Draft Environmental Impact Statement

Mertarvik Infrastructure Development
Nelson Island, Alaska

Critical habitatimplement
Of

Computer generated rendering of proposed Mertarvik community layout – ANTHC 2017

December 2017

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Draft Environmental Impact Statement

Mertarvik Infrastructure Development
Nelson Island, Alaska

Prepared for the
Denali Commission
by the
U.S. Army Corps of Engineers, Alaska District

with the
U.S. Department of Transportation Federal Aviation Administration
as a Cooperating Agency

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Nelson Island, Alaska

Cover Sheet

Lead Agency:	The Denali Commission
Cooperating Agencies:	U.S. Department of Transportation Federal Aviation Administration (FAA)
Title of Proposed Action and Location:	Mertarvik Infrastructure Development, Nelson Island, Alaska
EIS Designation:	Draft Environmental Impact Statement
Affected Jurisdiction(s):	Village of Newtok, Bethel Census Area
Contact Information:	CAPT Donald Antrobus, PE dantrobus@denali.gov 907-271-3500 510 L Street, Suite 410 Anchorage, AK 99501
Comments Due By:	February 13, 2018 Please submit comments to CAPT Antrobus at the above email address or postal address.

Abstract

This draft Environmental Impact Statement evaluates the potential environmental effects associated with development of critical infrastructure and subsequent long-term occupation of a new village site designed to receive the residents of the village of Newtok, Alaska. The purpose of the proposed action is to provide the residents of Newtok a safe place to live that allows them to maintain their community, way of life, and cultural identity within their traditional lands. The proposed action is needed to avoid potential loss of life and/or the indefinite displacement of Newtok residents associated with the rapidly eroding Ninglick River shoreline that threatens critical village infrastructure. This EIS is submitted for review pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 and applicable laws and Executive Orders.

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Executive Summary

The village of Newtok is an Alaska Native community of 374 residents (2016 Department of Labor estimate) located near the southwest coast of Alaska on the banks of the tidally influenced Ninglick River. A bend of the Ninglick River is rapidly eroding toward Newtok at an average rate of nearly 70 feet of per year. This erosion is a result of a combination of river scour, permafrost thawing, and storm surge. The village has lost its barge landing and landfill to the erosion, will begin to lose houses in 2017 or 2018, and is expected to have its school, water source, and airport access threatened by 2020. Changes in local hydrology brought about by the erosion have also increased vulnerability to severe flooding, limited boat and barge access, and impaired waste management practices at the village.

The purpose of the Mertarvik Infrastructure Development project is to provide the people of Newtok a place to live that allows them to keep their community and way of life within their traditional lands, while creating the necessary infrastructure for a safe, stable, and healthy existence.

The preferred alternative for this project has been shaped and constrained by a series of events, studies, and decisions occurring over at least four decades. This draft Environmental Impact Statement (EIS) describes a number of alternatives in a historical context for the purpose of illustrating how the long-term evolution of the project led to the selection of a new village site to be constructed at Mertarvik on Nelson Island, a site granted to the village in a land exchange approved by the U.S. Congress (Public Law 108-129), and Alternative 2 of the three community layout plans evaluated, as the preferred alternative. The NEPA analysis in this EIS is confined to the no action alternative and the community layout plan alternatives developed and refined in 2016-2017 by the Newtok Village Council and the Denali Commission.

The constant factor in all these alternatives, including the no action alternative, is the present threat to Newtok from erosion and flooding, and the inevitable destruction of the current village site. Given that engineered solutions to control or moderate the erosion have been abandoned as impractical, there is no alternative that preserves a status quo at Newtok. The alternatives discussed in this EIS are all responses that have been proposed to an ongoing, unstoppable catastrophe for the community of Newtok.

The preferred community layout plan (CLP) includes as a major feature a replacement airport in addition to other necessary infrastructure to include a school, landfill, homes, powerplant, water treatment plant, washateria etc. It is anticipated that a phased approach will be used to construct the new community over the next several years. Some infrastructure has already been constructed at the site: barge landing, access road, evacuation center, and some pioneer homes.

This EIS evaluated the environmental impacts of each CLP alternative on the resources at the Mertarvik site in the table below. The environmental impacts of the three alternatives are essentially identical. No significant negative impacts were found under any alternative; each alternative provides beneficial effects for several resource categories, such as culture and public health. See section 5.1 for an explanation of the terms in the table.

Table i. Summary of Environmental Impacts by Resource Category

Resource Category	No Action Alternative	CLP 1 Alternative	CLP 2 Alternative (preferred)	CLP 3 Alternative
Geology, Soils, & Topography	No impact	MINOR impacts		
Hydrology & Hydraulics	No impact	MINOR impacts		
Floodplains	No impact	LESS THAN SIGNIFICANT impacts		
Surface Water	No impact	LESS THAN SIGNIFICANT impacts		
Groundwater	No impact	LESS THAN SIGNIFICANT impacts		
Air Quality	No impact	LESS THAN SIGNIFICANT impacts		
Climate & Climate Change	No impact	MINOR impacts		
Habitat	No impact	MINOR impacts		
ESA Species	No impact	LESS THAN SIGNIFICANT impacts		
MMPA Species	No impact	MINOR impacts		
Migratory Birds	No impact	MINOR impacts		
EFH & Anadromous Streams	No impact	MINOR impacts		
Wetlands & other Special Aquatic Sites	No impact	LESS THAN SIGNIFICANT impacts		
Protected Lands	No impact	MINOR impacts		
Cultural History & Cultural Resources	No impact	MINOR impacts		
Community & Culture	MAJOR impacts	MINOR impacts		
Socioeconomics	MAJOR impacts	MINOR impacts		
Subsistence Resources & Practices	MAJOR impacts	MINOR impacts		
Land Use & Compatibility	No impact	MINOR impacts		
Public Health & Safety	MAJOR impacts	MINOR impacts		
Public Services & Utilities	MAJOR impacts	MINOR impacts		
Noise	No impact	LESS THAN SIGNIFICANT impacts		
Visual Environment	No impact	MINOR impacts		

The Newtok Village Council, the governing body of Newtok Village, the federally recognized tribe for Newtok, and the residents of Newtok support development of infrastructure at Mertarvik as it provides a place where they can maintain their cultural identity and subsistence way of life within their traditional lands.

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Acronyms and Abbreviations

AAC	Alaska Administrative Code
ACM	Asbestos Containing Materials
AEA	Alaska Energy Authority
ADCRA	Alaska Division of Community and Regional Affairs
ADEC	Alaska Department of Environmental Conservation
ADCCED	Alaska Department of Commerce, Community, and Economic Development
ADEH	Alaska Division of Environmental Health
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOTPF	Alaska Department of Transportation and Public Facilities
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ANTHC	Alaska Native Tribal Health Consortium
APDES	Alaska Pollutant Discharge Elimination System
APE	Area of Potential Effect
AS	Alaska Statute
ASCG	Arctic Slope Consulting Group
ATV	All-Terrain Vehicle
AWQS	Alaska Water Quality Standards
bgs	Below Ground Surface
BIA	Bureau of Indian Affairs
BMP	Best Management Practice
BOD	Biological Oxygen Demand
BOD_5	5-Day Biological Oxygen Demand
C	Celsius
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CCHRC	Cold Climate Housing Research Center
CGP	Construction General Permit
CH	Critical Habitat
CLP	Community Layout Plan
cm	Centimeter
CRA	Certificate of Reasonable Assurance
CWA	Clean Water Act
cy	Cubic Yards
dBA	A-Weighted Decibels
DNL	Day-Night-Level

DoD	Department of Defense
DPS	Distinct Population Segment
DWPP	Drinking Water Protection Program
EA	Environmental Assessment
EDA	Economic Development Agency
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ELG	Effluent Limitation Guideline
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
F	Fahrenheit
FAA	Federal Aviation Administration
FC	Full Compliance
FAR	Federal Aviation Regulation
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Regulation
FWCA	Fish and Wildlife Coordination Act
GMU	Game Management Unit
GPM	Gallons-Per-Minute
HUC	Hydrologic Unit Code
HUD	Department of Housing and Urban Development
IAW	In Accordance With
IRR	Indian Reservation Roads
IRT	Individual Readiness Training
kHz	Kilohertz
l	Liter
LKSD	Lower Kuskokwim School District
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Levels
MEC	Mertarvik Evacuation Center
MGD	Million Gallons per Day
MOA	Memorandum of Agreement
MMPA	Marine Mammal Protection Act
MSGP	Multi-Sector General Permit
MSL	Mean Sea Level

m	Meter
mg	Milligrams
µg	Micrograms
µPa	Micropascals
µS	Microsiemens
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFS	Non-Frost Susceptible
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent to Prepare an EIS
NOT	Notice of Termination
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPG	Newtok Planning Group
NPIAS	National Plan of Integrated Airport Systems
NRHP	National Register of Historic Places
NTC	Newtok Traditional Council
NVC	Newtok Village Council
NWR	National Wildlife Refuge
O_3	Ozone
PC	Partial Compliance
PCE	Primary Constituent Element
PEM1	Palustrine Emergent Persistent (Wetland)
pH	Potential of Hydrogen
PL	Public Law
PM_{10}	Particulate Matter less than 10 micrometers in diameter
$PM_{2.5}$	Particulate Matter less than 2.5 micrometers in diameter
PML	Palustrine Moss-Lichen (Wetland)
POTW	Publicly Owned Treatment Works
PSS	Palustrine Shrub-Scrub (Wetland)
PWS	Public Water System
PWSID	Public Water System Identification
RALO	Rural Alaska Landfill Operator
RSV	Respiratory Syncytial Virus
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SMCL	Secondary Maximum Contaminant Levels
SPCC	Spill Prevention, Control and Countermeasures

SREB	Snow Removal Equipment Building
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
TBEL	Technology-Based Effluent Limits
TMDL	Total Maximum Daily Load
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VSWP	Village Safe Water Program
WBD	Watershed Boundary Dataset
WET	Whole Effluent Toxicity
WHP	Wellhead Protection
WOTUS	Waters of the United States
WQBEL	Water Quality-Based Effluent Limit

1. Introduction

The village of Newtok (Figure 1) is an Alaska Native community of 374 residents (2016 Department of Labor estimate) located on the southwest coast of Alaska, on the banks of the tidally influenced Ninglick River. A bend of the Ninglick River is rapidly eroding toward Newtok, with an average of nearly 70 feet of village land lost each year to a combination of river scour, permafrost thawing, and storm surge. The village has lost its barge landing and landfill to the erosion, will begin to lose houses in 2017 or 2018, and is expected to have its school, water source, and airport access threatened by 2020. Changes in local hydrology brought about by the erosion have also increased vulnerability to flooding, limited boat and barge access, and impaired waste management practices at the village.

This draft Environmental Impact Statement assesses the potential environmental impacts of constructing critical infrastructure at a new community site at Mertarvik. This includes an airport; solid waste landfill; wastewater collection system and treatment lagoon; bulk fuel farm and fuel dispensing facility; power house and power distribution system; water treatment plant, storage tank, and distribution lines; housing; school; public buildings; and all associated connecting roads and trails. The proposed site, Mertarvik, is about 9 miles south of Newtok on the northeast shore of Nelson Island in Southwest Alaska, centered at roughly 60.82°N, 164.50°W (Figure 1). The name Mertarvik, in the Yup'ik language, means "getting water from the spring," and refers to a freshwater spring in the area that has been traditionally valued as a source of drinking water. The Mertarvik site is on elevated land underlain by the Nelson Island basalt dome, and is expected to be far less susceptible to erosion and flooding than sites on the surrounding Yukon Delta alluvial plain.

1.2 Project Authority

The U.S. Congress established the Denali Commission through the Denali Commission Act of 1998, as amended, as an independent Federal Agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, the U.S. Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities.

This EIS has been developed in accordance with (IAW) the National Environmental Policy Act of 1969 (NEPA; United States Code [USC] 4321), the implementing regulations issued by the President's Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Denali Commission's policies and procedures for compliance with the National Environmental Policy Act (NEPA) of 1969, as amended (45 CFR §900).

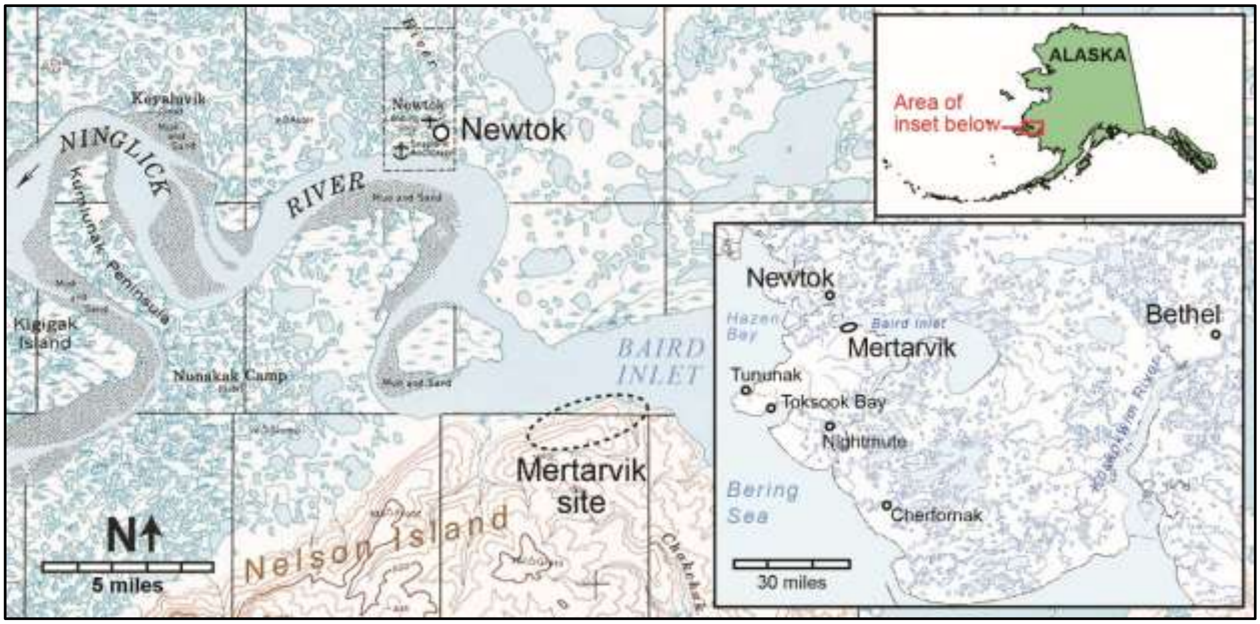


Figure 1. Location and vicinity map of the Mertarvik community site and village of Newtok, Alaska.

The Denali Commission identified funding in FY 2016 to undertake environmental review work at Mertarvik. These funds became available in mid-August 2016. The Commissioners did not specify that the Denali Commission would do this work, but allowed that other Federal agencies could do the work on behalf of the Commission (ADCRA 2017g).

1.2 Study Participants

The Denali Commission is the lead Federal agency for this proposed action. This EIS was prepared primarily by the staff of the Environmental Resources Section, Civil Project Management Branch, U.S. Army Corps of Engineers (USACE), Alaska District, on behalf of and funded by the Denali Commission.

The Denali Commission sent letters of invitation to two agencies that expressed interest in being Cooperating Agencies—the Federal Aviation Administration (FAA) and the U.S. Fish and Wildlife Service (USFWS)—on March 2, 2017 and March 6, 2017, respectively. Both agencies contributed significant content and/or guidance, although the USFWS ultimately withdrew as a Cooperating Agency when they realized there would be no significant impacts to the Yukon Delta National Wildlife Refuge. The Denali Commission also sent letters to several other agencies on March 17, 2017, inviting them to be participating agencies. Several Federal, State and tribal agencies participated in the alternatives development process by providing informal recommendations to the Denali Commission, including the Council on Environmental Quality (CEQ), U.S. Environmental Protection Agency (USEPA), FAA, U.S. National Marine Fisheries Service (NMFS), U.S. Department of Housing and Urban Development (HUD), Federal Emergency Management Agency (FEMA), Alaska Department of Fish and Game (ADFG), Alaska Department of Environmental Conservation (ADEC), Alaska Native Tribal Health Consortium (ANTHC), and the Newtok Village Council (NVC).

1.3 Scope of Environmental Analysis

NEPA requires Federal agencies to solicit public input on proposed actions, consider the potential impacts to the natural and human environment from their proposed actions as part of their decision-making process, and to fully disclose the potential impacts in a document that is circulated for public review. The NEPA process is intended to support public officials in making decisions based on an informed understanding of the potential environmental consequences and to take appropriate actions that protect, restore, and enhance the environment (40 CFR §1500.1). NEPA therefore facilitates the incorporation of environmental considerations into the decision-making processes of Federal agencies that have the ability to react to potential environmental consequences prior to taking action.

The scope of this EIS is primarily limited to the construction of new community infrastructure (e.g., homes, school, airport, community service facilities, power and water supply, etc.) at Mertarvik, as defined in the community layout plan (CLP) developed in 2016-2017 by the NVC and supported by the Denali Commission. The proposed Mertarvik Airport layout and alignment was developed by the Alaska Department of Transportation and Public Facilities (ADOTPF) and conditionally approved by the FAA, in coordination with the CLP preparation.

This EIS does not present or analyze alternatives for decommissioning activities (e.g., the dismantling of homes, fuel systems, and other structures, securing potential sources of contamination, etc.) at the existing Newtok village site, except where such an analysis is required by the FAA (a Cooperating Agency in the preparation of this EIS) under its internal policies for development of new/replacement airports. Decommissioning is discussed in the context of "connected actions" under NEPA in section 5.23.4. No statutory or regulatory trigger has been identified that requires decommissioning at Newtok in response to the proposed development at Mertarvik, and the development is not an interdependent part of a larger action that would depend upon decommissioning as a necessary component. Therefore, analysis of possible future decommissioning activities at Newtok does not lay within the scope of this EIS.

1.4 Incorporation of other NEPA and Related Documents by Reference

The preparation of this EIS was aided greatly by the long-term efforts of the State of Alaska Division of Community and Regional Affairs (ADCRA) and the Newtok Planning Group (NPG). The NPG was formed in 2006 to coordinate the efforts of State and Federal agencies and non-governmental organizations assisting with the Newtok relocation process. As part of this coordination, the NPG created a website that collects, organizes, and archives the many various studies, reports, histories, NEPA documents, community layout plans, memoranda, and resolutions that have been generated over several decades in support of the relocation project:

https://www.commerce.alaska.gov/web/dcra/PlanningLandManagement/NewtokPlanningGroup.aspx. This EIS cites extensively the project documents archived on the NPG website, as well as original Newtok histories and other content provided there.

Listing all the previous studies that have informed this EIS would be unwieldy and provide little context. Much of Section 4 (Alternatives) is devoted to identifying, describing, and summarizing the previous studies and reports that have influenced and led to the proposed action. When referenced, the results and analyses of these various studies are incorporated by such reference in accordance with (IAW) 40 CFR §1502.21.

2. Purpose and Need for the Proposed Action

The purpose of the Mertarvik Infrastructure Development project is to provide the people of Newtok with a place to live that allows them to keep their community and way of life within their traditional lands, while also providing the necessary infrastructure for a safe, sustainable, and healthy existence.

Few Alaska Native communities are as imminently threatened with displacement from coastal erosion as the village of Newtok. The rapidly advancing erosion of the Ninglick River shoreline and increasingly severe flooding is expected to make Newtok's current location unsustainable for the community as early as 2020 and force the relocation of the village's residents.

Newtok is situated near an outside bend of the Ninglick River on low land surrounded by flat, marshy tundra. Soils in the area are typically silt, with a shallow active layer overlaying deep continuous permafrost. The permafrost is ice-rich, and summer heating of exposed soil at the river's edge results in a loss of soil structure and a high vulnerability to erosion by river current and wave action (Figure 2). Newtok is about 19 river-miles from the Bering Sea and experiences twice-daily tides that also contribute to the breakdown of the weakened river bank, as well as periods of increased wave action from storm-surges and high winds coming in from the ocean (Figure 3; ASCG 2004, Woodward-Clyde 1984).

Figure 2. Breakdown of the Ninglick River bank at Newtok, October 2016 (photo courtesy of Lemay Engineering)

Figure 3. Storm surge actively eroding the Ninglick River bank at Newtok, October 2016 (photo courtesy of Lemay Engineering)

Encroachment of the Ninglick River towards Newtok has been evident for many decades and under evaluation since at least the 1980s. Woodward-Clyde (1984) used field measurements and historic data to calculate that the river had been advancing on the village at rates of 42 to 113 feet each year. In 2003, the Arctic Slope Consulting Group (ASCG) worked with the Newtok Traditional Council (NTC) to update and expand upon the Woodward-Clyde study, calculating an annual average erosion rate of 68 feet per year, and creating a map showing historical and projecting future extents of erosion (Figure 4; ASCG 2004). Although the rate of erosion varies greatly from year to year, the projected erosion extent for 2017 shown on the 2004 map correlates well with the actual shoreline alignment observed in late 2016 (Figure 5). At this rate of erosion, the community, which already lost its former dumpsite in 1996 and was forced to shift its barge landing area inland, will start losing some homes by 2017 or 2018. The school building, a vital part of the village infrastructure that has helped supplement a failing village water system and supports other community services, is projected to be in jeopardy by 2020. The southern end of the airport runway will begin eroding around the same time, with the apron and the access road between the airport and village rendered unusable by about 2030 (Figure 5). Prior to the runway's erosion, the community will have already lost its only source of clean drinking water. The 2,180-foot-long State-owned gravel airstrip may remain usable for up to 20 more years, while its southern end gradually erodes away (a minimum of about 1,800 feet of runway is required for most airplanes servicing Newtok). The airfield is currently scheduled to be resurfaced with gravel in 2018, but that will be the last refurbishment of the airport to be conducted by the ADOTPF (Merritt 2017).

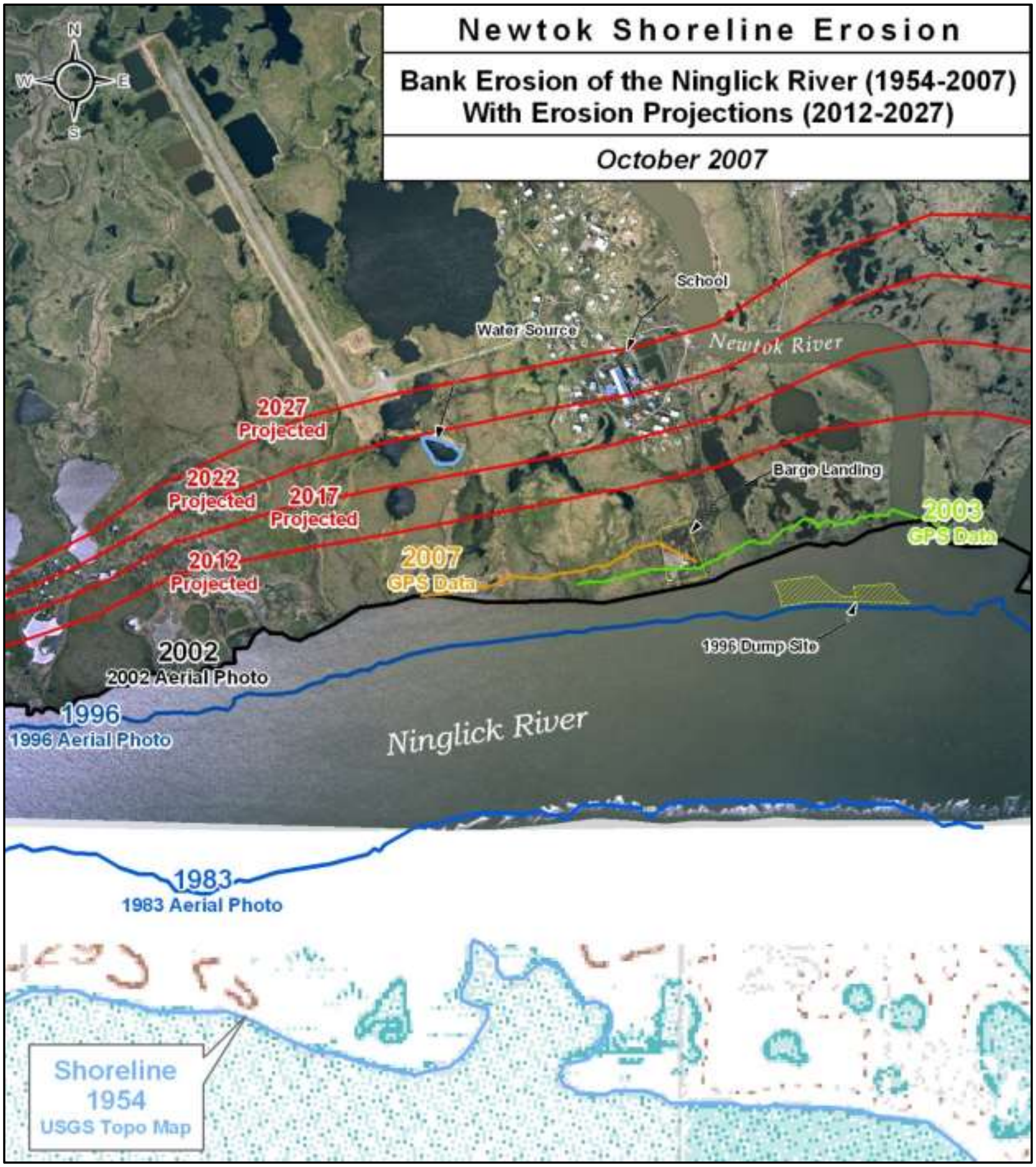


Figure 4. Historic shoreline positions and projected erosion limits as of 2003 (ASCG 2004, updated in 2007).

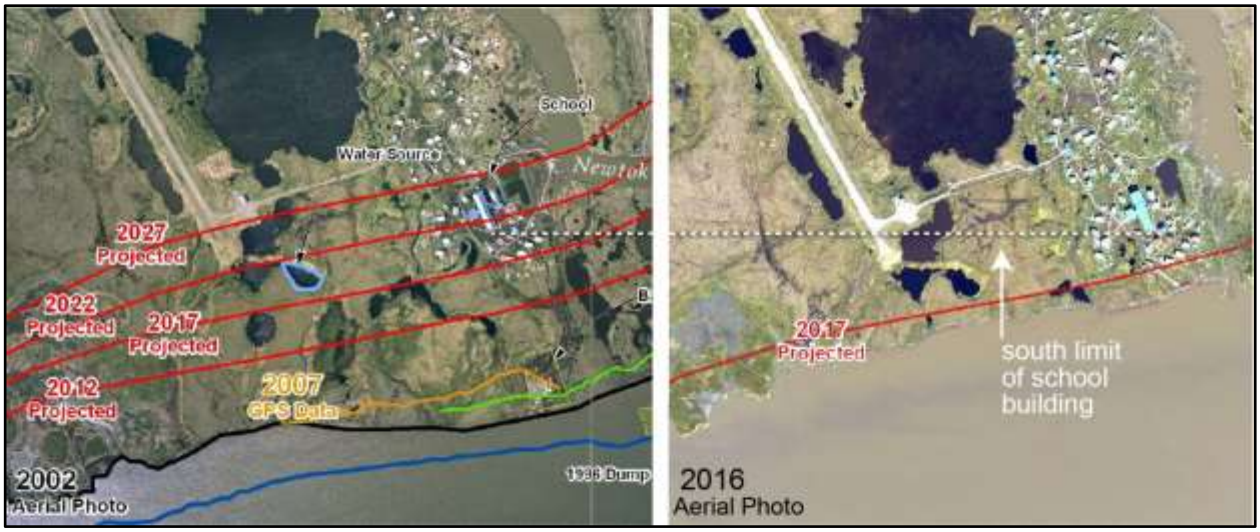


Figure 5. Comparison of projected erosion rates, with the shoreline position as of September 2016 (left, ASCG 2004; right, 2016 aerial photo courtesy of USGS)

Engineered solutions to protect the village in place, or to slow the pace of erosion, have been previously examined. A 1987 attempt to harden the riverbank with an experimental seawall of canvas bags filled with cement failed when the seawall was undercut and washed away. Engineered alternatives that would redirect the river flow away from Newtok using spur dikes or a cut-off channel have also been considered (section 4.3.1).

In addition to the physical destruction of the Newtok village site, the progressive erosion of the Ninglick River bank also contributes to flooding of the village and to the silting-in of the Newtok River. The Newtok River once flowed along the east and north sides of the village; the hydraulic "capture" of the Newtok River by the advancing Ninglick River in 1996 quickly resulted in the loss of the land buffer between the village and the Ninglick River and turned the Newtok River from a flowing stream into a tidal slough directly connecting the village with the Ninglick River. Newtok subsequently became more vulnerable to storm surges and subject to more frequent and severe flooding.

The change to the hydraulics of the Newtok River has since led to a host of difficulties affecting the quality of life in the village. Human waste is no longer carried away by the Newtok River, and contaminated water from the stagnant slough can be forced into the village during storms, creating public health concerns. The Newtok River has become progressively shallower due to accumulating sediment and is impassible to nearly all watercraft at low tide.

The village barge landing on the Ninglick River was lost to erosion in 2006. Barges delivering fuel and other supplies then landed at the village via the Newtok River channel for a time, but the shoaling of the Newtok River has made barge access to the village increasingly limited, and barges now unload at improvised landings on the eroding Ninglick River shoreline. This diminished capacity to land barges makes projects to mitigate the effects of erosion and flooding, or to maintain Newtok's existing infrastructure, much more difficult and expensive, and further degrades the quality of life at Newtok (ADCRA 2017h).

3. Public Participation and Scoping

Public participation is an integral component in the preparation of an EIS and begins early in the process of planning and developing the proposed action. The Denali Commission implements public involvement to support the NEPA process according to guidelines established by the CEQ and the Denali Commission's procedures specified in 45 CFR §900. These guidelines promote sound decision making by providing opportunities for the public to be involved in the NEPA process, and they form the framework for public participation in the environmental impact analysis process. The Denali Commission encourages all persons having an interest in the proposed action to participate.

The process begins by the Denali Commission issuing a Notice of Intent to Prepare an EIS (see section 0). Subsequent opportunities for public participation include the following:

- A public scoping process to assist in identifying alternatives and determining the scope of the analysis
- A 45-day public review period for the draft EIS
- Publication of the final EIS (FEIS) at least 30 days before making a final decision and issuing the Record of Decision (ROD).

Scoping assists in identifying the key concerns to be addressed during the analysis and preparation of the EIS, and concludes with a ROD.

3.1 Notice of Intent (NOI)

Pursuant to CEQ Regulations, the Denali Commission, in cooperation with the Newtok Village Council (NVC), initiated preparation of this EIS for the proposed action by publishing a notice of intent (NOI) to prepare an EIS in the Federal Register (FR) on March 3, 2017 (https://www.gpo.gov/fdsys/pkg/FR-2017-03-03/pdf/2017-04119.pdf). The NOI invited individuals, organizations, and agencies to submit comments concerning the scope of the EIS. The comment period ended on April 3, 2017, with comments received only from the U.S. Environmental Protection Agency (USEPA) in a letter dated April 4, 2017 (see Appendix A). The Denali Commission considered those comments in defining the scope of the analysis performed and documented in the EIS.

3.2 Scoping Process

Scoping is a process for determining the range of issues to be addressed in an EIS and for identifying significant issues associated with the alternatives (40 CFR §1501.7). The objectives of the scoping process are to notify those interested – e.g., other Federal, district, and local agencies, tribes, and other groups – about the alternatives being considered; solicit comments about environmental issues, alternatives, and other items of interest; and consider those comments in the preparation of the EIS. The Denali Commission actively solicited input and comment on the EIS process from individuals, organizations, and agencies that previously have taken active interest in Denali Commission projects.

An agency kick-off meeting and two open house agency and public scoping meetings were held with displays, a presentation, and time for public comments and questions to be considered in the planning of the proposed action and preparation of the EIS

3.2.1 Agency Kickoff Meeting

An EIS Kickoff Meeting was held on February 7, 2017 from 1 to 4 p.m. at the Denali Commission office at 510 L Street, Anchorage, AK. An email invitation was sent by the Commission on January 30, 2017 to a comprehensive list of Federal, State, local, and Native organization stakeholders. A teleconference line was made available. The meeting was attended by 29 individuals representing 16 Federal, State and tribal agencies and one organization. The purpose of the meeting was to identify agencies and organizations interested in the proposed action, identify significant environmental issues and compliance requirements likely to be addressed in the EIS (to be confirmed through the public scoping process), and determine roles and responsibilities. Alternatives, initial designs, concerns, constraints, and considerations were openly shared, and constructive comments received that gave direction to the EIS development team.

3.2.2 Village of Newtok Public Scoping Meeting

The Newtok public scoping meeting was held on March 22, 2017, between 6 and 8 p.m. in the Newtok School gymnasium. The meeting was well attended, with 39 residents participating; several additional people joined the meeting after it started or left before the presentation ended. The presenters informed the audience that questions and comments were welcome during or after the meeting and of the availability of forms for providing written comments. The NEPA scoping function of this meeting was combined with a presentation of the preferred Mertarvik community layout plan (CLP) alternative selected earlier in March by the NVC. Unlike many NEPA public scoping meetings, the audience of Newtok residents was mostly already familiar with the proposed action.

The meeting format revolved around PowerPoint® presentations, with tribal administrator Tom John providing an oral translation into Yup'ik. The Denali Commission gave an introductory presentation on the project status and purpose of the meeting. The USACE Alaska District presented the NEPA scoping portion of the meeting, outlining the NEPA process, the project schedule, and the community input that was sought on environmental resources of concern and impacts of the proposed action. The ANTHC provided a brief update on the preferred CLP alternative. A USACE Alaska District biologist and archaeologist concluded the presentation with brief descriptions of past ecological and cultural resource surveys performed at the Mertarvik community site, with the intention of stimulating conversations about subsistence and cultural sites of concern.

The audience had few questions or comments during the meeting. Several attendees made general comments that they were eager for the relocation project to move forward. Two written comments and one verbal comment transcribed to a comment form are provided below. Individual discussions before and after the meeting between presenters and Newtok residents yielded more specific information about land use issues at Mertarvik and resources of concern. In particular, the USACE Alaska District archaeologist learned about potential grave sites, previously not identified as such, which are reportedly visible from the existing houses constructed by the Bureau of Indian Affairs (BIA) at Mertarvik.

- Written Comment #1: "Thank you for being concerned about traditional sites."
- Written Comment #2: "Liked the things you guys thought and asked before making the place, thinking of the animals and the land resources. And asking about what the other people think."
- Transcribed Verbal Comment: "Question about contaminants from landfill reaching fish stream (Takichak River) to the east."

The public scoping meeting in Newtok was documented using two digital voice recorders; the digital sound files are stored with the Denali Commission. In the absence of extensive public verbal commentary or discussion at the meeting, the Denali Commission decided to not have written transcripts of the meeting prepared at this time.

3.2.3 Anchorage Agency and Public Scoping Meeting

The Anchorage agency and public scoping meeting was held on March 29, 2017, at the Denali Commission offices at 510 L Street in Anchorage, from 1:30 to 4 p.m. The Denali Commission and USACE presented updated information on the proposed action and the scoping process to date. A primary objective of the meeting was to validate the scope of the proposed action, and to obtain feedback on the EIS work plan that had been shared with the participating and cooperating agencies.

The preferred CLP alternative (selected by the village of Newtok) was presented, along with a proposed outline of the EIS topics and the following list of items that would not be included in the EIS analysis:

- Decommissioning activities at Newtok;
- The conceptual small boat harbor and waterfront development;
- The concept of upgrading the Mertarvik airport to a regional hub; and
- A prospective exchange of additional lands with the USFWS.

Decommissioning at Newtok (e.g., dismantling of structures, removal of materials, etc.) is discussed in section 5.23.4. The Denali Commission has determined that, with the exception of some actions regarding the deactivation of Newtok airport, decommissioning activities at Newtok are not a "connected action" (as defined by the NEPA) to infrastructure construction at Mertarvik. The potential decommissioning activities discussed in section 5.23.4 pose a negligible risk of significant negative impacts to the environment and can be implemented without an EIS-level of analysis under the NEPA. The Commission has also identified several existing studies and plans that address decommissioning at Newtok:

- The Mertarvik Energy Master Plan (Cooper, *et al.* 2017b) discusses the draw-down of energy needs at Newtok at each phase of the proposed action, and describes recommended decommissioning steps for fuel storage, power supply, and electrical distribution equipment at Newtok at each phase.

- The Alaska Department of Commerce, Community, and Economic Development (ADCCED) funded a three-part environmental site inventory and assessment at Newtok, including an inventory of hazardous substances and contaminant sources, development of alternatives and preliminary costs for remediation, and a cleanup strategy (Hobbit 2015, 2016a, 2016b).

- Under the Waste Erosion Assessment and Review (WEAR) program, the ADEC Solid Waste Division has developed Detailed Action Plans (DAPs) for two sites at Newtok: the backhaul staging area (ADEC 2015a), and the Ungusraq Power Company (UPC) generator building (ADEC 2015b). The plans include recommendations for removing structures and debris, assessing soil contamination, and remediating contaminated soils if necessary.

Following the agency scoping meeting, the Denali Commission invited individual participating agencies by letter to identify any regulatory or policy requirements that might cause actions to be "connected" to the proposed activity. The USFWS provided a letter (dated June 26, 2017, see Appendix A) discussing resources that may be damaged if contaminants are released from

Newtok, and several nexuses between decommissioning and legal authorities, but did not demonstrate that decommissioning at Newtok is a connected regulatory requirement for the proposed construction at Mertarvik. No such requirements were identified by other agencies either.

The other three bulleted items above were considered too speculative and/or at too different a phase of planning to be included with the CLP infrastructure for analysis within this EIS. FAA eliminated the airport alternative related to the concept of Mertarvik Airport becoming a regional hub as unreasonable and speculative because a regional hub already exists, and there is neither the demand nor justification of establishing another. Additionally, it is not an alternative to the proposed airport as it requires the proposed airport in an expanded format to address additional flights and greater cargo and passenger handling. It would result in additional impacts for a speculative concept; therefore, it is an unreasonable alternative under NEPA.

3.3 Scoping Issues Identified

The Denali Commission received letters from several agencies following the agency and public scoping meeting:

- FEMA provided a letter dated March 31, 2017, requesting to join the project as a cooperating agency, and reiterating that the EIS "should include a description of anticipated decommissioning activities, to include demolition, dismantling, and disposal of infrastructure and housing; environmental remediation; and land restoration." FEMA also requested that scoping comments developed as part of an EA for a proposed FEMA action for relocation of existing homes from Newtok to Mertarvik be incorporated into the scoping comments received for the EIS. FEMA also requested an evaluation of the scope of environmental issues to include effects on floodplains and subsistence resources. In a follow-up letter, the Denali Commission invited FEMA to be a cooperating agency; however, FEMA did not respond.

- USDA provided a letter dated April 6, 2017, in which they offered to be a "consult agency" [*sic*], and will review and provide comments on the EIS only. The letter also stated that they believed the decommissioning of Newtok was a connected action and should be evaluated in the EIS, and that the review of alternative facilities and alternative locations for each facility must be outlined in detail in the EIS document." This would include the overall footprint of the community and the opportunity to utilize smaller lots to help reduce the impact to environmental resources.

- USEPA provided an 8-page letter dated April 4, 2017 with general and regionally specific advice on scoping and topics for the EIS to include air and water quality, wetlands, range of alternatives, effects of climate change, effects on aquatic resources, wastewater treatment and drinking supply, solid waste management, fuel storage, and mitigation measures among others. In the letter, the USEPA recommends that "decommissioning be discussed in the EIS as a likely connected action," but that the discussion could be "reasonably limited to discussing anticipated Federal and State requirements for decommissioning of infrastructure at Newtok," and other approaches short of a full NEPA analysis.

- The U.S. Department of Housing and Urban Development (HUD) sent a letter dated April 3, 2017, accepting the Commissions invitation to be a cooperating agency; however, HUD had been invited to be a participating agency, only.

These letters are included in Appendix A, Correspondence.

3.4 Other Scoping Comments

- FAA – Expressed a desire that the Purpose and Need be structured more like a generic EIS than a Federal civil works project. They also expressed a desire that lighting be addressed as potential light pollution.
- Newtok Resident – Concern expressed regarding the potential impact of the proposed Class II Municipal Solid Waste Landfill on the water quality of the Takikchak River.

3.5 Agency Consultation and Coordination

Agency coordination is a general term referring to the process whereby government agencies are afforded an opportunity to review and comment on the proposed action at various points in the analysis and at key milestones. This environmental study has been coordinated with agencies having direct or indirect jurisdiction over features in the proposed action area or an expected interest in the environmental study. The agencies that regularly attended these meetings were:

Federal Agencies

- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Indian Affairs (BIA)
- U.S. Council on Environmental Quality (CEQ)
- U.S. Department of Agriculture (DOA)
- U.S. Department of Energy (DOE)
- U.S. Department of Health and Human Services, Indian Health Service (IHS)
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Department of Interior (DOI)
- U.S. Economic Development Administration (USEDA)
- U.S. Environmental Protection Agency (USEPA)

- U.S. Department of Transportation, Federal Aviation Administration (FAA)
- U.S. Federal Emergency Management Agency (FEMA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. National Marine Fisheries Service (NMFS)

State Agencies

- Alaska Department of Commerce, Community and Economic Development (ADCCED)
- Alaska Department of Environmental Conservation (ADEC)
- Alaska Department of Military and Veterans Affairs (ADMVA)
- Alaska Department of Transportation and Public Facilities (ADOTPF)
- Alaska Division of Homeland Security and Emergency Management (ADHS&EM)
- Alaska Housing Finance Corporation (AHFC)

Native Organizations and Tribes

- Alaska Native Tribal Health Consortium (ANTHC)
- Newtok Village Council
- Native Village of Nightmute
- Nunakauyarmiut Tribe (Toksook Bay)
- Native Village of Tununak

Engineering Consultant

- DOWL LLC

4. Alternatives

4.1 Proposed Action

The proposed action is to construct the infrastructure at Mertarvik in accordance with the CLP chosen by the residents of Newtok and accepted by the Denali Commission. Please see section 4.6 for the specifics of the proposed action, CLP Alternative 2.

4.2 The No Action Alternative

Under the no action alternative, the comprehensive planned development of new village infrastructure at Mertarvik described above would not occur, and the expected environmental and human impacts, negative or beneficial, discussed in Chapter 5 would not happen. It is likely that some portion of the Newtok community may settle at Mertarvik on their own, and make use of the infrastructure already built. Non-Federal funding may be found for the piece-meal construction of additional homes and some utilities, but major infrastructure such as the airport and school would be difficult to fund in the absence of a comprehensive effort toward establishing a new community at Mertarvik.

At Newtok, the residents would gradually be displaced by the destruction of their homes, school, and other support facilities, by the increasing difficulty of life at Newtok, and be forced to find new places to live as personal circumstances allowed. The Newtok community would be physically divided, and its goal of maintaining its strong identity and cultural foundation would become difficult or impossible.

As required by the NEPA, the no action alternative is carried forward for further analysis in this EIS.

4.3 Alternatives Previously Considered but Not Carried Forward

This project has been shaped and constrained by a series of events, studies, and decisions occurring over at least four decades. This section describes a number of alternatives in a historical context for the purpose of illustrating how the long-term evolution of the project led to the selection of a new village site to be constructed on Nelson Island, and Alternative 2 of the three community layout plans, as the preferred alternative. This EIS does not attempt to analyze all previously defined potential alternatives to the currently proposed action nor alternatives to components of that action identified over the last four decades because NEPA does not require the repetitive analysis of alternatives previously dismissed in a prior NEPA analysis or related action unless they fall within the current scope of analysis and are "reasonable" alternatives. The NEPA alternatives analysis process involves analysis of alternatives and/or components of alternatives to the level of complexity required to determine its ability to ameliorate potential negative impacts of the alternative or component of an alternative in relation to other alternatives being analyzed to the same level of detail. Therefore, many alternatives are dismissed at a lesser level of analysis than alternatives carried forward for complete analyses because they are clearly impractical, non-constructable, do not provide valuable mitigation of potential impacts, *etc*.

Alternatives that were considered in the past, but fall outside the current scope of analysis of this EIS and are not carried forward for further analysis are described in the following sections, and include:

- Engineered solutions to stop or slow the erosion of the Ninglick River bank at Newtok, and allow the community to remain in place;
- The relocation of Newtok residents to other existing communities;
- Development of a new community site at a location other than Mertarvik;
- Community layout plans developed for Mertarvik prior to 2016.

4.3.1 Engineering Solutions to Maintain the Existing Community in Place

Maintaining the Newtok community at its current location would require providing protection for homes and infrastructure from the progressive erosion and flooding. Woodward-Clyde, in a 1984 study for the City of Newtok (Woodward-Clyde 1984), examined several engineering solutions. These included hardening the river bank with stone rip-rap or soil/cement-filled geofabric bags, construction of stone spur dikes to deflect and slow river flow along the river bank, and dredging a cut-off channel to divert a portion of the river flow away from the Newtok shoreline.

Any earth- or rock-work project at Newtok would encounter difficulties with the availability and quality of materials in the area. Woodward-Clyde considered the relatively low-cost option of using local soils amended with Portland cement to fill geofabric bags and create a revetment along the river bank. However, the 1984 study judged that the very high silt content of the local soil (90-95%) would not allow the Portland cement to set properly, greatly reducing the strength and rigidity of the soil-filled bag revetment, and leaving it vulnerable to wave and ice action. In 1987, the village, with the assistance of the Corps, attempted a version of this concept using an experimental system of bags filled with cement and polystyrene to build a seawall; this attempt proved to be ineffective and the bags eventually washed away (ASCG 2004). Rock for a revetment or spur dikes is available from several locations along Nelson Island and Kuskokwim Bay. The closest and therefore most-economical rock was identified at two Nelson Island sites, but the Woodward-Clyde report estimated that more than 50 percent of the highly weathered basalt available at the most accessible site would have to be wasted in the course of quarrying rock of a size and quality suitable for a revetment or spur dike (Woodward-Clyde 1984).

The Woodward-Clyde report concluded that spur dikes would be the most cost-effective structural answer to slowing or stopping the erosion and was the only alternative they carried forward for more detailed analysis. The recommended spur dikes would be rock structures built perpendicular to the river bank, about 6 feet in height and extending 150 feet onshore and roughly 250 feet out into the river along the riverbed. The spur dikes would function by diverting the river current and some wave energy away from the bank, and providing an area of calm water where sediment would accumulate. The spur dikes would not reduce the thawing of soil along the river bank, but the most positive outcome anticipated was that by reducing the erosive forces along the bank, a stable, vegetation-insulated shoreline might eventually result. Woodward-Clyde recommended 70 such dikes be built 300 feet apart along 4 miles of river bank, with construction phased over 9 years, although the project could be scaled to construct fewer dikes with correspondingly lower effectiveness (Woodward-Clyde 1984).

At the request of Newtok residents, Woodward-Clyde also looked at the possibility of a cut-off channel to help protect the village. They estimated that a cut-off channel with an adequate cross-sectional area would require excavating 28 million cubic yards of native soil, much of which would be frozen. A cut-off channel would be expected to slow rather than prevent the erosion of the river bank, as it would reduce river flow at the village but have little effect on storm surge, tidal action, or the thawing of the river bank soils (Woodward-Clyde 1984).

Ultimately, Woodward-Clyde concluded, in a cover letter for their November 29, 1984 report addendum, that relocating the village would be less expensive than any effective structural solution. In August 2003, ASCG staff, as part of their study for Newtok, met with members of URS Corporation (formerly Woodward-Clyde) who had worked on the 1983-1984 study, and reviewed the conclusions of the 1984 report. The consensus of that 2003 review was that there are no permanent engineering solutions to the erosion problem, only temporary measures that may slow the advancing river, but at a much higher cost in the long run than relocating the village (ASCG 2004).

These engineering alternatives to protect the current Newtok location from erosion are not carried forward for analysis in this EIS due to the conclusion that the projects would not solve the problem but only delay the destruction of Newtok.

4.3.2 Relocation of Newtok Residents to Existing Communities

This alternative would involve an organized relocation of Newtok residents to one or more existing communities. The basic options consist of moving the population of Newtok to:

- Nearby Nelson Island villages;
- Bethel or other larger communities.

The people of Newtok have close ties to the other villages surrounding Nelson Island: Nightmute, Toksook Bay, and Tununuk (Figure 1 inset). These Yup'ik villages share similar customs and lifestyles with those of Newtok. However, these villages have small populations comparable to that of Newtok (Table 1) and combining the populations of two villages would not only alter the culture of the village of Newtok but also that of the village accepting the Newtok residents. Absorbing all or portions of Newtok's population would significantly increase the populations of these villages and the demands the resulting population would have on the village's resources. This would have the potential to place an increased strain on the housing supply, school, and utility services of the host villages, and on local subsistence resources (ASCG 2004). New homes and enlarged infrastructure would need to be built to accommodate the increased population, requiring construction space that is often limited in Alaska coastal villages, and additional funding. Table 1 illustrates the high occupancy rate of existing housing in these villages as of 2010, and the low level of vacant housing typically available.

Table 1. Populations and Housing Stock of Nelson Island Villages

Village	2010 Population	2010 Housing Units, Total/Vacant
Newtok	354	72/2
Nightmute	280	61/2
Tununuk	327	90/6
Toksook Bay	590	135/10

2010 U.S. Census data, via ADCRA 2017j.

The Cold Climate Housing Research Center (CCHRC) conducted a housing needs assessment in May 2016, interviewing 55 of 66 households in Newtok. The assessment concluded that the majority of households in Newtok are severely overcrowded, under the criteria used by the U.S. Department of Housing and Urban Development (HUD), and up to 105 homes would be needed by the current population of Newtok to provide healthy, comfortable living arrangements (CCHRC 2016). Similar assessments have not been done for the other Nelson Island villages, but it is probable that the relocation of Newtok residents to those villages would lead to continued overcrowding for the Newtok people, while exacerbating any overcrowding at the host villages.

Because of the difficulties that relocating to an existing village would create both for the people of Newtok and the host villages, Newtok residents do not believe that relocation to another village is a viable option. The people of Newtok share a strong bond with each other and feel that relocation to an existing community would result in the end of their identity as a village and a unique culture, and would pose an unacceptable threat to their traditions and values (ASCG 2004).

Relocation to a larger established community such as Bethel or even Anchorage would pose an even greater perceived threat to Newtok's identity and values. While a larger community would have greater capability to provide housing and services to a relocated population, Newtok residents feel that it would be difficult to assimilate into a much bigger community, and that they would lose their close ties with one another and with their traditions. Bethel, with a 2010 population of 6,080, is perceived as having social problems similar to those found in big cities; for instance, importation of alcohol is banned in Newtok, but allowed in Bethel, an issue of great concern to Newtok residents (ASCG 2004).

Overall, relocating Newtok's residents to another existing community would not meet the purpose and need of the people of Newtok to keep their community and its unique culture intact. Alternatives involving the relocation of Newtok residents to an existing community are therefore not carried forward for analysis in this EIS.

4.3.3 Previously Considered Sites for a New Community

The idea of developing a new village site to which Newtok residents could relocate is not new. In 1994, the Newtok Traditional Council (NTC) identified and evaluated six potential new village sites; their selection criteria included:

- Soil foundation suitable for village development;
- Safe from erosion;

- Suitable land for an airport;
- Good barge access; and
- Access to subsistence hunting, fishing and gathering.

The six alternative sites identified that met these criteria are listed below and shown in Figure 6:

1. Tunuirun;
2. Kaikilirmiut;
3. Narukachuk;
4. Puklanarivik;
5. Tagkanirluta; and
6. Takikchak (essentially the same vicinity as the Mertarvik site, located on the north shore of Nelson Island between the Takikchak River and Baird Inlet).

By 2003, after an extensive engineering and cost analysis combined with Newtok resident surveys, all but the Takikchak/Mertarvik site had been discarded (ASCG 2004). The Mertarvik site was unique among the alternatives in making use of elevated, erosion-resistant lands on the Nelson Island basalt dome (described further in section 5.2), and is also relatively close to Newtok. The other sites considered were all on the low-lying alluvial plain, and presumably also vulnerable to rising sea levels and resulting flooding and erosion, potentially limiting their long-term viability. Several of the sites, such as Kaikilirmiut and Puklanarivik, were more remote and isolated than Newtok, and situated far up narrow, shallow waterways that could pose limitations for essential barge traffic. Kaikilirmiut also features an extensive archaeological site with many graves; some village elders opposed a move to Kaikilirmiut out of respect for the dead, and the numerous cultural resources would make development of the site more difficult. The Mertarvik site, however, was on lands that were then owned by the USFWS and part of the Yukon Delta National Wildlife Refuge. The Newtok Native Corporation approached their Alaska Congressional Delegation and the Washington DC staff of the USFWS for assistance in drafting legislation that would result in an exchange of lands between the parties.

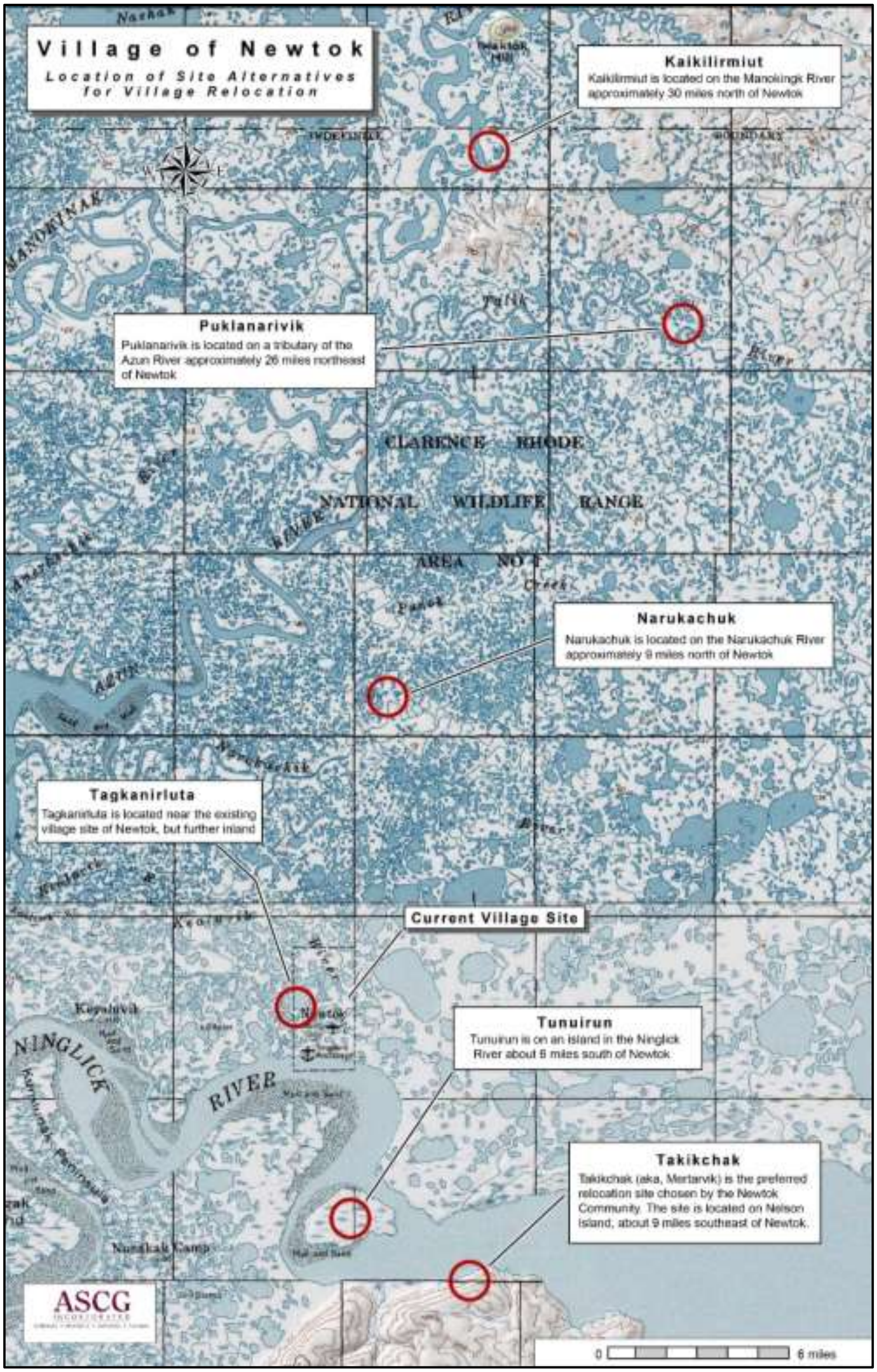


Figure 6. Potential sites for a new village considered in a 1994 evaluation (updated from ASCG 2004).

4.3.4 Previously Developed Community Layouts for Mertarvik (2000 - 2011)

The proposed physical layout for a new community at Mertarvik has evolved over the years as the result of a series of planning efforts. Most of these were developed only to a conceptual level, and may best be thought of as a continuum of efforts culminating in the 2017 community layout plan (CLP) alternatives, rather than as distinct alternatives that were abandoned.

In 2000, while the land exchange with the USFWS was still under negotiation, the NTC hired ASCG to assist in the development of relocation plans using funding obtained from the USACE and the Bureau of Indian Affairs (BIA). ASCG created a site layout and transportation plan, which was finalized in 2004 (ASCG 2004). The ASCG community layout was designed without detailed geographical information on the Mertarvik site, as such had yet to be generated. The 2004 plan (Figure 7) placed the community on sloping land relatively close to the Ninglick River in a simple linear layout, and provided road access to the Takikchak River to the west, assuming that the river would be the water source for the new village. The airport was sited on higher, more level ground south of the village site.

