UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE
AMBLER MINING DISTRICT INDUSTRIAL ACCESS PROJECT
AT GATES OF THE ARCTIC NATIONAL PARK AND PRESERVE
ENVIRONMENTAL AND ECONOMIC ANALYSIS

The Alaska Industrial Development and Export Authority (AIDEA), a public corporation of the State of Alaska, proposes to construct a 211-mile industrial access road to provide access to the Ambler Mining District. The proposed road would cross the Western Unit (Kobuk Preserve) of Gates of the Arctic National Park and Preserve (GAAR), including crossing the Kobuk River, a designated wild river under the Wild and Scenic Rivers Act. The legislation that established GAAR, Section 201(4) of the Alaska National Interest Lands Conservation Act (ANILCA), recognized the need for this access and requires the Secretary of Interior to permit such access.

The Alaska Department of Transportation and Public Facilities developed two road alignment options across the Kobuk Preserve—AIDEA's proposed alignment and an alternative alignment, as requested by the National Park Service (NPS)—and AIDEA proposed these two alignments for consideration by the NPS. Since they were developed and proposed by the applicant, the NPS has accepted these alignments as economically feasible construction alternatives that meet the goals of the project.

The NPS, in cooperation with the US Department of Transportation, Federal Highway Administration, prepared this environmental and economic analysis (EEA) to evaluate the two road alignments within the Kobuk Preserve pursuant to ANILCA section 201(4)(d), which requires the analysis in lieu of an environmental impact statement. This analysis is being prepared solely to provide the Secretaries of the Interior and Transportation with information to aid them in determining the most desirable route for the road right-of-way and the terms and conditions required for the issuance of that right-of-way.

ANILCA requires the analysis to address two primary issues –

> (i) alternative routes including the consideration of economically feasible and prudent alternative routes across the Preserve which would result in fewer or less severe adverse impacts on the Preserve; and
>
> (ii) the environmental, social and economic impact of the right-of-way, including the impact on wildlife, fish and their habitat, and rural and traditional lifestyles, including subsistence activities, and measures which should be instituted to avoid or minimize negative impacts and enhance positive impacts.

National Park Service
US Department of the Interior

Gates of the Arctic National Park and Preserve
Alaska

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AUGUST 2019

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Acronyms, Abbreviations, and Definitions

ADF&G	Alaska Department of Fish and Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
AIDEA/the applicant	Alaska Industrial Development and Export Authority
proposed Ambler road	proposed Ambler industrial access road
ANILCA	Alaska National Interest Lands Conservation Act
applicant-proposed alignment	211-mile Ambler road alignment presented in AIDEA's application
AWC	Anadromous Waters Catalog
BLM	Bureau of Land Management
BLM EIS	Environmental Impact Statement to analyze impacts on Ambler road alternatives
DOWL	DOWL HKM, civil engineering consultants
EEA	environmental and economic analysis
EIS	environmental impact statement
FHWA	Federal Highway Administration
GAAR	Gates of the Arctic National Park and Preserve
IDT	interdisciplinary team
Kobuk Preserve	Kobuk River Preserve/Western Unit of Gates of the Arctic National Park and Preserve
NEPA	National Environmental Policy Act of 1969, as amended
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWI	National Wetlands Inventory
ORV	outstandingly remarkable values (related to Wild and Scenic Rivers)
PEM	palustrine emergent wetland
PEPC	Planning, Environment and Public Comment
PFO	palustrine forested wetland
PML	palustrine moss-lichen wetland
PSS	palustrine scrub-shrub wetland
ROW	right-of-way
SF299	Standard Form 299 (the right-of-way application)
USACE	US Army Corps of Engineers
USCG	US Coast Guard
USFWS	US Fish and Wildlife Service
WACH	Western Arctic caribou herd

CHAPTER 1: INTRODUCTION

The Alaska Industrial Development and Export Authority (AIDEA or the applicant), a public corporation of the State of Alaska, proposes to construct an industrial access road that provides access to the Ambler Mining District. This road of approximately 211 miles would extend from the Dalton Highway to the Ambler Mining District on the east bank of the Ambler River along the south flank of the Brooks Range. AIDEA has requested a right-of-way (ROW) permit from Department of the Interior to build the proposed Ambler road across the Western Unit (Kobuk Preserve) of Gates of the Arctic National Park and Preserve (GAAR) to access the Ambler Mining District. The enabling legislation that established GAAR, Section 201(4) of the Alaska National Interest Lands Conservation Act (ANILCA; Public Law 96-487), recognized the need for this access and states that the Secretary of Interior shall permit such access in accordance with the provisions of ANILCA (201(4)).

The National Park Service (NPS), in cooperation with the US Department of Transportation, Federal Highway Administration (FHWA), prepared this environmental and economic analysis (EEA) in lieu of an environmental impact statement (EIS) in accordance with the regulations for implementing ANILCA (43 Code of Federal Regulations § 36.13(a)). Per ANILCA, an EEA shall be prepared solely for the purpose of determining the most desirable alignment for the ROW and terms and conditions that may be required for issuance of that ROW on NPS lands. ANILCA states that the EEA must consider alternative routes that are economically feasible and prudent, and which would result in fewer or less severe adverse impacts upon the Kobuk Preserve. The EEA must also consider the environmental, social, and economic impacts of the ROW including the impacts of the alignments on wildlife, fish, and their habitat, and rural and traditional lifestyles (including subsistence activities), and measures that should be instituted to avoid or minimize negative impacts and enhance positive impacts.

In addition to allowing surface transportation access across the Kobuk Preserve and requiring the preparation of an EEA to determine the most desirable route, ANILCA 201(4) also requires the NPS and FHWA to consider economically feasible and prudent alignments, which would result in fewer and less severe impacts upon the Kobuk Preserve. The Alaska Department of Transportation and Public Facilities (ADOT&PF) developed plans for two alignments that cross the Kobuk Preserve—AIDEA's proposed alignment (the northern alignment) and an alternative alignment, as requested by the NPS (the southern alignment)—and AIDEA proposed these two alignments for consideration in their permit application. Since ADOT&PF developed these alignments based on their own engineering and design criteria, and AIDEA proposed them in their permit application, the NPS and FHWA have accepted that they are both economically feasible and prudent for accomplishing the purposes of the Ambler Mining District Industrial Access Project. This document evaluates only these two alignments, the northern alignment and the southern alignment.

The proposed northern alignment across the Kobuk Preserve is 26 miles within the preserve and 211 miles in total. The proposed southern alignment is 18 miles within the preserve and 224 miles in total. Stream and river crossings are a major element in the cost of the project and their total number differs between the alignments. This document does not analyze the effects of mining activity that would be undertaken once the road is completed.

Due to the need for the overall project—construction of a road for surface transportation to the Ambler Mining District—to cross land managed by the Bureau of Land Management (BLM) and the need for other federal permits, the overall project is subject to the National Environmental Policy Act of 1969, as amended (NEPA). The BLM is the lead agency for the required NEPA analysis and is preparing an EIS (the BLM EIS) to determine the impacts from the applicant-proposed 211-mile alignment (applicant-

proposed alignment), and other alternatives, for the construction and operation of a road to the Ambler mining district. The US Army Corps of Engineers (USACE), the US Environmental Protection Agency, and the US Coast Guard (USCG) are the federal cooperating agencies helping to prepare the BLM EIS. The NPS and FHWA are participating agencies for the BLM EIS.

The proposed road would cross the Kobuk River, designated as a wild river under the Wild and Scenic Rivers Act. ANILCA § 1107(b) addresses the requirements for analyzing transportation and utility systems permitted under ANILCA that would cross a designated river. "Any transportation or utility system approved pursuant to this title which occupies, uses, or traverses any area within the boundaries of a unit of the National Wild and Scenic Rivers System shall be subject to such conditions as may be necessary to assure that the stream flow of, and transportation on, such river are not interfered with or impeded, and that the transportation or utility system is located and constructed in an environmentally sound manner."

This chapter describes the purpose of the federal action, the project background, objectives, issues and topics retained, and issues dismissed from analysis in the EEA.

PURPOSE OF FEDERAL ACTION

The purpose of the federal action is for the Secretary of the Interior and the Secretary of Transportation to respond to the applicant's proposal for a ROW as required by ANILCA. The NPS and FHWA prepared this EEA to consider factors set forth in Section 201(4)(d) of ANILCA. The applicant has submitted an application for a ROW with plans for constructing a road across public lands managed by the NPS. The purpose of action by the Secretary of the Interior and the Secretary of Transportation is distinct from that of the applicant, which is discussed in the following section.

PROJECT BACKGROUND

History of Gates of the Arctic National Park and Preserve

Nomenclature Used in this Document

GAAR = Gates of the Arctic National Park and Preserve

national park = wilderness portion of Gates of the Arctic National Park and Preserve

Kobuk Preserve = the Western Unit of the preserve; location of the NPS project area

When Congress established Gates of the Arctic National Park and Preserve in 1980 in ANILCA, it preserved a vast and undeveloped landscape that provided opportunities to experience solitude and the natural environmental integrity and scenic beauty in Alaska's Brooks Range. GAAR is comprised of the national park (7,523,897 acres) and two units that make up the national preserve—the Eastern Unit (Itkillik) and the Western Unit (Kobuk Preserve), together containing 948,608 acres (Appendix A, Figure 1). GAAR is devoid of roads and other developments and consists of glacially carved valleys, rugged mountains, arctic tundra, and boreal forest inhabited by wildlife, such as caribou, grizzly bear, moose, gray wolf, and Dall's sheep. Congress recognized that the wild and undeveloped character of the land and the opportunities it affords for solitude and wilderness travel were identified as special values of GAAR. Congress also recognized and protected opportunities for subsistence use of the resources of GAAR by local residents. The presence of mineral deposits in the Ambler Mining District to the west of GAAR was identified prior to the establishment of the park and preserve. In considering the designation of GAAR, Congress recognized a need for surface transportation access to connect the Ambler Mining District to the Dalton Highway east of GAAR and allowed for a transportation corridor across the Kobuk Preserve.

Applicant Purpose and Need

The applicant's purpose for submitting an application to the Department of the Interior, in part, is to secure a ROW through the Kobuk Preserve for the purpose of constructing an industrial access road to the Ambler Mining District. The proposed Ambler road is intended for industrial use, namely surface transportation to the mining district for mineral exploration and development. Access to the road would be controlled, and primarily limited to mining-related industrial uses, although other commercial uses may be allowed under a permit process. The applicant requires a road because there are no existing roads or other feasible surface transportation options for accessing the Ambler Mining District.

AIDEA Application

In November 2010, the ADOT&PF notified the NPS of its intention to submit an application for access across the Kobuk Preserve. The Alaska State Legislature funded ADOT&PF to study the feasibility of constructing the proposed Ambler road from the Dalton Highway to the Ambler Mining District. ADOT&PF identified multiple overland routes to the mining district, including two potential routes through the Kobuk Preserve.

In 2013, the Governor of Alaska assigned the lead for the Ambler Mining District Industrial Access Project to AIDEA. AIDEA, working with DOWL HKM (DOWL), a private engineering firm, continued to acquire environmental and economic data to inform road feasibility and route decisions, prepare preliminary road designs, and prepare an application for a ROW. Throughout this process, the NPS and FHWA engaged in multiple meetings with ADOT&PF and AIDEA to identify data gaps. The NPS issued permits for AIDEA's pre-application field studies on NPS lands, which were performed to gather data and information on resources that may impact or be impacted by a road.

An NPS interdisciplinary team (IDT) of GAAR and regional NPS staff was formed in May 2013 to address NPS responsibilities in responding to the application for a ROW. The NPS team worked in conjunction with FHWA, which provided technical expertise on road design and ROW stipulations. In addition to the studies coordinated by DOWL, the NPS conducted field studies related to park resources.

On November 24, 2015, AIDEA submitted a consolidated application in the form of a Standard Form 299 (SF299): Application for Transportation and Utility Systems and Facilities on Federal Lands. The application was submitted to the NPS, BLM, FHWA, USCG, and USACE. The application described an applicant-proposed alignment from the Dalton Highway to the Ambler Mining District, with two alternative alignment variations for the segment crossing the Kobuk Preserve. The northern alignment variation follows the southern foothills of the Brooks Range near the boundary between the Kobuk Preserve and the national park. The southern alignment variation crosses the preserve farther away from the national park boundary and further downstream on the Kobuk River. The portion of the proposed Ambler road that would cross NPS lands is approximately 26 miles for the northern alignment and 18 miles for the southern alignment (Appendix A, Figure 1). Both alignments would cross the Kobuk River.

An agency review of the initial application identified information deficiencies, which were conveyed to the applicant in a letter dated January 22, 2016. A revised application was determined to be complete and sufficient, and the permitting process was initiated June 30, 2016.

NPS PROJECT AREA

The NPS project area encompasses the northern and southern alignment within the Kobuk Preserve, as described in Chapter 2 (Alignments). For each of the resource topics, the geographic area of analysis is described in Chapter 3 (Environmental Analysis); the area of analysis for all resources is within the NPS

project area. For most resource topics, the area of analysis includes the entire NPS project area. The area of analysis is limited to the specific corridor surrounding the alignments within the NPS project area for wetlands. The NPS project area is presented in Figure 2 in Appendix A. Because the analysis in the EEA focuses solely on impacts within GAAR, it presents an incomplete assessment of impacts of the proposed Ambler road as a whole. For an analysis of impacts from the entirety of the proposed Ambler road, see the BLM EIS.

PUBLIC INPUT AND DEVELOPMENT OF THE ISSUES

The NPS requested public input to identify the issues relevant to the analysis of the two alignments. The NPS communicated with federal, state, and local agencies with legal jurisdiction or specialized expertise, communities in the project vicinity and broader region, non-governmental entities, and the general public. NPS and FHWA coordinated with other federal agencies during the NEPA permitting processes, including BLM, USACE, and USCG.

Through this process, issues associated with the decision of where to locate the ROW across the Kobuk Preserve were evaluated. Public input and agency consultation are discussed further in Chapter 4: Consultation and Coordination.

ISSUES AND RESOURCE TOPICS ANALYZED IN THE EEA

The NPS identified issues to be analyzed in the EEA through internal review and analysis, discussions with participating agencies, and input from the public. This EEA analyzes the impacts of the northern and southern alignments to the following resources within the Kobuk Preserve in the "Environmental Analysis" chapter: hydrology, floodplains, and permafrost; wetlands; water quality; fish; caribou; archeological resources; visitor experience; socioeconomics; and wild and scenic rivers.

ISSUES NOT ANALYZED IN THE EEA

The following issues were reviewed for analysis but were dismissed. These issues are described below with the reasons that further analysis is not warranted. Generally, issues were dismissed if the impacts were consistent between the two alignments and therefore did not inform a route determination. Dismissal does not mean that the proposed road would not have impacts on a resource. It simply means that analyzing the topic would not aid in selecting an alignment. Per the requirements of ANILCA, Section 201(4)(d), the EEA identifies measures to avoid or minimize negative impacts to resources and enhance positive impacts, including for those issues dismissed from analysis. These are summarized in Appendix C (Guidelines for Developing Terms and Conditions).

Air Quality

Road construction and operation activities could affect air quality through vehicle and stationary source emissions and generation of airborne particulates (fugitive dust), which may be enriched by heavy metals. In addition to affecting air quality, these sources can create visual impacts and potentially lead to the accumulation of trace metals in plants, water, and soils. Airborne contaminants, including metals such as zinc, copper, lead, and cadmium can injure or kill lichens, bryophytes, and vascular plants; change water quality; and pose a risk to aquatic biota (e.g., fish, and aquatic insects), which inhabit lakes, streams, ponds, and wetlands. The NPS considered the changes in air quality from construction and operation of the proposed Ambler road, recognizing the possible impacts on natural resources, human health, and visitor experience. The team determined that the changes in air quality would be similar between the two alignments, and an analysis would not inform a route selection decision. Air quality was dismissed as a

stand-alone analysis topic, but the effects of fugitive dust were evaluated in the "Water Quality," Fish," "Caribou," and "Visitor Experience" sections. Measures instituted to avoid or minimize negative impacts to air quality would be implemented through terms and conditions required for issuance of the ROW (Appendix C).

Upland Vegetation

The Kobuk Preserve contains largely undisturbed upland habitats that include boreal forest; needle-leaved, broad-leaved, and mixed forests; upland shrubs; and upland meadows (DOWL 2014a). The NPS considered the potential for impacts to vegetation along both alignments. Land disturbance associated with construction activities would remove native vegetation, leaving unvegetated, disturbed areas vulnerable to wind and water erosion. Indirect impacts include the potential for changes in species composition of mosses, lichens, and shrubs due to disturbance; colonization by non-native invasive plant species that could outcompete native species; and plant injury from deposition of contaminants-bearing fugitive road dust. The NPS recognizes that these impacts could occur from construction of the proposed road; however, upland vegetation was dismissed as a stand-alone analysis topic for several reasons. The upland habitat is consistent throughout the Kobuk Preserve, meaning that impacts of the northern or southern alignment would have a similar impact on vegetation communities. Although vegetation is not carried forward for detailed analysis as a separate topic, it is discussed in the "Caribou" section as it relates to differences in caribou use of specific habitats within the NPS project area. Measures instituted to avoid or minimize negative impacts to upland vegetation would be implemented through terms and conditions required for issuance of the ROW (Appendix C).

Grizzly Bear, Moose, Gray Wolf, Dall's Sheep, and Birds

Grizzly bear, moose, gray wolf, Dall's sheep and raptorial birds were considered for detailed analysis since their protection is a park purpose recognized by Congress when the park and preserve were created, and they are important resources for subsistence users. These species, however, were dismissed from detailed analysis. For grizzly bears, habitat use is similar in the northern and southern alignments, with similar numbers of bears, numbers of crossings, time of crossings, elevations, slopes, and land cover used (Joly et al. 2016). While the northern alignment is closer to more denning habitat it is not sufficiently close to pose likely impacts to bear denning behavior. Because impacts are not substantially different between the two proposed alignments, grizzly bears were dismissed from detailed analysis.

Studies of moose movements and habitat use in the central Brooks Range are few, but suggest that the areas of most frequent use are located at the eastern portion of the overall road alignment, close to the Dalton Highway (Joly et al. 2016). Previous studies of gray wolves indicate that the Walker Lake Pack contained 13 to 15 wolves and their home range occurred in proximity to the NPS project area, but the most recent survey of this pack was completed from 1987 to 1991 (Adams et al. 2008) and the data are not current. Without up-to-date population and movement data on wolves in the NPS project area, an analysis can consider available habitat and prey species (moose and caribou). The northern route is better drained and has more deciduous trees and shrub habitat, and more open lichen patches. These habitats provide better quality habitat for moose (and caribou), and thus for wolves. While this represents a difference between the two routes, the difference is not significant and there would not be discernable differences in the impacts on moose, and gray wolves for the northern and southern alignments. For this reason, moose and gray wolves were dismissed from detailed analysis.

GAAR contains significant populations of Dall's sheep (Lawler 2004), a highly visible large mammal that occurs in mountainous habitats. This species is an important subsistence species for local residents and valued where sport hunting is permitted in preserves (NPS 2014, 2017a). Unlike caribou and moose, Dall's sheep have distinct home ranges (Woolington 1997). Dall's sheep occur west of Walker Lake and

within portions of the Schwatka Mountains, which are north of the northern alignment (Rattenbury and Schmidt 2011). Although the northern alignment is closer in proximity to Dall's sheep habitat than the southern alignment, neither alignment is sufficiently close to suggest likely impacts on Dall's sheep population or habitat and Dall's sheep were eliminated as a topic subject to detailed analysis.

Approximately 120 bird species have been documented in GAAR, including a variety of waterfowl, raptors, grouse, shorebirds, and passerines (NPS 2014). A list of 46 avian species most likely to be impacted by the proposed road was compiled and analyzed. Bird population data are not available for the NPS project area, and potential bird habitat for each alignment was estimated based on vegetation data. Bird habitat along the proposed alignments is similar and therefore the NPS did not treat this topic with further, detailed analysis.

Special-status Species

There are no federally listed threatened or endangered species that inhabit, breed in, or overwinter in GAAR. The yellow-billed loon (*Gavia adamsii*), a federal candidate for listing, may occasionally visit, but there is no known habitat for this species in GAAR. This species normally inhabits locations well outside the NPS project area. Likewise, there are no state-listed species in GAAR. Therefore, special-status species was eliminated as a topic for detailed analysis.

Human Health and Safety

Human health and safety risks include those related to exposure to construction materials containing asbestos, the presence of physical challenges, such as rockfall and subsidence, and risks from construction activities. Asbestos is a demonstrated carcinogen and exposure can occur from airborne asbestos fibers. Naturally occurring asbestos has been documented in geological deposits adjacent to and west of the preserve, although the precise location of and concentrations of asbestos-bearing materials is not known for the project area. There is potential for asbestos-containing material to be used in road construction if asbestos-free materials are unavailable in specific areas. Measures intended to minimize these risks are discussed in Appendix C. There are dangers associated with construction-related work, such as traffic hazards and vehicle collisions, and working in northern Alaska poses its own risks due to harsh and changing conditions. Measures instituted to avoid or minimize negative impacts to human health and safety would be implemented through terms and conditions required for issuance of the ROW (Appendix C) but were not further analyzed for comparison of northern and southern alignments.

CHAPTER 2: ALIGNMENTS

This chapter describes two alignments proposed by the applicant for a ROW that would cross through the Kobuk Preserve. Descriptions of the construction elements are also included in this chapter. The applicant proposed mitigation measures and other measures that would avoid or reduce negative impacts are provided as proposed guidelines for terms and conditions (Appendix C).

DESCRIPTION OF THE ALIGNMENTS

The two alignments, the northern alignment and the southern alignment, are described below and are based on the descriptions in the NPS SF299 Supplemental Narrative section of the application (DOWL 2016a). The daylight limits include the driving surface and embankments of the proposed Ambler road and represent the area of permanent, direct impacts. The applicant would require a buffer of approximately 10 feet on either side of the road for construction activities where temporary, direct impacts could occur. For this EEA, the footprint for each alignment is the combined area of the daylight

limits and the 10-foot buffer on either side of the daylight limits. Also included are features associated with the alignment, including material sites, construction camps, long-term maintenance facilities, airstrips, access roads, turnout lanes, culverts, and bridges

Northern Alignment

The northern alignment is approximately 26 miles within the Kobuk Preserve (Appendix A, Figure 2). It crosses into the Kobuk Preserve north of the Helpmejack Hills and south of the southern boundary of the national park, and roughly parallels the national park boundary from the eastern boundary of the preserve to the Kobuk River crossing. The proposed Kobuk River bridge is approximately 2.5 miles south of Walker Lake. After crossing the Kobuk River, the northern alignment passes approximately 0.25 mile north of Nutuvukti Lake then heads generally west and exits the Kobuk Preserve at the Reed River.

Southern Alignment

The southern alignment is approximately 18 miles within the Kobuk Preserve (Appendix A, Figure 2). It travels east-west across the narrowest portion of the Kobuk Preserve, crossing into the preserve south of the Helpmejack Hills and 12 miles south of the southern boundary of the national park. The southern alignment crosses the eastern boundary of the Kobuk Preserve north of Norutak Lake. As it approaches the Kobuk River, the southern alignment parallels the Kobuk River to its south, traveling within 0.5 mile of the river for approximately 3 miles. After crossing the Kobuk River, the southern alignment continues west and parallels the Reed River to its south, approaching within 0.25 mile of the Reed River for approximately 1 mile before making a perpendicular crossing of the Reed River. The southern alignment continues north, exiting GAAR and crossing into the Beaver Creek Valley.

Construction Elements

Components related to the construction of the proposed Ambler road as defined in the application include description of the ROW, construction phases, duration and timing of construction, and road support facilities. Table 1 presents a comparison of the elements for each alignment.

Table 1. Matrix Comparing Elements of Alignments

Project Element	Northern Alignment	Southern Alignment
Total Project Footprint within the Kobuk Preserve (acres)a	Unknown	Unknown
ROWb (width in feet)	250–400	250–325
Construction Daylight Limits within the NPS Project Areac (acres)	283	229
Road Length within the NPS Project Area (miles)	26	18
Culverts within the NPS Project Area (number)	539	317
Bridges within the NPS Project Area (number)	5	2
Bridge area within the NPS Project Area (acres)	12	18
Vehicle Turnouts within the NPS Project Area (number)	2a	2a
Material Sites within the NPS Project Area	1 (47 acres)	1 (61 acres)
Construction Camp/Long-term Maintenance Facility for Materials and Crew	0	1 (5 acres)
Airstrips within the NPS Project Area	0	1 (81 acres)

Source: DOWL 2016a

a Data cannot be confirmed based on current information provided.

b As identified in the SF299

c Includes key project features (driving surface and embankments of the proposed Ambler road, material sites, construction camps, long-term maintenance facilities, airstrips, access roads, turnout lanes, culverts, and bridges)

Description of the ROW

In their application, AIDEA proposed a ROW through the Kobuk Preserve that would typically be 250 feet wide. In most cases, this would allow for area beyond the construction daylight limits and the 10-foot buffer. The ROW would allow for future maintenance and repair activities, brushing, and minor relocation or realignment of the road if a problem develops. It would allow for drainage maintenance upstream and downstream of culverts. The ROW will be widened at specific locations to account for stream and river crossings and certain topographic features. For example, the northern alignment ROW widens up to 400 feet for stream and river crossings. The southern alignment ROW widens up to 325 feet at several locations due to topographic features. The applicant identified the conceptual alignment locations (including GIS files documenting the locations) but proposed locations of the ROW are not currently available for either alignment. The proposed alignments are approximately 80-feet wide and occur entirely within the 250 to 400 feet of the ROW. The proposed alignments will be refined in subsequent engineering and design phases based on the results of continued field surveys (DOWL 2016b) Additional design features of the proposed Ambler road are described in the "Road Support Features" section.

Construction Phases

The applicant proposes to build and use the road in three phases. Figure 3 in Appendix A presents the typical sections for the phase I pioneer (seasonal use) road, phase II year-round, single-lane road, and phase III two-lane road. AIDEA's application states that project construction will begin in 2019 and occur intermittently over the life of the mining district, as described below. Transitions between phases of construction would respond to mine production and development activity in the district. The life span of the proposed Ambler road is a function of the need for surface transportation access by developments within the Ambler Mining District.

In May 2019, AIDEA clarified their application with additional information regarding the phasing of construction (AMDIAP 2019). Phase I would be completed in two years. Phase II would follow immediately and would be completed in two more years. Because the phase II single-lane road is expected to be sufficient for most development scenarios, culverts installed during phase I would be sized for the phase II road footprint. If future developments indicate the phase III two-lane road is desired, the culverts would be modified to accommodate the wider phase III road footprint (AMDIAP 2019).

Phase I. During phase I, a winter construction access trail would be established during the first year, and a pioneer road would be completed in the second year. Construction of the pioneer road would take place year-round, other than possible restrictions during spring break-up or bird nesting periods in compliance with the Migratory Bird Treaty Act. The pioneer road would be a single-lane, gravel-surfaced road, typically 16 feet wide (including 2-foot-wide shoulders) on a shallow embankment. All proposed bridges would be constructed as one-lane bridges in phase I and would remain as one-lane bridges through all construction and operational phases. Drainage structures installed in phase I construction would be designed to accommodate expansion to the phase II road footprint (AMDIAP 2019).

Phase II. Phase II construction would begin immediately after phase I construction is complete (AMDIAP 2019). Phase II would expand the pioneer road into an all-season, single-lane, gravel-surfaced road, typically 20 feet wide, over a full-thickness embankment. The single-lane full-embankment road would take two years to complete. This phase would result in year-round access but would likely be restricted to one-way traffic with guided truck conveys traveling east or west during specified hours.

