Draft Integrated Feasibility Report, Draft Environmental Assessment (EA), and Draft Finding of No Significant Impact (FONSI)

Alaska Deep-Draft Arctic Port System Study

Alaska District, Pacific Ocean Division

February 2015
Status: DRAFT

US Army Corps of Engineers

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Prepared by
U.S. Army Corps of Engineers
Alaska District

February 2015

DRAFT FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, as amended, the U.S. Army Corps of Engineers, Alaska District (Corps), has assessed the environmental effects of the following proposed action:

Alaska Deep-Draft Arctic Port System Study

The Alaska Deep-Draft Arctic Port System Navigation Improvements plan recommends a 2,150-foot-long (655 meters) extension of the existing 2,700-foot-long (823 meters) causeway, removal of the existing 270-foot-long (83 meters) spur, and dredging of the associated entrance channel to a depth of -28 feet (8.5 meters) Mean Lower Low Water (MLLW), with dredged materials disposed east of the existing harbor for the purpose of beach nourishment. Impacts nearly identical to those anticipated with construction of the proposed project have been previously assessed in support of the Corps' 2006 construction of the Nome Harbor entrance's existing configuration (*Navigation Improvements Final Feasibility Report and EA*), and the attendant 10-year maintenance dredging program (*Environmental Assessment, Maintenance Dredging Nome Harbor Entrance Channel, Nome, Alaska*), were completed in July 1998 and October 2012 respectively, and are incorporated herein by reference in accordance with the President's Council of Environmental Quality (CEQ) regulations at 40 CFR 1502.21. These documents are available from the U.S. Army Corps of Engineers' Alaska District website at http://www.poa.usace.army.mil/Library/ReportsandStudies.aspx.

I have determined that the navigation improvements will have no adverse effect on species protected under the Endangered Species Act, Marine Mammals Protection Act, or Migratory Bird Treaty Act, or on essential fish habitat protected under the Magnuson-Stevens Fishery Conservation and Management Act. We have also received concurrence from the State Historic Preservation Officer under the National Historic Preservation Act with regards to our determination that No Historic Properties Affected by the proposed project.

After evaluating the anticipated environmental, economic, and social effects, it is my determination that the proposed project does not constitute a major Federal action that would significantly affect the quality of the human environment. The proposed project has been coordinated with the appropriate resource agencies, and there are no significant unresolved issues. Therefore, preparation of an Environmental Impact Statement is not required.

_________________________ _____________

Christopher D. Lestochi — Date

Colonel, U.S. Army Corps of Engineers

District Commander

Executive Summary

This report documents the determination of the feasibility of constructing navigation improvements as part of a larger system of port facilities in the Arctic and sub-Arctic region. It also examines the need for navigation improvements to serve the Alaska Deep-Draft Arctic Port System at Nome, Alaska and determines the feasibility of Federal participation for these potential improvements.

The Arctic is changing: open water season is expanding, and more marine traffic is transiting favorable shipping routes between Asia and Europe in Arctic waters. Increased Arctic petroleum development activities require supply and support operations from vessels based 1,000 miles (1,852 kilometers) south of drilling grounds. The small number of existing facilities is overwhelmed by increased natural resource extraction along Alaska's western coast.

Increased deep-draft vessel traffic in the Arctic, coupled with limited marine infrastructure along Alaska's western and northern shores, poses risks for accidents and incidents and increases response times for search and rescue operations. It hinders development of future commercial navigation through the Northern passages and leads to operational inefficiencies. The waters between Alaska, Russia, and Canada also require international navigation coordination.

A large number of vessels working in the Arctic are oil and gas transport vessels, and limited facilities are available to support clean-up activities if a hazardous material spill occurs. The Oil Pollution Act of 1990 requires the oil and gas industry to have spill response equipment available during exploration and production. Currently, spill response vessels anchor in the relative protection of Port Clarence, however, the nearest port facilities with sufficient draft are at Dutch Harbor, approximately 1,000 miles (1,852 kilometers) away from the Chukchi Sea.

Enhancing port infrastructure – including deep-draft port facilities currently unavailable north of Unalaska/Dutch Harbor – would meet the State's goal of encouraging economic development in remote areas. It would provide local and regional economic development opportunities (resource extraction, tourism, research); decrease Arctic region operating costs; provide protected dockage to support offshore oil and gas endeavors, fishing fleet, and resource extraction vessels; and provide vessel repair and maintenance support. It would improve international relationships and increase U.S. exports, optimize the aforementioned benefits while preserving natural resources; raise awareness of U.S. as an Arctic nation; and provide upland support to vessels operating in the region (fuel, water, electricity, food, medical, storage, laydown/staging for resource extraction).

The Corps evaluated a number of alternatives during the study. The Tentatively Selected Plan, which maximizes the net National Economic Development (NED) benefits, was selected as the NED Plan, as well as the preferred alternative under the National Environmental Policy Act of

1969. The NED Plan also has the support of the local sponsor, the State of Alaska and the City of Nome. This plan meets the stated planning objectives through: addressing the need for enhanced marine infrastructure to support multiple maritime missions, facilitating holistic economic growth, being compatible with cultural, subsistence and natural resources, taking into account existing land uses, encouraging shared responsibility for development in the Arctic, and allowing for multi-purpose use of Arctic resources. This project would provide sufficient draft for petroleum support vessels enabling more efficient resupply, refuel, and crew changes along with decreasing existing Port congestion and providing the ability for deeper tanker loaded depth.

The plan includes demolishing the existing spur breakwater at the end of the causeway, constructing of a 2,150-foot-long (655 meters) causeway extension and 450-foot-long (137 meters) dock, and dredging the newly created protected area and associated entrance channel to -28 feet (8.5 meters) Mean Lower Low Water (MLLW). Local Service Facilities to be developed by the local sponsor include docks, mooring dolphins, utilities, and security gates.

The estimated project first cost is $210.8 million, which includes the cost of constructing the general navigation features, local service facilities, and the value of lands, easements, rights-of-way and relocations. The total cost of the project to be authorized (general navigation features) is $149.8 million ($97.4 million Federal and $52.4 million Non-Federal). The estimated Federal and non-Federal shares of the project first costs are $97.4 million and $113.5 million respectively, as apportioned in accordance with the cost sharing provisions of Section 101 of the Water Resources Development Act of 1986 (WRDA 1986), as amended (33 U.S.C. 2211) as follows:

The costs for deepening of the general navigation features from 0 to 20 feet are shared at the rate of 90 percent to the Federal Government and 10 percent to the non-Federal sponsor. The costs for deepening from 20 feet to 45 feet are shared at the rate of 75 percent by the Federal Government and 25 percent by the non-Federal sponsor. Accordingly, the Federal and non-Federal shares of the deepening estimated cost of $8.3 million are $6.8 million to the Federal Government and $1.5 million to the non-Federal sponsor.

In addition to the non-Federal sponsor's estimated share of the project first cost, the non-Federal sponsor must pay an additional 10 percent of the cost of the general navigation features of the project cost over a period not to exceed 30 years, with interest. The additional 10 percent payment is estimated to be $15 million before interest is applied. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor and the costs of utility relocations borne by the non-Federal sponsor will be credited toward payment of this amount.

The additional annual cost of operation and maintenance for the Tentatively Selected Plan is estimated at $244,000. Estimated associated costs include $61.0 million in non-Federal costs for development of local service facilities and $15,700 for navigation aids (a U.S. Coast Guard expense).

Pertinent Data

Tentatively Selected Plan

Channel and Basin		Causeway Extension	
Entrance Channel	27 acres	Design Wave	3.3 feet
Maneuvering Basin to 22-feet	27.4 acres	Length, Total	2,150 feet
Maneuvering Basin to 28-feet	16.5 acres	Crest Elevation	+28 feet
Total	71 acres	Crest Width	+24 feet
		Primary Armor	210,700 cy
Dredging Volume	441,000 cy	Secondary Armor	108,700 cy
		Core Rock	40,500 cy

Project Cost

Item	Federal ($)	Non-Federal ($)	Total ($)
General Navigation Features*	$97,341,000	$52,415,000	$149,756,000
Associated costs – local service facilities	$0	$61,034,000	$61,034,000
Lands, Easements, Rights of Way, Relocation, and Disposal (GNF)	$0	$25,000	$25,000
Navigation aids, U.S. Coast Guard	$15,700	$0	$15,700
NED Project Cost	$97,360,000	$113,450,000	$210,810,000
Annual cost, benefit, and benefit cost ratio based on a 2015 price level, $3^3/_8$ percent, 50-year project period of analysis			
NED Investment Cost (Interest During Construction)	$7,050,000		
Annual Operation, Maintenance, Repair, Rehabilitation, and Replacement	$244,000		
Total Annual NED Cost	9,195,000		
Annual NED Benefits	11,542,000		
Net Annual NED Benefits	2,347,000		
Benefit/Cost Ratio	1.26		

Conversion Table for SI (Metric) Units		
Multiply	By	To Obtain
Cubic Yards (cy)	0.7646	Cubic Meters (m^3)
Acre (ac)	0.4049	Hectare (ha)
Feet (ft)	0.3048	Meters (m)
Feet Per Second	0.3048	Meters Per Second
Inches (in)	2.5400	Centimeters (cm)
Knots (international)	0.5144	Meters Per Second
Miles (U.S. Statute)	1.6093	Kilometers (km)
Miles (Nautical)	1.8520	Kilometers
Miles Per Hour	1.6093	Kilometers Per Hour
Pounds (mass) (lb.)	0.4536	Kilograms (kg)

List of Acronyms and Abbreviations

ADCRA	Alaska Division of Community and Regional Affairs
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
ANCSA	Alaska Native Claims Settlement Act
ATS	Alaska Townsite Survey
AWC	Anadromous Waters Catalog
C	Celsius
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFEC	Commercial Fisheries Entry Commission
CFR	Code of Federal Regulations
COL	Colonel
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CY	Cubic Yards
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineer Regulations
ESA	Endangered Species Act
etc.	Et Cetera
FAA	Federal Aviation Administration
F	Fahrenheit
FC	Full Compliance
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR/EA	Feasibility Report and Environmental Assessment
FWCA	Fish and Wildlife Coordination Act
ft	feet
GNF	General Navigation Feature
GRP	Gross Regional Product
IDC	Interest During Construction
kg	Kilograms
lbs	Pounds

LERR	Lands, Easements, Real Estate, and Rights-Of-Way
LERRD	Lands, Easements, Real Estate, Rights-Of-Way, and Disposals
LPP	Locally Preferred Plan
LSF	Local Service Facilities
M	meter
m^3	Cubic meter
mg	Milligrams
MBTA	Migratory Bird Treaty Act
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MMPA	Marine Mammal Protection Act
MSL	Mean Sea Level
MTL	Mean Tide Level
MTS	Marine Transportation System
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
OCS	Outer Continental Shelf
OCT	Opportunity Cost of Time
OMB	Office of Management and Budget
OMRRR	Operation, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
OSV	Offshore Supply Vessel
PC	Partial Compliance
PED	Preconstruction Engineering and Design
R	Republican
RED	Regional Economic Development
S&A	Supervision and Administration
SHPO	State Historic Preservation Officer
TSP	Tentatively Selected Plan
U.S.	United States
UDV	Unit Day Value
USACE	United States Army Corps of Engineers
USC	United States Code

USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USS	United States Survey

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1.0 INTRODUCTION

1.1 Authority

This study is being conducted under authority granted by the House Public Works Committee Resolution for Rivers and Harbors in Alaska, adopted 2 December 1970. The resolution states:

> *"Resolved by the Committee on the Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Numbered 414, 83rd Congress, 2nd Session; and other pertinent reports, with a view to determining whether any modifications of the recommendations contained herein are advisable at the present time."*

1.2 Scope of the Study

This report documents the study to determine the feasibility of constructing navigation improvements as part of a larger system of port facilities in the Arctic and sub-Arctic region. The feasibility study was conducted and the report prepared in accordance with Engineer Regulation (ER) 1105-2-100 and the study authorization. The feasibility of each alternative was determined by considering engineering, economic, environmental, and other pertinent criteria. Federal interest was considered throughout the entire study process in accordance with applicable laws and policies. This document incorporates the Environmental Assessment prepared for this feasibility study. Principles of SMART planning were used to prepare this feasibility study. The study has utilized planning charettes, vertical team collaboration, and risk analysis to establish study-specific planning criteria, select project sites, develop measures and alternatives, and select the recommended alternative.

1.3 Study Participants and Coordination

State of Alaska is the non-Federal partner for this study and input was received from various state and Federal agencies as well as local and tribal governments. Coordination activities required under the National Environmental Policy Act of 1969 have also been conducted and their input has been incorporated into this document.

1.4 Related Studies and Reports

Northern Sea Route Reconnaissance Report – June 1995 – This study investigated navigation improvement needs related to deep-draft waterborne commerce via the Northern Sea Route. The study recommended further investigation of channel improvements at Unalaska/Dutch Harbor.

Reconnaissance of Navigation Improvements – Western and Arctic Coasts, Alaska – December 1997 - This study investigated the present state of waterborne commerce in the area and probable future conditions. Five ports were identified as major regional centers of waterborne transportation: Unalaska/Dutch Harbor, Naknek, Dillingham, Bethel, and Nome.

Navigation Improvements Final Interim Feasibility Report and Environmental Assessment – Nome Alaska – July 1998 – This study recommended a plan for improvements to the marine navigation system at Nome, Alaska, which would reduce vessel delays, reduce damage to vessels due to grounding and hazardous entrance conditions, and ultimately increase vessel traffic and harbor use.

National Arctic Strategy – signed by President Barack Obama – May 2013 - This report lays out the U.S.'s overarching national strategy for the Arctic including three key lines of effort: advance national security interests, pursue responsible stewardship, and strengthen cooperation within the Arctic region/international community.

Managing for the Future in a Rapidly Changing Arctic, a Report to the President by the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska – March 2013 - This report focuses on developing a common, scientifically based management approach for Federal, state, tribal, municipal, industry, and non-governmental representatives to use when making decisions about natural resources protection and development in the U.S. Arctic.

U.S. Arctic Marine Transportation System: Overview and Priorities for Action 2013 - This report published by the U.S. Committee on the Marine Transportation System focuses on the need for an Arctic Marine Transportation System (MTS) capable of meeting safety, security and environmental protection requirements while establishing navigable waterways; building physical, informational and safety infrastructures for circumpolar states. One of the future recommended actions is to "Continue USACE/ADOT&PF study process on feasibility and planning for a deep-draft Arctic port."

Arctic Strategy, Department of Defense – November 2013 - This report lays out the Department of Defense strategy for "a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is protected, and the nations work cooperatively to address challenges.

U.S. Coast Guard Arctic Strategy – May 2013 - This strategy outlines the U.S. Coast Guard's plan for achieving three strategic objectives; improving awareness, modernizing governance, and broadening partnerships in the Arctic during the next 10 years. By leveraging search and rescue operations, maritime border security, intelligence collection, disaster response, and environmental protection, the U.S. Coast Guard can support the entire DHS enterprise and component capabilities to secure our borders, prevent terrorism, adapt to changing environmental conditions, enable community resilience, and inform future policy.

U.S. Coast Guard Arctic Deepwater Seaport Feasibility – A Report to Congress – February 2014 - This report was prepared under the direction of Congress and called on the Commandant of the Coast Guard, in consultation with the Commanding General of the U.S. Army Corps of Engineers, the Maritime Administrator and the Chief of Naval Operations, to conduct a feasibility study on establishing a deepwater seaport in the Arctic to protect and advance strategic U.S. interests in the Arctic region.

National Security Presidential Directive 66/Homeland Security Presidential Directive 25 – January 2009 - This directive establishes U.S. Arctic region policy and directs implementation actions to meet policy, national/homeland security, governance, boundary, scientific cooperation, maritime transportation, economic/energy, and environmental protection initiatives/issues in the Arctic.

U.S. Arctic Research Commission Report on the Goals and Objectives for Arctic Research 2013-2014 - This report provides insight into the importance of advancing our knowledge about changes in the Arctic's ecosystem, resources, and infrastructure in order for federal, state, local, and tribal governments, nongovernmental organizations and the industry decision-makers to meet future resource development challenges.

Alaska Deep-Draft Arctic Port System Study – March 2013 – The Corps and the State of Alaska established the foundation for this study in 2008 and 2010 and built on the good work of others such as the Northern Waters Task Force, the Arctic Marine Shipping Assessment, and workshops with the Institute of the North. This study presents opportunities for development of marine infrastructure in the Arctic by Federal, State, local and/or private sector.

More information on the Alaska Regional Ports study efforts can be found at: http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaRegionalPortsStudy.aspx.

1.5 Study Area

The study area lies within the State of Alaska and waters off Alaska's western and northern coasts. The Congressional delegation is composed of:

Senator Lisa Murkowski (R)
Senator Dan Sullivan (R)
Representative Don Young (R)

The Alaska Deep-Draft Arctic Port System Study focuses attention on the coast of Alaska, from the mouth of the Kuskokwim River along the western coast of Alaska to Barrow, and includes Nunivak Island, St. George Island, St. Paul Island, St. Matthew Island, and St. Lawrence Island.

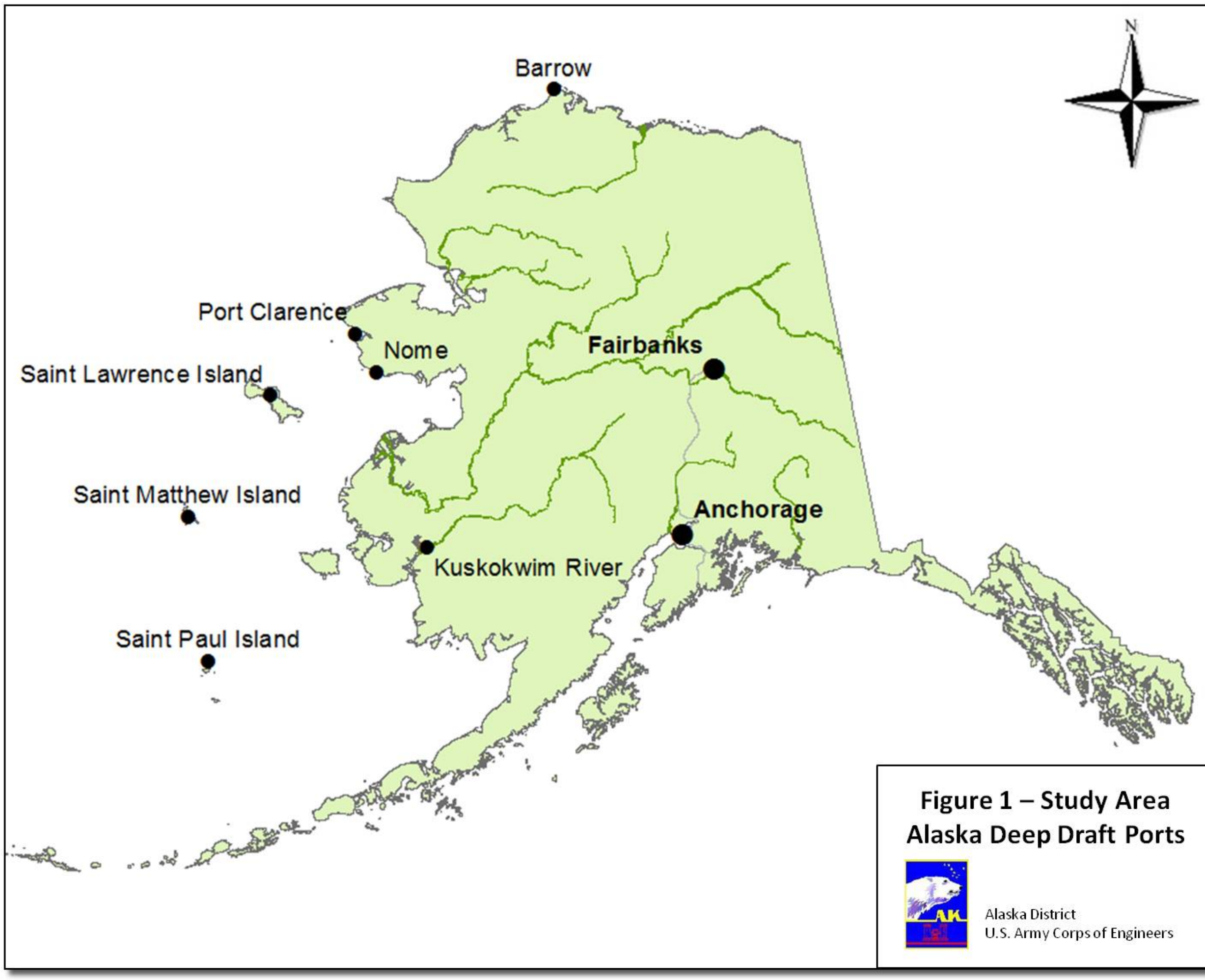

Figure 1: Arctic Deep Draft Port Study Area

Given that the study area covers such a vast amount of land and sea, a tiered screening approach was used to rank potential sites to identify the primary sites to target for developing detailed alternatives. Section 0 describes this approach.

1.5.1 Area Description

The topography and bathymetry along Alaska's western and northern coasts varies and can include capes with vertical cliffs, coastal plains, barrier and oceanic islands, and estuaries. Ice cover also varies, lasting from just a few months in the more southerly locations such as St. Paul Island to nearly year-round in Barrow. The climates of these locations also vary, from Arctic Maritime to Arctic, with some locations experiencing marine climates in the summer and continental climates in the winter when there is solid ice cover.

1.5.2 Population and Demographics

The population patterns of the area are small and dispersed concentrations of population, and each coastal village maintains a close tie to their distinct Federally-recognized tribes. The Alaska

Native cultures are generally Yup'ik Eskimo, Cup'ik Eskimo, and Inupiaq Eskimo. The majority of villages in the region practice a subsistence-based lifestyle with the larger population centers engaging in mixed-subsistence and cash-based economies. The area tends to have low per capita incomes and high unemployment rates. Although the unemployment rate is high, a large portion of the potential workforce does not seek employment because of job scarcity. Therefore, the unemployment rate is generally understated.

1.5.3 The Changing Environment

The Arctic is changing. As the open water season expands, more marine traffic is transiting Arctic waters in order to take advantage of more favorable shipping routes between Asia and Europe. There has been an increase in Arctic petroleum development activities, necessitating supply and support operations from vessels currently based 1,000 miles (1,852 kilometers) south of the drilling grounds. Increased natural resource extraction along the Alaska's western coast is overwhelming the small number of existing facilities. The Alaska Deep-Draft Arctic Port System Study was conducted in recognition of the need for marine infrastructure in the Arctic. The study was published in 2013 and presented opportunities for Arctic development by Federal, State, and local governments as well as private industry. The study recommended sites to consider in developing a system of ports to meet the growing needs of a diverse group of stakeholders.

2.0 PLANNING CRITERIA/PURPOSE AND NEED FOR THE PROPOSED ACTION

This section details the problems this study seeks to address, objectives for alternative solutions, opportunities that may arise from Federal involvement in navigation improvements, and constraints to avoid. It also lays the foundation for the methods used to evaluate differing plans.

2.1 Problem Statement

Increased deep-draft vessel traffic in the Arctic, coupled with limited marine infrastructure along Alaska's western and northern shores, poses risks for accidents and incidents and increases response times for search and rescue operations. It hinders development of future commercial navigation through the Northern passages and leads to operational inefficiencies. The waters between Alaska, Russia, and Canada also require international navigation coordination.

A land-based oil and gas industry has existed for many years on Alaska's North Slope. However, much of the anticipated new development will occur in the Chukchi Sea off of Alaska's northwestern coast. The oil and gas industry is currently utilizing Dutch Harbor as a base for resupply vessels and logistical support. Dutch Harbor is the only port in the region that can accommodate the draft of the fleet. The vessels draft a depth several feet greater than what is afforded at the next deepest port in the region – Nome Harbor. Perishable goods are either barged or flown to Dutch Harbor where they are transferred to supply vessels for shipment to the Chukchi Sea. Dutch Harbor is approximately 1,000 miles (1,852 kilometers) from the Chukchi Sea. Round-trip sailing from Dutch Harbor to the Chukchi Sea takes 10 days and requires numerous vessels to ensure a steady stream of supplies reach the Chukchi Sea during the limited open water season.

Because of long sailing times through remote and rough waters, safety and security are paramount concerns. The nearest U.S. Coast Guard station is located on Kodiak Island, approximately 800 air miles (1,482 kilometers) from the Chukchi Sea. Due to a lack of available draft along the western and northern coasts, U.S. Coast Guard activity is limited to small vessels and helicopters. No port can accommodate larger U.S. Coast Guard cutters and ice breakers. Currently, if a critical need for supplies arises, the U.S. Coast Guard uses the Port of Nome to lighter goods to deep-draft vessels. These limitations lead to unacceptably long response times on calls for assistance.

A large number of vessels working in the Arctic are oil and gas transport vessels, and limited facilities are available to support clean-up activities if a hazardous material spill occurs. The Oil Pollution Act of 1990 requires the oil and gas industry to have spill response equipment available during exploration and production. Currently, spill response vessels anchor in Port Clarence. However, the nearest port facilities with sufficient draft are at Dutch Harbor, approximately 1,000 miles (1,852 kilometers) from the Chukchi Sea.

Existing port facilities in the region are overcrowded and do not have sufficient draft to accommodate new, deeper drafting vessel traffic. Nome Harbor is a prime example. As the primary and most developed port in the region, Nome Harbor is overcrowded. Supply barges deliver goods and transship goods to other vessels for delivery to surrounding villages. Due to overcrowded conditions, these supply barges are often forced to anchor offshore and lighter goods to shore.

Overcrowding is also caused by large fleets of gold dredging vessels that mine marine sediments, and commercial fishing vessels demanding space and services during the short open-water season. Partially due to the overcrowding, mooring facilities at Nome Harbor are often damaged. And despite the abundance of land available around Nome Harbor, much of the land adjacent to the harbor is developed, so upland storage availability is further from than port than optimal.

Port Clarence, a body of naturally occurring deep water, provides some limited natural protection. Vessels staged for spill response or awaiting orders utilize Port Clarence as an anchorage basin. Vessels must keep watch to avoid dragging anchor and colliding with other vessels. However, no upland facilities are available for landside support, so resupply, staging, and crew changes are unavailable at this location.

Other harbor facilities in the region such as those in Kotzebue, Mekoryuk, and Bethel are not configured for larger vessel use. Their basins have insufficient space or draft for larger vessels.

2.2 Statement of Purpose and Need

The number of deep-draft vessels transiting the Arctic has substantially increased in the past five years. The number of vessels transiting the Northern Sea Route (the Northwest Arctic) increased from four in 2009 to 70 in 2013.[1] Russia issued 622 permits for this route in 2013. All of these vessels pass Alaska's shore as they travel to or from Pacific Ocean destinations. With climate change resulting in faster melting of Arctic ice than in previous decades, thinner layers of ice are likely to make navigation through the Arctic viable year-round, which is an economically practicable alternative to the Panama or Suez Canals. Increased vessel traffic, coupled with limited marine infrastructure along Alaska's Western and Northern shores, poses increased risks for vessel groundings and fuel spills. Increased contamination from fuel spills and vessel dumping may threaten wildlife that support indigenous populations through subsistence activities. Current response time for a U.S. Coast Guard cutter dispatched from Kodiak is seven days, which is unacceptably long in a disaster situation. Outside of emergencies, the Coast Guard is responsible for patrolling and enforcing the U.S. Exclusive Economic Zone (EEZ) that extends 200 nautical miles from shore. As resource vessel activity increases, the U.S. Coast Guard presence needs to expand to ensure safe navigation, enforce the nation's laws, and maintain national security.

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[1] Northern Sea Route Information Office. http://www.arctic-lio.com

The purpose and need for the proposed project is to enhance the availability of port infrastructure in the region – including facilities with drafts currently unavailable north of Unalaska/Dutch Harbor – to meet the State's goal of encouraging economic development in remote areas; provide local and regional economic development opportunities (resource extraction, tourism, research); decrease Arctic region operating costs; provide protected moorage to support offshore oil and gas endeavors, fishing fleet, and resource extraction vessels; and provide vessel repair and maintenance support. The proposed project would also improve international relationships and increase U.S. exports, optimize the aforementioned benefits while preserving natural resources; raise awareness of U.S. as an Arctic nation; and provide upland support to vessels operating in the region (fuel, water, electricity, food, medical, storage, laydown/staging for resource extraction).

2.3 Planning Objectives

Planning objectives are desired results that arise from implementing navigation improvements. Objectives include those required by legal, policy, and regulatory requirements (National Objectives) and those that are more specific to the study (Study-Specific Objectives). Constraints are factors that plan development should avoid.

2.3.1 National Objectives

The Federal objective of water and land resources planning is to contribute to National Economic Development (NED) in a manner consistent with protecting the nation's environment. NED features increase the net value of goods and services provided to the economy of the United States as a whole. Only benefits contributing to NED may be claimed for Federal economic justification of a project. For the purposes of this study, NED features may include: breakwaters, channels, basins, float systems, and uplands.

Water resource planning must be consistent with NED objectives and must consider engineering, economic, environmental, and social factors. The following objectives are guidelines for developing alternative plans and are used to evaluate those plans.

2.3.1.1 Federal Engineering Objectives

Navigation improvement plans should be adequately sized to accommodate user needs and provide for harbor-related facilities development. They should protect against wind-generated waves and boat wakes. Adequate depths and entry channels are required for safe navigation. Plans must be feasible from an engineering standpoint and capable of being economically constructed.

2.3.1.2 Federal Economic Objectives

Principles and guidelines of Federal water resources planning require identifying a plan to provide the greatest contribution to NED. The NED plan is defined as the environmentally acceptable plan providing the greatest net benefits. Net benefits are determined by subtracting annual costs from annual benefits. Corps' policy requires recommending the NED plan unless there is adequate justification to do otherwise. In addition to identifying the NED plan, contributions to regional economic development (RED), environmental quality (EQ), and other social effects (OSE) should be presented.

All alternatives that would meet project needs must be presented and should be described in quantitative terms, if possible. Plan benefits must be expressed in terms of time-value of money and must exceed equivalent project economic costs. To be economically feasible, each separate portion or purpose of the plan must provide benefits at least equal to its cost. The scope of development must be such that benefits exceed project costs to the maximum extent possible. The economic evaluation of alternative plans is on a common basis of October 2014 prices, a period of analysis of 50 years, and the Federal fiscal year 2015 interest rate of 3.375 percent.

2.3.2 Study-Specific Objectives

Study-specific objectives were identified during the planning charette. These objectives were vetted through the vertical team (i.e., District, Division, and Headquarters representatives of the Corps) to provide a clear path for the study and are discussed in detail below. They were incorporated as "guiding principles" to ensure that broader Arctic issues were considered. Even though some of these objectives may not directly apply to plan selection in this study, it is important to understand that any improvements implemented as a result of this study will be received in the context of a larger geographic and geopolitical picture.

2.3.2.1 Objective 1: Support Multiple Maritime Missions

Any facility constructed as a result of this study should be able to support a number of maritime missions in the Arctic. These missions include:

- Resource exploration, development, and export
- Search and rescue
- National security
- Cargo transportation
- Emergency response

2.3.2.2 Objective 2: Holistic Growth

Any plan implemented as a result of this study should facilitate economic development at the local, regional, state, and national level. While the Corps is most concerned with national economic development, stakeholders associated with the study represent all levels of government and private industry. The Tentatively Selected Plan should strive to ensure sustainable growth for all interested parties, where appropriate.

2.3.2.3 Objective 3: Compatibility

Any plan implemented as a result of this study should take into account cultural, historic, subsistence, and other natural resources. The areas evaluated in this study have been occupied and/or utilized to varying degrees by Federally-recognized Alaska Native tribes for many years. Development at these sites should take into account current and traditional uses.

2.3.2.4 Objective 4: Upland Development

Plans should allow for sufficient development of upland facilities. Navigation improvements can efficiently and effectively benefit stakeholders when adequate upland development is planned. Plans should take into account either existing facilities or the potential development of facilities to include:

- Supply movement and storage
- Multimodal links
- Maritime support facilities such as maintenance and repair facilities
- Staging areas
- Other support facilities

2.3.2.5 Broader Arctic Objectives

Given the emerging commercial use of the Arctic, two broader objectives were developed. These objectives are not necessarily specific navigation improvements resulting from this study but are important to take into account as development occurs.

2.3.2.5.1 Objective 5: Public/Private Synergies

Development in the Arctic is a task too large for any one agency or business to effectively address alone. In order to facilitate sustainable and planned growth in the region, plans should be coordinated among the various interests. Policy compliant plans addressing various stakeholder needs should be sought.

2.3.2.5.2 Objective 6: Enhance Management of Arctic Issues

Solutions should allow for multi-level and/or multi-jurisdictional management of Arctic issues, and multi-purpose uses should be sought.

2.4 Constraints

Constraints are restrictions from laws, policies, and resource availability that limit the planning process. The following sections detail constraints and considerations taken into account during plan formulation.

2.4.1 Study Specific Constraints

One study-specific constraint was identified. Some of the sites investigated in this study are located on lands subject to the Alaska Native Claims Settlement Act. This Act may limit or constrain project alignments, dimensions, or a sponsor's ability to secure real estate needed for project construction.

2.4.2 Other Planning Considerations

Some issues identified early on in the study did not rise to the level of constraints. These issues are documented as planning considerations, helped guide plan formulation but were not selected or were eliminated based on these factors:

- Some investigated locations have less existing necessary data than others including topography, bathymetry, and geotechnical borings.
- Some locations are more conducive to development than others due to naturally occurring water depths, natural protection, available lands for upland development, etc.
- Some locations have longer open-water seasons than others. Generally, the further north a location lies, the shorter the open-water season.
- Locations selected for development should be able to accommodate vessels of various sizes including considerations for length, beam, and draft.
- Locations selected for utilization by the oil and gas industry should have the ability to secure existing storage facilities or construct appropriately secure storage facilities.

2.5 Planning Criteria

A key step in the study process is evaluating sites and alternative plans. Planning criteria determine how the recommended site is selected and how alternatives are evaluated. This section details the criteria used to make those determinations.

2.5.1 National Evaluation Criteria

Federal Principles and Guidelines establish four criteria for evaluating water resources projects. Those criteria and their definitions are listed below.

2.5.1.1 Acceptability

Acceptability is defined as "the viability and appropriateness of an alternative from the perspective of the Nation's general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency."

2.5.1.2 Completeness

Completeness is defined as "the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale."

2.5.1.3 Effectiveness

Effectiveness is defined as "the extent to which an alternative alleviates the specified problems and achieves the specified opportunities."

2.5.1.4 Efficiency

Efficiency is defined as "the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost."

2.5.2 Study-Specific Evaluation Criteria

Navigation improvements that effectively serve both Federal and non-Federal interests must be sited, planned, and operated so that they safely and efficiently meet user needs. The following criteria are based on the objective and needs described in Section 2.3 and are related to providing improvements that are safe, usable, and maintainable.

Per the study objectives, an Arctic port must meet the needs of multiple users with various missions. The criteria utilized to select site(s) must also meet the needs of the diverse group. The port site selection criteria were based on stakeholder input for use in the Multi-Criteria Decision Analysis (MCDA) tool developed by the USACE Institute of Water Resources.[2] Following is a concise description of the criteria used in identifying a port site.

2.5.2.1 Port Proximity

For the purposes of gains in efficiency during the future without-project condition, it was important to consider a port's proximity from the destination of vessels currently porting at Dutch Harbor. Port proximity is measured in time and distance from Outer Continental Shelf (OCS) endeavors, potential and operational mines, existing oil spill response equipment, and shipping lanes.

2.5.2.2 Intermodal Connections

For the purposes of gains in efficiency in resupply operations, it is important to be able to access a road-accessible runway capable of handling large supply shipments within 100 miles (185 kilometers) of the selected site.

2.5.2.3 Upland Support

A large portion of a project's benefits are earned through adequate upland capabilities. Uplands provide storage and staging areas, maintenance and repair functions, and opportunities for crew changes. Generally, larger communities with existing facilities are those that act as "hub communities" in rural Alaska. These communities were graded favorably based on their ability to effectively provide ancillary services and/or development of that ability.

2.5.2.4 Water Depth and Availability

Water depth was measured as the distance from the shore to natural depths of minus 35 feet, and minus 45 feet MLLW and the length of the ice-free period at those depths. The natural depth of

[2] The complete criteria development process and MCDA analysis can be found at http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaRegionalPortsStudy.aspx.

water and the period of open navigation at a particular site are directly related to the efficiency and effectiveness of navigation improvements at that site.

2.5.2.5 BCOES

In addition to completeness, effectiveness, efficiency, and acceptability, alternatives can be developed for bidability, constructability, operability, environmental, and sustainability (BCOES, ER 415-1-11, Jan 2013). The following describes BCOES.

Bidability is defined as clarity of the acquisition documents, soundness of the government's evaluation and selection criteria for negotiated acquisitions, and bidders or proposers ease of understanding government requirements. Bidability helps lead to competitive bids or proposals that are responsive to these requirements.

Constructability is defined as the ease of constructing a specified or designed project according to the government's requirements, including the proposed construction duration and the ease of understanding and administering contract documents during their execution.

Operability is defined as the ability to efficiently operate and maintain a facility or facilities during their life cycle when the facility or facilities are built according to the project's plans and specifications.

Environmental is defined as the ability to best achieve stewardship of air, water, land, animals, plants, and other natural resources when constructing and operating the project, and complying with the Environmental Impact Statement, Environmental Assessment, or other environmental-related project requirements. The Corps' Environmental Operating Principles (EOPs) in ER 200-1-5 provide direction on achieving synergy between the environment and the execution of projects. The Environmental parts of a BCOES review shall address all EOPs including compliance with all applicable local, state, and Federal environmental requirements.

Sustainability is defined as using methods, systems, and materials that optimize incorporating a site's natural land, water, and energy resources as integral aspects of the development and minimize or avoid harm to the air, water, land, energy, human ecology and nonrenewable resources on- and off-site of the project.

3.0 SITE SELECTION PROCESS

Site selection is the first major decision point when considering constructing new navigation improvements. Generally, site selection is limited to reasonable and prudent alternate sites within a tightly defined geographic area. However, given the large geographical area being considered in this study and the wide range of identified stakeholder interests, detailed analysis as part of the site selection process was required. In May 2011, a group of Federal and State stakeholders met to identify preliminary sites. The group used previously published works of the State of Alaska Northern Waters Task Force as a starting point for the sites considered and added several other sites based on the State's "Roads to Resources" program. This meeting produced the March 2013 report entitled "Alaska Deep-Draft Arctic Port System Study." [3] This section explains the site selection process in cursory detail.

3.1 Sites Considered for Initial Analysis

The study area includes a number of geographically favorable sites along the western and northern coasts of Alaska west of the Canadian Border and north of the Kuskokwim River mouth including Nunivak Island, St. Paul Island, St. George Island, St. Matthew Island, and St. Lawrence Island. This area is rural and remote – all communities except for Prudhoe Bay are located off the continental road system.

The sites considered in this study include:

Barrow (1)	Mary Sachs Entrance (6)	Prudhoe Bay (11)
Bethel (2)	Mekoryuk (7)	St. Lawrence (12)
Cape Darby (3)	Nome (8)	St. Paul Island (13)
Cape Thompson (4)	Point Franklin (9)	Wainwright (9)
Kotzebue (5)	Port Clarence (10)	

Note: Numbers following the community name indicates the order in which they are addressed in the following paragraphs.

These locations are shown in Figure 2.

[3] http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaRegionalPortsStudy.aspx

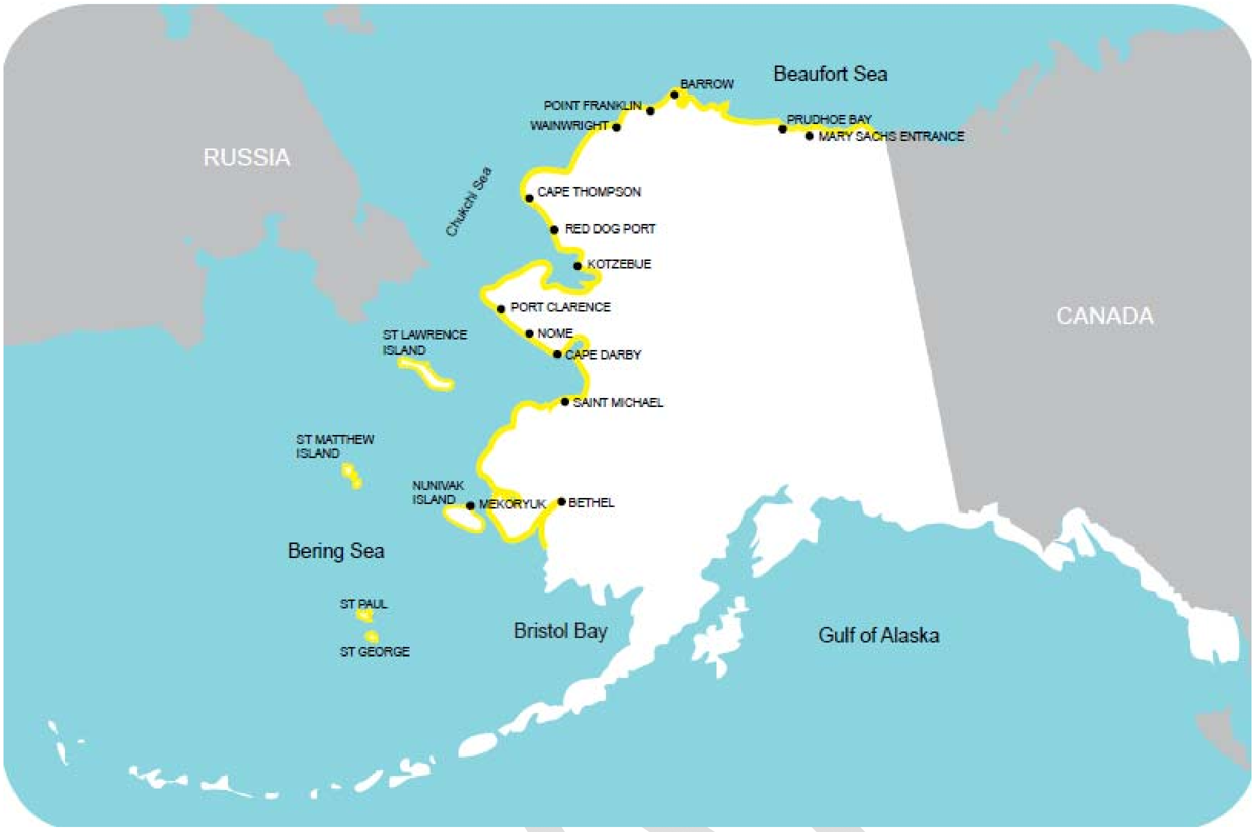

Figure 2: Potential Port Sites
Source: Alaska Deep-Draft Arctic Port System Study

The following sections give a brief description of the communities considered for deep-draft harbor development.