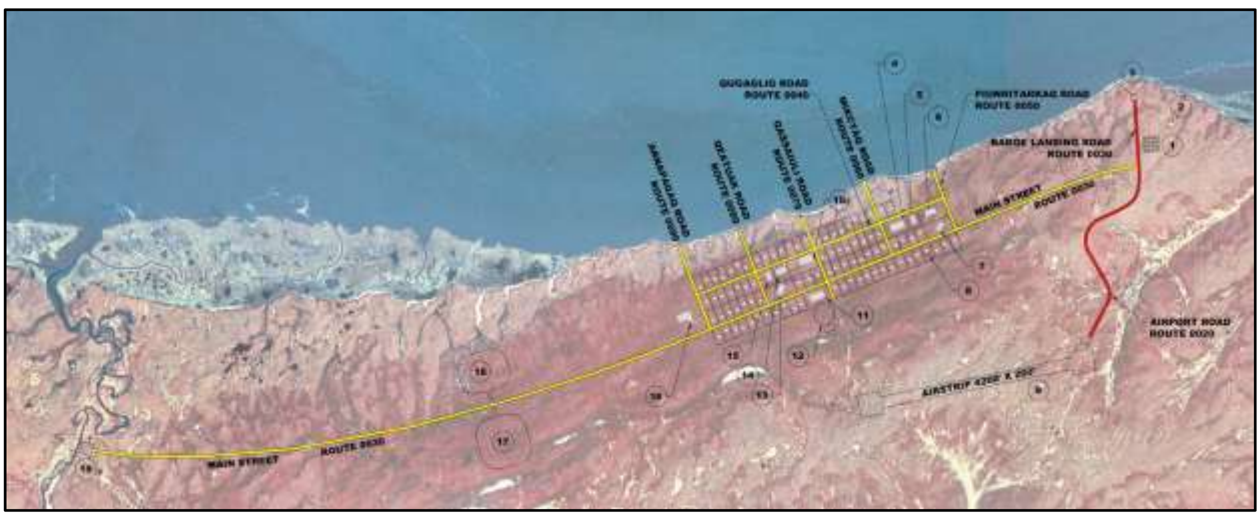


Figure 7. Mertarvik community layout developed by ASCG (ASCG 2004).

In 2006, the Alaska Department of Environmental Conservation's (ADEC) Village Safe Water Program (VSWP) initiated a new CLP process, incorporating new information on topography, geology, wetlands, and potential airport layouts, information that had been obtained since the initial ASCG effort. This was the first of several CLPs developed through the coordination with the Newtok Planning Group. The Alaska Division of Community and Regional Affairs (ADCRA) formed the NPG in May 2006, in response to requests from Newtok for assistance in coordinating the village relocation effort. The ADCRA is a division of the Alaska Department of Commerce, Community, and Economic Development (ADCCED), which is directed by two Alaska Administrative Orders (AO 231 and AO 239) "to act as the state coordinating agency to coordinate with the other state and federal agencies to propose long-term solutions to the ongoing erosion issues in... affected coastal communities" (ADCRA 2017i).

The VSWP, in collaboration with the Newtok community, prepared two basic configurations for the 2006 CLP: a conventional grid layout similar to the 2004 CLP, and an innovative "boomerang" layout that featured centrally located community buildings surrounded by family housing (Figure 8).

Both 2006 configurations moved the center of the village southward from a pronounced slope to more level ground about 0.6 mile south of the shoreline; this would reduce the amount of excavation and filling that would be required to prepare construction sites, and moved the center of the village farther from coastal hazards. Siting village homes and community buildings on higher ground would allow gravity to be used to move waste through a sanitary sewer system, minimizing costly lift stations and force mains. The plan included recirculating water loops to supply continuously running domestic water to homes and community buildings, reducing the risk of frozen pipes. The "boomerang" configuration aided the incorporation of more cost-effective utility systems by providing a more compact community layout with more centralized community infrastructure (ADCRA 2017h). Water would be supplied from a groundwater well installed in the watershed above Mertarvik spring, which VSWP intended to investigate the following year (NPG 2006, Golder 2007, Golder 2008).

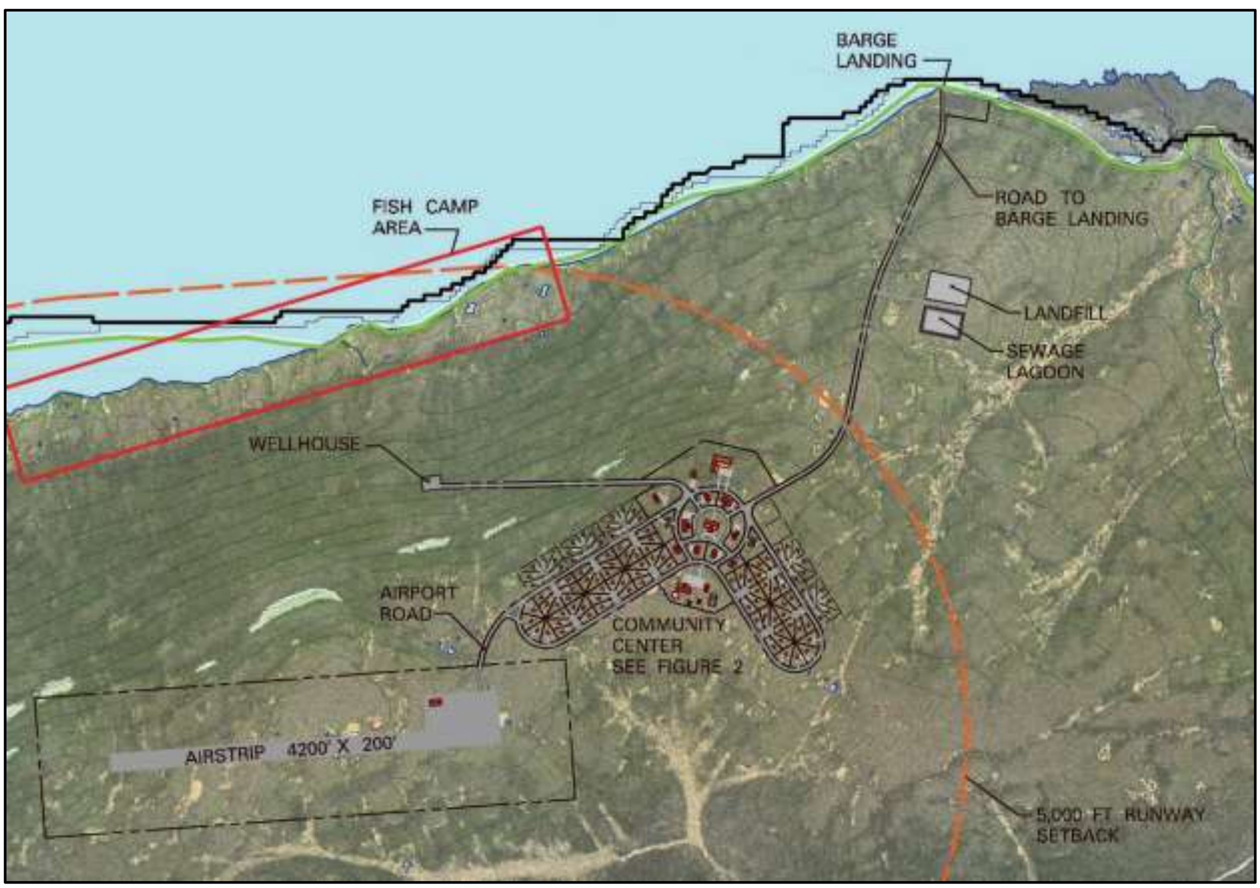


Figure 8. Mertarvik community layout designed by VSWP (VSWP 2006; full-size graphic available at https://www.commerce.alaska.gov/web/Portals/4/pub/fig1.pdf).

In 2008, Newtok was awarded a grant through the ADCRA to further develop the 2006 VSWP CLP. The community hired HDR Alaska to continue work on a new CLP. The 2008 CLP process began with the identification of agency requirements by members of the NPG, followed by an initial community planning workshop to identify Newtok's goals and objectives. The planning requirements included in this process were to:

- Centrally locate community facilities;
- Accommodate alternative energy sources;
- Locate the washateria and water treatment plant near the power plant to recover waste heat;
- Accommodate 63 single-family housing units with room for expansion;
- Provide access to the barge landing, airport, gravel source, and fish camp (ADCRA 2017h).

Also in 2008, work began on the design and construction of a barge landing at Mertarvik. An early 2008 change in the proposed location of the barge landing affected the 2008 CLP and all subsequent layouts. The northernmost point at Mertarvik was originally envisioned for the barge landing (Figure 7, Figure 8). However, after reviewing maps, photographs, and boring logs, and interviewing local residents and barge operators, the Alaska Department of Transportation and Public Facilities (ADOTPF), working under a Memorandum of Agreement (MOA) with the ADCCED, decided to shift the barge landing to a bight 4,400 feet to the west of the point (Figure 9). This new location avoided boulders and shallow bedrock present at the point, provided submerged lands and adjacent uplands that were easier to develop for the barge landing and connecting road, and was more sheltered from the river current. The move was approved by the USACE and the Newtok leadership.

The 2008 CLP process resulted in three alternatives. The community voted to select one as the preferred alternative, which was subsequently modified slightly based on community comments to become the final CLP (Figure 9; ADCRA 2017h).

The proposed positioning of the center of the village on the crest of the slope (Figure 7, Figure 8) led to concerns about the long walking distance between the village and subsistence resources, and about exposure to high winds and dust. The village location in the 2008 CLP also threatened to conflict with the optimal alignment in development for the replacement airport. Newtok passed a resolution in April 2009 to move the center of the village farther down the slope. Newtok retained HDR Alaska to develop a revised version of the 2008 CLP that took into account these concerns and restrictions, as well as new geotechnical information, while maintaining the objectives of the 2008 CLP. HDR developed two alternatives, the preferred choice of which, with further community input and modification, became the final 2011 CLP (Figure 10; ADCRA 2017h).

In 2015, the Newtok Village Council (NVC) pursued a grant application to the Federal Emergency Management Agency (FEMA) to relocate 12 homes from Newtok to Mertarvik. VSWP offered to take the 2011 CLP to a preliminary paper plat level to include with the grant application to show where the relocated homes would go. Modifications were made to lot and road alignments, and lots were added for future development, but the general design of the 2011 layout, selected by the residents of the village of Newtok, was retained (Figure 11; ADCRA 2017h). This conceptual plan became the basis of the CLPs and design work funded by the Denali Commission in 2016 and 2017 (Section 4.5).

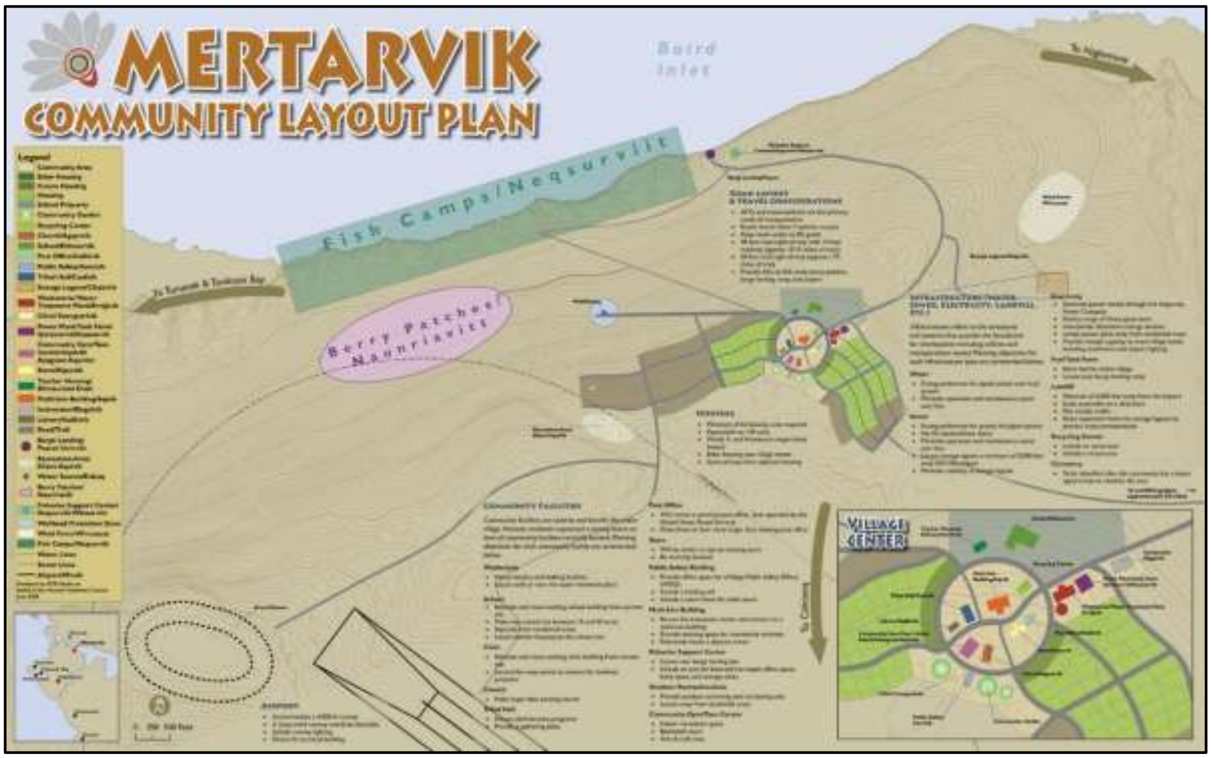


Figure 9. Final 2008 CLP presentation graphic (full-size graphic available at https://www.commerce.alaska.gov/web/Portals/4/pub/2008_Newtok_CLP_FINAL.pdf).

Figure 10. Final 2011 CLP presentation graphic (full-size graphic available at https://www.commerce.alaska.gov/web/Portals/4/pub/Newtok_CLP_Update_Final.pdf).

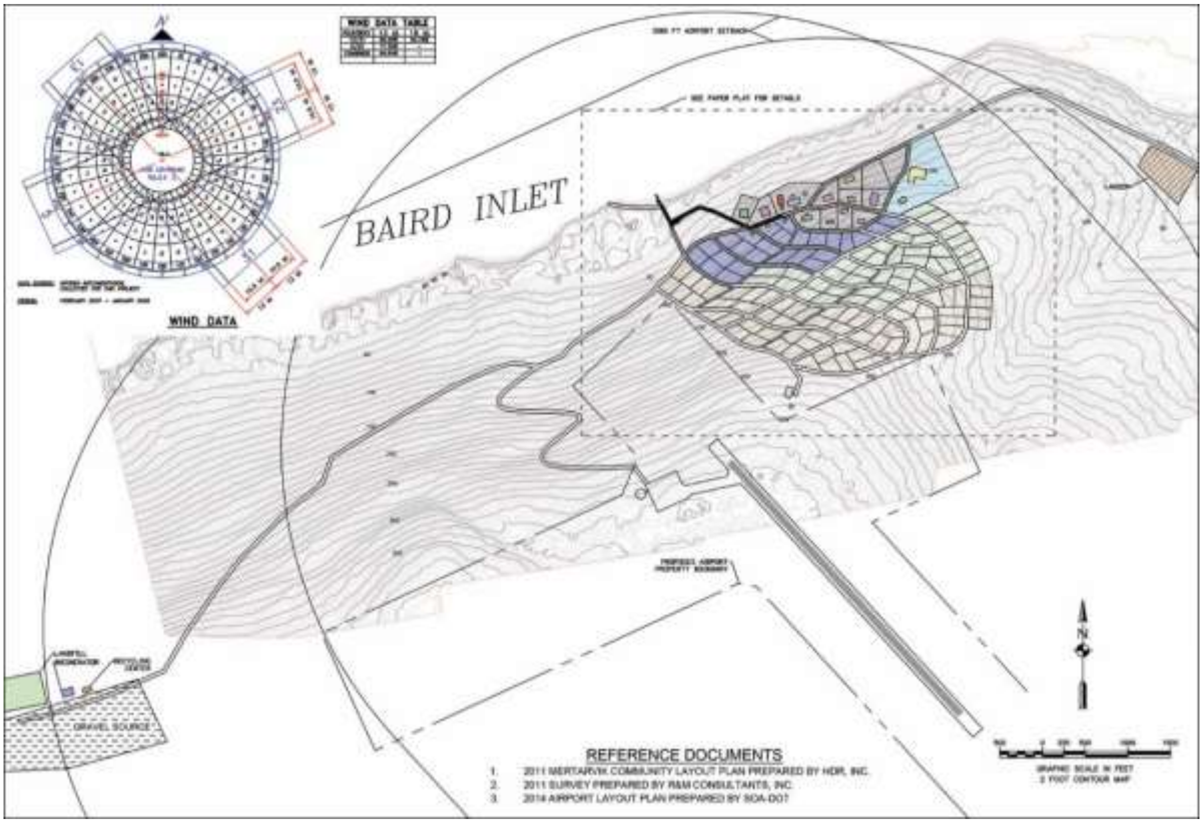


Figure 11. Final 2015 CLP (full-size graphic available at https://www.commerce.alaska.gov/web/Portals/4/pub/Mertarvik_Final_CLP_5.12.2015.pdf).

4.4 Alternatives Carried Forward

The alternatives carried forward in this EIS are limited to three CLP alternatives developed and refined in 2016 and 2017 by the NVC and the Denali Commission, and to the no action alternative (section 4.2). All three of the 2017 CLP alternatives incorporate as part of the CLP infrastructure the final airport layout plan conditionally approved by the FAA in 2014. The evaluation of airport location and layout alternatives was conducted by the FAA and Alaska Department of Transportation and Public Facilities (ADOTPF) prior to the development of the 2017 CLPs, but was informed by the evolution of previous community layouts (section 4.3.4). The development of the airport layout plan is described in section 4.5.2.

In 2016, the Denali Commission, in its new assignment as the Federal central coordinator for Alaskan climate resilience efforts, provided funding for the NVC to hire a project manager to handle the relocation projects already underway. The NVC hired DOWL LLC for this role. The Denali Commission also directly funded the Alaska Native Tribal Health Consortium (ANTHC) to prepare a new set of CLPs.

The 2017 Mertarvik CLPs were developed in direct collaboration with the community of Newtok, over the course of 8 months in 2016-2017. The Commission and the ANTHC sought input from not only the Newtok Village leadership, "…but also the elders, the hunters, the gatherers, and the future leaders studying at the Newtok Ayaprun School. The people that would serve the community of Mertarvik in the years to come also needed to be represented: The Lower Kuskokwim School District, The Yukon Kuskokwim Health Corporation, the Association of Village Council Presidents, and many other partners. The layout further needed the technical guidance of the surveyors, architects, engineers, and builders that would be helping the community to design and construct the new community. And lastly, the layout required the consideration of the Federal and State agencies that would provide the funds needed to develop a healthy and sustainable Mertarvik" (ANTHC 2017c).

4.4.1 Goals

The Commission, working with the Newtok community, identified the following five goals for the CLP process (ANTHC 2017c):

> **1. Expedient Development.** The most commonly voiced goal of the community was to make the development of Mertarvik proceed as quickly as possible. The erosion and public health crises in Newtok require immediate action to develop a new community and cannot wait for an ideal set of resources, design, and construction conditions. Expedient development may include starting home construction where permitting is already acquired, developing low cost projects that are achievable with current community resources, or building certain infrastructure needed in Mertarvik before ideal conditions exist.
>
> **2. Pioneering Approach.** The residents of Newtok are committed to a "pioneering approach," a phased development in which community members would begin to move to and live in Mertarvik in advance of the complete build-out of the planned infrastructure. This Pioneering Phase was an element of a Strategic Management Plan prepared in 2012 (Agnew::Beck Consulting 2012). The early inhabitants of Mertarvik would have access to limited services. A conceptual schematic of the Pioneer Phase layout, with its core of existing basic infrastructure, is shown in Figure 12.
>
> **3. Affordability of Construction.** The cost of building an entire community is daunting; early estimates suggest that roughly $120 million will be needed for development of the entire proposed community infrastructure. Minimizing each component cost of the relocation was an important factor for the community.

4. Affordability of Operation. Minimizing operations and maintenance costs was a critical goal in the development of the layout plan. This includes minimizing fuel and electricity use, reducing road maintenance needs, providing easy access to cover for the landfill, and reducing labor requirements.

5. Subsistence Lifestyle. The community's strong cultural foundation and traditional subsistence lifestyle needed to be represented in the CLP; access to subsistence resources and a focus on infrastructure development that minimizes impacts on the local habitat were important considerations.

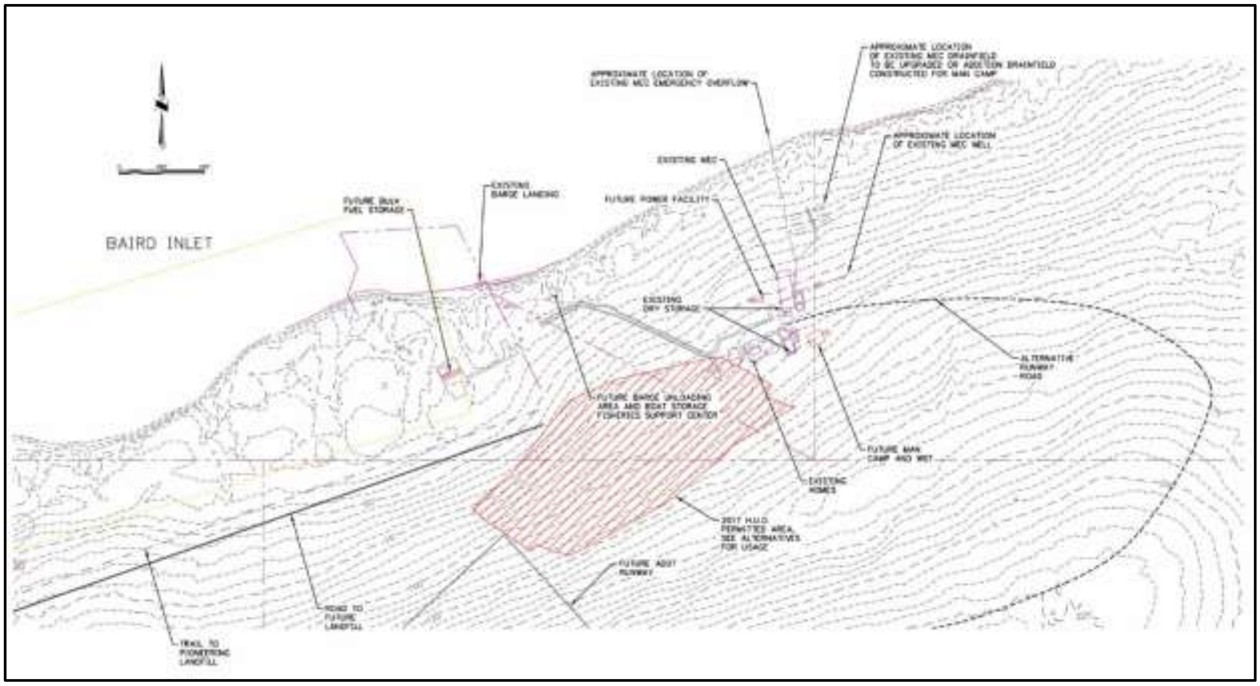


Figure 12. Mertarvik Pioneering Stage layout (ANTHC 2017a).

4.4.2 Constraints and Limitations

As has been described previously, the currently proposed infrastructure development activity is the culmination of numerous previous decisions, on-going construction projects, and other "facts on the ground" that have shaped and constrained the alternatives available for the proposed action, but are beyond the scope of this NEPA analysis.

- **Community Location Determined by Previous Decisions and Existing Factors**

The Mertarvik area of northern Nelson Island was selected in 1994 by the residents of the Newtok as a preferred location for a new village site (section 4.3.3). On November 17, 2003, in recognition of the needs and desires of the residents of the village of Newtok and in recognition of the imminent threat to the continued existence of their community as a whole, the U.S. Congress authorized Public Law 108-129, resulting in an exchange of lands between the Newtok

Native Corporation and the Department of the Interior (DOI). The Act established the acreages to be exchanged, based on a 1.1 to 1 formula in which Newtok received 10,943 acres of USFWS land in the Yukon Delta National Wildlife Refuge in exchange for 12,101 acres of Newtok Native Corporation land (Figure 13) that had been previously conveyed to the Newtok Native Corporation under the Alaska Native Claims Settlement Act (43 USC §1601 *et seq.*). The disparate exchange rate was due in part to the fact that Newtok received the surface and subsurface estates of the gained lands, while the USFWS received only the surface estate.

The choice of a new community location on Nelson Island has also been constrained by geography and access considerations. Although all of the 10,943 acres transferred from the USFWS would be potentially available for development, in practice the new community will need ready access to a waterway, both for subsistence and for a barge landing to bring in supplies and equipment. A limited portion of the transferred land fronts onto the Ninglick River or Baird Inlet (Figure 13). Baird Inlet is not well characterized bathymetrically, but aerial photographs show broad areas of shallows and mud flats paralleling the Baird Inlet shoreline to the east of Mertarvik. Similar shallows exist to the west, where a large zone of estuarine wetlands spreads along the shore from the mouth of the Takikchak River. Reliable access to Nelson Island's north shore by heavy barges, without extensive dredging, exists only along a span of shoreline about 1.5 miles wide, where the Ninglick River main channel approaches relatively close to the shoreline. For this reason, nearly all studies and plans for a new community site since 2000 have focused on this relatively small portion of the Nelson Island shoreline between the Takikchak River and the entrance to Baird Inlet.

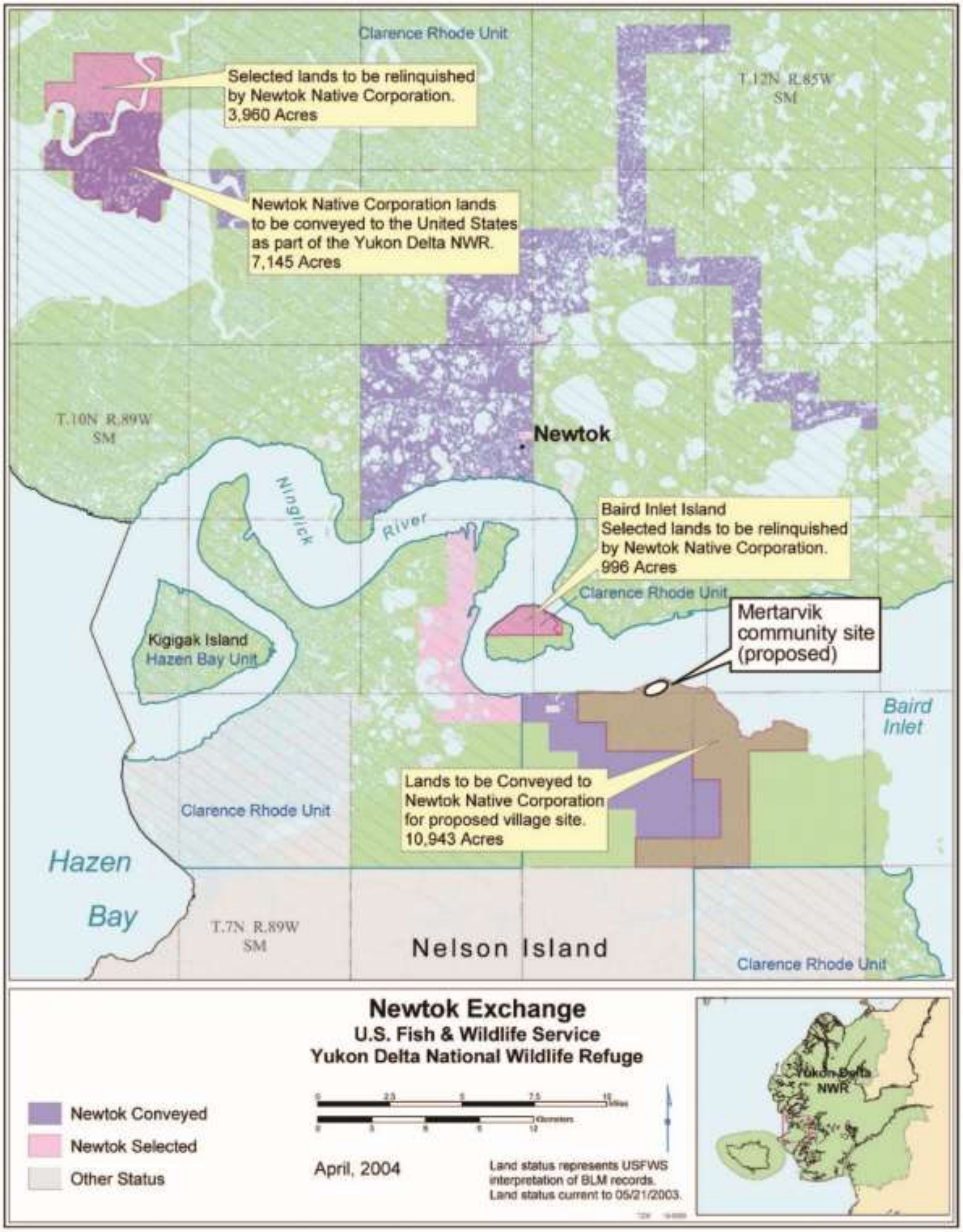


Figure 13. USFWS map illustrating the 2003 exchange of lands between Newtok Native Corporation and the USFWS (annotated).

- **Infrastructure Already Completed at Mertarvik**

While planning of the overall Mertarvik community layout was underway, several pieces of infrastructure have been constructed at Mertarvik to prepare for emergency evacuations in the event of natural disasters and further construction efforts. These existing efforts furthered the investment in and commitment to the Mertarvik location, and also became "anchors" that some of the 2017 CLP were designed around. These features also represent part of the Pioneering Phase development discussed elsewhere. The following infrastructure has already been started or completed at Mertarvik:

<u>Barge Landing</u>

In 2006, the ADCCED applied for and was awarded an Economic Development Administration Investment Assistance Grant for a barge landing and staging area at Mertarvik on behalf of the NTC. The U.S. Department of Commerce, Economic Development Administration (EDA) was the Federal funding agency for the proposed action (ADCRA 2017c).

The Mertarvik Barge Landing Facility was the first piece of major infrastructure to be installed at Mertarvik. ADCCED partnered with the ADOTPF to see this project through from planning and design to actual construction. ADOTPF provided the State of Alaska with monies to match the EDA grant for this approximately $2 million project. The project was completed in 2009. The barge landing facility consists of a 16-foot-wide by 230-foot-long barge ramp/access road, and 65-foot by 130-foot upland multi-use staging area (Figure 14). The project location is within a bight (or cove) on the north side of Nelson Island (ADCRA 17c).

During construction, it was discovered that only shallow draft vessels would be able to use the barge landing ramp as planned due to sediment conditions that made full installation of the concrete plank ramp extremely difficult. As a result, the completed landing ramp length was approximately 50 feet shorter than the original designed length, translating into reduced water depths for most barge operations.

A second barge landing was constructed 500 feet to the west, where the mean lower low water line is closer to the toe of the bluff, allowing barges to land over the range of tides in the Ninglick River. Access to the site required the construction of approximately 500 feet of new access road and 35 feet of new landing area. The deep draft barge landing and gravel road connecting it to the initial barge landing facility was completed in the summer of 2010 (ADCRA 2017c).

The barge landing and staging area will be critical to the future development of Mertarvik, as it allows for the delivery of construction equipment and bulk materials to the site. The barge landing and staging area is also essential for the relocation

Figure 14. A September 1st, 2017 aerial photograph of the Mertarvik project site viewed from the northeast, with existing infrastructure identified in annotations.

of structures that may be suitable to move from the old village to Mertarvik. Despite some limitations of the existing barge landings, the goal of "expedient development" did not allow for the permitting, design, and construction of a new barge landing, and so the existing barge landing became an "anchor point" for subsequent layout design. With significant bulk fuel needs for construction activities and the pioneering community, and technical limitations on fuel transfer from the barge, the bulk fuel farm in turn was recommended for development near the barge landing.

Mertarvik Access Road

The Mertarvik Access Road, leading from the barge landing facility to the evacuation shelter, was constructed in 2010-2011 through the collaborative efforts of the State of Alaska Department of Transportation and Public Facilities (ADOTPF), USACE, the Bureau of Indian Affairs (BIA), and the military Innovative Readiness Training (IRT) Program (ADCRA 17e).

The road was built with gravel topped by polyethylene road mats, a technology used by oil companies on Alaska's North Slope for road development on tundra. The 1,000-pound, 8 by 14-foot polyethylene mats interlock to form a strong, stable and uniform surface over tundra which can support pioneer infrastructure development by trucks, tractors, and loaders. The mats can also be reused and picked up and placed somewhere else, so they are considered an ideal technology for a newly developing village. These mats were also used to create working and living surfaces on top of the tundra, and to allow heavy equipment to travel along an unimproved trail leading to the quarry site (Figure 14; ADCRA 2017e).

Funding for the Mertarvik Access Road was provided by State of Alaska capital budget funds appropriated to ADOTPF, combined with BIA Indian Reservation Roads (IRR) Program funds. The ADOTPF funded the USACE to design the road. ADOTPF provided construction management for the road, which was built by IRT Marine Reserve Engineers and Navy Reserve Seabees.

After development of the new village is complete, the polyethylene mat road will support travel by foot or by all-terrain vehicles in the summer and by snow machine in the winter.

Rock Quarry

The rock quarry at "Hill 460" was investigated in 2008 and opened for production in 2011; it and the quarry access road will be vital to construction efforts at Mertarvik, particularly for the airport. The existing quarry was another "anchor point" affecting subsequent layout design.

Mertarvik Evacuation Center (MEC)

In 2008 the NTC received a community planning grant through the Alaska Climate Change Impact Mitigation Program for the conceptual design of the MEC. In fiscal year 2011, the NTC was awarded a $4 million grant by the Alaska legislature for the design and construction of the MEC, the design of which would be based on the conceptual design prepared by the Cold Climate Housing Research Center (CCHRC, ADCRA 2017d).

The design was completed in February 2011, and work on the piling-supported foundation for the 6,200-square-foot MEC structure was completed in the summer of 2011 (ADCRA 2017d), with further work by the community members to finish building the MEC in coming years

The MEC was envisioned by the NPG as providing the community with a large multi-purpose structure to be built early in the community development process. The MEC would serve in the near-term as emergency refuge for Newtok residents in the event of severe flooding, as a construction and relocation support facility during the community build-out, and as a community center for the completed community. This concept tended to keep the center-of-gravity of the various planned community layouts near the MEC.

The MEC groundwater supply well was also drilled and installed in 2011, about 230 feet east of the MEC foundation. A private organization funded construction of a small well house in 2016 and the installation of a hand-pump and portable water treatment system to facilitate the interim use of the well (Meeks 2017).

Pioneer Home Construction

Eleven housing structures currently exist or have been started at Mertarvik, eight of which are within the currently proposed village layout. The first three houses built in the Mertarvik area were acquired through the Bureau of Indian Affairs (BIA) Housing Improvement Program HIP) grants and were constructed in 2007 (DCRA. 2017e). These houses were built along the shore near Mertarvik spring, which is well to the west of the CLPs developed in 2016-2017. During the Newtok Scoping Meeting, some local residents reported that these houses are used occasionally but not occupied full time. These three structures would need to be relocated to sites within the current village layout and renovated before they can be a sustainable part of the new community.

Another three houses were built by Newtok community members in the summer of 2012, using Structural Insulated Panel (SIP) home packages. These houses were purchased by the community using grants from the Association of Village Council Presidents (AVCP) Regional Housing Authority, through HUD's Native American Housing Assistance and Self Determination Act (NAHASDA) Program. These houses are located within the current village layout, near the MEC foundation (Figure 14), and are currently occupied.

A single prototype house designed by the Cold Climate Housing Research Center (CCHRC) and funded by a BIA HIP grant was assembled by a local crew in the summer of 2016 (ADCRA 2017f). The house is both extremely energy efficient and moveable. It has a skiddable foundation and can be towed across the ice or tundra when needed. It also contains its own small water-treatment plant and a generator, which can be used before public utilities are available at the new site. This house is currently set up on the large general use pad near the barge landing (Figure 14), and is used by construction and survey crews working at the site.

Four more houses were started in 2017 by the AVCP and are expected to be completed in 2018, and one more home is funded to be started in 2018.

- **Airport Alignment Requirements**

In the absence of connectivity to a road network to the rest of the state of Alaska, and the seasonality of water access, the proposed airport is the largest and one of the most critical pieces of infrastructure for the community. The alignment and layout for the airport is far less flexible than the layout of the community, and so the 2014 conditional approval by the FAA of an Airport Layout Plan (ALP) for Mertarvik established certain limitations for the general Mertarvik CLP. For example, the FAA approval is subject to the condition that a 5,000-foot minimum separation be maintained between the airport and the both the landfill and the wastewater treatment lagoon (FAA 2014), which has the effect of requiring those community features to be set well to the east or west of the community center. The airport also requires a broad runway protection zone in which no development may occur, and obstacle clearance restrictions limit where tall structures such as water storage tanks and wind turbines can be placed on the upper slope.

- **Construction Planning**

The formulation of CLP alternatives began after funding and environmental permitting had been acquired for the development of the rock quarry road, construction camp, and the construction planned for 2017. These permits were not possible to adjust significantly before construction activities would begin, and so the proposed 2017 construction was incorporated into each CLP alternative.

- **Site Conditions**

The need for Newtok residents to be relatively close to the water and subsistence resources, and away from the preferred airport site, confined the area available for the community layout to a broad slope with a grade ranging from 5 percent to 14 percent. This slope provides a significant challenge for the layout and construction of structures and roads; the CLP goals of minimizing construction and operation costs will require minimizing the amount of cutting and filling needed to create buildable foundations and roadbeds. The slope provides both challenges and opportunities for the management of water supply and wastewater.

- **Environmental Resources**

The NEPA process for this EIS was started roughly around the same time as NVC's preliminary selection of the preferred CLP alternative: February 2017. NVC's and the Commission's alternatives formulation, however, was informed by the multitude of previous environmental studies in the proposed action area, such as the USACE 2008 and 2011 environmental assessments (EAs), and the 2016 HUD environmental review. The Commission was aware of cultural sites and high-value wetland areas (estuarine wetlands along the coast to the west of the project area; see Appendix C) identified in those previous assessments, and avoided those resources in all of its CLP alternatives. Archaeologists and biologists with the USACE performed a cursory review of the CLP alternatives in February and March 2017, and provisionally agreed that the CLP alternatives did not appear to directly impact any known high-value resources, and that none of the three CLP alternatives were conspicuously more environmentally damaging or advantageous than the others.

4.5 CLP Development Process

The development of the preferred CLP required input from a diverse array of stakeholders. The wants and desires of the community, the technical feasibility of design and construction, the fundability and regulatory approval of funding agencies, were all major components of the planning process. With such a diverse group, a strict process of development was required to ensure an appropriate CLP was developed. The most critical element of the process was to maintain full engagement and ownership from the residents of Newtok as the array of local, regional, state, and national partners of the community each provided their sometimes-competing preferences and requirements. Inclusion in the development process was focused on the organizations working actively and directly on the relocation of Newtok to Mertarvik (Table 2). It should be noted that many more partners were consulted directly and/or considered indirectly during this process. Those most heavily engaged have active funding or design and construction efforts underway (ANTHC 2017a).

In general, ANTHC first sought guidance and input from the Newtok Village Council, then expanded the outreach and collection of data to the community at large. After collecting data and guidance from the community, ANTHC advanced progress on development of the CLPs, then sought technical and non-technical feedback from external partners working on the Mertarvik relocation effort. ANTHC then made refinements to the CLPs, and presented the progress to the Newtok Village Council. The cycle repeated with iterative improvements to the community layout as additional data, input, and approval from the community was acquired (ANTHC 2017a).

Table 2. Timeline of the 2016-2017 Development CLP Process (ANTHC 2017c).

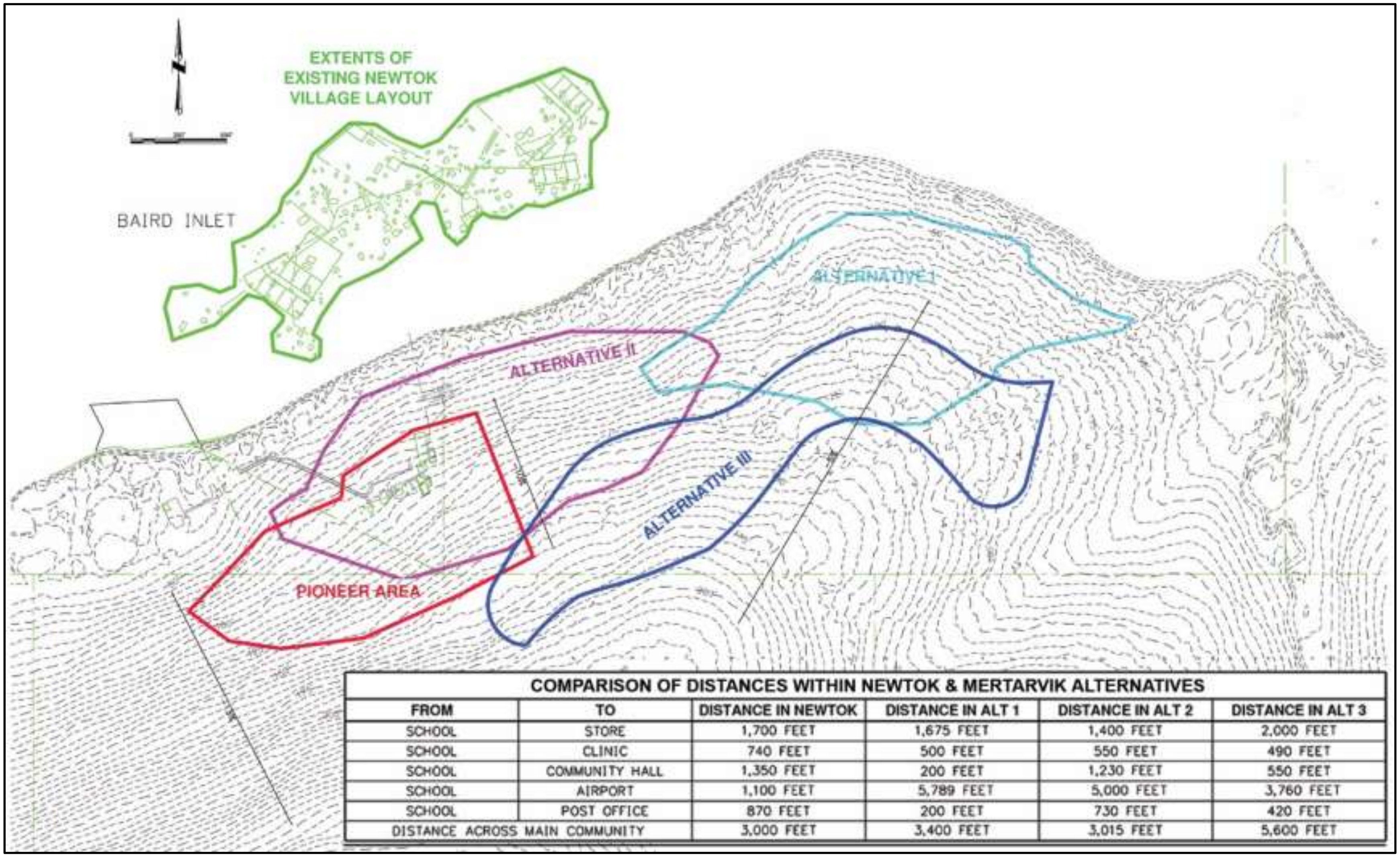
Date	Description and Notes
11/01/2016-11/15/2016	ANTHC Reviewed existing efforts, including VSWP "Community Plat", and all content on Newtok Planning Group Website.
11/15/2016-11/16/2016	Newtok Site Visit #1 to introduce team and initiate outreach for ideas, stories, history, concerns, and questions. Participated in a Council meeting, community meeting, and a traditional potluck.
11/17/2016-11/30/2017	ANTHC developed pre-conceptual layout plats to guide discussion and ideation development. Identified gaps in existing data, developed list of stakeholders and defined stakeholder input requirements. Organized community development factors for consideration around "sectors" of the community (energy, transportation, utilities, etc.)
12/1/2016-12/12/2016	ANTHC met with Newtok technical partners to define data needs, and to define requirements and preferences for infrastructure from technical/funding standpoints.
12/13/2016-12/14/2016	Newtok Site Visit #2 to engage with students and provide outreach presentations. Participated in a community meeting where pre-conceptual layouts were presented to generate feedback. Also participated in a community potluck.
12/15/2016-1/10/2017	Synthesized stakeholder requirements and preferences to identify infrastructure development synergies and conflicts. Developed conceptual maps for 4 CLP preferences.
1/11/2017-1/13/2017	Newtok Site Visit #3 to conduct in-home interviews with community residents. Participated in NVC Council meeting and a community meeting. Performed door-to-door interviews to engage with residents to share and collect data to further define community preferences and requirements.
1/14/2017-1/17/2017	ANTHC developed 4 alternative CLPs with variable attributes: 1. Community Center to East of MEC, Close to Water 2. Community Center around MEC, Close to Water 3. Community Center around MEC, High on Hillside 4. Community Center to East of MEC, High on Hillside
1/16/2017 - 1/22/2017	Conducted an ANTHC Internal Technical Review (ITR) with participation by a variety of senior engineers across multiple disciplines.
1/23/2017-1/29/2017	Conducted External Design Reviews of CLP alternatives with various technical and funding agency stakeholders.
1/30/2017-2/26/2017	Refined CLP alternatives based upon review feedback from partners. Developed a pro's and con's comparison across CLPs. Performed an analysis of a variety of opportunities by sector across 3 alternatives. Developed video, 3D, graphic, and map tools to communicate alternatives to community.
2/27/2017-3/01/2017	Newtok Site Visit #4 to participate in NVC Council meeting, a community meeting, and a community potluck. Collected community feedback on CLP preferences and gather additional improvement recommendations.
3/2/2017-3/10/2017	Conducted an ANTHC Internal Review of the preferred alternative – Alternative 2 – and update the alternative to reflect community preferences.
3/17/2017	The NVC signed resolution selecting CLP Alternative 2 with the 65% design completed.
3/17/2017-3/21/2017	Identified data gaps and further refined needs and requirements to advance 65% CLP to 95%. Provided 65% documents for use in advancement of geotechnical investigations and EIS development.
3/22/2017-3/23/2017	Newtok Site Visit #5 for EIS Public Scoping Meeting, and to provide a community update on the preferred CLP and status of the EIS.

Date	Description and Notes
3/24/2017-5/11/2017	Sought additional stakeholder feedback and analysis. Identified and completed filling of data gaps identified previously. Defined proposed roads, etc. with technical partners. Developed Community Questionnaire #2.
5/11/2017-5/15/2017-	Development of 95% CLP Design Review
5/16/2017-5/18/2017	Newtok Site Visit #6 to participate in NVC Council meeting and a community meeting to present the 95% CLP. Conduc6ted in-home survey interviews, and participated in a community BBQ in collaboration with the school.
5/19/2017-6/1/2017	External Review of 95% CLP, incorporating survey results.
6/1/2017-6/5/2017	Implemented improvements to the Final CLP
6/5/2017	100% CLP provided to NVC for their final review
6/5/2017-6/22/2017	Development of 65% CLP Report
6/22/2017	Newtok Site Visit #7 to participate in NVC Council meeting and a community meeting to present 100% CLP to the resident of the village of Newtok.

4.5.1 Formulation of CLP Alternatives

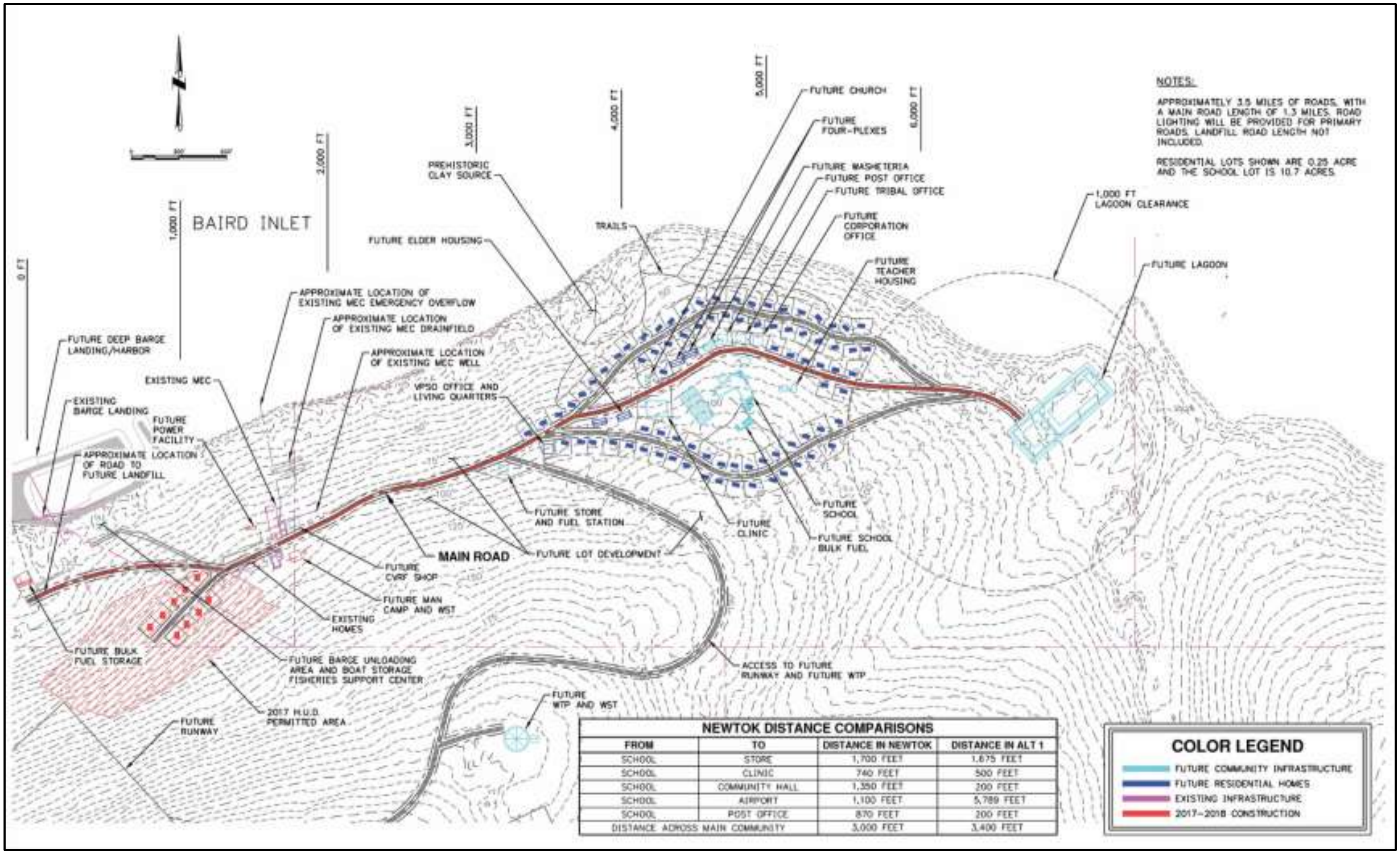
To increase community ownership of the CLP process, it was critical for the community to have a formal choice in the selection of the final CLP. Surveys of the community found roughly equal numbers of people preferring to be located near the water, versus higher up on the slope. On the other hand, an analysis of the topography at the Mertarvik community site suggested that the CLP could be focused either around the existing development at the MEC and barge landing, where grades average 10 percent to 13 percent, or shifted farther to the east where grade is a flatter 5 to 7 percent.

ANTHC, as the Commission's contractor, developed three alternative CLPs that attempted to balance these two divergent options, while adhering to the five CLP goals. Alternative 1 was set relatively close to the water, to the east of the MEC (Figure 15, Figure 16). Alternative 2 was centered on the MEC, with an option available for community development to be weighted more heavily either downslope or upslope from the MEC (Figure 15, Figure 17). Alternative 3 was set much higher on the slope than either Alternative 1 or Alternative 2, and had a more elongated configuration than the other alternatives (Figure 15, Figure 18). ANTHC prepared lists of advantages and disadvantages in various formats for presentation to the community, as well as tools to help evaluate the "pros and cons" of the alternatives. The pros and cons presented for each CLP alternative are shown in Figure 19, Figure 20, and Figure 21, with a summary in Figure 22 (ANTHC 2017a).



COMPARISON OF DISTANCES WITHIN NEWTOK & MERTARVIK ALTERNATIVES					
FROM	TO	DISTANCE IN NEWTOK	DISTANCE IN ALT 1	DISTANCE IN ALT 2	DISTANCE IN ALT 3
SCHOOL	STORE	1,700 FEET	1,675 FEET	1,400 FEET	2,000 FEET
SCHOOL	CLINIC	740 FEET	500 FEET	550 FEET	490 FEET
SCHOOL	COMMUNITY HALL	1,350 FEET	200 FEET	1,230 FEET	550 FEET
SCHOOL	AIRPORT	1,100 FEET	5,789 FEET	5,000 FEET	3,760 FEET
SCHOOL	POST OFFICE	870 FEET	200 FEET	730 FEET	420 FEET
DISTANCE ACROSS MAIN COMMUNITY		3,000 FEET	3,400 FEET	3,015 FEET	5,600 FEET

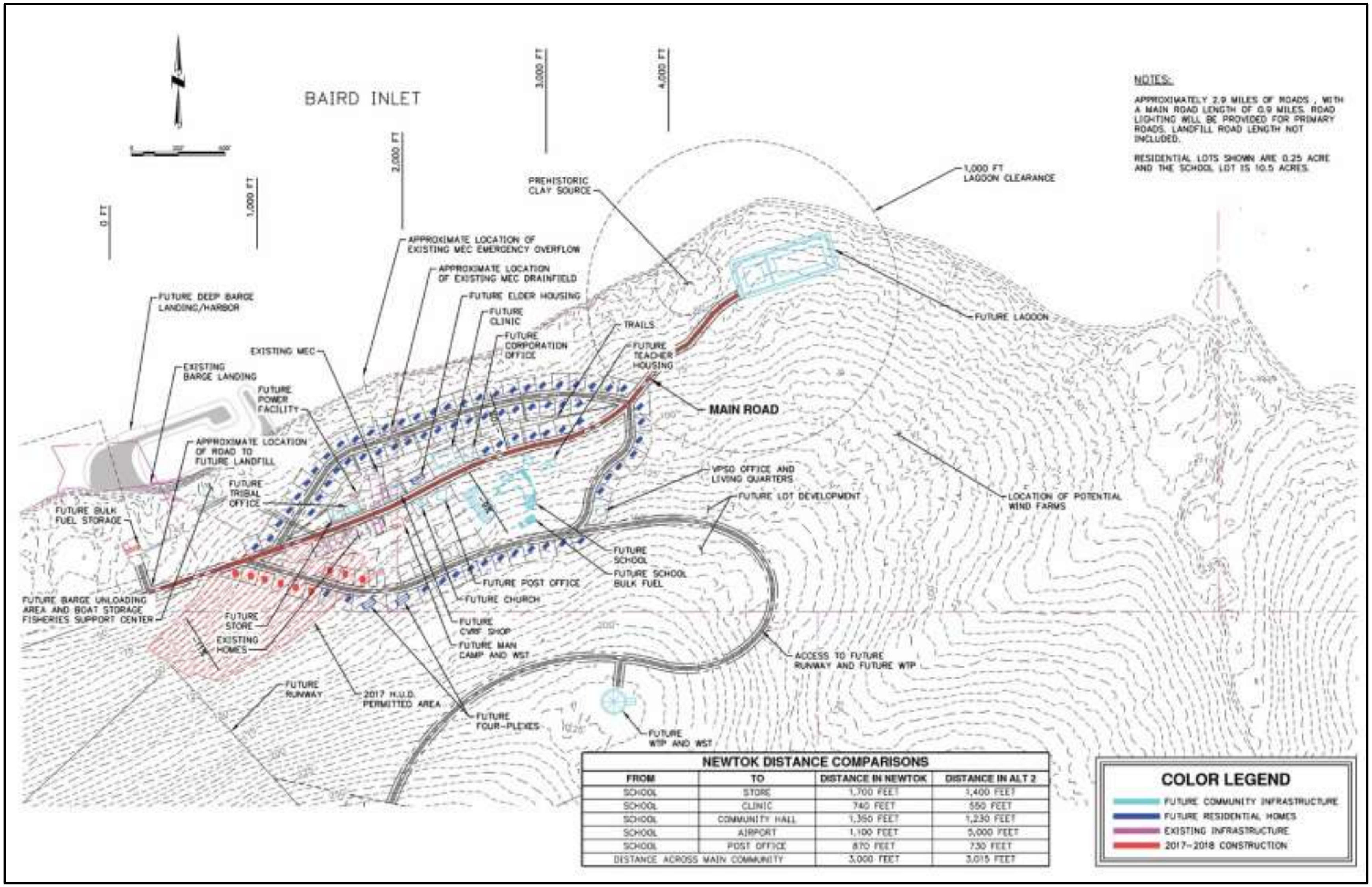
Figure 15. Comparison of the three 2017 CLP alternative footprints, relative to the Pioneer Area, and with the layout of Newtok shown for size comparison (ANTHC 2017a). The Pioneer Area represents infrastructure largely in place or started prior to 2017, and is not itself an alternative.



NEWTOK DISTANCE COMPARISONS

FROM	TO	DISTANCE IN NEWTOK	DISTANCE IN ALT 1
SCHOOL	STORE	1,700 FEET	1,675 FEET
SCHOOL	CLINIC	740 FEET	500 FEET
SCHOOL	COMMUNITY HALL	1,350 FEET	200 FEET
SCHOOL	AIRPORT	1,100 FEET	5,789 FEET
SCHOOL	POST OFFICE	870 FEET	200 FEET
DISTANCE ACROSS MAIN COMMUNITY		3,000 FEET	3,400 FEET

Figure 16. CLP Alternative 1 (ANTHC 2017a).



NEWTOK DISTANCE COMPARISONS

FROM	TO	DISTANCE IN NEWTOK	DISTANCE IN ALT 2
SCHOOL	STORE	1,700 FEET	1,400 FEET
SCHOOL	CLINIC	740 FEET	550 FEET
SCHOOL	COMMUNITY HALL	1,350 FEET	1,230 FEET
SCHOOL	AIRPORT	1,100 FEET	5,000 FEET
SCHOOL	POST OFFICE	870 FEET	730 FEET
DISTANCE ACROSS MAIN COMMUNITY		3,000 FEET	3,015 FEET

Figure 17. CLP Alternative 2 (ANTHC 2017a).