Phase III. If traffic volumes on the road justify upgrading the road to two lanes, construction of phase III would commence. Expansion of the phase II single-lane, full-embankment road to a phase III two-lane,

full-embankment road would take two years to complete. During this final stage, a two-lane, gravel-surfaced road, typically 32 feet wide, would be constructed over the existing phase II footprint. Culverts would need to be extended to accommodate the phase III footprint. The phase III road would be an all-season road designed to support mining exploration, development, and operations and any additional commercial usages allowed under permit.

Road Support Features

The applicant's project plans propose construction of support facilities including material sites, construction camps, maintenance facilities, airstrips, access roads, turnout lanes, and bridges and culverts.

Material Sites. Material sites are planned to supply borrow material, gravel, and riprap for road construction and serve as staging areas for construction activities. One potential material site (approximately 47 acres) has been identified for the northern alignment located within the Kobuk Preserve in the valley southwest of Walker Lake (Appendix A, Figure 4). One potential material site location has also been identified for the southern alignment within the Kobuk Preserve near the Kobuk River (approximately 61 acres) (Appendix A, Figure 5). Proposed in conjunction with the material site located on the southern alignment are a construction camp (which would be developed into a long-term maintenance facility following construction) and an airstrip are (Appendix A, Figure 3).

Construction Camps/Maintenance Facilities. One construction camp is proposed along the southern alignment adjacent to the airstrip (Appendix A, Figure 5) within the Kobuk Preserve. Camps would be approximately 5-acres each, with room for helicopter landings, equipment and material storage, and employee facilities (e.g., housing, food service). Construction would occur in both directions from these camp areas, with equipment staged along the ROW via the pioneer road. Camps co-located with airstrips, such as the one proposed for the southern alignment, would transition to maintenance facilities following construction.

Airstrip. The airstrip would be associated with the construction camp along the southern alignment and would be needed to provide air support for road construction activities. The landing surface would be 150-feet wide x 3,000-feet long and the airstrip footprint would be 550-feet wide x 6,400-feet long (81 acres).

Access Roads. Four access roads with lengths ranging from approximately 290 to 1,600 feet along the northern alignment and five roads ranging from 260 to 5,500 feet along the southern alignment would be needed to provide access to material sites and water sources for construction and maintenance activities. Access roads would be two-lanes wide at full buildout. When the main road is one lane, two-lane access roads would be needed into material sites to avoid having to stack waiting trucks out on the main road.

Water Extraction Sites. Water would be used to aid in compaction of gravel as the road is built and for dust control and application of dust palliatives during its operation over the life of the road. Trailer-mounted portable pumps, typically four inches but sometimes larger, would fill water trucks via overhead fill pipes. A suction hose placed in a waterbody would supply water to the pump. A screened metal box on the hose end to would exclude fish and act as a debris strainer.

The applicant has proposed five water extraction sites along the northern alignment inside GAAR: one at the Kobuk River, three at unnamed streams, and one at an unnamed pond. Along the southern alignment, the applicant has proposed three water extraction sites inside the Kobuk Preserve: one at the each of the Kobuk and Reed rivers and one at an unnamed pond.

Turnout Lanes. Within the Kobuk Preserve, two turnout lanes (gravel surface) are proposed along the northern alignment (Appendix A, Figure 4) and two turnout lanes are proposed along the southern alignment (Appendix A, Figure 5). A turnout lane would be needed adjacent to the road at various locations to allow trucks to pull over to enable other trucks to pass and for emergency parking. Vehicle turnout lanes would be 20 feet wide and 250 feet long.

Bridges and Culverts. Within the Kobuk Preserve, 5 bridges and 539 culverts would be needed to cross waterbodies for the northern alignment, and 2 bridges and 317 culverts would be needed for the southern alignment (Table 2). Considering the entire length of the Ambler road, the northern alignment would require 29 bridges and 2,903 culverts, and the southern alignment would require 25 bridges and 3,179 culverts.

Table 2. Summary of Water Crossing Structures within the NPS Project Area

Crossing Classification	Diameter	Number of Culverts and Bridges along the Northern Alignment	Number of Culverts and Bridges along the Southern Alignment
Culverts			
Minor	3 feet	533 (2,869 total)	316 (3,155 total)
Moderate	4 – 10 feet	2 (15 total)	0 (12 total)
Major	11 – 20 feet	4 (19 total)	1 (12 total)
Bridges			
Small	< 50 feet	0 (3 total)	0 (3 total)
Medium	50 – 140 feet	4 (15 total)	0 (12 total)
Large	> 140 feet	1 (11 total)	2 (11 total)

Source: DOWL 2016a and BLM Draft EIS

A majority of bridge construction activities would take place in the winter when waterbodies are frozen, facilitating vehicle crossings required during construction. Staging areas would typically be less than one acre and would be located within the construction daylight limits and 10-foot buffer when they are required inside of GAAR. Additional temporary staging and construction areas would be required for bridges. The size and location of these temporary staging and construction areas were estimated conservatively as a buffer around each bridge location, upstream and downstream of the river crossing and parallel to the abutment locations. For small bridges, a buffer of 100 feet was used; for medium bridges, a 200-foot buffer was used. For large bridges, specific buffers were created and ranged from 200 feet to the length of the bridge. Actual staging and construction areas would be further defined during detailed design depending on the topography of a given waterway crossing.

Communications Infrastructure. A fiber optics line would be installed within the roadbed during phase II construction of the proposed Ambler road. The communications infrastructure would include 7 to 12 radio towers across the distance of the entire Ambler road project, with a single radio tower within the Kobuk Preserve, regardless of the alignment. Towers would be 100- to 150-feet tall and would require a pad measuring 400 feet by 400 feet. Towers would be located at each long-term maintenance facility and several material sites over the entire road from the Dalton Highway to the Ambler Mining District. Each tower would require a generator shed, equipment rack shed, and 4,000-gallon fuel tank. A backup satellite communications system would also be installed for two-way radio coverage in the event of a failure of the fiber optic system. Five satellite dishes, each approximately 10-feet tall, would be co-located with the fiber optic equipment at maintenance facilities. The applicant will work with the NPS to situate the radio tower in a location that maximizes effective function and minimizes visual impacts.

MITIGATION MEASURES PROPOSED BY THE APPLICANT

Construction projects in interior Alaska are challenging due to the extreme and dynamic environmental conditions. To protect natural and human resources, the applicant identified mitigation measures in their application, such bridge designs that adequately convey a 100-year peak flood, proposing a spill prevention and response plan, and revegetating fill slopes with native seed, trees, or shrubs. Additional mitigation measures proposed by the applicant are detailed in Appendix C. The NPS and FHWA commit to working with the applicant to monitor resource conditions in the Kobuk Preserve and bolster or refine mitigation measures in response to changing conditions and to ensure resource protection.

Since the applicant has not completed final engineering and design plans and continues to develop resource information needed to inform these plans, terms and conditions are discussed generally and focus on goals and objectives needed to protect resources rather than prescribing specific mitigation measures. To reduce negative impacts of the alignments on park resources, the NPS suggests material sites and associated features (airstrip, construction camp, long-term maintenance facility) be located outside of NPS lands wherever feasible (see Appendix C).

CHAPTER 3: ENVIRONMENTAL ANALYSIS

This chapter analyzes the environmental consequences (impacts) that would occur as a result of construction of the proposed Ambler road on the northern and southern alignments. The following resources are addressed: hydrology, floodplains, and permafrost; wetlands; water quality; fish; caribou; archeological resources; visitor experience; socioeconomics and wild and scenic rivers.

The analysis takes into account the three-phase construction plans proposed by the applicant and described in Chapter 2. Individual impacts from each phase would be similar for most resources; however, the cumulative effect of multiple construction periods on the same resources could increase the impacts compared to the incremental effect of an initial concerted effort to complete the full development required for a road suitable for year-round use. The combination of phases I and II would reduce this additive effect. Phase III would represent a new construction effort, after mitigation and restoration of phase I and II construction.

The analysis also accommodated the fact that the proposed location for the alignment is preliminary and is expected to change once detailed studies are available. Likewise, while the applicant identified the conceptual alignment locations (including GIS files documenting the locations), precise and detailed locations of the ROW are not currently available for either alignment. To address this uncertainty, the impacts would typically be analyzed for the entire ROW, a wider area within which the alignment would be located, providing the applicant flexibility in final design. For most analyses, the impacts are discussed qualitatively and comparatively. For the wetlands analysis, acreages of impacts were identified based on the construction daylight limits and the 10-foot buffer.

The proposed northern alignment across the Kobuk Preserve is 26 miles within the Preserve and 211 miles in total. The proposed southern alignment is 18 miles within the Preserve and 224 miles in total. While the southern alignment is 8 miles shorter than the northern alignment within the preserve (the area of analysis for this EEA), the two alignments merge outside of the eastern and western preserve boundaries. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve (Appendix A, Figure 2). These areas outside of the preserve are evaluated in the BLM EIS.

GENERAL PROJECT SETTING

GAAR lies in the central Brooks Range of northern Alaska, mountainous terrain with numerous clear, fast-flowing streams and large scour lakes. Sparse black-spruce forests cover north-facing slopes and poorly drained lowlands. Boreal forests of white spruce, quaking aspen, and paper birch are typically found on south-facing slopes. Visitors discover intact ecosystems where people have lived with the land for thousands of years, and GAAR remains largely unchanged except by forces of nature. For millennia nomadic hunters and gatherers traveled the mountains' forested southern slopes and the Arctic Coast. Many rural Alaskans continue to take sustenance from the land's fish, wildlife, and plants and use these resources for food, shelter, clothing, transportation, handicrafts, and trade. (NPS 2014).

Subsistence

In 1980, Congress formally recognized the social and cultural importance of protecting subsistence for both Native and non-Native rural residents when it passed ANILCA. This legislation created millions of acres of new national park and national preserve lands in Alaska and helped to preserve subsistence use. The new law defined subsistence as "Customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of non-edible by-products of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade" (16 United States Code § 3113).

In 1981, ten communities near GAAR were designated by the NPS as *Subsistence Resident Zone Communities.* Alatna, Allakaket, Ambler, Anaktuvuk Pass, Evansville/Bettles, Hughes, Kobuk, Nuiqsut, Shungnak, and Wiseman were identified as communities with a significant concentration of subsistence users who have customarily and traditionally used GAAR resources. Resident zone status allows permanent residents within these communities to participate in subsistence activities on national park lands in GAAR. According to the 2018 population estimates (US Census Bureau 2018), these communities include approximately 1,500 people.

Subsistence activities occur throughout the year and are concentrated along rivers that connect low-lying communities. Subsistence activities include hunting, fishing, trapping, and gathering of plants, as well as wood for heating homes. Subsistence activities are seasonal due to changing availability of animal and plant resources throughout the year. Winter trapping efforts concentrate on the harvest of lynx, wolverine, wolf, marten, hares, and fox. Hunting, fishing, trapping, and gathering, in repeated seasonal cycles, remains a vital part of evolving subsistence lifeways (NPS 2016).

Historically, the most important resource to the Native inhabitants in the area was caribou. The movement of caribou was a primary factor influencing the subsistence strategy of people in the central Brooks Range prior to contact with outsiders. Even today, caribou migrate seasonally and provide local people with sustenance. Other resources used by local people include fish, moose, Dall's sheep, bears, waterfowl, marmot, ptarmigan, hare, furbearers, a variety of plant life, and even a few mineral deposits (NPS 2014).

The land area of GAAR is vast, and most resources, except for Dall's sheep, typically are found in or near the valley floors. Subsistence users generally access their hunting grounds or fishing locations via all-terrain vehicles, snow machines, or boats. Off-road vehicles are not allowed throughout GAAR, except for specific lands around the Anaktuvuk Pass (NPS 2014). Figure 6 in Appendix A presents the historic and current use areas of the Alatna, Allakaket, Evansville/Bettles, Kobuk, and Shungnak communities in relation to the Kobuk Preserve and the NPS project area.

Residents of the communities of Ambler, Shungnak and Kobuk have long-established hunting and fishing camps at private allotments and elsewhere along the banks of the Kobuk River. Acquired through demonstration of long-term use of an area and its resources, allotments represent family legacies within the region. Some are located very close to established villages (Devinney 2005). There are two private Alaska Native allotments in the NPS project area, one adjacent to Nutuvukti Lake and one along the Kobuk River near the southern border of the preserve (Appendix A, Figure 6). The northern alignment would be approximately 1.5 miles from the allotment adjacent to Nutuvukti Lake, and the southern alignment would be approximately 6 miles from the allotment along the Kobuk River.

In the summer and fall, waterways remain an important method of accessing fish and terrestrial resources; however, during the winter months, these same waterways are used as frozen highways by snow machines. Accessing resources in the winter becomes easier by early November when waterways are frozen and snow cover makes travel by snow machine possible. Snow machine access can be hindered by deep snow and rugged terrain, which is why most winter use occurs in the northern half of GAAR where the land is treeless and has a shallow, wind-blown snowpack that makes snow machine travel less difficult. Hundreds of miles of valleys are traveled each winter within GAAR for subsistence purposes (NPS 2014). Within GAAR, the Kobuk River, up to the lower canyon, is still used for hunting, fishing, and gathering, and the Alatna River is still used for hunting Dall's sheep, moose, and bears throughout the Endicott Mountains. The Kobuk Preserve is visited infrequently by caribou hunters, who mainly hunt caribou closer to their communities (NPS 2014).

The addition of a road through the preserve would directly affect subsistence resources. Refer to the "Caribou," "Fish," and "Wild and Scenic Rivers" sections in this analysis for the impacts of the proposed Ambler road on these resources. Indirect impacts could also occur. Climate change, discussed in more detail in the following section, also indirectly affects subsistence users. Climate change impacts could affect when and where resources are available, as well as the time and energy required to acquire resources for subsistence use.

Section 810 of ANILCA requires that an evaluation of subsistence uses, and needs be completed for any federal determination to "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." An evaluation of potential impacts on subsistence under Section 810 of ANILCA will be completed by BLM for the entire proposed Ambler road project; the NPS has regular contact with the upriver communities and has worked with BLM throughout the process.

Climate Change

Climate is one of the most important drivers of ecological condition, particularly in Alaska where changes to the climate condition (e.g., temperature and precipitation) can have larger scale and more rapid impacts compared to areas within the continental United States. In GAAR, warming temperature due to climate change poses a major threat to resources. Statewide, over a period of 50 years, Alaska's average annual temperatures have increased by 3.4 º Fahrenheit; this has also led to an increase in the occurrence of snow-free days (by an additional 10 days recorded between 1970 and 2000), along with increased precipitation (US Global Change Research Program 2009). Some of the largest current impacts on the resources of GAAR from warming include an increase in length of growing seasons and effects on timing of snowmelt, as well as permafrost thawing and melting buried glacial ice (NPS 2017a).

Climate change models currently predict that GAAR will experience an increase of up to 10°F mean annual temperature over the next 60 years (NPS 2017a). This will likely be accompanied by longer persistent warm periods with temperatures above freezing in the winter. This is anticipated to decrease snow cover and increase melting/icing events, which can cause negative impacts on foraging animals, as well as increase the likelihood of desiccation of plant species left uncovered by snow (NPS 2017a).

Climate change is expected to cause the total annual precipitation to increase throughout the next century, particularly in the summer season. Precipitation in Alaska is projected to increase during all seasons by the end of this century and more extreme variation in flow regimes are also predicted (Markton et al. 2018). Variations in the type and timing of precipitation can disrupt wildlife cycles, such as bird migrations, availability of prey and plant species, and the molt/shed of prey species that depend on camouflage from predators (e.g., hares, ptarmigan). Additionally, warmer temperatures in the spring are expected to cause the timing of events (e.g., fire season and wildlife migrations) to shift, resulting in ecosystem-level ripple effects. Altered environmental factors from climate change will cause wildlife numbers to fluctuate and change migratory patterns in unknown ways. These variations could alter the availability of and access to key wildlife species used for subsistence by local residents (NPS 2017a).

Rivers will likely warm and become more filled with sediment seasonally, potentially changing species composition. A change or reduction of invertebrate prey species may result in a shift in the composition of aquatic species, which could affect piscivorous predators (e.g., bears, osprey).

Permafrost is projected to thaw across large portions of interior Alaska by 2100 under both low and high greenhouse gas emissions scenarios. A recent modeling study found that area of talik (unfrozen ground surrounded by permafrost) will see sporadic increase in the NPS project area, with almost total thaw of frozen ground within the GAAR boundary by 2100 (Panda et al. 2016). This has the potential to alter local hydrology and impact roads and infrastructure (Stewart et al. 2013; NPS 2017a). The growing season is projected to increase 15–25 days by 2050, and warmer spring temperatures already are linked to increased wildfire activity in Alaska (Stewart et al. 2013).

Climate change is occurring and will continue to occur in Alaska independent of the proposed Ambler road but the effects in the vicinity of the road could be exacerbated by changes in the thermal regime due to road development, and increased emissions. Climate change must be considered part of the current conditions in GAAR, although it creates a shifting baseline. Climate change is discussed in the discussion of impacts to the resources in the following sections, where appropriate.

HYDROLOGY, FLOODPLAINS, AND PERMAFROST

This section describes the hydrology, floodplains, and permafrost present within the NPS project area. We start the analysis of impacts with these resources because changes to these resources impact all of the other resources. If permafrost degrades, it can cause changes to ground and surface waters, and slumping of soils and rocks. Slumping of soil and rock (e.g., landslides, rockslides) can then impact nearby waterways – streams and surface flows – dumping soils and rock into streams, causing sedimentation of streams, and alteration of stream flow. Sedimentation and changes to streamflow impact the biological communities – fish, invertebrates and others – that depend on the streams. Terrestrial animals can be affected by loss of and changes to habitat resulting from changes to the physical resources. Land and rockslides can also impact archeological resources, by dislodging them. As the basis of the ecological community in the Kobuk Preserve, changes to the hydrology, floodplains and permafrost would have far-reaching impacts to resources within the area. Available reports and data sources were reviewed and evaluated to determine current conditions and to predict the impacts from construction, operation, and maintenance of the proposed Ambler road. Minimal data are available for analysis of hydrology and floodplains within the Kobuk Preserve. There are no US Geological Survey gaging stations within or upstream of the NPS project area. Similarly, there are no floodplain maps. This analysis is based on watershed mapping using data from US Geological Survey National Geospatial Program (USGS 2018) and the wetlands delineation completed by the applicant (DOWL 2014a). Information on hydrology found in AIDEA's application (DOWL 2016b) and related studies (DOWL 2011; Kane et al. 2015) were also used.

Information about the potential for permafrost within the NPS project area was obtained from research conducted by NPS staff (Swanson 2016), Alaska Department of Transportation staff (Speeter 2015), AIDEA's application (DOWL 2016b), and from a geologic hazards analysis completed by FHWA staff for this project (FHWA 2019). The FHWA analysis was designed to assess potential geologic hazards relative to road construction within the Kobuk Preserve. The geographic area analyzed for hydrology, floodplains, and permafrost is the NPS project area (Appendix A, Figure 2).

Impacts

Surface flow patterns in northern Alaska are strongly influenced by the presence of permafrost, which restricts the percolation of water through the soil. The presence of discontinuous permafrost throughout the project area creates the conditions that allow for the extensive wetlands in the NPS project area. Shallow surface water flowpaths and saturated zones above the permafrost table would be regularly encountered in the NPS project area. Permafrost in the Kobuk Preserve is lightly frozen and is vulnerable to thaw. Construction of the proposed Ambler road on thaw-unstable permafrost could cause additional thawing. Changes in permafrost increase the potential for slope instability as the active layer grows and the permafrost decreases. Thermally induced settlements can trap water at the toe of a road embankment, creating linear ponding. With the construction of the proposed Ambler road, natural drainage could be disrupted. Depending on drainage structure design, installation, and maintenance, sheet flow could be concentrated into point flow as it crosses the road, altering the hydrologic function. Proper location, design, installation, and maintenance of culverts are important to preserve hydrologic function and avoid changes in wetland type and function from one side of the road to the other. Surface waters maintain wetlands within the NPS project area, and ultimately, preserving natural flow patterns across the NPS project area would be critical to preserving the wetlands and aquatic environments. This section explains how the proposed Ambler road along the northern and southern alignments would impact the hydrology, floodplains, and permafrost within the NPS project area.

FHWA assessed geologic hazard and risk susceptibility on both proposed alignments (FHWA 2019). This geologic risk analysis is used to help identify areas where the interactions of various physical resources result in a higher likelihood of change to the physical environment. Areas of high or moderate-high risk are identified as areas where changes to permafrost would be expected to be greater. For more detail please consult the technical memorandum (FHWA 2019).

Hydrology and Floodplains. The NPS project area includes two major watersheds – the Kobuk River watershed and the Koyukuk River watershed. The proposed Ambler road only impacts tributaries to the Kobuk River watershed. Within the Kobuk River watershed are 14 subwatersheds potentially affected by the proposed alignments (Appendix A, Figure 7). More than 60% of the land within the NPS project area is covered by rivers, streams, lakes, or wetlands. In addition to the Kobuk and Reed rivers and Nutuvukti and Walker lakes, the NPS project area includes numerous small perennial and ephemeral streams. The rivers, streams, and smaller waterbodies in the Kobuk Preserve are undisturbed and function naturally, having outstanding floodplain values for ecosystem quality. Little information is available on flow or flood history of these waterbodies. Peak runoff typically occurs in spring and early summer following snowmelt. Summer storms can also cause high flow events (DOWL 2011; Kane et al. 2015). Flooding caused by ice jams has been documented in areas near the NPS project area (within the larger project area for the BLM EIS) (Kane et al. 2015) and likely occurs on the rivers within the NPS project area.

The proposed Ambler road would be constructed on top of an embankment ranging from 3 to 8 feet or more above the current grade, creating essentially a dam and disrupting the flow of groundwater and surface water, including hundreds of ephemeral and smaller streams. To minimize disruption of groundwater flow the applicant's proposal includes several hundred culverts (see Table 1) for smaller streams, rills, swales, wetlands, and areas of sheet flow. Bridges would be used for larger rivers. The

applicant states that sufficient measures would be taken to maintain hydrologic connectivity, but additional engineering design work is needed to assess the effectiveness of the culvert and bridge designs in regard to hydrological impacts. Data gaps are described in proposed guidelines for developing ROW terms and conditions (see Appendix C).

No gaging stations occur within or upstream of the project area, but a study completed for this project collected data on the Kobuk and Reed Rivers (Kane et al. 2015). For the Kobuk River, the study provides two years of data for water elevation and information about timing of ice breakup. Discharge data were not collected. Ice breakup varied in timing and duration between the two years studied (2013 and 2014). For the Reed River, data were collected from 2012 to 2014 on water level elevation, discharge, and ice breakup. Peak water elevation was similar for the three years studied. The maximum peak water elevation observed was slightly over bankfull. Water elevations over bankfull were also noted during ice breakup caused by ice jams. For the years studied, ice breakup and the resulting high flow occurred in the late May or early June time period for both the Kobuk and Reed rivers. High flow events continued through the summer due to rain events. In wet years, such as 2014, this led to sustained high flows (Kane et al. 2015).

Maintaining hydrologic connectivity is easier for larger rivers and streams with well-defined channels. The applicant proposes to design the bridges to span, at a minimum, the bankfull width of the natural channel (DOWL 2016b). Available data collected for the Kobuk and Reed rivers described above (Kane et al. 2015) suggests bankfull would not be sufficient to pass flow during ice breakup and ice jams. The risk of water and ice backup, causing erosion and gouging of streambanks, flooding, and other alterations of the river corridor, including impacts to fish habitat highlights a critical need for adequate bridge design and sizing to allow the free flow of water and ice at peak flow. The lack of historical flow data hampers the evaluation of the adequacy of the bridges to pass high flow events and is a data gap described in proposed guidelines for ROW terms and conditions (Appendix C).

For waterbodies where culverts are used to maintain connectivity, there is insufficient data available to determine if the culverts are sized adequately to pass flow and maintain existing hydrologic conditions. Except for information reported for the Kobuk and Reed rivers (Kane et al. 2015), there are no data on stream size or flow for the many waterbodies crossed within the NPS project area. Culvert failure is a common problem for similar road construction projects in Alaska. Impacts result from ice jams due to incorrect sizing of culverts, or movement of the culvert caused by the freezing and thawing of the ground. If a culvert is not sufficient to pass all flow and maintain the hydrologic connectivity the same as existing conditions, it would alter the hydrology and floodplains. This could include ponding above the culvert and channelization and erosion downstream of the culvert. If the placement of the culvert changes (culverts can be moved or dislodged due to ground upheaval or road settlement caused by freezing and thawing), it could render the culvert ineffective. The culvert could be tipped above the streambed, preventing flow from entering the culvert. This could lead to ponding along the roadway embankment. The Kobuk Preserve has extensive streams and surface flows that shape the local ecology. Each alignment includes several hundred culverts within the Kobuk Preserve. The potential for permanent impacts to hydrology and other resources dependent on hydrology (permafrost, wetlands, fish, etc.) is high, therefore, proper functioning of the culverts would be critical.

In their application, the applicant acknowledges the challenges of maintaining hydrologic connectivity for this project. The applicant proposed additional data collection to inform design and mitigation measures to avoid and mitigate impacts. Measures are detailed in the application and summarized in Appendix C. To avoid hydrologic problems documented for other roads in Alaska, NPS and FHWA would work collaboratively with the applicant to collect the data needed to site and design culverts and to develop effective monitoring and mitigation programs to increase the likelihood of the culverts functioning properly.

Aerial imagery of the proposed crossings within the Kobuk Preserve shows that most rivers and streams are sinuous with braided sections, indicating these rivers and streams still have active channel migration. Floodplain values would be impacted by the construction of bridges and the long-term presence of bridges in the river channels. Concrete structures are immovable and as such, when located inside the floodplains, restrict the natural movement of streams. It is expected that the bridge piers would be inside the river channel, within the floodplain, and therefore would restrict natural channel migration. The bridges crossing the Kobuk River along either the northern or southern alignments would have multiple piers, including several in the river channel. The extent of bridge impacts to floodplain function cannot be assessed but ice jams, flood flows, and debris and sediment being obstructed at the juncture during periods of maximum water elevation are risks that need to be taken account in the bridge design process. Based on the very limited data collected (Kane et al 2015), it is reasonable to expect ice jams or high flows that surpass bankfull most years. More information on bridge design is needed to determine actual impacts to floodplain functions and values. To avoid impacts associated with peak flows, bridges should be designed to pass flows in excess of peak flows. Many of the impacts to floodplain values are discussed in the "Water Quality" and "Fish" sections of this chapter.

Construction of the embankment would consolidate soils below the roadbed, which would impact groundwater flow, potentially impeding flow and forcing groundwater to the surface. As noted in the application (DOWL 2016b), consolidation would be greatest near the surface, generally within the top 10 feet of the existing ground surface. If the groundwater does surface, it would likely collect and lead to additional impacts to permafrost. Areas with shallow groundwater flows would be more susceptible to impacts from consolidation. Due to a lack of soil data it is not possible to identify these areas within the NPS project area. This represents an additional data gap that can be addressed by the required terms and conditions of the ROW grant (see Appendix C).

Permafrost. Permafrost is ground (soil, rock, ice, and organic material) that remains frozen (below 0 degrees Celsius [°C] or 32°F) for two years or more. The active layer is a layer of ground material above the permafrost that melts and freezes each year. If ground temperatures increase, ice within the permafrost can melt, causing changes to the surrounding physical and ecological resources. Permafrost degradation impacts surface and groundwater hydrology, including interactions between surface and groundwater, and can lead to erosion and subsidence of soil and rock materials. Depending on the extent of degradation impacts can be severe including rock and landslides, slumping, local flooding, and the draining of thermokarst lakes and wetlands. Another effect of permafrost thaw is the release of carbon dioxide, methane, nutrients, and microbes which had previously been stored in the frozen ground.