3.1.1 Barrow

The City of Barrow (Ukpeagvik) is the northernmost city in the U.S. and is located 730 miles north of Anchorage. The city lies on Point Barrow, which extends into the Arctic Ocean, with the Chukchi Sea lying to the west and the Beaufort Sea lying to the east. Barrow is the largest community of the North Slope Borough and acts as a hub for the villages of the Borough, providing goods, services, and transportation. Barrow has a 7,100-foot by 150-foot asphalt runway. Barrow receives 5 inches of rain and 20 inches of snowfall per year and temperatures range from -56 to +78 degrees Fahrenheit (F). According to the 2010 U.S. Census, Barrow has 4,212 residents.[4] The majority of the population is Inupiaq Eskimo, with significant minority populations from a number of other races. The median household income is $90,500, and approximately 12 percent of the population falls below the Federal poverty line.

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[4] Population estimates courtesy of State of Alaska Department of Labor and Workforce Development

3.1.2 Bethel

The City of Bethel (Orutsaramuit) is located 70 miles upstream of the mouth of the Kuskokwim River, 400 miles west of Anchorage. Bethel acts as a hub community for a large number of villages in the Kuskokwim Delta and on the Bering Sea coast. Bethel has a 1,858-foot by 75-foot asphalt and gravel runway. Bethel receives 16 inches of rain and 50 inches of snowfall per year with temperatures ranging from -2 to +62 degrees F. According to the 2010 U.S. Census, Bethel has 6,080 residents. The majority of the population is Yu'pik Eskimo, with significant minority populations from a number of other races. The median household income is $77,500, and approximately 12 percent of the population falls below the Federal poverty line.

3.1.3 Cape Darby

Cape Darby is a mountainous point extending southward into Norton Sound approximately 80 miles east of Nome and 15 miles south of the village of Golovin. The area experiences a marine climate in the summer when open water is present and a continental climate in the winter once sea ice forms. Temperatures range from -40 to +80 degrees F. The area receives 19 inches of rain and 40 inches of snowfall annually. There is no population base on Cape Darby. The village of Golovin lies 15 miles to the north. In 2010, Golovin had a population of 156 people who mostly practice a subsistence lifestyle. About 90 percent of Golovin's population is Kauweramiut Eskimo.

3.1.4 Cape Thompson

Cape Thompson (Uivaq) is a mountainous headland that protrudes southwestward into the Arctic Ocean 25 miles southeast of the village of Point Hope and 125 miles northwest of the City of Kotzebue. It is the former site of Project Chariot, a 1958 proposal to construct an artificial harbor by detonating nuclear devices. The area has an Arctic climate with temperatures ranging from -49 to +78 degrees F. The area receives an average 10 inches of rain and 36 inches of snowfall per year. There is no population base at Cape Thompson. The village of Point Hope lies 25 miles to the northwest. In 2010, Point Hope had a population of 674 people who mostly practice a subsistence lifestyle. About 90 percent of Point Hope's population is Tikeraqmuit Inupiat Eskimo.

3.1.5 Kotzebue

The City of Kotzebue (Kikiktagruk) is located on the northwestern tip of Baldwin Peninsula approximately 550 miles northwest of Anchorage and is the largest community of the Northwest Arctic Borough. Kotzebue acts as a hub community for the villages of the Borough, providing goods, services, and transportation. Kotzebue has two runways: a 5,900-foot by 150-foot asphalt runway and a 3,876-foot by 90-foot gravel runway. The area experiences a transitional climate with long, cold winters and cool summers. Temperatures range from -52 to +85 degrees F. The area receives 9 inches of rain and now 40 inches of snow per year. There is an existing small boat harbor located within Swan Lake. Bathymetrical issues limit the draft of ocean-going barges and force the vessels to lighter in goods from 12-15 miles offshore. The City is working with the State of Alaska to develop a 10-mile road to Cape Blossom to facilitate developing a harbor capable of accommodating these vessels. According to the 2010 United State Census, Kotzebue has 3,201 residents. The majority of Kotzebue's residents are Inupiaq Eskimos with significant minority populations from other races. Residents generally practice a subsistence or mixed-subsistence lifestyle. The median household income is $81,354, and approximately 16 percent of the population falls below the Federal poverty threshold.

Figure 3: Kotzebue Barge Operations
Source: Joseph A. Davis, ConsultNorth via Alaska Deep Draft Arctic Port System Study

3.1.6 Mary Sachs Entrance

Mary Sachs Entrance is a protected area along Alaska's northern coast 50 miles east of Prudhoe Bay. Natural protection is provided by a chain of barrier islands. The coastal plain is flat with a number of streams draining into the sea. The only development in the area is a single oil-support pad. There is no population base at Mary Sachs Entrance.

3.1.7 Mekoryuk

The village of Mekoryuk lies on the northern coast of Nunivak Island, 560 miles west of Anchorage. The village is located at the mouth of Shoal Bay, which provides a naturally protected area with close access to the Bering Sea. Mekoryuk has a 3,070-foot by 75-foot gravel runway. The island experiences frequent fog and storms with 15 inches of rain and 57 inches of snow on an annual basis. Temperatures range from -48 to +76 degrees F. There is an existing, tidally dependent Federal small boat harbor that provides protection to Mekoryuk's fleet of skiffs that are utilized to procure subsistence resources. Mekoryuk is the only village on the island and has a population of 191 people according to the 2010 United States Census. About 93 percent of Mekoryuk's residents are Nuniqarmiut Cup'ik Eskimos who practice a subsistence lifestyle. The median household income is $36,250, and approximately 19 percent of residents fall below the Federal poverty threshold.

3.1.8 Nome

The City of Nome lies on the southern coast of the Seward Peninsula approximately 550 miles northwest of Anchorage. Nome serves as the major hub for commerce, education, transportation and government services for much of Northwest Alaska. The area receives 18 inches of rain and 56 inches of snowfall per year. Temperatures range from -3 to +65 degrees F. According to the 2010 United States Census, Nome has 3,598 residents. The majority of Nome’s residents are Alaska Natives with significant minority populations of other races. The median household income is $71,643, and approximately 10 percent of residents fall below the Federal poverty threshold. Nome is served by regular, scheduled jet service into Nome Airport, with a 6,000-foot-long main runway and a 5,576-foot-long crosswind runway. Nome City Field also offers a 1,950-foot-long gravel airstrip. Nome cannot be reached by road from Anchorage or other population centers of Alaska, but is the hub for a regional network of roads that grant access to various villages, mines, and resource development sites eastward to Solomon, northwest to Teller, and north to Taylor.

Historically, main commodities shipped through Nome include dry goods, fuel, and rock products. Nome is a hub community, which means it receives freight bound for a number of villages. Once the freight arrives in Nome, it is loaded onto smaller barges and shipped to area communities. During the last 10 years, the amount of dry cargo coming in and out of Nome has steadily increased from 14,554 short tons in 2004 to 56,576 short tons in 2013. The fuel handled at Nome increased from 10,041,793 gallons in 2004 to 11,570,561 gallons in 2014. The mix of fuel handling has changed as the amount of inbound fuel continues to climb while the amount of outbound fuel falls. However, this is a result of changes in shipping practices rather than decreased demand. Because of increased fuel usage at Nome, surplus storage capacity to accommodate surrounding villages is inadequate. Fuel shippers have changed their practices – smaller delivery barges now lighter fuel directly from mainline ocean going barges when delivering to outlying villages.

Because of its proximity to a regional road network and presence of existing infrastructure, Nome was selected for detailed consideration. Outside of the existing harbor, there are multiple sites in the greater Nome area that could be good candidates for navigation improvements. These sites have unique attributes that make them attractive and for that reason, they will be included for detailed consideration as well.

3.1.9 Point Franklin/Wainwright

The City of Wainwright lies on Alaska’s northern coast, 715 miles north-northwest of Anchorage. Point Franklin extends eastward from the coast near Wainwright to provide protection to Peard Bay. The area receives 5 inches of rain and 12 inches of snow annually. Temperatures range from -56 to +80 degrees F. According to the 2010 United States Census, Wainwright has a population of 556 people. The majority of Wainwright's residents are Native Alaskans. The median household income is $61,875, and approximately 12 percent of residents fall below the Federal poverty threshold.

Figure 4: Wainwright/Point Franklin Area
(Source: Google Earth with USACE Amendments)

3.1.10 Port Clarence/Teller/Brevig Mission

Port Clarence is a protected body of water with an area approximately 175 square miles on the west coast of the Seward Peninsula approximately 60 miles north of Nome. The Nome-Teller Highway's northern terminus is the village of Teller, which lies on the eastern shore of Port Clarence. The area receives 12 inches of rain and 50 inches of snow annually. Temperatures range from -45 to +82 degrees F.

Figure 5: Port Clarence Area Map
(Source: Google Earth with USACE amendments)

As shown in Figure 5, there are multiple sites within Port Clarence that could support navigation improvements. Each of these sites has a unique set of positive attributes. In addition to these sites, there are other potential sites in the greater Port Clarence area that could be candidates that warrant further consideration. Because of its proximity to a regional road network, naturally deep depths, and presence of existing infrastructure, Port Clarence was selected for detailed consideration.

3.1.11 Prudhoe Bay

Prudhoe Bay is an unincorporated area in the North Slope Borough on the Beaufort Sea coast approximately 645 miles north of Anchorage. It is the site of a major oilfield and the northern terminus of the Trans-Alaska Pipeline System. Some marine infrastructure exists that helps facilitate movement of people and supplies to and from near-shore oil fields. The area receives 20 inches of combined rain and snowfall annually. Temperatures range from -48 to +77 degrees

F. According to the United States census, there are 2,174 residents with a per capita income of $94,906, and about 6 percent fall below the Federal poverty threshold.

3.1.12 St. Lawrence Island

St. Lawrence is located south of the Bering Strait. There are two communities on the island: Savoonga and Gambell. The island is the sixth largest island in the Unites States at 90 miles long and between is 8 to 22 miles wide. The island has been inhabited intermittently for the past 2,000 years by Yup'ik Eskimos. The island is jointly owned by Savoonga and Gambell. The economies are largely based on subsistence hunting of walrus, seal, fish, and bowhead and gray whales. Islanders are known for their quality ivory carvings.

3.1.13 St. Paul Island

St. Paul Island is located in the central portion of the Bering Sea approximately 775 miles west-southwest of Anchorage and 275 miles north-northwest of Dutch Harbor. Temperatures range from -12 to +64 degrees F. According to the United States census, there are 479 residents, the majority of which are Alaska Natives. The median household income is $38.750, and approximately 11.5 percent of the population falls below the Federal poverty threshold. St. Paul is the site of an existing Federal small boat harbor and a 6,500-foot-long runway that provides propeller-powered fixed-wing aircraft service to the island.

3.2 Site Screening Process

The following table summarizes the criteria and the qualitative or quantitative input values that were assigned for running the Multi-Criteria Decision Analysis (MCDA) tool.

Table 1 Summary of Decision Criteria

Criteria	Qualitative Value	Quantitative Value
Port Proximity	very good = 5, good = 4, medium = 3, low =2, very low = 1, potential = 0	time and distance from OCS oil and gas endeavors, mining operations and potential, oil spill response existing, community resupply, and shipping lanes
Intermodal Connections	2=existing, 1=planned, 0=none/potential	air service within 100 miles, jet service assumes 4,000' runway needed, gravel runway for C-130, road and rail potential is to Railbelt or other communities, harbors constitute existing marine infrastructure
Upland Support	Based hub concept - major hub = 5, regional hub = 4, minor hub = 3, community = 1, none/potential = 0	based on hub concept where a major hub serves many communities, a regional hub serves a geographic region, minor hub serves some nearby communities, and a community has very little transfer of goods to areas outside its home
Water Depth	function of distance - <=1/2 mile = 5, >1/2 and <=1 = 4, >1 and <=2 = 3, >2 and <=5 = 2, >5 and <=10=1,>10 = 0)	-35 (5.8 fathoms) or -45 (7.5 fathoms) Function of distance from shore
Navigation Accessibility	very good = 5, good = 4, medium = 3, low =2, very low = 1, potential = 0	months ice conditions allow traffic, and engineering considerations (wind, wave, tides, currents)

Initially, the study team used the MCDA software weighting all criteria equally to see which locations bubbled up to the top for consideration. The water depth criterion included the ranking of distances to minus 35-feet and minus 45-feet.

For the next round of runs using the MCDA software, more weight (i.e., importance) was applied to the distance to deep water before running the model. Distance to deep water was assumed a proxy for cost, as annual or periodic dredging to maintain necessary depth would likely be very expensive. Again, all the port missions were run to determine if there was one site that would best meet all needs. The top five results from each of those runs are displayed in the following table. Additional model runs applying more weight to "Navigation Accessibility," because that criterion determines the number of months the port could be used throughout the year, were also conducted. Of all the criteria, "Distance to Deep Water" and "Navigation Accessibility" were determined more important in port siting because of costs and usability.

Nome, Cape Blossom (Kotzebue), and Port Clarence (Teller) are the top choices when all criteria are weighted the same. Nome remains in the top spot when water depth as a proxy for cost is given additional weight followed by either Port Clarence (Teller) or Cape Darby.

Table 2 - First Round of Evaluation – All locations, all criteria

Rank	Equal Wts		5X water depth		10X water depth		5X water, 2X navigation		2X water, 5X navigation	
	Port	Score	Port	Score	Port	Score	Port	Score	Port	Score
1	Nome	0.9150	Nome	0.9083	Nome	0.9054	Nome	0.9050	Nome	0.8975
2	Cape Blossom (Kotzebue)	0.6933	Port Clarence (Teller)	0.7398	Cape Darby	0.8222	Port Clarence (Teller)	0.7533	Port Clarence (Teller)	0.7758
3	Port Clarence (Teller)	0.6167	Cape Darby	0.7235	St Paul Island	0.7780	Cape Darby	0.7511	Cape Darby	0.7511
4	Prudhoe Bay	0.6750	St Paul Island	0.7102	Port Clarence (Teller)	0.7613	St Paul Island	0.7017	Cape Blossom (Kotzebue)	0.6967
5	Barrow	0.6539	Barrow	0.6744	Barrow	0.6835	Barrow	0.6694	St Lawrence Island	0.6708

Note: The scores depicted in these tables are a percent of the total.

3.3 Sites Considered for Detailed Analysis

Based upon a thorough consideration of the merits of each potential site, and a multi-criteria decision analysis based upon the criteria discussed in Section 2.5.2, all but two sites were screened from further investigation; Nome, and Port Clarence. However, within these two areas, there were multiple sites that could support navigational improvements. These are shown in Figure 6 and discussed in the sections below.

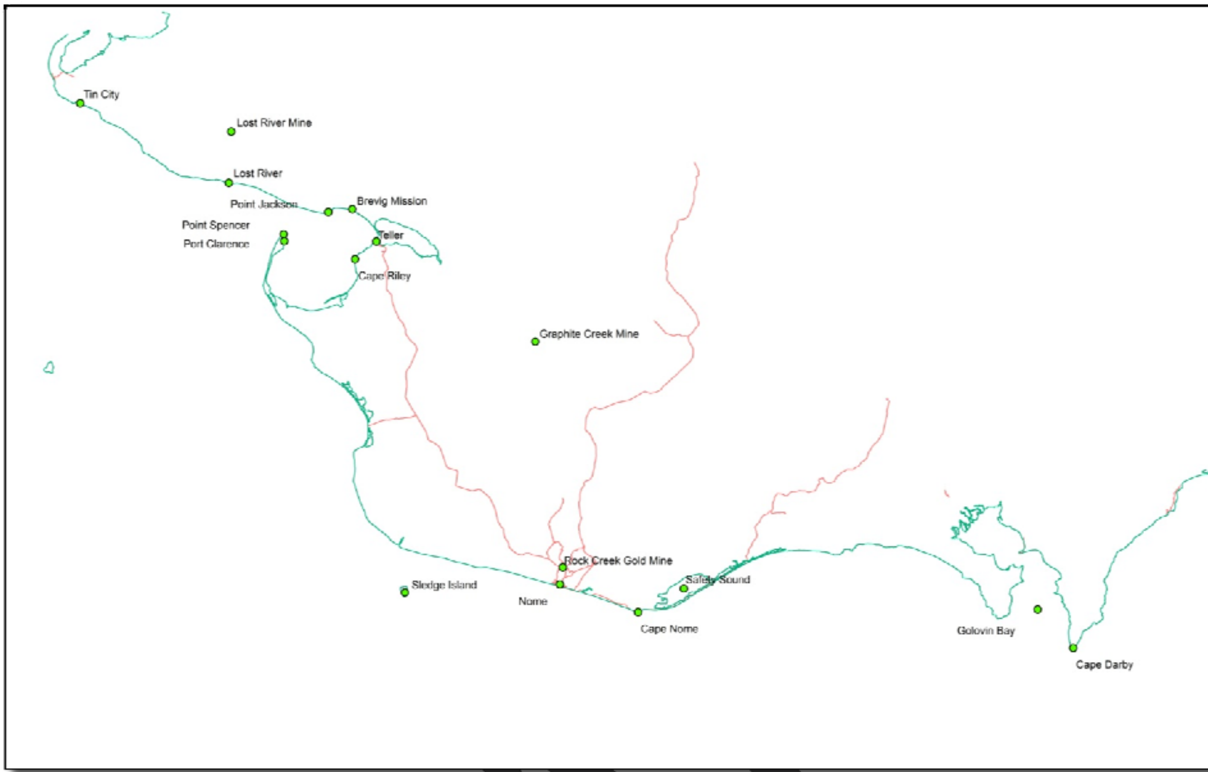

Figure 6: Sites Selected for Further Consideration

3.3.1 Cape Darby

While Cape Darby scored highly in the initial round of screening, this would be a single purpose port for shipping ore out of the Ambler Mining District. Resources that could be extracted would include rock, silver, gold, and uranium deposits. There is a high potential for commercial use of this site but navigation improvements at this site would not meet the study objective requiring support of multiple maritime missions. This is partly due to the site's location 80 miles east of Nome, making it a less attractive option for vessels that would support petroleum development in the Chukchi Sea. Because of these considerations, Cape Darby was eliminated from further consideration.

3.3.2 Nome

Nome is the hub for more than 50 communities along the western shore of Alaska and lies 125 miles from the Bering Strait. It is a regional center for retail goods, medical services, transportation, mining, fishing, and other businesses. In the multi-criteria decision analysis, Nome scored well in a number of categories. Nome is located in close proximity to mining operations, offshore petroleum operations, shipping lanes, and other communities. It has favorable distances to naturally deep water, scheduled jet service, an existing harbor, and a limited road network. Multiple sites in and near Nome were considered.

3.3.2.1 Nome Harbor Expansion

The existing port and small boat harbor facilities at Port Nome have a maximum depth of -22.5 feet (6.8 meters) MLLW. The current marine infrastructure serves a fleet of tugs and barges, landing craft, fuel tankers, government vessels, research vessels, cruise ships, recreation vessels, commercial fishing vessels, and a fleet of gold dredges. The original navigation project was completed in 1917 and was upgraded to its current configuration in 2006. The main breakwater is 3,025 feet (922 meters) in length with a 270-foot-long (82 meters) spur breakwater extending from the end of a 2,700-foot-long (823 meters) causeway. Two docks provide 400 feet (122 meters) of berthing. A detailed listing of the various harbor facilities is shown in Figure 7.

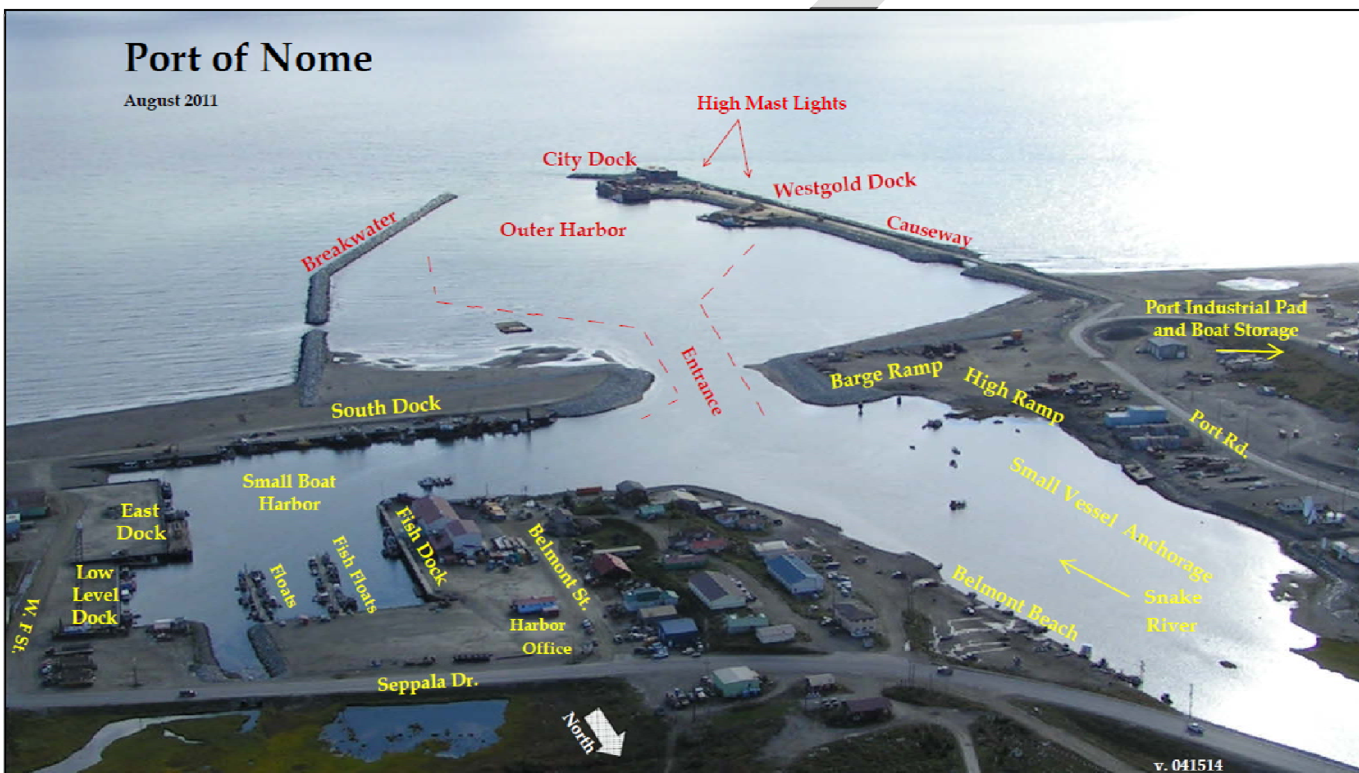

Figure 7: Port of Nome Facilities
(Source: City of Nome Strategic Plan)

3.3.2.1 Cape Nome

Cape Nome is the site of an existing quarry and load-out facility approximately 15 road miles (28 kilometers) east of Nome. It has access to deep water and existing, albeit rudimentary navigation improvement already constructed. While construction of navigation improvements at this location would facilitate the export of rock from the Cape Nome Quarry, it would be unlikely to support multiple maritime missions, construction of multi-directional wave protection would be very expensive due to the natural water depths, and there is no current upland development. Development of this site would require the development of a utility system including water and electricity and would be unattractive for petroleum supply vessels due to the area's distance from stores that would provide supplies and an airport that would facilitate crew changes.

Figure 8: Cape Nome (Courtesy: Corps of Engineers)

Because of the expense to construct additional wave protection, potential for single owner issues, distance from supplies and intermodal connections, the site's undeveloped nature, and associated costs of developing basic infrastructure, Cape Nome was eliminated from further consideration.

3.3.2.2 Wooley Lagoon

Wooley Lagoon is a naturally protected lagoon approximately 100 road miles (185 kilometers) west of Nome. While the site's proximity to the Bering Strait shipping lanes makes it attractive from a geographic sense, it is naturally shallow. Multiple rivers drain into the lagoon, making sedimentation a possible issue from an operation and maintenance viewpoint. This site is also a traditional use location for freshwater gathering for the King Island tribe. Because of the costs to develop basic support infrastructure, the area's status as a traditional use site by a Federally-recognized tribe, and the possibility for a high lifecycle dredging regime in the face of cheaper alternatives, Wooley Lagoon was eliminated from further consideration.

3.3.2.3 Sledge Island

Sledge Island is a marine island located in western Norton Sound 23 miles (42.5 kilometers) west of Nome and is the former site of an observation post and communications center used by the U.S. Army Air Force during World War II. The site's proximity to naturally deep water and the Bering Strait shipping lanes makes it an attractive site. However, the island is steep-sided, making development of uplands difficult. In addition, the island is currently owned by the U.S. Department of Interior and is part of the Alaska Maritime National Wildlife Refuge. Because of the environmental status of the island and challenges associated with developing sufficient uplands to support multiple maritime missions, Sledge Island was eliminated from further consideration.

3.3.2.4 Nome Dredge Pond

The Nome Dredge Pond is a 20-acre man-made lake located on Submarine Beach Road off the south end of Nome airport's Runway 3 and is immediately adjacent to the existing harbor. In addition to development of upland support facilities, development of this site would include excavating the pond to navigable depths, breaching the beach berm, dredging a channel to deep water, and construction of jetties to protect vessels entering the channel. Development of this site to a navigable depth capable of supporting multiple maritime missions would be very costly and would require large lifecycle operation and maintenance costs to maintain the channel to deep water. In addition, the pond is located within the flight path of Nome Airport and would either affect aerial navigation or be subject to height restrictions within and around the harbor, which could limit the site's effectiveness. The site is owned by a mining company that believes there is still economically-recoverable gold in the pond's sediments and therefore they are unwilling to sell the land which could lead to lengthy LERRD-acquisition process. Because of the costs of site development and impacts to aerial navigation, this site was eliminated from further consideration.

3.3.2.5 Safety Sound

Safety Sound is an estuarine lagoon approximately 15-square miles in area located 20 road miles (37 kilometers) east of Nome. In addition to development of upland support facilities, development of this site would include excavating the sound to navigable depths, breaching the beach berm, dredging a channel to deep water, and construction of jetties to protect vessels entering the channel. There are no utility connections at the site which would require costly connections to utilities at Nome or the development of a standalone utility system on-site.

In addition to these considerations, there are major environmental and cultural impacts that would be associated with development of this site. In addition to providing eelgrass habitat, Safety Sound is part of the Pacific Flyway and has been named as one of the "Important Bird Areas of North America" by the National Audubon Society.

The sound is the site of the former Ayasayuk village and multiple house pit sites have been identified along the barrier beach.[5] The sound is also the site of the "Nuuk" subsistence site and supports ongoing subsistence activities. Because of the costs of site development as well as the environmental and cultural impacts associated with development of this site, it was eliminated from further consideration.

3.3.3 Port Clarence

In the multi-criteria decision analysis, Port Clarence scored well in a number of categories. Port Clarence is located in close proximity to mining operations, offshore petroleum operations, and shipping lanes. It has favorable distances to naturally deep water, scheduled air taxi, a limited road network, and no harbor facilities.

While there are no existing marine facilities at Port Clarence, several aspects of the area make it a positive site for further consideration. There are natural 40-foot (12 meters) depths off the tip of Point Spencer and natural 27-foot (8 meters) depths off the tip of Cape Riley. The Nome-Teller Highway is within 5 miles (9 kilometers) of Cape Riley, and an existing runway at the decommissioned Coast Guard LOnge RANge (LORAN) Station justifies this site's further consideration.

3.3.3.1 Point Spencer

Point Spencer is the site of a decommissioned Coast Guard LORAN Station. While there are no existing marine improvements, the site is close to natural depths up to -40 feet (12 meters) MLLW and has multiple upland assets include an 8,500-foot-long hybrid-gravel/asphalt runway, associated apron, and support buildings. The site's natural protection from western and some northerly waves negates the need for construction of wave protection.

3.3.3.2 Cape Riley

Cape Riley lies just to the west of Teller on the eastern shore of Port Clarence. While it is an undeveloped site, it is in close proximity to natural depths of -27 feet (8 meters) MLLW and is within 5 miles (9 kilometers) of the Nome-Teller Highway. Development at this site would mostly support mine-related navigation by exporting ore from the Graphite One Mine. The site could be used to support other mining developments as they came online. Additionally, the site could be the water link to other Port Clarence development.

3.3.3.3 Point Jackson

Point Jackson is a spit to the west of the village of Brevig Mission and lies on the northern shore of Port Clarence. The majority of the village populations are Alaska Natives. According to the 2010 United States Census, Brevig Mission has a population of 388 and Teller has a population

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[5] State of Alaska Department of Fish and Game: http://www.adfg.alaska.gov/index.cfm?adfg=viewinglocations.nomecouncil14to34

of 229. Brevig Mission has a median household income of $34,125, and approximately 57 percent of residents fall below the Federal poverty threshold. Teller has a median household income of $25,500, and approximately 47 percent of residents fall below the Federal poverty threshold.

3.3.3.4 Tin City

Tin City is located on the western tip of the Seward Peninsula approximately 100 miles (185 kilometers) northwest of Nome. It is the site of the decommissioned Tin City Long Range Radar Station and is owned by the U.S. Air Force. The station has a 5,000-foot-long (9,260 kilometer) gravel runway and a small local gravel road network. The site's proximity to the Bering Sea shipping lanes and the Chukchi Sea make it an attractive site for navigation improvement.

Figure 9: Tin City Long Range Radar Station (Courtesy: Corps of Engineers)

Additionally, Tin City is near the world's largest proven deposit of fluoride and could be used for export of material related to mine development. However, there is no set plan for development and bathymetry at the site is not conducive to development of a deep-draft port. The costs to upgrade existing facilities to support crew changes and resupply efforts would be prohibitive in nature compared with other, more efficient sites. Because of this, Tin City was eliminated from further consideration.

3.3.3.5 Lost River

Lost River is a located on the coast of the Seward Peninsula 12 miles (22 kilometers) northwest of Point Spencer. It is the site of a small airstrip but there are no other support facilities in place. The site is approximately 20 miles (37 kilometers) from Brevig Mission and constructing a road connecting to the Nome-Teller Highway would be cost-prohibitive given the topography of the area and the number of stream and river crossings such a road would entail. Bathymetry and nearshore topography would make it difficult and costly to develop a deep-draft port that supports multiple maritime missions. This site would be more costly to develop than other, more efficient and effective sites and therefore was eliminated from further consideration.

3.4 Summary of Site Selection Process

After multiple screening processes based on established criteria needed to ensure the successful development of navigation features that would be likely to reasonably maximize net NED benefits in consideration of the nation’s environment, three sites were chosen for development of alternatives: Nome Harbor, Point Spencer, and Cape Riley. A discussion of the existing and future without-project conditions at these sites follows with formulation of measures and alternatives discussed in Section 0.

4.0 BASELINE CONDITIONS/AFFECTED ENVIRONMENT

Several previous studies have characterized the baseline conditions/affected environment existing within the proposed project area.

The Navigation Improvements Final Interim Feasibility Report and Environmental Assessment (USACE 1998) analyzed the environmental effects likely to accrue to the construction of the current Nome Harbor configuration, including:

1. Abandonment of the former Nome Harbor entrance;
2. Construction of a 985-foot-long (300 meter), 360-foot-wide (110 meter), and -22-foot (6.7 meter) MLLW deep navigation channel;
3. Construction of a 2,985-foot-long (910 meter) rubblemound breakwater with a crest elevation of 14 feet (4.3 meters);
4. Construction of a 230-foot-long (70 meter) rubblemound breakwater extension to the pre-existing causeway with a crest elevation of 14 feet (4.3 meters);
5. Placement of 98,000 CY (75,000 m^3) of dredged material to fill the former navigation channel, using a barge-mounted crane with an open-bucket clamshell dredge; and
6. Placement of 490,000 CY (375,000 m^3) of dredged material at one of two dredged material disposal sites located east of the then-proposed breakwater, one of which is used to support maintenance dredging activities. Dredged material was excavated using a combination of:
   - Diesel-powered suction head hydraulic dredge, with transportation of dredged material via pipeline and booster pumps; and
   - Barge-mounted crane with an open-bucket clamshell dredge.

The 1998 report also addressed the environmental effects of potentially using a hopper dredge, with dredged material excavated using a suction head hydraulic dredge, transported to a near-shore (versus onshore) disposal site, and placed inside the depth of closure – i.e., the seaward limit of sediment transport due to seasonal beach profile changes caused by erosion and accretion. This method allows subsequent wave action to then transport sand to the beach for beach nourishment and shoreline protection.

More recently, the Maintenance Dredging Nome Harbor Entrance Channel Environmental Assessment (USACE 2012) analyzed the environmental effects likely to accrue to the continuous disturbance of the harbor navigation channel through annual maintenance dredging activities. The study analyzed the beneficial uses realized from the placement of 26,000 to 65,000 CY (20,000 to 50,000 m^3) of dredged material directly on the beach but above MLLW, or immediately offshore but inside the depth of closure, east of the breakwater for beach nourishment and shoreline protection. A hydraulic cutter-head dredge is currently used in maintenance dredging and dredged sediment is moved via a pipeline to the placement site.

Both of these analyses concluded that their respective projects did not constitute a major Federal action significantly affecting the quality of the human environment, and that no significant short-term or long-term adverse effects were anticipated.

To reduce redundancy, and to comply with the spirit and intent of 40 CFR 1502.21, the analyses and discussion of impacts in Navigation Improvements Final Interim Feasibility Report and Environmental Assessment (USACE, 1998) and Maintenance Dredging Nome Harbor Entrance Channel Environmental Assessment (USACE, 2012) are hereby incorporated by reference. The discussion that follows briefly summarizes the relevant information presented in those studies, with additional discussion related to the differences between those projects and the currently proposed project when and if needed.

4.1 Community and People

4.1.1 History

Both Nome and Port Clarence are located on the Seward Peninsula, about 60 miles (111 kilometers) apart, with Nome on the southern coast and Port Clarence (villages of Brevig Mission and Teller) on the western coast. Malemiut, Kauweramiut, and Unalikmiut Eskimos have historically inhabited the Seward Peninsula. Four Federally-recognized tribes inhabit the Nome and Port Clarence project areas: King Island Native Community, Nome Eskimo Community, Native Village of Brevig Mission, and the Native Village of Teller.

Since 1865, when gold was discovered near Nome, the area has been known for gold extraction. One of the most famous gold rushes in American history began in 1898 when a large gold deposit was discovered along the banks of Anvil Creek. During the gold rush's peak, Nome grew to more than 20,000 residents. The City of Nome was founded in 1901. The population declined with the ending of the gold rush shortly after the turn of the century, the influenza epidemic in 1918 (Spanish Flu), The Great Depression that began in 1929, and a fire that destroyed much of the city in 1934.

Recent gold prices, newer technologies, easier access, and television publicity has resulted in an exponential increase in the recreational mining of shallow marine waters. In 1996, there were only three dredging operations in Nome's 320 acre public mining area. By 2011, there were 39 active permits and the public mining area had almost doubled in size to 570 acres. In 2012, there were 148 permits issued by the Alaska Department of Natural Resources (ADNR). On a more commercial scale, for example, the Nome Offshore Placer Mining Operation employed the floating dredge *Bima* (Singapore-built, 14-stories tall, 15,000 short tons, 361 feet (110 meters) long, 98 feet (30 meters) wide) to conduct sea floor dredging between 1987 and 1990 on 21,750 acres of offshore mineral claims in Norton Sound. The impacts from mining on the seafloor and to species were studied by the Alaska Department of Fish and Game (ADFG) and Dr. Stephen Jewett, finding that more diverse and less-disturbed conditions existed in water deeper than -30 feet (9 meters) MLLW, and that recovery of the seafloor and living habitats from mining impacts occurred much slower.

4.1.2 Government and Tax Structure

Political subdivisions within the State of Alaska are termed "municipalities." The taxation powers and limitations of each municipality depend upon its classification. There are five categories of municipalities:

1. Home Rule City
2. Home Rule Borough
3. General Law City
4. General Law Borough
5. Unified Municipality

General law cities are incorporated as either First Class Cities or Second Class Cities, with Nome classified as a First Class City and Brevig Mission and Teller classified as Second Class Cities within the Nome Census Area.[6]

The Nome City Council consists of six at-large members elected to three-year terms. The executive branch is represented by a mayor and city manager. The city employs a 5 percent sales tax, 6 percent bed tax, and a 12.0 mill property tax. In 2013, Nome collected sales tax receipts of $5.37 million, bed taxes of $158,000 and property taxes of $2.65 million based on locally assessed real and personal property of $266.6 million.[7]

The Brevig Mission City Council consists of seven at-large members elected to three-year terms. The executive branch is represented by a mayor. Brevig Mission employs a 3 percent sales tax, and no property tax. In 2013, Brevig Mission collected sales tax receipts of $36,177.

The Teller City Council consists of six at-large members elected to three-year terms. The executive branch is represented by a mayor. Teller employs a 3 percent sales tax, a 3 percent raw fish tax, and no property tax. Teller collected $41,226 in sales tax receipts in 2013.

4.1.3 Demographics and Socio-Economic Conditions

Nome's population is 58 percent Alaska Native, 36 percent White, and 3 percent Asian. The population is 53 percent male and 47 percent female.[8] The median age is 36 and 7 percent of the population is over the age of 64. Per capita income is $32,374, with approximately 10 percent of

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[6] Alaska Department of Commerce - http://commerce.state.ak.us/dnn/Portals/4/pub/OSA/Taxable%202013%20-%202013-12-31.pdf

[7] State of Alaska Department of Commerce - http://commerce.state.ak.us/dnn/Portals/4/pub/OSA/Taxable%202013%20-%202013-12-31.pdf

[8] State of Alaska Department of Commerce, Community, and Economic Development

the population falling below the Federal poverty threshold. The largest employment sectors are shown in Table 3.

Table 3: Major Employment Industries

Industry	Percent of Total Employed
Educational and Health Services	25.0
Trade, Transportation, and Utilities	18.2
Local Government	15.3
State Government	12.2

Source: State of Alaska Department of Commerce, Community, and Economic Development

Brevig Mission's population is 91 percent Alaska Native, 5 percent White, and 0.5 percent Black or African American. The population is 52 percent male and 48 percent female. The median age is 21 and 15 percent of the population is over the age of 64. Per capita income is $8,389, with approximately 57 percent of the population falling below the Federal poverty threshold.

Teller's population is 96 percent Alaska Native and 4 percent White. The population is 52 percent male and 48 percent female. The median age is 26 and 15 percent of the population is over the age of 64. Per capita income is $10,498, with approximately 47 percent of the population falling below the Federal poverty threshold.

4.1.4 Land Use and Project History

Land use near the Nome Harbor is dedicated to industry, generally related to marine transportation. Land use in Brevig Mission and Teller is generally subsistence-based.

4.2 Physical Environment

4.2.1 Climate

Nome is located on the edge of the Bering Sea on the south coast of the Seward Peninsula facing Norton Sound, 539 air miles (998 kilometers) northwest of Anchorage and 102 miles (189 kilometers) south of the Arctic Circle. Nome lies in the transitional climate zone, characterized by an average annual precipitation of about 30 inches, and average annual temperatures of about 27 °F. The coldest month in 2013 was February, with a mean minimum temperature of -9.1 °F. The warmest month was August, with a mean maximum temperature of 58.9 °F. The climate is influenced by both maritime and continental conditions. Maritime dominates in the summer, while in the winter, conditions shift to a mostly continental climate. The area is known for numerous intense storms, particularly during the fall months. For example, during October and November 1989 and 1990, peak easterly winds of over 25 knots were observed at Nome for 9 and 24 days respectively (NOAA, Local Climatological Data Monthly Summary). Storms usually arrive from the southwest, although intense storms can also come from the south and southeast. The severe storm of 4-5 October 1992 approached from the south-southeast with winds to 50 knots (94 km/h), disrupting the nearshore habitat down to a depth of 40 feet (12 meters) MLLW (Jewett 1999), with storm surge damages exceeding $6 million in a population of less than 4,000 (Nome Nugget 1992).