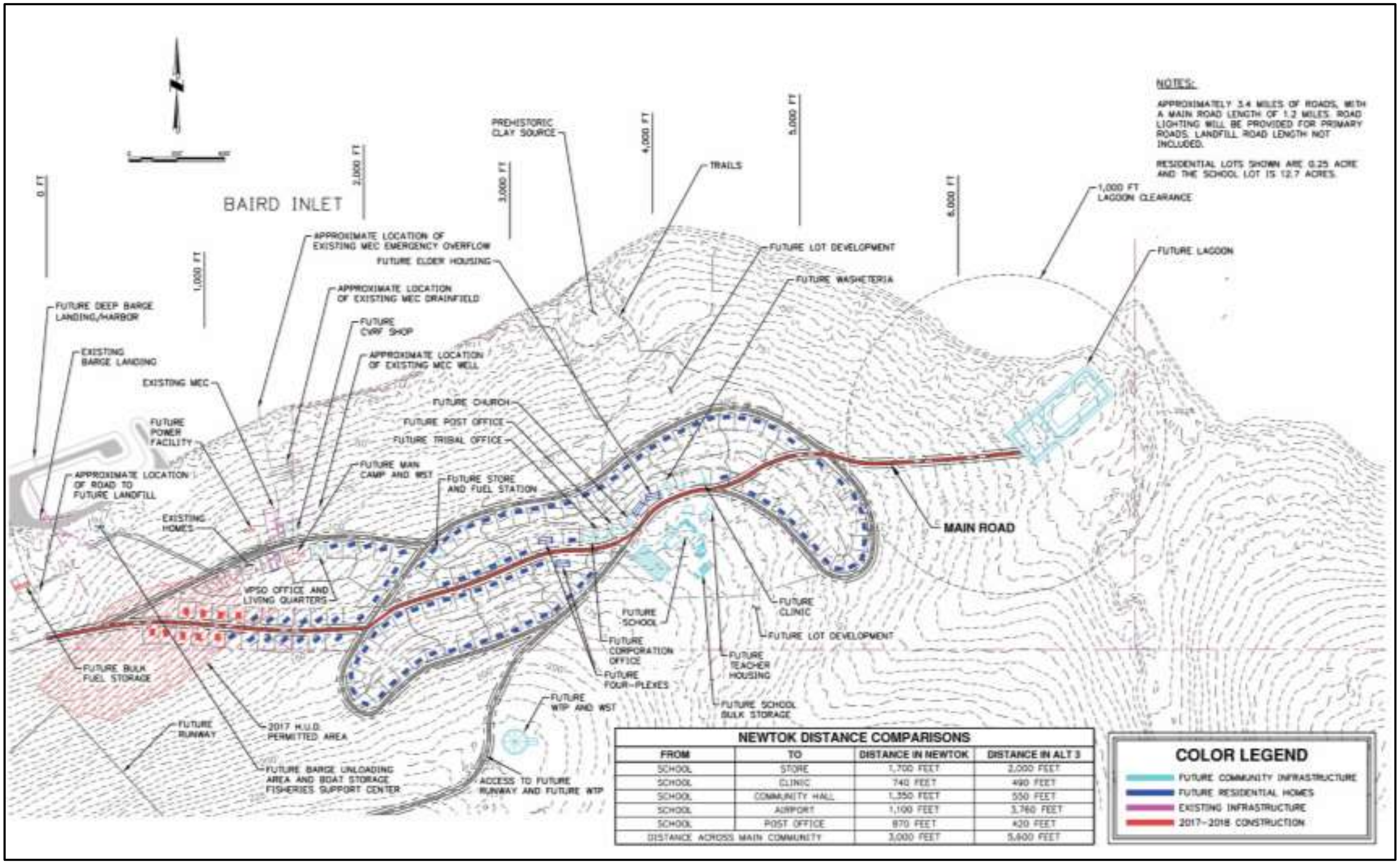


Figure 18. CLP Alternative 3 (ANTHC 2017a).

SITE PLAN 1 OPTION CONSIDERATIONS:

Cultural integration – land use, historical access to subsistence use areas, residential interviews
Technical aspects – cost feasibility, access and placement, sustainability, operations and maintenance
Pioneering Phase into Mertarvik site

	Water	Sewer	Transportation	Power - Energy	Housing	School	Landfill	Other Infrastructure	Funding - Permitting
Pro's	Limited/No Circulation – No pumps needed	Potential to utilize gravity for pipes	Limited Roads –more cost effective	Power plant located far from Mertarvik	Utilized land contour for privacy	Centrally located	Far from town	Centrally Located	Pioneer Phase can build with current permit
	Buried Pipes plausible	Lagoon located down wind	Relatively flat for reduced elevation change at new site	Short fuel pumping Linear layout for distribution	Flat Land more suitable for pads More cost effective	Sufficient Space 10.6 acres	Nearby "Shop" for landfill equipment	MEC central for Pioneer Phase	Linear Layout vs. Steep - more cost effective
	Linear layout Room for expansion	1000' buffer from city center	Room to expand	Potential for underground power lines	Potential to grow	Gravity water and sewer	Safer from animals at landfill	Separation from "Industrial" facilities from main town site	
	Pioneer Phase area can access MEC water and drain field		Room for developed trail system	Phased users (school, clinic, MEC, man camp) can move with growth and repurpose	More space than Newtok Trail system to beach	Flatter land – more cost effective	Can reuse overburden from quarry to develop landfill		
			Barge landing very isolated						
Con's	Far From Existing West Well (other side of airport)		Pioneering phase further away from Mertarvik	Power plant near Pioneer Phase	Potential Relocation of first homes required	Potential for shadowing and snow drifting	Far from town	Boat winter storage is further away	
	Drill more water wells		Barge landing far from town	Far from Mertarvik Far for local distribution of fuel, minimized heat recovery	Potential for "2 village" thought and siting	Need for mitigating potential fuel spills in delivery		MEC reuse will be far from Mertarvik (2000')	
			Potential for localized ponding	Need to mitigate potential fuel spills		Fuel storage is far away			

LAYOUT PLAN 1 ANALYSIS:

Flatter slopes for housing pads, yet sloped enough for gravity W&S, leaves room for growth, leaves "industrial" section near power and barge landing, in general cheap construction, and maintains mostly centralized community facilities. Does however create "2" villages spaced about half mile apart, and minimizes waste heat utilization while maximizing fuel spill risk.

Figure 19. Pros and Cons of CLP Alternative 1 (ANTHC 2017a).

SITE PLAN 2 OPTION CONSIDERATIONS:

Cultural integration – land use, historical access to subsistence use areas, residential interviews
Technical aspects – cost feasibility, access and placement, sustainability, operations and maintenance

	Water	**Sewer**	**Transportation**	**Power - Energy**	**Housing**	**School**	**Landfill**	**Other Infrastructure**	**Funding - Permitting**
Pro's	Limited/No Circulation Required	Lagoon downwind from site layout	Multiple but minimal Roads	Short fuel pumping Reduced bulk fuel storage	Centrally located	Central	Far from town	Centrally Located	Can build Pioneer homes for permeneance
	Buried Pipes plausible	Lagoon far from town	Can "reuse" road built during 2017 construction	Potential for underground power lines	Wouldn't need to move Pioneer homes	Possible gravity to sewage lagoon for independent system	Nearby "Shop"	MEC closeby	Won't need to move Pioneer homes
	Potential for gravity	Room for expansion	Close to airport	More waste heat use	Easy access to Beach		Safer from animals		
				Fuel dispensing more efficient			Can reuse gravel to create landfill		
Con's	Far From Existing West Well	Lift Station likely required, additional O/M	Longer roads – more expensive Trucks drive through town	Close to town Noise, smell factors	Steep Slope 10% grade More expensive pads	Less space available than ideal	Far from town	No Separation from "Industrial" facilities from main town site	More expensive to develop
	Roads longer to create gravity	May need heated force main	Steeper elevation changes		Closer together Potential for snow drifting	Steeper slope – more expensive construction			
	Abandon MEC well likely necessary	Required abandonment of MEC septic	Close to airport , Potential for localized ponding		Closer to airport				
			10% grade Steep = more expensive						

LAYOUT PLAN 2 ANALYSIS:

Layout 2 exists closer to existing development, and allows for maximal utilization of heat recovery and keeps the community closer together. The site is expensive to construct based upon the steep hillside and may present technical challenges, as well as increasing O/M costs for potential water and sewer. The site minimizes fuel transfer requirements and distances to travel for self-haul services and beach access.

Figure 20. Pros and Cons of CLP Alternative 2 (ANTHC 2017a).

SITE PLAN 3 OPTION CONSIDERATIONS:

Cultural integration – land use, historical access to subsistence use areas, residential interviews
Technical aspects – cost feasibility, access and placement, sustainability, operations and maintenance

	Water	Sewer	Transportation	Power - Energy	Housing	School	Landfill	Other Infrastructure	Funding - Permitting
Pro's	Limited/No Circulation Required	Pumping Only Required From MEC	Limited Roads	Power Plant located far from community center	Large Lots – plenty of space	Relatively Central	Far from town	Most community buildings Centrally Located	
	Buried Pipes plausible	Lagoon located down wind	Relatively flat for reduced elevation change, least expensive/challenging construction	Short fuel pumping	Flat Land more suitable for pads	Maximal Space 12.7 acres	Nearby "Shop"	Separation from "Industrial" facilities from main town site	
	Potential for gravity	Potential for majority gravity service	Room for developed trail system	Potential for underground power lines	Less potential for "2 village site" setting	Gravity service to potential lagoon	Safer from animals		
		Relatively inexpensive construction	Best "flow" of traffic		More spread out	Ease of access to airport	Can reuse gravel to create landfill		
		Low O/M Cost				Flattest possible location for ease of construction			
Con's	Far From Existing Community Well	Sewage Lagoon Relatively Close to Community	Barge landing far from town	Fuel distribution for community members far from community center	Potential relocation of first homes possible	Not as central to all	Far from town	Boat winter storage is further away	Phased construction may present challenges
	Drill more water wells needed	Lift station required for MEC-Center	Pioneering phase further away from Mertarvik	Waste Heat well utilized but not optimized	More spread out			Some community buildings separated	
			Additional culverts required, Potential for localized ponding						

LAYOUT PLAN 3 ANALYSIS: Allows for a flatter slope for development and room to expand, provides centralized public buildings and road access to subsistence both east and west. This also allows for access to the watering spring on the west beach on the Pioneer Landfill road. In general likely the cheapest simplest construction option, and accommodates more space between homes while maintaining central facilities. Phasing construction may be a challenge, but mostly minimizes many of the challenges of layout 1.

Figure 21. Pros and Cons of CLP Alternative 3 (ANTHC 2017a).

SITE LAYOUT ANALYSIS, CONSIDERATIONS & RECOMMENDATIONS

Cultural Factors: land use, historical access to subsistence use areas, residential input, lifestyle needs
Technical Factors: cost feasibility, access and placement, sustainability, operations and maintenance
Development Considerations: cost effectiveness, historical weather patterns (wind, snow drifting, rain), access to major infrastructure, safety, food security, health

	LAYOUT OPTION 1			LAYOUT OPTION 2			LAYOUT OPTION 3		
PRO'S	Flatter Ground More Cost Effective	**Room to Grow**	**Potential for Buried W&S**	Sewage Lagoon Far Away	**Room to Grow**	**Potential for Buried W&S**	Flatter Ground	**Room to Grow**	**Potential for Buried W&S**
	School Central	Power Plant far from town	**Ability to use MEC system during Pioneer Phase**	**Landfill Far Away Close to Shop**	School Central	Public Buildings Central	Fewer Roads Developed Trails	**Landfill Far Away Close to Shop**	**Ability to use MEC system during Pioneer Phase**
	Landfill Far Away Close to Shop	Access to Beach	Airport Far Away	Access to Beach	Short Distance for Fuel Pumping	Smaller Footprint	Less Crowded	School Mostly Central	Power Plant far from town
	Less Crowded			**Ability to use MEC system during Pioneer Phase**			Best Traffic Management		
CON'S	MEC is more isolated and far away	Boat Storage Far Away	Most roads, though flat	Steeper Slopes Up to 10% grade	Airport close Beach far	More expensive foundations for most facilities	Lift Station near MEC for pioneering homes	**Landfill Far Away Far From Beach**	Barge Landing Far Away
	Barge Landing Further Away	Airport Far Away	**Landfill Far Away**	**Far from West Well**	Abandon MEC W&S system	Homes on slope – potential for more drifts	Sewage Lagoon closer to town	**Far from West Well**	Boat Storage Far Away
	Far from West Well	Sewage Lagoon Closer	Potential for 2 village areas	More crowded	**Landfill Far Away**				
AGENCY COMMENTS	HUD, DC, BIA, AEA: 1. The HUD permitted area is much larger for non-housing facilities 2. Concerns for the location of the bulk fuel and power plant. 3. Concerns for subsistence living—are any of the proposed locations on specific subsistence resource lands? 4. Recommended placing pull outs or rest areas for foot traffic, specifically elders, along the road/trails. 5. Recommended placing lighting on the road. 6. Recommend Adding proposed harbor to layout 7. Request LF of road and proposed quantity of housing lots 8. AEA recommends site 2, HUD, BIA, DC no stated preference, all plausible.			SOA DCRA: 1. Best to consider phasing approach of construction in all layouts 2. Recommended color coding phases during eventual recommendation 3. Recommended improve ability of community to visualize layouts 4. Ensure SHPO concerns are highlighted on maps. 5. Cost Estimate for construction of each alternative recommended 6. Layout 2 is preference, though all are possible.			Technical Consultants (Kinney, GEI, LCG, HDL, DOWL, CCHRC) 1. Alt 1: Future airport access is less direct 2. Alt 2: More feasible than 1 for construction 3. Alt 3: Best for topo. Delete road leg to sewage lagoon 4. Considerations: Drainage, Heavy Vehicle Access, specifically for airport construction and Intersection Grades 5. Alt 3. Is best aesthetic option 6. Alt 2 is best for minimizing fuel spill risk and power considerations 7. LCG, Kinney, GEI preference for Layout 3, HDL, CCHRC preference for site 2. DOWL no stated preference		

Figure 22. Summary and Comparison of CLP Alternatives (ANTHC 2017a).

4.5.2 Development of the Airport Layout Plan

The ADOTPF has been studying prospective sites at the Mertarvik community site since at least 2007, when they identified six potential locations for the new airport in a 2007 reconnaissance study conducted for the ADOTPF by PDC Engineers Inc. (PDC 2008). According to the ADOTPF's March 2008 reconnaissance report (incorporated here by reference), three sites (Alternatives 2, 5, and 6) were eliminated based on information received from pilots, the public, and a site visit. Some of the reasons given for eliminating these alternatives are: (1) pilots expressed a concern with the nearby hills for Alternatives 2 and 5; (2) land acquisition for Alternative 2 would be more difficult because of Native allotments; (3) Alternative 5 would require property from the Yukon Delta National Wildlife Refuge for the runway, taxiway, and apron, and land from the Newtok Native Corporation for an access road to the community (4) the location for Alternative 5 is farther from the community site than any of the other alternatives; (6) the topography of the site for Alternative 6 would require either deep fills at each end of the runway or cutting out the hill near the center portion of the runway to obtain the line of sight requirements and clearance of the FAR Part 77 primary surface; and (7) the Alternative 6 location has limited flat terrain for apron and aviation support areas and would require deep fills.

The remaining three potential sites, designated Alternatives 1, 3, and 4, in the 2008 report, were then evaluated based on the following eight criteria:

- Orientation for wind;
- Proximity to the community;
- Airspace penetrations;
- Environmental impacts;
- Bird and wildlife hazards;
- Topography and soils;
- Site development and maintenance costs; and
- Proximity to material sources and the new barge landing.

The general results of the evaluation were as follows. The sites ranged from 0.25 mile to 2 miles from the planned village site and were between 1 and 3 miles from both the planned barge landing and the most likely material source. All three sites allowed some flexibility of runway orientation to maximize wind coverage, although it was not known at that time whether any could achieve 95 percent wind coverage, and only Alternative 1 appeared able to accommodate a crosswind runway. Based on the level of mapping detail available (4-foot contours for Alternative 1 and 50-foot contours for Alternatives 3 and 4), the sites appeared to be in rolling hills (Alternative 1) or flat terrain with possible rolling hills (Alternatives 3 and 4), with no airspace penetrations identified. All three sites appeared to have similar soil conditions, with preliminary investigation indicating that the foundation soils are moderately stable where unfrozen, relatively ice-poor where frozen, and only marginally susceptible to detrimental effects from seasonal frost. Overall environmental impacts for all three sites appeared to be minimal, although all three would have unavoidable wetland impacts.

Airport layouts were then developed for the runway, apron, taxi way, and access route for the three identified alternative sites. Evaluation of the three alternatives was based on high-level information as compared with site-specific predesign-level information. At that level, all three sites were relatively similar, and because all three appeared viable, they were all carried forward for additional evaluation (Figure 23, PDC 2012).

In addition to the airport relocation reconnaissance study commissioned in 2007, ADOTPF commissioned a follow-up study for site selection and development of an airport layout plan in December 2009. The culmination of these two studies resulted in the December 2012 Mertarvik Airport Site Selection Study report, also prepared by PDC Engineers Inc. The 2012 report recommended the selection of Site 1 for future construction of an airport. Engineering studies determined that Alternative 1 would be the easiest to access and the most cost-effective to construct, operate, and maintain. This site is the closest to the Mertarvik community site, an important factor during inclement weather (PDC 2012). However, the site is still far enough away to allow for community expansion well beyond the boundaries shown for development.

According to the 2012 report, additional engineering analysis determined that an "optimized" single runway (Alternative 1.1), oriented at 138° would be the preferred build alternative. At 100 feet wide and within a 300-foot safety area, this runway would provide sufficient wind coverage without the need for an additional crosswind runway. Initial construction would consist of a 75-foot-wide by 3,300-foot-long runway with a 150-foot by 3,900-foot safety area. Staged construction of Alternative 1.1 would allow for operation and use of the airstrip while allowing it to be gradually expanded to its ultimate size of 100 feet wide by 4,000 feet long with a 300-foot by 4,600-foot safety area.

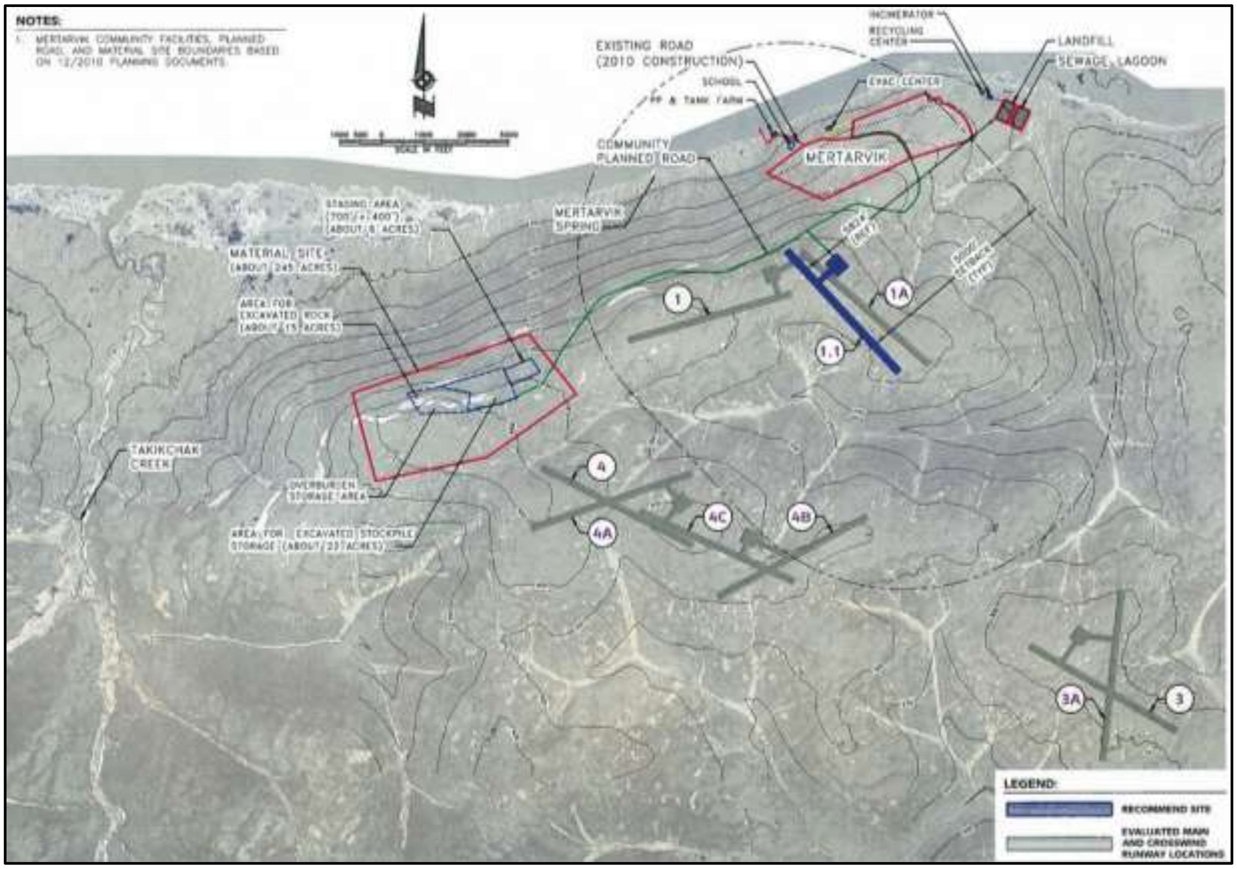


Figure 23. Mertarvik Airport location and layout alternatives (PDC 2012).

In a letter dated May 22, 2014, the FAA informed the ADOTPF that they had completed their review of the updated Airport Layout Plan (ALP) for the Newtok Airport and Mertarvik, Alaska (Figure 24). The ALP design was conditionally approved subject to the condition that the proposed Class III Municipal Solid Waste Landfill and wastewater treatment lagoon at Mertarvik maintain a minimum separation requirement of 5,000 feet from the airport.

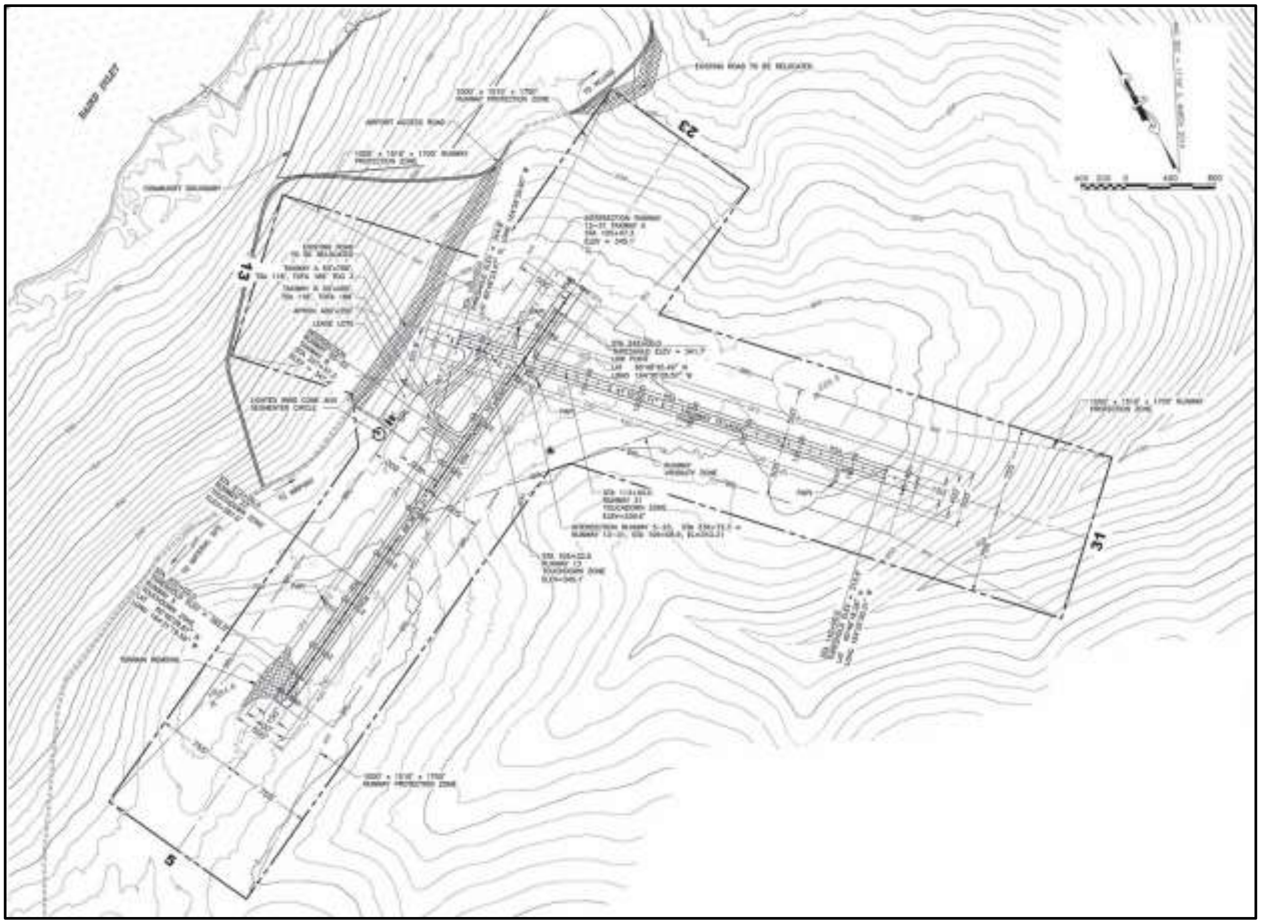


Figure 24. Preferred Mertarvik Airport Layout Plan (ALP) as approved by the FAA in 2014. The airport road and apron were later reconfigured to accommodate the 2017 CLPs.

In the collaboration between the Commission and the FAA that occurred during the scoping and preparation of this EIS, minor adjustments were made to both the airport layout and to the community site layout. The airfield apron was flipped to the east side of the north-south runway and reshaped to fit within the airport protection boundary, and the airport road route was modified to better reflect the approach from the village center. The proposed locations of some community infrastructure were shifted to ensure that they did not intrude upon FAA restricted areas or other requirements.

4.6 Preferred Alternative

The preferred Mertarvik Infrastructure Development alternative, and proposed action, is CLP Alternative 2, with some minor modifications made after selection by the people of Newtok. Figure 25 and Figure 26 show the final selected CLP as of June 2, 2017. The preferred alternative was accepted unanimously by a quorum of the Newtok Village Council, in a resolution dated June 22, 2017.

The FAA's preferred alternative is construction of the replacement airport at Mertarvik as proposed and further defined in section 4.5.1. FAA's preferred alternative is, of course, a component of the overall preferred alternative and is the same for all CLP alternatives. FAA's preferred alternative is a component of the larger preferred alternative because the agency's authority and role encompass only the airport component of the project.

4.6.1 Infrastructure Elements

The preferred alternative is shown in Figure 25, Figure 26, and Figure 26a. The individual structures and features that make up the CLP, such as homes, community buildings, and utilities, are annotated on Figure 26, and listed in Table 3. The preferred alternative also includes nearly 28,000 linear feet of gravel roads, and 14,350 linear feet of designed and maintained gravel trails (Figure 25, Figure 26). The roads are assumed to have 40-foot wide beds; the width of the trails will vary according to their expected use and the local topography.

The preferred CLP was designed using lot sizes assigned for each structure and facility. Many of the proposed infrastructure elements have not yet been designed, so their structural footprint in Table 3 is estimated based on their planned use and on similar structures existing in other rural Alaska communities.

Design work on the CLP infrastructure elements is underway, particularly for essential utilities. Design plans and studies completed for Mertarvik as of November 2017 include:

- *Mertarvik Bulk Fuel & Rural Power System Conceptual Design Report*, August 2017 (Cooper, et al 2017a).
- *Newtok-Mertarvik Relocation Energy Master Plan, Final,* May 2017 (Cooper, et al 2017a).
- *Mertarvik Housing Master Plan*, February 2017 (CCHRC 2017).
- *Mertarvik Multi-Purpose Building Retrofit Feasibility Study*, January 2016 (CCHRC 2016).

These design documents and others are available at the Newtok Planning Group website, https://www.commerce.alaska.gov/web/dcra/PlanningLandManagement/NewtokPlanningGroup.aspx, and are incorporated by reference in this EIS.

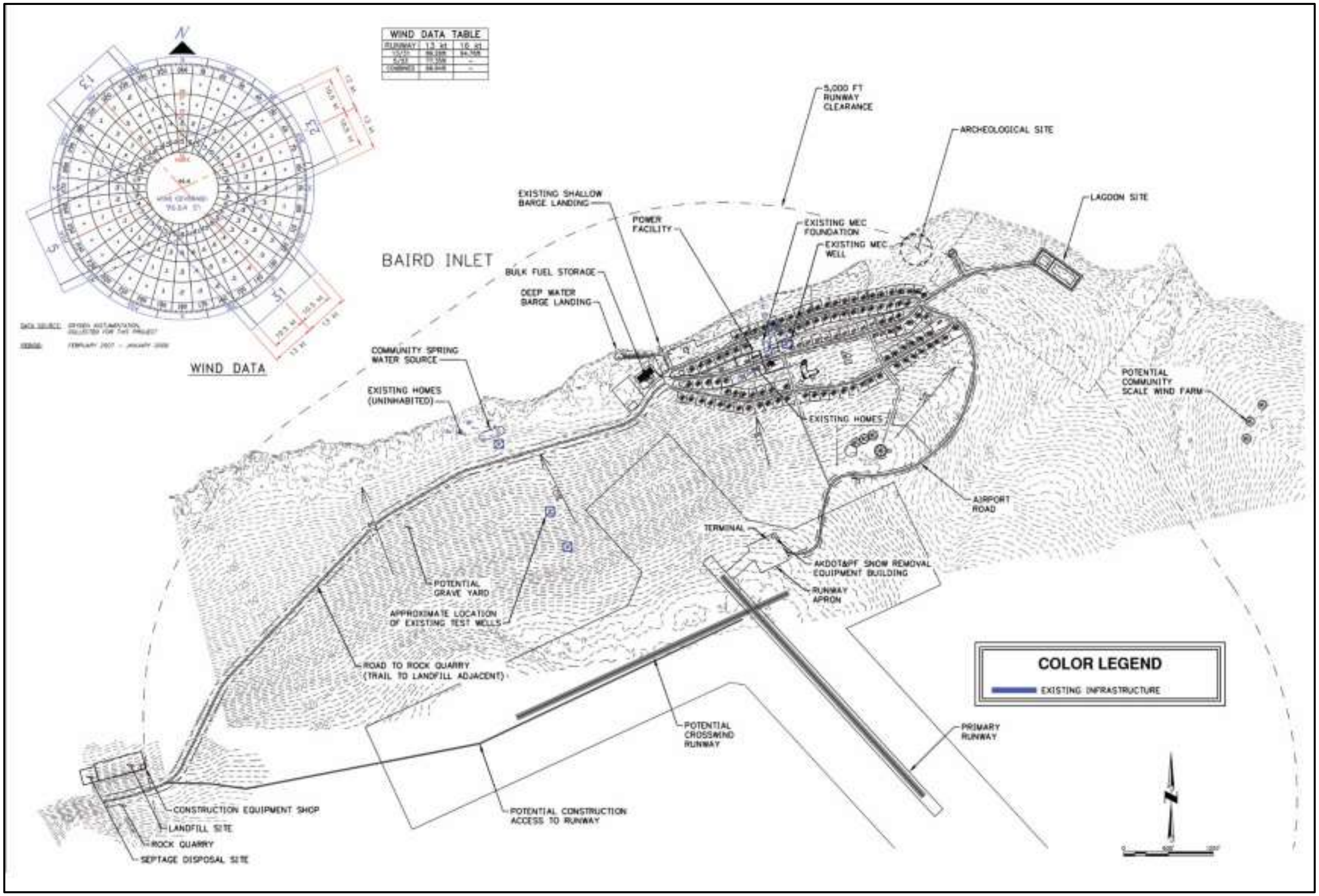


Figure 25. Preferred Alternative - ANTHC CLP Alternative 2 (with post-selection revisions; ANTHC 2017b; airport road alignment updated by USACE 20 Nov 2017)

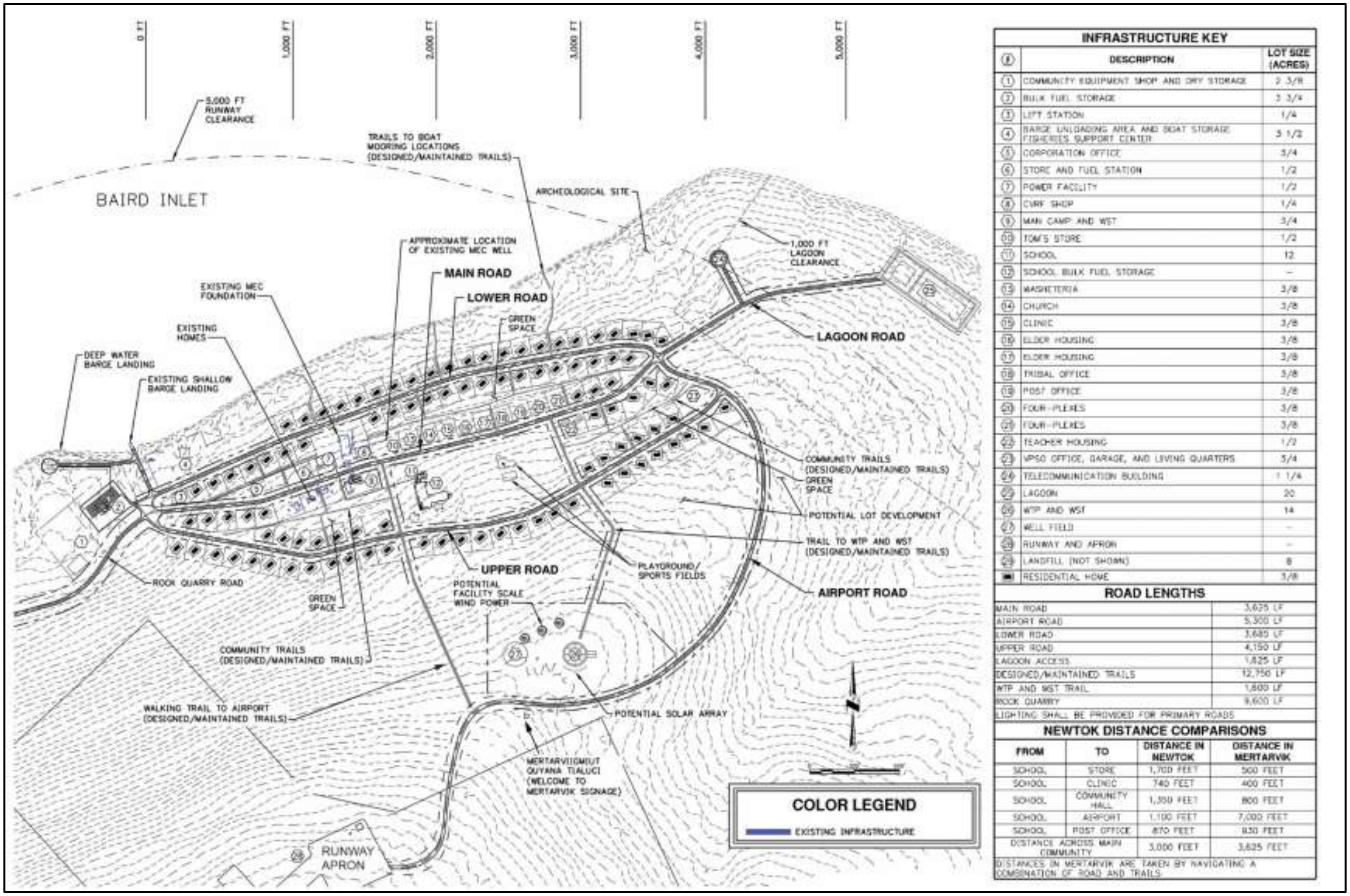


Figure 26. Preferred Alternative - ANTHC CLP Alternative 2 with detail of community center (ANTHC 2017b; airport road alignment updated by USACE Nov 2017)

Figure 26a. Computer-generated rendering of the preferred alternative, annotated with major infrastructure elements; refer to Figure 26 and its Infrastructure Key (ANTHC 2017).

Table 3. List of CLP Infrastructure Elements, with Lot and Estimated Footprint Areas.

Infrastructure Key **(**matches Figure 26**)**	**Infrastructure Element**	**Lot Size Provided (acres)**	**Estimated Structure Footprint (acres)**
1	Community Equipment Shop & Dry Storage	2.375	0.33
2	Bulk Fuel Storage	3.75	1.75
3	Lift Station	0.25	0.125
4	Barge Unloading area & Boat Storage Fisheries Support Center	3.50	0.33
5	Corporation Office	0.75	0.125
6	Store & Fuel Station	0.50	0.125
7	Power Facility	0.50	0.33
8	CVRF Shop	- [a]	0.25
9	Construction Camp & Water Storage Tank	0.75	0.125
10	Tom's Store	0.50	0.125
11	School	12.00	3.25
12	School Bulk Fuel Storage	- [a]	0.25
13	Washateria	0.375	0.125
14	Church	0.375	0.10
15	Clinic	0.375	0.10
16	Elder Housing	0.375	0.125
17	Elder Housing	0.375	0.125
18	Tribal Office	0.375	0.125
19	Post Office	0.375	0.10
20	Fourplexes	0.375	0.125
21	Fourplexes	0.375	0.125
22	Teacher Housing	0.50	0.125
23	VPSO Office, Garage, & Living Quarters	0.75	0.125
24	Telecommunications Building	1.25	0.25
25	Wastewater Treatment Lagoon	20.00	14.00
26	Water Treatment Plant & Water Storage Tank	14.00	1.25
27	Well Field	- [a]	0.10
28	Airport Runway, Taxiway, & Apron	495.00[b]	58.6[c,d]
-	Landfill	8	7
-	Single Family Homes, total (100 each new)	37.50	10.00
	Total Occupied Acreage	**605**	**127**

a. Infrastructure element not provided a separate lot.
b. 495-acre value refers to the total area that must be deeded to the State of Alaska for operation of the airport.
c. Acreage value for the airport footprint is from PDC Engineers 2017; other values from ANTHC 2017b.
d. This acreage does not include a crosswind runway.

The following sections provide descriptions of select infrastructure elements, with their likely characteristics, requirements, and construction considerations. These descriptions are based on geotechnical investigations, preliminary engineering reports, regulations, design standards, and/or typical design and construction practices with similar facilities constructed in other rural Alaska communities.

Solid Waste Landfill: The proposed facility will be a Class III Municipal Solid Waste Landfill (MSWLF) designed and permitted in accordance with Alaska Department of Environmental Conservation (ADEC) Solid Waste Management regulations,18 AAC 60, as amended through November 7, 2017. The landfill will be sized with a 20-year design population of 518 people, based on a projected annual growth rate of approximately 6.5 percent; and a per capita waste generation rate of 7.5 lbs/day.

The proposed landfill site is located north of the existing rock quarry. The quarry road will double as an access route from the town center to the landfill. The selected location satisfies Federal Aviation Administration (FAA) airport separation requirements. The location near the quarry also has the added advantage of ready access to cover material. Geotechnical investigations of the site, consisting of 9 borings, did not encounter any frozen materials to the extent of the borings which were terminated at approximately 16-feet below ground surface. Subsurface conditions generally consist of organic material to 2.5 feet, overlying silty gravel with sand. Groundwater was not observed in the test holes at the time of drilling in July 2017 (Golder 2017).

The proposed landfill will be developed as a trench and fill type facility, consisting of an unlined active waste disposal cell, a cold storage building, a carrion waste disposal cell, a septage disposal site, two incinerators, and a designated area for stock-piling salvageable items. Disposal trenches will be excavated on as-needed basis, with each cell approximately 8 feet wide, up to 100 feet long, and 5 to 8 feet deep. The facility will be equipped with an incinerator to reduce the volume of inert waste prior to disposal. Ash will be placed into the active disposal cell and compacted with other municipal solid waste. The entire landfill area will be fenced to prevent waste from migrating from the designated site and in order prevent unauthorized access. The facility footprint, including active operating areas and sufficient land for trench development throughout the design life of the facility, is approximately 7 acres.

Hazardous materials will not be accepted at the landfill. Hazardous materials will be separated, containerized, and stored for future backhaul from Mertarvik to an approved offsite disposal facility. Hazardous material storage containers will be located at a site near the barge landing to facilitate future shipment from Mertarvik.

Construction of the facility will require limited cut and fill methods to establish working surfaces and pads for salvageable material storage area and for the cold storage container. Primary disposal trenches shall be directly excavated to the size and depths noted above. Excavated materials shall be stockpiled adjacent to the trenches and used for routine cover operations as solid waste is compacted into the trenches. Excavated materials will be stockpiled in a manner to prevent surface water runoff into active trenches.

Wastewater Treatment Facility: The proposed treatment facility will be a two-cell facultative wastewater lagoon, typical of wastewater treatment facilities used throughout rural Alaska. These lagoons are easy to operate and maintain, they handle a wide range of flows and provide for many years of accumulated sludge storage. The facility shall be designed, permitted, and constructed in accordance with ADEC Wastewater Disposal Regulations, 18 AAC 72, as amended through November 7, 2017, and in accordance with ADEC "Lagoon Construction Guidelines," as revised July 18, 2013. Typical design criteria from these documents are summarized in Table 4.

Table 4. ADEC Design Criteria for Wasterwater Treatment Systems

Parameter	Value	Units
Minimum Design Service Life	20	years
Total BOD Loading	20	lbs./acre/day
BOD Strength	0.17	lbs./person/day
BOD Removal	85%	minimum
SS Removal	85%	minimum
No. of Cells	2	minimum
Minimum Freeboard	3	feet
Primary Cell Maximum Depth	10	feet
Primary Cell Retention	40-60	days
Secondary Cell Depth	5	feet
Secondary Cell Retention	240-365	days
Minimum Cell Sludge Storage	2	feet

Based on these criteria, a 20-year design population of 518 people, and an average per capita wastewater generation rate of 75 gallons/day, a conservatively designed wastewater treatment lagoon system is expected to have two cells with a total surface area of 9 to10 acres. Adding an estimate for earthen berms required to form the lagoon ponds, the entire facility will have an estimated footprint of approximately 14 acres.

Treated effluent from the lagoon will be seasonally discharged into the Baird Inlet. Permitting authority for wastewater discharges in Alaska is administered by ADEC under the Alaska Pollutant Discharge Elimination System (APDES). The APDES program issues both individual and general permits. It is anticipated that the Mertarvik lagoon will be permitted under a general permit for small domestic lagoons that discharge to surface water. Effluent limits and monitoring requirements will be defined in the permit.

Six test holes were drilled at the lagoon site to a depth of 16 feet to evaluate subsurface conditions. Conditions at the lagoon site generally consist of organic material up to five feet thick, overlying a mixture of silt and silty sand. Gravel was observed intermixed with the silt and sand in several boreholes. Permafrost was observed on one of 6 boreholes. Bedrock was encountered in one borehole at a depth of 5 feet, but not observed in the other holes. Groundwater was not observed at the time of drilling in any of the boreholes advanced at the site (Golder 2017).

Construction of the lagoon will involve cut and fill construction methods, including the removal of 2 to 3 feet of surface organic material from the entire 14-acre site and the subsequent placement of suitable material for the construction of earthen containment berms. Berms will be constructed to a height of 10 to 15 feet with 3:1 side slopes. Fill material will be sourced from within the footprint of the excavations and/or imported from the existing rock quarry.

The proposed lagoon location satisfies FAA airport separation requirements. The location is also predominantly downwind of proposed housing and public facilities.

Energy Systems: The *Mertarvik Bulk Fuel and Rural Power System Conceptual Design Report*, was written by Gray Stassel Engineering, Inc. and HDL Engineering Consultants and published in August 2017 (Cooper et al 2017). The following descriptions of bulk fuel and power generation systems are excerpted from this report.

<u>Bulk Fuel Storage and Dispensing Facilities</u>**:** The new fuel storage tank farm will consist of two gravel containment cells lined with a fuel resistant liner. New single-wall, horizontal fuel tanks will be installed inside the containment including: (8) 27,000-gallon bulk tanks, (2) 20,000-gallon bulk tanks, (1) 12,000-gallon intermediate tank, and (1) 20,000/8,000-gallon dual compartment tank for a gross fuel capacity of 214,000 gallons of diesel fuel and 82,000 gallons of gasoline. The tank farm will also include two marine header fill points and associated piping; truck fill; retail sales dispensing tank and dispensers; and fuel conveyance piping between the tank farm, retail sale dispensing tank, and power plan intermediate tank.

The tank farm will be constructed on an approximately 300-foot wide by 200-foot long gravel pad. An approximately 65-foot wide by 225-foot long gravel fuel containment berm with a fuel resistant liner will be installed to separate the containment into two cells to meet code requirements. A drive-through fuel transfer spill containment will be installed adjacent to the tank farm for truck fill operations. A 6-foot chain link fence with a barbed wire top will surround the tank farm pad to secure the area.
Subsurface conditions at the tank farm site were evaluated via six test holes drilled near the proposed site. The site is generally underlain by tundra/peat, then ice rich fine grained soils to an

average depth of 18 to 22 feet. The foundation for the tank farm is anticipated to include a passive refrigeration system with thermosiphons and flat-loop evaporators. The thermosiphons will be required to provide a stable foundation over the permafrost (Golder 2017).

Tank farm foundation construction will include excavation and removal of surface organic material, installation of fuel resistant geomembrane liner, installation of thermosiphons, placement and compaction of select local fill material for pad construction, and installation of gravel or timber containment dikes.

The construction of a gravel "working" pad and driveway around the tank farm and truck fill containment foundation area is recommended to support tank farm construction and maintenance operations. Construction of the working pad area will include the installation of a geotextile separation fabric over the existing organic layer that is covered with a 3-foot minimum layer of non-frost susceptible (NFS) structural fill material.

Power House**:** The power plant will consist of a pre-fabricated module with a segregated generator room and control room/office. The module will include three new Tier-2 and Tier-3 marine diesel engine-generators, new automatic start/stop/paralleling switchgear, a new heat loop for generator heat recovery with community buildings, remote radiators with variable speed fan control, a fire suppression system, critical grade exhaust silencers and associated engine coolant piping and ventilation equipment. The power plant will connect to a new intermediate fuel storage tank via an automated fuel transfer pipeline; automated load balancing; new switchgear; and a supervisory control and data acquisition (SCADA) system.

The power plant will be equipped with critical grade mufflers to minimize exhaust noise. The power plant structure will be insulated and ventilation ducts will be sound lined to minimize noise transmission from the plant to the surrounding environment.

The facility will initially be equipped with two 67 kW and one 100 kW generators to meet the projected electric loads during development of Mertarvik. The final generator configuration will include two 210 kW and one 100 kW marine generators. The power plant will provide recovered heat to serve the nearby community buildings.

The proposed power plant design includes an intermediate tank adjacent to the power plant with sufficient capacity to meet the long-term power generation fuel needs. The future peak monthly fuel consumption is estimated to be 8,500 gallons per month. A 10,000-gallon intermediate tank will provide adequate fuel storage for a full month of operation.
The intermediate tank will be set up for both truck fill and for fuel transfer from the tank farm. The tank fill line will be equipped with an overfill protection valve. The intermediate tank will be equipped with a fuel transfer meter to record all fuel transfers from the tank farm to the power

plant intermediate tank. The intermediate tank will have one outlet connection for the power plant that will be equipped with a normally closed actuated ball valve that opens when the day tank is filling. The day tank will be equipped with a fuel transfer meter to record all fuel use.

It is anticipated that the new module and intermediate fuel tank will be supported on concrete grade beams imbedded in a structural gravel pad. Grade beams will be provided with adjustable connections to account for minor settlement. Gravel pad construction will include excavation and removal of surface organic material and placement and compaction of select local fill material over a geotextile separation fabric. In the event that the structural gravel pad is less than 6 feet thick, then at least 2 inches of rigid insulation will be placed in the pad below the concrete grade beams.

The existing Newtok power system is owned and operated by Ungusraq Power Company (UPC). The UPC operates under Regulatory Commission of Alaska (RCA) Certificate of Public Convenience and Necessity (CPCN) Number 375. This certificate enables and requires UPC to provide power to Newtok residents within its service territory. In order to expand its service territory to include Mertarvik, UPC must file an Application for an Amended Certificate with RCA. An application must be reviewed by the RCA within 180 days by statute and therefore should be submitted at least 6 months in advance of need.

<u>Power Distribution System</u>: The electrical distribution system will be 12.47/7.2 kV, 3-phase overhead construction to minimize line losses, and meet the long term needs of the community. Pole-mounted transformers will stepdown the 7200 V distribution voltage and provide 120/240 V single-phase power to residential services. For larger customers, 208 V and 480 V 3-phase power will be provided, as required.

Construction will be in accordance with Rural Utility Service Bulletin 1728F-804, Specifications and Drawings for 12.47/7.2 kV Line Construction. In general, the system will be three-phase, four-wire. Single-phase taps will be provided where serving individual locations or for limited loads. The primary overhead conductor used will be No. 2 AWG Aluminum Conductor Steel Reinforced (ACSR), with 7/1 stranding.

Where the electrical distribution system is required to be installed underground, such as at or around the airport, it will be constructed in accordance with Rural Utility Service Bulletin 1728F-806, Specifications and Drawings for Underground Electric Distribution.

In general, construction will consist of the installation of 40-foot power poles, located within proposed road rights-of-way. The type of pole foundations, direct buried or pile, will be determined based site-specific conditions at the specific installation location.

Water Storage Tank: The Cold Regions Utilities Monograph, Third Edition, recommends that rural water storage tanks be designed with a minimum of 10 days of emergency storage. Based on a 20-year design population of 518 people, and daily per capita water consumption of 75 gallons, a conservatively sized water storage tank for Mertarvik will have a capacity of approximately 400,000 gallons. A tank of this size is estimated to have a 40 to 48-foot-diameter floor with a height of 32 to 40 feet. It is expected that the water storage tank will be an insulated, bolted steel ground tank, typical of water storage tanks throughout rural Alaska. The tank will be erected on a structural gravel pad that is adapted for the specific conditions at the Mertarvik site.

Based on one borehole that was drilled at the proposed tank site, subsurface conditions consist of an organic mat overlying unfrozen silty sand, overlying frozen silty gravel with sand. Volcanic ash was intermixed with the silty gravel with sand at approximately 20 feet. The frozen soil encountered near the surface is assumed to be seasonal frost, while the deeper frozen soil is assumed to be permafrost. Visible ice content by volume was estimated to range from 5 to 20 percent. Weathered bedrock was encountered at 35 feet below ground surface. Groundwater was not observed at the time of drilling (Golder 2017).

It is expected that the water storage tank will be installed on a foundation system that is designed to maintain frozen subsurface conditions in order to eliminate detrimental thaw consolidation of subsurface soils. The foundation for the water storage tank is anticipated to include a passive refrigeration system with thermosiphons and flat-loop evaporators installed within a structural gravel pad. The pad will be approximately 60 to 70 feet in diameter at the top, with 2:1 side slopes, and ground level footprint of approximately 80 feet in diameter. In general, pad construction will include excavation and removal of surface organic material, installation of thermosiphons, and placement and compaction of select local fill material over a geotextile separation fabric and rigid board insulation.

Water Distribution and Wastewater Collection Lines: Long-term development plans include the installation of community water supply and wastewater collection systems. The proposed water distribution system is expected to be a network of nominal 6 and 8-inch insulated and buried pressure pipes emanating from the water treatment plant site. Water distribution systems will be designed and permitted in accordance with ADEC Drinking Water regulations, 18 AAC 80, amended as of November 7, 2017.

The wastewater collection system is expected to be a network of nominal 8-inch insulated gravity sewer lines and 4-foot diameter manholes terminating at the wastewater treatment lagoon. Manholes will be located at a maximum spacing of 300 feet and at all bends in the collection system. A single lift station, with an estimated footprint of approximately 900 square feet, is expected at the west end of the townsite. The station will pump through a pressure force main which discharges into the gravity collection system near the school. The wastewater collection system will be designed and permitted in accordance with ADEC Wastewater Disposal regulations, 18 AAC 72, amended as of November 7, 2017.

Water distribution and wastewater collection system piping will be installed within the rights-of-way established for town site roads. Subsurface conditions observed in the boreholes along the proposed roads were highly variable. Soils generally consisted of organic material up to 3 feet thick, with an average thickness of approximately 1 foot, overlying a mixture of silt, sandy silt, silty sand, and silty gravel. The lithology and thickness of the soil layers were generally not consistent between boreholes. Permafrost was observed in two boreholes: Borehole G17-T02 and G17-T03. The permafrost did not extend to the bottom of either borehole. No visible ice was observed within the frozen samples. Small zones of near surface relic seasonal frost were observed in nine of the boreholes. Groundwater was not observed at the time of drilling (Golder 2017).

Initial estimates of seasonal frost penetration indicate that in areas void of permafrost or organic soils at the surface range from 6 to 9 feet. Therefore, it is expected that pipelines will be buried to a depth of 8 to 10 feet in order to protect pipelines from freezing temperatures and reduce system heating costs.

Generally, construction will consist of trench excavation within designated road rights-of-way to a depth of 8 to 10 feet. Pipelines will be bedded in select granular material. A geotextile pipe wrap may be utilized to provide separation between the granular bedding materials and in situ fine grained soils.

Community Roads: The preferred CLP includes approximately 5.3 miles of roads. This total includes townsite subdivision roads (2.2 miles), the quarry/landfill road (1.8 miles), the airport road (1.0 mile), and the lagoon access road (0.3 mile).

Subsurface conditions observed in the boreholes advanced along the proposed townsite roads were highly variable. The soil generally consisted of organic material up to 3 feet thick, with an average thickness of approximately 1 foot, overlying a mixture of silt, sandy silt, silty sand, and silty gravel. The lithology and thickness of the soil layers were generally not consistent between boreholes. Permafrost was observed in two boreholes: Borehole G17-T02 and G17-T03. The permafrost did not extend to the bottom of either borehole. No visible ice was observed within the frozen samples. Groundwater was not observed at the time of drilling (Golder 2017).

It is anticipated that typical road sections will be designed and constructed to maintain frozen ground where it exists. In general, roads will be constructed without removing the tundra or surface organic mat. Vegetation will be trimmed to create a relatively smooth tundra surface prior to placement of a geotextile directly on the tundra surface. Select structural fill will be placed and compacted on top of the fabric. Culverts will be installed as required in order to maintain existing surface drainage patterns.

Typical townsite road sections will be approximately 11 feet wide at the driving surface with a height of 4 to 5 feet above existing grade and 3:1 side slopes. The width of the road at ground surface will vary depending on the slope of the terrain but is expected to average about 40 feet. The quarry road will be constructed in a similar manner but will have a surface width of 16 feet. The quarry road will be constructed to a greater width in order to accommodate movement of heavy construction equipment between the quarry and the townsite during the development of Mertarvik.

Buildings and Foundations: Other structures included in the preferred CLP are the school and teacher housing, water treatment plant, washateria, clinic, post office, tribal and corporation offices, store, elder housing, and private residences. The variable nature of the subsurface conditions across the site indicates the potential for differential settlement at some locations if the permafrost thaws as a result of site development and as a result of seasonal frost jacking. Understanding site specific conditions will be necessary to inform geotechnical recommendations and design of the foundation systems for these facilities.

Preliminary geotechnical analysis (Golder 2017) has identified several options for foundation systems that may be utilized depending on the requirements of the structure and site-specific conditions. These options are reproduced below.

<u>Maintaining frozen soils in existing permafrost areas</u>**:** Based on the long-term warming trends predicted in the region, it is anticipated that the permafrost in the community will continue to degrade with time. By maintaining permafrost, long-term thaw settlement can be reduced over the design life of the facility. Depending on the development, maintaining permafrost can be done by passive and/or active cooling techniques paired with elevating heated structures to allow blow through space between the ground and structures, and by utilizing rigid insulation in pad or embankment sections.

<u>Utilizing rigid insulation in areas with frost susceptible subgrade soils</u>**:** In areas without permafrost, placing rigid insulation under and around heated and unheated foundations, roads, or pads can limit the amount of seasonal frost that penetrates into the frost susceptible subgrade soils. This will reduce the amount of differential movement that the foundations will experience seasonally.
<u>Excavating and replacing frost susceptible soil</u>: Replacing frost susceptible soil with NFS structural fill within the zone of frost penetration can limit the amount of seasonal movement that will occur. However, deeper excavations may be required with this option, and depending on the

season, dewatering may be required. Achieving adequate compaction of the NFS structural fill may also be a concern if excess water is present.

Supporting developments on deep foundations: Deep foundations, including driven piles and helical piles, can be designed so that degradation of frozen soils or seasonal movement of soils does not impact the structure.

Supporting developments on adjustable foundations: Adjustable foundations, such as triodetic foundations, can have a high tolerance to settlement and can be utilized to decrease the impacts of differential movement of structures. However, long-term maintenance and re-leveling efforts are typically required with this solution.

Airport: FAA's process for the design of airports includes incorporation of primary (the main) and crosswind runways, if needed, to maximize the frequency within which aircraft can take-off and land as wind direction varies. In 2014, FAA conditionally approved an ALP for Mertarvik Airport that includes both a primary and crosswind runway. The proposed primary runway at Mertarvik provides an 89.26 percent probability that aircraft can take-off and land safely in relation to the typical prevailing wind direction year round. The proposed crosswind runway increases that probability (i.e., improves the margin of safety) to 96.64 percent of time aircraft can take-off and land based on prevailing wind direction. Therefore, FAA incorporates crosswind runways in airport designs as needed to maximize the safety of flight operations. However, the crosswind runways included in the designs of most remote Alaska community airports are almost never constructed because of a lack of air carrier demand that would justify the additional cost of construction, operation, and maintenance. This EIS therefore provides an analysis of the expected impacts (e.g., wetland acres impacted, water quality, etc.) associated with the construction and operation of the primary runway only. The reader is asked to note that the crosswind runway appears in the document in several figures and is occasionally referenced because it was a component of historic planning and analyses for the currently proposed airport. At this time, however, there is no reasonable expectation that the air carrier demand at the Mertarvik Airport will warrant the construction of the crosswind runway; therefore, this project feature is not expected to be constructed at this time.

The Mertarvik airport would accommodate small, wheeled aircraft (Critical Aircraft - Beech 1900, the most demanding aircraft expected to make regular use of the airport—500 or more annual operations). Anticipated near-term construction would include the primary (13 – 31) runway, an apron and taxiway. This proposed construction would provide an airport comparable to that at the existing village of Newtok and facilitate flight operations under 89.6 percent of normal wind conditions.