Discontinuous permafrost occurs throughout the NPS project area. Because the NPS project area is currently devoid of human development, the permafrost is undisturbed, except for changes associated with climatic warming. A recent study of ground temperatures in the Kobuk Preserve (Swanson 2016) indicates that ground temperature along the two alignments hovers just below the 0°C (32°F). Permafrost temperatures in the NPS project area are relatively warm, near −1°C (30°F) (Swanson 2016). As Swanson (2016) noted, permafrost that is near the freezing point of water is highly susceptible to thaw and subsidence with minor changes in the thermal regime.

The susceptibility of the permafrost to thaw in the NPS project area was documented through a series of photos during soil studies by Speeter (2015). An area that was first subjected to fire (reducing the organic mat that serves insulating layer over the permafrost) and then heavy rains the following year became vulnerable to extensive thaw and erosion, eventually leading to landslides in the area. This documents that frozen soils at this latitude within the Kobuk Preserve are thermally unstable and can easily result in structural failures if the organic mat is compressed, removed, or burned and/or exposed to surface water that accelerates melting and erosion (Speeter 2015).

Water ponding along the toe of the road embankment, due to poor drainage within and adjacent to the embankment, compaction of the vegetation mat above the permafrost, or alteration of groundwater and surface water flows can all act as heat sinks or cause changes in the thermal regime. As ice in the permafrost melts and the water drains away, these changes can create new heat sinks and exacerbate the problem, causing impacts beyond the initial area of impact. Vehicle traffic and a dark gravel surface material would also cause increases in ground temperature under and adjacent to the road. Measures proposed by the applicant are described in their application and summarized in Appendix C. Measures include additional data collection and detailed thermal modeling to inform design. While proposed measures would avoid or minimize some impacts to permafrost from road construction and operation, the susceptibility of the permafrost to thaw in the NPS project area would mean degradation would still be likely to occur. As noted above, impacts to permafrost lead to impacts to other resources. These impacts would be realized along the entire length of the proposed Ambler road within the Kobuk Preserve and would permanently alter the permafrost and hydrology of the NPS project area.

Comparative Analysis

The proposed Ambler road would likely have significant impacts on hydrology, floodplain function, and permafrost within the Kobuk Preserve. Rivers, streams, and other waterbodies in the NPS project area would be altered by the construction of the embankment for the road and the bridges and culverts required.

The bridges, culverts, and the road embankment would likely have significant adverse impacts on floodplain functions and values. During and after construction of the new facilities, degradation of the permafrost would occur as a result of exposure of the permafrost, compaction of the soil above the permafrost, and alteration of surface and groundwater flow. Measures proposed by the applicant could avoid and reduce some impacts, but impacts would still occur. The Kobuk Preserve is currently unimpacted by modern human development except for impacts associated with climate change. More than 60% of the land cover within the NPS project area consists of waterbodies or wetlands. Changes to the hydrology, floodplains, and permafrost would alter these resources and the ecological communities that inhabit these areas. These impacts could not be reversed and would be permanent, forever changing the landscape of this area.

The probability of impacts on the local hydrology and floodplain function from culverts is likely even greater than for bridges because there are more culverts and there is even less information about peak flow conditions. Along the northern alignment, there are over 500 culverts proposed within the Kobuk Preserve compared to 300 along the southern alignment, therefore there is a greater chance that individual culverts would be undersized for peak flow events along the northern alignment.

The bridges crossing the Kobuk River along either the northern or southern alignment would have multiple piers, including several in the river channel. Additionally, the southern alignment would use a multi-span bridge to cross the Reed River, and the northern alignment would use bridges to cross four other rivers within the NPS project area. The bridges for the northern alignment would generally be placed on sections of river that are sinuous with braided channels, indicative of active channel migrations. While some data exist for the Kobuk River, assessment of the bridges for the other four rivers along the northern alignment is hampered because there are no data regarding river conditions. Based on examination of aerial imagery along the southern alignment, the Kobuk River channel appears to be more stable than that of the northern alignment bridge area. The channel is well defined, lacks braiding, and is relatively straight. The Reed River crossing along the southern alignment is highly sinuous with multiple channels, indicating channel migration is likely still active in this area. As noted above, a concrete structure within the floodplain would physically restrict natural migration of the river channel.

In addition to the proposed Ambler road, the applicant proposes to construct support facilities within the Kobuk Preserve. The applicant proposes material sites along both alignments to be used to mine gravel for road construction and maintenance. The material site along the northern alignment would be 47 acres and the material site along the southern alignment would be 61 acres. Within the preserve along the southern alignment, the applicant proposes a construction camp, long-term maintenance facility and an airstrip co-located with a material site. The construction camp/maintenance facility would be about 5 acres and the airstrip would be 81 acres. The northern alignment includes a similar facility, but it is located immediately west of the preserve on the banks of the Reed River. Compaction of the soil from construction would impact the permafrost as described above. Depending on the exact siting of the material sites, construction camp and airstrip, surface waters would be impacted in different ways. While the applicant would work with NPS to avoid surface waters, given the extensive surface waters in the Kobuk Preserve (approximately 60 percent of the area is covered by surface waters or wetlands), and the size of the material sites and construction camp, it would be difficult to avoid all impacts to surface waters and floodplains. NPS would work with the applicant to avoid and/or mitigate impacts, including the possibility of locating these facilities outside of GAAR to avoid impacts to Preserve lands altogether.

Approximately 143 acres, or 35% of the area of the northern alignment within GAAR is at a moderate-high or high risk of having negative impacts from geologic hazards associated from the roadway construction and long-term maintenance (Appendix A, Figure 8) (FHWA 2019). Approximately 157 acres, or 38% of the area of the southern alignment within GAAR falls in these same categories. The sections of the alignment ranked moderate-high or high would likely be at risk for significant changes to the physical resources, which could result in adverse impacts on the local hydrology and permafrost as a result of road construction and long-term maintenance.

Conclusion

The types of impacts on hydrology, floodplain function, and permafrost would be similar for the northern and southern alignments. The northern alignment would require many more river and stream crossings on NPS lands than the southern alignment. As discussed above, the construction and long-term maintenance of bridges and culverts would likely alter stream flow, floodplain functions and values, and degrade permafrost, to some degree despite mitigation efforts. Development of the southern alignment, as proposed, would include the construction and operation of support facilities along the Kobuk River within the preserve, whereas these facilities are located immediately west of the preserve along the Reed River for the northern alignment. The southern alignment would have fewer impacts from the placement of culverts but would have the direct impacts associated with the support facilities, impacting approximately 152 acres along the Kobuk River. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. These areas outside of the preserve are evaluated in the BLM EIS.

WETLANDS

Wetlands are identified as those areas with hydrophytic vegetation, hydric soils, and positive wetland hydrology. Little actual data on wetlands exists for GAAR, but it has been estimated that approximately 60 percent of the landscape is wetlands, if so, that would mean approximately 5 million acres of the 8.4 million acres of GAAR are wetlands. This section identifies the impacts that could occur to the wetland systems present along the alignments within the NPS project area (Appendix A, Figure 2). This analysis examines the areas within the construction daylight limits, a 10-foot road buffer, and a 328-foot wide buffer for each alignment. A buffer extent of 328 feet (100 meters) was chosen based on data collected for the Dalton Highway (Myers-Smith et al. 2006; Auerback et al. 1997).

Available wetland data and wetland delineation reports were reviewed and evaluated to determine current conditions of wetlands within the NPS project area and to predict the impacts on wetlands from construction, operation, and maintenance of the proposed Ambler road. National Wetlands Inventory (NWI) maps, which are prepared from the analysis of high-altitude imagery and identify wetlands based on vegetation, visible hydrology, and geography, were used by the applicant as the starting point for a 2014 wetland delineation conducted along a 2,000-foot-wide corridor along the alignments (DOWL 2014a). Within the 68,067-acre area evaluated, 39,949 acres were identified as potentially jurisdictional wetlands, 1,115 acres of Waters of the United States, and 27,003 acres of uplands.

The 2014 delineation was compared with the NWI mapping data, and the differences in these two data sources are discussed in this analysis. Eight wetland types were observed along the northern and southern alignments within GAAR; these can be grouped as palustrine forested wetlands, palustrine scrub-shrub wetlands, palustrine emergent wetlands, open water, and riverine wetlands. Figures 9 and 10 in Appendix A present the wetlands that occur along the northern and southern alignments, respectively.

Wetlands in GAAR are an important part of the landscape since these wetlands are unaltered by direct anthropogenic disturbances and are in relatively pristine condition. The foundation of this intricate wetland system is the unimpeded flow of water over the entire NPS project area. Wetlands provide a number of functions from an ecological and human perspective. The high quality of wetlands in the NPS project area allows them to perform many of these important ecological functions.

Impacts

Overall the construction of the proposed Ambler road and related support facilities (material sites, construction camp, long-term maintenance facility and airstrip) would result in long-term, adverse impacts to wetlands within the NPS project area. Construction would result in placing fill in wetlands, altering hydrology, degrading permafrost, removing vegetation, altering vegetation communities, and changing soil conditions. All of these modifications could result in transition in habitat types, degradation of habitat, alteration or loss of wetland functions, and potential ecosystem changes. Modifications would impact wetland function, carbon storage and assimilation, nutrient cycling, and other water quality services.

Both alignments for the proposed Ambler road would cross a substantial number of wetlands. It is assumed that both alignments are completely underlain by discontinuous permafrost. The presence of permafrost creates the conditions that allow for the extensive wetlands in the NPS project area. Surface flow patterns in northern Alaska are strongly influenced by the presence of permafrost, which restricts the percolation of water through the soil. Road construction on permafrost soils would likely change the thermal regime and lead to permafrost degradation and changes in hydrology. These changes to the permafrost and hydrology would impact wetlands and the wildlife that depend on these wetlands.

The development and maintenance of the proposed Ambler road in wetland areas and within drainages to wetland areas would impact the hydrology of the wetland system by impounding water upstream of the road, if the culverts were not placed properly or if they fail to function properly during the life of the road. This could result in isolating wetlands from upstream hydrology (Ives and Schick 2017). The northern and southern alignments both generally run perpendicular to the slope of the surrounding terrain, increasing impoundment effects and hydrological disconnection. Proper location, design, installation, and maintenance of culverts are important to preserve hydrologic function and minimize changes in wetland type and function in wetlands upstream and downstream of the road and culverts. Pooling of water along the road may increase the rate of permafrost thaw, further impacting wetlands along the road and increasing the potential for erosion (Ives and Schick 2017). As permafrost thaws, near-surface moisture drains to deeper soil levels, resulting in further loss of wetland habitat (Avis et al. 2011).

The applicant has proposed additional data collection and modeling to better design the road to avoid the impacts described above. Additional mitigation measures are provided in the application to avoid and or reduce impacts to hydrology and permafrost, and thus to wetlands. NPS and FHWA would work collaboratively with the applicant in the design of data collection efforts, design of the road and construction of the road to avoid impacts to wetlands, hydrology and permafrost.

Surface waters maintain wetlands within the NPS project area and ultimately preserve natural flow patterns across the NPS project area. The disturbance or loss of wetlands would also impact the ecological functions currently present in the NPS project area. Some wetlands in the NPS project area provide fish habitat; this function could be impacted through the alteration of localized hydrology. Changes in wetland vegetation that result from road impacts would potentially impact the thermal regime, shoreline stabilization, fish and wildlife habitat, nutrient regime, water clarity, and other chemical qualities of the water.

The northern and southern alignments would sustain similar temporary and permanent direct and indirect impacts on wetlands as a result of construction, operation, and maintenance of the proposed Ambler road, but the acreages of wetlands impacted would differ between the two alignments. Direct effects to wetlands in the construction daylight limit and 10-foot road buffer would include the placement of gravel fill, construction of culverts, and bridges within wetlands (Ives and Schick 2017). Direct impacts represent a total and permanent loss of wetland acreage. Indirect impacts are those that would occur on wetlands within 328 feet on either side of the road's 10-foot buffer. Although impacts could occur beyond 328 feet, these impacts would be expected to be negligible. Indirect effects would be those that result in the alteration of the functions of the wetland, including changes to hydrology, vegetation, soil characteristics, and underlying permafrost, and other factors (Ives and Schick 2017). Further, ions (e.g., metals, calcium, chloride) from foreign materials be dissolved and transported to surrounding aquatic systems, causing water quality alterations. The magnitude, frequency, and duration of water quality alterations are important considerations that can influence wetland systems. These types of impacts are described in the "Water Quality" section.

Comparative Analysis

The northern and southern alignments would likely result in long-term adverse impacts to wetlands within the NPS project area, causing alteration or permanent loss of wetland functions. Since the four most dominant wetland types are the same for both alignments, the functions of these currently pristine systems are likely very similar; however, the alignments differ in the amount of wetland acres impacted. Table 3 presents the direct and indirect wetlands impacts calculated based on the results of the 2014 wetland delineation.

Using the 2014 delineation, approximately 1,272 acres of wetlands would be impacted along the northern alignment (including direct and indirect impacts; Table 3). Of these wetlands impacted, approximately 174 acres would be permanently lost (Table 3). The northern alignment would also impact Nutuvukti fen, which is located approximately 0.25 mile downstream of the alignment. Nutuvukti fen is classified as a patterned fen, which means that it is composed of peat (partially decomposed plant remains) and its surface is covered by an intricate pattern of ridges and pools. There are few patterned fens in interior Alaska, and Nutuvukti fen is one of the largest (NPS 2017a). Nutuvukti fen is recharged by drainage through glacial outwash soils where the proposed Ambler road would be constructed. This fen borders Nutuvukti Lake, and runoff from the fen feeds directly into the lake. Upstream impoundments could disrupt recharge of this fen. Fens are an important part of the ecosystem because of their biological diversity and hydrologic characteristics.

On the southern alignment, approximately 1,446 acres of wetlands would be impacted (including direct and indirect impacts, Table 3). Of these wetlands impacted, approximately 240 acres would be permanently lost (Table 3).

The NWI maps include significant areas of the alignment north of Nutuvukti Lake as wetlands that were not delineated in the 2014 wetland delineation. In addition to the wetland types noted in the 2014 wetland delineation report, the NWI maps also note the presence of palustrine moss-lichen wetlands. These are areas where mosses or lichens cover substrates other than rock. Because the NWI maps include additional wetlands not identified in the 2014 wetland delineation, these values represent a more conservative evaluation of potential wetland impacts.

For the northern alignment, approximately 2,047 acres of wetlands would be impacted (including direct and direct impacts, Table 4). Of these wetlands impacted, approximately 288 acres of wetlands would be permanently lost. For the southern alignment, the acreages are similar to the 2014 delineation. Approximately 1,432 acres of wetlands would be impacted (including direct and direct impacts, Table 4) by the southern alignment. Of these wetlands impacted, approximately 229 acres of wetlands would be permanently lost (Table 4).

Table 3. Impacts to Wetland Acreage Along the Proposed Alignments

Wetland Class	Northern Alignment Direct (Acres)	Northern Alignment Direct (Percent)	Northern Alignment Indirect (Acres)	Northern Alignment Indirect (Percent)	Southern Alignment Direct (Acres)	Southern Alignment Direct (Percent)	Southern Alignment Indirect (Acres)	Southern Alignment Indirect (Percent)
PEM	1.3	<1	11.1	1	1.2	<1	12.6	1
PSS	85.6	21	588.4	27	85.6	21	461.9	28
PFO	78.5	19	472.9	22	139.6	34	707.7	43
OW	0.02	<1	5.3	<1	0.1	<1	2.8	<1
Riverine	8.6	2	20.4	1	13.7	3	20.6	1
Wetland Total	**174.1**	**42**	**1,098.10**	**51**	**240.2**	**58**	**1,205.50**	**73**
Upland	238.3	58	975.9	45	111.8	27	238.5	14
No Value	0.1	<1	100.3	5	63.1	15	211.9	13
Grand Total	**412.5**	**100**	**2,174.30**	**100**	**415.1**	**100**	**1,655.90**	**100**
	2,587				**2,071**			

Source: DOWL 2014a

Notes:

PEM = palustrine emergent wetland
PSS = palustrine, scrub-shrub wetland
PFO = palustrine, forested wetland
OW = open water
No Value = no data on wetland presence was available

Table 4 presents wetlands impacts calculated using the NWI mapper, which (as noted above) included wetlands not included in the 2014 delineation.

Table 4. Direct and Indirect Impacts to Wetlands in the Kobuk Preserve based on NWI Maps

Wetland Class	Northern Alignment Direct (Acres)	Northern Alignment Direct (Percent)	Northern Alignment Indirect (Acres)	Northern Alignment Indirect (Percent)	Southern Alignment Direct (Acres)	Southern Alignment Direct (Percent)	Southern Alignment Indirect (Acres)	Southern Alignment Indirect (Percent)
PEM	2.5	<1	25.6	1	1.1	<1	18.2	1
PSS	253	61	1,559.00	72	201.7	49	1,159.00	70
PFO	24.8	6	150.4	7	0	0	1.7	<1
PML	2	<1	12.9	<1	11.8	3	6.9	<1
OW	0.8	<1	5	<1	0.2	<1	6.2	<1
Riverine	5.3	1	5.7	<1	14.1	3	10.8	<1
Wetland Total	**288.3**	**70**	**1,758.60**	**81**	**228.9**	**55**	**1,202.80**	**73**
Upland/Other	124.1	30	415.7	19	186.2	45	453.1	27
Grand Total	**412.5**	**100**	**2,174.30**	**100**	**415.1**	**100**	**1,655.90**	**100**
	2,587				**2,071**			

Notes:

PEM = palustrine emergent wetland
PSS = palustrine, scrub-shrub wetland
PFO = palustrine, forested wetland
PML = palustrine moss-lichen wetland
OW = open water
No Value = no data on wetland presence was available

Impacts to wetlands from the construction of the support facilities (material site along the northern alignment and a construction camp, long-term maintenance facility, airstrip, and material site along the southern alignment) are included in the acreage estimates above. NPS would work with the applicant to avoid and/or mitigate impacts, including the option of locating these facilities out of GAAR to minimize or avoid impacts to preserve lands. If the facilities were to be moved outside of the preserve, it would reduce the acreage of wetlands impacted. Using the 2014 delineation, the acreage of wetlands impacted along the northern alignment would be reduced from 1,272 to 1,243 acres of wetlands (including direct and indirect impacts). Wetlands permanently lost along the northern alignment would be reduced from 174 acres to 163 acres. On the southern alignment, without the support facilities, impacts to wetlands would be reduced from 1,446 acres to 1,337 acres (including direct and indirect impacts). Wetlands permanently lost along the southern alignment would be reduced from 240 acres to 215 acres.

Calculating impacts to wetlands using the NWI mapper, and postulating the potential removal of the support facilities from GAAR would reduce the acreage of wetlands impacted along the northern alignment from 2,047 acres to 2,011 acres (including direct and direct impacts, Table 4). Wetlands permanently lost along the northern alignment would be reduced from 288 acres to 277 acres. For the southern alignment, the acreages are similar to the 2014 delineation, and the reduction of impacts with the removal of the support facilities is also similar. Removing the support facilities along the southern alignment would reduce the area of impact from 1,432 acres to 1,335 acres. Wetlands permanently lost along the southern alignment would be reduced from 229 acres to 205 acres.

Conclusion

Using the NWI maps, the southern alignment would be more protective of wetlands in GAAR, because it would impact less wetland habitat than the northern alignment even with the support facilities located inside the preserve. If the facilities proposed for the southern alignment were to be moved outside the preserve, the impacts along the southern alignment would be further reduced. Furthermore, the northern alignment would impact the high value Nutuvukti fen, one of the few patterned fens in interior Alaska,

and one of the largest. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. These areas outside of the preserve are evaluated in the BLM EIS.

WATER QUALITY

This section focuses on the water quality of the Kobuk and Reed rivers and Nutuvukti Lake in terms of physical and biological parameters. The proposed Ambler road project could have impacts on any waterbody near the road, but the impacts on water quality of the numerous streams crossed by the road are expected to be similar along the two alignments. Therefore, this analysis focuses on the watersheds within the Kobuk Preserve that drain into the major lakes and rivers and areas where the alignment crosses direct tributaries to those rivers. The geographic area analyzed for impacts on water quality is the NPS project area (Appendix A, Figure 2). Available data were reviewed and evaluated for the discussion of the current conditions of the Kobuk and Reed rivers and Nutuvukti Lake. All construction, operation, and maintenance activities within the NPS project area were analyzed to determine the potential impacts on water quality from erosion, sedimentation, contamination (i.e., fugitive dust and spills), water extractions, and permafrost degradation. The potential impacts on water quality are discussed qualitatively.

Water quality is a function of the physical and chemical characteristics of an aquatic system. Water quality characteristics are typically determined by measurements of conductivity, pH, temperature, hardness, alkalinity, and dissolved oxygen. Water quality is also influenced by the concentrations of metals, contaminants, and asbestos. Aquatic organisms have a range of tolerances for water quality characteristics that are necessary for survival, growth, and reproduction. Although these parameters are necessary, they are not exclusively sufficient for understanding and interpreting potential adverse effects that can occur in an aquatic system. Water quality in GAAR is pristine with highly oligotrophic, clear waters with few contaminants. Currently, the water quality of the aquatic systems surrounding the two proposed alignments is influenced by the native soils and their source of water. Because of the high latitude of the NPS project area, most of these aquatic systems are likely fed by snow melt. Limited human activity occurs in the areas surrounding the proposed road alignments. Due to the current absence of roads and vehicles in this area, but acknowledging limited floatplane and very limited motorized boat traffic, there has been low potential for spills of oil, gas, other vehicle fluids, or road deicers to enter surface waters through runoff. Within the NPS project area, water quality parameters have been measured and published in reports since the 1980s for lakes (Jones et al. 1989) and since the 1960s for rivers (Brabets 2001).

Nutuvukti Lake is within the Kobuk Preserve, located directly downstream from the northern alignment, and is the only large lake within the Kobuk Preserve that would be directly impacted by the proposed Ambler road. Nutuvukti Lake is characterized as a low altitude lake (< 250 m elevation) surrounded by forest (LaPerriere et al. 2003; Jorgenson et al. 2009). Lakes in GAAR typically have watersheds dominated by floodplain forest, deciduous brush, spruce with lichen, and black spruce with moss vegetation (LaPerriere 1999). The Kobuk and Reed rivers flow within and outside of GAAR and the NPS project area (Appendix A, Figure 7). Water quality in the Kobuk River is considered to be unaffected from its natural state, and most of the other surface waters in GAAR remain almost totally unaffected by pollutants (NPS 2014). Overall, the lakes and rivers in GAAR have high water quality and are considered pristine.

Impacts

Construction, operation, and maintenance of the proposed Ambler road and associated support facilities (one material site along the northern alignment and a construction camp, long-term maintenance facility, airstrip and material site along the southern alignment) through the Kobuk Preserve for the transportation of mining related material have the potential to cause both physical and chemical alterations to the current water characteristics, leading to adverse changes in water quality in the surrounding aquatic environments (Hedrick et al. 2010; Viadero and Fortney 2015; Dudka and Adriano 1997). Any impacts on water quality would have direct adverse impacts to aquatic life, particularly during reproductive life stages. Suspended sediment in water can also cause disruptions to aquatic systems by decreasing light penetration for aquatic vegetation (Hansmann and Phinney 1973; Lenat et al. 1981; Hedrick et al. 2010). Sedimentation and erosion, as well as water extractions, can alter water temperature and water chemistry, including dissolved oxygen and turbidity. Fugitive dust carrying metals has the potential to cause issues related to metal toxicity of aquatic organisms. Any changes in water quality from baseline conditions to which aquatic life in a particular system are adapted can potentially impact aquatic species.

Erosion and Sedimentation. During construction of the proposed Ambler road and support facilities (material sites, construction camp, long-term maintenance facility and airstrip), surficial vegetation would be removed, exposing underlying soils and creating the opportunity for sediments to erode or become airborne. Effective management practices for controlling erosion are important to implement during construction, especially with consideration of heavy rain events and spring melt conditions. Ground disturbing activities would occur during all three phases of construction. The impacts on water quality from sedimentation and erosion would likely be highest during construction. The phased construction of the road, as proposed by the applicant, would cause repeated impacts, resulting in overall greater impacts on water quality. Operation of the support facilities could also pose erosion risks and careful mitigation measures should be planned for these road-related facilities.

The roadway would disturb natural slope drainage and could create focal points of higher energy flow, increasing available energy for erosion and deposition at and below culvert locations. Eroding soils could be transported away from the road and end up in downgradient streams, rivers, and lakes. It is possible that wind-driven erosion could transport dust to waterbodies upgradient of the construction area, but the main impacts would likely arise from erosive forces carrying waterborne sediments downstream. Snowmelt from the road surface could also carry soil particles into waterbodies.

Any eroded sediments entering aquatic systems would have adverse impacts on water clarity and chemistry. In addition, sediments in waterbodies can abrade sensitive membranes, such as gills, of aquatic organisms (Sutherland and Meyer 2007). Sediments eventually settle to the bottom of lakes and rivers, where they can cause impacts by decreasing light penetration for aquatic vegetation and covering the habitat of macroinvertebrates and spawning fish (Hansmann and Phinney 1973; Lenat et al. 1981; Hedrick et al. 2010).

The applicant proposes using riprap and porous matting to stabilize cut slopes and culvert ends to prevent erosion and sediment discharge into waterbodies. The NPS and FHWA would work with the applicant to collect baseline data prior to the commencement of construction and to monitor conditions during construction, operation, and maintenance activities to ensure erosion and sediment controls remain effective.

Fugitive Dust and Spills. Metals in ore concentrates, mining-related products, and materials used for road construction, operation, and maintenance could be introduced into waterbodies as a result of the proposed project. The road would be constructed of crushed gravel, which would generate fugitive dust.

To reduce road dust the applicant would apply a dust palliative such as calcium chloride during road construction and operation.

Safety measures employed for concentrate hauling trucks using similar industrial roads can the reduce risk of truck accidents and trailer overturns/spills, but accidents can still occur on an infrequent basis (AIDEA 2017). The 52-mile long DeLong Mountain Transportation System (DMTS) road, for example, accumulated 28 ore concentrate spill sites during the 13-year period between 1989-2002 (Turner 2003). During initial mine development, approximately 80 trucks per day are anticipated on the proposed Ambler road (40 round trips). The number of vehicles is expected to increase over time as other mines are developed within the mining district and could reach approximately 168 round trips per day year-round (BLM 2019). The ore concentrate would be loaded into sealed containers within a loading facility at the mines, which would then be loaded onto trucks and transported from the Ambler Mining District to the Dalton Highway and beyond. Properly functioning containers can reduce the risk of ore concentrate escapement. Trucks exposed to concentrate and ore-rich muds at the mine site and during loading and unloading activities pose a risk of generating dust containing elevated levels of metals (copper, lead, zinc, silver, and gold) as trucks traverse the road, including the section through the preserve (Brumbaugh and May 2008, Neitlich et al. 2017). Truck washing procedures, if implemented effectively, can reduce this risk. These risks also dissipate with distance from the mine and loading sites, and are expected to be reduced by the point at which trucks enter the preserve. The use of construction equipment is likely to result in the introduction of some amount of contaminants, such as fuel or oil, entering surface waters from leaks or spills. Well-designed and carefully implemented mitigation measures can reduce the risk of spills.