Brevig Mission is located at the mouth of Shelman Creek on Port Clarence, 5 miles (9 kilometers) northwest of Teller and 65 miles (120 kilometers) northwest of Nome. Teller is located on a spit between Port Clarence and Grantley Harbor, 72 miles (133 kilometers) northwest of Nome. The climate in Port Clarence is maritime when ice-free and then changes to a continental climate after freezing. Port Clarence is generally ice-free between early June and mid-November, while Grantley Harbor is generally ice-free from early June to mid-October. Summer temperatures average 44 to 57 °F, while winter temperatures average -9 to 8 °F. Extremes have been measured from -45 to 82 °F. Annual precipitation averages 11.5 inches, and annual snowfall averages 50 inches.

4.2.2 Geology and Topography

Beaches, coastal plains, high hills, and watercourses are the major topographical features of the southwestern and western Seward Peninsula area. Because of the relatively low wave energy along the coast, beach sediment is distributed at random. No clearly defined areas exist where sand or gravel of similar size are regularly deposited. Beach sediments are deposited over time and as a result, the shoreline is a dynamic and changing environment. In Nome, at least six distinct geologic or ancient beach sites are known to exist on the coastal plain, inshore from the current beach. These ancient beaches are the sites of placer gold deposits, which played an important role in the region's history and economy.

The coastal plain is about 4 miles (7.4 kilometers) wide and is a nearly level, crescent-shaped lowland extending from Cape Nome to the hills west of Cripple River. The plain is underlain with deposits laid down over time by ocean currents and watercourses. These deposits consist of silt, interstratified fine sand, well-rounded gravels, and beds of angular fragments. The mantle overlaying the lower deposits consists of silty loessial (wind-laid) deposits ranging from a few centimeters to a meter thick. Permafrost extends several meters in depth. The coastal plain area is covered by moist tundra, and the soil is generally classified as Histic Pergelic Cryaquepts, a loamy, gently sloping soil association.

High hills border the coastal plain and range to about 1,000 feet (300 meters) in elevation. They are formed by folded and faulted interbedded schists and limestones of the Nome group. In general, the soil of the hills consists of rubble or gravel and overlie bedrock at shallow depths. The soil is generally classified as Pergelic Cryumbrepts, a very gravelly, hilly to steep association. Common features caused by frost action include stone nets (rings of large stones surrounding a central area of finer debris), frost boils (small frost-heaved and cracked knolls), and solifluction lobes (created from water-saturated ground slowly flowing down the hills). The lower slopes have soils formed in gravelly deposits laid down by streams or moved by soil creep from steeper, higher slopes.

4.2.3 Marine Environment

The harbor at Nome was originally sited where the Snake River discharged into Norton Sound. The site is located on an exposed stretch of low-relief sand and gravel coastline. The seabed near the harbor is a largely featureless expanse of sand and gravel that deepens very gradually, only reaching a depth of -40 feet (12 meters) MLLW at a distance of about 3,000 feet (914 meters) offshore. The natural environment includes the continuous migration and redistribution of benthic sediments and frequent disruption from ice scouring and violent storms. Studies of the general biological setting offshore of Nome describe species typical of a high-energy, sandy-gravelly coastal environment dominated by epifaunal and infaunal species such as sea stars, polychaetes, bivalves, and amphipods that are adapted to a loose, shifting substrate (USACE 1998; Feder and Mueller 1974).

Port Clarence is one of Alaska's few naturally deep-water ports, located about 35 miles (64 kilometers) southeast of Cape Prince of Wales. Port Clarence is formed by a low-lying sand spit which extends northward for about 10 miles (18.5 kilometers) from the mainland, terminating at Point Spencer. The highest elevation on the spit is a small knoll near the southern end, rising +24 feet above mean sea level. The eastern shoreline of Port Clarence is comprised of a wall of cliffs, with intermittent crescent-shaped beaches. Grantley Harbor and Imuruk Basin are under tidal inflluence. Two narrow sand spits, between which a deep channel is kept open by tidal action, separate Grantley Harbor from Port Clarence, and a narrow, winding canal with steep rock walls connects the harbor with Imuruk Basin. The Kigluaik Mountains rise abruptly from the southern shore of Imuruk Basin. The coastline north of Port Clarence is a low plain which includes Brevig Lagoon, about 20 miles (37 kilometers) long and also under tidal influence. The seabed approaching Port Clarence deepens more rapidly than it does at Nome, quickly reaching depths of -120 feet (-36 meters) MLLW. The channel between Point Spencer and Point Jackson is approximately 4 miles (7.4 kilometers) wide, with depths of between -42 and -48 feet (12.8 to 14.6 meters) MLLW. The northern half of the bay has an average depth of -42 feet (12.8 meters) MLLW as close as 1 mile (1.8 kilometers) from the shore, with depths then gradually shoaling to the beaches. A more detailed discussion of the hydrology of the project area is provided in Section 3.3 of the Hydraulic Appendix.

4.2.4 Ice Conditions

Ice can form at Nome and Port Clarence as early as mid-October but typically begins forming in early November. Ice breakup typically occurs in late May. Once ice has formed, the Port of Nome closes for the winter and all vessel movements cease. A more detailed discussion of ice conditions is included in the Hydraulic appendix. Shore fast ice generally extends seaward out to the -60 foot (-18 meters) MLLW isobath (e.g., 7 miles (13 kilometers) from shore) depending on seasonal conditions, and may be anchored by ice keels in depths from -30 to -60 feet (-9 to -18 meters) MLLW (Jewett 1999). Pressure ridges begin occurring approximately 0.25 miles (.46 kilometers) from shore. Early winter ice sheet thickness is approximately 1 foot (.3 meters) with maximum thicknesses of 4.5 feet (1.3 meters). Ice formations at pressure ridges have been estimated to be up to 30-feet (9 meters) thick. Ice gouging occurs sporadically and trends east to west; gouges are typically less than 75 feet (23 meters) wide and cut 1.5 to 2 feet (.45 to .6 meters) deep into the substrate (Thor and Nelson 1981).

4.2.5 Sediment Transport and Quality

Littoral drift movement is primarily dependent on the wave climate and the incident wave angle to the beach. Because a majority of the time, beach waves approach the Nome Harbor site from the southwest, net sediment transport at Nome is from west to east. This movement is evidenced by the large accumulation of sediment on the west side of the harbor causeway, which tends to act as a littoral barrier. The gross annual sediment transport rate is estimated to be 120,000 cubic yards, while the net transport towards the east is an estimated 60,000 cubic yards each year (USACE 1998).

Under normal flow conditions, the Snake River discharges about 5,900 cubic yards of sediment per year. This river is a stable, low-velocity stream that drains the relatively flat tundra coastal plain surrounding Nome (USACE 1998).

The City of Nome, in conjunction with the Navigation Improvements Final Interim Feasibility Report and Environmental Assessment (USACE 1998), worked with a soil testing laboratory contractor for sediment analysis of the project area. Grain-size descriptions of the subsurface soil samples tended to be more coarse-grained than the offshore sediment samples. Although the soil testing laboratory described all the samples as sand with or without silt and gravel, the samples field description indicated greater difference. The subsurface soil samples were generally described as predominantly medium sand, while the offshore sediment samples were described as fine sand. While there was some variability in the subsurface soil samples descriptions, the four offshore sediment samples were nearly identical (fine sand).

Based on the blow counts of standard penetration testing (ASTM Practice D 1586), combined with visual validation, the subsurface soil samples were characterized as loose. Another indication of the looseness of the soils is that heaving sands were encountered in each of the borings drilled. The heaving sands prevented sampling more than 3 meters (9.8 feet) below the water table.

Harding Lawson Associates subsurface drill logs along the causeway alignment indicated that substrate to a depth of -6.7 meters (22 feet) MLLW was gray gravelly silty sand and occasionally clean sand and silty gravel (Holocene *Recent* Deposits). A quantity of soils are classified as "gray gravelly sands and silty gravel," and "medium dense to very dense," "... containing angular rock fragments (Glacial Till)."

4.2.6 Water Quality

Nome and Port Clarence are both nestled on the edge of Norton Sound, an inlet of the Bering Sea. Norton Sound supports a variety of sea life in a marine setting and is used for aquaculture, seafood processing, industrial water supply, contact and secondary recreation; growth and propagation of fish, shellfish, other aquatic life, wildlife, harvesting for consumption of raw mollusks or other raw aquatic life (US EPA, 2002).

Norton Sound water quality is characterized by strong seasonal variations in temperature and salinity. During winter, Norton Sound is a well-mixed environment with uniformity of physicochemical conditions throughout the water column. Average temperature for Norton Sound waters are 32°F with a salinity of 30 parts per thousand (ppt) (Alaska Department of Environmental Conservation - ADEC, 2013). During summer months, Norton Sound stratifies with surface temperatures reaching 50 °F to 59 °F and salinities of 20 ppt to 30 ppt (ADEC, 2013).

4.2.6.1 Dissolved Oxygen. Hood and Burrell (1974) reported that dissolved oxygen concentrations in the waters of northern Norton Sound were uniformly high, as expected in waters of high primary productivity. Frequent summer storms thoroughly mix the shallow waters and prevent creation of a seasonal pycnocline. Thus, dissolved oxygen levels in bottom waters are similar to surface values. The effect of the winter-spring ice cover on dissolved oxygen levels is not known.

4.2.6.2 pH. Levels of pH in Norton Sound range from 7.744 to 8.073, well within the normal summer limits found in other coastal areas at northern latitudes.

4.2.6.3 Organic Carbon. Levels of dissolved organic carbon in seven water samples collected near Nome were uniform, ranging from 2.0 to 2.68 mg C/liter (Hood and Burrell, 1974). Particulate organic matter in the same samples was much lower and ranged from 0.090 to 0.197 mg C/liter. Concentrations were higher in Norton Sound than those in the southern Bering Sea and Chukchi Sea, but well within the range of other oceanic waters.

4.2.6.4 Nutrients. The waters of Norton Sound are extremely productive and support extensive phytoplankton growth throughout the summer. Sources of nutrients include freshwater runoff and coastal upwelling. Nitrogen depletion in the summer seems to limit phytoplankton growth in Norton Sound. Phosphorus and silic acid are present in excess. Nutrient concentrations have not been measured during the winter; however, levels are expected to be high due to nutrient regeneration from bottom sediments.

4.2.6.5 Trace Metals. Total metal concentrations (dissolved and particulate) in Norton Sound are similar to those occurring on other oceanic areas. Levels of lead, cadmium, copper, and zinc are uniformly low (Hood and Burrell, 1974), and are typical of areas removed from known sources of pollution. The seasonality of trace metal levels in Norton Sound has not been determined. However, depletion of trace metals in nearshore waters during the summer might be expected due to the increased runoff from the Snake and Nome Rivers, and to the elevated levels of suspended matter that may act as metal scavengers.

4.2.6.6 Petroleum and Chlorinated Hydrocarbons. Detailed analyses of hydrocarbons in surface waters of Norton Sound revealed low levels (generally less than 1 *u*g/kg), primarily of biogenic (terrigenous and marine) hydrocarbons (Shaw, 1977). Petroleum hydrocarbons have not been measured but are expected to be quite low because the area is remote from any known sources of such pollution.

4.2.6.7 Biological Indicators. Benthic marine invertebrates are often good water quality indicators of "slugs" of pollutants that can sometimes go undetected by periodic grab sampling. They are then useful as long-term indicators. Previous studies describe existing biota at the mouth of the Yukon River as deposit feeders such as polychaete worms, small clams, and cockles indicating presence of suspended detritus in the water column. The western portion of Norton Sound is an environment less suitable for these species so they are not expected to occur at densities and distribution as at the mouth of the Yukon River delta. Surrounding the Yukon River delta, polychaete worms, *Pectinaria*, sand dollar, and clams were prevalent. In general, Norton Sound was found to be dominated by *Echinoderms* with mollusks having the highest presence (ADEC, 2013). This indicates that there are adequate food sources for decomposers, first, second, and tertiary food levels. It also indicates that there are likely no acute toxins present or overproduction of organics leading to low dissolved oxygen conditions in the water column. However, without additional data, it is difficult to determine whether ample food sources exist, if dissolved oxygen concentrations for organisms higher on the food chain are adequate, and if chronic toxic conditions are preventable.

Since 1985, Norton Sound has been an important location for suction dredge placer mining, including in the greater Nome area. In 2011, Alaska opened up 23,793 acres of Norton Sound to offshore mining leases, each requiring a National Pollutant Discharge Elimination System (NPDES) permit with subsequent water quality monitoring requirements. The increase in mining and dredging operations has resulted in higher concentrations of chromium, lead, zinc, cadmium, copper, mercury, and nickel contamination concerns in Norton Sound. Trace metal concentrations could be mobilized during the suction dredging process by releasing metals sequestered in interstitial spaces (pore water) and sediments, washing metals off dredged tailings, re-suspension of particulate trace metals, and exposing previously burned deposits with high metal content to the water column (US EPA, 2002). As part of the NPDES permitting process, permit applicants are required to use Best Management Practices (BMPs) to prevent beach erosion, fines, turbidity, equipment contamination, and red crab disturbance (US EPA, 2002). Increased turbidity in the dredging area cannot extend beyond a 1600-foot (487 meters) mixing zone. In surface waters, metals monitoring performed during mining season indicated a rise in concentrations of arsenic, chromium, and cadmium with concentrations of lead, copper, nickel, and zinc above Alaska water quality criteria for protection of aquatic life. However, it is believed that higher metal concentrations are due to particles being re-suspended from sediment rather than in dissolved form in the water column. It is also believed that these metal concentrations would not cause adverse impacts to aquatic life (not directly coming into contact with respiratory tissues of marine benthic receptors) outside of the dredging mixing zone (ADEC, 2013). Samples of king crab and sediment collected in 2012 indicated no increase in metals or mercury (ADEC, 2013).

Rivers that drain into Norton Sound include the Stewart River (drains the Kigluaik Mountains) which is a tributary to the Sinuk River and the Yukon River, the Snake River (at Nome), Solomon River, Tisuk River, and the Nome River among others. Land areas in these drainages have historically been used for mining purposes. In 2005, USGS in cooperation with the Alaska Army National Guard, performed a water quality study of the Stewart River that showed trace metal concentrations in the sediment that included arsenic, chromium and nickel at all sites; and copper and zinc at a few sampling sites that exceeded Threshold Effect Concentration Standards (TEC) (USGS, 2005). Maximum trace metal concentrations and corresponding Threshold Effect Concentration Standards are listed below in Table 2.

Table 4: Stewart River Trace Metal Concentrations and corresponding TEC Standards

Trace Metal	Maximum Study Result (µg/g)	TEC Standard (µg/g)
Arsenic	400	9.8
Chromium	120	43.4
Nickel	93	22.7
Copper	64	31.6
Zinc	200	121

Source: USGS. Baseline water quality characteristics of the Alaska Army National Guard Stewart River Training Area near Nome, Alaska. 2005.

Sediment from these rivers are transferred downstream and eventually empty into Norton Sound. The EPA’s Watershed Assessment and Tracking Program lists all rivers in the area as needing a calculation of Total Maximum Daily Loads (TMDL), although the rivers are considered to be “not impaired.” (US EPA).

Although suction dredging mines are listed on the EPA list of Alaska’s NPDES permits, Nome wastewater treatment plants are not on this list. No evidence of existing wastewater treatment plants was located. Plans for wastewater treatment facility construction in 2005-2010 exist, but whether or not these plans were carried through is unknown.

Under the no action alternative, proposed construction activities would not take place. No activities would occur that would add concentrations of contaminants to the sediment or water column. Existing water quality conditions would remain the same or be impacted by sources independent from the Port activity. Currently, it is possible that leakage of organic pollutants could occur from storage tanks, off-shore mining operations, or boat traffic that could add to water contamination. Metals concentrations from Norton Sound placer mining operations could continue or increase because of metals released from dredged sediments. Upstream land-based mining operation discharge could also contribute to metals deposit and contamination. Glacial-fed rivers such as the Snake River carry large metal concentrations such as aluminum, barium, iron, and magnesium in sediments deposited at the mouth of the river, eventually reaching

Norton Sound. Other potential and ongoing contamination sources include wastewater and stormwater discharge from the City of Nome, automobile traffic, and industrial and commercial uses.

4.2.7 Air Quality

Air quality is determined primarily by meteorological conditions, the type and amount of pollutants emitted, and their subsequent dispersion into the atmosphere. Overall, air quality in the area is expected to be good or excellent due to the community's isolation, a small number of pollutant sources, and persistent winds from Norton Sound. Occasionally, it is likely that both Nome and Port Clarence experience periodic increases in fine or coarse particulate matter.

Fine particulate matter ($PM_{2.5}$), a primary product of combustion and coarse particulate matter or dust (PM_{10}), has been reported to be concerning in several Interior Alaska communities (ADEC 2012). Because of increasing complaints about these particulates, Alaska began monitoring $PM_{2.5}$ and PM_{10} in rural villages and implementing measures to control combustion and dust. Kotzebue, a community comparable in size to Nome, experienced 11 exceedances of the air quality standard between 2003 and 2005, and other small communities monitored also experienced exceedances, including Noorvik, Noatak, and St. Mary's. According to ADEC (2012), "The state believes these high dust levels represent the conditions that would be found in other similar sized rural communities if they performed monitoring."

In Nome, combustion emissions result from using the community's electric generator, fuel oil or wood stoves that generate smoke, and vehicles such as trucks, cars, boats, and snow machines. Potential for increases in $PM_{2.5}$ are especially likely in winter months when extremely strong inversions trap emitted particles close to the ground (ADEC 2012).

In most of the rural communities in Alaska, coarse particulate matter or dust (PM_{10}) has also been identified as a problem resulting from dust entering the air column from unpaved roadways (ADEC 2012). Both Nome and Port Clarence have both paved and unpaved roads and may experience periodic and temporary increases in dust in dry weather conditions as a result of cars, trucks, or all-terrain vehicles (ATV) using the unpaved roads.

Under the no action alternative, air quality is expected to continue with current trends, remaining good to excellent with potential days of particulate matter pollution (both $PM_{2.5}$ and PM_{10}). Increased shipping through the Bering Strait may contribute additional emissions to the Nome or Port Clarence area. If population experienced a substantial growth without improving roadway paving, adjacent communities may experience increased dust pollution. However, ADEC has initiated a program with the Alaska Department of Transportation and Public Facilities (DOT&PF) and University of Alaska Fairbanks (UAF) Department of Engineering to mitigate PM_{10} issues in rural Alaska and hopes to expand that program to all rural communities in the future (ADEC 2012).

4.2.8 Noise

Ambient noise level analyses have either not been conducted or are not available for most of rural Alaska. Noise levels are unknown for population centers on Seward Peninsula such as Nome, Teller, and Brevig Mission. However, a qualitative evaluation of noise condition in the area can be made based on the size of the community, level of development, land use conditions, and natural environment. In general, noise sources in Nome include residential neighborhoods, vehicular traffic, the Port of Nome, Nome Airport, Nome City Field, commercial and industrial land uses in town, wildlife, and weather conditions.

Ambient noise is noise for which no single source is identifiable. In a community environment such as Nome, a mixture of road traffic, generators, lighting, factories, wind, wildlife, and other noises may generate ambient noise. In ocean environments, wind, waves, surf, shifting and breaking of sea ice, and sea vessel traffic may generate ambient noise (Richardson *et al.* 1995).

Point sources of noise pollution are distinct from background noise. The airport likely generates the greatest intermittent noise levels in the area. Nome Airport is located less than a half mile from the study area's northern boundary. In 2012, 27,450 flights were recorded in the Airport Master Record (FAA 2014). Jet passenger airplanes, military aircraft, and helicopters use Nome Airport. Jet passenger airplanes likely contribute the loudest point source of noise in the vicinity; typical noise levels measured for a Boeing 737-400, the most common jet type at Nome, ranged from 82 to 100 dB (FAA 2012).

Shipping activities at the Port of Nome also contribute to intermittent or temporary noise. Local commercial or private fishing vessels are the primary shippers at the Port of Nome (USACE 2012). Larger commercial or military vessels also periodically use the Port of Nome. The Marine Exchange of Alaska (MXAK) reported more than 400 total vessel trips through Norton Sound in 2011, and that cargo and towing vessels comprised the majority of those (USACE 2013). The Port of Nome reports that two cruise liners are scheduled to stopover a total of six times in 2014 (Port of Nome 2014). Ambient or intermittent noise levels from shipping activity in Nome have not been studied, and little comparable data is available for estimating the noise that is generated by shipping.

Facilities and land uses that are noise sensitive are known as sensitive noise receptors. These areas are afforded additional protection under Federal noise laws. Sensitive noise receptors present in the Nome area include but not limited to the Norton Sound Regional Hospital, Nome Elementary School, Nome-Beltz Junior/Senior High School, Anvil City Science Academy, Nome Adventist School, University of Alaska Fairbanks Northwest Campus, Kawerak Headstart Program, Carrie McLain Museum, Nome Community Baptist Church, Bible Baptist Church, St. Joseph Catholic Church, and Church of the Nazarene, XYZ Senior Center, Nome Recreation Center, Nome Community Center, and city residential areas.

The underwater noise environment at the Port of Nome has not been measured. The noise environment depends on the size, speed, type, and presence of shipping vessels in the region. The main source of noise is the ship's propeller, which produces noise below the 5-500 Hz range (Reynolds *et al.* 2005).

Under the no action alternative, noise conditions would be expected to rise as shipping increases through the Bering Strait. In recent years, Arctic Ocean ice cover has reduced, and it is expected that eventually a prolonged period of open water passage will be available. Shipping through the Bering Strait saves substantial time and will become a more commonly used route in global shipping and potentially result in more shipping traffic through Nome and Point Spencer. Because of the community's isolation and slow population growth, noise impacts in Nome are not expected to dramatically change.

4.2.9 Waves, Currents, and Tides

The tidal range at Nome is narrow, with a mean range of tide (difference between mean high water and mean low water) of 1.03 feet (.31 meters), and a mean diurnal range (difference between mean higher high water and mean lower low water in a single day) of 1.52 feet (.46 meters) (NOAA 2012). The highest observed water level was +9.8 feet (+3 meters) above MLLW on 19 October 2004, and the lowest observed water level was -6.69 feet (-2 meters) MLLW on 11 November 2005.

Nome is susceptible to positive and negative surges from meteorological and atmospheric conditions. These surges cause changes in water elevations greater than those caused by tidal fluctuations. Published tidal data for Nome is shown in Table 5.

Table 5: Published Tidal Data for Nome

Level	Feet (meters)
Highest Observed Water Level (19 October 2014)	+9.80 (3)
Mean Higher High Water (MHHW)	+1.52 (.46)
Mean High Water (MHW)	+1.33 (.4)
Mean Low Water (MLW)	+0.30 (.09)
Mean Lower Low Water (MLLW)	0.00 (datum)
Lowest Observed Water Level (11 November 2005)	-6.69 (2)

Source: NOAA NOS, Tidal Epoch 1983-2001, published 6 October 2011

The nearest data point for currents is located at Sedge Island, approximately 20 nautical miles (37 kilometers) west of Nome. Currents at this station range from 0.5 knots on the ebb tide to 1.0 knots on the flood tide. The Corps conducted a three-dimensional physical model study for Nome in 1999. Generally, current velocities ranged from 0.4 to 1.3 feet per second at the harbor entrance.

The wave climate at Nome is governed by exposure to conditions in Norton Sound and the Bering Sea. During the open water period, waves can approach from the southwest, south, or southeast depending on wind direction. Short period waves can be generated by local winds in Norton Sound, while longer period swell can approach from an area of exposure between St. Lawrence and St. Matthew Islands. Generally, wave heights are less than 6 feet (1.8 meters) with periods less than 12 seconds. However, during strong southwesterly, southerly, or southeasterly winds, wave heights can increase to between 10 and 15 feet (3 to 4.5 meters) with periods of 12 to 16 seconds. During storms associated with typhoon remnants, waves can reach 19 feet (5.8 meters) in height with periods greater than 18 seconds.

The tidal range at Port Clarence is subject to significant changes due to meteorological conditions. Moderate to strong south or southwest winds of several days duration will raise the height of the tide in the area without appreciably increasing the range. This is actually a datum change and is appreciable along the entire southern coast of the Seward Peninsula. It is reported that continued strong north winds produce a lowered datum, but to a lesser extent. Along the outside of the port, west of Point Spencer and south of Cape York, there is a 1 to 2 knot current, with velocity appreciably affected by direction, force, and duration of the wind. Current observations in the entrance to Port Clarence indicate that the velocity seldom exceeds 0.5 knot for distances of 2 to 3 miles (3.7 to 5.6 kilometers) north of Point Spencer. One mile east of the point, however, velocities of up to 1 knot have been observed.

4.2.10 Storm Surge and Set Down

The northern coastline of Norton Sound is subject to storm surge due to its exposure to a long southwest fetch. Shallow depths and a mildly sloping offshore shelf contribute to water elevation increases during storm surge events. Storm surge events normally occur during fall months with the largest recorded surge of +12 feet (3.6 meters) MLLW occurring in November 1974 during the "Great Bering Sea Storm." The Corps' Engineer Research and Development Center (ERDC) published a study of storm-induced water levels for the western coast of Alaska that estimates the 50-year storm surge water level at Nome to be +9.66 feet (3 meters) MLLW.[9]

Periods of low water that occur during north winds and/or high pressure atmospheric conditions are known as set downs. Set downs typically occur during fall months when north winds are more prevalent and generally last two to three days. Set down events of -2 feet to -4 feet (-.6 to -1.2 meters) corresponding to winds of 20 knots and pressures or 1,000 millibars are prevalent with a maximum recorded set down of -6.69 feet (2 meters).

4.2.11 Sea Level Change

Following guidance provided by EC 1165-2-212, calculations of "low", "intermediate", and "high" scenarios for sea level change were calculated with results shown in Table 6.

[9] 2009, U.S. Army Corps of Engineers ERDC, "

Table 6: Estimated Sea Level Change at Nome

Scenario	Low Feet (meters)	Intermediate Feet (meters)	High Feet (meters)
Global Mean Sea Level	+0.28 (0.08)	+0.75 (0.23)	+2.24 (0.68)
Nome	+0.00 (0.0)	+0.47 (0.14)	+1.97 (0.6)

4.3 Biological Resources, Terrestrial

The entire project is within the marine environment. Only a brief description of the terrestrial resources in this region of the Seward Peninsula is included.

Two big game species are found near Nome: moose (*Alces alces gigas*) and grizzly bear (*Ursus arctos horribilis*). The numbers of both species were drastically reduced during the gold rush in the early 1900s. Both species are close to the range's carrying capacity. In winter, moose move into river valleys to forage on willows and birch. Numbers are low in the Snake River drainage near Nome because of snowmachine traffic.

Grizzly bear numbers are rarely seen near Nome but are frequently seen in May and early June along the beaches to the west, opposite Sledge Island.

Several species of furbearers are found in the area. Wolves (*Canis lupus)* have been found throughout the Seward Peninsula but the largest numbers are in the eastern region. They are very rarely seen in the Nome and Port Clarence area.

Red foxes (*Vulpes vulpes)* are found throughout the Seward Peninsula. They are omnivorous and feed on small mammals, such as mice, lemmings, and hares; birds; eggs; invertebrates; plants; and carrion. Nome residents trap foxes in winter; foxes are the most important fur species in the area.

Few birds are year-round residents of this region of the Seward Peninsula; those found year-round include rock (*Lagopus mutus*) and willow (*Lagopus lagopus*) ptarmigan, northern hawk-owls (*Surnia ulula*), snowy owls (*Bubo scandiacus),* and possibly common ravens (*Corvus corax)*.

4.3.1 Biological Resources, Marine

4.3.1.1 Marine Birds

Large seabird colonies are located on Bluff Cliffs (east of Cape Nome), Sledge Island and Square Rock. Smaller bird colonies are located at Rocky Point, Cape Darby, Bluff, and Safety Sound. Safety Sound is also used by the rare Aleutian tern (*Sterna aleutica*) (Jewett et al 2013).

The wetlands in the Nome and Port Clarence area provide major nesting and feeding habitats for several breeding and migrant waterfowl and shorebird populations. The most common ducks include green winged teal (*Anas carolinensis*), northern pintail (*A. acuta*), and American widgeon (*A. americana*) (USACE 2012). Canadian goose (*Branta canadensis*), black brant (*B. bernicla nigricans*), tundra swan (*Cygnus columbianus*), and greater scaup (*Aythya marila)* also occur in the area (ADEC 2013). Common eiders (*Somateria mollissima*) are another common waterfowl found near both Nome and Port Clarence (Bollinger and Platte, 2012). All of the aforementioned bird species are migratory, with the exception possibly being the glaucous gull (*Larus hyperboreus*), which is a fulltime resident in part of its Alaskan range, including just south of the Norton Sound (Audubon 2014).

The most abundant seabirds include common murre (*Uria aalge*), glaucous gull, black-legged kittiwake (*Rissa tridactyla*), horned puffin (*Fratercula corniculata*), pelagic cormorant (*Phalacrocorax pelagicus*), and thick-billed murre (*U. lomvia*). Less abundant species that also breed in Norton Sound include the parakeet auklet (*Aethia psittacula*), tufted puffin (*Fratercula cirrhata*), and pigeon guillemot (*Cepphus columba*). Common shorebirds include semipalmated sandpiper (*Calidris pusilla*), western sandpiper (*C. mauri*), dunlin (*C. alpina*), and black turnstone (*Arenaria melanocephala*), and several species of tern (Sternidae) nest along sandy beaches and gravel bars (USACE 2012).

The yellow-billed loon (*Gavia adamsii*) is a candidate species under the Endangered Species Act. Yellow billed loons nest on coastal inland low lying tundra with breeding range mostly in the northern coastline of the Seward Peninsula.

4.3.1.2 Marine Fish and Invertebrates

Demersal or bottom feeding fish include saffron cod (*Eleginus gracilis*), arctic cod (*Arctogadus glacialis*), starry flounder (*Platichthys stellatus*), yellowfin sole (*Limanda aspera*), sculpin (Cottoidea) and Alaska plaice (*Pleuronectes quadrituberculatus*). These six species represent more than 90 percent of the fish biomass. Both saffron and arctic cod are the most abundant demersal species and are important food items for marine mammals. In the winter, saffron cod is an important subsistence resource. Saffron cod spawn in the fall through winter and eggs are deposited on sandy bottoms. Yellowfin sole move and spawn in shallower inshore water during spring and summer, then move offshore in fall and winter (Jewett et al 2013).

Pelagic fish species, those neither near the bottom nor near the shore, include the five species of salmon, herring, smelt, capelin, Pacific sand lance (*Ammodytes hexapterus*), sheefish (*Stenodus nelma*), whitefish, Arctic char (*Salvelinus alpinus*), and Arctic grayling (*Thymallus arcticus*). The most abundant in Norton Sound are the Arctic char, chum salmon (*Oncorhynchus keta*), and pink salmon (*O. gorbuscha*) (Jewett et al 2013). Pacific sand lance is a common species that has been sampled in both Norton Sound and Port Clarence. Anadromous fish in the area include salmon, whitefish, Arctic char, rainbow smelt (*Osmerus mordax*), capelin (*Mallotus villosus*), and Dolly Varden (*Salvelinus malma*). Salmon migrate as juveniles along the nearshore waters off Nome and Point Spencer and then return to freshwater to spawn (ADEC 2013). Juvenile salmon are believed to out migrate from the Snake River in mid-June (USACE 2012). Arctic char overwinter in freshwater and out migrate to estuarine water in late May to early June with ice breakup (Jewett et al 2013).

Common benthic invertebrates in Norton Sound include various echinoderms (sea stars and sea urchins), soft corals, and shrimp. The only commercially important benthic invertebrate is the red king crab (*Paralithodes camtschaticus*). Red king crab frequent the offshore waters off the Seward Peninsula during winter and are harvested by subsistence fishermen through the ice. The red king crab population in Norton Sound is unique in that it: 1) is separate from other stocks in the Bering Sea (Seeb et al. 1989, Jewett 1999), 2) lives under the ice for 5 to 6 months a year (Dupre 1980), and 3) is confined to waters less than 100 feet (30 meters) in depth. The red king crab reproductive activities take place in March through June in nearshore waters. Crabs then migrate offshore during ice breakup beginning in May (Jewett et al 2013). Juveniles less than two years old live in shallow waters such as shell hash, cobble, algae and bryozoans to avoid being preyed upon. Older juveniles form pods and travel together, feeding at night. Pods can consist of tens of thousands of individuals. Mature red king crabs move into deeper water (typically less than 650 feet (200 m)) to feed. Females return to shallow waters to hatch their eggs (NOAA 2014b).

4.3.1.3 Marine Mammals

4.3.1.3.1 Spotted Seal

Spotted seals (*Phoca largha*) are distributed along the continental shelf of the Bering, Chukchi, and Beaufort seas, and the Sea of Okhotsk south to the western Sea of Japan and northern Yellow Sea. From tagging data, seals in the northeastern Chukchi Sea move south in October and pass through the Bering Strait in November. Seals overwinter in the Bering Sea along the ice edge, and during spring they inhabit mainly the southern margin of the ice in areas where the water depth does not exceed 650 feet (200 meters). In summer and fall, spotted seals regularly use coastal haul outs. Spotted seals are strongly associated with pack ice (Allen and Angliss, 2013). Historical data for important haul outs during open-water periods in the northern Norton Sound area are shown in (Figure 10). They include Cape Darby (80 miles [129 km] east of Nome), Safety Sound (entrance 20 miles [32 km] east of Nome), and the beach area east and west of Safety Sound (within 4 miles (6.4 km] east of Nome) (Frost, Lowry, and Burns 1982). Port Clarence is an important area for spotted seals, both in spring on the sea ice and in summer. While seals spread out on the sea ice in the spring throughout Port Clarence, most summer use (open water period) is focused on the shallow southern portion of Port Clarence, approximately 7-10 miles (11-16 km) from the project area at Point Spencer. Adults mainly feed on herring, arctic cod, Alaska pollock (*Theragra chalcogramma),* and capelin, while juveniles feed mainly on krill and small crustaceans. The estimated population size for the Alaska stock of spotted seals is 59,000 animals. Currently, the population trend for this stock is unknown.

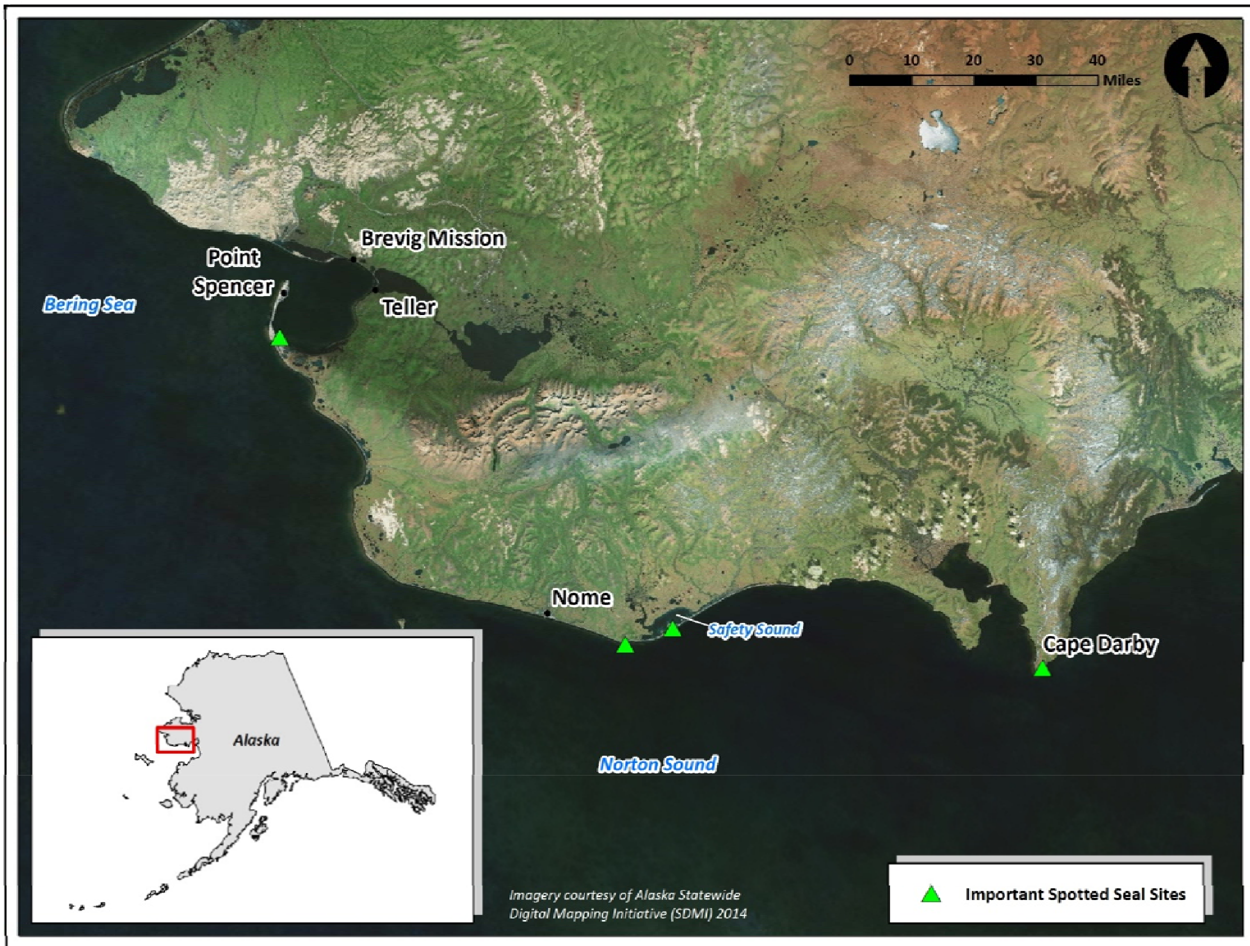

Figure 10: Historically important haul outs during open-water periods

The main concern for the spotted seal is the modification of sea-ice habitat due to a warming climate. Sea ice in the Bering Sea is expected to continue forming annually in winter for the near future. Spotted seals may be able to adjust their breeding grounds to follow the northward shift of the annual ice front into the Chukchi Sea. Ocean acidification is a second concern. It may alter prey populations and other important aspects of the marine ecosystem. This concern could be somewhat ameliorated by the spotted seals' apparent dietary flexibility. Additional habitat concerns include the potential negative influence from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as vessel traffic disturbance, seismic exploration noise, or oil spills potential (Allen and Angliss 2013).

4.3.1.3.2 Ribbon Seal

Ribbon seals (*Histriophoca fasciata*) are listed as a candidate species under the Endangered Species Act. They are found in the open sea, on the pack ice, and only rarely on shore fast ice. They range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort Seas. As the ice recedes in May to mid-July, seals move farther to the north in the Bering Sea where they move out on the receding ice edge and remnant ice (Allen and Angliss 2013). During the rest of the year, little is known about the range of ribbon seals. Given their distribution, it would be unlikely to find ribbon seals near Nome or inside Port Clarence when ice is present and even less likely during open water periods. An estimated population size of 90,000 to 100,000 is thought to inhabit the Bering Sea. The current population trend is unknown but recent estimates suggest that no major declines have occurred in recent decades. Ribbon seals are still hunted today by Alaska natives for subsistence but the number of seals harvested is relatively small (less than 100 in Alaska) (NMFS 2013h).

With the Arctic climate changing, ribbon seals will be vulnerable to reductions in sea ice. A second concern is the modification of habitat by ocean acidification, which may alter prey populations and other important aspects of the marine ecosystem. Ocean acidification may impact ribbon seal survival and recruitment through disruption of trophic regimes. Additional habitat concerns include the potential negative influence from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as disturbance from vessel traffic, seismic exploration noise, or the potential for oil spills (Allen and Angliss 2013).

4.3.1.3.3 Beluga Whale

An estimated 12,000 beluga whales (*Delphinapterus leucas*) migrate annually through the northern Bering Sea. In spring, they move through the Norton Basin area with most passing through the Bering Strait. Beluga whales are common in northern Norton Sound, and about 1,000 to 2,000 whales occur throughout the summer in the nearshore waters of Norton Sound (Burns et al., 1985a). Pods of a few to more than 200 whales occur in nearshore waters off Cape Nome, and pods of up to 30 whales have been observed feeding on schools of fish near river mouths in the Nome area (Frost et al., 1982). Belugas also feed on spawning fish such as salmon, smelt, herring, and saffron cod. Calving is reported to occur in Norton Bay near Moses Point and likely occurs in the other major estuaries of Norton Sound. Beluga whales were historically common in Port Clarence prior to the 1980s when their appearance coincided with the arrival of herring (Frost et al., 1982). Current data is not sufficient for an evaluation of population trend for the Eastern Bering Sea stock (Allen and Angliss 2013).

Ice-associated animals, such as the Beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the associated influence on prey availability. Belugas are likely to be less sensitive to climate change because of their wide distribution and adaptability. Potential human-induced threats include increasing oil and gas exploration and development and increased nearshore development (Allen and Angliss 2013).