An access road from the community would also need to be constructed for the airport. The proposed airport would be comprised of the following components.

- Runway – Gravel surfaced 75 feet wide and 4,000 feet long
- Runway Safety Areas – 150 feet wide, 4,600 feet long, centered on the runway centerlines
- Runway Object Free Areas – 500 feet wide, 4,600 feet long, centered on the runway centerlines
- Runway Protection Zones – 1,000 feet x 1,510 feet x 1,700 feet, located at each end of each runway.
- Taxiway A – Gravel surfaced, 380 feet long and 50 feet wide
- Aircraft Apron – Gravel surfaced, 350 feet by 400 feet
- Navigational Aids – Lighted Wind Cone and Segmented Circle
- Visual Approach Aid – Precision Approach Path Indicator, Runway Edge Identifier Lights
- Runway Lights – Medium Intensity Runway Lights
- Perimeter Fence – None currently proposed
- Support Facilities – Weather Station and Communications TBD
- Access Road – 2 lane gravel
- Snow Removal Equipment Building(s) – 2, dimensions TBD
- Overhead Utility Lines – Expected to be routed along the access road
- Lease Lots (on Apron) – Unknown number, size and probable use at this time
- Timing of Construction – 2020-2021 (approximately May to October for most construction work, although preparatory work such as quarrying and positioning material may take place throughout the year)
- Fill Material Haul Route – Would cross airport property en route to the runway and apron from the quarry NW of the proposed airport.

Construction of the runway, taxiway, apron, and access road involve cut and fill construction methods, meaning removal of existing surfaces and placement of suitable fill at least 5 feet thick to form operational surfaces and preclude permafrost degradation. All final surfaces would be graveled and compacted as needed to meet operational requirements. Fill material will be sourced from within the footprint of the airport excavations, where possible, to re-use excavated material, from the community's materials source and/or barged in from an as yet undetermined materials source, if needed. There is, however, no proposal at this time to create a new materials source outside the Mertarvik community site to supply materials for the proposed action, or an indication that it would be required, based on estimated quantities of fill to be needed.

4.6.2 Sequence of Construction

The Mertarvik Strategic Management Plan (Agnew::Beck Consulting 2012) envisioned the Mertarvik development and relocation of Newtok residents as occurring in four phases:

- Phase 1: *Uplluteng* (Getting Ready). This phase includes all planning activities and initial infrastructure construction to-date, prior to active habitation of the site.

- Phase 2: *Upagluteng* (Pioneering). Seasonal habitation by approximately 25 to 100 people, living with limited community infrastructure.

- Phase 3: *Nass'paluteng* (Transition). A steady increase in population from roughly 100 to 200 people, with services and community infrastructure added and scaled up to accommodate the growth.

- Phase 4: *Piciurlluni* (Final Move). The final relocation of all Newtok residents (approximately 350 people) into an essentially complete new community.

The draft CLP report (ANTHC 2017c) reflects this phased approach in its Design and Construction Phasing Recommendations. The ultimate goal is to have all Newtok residents relocated to the new site in 10 years. Certain population thresholds at Mertarvik may need to be demonstrated before some Federal and State agencies are able to provide key community services or invest in community facilities at Mertarvik, such as the airport, school, and Post Office. For example, the United States Postal Service (USPS) has a set threshold of 25 families or 75 persons before they will provide mail service to a community. Delay in the establishment of these facilities in Mertarvik may impact the beginning and duration of the transition period wherein residents make the move from Newtok to Mertarvik. The report recommends building roads and pads supporting individual pieces of infrastructure a year in advance of erecting those structures, where possible, and pacing critical service (power, water, sewer, etc.) development ahead of actual need. The report's recommended construction sequence is outlined below; the actual implementation will be highly dependent on funding availability, and the sequence is likely to be subject to considerable adjustment.

Phase 2, *Upaluteng* (2017-2018)

<u>2018</u>

- Construct five additional houses to bring the total of usable homes to 13, housing families with an estimated 20 students.
- Develop 2,000 linear feet of roadways to connect houses and pioneering community infrastructure.
- Continue construction of MEC facilities to allow for use as an emergency shelter and pioneering schoolhouse.

- Complete development of the MEC well for year-round self-haul water supply.
- Construct a preliminary power plant and electric distribution.
- Construct an initial landfill cell with fencing and a burn unit to accommodate trash from pioneering community.
- Develop temporary septic disposal system.

Phase 3, *Nass'paluteng* (2019-2022)

2019

- Construct 10 additional houses, with the goal of providing sufficient housing to accommodate enough students to trigger the need for a new school, and to shelter residents whose Newtok homes are at greatest risk from erosion.
- Begin design and development of a water source sufficient to replace the MEC well for full community service.
- Construct roadways sufficient to support construction activities 2019-2020. Construct 2,000 linear feet of trails for access to the MEC and to the beach for subsistence activities.
- Begin airport construction, to include expansion of borrow source, construction of an access road between the quarry and the airport site, and removal of overburden from the runway footprint.
- Develop community equipment shop to store and repair construction and maintenance equipment.

2020

- Construct an estimated additional 10 homes.
- Expand the landfill to accommodate the growing population, continued construction activities, and the future new school.
- Construct airport access road, the road from the school to the sewage lagoon site. Continue constructing trails between housing and community facilities.
- Continue airport construction.
- Upgrade bulk fuel storage to allow for increased fuel usage.
- Construct Phase 1 of the Fisheries Support Center (boat haul-out, repair, and storage facility located near the shallow barge landing).

2021

- Construct an estimated additional 10 homes.
- Construct the water storage tank and water treatment plant, including its access trail.
- Construct the sewage lagoon starter cell.
- Build upper residential road to accommodate upcoming home development.
- Complete airport, including surfacing and construction of airport structures.

- Construct school foundation and building shell; school construction needs to be completed by 2022, as part or all of the Newtok Ayaprun School building may need to be shut down as the erosion threat progresses.
- Upgrade power plant significantly to accommodate additional electrical requirements from the airport, school, and health clinic.
- Construct village store.

<u>2022</u>
- Continue construction of as many houses as funding allows, to accommodate a large shift in population from Newtok to Mertarvik once the Newtok school is shut down.
- Develop a water system capable of producing water year-round sufficient to supply the community, including the school and health clinic, with roughly 3,000 feet of water main.
- Develop a sewer system capable of providing the school, clinic, and MEC with sewer discharge to the starter cell lagoon constructed in 2021. System would be capable of connecting additional gravity services located along the main road.
- Complete the new full-sized school, focusing on vertical and interior construction, including construction of teacher housing sufficient to house teachers for the new facility.
- Construction of new health clinic.
- Development of heat recovery systems at the school and other non-residential facilities nearby, and facility scale solar and wind energy generation to support other high energy users.
- Construct small vehicle repair shop.

Phase 4, *Piciurlluni* (2023-2027)
<u>2023</u>
- Construct an additional 20 housing units.
- Expand water and sewage services, and enlarge sewage lagoon to accommodate the entire community.
- Complete 2,000 feet of roadway, and 2,000 feet of pedestrian trails.
- Renovate the MEC to serve as a community cultural and recreation center.

<u>2024</u>
- Construct an additional four houses and tie into existing water and sewer service.
- Develop a lift station and sewer force main connecting from the intersection of the main and lower roads to the gravity sewer main located at the school.
- Develop a high-penetration wind energy system.
- Construct a church.

<u>2025</u>
- Construct four additional houses.
- Continue to extend water and sewer services.
- Construct housing and facilities for a Village Public Safety Officer (VSPO).

2026
- Construct four additional houses.
- Continue to extend water and sewer services.
- Construct corporate offices for the Newtok Native Corporation.

2027
- Construct four additional houses.
- Continue to extend water and sewer services.

The Newtok-Mertarvik Energy Master Plan (Cooper, *et al*, 2017) presents a similar recommended construction timeline, summarized in Table 5, based on a phased buildup of energy infrastructure at Mertarvik paired with a draw-down of the Newtok power plant.

Table 5. Recommended Sequence of Construction at Mertarvik, per Cooper, et al, 2017b.

Phase	Estimated Completion	Mertarvik Year-Round Residents	Homes and Facilities Constructed
1	completed 2006-2016	0	7 homes completed Shallow and deep-water barge landings MEC foundation, well, and septic system 4 storage buildings Pioneer roads and trails Quarry opened
2A	Fall 2017	0	20-person construction camp Temporary cafeteria and washateria for construction camp 7 houses completed, 4 homes started
2B	Fall 2018	Up to 35	17 houses completed Construct temporary school in MEC
3A	Fall 2019	Up to 100	27 houses completed Construct wastewater treatment lagoon Construct Class Municipal Solid Waste Landfill Construct temporary public facilities in MEC (i.e. washateria, clinic, classroom, post office, city office)
3B	Fall 2020	Up to 200	42 houses completed Construct airport
4	Fall 2021	Up to 400	103 houses completed Construct new school/relocate existing school from Newtok Construct new clinic Construct remaining community buildings Construct piped water and sewer system Construct water treatment building Construct sewage treatment facility

For airport construction, the ADOTPF estimates that planning, design, and permitting will continue from 2017 through 2019, with construction in the ice-free portions (approximately May to October or less per year) of 2020 and 2021. The two factors that have the greatest and as yet unknown potential to affect the schedule for the subsequent post EIS selected alternative are funding for each Federal agencies' required work and the effects on-going and potentially accelerated erosion rates.

FAA's analysis of airport-related impacts is based on the construction of the runway, related taxiway, and apron as shown on Figure 25.

The airport schedule of construction includes the temporary construction impacts (stockpiling, staging, reclamation of temporary impacts, etc.) as needed.

Temporary impacts would result from construction of the haul road from the materials source Permanent impacts would result from construction of the airport access road, runway, taxiway, apron, building(s), navigational aids, and lighting needed for the runway.

5. Affected Environment and Environmental Consequences

5.1 Introduction

This chapter provides the alternatives analysis portion of the EIS, describing what is known about the existing environment and the resources therein, and then assessing the potential consequences of the alternatives (brought forward from Chapter 4) upon that environment. Categories of resources within the affected environment (e.g., surface water, cultural resources, etc.) have been identified for analysis in the following sections of this chapter, and are summarized in Table 5 below. These resource categories were selected based on feedback obtained during public and agency scoping meetings, statutorily-required analyses (e.g., the Endangered Species Act, the National Historic Preservation Act, Section 4(f) Analyses), and NEPA policy requirements of the FAA.

The application of NEPA analysis to these alternatives presents some unusual twists, in that the existing human population that would be affected by the proposed actions (the populace of Newtok) does not currently live in the affected physical environment (Mertarvik), but is planning to live there in the future. The affected population is also the primary beneficiary of the proposed action, and has been an active participant in the scoping and development of the proposed action. Therefore, in the following sections, the analysis of effects of the proposed action on resources in the physical setting (e.g., land, water, wildlife, cultural sites, etc.) will focus on the Mertarvik community site, while some analyses of effects on the human environment (e.g., culture, public health, infrastructure, etc.) will use the current conditions experienced by the people of Newtok as the baseline for the affected environment (a.k.a., the "existing population"), or both. The differing foci of analysis for each resource category are summarized in Table 5.

Regulations for implementing the NEPA require that the EIS "succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration" (40 CFR §1502.15). Depending on the resource considered, the potentially affected environment for this EIS may be limited to part or all of the proposed Mertarvik village site; the Newtok village site; may extend off-site to Nelson Island, Baird Inlet, the Yukon Delta National Wildlife Refuge, Bristol Bay, and even Cook Inlet, Gulf of Alaska, and Bering Sea. The area of effect addressed for each resource category is discussed in the subsequent sections.

NEPA regulations on EIS preparation state that the EIS should, "(b)ased on the information and analysis presented in the sections on the Affected Environment and the Environmental Consequences… present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public" (40 CFR § 1502.14). However, as will be demonstrated in the following sections, the three CLP construction alternatives brought forward for analysis differ very little in their respective environmental impacts, offering no clear environmental basis for choosing one over the other. This is due to the fact that, (a) the three CLP alternatives are essentially different configurations of the same suite of necessary village infrastructure elements, (b) the general area previously chosen for the new community (and where all three CLP alternatives are set) is relatively homogeneous in terms of habitat, hydrology, soil types, and similar attributes, and (c), the development of the three CLP alternatives was informed by previous investigations of the Mertarvik area for sensitive resources such as cultural sites and high-value wetlands; all three CLP alternatives were designed to avoid known sensitive resources.

In the absence of a useful comparative basis upon which to assess the impacts of the alternatives, this EIS evaluates the *significance* of impacts on each resource category. In the following sections of this chapter, this EIS makes determinations of significance using the following criteria, in order of precedence:

1. FAA significance thresholds established in the FAA Order 1050.1 Desk Reference (FAA 2015), where such thresholds are available for and relevant to a given resource category. For some resource categories (e.g., air quality) the FAA establishes significance thresholds, where quantitative data are not available for the Mertarvik site. In such instances, the FAA threshold will be discussed in terms of the best available qualitative information.

2. Where an FAA significance threshold is not available or applicable, the significance of an impact will be described as *Major* or *Minor*, based on best professional judgment and knowledge of similar past effects on similar resources.

Minor: For the resource, expected environmental impacts are not detectable or are so minor that they will not noticeably alter or lead to the alteration of any important attribute of the resource. Noticeable impacts may be minor if they are highly localized, upon a resource that is widespread and abundant within the project vicinity.

Major: For the resource, environmental effects are clearly noticeable and/or are sufficient to alter important attributes of the resource.

Impacts that can be characterized as Minor are here defined as being below a threshold of significance; impacts which exceed a characterization of Minor and must be regarded as Major, are likewise considered as being above a threshold of significance.

The evaluation of impact significance described above is applied only to adverse or negative impacts, as is the convention in NEPA analyses. Since the intent of the proposed action is to preserve and improve the human condition of the people of Newtok, the overall project impact will be positive for many human environment resource categories. Where an overall beneficial effect is expected, this is described in each resource category section, along with the significance determination. For example, the project is expected to have strongly positive effects on the resource category "Community and Culture" (section 5.15), but the magnitude of impact is designated as "Minor," as the expected adverse impacts do not meet the significance threshold described above.

Table 6 summarizes the focus of impact analysis and significance criterion used for each resource category in the following sections of this chapter.

Table 6. Summary of Impact Focus and Significance Criteria by Resource Category

Section	Resource Category	Focus of Impact Analysis	Significance Criterion Used
5.2	Geology, Soils, Topography	Mertarvik site	Minor/Major
5.3	Hydrology, Hydraulics, & Floodplains	Mertarvik site	Minor/Major [FAA for floodplains]
5.4	Surface Water	Mertarvik site	FAA
5.5	Groundwater	Mertarvik site	FAA
5.6	Air Quality	Mertarvik site	FAA
5.7	Climate & Climate Change	Mertarvik site	Minor/Major
5.8	Habitat	Mertarvik site	Minor/Major
5.9	Endangered & Threatened Species	Mertarvik site	FAA
5.10	Migratory Birds	Mertarvik site	Minor/Major
5.11	Essential Fish Habitat & Anadromous Streams	Mertarvik site	Minor/Major
5.12	Wetlands & other Special Aquatic Sites	Mertarvik site	FAA

Section	Resource Category	Focus of Impact Analysis	Significance Criterion Used
5.13	Protected Lands	Mertarvik site	Minor/Major
5.14	Cultural History & Cultural Resources	Mertarvik site	Minor/Major
5.15	Community & Culture	Existing population	Minor/Major
5.16	Socioeconomics	Existing population	Minor/Major
5.17	Subsistence Resources	Existing population	Minor/Major
5.18	Land Use & Compatibility	Mertarvik site	Minor/Major
5.19	Public Health & Safety	Existing population	Minor/Major
5.20	Public Services & Utilities	Existing population	Minor/Major
5.21	Noise	Mertarvik site & Existing population	FAA
5.22	Visual Environment	Mertarvik site & Existing population	Minor/Major

The No Action alternative will generally have no impact on physical resources (sections 5.2 through 5.14) at Mertarvik, but is found to have significant impacts on some cultural and public welfare resource categories (e.g., Community and Culture).

Table 3 (section 4.6.1) provides the assigned lot sizes and estimated structural footprints for each infrastructure element. In many cases, building construction will require placement of a gravel pad that may be considerably larger in area than the structure's footprint. While not all of a given lot will be directly impacted by construction, in some quantitative analyses of effects (e.g., wetlands) we make the conservative assumption that the entire area of a lot will be altered or impacted in some way. More detailed estimates of structural footprints are available for the airport, in an environmental study prepared for ADOTPF (PDC Engineers 2017). This study (excerpts of which are provided in Appendix D) included an updated wetland impact evaluation focused on just the proposed airport and associated features, incorporating more detailed assumptions about overburden disposal, embankments and construction work areas.

5.2 Geology, Soils, and Topography

5.2.1 Affected Environment

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect, and cumulative impacts on geology, soils and topography in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Nelson Island is on the southwest Alaska coast, bordered by the Ninglick River to the north, Baird Inlet to the northeast, and the Kolavinarak River to the east and south; the west end of Nelson Island extends into the Bering Sea (Figure 27). The island features a large expanse of volcanically formed uplands, surrounded by the flat coastal alluvial plain of the Yukon-Kuskokwim (Y-K) Delta. These uplands consist of multiple Quaternary basalt flows overlaying Cretaceous sedimentary rock. The terrain of the Nelson Island uplands consists primarily of rolling hills and gentle to moderate slopes, with elevations ranging from a few tens of feet to as much as 1,480 feet above mean sea level (MSL) along some ridges. The proposed Mertarvik village site is located near the northeast corner of the island, on a northwest-facing slope overlooking the Ninglick River near where it joins Baird Inlet. The slope rises roughly 350 feet above MSL over a horizontal distance of about 0.6 mile, from the shoreline to where the slope transitions to flatter terrain inland where the new airport would be built (Figure 28, Figure 29; R&M 2009, USACE 2008).

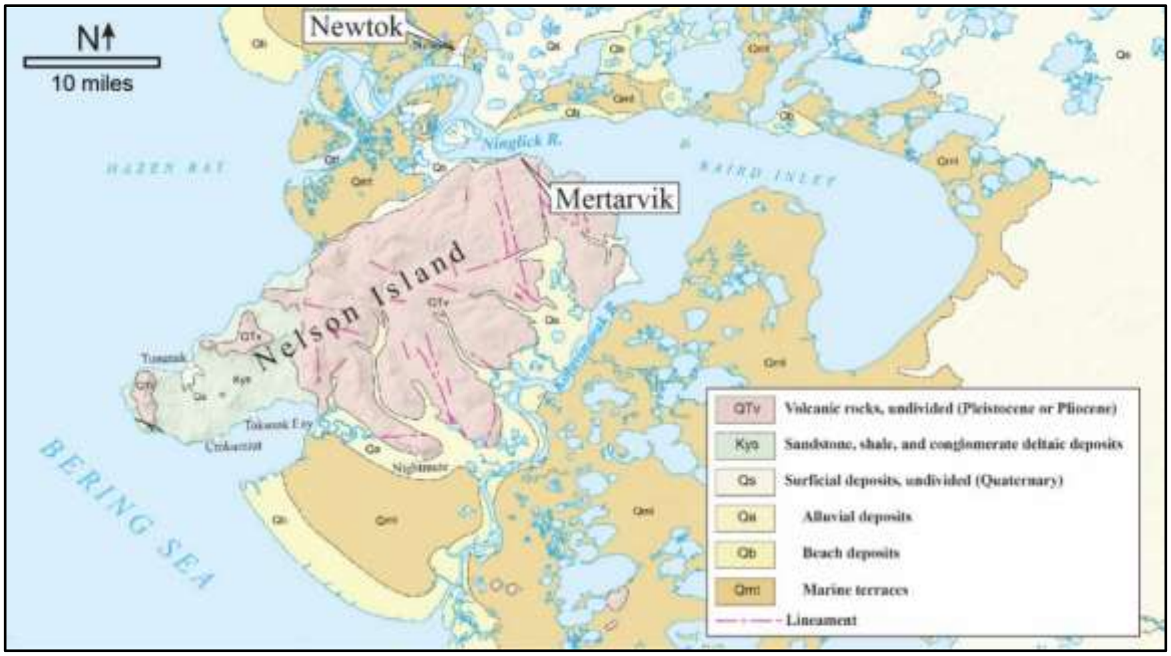


Figure 27. Geologic map of Nelson Island and vicinity (Wilson *et al.* 2013).

Figure 28. Mertarvik town site looking west in 2013, showing the upward slope of the land from the Ninglick River (right) towards the Nelson Island interior (left). The IRT construction camp is

seen on the right, while the road to the quarry is visible on the far left (photo by Sally Cox, ADCCEA).

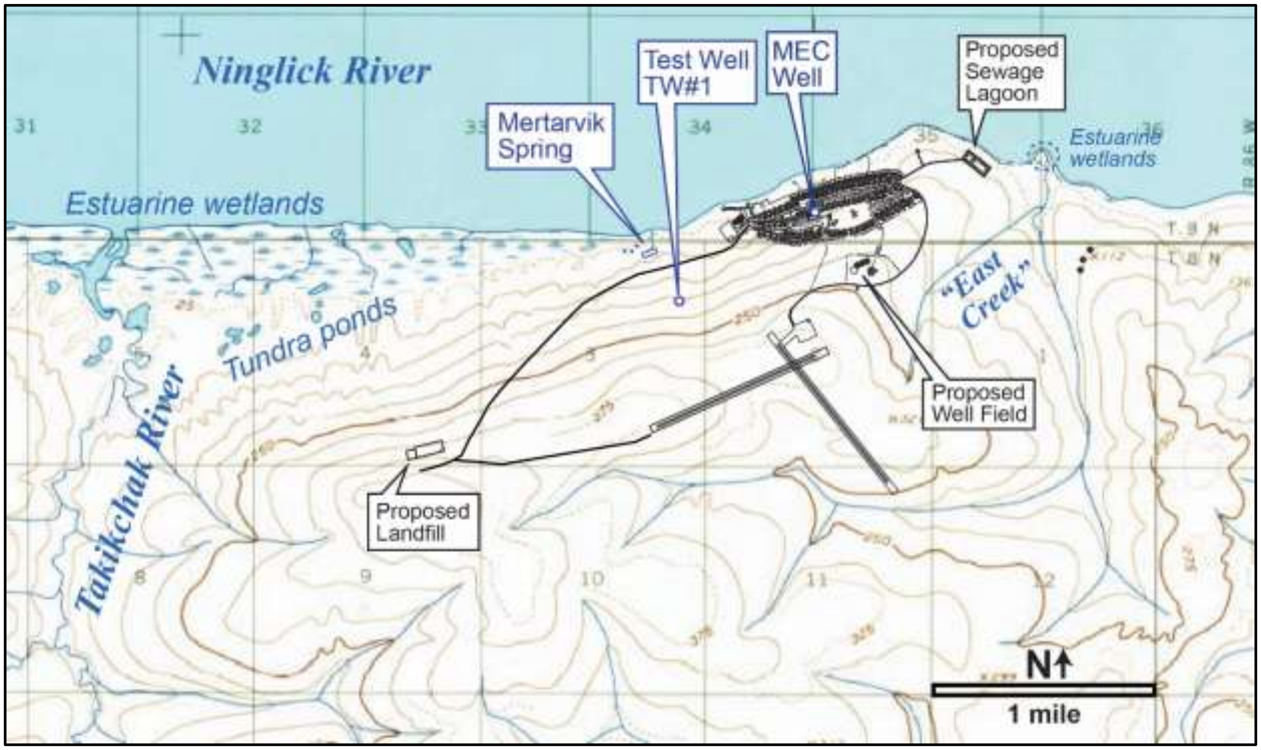


Figure 29. Proposed Mertarvik CLP in relation to local topography, drainages, and surface and groundwater features discussed in this section (background map is USGS "Baird Inlet D-7").

Through 2017, four subsurface geotechnical investigations had been performed in the Mertarvik area. The USACE Alaska District Geotechnical branch drilled 35 exploratory boreholes in 2007 and 2008, extending from the shoreline to the crest of the slope (USACE 2008). Those borings found relatively uniform soils created by the weathering of the underlying basalt bedrock. A layer of peat and tundra vegetation varying from 1 to 2 feet in thickness was noted at the surface, overlaying silts mixed with organic material and variable amounts of sand, gravel, or cobbles. The organics in the soil decreased with depth, while rock fragments increased as the bedrock surface was approached. Depths to bedrock ranged from 4 feet to greater than 31.5 feet below the ground surface.

A geotechnical investigation conducted in June, July and October 2017 drilled 41 geotechnical boreholes and dug eight test pits located in specific areas of the preferred CLP footprint where data gaps existed (Golder 2017). Boring target depths ranged from 15 to 40 feet below ground surface (bgs); test pits were advanced to 12 and 16 feet bgs.

The 2007-2008 investigations found discontinuous permafrost (Figure 30), in greatly varying condition across the Mertarvik community site. The USACE investigations encountered frozen soil in 19 of 35 borings. In general, the permafrost was either present to within 2 to 3 feet of the ground surface or has degraded to below the bedrock surface; the permafrost also appeared to be degraded at locations along drainage pathways and in areas where water may pond. In some locations, the degraded permafrost was marked by thaw features where the ground surface had subsided several feet (USACE 2008). The sporadic nature of the permafrost at Mertarvik was also apparent during the excavation of test pits for septic system percolation tests at the MEC site in 2011; two of four test pits encountered frozen soil (Longtin 2011). In thawed areas, soils were generally wet. Most of the soils were frost susceptible with a frost classification of F4 ("especially high frost-susceptibility;" USACE 1984), although some soil samples near the bedrock surface, where gravel from weathered bedrock was present, had a lower frost classification of F2

Figure 30. Typical subsurface soil core sample showing presence of ice (USACE 2008).

A geotechnical investigation performed in October-November 2008 on behalf of the ADOTPF (R&M 2009) concentrated on two previously considered airport locations that were well south of the selected alignment, and on a potential material borrow source roughly 2 miles to the southwest of the selected Mertarvik community site. The findings of this investigation were generally similar to those of the USACE investigations described above. The borrow site at "Hill 460" features an outcropping of basalt bedrock. Eight borings drilled in the area revealed bedrock at depths of 6 feet to greater than 20 feet bgs; permafrost was encountered in four of the eight borings, starting at depths ranging from 3 to 6.5 feet bgs. A rock quarry was opened at Hill 460 in July 2011.

The 2017 geotechnical investigation found similar soil conditions as encountered in the previous investigations. Permafrost was observed in 14 of the 41 borings, and relic near-surface seasonal frost was found in several other borings. Bedrock, ranging in depth from 5 to 40 feet bgs was encountered in 19 boreholes and two test pits. Groundwater was not observed during the drilling of any of the 2017 borings, although groundwater was seen flowing through the sidewall of one of the test pits (Golder 2017).

The deeper subsurface soils and stratigraphy at Mertarvik are known directly from only two well borings (Figure 30) as of the end of 2016. The MEC supply well drilled in June 2011 logged sands and gravels from the ground surface (at an elevation of roughly 77 feet above MSL) to about 45 feet bgs, where boulders and weathered bedrock were encountered (Denali Drilling 2011). The drillers logged more sand and gravel between 50 and 60 feet bgs, then rock from 60 to 80 feet bgs, and groundwater appearing in a layer of gray silt from 80 to 125 feet bgs. The boring for Test Well 1 (TW#1), drilled in 2007 upslope of Mertarvik Spring, was started at an elevation of about 135 feet above MSL. That boring logged 21.5 feet of silt and organic overburden, then five separate layers of hard gray rock (thought to be individual basalt flows), interlayered with silt, to a depth of 104.5 feet bgs (Golder 2009).

Mertarvik is in an area of low seismicity. Nelson Island and the Y-K Delta are generally devoid of Quaternary faults (active faults that have evidence of surface deformation occurring in the last 1.6 million years); the closest such recognized faults are 150 to 200 miles from Mertarvik (Koehler 2013). A search of the U.S. Geological Survey (USGS) earthquake database listed eight earthquakes of magnitude 2.5 or greater occurring between 1950 and 2017 within about 250 miles of Mertarvik. These earthquakes ranged in magnitude from 2.7 to 4.7, with the strongest being one of a pair that occurred about 77 miles southeast of Mertarvik in February and March 2013 (USGS 2017).

5.2.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have minimal direct or indirect impacts on the geology and topography in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area. Direct impacts would consist of placement of fill for building pads, road prisms, and airport runways and aprons, creating minor and highly localized areas of altered topography and surface soil geology. Construction in the area, particularly of building foundations and roads, will need to be adapted to the presence of permafrost, and minimize the potential for degrading permafrost and causing subsidence. Long term changes to the area permafrost profile as a result of filling and construction across the project site is a potential indirect effect. Because of the discontinuous nature of the permafrost, and the highly variable depth to bedrock, further geotechnical investigation may be necessary before deciding the final siting of some structures.

5.2.3 Significance Determination

No FAA significance threshold is available for this resource category.

The Denali Commission has determined that the environmental impacts on geology, soils, or topography associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any important attribute of the resources. The impacts are considered Minor, and therefore not exceed the significance threshold for this resource category defined in section 5.1 (MINOR).

The no action alternative would have no impact on the geology, soils, and topography of Mertarvik.

5.3 Hydrology, Hydraulics, and Floodplains

5.3.1 Affected Environment

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on hydrology, hydraulics and floodplains in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The United States is divided and sub-divided into successively smaller hydrologic units, which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The Watershed Boundary Dataset (WBD) maps the full areal extent of surface water drainage for the U.S. using a hierarchical system of nesting hydrologic units at various scales, each with an assigned hydrologic unit code (HUC). HUCs are delineated and georeferenced to USGS 1:24,000 scale topographic base maps according to compilation criteria monitored by the national Subcommittee on Spatial Water Data. The hydrologic unit hierarchy is indicated by the number of digits in groups of two (such as HUC 2, HUC 4, and HUC 6) within the HUC code. In EnviroAtlas, HUC 4 represents the subregion level, delineating large river basins. HUC 8 maps the subbasin level, analogous to medium-sized river basins; and HUC 12 is a more local sub-watershed level that captures tributary systems (about 90,000 nationwide used by EnviroAtlas to portray national metrics for the conterminous U.S.). The Mertarvik community site lies within the HUC 12, hydrologic units of Baird Inlet, 190305024809, and Ninglick River-Frontal Hazen Bay, 190305024905.

The Baird Inlet hydrologic unit extends about 40 miles longitudinally and has a maximum lateral extent of about 23 miles, covers 334,506 acres, and is composed of the lands forming the margin of Baird Inlet, falling from an elevation of about 320 feet above MSL to sea level at a fairly consistent slope of about 15 percent in the project area. Numerous small streams and drainages are interspersed across the hydrologic unit, all draining into Baird Inlet.

The Ninglick River-Frontal Hazen Bay hydrologic unit extends about 17 miles longitudinally and has a maximum lateral extent of about 14 miles, covers 107,044 acres, and is composed of the lowlands bordering the Ninglick River from its confluence with Baird Inlet to the marine waters of Hazen Bay, a length of about 26 river miles. The majority of the hydrologic unit is very low elevation, about 25 feet above MSL, with the notable exception of the southeastern corner rising steeply to 375 feet above MSL. The portion of the Mertarvik community site extending into the Ninglick River-Frontal Hazen Bay hydrologic unit would occupy this southeastern corner of the unit. A traditionally significant source of drinking water from a spring is located in this unit as well, immediately to the east of the three homes in vicinity of 60.8190 °N, 164.5261°W (Figure 31).

The Mertarvik community site is set on a slope of 5 percent to 14 percent; except for the barge landing and other features that must be placed along the shore, the proposed construction will be at elevations ranging from 25 feet to over 300 feet above MSL. The site has not yet been officially evaluated for flood risk, but it is not in a floodplain and appears to be at a low risk of inundation.

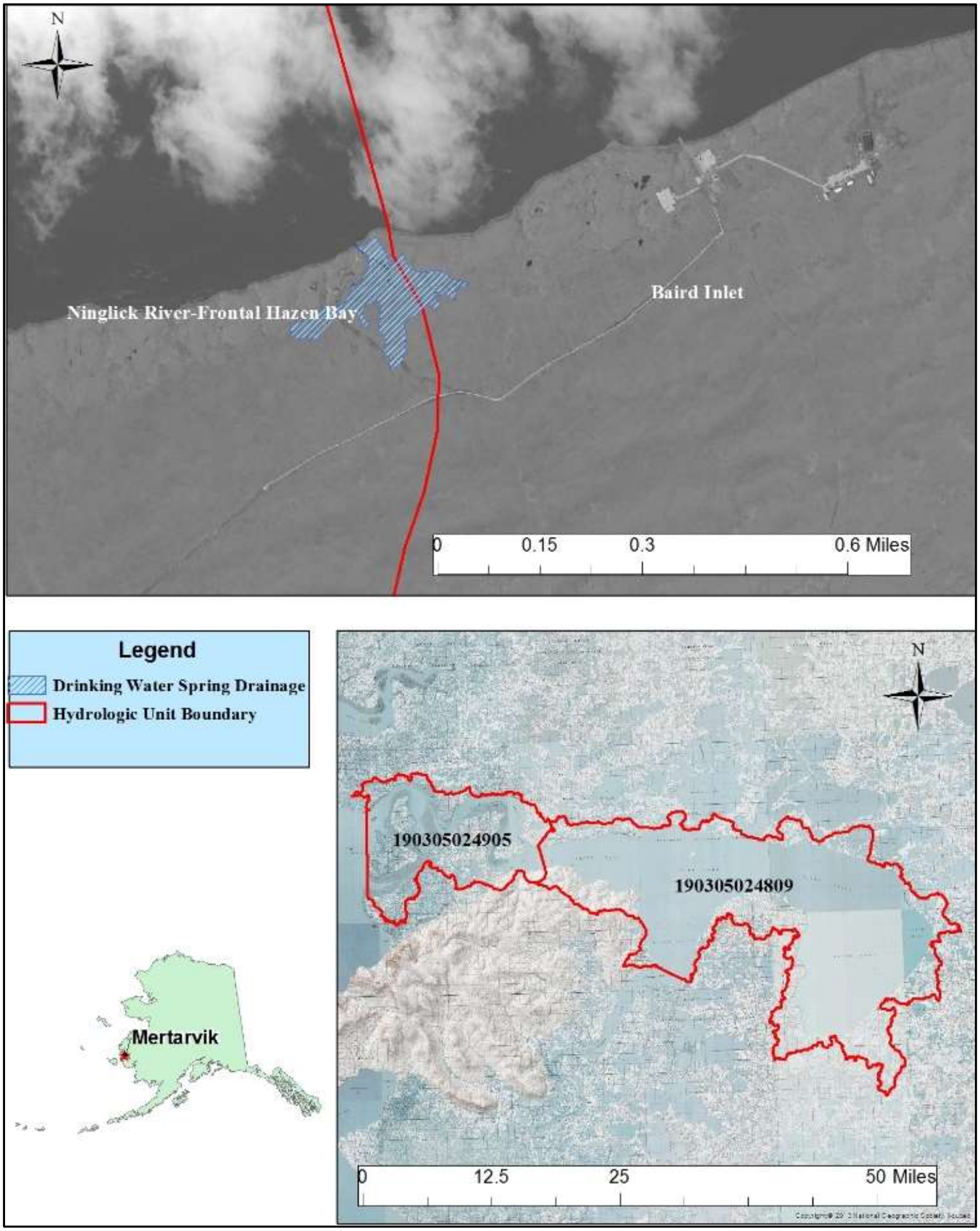


Figure 31. Existing Mertarvik town site infrastructure and spring in relation to USGS hydrologic unit boundaries.

5.3.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have minimal direct or indirect impacts on the hydrology, hydraulics, or floodplains in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area. Full infrastructure build-out of the Mertarvik community site would include about 28,000 linear feet of road, 13,175 feet of trails, several water storage tanks and a well field impacting about 0.98 acre, a 0.97-acre Class III Municipal Solid Waste Landfill, 3.58-acre gravel quarry, 14-acre wastewater treatment lagoon, and a 58.6-acre aircraft runway and apron. Approximately 10.83 acres could be impacted by the construction of 99 homes, a school, playground, sports field, various offices, a church, fourplexes, a washateria, and other facilities. The residential lots in Mertarvik will all be about 0.375 acre, and the building pads for the homes will be 0.08 acre. Some of the homes in Mertarvik may be constructed on multipoint foundations placed directly on the tundra, others may be constructed on adjustable piles in direct contact with the ground without requiring the placement of any fill. The school would impact about 0.66 acre, the offices would impact about 0.04 acre each, and the playground could require 0.27 acre of fill.

Airport construction also includes surficial disposal of excess overburden excavated from the runway and taxiway footprints to allow formation of a thaw stable base that would preclude degradation of discontinuous permafrost know to occur in the area. This disposal method is expected to involve spreading of a thin layer of mineral soils over approximately 50 acres of existing tundra surface. Specifically, on top of the existing plant material covering existing soils. Spreading in this fashion is intended to allow rapid growth of plant materials through the thin mineral soil layer spread to dispose of excess overburden.

The project area is a mosaic of wetland, upland, and barren rock habitats underlain by discontinuous permafrost, promoting shallow subsurface flow through predominantly wetland land cover. The primary direct impacts to the hydrology in the project area would be the placement of gravel in wetlands. Roads and fill pads alter the way water flows through wetlands and can promote desiccation down-gradient and ponding above-gradient of the fill due to the interruption of shallow subsurface flow through wetlands. Ponding above permafrost soils can contribute to thermokarst, also referred to as thermal erosion, by the increased absorption potential of solar radiation by standing water. Desiccation alters the hydrologic regime of the impacted areas and can cause a transformation in the vegetation community, preventing hydrophytic vegetation from retaining dominance, and potentially changing areas of wetlands into uplands.

Existing disruption to hydrology in the Mertarvik community site area is marginal; the few buildings and permanent roads that have been constructed do not impede any mapped streams, but the fill associated with roads and buildings disrupt shallow subsurface flow through the wetlands present on the site. The Ninglick River-Frontal Hazen Bay unit contains three pile-supported houses connected to the road leading to the larger settlement by an unimproved trail. The houses in that unit are down-gradient of the delineated spring sub-watershed, minimizing their impacts to hydrology. The road extending about 1,500 feet into the Ninglick River-Frontal Hazen Bay unit is constructed of composite, modular panels placed on top of the tundra, contributing to very little impact on hydrology. The Baird Inlet unit contains more development: three houses, four storage huts, the pile supported foundation of the MEC, about 4,000 feet of gravel/modular road, about 1.6 acres of gravel/modular pad for storage and staging of materials, and about 0.5 acre of additional gravel fill around the margins of the buildings. The estimated total gravel area of gravel fill placed in the existing Mertarvik community site is 3.6 acres in a hydrologic unit encompassing 334,506 acres.

No planned construction in Mertarvik would take place below the ordinary high water mark of a mapped stream, removing the need to provide hydraulic conductivity for linear drainage features. The primary hydraulic concern is alteration to the sheet flow though wetlands.

Building pads would impact a total of 10.83 acres of wetlands contained within the Baird Inlet hydrologic unit. The building pads would not have a significant impact on hydrology because they would not extend to the aquitard created by permanently frozen soil and also do not present a continuous barrier to shallow subsurface sheet flow (Figure 32).

Figure 32. Proposed Mertarvik CLP in relation to USGS hydrologic unit boundaries.

5.3.3 Significance Determination

The FAA has not established significance thresholds for hydrology or hydraulics, but has established a significance threshold for floodplains: "The action would cause notable adverse impacts on natural and beneficial floodplain values" (FAA 2015). Since none of the alternatives impact floodplains (as none exist in the project area), none of the alternatives would exceed this threshold (LESS THAN SIGNIFICANT).

The Denali Commission has determined that the environmental impacts on hydrology and hydraulics associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any important attribute of these resources. The impacts are considered minor, and therefore do not exceed the significance threshold for this resource category defined in section 5.1 (MINOR).

The no action alternative would have no impact on hydrology, hydraulics, or floodplains.

5.4 Surface Water

5.4.1 Affected Environment

While the three CLP alternatives have been developed within the same overall Mertarvik community area, the expected direct, indirect and cumulative impacts on surface water in the Mertarvik region differ somewhat. As a result, the anticipated impacts of the CLP alternatives will be identified and attributed to the appropriate CLP(s).

There are no permanent waterbodies or streams within the proposed construction footprint of any of the three CLP alternatives. The major surface water features within the general project area, other than the Ninglick River, are the Takikchak River, Mertarvik spring, and a handful of small tundra ponds near the mouth of the Takikchak River. A drainage called “East Creek” on some maps runs along the east and south footprint of the proposed Mertarvik community site, before discharging into Baird Inlet (Figure 29); this drainage is believed to be seasonal or intermittent.

The Takikchak River (Figure 33) discharges into the Ninglick River about 2.8 miles west of the barge landing and approaches no closer than 1.25 miles to the westernmost part of the proposed development, the quarry, and proposed Class III Municipal Solid Waste Landfill near Hill 460 (Figure 29). The Takikchak River drains an area of 19.56 square miles and is a complex stream-system of meanders, side-channels, riffle complexes, deep pools, and beaver ponds. The river is tidally influenced within roughly 0.4 mile upstream of its mouth (USACE 2005a). The USGS collected water flow data for 2004 and 2005 using a water-stage recorder and crest-stage gage installed on the Takikchak River about 1 mile upstream from its mouth (USGS 2006). Table 7 summarizes some of the values generated during 2004 and 2005.

Figure 33. View of the Takikchak River roughly 0.8 mile upstream from its mouth, looking upstream, August 2005 (USACE 2005a).

Table 7. Summary Statistics for Water Years 2004-2005, Station 15304400 Takikchak River

Statistic	Value (cfs)	Date
Annual mean flow	28.2	2004-2005
Maximum peak flow	334	May 25, 2005
Highest daily mean flow	194	May 26, 2005
Lowest daily mean flow	8.0	April 16, 2005

Mertarvik spring (Figure 28, Figure 34) has historically been a valued source of safe, fresh drinking water for the residents of the village of Newtok. Golder investigated the spring as part of their 2007 geophysical and hydrology survey at Mertarvik (Golder 2007). As they described it, "the spring flow originates/daylights about 400 feet to 500 feet from Baird Inlet as a series of major and minor seeps near the elevation of 30 feet above MSL across an area that is approximately 175 feet wide. A few of the major seeps appear to be discharging at a relatively high rate of 0.5 cubic feet per second (cfs), but no measurements were made. These major and minor seeps eventually join in a ponded area, resulting from local topography and a beaver dam that is currently breached. The flow becomes a single channel a short distance below the beaver dam breach before it reaches Baird Inlet." Additional measurements made in June 2007 estimated a total outflow from the spring ranging from 4.2 to 5.8 cfs, with an average of 5.1 cfs. Golder calculated that precipitation recharge of the relatively small surface catchment area above the spring (0.37 square mile) could not account for the generous year-around flow from the spring, and so concluded it must be fed primarily by groundwater (Golder 2007).

Figure 34. June 2005 view of Mertarvik spring, looking inland (south) with the active groundwater seep in the middle distance (USACE).

Limited water quality data are available for surface water at the Takikchak River and Mertarvik spring; no water quality data appears to be available for the Ninglick River near Mertarvik. No waterbodies in the area around Mertarvik are on the State of Alaska Impaired Waterbodies 303(d) List.

The USGS collected and analyzed four rounds of water samples from the Takikchak River between October 2004 and September 2005, from a station about 1 mile upstream from its mouth. The USGS tested the water samples for standard water quality physical parameters, as well as a wide range of metals and organic compounds, and total coliform bacteria. Table 8 presents a few of the results; the complete report is available online (USGS 2005a).

The results of the USGS analyses indicate Takikchak River water to be of very high quality at the time sampled. Dissolved metal concentrations were all below drinking water standards, and no organic contaminants were detected. The Takikchak River is well oxygenated, with low dissolved matter or suspended sediment. The “total coliform” test reported by the USGS detects a wider range of bacteria than the “fecal coliform” standard on which the water quality regulations are based (ADEC 2017), and are not entirely comparable. The presence of coliform bacteria is expected, given the known use of the Takikchak River by beavers, waterfowl, and other wildlife (section 5.10).

Table 8. USGS Water Quality Measurements at Takikchak River, 2004-2005.

	pH	DO, mg/l	Cond., µS/cm	TDS, mg/l	Suspended Sediment, mg/l	Iron (filtered), µg/l	Total Coliform, colony/100ml
Oct 2004	7.2	12.6	80	66	2	27	27
Mar 2005	7.2	14.9	87	71	2	7	< 1
May 2005	7.1	--	42	38	9	55	118
Sep 2005	7.5	12.6	75	69	3	28	56
Standard	*6.5-8.5*[a]	*7*[b]	--	*1,000*[a]	--	*1,000*[c]	*200*[d]

DO: Dissolved Oxygen.
Cond.: Specific Conductance
TDS: Total Dissolved Solids (reported in USGS 2005 as "Residue on evap. at 180degC water filtered").
a: ADEC 2017, water quality standard for "Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife."
b: ADEC 2017, "D.O. must be greater than 7 mg/l in waters used by anadromous or resident fish".
c: ADEC 2008, Aquatic Life for Fresh Water, Chronic.
d: ADEC 2007, Fecal coliform for fresh water, non-drinking, culinary, or food processing uses, 30-day geometric mean.

It is unknown whether the Takikchak River has been tested for *Giardia* or *Cryptosporidium* parasites.

The USGS also tested water flowing from Mertarvik spring in May and September 2005 (USGS 2005b) for a small number of field parameters (Table 9).

Table 9. USGS Water Quality Measurements at Mertarvik Spring, 2005.

	pH	DO, mg/l	Cond., µS/cm	Temperature, °C
May 2005	7.2	--	98	1.8
Sep 2005	7.5	13.6	98	1.7

DO: Dissolved Oxygen.
Cond.: Specific Conductance, or conductivity

The conductivity measured in the spring water is comparable to that of the Takikchak River, suggesting it may have a similar level of TDS.

5.4.2 Environmental Impacts

Temporary surface water quality impacts associated with construction of the proposed Mertarvik infrastructure include construction-related turbidity at the barge landing site during the contractor's mobilization and demobilization, run-off from the construction of haul roads to/from construction sites, and runoff from exposed soils from construction surfaces (e.g., airport runways, roads, building pads). If gravel must be imported for fill via barge (considered very unlikely), barge operations may increase turbidity around the barge landing. While construction of infrastructure is not expected to directly impact streams or ponds, erosion of fill during and immediately after construction of infrastructure elements may increase suspended sediment levels in surface waters (i.e. precipitation and snow melt runoff) at and around infrastructure footprints, specifically, haul routes, stockpile and staging areas, equipment access routes, roadways, building pads, and airport runway, taxiway, and apron.

Operational surfaces will be constructed via placement of fill on the tundra surface, versus cut and fill construction, and because fills are designed and expected to stabilize shortly after construction, suspended sediment effects to temporary surface flows are expected to be negligible. Further, the lack of defined surface flow pathways (i.e. streams) and tundra vegetation in relation to the limited quantities of water running off over the tundra in the Mertarvik area would result in suspended sediments rapidly settling out. Therefore, temporary water quality impacts are not expected to be significant as the potential effects are temporary and highly localized. Furthermore, construction of infrastructure features will follow project design and will implement required BMPs to minimize effects.

The Takikchak River will be buffered by its distance (Figure 33) from direct construction impacts. However, its relative proximity to the proposed Mertarvik community site is likely to subject it to greater use by the residents of Mertarvik along a greater extent of its length than it currently receives. An increase in traditional subsistence uses of the river is unlikely to cause significant adverse physical effects to the river course. ATV access to and across the river channel has the potential to cause breakdown and erosion of the river bank, with subsequent harm to water quality and the aquatic environment. The residents of Mertarvik should work with the ADFG to establish a minimally damaging ATV crossing point at the Takikchak River under a stream crossing General Permit. At the public scoping meeting in Newtok, concern was expressed that pollutants from the proposed landfill could impact the river. The design of the landfill is currently underway, with final design to be approved and a permit to operate (with environmental conditions to avoid adverse effects) issued by the Alaska Department of Environmental Conservation (ADEC). Similarly, the wastewater treatment system will be subject to ADEC approval of its final design and to a permit governing its discharge of effluent into Baird Inlet.

Limited information exists regarding the “East Creek” drainage (Figure 29). It is believed to be intermittent, and no important uses or resources associated with it have been identified by Newtok residents. The waste water treatment lagoon is the only proposed infrastructure element that approaches the East Creek drainage, but contour maps suggest that any accidental release from the lagoon would tend to migrate directly toward Baird Inlet rather than into East Creek. The lagoon will be designed and constructed to minimize the risk of any such discharge, and sediment control best management practices will reduce temporary construction impacts to less-than-significant levels.

Indirect surface water quality impacts associated with long-term use of the Mertarvik area and the operation and maintenance of infrastructure features include the same effects as noted above, however in this case, resulting from operational surface maintenance activities and operations displacing small quantities of fill material onto the tundra. The largest operational surface will be the Mertarvik Airport, and experience indicates that these impacts will be minimal based on similar effects occurring at similarly-constructed airports in similar landscape positions within the Kuskokwim River Valley, for example Nightmute, Eek, Akiak, and Tuntutuliak.

5.4.3 Significance Determination

Under the FAA significance criteria for surface waters (FAA 2015), a significant impact exists if the action would:

1. Exceed water quality standards established by Federal, state, local, and tribal regulatory agencies; or
2. Contaminate public drinking water supply such that public health may be adversely affected.

Additional factors provided by FAA guidance include consideration of whether the action has the potential to:

- Adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values;
- Adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or
- Present difficulties based on water quality impacts when obtaining a permit or authorization.

Denali Commission has determined that no significance threshold or additional factor for surface water listed above would be exceeded by any of the three CLP alternatives, as proposed (LESS THAN SIGNIFICANT).

The no action alternative would have no impact on surface water at Mertarvik.

5.5 Groundwater

5.5.1 Affected Environment

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on groundwater in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively. Shallow groundwater in the Mertarvik area is thought to flow in discontinuous zones along the porous surfaces of multiple basalt layers, seasonally perched over permafrost and denser soils.

Shallow subsurface geotechnical investigations observed groundwater in only one boring, at a depth of 5 feet bgs (USACE 2008; R&M 2009). Little to no empirical information exists as to how such flows contribute to the Mertarvik Spring. The Golder geotechnical studies (Golder 2007, Golder 2008) in the area upgradient of the spring were performed in order to develop a water supply for the community that was located farther to the west than the preferred CLP; there are no current plans to develop a water supply in that area, and TW#1 will not be used as a supply well at this time.

More substantial groundwater is found at depth along the upper surface of the subsurface basalt flows, either in layers of sand and gravel or in the porous vesicular outer layer of the basalt itself (Dieck 2017, pers. Comm.). The groundwater supply well installed to support the MEC in 2011 was screened from 106 to 116 feet bgs and had a static water level of 67.7 feet bgs (Denali Drilling 2011). That well was subjected to a 24-hour pump test in June 2011, at 15 gallons-per-minute (GPM). The static level was drawn down to 74 feet bgs, but reportedly recovered quickly (Longin 2011). TW#1 was screened between 103.5 and 108.5 feet bgs, with a static level of 101 feet bgs. TW#1 was subjected to only a 2-hour pump test at 15 GPM, with no draw-down observed (Golder 2008).

The location and availability of groundwater at Mertarvik is known from only these two wells, neither of which will be used to supply drinking water to the completed community. TW#1 is too far to the west of the selected current town site (Figure 29) to be a practical supply well, and the MEC well will become unsuitable as a primary potable water supply as the Mertarvik community site is built up around it. The current plan calls for a new well field to be developed upslope from the Mertarvik community site. No deep borings had been drilled in that area as of the writing of this EIS, but groundwater is presumed to be readily available in this area, based on general understanding of the local geology and hydrology.

Groundwater quality data is available from one sample taken from TW#1 in October 2007 (Golder 2008). The sample was analyzed for metallic and inorganic primary and secondary chemical contaminants regulated in drinking water IAW Title 18, Chapter 60 of the Alaska Administrative Code (18 AAC 60) and in 40 CFR §141.62(b) and 40 CFR §143.3. The full analytical results are reported in Golder 2008; the concentrations of metals and other inorganic constituents reporting in the sample were all below drinking water maximum contaminant levels (MCLs) and secondary MCLs (SMCLs), except for iron. The concentration of iron in the sample slightly exceeded the SMCL (357 µg/l, versus the SMCL for iron of 300 µg/l).

The USEPA does not enforce SMCLs, as they are established as guidelines to assist public water systems in managing their drinking water for cosmetic (skin or tooth discoloration) or aesthetic (taste, odor, color) effects, rather than MCLs that pose a toxicity concern or that may affect the functioning of plumbing and boilers. The MEC well had not yet been sampled and tested for water quality as of mid-2017. Given the current lack of sources of contamination at Mertarvik, there is little reason to believe that its water quality differs significantly from the water tested at TW#1. The MEC is currently equipped for limited use, with a hand-pump and portable water treatment system (Meeks 2017).

5.5.2 Environmental Impacts

Potential direct or indirect threats to groundwater would be the same for each of the three CLP alternatives: releases of fuel or other contaminants from fuel storage tanks and associated pipelines, and leachate from the landfill and wastewater treatment lagoon. The groundwater that feeds Mertarvik Spring is potentially vulnerable to contamination. Little of the currently planned development lies upgradient of the spring, but a large release of fuel or other contaminants from the airport or along the quarry road could potentially impact the quality and usability of water drawn from it. The likelihood and route of contaminants migrating into area aquifers would be strongly influenced by the presence or absence of permafrost and the relationship of groundwater to the subsurface basalt layers at any particular release site. The siting of each of these pollutant sources will be guided by a source water assessment and development of a wellhead protection program required by the Safe Drinking Water Act's Ground Water Rule (GWR) (40 CFR Part 141, Subpart S), as implemented by the Alaska Department of Conservation.

5.5.3 Significance Determination

Under the FAA significance criteria for groundwater (FAA 2015), a significant impact exists if the action would:

1. Exceed groundwater quality standards established by Federal, state, local, and tribal regulatory agencies; or

2. Contaminate an aquifer used for public water supply such that public health may be adversely affected.

Additional factors provided by FAA guidance include consideration of whether the action has the potential to:

- Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values;
- Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or
- Present difficulties based on water quality impacts when obtaining a permit or authorization.

The Denali Commission has determined that none of the three CLP alternatives, as proposed, would exceed the significance threshold or additional factors listed above (LESS THAN SIGNIFICANT).

The no action alternative would have no impact on groundwater at Mertarvik.

5.6 Air Quality

5.6.1 Affected Environment

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on air quality in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The Mertarvik site presumably enjoys very good air quality because of the absence of significant air pollutant sources. There is no established ambient air quality monitoring program at Mertarvik, however, and little existing data to compare with the National Ambient Air Quality Standards (NAAQS) established under the Clean Air Act (CAA). These air quality standards include concentration limits on the “criteria pollutants” carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrogen oxides (NO_x), lead (Pb), and particulate matter (PM_{10}, $PM_{2.5}$). The proposed Mertarvik site is not in a CAA “non-attainment” area, and the “conformity determination” requirements of the CAA would not apply to the proposed action at this time.

5.6.2 Environmental Impacts

To analyze the air quality impacts of proposed actions, the first step is to determine whether the proposed action’s potential emissions warrants an air quality assessment. Typically, an EIS is assumed to need some level of air quality assessment, which starts with an emissions inventory, and includes an analysis sufficient to disclose the extent of the project’s impact on the attainment and maintenance of the NAAQS. The change to air quality impacts related to the proposed action includes temporary construction emissions and a potential phased modification of the location of emissions (e.g., airport and other transportation, energy production, heating), or more specifically, a temporary split in the same total quantity of emissions between Newtok and Mertarvik until the entire community relocates to Mertarvik. Temporary construction emissions are expected to be comprised of dust related to extraction, transport, placement and ‘working” of fill materials into their final constructed configuration. These emissions include diesel and gasoline emissions from a small fleet of vehicles, construction equipment and a transportation barge for mobilization and demobilization. Infrastructure development will occur over several years, with each element taking from a few months to several years. For example, the Mertarvik Airport is expected to take two construction seasons to construct.

Because the local and regional air quality environment is “attainment,” meaning no criteria pollutant levels have been exceeded, and as no increase in total airport emissions (beyond temporary construction emissions) is expected, neither an emissions inventory nor modeling of air quality impacts is necessary. Should further agency and public comment demonstrate a need for a more detailed assessment, the Denali Commission and/or FAA will determine the level of detail and include it in the Final EIS or a supplemental NEPA analyses prior to construction of specific elements of the proposed action (project).

Temporary air quality impacts would include construction-related emissions. Temporary impacts would also include emissions from construction equipment excavating fill at the quarry site, fill material transportation, and dust generation-related emissions. Emissions related to power generation for tools used to construct, erect, and/or install man-made infrastructure are also expected. Temporary air quality impacts off-site include any aircraft or barge-related emissions related to shipping infrastructure material via aircraft or barge, or fill material via barge to the proposed construction site.

Temporary air quality impacts are expected to be minor as regulatory and contractual requirements will specify that any and all equipment used must meet emissions requirements at the time the equipment was manufactured, and best management practices (BMP), such as dust control, will be used to minimize air quality impacts. Additionally, there is no expectation that local or regional air quality will degrade in the foreseeable future. Nor is there any expectation of more than minimal, if any at all, community population growth as a result of infrastructure development.

Direct long-term air quality impacts associated with the development and utilization of infrastructure at Mertarvik includes the transfer of those same operations emissions from Newtok to Mertarvik (e.g., aircraft landing at Mertarvik instead of Newtok). As proposed, there is no expectation that replacement services at Mertarvik will increase existing emissions at Newtok as there are no known expected increases in such services and should, in fact, decrease as the population transfers to Mertarvik. For example, flight operations type, frequency, fleet mix, cargo, or passenger transportation requirements are expected to be divided between the two locations. If some services are simultaneously provided at both Newtok and Mertarvik, there is the potential to temporarily increase emissions. The emissions are expected to be quite minimal since current operations would not be doubled, but rather distributed. As erosion begins to claim the runway, the existing Newtok Airport will be restricted to serving smaller and smaller aircraft that typically emit fewer emissions than multi-engine aircraft until these intermittent operations cease entirely.