Any gravel dust, dust palliatives, and ore concentrates not contained by sound operational procedures and various mitigation measures could be carried into downstream waterbodies during snowmelt and rainfall events. Dry fallout of dust would also occur. The applicant proposes to install culverts at stream crossings and in areas with sheet flow. Appropriately sized culverts are necessary to convey water in a manner similar to natural conditions; however, if the culverts clog with debris or ice, it could cause water to flow around the clogged culverts and over land. Such flooding could pick up fugitive dust particles and other contaminants, and eventually end up in the aquatic environments. Under some conditions, metals and other compounds could dissolve in surface water and be transported to downstream aquatic systems. Increased inputs of metals to aquatic systems from fugitive dust or fuel or ore concentrate spills, however uncommon, could potentially disrupt natural functioning of the aquatic food chain (Eisler 2000; Peplow and Edmonds 2005). While the levels of injury in aquatic systems along the Red Dog Haul Road is thought to be low (Exponent 2007), risk assessment would require site-specific information on both contaminants and receptors. Heavy metals, such as zinc and copper, can destabilize ecosystems; bioaccumulation of heavy metals in some organisms can cause toxic effects on biota (Pandey 2014). The physical and chemical characteristics of water at a site can influence an organism's response to a metal and can be used to explain and understand metal toxicity. Toxicity of metals to aquatic life generally increases as conductivity, pH, hardness, and alkalinity decrease (DiToro et al. 2001).

Foreign materials may alter water characteristics, including pH and water hardness and affect water quality. Slight alterations in these water parameters would not necessarily result in adverse effects to aquatic organisms, but it is possible that the overall water quality may be degraded to the point where it has modest adverse effects on aquatic life. Nutuvukti Lake is oligotrophic with fairly low productivity, and the addition of inorganic nutrients could affect productivity and biodiversity of the lake (Roch et al. 1985).

The applicant's design for the proposed Ambler road would incorporate the latest technologies for dust minimization and mitigation based on ongoing research conducted by the University of Alaska Fairbanks.

The NPS and FHWA would work with the applicant to monitor fugitive dust, to identify issues, and to employ additional protective measures for dust abatement where necessary.

Flow Reduction from Pumping Operations. Temporary water extractions from waterbodies are proposed for construction and maintenance activities associated with the road. Removal of water from streams and lakes could impact flow and water levels, which could adversely affect water quality through changes in temperature, dissolved oxygen, and turbidity. This could adversely impact aquatic life. Because the applicant has not specified the volume and frequency of water necessary for construction, operation, and maintenance of the proposed Ambler road and because the volume, flow, and other characteristics of most waterbodies in the NPS project area are unknown, an analysis of the effects of water extractions cannot be performed. Data gaps such as these can be addressed by the required terms and conditions of the ROW grant (see Appendix C).

Permafrost Degradation. Climate change is causing degradation of permafrost, as discussed in the "Hydrology, Floodplains, and Permafrost" sections in this chapter. Permafrost degradation, particularly in regions with high ice content, has a strong effect on water quality. Increased nitrogen, total dissolved solids, turbidity, and dissolved sources of organic carbon are all common impacts to water quality following permafrost degradation. Studies in the region indicate that permafrost thaw can lead to slumping and landslides, resulting in considerable suspended sediment flux in rivers during periods of active thermal erosion (see discussion in hydrology, floodplains and permafrost earlier in this chapter). Erosion and road runoff could increase sedimentation in streams and water bodies, resulting in increased deposition of previously frozen inorganic material to rivers and lakes, which changes water chemistry (O'Donnell et al. 2017; Houben et al. 2016). Some changes observed in lakes include reductions in nutrient availability and primary productivity (Houben et al. 2016). Climate change is currently occurring and is expected to continue. The proposed Ambler road would contribute to widespread permafrost degradation, and preserving permafrost under the road would be difficult, even under the current climate.

Comparative Analysis

The proposed Ambler road would likely have impacts on water quality within the Kobuk Preserve. This section focused on two major rivers and one lake, but the Kobuk Preserve contains hundreds of smaller rivers and streams that feed into these major waterbodies. This analysis is simplified due to a lack of information on the individual waterbodies that would be impacted by construction, operation, and maintenance of the proposed Ambler road. Data gaps such as these can be addressed by the required terms and conditions in the ROW grant (see Appendix C).

The northern alignment would cross the Kobuk River via a large bridge and pass north of Nutuvukti Lake. Table 5 presents the number of subwatersheds that would have direct and indirect impacts on the large waterbodies within the NPS project area (Appendix A, Figure 7). Without flow data for the waterbodies, the extent of the impacts downstream from the proposed Ambler road cannot be estimated; however, based on the flow pattern of each subwatershed, the potential for direct and indirect impacts can be determined.

Table 5. Number of Subwatersheds in the NPS Project Area with Direct and Indirect Impacts on Large Waterbodies

Waterbody	Northern Alignment Direct	Northern Alignment Indirect	Southern Alignment Direct	Southern Alignment Indirect
Kobuk River	7	2	4	0
Reed River*	--	--	1	0

* The northern alignment crosses the Reed River outside of the Kobuk Preserve.

Nutuvukti Lake is located downgradient of and in close proximity to the northern alignment. The landscape in that area also has limited capacity to absorb or moderate the effects of erosion or spills before contaminants reach the lake. The land between the proposed Ambler road and the lake is predominantly permafrost with a shallow active layer that is typically water-saturated. As a result of this permafrost and the slope of the topography and geology in the area of Nutuvukti Lake, sediment erosion and spills would run directly into the lake. Fugitive dust containing metals and other foreign materials could also enter directly into Nutuvukti Lake. As a result, Nutuvukti Lake would be adversely impacted by construction, operation, and maintenance of the proposed Ambler road.

The northern alignment would cross the Kobuk River within GAAR. Waterbodies crossed by bridges would have fewer impacts than those crossed with culverts, as there is less chance for bridges to be clogged with ice and debris. The Kobuk River would be adversely impacted from sedimentation and erosion downstream of the proposed road, especially during construction activities. Nine watersheds crossed by the northern alignment would have direct and indirect inputs into the Kobuk River (Table 5), as the flow pattern would cross the road and lead to the Kobuk River or its tributaries. The introduction of mine-related dust or compounds used for road construction and maintenance could impact water characteristics, including water chemistry, and could degrade water quality to a point where it would have adverse impacts on aquatic communities.

The southern alignment would cross the Kobuk and Reed rivers via large bridges inside the boundaries of GAAR. As stated for the northern alignment, bridge crossings would result in fewer impacts from sedimentation and erosion than culvert crossings. Impacts on rivers would be similar to those described for the northern alignment, with the potential for eroded sediments and metal contaminants to impact water quality downstream of the road alignment. Under the southern alignment, four subwatersheds would have a direct impact on the water quality of the Kobuk River, and one would have a direct impact on the Reed River (Table 5).

The applicant has proposed five water extraction sites along the northern alignment inside GAAR, one at the Kobuk River, three at unnamed streams, and one at an unnamed pond. Along the southern alignment, the applicant has proposed three water extraction sites inside the Kobuk Preserve, one at the each of the Kobuk and Reed rivers and one at an unnamed pond. Construction of the access roads to the waterbodies, including the Kobuk River, would cause impacts during construction and operation, as the roads would be dirt or gravel and erosion could occur. Due to the lack of information for volume and frequency, the impacts from water extraction on the waterbodies cannot be estimated at this time. As stated, data gaps are addressed in proposed guidelines for developing ROW terms and conditions (see Appendix C).

The material sites would be active gravel pits and would include mining equipment to extract the gravel and trucks to transport the gravel. Runoff from the material sites could increase sedimentation in surface waters. There is one material site proposed along each alignment within GAAR. The material site along the southern alignment is adjacent to the Kobuk River, creating the potential for impacts to the Kobuk River. In addition to the material site, the applicant proposed a camp, long-term maintenance facility, and airstrip along the southern alignment adjacent to the Kobuk River. Impacts to the Kobuk River and other nearby surface waters could be caused by the operation of construction and maintenance equipment, the release of hazardous materials used to operate and maintain the equipment, release of wastewater to septic systems or lagoons, use of water for potable water consumption, and release of pollutants from the burning of solid waste, potentially including sewage sludge. The burning of solid waste could cause pollutants to become airborne and settle in adjacent surface waters. The construction and operation of these facilities along the banks of the Kobuk River would likely cause impacts to the water quality of this pristine river. The NPS would work with the applicant to avoid and/or mitigate impacts, including the option of moving these facilities out of GAAR to avoid impacts altogether, eliminating the potential for impacts to water quality in the Kobuk Preserve from these facilities.

Conclusion

The types of impacts on water quality would be similar for the northern and southern alignments. Sedimentation and erosion caused by culverts would affect more streams (perennial, ephemeral, rills, etc.) within the preserve along the northern alignment. However, the support facilities proposed for the southern alignment adjacent to the Kobuk River would have the potential to cause long-term, adverse impacts to water quality. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. These areas outside of the preserve are evaluated in the BLM EIS.

FISH

This section focuses on the physical habitat and life history parameters of fish populations of the Kobuk and Reed rivers and Nutuvukti Lake and their tributary streams in proximity to the NPS project area. The geographic area analyzed for impacts on fish is the NPS project area (Appendix A, Figure 2). Although few fish surveys have been conducted, it is assumed that current fish diversity and populations are healthy in the NPS project area. Available data were reviewed and evaluated to discuss the current conditions of the Kobuk and Reed rivers and Nutuvukti Lake and to analyze direct and indirect impacts from road construction, operation, and maintenance on fish populations. The impacts on fisheries are discussed qualitatively and focus on areas where sportfish and subsistence species are known to occur. Construction, operation, and maintenance activities were analyzed to determine the effects on fisheries from stress, changes in water quality and quantity, fish passage obstruction, and habitat destruction and fragmentation. Fish are an important subsistence resource used by surrounding communities and impacts to fish populations would have impacts on these communities. ANILCA requires the protection of habitat for populations of fish.

Seventeen species of fish are known to inhabit streams and lakes throughout GAAR (Table 6). Species most often harvested for subsistence in the Kobuk drainage include anadromous chum salmon and whitefish, including sheefish, although baseline surveys are lacking for about half of the waterways in the Kobuk drainage (ADF&G 2018). Sport harvest is concentrated on Walker Lake and the Kobuk River for lake trout, sheefish, and salmon respectively, although sportfishing takes place in many other areas of GAAR. Sheefish and chum salmon are known to spawn in the Kobuk River (NPS 2014). The most widespread species in GAAR is the arctic grayling, which is found in nearly all permanent watercourses and those lakes that have an outlet stream. Table 6 identifies whether the fish species are anadromous or resident species. It is important to note that for anadromous species, rivers and streams are not just habitat but important migration corridors and should be considered essential habitat required for completion of their life cycles.

The Alaska Department of Fish and Game (ADF&G) is responsible for maintaining the Anadromous Waters Catalog (AWC), which is the Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes. The AWC has identified almost 20,000 streams, rivers or lakes throughout Alaska that are specified as being important for the spawning, rearing or migration of anadromous fish, but more than half of water bodies identified have not been surveyed (ADF&G 2018). Lacking surveys, NPS biologists evaluated the water bodies along the two alignments for the potential to provide spawning, rearing, or migrating habitat for anadromous fish. ADF&G surveys have found fish at all locations surveyed and as more surveys are completed, the results will continue to expand the number of AWC streams in the NPS project area. For the purposes of this analysis, it is assumed that all perennial streams, which are extensive throughout the NPS project area, would have resident or anadromous fish and thus would need fish passage at road crossings. Additional fisheries surveys would be necessary to determine the presence or absence of fish in all streams that would be crossed by the northern and

southern alignments. Data gaps such as these can be addressed by the required terms and conditions in the ROW grant (see Appendix C). In addition to fish surveys, information from community elders helped characterize the fish populations within the NPS project area. Community elders have indicated that there is important habitat for sheefish spawning on the Reed River, which is located between the two alignments.

Table 6. Fish Known to Occur in GAAR

Common Name	Scientific Name	Subsistence / Sport Fishing Species?	Typical Life History
Alaska Blackfish	*Dallia pectoralis*	Yes / No	Resident
Arctic Char	*Salvelinus alpinus*	Yes / Yes	Resident
Arctic Grayling	*Thymallus arcticus*	Yes / Yes	Resident
Broad Whitefish	*Coregonus nasus*	Yes / Yes	Resident or Anadromous
Burbot	*Lota lota*	Yes / Yes	Resident
Chinook Salmon	*Oncorhynchus tshawytscha*	Yes / Yes	Anadromous
Chum Salmon	*Oncorhynchus keta*	Yes / Yes	Anadromous
Dolly Varden	*Salvelinus malma*	Yes / Yes	Resident or Anadromous
Humpback Whitefish	*Coregonus pidschian*	Yes / Yes	Anadromous
Lake Trout	*Salvelinus namaycush*	Yes / Yes	Resident
Least Cisco	*Coregonus sardinella*	Yes / Yes	Resident or Anadromous
Longnose Sucker	*Catostomus catostomus*	Yes / No	Resident
Ninespine Stickleback	*Pungitius pungitius*	No / No	Marine / Estuarine, Resident, or Anadromous
Northern Pike	*Esox lucius*	Yes / Yes	Resident
Round Whitefish	*Prosopium cylindraceum*	Yes / Yes	Resident
Sheefish	*Stenodus leucichthys*	Yes / Yes	Resident or Anadromous
Slimy Sculpin	*Cottus cognatus*	No / No	Resident

Impacts

The Kobuk Preserve is currently undeveloped and experiences consumptive use of the resources by subsistence and recreational user groups. Despite this consumptive use, population dynamics and the natural life cycles of fish species are largely uninterrupted in the preserve. The rivers and streams in the Kobuk Preserve support several important fisheries including large runs of arctic char and chum salmon and spawning grounds for sheefish.

The proposed Ambler road would cross the Kobuk Preserve via either the northern or southern alignment and would include installation of several hundred structures (bridges and culverts) to maintain hydrology within the NPS project area. The project would result in potentially significant changes to fish habitat conditions through changes in water quality and hydrology, habitat fragmentation, and the addition of barriers to fish migration. Assuming drainage structures friendly to fish passage are constructed and maintained, road impacts to water quality would have the most drastic effects on fisheries along each alignment. Impacts to water quality are discussed more extensively in the “Water Quality” section.

Anadromous fish migrate extensively; therefore, it is important to analyze both direct and indirect project-related impacts that could disturb migratory fish. In addition to the direct impacts to fish habitat, other concerns include environmental changes induced by the proposed Ambler road and potential climate-driven changes that may be accelerated due to phased road construction. These potential changes include permafrost degradation; increased turbidity from poor soil stability and erosion along the alignment; changes in riparian vegetation due to shrub encroachment resulting from road dust; and increased sedimentation that could impact essential fish habitat. Fish could also be affected from temporary water extractions, depending on the location, frequency, and quantity of water removed. The alignments would differ in where streams and rivers are crossed, which could possibly affect spawning habitat.

Habitat Alteration and Bioaccumulation. Impacts to streams from road, bridge, and culvert construction and maintenance, should they occur, would impact fish habitat. As discussed previously, degradation of permafrost can result in soil slumping, causing large quantities of soil and rock to impact surface waters. Permafrost degradation also alters the surface and subsurface hydrology, which can cause erosion and sedimentation of streams and alter streamflow. The Kobuk Preserve is home to important fisheries and the rivers in the Kobuk Preserve provide important habitat, including spawning habitat for some species. Sedimentation of spawning habitat can eliminate use of the areas for spawning and reduce the viability of eggs spawned in the area. Runoff from the proposed road would carry fine sediment or spill remnants to streams, lakes, and wetlands. Suspended and subsequent settling of fine sediment in water can cause issues in aquatic systems by decreasing light penetration for aquatic vegetation and covering habitat of macroinvertebrates and spawning fish (Ritchie 1972; Hansmann and Phinney 1973; Lenat et al. 1981; Hedrick et al. 2010). This would ultimately reduce the productivity, survival, and growth of fish. The destruction of aquatic habitats through erosion and sedimentation is typically long-term, impossible to restore, and difficult to mitigate placing a high priority on avoiding these initial impacts. Depending on the severity, runoff could potentially impact additional fish habitat downstream of the chosen alignment.

As discussed in the “Water Quality” section, the construction, use, and maintenance of the proposed Ambler road could contribute heavy metals, salt, organic molecules, ozone, and nutrients to the environment which are currently at natural levels in this undisturbed area. Effective mitigation measures can reduce the risk of adverse impacts on water quality and water chemistry from road salts, organic molecules, ozone, and nutrients, and in turn, protect fish habitat. Road surface runoff would enter local waterways during all phases of construction and during maintenance of the proposed Ambler road from snowmelt, flooding, erosion and sedimentation. If highly mineralized gravel sources are used or if the geologic composition significantly differs from the local geology, road runoff would change local baseline water quality affecting fish at chronic or even lethal levels (Al-Chokhachy et al. 2016). Further, the use of dust palliatives, such as calcium carbonate, could influence water quality through road runoff. Because fish are adapted to specific flows and chemistry and anadromous fish imprint on and home to natal water quality, significant changes in natural water chemistry parameters, if they occur, could impact fish production.

Metals including lead, aluminum, iron, cadmium, copper, manganese, nickel, zinc and boron are present in gasoline and road salts and can be spread to habitats adjacent to the road via wind and runoff (Trombulak and Frissell 2000). Contamination of soils, plants, and aquatic organisms from heavy metals increases with the amount of traffic present and decreases with distance from the road; however, contaminating particles spread exponentially farther in aquatic environments when compared with terrestrial environments (Trombulak and Frissell 2000). Further, deicing agents can increase the mobility of chemical elements in soils, assisting in the contamination of aquatic environments (Forman and Alexander 1998). This could lead to impacts on fish populations not only directly adjacent to the road, but also downstream of the road. Metals bioaccumulate in the tissues of fish and other aquatic organisms.

When fish ingest toxicants present in water and food sources through the gills and from consuming prey, they are not able to break down or excrete the substance, leading to bioaccumulation.

Fish Passage Obstruction and Habitat Fragmentation. In order to reproduce, feed, and recycle nutrients between ecosystems, fish need to be able to migrate between waterways throughout various life stages. Currently, fish passage within the NPS project area is uninterrupted as there is little to no human development present in GAAR. Human developments, such as roads, often act as barriers to fish passage. Fish spawning, rearing, and migratory habitat is commonly lost as a result of improperly designed or installed bridges and culverts. Culverts permanently destroy streambed habitat for the entire length of the culvert and indirectly impact adjacent habitat areas. Improperly designed or installed bridges and culverts would lead to changes in water velocity in streams and rivers impairing fish migration and isolating fish populations from other areas of the watershed (Envirowest Environmental Consultants 1990; Harper and Quigley 2000; Wofford et al. 2005). Industrial stream crossings are shown to influence physical habitat characteristics in freshwater ecosystems, restrict biological connectivity, and impact fish community structure (Maitland et al. 2016).

Fish migration barriers created by roads without adequate fish passage frequently fragment headwater populations of salmonids and other migratory fish. Eventually, these permanent barriers could reduce the distribution and density of a population by encouraging selection for non-migratory behavior (Furniss et al. 1991; Trombulak and Frissell 2000). Although the research available for the location of fish spawning and rearing near each of the alignments is not extensive, the absence of data does not mean absence of fish or fish spawning. For the purpose of this analysis, it is assumed that both alignments would pass through at least some rearing or spawning areas. These areas could be seriously impacted if the road, culverts, or bridge structures impede fish migration, prevent the flow of groundwater leading to a decrease in fish egg survival and limit water inflows to groundwater charged wetlands, streams, and lakes.

The applicant's design would comply with ADF&G fish passage standards and culverts would be installed using stream simulation principles; however, sustaining the proper conditions in the harsh conditions of interior Alaska is difficult. The NPS and FHWA would work collaboratively with the applicant to monitor the functionality of the drainage structures and quickly identify and resolve issues, such as clogging or perching, that would affect fish passage.

Comparative Analysis

The proposed Ambler road could have significant impacts on fish populations within the Kobuk Preserve and throughout the project area in proximity to and downstream of the road segment through the preserve. This analysis is simplified due to a lack of information on the population extent of the individual species present within the NPS project area that would be impacted by construction, operation, and maintenance of the proposed Ambler road.

Based on available data, the northern alignment crosses one designated AWC stream and the southern alignment crosses four designated AWC streams. It is important to note that AWC designations are continuously being added as more surveys take place within the NPS project area. The adverse impacts on fisheries from construction and operation of the proposed Ambler road under both alignments would result in appreciable effects, including mortality and habitat destruction and fragmentation, habitat avoidance and displacement, migration alterations, and water quality effects from fugitive dust and erosion. Small changes in water quality can have relatively large impacts on fish production if they cause chronic effects, impairs migration, or causes mortality.

Fish passage impacts along both alignments could be severe if hydrology is not maintained. However, as previously stated, the NPS and FHWA would work with the applicant to monitor drainage structures and

identify and correct any issues that would affect fish passage in waterbodies in the Kobuk Preserve. The northern alignment has the potential for greater impacts on fish passage in the preserve due to the greater overall length of the alignment within the preserve and the greater number of proposed bridges and culverts within the preserve. The northern alignment would have greater impacts on fish habitat within the preserve, specifically in the Kobuk River drainage, since it is located farther upstream. The southern alignment would also have adverse impacts on fish in the Kobuk River although the extent of downstream impacts would be less than that of the northern alignment. The northern alignment would have adverse impacts on fish populations at Nutuvukti Lake because of the proximity of the proposed alignment to the lake and the slope and geography of the land between the alignment and the lake, as discussed in the "Water Quality" section.

The applicant has proposed five water extraction sites along the northern alignment inside GAAR, one at the Kobuk River, three at unnamed streams, and one at an unnamed pond. Along the southern alignment, the applicant has proposed three water extraction sites inside the Kobuk Preserve, one at the each of the Kobuk and Reed rivers and one at an unnamed pond. Construction and operation of the access roads to the waterbodies, including the Kobuk River, could cause erosion and sedimentation, resulting in impacts to fish habitat. Water extractions would likely be the cause of stress for fish leading to flight response or avoidance of preferred habitat during the water extraction process. More details on the volume of water needed or the frequency of extractions for construction, operation, and maintenance of the proposed Ambler road are necessary to accurately assess the impacts of water extraction on fish. Data gaps such as these can be addressed by the required terms and conditions of the ROW grant (see Appendix C).

The support facilities (material sites, construction camp, maintenance facility, and airstrip) proposed for construction and operation of the proposed Ambler road could impact fish resources and habitat. Impacts to water quality from the facilities could degrade fish habitat with sedimentation being a particular concern. The Kobuk River is an important river for salmon, sheefish and other species and contains important spawning habitat. The construction of these facilities for the southern alignment adjacent to the Kobuk River could cause long-term, adverse impacts to many of the fish species found in the river. The NPS would work with the applicant to avoid and/or mitigate impacts, including the option of moving these facilities out of GAAR to avoid impacts altogether, eliminating the potential for impacts to water quality in the Kobuk Preserve from these facilities. Similar facilities are proposed along the northern alignment, just west of the preserve. Similar impacts could occur to the fish resources of the Reed River, also an important river for many species. While the facilities along the northern alignment would be located outside the preserve, the Reed River flows into the preserve downstream of the proposed facilities and fish resources of the preserve could be impacted.

Many rural Alaskans continue to live off the land, relying on natural resources for food, shelter, clothing, transportation, handicrafts, and trade. Fish are an important resource for people who live a subsistence lifestyle. Within GAAR, the Kobuk River is used for fishing (NPS 2014). Within the NPS project area, there are two private Alaska Native allotments, one adjacent to Nutuvukti Lake and one along the Kobuk River near the southern border of the preserve (Appendix A, Figure 6). Impacts to the water quality and fish habitat in the NPS project area would have a direct adverse impact on fish as a subsistence resource.

Conclusion

Overall, the types of impacts on fisheries and fish habitat would be similar for northern and southern alignments. Sedimentation and erosion caused by culverts would impact fish habitat, especially spawning habitat. This would affect more streams (perennial, ephemeral, rills, etc.) within the preserve along the northern alignment as compared to the southern alignment. The northern alignment is located further upstream in the Kobuk River watershed, affecting a greater number of subwatersheds, and crosses a greater number of rivers and streams. Impacts described for fish would adversely affect the subsistence

communities, as fish are an important subsistence resource. If the support facilities were constructed inside GAAR, the construction camp, long-term maintenance facility, airstrip, and material site located on the southern alignment adjacent to the Kobuk River would have the potential to cause long-term, adverse impacts to the fisheries in the Kobuk River. Similar facilities for the northern alignment are located outside the preserve and would be unlikely to impact fish resources of the preserve. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. These areas outside of the preserve are evaluated in the BLM EIS.

CARIBOU

This section focuses on the caribou of the Western Arctic caribou herd (WACH), the largest herd in Alaska. Caribou are an important resource to GAAR, to subsistence communities, and to the public as a whole. Although the Kobuk Preserve contains only a small portion of the WACH range, it was retained as a resource topic in this EEA due to the importance of this species. Caribou are an integral part of the arctic ecosystem and are an essential resource to residents who live a subsistence lifestyle.

The ecosystems within GAAR are natural and healthy and support diverse wildlife communities, including caribou. GAAR is entirely within the annual range of the WACH, which encompasses more than 140,000 square miles (Wilson et al. 2016). The geographic area analyzed for impacts on caribou is the NPS project area, specifically the area along the northern and southern alignments (Appendix A, Figure 2). The NPS project area is within the migratory route and winter range of the WACH (Appendix A, Figure 11), and caribou generally move north to south in this area. Caribou complete semi-annual migrations across the NPS project area, through the orange area shown in Figure 11 in Appendix A, from their calving grounds, shown in pink, to their winter range, shown in light blue. Lichens are the primary food source for caribou and caribou preferentially use habitats that have higher lichen availability, especially during winter (Joly et al. 2010). Both alignments exhibit similar vegetative land cover composition (Joly et al. 2016). Vegetation along both alignments within the NPS project area is predominantly spruce forest, with areas of deciduous forest and low shrub and lichen habitat. However, the proposed northern alignment provides a slightly higher percentage of low shrub/lichen habitat than the southern alignment (8.4 percent along the northern alignment compared to 7.9 percent along the southern alignment) (Joly et al. 2016).

Monitoring of the Western Arctic Caribou Herd (WAH) has been conducted by NPS and collaborating agencies since 2009 and detailed methodologies can be found in the ARCN Caribou Vital Sign Protocol (Joly et al. 2012). Caribou are outfitted with collars equipped with GPS technology that transmits position data via satellite at 8-hour intervals. Up to the most recent annual report, 95 collars have been deployed and nearly 250,000 GPS locations have been recorded from WAH caribou (Joly and Cameron 2015). Available data on caribou within the Kobuk Preserve were used to determine the baseline conditions for caribou, including available habitat and movement patterns. Data collected and trends observed near other roads and development in caribou habitat in Alaska were assessed to predict potential impacts from the proposed Ambler road project. Figure 11 in Appendix A presents the caribou crossings within the NPS project area. Based on GPS locations, straight-line vectors were drawn between consecutive locations to show individual caribou crossings of the proposed alignments. Within the Kobuk Preserve, caribou appear to favor the habitat along the proposed northern alignment compared to the habitat along the southern alignment. There were 7 times as many crossings within the Preserve along the northern alignment (28 crossings) as compared to the southern route (4 crossings) (Joly et al. 2016).

Currently, population dynamics and the natural life cycles of caribou within GAAR are largely uninterrupted. Caribou migrate extensively; therefore, it is important to analyze both direct and indirect

project-related impacts that could disturb caribou resources. Construction of a road through a large roadless area could alter habitat, cause changes to vegetation communities, and inhibit migratory movement. Construction and the traffic associated with operation of the proposed Ambler road were analyzed to determine the effects on caribou from impacts to their habitat, food resources, movement, and distribution. The presence of the proposed Ambler road could lead to habitat fragmentation and degradation and could influence wildlife movements.