4.3.1.3.4 Harbor Porpoise

Harbor porpoise (*Phocoena phocoena*) primarily frequent coastal waters, and in the Gulf of Alaska and Southeast Alaska occur most frequently in waters less than 300 feet (90 meters) deep. They feed on demersal and benthic species, mainly schooling fish and cephalopods. They are assumed to be year-round residents but are less frequently seen in the fall and winter. While it is likely that harbor porpoises could be observed near Nome and Port Clarence, the frequency of observations and the number that might be observed is uncertain. Historical harbor porpoise sightings were reported just offshore from Nome in 1981 (Frost, Lowry, and Burns 1982). Population trends and status of the Bering Sea stock are currently unknown.

Harbor porpoise are considered more vulnerable to nearshore physical habitat modifications, because most are found in waters less than 330 feet (100 meters) in depth and often concentrate in nearshore areas and inland waters (Allen and Angliss 2013). Despite these potential impacts, low abundance in the project area and the sparse coastal development will likely result in minimal impacts to harbor porpoises in the future.

4.3.1.3.5 Minke Whale

Minke whales (*Balaenoptera acutorostrata*) are the smallest of the baleen whales and occur from the Bering and Chukchi Seas south to near the equator. They are believed to be migratory in the northern part of their range. Two stocks of minke whales are recognized in U. S. waters: 1) Alaska, and 2) California/Washington/Oregon. Around Alaska, their highest concentrations in summer are around Kodiak Island and in northeast Gulf of Alaska. They are common in the Bering and Chukchi seas and occur around the 330-foot (100 meters) contour near the Pribilof Islands (Allen and Angliss 2013). While minke whales likely use habitat offshore of Nome and could possibly enter Port Clarence, the details of their summer habitat use patterns in these areas are unknown. The minke whale population is considered stable through almost all of its range. A very small number of minke whales are taken for subsistence by Alaskan Natives (NMFS 2014e).

Minke whales are considered common in the waters off Alaska, and the number of human-related removals is currently thought to be minimal (Allen and Angliss 2013). Increased human activity will increase the chance of oil spills and ship strikes in this portion of the whales' range. Shipping and some oil and gas activities have been occurring throughout the whales' range during the past several decades but have not prevented the species' recovery.

4.3.1.3.6 Pacific Gray Whale

Pacific gray whales (*Eschrichtius robustus*) are bottom feeders, thereby scooping and filtering benthic amphipods off of bottom sediments. They are found mainly in shallow coastal waters in the North Pacific. The Eastern North Pacific stock of gray whales is found in the study area. Most of the Eastern North Pacific stock spends the summer feeding in the northern and western Bering and Chukchi Seas. Counts of migrating gray whales estimate their population between 18,000 and 30,000 animals. While gray whales likely use habitat offshore of Nome and could possibly enter Port Clarence, the details of their summer habitat-use patterns in these areas are unknown. The Eastern North Pacific stock of gray whales was removed from the Endangered Species List in 1994, and its population continues to grow. A 1999 study found a lack of imminent threat and continued population growth (NMFS 2013e).

The potential reduction in the extent of sea ice due to climate-related warming will likely influence marine mammal species in the Arctic, including the gray whale. However, gray whales are adaptable and versatile and are opportunistic foragers. Marine mammal species that feed both pelagically and benthically (such as gray whales) will fare better than those that only feed benthically (Allen and Angliss 2013). Ocean acidification is another future concern that could impact gray whales by affecting their prey.

4.3.1.3.7 Pacific Walrus

Walruses (*Odobenus rosemarus divergens)* are found along the perimeter of the Arctic Ocean and subarctic seas. Walruses are currently a candidate species under the Endangered Species Act, and a decision whether to list them as threatened or endangered is expected by October 2017. If not listed by that time, they will be removed from candidate status. Walruses use floating ice for much of their habitat but also use coastal haul-outs in the Bering Sea during the ice-free summer months. Walruses are very specialized bottom feeders, predominantly focusing on clams, with some other associated invertebrates. Population size and trends are largely unknown because the walrus' distribution is wide ranging (USFWS 2009). Walruses are an important subsistence resource and harvests range from 3,200 to 16,000 animals a year. The level of harvest is closely monitored to remain sustainable. Herds of walruses appear on St. Lawrence Island, among others in the Bering Sea. Although generally walruses are not found in the Norton Sound, intermittent use of islands in Norton Sound has been reported, and King Island has been used regularly as a summer haul out area by several thousand walrus.

The primary threat to walruses is based on climate changes. Diminished sea ice has led to an increase in the number of walruses using coastal resting areas, rather than in the continental shelf sea waters where they normally feed (USFWS 2009). Shore-based haul outs can lead to increased predation rates by polar bears (*Ursus maritimus*), increased incidence of mortality due to stampedes, and increased energetic costs of accessing important foraging areas. Foraging bouts without nearby sea ice can increase the mortality risk from killer whale attacks (*Orcinus orca*) since it would not be possible to haul out on the sea ice to escape an impending attack. Climate changes can also influence distribution and abundance of prey and alter the type and prevalence of disease.

4.3.1.3.8 Killer Whale

Killer whales (*Orcinus orca*) are wide-spread surface feeders, preferring shallow areas of the continental shelf to prey on large fish and marine mammals. Transient killer whale pods are known to have ranges from the Puget Sound through Prince William Sound and Kodiak Island. Other residents are more localized, such as in the Gulf of Alaska, and are usually seen in the Bering Sea from June through October. Nome and Point Spencer study area could have either transient or resident killer whales present. Historically, they have been found around St. Lawrence Island and less frequently in Norton Sound (Menzel and Wright 1982).

As the most widely distributed marine mammal, the killer whale population is substantially adaptable. Current threats to killer whales include contamination, depletion of prey from overfishing, ship collisions, oil spills, noise disturbance, entanglement in fish gear, and irresponsible whale watching.

4.3.2 Federal and State Threatened and Endangered Species

4.3.2.1 Steller sea lion Western Distinct Population Segment (DPS) (Endangered)

Steller sea lions (*Eumetopias jubatus*) use a variety of marine and terrestrial habitats for their haul outs and rookeries. These are generally located on exposed rocky shorelines, wave-cut platforms, and/or gravel beaches. Rookeries are most often found on offshore islands and reefs. Steller sea lions display strong site fidelity to specific locations. Adults and some juveniles may travel far out to sea and into water greater than 3,280-feet-deep (1000 meters), although they are generally found within the 656-foot-depth (200 meter) contour. Critical marine habitat includes aquatic zones around rookeries and haulouts and special feeding zones (Figure 11). Pollock and mackerel aggregations that usually support large fisheries are important prey species. St. Lawrence Island is the closest critical habitat haul out site for Steller sea lions from Nome or Point Spencer (USFWS, 2008). Steller sea lions have historically been seen by Nome residents (Frost, Lowry, and Burns 1982). Steller sea lions are likely rare in the area, as haul outs and rookeries are not documented in Norton Sound, and no critical habitat areas are designated north of St. Lawrence Island (NMFS 2014d). Alaskan Natives still harvest some Steller sea lions for subsistence (NMFS 2013a).

Figure 11: Aquatic zones around rookeries and haul-outs, and special feeding zones
Source: National Marine Fisheries Service – Office of Protected Resources.

Without this project, potential threats to Steller sea lions will continue to be environmental variability, competition with human fisheries for Alaska Pollock, Atka mackerel (*Pleurogrammus monopterygius*), and Pacific cod; predation by killer whales; toxic substances; and interaction with active fishing gear. Factors causing direct mortality are likely the most important concerning their decline (Allen and Angliss, 2013).

4.3.2.2 Bowhead whale (Endangered)

Bowhead whales (*Balaena mysticetus*) use baleen plates for filtering zooplankton, other invertebrates, and fish out of the ocean. The whale's massive skull is used to break through the ice. Bowhead whales spend summer months in ice-free water in the southern Beaufort Sea. In other months they are mostly found in icy waters and are the only baleen whales that spend their entire lives in and around Arctic waters. The Bering-Chukchi-Beaufort stock is estimated at 6,400 to 9,200 individuals (NMFS 2012). Bowheads are a slow and non-aggressive whale, historically favored for hunting. Bowheads are most sensitive during their spring migration when calves are present, and their movements are restricted to open leads in the ice. Commercial exploitation reduced the bowhead whale population towards 3,000 individuals in the early 20th Century. Targeted for their large amounts of blubber, bowheads were easy targets because of their large size and slow speeds. Currently subsistence harvest is limited to nine Alaskan villages (NMFS 2012). While it is possible that bowhead whales may occasionally be found near Nome or Port Clarence, during spring and fall migration they are more likely to be found in the Western Bering Sea or passing through the Bering Strait. Critical Habitat has not been designated for bowhead whales.

Without this project, threats to bowhead whales would include ship strikes and entanglement in fishing gear. Increasing Arctic oil and gas development has led to an increased risk to bowhead whale habitat of various forms of pollution, including oil spills, other pollutants, and nontoxic waste. Bowhead whales are sensitive to noise from offshore drilling platforms, seismic survey operations, and vessel traffic from exploration and drilling operations. Active drill rig or seismic operations have shown to cause bowhead whales to deflect away from the activity (Miller et al 1999).

Another concern is climate change in the Arctic, as ice-associated animals, such as the bowhead whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. In recent years, high calf production suggests that stock may be tolerating the recent ice-retreat.

4.3.2.3 Fin whale (Endangered)

Fin whales (*Balaenoptera physalus*) are the second largest species of whale. They filter krill, small schooling fish, and squid through their baleen plates and are found in deep offshore waters of all major oceans. Fin whales are migratory and move in and out of high latitude feeding areas. Much of the North Pacific range of fin whales has not been surveyed so the total number of individuals is unknown. A rough population estimate west of the Kenai Peninsula was 5,700 individuals (NMFS 2013b). Fin whales are the most common whale reported to have collisions with vessels. Commercial whaling was a large historical threat. While fin whales utilize Norton Sound and possibly pass through the Bering Strait into the Chukchi Sea, the number of fin whales passing through this area is currently unknown. Fin whales are only expected in these areas during summer and early fall during open water periods.

Without this project, threats to fin whales include collisions, entanglement, reduced prey abundance, habitat degradation, and disturbance from low-frequency noise. Reductions in schooling fish numbers, either by natural processes or human induced consequences, would continue to be a threat to fin whale populations (NMFS 2013b).

4.3.2.4 Humpback whale (Endangered)

The highly maneuverable humpback whale (*Megaptera novaeangliae*) filters krill, plankton and small fish using baleen. They are known for breaching or slapping the surface of the water.

Humpback whales travel large distances, and in summer, they migrate to high latitude feeding grounds. Humpback whales are usually near the surface, whether they are feeding, calving, or migrating. Humpback whale numbers are increasing during most of their range, including the Western North Pacific stock that winters near Japan and migrates to the Bering Sea and Aleutian islands. The North Pacific population is under review for delisting (NMFS 2014a). While humpback whales utilize Norton Sound and pass through the Bering Strait into the Chukchi and possibly a limited portion of the Beaufort Sea, the numbers of humpback whales that pass through this area is unknown. Humpback whales are only expected in these areas during summer and early fall during open water periods.

Without this project, threats to humpback whales are entanglement in fishing gear and inadvertent ship strikes due to increased shipping in higher latitudes with changes in sea ice coverage. Whale watching vessels pose an additional threat (NMFS 2014a). Possible changes in prey distribution with climate change could influence humpback whales. Oil and gas activities in the Chukchi and Beaufort seas are also a future concern.

4.3.2.5 North Pacific Right whale (Endangered)

The rarest of all large whale species, the North Pacific right whale *(Eubalaena japonica*), feeds by skimming zooplankton with baleen as it moves through the water with its mouth open. Critical habitat was designated within the Gulf of Alaska and Bering Sea, just north of the Aleutian Islands. North Pacific right whales are thought to spend summer on the high latitude feeding grounds then migrate to more temperate water during the winter (NMFS 2013d). The range of the Eastern North Pacific Stock includes the Bering Sea's northern limits so overlap exists within the project area. However, the population is only likely in the low hundreds, and most of the recurrent sightings are in designated critical habitat in the southeastern Bering Sea and east of Kodiak Island. Right whales sightings, while unlikely, would only be expected in the project area during summer and early fall during open water periods.

Because of their rare occurrence and scattered distribution, current threats to North Pacific right whales are largely unknown. Without this project, proposed threats to the North Pacific right whale population are anthropogenic noise, vessel interactions, and contaminants (NMFS 2013d).

4.3.2.6 Polar Bear (Threatened)

Polar bear (Ursus maritimus) primary habitat is sea ice. Polar bears depend on sea ice as a platform for hunting their primary prey: seals. The U.S. contains portions of two subpopulations: the Chukchi Sea population (unknown numbers) and the Southern Beaufort Sea population (estimated 1,526 bears). Under Federal protection, Alaska Natives are allowed to harvest polar bears for subsistence and handicraft purposes (USFWS 2012a). Their seasonal presence in the Nome and Port Clarence area is associated with the presence of sea ice. Polar bear appearance in the Norton Sound region is rare but not unheard of, with only a few polar bears seen every three to five years. It is unlikely that polar bears would be in the project area during the ice-free season.

Without this project, the main threat to polar bears is the loss of sea ice habitat due to climate change. A long-term warming trend would likely reduce sea ice and impact polar bears by shifting their prey offshore where it is energetically more costly to obtain or is beyond their swimming abilities. However, a warming climate may also lead to more walrus onshore and thus more opportunities for relatively low-cost foraging opportunities for polar bears. Climate changes can also alter the type and prevalence of disease. Polar bears are generally susceptible to human induced disturbances such as development, habitat alteration, and human caused mortality (USFWS 2012).

4.3.2.7 Bearded seal (Threatened)

Bearded seals (*Erignathus barbatus nauticus*) are commonly found around sea ice and feed on benthic prey such as arctic cod, shrimp, clams, crabs and octopus. They dive to depths up to 325 feet (100 meters). They are the largest of the arctic seals. Estimates of the Alaskan stock of bearded seals range from 250,000 to 300,000 animals (NMFS 2013f). Any bearded seals near Nome or Port Clarence would be a part of the Beringia Distinct Population Segment (DPS). Their normal range extends from the Arctic Ocean (85°N) south to Sakhalin Island (45°N) in the Pacific, and south to Hudson Bay (55°N) in the Atlantic. Bearded seals inhabit the seasonally ice-covered seas of the Northern Hemisphere where they whelp and rear their pups, and they molt their coats on the ice in the spring and early summer. Bearded seals are harvested annually for subsistence by Alaska Natives.

Without this project, threats to bearded seals would remain the loss of sea ice due to climate change. For bearded seals, the presence of sea ice is a requirement for whelping and nursing young. Similarly, the molt is believed to be promoted by elevated skin temperatures that, in polar regions, can only be achieved when seals haul out of the water. Thus, if suitable ice cover is absent from shallow feeding areas during peak times of whelping and nursing (April/May), or molting (May/June and sometimes through August), bearded seals would be forced to seek either sea-ice habitat over deeper waters (perhaps with poor access to food) or coastal regions in the vicinity of haul-out sites on shore (perhaps with increased risks of disturbance, predation, and competition). Both scenarios would require bearded seals to adapt to suboptimal conditions and to exploit habitats where they may not be well adapted, likely compromising reproduction and survival rates.

Ocean acidification that results from increased carbon dioxide in the atmosphere may impact bearded seal survival and recruitment through disruption of trophic regimes that are dependent on calcifying organisms. Because of bearded seals' apparent dietary flexibility, this threat may be less of an immediate concern than threats from sea-ice degradation.

Additional habitat concerns include the potential effects from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as disturbance from vessel traffic, seismic exploration noise, or oil spill potential.

4.3.2.8 Ringed seals (Threatened)

Five subspecies of ringed seals are currently recognized. Only the Arctic ringed seal (*Phoca hispida hispida),* which occurs in the Beaufort, Chukchi, and Bering Sea, occurs near the project area. Arctic ringed seals are abundant in the Norton Sound when ice is present. Their diet includes arctic and saffron cod, sculpin, shrimp, mysids and amphipods. They are migratory and leave their winter habitat – land-fast ice – in the spring. They spend most of the summer in the Chukchi or Beaufort Seas. Breeding occurs in April through May, and pupping occurs in the following year, in March through April. Both breeding and pupping occur in the land-fast ice zone (NMFS 2013g). Ringed seals are harvested annual by Arctic natives for subsistence (NMFS 2013g).

Without this project, climate change will remain the most serious threat for ringed seal populations because much of their habitat is dependent upon pack ice. Changes in ocean temperature, acidification, and ice cover threaten prey communities on which ringed seals depend. Diminished snow accumulation will impact the ringed seal ability to excavate snow caves over their breathing holes in the ice, in which they give birth, nurse their young, and rest. Without these snow caves, newborn seals are vulnerable to freezing and predation. Changes in the ringed seal's habitat will be rapid relative to their generation time and, thereby, will limit adaptive responses. As ringed seal populations decline, the significance of currently lower-level threats, such as increases in human activities, and changes in populations of predators, prey, competitors, and parasites may increase.

4.3.2.9 Short-tailed albatross (Endangered)

The short-tailed albatross (*Phoebastria albatrus*) is a long-lived, slow-to-reproduce sea bird, some of which live more than 40 years. They mate for life and begin breeding at seven or eight years of age. After breeding on two islands in Japan, they move to feeding areas in the North Pacific and feed on squid, fish, and shrimp seized from the open ocean surface. Short-tailed albatross forage widely across the temperate and subarctic North Pacific and can be seen in the Gulf of Alaska, along the Aleutian Islands, and in the Bering Sea; however, no sightings have occurred in the Norton Sound or Port Clarence. The world population is currently estimated to be about 1,200 birds and is increasing (USFWS 2014a). Natural threats are loss of nesting habitat to volcanic eruptions, severe storms, and competition with black-footed albatrosses for nesting habitat.

Without this project, threats to short-tailed albatross will continue to be hooking and drowning on commercial online gear, ingestion of plastic debris, contamination from oil spills, and potential predation by introduced mammals on breeding islands (USFWS 2014a).

4.3.2.10 Eskimo curlew (Endangered)

The Eskimo curlew (*Numenius borealis*) was listed in 1967. Its precipitous decline took place in the late 1800s due to excessive sport hunting and habitat loss. The last physical evidence of the bird's existence was in 1963, with 39 potential sightings before 2006. The likelihood that the

Eskimo curlew remains existent is extremely low. Little information exists on their biology. They bred on barren grounds in the Northwest Territories, Canada where they fed on overwintered berries. Eskimo curlew are believed to have used intertidal habitats in western and northwestern Alaska. Eskimo curlews migrated to South America for the winter, feeding on insects and other invertebrates (USFWS, 2014b). Conversion of tall grass prairie migration stopover sites and the conversion of wintering habitat into agriculture most likely led to the bird's decline.

Habitat within the Arctic breeding range has remained largely undisturbed. Potential threats from human development would be difficult to assess due to limited knowledge of breeding areas or habitat requirements (USFWS, 2014b).

4.3.2.11 Steller's eider (Threatened)

The Steller's eider (*Polysticta stelleri*) is a small marine duck with a square head and angular bill, and it is known to live in all coastal waters except southeast Alaska. The Alaska breeding population was designated as threatened in 1997. They breed several kilometers inland, with nests in small depressions, in vegetation surrounding small ponds or within drained lake basins in the flat coastal belt of open tundra. Most Steller's eiders in Alaska breed on the North Slope, in a band that stretches from Pt. Lay to the Shaviovik River east of Prudhoe Bay. Following hatching of its young, all members move to coastal habitats. Steller's eiders forage in water less than 33 feet (10 meters) deep and feed mostly on mollusks, crustaceans, and other marine invertebrates (USFWS 2014c). In winter, most of the world's population of Steller's eiders ranges throughout the Alaska Peninsula and eastern Aleutian Islands. Critical habitat was designated as approximately 2,831 square miles (1,145 hectares) on land and sea and includes nesting areas on the Yukon-Kuskokwim Delta and areas on the north side of the Alaska Peninsula (Izembek Lagoon, Nelson Lagoon, and Seal Islands). The areas designated as critical habitat consist of breeding grounds, molting, wintering, and feeding areas for Steller's eiders. Neither Norton Sound nor Port Clarence is within Steller's eider designated critical habitat.

Threats continue to be mortality from hunting and shooting, ingestion of lead shot, nest predation by common ravens and Arctic foxes, and exposure to petroleum and other contaminants (USFWS 2014c).

4.3.2.12 Spectacled eider (Threatened)

The spectacled eider (*Somateria fischeri*) is a medium-sized sea duck with a sloped forehead and bill. Spectacled eiders spend most of the year in marine waters feeding on benthic invertebrates. During winter months they are found on open water or resting on ice. In spring, nesting pairs move to areas on wet coastal tundra and nest usually within 10 feet (3 meters) of freshwater ponds and wetlands. There, they feed on aquatic insects, crustaceans, and vegetation (USFWS 2010). Norton Sound is included in the critical habitat for the spectacled eider. Critical habitat for this sea duck was designated for molting in Norton Sound and Ledyard Bay, for nesting on the Yukon-Kuskokwim Delta, and for wintering south of St. Lawrence Island. Spectacled eiders use shallow offshore waters in the far-east end of Norton Sound as molting habitat from July through October, then winter in a concentrated ice free zone south of St. Lawrence Island. Spectacled eiders found near Nome would most likely be in transit (USFWS 2012b).

Threats include ingestion of lead shot, shooting, and predation by mammalian and avian predators. Other threats from climate change include potential alterations to breeding pond salinity, availability of food such as benthic prey and in sea ice, and increased competition due to loss of sea ice. Offshore oil and gas development in molting or staging areas is also a threat (USFWS 2010).

4.3.3 Special Aquatic Sites

Special aquatic sites are large or small geographic areas with special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the overall environmental health or vitality of the entire region's ecosystem. Special aquatic sites include marine sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle pool complexes. No special aquatic sites are known to be present within the onshore or near-shore project areas.

4.3.4 Essential Fish Habitat

According to NOAA, essential fish habitat (EFH) includes waters and substrate necessary for fish spawning, breeding, feeding or growth to maturity. EFHs exist at Nome for the following species: chum salmon, pink salmon, coho salmon (*Oncorhynchus kisutch*), sockeye salmon (*O. nerka*), and Chinook salmon (*O. tshawytscha*), and for several species of Bering Sea ground fish. These species are discussed below. Without this project, the threats to essential fish habitat come from climate change and ocean acidification. Climate change could lead to habitat changes that shift species distribution. If ocean temperatures continue to warm, subsequent new shipping routes could lead to the introduction of invasive species. Ocean acidification could also change the distribution of species and impact food web dynamics (NMFS 2011).

4.3.4.1 Salmon

Six salmon-producing streams empty into Norton Sound near Nome: Sinuk River, Cripple River, Penny River, Snake River, Nome River, and Hasting Creek. In general, juvenile salmon migrate along shallow shorelines and forage on benthic invertebrates until they grow large enough to move offshore. The locations of the EFH for the juvenile and adult life stages of salmon are as follows (NOAA 2014a):

4.3.4.1.1 Pink, Chum, and Coho Salmon

Juvenile: live in marine waters off the coast of Alaska from the mean higher tide line to the 200-nautical-mile limit (nm) (370 kilometers) of the U.S. Exclusive Economic Zone (EEZ).

Adult: live in marine waters off the coast of Alaska to depths of 650 feet (200 meters) and range from the mean higher tide line to the 200-nm limit (370 kilometers) of the U.S. EEZ.

4.3.4.1.2 Sockeye Salmon

Juvenile: live in marine waters off the coast of Alaska to depths of 165 feet (50 meters) and range from the mean higher tide line to the 200-nm limit (370 kilometers) of the U.S. EEZ until December of their first year at sea.

Adults: live in marine waters off the coast of Alaska to depths of 650 feet (200 meters) and range from the mean higher tide line to the 200-nm limit (370 kilometers) of the U.S. EEZ.

4.3.4.1.3 Chinook Salmon

Juvenile: Marine waters off the coast of Alaska from the mean higher tide line to the 200-nm limit (370 kilometers) of the U.S. EEZ. During their first winter at sea, juvenile Chinook salmon are at this life stage from April through annulus formation in January or February.

Adult: Marine waters off the coast of Alaska and ranging from the mean higher tide line to the 200-nm limit (370 km) of the U.S. EEZ.

4.3.4.2 Groundfish

The following are the Groundfish Resources of the Bering Sea/Aleutian Islands Region. A description of the EFH is included for each life stage per species only if enough scientific information is known (NPFMC 2014).

4.3.4.2.1 Walleye Pollock

Eggs are located in pelagic waters along the entire shelf (0 to 200 m, 0 to 656 ft.), upper slope (200 to 500 meters, 656 to 1,640 feet), and intermediate slope (500 to 1000 meters, 1,640 to 3,280 feet).

Larvae are located in epipelagic waters along the entire shelf (0 to 200 m, 0 to 656 feet), upper slope (200 to 500 meters, 656 to 1,640 feet), and intermediate slope (500 to 1000 meters, 1,640 to 3,280 feet).

Late Juveniles are located in the lower and middle portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet). No known preference for substrates exists.

Adults are located in the lower and middle portion of the water column along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 1,000 meters, 656 to 3,280 feet). No known preference for substrates exists.

4.3.4.2.2 Pacific Cod

Larvae are located in epipelagic waters along the entire shelf (0 to 20 meters, 0 to 66 feet), upper slope (200 to 500 meters, 656 to 1,640 feet), and intermediate slope (500 to 1000 meters, 1,640 to 3,280 feet).

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50m, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet.), and outer (100 to 200 meters, 328 to 656 feet) shelf, wherever there are soft substrates consisting of sand, mud, sandy mud, and muddy sand.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are soft substrates consisting of sand, mud, sandy mud, muddy sand, and gravel.

4.3.4.2.3 Yellowfin Sole

Late Juveniles are located in the lower portion of the water column within nearshore bays and along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are soft substrates consisting mainly of sand.

Adults are located in the lower portion of the water column within nearshore bays and along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are soft substrates consisting mainly of sand.

4.3.4.2.4 Greenland Turbot

Eggs are located principally in benthypelagic waters along the outer shelf (100 to 200 meters, 328 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet) in the fall.

Larvae are located principally in benthypelagic waters along the outer shelf (100 to 200 meters, 328 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet) and seasonally abundant in the spring.

Late Juveniles are located in the lower and middle portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are softer substrates consisting of mud and sandy mud.

Adults are located in the lower and middle portion of the water column along the outer shelf (100 to 200 meters, 328 to 656 feet), upper slope (200 to 500 meters, 656 to 1,640 feet), and lower slope (500 to 1000 meters, 1,640 to 3,280 feet) wherever there are softer substrates consisting of mud and sandy mud.

4.3.4.2.5 Arrowtooth Flounder

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are softer substrates consisting of gravel, sand, and mud.

Adults are located in the lower portion of the water column along the inner (0 to 50), middle (50 to 100 meters, 164 to 328 feet.), and outer (100 to 200 meters, 328 to 656 feet) shelf and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are softer substrates consisting of gravel, sand, and mud.

4.3.4.2.6 Rock Sole

Larvae: Located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and upper slope (200 to 1,000 meters, 656 to 3,280 feet).

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50 m, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand, gravel, and cobble.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand, gravel, and cobble.

4.3.4.2.7 Alaska Plaice

Eggs are located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and upper slope (200 to 500 meters, 656 to 1,640 feet) in the spring.

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand and mud.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand and mud.

4.3.4.2.8 Rex Sole

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are substrates consisting of gravel, sand, and mud.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are substrates consisting of gravel, sand, and mud.

4.3.4.2.9 Dover Sole

Late Juveniles are located in the lower portion of the water column along the middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates consisting of sand and mud.

Adults are located in the lower portion of the water column along the middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates consisting of sand and mud.

4.3.4.2.10 Flathead Sole

Eggs are located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet.) in the spring.

Larvae are located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet).

Late Juveniles are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand and mud.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (100 to 200 meters, 328 to 656 feet) shelf wherever there are softer substrates consisting of sand and mud.

4.3.4.2.11 Sablefish

Larvae are located in epipelagic waters along the middle shelf (50 to 100 meters, 164 to 328 feet), outer shelf (100 to 200 meters, 328 to 656 feet), and slope (200 to 3,000 meters, 656 to 9,842 feet).

Late Juveniles are located in the lower portion of the water column, varied habitats, generally softer substrates, and deep shelf gullies along the slope (200 to 1,000 meters, 656 to 3,280 feet).

Adults are located in the lower portion of the water column, varied habitats, generally softer substrates, and deep shelf gullies along the slope (200 to 1,000 meters, 656 to 3,280 feet).

4.3.4.2.12 Pacific Ocean Perch

Larvae are located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet).

Late Juveniles are located in the middle to lower portion of the water column along the inner shelf (1 to 50 meters, 3 to 164 feet), middle shelf (50 to 100 meters, 164 to 328 feet), outer shelf (100 to 200 meters, 328 to 656 feet), and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates consisting of cobble, gravel, mud, sandy mud, or muddy sand.

Adults are located in the lower portion of the water column along the outer shelf (100 to 200 meters, 328 to 656 feet) and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates consisting of cobble, gravel, mud, sandy mud, or muddy sand.

4.3.4.2.13 Shortraker and Rougheye Rockfish

Larvae are located in epipelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet).

Adults are located in the lower portion of the water column along the outer shelf (100 to 200 meters, 328 to 656 feet) and upper slope (200 to 500 meters, 656 to 1,640 feet) regions wherever there are substrates consisting of mud, sand, sandy mud, muddy sand, rock, cobble, and gravel.

4.3.4.2.14 Northern Rockfish

Larvae are located in pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet).

Adults are located in the middle and lower portions of the water column along the outer slope (100 to 200 m, 328 to 656 ft.) and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates of cobble and rock.

4.3.4.2.15 Thornyhead Rockfish

Larva: are located in epipelagic waters along the outer shelf (100 to 200 meters, 328 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet).

Late Juveniles are located in the lower portion of the water column along the middle and outer shelf (50 to 200 meters, 164 to 656 feet) and upper to lower slope (200 to 1,000 meters, 656 to 3,280 feet) wherever there are substrates of mud, sand, rock, sandy mud, muddy sand, cobble, and gravel.

Adults are located in the lower portion of the water column along the middle and outer shelf (50 to 200 meters, 164 to 656 feet) and upper to lower slope (200 to 1,000 meters, 656 to 3,280 feet) wherever there are substrates of mud, sand, rock, sandy mud, muddy sand, cobble, and gravel.

4.3.4.2.16 Yelloweye Rockfish

Larvae are located in the epipelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet.)

Late Juveniles are located in the lower portion of the water column within bays and island passages and along the inner (0 to 50 meters, 0 to 164 feet.), middle (50 to 100 meters, 164 to 328 feet), and outer shelf (100 to 200 meters, 328 to 656 feet) wherever there are substrates of rock and in areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges.

Adults are located in the lower portion of the water column within bays and island passages and along the inner shelf (0 to 50 meters, 0 to 164 feet), outer shelf (100 to 200 meters, 328 to 656 feet), and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates of rock and in vegetated areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges.

4.3.4.2.17 Dusky Rockfish

Larvae are located in the pelagic waters along the entire shelf (0 to 200 meters, 0 to 656 feet) and slope (200 to 3,000 meters, 656 to 9,842 feet.)

Adults located in the middle and lower portions of the water column along the outer shelf (100 to 200 meters, 328 to 656 feet) and upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates of cobble, rock, and gravel.

4.3.4.2.18 Atka Mackerel

Larvae are located in epipelagic waters along the shelf (0 to 200 meters, 0 to 656 feet), upper slope (200 to 500 meters, 656 to 1,640 feet), and intermediate slope (500 to 1000 meters, 1,640 to 3,280 feet.)

Adults are located in the entire water column, from sea surface to the sea floor, along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer shelf (100 to 200 meters, 328 to 656 feet) wherever there are substrates of gravel and rock and in vegetated areas of kelp.

4.3.4.2.19 Skates

Adults are located in the lower portion of the water column on the shelf (0 to 200 meters, 0 to 656 feet) and the upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are of substrates of mud, sand, gravel, and rock.

4.3.4.2.20 Sculpins

Juveniles are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), outer shelf (100 to 200 meters, 328 to 656 feet) and portions of the upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates of rock, sand, mud, cobble, and sandy mud.

Adults are located in the lower portion of the water column along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), outer shelf (100 to 200 meters, 328 to 656 feet) and portions of the upper slope (200 to 500 meters, 656 to 1,640 feet) wherever there are substrates of rock, sand, mud, cobble, and sandy mud.

4.3.4.2.21 Squid

Late Juveniles located in the entire water column, from the sea surface to sea floor, along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (200 to 500 meters, 656 to 1,640 feet) shelf and the entire slope (500 to 1000 meters, 1,640 to 3,280 feet.)

Adults located in the entire water column, from the sea surface to sea floor, along the inner (0 to 50 meters, 0 to 164 feet), middle (50 to 100 meters, 164 to 328 feet), and outer (200 to 500500 meters, 656 to 1640 feet) shelf and the entire slope (500 to 1000 meters, 1,640 to 3,280 feet.)

4.3.4.2.22 Other

EFH is also present for Sharks, Eulachon, Capelin, Sand Lance, Sand Fish, Euphausiids, Myctophids, Pholids, Gonostomatids, and Octopus.

4.4 Historical and Cultural Resources

The Inupiat people have lived in the region of the Seward Peninsula for at least the last 4,500 years. Four cultural sites are listed in the Alaska Heritage Resources Survey database (AHRS) within the area of potential effect for Nome (AHRS 2014). The beach at Belmont Point was formerly the site of a 65-foot wooden boat, the Lieutenant C.V. Donaldson, built in Valdez by the U.S. Army in 1907. Until 1923, the vessel ferried passengers and supplies to and from Fort Liscum and occasionally rescued stranded mariners. Originally put on the National Register of Historic Places in 1990, the boat has since been dismantled and removed from listing. Buried remnants associated with the European settlement of the area (ca. 1898) (NOM-158) underlay at least part of the contemporary town of Nome. No determination of eligibility has been completed for this property. The Samuelson Trail (NOM-244), a section of a wagon trail used to haul freight to Anvil Creek during the first notable placer gold discovery in the Nome area, lies partially within the project area. In 2012, the Alaska Department of Transportation completed a preliminary determination of eligibility assuming the trail was eligible for the National Register of Historic Places. Multiple house pits compose the Snake River Spit site (NOM-146). Prehistoric artifacts recovered from the site date back to the late Thule period (approximately B.P. 240). This site was determined eligible for the National Register in 2009.

The Lieutenant C.V. Donaldson has been dismantled, and the former vessel site is not eligible for the National Register of Historic Places. Therefore, without this proposed project, there will be no effect to the site. Without this proposed project, remains associated with the European settlement of Nome and the Samuelson Trail will not be disturbed. The Snake River Spit site was partially excavated in 2009, and a report discussing the artifact analysis was produced as mitigation for damage caused by the creation of a new harbor entrance channel. The remainder of the site has since been covered by rock revetment for bank stabilization. The protection offered by the revetment will remain without this proposed project.

4.5 Traffic Patterns

Marine traffic along Alaska's western and northern coasts falls into four categories: local traffic, petroleum traffic, research and government traffic, and transient traffic. The vessels types associated with each of those categories are discussed in the sections below.

4.5.1 Arctic Traffic

4.5.1.1 Transient Traffic

Transient traffic includes those vessels transiting the area to transport goods from one out-of-region port to another. An example of a vessel in this category is a container vessel originating in Southeast Asia and transiting the Northern Sea Route to Europe.

During the past decade as the Arctic Ocean has experienced longer open water periods, and the number of vessels sailing the Northern Sea Route (through Russian waters) and the Northwest Passage (through Canadian waters) has dramatically increased. In 2012, 66 percent of vessel traffic near the Seward Peninsula was from non-U.S. flagged vessels representing 21 countries. A number of these vessels are transiting the Northern Sea Route, which requires a permit from Russia. The number of permits issued for this route has risen from 4 permits in 2009 to 622 in 2013. Utilizing the Northern Sea Route and Northwest Passage can cut as many as 5,000 miles and 20 days off a voyage normally routed through the Panama or Suez Canals, and this route avoids political instability that exists in some of those areas.

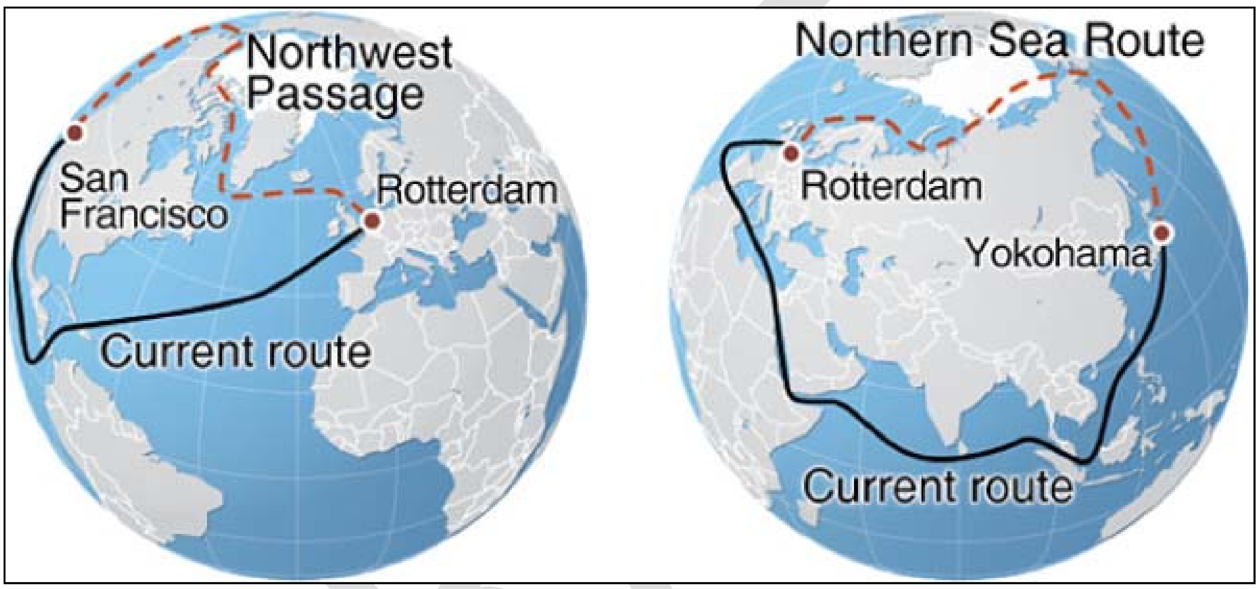

Figure 12: Northwest Passage and Northern Sea Route in comparison to current routes

It is reasonable to expect that this traffic will grow as the open water season lengthens. While these vessels will not necessarily be stopping in Nome or Port Clarence, their presence requires monitoring for navigational safety and national security. With such a high number of foreign-flagged vessels transiting through this environmentally sensitive area, it is important that proper patrols are in place or assets are available to render assistance in the event of a spill or accident. In addition, there is a severe lack of assets available to enforce maritime law and American sovereignty in the area. This increase in traffic highlights these shortcomings and the need for these assets to be available during the open water period. The types of vessels that would be used for monitoring and response can vary from small oil spill response vessels to large United States Coast Guard and Navy ships.

4.5.1.2 Petroleum Traffic

Petroleum traffic is related to supply and crew vessels servicing exploration and development operations in the Chukchi Sea. In 2012, marine support vessels servicing exploration activities in the Chukchi Sea were based out of Dutch Harbor, which is approximately 800 miles south of the Bering Strait.