All emission sources are expected to meet Federal and State emissions regulations. While both locations are temporarily in operation simultaneously, emissions would occur at both locations.

However, no entity has proposed to fly in more than minimal quantities of supplies and materials for construction at Mertarvik, so no known quantifiable increase in aircraft or barge operations, and therefore emissions, is known at this time.

Indirect air quality impacts include a dust shadow effect on the surrounding tundra wherever fills are placed and maintained, and emissions from vehicles and all-terrain vehicles (ATV's). Specifically, vehicle use and maintenance of the haul road and access road, vehicle and aircraft use of airport operational surfaces, regular maintenance activities, and commerce would generate dust and, in some cases, displace minor amounts of gravel fill to the adjacent tundra. Wind erosion of all fill placements would likewise impact adjacent tundra, and to a lesser degree, air quality in the community overall. These impacts are expected to be minor since wind erosion of fill surfaces has not typically resulted in the deposition of measurable quantities of fill to adjacent tundra in Alaska.

5.6.3 Significance Determination

Under the FAA significance criteria for air quality (FAA 2015), a significant impact exists if the action "would cause pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS), as established by the Environmental Protection Agency under the Clean Air Act, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations."

Under any of the three CLP alternatives, the new power generation and heating equipment installed at Mertarvik is expected to be cleaner and more efficient than the equipment at Newtok that will be gradually phased out. The new emissions sources installed at Mertarvik will be subject to current Federal and State emissions sources. Considering the 9-mile distance between the two sites, the temporary simultaneous operation of emissions sources at Newtok and Mertarvik is unlikely to create an additive exceedance of any air quality standard. Particulate emissions at Mertarvik caused by construction equipment and vehicles can be minimized through best management practices and the adoption of local traffic ordinances.

The Denali Commission has determined that none of the three CLP alternatives, as proposed, would exceed the significance threshold for air quality defined above (LESS THAN SIGNIFICANT).

The no action alternative would have no impact on air quality at Mertarvik.

5.7 Climate and Climate Change

5.7.1 Affected Environment

Little direct climatological data is available for Nelson Island. In general, Newtok and the proposed Mertarvik site experience similar weather, within a transitional climate zone that shares characteristics of subarctic, arctic, and maritime climates. Winters are long and cold; summers are short and mild. Average summer temperatures range from 40 °F to 60 °F; average winter temperatures range from 0 °F to 20 °F. Extreme temperatures in winter can go as low as -48 °F and in summer as high as 87 °F. Annual precipitation is 16 inches, with 53 inches of snowfall (ADCRA 2017j).

“Climate” is defined as average weather patterns over a period of time-from a few decades to thousands of years. Significant, lasting change to existing weather patterns is commonly called “climate change.” The term “greenhouse gases” refers to a variety of gases in the earth’s atmosphere that react with sunlight in a way that influence global air temperature. Greenhouse gases are defined as including carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The emissions discussed below refer in part to these greenhouse gas and other combustion engine emissions.

5.7.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on climate and climate change in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The destructive erosion of the Ninglick River bank at Newtok is the result of a combination of processes: the physics of a meandering stream system, the thawing and breakdown of seasonally frozen soils and permafrost, tidal action, and surge generated by storms in the Bering Sea. Climatological conditions attributed to anthropogenic climate change may exacerbate some of these processes and accelerate the erosion, though not in a manner that can be quantified at this time. Longer and warmer summers would extend the existing thaw season, leaving weakened soils exposed to erosion for a longer period each year. Likewise, a shorter season of heavy ice-cover on the Ninglick River would extend the period of active erosion each year. Stronger and more frequent storms, as well as sea level rise, would increase the damaging effects of storm surge and the frequency of severe flooding (State of Alaska 2017).

In terms of climate resilience, the proposed Mertarvik town site offers many advantages over the existing Newtok location. There is no evidence of erosion of the Mertarvik shoreline such as is occurring at Newtok. The proposed center of the Mertarvik community will be built at elevations of roughly 50 to 175 feet above MSL, offering much greater insurance against potential future sea level rise than Newtok's elevation of 20 feet above MSL or less. Mertarvik's position 9 miles farther upriver from the mouth of the Ninglick River than Newtok, and the presence of an additional 90-degree bend in the river, should provide some relative protection from storm surge. The basaltic bedrock and soils originating from weathered basalt at Mertarvik offer a construction base more robust and stabile than does the frozen silt of Newtok. Discontinuous permafrost exists at Mertarvik, but if it were to degrade in response to a warming climate, the result would be localized subsidence limited by the relatively shallow bedrock.

All three of the CLP alternatives provide essentially equivalent levels of climate resilience. In Alternatives 1 and 3, the center of the community is positioned at a higher elevation than in Alternative 2, but it is unclear if this would confer any real advantages. Some coastal infrastructure, such as the barge landings and fuel unloading headers and piping, will need to be located at the shoreline by necessity, and the three CLP alternatives do not offer different positioning for these coastal facilities.

The three CLP alternatives would generate equivalent emissions of greenhouse gases, in both the short-term during construction and in the long term, because under the three alternatives, the same facilities would be constructed and the same equipment would be installed. In the long term, the completed community at Mertarvik should generate less greenhouse gas and particulates than is currently emitted at Newtok for a comparable delivery of heat and electricity, as the power equipment installed at Mertarvik would be much newer and more fuel-efficient. All three CLP alternatives also make provisions for future installation of solar and wind power generation. In the short term, during the construction and transition phase, greenhouse gas emissions may be temporarily elevated above current levels due to emissions from construction equipment at Mertarvik, and the need to generate power at Newtok and Mertarvik simultaneously.

Emissions at Mertarvik are replacing emissions at Newtok with the exception of temporary construction-related emissions and the potential temporary and as yet unknown change in operations between the two village sites (energy production, flight operations, heating) while both locations are operational. The emissions related to construction would be a temporary, incremental localized increase. The remaining potential change in aircraft emissions occurring if an air carrier decides to temporarily serve both communities at one time. The increased emissions would be limited to those emissions released during the approximately 11-mile flight between the communities and the additional take-off and landing for those flights that would stop at both communities.

With respect to flight operations, it is currently unknown whether commercial carriers would temporarily serve both airports, or alternate service between the two airports, as the projections for community construction and relocation are largely conceptual at this point. Therefore, it can only be noted that if an increase in the frequency or duration of ground or air operations occurs as a result of both airports operating simultaneously, an incremental increase in localized emissions would temporarily result.

As previously noted, the overall effect is expected to be a short term slight increase in emissions due to infrastructure construction and some duplication of flights with two airports and a long-term no change in emissions as the operations at Mertarvik Airport are expected to replace the operations at Newtok Airport. Temporarily, due to construction, a localized and de minimis increase in emissions would result. No information is available that indicates that the potential for a temporary increase in emissions or the change in location of emissions would be significant.

5.7.3 Significance Determination

The CEQ has stated that "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand", and therefore the FAA does not provide a significance threshold for climate change (FAA 2015).

The Denali Commission has determined that the environmental impacts on climate and climate change associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter the climate, and not reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on climate or climate change at Mertarvik, but offers no climate resilience. The land base under the Newtok Village and therefore the Newtok Village itself, is expected to succumb to erosion as continued sea level rise, storm erosion, riverine erosion and permafrost melting occurs.

5.8 Habitat

5.8.1 Affected Environment

5.8.1.1 Regional Setting

Newtok and Mertarvik are both within the Yukon-Kuskokwim (Y-K) Delta ecoregion. This region spans almost 19 million acres of Southwest Alaska and is dominated by a flat coastal plain of marshes, wet meadows, and meandering streams, punctuated by isolated volcanic features such as basalt domes and small cinder cones. Wet tundra communities on the coastal plain consist of sedge mats, mosses, and low-growing shrubs. Uplands created by peat mounds, sand deposits, and volcanic soils support dwarf scrub communities of birch and other shrubs. Willow thickets form along rivers and on better-drained slopes, while alders, birch, and stunted spruce grow along major streams (ADFG 2015).

The region's lakes, streams, and wetlands support abundant populations of waterfowl and shorebirds; more than 20 species of waterfowl and 10 species of shorebirds are known to breed here. The Y-K Delta supports the breeding of half of the world's Pacific Black Brant, the majority of the world's emperor geese, all of North America's cackling Canada geese, and the highest densities of nesting tundra swans, long-tailed ducks, common eiders, and spectacled eiders. Large runs of anadromous fishes, including arctic lamprey, Dolly Varden, whitefish, and all five species of Pacific salmon migrate up the Yukon and Kuskokwim Rivers and other major drainages. Northern pike, arctic grayling, white fish, sticklebacks, and rainbow trout are resident in many streams. Coastal waters of the ecoregion provide feeding habitat for beluga and minke whales, walruses, and bearded, spotted, ribbon, and ringed seals. Terrestrial mammals include river otters, brown bears, moose, and wolves (ADFG 2015).

5.8.1.2 Local Setting

On Nelson Island, terrestrial mammals are relatively low in diversity and consist of arctic fox (*Vulpes lagopus*), red fox (*Vulpes vulpes*), beaver (*Castor canadensis*), small mammals, moose (*Alces alces*), introduced muskoxen (*Ovibos moschatus*), and an occasional brown bear (*Ursus arctos*).

Brown bears are found mainly in the mountains east of the Y-K Delta lowlands and near the major rivers. Lowland habitats of the delta have very few brown bears (Seavoy 2003). Brown bears are also known to feed on sea mammal carcasses washed ashore in some areas of the Bering Sea coast, south of Nelson Island (Gray and Harbanuk 2005). Brown bears could swim to Nelson Island, but Newtok residents say they are rare in the project vicinity (D. Charles, personal communication, November 2007).

Nelson Island is home to 200 to 300 muskoxen (Perry 2005) and are occasionally seen near the project site (D. Charles personal communication, November 2007). The muskoxen inhabiting Nelson Island are descendants of the 34 muskox captured in East Greenland in 1930 and transferred to Nunivak Island to re-establish the previously extirpated Alaska stock of muskox. USACE Alaska District geotechnical engineers saw two small groups of muskoxen, six to seven animals in each group, near the project site during September 2007 (G. Carpenter, personal communication, November 2007).

Moose are rare on Nelson Island (D. Charles, personal communication, November 2007). USACE geotechnical engineers did not observe any moose during their field work at the project site (G. Carpenter, personal communication, November 2007). USACE Alaska District biologists conducting fisheries studies in nearby Takikchak River during September 2007, and bird and vegetation studies on the project site during June and August 2007 did not observe any moose or any indication of their presence (C. Hoffman, personal communication; E. Campellone, personal communication, November 2007).

Small mammals, including voles, shrews, lemmings, short-tailed weasels (*Mustela ermine*; Figure 35), and mink, range across much of Nelson Island, and could be present throughout the project area. USFWS biologists noted an abundance of voles and lemmings during an August 2006 field study of the area (USFWS 2006).

Traditional ecological knowledge says that the numbers of beavers on Nelson Island have increased significantly since the 1970s (Anderson et. al. 2004, Gray and Harbanuk 2005), and Newtok residents say they are seen in the Takikchak River drainage (D. Charles, personal communication). USACE Alaska District biologists saw beavers in the Takikchak River drainage during site visits (Figure 36), and USFWS biologists also noted beavers during an August 2006 field study of the area (C. Hoffman and E. Campellone, personal communications, November 2007; USFWS 2006).

Figure 35. Short-tailed weasel photographed near Mertarvik in 2005 (USACE).

Figure 36. Beaver dam on the Takikchak River, 2005 (USACE).

Reindeer (*Rangifer tarandus*) were introduced to Nelson Island in 1934, but there are no reindeer on the island today. There are also no caribou on Nelson Island. Caribou range to north, east, and southeast of Nelson Island, but their range does not extend to the island. The Mulchatna herd, which ranges south of the Kuskokwim River, possibly comes closest to Nelson Island (Seavoy 2005).

Nelson Island and the proposed Mertarvik site are at the western edge of Baird Inlet, a large brackish estuary connected to the Bering Sea by the Ninglick and Kolavinarak Rivers. Steller sea lions (*Eumetopias jubatus*) and beluga whales (*Delphinapterus leucas*) of the eastern Bering Sea stock may occasionally ascend the Ninglick River to Baird Inlet, but this would not be a common occurrence. The nearest sea lion rookery is at Cape Nehalem, approximately 175 miles southeast of the project site.

Spotted seal (*Phoca largha*), a species closely related to the common harbor seal, is the marine mammal more likely to be seen in the Ninglick River and Baird Inlet. Several spotted seals were seen in the vicinity of the proposed barge landing by USACE Alaska District geotechnical engineers during geophysical studies of the project site in September 2007 (G. Carpenter personal communication).

The bird species found in the Nelson Island and Baird Inlet area are overwhelmingly migratory, using the habitat in the area only in the summer and autumn for nesting and feeding; migratory birds are described further in section 5.10 below. Few birds remain in the local area through the winter, limited primarily to the common raven (*Corvus corax*), several species of ptarmigan (*Lagopus* spp.), and potentially snowy owl (*Bubo scandiacus*) and gyrfalcon (*Falco rusticolus*). Information on fish species in local drainages is provided in section 5.11 below.

Vegetation in the Mertarvik area is dominated by wetland plant communities. Open low mesic shrub; birch-ericaceous shrub is the most abundant vegetation community in the central Mertarvik project area ("ericaceous" refers to plants such as blueberry and lingonberry that prefer acidic, infertile soils; "mesic" refers to soils with moderate moisture levels, i.e., neither very wet nor very dry). Species such as dwarf birch (*Betula nana*), Labrador tea (*Rhododendron tomentosum*), reindeer lichen (*Cladina arbuscula*), cloudberry (*Rubus chamaemorus*), water sedge (*Carex aquatalis*), and cottongrass (*Eriophorum* spp.) compose the vegetation community. Shrubs at least 8 inches tall compose 25 to 75 percent of the cover. These communities can develop on sites with a wide variety of moisture, temperature, and soil conditions. Acidic mineral soils with a well decomposed organic layer 2 to 12 inches thick are characteristic. Permafrost is usually present at least 20 inches below the surface. Open low mesic shrub-ericaceous shrub communities are generally quite stable, provided moisture regime is consistent, which can be influenced by permafrost degradation. The vegetation grades into crowberry dwarf shrub tundra as topographic gradient increases moving to the west of the main cantonment area. This increased grade likely results in shallower soils, and the area is likely more protected from the wind and sheet flow is more constrained. Crowberry dwarf shrub tundra is dominated by crowberry (*Empetrum nigrum*), with other ericaceous shrubs like lingonberry (*Vaccinium vitis-idaea*), billbery (*Vaccinium cepitosum)* alpine blueberry (*Vaccinium uliginosum*), bearberry (*Arctostaphylos alpine*), mountain heather (*Cassiope mertensiana*) and herbaceous plants like club moss (*Pedicularis* spp.) and sedges (*Carex* spp.).

Mesic graminoid herbaceous (i.e., grasses and grass-like plants) communities dominate the area proposed for the runway, with tussock tundra forming the largest fourth division component. Tussock cottongrass (*Eriophorum vaginatum*) is the primary tussock-former in these communities, with low shrubs such as dwarf birch, Labrador tea, cloudberry, and bearberry occupying the interstices. Reindeer lichens and moss are usually present as well. Mesic graminoid herbaceous plant communities are generally very successionally stable and often represent climax vegetation; in the project area, they occur on north-facing slopes where permafrost is closer to the surface. Soils are acidic and contain poorly decomposed organic material. Deeper permafrost tables enable the development of bluejoint-herb communities dominated by bluejoint grass (*Calamagrostis canadensis*), and interspersed with herbaceous species like horsetail (*Equisetum* spp.), Arctic sweet coltsfoot (*Petasites frigidus*), and fireweed (*Chamerion angustifolium*).

5.8.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on natural resources in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The development of new infrastructure at the Mertarvik site on Nelson Island would result in direct impacts to a very small proportion of the biological resources and habitat available in the area. A detailed quantitative assessment of impacts to wetland and upland habitat is provided in section 5.12. The collective footprint of the proposed permanent fill and temporary construction areas for all proposed Mertarvik infrastructure has not yet been finally mapped or delineated in detail regarding the types of habitats; therefore, the specific acreage of wetland versus terrestrial habitat provided herein is only a close approximation. The assumption is that the temporary construction footprint will impact an area 50 percent beyond the permanently filled footprint. Therefore, temporary construction impacts are expected to impact roughly 99 acres of combined wetland and terrestrial habitat, while permanent fill is expected to impact about 66 acres of wetland and terrestrial habitat combined. These acreage estimates are considered generous (by 5 to 10 percent) to ensure potential impacts are adequately addressed. Further design work will refine acreage estimates.

Terrestrial mammals, like muskox and moose, may avoid the area immediately surrounding the project area due to the elevated noise and activity, but abundant replacement habitat is available on Nelson Island. The construction of a Class III Municipal Solid Waste Landfill may have the effect of attracting foxes and bears, so a fence should be constructed around the landfill to avoid creating a hazard to human health or an increase in fox population, endangering native birds and their nests. Dust from road construction and use would settle on vegetation downwind of the fill and reduce primary productivity, but the decline would not likely be measurable.

Newtok residents have stated that they do not believe that living at Mertarvik instead of Newtok will substantially change their hunting and subsistence practices. The Mertarvik site is already part of their traditional subsistence area, although berries are the only resource obtained from the immediate site footprint. The subsistence pressure on game, fish, and plant species in the area should therefore not change significantly as a result of the change in the community’s area of habitation.

Terrestrial Habitats

The construction of various Mertarvik infrastructure elements is expected to disturb or temporarily destroy vegetative cover impacted by the operation of heavy equipment through or over it. Areas impacted by stockpiles may also see temporary loss of vegetation. No proposed construction work outside fill footprints is expected to permanently remove vegetative cover.

Areas temporarily disturbed are expected to re-vegetate with native vegetation within 1 to 5 years. The contractors utilized will be required to clean their heavy equipment before arrival on site to preclude the introduction of invasive species.

Direct impacts include a permanent loss of an estimated 66 acres of tundra wetland, “upland” tundra, and barren rock habitat.

Indirect impacts are expected to be dust shadow impacts potentially reducing vegetative growth as dust erodes by various means off placed fills and modification of surface hydrology flow patterns due to fill intercepting or re-directing flows.

The construction, operation and maintenance of various Mertarvik infrastructure elements would cumulatively result in a minor loss of terrestrial habitat within the community boundary, but a minor loss within the overall Nelson Island region. There would also likely be an increased level of disturbance for species utilizing remaining terrestrial habitats in the immediate vicinity of the community to an extent that most animals would relocate away from the disturbance.

Aquatic Habitats

Aquatic habitats, where temporary fills are stockpiled or staged (if any), are expected to have had liners placed on the ground surface prior to stockpiling or staging. Therefore, removal of those liners should facilitate natural restoration within the same or less time as areas impacted by wheeled and tracked equipment. If vegetative restoration is required, it is expected that organics removed from areas in which terrain must be removed for safe flight operations will be used to facilitate natural re-vegetation.

Indirect impacts are expected to be increased turbidity resulting from precipitation or snow melt erosion of fill materials. As well as modification to wetland hydrology as fills intercept and/or re-direct surface flows. The result is expected to be minor to moderate changes in wetland hydrology, vegetation and possibly wetland type in the immediate vicinity (several hundred yards) of the placed fills.

5.8.3 Significance Determination

No FAA significance threshold is available for impacts to “habitat”, as a resource category. The FAA does have a resources category of “biological resources”; the FAA provides non-threshold factors for this resource category that may be applied to the general biological settings described in this section. The FAA guidance (FAA 2015) recommends evaluating the proposed actions for the potential to cause:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);

- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required for population maintenance.

None of the CLP alternatives are expected to create impacts similar to those listed above. The Denali Commission has determined that the environmental impacts on habitat with the implementation of any of the three CLP alternatives will not noticeably alter any important attribute of the resource, and not reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on biological resources in general at Mertarvik. Impacts on wildlife and habitat would decrease as subsistence use of the area may diminish as most of the residents of Newtok are forced to leave the general area.

5.9 Endangered and Threatened Species

This section discusses species provided with protected status under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on protected species in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

5.9.1 Affected Environment

Endangered Species Act

Jurisdiction under the Endangered Species Act (ESA) is divided by species between the USFWS and the NMFS. Through informal consultation with the USFWS and the NMFS (USACE 2017a, USACE 2017b), the USACE identified the ESA-listed species (Table 10) that may be present in the area of the proposed action, or potentially affected by project-related activities, such as ocean transport of project materials.

Table 10. ESA-Listed Species Potentially Affected by the Proposed Action.

Species	Listed Population	ESA Status	Agency Jurisdiction
Spectacled eider, *Somateria fischeri*	All	Threatened	USFWS
Steller's eider, *Polysticta stelleri*	All	Threatened	USFWS
Northern sea otter, *Enhydra lutris kenyoni*	Southwestern Alaska DPS	Threatened	USFWS
Short tailed albatross, *Phoebastria albatrus*	All	Endangered	USFWS
Steller sea lion, *Eumetopias jubatus*	Western DPS	Endangered	NMFS
Ringed seal, *Pusa hisipida*	Arctic DPS	Threatened (under appeal)	NMFS
Bearded seal, *Erignathus barbatus*	Beringia DPS	Threatened	NMFS
Humpback whale, *Megaptera novaeangliae*	W. Pacific DPS	Endangered	NMFS
	Mexico DPS	Threatened	NMFS
N. Pacific right whale, *Eubalaena japonica*	All	Endangered	NMFS
Sperm whale, *Physeter macrocephalus*	All	Endangered	NMFS
Fin whale, *Balaenoptera physalus*	All	Endangered	NMFS
Blue whale, *Balaenoptera musculus*	All	Endangered	NMFS
Western No. Pacific gray whale, *Eschrichtius robustus*	All	Endangered	NMFS
Beluga whale, *Delphinapterus leucas*	Cook Inlet DPS	Endangered	NMFS

DPS: Distinct Population Segment

The ADFG is also responsible for determining and maintaining a list of endangered species in Alaska under state law (AS 16.20.190). The State of Alaska endangered species list currently includes:

- Short tailed albatross (*Phoebastria albatrus)*
- Eskimo curlew (*Numenius borealis)*
- Blue whale (*Balaenoptera musculus)*
- Humpback whale (*Megaptera novaeangliae)*
- Right whale (*Eubalaena japonica)*

Of the species listed above and in Table 10, only the spectacled and Steller's eiders and the Eskimo curlew have the potential to be within the Mertarvik site itself. Increased barge traffic delivering construction materials and equipment to Mertarvik along a presumptive shipping route from Anchorage (Figure 38) may potentially impact marine species under both USFWS and NMFS jurisdictions.

Spectacled and Steller's Eiders

The spectacled eider is a sea duck that nests along the arctic coasts of Alaska and Russia, and on the Y-K Delta. Molting areas exist in Norton Sound and Ledyard Bay in Alaska. In the winter, the entire global population of spectacled eiders gathers in persistent gaps in the sea ice in the Bering Sea south of St. Lawrence Island.

Steller's eider is the smallest of the eider species. It currently nests almost exclusively in northeastern Siberia, with less than 1 percent of the population breeding in North America. Alaska's breeding population nests primarily on the Arctic Coastal Plain, with very small numbers found nesting on the Y-K Delta. Most of the world's Steller's eider population winters in the Aleutian Islands and along the Alaska Peninsula. See section 5.9 for additional discussion on spectacled and Steller's eiders.

The USACE Alaska District has been coordinating with the USFWS regarding relocating the village of Newtok to Mertarvik since 2005. In June 2005, at USACE' request, the USFWS conducted a survey to help with assessing the potential impacts to threatened and endangered species at the prospective relocation site. The USFWS concluded in its field report (USFWS 2006) that, although ESA-listed spectacled and Steller eiders have nested in the area, none were nesting at the Mertarvik site at the time of the survey. The USFWS field report stated that "ideal nesting habitat for spectacled and Steller's eiders is a complex of sedge-grass meadows, pond shorelines, peninsulas and islands… On nesting grounds, they feed by dabbling in shallow freshwater or brackish ponds, or on flooded tundra." This type of habitat does not exist in the area expected to be impacted by the construction of the preferred Mertarvik CLP alternative, although it may exist near the mouth of the Takikchak River. Spectacled eiders do breed along the western Alaska coast, and designated critical habitat (CH; Figure 37) for this species exists roughly 6 miles from the Mertarvik site; this suggests that they may be present in wetlands or open water near the Mertarvik site.

The threatened Steller's eider was once locally common in portions of the Y-K Delta, but nesting by Steller's eider in western Alaska is now extremely rare; their Alaskan breeding range is primarily confined to the Arctic Coastal Plain (USFWS 2011). Steller's eiders could potentially be found in the vicinity of Mertarvik, but these would most likely be transient, migrating between the North Slope breeding range and their wintering and molting areas along the Alaska Peninsula.

Eskimo Curlew

The Eskimo curlew is considered to likely be extinct, although it retains its "endangered" listing under the ESA and State of Alaska designation; its last confirmed sighting was in 1987, in Nebraska. This far-ranging species nested on arctic tundra in Alaska and Canada, then migrated as far as South America for the winter. Its historical range potentially extended into the northern Y-K Delta (ADFG 2017), but the species was not included in informal consultation with the USFWS, and was therefore not included in Table 10 for consideration in this EIS.

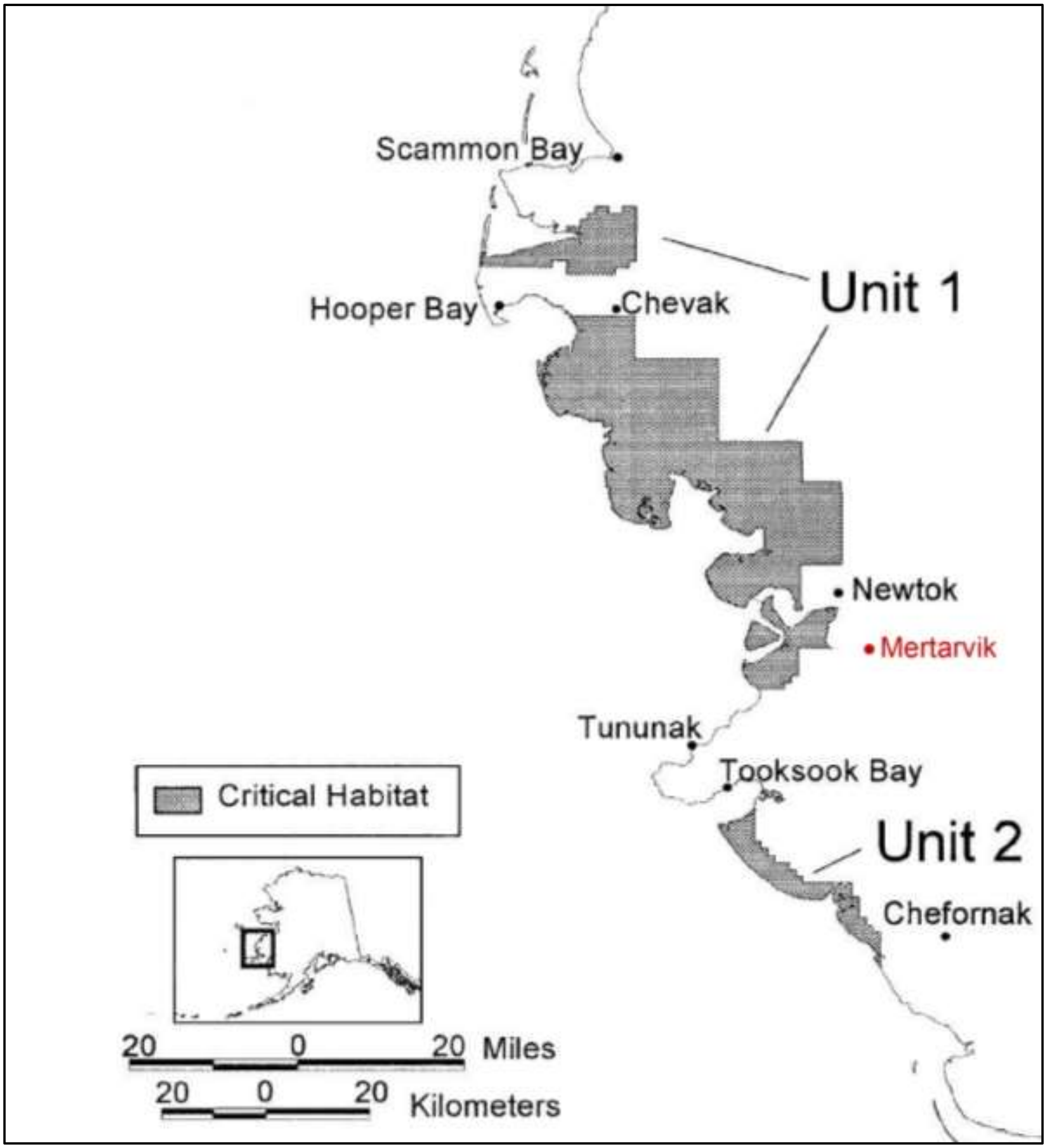


Figure 37. Spectacled eider critical habitat (adapted from USFWS 2001)

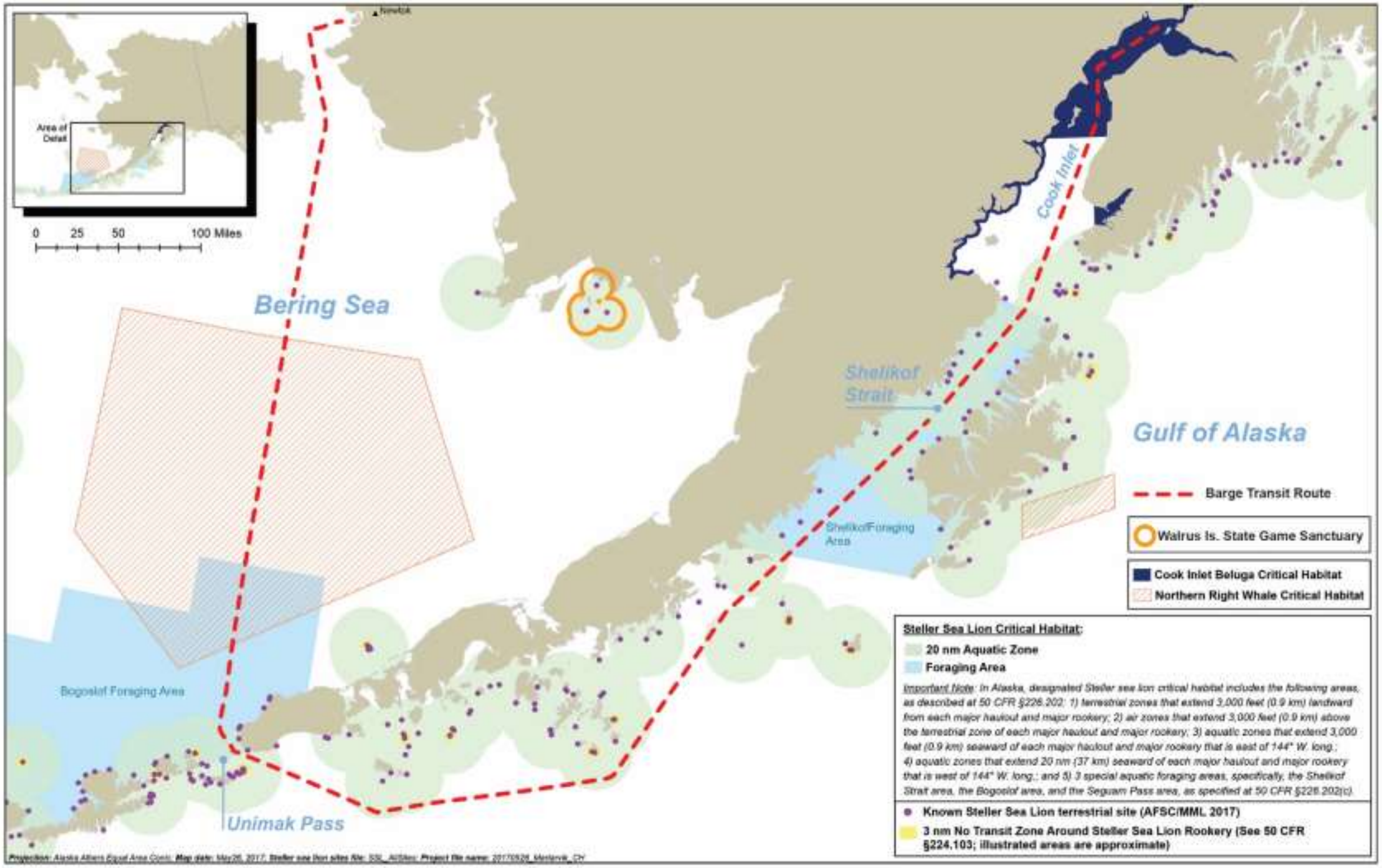


Figure 38. Critical habitat and sanctuaries of selected marine mammal species in relation to a presumptive barge route between Anchorage and Mertarvik (prepared by NMFS/Protected Species Division, with USACE additions)

Northern Sea Otter

Northern sea otters are found throughout the Aleutian Islands, along both the Bering Sea and Gulf of Alaska coasts of the Alaska Peninsula, and along much of the Alaska mainland Pacific coast. Figure 39 shows the critical habitat (CH) units designated for the threatened Southwest Alaska Distinct Population Segment (DPS). No sea otters are expected in coastal waters near the Y-K Delta, although the barge route would pass sea otter habitat along the Alaska Peninsula. Northern sea otters are primarily nearshore animals; the CH description (USFWS 2013) includes as a primary constituent element (PCE) "Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m (328.1 ft.) from the mean high tide line."

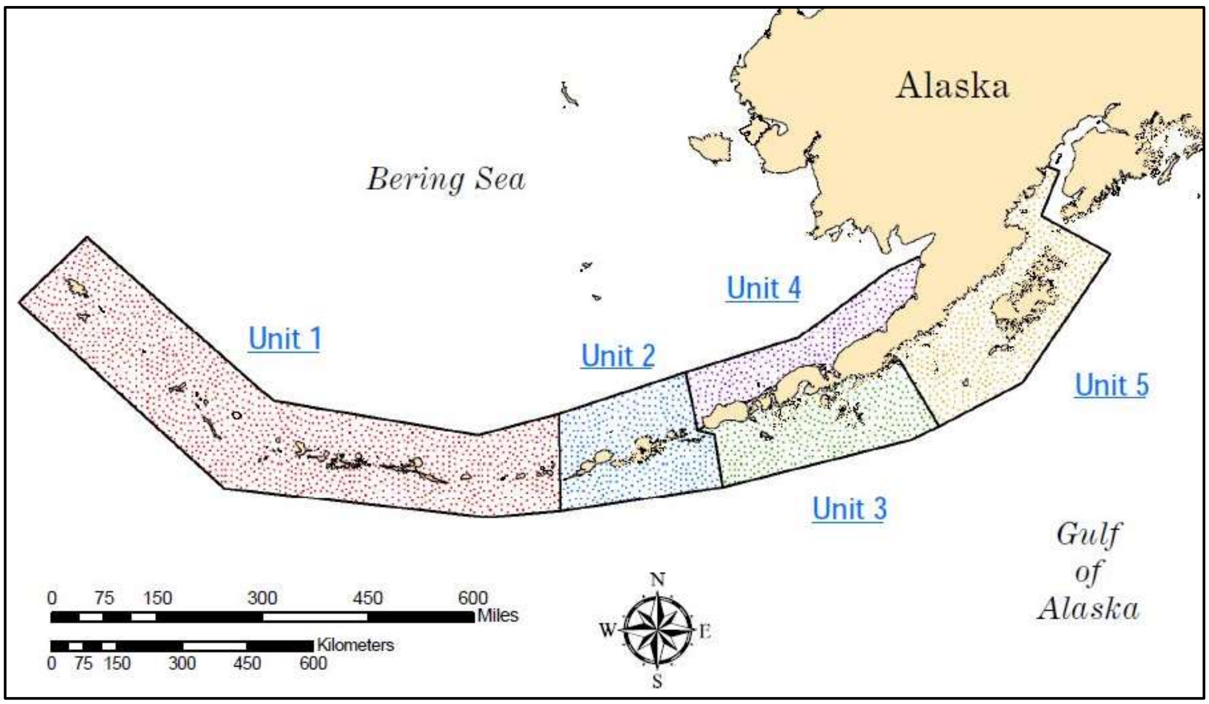


Figure 39. Critical habitat units of the northern sea otter, Southwestern Alaska DPS

Short-Tailed Albatross

Short-tailed albatross range across much of the North Pacific Ocean as adults and sub-adults, but tend to concentrate along the break of the continental shelf, where upwelling and high primary productivity result in abundant food resources. The major threats to short-tailed albatross are large-scale fishing operations within the species' characteristic feeding areas and impacts to their limited breeding sites near Japan (USFWS 2008). The barge route could potentially take ocean-going barges close to areas where short-tailed albatross concentrate to feed. There is no designated CH for this species.

Steller Sea Lion

The Steller sea lion was listed as a threatened species under the ESA in November 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions into two DPSs based on genetic studies and other information (62 FR 24345); at that time, the eastern DPS was listed as threatened and the western DPS was listed as endangered.

Steller sea lions prefer the colder temperate to sub-arctic waters of the North Pacific Ocean. Haul outs and rookeries usually consist of beaches (gravel, rocky or sand), ledges, and rocky reefs. In the Bering Sea and Okhotsk Sea, sea lions may also haul out on sea ice, but this is considered atypical behavior. Critical habitat (CH) for Steller sea lions was designated in 1993 and is described in 50 CFR §226.202. Critical habitat in Alaska west of 144°W longitude consists of:

a) Aquatic zones that extend 20 nautical miles (nm), or 37 km, seaward of each major haul out and major rookery (as listed in Tables 1 and 2 to 50 CFR §226).
b) Terrestrial zones that extend 3,000 feet (0.9 km) landward from each major haul out and major rookery.
c) Air zones that extend 3,000 feet (0.9 km) above the terrestrial zone of each major haul out and major rookery in Alaska.
d) Three special aquatic foraging areas: the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area, as specified at 50 CFR §226.202(c).

A barge traveling from Anchorage to Mertarvik would pass through the 20-nm aquatic zones of numerous CH haul outs and rookeries (Figure 38), especially within Shelikof Strait and Unimak Pass, and also through the Shelikof Strait and Bogoslof special aquatic foraging areas.

North Pacific Right Whale

The North Pacific right whale is among the rarest of the great whale species. It was originally listed as the "northern right whale" under the Endangered Species Conservation Act, and continued to be listed as endangered following the passage of the ESA in 1973. The listing was later divided into two separate endangered species: North Pacific right whales and North Atlantic right whales.

North Pacific right whales are found from Baja California to the Bering Sea with the highest concentrations in the Bering Sea, Gulf of Alaska, Okhotsk Sea, Kuril Islands, and Kamchatka area. They are primarily found in coastal or shelf waters. Seasonal distribution of this species is poorly understood (NMFS 2013). In the spring through the fall their movements follow the distribution of prey, primarily high densities of zooplankton. In the winter, pregnant females move to shallow waters in low latitudes to calve; the winter habitat of the rest of the population is unknown.

Two areas of CH were designated for North Pacific right whales in 2008 (73 FR 19000). One of these is in the Gulf of Alaska south of Kodiak Island; the other is within Bristol Bay north of the

Alaska Peninsula and eastern Aleutian Islands (Figure 38). Either of these critical habitat areas could potentially be along the route of proposed action -related shipping, although barges are more likely to travel the more direct route through the relatively sheltered waters of Shelikof Strait rather than run south of Kodiak Island.

Humpback Whales

Humpback whales were originally listed as endangered with the passage of the ESA in 1973. The NMFS has recently reviewed the listing status of humpback whales; guidance from the NMFS on humpback whales occurring in Alaskan waters (NMFS 2016) discusses three DPS:

1. Western North Pacific DPS (ESA endangered);
2. Mexico DPS (ESA threatened); and
3. Hawaii DPS (not listed under the ESA).

Whales from these three DPSs overlap to some extent in feeding grounds off Alaska. An individual humpback whale encountered in the Bering Sea has an 86.5 percent probability from being from the unlisted Hawaii DPS, an 11.3 percent chance of being from the threatened Mexico DPS, and a 4.4 percent chance of being from the endangered Western North Pacific DPS (Table 11). No CH is designated in Alaskan waters for humpback whales.

Table 11. Humpback Whale DPS Distribution in Alaskan Waters

Summer Feeding Areas	**Hawaii DPS (not listed)**	**Mexico DPS (threatened)**	**Western North Pacific DPS (endangered)**
Aleutian Islands, Bering, Chukchi, and Beaufort Seas	86.5%	11.3%	4.4%
Gulf of Alaska	89.0%	10.5%	0.5%

Sperm Whales and Fin Whales

Sperm whales and fin whales are deep-water oceanic species that range throughout the North Pacific Ocean and would be encountered only incidentally by proposed action-related vessels. Sperm whales tend to inhabit areas with a water depth of 1,968 feet (600 m) or more, and are uncommon in waters less than 984 feet (300 m) deep. Female sperm whales are generally found in deep waters (at least 3,280 feet, or 1000 m) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). These conditions generally correspond to sea surface temperatures greater than 15 °C, and while female sperm whales are sometimes seen near oceanic islands, they are typically far from land. There is no critical habitat designated for sperm whales or fin whales.

Gray Whales

Gray whales occur in two isolated geographic distributions within the North Pacific Ocean: the Eastern North Pacific stock, found along the west coast of North America, and the Western North Pacific or "Korean" stock, found along the coast of eastern Asia. A small number of endangered Western North Pacific DPS of gray whales may make their way to the coastal waters of North America during the summer and autumn feeding season, mixing with the unlisted Eastern Pacific population (Moore and Weller 2013).

Most of the Eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas, but gray whales have also been reported feeding along the Pacific coast during the summer, in waters off Southeast Alaska, British Columbia, Washington, Oregon, and California. In the fall, gray whales migrate from their summer feeding grounds, heading south along the coast of North America to spend the winter in their breeding and calving areas off the coast of Baja California, Mexico. Calves are born in shallow lagoons and bays from early January to mid-February. From mid-February to May, the Eastern North Pacific stock of gray whales can be seen migrating northward with newborn calves along the West Coast of the U.S. No critical habitat is designated for this species.

Beluga Whales

Beluga whales are generally found in shallow coastal waters, often in water barely deep enough to cover their bodies, but are also seen in deep waters. They seem well adapted to both a cold ocean habitat and a warmer freshwater habitat. Belugas can be found swimming among icebergs and ice floes in the waters of the Arctic and subarctic, where water temperatures may be as low as 32° F (0° C). They can also be found in estuaries and river basins. The Cook Inlet DPS of beluga whales could be encountered anywhere in Cook Inlet year round, although they tend to concentrate at the northern end of Cook Inlet during the summer months, then disperse more widely through the inlet during autumn, winter, and spring (NMFS 2016a). CH designated for Cook Inlet belugas is shown on Figure 33 and Figure 40; a special exclusion zone is discussed further below.

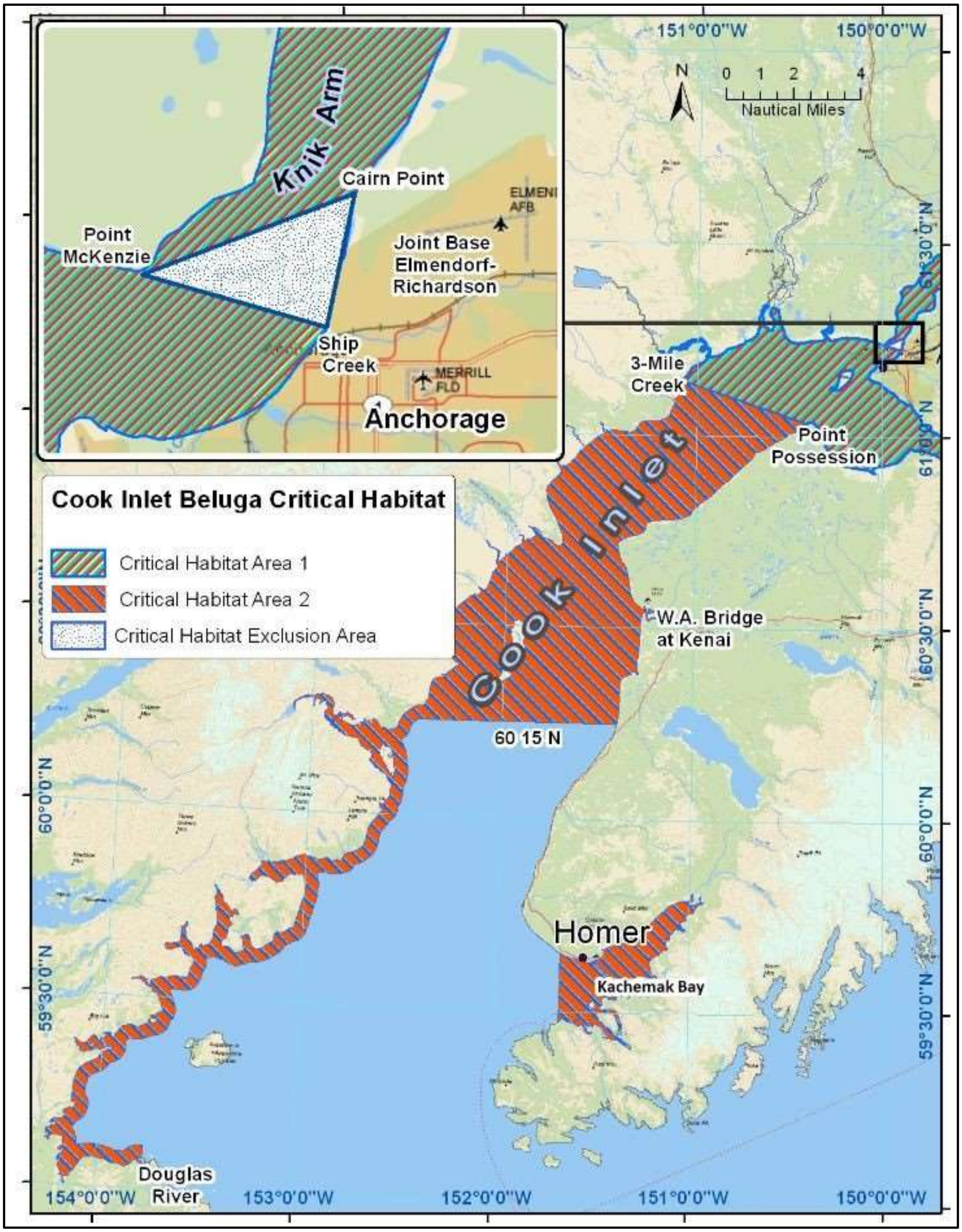


Figure 40. Critical Habitat for Cook Inlet beluga whales (from NMFS 2106a)

Ringed Seals and Bearded Seals

Ringed seals and bearded seals are ice seals, residing in arctic waters and are commonly associated with ice floes and pack ice. The bulk of the population move southward or northward in close association with the seasonal advancing and retreating of sea ice.

The ringed seal is found in the Northern Hemisphere with a circumpolar distribution ranging from 35°N to the North Pole. There is only one recognized stock of ringed seals in U.S. waters: the Alaska stock.

Bearded seals are found in the Northern Hemisphere with a circumpolar distribution that does not extend farther north than 80°N and inhabit waters less than 650 feet (200 m) deep. The Alaska stock of bearded seal is the only stock found in U.S. waters.

Arctic ringed seals and Beringia DPS bearded seals were listed as endangered on December 28, 2012; but the District Court of Alaska issued a decision vacating the listing. In October 2016, the Ninth Circuit Court of Appeals found that in light of the NMFS's robust rulemaking process, and pursuant to a highly deferential standard of review, the NMFS's final rule listing the Beringia distinct population segment of bearded seals as threatened was not arbitrary or capricious, and its listing was supported by substantial evidence (Alaska Oil and Gas Association vs Pritzker, 2016). The NMFS has also appealed the District Court of Alaska's decision to vacate the listing of Arctic ringed seals; the court's decision is pending at the time of this analysis. Critical habitat was proposed in conjunction with the listing of ringed seals in December 2014; the rule has not been finalized due to legal challenge to the listing of ringed seals as endangered (79 FR 73010, Figure 41).

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) provides protection for all whales, dolphins, porpoises, seals, sea lions, and sea otters, regardless of a species' listing under the ESA. All of the ESA species in Table 10
, excluding the birds, are also protected under the MMPA.

Non-ESA marine mammals that could potentially be impacted by proposed action-related activities, primarily by the transit of project barges, include (NMFS 2017a):

- Pacific Walrus (*Odobenus rosemarus divergens*)
- Northern fur seal (*Callorhinus ursinus*)
- Ribbon seal (*Histriophoca fasciata*)
- Spotted seal (*Phoca vitulina largha*)
- Harbor seal (*Phoca vitulina*)
- Harbor porpoise (*Phocoena phocoena*)
- Dall's porpoise (*Phocoenoides dalli*)

- Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)
- Stejneger's beaked whale (*Mesoplodon stejnegeri*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Killer whale (*Orcinus orca*)
- Minke whale (*Balaenoptera acutorostrata*)

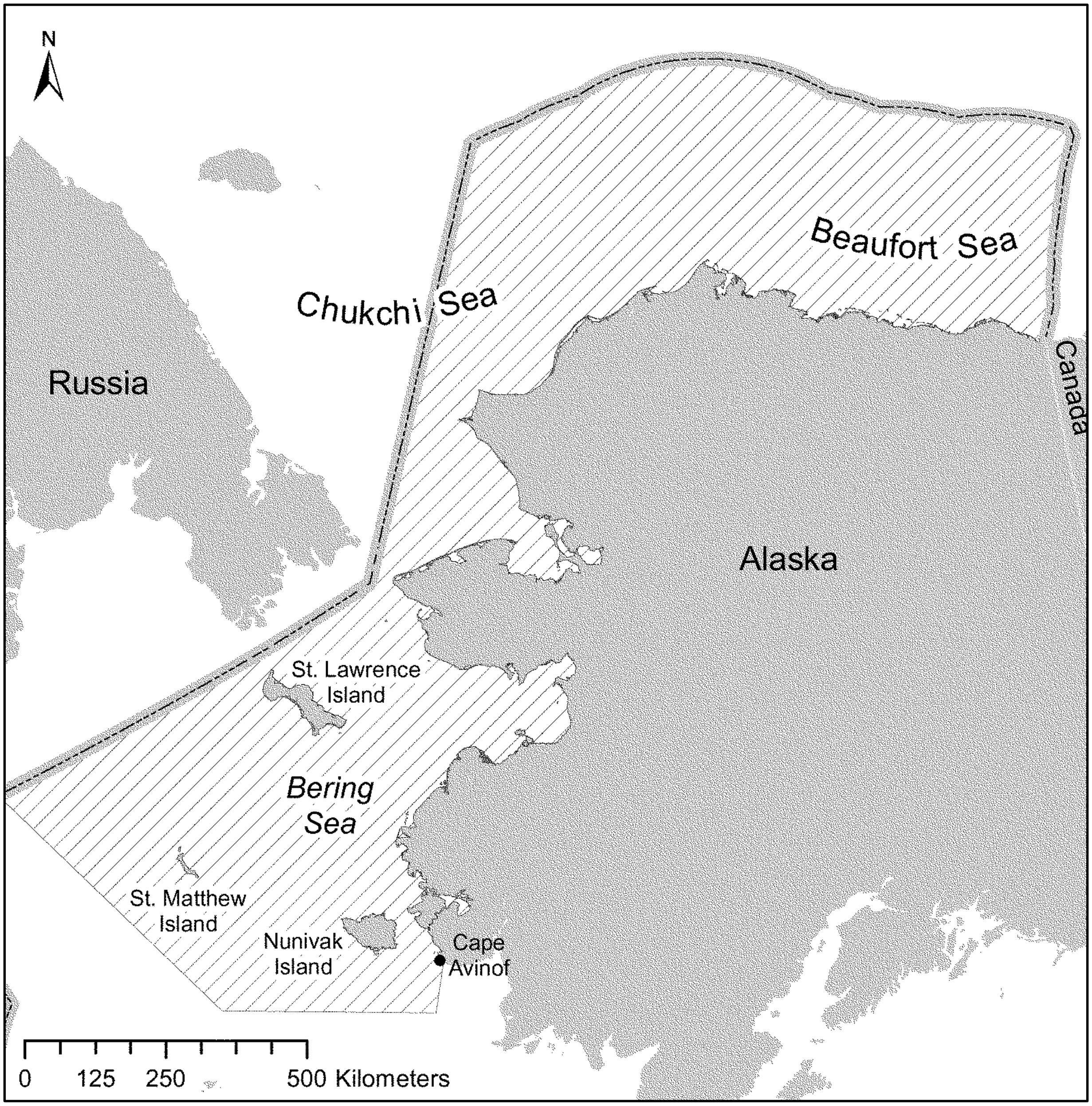


Figure 41. Proposed critical habitat for ringed seals (from 79 FR 73010).

The Pacific walrus was an ESA candidate species until 4 October 2017, when the USFWS determined that the species does not, at this time, require protection under the ESA (USFWS 2017c). The Pacific walrus currently has no status under the ESA, but is protected under the MMPA. The Alaskan population spends the winter on the Bering Sea pack ice before separating in the spring. Females with young migrate northward from the Bering Sea into the Chukchi Sea, following the receding ice pack. Most males concentrate in Bristol Bay in the ice-free months, congregating at shore haul-outs when not foraging for food. By late fall, the females and their offspring are moving south back into the Bering Sea, migrating ahead of the advancing sea ice, while the males that summered in Bristol Bay move north to join the returning population in waters near St. Lawrence Island (ADFG 2017d). The barge route (Figure 38) does not approach the Bristol Bay haul-outs and feeding areas, but may cross paths with walrus migrating to and from the winter gathering area in the Bering Sea.

The Walrus Islands State Game Sanctuary (Figure 38) protects a group of seven small craggy islands and their adjacent waters in northern Bristol Bay, approximately 65 miles southwest of Dillingham. The sanctuary includes Round Island, Summit Island, Crooked Island, High Island, Black Rock and The Twins (ADFG 2017d). There is no CH designated under the ESA for this candidate species.

5.9.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on endangered and threatened species in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Spectacled Eider

Spectacled eiders breed along the western Alaska coast, and the proximity of designated CH for this species to Mertarvik suggests that they may be present in wetlands or open water near the Mertarvik community site, although breeding near the site is unlikely. The estuarine wetlands near the mouth of the Takikchak River and adjacent tundra ponds several miles to the west of the Mertarvik site (Figure 29) probably contain suitable nesting habitat for eiders, although none were found in the USFWS 2005 survey of those wetlands. The long-term nest population study (Fischer et al. 2017) shows the overall estimates of spectacled eider nests in 2005 was 9 percent above the long-term mean (1985-2016) and the 2005 results together with the relatively higher population estimates for the other areas on the Yukon River Delta during that same year leads to the conclusion that wetlands near Mertarvik do not support eider nesting (USFWS 2017b).

Spectacled eiders are unlikely to be directly impacted by the proposed action, but the presence of construction activity, human habitation, aircraft flight routes, and increased human access to the

Takikchak River, may displace some individual eiders from nearby wetlands, and cause them to find other nesting and feeding habitat in the abundant surrounding wetlands. There is currently no flight seeing tourism service operating out of Newtok, nor is FAA aware of any proposed for Mertarvik. The USFWS concurred with the Denali Commission's (through the USACE Alaska District as their agent) determination (USACE 2017a) that the proposed action may affect, but is not likely to adversely affect spectacled eiders in a letter dated June 20, 2017 (USFWS 2017b).

Steller's Eider

Steller's eiders could potentially be found in the vicinity of Mertarvik, but these would most likely be transient, migrating between the North Slope breeding range and their wintering and molting areas along the Alaska Peninsula. These transient individuals may be displaced or prevented by human activity from resting on the Ninglick River near the Mertarvik site. Relocating additional residents to the Mertarvik site could result in additional pressure from hunting and egg gathering, but the community is moving farther away from preferred spectacled eider nesting habitat, away from the coast. Take for hunting is analyzed annually under a separate consultation for subsistence hunting regulations (USFWS 2017b).

The USFWS concurred with the Denali Commission's effects determination (through the USACE Alaska District as their agent)(USACE 2017a) that the proposed action may affect, but is not likely to adversely affect Steller's eiders in a letter dated June 20, 2017 (USFWS 2017b).

Northern Sea Otter

Northern sea otters are largely confined to nearshore waters. The CH designated for northern sea otters (USFWS 2009) includes as a PCE "Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m (328.1 ft.) from the mean high tide line." An ocean-going barge and tug or landing craft is unlikely to intentionally approach within 100 meters of the Kodiak Island or Alaska Peninsula coastline and thus enter sea otter CH. Slow-moving barges (typically less than 9 knots) would not present a ship-strike hazard to northern sea otters. The Denali Commission made the determination to the USFWS (USACE 2017a) that the proposed action and associated vessel activity will have no effect on northern sea otters; the USFWS has not challenged this determination.

Short-Tailed Albatross

The short-tailed albatross is threatened primarily by large-scale fishing operations within the species' characteristic feeding areas and impacts to their limited breeding sites near Japan (USFWS 2008b). The barge route would potentially take ocean-going barges close to areas where short-tailed albatross concentrate to feed, but the risk of proposed action-related vessels encountering and adversely impacting members of this rare and widely-dispersed species during simple transits to and from the proposed action site is sufficiently low to be discountable. The Denali Commission made the determination to the USFWS (USACE 2017a) that the proposed action and associated vessel activity will have no effect on the short-tailed albatross; the USFWS has not challenged this determination.

Steller Sea Lion

Steller sea lions may be present in any part of their range throughout the year, although most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (NMFS 2008). Rookeries in the Western DPS range are protected by a 3-nm "no transit zone" (50 CFR §224.103) in addition to the CH designations discussed previously. Project-related vessels would pass through the 20-nm nautical zone of numerous CH rookeries and haul outs, and through the Shelikof and Bogoslof Foraging Areas, but would not approach within 3 nm of any of the rookeries or haul outs shown on Figure 38.