Impacts

The implementation of the proposed Ambler road across the caribou migration route could introduce a barrier of human development where there was none previously. This could cause impacts to caribou, such as mortality and flight response, habitat avoidance and displacement, movement alterations, and geophysical alterations, which could lead to population-level effects (Bolger et al. 2008). Fugitive dusts enriched with zinc decreased lichen cover beyond 1.2 miles (2000 m) from the Red Dog haul road (Exponent 2007), although the use of containerized loads and diligent truck washing procedures should reduce these risks for the Ambler Road and minimize the potential to impact caribou lichen forage. The long-term effects of road impacts on caribou population health are not fully known. While any one effect alone may not be detrimental, there may be cumulative negative effects on population, health, natural movements, and distribution.

Mortality and Flight Response. Disturbance from road noise can elicit a flight response in caribou, causing caribou to panic and run, resulting in increased energy expenditure and displacement from preferred habitats. The risk of disturbance from passing vehicles or mortality from vehicle collisions would be highest during the spring and fall migration periods.

Habitat Avoidance, Destruction, and Displacement. Lichens make up the majority of WACH caribou diet and are a strong driver of habitat use and caribou movement. Lichen-rich habitat within the construction daylight limits would be cleared by construction activities, resulting in habitat destruction beyond the proposed Ambler road in the Kobuk Preserve. This could cause caribou to avoid areas that were once abundant in lichen resources. The noise generated from the Ambler road and the affiliated facilities will also contribute to habitat avoidance by caribou, though the level and duration of noise at these facilities would vary. In addition, roads may act as a barrier and displace caribou. Since both the northern and southern alignments are located within the migratory area and winter range of the WACH, road-related disturbance over time may lead to displacement and ultimately abandonment of previously used habitat.

Movement Alterations. Although the crossing of semi-permeable barriers such as roads is possible, caribou would still be affected by the road when trying to move between seasonal ranges (Wilson et al. 2016). Roads may delay caribou migration or deflect caribou from migration routes until the caribou find a suitable crossing point (Child 1973; Wilson et al. 2016). In 2015, Wilson et al. studied the effects of the Red Dog Mine Industrial Access road on the WACH caribou population. This study found that even though the volume of traffic on the Red Dog Mine road was very low (49 round trips per day, or just over 4 vehicles per hour, 24 hours per day), the physical road affected the migration of approximately 30% of collared individuals, representing approximately 72,000 individuals according to 2017 population estimates. These individuals exhibited altered and unusual routes of travel and took about 33 days to cross the road (ten times longer compared to the other 70% of caribou) (Wilson et al. 2016).

Fugitive Dust and Geophysical Alteration. As stated in the “Water Quality” section of this report, metals in ore concentrates, mining-related products, and materials used for road construction, operation, and maintenance have the potential to be introduced into waterbodies as a result of the proposed project. This could contaminate drinking water and vegetation within caribou-preferred habitats near the chosen

alignment, but proper mitigation measures should reduce these risks. The proposed Ambler road would be constructed of crushed gravel, which could have the potential to generate fugitive dust, though dust palliatives can reduce these effects. The applicant has proposed mitigation measures, which are essential to reduce fugitive dust along the length of the road, which can degrade and contaminate vegetation including lichens and mosses near the chosen alignment (see Neitlich et al. 2017, Hasselbach et al. 2005). The NPS and FHWA would work with the applicant to monitor fugitive dust and to identify and mitigate contamination issues to the extent possible.

Comparative Analysis

The NPS project area is on the periphery of the typical WACH range, but data show a meaningful portion of the herd wintering or migrating in GAAR, including the Kobuk Preserve and the NPS Ambler Road project area. The impacts on WACH from the northern and southern alignments would be similar but less acute along the southern route.

The northern alignment is located further within the WACH migratory area. The population of caribou along this alignment would be denser and a greater number of individuals would be affected by the alignment and the likelihood for vehicle collision within the preserve would be greater than that of the southern alignment. Joly et al. (2016) reported that caribou crossing of the northern alignment was more frequent than crossings of the southern alignment. This study examined data from a sample of collared caribou that represent larger trends among the entire herd. The study found the number of collared caribou crossing the northern alignment (28 crossings observed) within the preserve was seven times more than the number of collared caribou crossing the southern alignment (4 crossings observed) within GAAR (Joly et al. 2016). While these are small absolute numbers the pattern is clear and representative of broader trends of caribou movement in the NPS study area that show a greater intersection of caribou movement with the northern alignment than the southern alignment.

High-quality lichen-rich caribou habitat is more prevalent along the northern alignment within the preserve than the southern alignment, as the northern alignment traverses more alpine and dwarf shrub habitats rich in lichens. The presence of the proposed Ambler road near lichen-rich habitats could displace caribou from lichen-rich resources and impact the abundance of this important food source due to direct habitat loss from the road, and potential degradation by fugitive dust depending on the effectiveness of dust mitigation measures (Wilson et al. 2016).

The support facilities (material sites, construction camp, long-term maintenance facility, and airstrip) proposed for construction and operation of the proposed Ambler road could impact caribou. The types of impacts would be similar to those described for construction and operation of the road itself, as the suite of caribou responses to threats are limited to flight and avoidance.

Historically, the most important resource to the Alaska Native inhabitants in the area was caribou. Currently, the Kobuk Preserve is visited infrequently by caribou hunters, who mainly hunt caribou closer to their communities (NPS 2014). However, impacts on the WACH from the proposed Ambler road could have an impact on subsistence hunting throughout in their range.

Conclusion

Construction and operation of either alignment would result in adverse impacts to caribou including mortality and flight response, habitat avoidance and displacement, movement alterations, geophysical alteration, and fugitive dust. The types of adverse impacts would be similar for the northern and southern alignments, but the data illustrate that caribou use habitat along the northern alignment more frequently, resulting in a greater impact from the northern alignment on caribou than the southern alignment. Impacts

on the WACH from the proposed Ambler road could have an adverse impact on subsistence users, whether they hunt in the Kobuk Preserve or elsewhere. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. These areas outside of the preserve are evaluated in the BLM EIS.

ARCHEOLOGICAL RESOURCES

GAAR has a rich, well-preserved, and significant archeological record that documents an estimated 13,000 years of human activity. Examples of archeological sites found in GAAR include campsites, villages, hunting overlooks, fish camps, caribou drive lines, and historic gold mining operations. There are archeological resources within GAAR that are both historically important and important to contemporary users of lands within GAAR. Evaluation of cultural resources will continue in the context of the National Historic Preservation Act Section 106 compliance process within the scope of the broader Ambler Road project. NPS is a participant in the development of a multi-party programmatic agreement and cultural resource management plan that will ensure proper consideration and management of cultural resources.

More than 1,800 archeological sites have been identified within GAAR; however, only a handful of archeological surveys and inventories have been conducted within the Kobuk Preserve and adjacent areas, including portions of the national park. Nevertheless, the distribution and nature of archeological resources is known well enough to understand that archeological resources are present, abundant, and well preserved. Although most known sites have not been thoroughly evaluated to determine their significance, many sites are known to have high research value (Baltensperger et al. 2019).

The proposed Ambler road would cross areas of cultural importance, which include archeological resources, and ground-disturbing construction activities could impact archeological deposits. Current studies and modeling efforts show that differences exist in archeological site distribution between the two proposed alignments. The geographic area analyzed for impacts on archeological resources is the NPS project area (Appendix A, Figure 2).

Due to the large amount of unsurveyed area, the NPS used a set of hundreds of documented archeological sites within the Kobuk Preserve and the adjacent national park to develop a spatial model predicting the relative likelihood of finding undocumented archeological sites in unsampled areas of the NPS project area. The model uses 11 factors to calculate probability of existing resources, including the distance to lakes, elevation, distance to anadromous streams, distance to rivers, distance to villages, distance to the coast, ecotype, slope, aspect, surficial geology, and distance to streams (Baltensperger et al. 2019).

The spatial model results predicted areas of high archeological site potential in valleys associated with the Kobuk River, especially in association with large glacial lakes. Proximity to lakes was the most important predictor in the model development followed by elevation and proximity to anadromous streams and large rivers. Areas within 0.5 mile of lakeshores (especially near Walker and Nutuvukti lakes) were predicted to have higher probability for archeological resources than areas away from water bodies. Elevations between 500 and 1,000 meters (0.3 and 0.6 mile) and areas adjacent to anadromous water courses, including the Upper Kobuk and Reed rivers and Beaver Creek were also predicted to have a high likelihood of archeological sites. The spatial analyses demonstrated substantial differences in the prediction of high-potential archeological areas that would be affected by the northern and southern alignments (Baltensperger et al. 2019).

In addition to archeological resources, NPS staff documents and manages information regarding ethnographic resources. Ethnographic resources at GAAR are those cultural and natural features that are

of significance to traditionally associated peoples. Traditionally associated peoples generally differ as a group from other park visitors in that they typically assign significance to ethnographic resources or places closely linked with their own sense of purpose, existence as a community, and development as ethnically distinctive peoples. NPS staff will continue work with local Alaska Native communities to identify these resources and minimize effects both directly and within the scope of the broader Ambler Road project. The multi-party programmatic agreement and cultural resource management plan being developed for the project includes ethnographic resources and places of traditional importance.

Impacts

Adverse effects to archeological resources would be caused by ground disturbance or construction within a documented or undocumented site. These actions would result in adverse effects by causing damage to or alteration of a historic structure or cultural feature; displacement or removal of contributing or associated object or cultural feature; altering aspects of the historic landscape or setting that make a site culturally significant; or restricting access to traditional cultural places or resources, including culturally important plant, animal, or material resources. In addition to impacts from construction, the construction camp and the long-term maintenance facility along southern alignment would require a crew of workers that would be living at the site within the Kobuk Preserve and presenting risks of unauthorized collection of artifacts.

Comparative Analysis

Archeological surveys for the proposed Ambler road alignments are limited. The applicant identified and surveyed locations of interest. However, only 41 locations were surveyed based on a previous version of the road alignment that does not perfectly align with the alignment proposed in the permit application. The NPS has not completed surveys specifically for the proposed Ambler road project; however, the NPS has conducted surveys in the general project area. These surveys are a relevant basis for generally characterizing the archeological potential and significance in the NPS project area. Adequate archeological resource surveys are needed to better understand the extent of archeological resources along the alignments.

The NPS archaeological potential model results show that the proposed northern alignment would involve a larger area with high potential to contain archeological sites compared to the southern alignment within the Kobuk Preserve (Baltensperger et al. 2019). Both alignments have the potential to affect archeological resources in the Kobuk Preserve due to the proximity to prominent water bodies. The northern alignment is near Walker and Nutuvukti lakes, as well as the Kobuk River, while the southern alignment is close to fewer large water bodies, reducing the probability for archeological resources.

The highest potential for resources exists within the corridor of the Kobuk River. The northern alignment would travel within 0.25 mile of the river for approximately 1.7 miles and the southern alignment would travel within 0.25 mile of the river for approximately 0.8 mile; however, the southern alignment would also construct an airstrip and a material site within portions of the boundary. Additionally, the southern alignment provides greater opportunities for collection of artifacts due to the presence of the construction camp and long-term maintenance facility adjacent to the Kobuk River. The southern alignment would also cross the Reed River within the Kobuk Preserve, but there is less area of high archeological potential at this crossing compared to the northern alignment. Although the types of sites along the alignments are unknown, most of these resources would likely be lithic scatters. Other site types could include artifact scatters, cabins, cache pits, cairns, camps, faunal remains, rock features, hearths, and other features. The impacts along each alignment would be direct and adverse resulting from surface and subsurface construction activities and unauthorized artifact collection. Because of the potential for resources along waterways, the presence of support facilities (i.e., airstrip, material site, construction camp, long-term

maintenance facility) adjacent to the Kobuk River could have a large impact on archeological resources. Adverse effects from such facilities could be avoided by locating all material sites and associated features outside the Kobuk Preserve, if feasible.

Conclusion

The northern and southern alignments both have the potential to impact archeological resources through ground disturbance. Predictive modeling indicates that the greatest potential for the presence of archeological resources is near lakes and anadromous waterbodies. The location of the northern alignment near both Walker and Nutuvukti lakes increases the potential for impacts to archeological resources. The material site and associated features along the southern alignment could affect a large number of archeological resources, as combined the features would cover approximately 147 acres of land adjacent to the Kobuk River where site potential is high. Additionally, having a population of workers living within the park in an area of high potential could increase archeological resource collection. Locating the airstrip, material site, construction camp, and long-term maintenance facility outside of the Kobuk Preserve, the southern alignment would be more protective of archeological resources within the Kobuk Preserve, based on its location in relation to areas of high archeological site potential. When including mileage outside of preserve boundaries to the junctions where the northern and southern alignments merge, the southern alignment includes 43 miles outside of the Kobuk Preserve, while the northern alignment includes only 18 miles outside of the preserve. The potential for archeological resources is lower outside of the Kobuk Preserve, but the potential exists, especially near waterbodies. The impacts from constructing the entire length of the Ambler road alternatives covered in the BLM EIS.

VISITOR EXPERIENCE

Visitors come to national park system units to experience the unique characteristics of each unit. For many visitors, being immersed in a natural environment or a cultural landscape is the experience they are seeking. The quality of the recreational opportunities available affects how visitors experience the area. People visit GAAR for a variety of reasons and to engage in recreational activities that include hiking, camping, backpacking, river float or canoe trips, packrafting, wildlife viewing, birdwatching, photography, fishing, and hunting (only in the preserves).

Visitors are not required to register or pay a fee to enter GAAR; therefore, visitation is difficult to track. In 2017, approximately 40 people visited the Walker Lake area of GAAR. From 2013 to 2017, the annual visitation average to the Walker Lake area was approximately 85 people. Visitation is determined from counting visitors who participate in the NPS program for bear resistant food containers, which loans out the containers free of charge, and those traveling with a registered guide. Consequently, these visitor use data are minimal and likely underrepresent visitation. GAAR has a low number of visitors when compared to other large parks, but the amount of time each visitor spends in GAAR is one of the highest of all national park system units with an average length of stay of 8 to 10 days.

GAAR is widely recognized as a premier wilderness park in the national park system, encompassing nearly 8 million acres of wilderness. The arctic ecosystems of GAAR are managed to protect their wild and undeveloped character and provide continued opportunities for subsistence activities. A 2017 wilderness character assessment of GAAR showed the park and preserve to have well-preserved wilderness characteristics (Pace et al. 2017).

The geographic area analyzed for impacts on visitor experience is the NPS project area (Appendix A, Figure 2). This section explains how the proposed Ambler road along the northern and southern alignments would change the visitor experience by altering the landscape and the recreational opportunities in the Kobuk Preserve.

Impacts

GAAR is valued for its remoteness and naturalness. The remote location, challenging access, and current NPS management all combine to provide visitors with unique wilderness recreation opportunities. The northernmost portion of the NPS project area includes a small section of Gates of the Arctic National Park, which is designated as wilderness, and as a whole, is considered one of the least developed wilderness areas in the National Wilderness Preservation System. Under the proposed Ambler road, recreational opportunities for visitors would not change once the construction is complete, but the quality of the opportunities would be different in areas near the road. The proposed Ambler road would be the only substantial human-made development inside the Kobuk Preserve. The visual and auditory intrusion on the natural setting of GAAR would result in impacts on the visitor experience. Changes to the viewshed and soundscape from the presence of the proposed Ambler road and the activity associated with it would affect visitors, including those floating on the Kobuk River.

Construction. Visitors would be restricted from areas of active construction for safety concerns. Although construction would be short-term, it would create impacts on the viewshed and soundscapes due to the use of heavy equipment and activities associated with road construction, including building bridges across rivers and streams. Construction activities would occur periodically throughout the life of the road, as the applicant proposes to build the road in phases over a decade or longer, and road maintenance would be an ongoing activity for the life of the road.

Viewshed Impacts. Vegetation clearing for the road and associated features would alter views within the NPS project area. Once constructed, the contrast of color between the proposed Ambler road and the surrounding natural lands would be apparent to visitors. The applicant proposes to revegetate fill slopes with native vegetation to reduce the contrast between the gravel road and the existing forest. A visual resource inventory was completed to characterize the scenic quality of the Kobuk Preserve in the NPS project area and to provide a baseline against which to compare the potential impacts of the proposed alignments (Meyer and Sullivan 2016; DOWL 2014b). The viewshed analysis determined that the proposed Ambler road along the northern alignment would be visible from 128,412 acres of GAAR with very high cumulative scenic inventory value, thus having adverse impacts on the viewshed compared to current conditions (Meyer and Sullivan 2016; DOWL 2014b). Comparatively, the southern alignment, which goes through the narrowest portion of the Kobuk Preserve, would be visible from 99,752 acres that have very high cumulative scenic inventory value. Figure 12 in Appendix A presents the area from which the northern and southern alignments would be visible based on the viewshed modeling. Dust plumes from traffic would impact the viewshed for the life of the road, as long as there is traffic and it remains a gravel road. Dust plumes would be mitigated with the use of a dust palliative, such as calcium chloride, but even the best palliatives are not completely successful in mitigating traffic-related dust on a gravel road. At a minimum, there would be an estimated 80 trucks per day (40 round trips) on the proposed Ambler road during initial mine development activities, and at a maximum, there would be approximately 168 round trips per day year-round (BLM 2019). Dust plumes would also be present at material sites, as rock would be collected, crushed, and transported from these areas. On the southern alignment, the material site would have a construction camp and long-term maintenance facility associated with it, which would likely have higher vehicles traffic, as well as an airstrip and communications tower, which would result in additional visual intrusions. Although plans are not finalized, it is likely that the material site along the northern alignment in the Kobuk Preserve would also have a communications tower, as the applicant expects to have a tower within the preserve regardless of the alignment. The vehicle and air traffic, dust plumes, and communications towers would serve as a dynamic reminder of human development and activity in the Kobuk Preserve. Further, particles from the dust plumes would settle on the surrounding landscape, creating additional visual impacts from altered vegetation communities and plant health.

Soundscape Impacts. An environmental sound analysis modeled and analyzed the impacts on the soundscape at GAAR from haul trucks on the proposed Ambler road (BSA 2015). Of the 25 sound modeling locations, haul trucks would be audible at 10 locations along each alignment, and where audible, the sound levels would be moderate to very faint. When average truck noise levels (sound heard by a hypothetical visitor over an hour) were examined, the truck noise would be heard above ambient noise levels (natural and anthropogenic sounds) at five locations on the northern alignment and four locations on the southern alignment. The sound analysis determined the potential for impacts from human-caused sounds on the soundscape in the Kobuk Preserve; however, the analysis considered only traffic noise during the post-construction operational phase of the road project with an average of 40 round trips per day. Overall, the results of this analysis show that the northern and southern alignments would have similar impacts on the soundscape for the activities that were analyzed. Additional vehicle noise impacts would be expected during the construction phase, during maximum use of the road, and during the course of maintenance activities. Further, the sound analysis did not consider the impacts on soundscapes from material sites along the alignments (both northern and southern) where rock would be mined and crushed or from the airstrip associated with the material site on the southern alignment.

It should be noted that the noise generated by a haul truck is not substantially different from the noise of aircraft used to transport visitors to the Kobuk Preserve and Walker Lake areas. The difference would be the increase in frequency of human-made noise from the haul trucks. Another difference between the use of aircraft and haul trucks is engine brake noise; this low-frequency noise is more audible above ambient sound levels. The sound analysis assumed 80 haul trucks per day, which is more than six times the number of aircraft noise events on the busiest day recorded in 2013 and 2014 (BSA 2015; Betchkal 2018). It is important to note that the assumption of 80 haul trucks per day is an estimate of the minimum number of vehicles that would use the proposed Ambler road per day; the maximum number per day could be closer to 330 trucks year-round (BLM 2019).

Wilderness. The enabling legislation for GAAR includes direction to maintain the wild and undeveloped character of the area, provide continued opportunities for wilderness recreational activities, protect park resources and values, and provide continued opportunities for subsistence uses by local residents where such uses are traditional (Pace et al. 2017). Wilderness characteristics are a fundamental resource and value of the Kobuk Preserve, which is bordered on the north by designated wilderness within the national park. Providing opportunities for solitude and challenging wilderness adventures, as well as being a premier wilderness park in the national park system, are identified as two of the values that are significant about the area. For GAAR visitors, much of their experience stems from the quality of the wilderness. In public comments for a recent General Management Plan and for this project, commenters emphasized the high value of the park and preserve's large, remote and undeveloped character.

Comparative Analysis

The physical presence of a road with regular traffic and a connection to the greater transportation network of the Federal Highway System would redefine many aspects of the current visitor experience. Either alignment would have a large adverse impact on the quality of the visitor experience within the NPS project area. Given the extremely large size of GAAR (nearly 8 million acres), a relatively small area would be affected by the viewshed and soundscape changes brought about by the proposed Ambler road. However, the changes would occur near the primary access point for southern part of GAAR (Walker Lake), so nearly all visitors to this part of GAAR would be affected. After construction, there would be auditory and visual impacts from operation of the proposed Ambler road. The visual resource inventory, the environmental sound analysis, and the wilderness character mapping results showed that there is little difference between the alignments when looking solely at the distance from the roads where impacts would occur for the activities analyzed (BSA 2015; Meyer and Sullivan 2016; DOWL 2014b; NPS 2017b). Dust plumes and construction/maintenance and traffic noise would be regular reminders of the

presence of the road; even small changes in ambient dust or noise would have a large impact on an area where these factors are naturally absent. Construction activities and impacts from the road itself would be similar between the alignments; the differences occur with respect to the length and location of the alignments and the associated features. During construction and operation of the proposed Ambler road, the recreational opportunities of GAAR would persist, and visitor requirements would remain unchanged. If an alignment through the Kobuk Preserve is approved, the NPS would make information available to the public through the park website, through concessionaires, and at ranger stations about the activities associated with the road, including location, duration, and expected conditions.

The two primary points of access near the NPS project area are Walker Lake and Nutuvukti Lake. Both are near the northern alignment at 1.5 miles and less than 0.25 mile, respectively. Walker Lake provides an opportunity for a remote wilderness experience in national park with relatively easy access via float plane. For some visitors, float plane access is probably an additive to the remote and wilderness aspects of the experience. Noise from regular traffic on the road would intrude on a soundscape currently defined by natural sounds that are punctuated by sounds of aircraft 5 to 7 times per day and averaging 5 minutes in duration (Betchkal 2014). Periodic noise from material site along the northern alignment would further impact the soundscape. The viewshed modeling did not take into account the support facilities associated with the road that would be located within the Kobuk Preserve. The 100- to 150-foot communications tower that would further impact the viewshed. Although Walker Lake experiences a minor amount of day use, most visitors dropped off at the lake stay for one or more days before getting picked up or moving on to a river trip or some other adventure. Primary visitor use at Walker Lake occurs in the summer, and the primary use and activity on the proposed Ambler road would also be in the summer. Given that it is daylight 24 hours per day in this location most of the summer, there would likely be traffic and activity on the road 24 hours per day, providing visual and auditory reminders of its presence. Although located outside of the Kobuk Preserve, the sights and noise associated with the material site, airstrip, and long-term maintenance facility east of the Reed River would affect also visitors to Walker and Nutuvukti lakes. Despite the effort and commitment required of GAAR visitors to reach this wilderness location, the proposed Ambler road along the northern alignment would provide regular reminders that it is not as remote and inaccessible as it once was.

Conversely, distance and topography combine to make visual and auditory reminders along the southern alignment indiscernible to visitors to Walker Lake. Viewshed modelling indicates that some minor portions of the southern alignment would be visible from higher elevations in the mountains surrounding Walker Lake. However, the Walker Lake visitor experience would be essentially unchanged from what it was before the construction of the road. The southern alignment would be approximately 4 miles away from the southern end of Nutuvukti Lake. Park visitors traveling to Nutuvukti Lake would be able to see the proposed Ambler road from the higher elevations surrounding the lake, particularly near the southern end. Given the topography around Nutuvukti Lake, it is probable that vehicle noise from traffic on the road could be heard from the southern half of the lake. The communications tower that would be located at the material site along the southern alignment would likely be seen from more locations near Walker and Nutuvukti lakes. However, these exposures to these indicators of the presence of the road compare to the quarter-mile proximity of the northern alignment to Nutuvukti Lake. The sights and sounds of the proposed Ambler road from these two lakes are important as Walker and Nutuvukti lakes are popular visitor destinations. For visitors near the southern alignment, including those that float the Kobuk River, the construction camp and long-term maintenance facility would present another adverse impact on the wilderness experience. This camp/facility would require a crew that would likely permanently reside at the material site location within the Kobuk Preserve. Encountering a permanent camp with residents would adversely affect the feeling of solitude or primitive and unconfined recreation for GAAR visitors.

Walker Lake is also the starting point for a remote wilderness float trip that can range from as short as 86 miles to the Pah River or as long as 300 miles to the community of Noorvik or beyond. At a closest

approach of 1.5 miles from the proposed Ambler road to Walker Lake, the road and the dust plume from traffic on the northern alignment would be visible to park visitors and detract from an experience that is otherwise largely devoid of evidence of modern human development. Visitors that float the Kobuk River would approach and pass under the bridge but after passing it indications of the proposed Ambler road would be gone, and the visitor experience would be comparable to what it was before the road was built. The southern alignment would cross the Kobuk River and the Reed River within the boundaries of the preserve, requiring bridges at both locations. Visitors floating the Kobuk River would be exposed to the sights and sounds of the road as they approached the bridge, but similar to the northern alignment, these indicators of development would soon be left behind, and the river experience would remain much the same as it was prior to construction of the road. The same would be true for visitors floating the Reed River.

Sport hunting and fishing are the two primary activities for visitors using Nutuvukti Lake as a point of access. The immediate proximity of the proposed Ambler road along the northern alignment ensures that visitors to Nutuvukti Lake would see the road and hear traffic on it. The proposed road would become part of the experience at Nutuvukti Lake. The character of the location and the experience would change dramatically with the northern alignment. To the degree the presence of, or activity on, the road influences wildlife behavior or has adverse effects on fish and other aquatic species in the lake, the proposed Ambler road along the northern alignment has the potential to adversely affect the primary reasons for visiting this location in GAAR. Similarly, as the southern alignment is surrounded by preserve lands, the presence of the road and the activity on it may affect wildlife presence and movement, creating measurable impacts to sport hunting opportunities. Another impact of the southern alignment would be the construction/maintenance crew that would be living at the facility associated with the material site. If these workers were to fish or hunt in the Kobuk Preserve, this could affect fishing and hunting opportunities for visitors.

Locating all material sites and associated features located outside of the Kobuk Preserve would help to mitigate the impacts of the alignments on the visitor experience. Locating these features outside the Kobuk Preserve would create a scenario where the impacts from the sights and sounds of the proposed Ambler road would be similar for the northern and southern alignment. If the material sites and other features were located outside of the Kobuk Preserve, the main difference between the alignments would be the location in proximity to designated wilderness and to popular visitor destinations in and near to the Kobuk Preserve.

Conclusion

Walker Lake and Nutuvukti Lake are the primary points of access to the Kobuk Preserve and surrounding areas. The northern alignment would provide visitors to these lakes with audio and visual signs of human development while they remain in that area, affecting the natural and undeveloped recreational experience that the preserve currently provides. The southern alignment would allow for a continuation of the current visitor experience, with the exception of development for Kobuk River travelers and some visual and auditory effects that may be experienced from portions of Nutuvukti Lake. Visitors floating the Kobuk River would first encounter the airstrip that is adjacent to the river, cross under the bridge, then pass the material site that is also adjacent to the river. In total, the southern alignment would result in a float trip with approximately 3 miles affected by development, while the northern alignment would affect approximately 1.5 miles of a float trip. For visitors who travel elsewhere in GAAR from Walker Lake or who limit their activities to the vicinity of Walker Lake or Nutuvukti Lake the experience would be essentially unchanged from what is available currently under the southern alignment. The northern alignment would have substantial impacts to the visitor experience while the southern alignment would generally preserve the current visitor experience.