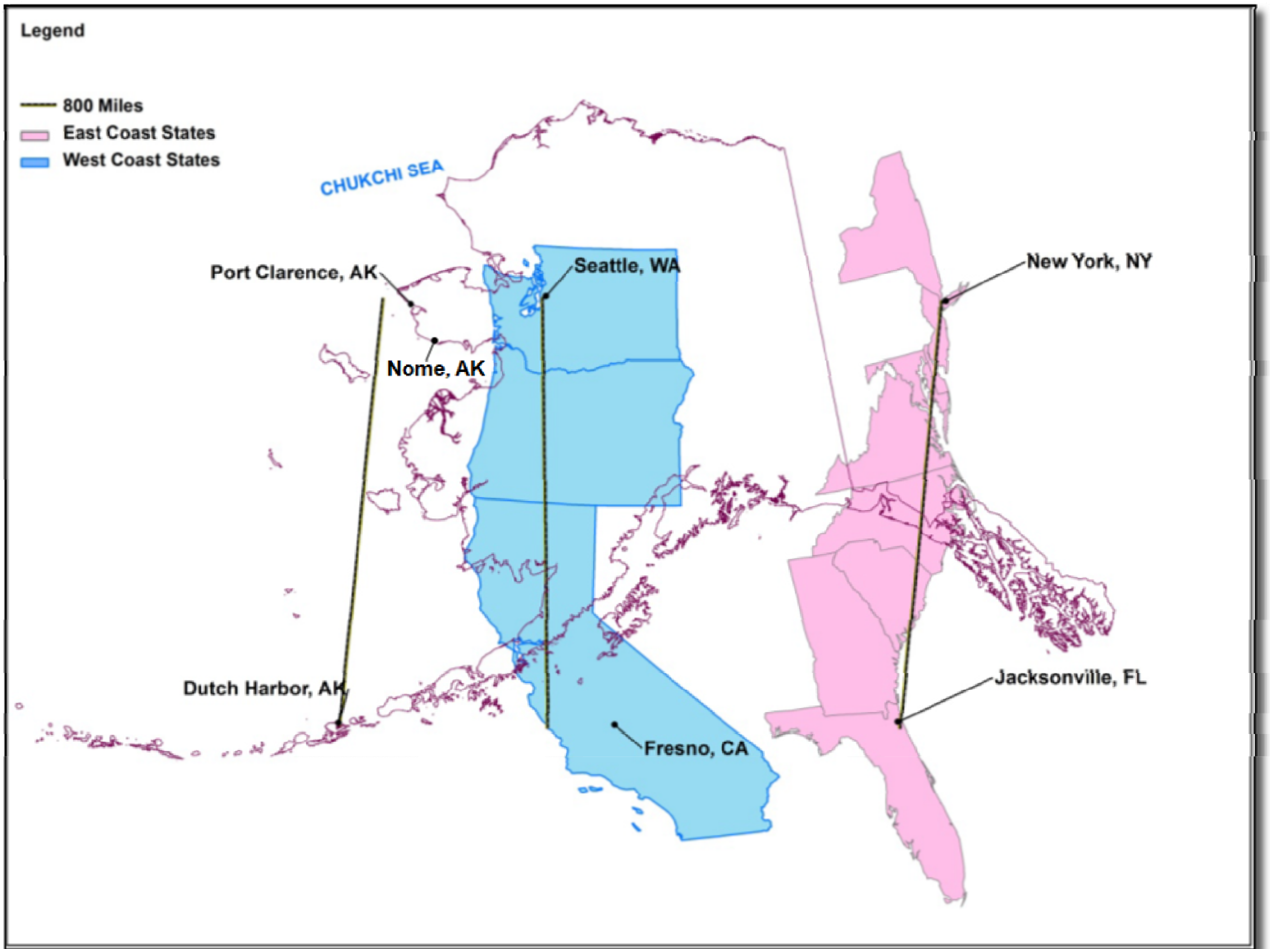

Figure 13: Comparison of current distance to other coasts

As shown in Figure 13, 800 miles is a distance equal to that between Seattle, Washington and Fresno, California or between New York City and Jacksonville, Florida.

Eight companies currently have leases in the Chukchi Sea. However, Shell Oil is the only company currently conducting exploration. Due to operational and regulatory challenges, Shell's last active exploration activities occurred in 2012. Despite these setbacks, Shell Oil is planning on conducting operations in 2015. Even though Shell Oil did not conduct operations in 2014, they published a development plan that included the vessels they would have used had exploration occurred. The fleet characteristics are shown below in Table 7. This fleet is anticipated for Shell Oil use in 2015. For the purposes of this study, the fleet characteristics show their existing condition.

Table 7: Existing Petroleum Exploration Fleet

Vessel Description	Length (ft)	Beam (ft)	Draft (ft)	Capacity	Flag
Polar Class / Multipurpose	380	85	27	4,870	Foreign
Anchor Handling (AH) Offshore Support Vessel	361	80	24	4,129	USA
AH Supply Vessel	361	80	24	4,129	USA
Polar Class / Multipurpose	380	85	27	4,870	Foreign
Offshore Supply Vessel (OSV) / Oil Spill Response (OSR)	301	60	21	4,378	USA
OSV	280	60	16.5	3,687	USA
OSV	300	64	20	5,450	USA
OSV	300	64	20	5,450	USA
Science Vessel/OSV	280	60	16.5	3,687	USA
Tug & Barge / Containment System	460	104.4	20	4,404	USA
Tug & Ware Barge	550	99	19	11,732	USA
Tug & Barge	550	99	19	11,732	USA
OSR Tug & Barge	476	76	22	4,404	USA
Landing OSR	134	32	7		USA
Mobile Offshore Drilling Unit	514	85	27	15,296	Foreign
Tug	150	40	20	1	USA
OSR Tug & Barge	295	90	15	3,030	USA

Source: Shell Oil 2014 Exploration Plan

The fleet mobilizes from Seattle early in the season, setting up operations at Dutch Harbor in anticipation of ice retreat. From there, the fleet loads and ships supplies to oil and gas exploration projects in the Chukchi Sea. To provide continuous support during the open water season, the majority of these vessels remain in the Chukchi Sea. Three OSVs or "supply vessels" make multiple resupply trips between Dutch Harbor and the Chukchi Sea with each roundtrip taking 10 days to complete.

4.5.2 Traffic at Port of Nome

4.5.2.1 Local Traffic

Traffic calling at the Port of Nome is generally comprised of those vessels conducting local commerce. It is a varied category that includes commercial fishing vessels, skiff traffic, landing craft, cruise ships, barge tows, and bulk fuel tankers. Table 8 details the existing local fleet and calls associated with these vessels. Larger vessels such as cruise ships and tankers lighter people and goods to/from shore but are unable to enter the harbor as currently configured and other vessels may be tide limited depending on their loaded conditions at time of arrival.

Table 8: Local Traffic Calls at Nome, 2012

Vessel Type	Vessel Class	2012 Calls	Length (ft)	Beam (ft)	Draft (ft)	Capacity (metric tons)
Tug & Barge	Small	48	299	54	14.0	4,400
	Medium	32	376	78	18.0	10,653
	Large	12	511	96	18.0	14,157
Landing Craft	Small	6	78	24	3.5	300
	Large	60	152	50	9.8	500
Tanker	Tanker	6	417	67	28.5	11,611
Cruise Ship	Small	4	234	42	14.8	620
	Medium	1	403	59	16.1	1,177
	Large	1	644	98	23.0	4,558
Tugboat	Tugboat	17	129	37	19.0	488

Source: Port of Nome, Alaska

Small vessel traffic, including commercial fishing, recreation, subsistence, and gold dredge vessels, utilize existing small boat harbor facilities at Nome. While they are part of the fleet that utilizes navigation improvements at Nome, these smaller vessels are not analyzed as a part of this study.

4.5.2.2 Research and Government Traffic

Regional traffic includes research and government vessels. Government vessels currently visiting Nome but unable to access the Port are Coast Guard ships including cutters, buoy tenders, and ice breakers. The USCGC Polar Star and USCGC Polar Sea icebreakers and sister ships are 399 feet long with 83.5-foot beam and a 28-foot design draft. They are able to navigate through ice up to six feet thick at a constant speed of three knots and are able to break through 21 feet of ice through ramming and backing. The USCGC Healy is the Coast Guard's newest ice breaker. It is 420 feet long with an 82-foot beam and a 29.3-foot fully-loaded draft. It is able to break 4.5 feet of ice continuously at three knots and can break 8 feet of ice through ramming and backing. The USCGC Spar is a 225-foot-long oceangoing buoy tender that is homeported in Kodiak, Alaska but has operational authority over the Aleutian Islands. In addition to its buoy-tending duties, the USCGC Spar engages in maritime homeland security, maritime environmental protection, maritime law enforcement, search and rescue, and domestic ice breaking. These ancillary missions bring the USCGC Spar north to the study area's waters. Currently, none of these vessels are able to enter Nome's harbor and are forced to lighter crew and goods to and from shore. The U.S. Coast Guard anticipates commissioning four new icebreakers during the course of this study's analysis period, none of which could access Nome under current conditions.

In addition to U.S. Coast Guard traffic, the USNS Sumner anchored offshore of Nome in 2012. The USNS Sumner is an oceanographic survey ship that supports worldwide oceanography programs. The vessel is 328.5 feet long with a 58-foot beam and a 19-foot draft. Although the USNS Sumner has three feet of underkeel clearance at Nome, the U.S. Navy will not let it enter the harbor.[10] If sufficient depth conditions were available, the U.S. Navy would utilize Nome to take on fuel and supplies and for shelter from storms. Table 9 details the existing government and research vessel fleet and number of calls associated with these vessels.

Table 9: Research and Government Traffic Calls at Nome, 2012

Vessel Type	Vessel Class	2012 Calls	Length (ft)	Beam (ft)	Draft (ft)	Capacity (metric tons)
Government	Cutter	4	225	46	13.0	350
	Buoy Tender	3	329	58	19.7	2,328
	Ice Breaker	2	378	50	17.0	3,250
Research	Small	21	180	40	15.0	730
	Medium	3	269	56	18.4	2,808
	Large	4	422	85	29.8	4,870

Source: Port of Nome, Alaska. Note: USNS Sumner not included since it did not enter the harbor.

[10] Electronic Correspondence, Michael Bosworth, SEA 05TB, Deputy Group Director, Chief Technology Office, 11 April 2013.

5.0 FUTURE WITHOUT-PROJECT CONDITIONS

Much uncertainty exists regarding future conditions at Nome, specifically surrounding petroleum development and the level of marine support required in the future. Because of this uncertainty, multiple "without-project" conditions were developed. The first is a "no growth" scenario that assumes vessel traffic levels at the base planning year of 2020 remain the same during the 50-year analysis period. The second scenario is considered the "base case" and projections are based on historical trends, assumes some growth during the 50-year period of analysis. This scenario is a projection of levels of growth using historical commodity transfers and vessel calls at the Port of Nome. The third scenario is the "base case petroleum development" scenario. It assumes that three of the eight oil companies currently holding leases in the Chukchi Sea engage in exploration and/or production. It makes reasonable assumptions about levels of navigation activity that would occur under this scenario. The "base case" and "base case petroleum development" scenarios are discussed below.

5.1 Future Without-Project Conditions – Base Case Scenario

The base case scenario assumes a rate of growth commensurate with what would be expected without Federal investment in navigation improvements and without petroleum exploration and production. This scenario accounts for the future growth commensurate with current patterns and with no initiation of new business that would significantly affect current navigation needs or patterns. Under this scenario, vessel calls at Nome would experience growth comparable to historical trends until the year 2040 at which point all levels would be held constant until the analysis planning period ends in 2070. This growth was modeled using HarborSym. The model is discussed and results presented in Section 5.1.5.

5.1.1 Economic Conditions

The area's economy would continue to experience nominal growth. The number of vessels transiting the Bering Strait via the Northern Sea Route and Northwest Passage would continue to increase as the open water period lengthens, and cost savings over traditional routes through the Panama and Suez Canals are realized.

5.1.2 Moorage Facilities

5.1.2.1 Nome

The future "without-project" (FWOP) condition must take into account all changes that are reasonably certain to occur during the analysis period. The Port of Nome is currently in the advanced planning stages for construction of two local service facilities. The first dock, approximately 200 feet (60 meters) in length and referred to as "Middle Dock" in planning documents, will be located between the existing City and West Gold docks. The Port of Nome is also expanding the existing barge ramp's capacity.

5.1.2.2 Port Clarence

There are no planned navigation improvements for Port Clarence. It is assumed that during storms or while awaiting orders, vessels would utilize the naturally deep water as an anchorage.

5.1.3 Commodity Movements

For this scenario, three commodities currently transiting into and out of Nome (Fuel, Dry Cargo, and Gravel) were retained, with future forecasts based on historic trends. For all commodities, forecasts were made for the years 2020, 2030, and 2040, with the assumption that commodity levels remain constant from 2040 to the end of the planning period in 2070. Under this scenario, fuel and gravel movements are expected to see modest growth, with significant growth in dry goods movements.

Table 10: Historic and Future Commodity Movements, Metric Tons, FWOP Base Case Scenario

Year	Fuel	Dry Cargo	Gravel	Total
2009	46,352	26,801	81,683	154,836
2010	38,134	28,441	154,068	220,643
2011	25,088	34,377	63,435	122,901
2012	45,523	57,788	33,058	136,370
2013	30,786	42,217	2,181	75,184
2020	44,075	56,349	55,241	155,665
2030	48,658	78,603	60,177	187,438
2040	53,240	100,858	65,114	219,212
2050	53,240	100,858	65,114	219,212
2060	53,240	100,858	65,114	219,212
2070	53,240	100,858	65,114	219,212

5.1.4 Fleet Composition

Under the base case scenario, sufficient vessel growth will need to occur to handle the anticipated growth in commodity movements. Like commodity growth, the total number of vessels in the fleet is held constant from 2040 to 2070.

Table 11: Future Without-Project Base Case Fleet

Vessel Type	Vessel Class	Existing	2020	2030	2040	2050	2060	2070
Tug & Barge	Small	48	58	74	89	89	89	89
	Medium	32	48	57	79	79	79	79
	Large	12	12	20	24	24	24	24
Landing Craft	Small	6	8	10	12	12	12	12
	Large	60	77	109	147	147	147	147
Tanker	Tanker	6	7	7	7	7	7	7
Cruise Ship	Small	4	5	7	7	7	7	7
	Medium	1	2	3	3	3	3	3
	Large	1	1	1	1	1	1	1
Government	Cutter	4	6	7	7	7	7	7
	Ice Breaker	3	2	2	2	2	2	2
	Buoy Tender	2	2	2	2	2	2	2
Research Vessel	Small	21	26	28	29	29	29	29
	Medium	3	3	3	3	3	3	3
	Large	4	4	4	4	4	4	4
Tugboat	Tugboat	17	23	30	46	46	46	46
Total		224	284	364	462	462	462	462

5.1.5 Summary of Without-Project Conditions

In the base case scenario, Nome will see modest growth related to vessel traffic through the year 2040 at which point growth becomes static. Even with this conservative approach, vessel traffic will increase twofold during the 50-year planning analysis period. Table 12 and Table 13 show the modeling results for the base case scenario.

Transportation costs are calculated using the USACE-approved model HarborSym. In HarborSym, the commodity and fleet projections, as described in the previous section, are combined with vessel hourly operating costs[11], and details on vessel operations both in-port and at-sea for specific vessel classes. HarborSym conducts Monte Carlo simulations based on these input data and calculates the total transportation costs for the vessel fleet calling at Nome over a given timeframe – one operating season in this case. Detailed HarborSym inputs and outputs are described in the Economics Appendix, and the table below summarizes the transportation costs, by year.

[11] Hourly vessel operating costs have been coordinated with the Institute for Water Resources (IWR).

Table 12: Transportation Costs, FWOP Base Case Scenario

Year	Vessel Calls	Transportation Costs		Commodities (MT) Transferred
		Total	Allocated to Port	
2020	284	$124,202,321	$23,492,054	160,387
2030	362	$139,702,085	$25,850,261	187,438
2040	459	$160,350,922	$29,019,496	219,212

Table 13: Wait Times, FWOP Base Case Scenario

Year	Vessel Calls	Wait Time (hrs)		Transfer Time (hrs)	Docking Time (hrs)	Undocking Time (hrs)
		Dock	Channel			
2020	284	106	76	9,273	145	107
2030	362	119	175	11,358	184	137
2040	459	62	272	14,316	232	172

As shown above, as the amount of maritime activity grows over time, costs and times associated with the activity grow as well. The no growth scenario is equal to the base case scenario with all variables held constant after the year 2020.

5.2 Future Without-Project Conditions – Base Case Petroleum Development Scenario

The base case petroleum development scenario assumes a rate of growth commensurate with what would be expected without Federal investment in navigation improvements but where maritime activity increases because of petroleum exploration and production. This scenario accounts for future growth of current patterns and the initiation of new business that would significantly affect current navigation needs and patterns. Under this scenario, until the year 2040, vessel calls at Nome would experience growth well above historical trends, at which point all levels would be held constant until the end of the planning analysis period. This growth was modeled using HarborSym. The results of the model are presented below in Section 5.2.5.

5.2.1 Economic Conditions

While the base case scenario focused on Nome's historic patterns and future growth that could likely be expected, it was very conservative in nature. It did not factor in a number of potential developments that could reasonably be expected as development in the Arctic continues during the analysis period. These potential developments are discussed in the sections below.

5.2.1.1 Offshore Petroleum Exploration and Development

Alaska's Outer Continental Shelf (OCS) holds great potential for energy extraction. The Bureau of Ocean Energy Management (BOEM) estimates that the Chukchi Sea may hold more than 15 billion barrels of recoverable oil and nearly 78 trillion cubic feet of recoverable natural gas, second only to the Central Gulf of Mexico in terms of estimated reserves. The Beaufort Sea is also estimated to hold 8 billion barrels of oil and nearly 28 trillion cubic feet of natural gas. For comparison's sake, the Prudhoe Bay oil field was estimated to hold 10 billion barrels of oil and

26 trillion cubic feet of natural gas at the beginning of that field's life in the late 1970s. The combined estimated reserves in the Chukchi and Beaufort Seas hold twice as much oil and four times as much natural gas as Prudhoe Bay did prior to extraction. The leases in Beaufort Sea are relatively close to shore and are located near existing support facilities at Prudhoe Bay. The Chukchi petroleum fields are located a greater distance from shore and are not located near any established energy extraction infrastructure. This distance necessitates support from a harbor along the western coast.

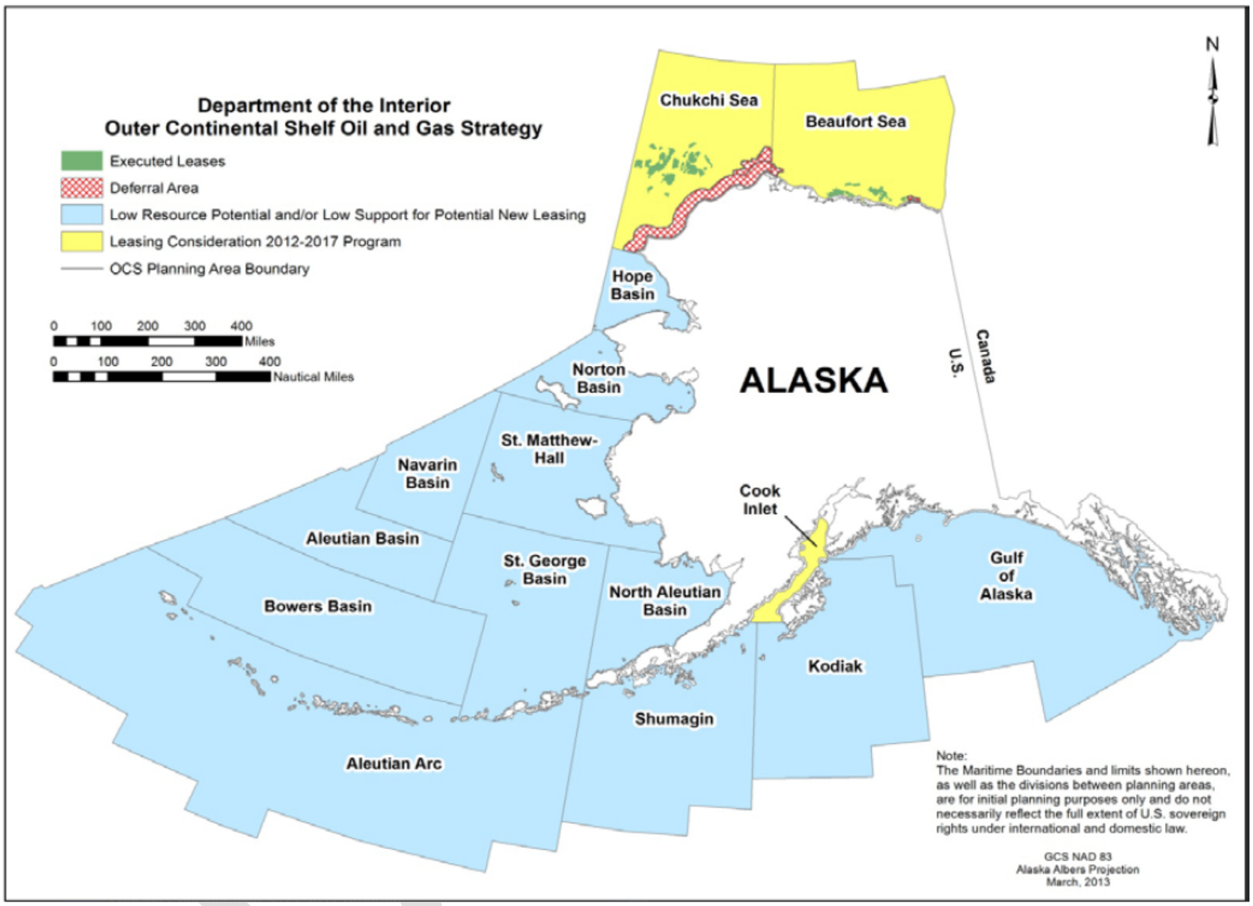

Figure 14: OCS Petroleum Leasing Program, Alaska Planning Areas
Source: BOEM, Alaska OCS Region

Though exploration activities have experienced issues during the past two years, it is anticipated that exploration will continue in 2015. Energy companies have invested nearly $3 billion in Chukchi Sea leases and are expected to expend significantly more in future lease sales in 2016 and 2017. Because of this significant investment, it is likely that exploration and development will take place.

However, there is great uncertainty about the timeframes in which exploration and development will take place, and uncertainty related to how many energy companies will be involved in these operations. Seven energy companies currently hold leases in the Chukchi Sea including:

ConocoPhillips
OOGC America, Inc.
Eni Petroleum U.S., LLC
Iona Energy Company
Repsol E&P USA, Inc.
Shell Gulf of Mexico, Inc.
Statoil USA E&P, Inc.

In addition to these seven companies, some leases are held by joint ventures made up of two or more of these companies.

This study assumes three companies will proceed to the exploration and production phases of development in the Chukchi Sea during the project analysis period. The number of oil companies could increase with future lease sales. Therefore, this assumption is seen as a conservative estimate, or base case for the petroleum development scenario. Given previous studies and known expertise, it is assumed that Shell Oil, ConocoPhillips, and Stat Oil will be the three companies that proceed with exploration and production.

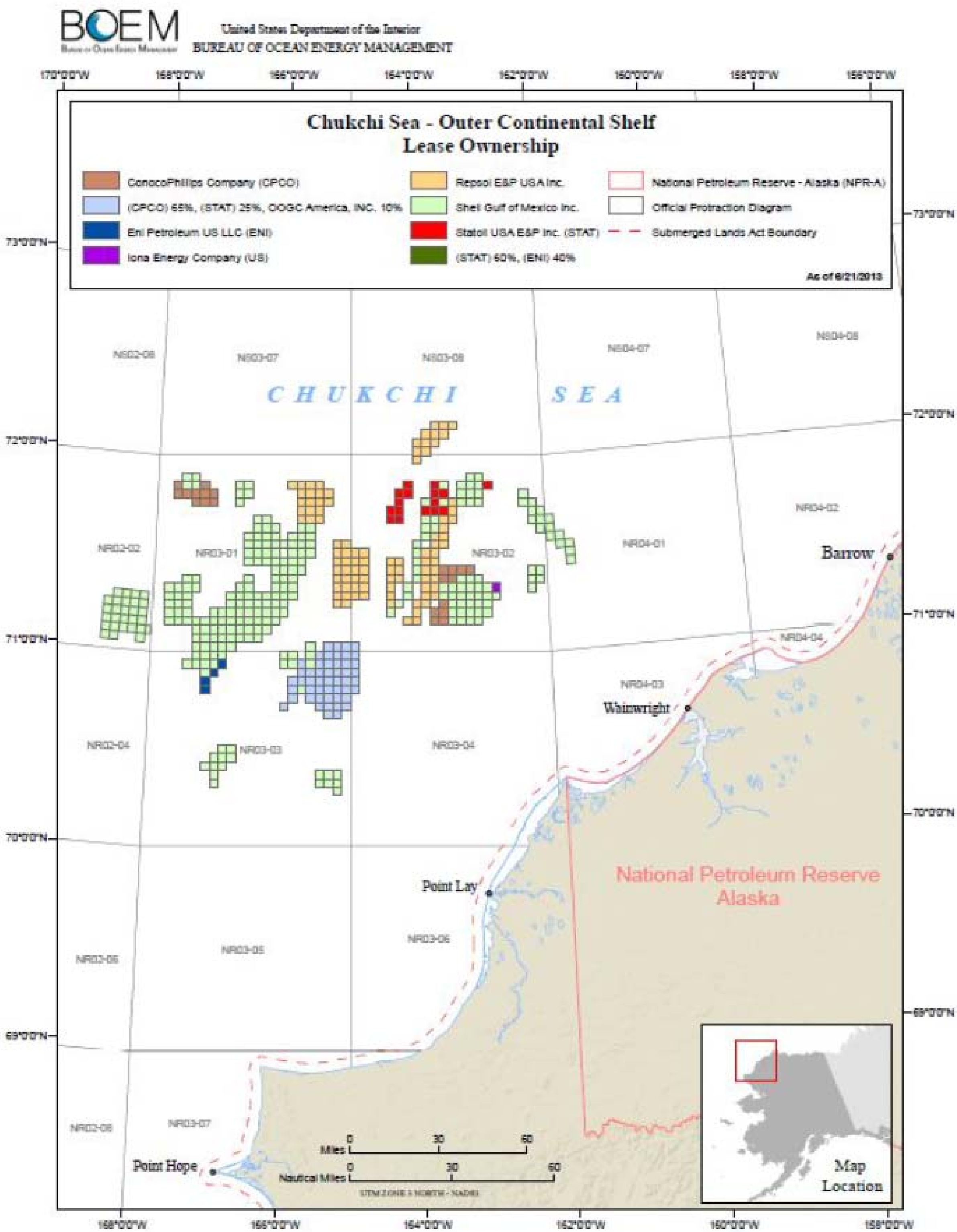

Figure 15: Current Chukchi Sea Lease Ownership, by Company
Source: BOEM Alaska OCS Region, Leasing and Plans

It was important to consider timing of exploration and production activities, since this timing directly relates to the benefit stream of any navigation improvements. For the purposes of this study, it is assumed that exploration activities for three companies will be active by 2020, the base year of the period of analysis. While it is entirely possible that exploration could progress more quickly if reserves are proven, future exploration setbacks could delay production by many years. Therefore, it was decided to move the beginning of exploration to 2020 to account for either scenario. Once exploration begins, it is estimated that production would begin in 10 to 15 years. This estimate is based on interviews with energy companies and estimates provided by BOEM. For the purposes of this study, it is assumed that production will begin in 2030, 10 years after the beginning of exploration. Sequencing of exploration and production was heavily considered. While it is possible for energy companies to conduct exploration on multiple leases at the same time, for the purposes of study, it is assumed that each company will only begin exploration at a new lease site once production has commenced at the existing exploration site. Therefore, each company would only have one rig at a time in the exploration phase.

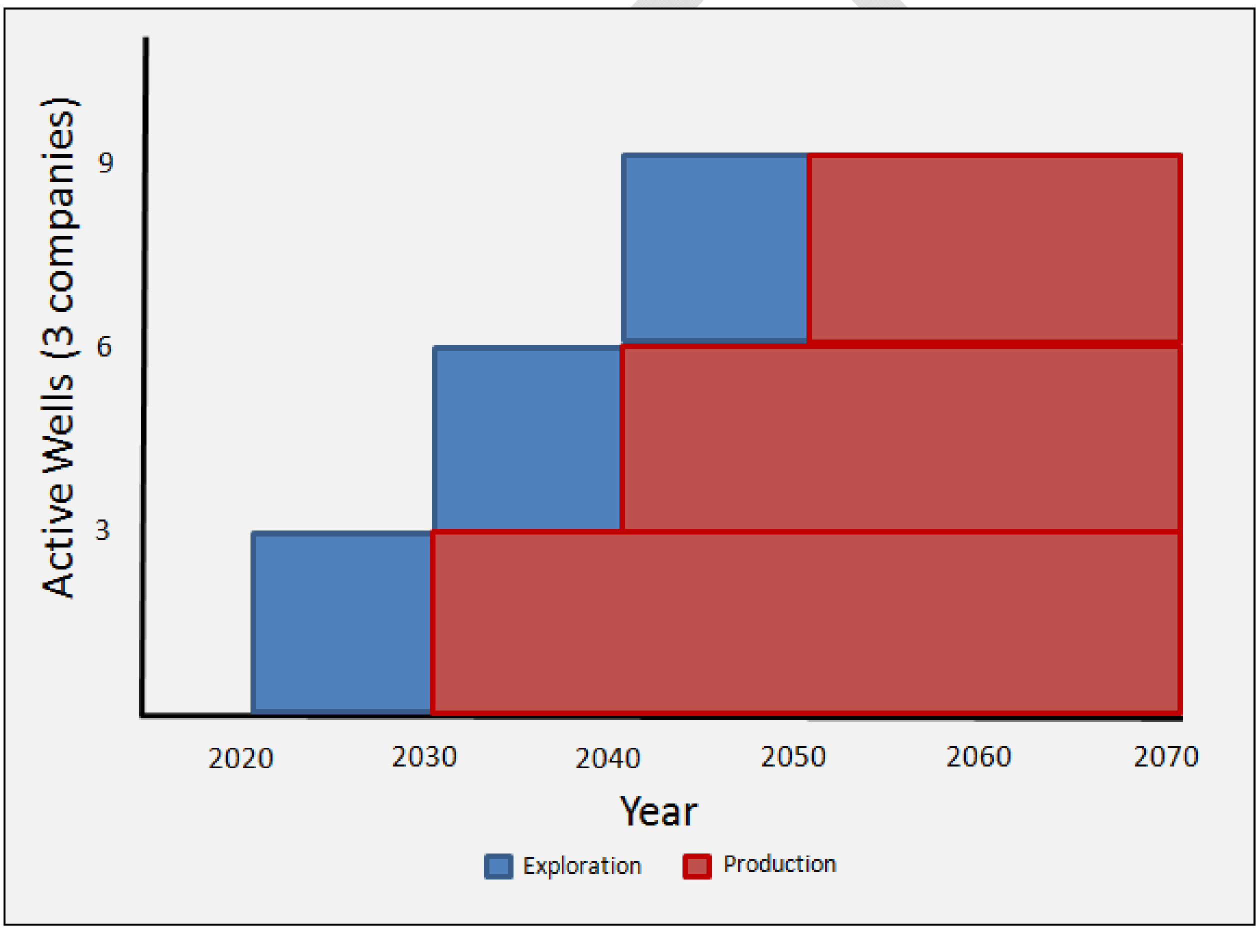

Figure 16: Petroleum Exploration and Development Schedule

For this study, the future open water season is held static at 120 days (1 July through 31 October). The actual length of seasons may vary depending on ice conditions, weather, and the use of icebreakers to extend the season.

To summarize, beginning in 2020, it is assumed that three energy companies will begin exploration activities in the Chukchi Sea, progressing to production in 2030, at which time they will begin exploration on a second site. Each season will be 120 days in length.

Given previously published exploration plans, each company may use up to 30 vessels to support its exploration program.[12] All vessels would base out of Dutch Harbor, where supply vessels would make multiple trips each season to continually resupply the operations. Previous exploration plans indicate that approximately 30 round trips would be required to keep the exploration activities properly supplied. Non-supply vessels would mobilize to the Chukchi Sea in July, remain onsite for the entirety of the 120-day season, and demobilize at the end of October.

5.2.1.2 Increase in Mining Activity

Another consideration is development of the Graphite One Mine located approximately 40 miles north of Nome and approximately 10 miles off of the Nome-Teller Highway. Graphite One Resources, the mine's owner, has engaged in exploratory drilling in what is referred to as a "world-class" flake graphite deposit and is studying transportation logistics that would be associated with mine development. Should the mine proceed to production, it is estimated that the mine would operate for 50 years and produce 50,000 metric tons of graphite per year. The graphite would be moved in one-ton super sacks via road to the Port of Nome where it would be loaded onto tugs and barges for shipment out of the area. There is existing capacity aboard the without-project tug and barge fleet to accommodate approximately 130,000 tons of material. Therefore, while development of the Graphite One Mine may increase land-side activity and perhaps loading times, it is not expected to increase the number of vessels calling on Nome.

Additional mining interests in the Nome area that were briefly considered include Lost River Mine and Rock Creek Gold Mine. However, there is limited information available about the production potential and timeframes associated with these mines. Because of this limited information, increases in vessels traffic related to these mines are not anticipated.

5.2.1.3 Growth in Research Vessel Traffic

The base case petroleum development scenario includes an increase in research vessel traffic. Due to the historical ice conditions, little information is available to base future projections of activity. However, it is assumed growth in Arctic activity will spur scientists to take advantage of longer open water periods, which will lead to increased research vessels. Because of this uncertainty, it is assumed that vessel calls to Nome will increase by one percent per year between the base year of 2020 and the year 2040. Beyond 2040, the number of calls is assumed to remain static.

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[12] Number of vessels taken from Shell's filed but unused 2014 exploration plan.

Table 14: Research Vessel Calls, Petroleum Development Scenario

Vessel Class	Existing	2020	2030	2040	2050	2060	2070
Small Research Vessel	21	28	33	37	37	37	37
Medium Research Vessel	3	3	3	4	4	4	4
Large Research Vessel	4	4	5	5	5	5	5
Total	28	35	41	46	46	46	46

5.2.1.4 Growth in Cruise Ship Traffic

As the Arctic opens, it is expected to see an increase in tourism, particularly from cruise ships. There is inconsistent historical data to base a forecast of future cruise vessel activity. To address this uncertainty, information on expected growth in the cruise industry was utilized. According to best available data, the cruise industry is expected to see a 4.48 percent annual increase in cruise ship sailings during the period of analysis. For this study, that annual increase was applied through the year 2040, at which point cruise traffic is held constant.

Table 15: Cruise Ship Calls, Petroleum Development Scenario

Vessel Class	Existing	2020	2030	2040	2050	2060	2070
Small Cruise Ship	4	6	12	18	18	18	18
Medium Cruise Ship	1	3	6	8	8	8	8
Large Cruise Ship	1	1	2	3	3	3	3
Total	6	10	20	29	29	29	29

5.2.1.5 Additional Government Vessel Presence

In the base case petroleum development scenario, more joint maneuvers with Canada can be expected to occur, with additional vessels from the U.S. and Canadian Coast Guards calling on Nome including: cutters, buoy tenders, and ice breakers. As the level of activity in the Arctic increases, the increase in the number of government vessel calls at Nome is based on the need for additional monitoring, particularly activity related to petroleum exploration and development. There may be ships in this group of vessels that will not be able to enter the harbor at Nome due to depth restrictions.

Table 16: Government Vessel Activity, Petroleum Development Scenario

Vessel Class	Existing	2020	2030	2040	2050	2060	2070
Cutter	4	12	20	20	20	20	20
Ice Breaker	2	4	8	8	8	8	8
Buoy Tender	3	8	16	16	16	16	16
Total	9	24	44	44	44	44	44

5.2.2 Moorage Facilities

The change in moorage facilities for the base case petroleum development scenario mirrors that of the base case scenario.

5.2.3 Commodity Movements

The change in commodity movements for the petroleum development scenario mirrors that of the base case scenario. The vessel fleet associated with petroleum development activities will not stop in Nome under the “without-project” condition so no commodity transfers at Nome are associated with those vessels.

The increases in research, cruise, and government vessel calls at Nome are due to vessel resupply and crew change activities. For the purposes of this study, these activities are not considered commodity transfers, and no additional commodity movements are associated with these vessels.

The only increase in commodity movements under this scenario is the addition of 50,000 metric tons of outbound graphite. The graphite will occupy existing backhaul capacity on existing tug and barge traffic. Therefore there is no increase in vessel calls because of this activity.

5.2.4 Vessel Calls

As shown in Table 17, under the Base Case Petroleum Development scenario, the number of vessel calls at the Port of Nome is expected to more than double in size over the period of analysis.

Table 17: Fleet Composition, Base Case Petroleum Development Scenario

Vessel Type	Vessel Class	Existing	2020	2030	2040	2050	2060	2070
Tug & Barge	Small	48	58	74	89	89	89	89
	Medium	32	48	57	79	79	79	79
	Large	12	12	20	24	24	24	24
Landing Craft	Small	6	8	10	12	12	12	12
	Large	60	77	109	147	147	147	147
Tanker	Tanker	6	7	7	7	7	7	7
Cruise Ship	Small	4	7	12	18	18	18	18
	Medium	1	3	6	8	8	8	8
	Large	1	1	2	3	3	3	3
Government	Cutter	4	11	20	20	20	20	20
	Buoy Tender	3	8	16	16	16	16	16
	Ice Breaker	2	4	8	8	8	8	8
Research Vessel	Small	21	28	33	37	37	37	37
	Medium	3	3	3	4	4	4	4
	Large	4	4	5	5	5	5	5
Tugboat	Tugboat	17	23	30	46	46	46	46
Petroleum	Petroleum	0	193	301	407	407	407	407
Total		224	495	713	930	930	930	930

5.2.5 Summary of Without-Project Conditions – Base Case Petroleum Development Scenario

In the Base Case Petroleum Development Scenario, Nome vessel traffic is expected to nearly double through the year 2040. Traffic is assumed to remain static after 2040 in order to provide a conservative estimate and account for uncertainty in this scenario.

Base Case Petroleum Development Scenario transportation costs are calculated in HarborSym in the same manner as the base case, by hourly vessel operating costs with future vessel calls. Table 18 summarizes these transportation costs. Detailed HarborSym inputs and outputs are contained in the Economics Appendix.

Table 18: Transportation Costs, FWOP Base Case Petroleum Development Scenario

Year	Vessel Calls	Transportation Costs		Commodities (MT) Transferred
		Total	Allocated to Port	
2020	490	$209,685,866	$90,267,117	199,607
2030	702	$293,465,668	$114,162,740	234,072
2040	920	$347,973,195	$136,032,403	269,632

Table 19: Wait Times, FWOP Base Case Petroleum Development Scenario

Year	Vessel Calls	Wait Time (hrs)		Transfer Time (hrs)	Docking Time (hrs)	Undocking Time (hrs)
		Dock	Channel			
2020	490	146	144	14,750	290	206
2030	702	150	266	20,344	426	300
2040	920	53	337	26,097	560	392

Table 18 and Table 19 show the growth in maritime activity, associated costs, and wait times.

5.3 Comparison of Base Case and Base Case Petroleum Development Growth Scenarios

Table 20: Comparison of Scenarios

Year/Category	2020			2030			2040		
	Base	Petroleum	Δ	Base	Petroleum	Δ	Base	Petroleum	Δ
Vessel Calls	284	490	206	362	702	340	459	920	461
Wait Time Dock (hrs)	106	146	40	119	150	31	62	53	-9
Wait Time Channel (hrs)	76	144	68	175	266	91	272	337	65
Transfer Time (hrs)	9,273	14,750	5,477	11,358	20,344	8,986	14,316	26,097	11,781
Docking Time (hrs)	145	290	145	184	426	242	232	560	328
Undocking Time (hrs)	107	206	99	137	300	163	172	392	220

6.0 FORMULATION AND EVALUATION OF ALTERNATIVE PLANS

6.1 Plan Formulation Rationale

Plan formulation is the process of building alternative plans that achieve the project's stated purpose and need, meet project objectives, and avoid project constraints. A set of one or more management measures created to address one or more planning objectives is defined as an alternative plan. A feature or activity implemented at a specific geographic location to address one or more planning objectives is defined as a management measure. Features are "structural" elements requiring construction or assembly on-site. Conversely, an activity is defined as a "nonstructural" action. Each alternative plan will be formulated under its listed criteria.

6.2 Management Measures

A list of management measures follow. After a criteria-based screening process was performed, all listed measures were considered.

6.2.1 In-Water Measures

In-water measures are generally those measures directly related to increasing the efficiency of navigation from sea to a mooring facility, improvements to mooring facilities, and protection of vessels while at a mooring facility. These measures are briefly discussed below.

6.2.1.1 Rubblemound Breakwaters

Breakwaters provide protection against wave action to a specific mooring area. The Corps of Engineers generally formulates wave protection to a standard of less than 1-foot (0.3 meters) with consideration given to types of vessels, general wave climate, and wind and wave conditions. Rubblemound breakwaters are constructed of rock or concrete armoring units in order to dissipate wave energy through spaces between the breakwater materials.

6.2.1.2 Other Moorage Protection

In areas where rock may be scarce or the wave climate more favorable, other forms of wave protection such as floating breakwaters or wave barriers may be more appropriate and cost-effective than rubblemound breakwaters. These structures serve the same purpose as rubblemound breakwaters but were different enough in nature to consider separately.

6.2.1.3 Jetties

Jetties are rubblemound structures extending perpendicular from the shoreline, providing protection against waves and currents and are generally meant to assist vessels entering an inland port such as a river mouth.

6.2.1.4 Dredged Channels

Dredging channels can provide access to new or existing protected moorage for vessels with deeper design drafts or allow vessels currently calling on the area to enter a protected area at a deeper loaded depth, increasing navigation efficiencies.

6.2.1.5 Dredged Basin

Basins are important to the efficient and safe operation of a port facility. Turning basins provided turning areas for vessels accessing or leaving dock facilities. Anchorage basins provide safe moorage for vessels awaiting access to landside facilities or for those vessels not requiring access to landside facilities.

6.2.1.6 Dredged Material Disposal Areas

In cases where dredging is required, disposal of dredged materials is of paramount concern. Options for disposing of dredged material include (but are not limited to) offshore disposal, nearshore disposal to provide beach nourishment, and upland disposal in a confined disposal facility.

6.2.1.7 Docks

Docks are landside facilities that allow vessels to tie up and transfer cargo, fuel, and people between the vessel and shore.

6.2.1.8 Ice Mitigation

The use of ice mitigation measures can increase the open water time of a port facility in environments where ice formation is an issue. Ice mitigation measures can include the use of icebreakers or bubblers.

6.2.1.9 Mooring Buoys

Mooring buoys provide cost-effective offshore mooring facilities for vessels that do not require access to docks or other land-side facilities.