Whales, Dolphins and Porpoises

Whales, dolphins, porpoises, seals, and sea lions in the open ocean face common threats from human activity:

- Ship strikes
- Direct impacts from human fishing (e.g., entanglement in fishing gear)
- Indirect impacts from human fishing (e.g., competition for food resources)
- Contaminants and pollutants
- Habitat degradation caused by human activities and disturbance
- Hunting and predation

Proposed action-related vessels could potentially pose threats to marine mammals through ship strikes and disturbance from noise. The effects of proposed action-related vessels would be a minor incremental increase over the effects of very similar vessels that travel between communities on the Gulf of Alaska and Bering Sea every year. The probability of strike events depends on the frequency, speed, and route of the marine vessels, as well as distribution of marine mammals in the area. An analysis of ship strikes in Alaskan waters (Neilson et al, 2012) found that whale mortalities are more likely when large vessels travel at speeds greater than 12 knots. Another study (Vanderlaan and Taggart 2007) used observations to develop a model of the probability of lethal injury based upon vessel speed, projecting that the chance of lethal injury to a whale struck by a vessel is approximately 80 percent at vessel speeds over 15 knots, but approximately 20 percent at 8.6 knots. The relatively low speed of a typical ocean-going barge and tug (typically no more than 9 knots), together with a barge's blunt prow and shallow draft, make it far less likely to strike and inflict injury upon a marine mammal than larger, faster ocean-going vessels such as cruise ships and cargo ships. The limited maneuverability and long stopping-distance of a barge and tug would make it difficult for the vessels to avoid an observed marine mammal, and in many circumstances unsafe for them to attempt to do so. Conversely, however, the vessels' low speed and consistent course would enable marine mammals to avoid the path of the barge and tug well before there was a danger of collision.

Pacific walrus would be at risk of encountering proposed action-related vessels only during the male walrus's spring and fall migrations to and from Bristol Bay. Project vessels would be operating during summer months when sea ice is absent from the Bering Sea; the vessels would, in general, be unlikely to encounter Pacific walrus in the open Bering Sea and will have no need to approach walrus concentrations areas in Bristol Bay (Figure 38).

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871). The NMFS recently developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary threshold shifts (PTS and TTS; Level A harassment; 81 FR 51693). The NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels (measured in micropascals, or μPa), expressed in root mean square (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA; NMFS 2017):

Under the PTS/TTS Technical Guidance (NMFS 2016), the NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA. These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (LE) and peak sound level (PK) for impulsive sounds and LE for non-impulsive sounds:

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1μPa_{rms}

Tugboats may generate significant underwater noise, especially when maneuvering or holding a barge in position against a dock or the shore. During a 2001 acoustic survey of Cook Inlet (Blackwell and Greene 2002), the highest level underwater broad-frequency noise recorded (149 decibels (dB) re 1μPa, at a distance of 102 meters) was generated by a tugboat docking a gravel barge. The same tug/barge combination generated a maximum level of 125 dB re 1μPa, at a distance of 190 meters, when in transit. The underwater noise level generated by a tugboat can vary greatly with the size/horsepower of the tugboat engine and whether noise-reducing features, such as propeller cowlings, are present. Diesel-powered tugs typically generate underwater noise at relatively low frequencies, roughly in the 0.02 to 1 kHz range (USACE 1998).

At 0.02 to 1 kHz, the typical frequency range of underwater noise generated by a tugboat engine (USACE 1998) places it at the lower end of the generalized hearing range of low frequency (LF) cetaceans, and below or at the very lower limit of the hearing range of other marine mammals (Table 12). The noise generated by the tugboat engine is assumed to be non-impulsive/continuous; no source of impulsive noise from the tug and barge is anticipated other than brief, incidental sounds from docking or landing. The 125 dB re 1µPa, at a distance of 190 meters, of a tug and barge in transit (Blackwell and Greene 2002) falls well below the Level A harassment (injury) acoustic thresholds for non-impulsive noise shown in Table 12, but slightly exceeds the 120 dB re $1\mu Pa_{rms}$ default conservative threshold for a Level B disturbance from continuous noise. There is the potential for LF cetaceans within a few hundred meters of proposed action-related vessels in transit to experience a Level B disturbance (behavioral disruption) due to underwater noise; other marine mammals would likely be insufficiently sensitive to the low-frequency engine noise to experience a disturbance.

Table 12. Marine Mammal Hearing Groups and Level A Acoustic Thresholds

Hearing Group	**Relevant ESA Species**	**Generalized Hearing Range**	**PTS Onset Acoustic Thresholds**	
			Impulsive	Non-Impulsive
Low-Frequency Cetaceans (LF)	Humpback whale NP right whale NWP gray whale Blue whale Fin whale	0.007 to 35 kHz	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB
Mid-Frequency Cetaceans (MF)	Sperm whale Beluga whale	0.15 to 160 kHz	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency Cetaceans (HF)	*Porpoises (non-ESA)*	0.275 to 160 kHz	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,MF,24h}$: 198 dB
Phocid Pinnipeds (PW)	Ringed seal Bearded seal Harbor seal	0.05 to 86 kHz	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW)	Steller sea lion	0.06 to 39 kHz	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

PTS: Permanent Threshold Shift: a permanent reduction in the ability to hear.
kHz: kilohertz (sound frequency)
dB: Decibels, unweighted (sound intensity)
L_{pk}: Peak sound level; “flat” = unweighted within the generalized hearing range.
L_E: Cumulative sound level; “24h” = 24-hour cumulative period.
LF, MF, HF, PW, OW: defined in “Hearing Group” column
(Adapted from NMFS 2016b)

For air-transmitted noise, NMFS uses the following threshold for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance under section 3(18)(A)(ii) of the MMPA (NMFS 2017):

- 90 dB re 20μPa_{rms} for harbor seals
- 100 dB re 20μPa_{rms} for non-harbor seal pinnipeds

Air-transmitted noise levels generated by tugboat diesel engines are comparable to those of large construction equipment, generally 70 to 100 A-weighted decibels (dBA) within 50 feet of the engine (Navy 1987; USACE 2011; Dyer and Lundgard 1983). Thornton (1975) measured in-air barge noise at levels between 88 and 93 dBA in the aft deck of two barges. These levels fall below the level B disturbance threshold for pinnipeds (excluding harbor seals). Except when traveling the Ninglick River, proposed action-related vessels would rarely be closer than several nautical miles from shore. The USACE considers the effects of air-transmitted noise on marine mammals to be discountable.

5.9.2.1 Proposed Avoidance and Minimization Measures

For spectacled and Steller's eiders, no conservation recommendations were proffered by the USFWS (USFWS 2017b), and no species-specific avoidance or minimization measures are proposed here. General measures to minimize the degradation of area wetlands and waterways, through sediment management and thoughtful layout of roads and wastewater management, will serve to avoid impacts to these ESA species.

The NMFS has recommended the following general measures to minimize the risk and harm to protected marine species (ESA and MMPA):

- To reduce the risk of collisions with protected species, proposed action-related vessels will be limited to a speed of 8 knots, or the slowest speed above 8 knots consistent with safe navigation:
  - when within 3 nautical miles of any of the Steller sea lion haul outs or rookeries shown on Figure 38;
  - when transiting the North Pacific right whale CH areas shown on Figure 38; and
  - when transiting the Cook Inlet beluga whale CH areas.
- Vessel operators will strive not to approach within 100 yards of a marine mammal to the extent practicable, given navigational and safety constraints.
- The contractor performing the work will prepare an Oil Spill Prevention and Control Plan describing steps to avoid and mitigate releases of hazardous substances.

Cook Inlet Beluga Whales

The NMFS has recommended special conservation measures to minimize the impacts of vessel strikes on Cook Inlet beluga whales and North Pacific right whales within their respective CH (Gill 2017a):

Exercise special caution in the vicinity of the Susitna Delta to minimize the impacts of vessels within this seasonally vital Cook Inlet beluga whale habitat. The Susitna Delta Exclusion Zone (Figure 42) is defined as the union of the areas defined by:

- a 10-mile (16 km) buffer of the Beluga River thalweg seaward of the mean lower low water (MLLW) line,
- a 10-mile (16 km) buffer of the Little Susitna River thalweg seaward of the MLLW line, and,
- a 10-mile (16 km) seaward buffer of the MLLW line between the Beluga River and Little Susitna River.
- The buffer extends landward along the thalweg buffers to include intertidal area up to mean higher high water (MHHW). The seaward boundary has been simplified so that it is defined by lines connecting readily discernable landmarks.

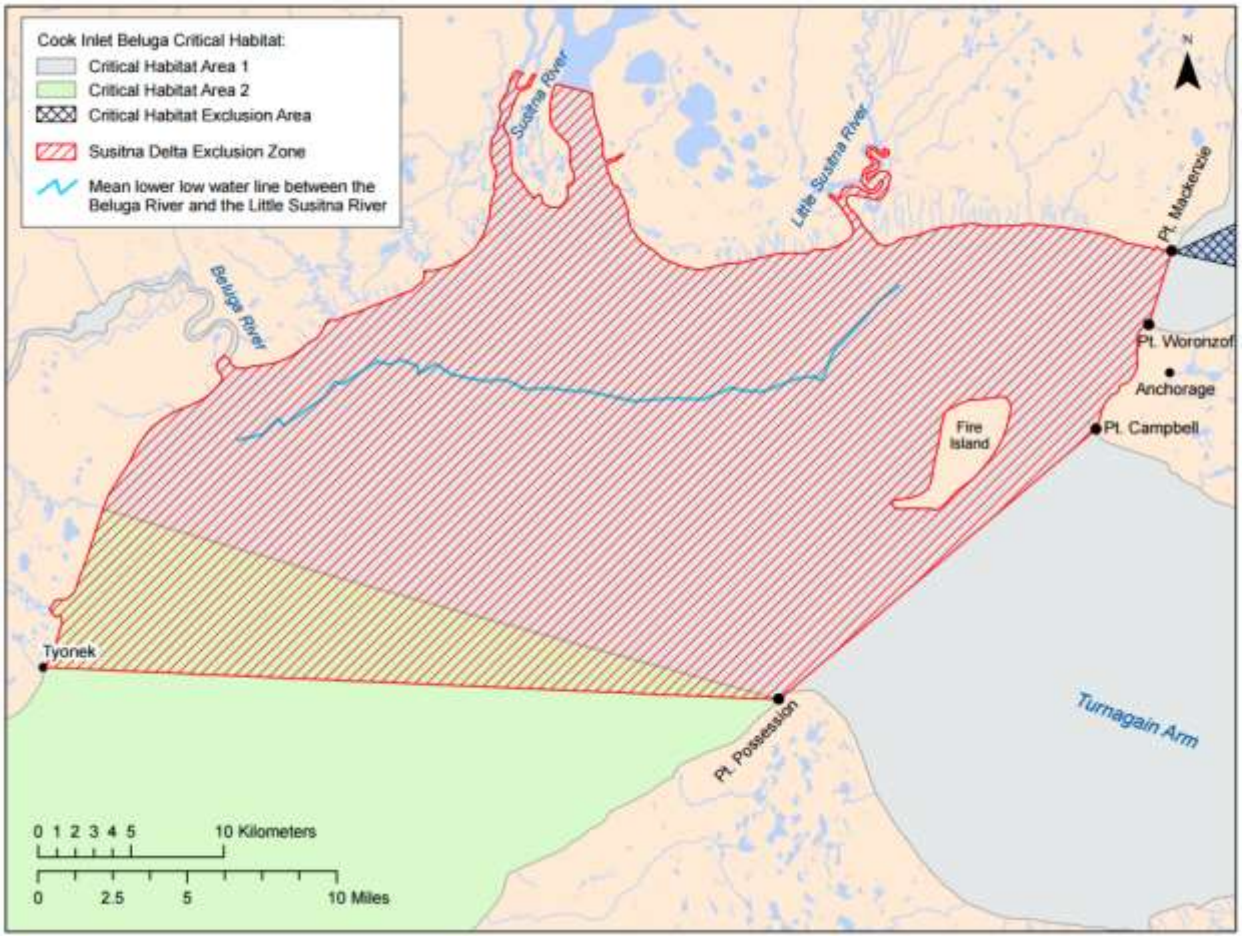


Figure 42. Boundaries of the Susitna Delta Exclusion Zone.

For vessels operating in the Susitna Delta Exclusion Zone, the following should be implemented:

- All vessels operating within the designated Susitna Delta area should maintain a speed below 4 knots. Crews must note the numbers, date, time, coordinates, and proximity to vessels of any belugas observed during operations, and report these observations to NMFS.
- Protected species observers (PSOs) must be in place to monitor for ESA-listed species prior to and during all vessel movements when vessels are under power (propellers spinning) within the Susitna Delta Exclusion Zone. PSOs are not required to be observing when vessels are not under power (in gear).
- PSOs must be located in a position that affords a view of all waters within a 100-meter radius of all vessels under power (in gear).
- Exercise special caution in the vicinity of the Susitna Delta to minimize the impacts of vessels within this seasonally vital Cook Inlet beluga whale habitat.
- Vessel operators must avoid moving their vessels when PSOs are unable to adequately observe the 100-meter zone around vessels under power (in gear) due to darkness, fog, or other conditions, unless necessary for ensuring human safety.

- If any vessels enter the Susitna Delta Exclusion Zone at any time, PSOs must record and email to NMFS: date, time, number, and geographic coordinates of ESA listed marine mammals observed during vessel movements, and descriptions of any deferred vessel movements or vessel re-directions.

North Pacific Right Whale

The vessel operator should avoid transits within designated North Pacific right whale CH (Figure 38). If transit with North Pacific right whale CH cannot be avoided, NMFS recommends a route along the western boundary of the CH where historic and contemporary observations indicate that North Pacific right whales are not as concentrated as other areas in the CH. In addition, if transit with North Pacific right whale CH cannot be avoided, NMFS recommends that transit in right whale CH be limited to between September and March, a time of year right whales may be at lower numbers in the Bering Sea.

If transiting in North Pacific right whale CH, vessel operators are requested to exercise extreme caution and observe the 10-knot (18.52 km/h) vessel speed restriction. Operators transiting through North Pacific right whale CH should have trained Protected Species Observers (PSOs) actively engaged in sighting marine mammals. PSOs would increase vigilance and allow for reasonable and practicable actions to avoid collisions with North Pacific right whales. Operators will maneuver vessels to keep 800 meters away from any observed North Pacific right whales while within their designated CH, and avoid approaching whales head-on consistent with vessel safety. Vessels should take reasonable steps to alert other vessels in the vicinity of whale(s), and report of any dead or injured listed whales or pinnipeds.

The USACE submitted an ESA determination letter to the NMFS dated 24 May 2017 (USACE 2017b), in which the USACE determined that the proposed action activities may affect, but not likely to adversely affect, the ESA-listed marine species under NMFS jurisdiction identified in the letter. The NMFS declined to concur, stating that the proposed actions were too prospective at this time, that a NEPA analysis (i.e., this draft EIS) alone was insufficient to trigger an ESA Section 7 consultation, and that the NMFS would wait until brought into consultation by the USACE Regulatory Division as it processes individual Clean Water Act permit requests (Gill 2017a).

5.9.3 Significance Determination

Under the FAA significance criteria for “biological resources” (FAA 2015), a significant impact would occur when “the U.S. Fish and Wildlife Service or the National Marine Fisheries Service determines that the action would be likely to jeopardize the continued existence of a Federally-listed threatened or endangered species, or would result in the destruction or adverse modification of federally-designated critical habitat.”

The FAA has not established a significance threshold for non-ESA species, but the FAA guidance recommends evaluating the proposed actions for the potential to cause "adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats." Non-listed species protected under the MMPA may be regarded as "special status species".

The Denali Commission has determined that none of the three CLP alternatives, as proposed, would exceed the significance threshold defined above for an ESA-listed species (LESS THAN SIGNIFICANT). None of the CLP alternatives are expected to create adverse impacts to non-ESA species, with the avoidance and minimization measures described in the previous section (MINOR). The

<u>Pursuant to Section 7 of the Endangered Species Act:</u>
The Denali Commission has determined that the proposed action will not affect the following ESA-listed or candidate species or any designated critical habitat:

- Northern sea otter
- Short-tailed albatross

The Denali Commission has determined to the USFWS that the proposed action may affect, but is not likely to adversely affect, the following ESA-listed species or any designated critical habitat:

- Spectacled eider
- Steller's eider

The USFWS concurred with the Denali Commission's determination (through the USACE Alaska District as their agent; USACE 2017a) that the proposed action may affect, but is not likely to adversely affect spectacled or Steller's eiders in a letter dated June 20, 2017 (USFWS 2017b). The FAA will conduct its own Section 7 ESA consultation with the USFWS for these ESA-listed species.

With the avoidance and minimization steps outlined in section 5.9.2.1, the Denali Commission has determined that the proposed action may affect, but is not likely to adversely affect, the following ESA-listed species or any designated critical habitat:

- Steller sea lion, Western Distinct Population Segment (DPS)
- Humpback whale, Western North Pacific DPS
- Humpback whale, Mexico DPS

- North Pacific right whale
- Gray whale, Western North Pacific population
- Sperm whale
- Beluga whale, Cook Inlet DPS
- Ringed seal
- Bearded seal

By a letter dated May 24, 2017, the USACE Alaska District, on behalf of the Denali Commission, requested ESA Section 7 concurrence from the NMFS on these determinations. NMFS responded by saying they were unable to concur with these determinations at this time, preferring to withhold such concurrence until such time as Department of the Army permit applications for each element of the preferred alternative has been received by the USACE Alaska District Regulatory Division, and more sufficient detail is provided on specifics as to the types and number of tugs and barges is known. On June 9, 2017, at the request of the NMFS, the USACE Alaska District withdrew its request to the NMFS for ESA Section 7 concurrence on the entire scope of the project.

The FAA will conduct its own Section 7 ESA consultation with the NMFS for these ESA-listed species.

The no action alternative would have no impact on ESA-listed species, or species protected under the MMPA.

5.10 Migratory Birds

The Migratory Bird Treaty Act of 1918 (MBTA, 16 USC §§1361-1407)) implements the United States' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource.

The MBTA protects over 800 species of birds within the United States. The list of migratory bird species protected by the MBTA appears in 50 CFR §10.13, and represents almost all avian families found in North America. In Alaska, all native birds except grouse and ptarmigan are protected under the MBTA; grouse and ptarmigan are protected and managed under State of Alaska regulations. Under the MBTA, it is illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations.

Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions (66 CFR §3853). In particular, Federal or Federally-funded construction work must avoid destroying the active nests of species protected under the MBTA.

5.10.1 Affected Environment

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on migratory birds in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Foot surveys to evaluate migratory bird usage of the Mertarvik area were conducted in early June 2005 by a USACE biologist (USACE 2005b). These surveys broadly characterized species present, relative abundance, and habitat associations during the early portion of the egg-laying period for most birds. Approximate routes for the foot surveys are depicted in Figure 43. A summary of the observations is presented in Table 13.

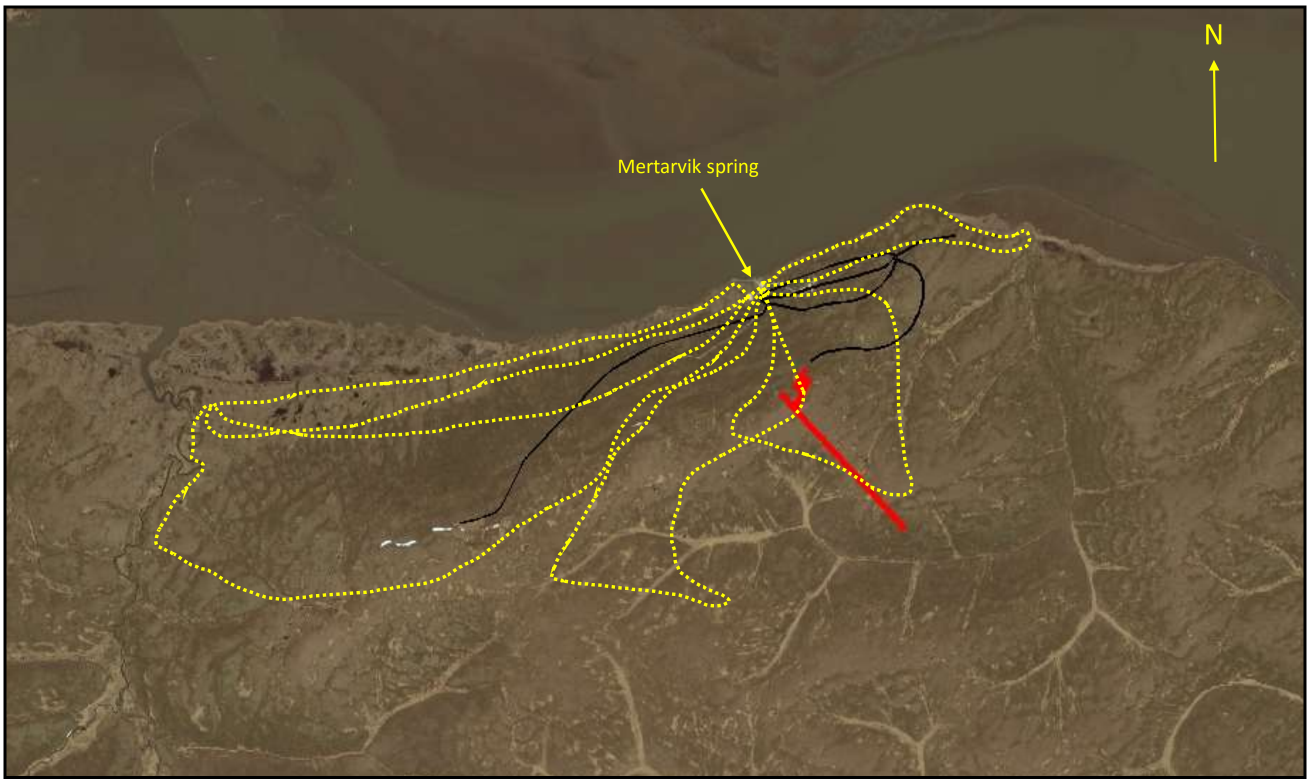


Figure 43. Routes hiked (yellow lines) during the 2005 bird habitat surveys (USACE 2005b). The spring area was used as a base camp during the surveys; black lines represent roads of a proposed Mertarvik town site. The proposed runway location is shown in red.

Table 13. General Bird Descriptions

Species	Description
Black Turnstone	Observed along the shore near our campsite on several occasions.
Bar-tailed godwit	A male was observed several times a day foraging on the shore near the camp. A female was seen less frequently. A female on a nest with four eggs was found on the south side of the ridge, approximately 1.5 miles from camp.
Western sandpiper	The most common shorebird observed near the relocation site.
Red-necked phalarope	Common. Often seen foraging on ponds and in pools on streams.
Short-eared owl	Uncommon. One observed on higher ground about a mile south of camp. Remained in area, but no nest observed.
Parasitic jaeger	Common. Several observed daily near camp and during hikes. Most abundant jaeger species.
Long-tailed jaeger	Common. Several observed daily near camp and during hikes. A close second in abundance to parasitic jaeger.
Yellow wagtail	Common. Several seen daily, often perched on willows.
Lapland longspur	Abundant. Most common passerine, some nesting near camp. Often found concentrated on the few remaining snowdrifts on the hillside or along the steep banks near the coast where they forage for seed and insects.
Redpoll	Uncommon. A few seen during 8 days on site.
Willow ptarmigan	Abundant. Males observed constantly, a few females were flushed from nests in dense willows. Males very vocal.
Northern pintail	Common. Observed on the tundra and on ponds. Also seen in small numbers on the pool created by the fresh water spring next to camp.
Green-winged teal	Common. Observed on ponds. Also seen in limited numbers on the pool created by the fresh water spring next to camp.
Emperor goose	Common. Observed on the coastal wetlands and also along the shore at low tides. At low tides, they were commonly observed drinking freshwater runoff from melting snow of from the fresh water spring near camp. Local birds may have been non-breeders.
Long-tailed duck	Uncommon. A few seen or heard offshore or on ponds in coastal wetlands.
Black scooter	Uncommon. A few seen offshore and one pair seen on a pond perched on the hillside near the unnamed river.
Harlequin duck	Uncommon. One male observed on a gravel bar in the unnamed river. Harlequins are considered uncommon in the Y-K Delta since the habitat is unsuitable, but areas of Nelson Island appear to provide some useable habitat due to the mountain streams.
Mew gull	Abundant along the coast.
Glaucous gull	Abundant along the coast,

Waterfowl occupying the coastal wetlands (Figure 44) between the proposed Mertarvik community site and the Takikchak River to the west were also surveyed. The vegetation was low and the survey should be considered complete for waterfowl, but it is likely that some shorebirds were missed due to the large distance surveyed. A complete list of waterfowl species observed during the foot survey is included in Table 14.

Figure 44. Coastal wetlands at Mertarvik.

Table 14. Waterfowl Observations in Wetlands in June 2005.

Species	Number Observed
Northern pintail	19
Green-winged teal	18
Pacific Black Brant	3
Greater scaup	13
Canada goose	15
Cackling Canada Goose	9
Emperor goose	46
Mallard	3
Tundra swan	2
American Widgeon	2
Northern shoveler	19
Sandhill crane	1
Long-tailed duck	3
White-fronted goose	11
Western Sandpiper	38
Dunlin	42
Red necked phalarope	33
Arctic tern	3
Bar-tailed godwit	2
Black turnstone	7
Lapland longspur	8
Savannah sparrow	4

Species	Number Observed
Yellow wagtail	9
Mew gull	49

During the survey, most of the birds appeared to be foraging or resting. Most of these wetlands are very wet and probably subject to periodic inundation at the highest tides. Therefore, they are probably of low value as nesting habitat. However, birds likely use this area during pre- and post-nesting periods; non-breeders likely use the area during the breeding season. A fox was seen in the wetlands during the survey where it was likely foraging for eggs and/or rodents.

During the spring of 2005, the USACE requested that the USFWS provide expertise in assessing impacts to threatened and endangered species at the Mertarvik site on Nelson Island. USFWS biologists initiated intensive ground surveys of the Mertarvik site and nearby wetlands in June 2005.

Spectacled (*Somateria fischeri*) and Steller's (*Polysticta stelleri*) eiders were listed as threatened under the Endangered Species Act of 1973 in 1993 and 1997, respectively. Both species nest or have historically nested within the wetlands of the Y-K Delta. Kigigak Island, 14 miles west of the Mertarvik site, has a spectacled eider nesting concentration and is within designated critical habitat for those species. Baird Inlet Island, 4 miles west of Mertarvik, has a small spectacled eider nesting concentration (Wilson, 2016) and is not part of designated critical habitat for spectacled eiders.

Ideal nesting habitat for spectacled and Steller's eiders is a complex of sedge-grass meadows, pond shorelines, peninsulas, and islands (Dau 1974). On nesting grounds, they feed by dabbling in shallow freshwater or brackish ponds, or on flooded tundra (Dau 1974, Kistchinski and Flint 1974). Aerial photos at Mertarvik indicated approximately 430 acres of potential nesting habitat within the general area.

USFWS waterfowl experts Ellen Lance and Tim Bowman conducted a waterfowl nest survey of a 430-acre wetland complex near the proposed Mertarvik site on June 5, 2005. An initial reconnaissance of the area entailed walking the length of the wetland next to the uplands, followed by an intensive ground search through the marshy wetlands. Nearly all suitable nesting habitat within the proposed site at Mertarvik was searched. The wetland site surveyed consisted of a seawater-saturated brackish sedge meadow interspersed with tidal ponds. Lance and Bowman observed substantial numbers of waterfowl and shorebirds feeding and loafing in the wetland habitat (Table 15), but very few nests. Only two emperor goose nests (*Chen canagica*), two black turnstone nests (*Arenaria melanocephala*), and one mew gull (*Larus canus*) nest was found in the wetlands complex adjacent to the Mertarvik site. Nesting densities appeared far lower than what is typically encountered in other coastal areas of the Y-K Delta (Fischer et al.

2005). Service biologists considered the wetland habitat complex largely unsuitable for nesting waterfowl or shorebirds.

Table 15. Birds observed at the proposed Mertarvik town site coastal wetlands by the USFWS.

SPECIES	COMMENTS
Loon (unidentified) Gavia spp.	On pond in wetland
Sandhill crane (*Grus canadensis*)	Flying over wetland
Tundra swan (*Cygnus columbianus*)	Pairs and singles
Greater white-fronted goose (*Anser albifrons*)	Many; loafing in wetland
Emperor goose (*Chen canagica*)	Many; two nests found
Cackling Canada goose (*Branta canadensis*)	Many; loafing in wetland
Green-winged teal (*Anas crecca*)	Many
American wigeon (*Anas americana*)	Few
Northern pintail (*Anas acuta*)	Many
Northern shoveler (*Anas clypeata*)	Many
Greater scaup (*Aythya marila*)	One pair
Red-breasted merganser (*Mergus serrator*)	4 females, 1 male
Bar-tailed godwit (*Limosa lapponica*)	Few
Red-necked phalarope (*Phalaropus lobatus*)	Many
Common snipe (*Gallinago gallinago*)	Heard 1
Black turnstone (*Arenaria melanocephala*)	Many; two nests found
Dunlin (*Calidris alpine*)	Few
Western sandpiper (*Calidris mauri*)	Many; nesting in uplands, feeding in wetlands
Parasitic jaeger (*Stercorarius parasiticus*)	Few, flying
Long-tailed jaeger (*Stercorarius longicaudus*)	Few, flying
Mew gull (*Larus canus*)	Many; one nest found
Glaucous gull (*Larus hyperboreus*)	Few, flying
Arctic tern (*Sterna paradisaea*)	Few, flying
Willow ptarmigan (*Lagopus lagopus*)	Many; pairs, in uplands
Common raven (*Corvus corax*)	1 flying
Yellow wagtail (*Motacilla flava*)	Many; pairs, in uplands
Yellow warbler (*Dendroica petechia*)	Uplands
Grey-cheeked thrush (*Catharus minimus*)	2 singles
Savanna sparrow (*Passerculus sandwichensis*)	Many
Golden-crowned sparrow (*Zonotrichia atricapilla*)	Few, singing
American tree sparrow (*Spizella arborea*)	Many
Common redpoll (*Cardeulis flammea*)	Few; feeding on surface of snow
Lapland longspur (*Calcarius lapponicus*)	Many

5.10.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on migratory birds in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Potential impacts to migratory birds as a result of establishing a new community at Mertarvik involve both direct and indirect impacts. Direct impacts would occur from the conversion of bird nesting and foraging habitat to roads, buildings, and other community infrastructure. This loss would be permanent, but would only impact a small portion of the available bird habitat at the proposed Mertarvik site. The primary species that would be impacted, based on 2005 surveys, include Lapland longspurs and willow ptarmigan. These two species were observed nesting in the vicinity of the community site. A single bar-tailed godwit nest was observed on the high ground about 1.5 miles southwest of the proposed Mertarvik site in the same type of habitat that would be found at the proposed runway location. While the direct impacts of habitat loss have been minimized by the design of the preferred CLP alternative (see section 4.5), it is clearly impossible to relocate a community without having a new footprint that directly impacts habitat. However, vegetation clearing timing windows that have been prescribed by USFWS would be adhered to or adequate ground surveys would be conducted prior to construction to ensure that no established nests would be impacted during construction.

Indirect impacts are more varied and potentially impacts a much larger area, albeit to varying degrees. Disturbance from human activity (presence, noise) at the new community site would likely cause some birds to abandon this general area in favor of areas with less disturbance. While human activity would be constant in the new community, other areas in the vicinity could be impacted seasonally. For instance, emperor geese were observed foraging on the slopes of the small river valley approximately 3 miles to the west of the new community site. Human presence on foot or ATV would likely cause these geese to displace.

All-terrain vehicle (ATV) traffic will increase in the community and will likely extend to areas well beyond the community, potentially leading to impacts to migratory birds ranging from severe (e.g. nest trampling) to moderate (e.g. habitat degradation) or minor (e.g. temporarily displacing from disturbance, noise or physical presence). Impacts from ATV's could be minimized by establishing designated trails in resilient habitat (i.e. firm level ground) from the community to popular locations such as subsistence sites or connections to other communities on Nelson Island.

Hunting pressure for ptarmigan would likely increase in Mertarvik since it is heavily used ptarmigan habitat, and there is no ptarmigan habitat in Newtok. However, the waterfowl habitat near Mertarvik is poor compared to Newtok, so hunting pressure on waterfowl in Mertarvik would likely be less than is currently experienced in Newtok.

Potential impacts to Pacific Black Brant would likely remain unchanged as the community is developed at Mertarvik. Brant nest on Baird Inlet Island approximately 4 miles northwest of Mertarvik, but this nesting colony is still about the same distance as it is from Newtok. Changes in direct impacts are unlikely and increased impacts from aircraft overflight are unlikely. Aircraft flying over Baird Inlet Island would likely have the same altitude as they currently do when flying to or from Newtok, so the potential for change is unlikely. There is a much smaller Brant nesting area on the Baird Peninsula that is much closer to Newtok than Mertarvik, and this area would gradually see less disturbance over the years as air traffic to Newtok diminishes.

The USFWS has identified the time period between May 5 and July 25 as when migratory birds are most likely to be nesting in “shrub or open” habitat in the Y-K Delta region (USFWS 2009); the entire Mertarvik project area falls within this description. The USFWS recommends that construction projects avoid clearing vegetation or placing fill within potential nesting habitat during this time period, as the surest means of avoiding the destruction of active bird nests, eggs, or nestlings, thereby avoiding violations of the Migratory Bird Treaty Act. At Mertarvik, the risk of MBTA violations can be minimized by conducting fill-placement or ground-clearing activities prior to May 5 or after July 25, or performing preliminary vegetation-clearing outside the nesting period such that the future construction site no longer provides suitable nesting habitat. If ground-clearing work outside of the nesting period is not feasible, ground-nesting species can be excluded from an imminent construction site by laying tarps or other ground coverings at the site and/or placing deterrent devices (e.g., Mylar® flash-tape fastened to wooden stakes, etc.), prior to the start of and during the nesting season. These avoidance measures are discussed further in section 5.27.1

5.10.3 Significance Determination

No FAA significance threshold is available for impacts to “migratory birds”, as a resource category. The FAA guidance (FAA 2015) recommends evaluating the proposed actions for the potential to cause “adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;

The Denali Commission has determined that the environmental impacts on migratory birds associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of this resource, and not reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on migratory birds in the Mertarvik area.

5.11 Essential Fish Habitat and Anadromous Streams

Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity. Section 305(b)(2) of the MSFCMA requires Federal action agencies to consult with the NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

Similarly, the State of Alaska's Anadromous Fish Act (AS 16.05.871-.901) requires that a government agency provide prior notification and obtain permit approval from the Alaska Department of Fish and Game (ADFG) before altering or affecting the natural flow or bed of a specified river, lake, or stream, or to use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed of a specified river, lake, or stream.

5.11.1 Affected Environment

Nelson Island's encompassing waters, Baird Inlet, Ninglick River, Hazen Bay, Kangrilvar Bay, Kolavinarak River, and Etolin Straight, and several smaller streams, are designated as EFH under the North Pacific Fishery Management Council's fishery management plan for the salmon fisheries in the exclusive economic zone off Alaska. All five species of Pacific salmon, chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) are known to be present in these waters while exhibiting the marine juvenile, marine immature, or maturing adult life stages. No fish, juvenile or adult, were captured or seen in Mertarvik Spring.

The Ninglick and Takikchak Rivers are identified by ADFG in their "*Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes*." The intertidal Ninglick River is identified in the ADFG catalog as supporting coho and pink salmon. Meanwhile, the fresh waters of the Takikchak River are identified within the ADFG catalog as supporting coho salmon (ADFG 2017). Complementary to the ADFG catalog, data collected during biological baseline assessments in 2005 by USACE Alaska District biologists in support of the MEC at the Mertarvik community site on Nelson Island, noted all five species of Pacific salmon present in Takikchak River (Hoffman 2005).

5.11.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on essential fish habitat and anadromous streams in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Any impacts to EFH and anadromous waters associated with the project would largely be a function of the activities of barge and smaller vessel traffic along the Ninglick River and at the Mertarvik barge landing area, importing construction equipment and supplies. USACE Alaska District evaluated the impact of typical barge and landing craft activities upon EFH at the Mertarvik barge landing site (USACE 2008). The USACE determined that barge operations in support of the construction of the MEC would not result in significant long or short-term adverse impacts to EFH.

Because the barge landing area is now an improved structure, the possibility of EFH degradation by scour and short-lived potential increases in turbidity have been reduced to a negligible level. There will be no net loss of habitat or its quality, or change in its complexity. Underwater noise levels are not anticipated to rise above existing levels. Normal actions associated with barge and vessel traffic transiting the Ninglick River and landing at the Mertarvik barge landing area for the purposes of infrastructure development at Mertarvik do not pose a risk of short or long-term adverse effects to EFH or any of its constituent elements.

Due to the approximate 2-mile distance between the proposed Mertarvik community site and the Takikchak River (Figure 45), no adverse impacts to the anadromous waters of the Takikchak River are anticipated as a result of actions described in this EIS. No fish habitat permits under AS 16.05.871-.901 are expected to be required for the proposed action, as no modification to fish-bearing waters is planned.

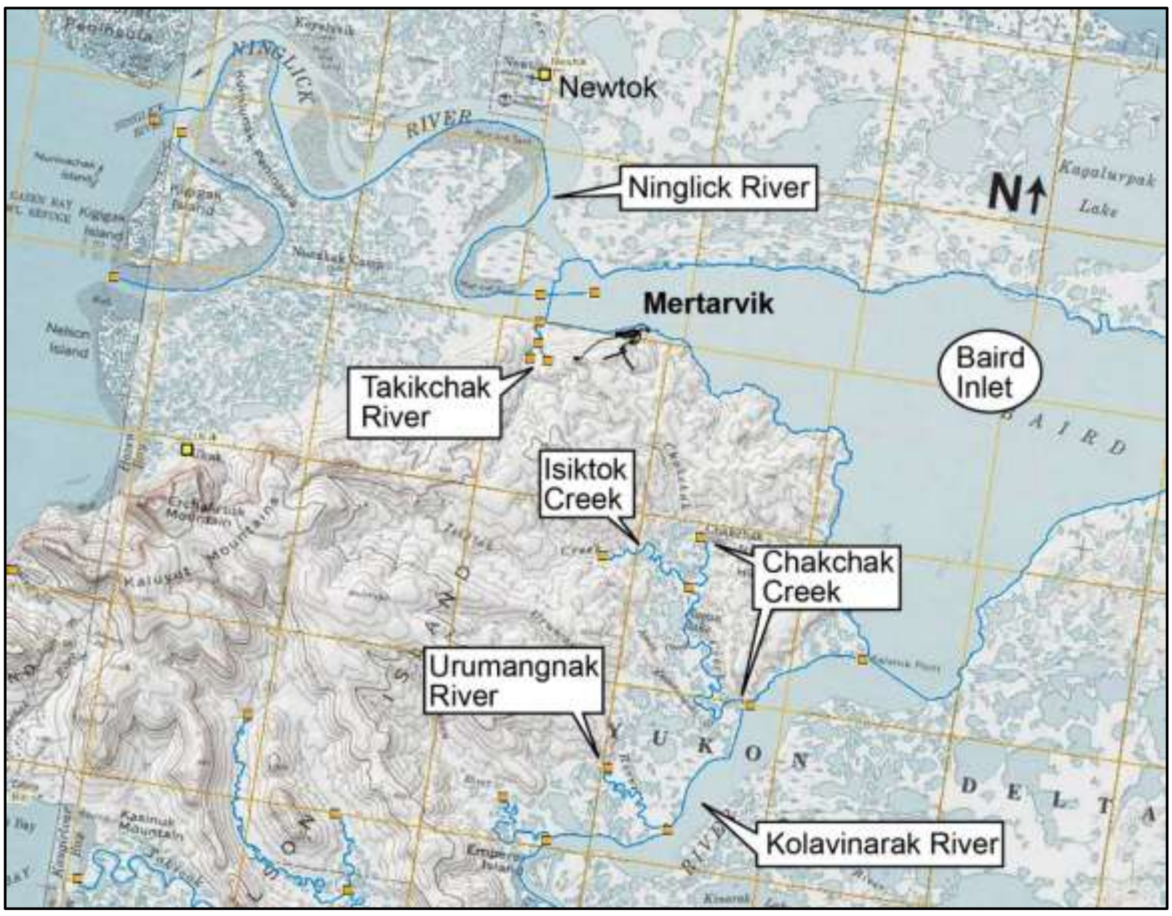


Figure 45. A screen shot from the ADFG Anadromous Waters Catalog online mapper, annotated to identify cataloged streams and waterbodies of north and east Nelson Island.

5.11.3 Significance Determination

No FAA significance threshold is available for impacts to EFH or anadromous streams as resource categories. For its resources category of "biological resources", the FAA provides non-threshold factors for this resource category that may be applied to the resources described in this section. The FAA guidance (FAA 2015) recommends evaluating the proposed actions for the potential to cause:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required for population maintenance.

None of the CLP alternatives are expected to create impacts similar to those listed above, with regards to EFH and anadromous streams. The Denali Commission has determined that the environmental impacts on EFH and anadromous streams with the implementation of any of the three CLP alternatives will not noticeably alter any important attribute of the resource, and not reach the threshold of significance as defined in section 5.1 (MINOR).

Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, the Denali Commission has also determined that none of the CLP alternatives will have an effect on Essential Fish Habitat.

The no action alternative would have no impact on EFH or anadromous streams in the Mertarvik area.

5.12 Wetlands and other Special Aquatic Sites

5.12.1 Affected Environment

Special aquatic sites, identified as part of the Clean Water Act (subpart E, 40 CFR §230) are waters of the U.S. (WOTUS), 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. The following ecosystems are considered to be special aquatic sites:

- Wetlands
- Coral reefs
- Sanctuaries and refuges

- Mudflats
- Vegetated shallows
- Riffle and pool complexes

Wetlands are the only special aquatic site found at in the project area. Wetlands are defined as those areas inundated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. In order for an area to meet the joint USACE-EPA definition of wetland, the area must meet the three parameters of appropriate hydrology, soils, and vegetation.

Wetlands perform a variety of important biological, chemical, physical, and hydraulic functions and are considered some of the most valuable ecosystems on earth. These functions include habitat for innumerable species at various life stages, nutrient assimilation, water purification and storage, storm energy attenuation, and countless other valuable ecosystem services. These functions are valuable to people and can be measured in terms of flood risk reduction, revenues generated by hunting and fishing, reduced costs of water treatment, and other metrics.

Wetlands occur more frequently at higher latitudes, largely because the cooler climate provides less opportunity for evaporation, which is part of the reason 43 percent of Alaska's surface area is covered by wetlands (Hall et al. 1994). A wetland delineation conducted in 2005 indicated that the area of the proposed action is approximately 93 percent wetlands; predominantly palustrine scrub-shrub (58percent of the study area), followed by palustrine emergent/scrub-shrub covering 16 percent of the study area, palustrine emergent comprising 12 percent of the study area, and estuarine wetlands contributing 8 percent to the total study area (USACE 2005d). This distribution of wetland areas is consistent with the rest of the Y-K Delta region: a vast area of about 50,000 square miles underlain by permafrost between the Yukon River in the north and Kuskokwim River in the south, dominated by wetlands, lakes, and slow, meandering rivers.

The wetlands in the area of the proposed action are WOTUS due to their surface and shallow subsurface hydraulic connection to the tidally influenced Ninglick River, thus, placing the wetlands under the jurisdiction of the USACE through its authority under Section 404 of the Clean Water Act (CWA). Proposals to place dredged or fill material into wetlands under the jurisdiction of the USACE require authorization from the District Engineer. The 2005 Wetland Delineation report is in Appendix C, Wetlands Delineation for the New Village of Newtok, Alaska.

Seven categories of wetlands were identified during the 2005 delineation (USACE 2005d), and each is described below, in descending order of total area (Figure 46). The level of detail in Figure 46 is necessarily constrained by page-size; more detailed wetland delineation maps are available in Appendix C and Appendix D.

Palustrine scrub-shrub Wetlands (1,841 acres)
The palustrine scrub-shrub wetlands represent about 58 percent of the delineated area and were separated into the following subclasses depending on the habitat of the dominant species: palustrine scrub-shrub evergreen wetlands dominated by crowberry tundra and birch-ericaceous shrub communities (937 acres), palustrine scrub-shrub/moss peat wetlands where sphagnum and low growing shrubs are the main component of the vegetation community (580 acres), and palustrine scrub-shrub broad leaved-deciduous dominated by willow (*Salix pulcha*) (324 acres). Palustrine scrub-shrub evergreen wetlands were found within the proposed Mertarvik community site. The palustrine scrub-shrub/moss peat wetlands are located at a slightly higher elevation, usually on mounds of about 1 foot in height. Palustrine scrub-shrub broad-leaved deciduous wetlands are well spread out in the general sampled area along several drainage ways and depressions.

Palustrine Emergent Persistent Scrub-shrub Wetlands (495 acres)
Palustrine emergent persistent/scrub-shrub wetlands represent approximately 16 percent of the total delineated area. They were divided into two groups: palustrine emergent persistent/scrub-shrub evergreen/moss (255 acres) and palustrine emergent persistent/scrub-shrub broad-leaved deciduous (240 acres). Palustrine emergent persistent/scrub-shrub/moss are wetlands located at the foot hills, with a similar component of low growing evergreen species as the palustrine scrub-shrub evergreen wetlands (top plateau), but with a conspicuous cover of tussock cottongrass (*Eriophorum vaginatum*). These wetlands also have a large component of rust-color sphagnum, which gives this community a rusty color and a deep 16-foot peat layer. Palustrine emergent persistent/scrub-shrub deciduous wetlands are dominated by bluejoint grass but have about 25 percent of willow cover. The vegetation community seems to be an intermediate state between willow-dominated communities and bluejoint grass meadows. They are found along drainage ways, depressions and slopes and have a large component of wildflowers, herbs, and ferns.

Palustrine Emergent Persistent Wetlands (370 acres)
Palustrine emergent persistent wetlands represent about 12 percent of the total delineated area. They are usually located in drainage ways and in depressions where snow persists until late spring. The communities are typically dominated by bluejoint grass with few herbs and almost no willows. Herbs within these communities include *Petasites frigidus*, *Equisetum* sp., *Athyrium filix-femina*, dwarf dogwood (*Cornus suecica*), and *Angelica lucida*. They are well-distributed within the delineated area but are usually common near willow thickets. Palustrine emergent persistent wetlands also include wet sedge meadow tundra dominated by *Carex aquatilis*, *Potentilla palustris* and green sphagnum. Wet sedge meadow tundra is usually found in areas with standing water along drainages that cross the bottom hills, lake fringes, and crisscross the top plateau tundra.

Figure 46. Categories of wetlands and uplands delineated in the Mertarvik area (USACE 2005d) Figure 47 shows the converse image, the wetland types within the construction footprint.

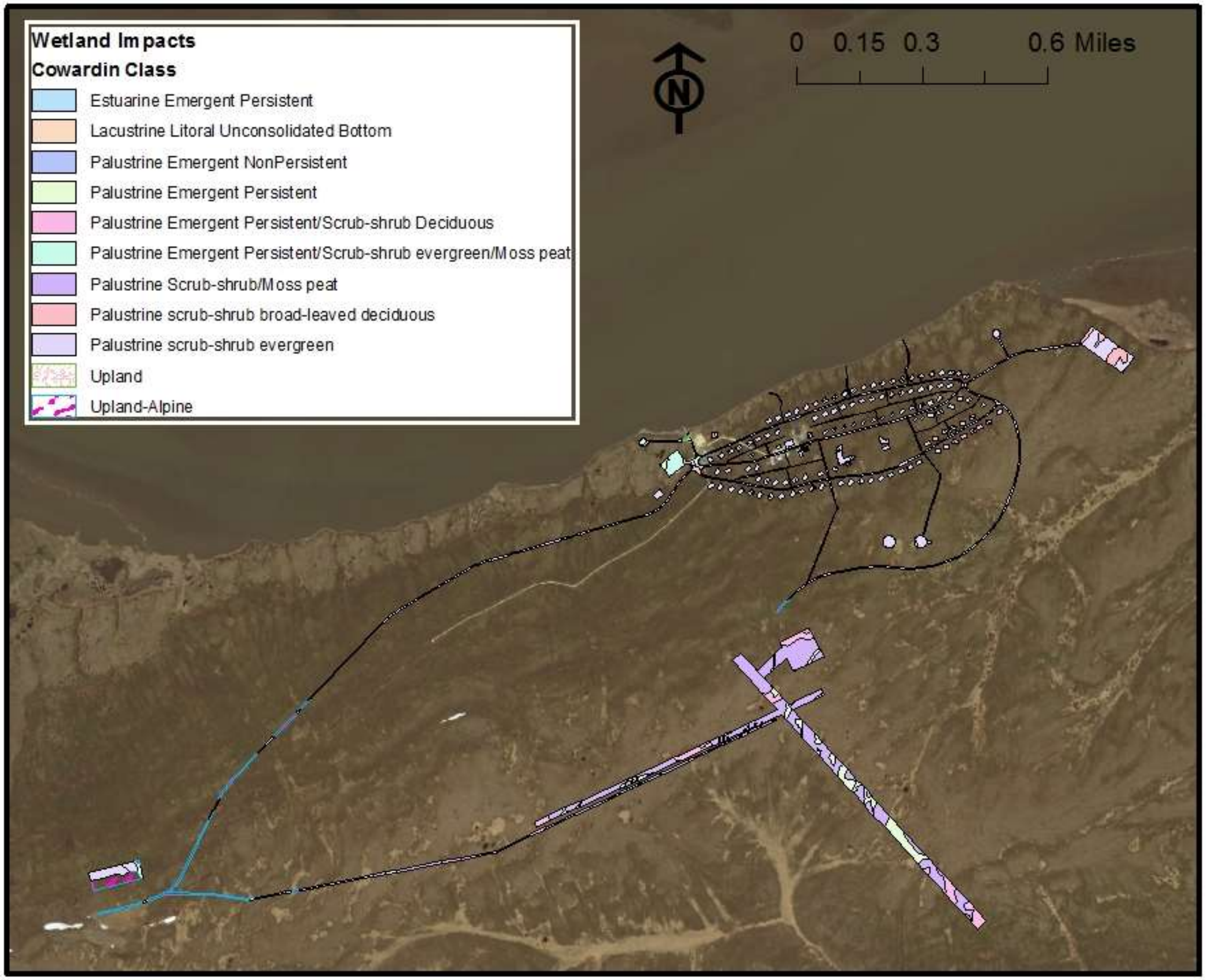


Figure 47. Direct impacts on wetlands by the proposed community layout at Mertarvik.

Estuarine Emergent Persistent Wetlands (250 acres)

Estuarine emergent persistent wetlands represent approximately 8 percent of the total delineated area. They are found in tidally influenced mudflats. Dominant species are tolerant to brackish water conditions, forming monotypic stands of Lyngby's sedge (*Carex lyngbyei*) communities or forming patches between tidally deposited mineral silts and clays as in the case of *Puccinellia phryganodes* and *Plantago maritima*. Bluejoint grass and beach rye grass (*Elymus arenarious*) are found at the inland fringes of these estuarine wetlands. About 236 acres are at the mouth of the Takikchak River and 14 acres at the mouth of the east drainage area.

Lacustrine Littoral Unconsolidated Bottom Wetlands (5 acres)

Lacustrine littoral unconsolidated bottom wetlands represent less than 1 percent of the total delineated area. These standing water habitats are usually at the bottom hills and, to a lesser degree, at the top of a plateau. They are formed in topographic depressions where snow pack and rainfall permanently accumulate, forming shallow fresh water ponds. With silty organic unconsolidated bottoms, these ponds only provide habitat for aquatic vegetation at their fringes, where light penetrates deep enough.

Palustrine Emergent Non-persistent Wetlands (0.42 acres)

Palustrine emergent non-persistent wetlands represent less than 1 percent of the total delineated area. These wetlands are usually found in small areas but are common along the fringes of small ponds, so they are difficult to delineate on a large-scale map. The dominant submerged species is common marestail (*Hippuris vulgaris*).

Uplands (221 acres)

Uplands represent about 7 percent of the total delineated area. They are mainly located on the windswept north facing slopes and at the sloped outskirts of the bottom hills, and exist in small, discontinuous fragments. At the upper slopes, the prostate vegetation is characterized by the presence of alpine species (arctic willow, dwarf azalea, alpine smartweed, net-vein willow, etc.) and a thick root mat. Bearberry is abundant as well. Soils are shallow and gravelly with an abundance of basalt outcrops. Lichens such as *Cetraria cucullata, Cladonia rangifera, Cladonia* sp.*, Thamnolia vermicularis,* and fruticose lichens dominate most of the ground cover, and crustose lichens are abundant in the basalt outcrops. The outskirts of the lower hills were also considered uplands because they did not meet hydric soil indicators.

5.12.2 Environmental Impacts

The selection of any of the proposed alternatives has the potential to impact wetlands, a special aquatic site category. Where the activity associated with a discharge that is proposed for a special aquatic site does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. In addition, where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge that do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise.

As described in the previous section, wetlands dominate the Mertarvik area, with uplands existing in fragments too small and discontinuous to be preferentially targeted for construction impacts. All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on wetlands and other special aquatic sites in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Impacts to wetlands have been quantitated using the best available information. Figures 46, 47, and 48 were generated using ArcGIS to superimpose the preferred CLP footprint onto the 2005 wetlands delineation data. The overlapping area, plus a conservative buffer area, was used to estimate the acreage of direct impacts to wetlands from all infrastructure elements other than airport features. For the airport, a November 2017 environmental study prepared for ADOTPF (PDC Engineers 2017) included an updated wetland impact evaluation focused on just the proposed airport, incorporating more detailed assumptions about overburden disposal, embankments and construction work areas. Relevant excerpts from the airport environmental study are provided in Appendix D.

Thus, the acreages discussed below are estimated values drawn from two different studies. These numbers are very much subject to change as the designs of the different infrastructure features are developed and refined, and should be regarded as illustrating the general magnitude of effects, rather than firm statements of impacts. As such, where there is overlap between the two sets of acreage values (e.g., the airport access road), we have expended limited effort in parsing out the different impacts, instead allowing some minor redundancy, and therefore additional conservatism, to exist in the numbers. As is described at the end of this section, the impacts to wetlands from individual infrastructure features will be assessed again, in greater detail, when CWA Section 404 discharge permits are applied for prior to construction.

Section 4.6.1 and Table 3 describe footprint areas for the completed CLP infrastructure elements. About 24,700 linear feet of road, 13,135 linear feet of trails, 1.8 acres of the quarry, about half of the 0.97-acre Class III Municipal Solid Waste Landfill, the entire 14-acre wastewater treatment lagoon, the entire 0.98-acre well field and water storage tank, and all 10.83 acres of building pads would be constructed in wetlands. Roads totaling 24,700 feet long and 30 feet wide would result in wetland impacts of 20.86 acres, with an additional 3.4 acres of upland impacts (Figure 47, Figure 48 and Figure 49).

The Class II Municipal Solid Waste Landfill would destroy 0.49 acres of palustrine scrub-shrub (PSS7) wetlands. The quarry is a total of 3.58 acres: 1.78 acres of which are uplands, 1.56 acres are palustrine scrub-shrub evergreen (PSS7), and 0.23 acres are palustrine emergent persistent (PEM1). When material extraction from the quarry is complete, the excavation would likely naturally be converted to open water habitat as it fills with groundwater and precipitation. This would have the effect of creating open-water habitat, which is less abundant in the immediate area of the proposed action than the palustrine wetlands that would be lost. This open water habitat would likely be greater than 6 feet deep and could retain an ice-free profundal zone that could provide overwintering habitat for fish. The well field, water storage tanks, and wastewater treatment lagoon would impact a total of 4.98 acres of wetlands: 3.48 acres of palustrine scrub-shrub evergreen (PSS7) wetlands, 1.46 acres of palustrine scrub-shrub broad leafed deciduous (PSS1), and 0.04 acres of palustrine emergent persistent (PEM1) wetlands would be lost.

Approximately 42,635 feet of road and trail would be constructed in conjunction with infrastructure development and construction access; most of that length would be constructed perpendicular to the direction of flow. If the road fill is placed to permafrost depth, it could interrupt the movement of water downslope, instigating ponding up-gradient of the linear feature, and desiccation down-gradient of the road. Due to the extensive use of modular composite road panels, placement of fill to permafrost depth is unlikely to be required. Of the 20.86 acres of wetland impacts from infrastructure road construction, 13.45 acres would be constructed in palustrine scrub- shrub evergreen (PSS7) wetlands, 3.4 acres would be constructed in palustrine broad leafed deciduous (PSS1), and 2.71 acres would be constructed in palustrine emergent persistent/palustrine shrub-scrub/palustrine moss-lichen wetlands (PEM1/PSS/PML). The remaining 1.1.3 acres of wetland impacts would be distributed across palustrine emergent persistent (PEM1), palustrine scrub-shrub (PSS), and palustrine moss-lichen (PML) communities. Uplands (UPL) totaling 1.7 acres would also be impacted. The construction access road would be 4,800 feet long and impact a total of 2.5 acres of wetlands; 1.78 acres of palustrine scrub-shrub/moss lichen wetlands, 0.48 acres of palustrine emergent persistent/scrub-shrub wetlands, and 0.24 acres of palustrine emergent persistent wetlands. Upland areas totaling 0.79 acres would also be impacted by the construction of the airfield access road. Trail construction would impact a total of 2.32 acres of wetlands: 1.62 acres of palustrine scrub-shrub evergreen (PSS7), and 0.64 acres of palustrine scrub-shrub broad leafed deciduous (PSS1); the remaining 0.07 acres of wetland impacts would be spread across palustrine emergent persistent, palustrine scrub-shrub, and palustrine moss-lichen wetlands. Uplands totaling 0.03 acres would also be impacted.

Building pads would impact a total of 10.83 acres of wetlands. Palustrine scrub-shrub evergreen (PSS7) wetlands would lose 7.94 acres, palustrine scrub-shrub broad leafed deciduous (PSS1) wetlands would lose 2.84 acres, and palustrine emergent persistent (PEM1) and palustrine emergent persistent/palustrine scrub-shrub/palustrine moss-lichen (PEM1/PSS/PML) wetland communities would lose 0.02 acres each.