SOCIOECONOMICS

This section describes economic factors and socioeconomic impacts of construction of the proposed Ambler road within the NPS project area.

Impacts

The proposed Ambler road has the potential to affect local businesses and the economies of individuals and communities in both a positive and negative manner. The patterns and level of visitor use are likely to be altered by the presence of a road. Development of an industrial road along the northern alignment, which is adjacent to NPS-managed designated wilderness, has the potential to deter wilderness-focused recreational users and could adversely impact local guides and outfitters who presently emphasize wilderness experiences in this area. There is insufficient data available to quantitatively compare the economic effects of the road on recreational factors across alignments at this time.

Native corporations have the potential to gain revenue from land leases, material sales, and mining-related revenues generated in the Ambler Mining District. Native corporations in the region could also benefit from providing goods and services to the mining companies conducting exploration and operations in the Ambler Mining District. These benefits are general in nature and unlikely to differ in a meaningful degree between the alignment alternatives across the Kobuk Preserve.

An analysis of the social and economic impacts of the proposed Ambler road as a whole is contained in Section 3.4.5 of the BLM Draft EIS (BLM 2019), which is incorporated herein by reference. According to that document, community services including health care, law enforcement and solid waste disposal would not differ between the alignments. Likewise, there is no data to suggest that state and local government revenues would be significantly different between the northern and southern alignments.

Due to the remoteness of communities in the project area, transportation of fuel and freight is expensive and poses a significant financial burden to area residents. A 2014 Preliminary Economic Impact Study by the McDowell Group classifies the potential economic transportation benefit of the proposed Ambler road into three categories: significant, moderate, or minimal (McDowell 2014). None of the communities in the ‘significant’ or ‘moderate’ benefit categories would be affected by a northern versus southern alignment decision due to their distance from NPS lands. Communities in the ‘minimal’ benefit category (Alatna, Allakaket, Hughes, and Huslia) are closer to the NPS southern alignment but are still approximately 40 to 95 miles away; far enough that it is unlikely they would have a spur road connection to the proposed Ambler road. As a result, there does not appear to be a significant economic difference between the alignments with regard to transportation benefits.

The design for the proposed Ambler road is still preliminary and the construction cost estimates reflect broad assumptions based on limited data, and would be more fully resolved during the project’s design and construction phases. Appendix C of the BLM EIS contains construction cost information for the entire road and all associated project elements. The BLM EIS Alternative B, which includes the NPS southern alignment, has a higher overall construction cost than the BLM EIS Alternative A due to the longer overall route (224 miles versus 211 miles, $556.8M versus $519.3M). At $2.49M/mile, the entire road cost with the southern alignment is 1.2% more expensive than the $2.46M/mile cost for the entire road with the northern alignment. With the exception of communication system towers (the southern alignment includes one additional tower), the support infrastructure is the same for both alignments. Only the location of those facilities varies between the northern and southern alignments.

Comparative Analysis

The northern and southern alignments would both provide increased employment opportunities. Section 3.4.5 of the BLM Draft EIS (BLM 2019) estimates that job creation directly related to road construction is expected to be approximately 7% greater on the southern alignment. For example, an estimated total of 680 jobs would be directly created annually by the construction of the entire proposed Ambler road under the northern alignment, while the southern alignment is estimated to directly support a total of 730 jobs annually. This translates into a cumulative total of 2,730 and 2,930 jobs respectively for the entire road over the estimated 4-year timeframe for Phase I and II construction (BLM 2019). The differences in job creation numbers are directly related to the longer length of the southern alignment.

Conclusion

The southern alignment—due to its greater length within the scope of the overall project—would have higher construction costs, but would afford greater opportunities for job creation than the northern alignment. Total project costs between the northern and southern alternatives vary by 1.2% with the southern alternative being higher. Development of the northern alignment could have a greater negative impact on guiding businesses that emphasize remote and undeveloped wilderness recreation in the designated wilderness portion of Gates of the Arctic National Park. Otherwise, the economic effects of the proposed Ambler road on businesses, communities, and individuals would not substantially differ between the northern and southern alignments. Positive and negative impacts of the project accrue primarily at a regional scale, and do also affect nearby communities. The impacts, however, hinge to the greatest degree on the presence of a road and to a much lesser degree on the route alternative through the Kobuk Preserve.

WILD AND SCENIC RIVERS

Within GAAR, the Kobuk River is designated as a wild river under the Wild and Scenic Rivers Act. From its headwaters in the Brooks Range, the river courses south and west through a wide valley to Kotzebue Sound. This analysis addresses impacts to the wild-designated portion of the Kobuk River, including a 0.25-mile boundary on either side of the river, which is entirely inside the Kobuk Preserve (Appendix A, Figure 13). The analysis of impacts on the wild-designated Kobuk River was based on a qualitative assessment of how the proposed alignments would affect the free-flowing character, water quality, the *wild* classification of the river, and the five Outstandingly Remarkable Values (ORVs) for which the river was designated. In addition, this analysis considers the protection and enhancement of the Kobuk River for the benefit and enjoyment of the public, as called for under the Wild and Scenic Rivers Act. The Kobuk River is an important subsistence resource used by surrounding communities and impacts to this river could have impacts on these communities.

In 1968, Congress passed the Wild and Scenic Rivers Act to establish a policy of the United States to preserve the free-flowing condition, water quality, and ORVs of certain selected rivers and their immediate environments for the enjoyment of present and future generations (16 USC 1271 et seq., Section 1(b)). In mandating issuance of a ROW across the Kobuk Preserve, Congress specified that the ROW would be issued in accordance with the provisions of ANILCA 1107. ANILCA 1107(b) is specific to wild and scenic rivers, and it provides that any transportation system unit traversing a designated wild and scenic river shall be subject to such conditions as may be necessary to ensure that the stream flow of and transportation on the river are not interfered with or impeded and the road is located and constructed in an environmentally sound manner. For purposes of this analysis, the NPS identified a 0.25-mile boundary on either side of the river as the immediate environment of the Kobuk River. This 0.25-mile boundary equates to approximately 320 acres per mile on both sides of the river.

Impacts

The construction of the proposed Ambler road across the Kobuk River means that a portion of this designated wild river would no longer be free from human development. Figure 14 in Appendix A presents the northern and southern alignments and the road features associated with each alignment within the Kobuk Preserve and specifically the bridge crossings of the Kobuk River and its boundary (Appendix A, Figure 14 insets).

Wild Classification. The lack of development, as well as the free-flowing condition and exceptional water quality of the upper Kobuk River are integral to its designation and classification as a *wild* river. Wild rivers are defined in Section 2(b) of the Wild and Scenic Rivers Act as: "Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America."

Under both the northern and southern alignments, the proposed Ambler road would cross the Kobuk River with a multi-span bridge that would have three sets of piers in the river. The piers would likely be constructed of steel piles with concrete caps. The bridge abutments would likely be protected with riprap mats placed along the riverbanks. The application proposes that both alignments would include an access road leading from the proposed Ambler road to the bank of the Kobuk River for water extraction.

Free Flow. The free-flowing condition of the upper Kobuk River remains untouched by human intervention. It moves and flows according to natural processes. Flow characteristics of the upper Kobuk River are similar to those of other large arctic rivers in Alaska. Between late October and late May, the river is frozen, and the flow is relatively low. Spring break-up brings increased flow as snowpack begins melting, and by June, water from the snowmelt and runoff from the basin enter the river. Studies on the Kobuk and other rivers along the proposed Ambler road indicate that ice jams during breakup can lead to more than bankfull conditions at the proposed bridge locations (Kane et al. 2015). Between the months of July and September, precipitation drives flow rates, which can vary with each storm.

An option to construct a full span bridge without piers in the river channel was evaluated at a conceptual level, but was deemed to be not economically feasible. A multi-span bridge with piers in the river and abutments within the floodplain was ultimately considered in this analysis. Such a design stands to alter natural channel migration and the free-flowing sinuosity, possibly causing impacts such as decreased water quality, habitat degradation and destruction, and changes to the visitor experience, as discussed in previous sections. Abutments affect the velocity across the channel by confining the river to a defined width in high-water events and preventing the lateral spread of the river in the flood plain. Piers reduce the cross-sectional area which affects the velocity across the channel and may act as barriers to floating ice or debris. The Kobuk River freezes from late fall through late spring (Durand et al. 2009); however, piers alter flow conditions and can initiate ice jams and increase the probability of ice jam flooding (Wang et al. 2015). Piers affect streamflow, channel geometry, and hydraulic efficiency. Piers and abutments also cause bridge scour as sediment is removed from around the piers due to increased turbulence and general scour related to flow constriction (Blodgett 1984). Constructing a multi-span bridge across the Kobuk River with piers in the river channel and abutments in the floodplain would require alteration of the bed and banks of the Kobuk River, resulting in long-term adverse impacts on the free flow of the Kobuk River.

The applicant has proposed water extraction sites along each alignment at the Kobuk River bridge sites. The applicant has also proposed water extraction sites at the Kobuk River, three unnamed streams, and one unnamed pond along the northern alignment and at the Kobuk River, the Reed River and one unnamed pond along the southern alignment (Appendix A, Figure 14). With the exception of the ponds, water extractions could have impacts on the Kobuk River, as water would be extracted from the river

itself as well as tributaries to the Kobuk River. These extractions would result in short-term, adverse impacts, because the extractions would not be permanent diversions; however, impacts could include changes in flow and water levels, temperature, dissolved oxygen, and turbidity, which could adversely impact aquatic life. Because the frequency and volume of the extractions are unknown, the magnitude and intensity of the impact cannot be estimated at this time. Data gaps such as these can be addressed in terms and conditions associated with the ROW (see Appendix C).

Tributaries to the Kobuk River that would be crossed by the proposed Ambler road along both alignments would have culverts installed to convey water under the road. Culverts can affect longitudinal connectivity of a waterbody, which, in turn, would affect the free flow of the wild-designated Kobuk River, resulting in long-term adverse impacts. However, proper drainage design can mitigate such impacts, and the NPS would work with the applicant to monitor drainages and identify and correct any connectivity issues in a timely manner.

Water Quality. The water quality of the upper Kobuk River is pristine and has no known contaminants or known pollution sources aside from possible trace amounts of fuel from float planes and motorized boats. A high standard of water quality exists in the upper Kobuk River and due to its wild river designation, keeping the water in its pure and natural state is a major priority and standard of management.

The water quality of the Kobuk River would be affected by erosion and sedimentation, fugitive dust, spills, flow reduction, and permafrost degradation. These same impacts could also occur in tributaries to the Kobuk River, indirectly impacting the river. Impacts to water quality would be long-term and adverse; however, due to lack of information on the characteristics of the Kobuk River at the proposed crossings (e.g., depth, flow), the intensity of the impacts cannot be determined at this time. Data gaps such as these can be addressed by the required terms and conditions in the ROW grant (see Appendix C). The impacts to water quality are discussed in detail in the "Water Quality" section.

This assessment assumes that subwatersheds that contain a portion of the Kobuk River or the river's 0.25-mile boundary are considered to have direct impacts to the Kobuk River, and subwatersheds that drain into other watersheds prior to flowing into the Kobuk River are considered to have indirect impacts. Some subwatersheds within the NPS project area would not have an impact on the Kobuk River (Appendix A, Figure 13).

Outstandingly Remarkable Values. The NPS has determined that five ORVs are present on the upper Kobuk River. The proposed Ambler road would likely have impacts on the Kobuk River's ORVs under both the northern and southern alignment. A brief list of impacts to the ORVs is presented below. Impacts associated with the river's ORVs are analyzed further in the "Fish," "Archeological Resources," and "Visitor Experience" sections in this chapter. The ORVs of the upper Kobuk River follow (NPS 2013):

- **Cultural Resources –** The designated Kobuk River and its boundary contain rich historic and prehistoric archeological resources that document the river as a convergence zone for inland and coastal cultures. The river contains evidence of human activity that spans at least 10,000 years. Construction of the bridge, the access road to the river for water extraction, and any associated features within the Kobuk River boundary could impact archeological sites or areas significant to traditional cultures. Impacts from construction would be localized and would not extend beyond the construction footprint of the features and construction daylight limits of the alignment; however, impacts from unauthorized collection of artifacts from workers could extend beyond the footprint. Construction activities would result in direct and adverse impacts due to surface and subsurface construction activities (Baltensperger et al. 2019). The Kobuk River is culturally important as a travel corridor for historic and current human activity, as is evidenced by the

archeological resources present along the river corridor. Types of archeological resources that could be affected along both alignments include lithic scatters, artifact scatters, cabins, cache pits, cairns, camps, faunal remains, rock features, hearths, and other features.

- **Fisheries –** The designated Kobuk River protects crucial spawning habitat for the Kobuk/Selawik sheefish population; this population only spawns in one other location. The Kobuk River provides habitat for at least nine species of resident and anadromous fish and the tributaries are likely to provide habitat for additional fish species. Grayling, Arctic char, whitefish, chum salmon, and lake trout inhabit the Kobuk River and support a major commercial chum salmon fishery. The Kobuk River provides several communities with subsistence fishing for sheefish, whitefish, and chum salmon, which all spawn in the upper portion of the river. Impacts on fisheries of the Kobuk River could stem from hindrances to fish passage, changes to fish habitat, and changes to water quality. The proposed Ambler road project could decrease water quality from sedimentation, erosion, fugitive dust, and potential spills could impact fish habitat, fishery health, and subsistence fish populations.
- **Geologic Values –** The designated Kobuk River includes geologic features, such as Walker Lake (a national natural landmark), the Endicott Mountains, the Arrigetch Peaks, and a series of canyons made of near vertical sheets of shale within the lower canyon. The proposed Ambler road project would not impact geologic values associated with the designated Kobuk River because the project would not alter significant geologic features of the river.
- **Recreational Opportunities –** The designated Kobuk River is the setting for an internationally renowned sheefish sport fishery, as well as other fishing opportunities. The Kobuk River provides for an interesting and ever-changing float experience from arctic mountains to lowland boreal forest. The river provides a range of unique conditions, including class I to class V rapids. The proposed Ambler road project would affect the experience of recreational users, including hikers, backpackers, rafters, and anglers. Viewshed impacts from bridges and the road, fishery impacts from decreased water quality, and construction and traffic noise could diminish the quality of the wild river experience of these users. Most travelers on the Kobuk River start directly from Walker Lake and float the outlet stream to the confluence with the mainstem of the Kobuk River just outside the national park boundary. The visibility of the road or the dust plume from traffic on the proposed Ambler road, as well as the noise generated from vehicles and equipment, would affect the viewshed and the recreation experience for visitors that float the Kobuk River. The impacts on the visitor experience are described in detail in the “Visitor Experience” section.
- **Scenery –** The designated Kobuk River provides a diverse range of scenery, from the dramatic headwaters at Walker Lake to the interior forested lowlands and uplands. The upper and lower Kobuk Canyons provide visitors with unique scenic opportunities, ranging from sheer bluffs to large sandstone boulders and narrow canyon walls. Viewsheds from the Kobuk River would be impacted by the bridge, as well as from vegetation removal and presence of the ROW and support facilities of the road (material sites, airstrips, construction camps, and long-term maintenance facilities) adjacent to the river in areas.

The impacts to the classification and free flow of the Kobuk River would be similar on the northern and southern alignments; therefore, these factors are not discussed further. The water quality and the ORVs that may be affected differently under the northern and southern alignments and are discussed in more detail below.

Comparative Analysis

The proposed Ambler road project would likely have adverse impacts on the designated Kobuk River. Under both alignments, the free-flowing condition of the river would be unavoidably altered by

construction of the bridge, including the requirement of three sets of piers in the river. Mitigation measures proposed by the applicant would help protect water quality and fisheries; however, construction, operation, and maintenance of the proposed Ambler road, as well as the stream crossings and other features associated with the road, could have adverse impacts on water quality, fish and wildlife habitat, and visitor experience under both alignments. Impacts described for wild and scenic rivers could affect the subsistence communities because the Kobuk River is an important subsistence resource.

The northern alignment has the potential to affect approximately 73 river miles of the wild-designated portion of the Kobuk River, stretching from the northern alignment to the western boundary of the Kobuk Preserve. At the crossing of the Kobuk River, the northern alignment would cross perpendicularly for approximately 0.5-mile within the buffer, then the northern alignment would run within the immediate area of the Kobuk River for an additional 1.2 mile east of the river crossing, for a total of 1.7 miles (Appendix A, Figure 14). The southern alignment has the potential to cause adverse impacts to approximately 52 river miles of the wild-designated portion of the Kobuk River. This area consists of the Kobuk River south of the southern alignment to the western boundary of the Kobuk Preserve. The southern alignment is farther downstream along the Kobuk River than the northern alignment. This alignment runs inside of the 0.25-mile immediate area for approximately 0.7 mile, then it would run inside the Kobuk River immediate area for an additional 0.1 mile east of the river crossing. In addition to the bridge crossing, an airstrip and a material site would be constructed partially within the immediate area of the Kobuk River for the southern alignment.

The following paragraphs summarize the impacts of the northern and southern alignments on the ORVs of the wild-designated Kobuk River.

- **Cultural Resources.** The northern and southern alignments of the proposed Ambler road would have direct and adverse impacts on archeological resources due to surface and subsurface construction activities (Baltensperger et al. 2019). The northern alignment would pass through an area that shows a high potential for archeological resources adjacent to the Kobuk River. The potential for impacts to archeological resources along the southern alignment in the area adjacent to the Kobuk River is roughly equivalent, however, the archeological resources along the southern alignment could be impacted to a greater degree if the construction of the airstrip and material site cannot be feasibly located away from the river corridor. Neither alignment would impact the ability for members of the community to use the river to travel for subsistence purposes, as explained in the "Archeological Resources" section.
- **Water Quality and Fisheries.** The northern alignment passes through nine subwatersheds within the NPS project area; seven of these subwatersheds drain directly into the Kobuk River and two subwatersheds are connected to the river indirectly through tributaries. Additionally, the northern alignment transverses one watershed outside the NPS project area, which indirectly impacts the Kobuk River. Within the NPS project area, the northern alignment transverses approximately 22 road miles with direct impacts and 4 road miles traverse watersheds with indirect impacts (Appendix A, Figure 13). In the southern alignment, approximately 18 road miles traverse four watersheds with direct impacts within the NPS project area and an additional 8 road miles travel through watersheds located outside the NPS project area that would directly impact the Kobuk River. The flow pattern of these watersheds with direct and indirect impacts would cross the road and lead to the Kobuk River or its tributaries. Chapter 2: Alignments presents the road support facilities that would be present within the watersheds that could contribute to the impacts on the water quality of the Kobuk River, including total material sites, long-term maintenance facilities, stream crossings, water extraction sites, and access roads. Fisheries could be impacted from construction features due to erosion, altered hydrology, interrupted flow, and contamination. Impacts are discussed in detail in the "Hydrology, Floodplains, and Permafrost," "Water

Quality," and "Fish" sections (see the "Fish" section of this analysis and Appendix C for discussion of mitigation measures).

- **Recreational Opportunities and Scenery.** Most travelers on the Kobuk River start directly from Walker Lake and float the outlet stream to the confluence with the main stem of the Kobuk River just outside the national park boundary. The northern alignment crosses the Kobuk River just below this confluence, so most river travelers would not be exposed to the proposed Ambler road or the bridge until shortly before they come upon it and would pass the bridge quickly. The proposed Ambler road along the northern alignment would have short-term adverse impacts on the recreation opportunities and scenery of the Kobuk River. The Kobuk River is somewhat incised into the landscape at the proposed crossing of the southern alignment, so travelers on the river would be more likely to hear activity on the road before they see the road or the bridge that crosses the river. The nature of the river at the southern alignment crossing is such that travelers on the river would not likely see the bridge until they are almost immediately upon it and would no longer see it shortly after passing under it, although visitors would hear vehicle traffic and construction and maintenance activities even after passing the bridge. Additionally, in the vicinity of the crossing the southern alignment bridge, visitors would encounter the airstrip, the material site, and the access road to the river associated with this alignment. As stated in the "Visitor Experience" section, visitors would experience increased human-caused noise and visual intrusions from airplanes and construction equipment in the material site (e.g., drilling equipment, crushers). Impacts on the recreational opportunities and scenery of the southern alignment would be short-term and adverse; however, due to the presence of the material site, long-term maintenance facility, and airstrip adjacent to the Kobuk River, the impacts from the southern alignment would be greater than those for the northern alignment.

If feasible, locating material sites and associated features outside the Kobuk Preserve would mitigate the impacts of the alignments on Wild and Scenic River resources. Situating these facilities outside the Kobuk Preserve would create a scenario where the impacts on the wild-designated Kobuk River would be similar for the northern and southern alignment, except where noted in the previous paragraphs.

Conclusion

If material sites, and associated support facilities were relocated outside of NPS lands, the types of impacts would be similar for northern and southern alignments. The adverse impacts from construction, operation, and maintenance of the proposed Ambler road have the potential to impact areas downstream of the alignments. The northern alignment would have greater adverse impacts on the designated wild river and its ORVs, as the northern alignment would have the potential to impact approximately 20 more river miles than the southern alignment.

CHAPTER 4: CONSULTATION AND COORDINATION

This chapter summarizes the process undertaken by the NPS to contact individuals, communities, agencies, and organizations for information or that assisted in identifying important issues, analyzing impacts, or that will review and comment on the EEA. Throughout the planning process, NPS staff encouraged elected officials, culturally associated groups, partners in other agencies, park visitors, and private citizens to participate in this planning effort, as summarized below.

Internal Review

An NPS IDT of GAAR and regional NPS staff was formed in May 2013 to prepare for review of AIDEA's application for a ROW. The IDT determined NPS responsibilities in responding to the application. FHWA has provided extensive technical expertise on road design and ROW stipulations.

Formal internal discussions for the proposed Ambler road project started in Fall 2017 between NPS staff from GAAR and the Alaska Regional Office, the NPS Denver Service Center, FHWA, Western Federal Lands Division Office, and contractors. Internal discussions included the differences between the EEA and a NEPA document, the roles of NPS and BLM, the potential for public access, and resources that would be included or dismissed from detailed analysis in the EEA.

Public Involvement

The NPS sought public comment on the two alignments proposed by the applicant through the Kobuk Preserve. The NPS was also interested in seeking public input in identifying issues relevant to analyzing the consequences of the two alignments.

The public comment period was open from September 27, 2017, through January 31, 2018. The Bureau of Land Management held 10 public meetings between November 13 and December 8, 2017, in communities that could be affected by the project; the NPS participated in these meetings. These meetings were held in the following communities or locations: Allakaket, Anaktuvuk, Alatna, Fairbanks, Wiseman, Anchorage, Ambler, Kotzebue, and Shungnak. The NPS distributed a project summary at these meetings and made the summary available online. Additionally, the NPS distributed postcards and newsletters and issued a press release. The NPS accepted comments on the project electronically through the NPS Planning, Environment and Public Comment (PEPC) website, by email, by fax, and by mail. The NPS welcomed comments from the public, as well as federal, state, and local agencies with jurisdiction by law or special expertise; non-governmental entities; and other interested and affected parties.

Nearly 15,600 pieces of correspondence from 29 states, the District of Columbia, and 2 other countries were received during the public comment period; however, more than 15,400 pieces of correspondence were form letters submitted by the National Parks Conservation Association and Wilderness Watch. Approximately 200 unique correspondences were entered into PEPC during the public comment period.

Interested parties will continue to be notified of the project's progress and are encouraged to visit the GAAR website at https://www.nps.gov/gaar/learn/management/ambler-row.htm to view information about this project.

Agency Consultation

Coordination with the BLM EIS Process

BLM is the lead agency for permitting for the entire Ambler Mining District Industrial Access Project and is preparing an EIS to determine the impacts from the applicant-proposed 211-mile alignment, as well as other alternatives, for the construction and operation of a road to the Ambler mining district. The USACE and the USCG are cooperating agencies helping to prepare the EIS. The NPS is not a cooperating agency but is working closely with BLM, USACE, and USCG through the NEPA and EEA processes.

Endangered Species Act Section 7 Consultation

In accordance with federal and state requirements for special-status species, the NPS contacted the US Fish and Wildlife Service (USFWS) regarding listed species under USFWS jurisdiction via phone on July 10, 2018 and followed up with an email. The NPS and USFWS discussed the proposed Ambler road project, the project location, and the NPS conclusion that the proposed Ambler road project through NPS lands would not have an effect on any listed species. The USFWS responded via email, stating that they concur that the proposed Ambler road project would have no effect on listed species or designated critical habitat.

Similarly, the NPS contacted the National Oceanic and Atmospheric Association (NOAA) regarding listed species under NOAA jurisdiction via phone on July 9, 2018 and followed up with an email. NOAA responded in an email on July 9, 2018, stating NOAA concurrence is not necessary since the NPS has determined that the proposed Ambler road project would have no effect on listed species.

Section 7 consultation is complete.

Section 106 of the National Historic Preservation Act Consultation and ANILCA Section 810 Analysis

BLM is conducting consultation for Section 106 of the National Historic Preservation Act and completing a Section 810 analysis for the entire proposed Ambler road, as required by ANILCA. The NPS is not required to do a separate Section 810 analysis for the portion of the road through NPS lands. The NPS and USACE are working closely with BLM to coordinate the Section 106 and Section 810 processes.