6.2.1.10 Navigation Aids

Navigation aids are structures such as lighthouses, lights, ranges, markers, buoys, fog signals, and day beacons. They are meant to increase the safety of navigation in the nearshore environment and are provided by the U.S. Coast Guard at 100 percent Federal expense.

6.2.1.11 Tugs and Pilot Facilities

Tugs and Pilots increase the safety and efficiency of navigation. Tugs provide turning and in-port assistance to large ships. Pilots are personnel with in-depth knowledge of local navigation conditions that assume control of the vessel within certain distances of a port.

6.2.2 Utilities

Given the remote nature of some of the sites being evaluated, the presence of utilities and to what degree they are constructed is worth considering.

6.2.2.1 Electricity

Electrical power is paramount to the operation of an effective, efficient, and safe harbor. Without it, there is no way to provide land-side lighting, transshipment facilities, potable water, or communications.

6.2.2.2 Fuel Storage and Dispensing System

The ability to store and provide fuel to vessels increases a port's effectiveness and desirability. By giving vessels the ability to take on fuel at the port there is more design draft available on the vessel to carry cargo, increasing navigation efficiency.

6.2.2.3 Potable Water

By providing potable water, ships are able to take on water for human consumption as well as ice for support of fishing vessels.

6.2.2.4 Communication Facilities

The ability to communicate with vessels seeking to enter or exit the port contributes to a port's safety and efficiency. These facilities can include VHF radio, internet, and landline, cellular, or satellite telephone capabilities.

6.2.2.5 Wastewater Treatment Facilities

Sanitation facilities are key to maintaining land-side human activity at a port. While a small facility could operate on more rudimentary systems such as outhouses or even flush-haul systems, a fully developed port facility should have the ability to treat and dispose of its wastewater.

6.2.3 Landside or Near Port Measures

6.2.3.1 Road Access

Access to a local or regional road system would allow for some transshipment of goods to inland communities or allow for export of mine ore at sites where that is a consideration.

6.2.3.2 Cargo Area

A port should have ample space to allow for cargo staging and offloading without affecting the operations of other vessels or landside activities.

6.2.3.3 Storage Facilities

Access to heated storage facilities would allow for safe storage of fluids and other temperature-sensitive materials.

6.2.3.4 Small Boat Access

Small boats may be present at some currently developed sites but even at as yet undeveloped sites it is important to be able to accommodate smaller vessels such as fishing vessels and harbor support vessels.

6.2.3.5 Ice Plant

Availability of ice allows a port greater ability to support fishing operations.

6.2.3.6 Vessel Repair Services

The ability to provide vessel repair services allows a port to more efficiently serve vessels and to provide a service that is not normally available in this region.

6.2.3.7 Harbormaster Structure

At sites without a harbormaster structure in place, development of this structure is required. Harbormasters provide invaluable management services by collecting fees, setting schedules and priority for moorage, and ensuring the overall viability of the port.

6.2.3.8 Customs and Immigration

In some cases, vessels visiting a port in this region may employ crew from various countries. Allowing these crewmembers to process through and clear customs can increase a port's efficiency. In addition, the ability to directly import and export cargo to/from other nations would be a strategic and logistical advantage to any port in the region.

6.2.3.9 Adjacent Land for Future Development

The development of a port facility in this region should reasonably allow for future port-related development commensurate with levels described in the future with-project conditions.

6.2.4 Upland Measures

6.2.4.1 Airport Access

Airport access is needed to ensure the efficient movement of port-related personnel and perishable goods that would not otherwise be available.

6.2.4.2 Equipment and Supply Access

Access to vendors selling equipment and supplies would increase the viability, efficiency, and effectiveness of a port by providing vessels and their crew with the supplies and equipment needed to continue operations in a timely manner.

6.2.4.3 Emergency Response Facilities

Given the remote nature of the sites being examined and the possibility of a marine emergency in these waters, the ability to stage emergency responders and related equipment is needed.

6.2.4.4 Food and Lodging Services

These services increase the ability of a port to provide essential services to marine-related personnel awaiting their shift on a vessel or conversely transportation out of the area.

6.2.4.5 Medical Facilities

The ability to provide medical care for personnel would greatly increase safety and health of crew members. Emergency services are not readily available in the region to fully address injuries and basic healthcare services are limited for routine medical needs.

6.2.4.6 Government Facilities

A key aspect of ensuring safe, reliable, and efficient navigation in the region is providing for operations of key government entities with responsibility to monitoring and regulating activities in the region.

6.2.5 Screening of Measures

The measures listed above were identified based on their ability to meet planning objectives. Table 21 lists these measures, whether it meets objectives, and whether they would be cost-shared as a General Navigation Feature, a non-Federal responsibility as a Local Service Facility, provided by the Federal government, or provided by some related entity.

Table 21: Effectiveness of Measures

Measures:	Objectives met:	GNF/LSF/GOVT/REL
In-Water Measures		
Breakwater	1, 2, 3, 4, 5, 6	GNF
Jetties	1, 2, 3, 4, 5, 6	GNF
Dredged Channels	1, 2, 3, 4, 5, 6	GNF
Dredged Basin	1, 2, 3, 4, 5, 6	LSF
Moorage protection	1, 2, 3, 4, 5, 6	GNF
Dredged material disposal areas (*could also be upland*)	1, 2, 3, 4, 5, 6	GNF
Docks (Lightering docks)	1, 2, 3, 4, 5, 6	LSF
Ice mitigation/Icebreaker	1, 2, 3, 4, 5, 6	LSF
Mooring and Harbor buoys	1, 2, 3, 4, 5, 6	LSF
Navigation aids	1, 2, 3, 4, 5, 6	GOVT
Tugs/Pilot Facilities	1, 2, 3, 4, 5, 6	LSF
Utilities		
Power	2, 4, 5	LSF
Fuel storage and fuel at dock	2, 3, 4, 5	LSF
Fresh Water	2, 3, 4, 5	LSF
Communication	2, 4, 5, 6	LSF
Wastewater treatment facilities (Sanitation)	2, 3, 4, 5	LSF
Landside/Near Port Measures		
Road access (Ramp at Cape Riley)	2, 4, 5, 6	LSF
Cargo handling/laydown area	2, 4, 5	LSF
Storage facilities (heated)	2, 4, 5	LSF
Small boat access	2, 4, 5	LSF
Ice plant	2, 3, 4, 5	REL
Vessel repair services	2, 4, 5	REL
Harbormaster (management structure)	2, 4, 5, 6	LSF
Customs and immigration	2, 3, 4, 6	REL
Land for economic development	2, 4, 5, 6	REL
Upland Measures		
Airport or access to airports	2, 4, 5, 6	REL
Access to equipment and supplies	1, 2, 3, 4	REL
Emergency response facilities	2, 3, 4, 6	REL
Food and housing services	2, 4, 5	REL
Broadband communication	2, 4, 5, 6	REL
Medical facilities	2, 4	REL
Government facilities	2, 4	REL

6.3 Preliminary Alternative Plans

6.3.1 No Action Plan

The No Action Plan (i.e., No Action Alternative) includes no construction of any navigation improvements in the study area. Public concerns, national security issues, and future environmental conditions would remain unchanged unless a non-federal entity elected to construct improvements. Under the No Action Plan, the identified purpose and need would not be met. Moorage facilities at Nome, Alaska would continue to experience overcrowding during the open water period, and facilities at Port Clarence would be unchanged. Petroleum supply vessels would continue to be based out of Dutch Harbor, Alaska, located over 1,000 miles (1,852 kilometers) from Outer Continental Shelf (OCS) exploration and production activities in the Chukchi Sea. As capacity at Dutch Harbor was filled, some activity would shift to Adak, even further from OCS activities.

6.3.2 Site Selection

An earlier screening process reduced the number of potential sites from over a dozen to three: Nome, Point Spencer, and Cape Riley.

6.3.3 Alternatives Considered

Multiple standalone alternatives were considered at Nome, Point Spencer, and Cape Riley with additional alternatives that explored the feasibility of these standalone alternatives in various combinations. Alternatives examined included varying dredge depths, wave protection configurations, and local service facilities. Screening was based on risk-informed decisions related to preliminary engineering criteria, rough order of magnitude costs, and anticipated navigation needs at each site. Alternatives selected from this group will be subject to further depth optimization. Additional detailed descriptions of these alternatives are included in the Hydraulics appendix.

6.3.3.1 No Action

This plan would not construct any navigation improvements at either Nome or Port Clarence. Navigational inefficiencies to the fleet would remain in place and become more exacerbated with increased navigation through the Arctic.

6.3.3.2 Nome

This stand-alone alternative would only construct navigational improvements at Nome and would serve local and regional cargo transfers, Search and Rescue operations, resource development, emergency response, fisheries, cruise ships, and gold dredges. Construction of this alternative would include lengthening and widening of the existing causeway, construction of new docking facilities, dredging the existing facilities to a greater depth, modifying the existing east breakwater, and identification of sufficient uplands in order to support the expanded port.

6.3.3.2.1 Alternative 1A

Alternative 1A would include a 2,150-foot (655 meters) causeway extension, a 450-foot (137 meters) long dock, and dredging to -28 feet (-8.5 meters) MLLW. These selected depths were based on the future with-project vessel characteristics expected at the Nome location. Approximately 441,000 cubic yards of dredged material would be removed from the harbor and deposited on the project's beach downdrift.

The existing stub breakwater would be demolished, and a 2,150-foot-long (655 meter) extension to the causeway would be constructed. This extension would protect the existing harbor from southeastern waves and provide protection to a new 450-foot-long (137 meter) dock. The causeway extension would be constructed to match the current causeway elevation on the sea side of +28 feet (8.5 meters) MLLW and on the harbor side of +15.5 feet (4.7 meters) MLLW. The extension would also include a 30-foot-wide (9 meters) driving surface for vehicle access to the new 450-foot-long (137 meter) dock.

Table 22 shows the estimated amount of material needed to construct the causeway extension.

Table 22: Causeway Material Amounts

Item	Amount (cy)
A1 Rock	181,600
A5 Rock	29,100
B2 Rock	100,300
B3 Rock	13,350
C1 Rock	30,700
C2 Rock	9,800
D Filter Material	47,725
F Fill Material	82,075
E Fill Material	367,350
Surface Course Material	3,950
Total	865,950

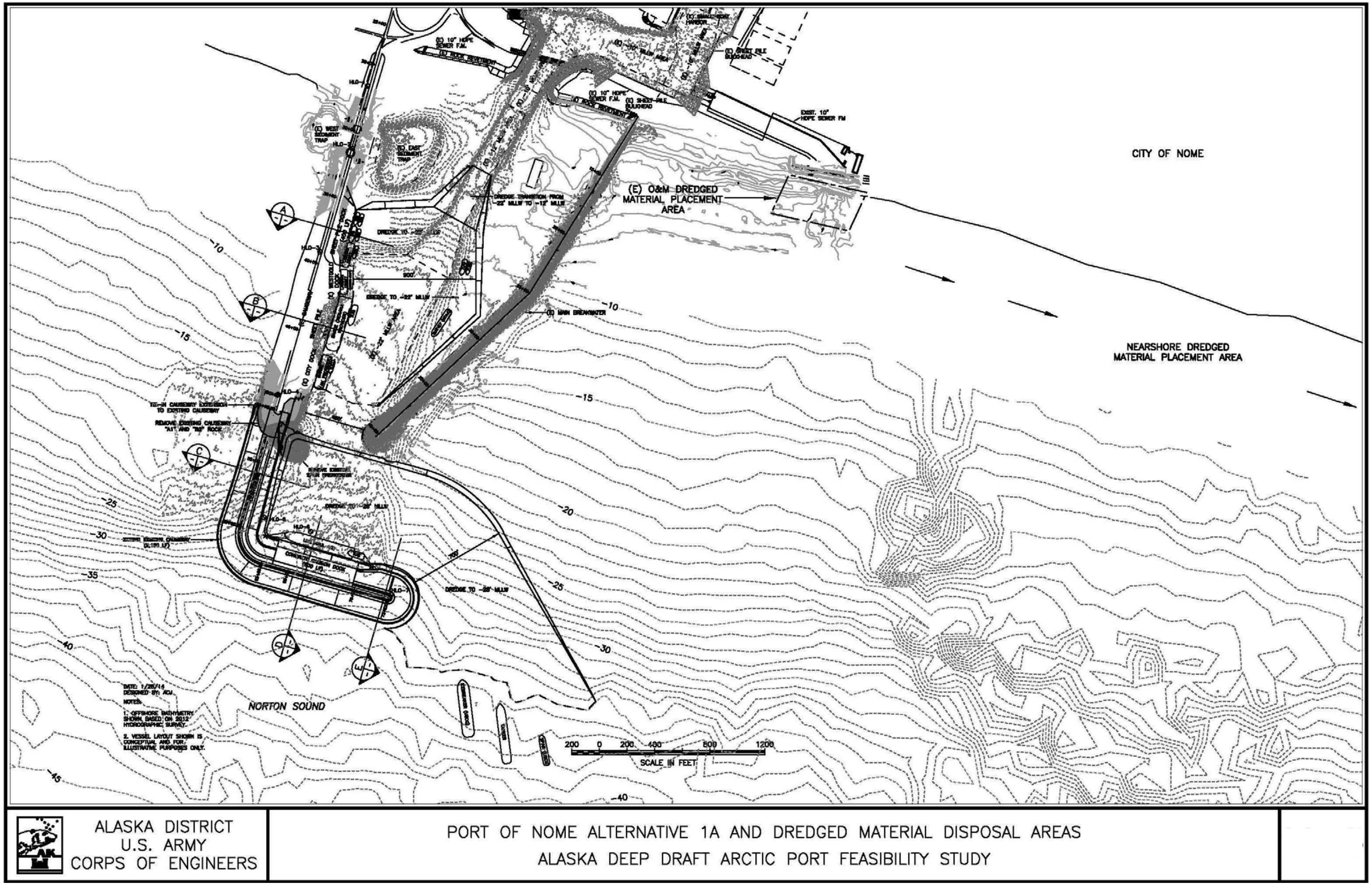

Figure 17: Nome Causeway Extension Layout

6.3.3.2.2 Alternative 1B

Alternative 1B is similar to Alternative 1A with the addition of a second 450-foot-long dock.

6.3.3.2.3 Alternative 1C

Alternative 1C would be similar to Alternative 1B with additional dredging to provide -28 foot draft to the existing interior dock.

6.3.3.2.4 Alternative 1A2

Alternative 1A2 would mirror Alternative 1A but would include modification of the existing east breakwater to resemble the existing western causeway. This would provide ice protection to the outer harbor and allow for petroleum drilling units to be overwintered in the harbor.

6.3.3.2.5 Alternative 1B2

Alternative 1B2 would mirror Alternative 1B but would include modification of the existing east breakwater to resemble the existing western causeway. This would provide ice protection to the outer harbor and allow for petroleum drilling units to be overwintered in the harbor.

6.3.3.2.6 Alternative 1C2

Alternative 1C2 would mirror Alternative 1C but would include modification of the existing east breakwater to resemble the existing western causeway. This would provide ice protection to the outer harbor and allow for petroleum drilling units to be overwintered in the harbor.

6.3.3.3 Point Spencer

This stand-alone alternative would not construct navigation improvements at Nome. It would focus mainly on providing improvements that would benefit: Search and Rescue operations, resource development, and emergency response.

6.3.3.3.1 Alternative 2A

The Point Spencer Alternative is located in the North Bight of the point, with depths of -20 to -25 feet (-6 to -7.6 meters) MLLW and within 2,000 feet (609 meters) of naturally deep water.

This alternative includes the construction of an 800-foot (244 meters) causeway to access an entrance channel and a 50-acre turning basin dredged to -35 feet (-10 meters) MLLW. This selected depth was based on vessels currently utilizing Port Clarence as a refuge harbor. Due to the low frequency of wave heights exceeding one meter (three feet) at the dock site, wave protection measures were identified as unnecessary. The causeway would be constructed with a crest elevation of +13 feet (4 meters) MLLW, and both the causeway and dock would be constructed with fill to avoid ice jacking forces that could apply to a pile-supported structure. The dock would be 200-feet-long (61 meters) with six mooring dolphins, providing a 1,200-foot (366 meters) mooring length.

Table 23 shows the amount of fill necessary to construct the causeway and dock.

Table 23: Point Spencer Causeway and Dock Quantities

Item	Quantity
A Rock (cy)	16,400
B Rock (cy)	3,500
C Rock (cy)	2,300
Class II Riprap (cy)	1,000
Rock Spall Fill (cy)	44,900
Aggregate Surface Course (cy)	1,900
Aggregate Subbase (cy)	4,000
Separation Geotextile (sq. yards)	6,400

With side slopes of 5H:1V, approximately 1.5 million cubic yards of material would be dredged to construct the entrance channel and turning basin. Dredged materials are anticipated to consist of silts, sands, gravel, cobbles, and glacial till. Because of these materials, the anticipated dredging method would be with a clam shell dredge instead of drilling and blasting. Some dredged material could be repurposed to construct a portion of the causeway. The remaining materials would be disposed offshore. Maintenance dredging is expected to be minimal due to the direction of littoral transport.

Local service facilities would include a 200-foot (61 meters) caisson dock, supporting a 1,200-foot (366 meters) long berthing area with six dolphins. The dock was placed as close as possible to the eastern shore of Point Spencer to maximize natural wave protection provided by the point. Other required facilities would include a 2,800-foot long (853 meters) road, a 15.5-acre staging area, a water treatment plant, lodging and dining facilities, a 5-million gallon fuel storage facility, a three-acre landfill, and multiple utility connections.

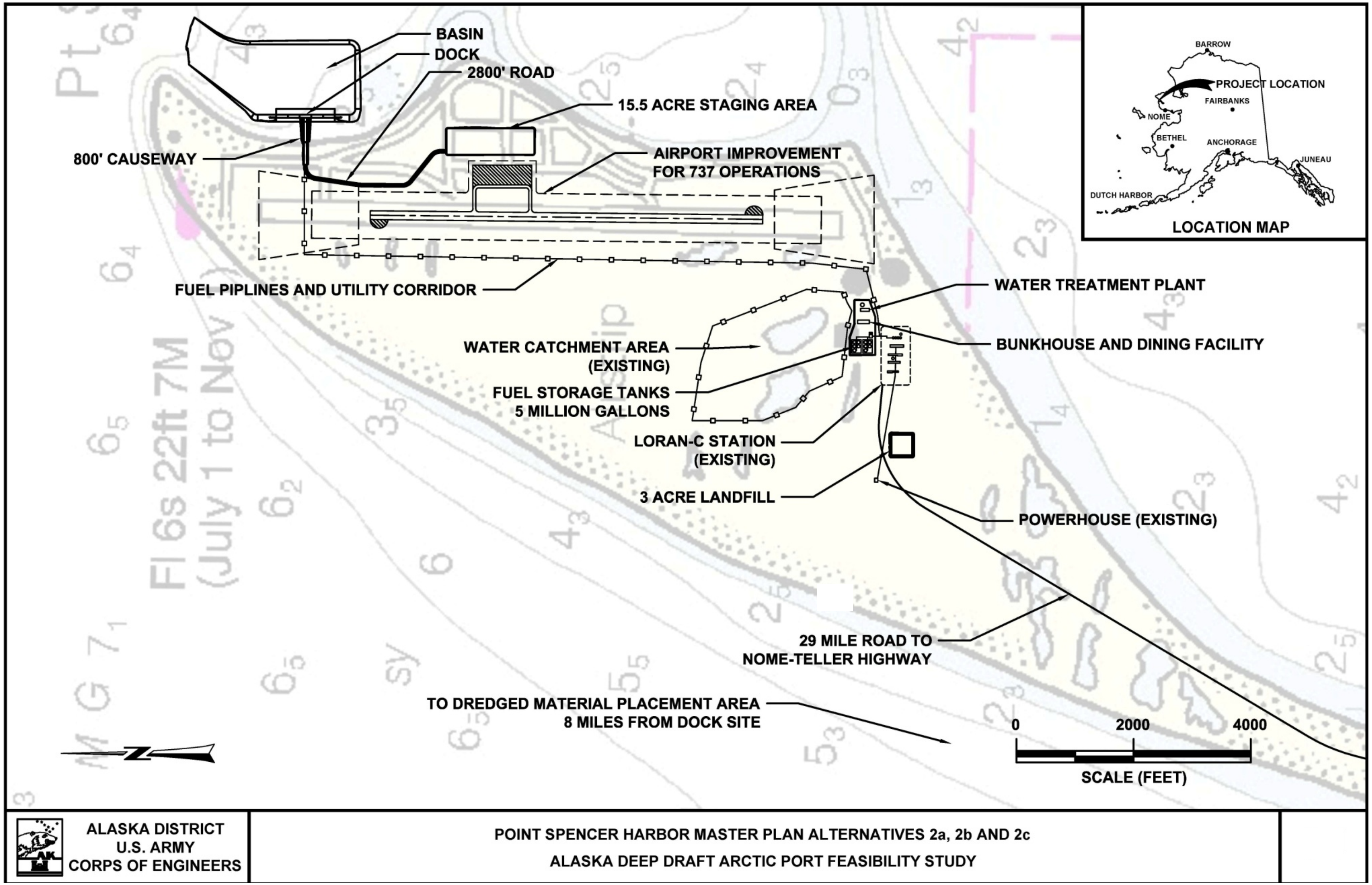

Figure 18: Alternative 2A

6.3.3.3.2 Alternative 2B

Alternative 2B would mirror Alternative 2A but would extend the dock from 200 feet in length to 600 feet (61 to 183 meters) in length.

6.3.3.3.3 Alternative 2C

Alternative 2C would mirror Alternative 2A but would extend the dock from 200 feet in length to 1,000 feet (61 to 305 meters) in length.

6.3.3.4 Nome-Point Spencer Combinations (Alternatives 3A-3I)

Iterative combinations of the various options were assembled to find the most practicable combination of features available. Since these combinations include Nome and therefore a jet-capable runway, the runway at Point Spencer would only be upgraded to its previous status as a propeller-aircraft capable runway. In addition, road access from Point Spencer to the Nome-Teller Highway would not be required. Various upland improvements at Point Spencer were examined for uses including: dredged material disposal and creation of fast lands above expected inundation levels. These lands would be used for development of local service facilities including housing, power, bulk fuel storage, etc.

6.3.3.5 Cape Riley (Alternative 4)

This stand-alone alternative would not construct navigation improvements at Nome. It would focus mainly on providing improvements that would benefit: Search and Rescue operations, resource development, and emergency response.

The Cape Riley Alternative includes the construction of a 5.5-mile (10 kilometers) long access spur from the Nome-Teller Highway, a 1,575-foot-long (480 meters) rubblemound breakwater, a 1.5-acre staging area, a 250-foot-long (76 meters) concrete caisson dock, a 550-foot (167 meters) wide turning basin, and associated entrance channel dredging to -12.5 feet (3.8 meters) MLLW. This selected depth was based on the anticipated design drafts of tugs and barges hauling ore from the Graphite One Mine. See Figure 19.

Construction of the breakwater would require approximately 48,300 cubic yards of A rock, 29,500 cubic yards of B rock, and 35,900 cubic yards of C rock.

This alternative would require dredging of approximately 200,000 cubic yards for an entrance channel and turning basin with side slopes of 3H:1V. Dredged materials are anticipated to consist of silts, sands, gravel, cobbles, and glacial till. Because of these materials, the anticipated dredging method would be with a clam shell dredge. With the anticipated bottom material and low tidal currents in the area, any required maintenance dredging is expected to be minimal.

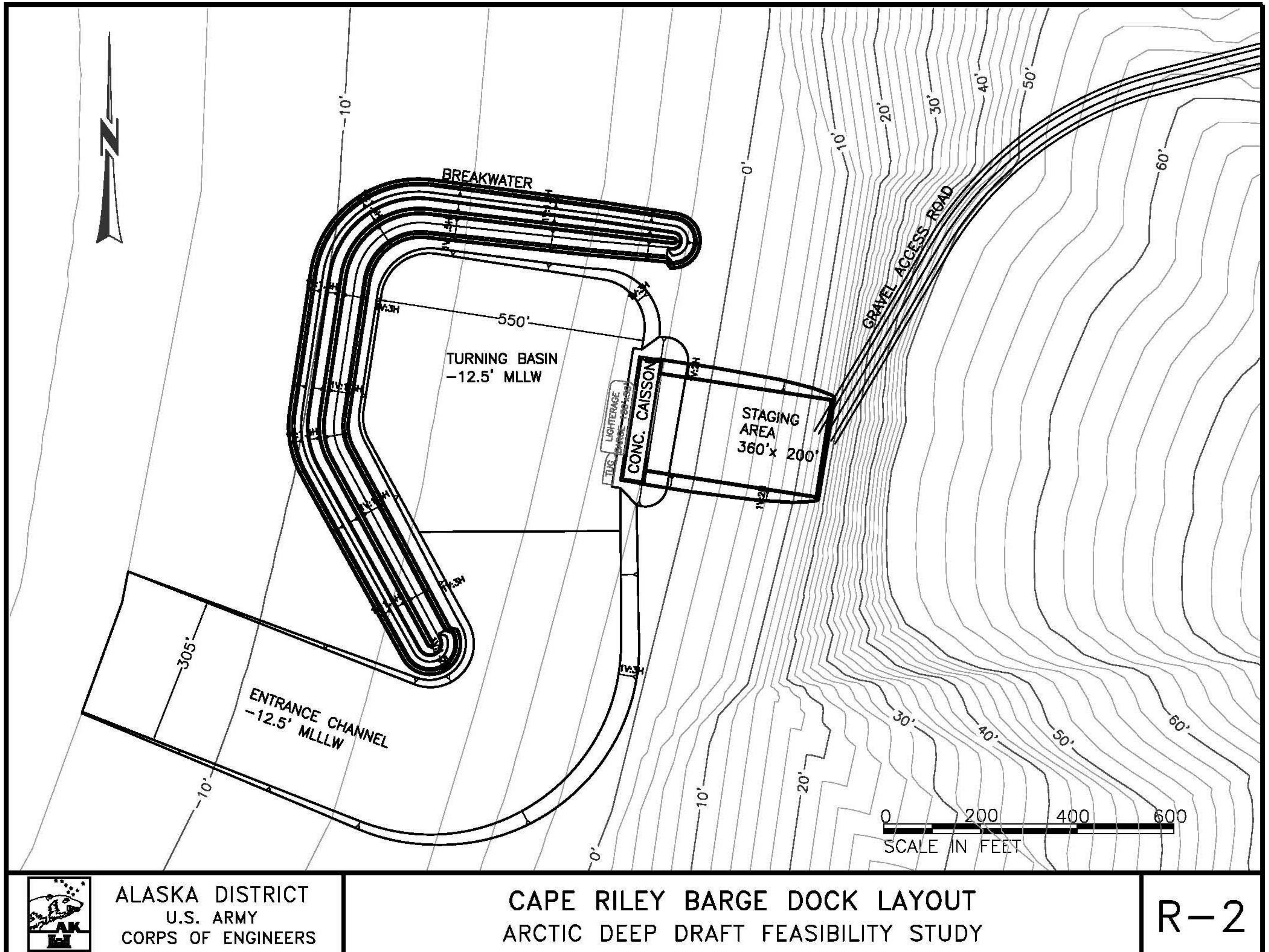

Figure 19: Cape Riley Alternative

6.3.3.6 Point Spencer and Cape Riley

Given that the Cape Riley alternative was not incrementally justified, this combination plan was eliminated from further consideration.

6.3.3.7 Nome and Cape Riley

Given that the Cape Riley alternative was not incrementally justified, this combination plan was eliminated from further consideration.

6.3.3.8 Nome, Point Spencer, and Cape Riley

Given that the Cape Riley alternative was not incrementally justified, this combination plan was eliminated from further consideration.

Site alternatives selected for further consideration follow.

6.3.4 Alternatives Eliminated from Consideration

6.3.4.1 Nome Oil & Gas Alternatives (1A2, 1B2, and 1C2)

These alternatives were quickly eliminated based on analyses of the incremental cost above other alternatives at Nome compared with the benefits they would render. Modification of the east breakwater to a configuration similar to that of the existing western causeway would increase the cost of the project by approximately three times while rendering little in the way of additional navigation benefits. Because these alternatives provide a similar level of navigation benefits at a greater cost than other Nome-based alternatives, they fail the efficiency test and were therefore eliminated from further consideration.

6.3.4.2 Point Spencer (Alternatives 2A, 2B, and 2C)

The current use of Port Clarence which is protected by Point Spencer is refuge for larger vessels during storms, which is expected to continue into the future. Various entities have discussed Point Spencer development that will support the oil and gas and other deep-draft industries, but presently none exist. Once industry demonstrates the need to transport materials on or off Point Spencer, a Federal navigation project would be needed. When Point Spencer is developed and inefficiencies are experienced due to lack of depth or other harbor limitations, re-investigation of Point Spencer by the Corps of Engineers would be warranted.

There are several indications a project would be needed in the future. The land ownership at Point Spencer is undergoing negotiations between the U.S. Coast Guard, Bering Straits Native Corporation, and the State of Alaska which demonstrates multiple parties' interest in development at Point Spencer. In addition, Bering Straits Native Corporation and others have been exploring public-private partnerships in developing marine facilities. Though not identified, a port authority, or some other governmental entity would likely serve as the non-Federal sponsor. As marine facilities are developed, the need for navigation access will increase thus warranting a re-examination of Point Spencer potential for a Corps project.

6.3.4.3 Cape Riley (Alternative 4)

While Cape Riley has naturally deep water and lies in the partially protected waters of Port Clarence, navigation improvements are infeasible at this time as the net annual costs for those improvements are more than the potential net annual benefits. A 5.5-mile (10 kilometer) road would be required to access the Nome-Teller highway. Facilities would also be required to transport material from the bluff's edge to tidewater. If these elements were constructed prior to a Corps project, a re-assessment would be warranted.

One private owner has been identified as a possible user of Cape Riley. Vessels owned by this user would haul ore out of the Graphite One Mine. However, Corps policy prohibits navigation improvements construction to benefit a single, private owner. No port authority exists and no public entity has plans to develop at this site. For these reasons, Cape Riley was eliminated from further consideration.

6.3.4.4 Combination Plans (Alternatives 3A-3I)

Since Point Spencer and Cape Riley were eliminated as standalone plans, all combination plans that included these eliminated plans were also eliminated.

6.3.5 Alternatives Carried Forward for Further Consideration (Alternatives 1A, 1B, and 1C)

The three standalone Nome alternatives were included for further consideration. This standalone site provides the same type benefits as the other sites at a lower overall cost, making it the most efficient site. Issues affecting slow upland development of support facilities do not exist, and an identified non-Federal partner is willing to cost-share navigation improvements. Because of these benefits, Nome was included for further consideration.

7.0 COMPARISON AND SELECTION OF PLANS

7.1 Comparison of Plans

Alternatives 1A, 1B, and 1C were compared based on their ability to provide incremental navigation benefits given their relative increases in costs (See Table 24). After further evaluation of the expected vessel traffic throughout the period of analysis, it was determined that given the capacity provided by an additional dock being constructed by the City of Nome prior to construction of this project, the dock capacity provided by Alternative 1A would be sufficient to capture expected project benefits and that the construction of additional dock space included in Alternatives 1B and 1C would not be incrementally justified. Therefore, Alternative 1A is selected as the most efficient alternative.

Table 24: Comparison of Alternatives

Alternative	Average Annual Costs
1A	$11,462,000
1B	$12,753,000
1C	$13,289,000

Note: These estimates were developed in 2012 as a rough order of magnitude for comparison purposes only and have not been inflated to current. However, each alternative is expected to provide the same amount of benefits and therefore this comparison is still valid.

7.2 Examined Depths

While the Nome project was carried forward, the correct depth of the project still needs to be determined to adequately identify the NED plan. Depths of -28 feet, -30 feet, -32 feet, and -35 feet (8.5, 9.1, 9.7, and 10.6 meters respectively) MLLW were analyzed to determine the tentatively selected plan (the optimization of the project to one of the above identified depths is ongoing).

Institute for Water Resources Report 10-R-4, "*Deep Draft Navigation,*" suggests that depth be measured in one foot increments to determine the optimal depth. However, discussions with the Deep Draft Navigation Planning Center of Expertise revealed that for this study, the increments listed above were reasonable and more efficient based on the expected vessel traffic.

7.3 Design Vessels

Based on existing and projected future vessel traffic associated with the Port of Nome, two design vessels were selected. These are the largest vessels expected to regularly call at Nome, with-project depths requiring five-foot underkeel clearances.

7.3.1 Tanker

The tanker currently calling at Nome is also the largest vessel expected in cases where with-project condition depths are less than -35 feet (10.6 meters) MLLW. This design vessel is 417 feet (127 meters) long with a 67-foot (20 meter) beam and a 29 foot (8.8 meter), fully loaded design draft. In the without-project condition, the tanker is limited to a draft of 17 feet (5 meters) in order to ensure adequate underkeel clearances.

7.3.2 Icebreaker

Once project depths reach -35 feet (10.6 meters) MLLW, various new vessels would be able to call at Nome, including the largest vessel, the USCSC Healy. The Healy is 420 feet (128 meters) long with an 82-foot (25 meters) beam and a 29.3 foot (9 meters) design draft. The Coast Guard requires five feet of underkeel clearance for this vessel. Therefore, the shallowest draft that can accommodate the Healy is -35 feet (10.6 meters) MLLW. Because of this, the Healy is the design vessel for the -35 feet (10.6 meters) MLLW with-project condition.

The design draft of the tanker and the Healy are similar; however, the tanker can light load to enter the harbor at a shallower draft, while the Healy does not have that capability.

7.4 Multiport Analysis

Corps policy dictates that deep draft navigation studies consider the degree to which ports operate as a system. Because of a limited transportation infrastructure in northern and western Alaska, no overlap exists in hinterlands served by Nome and those served by other ports. In the absence of navigation improvements at Nome, it is likely that the future without-project condition would persist with petroleum-related navigation continuing to operate out of Dutch Harbor.

7.5 Comparison of Alternative Plans

With depths of -28-feet (8.5 meters) MLLW, the Nome alternative has been identified as the NED plan. Plans with deeper depths may produce additional benefits, but the costs for those plans are greater than potential benefits.

7.6 With-Project Condition

As with the without-project condition, the degree to which the analyzed alternatives provide benefits depends heavily on petroleum development in the Chukchi Sea. Because of this, the different with-project conditions will be discussed separately.

7.6.1 With-Project Condition – No Growth and Base Case Scenarios

Additional depth at Nome will allow some vessels to call at a dock that must anchor offshore in the without-project condition. Due to requirements for underkeel clearance, assumed tidal availability, and other considerations, vessels that draft 22 feet (6.7 meters) or less will be able to access Nome Harbor in the with-project condition. Therefore, even with an increase in depth to -28 feet (10.6 meters) MLLW, certain ships that call on Nome will be unable to enter the harbor. Specifically, large cruise ships, government vessels, and research vessels will still be required to anchor offshore.

Due to natural growth in existing industries at Nome, including dry goods, gravel, and fuel, a corresponding overall increase in vessel calls will result, as shown in Table 25.

Table 25: With-Project Base Case Vessel Calls

Vessel Calls	2012	2020	2030	2040
No Growth Scenario	224	284	284	284
Base Case Scenario	224	284	364	462

The number of total vessel calls in the with-project condition is slightly less than the without-project base case scenario due to three fewer tankers calling at Nome. With the increased depth, tankers will be able to enter the harbor more fully loaded. There would be a corresponding reduction in the number of tug and barge pairs for lightering the tankers in the without-project condition. It is important to note that the amount of commodities remains unchanged from the without-project condition under the base case.

7.6.2 With-Project Conditions – Base Case Petroleum Development Scenario

Under this scenario, large cruise ships, government vessels, and research vessels will still be required to anchor offshore of Nome. The lightering of goods remain the same under the no growth and base case scenarios. In addition to these vessels, some petroleum-related vessels would draft too deeply to enter Nome Harbor.

Despite similar offshore anchoring requirements, more vessels will demand moorage at Nome, including vessels associated with petroleum exploration and development. Petroleum-related vessels are assumed to pre-stage at Dutch Harbor, but a larger fleet will be assigned because of increased exploration and development in the Chukchi Sea.

Under this scenario, Nome is expected to more than double its vessel calls as petroleum exploration and production activities increase.

Table 26: With-Project Base Case Petroleum Development Scenario Vessel Calls

Vessel Calls	2020	2030	2040
Petroleum Vessels	193	301	407
Graphite Export	0	0	0
Additional Research Vessel Calls	2	6	10
Additional Cruise Ship Calls	3	9	18
Additional Government Vessel Calls	13	33	33
Subtotal	211	349	468
Base Case Petroleum Development Calls	284	364	462
Total Vessel Calls	495	713	930

Under the petroleum development scenario, an increase is anticipated in shipped dry goods to support petroleum and vessel activity through Nome.

This increase is shown in Table 27.

Table 27: Commodities (MT) Transferred at Nome, With-Project – Base Case Petroleum Development Scenario

Year	Fuel	Dry Cargo	Gravel	Graphite	Total	Increase From Base Case	
						Metric Tons	Percentage
2009	46,352	26,801	81,683	0	154,836	0	0%
2010	38,134	28,441	154,068	0	220,643	0	0%
2011	25,088	34,377	63,435	0	122,901	0	0%
2012	45,523	57,788	33,058	0	136,370	0	0%
2013	30,786	42,217	2,181	0	75,184	0	0%
2020	44,075	68,039	55,241	50,000	167,355	61,690	40%
2030	48,658	136,078	60,177	50,000	244,913	107,475	57%
2040	53,240	204,117	65,114	50,000	322,471	153,259	70%
2050	53,240	204,117	65,114	50,000	322,471	153,259	70%
2060	53,240	204,117	65,114	50,000	322,471	153,259	70%
2070	53,240	204,117	65,114	50,000	322,471	153,259	70%

Table 28 summarizes the total transportation costs for the with-project condition in the base case. These calculations use the same method as the without-project condition - in HarborSym using detailed input and output data as described in the Economics Appendix.

Table 28: Transportation Costs, FWP Base Case Scenario

Year	Vessel Calls	Transportation Costs		Commodities (MT) Transferred
		Total	Allocated to Port	
2020	280	$124,254,000	$22,812,000	154,424
2030	358	$138,376,000	$24,870,000	184,538
2040	458	$158,230,000	$27,507,000	219,500

Table 29 summarizes the future with project vessel wait times in the base case, as calculated in HarborSym.

Table 29: Wait Times, FWP Base Case Scenario

Year	Vessel Calls	Wait Time (hrs)		Transfer Time (hrs)	Docking Time (hrs)	Undocking Time (hrs)
		Dock	Channel			
2020	280	76	89	8,394	134	98
2030	358	86	95	10,336	169	125
2040	458	62	152	13,040	213	158

Section 7.5.2 – With-Project Conditions – Base Case Petroleum Development Scenario

Table 30 summarizes the total transportation costs for the Petroleum Development Scenario, while Table 31 shows the vessel delay time. These calculations are conducted utilizing HarborSym. Detailed information on modeling inputs and outputs are available in the Economics Appendix.

Table 30: Transportation Costs, FWP Base Case Petroleum Development Scenario

Year	Vessel Calls	Transportation Costs		Commodities (MT) Transferred
		Total	Allocated to Port	
2020	478	$198,131,000	$80,704,000	334,562
2030	697	$275,015,000	$102,759,000	505,529
2040	918	$323,572,000	$120,775,000	676,711

Table 31: Wait Times, FWP Base Case Petroleum Development Scenario

Year	Vessel Calls	Wait Time (hrs)		Transfer Time (hrs)	Docking Time (hrs)	Undocking Time (hrs)
		Dock	Channel			
2020	478	78	584	13,410	266	186
2030	697	111	1,256	18,601	397	275
2040	918	73	2,438	23,957	517	359

7.7 Summary of Accounts and Plan Comparison

Table 32 presents a summary of the total present value of future without-project costs, future with-project costs, benefits, and average annual benefits. See Economics Appendix for the detailed analysis.

Table 32. Summary Present Value Transportation Costs and Benefits, by Scenario

Scenario Name	Total Present Value Transportation Costs			Average Annual Benefits
	Future Without Project	Future With Project	Benefits	
Base Case	$667,694,000	$638,414,000	$29,280,000	$1,220,000
No Growth	$582,690,000	$565,839,000	$16,850,000	$702,000
Base Case Oil and Gas Development Scenario	$2,860,570,000	$2,583,621,000	$276,948,000	$11,542,000

8.0 TENTATIVELY SELECTED PLAN

8.1 Description of Tentatively Selected Plan

The tentatively selected plan (TSP) includes the demolition of the existing spur breakwater at the end of the causeway, construction of a 2,150-foot-long (655 meter) causeway extension and 450-foot-long (137 meter) dock, and dredging the newly created protected area and associated entrance channel to -28 feet (8.5 meters) MLLW. This plan maximized net NED benefits and was selected as the NED Plan. The plan is acceptable to the local sponsor and became the Tentatively Selected Plan.

8.1.1 Plan Components

8.1.1.1 Causeway Extension

Under this plan, the existing stub breakwater would be demolished and a 2,150-foot-long (655 meter) causeway extension would be constructed to natural depths of -28 feet (8.5 meter) MLLW.

8.1.1.2 Dock

A 450-foot-long (137 meter) dock would be constructed on the harbor side of the causeway extension to provide moorage to vessels requiring depths of -28 feet (8.5 meter) MLLW. See Figure 20.