From the buildout of non-airport infrastructure, the total area of impacts to wetlands is estimated to be about 45 acres distributed across two each sixth-level hydrologic units (HUC 6) with a combined area of 441,550 acres. Palustrine scrub-shrub evergreen (PSS7) wetlands would experience the greatest loss, a total of 28.68 acres for the entire proposed action. Palustrine scrub-shrub/palustrine moss lichen (PSS/PML) communities would lose 1.98 acres, palustrine scrub-shrub broad leafed deciduous communities would lose 8.71 acres, palustrine emergent persistent (PEM1) communities would lose 1.53 acres; 4.61 acres of palustrine emergent persistent/palustrine scrub-shrub (PEM1/PSS) would be filled, and 2.77 acres of palustrine emergent persistent/palustrine scrub-shrub/palustrine moss-lichen (PEM1/PSS/PML) would be impacted. Upland impacts could be as great as 6.13 acres. Some wetlands surrounding the fill could experience greater construction-caused desiccation down-gradient of roads, but due to the scale of the impacts and abundance of similar wetlands in the watershed, infrastructure development at Mertarvik would not have a significant cumulative impact on wetlands.

Total buildout of the airport, which includes the runway, possible crosswind runway, apron, taxiway, access road, temporary haul road, and expanded quarry was estimated in the ADOTPF environmental study (PDC Engineers 2017; Appendix D) to impact 232 acres. For this analysis, the crosswind runway has been excluded; when the crosswind runway is excluded, the following acreage is estimated for the wetland categories:

- Palustrine Scrub-Shrub/Moss Peat (PSS/ML1) – 131.32 acres
- Palustrine Emergent Persistent (PEM1) – 36.7 acres
- Palustrine Emergent Persistent/Scrub-Shrub Deciduous (PEM1/SS6) – 20.4 acres
- Palustrine scrub-Shrub evergreen (PSS7) - 14.80
- Lacustrine Littoral Unconsolidated Bottom - 0.27 acres

The airport construction also includes surficial disposal of excess overburden excavated from the runway and taxiway footprints. This disposal method is expected to involve spreading of a thin layer of mineral soils over approximately 35 acres of existing tundra surface. Spreading in this fashion is intended to allow rapid growth of plant materials through the thin mineral soil layer spread, and is likely to alter the vegetation types growing within the disposal area, but without destroying its value as habitat in the future.

A functional assessment was performed to quantify the functions provided by the six Cowardin classes of wetlands that would be impacted by the construction of the Mertarvik Infrastructure Relocation Project. The Alaska Regulatory Best Professional Judgment Characterization (ARBPJC) methodology presented in Regulatory Guidance Letter (RGL) 09-01 was used, absent a more appropriate method. No implication of compensatory mitigation was included in the assessment. Data forms from the 2005 wetland delineation conducted by the USACE Regulatory Division were used to complete the ARBPJC forms. The functional assessment multipliers for each Cowardin class were applied to the acreage of impact associated with each infrastructure feature. The product was multiplied by the pre- and post-project conditional assessment in order to generate a functional differential between pre-and post-project conditions, expressed as a functional capacity unit. The pre- and post-project conditions were quantified using the North Slope Rapid Assessment Methodology (NSRAM) developed by the Engineer Research and Development Center (ERDC) for the Alaska District using ArcMap 10.4.1. The combination of functional and conditional assessments allows for the estimation of the loss of wetland functions as a result of the proposed project. The functional assessment report is included in this EIS as Appendix C and reflects the potential loss of 6.2 functional capacity units as a result of the project. This functional assessment was based on electronic drawings of the CLP provided by the ANTHC, and does not include the construction design data developed more recently for the airport features (PDC Engineering 2017). The functional assessment in Appendix C no longer precisely quantifies the functional degradation related to full build-out of the Mertarvik Infrastructure project, but is expected to be representative of the types of impacts across various wetland subclasses.

The proposed action has not yet been evaluated by the Regulatory Division of the USACE Alaska District, the enforcement agency for section 404 of the CWA in Alaska, and permitting authority for the placement of fill in wetlands. The Regulatory Division has stated that it will not issue permits for the project as whole as described in this DEIS because of the uncertain project timeline and insufficient details on construction methods and other potential site-specific impacts. The expectation is that entities involved in the proposed construction of various components of the proposed infrastructure that involve the placement of fill materials into WOTUS will apply for the DA permits required for their specific actions. The USACE Regulatory Division will make its own independent evaluation of the environmental impacts and significance of the proposed discharge and the appropriate level of mitigation required. The USACE permit review process is the NEPA analysis process and includes public notice, consultations with resource agencies, consideration of comments received, written evaluation of environmental impacts, and compliance determinations with the CWA Section 404(b)(1) Guidelines. Under section 401 of the CWA, the ADEC will independently certify that the proposed construction of various components of the proposed infrastructure that involve the placement of fill materials into WOTUS complies with the State Water Quality Standards for actions within State waters and issue a Certificate of Reasonable Assurance (CRA).

5.12.3 Significance Determination

Under the FAA significance criteria for wetlands (FAA 2015), a significant impact exists if the action would:

- Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;
- Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;
- Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);
- Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands;
- Promote development of secondary activities or services that would cause the circumstances listed above to occur; or
- Be inconsistent with applicable state wetland strategies.

The Denali Commission has determined that none of the three CLP alternatives, as proposed, would meet any of the significance criteria defined above for wetlands (LESS THAN SIGNIFICANT).

The no action alternative would have no impact on wetlands and other special aquatic sites in the Mertarvik area.

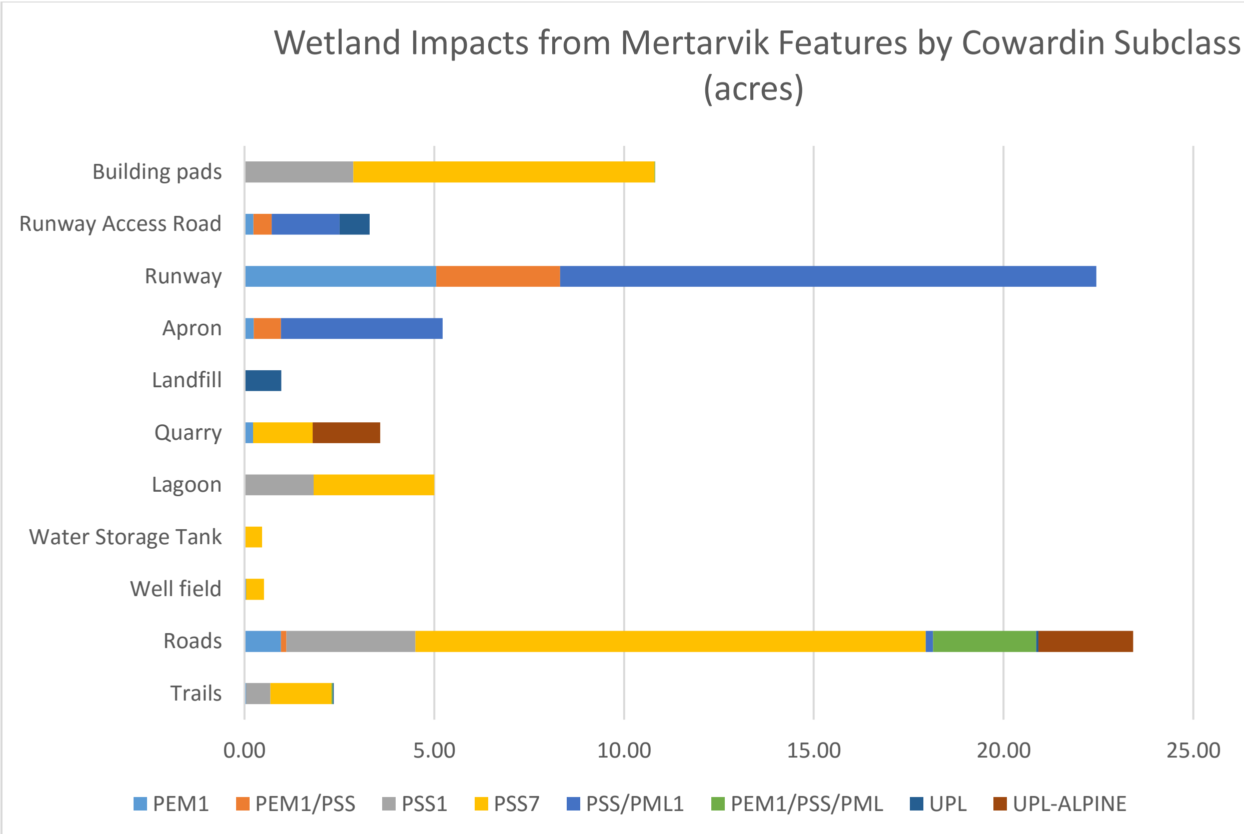


Figure 48. Acreage of impacts on wetlands (by Cowardin subclass) associated with feature types.

Symbol	Cowardin Subclass
PEM1	Palustrine Emergent Persistent
PEM1/PSS	Palustrine Emergent Persistent/Scrub-shrub
PSS1	Palustrine Scrub-shrub Broad-leaved Deciduous
PSS7	Palustrine Scrub-shrub Evergreen
PSS/PML1	Palustrine Scrub-shrub/Moss Lichen (Moss)
PEM1/PSS/PML	Palustrine Emergent Persistent/Scrub-shrub/Moss Lichen
UPL	Upland
UPL-ALPINE	Upland-Alpine

Figure 49. Key to Cowardin Wetland Classifications Identified at Mertarvik.

5.13 Protected Lands

5.13.1 Affected Environment

The only federally protected land in the area of the proposed action is the Yukon Delta National Wildlife Refuge (NWR), which surrounds the proposed Mertarvik community site. The refuge is one of the largest refuges in the nation, at 22 million acres, and is managed by the USFWS from the refuge headquarters office in Bethel, Alaska (Figure 50).

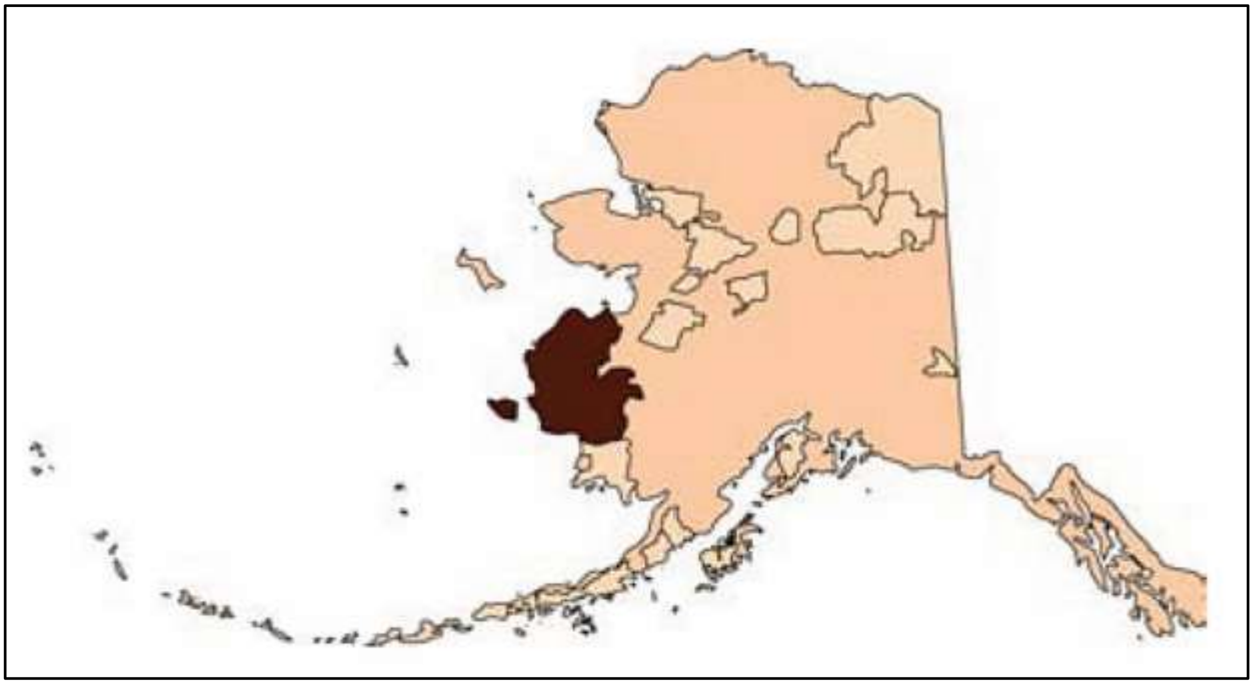


Figure 50. Extent of the Yukon Delta NWR (dark red) within Alaska (USFWS 2017).

The Yukon Delta NWR has expanded and evolved several times during its history. The first refuge lands were set aside by President Theodore Roosevelt in 1909 as a preserve and breeding ground for native birds. In 1929, Nunivak Island was set aside as a refuge and breeding ground for wild birds, game, and furbearing animals. In 1930, the small islands and all lands under the waters surrounding Nunivak Island were added to the refuge. Additional lands were reserved in 1937 when Hazen Bay Migratory Waterfowl Refuge was established. The Kuskokwim National Wildlife Range, established in 1960, was enlarged in 1961, and its name changed to the Clarence Rhode National Wildlife Range. With enactment of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980, these existing ranges and refuges were combined and enlarged to establish the Yukon Delta NWR. The ANILCA also established the Andreafsky and Nunivak Wilderness Areas and designated the Andreafsky River as a Wild and Scenic River. With the exception of several small additions to the refuge through land exchanges or purchases, all lands that now make up the refuge were in the public domain prior to refuge designation (USFWS 2017).

As described previously, the proposed Mertarvik community site is on land that was once part of the refuge, but was exchanged in 2003 to provide land for the relocation of the residents of Newtok. The USFWS transferred 10,943 acres of refuge land to the Newtok Native Corp in exchange for 12,101 acres of land from the NVC (Figure 13).

There are no State of Alaska-designated conservation areas, such as game refuges, wildlife sanctuaries, wildlife ranges, or critical habitat areas, in the vicinity of the proposed action (ADFG 2017b). The Mertarvik area is within ADFG Game Management Unit (GMU) 18. Hunts for black bear, brown bear, caribou, moose, muskox, wolf, and wolverine are permitted and managed within this GMU (ADFG 2017c).

The National Wild and Scenic Rivers System was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition. The nearest designated Wild and Scenic River to Mertarvik is the Andreafsky River, roughly 95 miles to the north.

5.13.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on protected lands in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

None of the CLP alternatives would directly impact Yukon Delta NWR lands or State of Alaska conservation areas, as none now exist in the immediate proposed action vicinity. The new boundaries of the refuge created in the Mertarvik area by the 2003 land transfer are set back several miles from where the community layout is planned, and the nearest refuge wilderness area is roughly 90 miles away on Nunivak Island; this distance attenuates the potential for indirect impacts on the refuge. Newtok residents have long used the Mertarvik area and the refuge lands for subsistence, and they assert that living at Mertarvik versus Newtok will not substantially alter their subsistence hunting and gathering patterns. Therefore, the establishment of a new community at Mertarvik should not result in significant new impacts on refuge wildlife resources. It is possible that the presence of a new community at Mertarvik, and increased overland travel on Nelson Island trails, may alter the distribution of large game animals, such as muskox and bear, but only in minor ways. The Andreafsky Wild and Scenic River is about 95 miles to the north of the project area, in a different watershed. The development at Mertarvik would have no direct or indirect impacts on that river.

The operations at the planned airport at Mertarvik will be replacement operations for those at Newtok Airport and exist in the same overall vicinity as the communities would only be 9 miles apart and aircraft accessing either over fly the same general area. Therefore, while flight patterns over a highly-localized part of the refuge (in the immediate vicinity of Newtok and the Mertarvik town site) may change, total flight operations overall are not expected to change. Also, as previously noted, some as yet unknown change in flight operations may occur temporarily while both airports are operational.

5.13.3 Significance Determination

The Denali Commission has determined that the environmental impacts on protected lands associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources (MINOR), and not reach the threshold of significance as defined in section 5.1.

The no action alternative would have no significant impact on protected lands in the Mertarvik vicinity.

5.14 Cultural History and Cultural Resources

5.14.1 Affected Environment

5.14.1.1 Cultural History

Local Cultural History

The cultural history of the Y-K Delta region has not been thoroughly studied by archaeologists or historians. The earliest known archaeological sites in the region date to approximately 1,550 years before present (BP), during the archaeological classificatory tradition known as the Norton culture. In the Y-K Delta, Norton occupation is thought to span from approximately 1,500–950 BP. Shaw (1983) identifies a significant change in artifact inventories from multiple sites around 950 BP; this cultural material appears to be associated with the Western Thule culture, a widespread cultural group who followed the people of the Arctic Small Tool tradition into the Bering Strait region around 1,000 BP, and then moved south into Norton territory shortly thereafter. The Western Thule are thought to be the direct ancestors of modern Yup'ik, Cup'ik, and Iñupiaq indigenous populations.

Regional Cultural History

Dumond (1984) has divided the cultural history of southwestern Alaska into the Paleoarctic, Northern Archaic, Arctic Small Tool, Norton, and Thule traditions. Most of the data for this reconstruction come from areas to the south of the Y-K Delta, and may not accurately represent the Newtok region. The Paleoarctic tradition is marked by blade and core technology. Microblades, cores, and core tablets were recovered along with large blades, transverse burins, and scrapers. The radiocarbon data suggest that the Paleoarctic Tradition existed from approximately 10,000 to 8,000 BP. The Paleoarctic Tradition was followed by the Northern Archaic Tradition, which dates to approximately 6,000–3,000 BP. Chipped lanceolate projectile points or knives, heavy chopper-like semilunar scrapers, and small endscrapers are representative of this tradition. In southwestern Alaska, the Brooks River Beach Ridge phase from the upper Naknek River drainage is associated with the Northern Archaic. Based on recovered tool types, Dumond (1984) suggested that subsistence strategies focused on land-based resources. The Arctic Small Tool Tradition appeared in the Naknek River drainage around 4,000 BP. The average tool assemblage consists of microblades, small burins, small bifacially chipped sideblades and endblades, unifacially flaked knives, triangular bifacial harpoon endblades, adze blades with polished bits, and an occasional lance or double-edged knife blade. Artifacts recovered from ancient village and camp sites indicate that some winter and most summer occupations focused on salmon and other riverine resources (Dumond 1984).

In southwestern Alaska, the Norton Tradition is represented by three phases that date between 2,300–950 BP. The earliest phase, the Smelt Creek phase, has plain and impressed fiber-tempered pottery, small non-stemmed projectile points, and large stemmed projectile points. The Brooks River Weir phase was derived from the Smelt Creek phase, with changes in the style of endblades, sideblades, and ground slate ulu forms. Pottery also changed shape, increased in size, and was more often check-stamped than plain. New styles of projectile points mark the third phase, the Brooks River Falls phase. During this time period, sideblades declined while ground slate ulus increased in popularity, and large, double-edged, ground slate knives and lance blades became common. The pottery became primarily plain and very thick (Dumond 1984).

The Western Thule Tradition dates from approximately 950–150 BP; the Thule people are thought to be the direct ancestors of modern Yup'ik, Cup'ik, and Iñupiaq peoples. Three distinct phases have been identified in southwestern Alaska – the Brooks River Camp, Brooks River Bluffs, and Pavik phases. Large barbed and stemmed ground slate lance and knife blades, and thick plain pottery dominate the Brooks River Camp phase. The Brooks River Bluffs phase shows fewer large lance blades; also, the style of projectile inset blades and adze blades changed and relatively thin plain pottery appeared. The last phase, the Pavik phase, contains Russian and American trade goods. Metal trade goods replaced most stone implements with the exception of ground slate inset blades. Across all three phases, osseous tools included non-toggling harpoon heads, occasional toggling harpoon heads, dart heads with inset tips, and other arrow forms designed for birds and land mammals. Settlements of significant size began to appear on the coast, and a dichotomy between interior and coastal subsistence focuses became apparent in the archaeological record during this time period (Dumond 1984).

5.14.1.2 Previous Archaeological Investigations at Mertarvik

USACE Alaska District and USFWS archaeologists surveyed the Mertarvik area, including the proposed Mertarvik site, in 2002 and 2005 (Grover 2007). These surveys identified several archaeological sites near the mouth of Takikchak River and Mertarvik Spring, mutually identified as part of an old winter camp and reindeer herding station called *Taqikcaq* (XBI-156, XIB-157, and XBI-158 (Table 16); XBI-156 includes two graves dating to the 1940s; these gravesites are marked with at least one wooden marker. XBI-157 contains five house depressions and an unidentified number of 55-gallon drums. XBI-158 contains two house depressions and 11 cultural depressions. These three archaeological sites are located to the west of the proposed Mertarvik community site (Grover 2007).

The 2002 and 2005 archaeological surveys also identified a cultural site (XBI-183) near the proposed community site (Table 16). XBI-183 consists of six shallow pits, about 1 mile northeast of the barge landing site. The six circular pits are approximately 3 feet in diameter and 18 inches deep. Newtok residents identified the circular pits as areas where clay was excavated for making pottery. XBI-183 was determined to be eligible for the National Register of Historic Places (NRHP) under Criterion D (yielded or may yield important relevant information) on August 31, 2007 (Grover 2007; AHRS 2017).

Table 16. Known cultural resources in general vicinity of the proposed action area.

AHRS #	Site Name	Description	NRHP Status	In APE
XBI-156	XBI-156	Old winter camp and summer herding station.	None	
XBI-157	XBI-157	5 depressions and 55-gallon drums.	None	
XBI-158	XBI-158	2 house depressions and 11 house pits.	None	
XBI-183	Clay Pits	6 pits for collecting clay.	Eligible	X

Although not identified on the Alaska Heritage Resources Survey (AHRS), the Mertarvik Spring may itself be considered a Traditional Cultural Property (Figure 51; Grover 2007). Traditional cultural properties (TCPs) are physical places that may be considered eligible for inclusion on the NRHP due to their association with cultural practices or beliefs of a living community that are (1) rooted in that community's history, and (2) are important in maintaining the continuing cultural identity of the community (National Register Bulletin No. 38).

Figure 51. Mertarvik Spring.

5.14.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on cultural resources in the Mertarvik region. The initial design of these CLPs avoided known cultural resources. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The relocation of the Newtok community to Mertarvik may result in the clay pits (XBI-183) being adversely affected; prior to construction of the Mertarvik community site, consultation under Section 106 of the National Historic Preservation Act must be performed IAW 36 CFR § 800.2(a)(1) to assess the project's effect on XBI-183 and to determine whether mitigation of its potential destruction is appropriate.

If future work at the Mertarvik community site encroaches on *Taqikcaq*, then XBI-156, XBI-157, and XBI-158 will require formal determinations regarding their eligibility for listing on the NRHP, and the project's effect on these sites will need to be assessed.

If the community wishes it, Mertarvik Spring will also require assessment as a potential TCP and a formal determination regarding its eligibility for listing on the NRHP. Per Appendix II of

National Register Bulletin No. 38, a trained ethnographic specialist working in concert with the Newtok community could provide a recommendation on the status of Mertarvik Spring as a TCP and to evaluate it for eligibility for the NRHP.

5.14.2.1 Future Archaeological Investigations at Mertarvik

The previous archaeological surveys at Mertarvik investigated most of the area where the current CLP alternatives are sited, but did not extend as far south as some elements of the current CLPs. Areas requiring additional archaeological investigation include the proposed primary runway, crosswind runway (if ever constructed), and community scale wind farm. Any changes to funding, Federal agency involvement, or the current layout plan as proposed will require full consultation with the Alaska State Historic Preservation Officer (SHPO), the public, and any other interested parties under Section 106 of the National Historic Preservation Act of 1966 [36 CFR § 800.2(a)(4)]. Denali Commission initiated informal Section 106 consultation [36 CFR § 800.4(b)] in the spring of 2017. The SHPO's office has requested a copy of the draft EIS prior to consultation on an assessment of effect [36 CFR § 800.4(d)] (Shina duVall, personal communication, 5 July 2017). The Denali Commission and the FAA will complete separate consultations with the SHPO. FAA initiated formal Section 106 consultation [36 CFR § 800.4(b)] with the Alaska SHPO on November 21, 2017.

Per 36 CFR § 800.13(b), if, after conclusion of Section 106 consultation, should any unknown and/or additional cultural resources be discovered before or during construction, any act, action or activity that has the potential to affect the resource shall be stopped in order to evaluate the resource and reinitiate Section 106 consultation as required by law. Upon evaluation of the resource(s), mitigation may be required to resolve any adverse impacts [36 CFR § 800.6].

5.14.3 Significance Determination

The FAA has not established a significance threshold for cultural resources (FAA 2015).

The Denali Commission believes that the implementation of any of the three CLP alternatives will have no significant impact on historic properties. The CLP alternatives will not cause the loss or destruction of significant scientific, cultural, or historic resources [40 CFR § 1508.27(b)(8)], with the exclusion of any unknown cultural resources at the proposed primary runway, possible crosswind runway, or proposed community scale wind farm. The potential impacts are determined to not reach the threshold of significance as defined in section 5.1. (MINOR). Comments received during the public review and comment period will be considered in the identification of historic properties and the assessment of effects under the NHPA (CEQ et al. 2013:28). Identification and evaluation will culminate in an assessment of effect under the NHPA [36 CFR § 800.4(d)].

The no action alternative would have no impact on cultural resources at Mertarvik.

5.15 Community and Culture

5.15.1 Affected Environment

The residents of the village of Newtok (in Yup'ik, *Niugtaq*, which translates to "rustling of grass") and Nelson Island area are known as the *Qaluyaarmiut*, or "dip net people." The *Qaluyaarmiut* have inhabited the region for at least the last 2,000 years. Today, they reside primarily in five villages: Newtok, to the north of Nelson Island across the Ninglick River, and the Nelson Island communities of Tununak, Nightmute, Toksook Bay, and Chefornak to the south. The residents of the five villages are closely connected and share many traditions that have been retained over generations, in part due to the isolation of the region and infrequent contact with people outside the area. As late as 1936, the *Qaluyaarmiut* maintained a traditional nomadic and subsistence lifestyle. Homes were typically small semi-subterranean sod houses; seal oil was used for cooking and heating. Mail service came only twice a year by dogsled from Bethel, and few outside goods beyond tea, flour, and hunting rifles were available. The Newtok site served primarily as the winter residence for the community. The village population would move by dog team in April, before ice break-up, to the summer fish camp at Nilikluguk on Nelson Island (about six miles from Tununak). At Nilikluguk, the community lived in tents all summer long. In early June, most of the men would travel to Bristol Bay to work in the canneries. The winter months were spent at the Newtok village site (ADCRA 2017a).

In 1934, a missionary named Father Deschout reestablished the Tununak mission and built a church. He remained on Nelson Island until 1962 and had a profound influence on the long term cultural integrity of the region. He spoke fluent Yup'ik and encouraged the people to retain certain traditions, such as winter dance festivals, which most other missionaries had strongly opposed. Father Deschout's respect for the Yup'ik language and lifestyle influenced the retention of *Qaluyaarmiut* traditions in the Nelson Island region (ADCRA 2017a).

The USGS first reported the village of Newtok in 1949, when the community moved from Old Kealavik (*Kayalivik* or *Keyaluvik*), a winter village located to the west of Newtok, to a site across the Newtok River from the current village location. The Federal Bureau of Indian Affairs (BIA) selected the current Newtok site for an area school building over other settlements because it was the farthest point up the Ninglick River that a BIA barge could navigate to offload school building materials. The BIA school was built in 1958, and like many communities in rural Alaska, the village developed around the school (ADCRA 2017a).
The traditional seasonal settlement pattern was retained into the 1960s, with most of the community summering in fish camps on Nelson Island and wintering at Newtok. By the 1970s, Newtok residents began to be more sedentary; the development of the current village community with a school, health clinic, airstrip, and modern housing encouraged a year-round population at Newtok.

According to a Department of Labor estimate in 2016, Newtok had a population of 372. The 2010 U.S. Census reports 96 percent of the residents identifying as American Indian/Alaska Native. A total of 72 households in Newtok were occupied in 2010.

Newtok incorporated as a 2nd class city in 1976 and was dissolved in 1997. The Newtok Traditional Council (NTC) was responsible for all local government affairs, including relocation efforts, until August 2015 (Grover 2007). After a legal dispute between two groups of tribal members claiming to be the tribal governing body of the Tribe in the village, the Interior Board of Indian Appeals upheld a 2013 Bureau of Indian Affairs ruling and the NTC was replaced by the Newtok Village Council (NVC) in August 2015 (Enoch 2015). NVC is the governing body of Newtok Village recognized as such by the Secretary of the Interior and the State of Alaska (U.S. District Court 2015).

The physical community of Newtok currently consists of residential, community, and commercial buildings. A Housing Master Plan (CCHRC 2017) identified 78 homes in Newtok, but determined that only 12 of the 78 houses were suitable for relocation to Mertarvik.

The Newtok Ayaprun pre-kindergarten through 12th grade school building is owned by the Lower Kuskokwim School District (LKSD) and currently has an enrollment of 132 students (ADCRA 2017b). The school building is equipped with its own tank farm, water and wastewater treatment plant, and generator. Eight teacher housing units are located to the south of the school building. The teacher housing buildings are expected to be threatened by river bank erosion within the next few years. River bank erosion is anticipated to impact other school facilities by 2022 (FEMA 2015 in Cooper et. al 2017b). Other community buildings within the village include the BIA School building (school is no longer in use), village council office; community hall; health clinic; post office; church; National Guard old and new armory buildings; community water tank, and washateria. The Newtok Native Corporation owns a store and warehouse. Commercial buildings in Newtok include Tom’s Store and the UPC generator building, a storage facility, office, and tank farm. Phone service is provided by United Utilities, which operates a small office in the community.

The Mertarvik site on Nelson Island is part of the traditional lands of the people of Newtok. It has long been used for subsistence, but populated only intermittently by small groups. There are no existing roads or runways providing road or air access to Mertarvik. The area is primarily accessed by small boats in the summer, by snow machine in winter, or by helicopter or floatplane (Cooper et al. 2017b).

5.15.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on community and culture in the Mertarvik region.

Moving the community as a whole will keep families intact and provide continuity of cultural identity. Some residents feel that it will be hard to move because Newtok has been their home for a long time (Enoch 2015). Others state they will feel relieved when the move is over, as Mertarvik has beautiful scenery and is on higher ground where they won't have to worry about high floods and losing their village (Enoch 2015). It is expected that the future village will be much more sustainable (not in danger of erosion) and the community will not have to move again. The nearby Nelson Island tribes of Native Village of Nightmute, Nunakauyarmiut Tribe (Toksook Bay) and Native Village of Tununak stated they do not anticipate any impacts to their communities as a result of Newtok's proposed move to Mertarvik. As of June 20, 2017, Village of Chefornak has not yet responded to the question (Andraschko MFR June 20, 2017).

5.15.3 Significance Determination

The FAA has not established a significance threshold for culture or community as resource categories (FAA 2015).

The Denali Commission has determined that the environmental impacts on the culture and community of the people of Newtok associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources, and not reach the threshold of significance as defined in section 5.1 (MINOR). The effects of the proposed actions are intended to preserve the culture and community of the people of Newtok, and are expected to have a significant beneficial impact on these resources.

The no action alternative would result in clearly noticeable and destabilizing effects on cultural identity and integrity, and is therefore considered to exceed the threshold of significance as defined in section 5.1 (MAJOR).

5.16 Socioeconomics

This section describes the baseline socioeconomic conditions in the area that could be affected by the proposed project and estimates potential socioeconomic effects that could result from proposed project implementation. Key socioeconomic resources addressed in this section include population, income, employment, demographics, education, housing, transportation, and licensed businesses. Newtok does not have taxation powers, so taxation revenues are not discussed.

5.16.1 Affected Environment

As is commonly found in rural Alaskan villages, the economy of the existing community at Newtok is a mix of subsistence, barter, and monetary exchange. The discussion below addresses primarily the monetary economy, as that is the only category for which clear quantitative data exist, but is not a full picture of how the affected population obtains the goods and services it requires. Subsistence is discussed in section 5.17.

Population: Newtok is an unincorporated census-designated place (CDP) in the Bethel Census Area. According to a Department of Labor estimate in 2016, Newtok had a population of 372. U.S. Census data show a steady increase in Newtok's population in recent decades, from 131 in 1980, 321 in 2000, and 354 in 2010 (ADCRA 2017j).

Demographics: The Newtok population is among the youngest in the state. In 2010, the median age was 21 years, compared to the statewide median age of 33.5 years. In comparison to the entire state, Newtok has proportionally more people under the age of 19 years (49.4%) and fewer people in the older age group of 65 and older (7.1%).

Education: The overall educational level of residents aged 25 to 65 years in the Bethel Census Area, of which Newtok is a part, is lower than that of the state as a whole. More of the region's residents have no high school degree, and fewer residents have college or professional degrees.

Employment and Income: In 2016, 169 (72%) of Newtok residents aged 16 or over were employed in some capacity, with total wages of $2,239,206. About half of these workers were employed year-around, with the rest being seasonal. Jobs in local government (e.g., the Lower Kuskokwim School District, etc.) made up 67% of Newtok employment; no State of Alaska or Federal government positions are currently located in Newtok. According to the U.S. Census Bureau's 2010-2014 American Community Survey 5-Year Estimates, the per capita income in Newtok was $9,257 annually, with a margin of error of ±$2,425. Based on income, 33.6 percent of Newtok residents are below the Federal poverty level.

The Alaska Permanent Fund dividend provides a substantial boost to village economies every year. The Alaska Permanent Fund was established by the Alaska legislature in 1976 to ensure that all Alaska residents benefited from oil production on state-owned lands. The dividend program distributes an annual payout to every Alaska resident, regardless of age, an equal amount out of the appropriable earnings of the Permanent Fund (Goldsmith 2010a). This dividend has become particularly important in rural parts of the state, as rural households are cash poor, and subsistence harvests can fluctuate dramatically from year to year. Under these circumstances, the cash provided by the dividend is notable, not only because of its size, but also its predictability (Goldsmith 2010b). The program disbursed more than $21 million to residents of the Y-K Delta region in 2012.

Some Newtok residents are shareholders of Calista Corporation, the ANCSA Regional Corporation representing Newtok and much of southwest Alaska. Dividends paid to shareholders or their descendants are another, if variable, source of cash income, and Calista Corporation's wide-ranging business operations may offer employment opportunities to Newtok residents, although not necessarily within Newtok itself.

Housing: In the 2010 census, there were a total of 72 housing units in Newtok, with 70 of those occupied. Of those occupied, 59 were owner-occupied, and 11 were renter-occupied. The average household size was 6 persons. There were 57 family households and 13 non-family households (ADCRA 2017j).

Transportation: Newtok is not connected to the rest of Alaska by road, and is primarily accessible by air or water. A state-owned gravel airstrip provides air access. Seaplane service is also an option when the Ninglick River or Baird Inlet are not frozen. Boats, skiffs, and snowmobiles are used for local transportation and subsistence activities. Winter snowmobile trails are marked to nearby villages of Chevak, Tununak, Toksook Bay, Nightmute, and Manaryarapiaq. Barges deliver cargo to Newtok during ice-free summer months. Four airlines (Arctic Transportation, Era Aviation, Grant Aviation, and Hageland Aviation Service) provide air service to Newtok. In 2016, these carriers transported a total of 1,702 passengers, and carried 125,213 lbs. or freight and 293,907 lbs. of mail through Newtok.

Licensed Businesses: In 2016, there were seven business licenses currently on file with the Alaska Department of Commerce (ADCRA 2017j):

1. Cuyayugaq's Fabric
2. Newtok Native Corporation
3. Newtok Traditional Council
4. Newtok Village
5. Simeon Fairbanks, Jr.
6. Toms Store, LLC
7. Ungusraq Power Company

5.16.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct and indirect impacts on socioeconomics in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

The criteria analyzed to assess the potential socioeconomic impacts of a proposed project typically include whether the project has the potential to:

- Divide or disrupt established communities;
- Cause extensive relocation due to a lack of replacement housing;
- Cause extensive relocation of community businesses;
- Disrupt local traffic patterns;
- Induce substantial economic growth, either directly or indirectly (adapted from FAA 2015).

Such criteria are not entirely applicable to the proposed project at Mertarvik. The proposed action is the construction of homes and infrastructure that are intended to essentially replace those at Newtok in danger of loss to erosion. A primary goal of the proposed action is to enable the community of Newtok to avoid being divided and disrupted by the ongoing erosion, by providing a new village setting for the community. Likewise, an extensive relocation of people and community businesses from Newtok to Mertarvik is a desired consequence of the proposed action, rather than an impact.

Significant temporary disruption of economic activity is likely as an indirect impact of the proposed action, during the period in which people and community activities are actively relocating to Mertarvik. Local government provides a majority of jobs in Newtok; those government entities would be expected to persist through the relocation, and be re-established at Mertarvik, so it is probable that they will maintain their paid positions. Some Newtok residents have been involved in previous construction activity at Mertarvik, and further temporary employment opportunities may be available during the proposed construction, perhaps off-setting economic losses from the disruption of other economic activity. Newtok residents have stated their concern that subsistence harvests may be temporarily reduced by the time demands that relocation will impose on individual families; food shortfalls may need to be alleviated by bringing in more food from outside the village, or sharing subsistence surpluses amongst families.

The proposed action will ultimately provide water and air transport infrastructure at Mertarvik that is equal or superior to what exists at Newtok. However, there are numerous unknowns as to how transportation of people and goods will be managed during the relocation period, and the potential disruptions may be regarded as temporary indirect impacts to economic activity. It is expected that both the Newtok and Mertarvik airports will be operational simultaneously for several years. Construction of the NPIAS airport at Mertarvik may result in commercial air traffic diverting scheduled flights to Mertarvik; however, that decision is the air carriers' decision, and not within the FAA's control. The rate at which Newtok residents relocate to Mertarvik, and the rate of deterioration of the Newtok airport, will also affect service to the respective airports.
Most bulk goods, including many food items, are transported to Newtok by barge. As the Mertarvik population grows, and the shoaling of the Newtok River makes barge deliveries at

Newtok more difficult, commercial barges may prefer or need to land at Mertarvik. Goods delivered to Mertarvik would then need to be lightered to Newtok to supply the people awaiting relocation. Whether lightering is performed by the commercial carrier or the community, this service would add to fuel and labor costs.

The proposed activity may indirectly induce some degree of economic growth, relative to the economic activity currently existing at Newtok. Simply having a location not in imminent danger of being washed away will greatly improve the community's position in attracting additional government projects and private investment. The additional "elbow room" available at Mertarvik, along with improved power and water supply, may encourage the development of small businesses, such as small engine and boat repair; the attendant zoning and land-use issues are matters for the community and its leadership to decide, and lay outside the scope of this analysis.

5.16.3 Significance Determination

The FAA has not established a significance threshold for socioeconomics as a resource category (FAA 2015). However, factors recommended by the FAA for consideration during assessments of socioeconomic impacts were used in the preceding section.

The Denali Commission has determined that the impacts on the socioeconomic environment of the people of Newtok associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of this resource, and not reach the threshold of significance as defined in section 5.1 (MINOR). The proposed action is expected to provide marked economic benefits and improved economic stability to the existing population in the long term, after indirect short-term disruptions during the transitional phase.

The no action alternative would result in clearly noticeable and continued destabilizing effects on the community at Newtok via continued erosion and flooding. This is therefore considered to have significant impacts (MAJOR) to socioeconomics arising, in part, due to a loss of homes, businesses, related jobs and civil infrastructure in addition to the extreme costs per resident to relocate if all costs are borne per individual. Even if individuals do not relocate to Mertarvik, they will still need to allocate time and resources that would have gone into subsistence living towards resolving impacts of erosion and flooding. Currently, this includes repairs of utilities and homes, adequately disposing of trash and human waste and suffering decreased health from below standard living conditions.

5.17 Subsistence Resources and Practices

5.17.1 Affected Environment

Newtok is a traditional Yup'ik village with an active subsistence lifestyle and economy. Relative isolation from outside influences has enabled the area to retain its traditions and customs, more so than other parts of Alaska. While subsistence traditions are a foundation for many local Alaskan village economies, no monetary value can be reasonably assigned to the value of these resources. Subsistence is essential to residents' diets and physical health because of the high cost of food in village stores, limited cash economy, and the deleterious effects of modern processed foods on a population that until recently relied almost exclusively on wild-caught and gathered foodstuffs. Therefore, the value of subsistence is more than a replacement cost of food. Subsistence constitutes a way of life, intricately connected to culture and traditions, maintains physical health and community and cultural structure.

The Newtok and Nelson Island area is part of the Yukon Delta National Wildlife Refuge, which is a 26-million-acre expanse that encompasses the Bering Sea coast and the Y-K Delta. The refuge has an abundance of water and wetland types that provides some of the richest waterfowl habitat in North America. Half of the waterfowl of Alaska are produced in the refuge; it is this biological wealth that is thought to be the reason why the ancestors of the *Qaluyaarmiut* originally settled in the area. The area's modern-day residents, including Newtok, continue to rely directly on the abundance of fishes, mammals, and fowl of the region for most of their food supply (ADCRA 2017a).

The availability of subsistence resources has historically determined where the *Qaluyaarmiut* lived during different times of the year. As recently as the 1960s, the current Newtok village site served primarily as a winter residence for the community. The village population would move by dog team in April, before ice break-up, to the summer fish camp at Nilikluguk on Nelson Island (about 6 miles from Tununak). The community spent the summer months at Nilikluguk and then moved back to the Newtok village site during the winter months.

The Nilikluguk fish camp was abandoned around 1968, after massive landslides buried the camp area and altered the shoreline enough to affect the seasonal movement of herring along this portion of the Nelson Island coast. Newtok villagers still use the area for spring sea bird and seal hunting (ADCRA 2017a). Currently, modern means of travel such as boats and snow machines allow residents to access subsistence sites and return home daily, making Newtok a year-round home (ADCRA 2017a and b).

Yup'ik people along the coast continue to practice a mixed subsistence economy with the adaptation of efficient modern equipment such as snow machines or all-terrain vehicles (ATVs) to patterns of traditional use (Frink 2009). Herring remains a large part of subsistence during the summer months and requires time for processing and drying (Knudson and Frink 2010). Traditionally, the coastal communities in Bristol Bay, the Yukon Delta, and on Nunivak Island focused on sea mammal hunting, with seals being especially important. Some inland resources were harvested; caribou and salmon were significant resources to the people at the mouths of rivers and some bays (VanStone 1984a). Riverine communities on the lower Yukon River, the lower and central Kuskokwim River, and the Togiak and Nushagak Rivers focused on fish supplemented by caribou (VanStone 1984a). Occasionally, members of these communities traveled to the coast to hunt sea mammals. The dialectical differences between the riverine and coastal communities were small and did not impede the movement of people between the two groups; people exchanged goods and established relationships that encouraged this movement (VanStone 1984a, 1984b).

Current seasonal subsistence harvests described by Newtok residents (John and Carl 2017) include:

Spring
- Eggs, seals and other marine mammals (occasionally beluga whale).
- Pike fishing in early spring.
- Muskox, under an ADFG permit system that rotates between villages (March only).

Summer
- Salmon.
- Berries, from June into autumn (crowberry, salmonberry, lingonberry, trailing raspberry).
- Greens.
- Kelp (collected along the Nelson Island seaward coast).
- Moose (August).

Autumn
- Seals (bearded, ringed, harbor, sea lion).
- Blackfish (September).
- Whitefish (by set-net in August-September).
- Goose grass.

Winter
- Pike (jigged from frozen ponds and streams).

The majority of these subsistence resources are aquatic. The Mertarvik hillside is within Newtok's traditional subsistence range, but is currently used primarily for gathering berries and greens. Salmon are caught at the Takikchak River to the west of the Mertarvik development site, and waterfowl may be taken from the estuarine wetlands at the mouth of the Takikchak River.

5.17.2 Environmental Impacts

All three CLP alternatives have been developed within the same overall Mertarvik community area and are expected to have similar direct, indirect and cumulative impacts on subsistence resources in the Mertarvik region. As a result, the anticipated impacts of each CLP alternative are indistinguishable from each other in this resource area and will be discussed collectively.

Land-based construction impacts at Mertarvik are expected to temporarily limit the potential for residents to hunt birds or mammals within and adjacent to the new community site. Berry picking or other harvest of vegetative materials is also expected to be reduced temporarily as construction progresses through the new community area. There may be exceptions during periods where construction ceases and new construction begins, however the likelihood that resources (berries, birds, fish, etc.) would be present and in a condition suitable for harvest during these timeframe is doubtful.

While delivery of construction equipment and building materials may affect fishing at the barge landing site temporarily, the impact is expected to be minor, since the barge landing is not expected to be a heavily-used fishing site from land or water.

Elimination of firearms-based hunting, for all practical purposes, within the newly developed community area is the most substantial anticipated effect on subsistence. However, given the small total acreage, landscape position, and types and quality of habitats affected, the effect is expected to be minimal. For example, if a hunter was using a rifle to hunt from what will be the new airport, nearly 160 degrees of a 360-degree circle would be unsafe directions to shoot as the shooter would be shooting over the community. If boat traffic on the river is considered, the unsafe-to-shoot arc expands to approximately 190 degrees. Subsistence hunting for birds with a shotgun would be affected to a lesser degree due to the shorter range when shot is used. In either case, the habitats affected by infrastructure construction are not expected to be high productivity tundra bird habitat. No permanent impacts to subsistence fishing are expected.

The indirect effect of infrastructure development is a shift of subsistence hunting away from the Mertarvik town site to less anthropogenic-affected environments, with the possible exceptions of berry picking and shoreline based fishing, both of which may increase due simply to the proximity of the relocated village. The consensus amongst Newtok residents appears to be that the move from Newtok to Mertarvik would have little or no impact on subsistence practices, and that the loss of berry and green resources to the direct impacts of development at Mertarvik would not be significant (John and Carl 2017). The major concern voiced by Newtok residents was that the time demands of construction labor and preparing to relocate families would temporarily interfere with subsistence practices, and result in less food being gathered by the community.

5.17.3 Significance Determination

The FAA has not established a significance threshold for subsistence as a resource category (FAA 2015).

The Denali Commission has determined that the environmental impacts on subsistence resources and practices associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources, and not reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on subsistence resources at Mertarvik, but would have a significant impact on subsistence practices for members of the existing population forced to move away from the Newtok area by erosion and flooding (MAJOR).

5.18 Land Use and Compatibility

5.18.1 Affected Environment

The land that would be affected by the proposed action would be the area of northeast Nelson Island where the CLP alternatives are sited, described in more detail in previous chapters of this section. The land has no current permanent inhabitants, and is undeveloped except for initial infrastructure constructed in support of Newtok village relocation efforts, described in section 4.3.2.

5.18.2 Environmental Impacts

As discussed previously, the U.S. Congress via Public Law 108-129, authorized the transfer of 10,943 acres of formerly USFWS land to the Newtok Native Corporation to be used for relocating the community of Newtok. Therefore, the land uses proposed under the CLP alternatives, including airport construction and operations, are the planned and intended uses.

The CLP alternatives represent the comprehensive planning and development of an entire community, and were thus able to identify and avoid potential land use conflicts before construction begins. For example, the design of the community incorporated FAA's requirements that landfills and sewage treatment ponds be constructed at least 5,000 feet from closest end of a runway airport, and the community layout was adjusted accordingly.

There are no expected impacts on land use and compatibility at the village of Newtok, as that community will be abandoning the location. Future land use will be dependent upon the rate of erosion and resulting land use opportunities.

5.18.3 Significance Determination

The FAA has not established a significance threshold for land use as a resource category (FAA 2015).

The Denali Commission has determined that the environmental impacts on land use at Mertarvik associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources, and not reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on land use.

5.19 Public Health and Safety

5.19.1 Affected Environment

The public health and safety of the people of Newtok has suffered from the impairment of services such as water supply and waste management caused by flooding and loss of infrastructure. These health concerns have been compounded by some reluctance on the part of Federal and State agencies to invest in improvements of infrastructure at Newtok, when much of the infrastructure is expected to be destroyed in a matter of years.

Public health professionals conducting an assessment of public health conditions in Newtok in 2016 found that sanitation conditions, which include inadequate potable water for drinking and hygiene, high levels of contamination from honey bucket waste, and household overcrowding, were "grossly inadequate to protect public health." The team concluded that existing conditions "appear(ed) to result from an initial lack of infrastructure development and failure to properly maintain existing infrastructure (Eichelberger 2016).

Newtok does not have piped potable water service. Newtok residents obtain water from the village water treatment plant, and/or the school, and haul it in containers to their homes. The source of water for the village water treatment system is a pond near the south end of the airstrip; this pond will be lost to the advancing Ninglick River around 2020. Residents also collect rainwater from the roofs of buildings, and from pond water and ice when no other sources are available. A limited number of residents, mostly school employees, have access to the school showers and laundry facilities. Most other households use compact, portable clothes washers for which additional water must be hauled (Eichelberger 2016).

Newtok runs out of treated water every spring because the storage capacity of the water treatment plant tank is too small to last the entire winter. Each summer (June, July, and August), before Newtok's surface drinking water source freezes, the water plant operator must pump and treat raw water until the storage tank is full. Mechanical failures and lack of funding for maintenance also contribute to shortages. The World Health Organization (WHO) defines sustained household water security in terms of quantity (13.2 gallons per person per day (gal/p/d)) and access: either 1 in-home tap or the ability to acquire water in fewer than 5 minutes. By contrast, "water insecurity" refers to inadequate access to clean water for all domestic needs. The WHO has identified a lower threshold for water insecurity resulting in high health concern as 5.28 gal/p/d. In Newtok, under normal circumstances, respondents reported an average daily consumption of treated water (hauled from either the water treatment plant or the school) of

1.36-2.31 gal/p/d. This rate is far below the WHO minimum standard for water security of 13.2 gal/p/d, and is less than half the WHO threshold for determining severe water insecurity. These conditions have serious implications for community health, particularly elders (who are at higher risk of infection due to their age) and children, for whom the health consequences of inadequate water security can last beyond one infection (Eichelberger 2016).

There is no piped sewage system in Newtok, and the majority of households use “honey buckets”, 5-gallon buckets topped with a toilet lid and lined with a trash bag. Newtok does not have a designated place to contain raw sewage, except for a sewage lagoon designated only for the school’s use. Instead, residents empty their honey buckets into the Ninglick River, which used to be located a significant distance from the nearest home. The Ninglick River has increasingly encroached on the community and captured the Newtok River, resulting in the community to be surrounded on two sides by raw human waste, and the contaminated shoreline is advancing upon homes and the village water supply pond. Raw sewage is visible next to the boats residents use for subsistence, including fishing, hunting, and hauling drinking water from alternative sources. These conditions contribute to cross-contamination in the community, especially during storms and floods, when waste can be carried directly into the community (Eichelberger 2016).

Inadequate sanitation and overcrowding of housing can lead to respiratory infection as well as water-borne illness. Between 1994 and 2004, 29 percent of infants were hospitalized with lower respiratory tract infections, including pneumonia and respiratory syncytial virus (RSV), attributing Newtok with one of the highest rate of lower respiratory tract infections in the state (ADCRA 2017a).

The erosion and flooding can also create direct physical hazards for the people of Newtok. A storm in September 2005 caused extensive flooding in and around Newtok, turning the village into an island for several days, isolating several houses, and making movement around the village very hazardous. While the rate of erosion along the Ninglick River bank has been steady over a matter of years, a single autumn storm can erode the river bank inland many feet overnight (ADCRA 2017a).

5.19.2 Environmental Impacts

Any of the three CLP alternatives, once complete, would provide a significant improvement in health and safety to the people of Newtok, compared to current conditions at Newtok village. Public health and safety will greatly improve once Mertarvik has completed build-out of its infrastructure. The Mertarvik site promises abundant safe water from groundwater sources, if developed properly. The CLP includes a sewage lagoon adequate for the entire community, and ultimately a piped sanitary sewer system. During the construction and transition phase, public health and safety will likewise transition from being non-existent to being fully provided and upgraded from previous conditions at Newtok. In the interim, the same living conditions that exist at Newtok will exist at Mertarvik until the proposed infrastructure is developed. No other adverse environmental effects are expected.

5.19.3 Significance Determination

No FAA significance threshold exists for public health and safety (FAA 2015).

The Denali Commission has determined that the impacts on public health and safety associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources, and not reach the threshold of significance as defined in section 5.1 (MINOR). The effects of the proposed actions are intended to improve the health and safety of the people of Newtok, and are expected to have a significant beneficial impact on these resources.

The no action alternative would result in a significant adverse impact on public health and safety of the existing population, and is therefore considered to exceed the threshold of significance as defined in section 5.1 (MAJOR). Some residents would still relocate to the Mertarvik site, regardless of the availability of infrastructure, and would subsequently live in underserved conditions, while others would have little choice but to continue to live at Newtok in substandard conditions, exposed to human waste and inadequate water supplies.

5.20 Public Services and Utilities

5.20.1 Affected Environment

As described elsewhere in this document, the public services and utilities available for the existing population at Newtok are generally substandard, and suffer from the direct effects of erosion and flooding as well as deferred maintenance. Newtok's stated intent to relocate, combined with the imminent threat of flooding and erosion, has rendered Newtok ineligible for capital funding for improvements to existing infrastructure (e.g. barge landing, water, sewer, bulk fuel tanks and power plant) to meet needs at the current village. Deferred maintenance and investment in Newtok's public infrastructure and facilities has adversely impacted the community's quality of life (ADCRA 2017b).

The condition of the existing Newtok power plant, power distribution system, fuel pipelines, and existing tank farms was evaluated recently (Cooper et al 2017b). The majority of the existing tanks and equipment are at or near the end of their useful life and only five tanks were identified for potential reuse in the new bulk fuel facilities in Mertarvik. Several power distribution poles are expected to be undercut by erosion in 2 to 3 years. The existing power system at Newtok is insufficient for current needs. Due to limitations with transformer sizing and electrical distribution capacity, residents customarily coordinate with their neighbors to avoid simultaneously using high-demand electrical devices, such as electric clothes dryers, to prevent tripping a transformer fuse or knocking the power plant offline. The power plant is designed to provide recovered heat to the adjacent water plant, and is currently the sole source of heat for the water plant. During a recent power outage that lasted several days, the water plant froze due to lack of recovered heat). The Newtok Ayaprun School generates its own prime power. The school power plant consists of two generators in a 40-foot insulated shipping container, which in 2016 was located about 350 feet from the eroding shoreline (Cooper et al. 2017b).

Deficiencies in drinking water and waste management at Newtok were described in the preceding section. The old landfill at Newtok was lost to erosion in 1996. The current unpermitted landfill is across the Newtok River from the village, and is accessible only by boat at high tide. During low tide periods, household garbage and other solid waste is stacked up in Newtok awaiting transportation (ADCRA 2017b).

Newtok lost its barge landing on the Ninglick River in 2005. Barge deliveries to the village are now restricted to improvised landings on the Newtok River; however, the altered hydrology of the Newtok River has severely limited when barge deliveries can be made. In August 2006, a fuel barge was grounded in the Newtok River for three days, and fuel has had to be flown into the village at considerable expense when delivery could not be made by barge. The impaired barge service to the community makes many goods and services more expensive and difficult to provide, such as food, fuel, and replacement parts for failing community utilities (ADCRA 2017b).

5.20.2 Environmental Impacts

The power, water, wastewater, and solid waste management utilities that are planned under any of the three CLP alternatives will represent a significant improvement in the services experienced by the existing population. Section 4.5.1 provides available details on the proposed Mertarvik solid waste landfill (to be designed and permitted in accordance with State regulations), wastewater treatment facility (which the Newtok community has never had), energy generation and distribution systems, water storage tank, water distribution and wastewater collection lines, and roads. The shoreline and existing barge landings at Mertarvik are far less vulnerable to erosion than at Newtok. Planned marine header fill points will allow bulk fuel to be piped directly to a contained tank farm. The potable water at Mertarvik will be supplied from groundwater, in contrast to the current inadequate and vulnerable supply of treated surface water and collected precipitation (section 5.19.1).

5.20.3 Significance Determination

No FAA significance threshold exists for public services and utilities (FAA 2015).

The Denali Commission has determined that the impacts on public services and utilities associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of those resources, and not reach the threshold of significance as defined in section 5.1 (MINOR). The effects of the proposed actions are intended to improve the health and safety of the people of Newtok, and are expected to have a significant beneficial impact on these resources.

The no action alternative would result in a significant adverse impact on the public services and utilities available to the existing population, and is therefore considered to exceed the threshold of significance as defined in section 5.1 (MAJOR). The existing utilities and services at Newtok will continue to deteriorate, with little expectation of financing for substantive upgrades.

5.21 Noise

5.21.1 Affected Environment

The affected noise environment in Mertarvik is the same as described in the community and culture section 5.15. Issues related to the noise environment were not identified as a concern during the scoping process, nor has the issue arisen in the months since scoping was initiated. As a result, this section is limited to a discussion of noise as it pertains to the FAA and their internal policies.

5.21.2 Environmental Impacts

FAA's analysis of potential noise impacts is guided by FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*; 14 CFR §150, *Airport Noise Compatibility Planning*; and NEPA requirements.

A noise study completed for a similarly sized airport to be constructed within the city of Angoon, Alaska, with a similar critical aircraft, demonstrated no significant noise impacts to the community outside airport boundaries. The demonstration of the impact of aircraft operational noise on the relocated community is contained in the Angoon Airport Final EIS (September 2016). Because Angoon is a similar sized airport utilizing similar aircraft and frequency of operations, FAA has determined that the noise study for Angoon is an appropriate reference for the proposed Mertarvik Airport. The primary difference between the two airports in relation to noise effects is that the proposed Angoon Airport will be located in the middle of the community at the same elevation, while the proposed Mertarvik town site airport would be located adjacent to the community and not less than 200 feet above the community.

The Angoon Airport noise study demonstrated that the 65 DNL remains within the airport boundary with the exception of extending a short distance beyond each end of the runway. The 65 DNL means the annual average Day-Night level of noise measured in dB would not exceed 65 dB. The 65-dB limit is a research-based limit beyond which many humans experience some level of annoyance. The proposed runway orientations at Mertarvik versus the community's location would result in the 65 DNL noise contour that extends past the runway ends impacting an area immediately north-northwest or south-southeast of the community depending on the runway alignment referenced. Because the 65 DNL does not typically exceed the toe of fill of the runway except slightly on either end, noise effects are expected to be compatible with all human activities.

Temporary airport construction noise, which includes the hauling of material from the quarry, is expected to be very similar to the construction noise the community will experience over a 5- to 7-year time frame as the overall community is relocated/constructed. The majority of airport construction noise related to operation of heavy equipment at the airport is expected to have only a minor to moderate disturbance effect on the community and then primarily only if the wind is carrying the noise to the community. This is largely because of the airport's landscape position above the community and the fact that the airport's primary runway would be constructed before a majority of the community has moved to the Mertarvik site.