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APPENDIX A: FIGURES

List of Figures

Ambler Mining District Industrial Access Project
Gates of the Arctic National Park and Preserve
Alaska

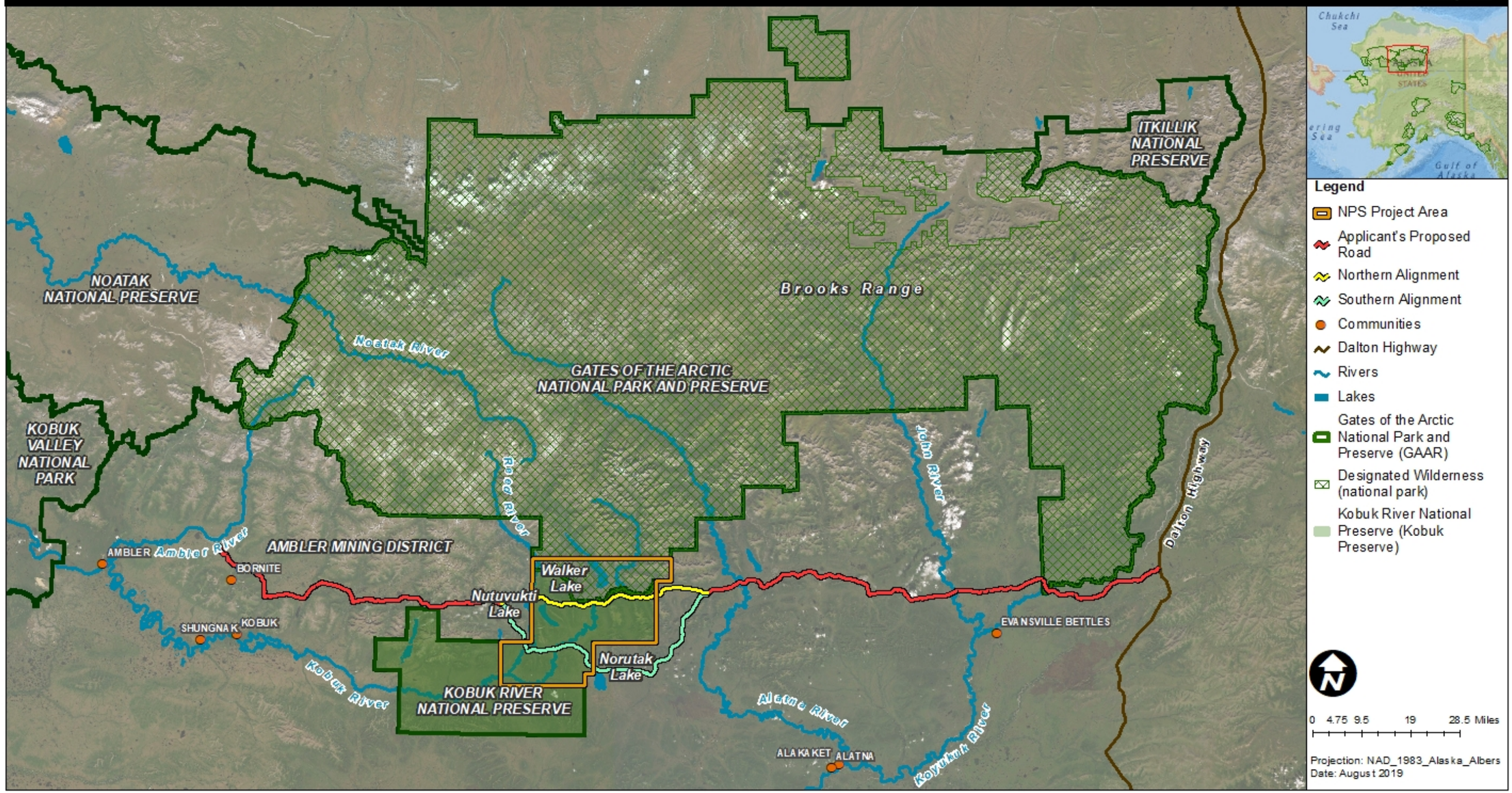


Figure 1. Gates of the Arctic National Park and Preserve and NPS Project Location

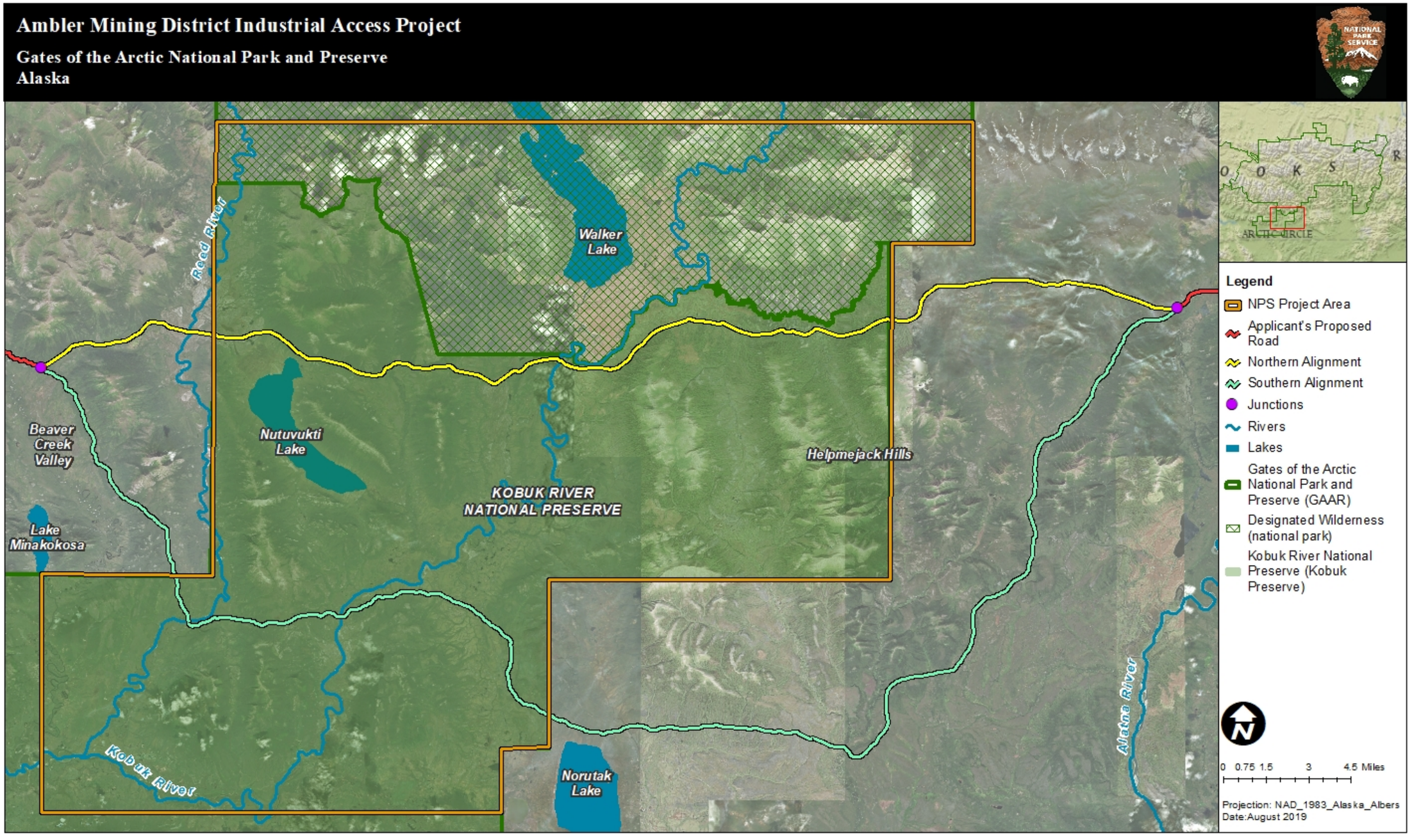
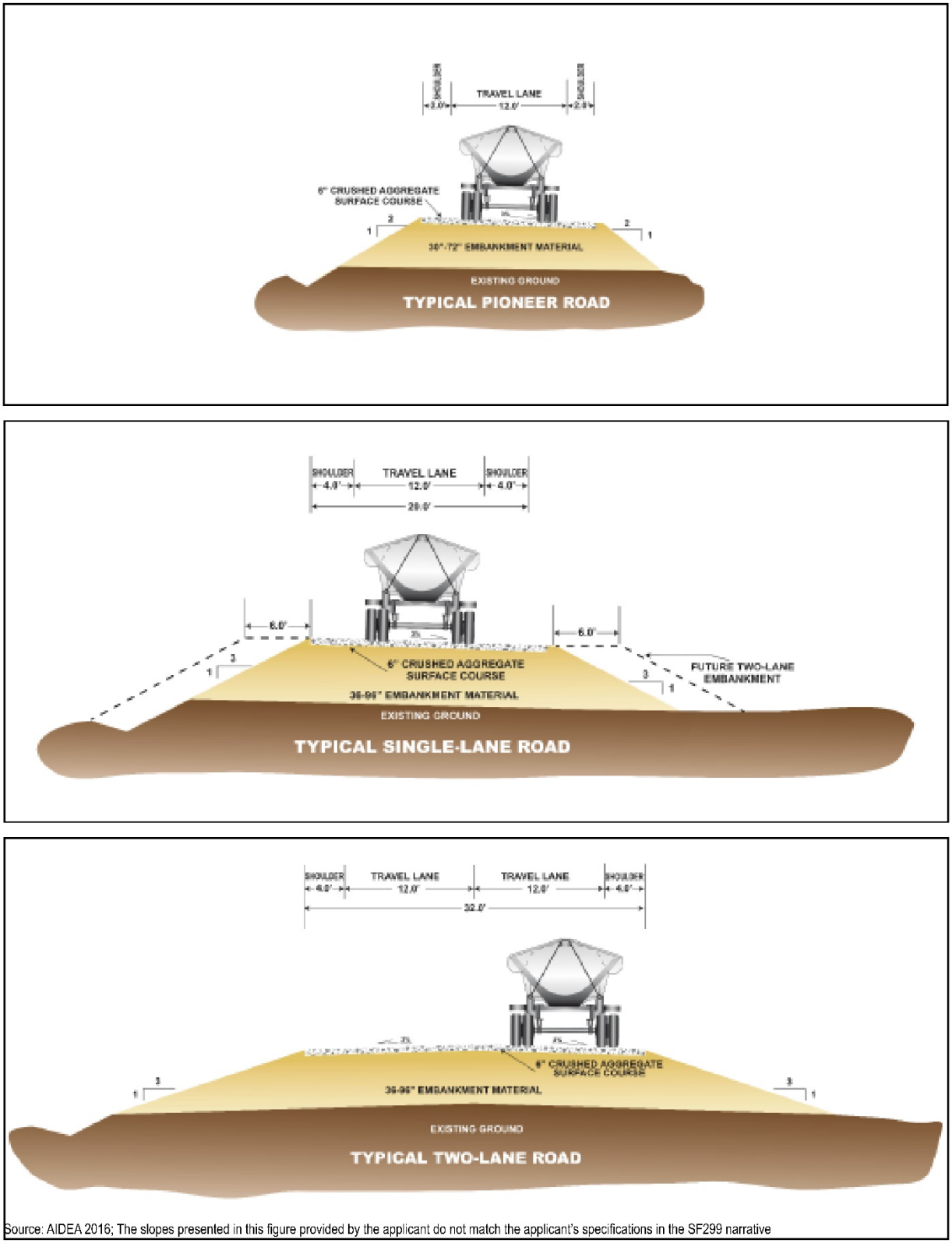


Figure 2. NPS Project Area Depicting the Northern Alignment and the Southern Alignment



Source: AIDEA 2016; The slopes presented in this figure provided by the applicant do not match the applicant's specifications in the SF299 narrative

Figure 3. Typical Sections for Phase I Pioneer Road, Phase II Single-Lane Road, and Phase III Two-Lane Road

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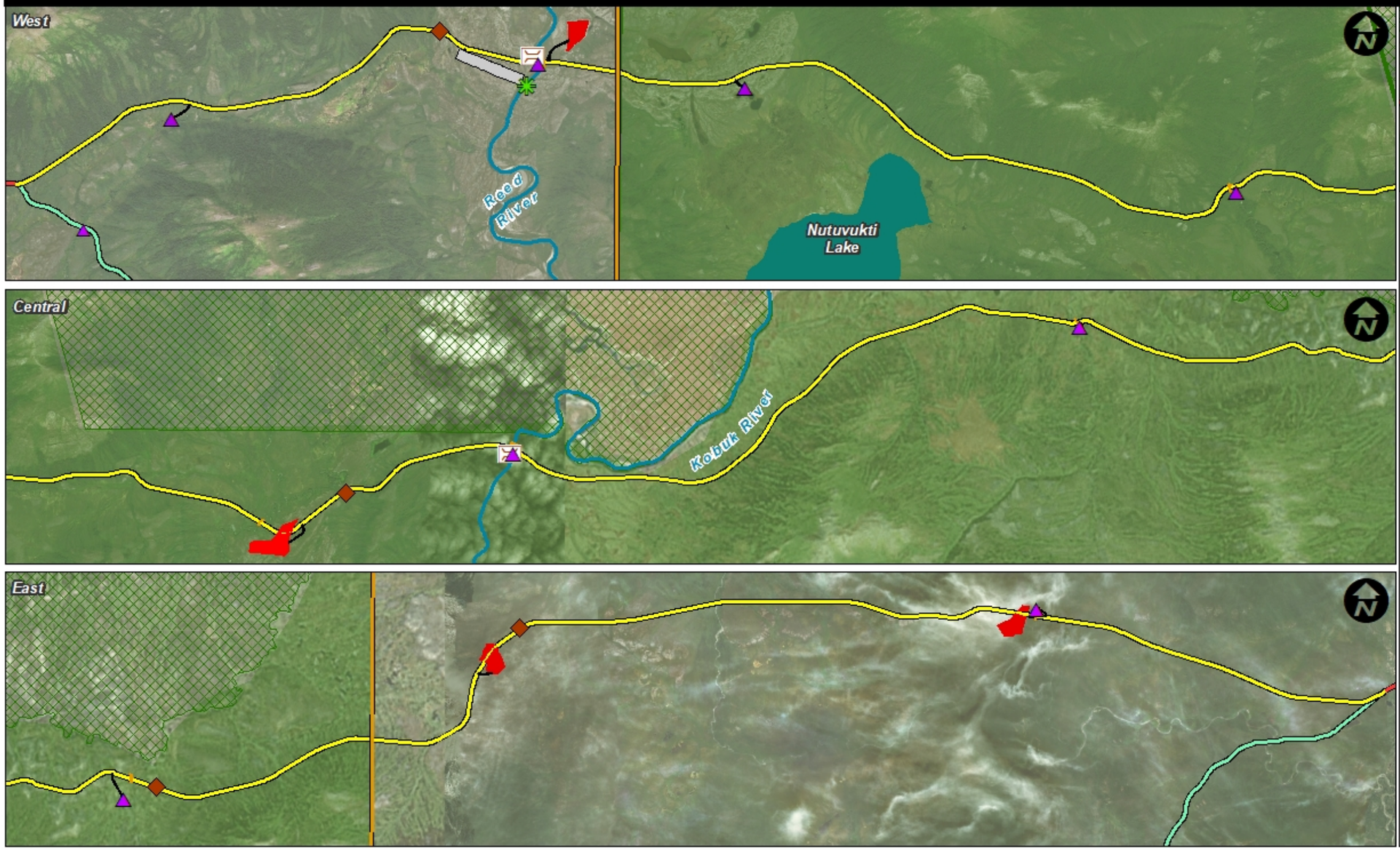

Figure 4. Northern Alignment with Road Support Features

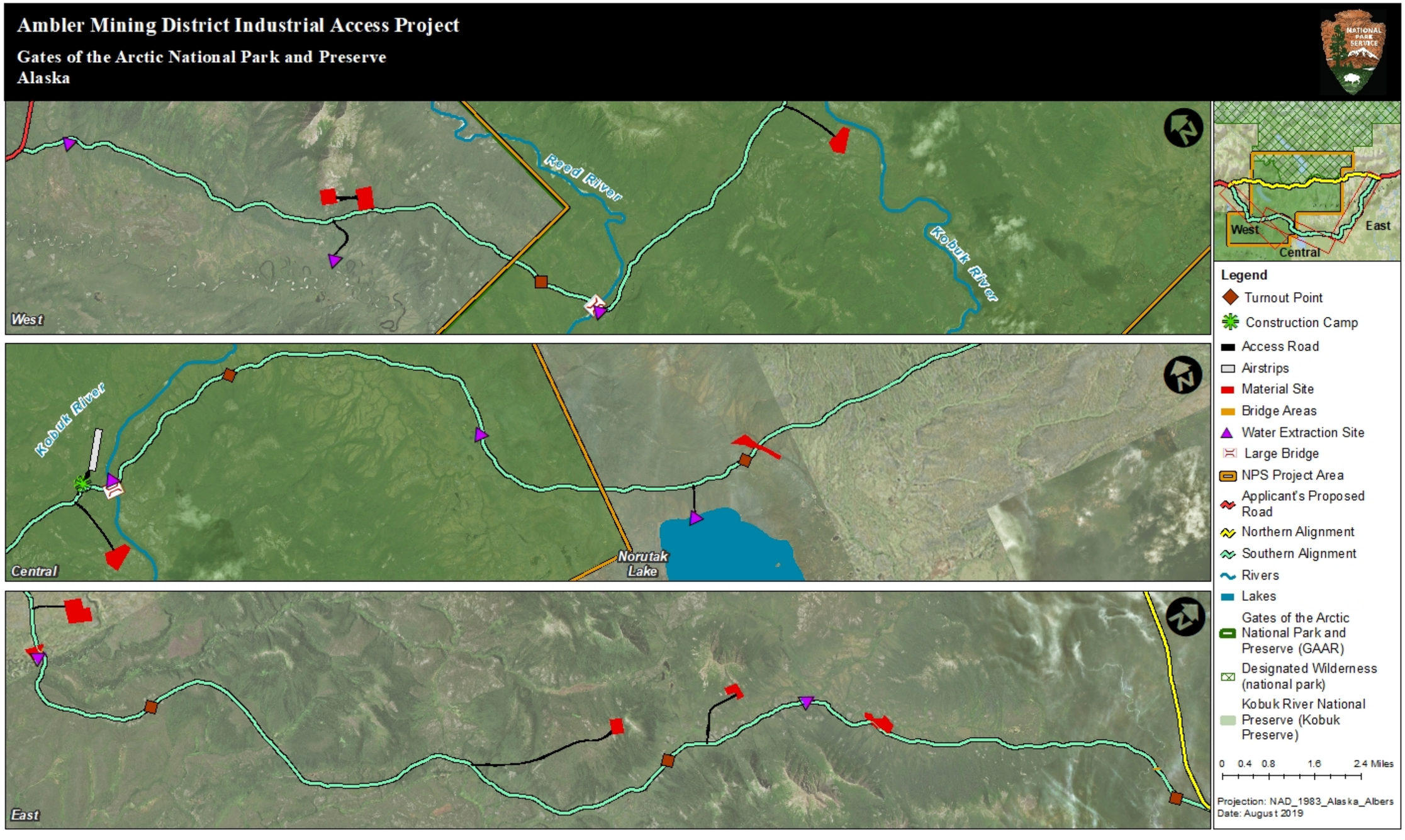

Figure 5. Southern Alignment with Road Support Features

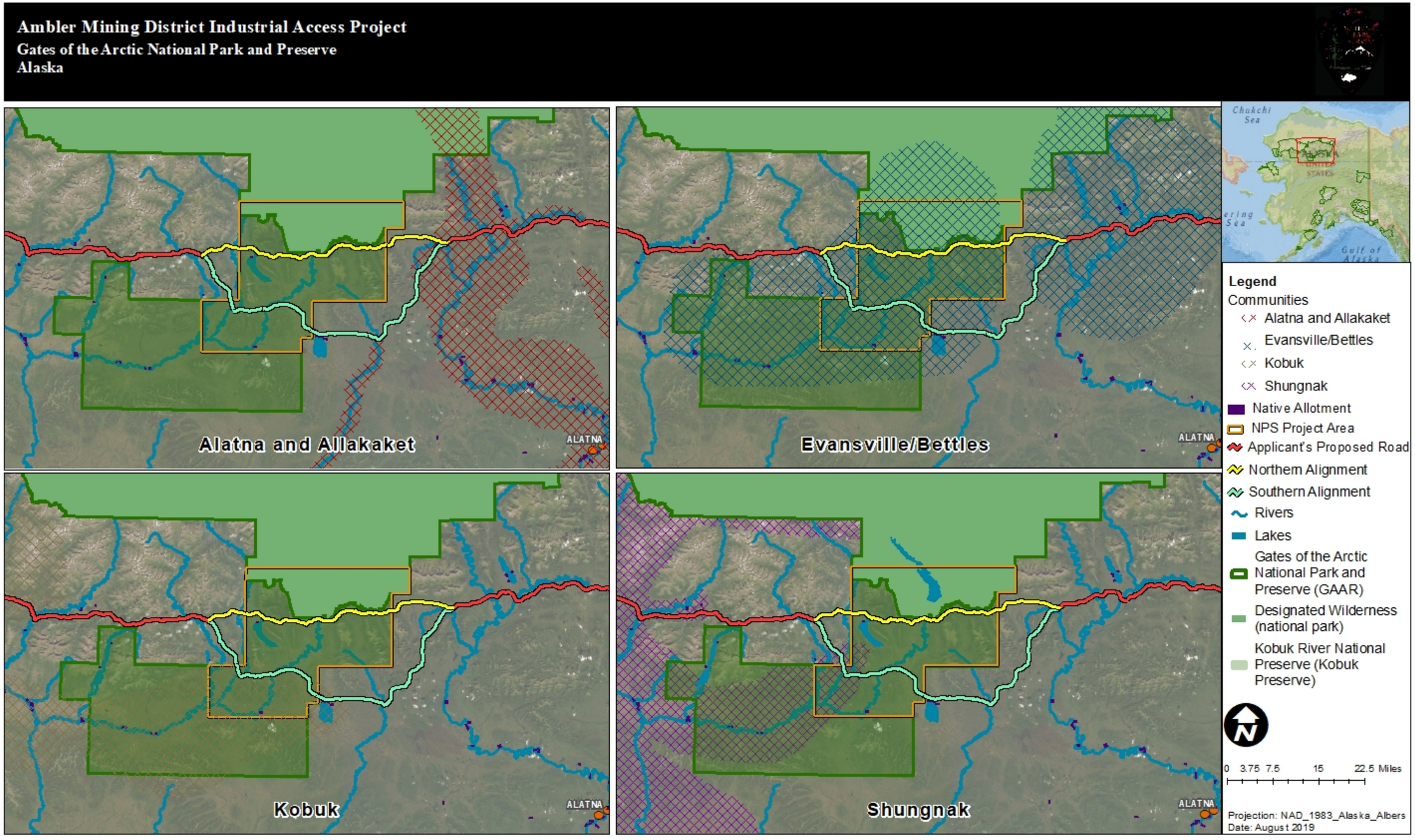

Figure 6. Native Alaskan Community Subsistence Use and Private Native Alaskan Allotments

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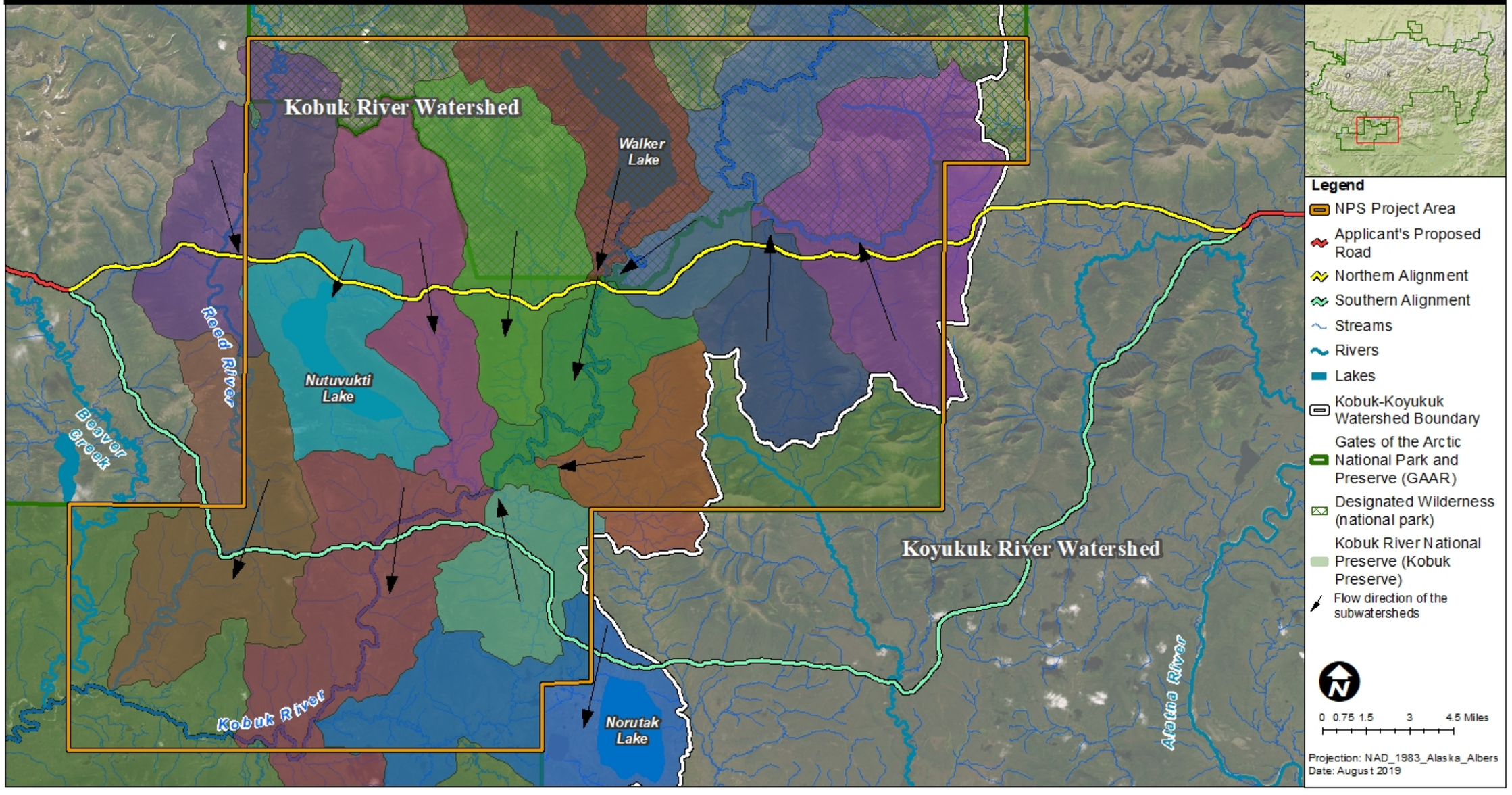

Figure 7. Direction of Flow of the Subwatersheds within the NPS Project Area

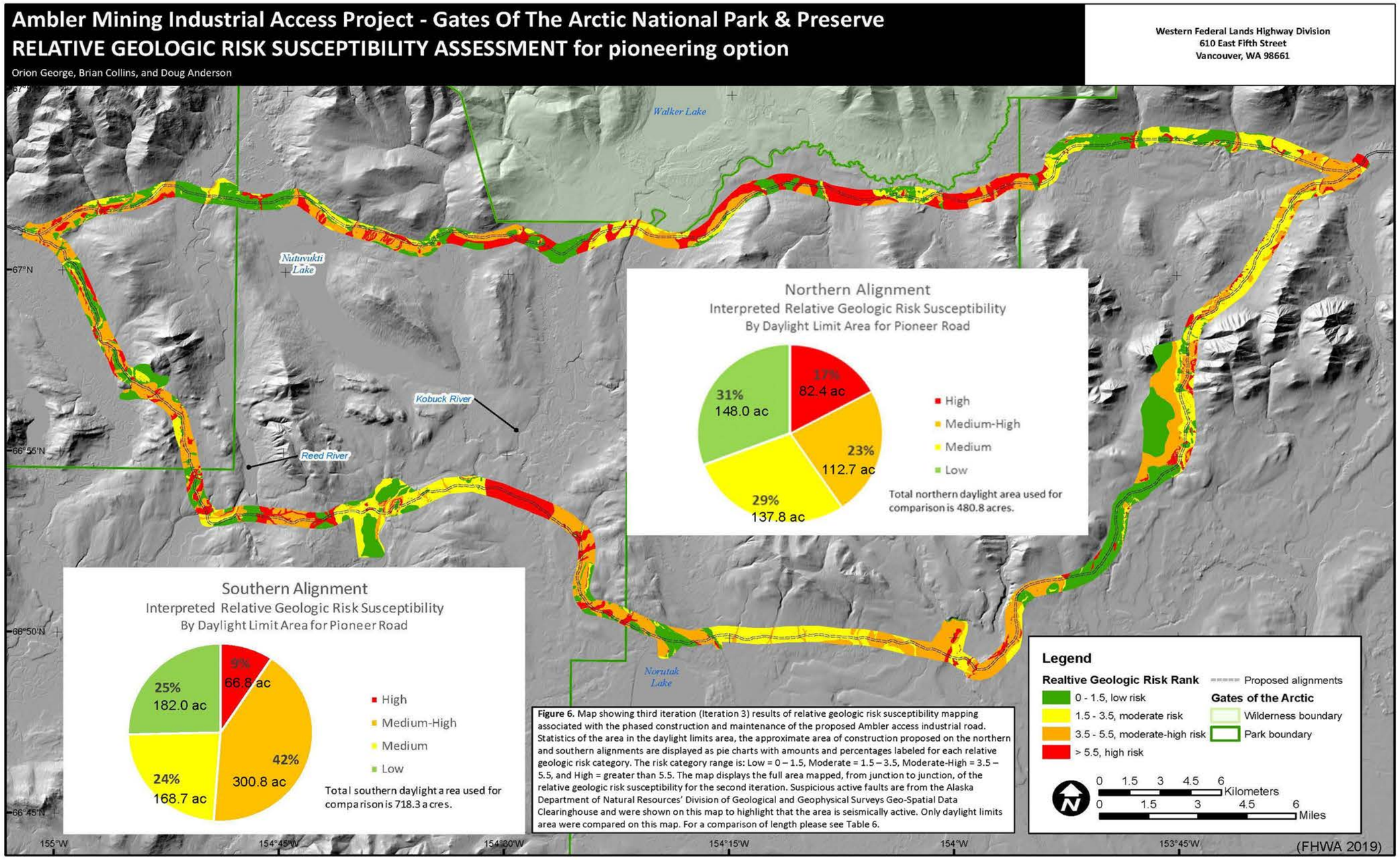

Figure 6. Map showing third iteration (Iteration 3) results of relative geologic risk susceptibility mapping associated with the phased construction and maintenance of the proposed Ambler access industrial road. Statistics of the area in the daylight limits area, the approximate area of construction proposed on the northern and southern alignments are displayed as pie charts with amounts and percentages labeled for each relative geologic risk category. The risk category range is: Low = 0 – 1.5, Moderate = 1.5 – 3.5, Moderate-High = 3.5 – 5.5, and High = greater than 5.5. The map displays the full area mapped, from junction to junction, of the relative geologic risk susceptibility for the second iteration. Suspicious active faults are from the Alaska Department of Natural Resources' Division of Geological and Geophysical Surveys Geo-Spatial Data Clearinghouse and were shown on this map to highlight that the area is seismically active. Only daylight limits area were compared on this map. For a comparison of length please see Table 6.