8.1.1.3 Dredging

Dredging may employ either a cutter head or clamshell. Materials may be disposed of through direct placement onshore, or in the nearshore environment inside of the zone of closure to ensure materials are pushed to the beach through wave action.

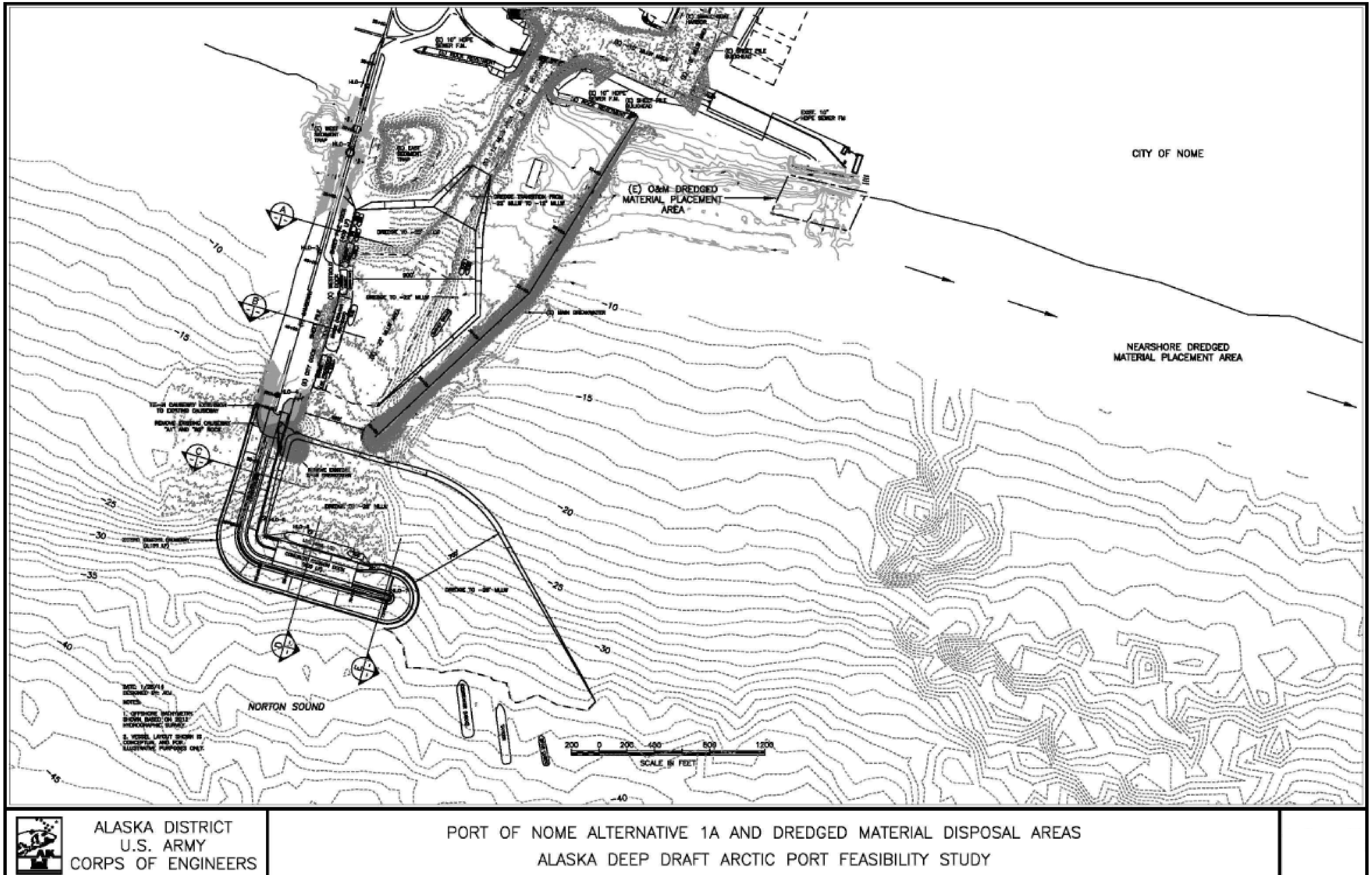

Figure 20: Tentatively Selected Plan – Nome Alaska

8.1.2 Plan Costs and Benefits

Table 33: Recommended Plan Costs and Benefits

Cost Category	Amount
Mobilization/Demobilization	$6,290,000
Demolition	$1,484,000
Breakwaters	$112,880,000
Dredging	$5,011,000
Docks	$20,612,000
Utilities	$2,096,000
Total NED First Costs	**$148,586,000**
Contingency (30 percent)	$43,743,000
Supervision and Administration	$15,386,000
Interest During Construction	$7,050,000
Present Value of Operations & Maintenance	$5,853,000
Total Present Value Project Costs	**$220,617,000**
Average Annual Costs (50 years at 3.375 percent)	$9,195,000
Total NED Benefits	$276,948,000
Average Annual Benefits	$11,542,000
Net Annual Benefits	**$2,347,000**
Benefit to Cost Ratio	1.26

8.1.3 Construction

8.1.3.1 Federal

The Corps will be responsible for construction of the general navigation features to include dredging and construction of the causeway extension. The U.S. Coast Guard will be responsible for installing any required aids to navigation.

8.1.3.2 Non-Federal

The City of Nome will be responsible for construction of the local service facilities to include the new dock.

8.1.4 Financial Analysis

The non-Federal partner's capability to provide funding is largely dependent upon grants from the State of Alaska either through direct capital project funding or through legislative grant. The State of Alaska could make this project a State-priority, in which case funding would likely be made available.

8.1.5 Dredging and Disposal

The tentatively selected plan would dispose of dredged material on the beach downdrift of the harbor. The amount of dredged material is comparable to that placed on the beach during regular Operations and Maintenance (O&M) operations.

8.1.6 Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRRR)

Total present value of the OMRRR cost for the tentatively selected plan over the 50-year period of analysis is $5.8 million. A brief discussion of the Federal and non-Federal responsibilities follows.

8.1.6.1 Federal

The Corps of Engineers will be responsible for maintenance of all general navigation features including breakwaters and O&M dredging of Federally authorized channels and turning basins.

8.1.6.2 Non-Federal

The City of Nome will be responsible for maintenance of all local service facilities including dock facilities and berthing areas.

8.1.7 Mitigation

Significant adverse environmental impacts have been avoided through plan formulation and project design. Compensatory mitigation is not proposed for this project. Impacts associated with placement of dredged material generated by the project are comparable to an operations and maintenance (O&M) activity, and the loss of two-dimensional soft bottom habitat within the causeway extension footprint is expected to be offset by the gain in three-dimensional (vertical), structurally complex, rocky habitat.

Incorporating the following mitigation measures into the preferred alternative ensures that nothing more than short-term, minor adverse impacts would occur to local water quality and local fish and wildlife populations, including ESA-listed species and their critical habitats, marine mammals, and essential fish habitat (EFH).

1. Consistent with the conditions of Alaska Department of Fish and Game Fish Habitat Permit FH13-III-0027, in-water construction may commence as soon as the ice goes out through June 25th within the harbor and entrance/inner channel, and through July 31st within the breakwater and causeway;

2. Dredging activities will cease if fish are observed in dredged sediments discharged to the beach. Coordination with the Alaska Department of Fish and Game will be initiated to determine if species and/or numbers are of concern before commencing with further dredging;

3. Fish passages constructed in the existing causeway and breakwater will be maintained to facilitate near shore migration of fish;

4. To accelerate recolonization of the causeway extension, all suitable for reuse armor rock removed from the existing breakwaters with sessile or attached adapted marine organisms and marine algae shall be used in constructing the new breakwater segments. If not reused, the rock shall be side cast to the base of the breakwater so that it may continue to provide habitat for marine resources;

5. Breakwater construction shall use core material and B and armor rock clean of organic debris and invasive species;

6. Workers conducting in-water construction will be instructed to watch for marine animals, and cease work if an animal approaches within 50 meters;

7. The selected contractor shall include an Oil Spill Prevention and Control Plan in its Environmental Protection Plan, which is submitted to the Corps for review and approval;

8. To minimize the danger to marine mammals from project-related vessels, speed limits (e.g. less than 8 knots) shall be imposed on vessels moving in and around the project area;

9. Project-related vessels and barges shall not be permitted to ground themselves on the bottom during low tide period unless there is a human safety issue requiring it; and

10. The causeway extension will be constructed prior to dredging. The causeway extension will help contain as much as possible of the turbid water.

8.2 Plan Accomplishments

Construction of the tentatively selected plan as described above would meet a number of planning objectives and provide navigation improvements and increased efficiency throughout the region.

The tentatively selected plan meets Planning Objective 1 by providing navigation improvements to multiple maritime missions in the Arctic. This project would provide sufficient draft for petroleum support vessels traveling to and from the Chukchi Sea, an 800-mile (1,482 kilometer) improvement over their current routing to/from Dutch Harbor.

The tentatively selected plan meets Planning Objective 2 by facilitating economic growth locally, regionally, statewide, and nationally. The economic analysis conducted within this study shows that this project contributes positively to both regional and national economic development. The petroleum industry contributes the majority of total annual revenues received by the State of Alaska. Increasing and supporting this vital industry contributes to the State of Alaska as a whole. This project would increase the amount of maritime activity at Nome, necessitating the development of support functions including those both directly and indirectly associated with the Port.

The tentatively selected plan meets Planning Objective 3 by being compatible with cultural, subsistence, and natural resources. Through avoidance and minimization, the project has been formulated in a way that is not expected to adversely impact any cultural, subsistence, or natural resource.

The tentatively selected plan meets Planning Objective 4 by taking into account existing and potential shore-side facilities. Nome has access to multimodal transportation links (air and regional roads), has established marine support services, and has developed other essential upland services such as cargo staging areas.

The tentatively selected plan meets Planning Objective 5 by continuing the established working partnership among the Corps of Engineers, the State of Alaska, and the City of Nome in serving the needs of the growing maritime industry in Northwest Alaska. Responsibility for developing this project to meet its expected potential is one of shared responsibility involving investments by Federal, State, and local government as well as private industry.

The tentatively selected plan meets Planning Objective 6 by allowing for multi-purpose use of Arctic resources. The project will serve many users including those engaged in petroleum development, mining, fishing, and transportation.

The tentatively selected plan is expected to serve an average of 930 vessel calls per year by the year 2040. These vessels include commercial fishing vessels, barges, tugboats, petroleum support vessels, tankers, gold dredges, cruise ships, and research vessels. By the year 2040, the project is expected to accommodate a fleet of approximately 50 vessels in support of the petroleum industry, contributing approximately $24 million in annual transportation benefits related to petroleum-related navigation alone.[13] This project will enable the petroleum support vessels to resupply, refuel, and conduct crew changes in a more efficient manner than what currently exists or would exist absent this project.

This project will increase efficiencies for the local fleet by decreasing congestion that delays local traffic entering and exiting the port and will allow the tanker to call on the port at a deeper loaded depth.

[13] Economics Appendix, Table 47

Due to the with-project draft of -28 feet (8.5 meters) MLLW, icebreakers will be unable to enter the harbor but will likely continue to anchor outside of the harbor with crew utilizing land-side facilities.

8.3 Integration of Environmental Operating Principles

Environmental operating principles have been integrated into the planning process wherever possible. Specific considerations follow.

Foster sustainability as a way of life throughout the organization: This project's selected location is the most likely to be sustainable into the future. Nome is a well-established community with a strong dedication to operating a robust and efficient harbor. The implementation of navigation improvements at Nome would reduce the amount of fuel used by petroleum support vessels during resupply trips, contributing to a decrease in the amount of fossil fuels utilized by the fleet when compared to the without-project condition.

Proactively consider environmental consequences of all Corps activities and act accordingly: The environmental review analyzed the beneficial and adverse effects of the proposed project on both the natural and built environment. The review also proposed avoidance, minimization, and mitigation measures as necessary to address adverse effects on the environment.

Create mutually supporting economic and environmentally sustainable solutions: The tentatively selected plan is the NED plan and therefore provides the maximum amount of benefits to the nation. The project was formulated to make it lasting and avoid long-term environmental impacts wherever possible.

Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps which may impact human and natural environments: An environmental assessment of potential impacts on the human and natural environment was conducted as required by NEPA. In addition, the principles of avoidance, minimization, and mitigation were implemented to the maximum extent possible.

Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs: This project has been designed in the context of climate change (in this case, the melting of sea ice) as it affects the opening of shipping channels in the Arctic region. As part of a broader study on this topic, the current project is designed to minimize risks to both the environment and navigation over the longer term through development of deep-draft port facilities to serve the exponential growth in vessel traffic. The project also provides for search and rescue, oil spill response, and other environmental and human benefits.

Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner: The Corps attended several meetings with the community and actively sought local and institutional knowledge associated with the human and natural environments that may be affected, both positively and negatively, by both action and inaction. This community feedback has been integral to proper formulation of alternatives. The Corps worked with other agencies to collect pertinent information throughout the preparation of the overall Arctic study and the environmental assessment. This information has been organized in a manner to create a more complete knowledge base about the area, its challenges, and its opportunities.

Employ an open, transparent process that respects the views of individuals and groups interested in Corps activities: The Corps has followed all applicable laws, regulations, and guidelines, including the National Environmental Policy Act (42 U.S.C. 4371 *et seq.*), CEQ Regulations for Implementing NEPA 40 CFR 1500 *et seq.*), and U.S. Army Corps of Engineers' regulations implementing NEPA (ER 200-2-2) for public involvement and has been responsive to stakeholder concerns. Public input has been solicited throughout the study and used for both environmental and economic analysis purposes. The Corps and the State of Alaska have worked extensively with stakeholders and the public during overall plan development and this specific project to solicit their input and feedback on alternatives, environmental effects, and appropriate avoidance, minimization, and mitigation measures.

8.4 Real Estate Considerations

This project lies within Section 35, Townships 11S, Range 34W, of the Kateel River Meridian. All submerged lands necessary for construction, operation, and maintenance of the proposed project are subject to navigational servitude. Lands, easements, relocations, and rights-of-way required for construction include those listed below in Table 34.

Table 34: Real Estate Requirements

Features	Owners	Acres	Interest	Category
Entrance Channel, Breakwater, Causeway, and Dock (BMHW)	City of Nome	112.0	Navigational Servitude	GNF
Entrance Channel, Breakwater, Causeway, and Dock (AMHW)	City of Nome	1.6	Navigational Servitude	GNF
Mooring Basin (BMHW)	City of Nome	7.1	Navigational Servitude	LSF
Dredged Material Disposal Site	City of Nome	20.0	Navigational Servitude	GNF

Notes to table: GNF: General navigational feature; LSF: Local service facilities

8.5 Summary of Accounts

USACE planning guidance establishes four accounts to facilitate and display effects of alternative plans. Previous studies have relied primarily on the use of the National Economic Development (NED) account showing the changes in economic value of the national output of goods and services. A benefit/cost ratio and an indication of the change in net benefits is the output of the NED evaluation and for this study forms the basis of the selected plan.

Also included as part of this study are evaluations of the Environmental Quality (EQ), the Regional Economic Development (RED) effects, and the Other Social Effects (OSE). EQ displays the non-monetary effects of the alternatives on natural and cultural resources and is described more fully in the integrated report. The RED benefits result in increased employment and income for the region and the state, and the OSE are generally positive and beneficial. Each of these is discussed in more detail as follows.

8.5.1 National Economic Development

The tentatively selected plan is the NED plan and provides the greatest amount of net annual benefits to the nation. It is the most effective plan at reducing navigational inefficiencies due to a lack of moorage facilities along Alaska's northern and western coasts.

8.5.2 Regional Economic Development

Economic benefits that accrue to the region but not necessarily to the nation include the shifting of vessel calls to Nome and from Dutch Harbor. This shift would bring new tax revenues to Nome that may or may not be offset by any decrease in receipts accruing to Dutch Harbor. More impact is seen during construction activities. The RECONS model was used to determine RED benefits that would accrue to the region and state. The economic impact of construction activities is shown below in Table 35. The impacts of jobs and income are a direct result of the construction activities and the jobs that are created or retained as a result of this activity.

Table 35: Regional Economic Impacts Due to Construction Activities

Region	Breakwater	Dock	Dredging	Total
Sales	$137,785,000	$8,074,000	$911,000	$146,770,000
Jobs	1,222	221	14	$1,457
Labor Income	$60,730,000	$5,773,000	$399,000	$66,902,000
GRP	$80,206,000	$6,563,000	$570,000	$87,339,000
State	**Breakwater**	**Dock**	**Dredging**	**Total**
Sales	$238,673,000	$38,052,000	$6,048,000	$282,773,000
Jobs	2,224	434	36	2,694
Labor Income	$107,235	$19,449,000	$2,227,000	$21,783,235
GRP	$145,824,000	$25,765,000	$3,428,000	$175,017,000
Total:	$663,328,681	$103,676,655	$13,583,050	$780,588,386

Note to table: GRP: Gross regional product

8.5.3 Environmental Quality

The proposed construction of a new harbor as discussed in this document would have minor but less than significant short-term environmental impacts. In the long term, the project is expected to improve the overall quality of the human environment.

8.5.4 Other Social Effects

Of greatest concern for the Other Social Effects evaluation is the lack of infrastructure in the region which reveals itself in the Health and Safety factors with a project at Nome. Mental and physical health and physical safety are all seen as improved with the Tentatively Selected Plan. Many see this port development as the stepping stone to increased economic development in the region with the promise of additional work-for-wages employment. One potential negative social factor is the loss of cultural identity as the Alaska Native way of life and individuals may be faced with the difficult choice of balancing a subsistence way of life with wage employment or having to choose between the two.

Table 36 Nome Alone Social Factors Metrics Evaluation

Social Factors	Metrics	Without-Project	Nome Alone
Health and Safety	Mental Health	0	+
	Physical Health	0	++
	Physical Safety	0	++
	Special Issues - Arctic	0	+
Economic Vitality	Business Climate	0	+
	Employment Opportunities	0	++
	Financial Impacts	0	+
	Tax Revenues	0	+
	Special Issues - Subsistence	0	0
Social Connectedness	Community Cohesion	0	0
	Community Facilities	0	0
	Special Issues – Traditional Knowledge	0	0
Identity	Cultural Identity	0	-
	Community Identity	0	0
	Special Issues – Alaska Native Way of Life	0	0
Social Vulnerability and Resiliency	Residents of Study Area	0	+
	Socially Vulnerable Groups	0	+
Participation	Public Participation	0	+
Leisure and Recreation	Recreational Activities	0	+

Notes to table: 0: Neutral -: Negative +: Positive ++: Very positive

Table 37 shows the four accounts for this alternative under each of the scenarios used in this evaluation.

Table 37 Four Accounts Summary for the Tentatively Selected Plan

Scenario Name	NED Net Benefits (B/C Ratio)	EQ	RED	OSE
Base Case	-$7,975,000 (0.13)	Positive	Increased employment and income for the region and the state	Beneficial
No Growth	-$8,493,000 (0.08)	Positive	Increased employment and income for the region and the state	Beneficial
Base Case Oil and Gas Development Scenario	$2,347,000 (1.26)	Positive	Increased employment and income for the region and the state	Beneficial

Note: Highlighted scenario is considered most probable.

8.6 Risk and Uncertainty

Fleet characteristics used as the basis for this evaluation and the volume of dredged material have been identified as potentially substantial risk factors for the study. These are discussed in turn.

8.6.1 Fleet Characteristics

The characteristics of the fleet are uncertain. The Arctic region is changing rapidly and while the petroleum industry has prepared operational plans, those are subject to change. In addition, there is strong advocacy for additional Coast Guard and research vessel capability in the Arctic along with international interest in the area. The Project Delivery Team (PDT) coordinated with the Vertical Team including the Deep Draft Navigation Planning Center of Expertise (DDN-PCX) to develop all key assumptions. Assumptions are deliberatively conservative in order to demonstrate the viability of the project.

8.6.2 Dredged Material Volume

During depth optimization, the volume of dredged material may substantially change. While this change alone is not expected to trigger the need for an Environmental Impact Statement in the place of an Environmental Assessment, it could substantially change construction plans and the mix of equipment needed for construction. Should the volume of dredged material exceed the amount considered acceptable for disposal for the beneficial purpose of beach nourishment, and an ocean dredged material disposal site (ODMDS) need to be designated under the Marine

Protection, Research and Sanctuaries Act (MPRSA), then an Environmental Impact Statement may be necessary.

8.7 Cost Sharing

Section 101 of PL 99-662 specifies cost shares for general navigation features in accordance with channel depth. For projects greater than 20 feet, the cost share is 75 percent Federal and 25 percent non-Federal. For dredging projects less than 20 feet, the cost share is 80 percent Federal and 20 percent non-Federal. The cost-share is paid during construction. Section 101 also requires the project sponsor to pay an additional amount equal to 10 percent of the total construction cost for general navigation features. This may be paid over a period not to exceed 30 years and Land, Easements, and Rights-of-way may be credited against it.

8.7.1 Cost Apportionment

Construction of the project will be apportioned in accordance with the Water Resources Development Act of 1986, as amended. The fully funded cost apportionment for the project features is summarized in Table 38.

Table 38: Construction Cost Apportionment

Portion of Project	Cost Contribution (%)	
	Federal	Non-Federal
General Navigation Features	65	35
Dredging to minus 20 feet	80	20
Dredging from minus 20 to minus 45 feet	65	35
Local Service Facilities	0	100
Aids to Navigation	100	0

Note: The non-Federal sponsor is also required to pay an additional 10 percent over time minus any credits.

8.7.1 Cost Allocation

Table 39 shows the cost allocation based on the most recent cost estimate and assuming an October 2014 price level. Figure 21 shows a representation of where these features lie within the project.

Table 39: Cost Allocation for Tentatively Selected Plan

Items	Total Project Costs	Implementation Costs			
		Federal	%	Non-Federal	%
General Navigation Features (GNF):					
Mobilization/Demobilization	$8,723,000	$6,542,250	75	$2,180,750	25
Demolition	$2,115,000	$1,586,250	75	$528,750	25
Breakwaters	$127,332,000	$95,499,000	75	$31,833,000	25
Dredging Above -20 feet MLLW	$3,769,000	$3,392,100	90	$376,900	10
Dredging Below -20 feet MLLW	$4,512,000	$3,384,000	75	$1,128,000	25
Survey	$280,000	$210,000	75	$70,000	25
Preconstruction, Engineering, & Design	$3,000,000	$2,250,000	75	$750,000	25
LERRD (GNF) Admin Costs	$25,000	$0	0	$25,000	100
Subtotal GNF	$149,756,000	$112,317,000	75	$37,439,000	25
Additional Funding Requirement					
10% of GNF		($14,975,600)		$14,975,600	
GNF LERRD Credit		$0		$0	
Adjustment for GNF LERRD credit		($14,975,600)		$14,975,600	
Relocations (GNF not creditable)					
Subtotal of GNF Related Items	$149,756,000	$97,341,400		$52,414,600	
LERRD (GNF) Acquisition Credit	$0	$0	0	$0	100
Aids to Navigation	$15,700	$15,700	100	$0	0
Local Service Facilities (LSF):					
Breakwaters	$34,569,000	$0	0	$34,569,000	100
Docks	$23,241,000	$0	0	$23,241,000	100
Utilities	$2,937,000	$0	0	$2,937,000	100
Dredging Above -20 feet MLLW	$217,000	$0	0	$217,000	100
Dredging Below -20 feet MLLW	$70,000	$0	0	$70,000	100
Subtotal LSF	$61,034,000	$0	0	$61,034,000	100
Final Initial Cost Requirements	$210,810,000	$97,360,000	46%	$113,450,000	54%

Note: **Totals may not sum due to rounding**

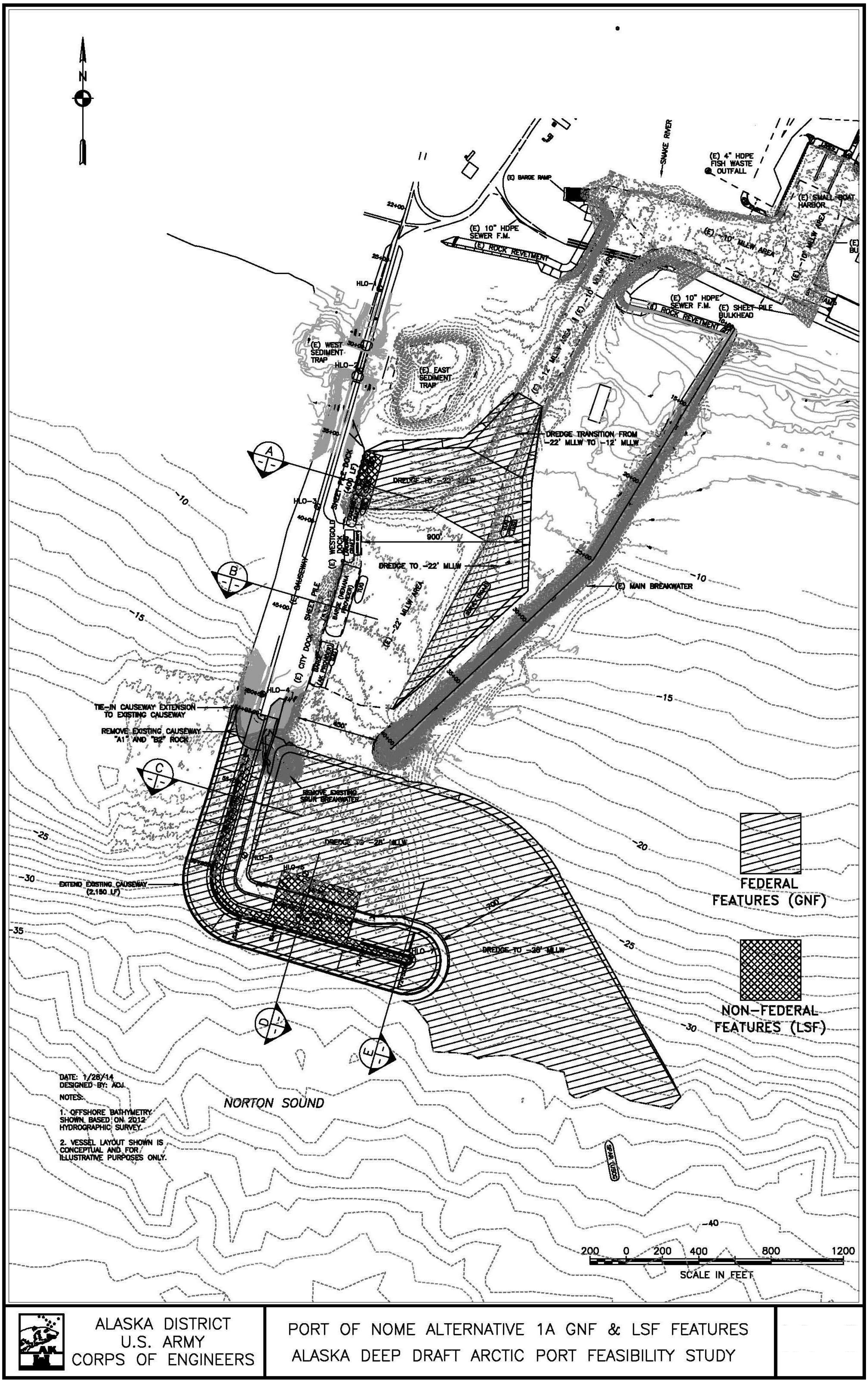

Figure 21: GNF & LSF Features of Tentatively Selected Plan

9.0 ENVIRONMENTAL CONSEQUENCES

The "preferred alternative" is the alternative which achieves the project purpose and need, giving consideration to economic, environmental, technical and other factors. The "preferred alternative" can be different from the "environmentally preferable alternative," although as in the case here, one alternative can often be both. For purposes of compliance with the National Environmental Policy Act of 1969 (NEPA), the Tentatively Selected Plan (TSP), the National Economic Development (NED) Plan, and the preferred alternative are synonymous. Use of the term "preferred alternative" in this part of the report shall be used whenever the discussion is intended to satisfy NEPA requirements.

This section discusses the environmental impacts likely to accrue to implementation of the preferred alternative, and then compared against the environmental impacts that would likely accrue without the project. To avoid duplication, the alternatives carried forward for further consideration were found to have similar impacts to the preferred alternative, unless otherwise noted.

The preferred alternative consists of two general activities: 1) placement of quarry rock to extend the existing causeway to a depth of -34 feet (10.3 meters) MLLW, and 2) dredging to establish safe navigation depths of -28 feet (8.5 meters) MLLW in the newly protected area and extended navigation channel, placing those sediments on an adjacent beach for purposes of beach nourishment and shoreline protection.

- The environmental consequences associated with the placement of quarry rock into the nearshore environment of Nome Harbor, thereby converting subtidal soft-bottom habitat to subtidal, intertidal, and supratidal hard-bottom habitat, were evaluated in Navigation Improvements Final Interim Feasibility Report and Environmental Assessment (USACE 1998). That evaluation is hereby incorporated by reference in accordance with 40 CFR 1502.21 of the President's Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500 *et seq.*).
- The environmental consequences associated with dredging within Nome Harbor, and the subsequent placement of those sediments on the beach east of and adjacent to the existing breakwater for the purposes of beach nourishment and shoreline protection, were evaluated in Maintenance Dredging Nome Harbor Entrance Channel, Nome, Alaska, Environmental Assessment and Finding of No Significant Impact (USACE 2012). That evaluation is likewise hereby incorporated by reference in accordance with 40 CFR 1502.21 of the President's Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500 *et seq.*).

9.1 Physical Environment

9.1.1 PHYSICAL ENVIRONMENT (TERRESTRIAL)

Construction of the preferred alternative will not significantly adversely affect the physical geographic nature of the area. Establishment of temporary staging area(s) for storage and processing of construction materials, parking of construction support vehicles, and daily assembly of construction crews would constitute a short-term land use change, but these short-term impacts to the terrestrial physical environment are considered minor and insignificant.

9.1.2 PHYSICAL ENVIRONMENT (MARINE)

As with the construction of the current configuration of Nome Harbor in 2006, proposed construction of the causeway extension would result in gains and losses of specific habitats in the marine environment, but likely result in a net gain in subtidal, intertidal, and supratidal habitat values. Losses of otherwise abundant subtidal soft-bottom sandy habitat (essentially two dimensional) will occur with the placement of quarry rock out to -34 feet MLLW, but the addition of sparsely-available rocky habitat (three dimensional, with subtidal, intertidal and supratidal elements) will replace those losses.

The proposed breakwater is a highly rugose structure, with extensive interstitial spaces created through placement of boulders, resulting in a net several-fold increase in available surface area for marine biota. This increase is on the order of 4 to 5 times that provided by a planar surface (e.g., a concrete seawall), even when accounting for the loss of surface areas which are in direct contact with either another boulder or with the substratum. In a study by MBC Applied Environmental Sciences in southern California (MBC 1987), rocky habitats have resulted in upwards of a 30% improvement in adjacent sand-bottom fish community diversity and abundance. As a result, the causeway extension is expected to result in a net gain in overall habitat value, and the long-term impacts to the marine physical environment are considered minor and insignificant.

Minor changes to bottom topography will result from project implementation, though these impacts are also considered negligible.

9.1.3 Bathymetry, Currents, and Tides

Because the causeway is a permeable (versus impermeable) structure designed to dampen wave energy only, with seawater allowed to move through the structure, the proposed project is not expected to have a significant effect on flushing or circulation in the inner or outer harbor. The proposed causeway extension is not expected to adversely affect current patterns, flow, velocity, flushing, or any other element of the harbor's hydrologic regime.

9.1.4 Water Quality

The deposition of quarry rock to extend the causeway will have no significant long-term effect on salinity, water temperature, water chemistry, clarity, color, odor, dissolved gas levels, or nutrients. Water quality in the immediate vicinity of the construction areas may temporarily decrease during the construction period, with some increased turbidity resulting from the stirring of bottom sediments during rock placement.

Temporary physical and chemical changes in water quality characteristics may result due to resuspension of bottom sediments during the proposed dredging activities. Contaminants present in the sediments could potentially become biologically available upon disturbance by the proposed dredging activities. Due both to the source of the material to be dredged, the general absence of anthropogenic pollutant sources, and the historical beach-compatible grain size of the dredged material (as determined from previous compatibility analyses), the short-term effects to water quality as a result of these activities are expected to be insignificant, with no long-term effects anticipated.

Dredging and disposal impacts may include temporary increases in turbidity and suspended solids, along with associated decreases in dissolved oxygen. These conditions in the water column may contribute to a decrease in light penetration and cause a general decline in aquatic primary productivity due to a temporary loss of phytoplankton populations. Any appreciable turbidity increase may also cause clog the respiratory and feeding apparatuses of fish and filter feeders. Motile organisms, however, would likely evacuate and avoid the dredging area, temporarily relocating to an undisturbed area.

Dredging activities, however, likely contribute only a small percentage to the total turbidity found in nearshore waters when compared with the turbidity created by the natural erosion of the beaches, and the resuspension of material by waves, currents, tidal action, and boat traffic. The use of a hydraulic dredge would confine most of the impacts to the immediate vicinity of the dredging activities, with turbidity levels dissipating rapidly through resettlement. The proposed project is not expected to cause significant impacts to water quality within or around the harbor or at the disposal site(s).

9.1.5 Air Quality

Although the actual equipment to be used for construction and dredging activities is not yet known, the worst case can be presumed (e.g., 4,000 horsepower diesel-powered hydraulic dredge). The proposed construction activities in Nome Harbor are subject to Federal and State air quality regulations and standards. The proposed causeway extension construction and associated dredging activities are not expected to increase airborne particulate matter in the project area above acceptable threshold levels. Operation of machinery and other equipment would cause a minor, temporary increase in air emissions because of exhaust, which would cease once construction and dredging is completed. To be considered "regionally significant," emissions associated with the project must exceed 10 percent or more of the region's emissions for a particular pollutant. Although no analysis or modeling was done, this short-term and relatively minor project will undoubtedly contribute far less than 10 percent for the area of pollutants such as carbon monoxide (CO), volatile organic carbon (VOC), particulate matter (10 micrometers or less, PM_{10}), and NOx (nitric oxide and nitrogen dioxide). National ambient air quality standards (NAAQS) are not expected to be exceeded.

9.1.6 Noise

Construction of the proposed project would result in noise associated with equipment such as dozers, backhoes, dredges, and pile drivers. Sound levels from construction would be variable but would be kept below established construction noise thresholds as necessary by using temporary noise barriers, acoustic curtains, and curtailed use of noisy equipment at night among other noise mitigation measures.

Operational noise would result from increased shipments at the Port of Nome and sound from the new facilities associated with the expansion of the Port. Land based operational sound sources would include cranes, trucks, vehicles, and other equipment used to unload vessels visiting the Port. Additional increases in airborne sound levels would result from cargo and other seagoing vessels accessing the Port. Generally the most sensitive land uses are located in the neighborhoods just northeast of the Port. In such areas, the project could increase existing sound levels by just under 10 dBA Leq before resulting in a significant impact. In order for a 10 dBA increase to occur from operation of the project operational noise would need to increase 2 fold. Currently, economic analyses conducted for the proposed project demonstrates that there would be an increase of vessels visiting the Port of less than double what is currently accessing the Port. If we conservatively assume that Port activity doubles with the project then receives sound levels from the Port would likely increase by 3 dBA at the nearest residences which would result in no significant impact. Because decibels are not additive, doubling the number of sound generators does not double the sound levels. For example, if two machines each individually produce a sound pressure level of 90 dB at a specific receptor, when both are operating together the combined sound pressure level only increases to 93 dB. For reference, a 3 dBA change in sound level is the minimum change that is noticeable by the average person.

Similarly, the underwater environment currently experiences some sound from ships accessing the Port. Again, if we assume a doubling of ships entering the Port, a 3-6 dBA increase may occur. Although existing underwater sound levels are unknown, generally ship noise from sources such as engines is not of sufficient strength to result in injury to marine wildlife. For example, according to a recent sound survey conducted at the Port of Anchorage, existing seagoing vessels ranged from a high of 149 dB re 1 µPa (a measurement of sound pressure) in close proximity and attenuating to less than 120 dB 1 µPa at 400 feet or less (Port of Anchorage EA 2005). These sound levels may result in temporary marine mammal disturbance, but are similar to what are already assumed to occur at the Port. Therefore no significant adverse impact is anticipated.

9.2 Biological Resources

Effects of construction of the preferred alternative on the marine environment at Nome will mostly be in terms of aquatic habitat disturbance caused by sediment disturbance from dredging, dredged material disposal, demolition of the existing spur at the end of the causeway, and construction of the causeway extension. Dredging to create the improved navigation channel and harbor area will remove approximately 441,000 cubic yards of material. This would transform approximately 120.7 acres from shallow sub-tidal habitat to deep sub-tidal habitat. The inner maneuvering area with an approximate average depth of 12 feet will be dredged to 22 feet (287,400 cubic yards removed), and the outer maneuvering area with approximate average depths of 25 feet will be dredged to 28 feet (153,600 cubic yards removed).

During dredging, sediment may be re-suspended into the water column by the diesel-powered suction head hydraulic dredge, though most material will be entrained within the suction head. The sediment-water slurry will then be transported to the onshore disposal site (approximately 20-acre site) via pipeline, with surf-zone disposal in the littoral zone above MLLW for the purpose of beach nourishment. The landward limit of discharge would be the seaward limit of any coastal strand vegetation present at the disposal site, and the seaward limit of discharge would be approximately MLLW, understanding that this MLLW isobaths will move seaward as dredged material accumulates.

Dredged materials will be comprised of silts, sands, gravel, cobble, and glacial till. The sands, gravels, and cobbles will settle out quickly; however the silts and clays will increase turbidity for longer periods. Dredged material would be similar to the sediments that would naturally transport through the area from river discharge or long-shore currents. The discharge will temporarily increase total suspended solid levels within the placement area, though this is an area of high wave energy and turbidity levels are typically elevated. Annual dredging has occurred in Nome Harbor since 2006, with dredge volumes between 20,000 and 50,000 cubic yards. The dredged material disposal site is just east of, and slightly larger than, the current annual dredged material placement site, and can accommodate the one-time disposal of 441,000 cubic yards of material.

The waters of Norton Sound off Nome are naturally quite turbid. The Alaskan Water Quality Standard for turbidity in marine waters is 25 NTU (Nephelometric Turbidity Units) (ADEC 2012); however, ambient (or baseline) conditions commonly exceed that level. Environmental baseline studies of Norton Sound found turbidity to be above 25 NTUs at two specific sampling sites for 22% and 13% of the time, and had maximum turbidity levels of 303.4 and 115.2 NTUs (Jewett et al 2013). Turbidity in Norton Sound is due to several factors. The Yukon and Snake Rivers discharge suspended loads of silt into Norton Sound. Wind transport and high intensity storms mix up sediment off the sea floor. Tidal mixing and strong coastal currents also play a role in adding to turbidity. Finally, land-fast ice in winter and spring causes extensive reworking of the sea floor habitat (Jewett et al 2013). Primary producers and aquatic filter feeders such as sea stars, polychaetes, bivalves, and amphipods are already adapted to the turbidity levels and natural disturbance regime. Temporary increases in suspended sediment should have little effect on those marine organisms.

Two other disposal alternatives are under consideration. The first would use a hopper dredge to dispose of material in the near-shore, within the zone of closure, allowing wave action to then push the sand ashore. The second would be to use a confined disposal facility (CDF), similar to what was used in the 2006 construction wherein the former navigation channel entrance was blocked and backfilled.

Disturbing sediments through dredging and construction activities can result in at least partial re-suspension of sediments that may contain low to moderate concentrations of arsenic and mercury. Arsenic is a common byproduct of gold mining, and the Nome harbor area has an extensive history of gold mining. High-arsenic sediments were buried in Nome Harbor under a 3-foot-thick cap in 1995-1996.

Demolition of the existing spur breakwater and main breakwater head will likely re-suspend and redistribute sediments into the water column. Salvaged armor stone will be incorporated into the new causeway construction, which will extend 2,150 linear feet (655 meters). Approximately 43,000 square feet of causeway and spur will be removed, with the expansion entailing 706,000 square feet of causeway not including the stub breakwater and main breakwater head areas already impacted by rock fill. Placement of quarry rock during construction is also expected to stir up small quantities of sediments at the site where rock is being placed.

Periodic maintenance dredging of approximately 59,000 cubic yards will be required on an approximately 10-year cycle, to maintain the deep draft port. This is similar to the existing maintenance dredging regime. It is assumed that the outer channel and maneuvering area dredged material will be deposited in the off shore disposal site, east of the port. The inner channel dredged material (40,000 cubic yards) at Nome will likely be deposited on the beach east of the main breakwater (current site of annual dredge discharge). Maintenance dredging will most likely involve a hydraulic cutter head dredge with pipeline discharge, as dredge material will mostly be sand. The effect of the introduced suspended sediment to the water column from the hydraulic cutter dredge would be minimal.

The placement of the annual dredged material would take place in the littoral zone along the shoreline, and would function as beach nourishment. The discharge of material could bury littoral organisms lacking mobility to escape, though this zone is subject to sand movement and these organisms are adapted to this environment.

The causeways and breakwaters are designed to be stable for the 50-year predicted wave conditions. Therefore, no significant loss of stone from the rubble mound structures is expected over the life of the project. It is estimated that at the worst case, 2.5 percent of the armor stone would need to be replaced every 25 years (4,200 cubic yards). This occasional maintenance activity could bury littoral organisms and/or generate temporary turbidity.