Direct noise impacts of aircraft operation at Mertarvik for a Beech 1900 (the airports critical design aircraft) are expected to fall with the 66.5 to 77 Day-Night-Level (DNL) decibel range measured at the engine noise source. These are the same decibel levels that the community experiences at Newtok. However, at Newtok the airport is located at the same elevation as the airport versus Mertarvik's location, which varies between approximately 200 and 300 feet higher than the community. Additionally, the change in configuration (i.e. runway position) of the airport at Mertarvik versus Newtok and resulting change in flight patterns would mean that the changes in flight pattern configuration, proximity, and sound variability due to weather and seasonal changes would likely result in sometimes lessened, and sometimes heightened, perception of airborne and ground based aircraft noise. However, given that there is no expectation that existing commercial flight operations frequency and timing will change after the community is completed in relation to frequency and timing currently at Newtok, no potentially significant noise impact is expected from aircraft operations.

The most prevalent indirect impacts of noise range from disturbance to irritation for both humans and animals. Given that no change, as noted above, is expected to occur in relation to the volume or timing of flights or class of aircraft utilizing the airport, negative noise impacts are expected to be very similar to Newtok level impacts. And, given the change in proximity of housing to the airport and the fact that homes will be newer and better insulated, fewer village residents are expected to be affected by aircraft operational noise impacts.

5.21.3 Significance Determination

The FAA's significance threshold for airport-caused noise is an action "that would increase noise by DNL (Day-Night Average Sound Level) 1.5 dB or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65dB level due to a DNL 1.5dB or greater increase, when compared to the no action alternative for the same timeframe." While no quantitative noise information exists for this project, studies at a similar rural Alaska airport indicate that this noise threshold would not be reached within the proposed residential and community areas of Mertarvik, therefore any impacts would be LESS THAN SIGNIFICANT.

The no action alternative would have no impact on the noise environment at Mertarvik.

5.22 Visual Environment

The affected environment for effects on the visual environment in Mertarvik is the same as described in the community and culture section 5.15. Issues related the visual environment were not identified as a concern during the scoping process, nor has the issue arisen in the months since scoping was initiated. As a result, this section is limited to a discussion of visual effects as it pertains to the FAA and their internal policies.

5.22.1 Affected Environment

No airport or other permanent exterior light sources yet exist at Mertarvik,

5.22.2 Environmental Impacts

The proposed airport is essentially on a plateau approximately 200 to 300 feet above the proposed community. Airport lighting is expected to include ground based medium intensity runway lighting, taxiway lighting, a pole mounted lighted wind sock, and sodium vapor lights on the two snow removal equipment buildings (SREB). Runway lighting is expected to be pilot activated.

Temporary construction effects include construction light emissions at the Mertarvik Airport. However, given that the length of daylight during the majority of the ice-free construction season exceeds 12 hours per day automatic lighting on equipment is expected to have no discernable visual effect. Given that the SREB sodium vapor lights are expected to be on the front of the building, which will be facing away from the community, only a light halo effect around the building is expected to be seen. Because the remainder of the lighting is ground-based, it is not expected to be seen from the downslope position of the community.

Indirect impacts include a diminution of the night sky (moonlight and starlight) in the vicinity of the airport when observed from off airport property. However, given the positioning of the lighting as noted above, it is expected to be a minimal and largely seasonal effect given the daylight length during summer versus winter at this latitude.

5.22.3 Significance Determination

The FAA has not established a significance threshold for visual effects (FAA 2015). The FAA has identified factors to consider when evaluating potential impacts on the visual environment. These include:

- The degree to which the action would have the potential to create annoyance or interfere with normal activities from light emissions; and
- The degree to which the action would have the potential to affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources.
- The degree to which the action would have the potential to affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources;
- The degree to which the action would have the potential to contrast with the visual resources and/or visual character in the study area; and
- The degree to which the action would have the potential to block or obstruct the views of visual resources.

The Denali Commission has determined that the environmental impacts on the visual environment of the people of Newtok associated with the implementation of any of the three CLP alternatives, as proposed, will not noticeably alter any attribute of this resource. The construction and lighting proposed for Mertarvik are not expected to reach the threshold of significance as defined in section 5.1 (MINOR).

The no action alternative would have no impact on the visual environment at Mertarvik.

5.23 Other Required Analyses

5.23.1 Relationship between the Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA regulations require, as part of the EIS environmental consequences analyses (40 CFR 1502.16), an "evaluation of the short-term uses of man's environment and the maintenance and enhancement of long-term productivity."

The proposed action would result in short-term uses of the environment during construction. Construction of the proposed action would require staging areas, stockpiling areas and roadway construction. Additional short-term impacts would be air quality degradation from increased emissions from construction vehicles and activities, noise impacts, other socioeconomic and community impacts from construction vehicles (possible roadway obstructions), and waste and debris generated from construction.

The proposed action is undertaken with consideration of the current and future requirements of the future residents of Mertarvik. The projected benefits from the property to be developed for use by the displaced residents of Newtok provided by the proposed action outweigh the local

short-term impacts and use of resources. The proposed action is consistent with the maintenance and enhancement of long-term productivity for the proposed action area and region.
The no action alternative would not have short-term uses of the environment that would result in impacts above those that can be expected when the village of Newtok finally succumbs to the erosive forces of the Ninglick River.

5.23.2 Irreversible and Irretrievable Commitment of Resources (40 CFR 1502.16)

Implementation of any one of the three CLP alternatives involves a commitment of a range of natural, physical, human, and fiscal resources. The land used in the development of infrastructure at Mertarvik is considered an irreversible commitment during the time period that the land is used, likely for many generations. However, if a greater need arises for the use of the land, the land can be converted to another use, assuming an alternate location for the residents of Mertarvik is identified and developed for such use. There is no reason, however, to believe that such a conversion would ever be necessary or desirable.

Fossil fuels, labor, and construction materials such as cement, aggregate and bituminous material would be expended during construction. The gravel extracted and committed for use as fill and surface material, and the habitats permanently covered by those fills, are resources effectively and irretrievably lost.

Additionally, human labor and natural resources would be used in the fabrication and preparation of construction materials and facilities. These materials are generally not retrievable; however, they are also not in short supply and their use would not have an adverse effect upon the continued availability of these resources.

The commitment of these resources is based on the concept that the U.S. Government, the State of Alaska, and the residents of the village of Newtok, would greatly benefit by the proposed action, providing residents of the village with a safe place to which to relocate, one which allows them to maintain their community and way of life intact within their traditional lands on a Congressionally-approved site located on the northeast end of Nelson Island prior, while also providing the necessary infrastructure for a stable and healthy existence. The benefits from the proposed action are expected to greatly outweigh the opportunity cost incurred from the commitment of these resources.

5.23.3 Cumulative Effects

Consideration of cumulative effects consists of an assessment of the total effect on a resource or ecosystem from past, present, and reasonably foreseeable future actions that alter the quantity, quality, or context of those resources within a broad geographic scope. Under the CEQ regulations, cumulative effects are defined as:

> "…the impact on the environment which results from the incremental impact of the actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR §1508.7)."

A cumulative-effects analysis considers the aggregate effects of direct and indirect impacts – from Federal, non-Federal, public, or private actions – on the quality or quantity of a resource. The intent of the cumulative effects analysis is to determine the magnitude and significance of cumulative effects, both beneficial and adverse, and to determine the contribution of the proposed action to those aggregate effects.

Past, present and future actions at the village of Newtok should also be considered in the context of cumulative effects. Past actions at Newtok include the establishment, existence and effects of human occupation and development of the site over a period of many decades, including the construction and operation of the existing Newtok Airport. Present actions at Newtok include the effects of continued occupation and use of the village by its residents. Reasonably foreseeable future actions at Newtok, including the activities associated with the actual evacuation to Mertarvik, also include deactivation of the airport and removal of man-made airport infrastructure, with the exception of past "fills" in WOTUS (e.g. the runway, taxiway and apron).

The year 2003 was defined as the start of the timeframe for consideration of past actions, which is the year in which the U.S. Congress authorized (PL 108-129) resulting in an exchange of lands between the Newtok Native Corporation and the Department of the Interior. The environmental effects of all past development actions undertaken by Federal agencies at Mertarvik since 2003 have been evaluated under NEPA, determined to be less than significant, and culminated in the preparation of Environmental Assessments (EA) and Findings of No Significant Impact (FONSI).

The Mertarvik town site is largely undeveloped. Development in the area since 2003 consists of:

- In 2007, the first three of what are now seven homes were constructed at Mertarvik using BIA Housing Improvement Program (HIP) grants.
- In 2009, the barge landing facility was completed by the ADCCED and ADOTPF, consisting of a 16-foot-wide by 230-foot-long barge ramp/access road, and 65-foot by 130-foot staging area.
- In July 2009, U.S. Navy and Marine Corps personnel established a base camp to support future DoD Innovative Readiness Training (IRT) program activities.
- In June 2010, the IRT program returned to build a small boat landing, and an access road from the barge landing area to the future Mertarvik community site.

- In subsequent summers, the IRT program helped prepare the Mertarvik town site for the MEC, and opened the quarry at Hill 460. The access road was constructed of gravel topped with 8-foot by 14-foot polyethylene mats (Dura-Base®); these mats were also used to create working and living surfaces on top of the tundra, and to allow heavy equipment to travel along an unimproved trail leading to the quarry site.
- In the summer of 2011, the 12,500-square-foot piling-supported foundation for the MEC was completed.
- Also in 2011, the MEC groundwater supply well was drilled and installed about 230 feet east of the MEC foundation.
- In the summer of 2012, three additional homes were built by Newtok community members using grants from the Association of Village Council Presidents (AVCP) Regional Housing Authority, through HUD's Native American Housing Assistance and Self Determination Act (NAHASDA) Program.
- In 2016, the Lions Club funded construction of a small well house, and the installation of a hand-pump and portable water treatment system, to facilitate the interim use of the well.
- Also in 2016, the seventh house was assembled on the Dura-Base® pad laid down for the IRT base camp in 2011. The house is a prototype designed by the Cold Climate Housing Research Center (CCHRC), funded by a BIA HIP grant.

The year 2022 was defined as the limit of the future timeframe for reasonably foreseeable future actions, since the current village of Newtok is expected to lose a critical amount of infrastructure by that time. The actual build-out year for construction of the proposed action is still unknown, and is dependent upon the availability of federal, state or tribal funding, and in some cases, the identification of the action agency responsible to undertaking various elements of the build-out.

At Newtok, people walk to nearby areas to pick berries and gather other foods and materials, but rely on boats in the open-water season and snowmachine in the winter to get to more distant resources. Development of a new community at Mertarvik will result in a shift of the current usage of resources at Newtok to the equivalent usage of resources in the Mertarvik area. Boats would still be used to reach fish camps and other areas traditionally used for subsistence gathering. People from Mertarvik would be able to walk to good berry picking areas on Nelson Island that are now reached only by boat, so use of those areas would likely increase. Other subsistence uses on that part of Nelson Island also would likely increase. There would be more fishing pressure on local streams, more hunting for local waterfowl, for ptarmigan and other birds, and more local hunting and trapping of smaller mammals. Hunting for large mammals would change less. Hunters from Newtok boat or snowmachine to customary places for large game and marine mammals and would continue this tradition. Boating access to those resources would change little, but people at Mertarvik would have better land access to large land mammals on Nelson Island. There would be more opportunity for hunting access by all-terrain vehicles (ATV's) and potential for increased pressure on Nelson Island game. The harvest of

wildlife across Alaska is regulated to meet management goals, and harvest regulations would help ensure viable populations were maintained. As the usage of resources at Newtok diminish, the usage of those resources will increase at Mertarvik.
The surrounding wetland habitat limits off-road use of ATV's at the existing Newtok community during summer. Snowmachines generally are more efficient and much faster in the winter. ATV use would increase on the high ground of northern Nelson Island and people would be able to range much farther than they can with ATV's at Newtok. Extensive ATV trails could be developed the Mertarvik site as a result of the Nelson Island terrain being higher and dryer than that surrounding Newtok. ATV use on the refuge could be restricted by the responsible Federal agency (U.S. Fish and Wildlife Service). Wetland habitat surrounding Mertarvik may be damaged from increased ATV off-road use, while areas that are currently impacted by those same activities around Newtok will become revegetated or reclaimed through natural processes.

Some of the structures and abandoned equipment at Newtok will remain after the community relocates to Mertarvik, and some of these areas, such as the landfill, wastewater treatment lagoon, airport runway, and other non-movable structures, could contribute to pollution of the Baird Inlet area as erosion allows the Ninglick River to move through the old village site. Some residents may choose to remain at the original town site and continue to use some of these facilities until forced to leave by erosion. Cleanup and environmental restoration of the village of Newtok would rest with the community and with federal and state agencies. No cleanup plans for Newtok have been developed. There is not enough information about who would move, what would remain, ownership, and other issues to formulate a cleanup plan at this time.

On a watershed, regional or state level, the long-term cumulative effects associated with the daily activities of the current residents of Newtok (e.g., greenhouse gas emissions), while improved due to upgraded facilities and utility services, should be insignificantly different from the cumulative effects associated with the daily activities of those same residents inhabiting the new village site at Mertarvik. For example, the cumulative effects associated with the operation of an airport to serve the community will be much the same, whether the active airport is located at Newtok or a few miles upstream at Mertarvik.

For a period of several years, the Newtok and Mertarvik airports may be in service simultaneously, although the FAA will remove its support of the Newtok airport once the Mertarvik airport is operational. However, demand for passenger and air cargo services to Newtok can be expected to decline as the Newtok population moves to Mertarvik. No long-term cumulative increase in air traffic or air services is anticipated.

As noted above in this section, cumulative impacts may occur to some resource categories if the proposed project proceeds. However, there are no known significant cumulative impacts.

5.23.4 Connected Actions

While NEPA was enacted to disclose and evaluate potential effects of federal actions, one category of effect that extends beyond federal actions is the connected action. If there are connected actions that fall within the above definition but are not federal actions, then those actions need to be evaluated.

Connected actions in NEPA analyses are defined under 40 CFR §1508.25(a)(1) as actions that:

- Automatically trigger other actions which may require environmental impact statements;
- Cannot or will not proceed unless other actions are taken previously or simultaneously; or
- Are interdependent parts of a larger action and depend on the larger action for their justification.

Several agencies stated during the scoping process that efforts to decommission infrastructure at Newtok should be discussed (as opposed to being analyzed) as connected actions to the infrastructure development at Mertarvik. Decommissioning activities include such actions as dismantling homes, fuel systems, and other structures and equipment, reusing or properly disposing of the demolition materials, securing potential sources of contamination, and mitigating environmental contamination, before the advancing erosion washes these structures, equipment, and materials into the Ninglick River.

Potential decommissioning activities at Newtok are not connected to the proposed action in that they:

- Are not being triggered by the proposed development, but rather, by the inevitable destruction of Newtok, and a desire to preemptively mitigate for potential damages to the environment as Newtok is incrementally destroyed through erosion over the coming years;
- Are not logistically or temporally linked to the process of developing Mertarvik, which can and will proceed regardless of the potential of any future decommissioning activities at Newtok; and
- Are wholly independent of the larger effort to relocate the village of Newtok to Mertarvik; the relocation is not dependent upon decommissioning activities, and does not depend on decommissioning activities as justification for the relocation.

The desirability of removing sources of contamination and debris from Newtok would exist regardless of whether construction occurs at Mertarvik, or if any other alternative were selected, for that matter. The proposed development at Mertarvik may nonetheless affect the timing and prioritization of proposed decommissioning activities at Newtok. For example, if the development proceeds as envisioned, and relocation can occur at a planned and orderly pace, then there will be more time to effectively plan and conduct decommissioning and salvage activities. Conversely, an uncertain or delayed relocation may result in more abandonment of structures, and lost opportunities for decommissioning. The decommissioning of fuel and power distribution equipment will need to be coordinated closely with the sequence of building abandonment at Newtok to ensure that those services continue to homes and structures that require them.

5.23.4.1 Potential Effects of FAA's Removal of the Newtok Airport from the National Plan of Integrated Airport Systems as a Result of the Construction of a Replacement Airport at the Mertarvik Town Site and Potential Effects of the State of Alaska's Deactiviation of the Newtok Airport

Regarding the development of the airport at the Mertarvik town site, the FAA determined that there were two connected actions that warranted disclosure and assessment of potential effects. Those two potential actions are FAA's removal of Newtok Airport from the National Plan of Integrated Airport Systems (NPIAS) if a replacement airport is constructed at Mertarvik and ADOT's eventual deactivation of Newtok Airport after the replacement airport at Mertarvik is constructed.

The NPIAS is composed of commercial service airports, all reliever airports and selected general aviation airports vital to safe aviation within the United States. The NPIAS also contains an inventory of short and long-range development projects and their estimated costs at these airports. The projects are eligible for Federal funds, on a cost shared basis, if approved and selected by FAA.

Regarding the State of Alaska's expected connected action, deactivation (i.e. closure) of the Newtok Airport at an unknown future date, this action is expected largely because demand for passenger and cargo services will substantially drop as existing Newtok residents move to the new community location followed by erosion of the airport. Also, because the Newtok Airport would no longer meet the requirements for inclusion in the NPIAS and would therefore be ineligible for Airport Improvement Program funding from FAA. Therefore, the State of Alaska has noted that they expect the existing Newtok Airport to eventually be deactivated for these reasons (M. Merritt, June 16, 2017, email).

The preceding therefore defines the analysis of the potential effects of the ultimate deactivation (closure) of the Newtok Airport by the ADOTPF based on those three primary elements in the following order of importance. First, the primary driver for future closure is the on-going erosion, which will ultimately shorten the runway beyond a usable length. This erosion is the same driver for the construction of the Mertarvik Airport and the community's need to relocate. Second, the specific timeframe for closure is unknown and in part relates to the rate at which community residents move to the Mertarvik Town site. Third, the construction and operation of an airport at Mertarvik to serve a relocated community is expected to result in at first a diminution of the need for the Newtok Airport and then closure due to a perpetual reduction in need. This is coupled with increasing maintenance costs for the State and/or unsuitability due to the rate at which the runway will erode and the lack of FAA funding to off-set costs of maintenance.

Given that both of the connected actions described above potentially affects only a few of the total number of resource categories previously analyzed for other impacts, the following effects breakdown addresses only those resource categories per connected action that would have known effects. And, because the affects per resource category are virtually identical per connected action the effects analyses for both connected actions are combined below within each defined resource category except as noted.

Air Quality - Newtok

Removal of the Newtok airport from the NPIAS approximately when the Mertarvik airport becomes operational would result in a reduction in the number of flights to the existing Newtok Airport. This would result in lower aircraft emissions at the Newtok Airport and less dust generation as most air operations move to the replacement airport.

Indirect air quality impacts expected to result from the deactivation of Newtok Airport are a cessation of emissions and dust generation related to airport use. None of the impacts are of such a scale that they would result in either a significant positive or negative impact.

Water Quality – Newtok

Indirect water quality impacts of the removal of Newtok Airport from the NPIAS include a reduction in the quantity of runway and apron fill materials being transferred to the adjacent tundra due to reduced aircraft operations and therefore a reduction of the quantity of suspended sediment in surface waters during snow melt and precipitation run-off.

Indirect water quality impacts expected to result from the deactivation of the Newtok Airport include a cessation of negative water quality impacts related to operation of the airport and related aircraft use (e.g. transfer of sediments to aquatic environments and/or water impacting runway or apron fills. Therefore, a reduction in the quantity of suspended sediment in surface waters would occur. None of the impacts are of such a scale that they would result in either a significant positive or negative impact.

Socioeconomics – Newtok

The indirect impact of removal of the Newtok Airport from the NPIAS is expected to be a loss of scheduled commercial passenger and cargo traffic to and from the Newtok Airport at some future date. At this time FAA cannot effectively estimate how near or far term that date may be. Whether the service reduction will occur at a single point in time or as a gradual reduction while both airports temporarily operate simultaneously is also not known. Additionally, commercial service may be precluded by on-going erosion prior to the removal of the airport from the NPIAS being an issue. This means, however, that the Newtok Airport would cease to be functional due to loss of adequate operating surface, which would immediately result in removal from the NPIAS anyway.

ADOT contracts with one local resident to maintain Newtok Airport and has an employee that manages this and numerous similar airports. Similar arrangements would be made for Mertarvik which could include both airports temporarily under a single contract. Therefore, while FAA cannot determine whether the same individuals would be employed at Newtok versus Mertarvik, the same number of people would likely be employed at both airports

As previously noted, upon removal of Newtok Airport from the NPIAS the FAA would no longer issue grants for the Newtok airport and ADOT would be required to provide all needed funding. Removal of Newtok from the NPIAS and the shift of scheduled commercial air traffic to the Mertarvik Airport are also expected to indirectly impact remaining residents by strengthening the inducement to move to the Mertarvik Town site. This is expected to primarily result from the additional year-round time and effort required to travel by boat or snow machine to the Mertarvik town site to retrieve supplies and materials or people delivered by commercial air traffic.

Deactivation of the Newtok Airport will also either lead to decreased flights/increased costs of travel to Newtok or required investment by the State to maintain the airport in a sufficient status that commercial air carriers serve both airports. The long-term potential for that is highly unlikely as more people move to Mertarvik. Therefore, people residing in Newtok are expected to experience decreased levels of air service including reduced importation of goods by air. It is also expected that the costs of goods in Newtok would increase as the village moves to Mertarvik and commercial flight operations transition to Mertarvik. There is also expected to be a period of time each spring and fall when either thin ice prevents travel by snow machine or flowing broken ice prevents travel by boat which will adversely affect residents still in Newtok.

The negative impacts of both connected actions; Removal of Newtok Airport from the NPIAS and the State of Alaska’s Deactivation of Newtok Airport are expected to be minor.

Subsistence Resources – Newtok

The primary indirect effect of both removal of Newtok from the NPIAS and eventual deactivation is a small but increased cost in money and time to obtain these subsistence supplies and materials due to the travel time and gasoline and oil expended to retrieve them from flights into Mertarvik Airport. As operations decrease at the Newtok site, animal use of the airport may increase bringing these animals closer to the residential areas. This would have a positive temporary impact if these animal species are of use to the residents of Newtok. However, hunting in the area of the airport is discouraged so any benefit may be small.

Environmental Justice and Children's Health and Safety – Newtok

Environmental Justice in Minority and Low Income Populations: Both minority and low income populations exist at Newtok.

Factors considered in the analysis of potential Environmental Justice (EJ) effects include potential human health, cultural resources and historic properties, community disruption, subsistence, economic and cumulative effects. Included in this analysis are potential impacts (noted in the next paragraph) to Children's Health and Safety; Executive Order 13045 Protection of Children from Environmental Health Risks and Safety Risks. The specific factors considered from the Executive Order are; air quality, water quality, physical dangers of construction and access to medical services outside the community.

Regarding children's safety, if removal from the NPIAS results in air ambulance services requiring patient pickup at Mertarvik versus Newtok, adults and children would experience potential effects of boat or snow machine transport to an air ambulance at Mertarvik. However, as long as the runway is operationally safe for the class of air ambulance attempting to use it this potential effect is only expected when weather conditions would preclude safe operations at Newtok but permit them at Mertarvik.

Indirect EJ impacts potentially resulting from deactivation include a temporary exacerbation of economic impacts related to time and costs of retrieving goods flown into Mertarvik Airport versus Newtok Airport. Because deactivation of Newtok Airport potentially requires remaining Newtok residents to travel to the Mertarvik Town site for goods and materials economic costs of remaining in Newtok may increase for remaining Newtok residents. The impact of both connected actions would be minor.

Regarding children's safety, if deactivation results in air ambulance services requiring patient pickup at Mertarvik versus Newtok adults and children would experience potential effects of boat or snow machine transport to an air ambulance at Mertarvik.

As noted in the previous Subsistence section deactivation at Newtok may indirectly increase subsistence costs and lessen time available for subsistence due to time spent traveling to and from Mertarvik to retrieve subsistence supplies and materials (i.e. air cargo).

The impacts of both connected actions; Removal of Newtok Airport from the NPIAS and the State of Alaska's Deactivation of Newtok Airport are expected to be minor. The potential exception is evacuation of injured children from Newtok via air ambulance after the airport is deactivated. At this time a rotor wing air ambulance can access Newtok with or without an airport weather depending. Given that residents are expected to move to Mertarvik (particularly children needing to attend school) the timeframe during which children might be without air ambulance access is expected to be small and diminish over time as all children move to Mertarvik.

Biological Resources – Newtok

Special Status Species – Newtok

Removal from the NPIAS conceivably has the potential to indirectly result in fewer disturbances to eiders transiting the Newtok area if that transit would have coincided with an historic flight arrival and departure time that might have disturbed the bird. There is no conceivable adverse impact to any eider from the effects of removing the Newtok Airport from the NPIAS.

Deactivation conceivably has the potential to indirectly result in fewer disturbances to eiders transiting the Newtok area if that transit would have coincided with an historic flight arrival and departure time that might have disturbed the bird. While this effect could be minimal for an individual bird it is negligible to the species. Neither connected action would have a significant impact on biological resources.

Noise – Newtok

The direct noise impact of Newtok Airport's removal from the NPIAS on Newtok noise levels, assuming commercial carriers switch to using Mertarvik Airport only, would be a reduction in commercial aircraft related noise.

The indirect impact of Newtok Airport deactivation on Newtok noise levels would be a reduction in aircraft related noise. Neither connected action would have a significant positive or negative impact on noise.

Climate Change and Greenhouse Gas Emissions

Removal of Newtok Airport from the NPIAS would result in a reduction of airport/aircraft related emissions at Newtok. However, as the existence of these greenhouse gas emissions to climate change is not considered significant nor is their reduction. See Chapter 4 Mertarvik Airport Climate Change and Greenhouse Gas Emissions analysis for FAA's analysis of these effects.

Deactivation of Newtok Airport would result in a reduction of airport/aircraft related emissions at Newtok. However, the existence of these emissions is not considered significant nor is their reduction. None of the impacts of either connected action would have a significant positive or negative impact.

5.23.5 Environmental Justice

Executive Order (E.O.) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs Federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of their actions on low-income, minority, and tribal populations, to the greatest extent practicable and permitted by law.

An environmental justice (EJ) analysis typically includes the following elements (USEPA 2017):

a) Identification of any minority and/or low-income status communities in the project area;
b) Identification of any adverse environmental or human health impacts anticipated from the project; and
c) Determination of whether those impacts would disproportionately affect minority and/or low-income communities.

5.23.5.1 Identification of Minority or Low-income populations

The site proposed for construction of the community at Mertarvik currently has no permanent human population. The expectation of this project is that as homes and community services are constructed at Mertarvik, the current residents of Newtok will relocate to Mertarvik over a span of several years. Therefore the village of Newtok is considered the affected population for the sake of this Environmental Justice Analysis.

The existing population of Newtok includes both minority and low-income components. As of the 2010 U.S. Census, Newtok was about 96 percent "American Indian and Alaska Native alone or in combination." Both Alaska Native and tribal populations are treated as minorities under this E.O. Income data from the U.S. Census Bureau's 2009-2013 American Community Survey show an estimated 30.10 percent (+/- 11.40%) of Newtok residents, regardless of minority status, have incomes below the Federal poverty level (ADCRA 2017j). Based on these percentages, the entire population of Newtok is considered to be minority, low-income, or both, for the purposes of this EJ analysis.

5.23.5.2 Identification of Adverse Impacts

The previous sections 5.2 through 5.22 analyzed potential project impacts on a range of resource categories, and identified no adverse effects that rise to a level of significance. For some categories most directly impacting the concerns of the affected EJ community, such as "Community and Culture" and "Public Health and Safety," the proposed action is intended to impact the population in strongly positive ways, enabling the Native village to maintain its cultural identity and carry on traditional practices in a safe and sustainable setting. The potential impacts on another resource category of particular concern to this community, subsistence, were found to be minor (section 5.17.3). Newtok residents have stated that they do not expect the proposed project to cause long-term changes to their subsistence practices.

There will be some inevitable disparity in the distribution of community services during the transition period. Families that move to Mertarvik during the early "Pioneer" phase will do so with the understanding that some services, such as power and water, will be limited while the community infrastructure is under construction. Towards the end of the transition period, residents in Newtok awaiting relocation will likely experience reduced services as infrastructure at Newtok is decommissioned or abandoned. The order in which Newtok residents relocate to Mertarvik is a matter for the community and its leadership to decide.

5.23.5.3 Determination

The Denali Commission has determined that there will be no disproportionate adverse impacts on minority or low-income communities as a result of the proposed action. This decision was informed by the following considerations:

- A substantial majority of the affected population, the village of Newtok, is minority, low-income, or both; this entire population is regarded as an EJ community for the purposes of the EJ analysis.
- The residents of Newtok have been active participants in the design and approval of the proposed action.
- Upon completion, the proposed action will provide adequate housing and services to the entire population of Newtok at the new Mertarvik village site.
- All three Mertarvik CLP alternatives feature a relatively compact and centralized layout of homes, designed to maximize the efficiency of utility distribution, and also to ensure convenient access to community services for all.
- All proposed residential sites included in the proposed alternative are considered to be equally desirable based on access to services and public facilities.
- Potential nuisances such as the waste water lagoon, the landfill, and the airport have been designed within the CLP to be an adequate distance from any homes, and are unlikely to disproportionately affect any segment of the Mertarvik community.
- The priority by which individuals and families are relocated from Newtok and the allocation of housing at Mertarvik are matters for the community and its leadership to decide, and are outside the scope of this EJ analysis.

5.23.6 Children's Environmental Health and Safety Risks

E.O. 13045, "Protection of Children from Environmental Health Risks and Safety Risks," applies to economically significant rules under E.O. 12866 that concern an environmental health or safety risk that EPA has reason to believe may disproportionately affect children. FAA guidance (FAA 2015) extends this analysis to individual Federal actions.

Under all alternatives except the no action, construction activities overall would produce a temporary increase in CO2 emissions for the duration of community relocation efforts. These temporary emissions are expected to be negligible in quantity compared to regional, U.S. and world greenhouse gas emissions.

Operation of major infrastructure such as the proposed airport, power generation plant, etc. at Mertarvik is also expected to have negligible impacts as the new modern infrastructure would be providing largely the same services (e.g. air transport, electricity, respectively) as older less emissions efficient equipment at Newtok. The exception being the fleet of aircraft serving either community location as they are expected to be the same aircraft making up the same air fleet mix. Because each piece of permanent emission emitting infrastructure has not been identified for Mertarvik, it is not possible at this time to quantitatively compare and contrast current versus potential future emissions.

The FAA has not established a significance threshold pertaining to impacts to children's environmental health and safety. However, the FAA recommends consideration of whether the proposed action or alternatives would have the potential to lead to a disproportionate health or safety risks to children. Under all alternatives except the no action, the proposed community at Mertarvik would have more modern infrastructure with newer and more technologically robust measures to protect children from injury and or exposure to harm. For example housing construction requirements that meet current building codes with related modern safety features, for example smoke alarms, anti-siphon valves, etc. The proposed community at Mertarvik would have more clearly defined and modern mechanisms and processes for restricting access to and disposing of potentially hazardous materials children might be exposed to.

The Denali Commission has determined that there will be no disproportionate health or safety risk to children as a result of the proposed action.

5.23.10 U.S. DOT Act of 1966 (49 U.S.C. §303) - Section 4(f) Analysis

Section 4(f) of the U.S. Department of Transportation (DOT) Act of 1966 (49 U.S.C. §303) (Section 4(f)) protects significant publicly owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites. The Act applies only to DOT agencies projects. The construction of the airport is the only potential DOT transportation project occurring at the Mertarvik town site.

The process the FAA follows per Section 4(f) is comprised of the following steps as needed.

1. Determine if properties potentially qualifying as significant 4(f) resources might be affected;
2. Conduct an initial assessment to determine if a physical or constructive use might occur; therefore, determining if a detailed analysis of potential 4(f) impacts is required;

3. Determine if a potential physical use of a significant 4(f) resource may result from implementation of any alternative;
4. Determine if a potential temporary occupancy might result from implementation of any alternative and therefore physical use of a significant 4(f) resource;
5. Determine if a constructive use may result from implementation of any alternative;
6. Determine if resources protected under Section 106 of the National Historic Preservation Act may be impacted (a potential 4(f) impact);
7. Determine if a 6(f)[1] impact may occur, (Note: if no "use" would occur i.e. physical, constructive, impacts to listed or eligible NHPA Section 106 resources or conversion of 6(f) assisted properties then the analyses ends at this point);
8. If potential physical use(s) may occur then make a *de Minimis* determination, if applicable,
9. Conduct a formal Section 4(f) evaluation and make a formal finding if impacts may occur and are not *de Minimis*,
10. Make a significance determination,
11. Define appropriate mitigation, and
12. Make a conclusory statement defining the agency's formal finding.

As noted above, the process only proceeds to a formal evaluation and finding if a physical or constructive use may occur to a significant Section 4(f) or Section 106 NHPA listed or eligible resource.

In order for Section 4(f) to apply the DOT action must result in either a physical or constructive use of the significant resource A physical use is defined as an action or alternative that would involve an actual physical taking of a Section 4(f) property through purchase of land, a permanent easement, physical occupation of a portion or all of the property, or alteration of structures or facilities on the property. The concept of constructive use notes that; "a project that does not physically use land in a park, for example, may still, by means of noise, air pollution, water pollution, or other impacts, dissipate its aesthetic value, harm its wildlife, restrict its access, and take it in every practical sense." Constructive use is defined as occurring; "when the impacts of a project on a Section 4(f) property are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired." Because the U.S. Congress authorized the transfer of 10,943 acres of USFWS Yukon-Delta National Wildlife Refuge (NWR) lands to the Newtok Native Corporation to create the Mertarvik town site in 2003, the construction and operation of Mertarvik Airport is not a physical use of a 4(f) property. Specifically, the former lands of the Yukon Delta National

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[1] 6(f) requirements relate to the potential conversion of land use of Land and Water Conservation Fund (16 U.S.C. §4801-8(f)) assisted properties.

Wildlife Refuge are now the property of the Newtok Native Corporation and no longer meet the definition of a 4(f) resource. Therefore, there are no potential physical use impacts to analyze.

Constructive use as noted above, requires substantial impairment of the protected activities, features, or attributes of the Section 4(f) property. This means that the value of the Section 4(f) property, in terms of its prior significance and enjoyment, is substantially reduced or lost. The only potential constructive use impact category defined in the Act that potentially applies to airport impacts on adjacent Yukon-Delta National Wildlife Refuge lands is aircraft noise. “Quietness” is not a stated purpose for refuge establishment but is for wilderness areas where the impact of man is minimal to non-existent.

The designated wilderness within the refuge is substantially north of Newtok (approximately 95 miles away) and would not be affected by the proposed project. The nearby refuge area experiences common use by the native population including noise generating machines such as snowmobiles, airplanes and motor boats as well as rifle and shotgun use.

No resources potentially eligible for listing or listed as defined under Section 106 of the National Historic Preservation Act would experience a physical or constructive use.

There are also no resources falling under 6f of the Land and Water Conservation Fund that would be affected.

Therefore, based on the limited and localized impact of aircraft noise as it currently exists and the expectation that there will be no substantial change in aircraft operations, the FAA believes that the limited flight operations at Newtok and the proposed replacement flight operations at Mertarvik will not result in a substantial impairment of any attributes of the refuge. Therefore, no constructive use under Section 4(f) of the Act would result from the proposed action.

Section 4f requires DOT entities to coordinate their 4f analyses with the agency responsible for managing the potentially affected 4f resource, in this case the U.S. Fish and Wildlife Service and the Yukon-Delta National Wildlife Refuge, respectively. FAA initiated that coordination on September 25, 2017. On November 8, 2017, via formal letter, the USFWS concurred with FAA’s 4(f) conclusion that there are no physical or constructive uses of Yukon Delta National Wildlife Refuge lands as a result of constructing and operating the airport as currently proposed (see letter in Appendix A Correspondence).

5.23.7 Incomplete or Unavailable Information (40 CFR §1502.22)

There is no incomplete or unavailable information of reasonably foreseeable significant impacts that would be relevant to making a reasoned choice among the alternatives identified in this EIS;

the cost of obtaining any additional information relevant to reasonably foreseeable significant adverse impacts on the human environment is not an issue.

As previously discussed in this EIS, the primary issue that remains as yet undetermined is when the various elements of the community infrastructure will be constructed (based on availability of Federal, State and tribal funding), and therefore when the related potential effects disclosed in this EIS would occur, and which federal, state or tribal agency will develop the various elements of the proposed action. While the erosion forcing the community's certain relocation continues unabated, and the limited relocation of a small number of pioneering residents and related infrastructure construction has been completed (barge landing, evacuation center, housing) or is ongoing, no funding exists on State or Federal level to accomplish more than a very small portion of the community's relocation effort.

While the composition of the future Mertarvik community is sufficiently well established to plat community and estimate infrastructure impact areas (section 4.5.1), design details for many infrastructure elements are still undergoing development. Future design and decisions that have potential environmental impact (e.g., buried vs. above-ground utilities) might require supplemental environmental analysis under NEPA, likely in the form of an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI).

Therefore, while the potential effects of the proposed action are valid, the actual timing of the occurrence of the majority of effects, and who will take lead in constructing the various elements of the plan, is unknown at this time. However, since these unknowns do not affect the level of significance of the expected impacts, they are likewise not considered significant.

5.23.8 Unresolved Issues

Aside from those stated in section 5.23.7 above, there are no known unresolved issues or conflicts.

5.23.9 Mitigation and Permitting

5.23.9.1 Mitigation

Mitigation has been defined by the CEQ to include:

- Avoiding an impact by not taking an action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing impact over time by preservation and maintenance operations; and
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR §1508.20).

These elements are listed and represent a sequence of steps that are generally taken in the planning of a project. Thus, compensation is to be used only as a last resort after opportunities to avoid, minimize, rectify, and reduce impacts have been exhausted.

From the earliest stages in the process of developing the proposed action, environmental considerations were incorporated in order to avoid, minimize or compensate for anticipated environmental consequences. Mitigation related to all construction activities at the Mertarvik town site, including airport construction, is expected to be comprised primarily of Best Management Practices commonly utilized during construction in this area of Alaska in relation to air and water quality impacts. For example, each of the three ANTHC CLPs avoided known cultural sites and provided watershed and wellhead protection for the Mertarvik spring. Land was set aside to provide a buffer along the Takikchak River and the wetlands near its confluence with the Ninglick River. Water and sewage systems were designed to minimize impacts to the environment, BMPs will be utilized to control fugitive dust emissions during construction, and speed limits will be established to reduce dust from ATV traffic on gravel roads. The new electrical generators to be installed will greatly reduce air emissions compared to the existing generators in use in the village of Newtok, and the wastewater collection, treatment and disposal system will modernize the honey bucket collection system now in use at Newtok. Fuel storage at the barge landing will be consolidated, with secondary containment and spill response equipment made readily available. The consolidation of all boat traffic to the barge landing areas will also minimize coastal bluff breakdown and the risk of fuel spills, as compared to having individual launch sites along the Ninglick River.

Environmental construction timing windows for this project relate to migratory birds. The USFWS has identified the time period between May 5 and July 25 as when migratory birds are most likely to be nesting in “shrub or open” habitat in the Y-K Delta region (USFWS 2009); the entire Mertarvik project area falls within this description. The USFWS recommends that construction projects avoid clearing vegetation or placing fill within potential nesting habitat during this time period, as the surest means of avoiding the destruction of active bird nests, eggs, or nestlings, thereby avoiding violations of the Migratory Bird Treaty Act. Table 17 summarizes the migratory bird nesting periods, and type of construction that may be affected.

At Mertarvik, the risk of MBTA violations can be minimized by:

a. Conducting fill-placement or ground-clearing activities prior to May 5 or after July 25, or performing preliminary vegetation-clearing outside the nesting period such that the future construction site no longer provides suitable nesting habitat;

b. Excluding ground-nesting species from an imminent construction site, by laying tarps or other ground coverings at the site and/or placing deterrent devices (e.g., Mylar® flash-tape fastened to wooden stakes, etc.), prior to the start of and during the nesting season.

Where the preemptive avoidance measures described above are not possible, the construction site should be surveyed for active nests prior to construction activities, and any nests found must be marked and protected until the young hatch and depart the nest. Additional consideration may be required in the fall to avoid impacts to emperor geese or other waterfowl that may feed on crowberry tundra habitat in the area. Consultation with USFWS should occur prior to construction to determine confirm construction windows.

Table 17. Construction and Bird Nesting Windows for Mertarvik

Activity	**Work Window**											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clearing, Site Preparation+												
Materials excavation, stockpiling within previously disturbed areas												
Construction of building pads, placement of fill*												
Utility installation, vertical construction												
Revegetation, restoration of disturbed areas												
Relocation of structures*												

Shaded areas depict time frames where no future work of that type should occur.

Orange indicates a work window to protect nesting birds

Gray indicates a potential work window to protect emperor geese during an important feeding time period

+Site preparation includes ground disturbing activities or disturbances.

*Construction of buildings pads/relocation of buildings could commence within no work window if site preparation has been previously completed and it is known that no nesting birds are present.

Specific to the existing Newtok Airport, mitigation is expected to be limited to the use of air and water quality Best Management Practices during the removal of manufactured infrastructure. Because the existing village site is expected to largely erode into the river over the next 20 years, there is no mitigation value to removing the existing runway, taxiway and apron and then reclaiming the habitat to off-set habitat losses at the Mertarvik town site. Nor is there mitigation value in reclaiming the gravel or fill material in place at the existing village airport in the form of the runway, taxiway and apron because there is a viable materials source at the Mertarvik town site. Specifically, the negative ecological impact of the excavation and transport of the existing airport fill material for re-use for the replacement airport would not be off-set by positive ecological impacts if the existing airport was reclaimed due to the short duration of its existence due to erosion.

5.23.9.2 Permitting

If a Department of the Army permit is required from the USACE Alaska District's Regulatory Division for wetland impacts associated with any element of the proposed action, then compensatory mitigation for some or all of the wetland impacts may be required.

Table 18 lists recommended consultations and required permits and clearances from different regulatory agencies and the associated anticipated time frames to complete each process. Also included are milestones during project progress when certain activities should be initiated. This table does not represent an exhaustive list of requirements but highlights the major milestones in the process.

This EIS may meet the required NEPA analysis as determined by the Federal agency implementing a future action.

Table 18. Permitting Considerations for Mertarvik Infrastructure Development Projects

Agency	Permit/Clearance/Consultation	When to Initiate	Approximate Timeline to Acquire Permit or Clearance
Federally Funded Actions			
NEPA	Environmental Assessment (EA)	Review need upon receipt of funding for a specific element of the proposed action	90-160 days*
SHPO & Tribes	Initiation of Consultation	Once the planning of an element of the proposed action has been initiated	30 days
	Finding of No Historic Properties Affected	Upon receiving concurrence of such from SHPO	30-120 days
State and Federally Funded Actions			
USFWS	Section 7 Consultation for Threatened and Endangered Species	Once the planning of an element of the proposed action has been initiated	30-120 days**
	Consultation regarding clearing windows for nesting birds and emperor geese	For any proposed ground disturbing activities	14-30 days
NMFS	Consultation for Essential Fish Habitat (EFH)	For any in-water work in the Ninglick River	14-30 days
ADFG	Title 16 Fish Habitat Permit	For any work within Takikchak River	30-90 days
USACE	Clean Water Act Section 404 Permit	Once the planning of an element of the proposed action has been initiated and fill in WOTUS is expected	120 days
ADEC	APDES Construction General Permit	1 month prior to construction, once 100% construction documents are complete	30 days***
Privately Funded Actions			
ADFG	Title 16 Fish Habitat Permit	For any work within Takikchak River	30-90 days

Agency	Permit/Clearance/Consultation	When to Initiate	Approximate Timeline to Acquire Permit or Clearance
USACE	Clean Water Act Section 404 Permit (Individual or Nationwide)	Once the planning of an element of the proposed action has been initiated and fill in WOTUS is expected	120 days
USFWS	Consultation regarding clearing windows for nesting birds and emperor geese	For any proposed ground disturbing activities	14-30 days
ADEC	APDES Construction General Permit	1 month prior to construction, once 100% construction documents are complete	30 days

* Initiation of NEPA document will begin with informal agency scoping and data-gathering. The NEPA process will continue throughout the entire proposed action until a Finding of No Significant Impact (FONSI) or Record of Decision (ROD) is obtained.
+ Length of consultation will depend on determination of affect by regulatory agency.
** Includes review and approval of SWPPP, pre-construction site visit, and submittal of notice of intent.

5.24 Summary of Environmental Impacts

Table 19 below summarizes the impacts determined for the resource categories addressed in sections 5.2 through 5.22. No significant direct, indirect, or cumulative negative environmental impacts were identified as a result of the analyses performed in Chapter 5 of this EIS.

6. Regulatory Compliance and Consistency with Plans and Policies

6.1 Regulatory Compliance

This EIS has been coordinated with all relevant Federal and state agencies, including the President's Council on Environmental Quality (CEQ), U.S. Environmental Protection Agency USEPA), U.S. Fish and Wildlife Service (USFWS), and Alaska Department of Environmental Conservation (ADEC). Information on this coordination is provided in the EIS and is summarized in Table 20.

Table 19. Summary of Environmental Impacts by Resource Category

Resource Category	No Action Alternative	CLP 1 Alternative	CLP 2 Alternative (preferred)	CLP 3 Alternative
Geology, Soils, & Topography	No impact	MINOR impacts		
Hydrology & Hydraulics	No impact	MINOR impacts		
Floodplains	No impact	LESS THAN SIGNIFICANT impacts		
Surface Water	No impact	LESS THAN SIGNIFICANT impacts		
Groundwater	No impact	LESS THAN SIGNIFICANT impacts		
Air Quality	No impact	LESS THAN SIGNIFICANT impacts		
Climate & Climate Change	No impact	MINOR impacts		

Resource Category	No Action Alternative	CLP 1 Alternative	CLP 2 Alternative (preferred)	CLP 3 Alternative
Habitat	No impact	MINOR impacts		
ESA Species	No impact	LESS THAN SIGNIFICANT impacts		
MMPA Species	No impact	MINOR impacts		
Migratory Birds	No impact	MINOR impacts		
EFH & Anadromous Streams	No impact	MINOR impacts		
Wetlands & other Special Aquatic Sites	No impact	LESS THAN SIGNIFICANT impacts		
Protected Lands	No impact	MINOR impacts		
Cultural History & Cultural Resources	No impact	MINOR impacts		
Community & Culture	MAJOR impacts	MINOR impacts		
Socioeconomics	MAJOR impacts	MINOR impacts		
Subsistence Resources & Practices	MAJOR impacts	MINOR impacts		
Land Use & Compatibility	No impact	MINOR impacts		
Public Health & Safety	MAJOR impacts	MINOR impacts		
Public Services & Utilities	MAJOR impacts	MINOR impacts		
Noise	No impact	LESS THAN SIGNIFICANT impacts		
Visual Environment	No impact	MINOR impacts		

6.2 Status of Environmental Compliance (Compliance Table)

Table 20. Summary of Relevant Federal Statutory Authorities

Federal Statutory Authority	Compliance Status FC-full compliance PC-partial compliance	Comment
Clean Air Act (CAA), as amended	**FC** Confirmed with State of Alaska, Air Quality Program that area of the proposed action is not or near a "non-attainment" or maintenance" area of Class I area.	Section 176(c) requires that Federal agencies assure that their activities are in conformance with Federally-approved state implementation plans for geographic areas designated as "non-attainment" and "maintenance" areas under the CAA.
Clean Water Act (CWA) of 1977, as amended (Sections 401 and 404)	**PC** Department of the Army permits under Section 404 will be applied for as elements of the proposed action are undertaken by various federal, state and tribal agencies.	The specific sections of the CWA that apply to the proposed action are Section 404, addressing discharges to WOTUS, and Section 401, which requires certification that the permitted action complies with the State Water Quality Standards for actions within State waters.
Coastal Barrier Resources Act of 1982	**Not Applicable** There are currently no coastal barriers designated under this law in the State of Alaska. No such coastal barrier landforms, designated or otherwise, exist in the Mertarvik town site area.	The Coastal Barrier Resources Act designated various undeveloped coastal barriers, which were illustrated by a set of maps adopted by law, and were made ineligible for both direct and indirect federal expenditures believed to encourage development of fragile, high-risk, and ecologically sensitive coastal barriers.
Coastal Zone Management Act (CZMA) of 1982	**Not Applicable** Denali Commission will continue to coordinate with State of Alaska environmental resource agencies to ensure compliance with state statutes.	The State of Alaska withdrew from the voluntary National Coastal Zone Management Program on July 1, 2011. Therefore, within the State of Alaska, the Federal consistency requirements under the Coastal Zone Management Act do not apply to Federal agencies.
Endangered Species Act (ESA) of 1973, as amended	**PC** Letters of coordination sent to the USFWS and NMFS and follow-up discussions about implementing mitigation measures have occurred with NMFS. See Appendix A - Agency Coordination.	The Denali Commission is required to coordinate with both the USFWS and NMFS to identify what ESA-listed species under those agencies respective jurisdictions may be present in the proposed action's area.

Federal Statutory Authority	Compliance Status FC-full compliance PC-partial compliance	Comment
Fish and Wildlife Coordination Act (FWCA), as amended	**FC** No waters of any stream or other body of water are foreseen to be proposed, permitted, or licensed to be impounded, diverted or otherwise controlled or modified.	The FWCA requires the Denali Commission 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.
Marine Mammal Protection Act	**PC** Letters of coordination sent to the USFWS and NMFS. See Appendix A - Agency Correspondence.	The Corps is required to coordinate with the USFWS and NMFS on potential impacts to species covered by this act and must address these agencies' concerns and recommendations.
Marine Protection, Research, and Sanctuaries Act of 1972	**FC** No ocean dumping of dredged material is part of the proposed action.	The Act regulates the dumping of materials into ocean waters and prevents, or restricts, dumping of materials that would degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. The Act provides for a permitting process to control the ocean dumping of dredged material.
Migratory Bird Treaty Act of 1918, with amendments	**PC** Construction and activity windows have been identified and will be respected during construction planning. These windows will be verified during the construction planning of specific project activities associated with the proposed action, and should be able to avoid the taking of migratory birds.	It is 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 Denali Commission is required to avoid a taking under this act during construction of a project.

Federal Statutory Authority	Compliance Status FC-full compliance PC-partial compliance	Comment
Magnuson-Stevens Fishery Conservation and Management Act	**PC** Nelson Island's encompassing waters are designated as EFH. The impact of typical barge and landing craft activities upon EFH at the Mertarvik barge landing site have been evaluated in previous NEPA documents, and determined that barge operations would not result in significant long or short-term adverse impacts to EFH. Each element of the proposed action will be re-coordinated with NMFS to confirm no changes have occurred in this assessment.	Federal action agencies 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.
National Environmental Policy Act of 1969, as amended	**PC** The Denali Commission completed this EIS in compliance with NEPA. This effort is on-going. Full compliance will be attained upon completion of the public review process and/or further coordination with responsible agencies	This Act requires that environmental consequences and proposed action alternatives be considered before a decision is made to implement a Federally-proposed action.
National Historic Preservation Act of 1966, as amended	**PC** Initial coordination with the State Historic Preservation Officer was initiated in mid-2017, but the SHPO has deferred formal consultation until after it has reviewed the EIS. The Denali Commission and the FAA will complete separate consultations with the Alaska SHPO.	Federal agencies are required to identify cultural or historic resources that may be affected by a proposed action and to consult with the State Historic Preservation Officer when a Federal action may affect cultural resources.
Executive Order 11990 - Protection of Wetlands	**PC**	To the extent possible, Federal agencies should avoid, to the long and short term, adverse impacts associated with the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Federal Statutory Authority	Compliance Status FC-full compliance PC-partial compliance	Comment
Executive Order 13112 – Invasive Species	**FC** The Denali Commission will require its contractor to implement measures to prevent the introduction of invasive species.	Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, prevent the introduction of invasive species.
Executive Order 12898 – Environmental Justice in Minority Populations and Low-income populations.	**FC** The proposed action has been developed specifically to provide the residents of Newtok with a safe place to which to relocate, allowing them to maintain their community and way of life intact within their traditional lands, while also providing the necessary infrastructure for a stable and healthy existence.	Each Federal agency shall conduct its programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such activities do not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination.
Executive Order 13175 - Tribal Consultation	**FC** This EO is not truly relevant to the proposed action, as the project is essentially that of the Tribal entity (NVC), with the DC acting as a facilitator. Neighboring villages were contacted as part of scoping, but did not identify impacts that would merit formal consultation under this EO.	Requires federal agencies to consult, on a government-to-government basis, with federally-recognized Indian tribes (to include Alaska Native tribes and communities) when developing federal policies with tribal implications. The purpose is to "have an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications."
State of Alaska, Department of Fish and Game Fish Habitat Permit, AS 16.05.841-871.	**FC** No fish habitat permits under AS 16.05.871-.901 are expected to be required for the proposed action, as no modification to fish-bearing waters is planned.	ADFG protects freshwater anadromous fish habitat and the free passage of anadromous and resident fish in fresh water bodies. Any activity or project below the ordinary high-water mark of an anadromous stream requires a Fish Habitat Permit.
State of Alaska, Department of Fish and Game Special Area Permit, AS 16.20.	**FC**	ADFG manages/permits activities that occur in legislatively designated special areas.

Federal Statutory Authority	Compliance Status FC-full compliance PC-partial compliance	Comment
State of Alaska, Department of Environmental Conservation, Clean Water Act, Section 401, 18 AAC 70.	**PC** Section 401 certification will accompany and Department of the Army permit issued under the Clean Water Act.	Any activity that might result in a discharge into WOTUS must obtain a water quality certificate from ADEC stating that the discharge will comply with the CWA, Alaska Water Quality Standards (18 AAC 70), and other applicable State laws.
State of Alaska, Department of Environmental Conservation, Solid Waste Program (18 AAC 60.300 and 18 AAC 60.211)	**PC** A permit will be obtained prior to the opening of the Mertarvik Class III Municipal Solid Waste Landfill.	This program issues permits for the disposal of solid waste, contaminated soil and the terrestrial placement of (contaminated and uncontaminated) dredged material.

PC = Partial Compliance, FC = Full Compliance

Note: This list is not exhaustive.

7. List of Preparers

Denali Commission

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Amanda Andraschko, Tribal Liaison, Programs and Project Management Division

- B.S. Sociology (emphasis Anthropology), Montana State University Bozeman, 1997
- M.A. Applied Cultural Anthropology, University of Alaska Anchorage, 2005
- 15 years of experience in tribal liaison and government-to-government relationships

Responsibility: Community and culture, environmental justice, government to government

Jan Deick, Geologist, Planning Section

- B.S. Geology, University of Minnesota Duluth, 1983
- M.S. Hydrology, University of Idaho Moscow, 1986
- 31 years of experience in hydrogeology, environmental science, contaminated site assessment and remediation, and water resource management (drinking water)

Responsibilities: Geology, soils and topography; hydrology, hydraulics and floodplains, surface water resources, groundwater resources, and water quality.

Matthew Ferguson, Fishery Biologist, Environmental Resources Section

- B.S. Biology, Drury University, 2013
- M.S. Environmental Management, Webster University, 2014
- 3 years of experience environmental science and management

Responsibilities: Hydraulics & hydrology, wetlands and other aquatic sites, biology, threatened and endangered species, and anadromous streams.

Christopher Floyd, NEPA Planner, Environmental Resources Section

- B.S. Biochemistry, Mississippi State University, 1986
- M.S. Biochemistry & Molecular Biology, Mississippi State University, 1988
- 28 years of experience in environmental chemistry and health, environmental impact assessment, and environmental compliance.

Responsibilities: NEPA management, coordination with Denali Commission and Cooperating Agencies, water quality, resource agency consultations.

Christopher Hoffman, Fishery Biologist, Environmental Resources Section

- B.A. Biology, Canisius College, Buffalo, NY, 1994
- Graduate Level Studies, Biology, University of Alaska Anchorage, 2003-2008
- 18 years of experience in biological and ecological sciences, mathematical modeling and biostatistics.

Responsibilities: Fishery biology, protected species, and birds

Kelly Eldridge, Archaeologist, Environmental Resources Section

- B.A. Anthropology, Grinnell College, 2007
- M.A. Anthropology, University of Alaska Anchorage, 2012
- Ph.D. Candidate, Anthropology, University of California, Davis, 2016
- 10 years of experience in cultural resource management

Responsibilities: Cultural history and cultural resources, subsistence

Forrest Kranda, Archaeologist, Environmental Resources Section

- B.A. Anthropology, California State University Fullerton, 2011
- M.A. Anthropology, University of Alaska Anchorage, (in progress)
- 2 years of experience in cultural resource management

Responsibilities: Cultural history and cultural resources, subsistence

Michael Noah, Marine Biologist, Environmental Resources Section

- B.S. Marine Biology, California State University Long Beach, 1982
- M.S. Biology, California State University Long Beach, 1984
- 35 years of experience in environmental program and project management, environmental impact assessment and mitigation in marine and coastal environments, and environmental compliance

Responsibilities: Oversight and guidance of EIS development; scope and content; independent review of the EIS for accuracy and compliance with CEQ regulations.

Michael Rouse, Wildlife Biologist, Environmental Resources Section

- B.A. Environmental Population and Organismic Biology, University of Colorado, 2005
- 14 years of experience in fisheries and aquatic ecology

Responsibilities: Essential Fish Habitat, anadromous waters

Diane Walters, Technical Editor, Environmental Resources Section

- B.A. Communications, University of the Pacific, 1979
- 39 years of experience in technical editing of environmental compliance documents, scientific reports, and coordination letters.

Responsibilities: Technical editor, document management, historical research, and coordination

Alaska Native Tribal Health Consortium

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Keith Gordon, Environmental Protection Specialist

- B.S. Fisheries and Wildlife Biology, Iowa State University, 1984
- 32 years of NEPA experience

Responsibilities: FAA EIS Lead

8. Distribution List

This EIS is being distributed to all Federal, State, and tribal agencies that have jurisdiction by law or special expertise with respect to any environmental impact involved, authorized to develop and enforce environmental standards, and to any person, organization or agency requesting the entire EIS (IAW 40 CFR §1502.19).

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