63	9.66	54.29	227.91
322	Retail Stores - Electronics and appliances	$6,716	1.68	$3,836	0.43	0.07	0.51	2.18
323	Retail Stores - Building material and garden supply	$375,629	93.76	$168,826	18.99	3.29	22.28	116.04
324	Retail Stores - Food and beverage	$9,305	2.32	$3,564	0.40	0.07	0.47	2.79
326	Retail Stores - Gasoline stations	$115,226	28.76	$49,634	5.58	0.97	6.55	35.31
332	Transport by air	$4,068	11.00	$2,600	0.98	0.26	1.24	12.24
333	Transport by rail	$82,983	86.47	$61,020	12.18	3.32	15.50	101.97

334	Transport by water	$23,364	113.95	$15,447	2.68	0.64	3.32	117.26
335	Transport by truck	$1,048,356	2,405.19	$675,938	397.80	60.79	458.59	2,863.78
337	Transport by pipeline	$46,929	112.69	$37,086	17.69	6.34	24.03	136.72
36	Construction of other new nonresidential structures	$9,514,899	3,394.03	$7,976,171	4,244.77	1,530.85	5,775.62	9,169.65
365	Commercial and industrial machinery and equipment rental and leasing	$5,099,801	2,092.61	$3,353,277	450.18	76.72	526.90	2,619.52
375	Environmental and other technical consulting services	$3,217,848	63.94	$1,421,886	178.06	39.29	217.35	281.30
386	Business support services	$4,616,067	184.99	$2,485,627	558.88	116.18	675.06	860.05
39	Maintenance and repair construction of nonresidential structures	$2,867,644	1,221.87	$2,142,143	1,540.60	494.27	2,034.87	3,256.74
417	Commercial and industrial machinery and equipment repair and maintenance	$7,343,574	156.30	$2,525,479	914.60	477.06	1,391.65	1,547.95
439	* Employment and payroll only (federal govt, non-military)	$9,305,010	0.00	$0	0.00	0.00	0.00	0.00
69	All other food manufacturing	$1,003,432	242.16	$1,300,760	643.94	170.04	813.98	1,056.14
	Total	**$57,713,532**	**34,701.10**	**$32,120,907**	**17,150.13**	**7,368.49**	**24,518.61**	**59,219.71**