The concrete caisson dock structure would require maintenance on an estimated 20-year cycle. Repairs would include patching damaged concrete surfaces with epoxy grout and grout injection for internal areas. The use of grout could cause localized elevation of pH on a temporary basis. The steel sheet docks and mooring dolphins would require replacing anodes on an estimated 15-year cycle.

The enhanced port at Nome will increase the total amount of vessel traffic in the area, thus increasing the potential for fuel spills and other accidental toxic releases. The additional activity will also increase exposure to invasive aquatic species attached or in the ballast water of wayfaring vessels.

9.2.1 Terrestrial Habitat

Dredged material will either be disposed of onshore below the MHHW mark, or immediately offshore, and serve as beach nourishment and shoreline protection. Using dredged material as beach nourishment increases the width of the beach and helps protect the Nome shoreline from waves and storms. The sediment is naturally distributed by wave action along the shoreline. Near-shore currents move sediment in both the east and west directions, but for Nome the net movement is to the east. This will have little effect on surrounding vegetation as the sediment will largely be placed below the high tide elevation. No additional effects to wetland or upland vegetation are expected given the developed port facilities at this site.

9.2.2 Marine Habitat

9.2.2.1 Marine Birds

Nome does not have any unique or valuable habitat for birds. Waterfowl could be displaced by vessels working in the area, although this would be short term and have no long term effects. Lights on working vessels could be an attractive nuisance; however, during the summer work season in that region of Alaska, there is very little actual darkness. This impact would be negligible. The most likely effects to birds would be from the potential for spills and discharge of other hazardous materials from construction vessels and equipment. Mortality from spills is caused by ingestion of toxins during preening as well as hypothermia from matted feathers. Any such effects to prey species would likely reduce the number of birds foraging in the area.

The dredged material that may be used as beach nourishment may attract shorebirds that would feed in the expanded intertidal area. The burial of benthic organisms could temporarily remove potential prey species, and thus could temporarily reduce foraging. There would likely be increased foraging after re-colonization.

9.2.2.2 Marine Fish and Invertebrates

The affected excavated area includes 120.7 total acres for Nome. The current causeway area at Nome has been dredged annually since 2006, and that area will not likely have had time to establish extensive benthic communities. However, this will not be the case for the dredging of the deep water portion at Nome. The existing populations of benthic organisms in the near shore environment are accustomed to an extensive amount of loose shifting sediment, but this proposed dredging would be beyond the natural sediment movement along the shoreline. The Nome site will require demolition and removal of the existing spur breakwater and main breakwater head. This could add additional suspended sediment to the water column. The benthic populations would be unlikely to recolonize to natural levels in one year. Previous studies of benthic response to mining in the Nome area have shown that in some cases at least 4 years were required for benthic communities to recover (Jewett et al 2013). The additional area of deep water is roughly 30 acres which, compared to the overall Norton Sound region, is a minimal loss to the benthic community.

Effects on fish would be from turbidity and increased sediment from dredging as well as noise from construction activities. Direct mortality from extremely high levels of suspended sediment is possible, especially affecting juvenile salmon. Such concentrations far exceed those caused by typical construction projects. Suspended sediment can clog fish gills and reduce their capacity for oxygen exchange, as well as induce other physiological impairment such as reduced growth and increased susceptibility to disease (Bash et al. 2001). Adult migrating fish have been found migrating through quite turbid waters. Temporary turbidity from construction could be much higher than background, although such levels are unlikely.

Noise and vibration caused by construction could alter the behavior of fish near the construction area, likely causing the fish to flee if they can. Both juvenile and adult salmon could respond to noise disturbance by delaying foraging and avoiding the project vicinity. Fish hear by converting noise pressure waves to vibrations. A fish's swim bladder acts as the transducer to convert the noise pressure to vibrations; thus rapid changes in volume can result in tearing, reduced hearing sensitivity, and loss of hydrostatic control (WSDOT 2012). According to NMFS interim guidance on in-water pile-driving actions, the vibratory pile-driving and impact pile driving disturbance threshold for fish is 150 dB_{RMS} (NMFS 2012) A common noise measurement is dB_{RMS} (RMS=Root Mean Square), which is the average sound level in decibels. The injury threshold for fish depends on size: 187 dB_{SEL} for fish greater than or equal to 2 grams, 183 dB_{SEL} for fish less than 2 grams and 206 dB_{Peak} (peak noise level) for all fish (NOAA et al. 2008).

Steel piles will be driven as part of the mooring dolphins and steel sheet piles will be installed as part of dock construction. Impact pile driving could result in behavioral effects on fish for a distance of 2.88 in-water miles (5 kilometers) from the construction activity. Noise-caused injury to fish from vibratory pile driving is not expected; however, noise from impact pile driving has the potential to exceed the injury threshold for fish weighing less than 2 grams up to 709 feet (216 meters) from the construction activity.

Table 40: Summary of Near-Source (10-meter) unattenuated sound pressures for in-water pile installation using an impact hammer and near-source unattenuated sound pressures for in-water pile installation

Pile Type and Approximate Size	Method	Relative Water Depth	Average Sound Pressure Measured in dB	
			Peak	RMS
16.524-inch-Steel Pipe Pile	Impact	~15 meters	188207	176194
Steel sheet pile pair; 48-inches in length per pair	Vibratory (Installation and Removal)	~15 meters	182	165
Steel sheet pile pair; 48-inches in length per pair	Impact (Installation Proofing)	~15 meters	205	190

Source: Caltrans 2007

Long shore migration of juvenile salmonids could be disrupted as they will avoid turbidity plumes. The dredging of the inner and outer channels and maneuver areas is essentially at the entrance to the Snake River. This could create difficulty for juvenile salmon migrating into and out of the river. Juvenile fish may encounter disturbance and delay or be exposed to high levels of turbidity. Timing will be important as the out migration from the Snake River begins in mid-June. ADF&G has directed dredging in the past to start as soon as the ice goes out, but be completed in the narrow inner channel by 25 June and for the rest of the project area by 31 July.

The transformation of the dredged areas will be from shallow sub-tidal habitat to deep sub-tidal habitat, which may affect juvenile salmon migration, as they generally migrate along the shoreline in shallow water. Migration through deeper water could expose them to predators and could also reduce the potential forage provided by benthic and epibenthic organisms in shallower waters. The causeway and breakwater constructed in 2006 incorporated fish passage features which will be maintained and unaffected by the proposed project. As a result, the additional modifications to the causeway and navigation channel depths are expected to have a less than significant effect upon the salmon fishery.

9.2.2.3 Marine Mammals

Dredging could temporarily and indirectly disturb any marine mammals in proximity to the site due to construction-generated turbidity, construction vessel traffic, and construction noise. Construction-generated turbidity would most likely cause marine mammals to temporarily avoid the area until the turbidity plume dissipates to background levels. Because of their ability to avoid and escape turbid waters, turbidity would not likely produce any long-term harm to marine mammals.

Construction vessel traffic would produce increased noise, though not appreciably greater than that which exists currently. Additional vessel traffic would result in increased potential for spills and toxic releases. The marine mammal's ability to avoid the area of temporary increased activity should minimize the likelihood of adverse effect.

Noise generated by both vibratory and impact driving of steel sheet piles reaches the highest peaks and spreads the farthest of any type of in-water construction. Construction noise and vibration could alter the behavior of all marine mammals near the construction area, likely causing them to flee. According to NMFS' interim guidance on in-water pile-driving actions, the vibratory pile-driving disturbance threshold for marine mammals is 120 dB_{RMS}. For impact pile driving the disturbance thresholds are 160 dB_{RMS} for marine mammals. The injury threshold for cetaceans is 180 dB_{RMS} and 190 dB_{RMS} for pinnipeds (NMFS 2012).

Vibratory pile driving could cause behavioral effects in marine mammals up to 2.5 in-water miles (4.6 kilometers) from the construction activity. Impact pile driving has a greater impact, but noise travels less distance than vibratory pile driving. For impact pile driving of steel sheet piles, behavioral effects for both pinnipeds and cetaceans can occur at distances up to 3,280 feet (1,000 kilometers) See

Table 41.

Background noise in the already busy port of Nome would be assumed to currently cause disturbance to marine mammals, particularly during daylight hours when most if not all pile installation activities would occur. Anthropogenic activities associated with the noise would likely also cause visual disturbance to marine mammals in close proximity. Such frequent and substantial baseline disturbance may translate into far fewer marine mammals actually being present in or near the area of potential effects during the construction period.

Guidelines implemented by the National Marine Fisheries Service related to sound characteristics in the context of the Marine Mammal Protection Act and the Endangered Species Act would be followed throughout project construction to ensure minimal or no disturbance of marine mammals.

Table 41: Summary of In-Water Noise Effect Distances

Threshold Definition	Distance Pinnipeds	Distance Cetaceans	Distance Fish
24-inch Steel Pipe Piling (Impact, Unattenuated) 15m Depth (49 ft.)			
Injury	18 m (61 ft.)	86 m (281 ft.)	NA
Peak	NA	NA	12 m (39 ft.)
SEL >2 g	NA	NA	86 m (282 ft.)
SEL <2 g	NA	NA	159 m (521 ft.)
Behavioral Effects	1,848 m (1.14 mi)	1848 m (1.14 mi)	8577 m (5.33mi)
24-inch Steel Sheet Piling (Vibratory) 15m Depth (49 ft.)			
Injury	0.2 m (0.7 ft.)	1 m (3.3 ft.)	0 m (0 ft.)
Behavioral Effects	3,981 m (2.5 mi)	3,981 m (2.5 mi)	46 m (151 ft.)
24-inch Steel Sheet Piling (Impact, Unattenuated, 15 m depth (49 ft.)			
Injury	10 m (33 ft.)	46 m (152 ft.)	NA
Peak	NA	NA	9 m (28 ft.)
SEL >2 g	NA	NA	117 m (384 ft.)
SEL <2 g	NA	NA	216 m (709 ft.)
Behavioral Effects	1,000 m (3,280 ft.)	1,000 m (3,280 ft.)	4,642 m (2.88 mi)

*Total number of strikes estimated at 200/day

The minimal amount of material disturbed from maintenance dredging at either site should not have a significant effect on marine organisms, as their environment is already one of disturbed sediments from river discharge and ice and wave disruption.

At Nome, the changes in depth (22 feet (6.7 m) inner harbor, and 28 feet (8.5 m) outer harbor) will be permanently maintained. The new depth, coupled with the addition and permanent location of the causeway extension, changes the entire entrance to the Snake River estuary, and could modify migration routes of fish and other species.

Increased vessel traffic could affect benthic organisms, fish, and mammals by increasing the potential of oil spills and other toxic releases. Increased exposure to invasive aquatic species could also affect marine wildlife by disrupting food chains and nutrient cycles. Vessel traffic will also increase the potential for vessel strikes.

9.2.3 Federal and State Threatened and Endangered Species and Protected Marine Mammals

Unless otherwise noted, the following determinations of effect are consistent with the determinations of effect made in previous environmental assessments of similar projects proposed for construction at Nome Harbor (USACE 1998, 2012).

9.2.3.1 Threatened and Endangered Species

9.2.3.1.1 Steller Sea Lion, Western distinct population segment (DPS) (*Eumetopias jubatus*) (Endangered)

Critical habitat for Western DPS Steller sea lions are aquatic zones around rookeries, haulout sites, and special feeding areas. The closest of these critical habitat sites is St. Lawrence Island, with no sites found in Norton Sound. As a result, there will be no effect upon Western DPS Steller sea lions, or their critical habitat, from the proposed construction actions.

9.2.3.1.2 Bowhead Whale (*Balaena mysticetes*) (Endangered)

In April and May, bowhead whales move north past St. Lawrence Island and through the Bering Strait into the southern Chukchi Sea as they continue north to the Beaufort Sea for the summer months. The migration north normally occurs 12 - 50 miles (22 to 93 kilometers) from the mainland (Wursig and Clark 1993). Construction activities would be unlikely to have negative effects on bowhead whales as the majority migrates much further north during the time of active dredging and construction, and their migration route occurs well off shore. As a result, there will be no effect upon bowhead whale, or their critical habitat, from the proposed construction actions.

9.2.3.1.3 Fin Whale (*Balaenoptera physalus*) (Endangered)

Fin whales utilize Norton Sound and potentially migrate through the Bering Strait to the Chukchi Sea. Fin whales are do not frequent near shore waters. As a result, there will be no effect upon fin whale, or their critical habitat, from the proposed construction actions.

9.2.3.1.4 Humpback Whale (*Megaptera novaeangliae*) (Endangered)

Humpback whale distribution is typically well offshore. During the summer months, Humpback whales are usually found in the Gulf of Alaska or potentially the southern Bering Sea, but not as far north as Nome. As a result, there will be no effect upon humpback whale, or their critical habitat, from the proposed construction actions.

9.2.3.1.1 North Pacific Right whale (*Eubalaena japonica*) Endangered

Although Norton Sound is included in the North Pacific right whale's range, critical habitat for the species is in the southern Bering Sea and Gulf of Alaska, and does not include Nome. Thought to spend the summer in high latitude feeding grounds, the North Pacific right whale is not likely to be encountered near Nome. As a result, there will be no effect upon North Pacific right whale, or their critical habitat, from the proposed construction actions.

9.2.3.1.2 Bearded Seal, Beringia DPS (*Erignathus barbatus*) (Threatened)

Bearded seals migrate north and south with the ice front, specifically the less stable and broken ice that occurs 3-4 miles (5.5 to 7.4 kilometers) offshore. This would keep them out of area for the majority of the year. Some juveniles have been found to linger and have been located around river mouths. Bearded seals can be found in the Norton Sound from late November to late June, and can be found in open water. The summer months find them dispersed throughout their range, but rarely in the nearshore waters of Nome. As a result, there will be no effect upon bearded seal, or their critical habitat, from the proposed construction and dredging actions.

9.2.3.1.3 Arctic Ringed Seal (*Phoca hispida*) (Threatened)

The Arctic ringed seal's range extends through the Bering Sea, but barely includes Nome. Arctic ringed seals are found in stable shorefast ice, and remain in contact with ice for most of the year. They are usually found foraging in water 32 to 65 feet (9.7 to 19.8 meters) deep. They migrate out of Norton Sound for the summer, which takes them out of the project area during the proposed construction and dredging season. As a result, there will be no effect upon Arctic ringed seal, or their critical habitat, from the proposed construction actions.

9.2.3.1.4 Polar Bear (Ursus maritimus) (Threatened)

A polar bear siting in Nome would be very rare. An individual polar bear would only arrive there following the sea ice edge in late fall and early winter. Polar bears would have little reason to remain in Norton Sound as the sea ice retreats. As a result, there will be no effect upon polar bear, or their critical habitat, from the proposed construction actions.

9.2.3.1.5 Steller's eider

Steller's eiders are in marine waters year round and only move inland to breed during late spring and early summer. Steller's eiders would only appear in the Nome area as migrating transients in the early spring or fall. Occasional individual Steller's eiders could be disturbed if they moved through the study area during construction, but this is highly unlikely. As a result, there will be no effect upon Steller's eider, or their critical habitat, from the proposed construction actions.

9.2.3.1.6 Spectacled eider

Spectacled eiders would only be found near Nome as migrating transients. Norton Sound is included in spectacled eider critical habitat; however, this includes only the eastern section, beginning at Cape Darby and not the study area (DOI 2001). Nome is not included in the critical habitat area. Overall, occasional individual spectacled eiders could be disturbed if they moved through the study area during construction, but this would be highly unlikely. As a result, there will be no effect upon spectacled eider, or their critical habitat, from the proposed construction actions.

9.2.3.2 Protected Marine Mammals

Other marine mammals routinely found within the vicinity of the proposed project include beluga whales *(Delphinapterus leucas),* gray whales *(Eschrichtius robustus),* harbor porpoise *(Phocoena phocoena),* killer whales (*Orcinus orca),* common Minke whales *(Balaenoptera acutorostrata),* northern fur seals *(Callorhinus ursinus),* and spotted seals *(Phoca largha).*

Other marine mammals that may be found within the vicinity of the proposed project include spotted seal and beluga whale. Species occasionally or rarely found include the Pacific walrus, ribbon seal, and killer, minke, and gray whales. Walrus and polar bears are closely associated with sea ice, and tend to migrate with the movement of the sea ice edge. These species are unlikely to be found in Norton Sound during the ice-free summer months when dredging would occur. Spotted seals and beluga whales do, however, make use of shallow coastal waters within the Norton Sound area during summer months. Beluga whales may feed on herring and other fish species within the proposed project area during the summer (USACE 1998).

9.2.4 Special Aquatic Sites

Special aquatic sites are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. These include:

1) Sanctuaries and refuges designated under state and Federal laws or local ordinances to be managed primarily for the preservation and use of fish and wildlife resources;

2) Wetlands, which are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

3) Mud flats, which are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems. When mud flats are inundated, wind and wave action may resuspend bottom sediments. Coastal mud flats are exposed at extremely low tides and inundated at high tides with the water table at or near the surface of the substrate. The substrate of mud flats contains organic material and particles smaller in size than sand. They are either unvegetated or vegetated only by algal mats.

4) Vegetated shallows, which are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and

eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes.

5) Coral reefs, which consist of the skeletal deposit, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef.

6) Riffle and pool complexes typically found along steep gradient sections of streams, recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. Pools are characterized by a slower stream velocity, a streaming flow, a smooth surface, and a finer substrate. Riffle and pool complexes are particularly valuable habitat for fish and wildlife.

There are no special aquatic sites known to be present within the project area, and therefore no impacts to special aquatic sites are expected.

9.2.5 Essential Fish Habitat (EFH)

Short term impacts to EFH would include potential water quality impacts from increased turbidity, noise from dredging and construction operations, potential pollution from spills, and disturbance from the movement of equipment. Some sediment would be re-suspension into the water column by the dredging activity. The discharge of the dredged material would likely increase the suspended solids along the shoreline of the placement area on a temporary basis.

The dredge vessels use fuel and lubricants and are potential sources of spills into the marine environment. The contractor will therefore be required to prepare a spill prevention and response plan and have appropriate spill response materials at the work site.

Construction noise will be generated by vessels, clam shell dredging, and the sheet pile driving for dock construction. Noise generated by the dredging vessels would be comparable to that created by other vessels in this busy harbor. The dredging will occur inside of the causeway and breakwater, and the causeway will therefore dampen the area affected by construction noise. The clamshell dredge and the driving of sheet pile may create abrupt, high-intensity noise that can disrupt behavior and even do physical damage to fish, but these effects are expected to be of short-term duration, localized to the construction site inside of the harbor, and further mitigated through the timing of construction.

Demolition of the existing spur breakwater will add to the turbidity and noise at an inopportune location for migrating juvenile salmon. The entrance to the harbor is also the entrance to the Snake River, a destination for adult salmon moving inland or juvenile migrating out to sea. Previous direction from the ADFG, through its issuance of Fish Habitat Permit FH13-III-0027, calls for dredging to start as soon as the ice goes out, but be completed in the narrow inner channel area by 25 June, and in the rest of the area by 31 July. This work-window is intended to protect juvenile salmon, which are believed to start out-migration from Snake River in mid-June, and thereby avoid or minimize the effects of turbidity and noise.

As a result, the Corps has determined that the proposed action will not adversely affect designated EFH in the project area.

9.3 Cultural and Subsistence Activities

Construction activities associated with the tentatively selected plan may affect resource availability and user access. In particular, noise from construction activities could result in deflection of subsistence resources such as marine mammals, fish, and waterfowl from traditional hunting and harvesting areas. This would result in reduced harvest success for subsistence users. Subsistence hunters on the North Slope and in Northwest Alaska have observed the impacts of noise on wildlife, particularly marine mammals, and have also reported experiencing reduced success rates when subsistence resources are diverted (SRB&A 2009, USEPA 2009). Noise related to pile driving, drilling, dredging, and associated traffic (i.e., truck, barge) may cause key marine mammal resources such as seals and beluga to divert around the construction site or to act skittish, making them more difficult to harvest (SRB&A 2009; USACE 2012). Dredging and construction of the causeway and dock will likely displace fish resources from the immediate construction areas. Coastal resources such as waterfowl may also avoid construction activities.

9.4 Coastal Zone Resource Management

Alaska withdrew from the voluntary National Coastal Zone Management Program[14] on July 1, 2011. Within the State of Alaska, the Federal consistency requirements under the Coastal Zone Management Act do not apply to Federal agencies, projects or individuals seeking any form of federal authorization or permit, and state and local government entities applying for Federal assistance.

9.5 Historical and Cultural Resources

The construction of the causeway extension would be visible from the downtown shoreline and would mainly involve views of barge-mounted cranes and material barges. The views of the construction equipment would be temporary (5-6 months annually for up to three years) and would be similar to views out to Norton Sound of gold dredging activities that occur during that same time period. While views of Norton Sound would be obstructed when looking in the direction of construction, no specific view would be lost, since other portions of Norton Sound would be visible at all times, depending only on weather.

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[14] http://coastalmanagement.noaa.gov/programs/czm.html

The 2,150 foot (655 meter) extension of the existing causeway would be of similar construction and would have a similar vertical dimension as the existing causeway. The extended length would be noticeable but would not be out of character with the existing causeway. The 450-foot (137 meter) precast concrete caisson dock at the end of the extended causeway would be more noticeable from the shoreline given its east-west orientation but would not disrupt any specifically notable views out to Norton Sound.

Some marine vessels docking at the new caisson dock would likely be larger than existing vessels using Port of Nome facilities and, thus, would be noticeable from the downtown waterfront. Waterborne vessels, however, would be consistent with a marine environment and would only be visible for short periods when in dock. Thus, there would be no long-term adverse visual effect from the proposed facility.

The Corps determined that no historic properties will be adversely affected by this action.

9.6 Environmental Justice and Protection of Children

On February 11, 1994, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, was issued. The purpose of the order is to avoid the disproportionate placement of Federal actions and policies having adverse environmental, economic, social, or health effects on minority and low-income populations. Construction of the proposed project would have beneficial effects on the Nome community. No racial, ethnic, age, or other protected population group would experience a disproportional adverse effect.

On April 21, 1997, Executive Order 13045, Protection of Children from Environmental Health and Safety Risks, was issued to identify and assess environmental health and safety risks that may disproportionately affect children. The proposed project would affect the community as a whole, and there would be no environmental health or safety risks associated with the project that would disproportionately affect children. All the alternatives considered are located offshore, in proximity to commercially developed areas, and away from homes, schools, and playgrounds. Children would not be put at risk by the proposed action.

9.7 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts associated with the construction and operation of the Deep-Draft Arctic Port at Nome.

9.8 Cumulative and Long-Term Impacts

Construction of the Deep-Draft Arctic Port at Nome, in combination with past port development; past gold mining and continued gold exploration of today; and increased vessel traffic from oil and gas, mining, and ecotourism could result in cumulative effects to the aquatic environment. These factors add up to a substantial change from a natural environment to what was originally a gold rush town of over 20,000, to a small village, and now to a larger town and port facility. This expansion will further add to the increasing industrialization and commercialization of the area, which is already seeing increased vessel traffic due to the diminishing sea ice brought about by climate change. Port development could reduce overall fish and wildlife populations and/or fish and wildlife's use of the area and reduce the overall function of the marine environment. The dredging of contaminated sediments could also result in cumulative effects due to potential increases in arsenic and mercury exposure. Increased vessel traffic could bring about spills and toxic releases, as well as increase the probability of inadvertent collisions with wildlife.

The cumulative impacts analysis evaluated the effects of implementing the proposed project in association with past, present, and reasonably foreseeable future Corps' and other parties' actions within and adjacent to the project area (see above). Past and present actions have resulted in the present conditions in the harbor. Reasonably foreseeable future actions that have been considered included relevant foreseeable actions within and adjacent to the project area and including those of the Corps, other Federal agencies, state and local agencies, and private and commercial entities. The cumulative impacts associated with implementation of the proposed action were evaluated with respect to each of the resource evaluation categories, and no cumulatively significant adverse impacts were identified.

9.9 Summary of Mitigation Measures

Incorporating the following mitigation measures into the preferred alternative ensures that nothing more than short-term, minor adverse impacts would occur to local water quality and local fish and wildlife populations, including ESA-listed species and their critical habitats, marine mammals, and essential fish habitat (EFH).

1. Consistent with the conditions of Alaska Department of Fish and Game Fish Habitat Permit FH13-III-0027, in-water construction may commence as soon as the ice goes out through June 25th within the harbor and entrance/inner channel, and through July 31st within the breakwater and causeway;

2. Dredging activities will cease if fish are observed in dredged sediments discharged to the beach. Coordination with the Alaska Department of Fish and Game will be initiated to determine if species and/or numbers are of concern before commencing with further dredging;

3. Fish passages constructed in the existing causeway and breakwater will be maintained to facilitate near shore migration of fish;

4. To accelerate recolonization of the causeway extension, all suitable for reuse armor rock removed from the existing breakwaters with sessile or attached adapted marine organisms and marine algae shall be used in constructing the new breakwater segments. If not reused, the rock shall be side cast to the base of the breakwater so that it may continue to provide habitat for marine resources;

5. Breakwater construction shall use core material and B and armor rock clean of organic debris and invasive species;

6. Workers conducting in-water construction will be instructed to watch for marine animals, and cease work if an animal approaches within 50 meters;

7. The selected contractor shall include an Oil Spill Prevention and Control Plan in its Environmental Protection Plan, which is submitted to the Corps for review and approval;

8. To minimize the danger to marine mammals from project-related vessels, speed limits (e.g. less than 8 knots) shall be imposed on vessels moving in and around the project area;

9. Project-related vessels and barges shall not be permitted to ground themselves on the bottom during low tide period unless there is a human safety issue requiring it; and

10. The causeway extension will be constructed prior to dredging. The causeway extension will help contain as much as possible of the turbid water.

10.0 PUBLIC AND AGENCY INVOLVEMENT

This EA and unsigned Finding of No Significant Impact (FONSI) have been prepared relying on previous NEPA-related scoping efforts, public input associated with the Nome entrance channel and harbor, and the most recent correspondence with state and Federal resource agencies. Per the NEPA process and Corps regulations and guidance, the EA and unsigned FONSI are subject to a 30-day public review. If requested, a public meeting may be held to discuss project alternatives and solicit public views and opinions.

10.1 Federal and State Agency Coordination

10.1.1 Relationships to Environmental Laws and Compliance

10.1.1.1 National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.)

The National Environmental Policy Act (NEPA) requires Federal agencies to:

- Assess the environmental impacts of major Federal projects, decisions such as issuing permits, spending Federal money, or actions on Federal lands;
- Consider the environmental impacts in making decisions; and
- Disclose the environmental impacts to the public.

This EA documents the analyses of the probable direct, indirect, and cumulative impacts likely to result from the construction and operations of the proposed project, and the steps taken to avoid and minimize adverse environmental effects as required in the CEQ regulations on implementing NEPA (40 CFR 1500 *et seq.*). This document presents information regarding the impacts of the proposed construction activities to guide future studies and is intended to satisfy all NEPA requirements.

In accordance with NEPA, CEQ Regulations, and Corps policies, this EA and Finding of No Significant Impact (FONSI) will be circulated for public and agency review, and the EA will be made available on the Alaska District website to the interested public prior to the implementation of this proposed action.

10.1.1.2 Clean Water Act of 1972 (33 USC 1251 et seq.)

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Specific sections of the CWA regulate the discharge of pollutants and wastes into aquatic and marine environments. The major action of the project invoking this regulation is the placement of rock into nearshore waters to create the breakwaters and dredging of sediments to achieve desired navigation depths. Other actions with the potential to affect water quality (e.g. disturbance of sediment during removal of the existing offshore structures) are also considered in the 404(b)(1) evaluation.

The Alaska Department of Environmental Conservation (ADEC) regulates compliance with State of Alaska water quality standards under Section 401. An evaluation to determine consistency with Section 404(b)(1) of the Clean Water Act, which governs discharge of dredged or fill material, has been completed (Appendix H), and will be submitted to the ADEC requesting state water quality certification. The Corps is coordinating their determination with the ADEC, and if they concur, they would issue a water quality certificate if there is reasonable assurance that the proposed corrective action would meet and maintain the standards. State water quality certification from the ADEC will be obtained prior to the finalization of the Environmental Assessment and signing of the Finding of No Significant Impact.

10.1.1.3 Rivers and Harbors Act of 1899 (33 USC 403 et seq.)

Section 10 of the RHA of 1899 prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. This section provides that the construction of any structure in or over any navigable water of the U.S., or accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers. The Chief of Engineers determination in the final Chiefs Report, subsequent to the final feasibility/EA report, will be the final decision as it relates to compliance with Section 10 of the RHA.

10.1.1.4 Endangered Species Act of 1973 (16 USC 1531 et seq.)

The Endangered Species Act (ESA) protects threatened and endangered species by prohibiting Federal actions that would jeopardize the continued existence of such species or result in destruction or adverse modification of their designated critical habitat. The Corps is required to coordinate with both the USFWS and NMFS to identify ESA-listed species under those agencies respective jurisdictions that may be present in the project area. The Corps then assesses how the proposed Federal action may impact listed species and makes one of several determinations including: “No Effect”, “May Affect but Not Adversely Affect”, and “May Affect and Likely to Adversely Affect.”

If the determination is “No Effect,” then the action may proceed without consultation with USFWS and NMFS. However, ESA Section 9 prohibitions will apply if unanticipated take occurs of a listed species.

If the determination is “May Affect but Not Likely to Adversely Affect,” USFWS and NMFS must be consulted. During consultation, the agencies will review the Biological Assessment (if one is prepared by the Corps) and either concur with the determination, end the consultation process and allowing the project to proceed, or not concur and recommend changes or mitigation measures to remove adverse effects and ending formal consultation.

If the determination is “May Affect and Likely to Adversely Affect,” the Corps must enter into formal Section 7 consultation with USFWS and NMFS (depending on the species involved). The action may not proceed as designed until formal consultation is complete. During formal consultation, the agencies will review the Biological Assessment and prepare a Biological Opinion.

The Corps requested a list of Federally-listed threatened and endangered species that may occur in the project area on December 16, 2013, and received lists from both agencies. The Corps then evaluated the potential for the proposed project to affect the continued existence of each Federally-listed species or its designated critical habitat. The Corps continues to coordinate with the USFWS and NMFS in finalizing the effects determination, but at this time has determined that the proposed action will not affect the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of the critical habitat of any listed endangered or threatened species.

10.1.1.5 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires the Corps to consult with the USFWS whenever the waters of any stream or other body of water are proposed to be impounded, diverted, or otherwise modified. The act authorizes USFWS to take the lead in consultation, to conduct surveys and investigations to determine the possible damages of proposed actions on wildlife resources, and to make recommendations to the Corps regarding measures to prevent the loss or damage to wildlife resources, as well as the development and improvement of such resources. The USFWS and NMFS have provided, and continue to provide, valuable input on fish and wildlife resources in the project area. A draft Fish and Wildlife Coordination Act Report is provided in Appendix B, and the FWCAR will be finalized prior to the finalization of the Environmental Assessment and signing of the Finding of No Significant Impact.

10.1.1.6 Magnuson-Stevens Fishery Conservation and Management Act Fishery Conservation Amendments of 1996, (16 USC 1801 et seq.)

The Magnuson-Stevens Fishery Conservation and Management Act provides for the conservation and management of all fishery resources between 3 and 200 nautical miles offshore. The 1996 amendments to this act require regional fisheries management councils, with assistance from the NMFS, to delineate Essential Fish Habitat (EFH) in Fishery Management Plans (FMPs) for all managed species. EFH is defined as an area that consists of “waters and substrate necessary for spawning, breeding, feeding or growth to maturity” for certain fish species. Federal action agencies, such as the Corps, that carry out activities that may adversely impact EFH are required to consult with the NMFS regarding potential adverse effects of their actions on EFH. The Essential Fish Habitat (EFH) assessment is provided in Appendix I.

10.1.1.7 Marine Mammal Protection Act, (16 USC 1361 et seq.)

The Marine Mammal Protection Act (MMPA) provides protection to marine mammals in both the State waters (within 3 miles from the coastline) and the ocean waters beyond. As specified in the MMPA, USFWS is responsible for the management of polar bears, walrus, and sea otters; NMFS is responsible for all other marine mammals such as whales, porpoises, and seals. The Corps is required to coordinate with these agencies on potential impacts to species covered by this act and must address these agencies' concerns and recommendations.

Coordination with NMFS with regards to MMPA species is ongoing, and appropriate measures will be adopted to avoid and minimize potential harm to any marine mammals encountered at the project site.

10.1.1.8 Migratory Bird Treaty Act, (16 USC 703 et seq.)

The essential provision of the Migratory Bird Treaty Act makes it unlawful, except as permitted by regulations, "to pursue, hunt, take, capture, kill…any migratory bird, any part, nest or egg," or any product of any bird species protected by the Act. The Corps is required to avoid a taking under this act during construction of the project. Migratory birds are expected to benefit from this project through the provision of additional supratidal roosting habitat, and increasing surface water productivity in the vicinity of the causeway extension.

10.1.1.9 National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.)

The purpose of the National Historic Preservation Act (NHPA) is to preserve and protect historic and prehistoric resources that may be damaged, destroyed, or made less available by a project. Under this Act, Federal agencies are required to identify cultural or historic resources that may be affected by a project and to consult with the State Historic Preservation Officer (SHPO).

Two cultural properties are known to exist on the beach east of the breakwater, one considered already highly disturbed and under a large amount of fill, and the other has been tested and analyzed in fulfillment of the 2011 Memorandum of Agreement supporting the Nome Navigational Improvements Project completed in 2006. The Corps has determined that the proposed project will result in no historic properties affected and has requested concurrence with that determination from the SHPO. The Corps will await the letter of concurrence prior to the finalization of the Environmental Assessment.

10.1.1.10 EO 12898 – Environmental Justice and Protection of Children

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires the Corps to identify and address any disproportionately high and adverse human health effects of its programs and activities on minority and low-income populations.

The recommended project is not immediately adjacent to any low-income or minority residential areas. The harbor improvements should be an asset to the community that improves subsistence and coastal resources access for all of the area’s residents. The Corps does not foresee that construction of the tentatively selected plan would create disproportionate adverse effects on the more vulnerable segments of the community.

10.1.1.11 EO 13112 – Invasive Species

Executive Order 13112, “Invasive Species” requires the Corps to prevent the introduction of invasive species to project construction sites.

The project is expected to involve locally quarried rock and locally contracted heavy machinery and barge. Therefore, the project is not expected to lead to the propagation of invasive species.

10.1.2 Status of Project Coordination

As of February 2015, coordination activities with major resource agencies were ongoing and described in the sections below.

10.2 Status of Environmental Compliance (Compliance Table)

Law, Regulation or Policy	Status	Comments	Full Compliance Expected
Clean Air Act	Coordination complete	An air quality assessment has been performed. The preferred alternative will not significantly affect air quality. The study area will remain in attainment.	Full compliance after review of the Draft EA and signing of the FONSI
Clean Water Act	Coordination on-going	The 404(b)(1) is complete. Water quality certification has been requested from the Alaska Department of Environmental Quality. Based on coordination with the ADEC, the placement of fill material will not violate water quality standards.	Full compliance upon receipt of Certificate of Reasonable Assurance from the ADEC
National Environmental Policy Act	Coordination on-going	The integrated draft EA is being coordinated with Federal and state resource agencies. Comments received during the agency review period will be incorporated.	Full compliance upon incorporation of comments received during 30-day public review and signing of the FONSI
Fish and Wildlife Coordination Act	Coordination on-going	USFWS and NMFS are active participants in the proposed project and have provided input. A Draft Fish and Wildlife Coordination Act Report is provided in Appendix G,	Full compliance upon receipt of the Final FWCAR and signing of the FONSI
Endangered Species Act	Coordination on-going	The Corps has concluded that the proposed action will not affect the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of the critical habitat of any listed endangered or threatened species.	Full compliance upon signing of the FONSI
Magnuson-Stevens Fishery Conservation and Management Act	Coordination on-going	An Essential Fish Habitat (EFH) assessment is provided in Appendix I.	Full compliance upon signing of the FONSI

Law, Regulation or Policy	Status	Comments	Full Compliance Expected
Coastal Zone Management Act	N/A	Alaska withdrew from the voluntary National Coastal Zone Management Program[15] on July 1, 2011. Federal consistency requirements under the CZMA do not apply to Federal agencies or projects.	N/A
Marine Mammal Protection Act	Coordination on-going	The Corps has concluded that the proposed action will not affect marine mammals.	Full compliance upon signing of the FONSI
Marine Protection, Research and Sanctuaries Act	N/A	Disposal of dredged material is for the purposes of beach nourishment, and there is not subject to MPRSA compliance.	N/A
Migratory Bird Treaty Act and Migratory Bird Conservation Act	Coordination complete	Migratory birds would likely benefit from the proposed project.	Full compliance upon signing of the FONSI
Rivers and Harbors Act of 1899	Coordination complete	The proposed project will not obstruct navigable waters of the U.S.	Full compliance upon signing of the FONSI
National Historic Preservation Act	Coordination on-going	The determination of no adverse effect to historic properties has been sent to the SHPO, requesting concurrence.	Full compliance upon receiving concurrence and signing of the FONSI
EO 12898 Environmental Justice	Coordination complete	Minority or low-income com-munities are not disproportionally affected by the project.	Full compliance upon signing of the FONSI
EO 13112 Invasive Species	Coordination complete	Project is not expected to lead to propagation of invasive species	Full compliance upon signing of the FONSI
EO 11990 Protection of Wetlands	N/A	Project will not impact wetlands	N/A

10.3 Views of the Sponsor and Stakeholders

The State of Alaska has expressed ongoing, enthusiastic support for the implementation of navigation improvements in the Arctic in general and specifically supports the Tentatively Selected Plan identified in this feasibility study. The City of Nome has also expressed enthusiastic support for the implementation of the plan recommended in this feasibility study and has expressed interest in assuming the lead role of non-Federal sponsor for the design and construction phases of the project. The State of Alaska would not have a direct role, but could

[15] http://coastalmanagement.noaa.gov/programs/czm.html

provide valuable financial and technical support for the design and construction phases of the project.

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The construction of the proposed project would have minor but largely controllable short-term environmental impacts. However, in the long term it would help improve the overall quality of the human environment. This assessment supports the conclusion that the proposed project does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, a finding of no significant impact will be prepared.

11.2 Recommendations

I recommend that the navigational improvements at Nome, Alaska be constructed generally in accordance with the plan herein, and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable at an estimated total Federal cost of $97.4 million and $244,000 annually for Federal maintenance.

a. Enter into an agreement which provides, through the execution of the project partnership agreement, 25 percent of design costs;

b. Provide, during period construction, any additional funds needed to cover the non-Federal share of design costs;

c. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the placement of dredged material required for project construction or operation and maintenance and for which a contract for the federal facility's construction or improvement was not awarded on or before October 12, 1996;):

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

d. Provide all lands, easements, and rights-of-way, including those necessary for the borrowing of material and the disposal of dredged or excavated material, and perform or ensure the performance of all relocations, including utility relocations, all as determined by the Federal Government to be necessary for the construction or operation and maintenance of the general navigation features;

e. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the general navigation features, an additional amount equal to 10 percent of the total cost of construction of the general navigation features less the amount of credit afforded by the Government for the value of lands, easements, rights-of-way, and relocations, including utility relocations, provided by the non-Federal sponsor for the general navigation features. If the amount of credit afforded by the Government for the value of lands, easements, rights-of-way, and relocations, including utility relocations, provided by the non-Federal sponsor equals or exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations, including utility relocations, in excess of 10 percent of the total cost of construction of the general navigation features;

f. Provide, operate, and maintain at no cost to the Government, the local service facilities including utilities, docks, berthing areas, and access roads; in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefor, to meet any of the non-Federal sponsor's obligations for the project unless the Federal agency providing the funds verifies in writing that the funds are authorized to carry out the project;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of completing, inspection, and, if necessary, for the purpose of operating and maintaining the general navigation features;

i. Hold and save the United States free from all damages arising from the construction or operation and maintenance of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Federal Government determines to be necessary for the construction or operation and maintenance of the general navigation features.   However, for lands, easements, and rights-of-way that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

l. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction or operation and maintenance of the general navigation features;

m. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the Water Resources Development Act of 1986, Public law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction or operation and maintenance of the general navigation features including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act; and

p. Comply with all the requirements of applicable Federal laws and implementing regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Army Regulation 600-7 issued pursuant thereto; and 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (labor standards originally enacted as the Davis-Bacon Act, the Contract Work Hours and Safety Standards Act, and the Copeland Anti-Kick Act).

The recommendations for implementation of navigation improvements at Nome, Alaska reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect the program and budgeting priorities inherent in the local and State programs or the formulation of a national civil works water resources program. Consequently, the recommendations may be changed at higher review levels of the executive branch outside Alaska before they are used to support funding.

Date: ________________________

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COL Christopher D. Lestochi
Commander
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Appendix A
Hydraulics and Hydrology

Appendix B

Economics

Appendix C
Cost Engineering

Appendix D

Real Estate Plan

Appendix E
General Correspondence

Appendix F
NEPA Correspondence

Appendix G

Draft U.S. Fish and Wildlife Coordination Act Report

Appendix H
Clean Water Act Section 404(b)(1)

Appendix I

Essential Fish Habitat (EFH) Evaluation