Figure 8. Geologic Risk along the Alignments

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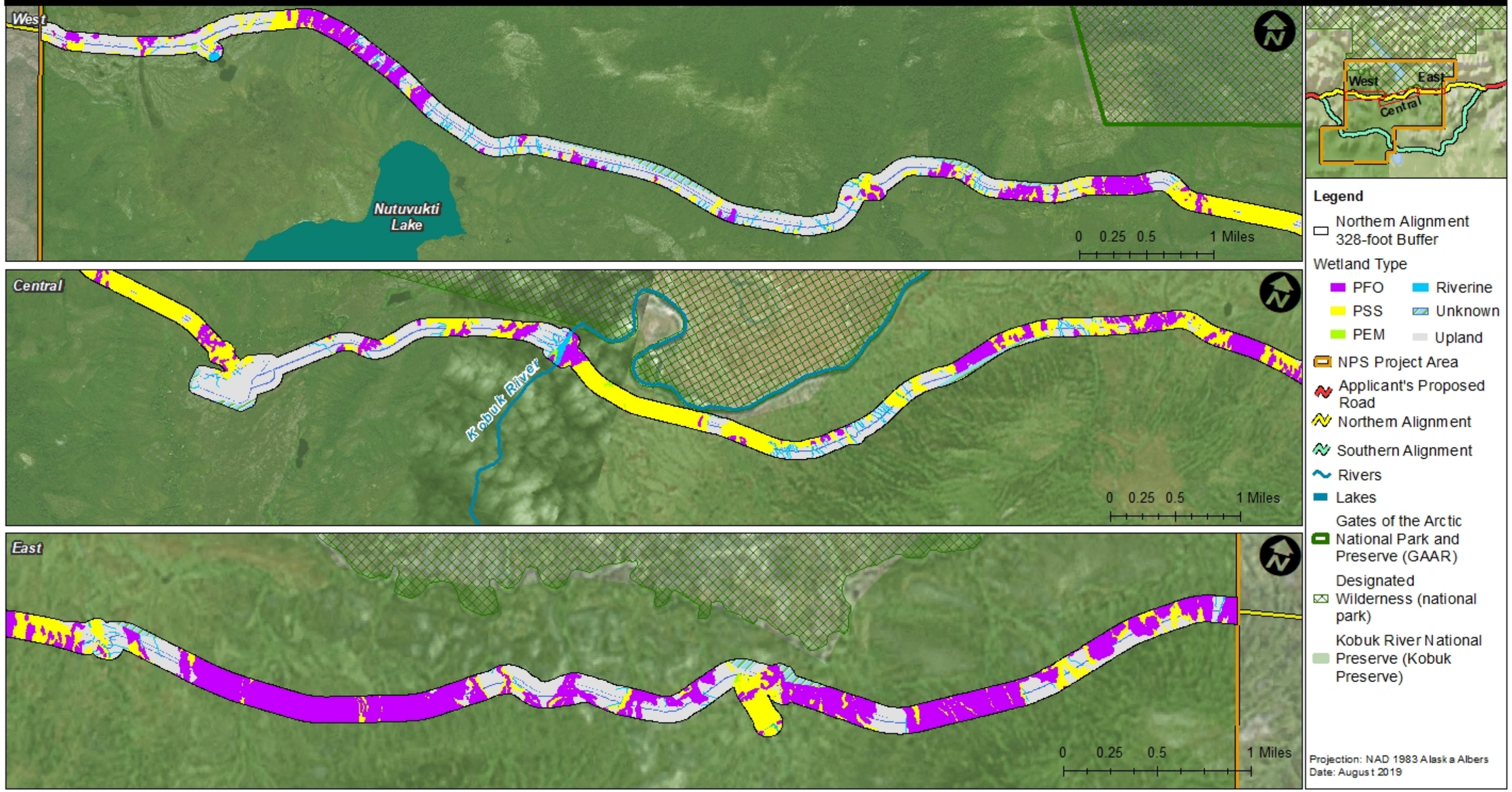

Figure 9. Wetlands Present along the Northern Alignment

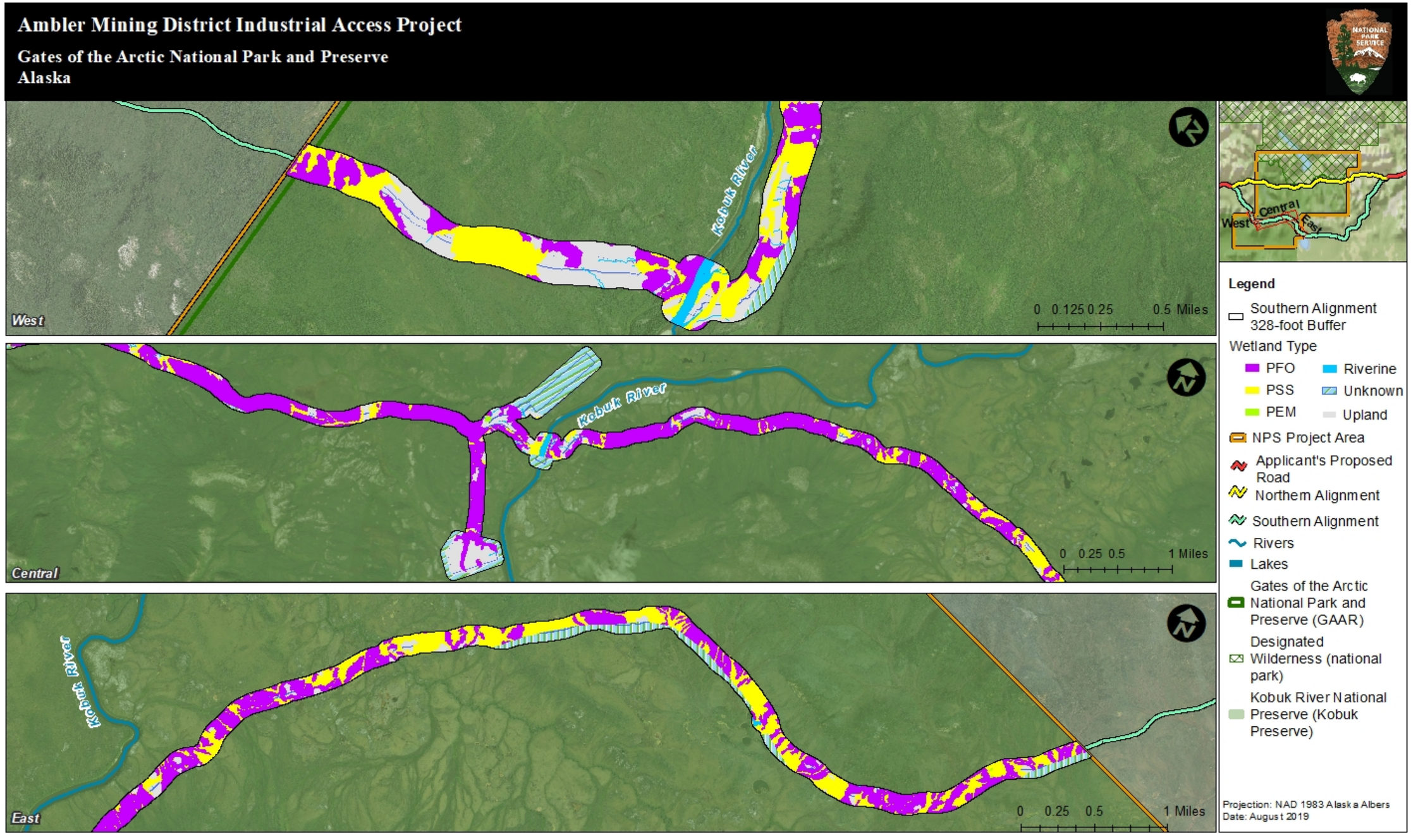

Figure 10. Wetlands Present along the Southern Alignment

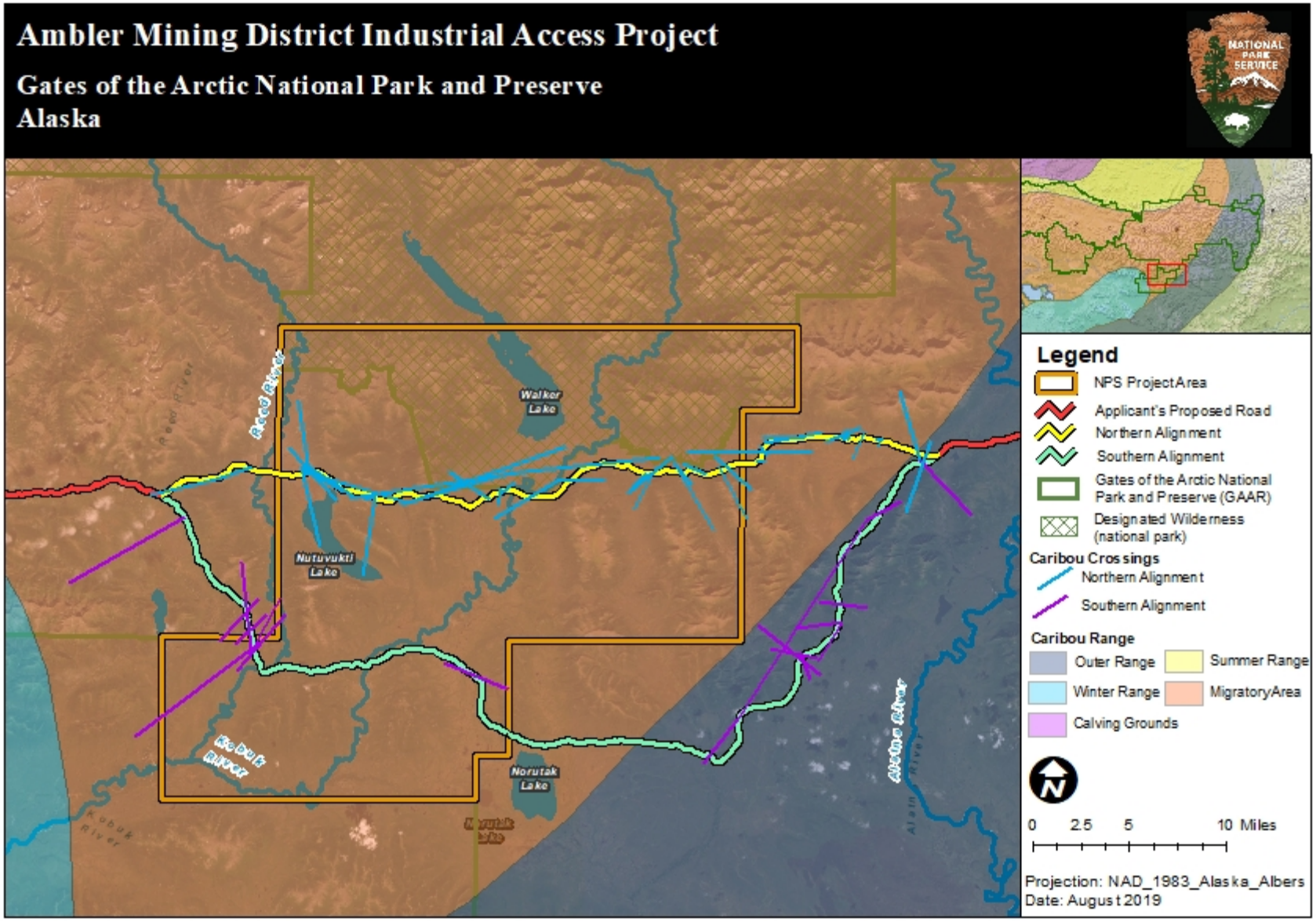

Figure 11. Comparison of Caribou Crossings Across the Northern and Southern Alignments

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Gates of the Arctic National Park and Preserve
Alaska

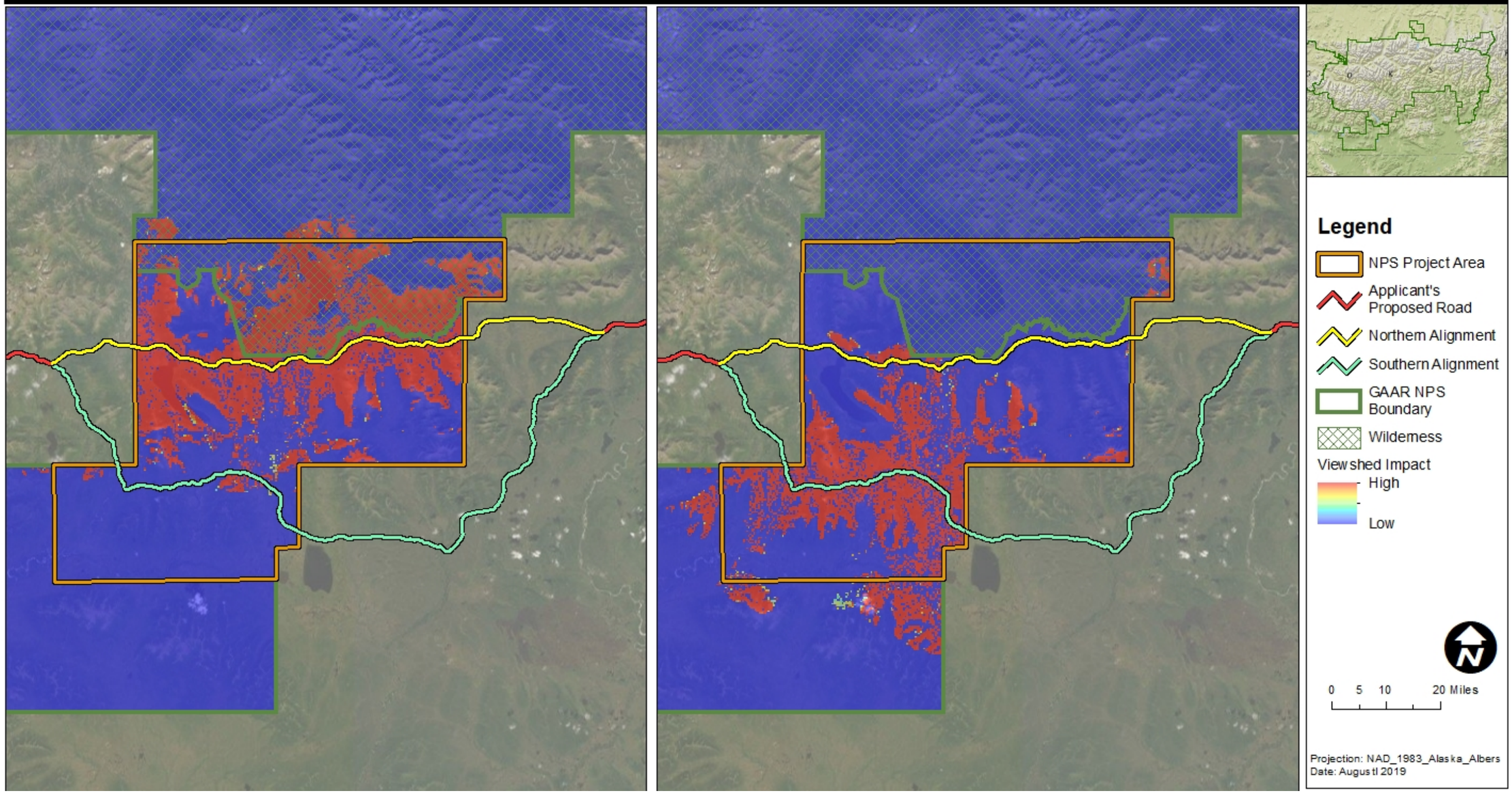

Figure 12. Viewshed Modeling Depicting the Area from which the Northern and Southern Alignments would be Visible

Ambler Mining District Industrial Access Project

Gates of the Arctic National Park and Preserve
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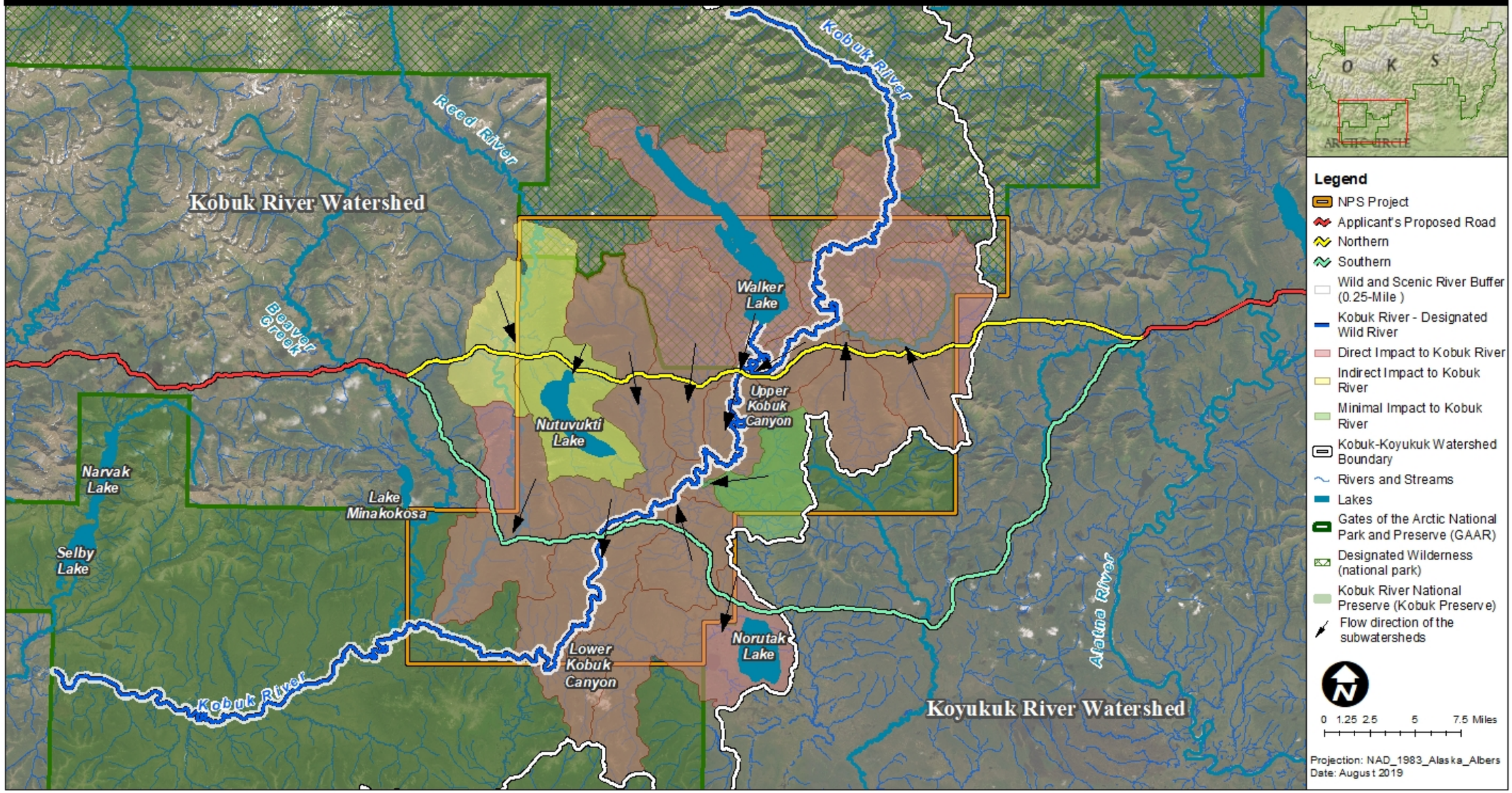

Figure 13. Wild Designated Kobuk River with Alignment Crossings and Subwatershed Flow Directions

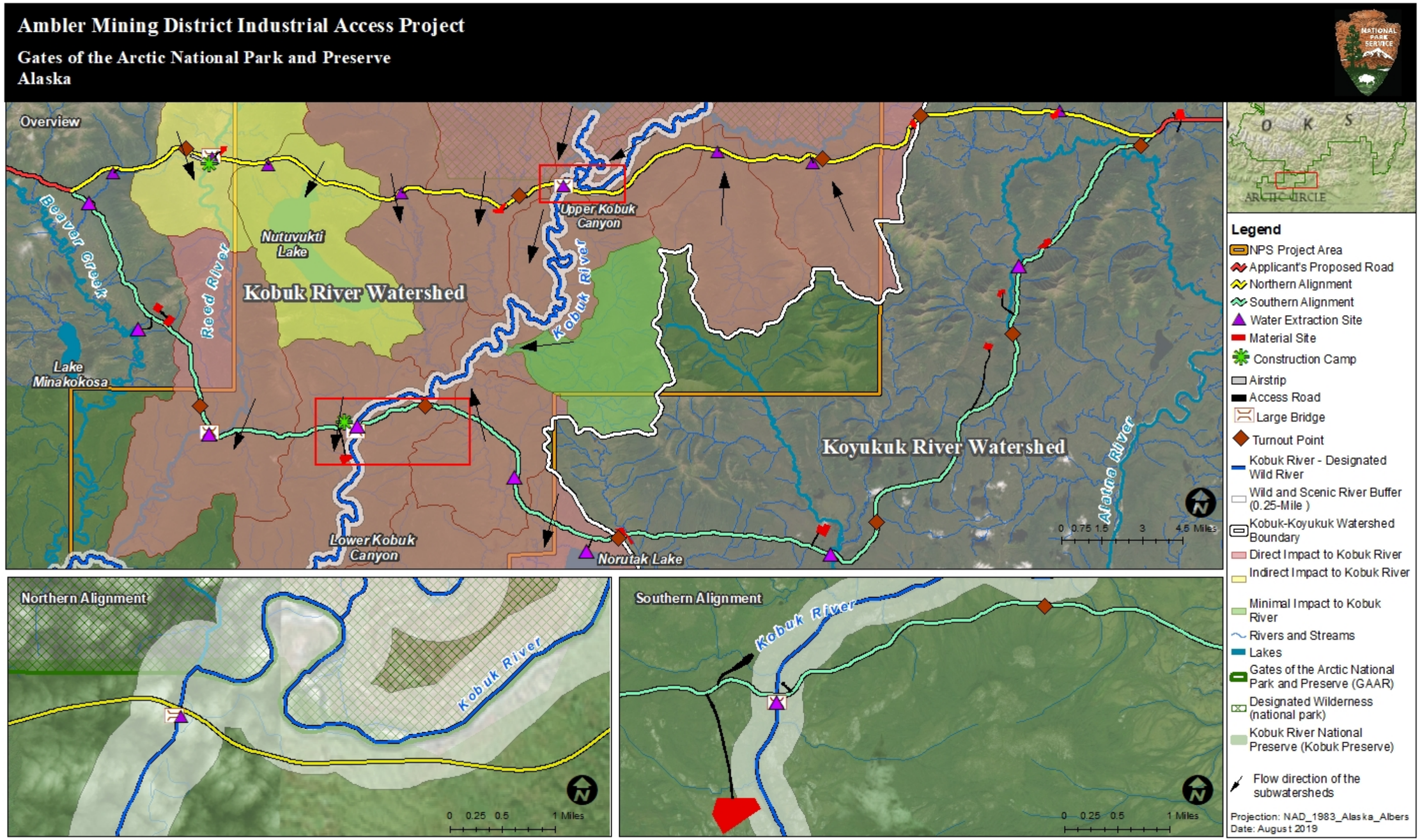

Figure 14. Details of the Proposed Bridge to Cross the Wild Designated Kobuk River for the Northern and Southern Alignments

APPENDIX B: REFERENCES

REFERENCES

Adams, L.G., R.O. Stephenson, B.W. Dale, R.T. Ahgook, and D.J. Demma. 2008. Population Dynamics and Harvest Characteristics of Wolves in the Central Brooks Range, Alaska. *Wildlife Monographs* 170(1): 1-25.

Alaska Department of Environmental Conservation (Alaska DEC) Spill Prevention and Response Division. 2018. *SPAR Annual Report, Fiscal Year 2018.*

Alaska Department of Fish and Game (ADF&G). 1978. Sheefish Life History and Habitat Requirements Arctic, Western, and Interior Region

Alaska Department of Fish and Game (ADF&G). 2018. "Fish Resource Monitor." Available online: http://extra.sf.adfg.state.ak.us/FishResourceMonitor/. Accessed June 20, 2018.

Alaska Industrial Development and Export Authority (AIDEA). 2017. Delong Mountain Transportation System Asset Management Review. http://www.aidea.org/Portals/0/PDF%20Files/2017Dec-DMTSFinalReport.pdf.

Al-Chokhachy, R., T.A. Black, C. Thomas, C.H. Luce, B. Rieman, R. Cissel, A. Carlson, S. Hendrickson, E.K. Archer, and J.L. Kershner. 2018. Linkages between unpaved forest roads and streambed sediment: why context matters in directing road restoration. *Restoration Ecology* Vol. 24, No. 5, pp. 589–598.

Ambler Mining District Industrial Access Project (AMDIAP). 2019. Ambler Mining District Industrial Access Road, Summary of additional information provided for the SF299 application. May 2019.

Auerback, N.A., M.D. Walker, and D.A. Walker. 1997. Effects of roadside disturbance on substrate and vegetation properties in arctic tundra. *Ecological Applications* 7: 218-235.

Avis, C.A., A.J. Weaver, and K.J. Meissner. 2011. Reduction in areal extent of high-latitude wetlands in response to permafrost thaw. *Nature Geoscience* 4: 444-448.

Baltensperger, A., A, Freeburg, and J. Rasic. 2019. Modeling Archeological Site Potential in the Kobuk Preserve Unit of Gates of the Arctic National Park and Preserve.

Betchkal, D. 2014. "GAAR Kobuk Preserve Soundscape Inventory 2013-2014." Presentation. September.

Big Sky Acoustics, LLC (BSA). 2015. Ambler Mining District Industrial Access Road Environmental Sound Analysis. Prepared for DOWL Inc. November.

Blodgett, J.C., 1984, Effects of bridge piers on streamflow and channel geometry. In *Second Bridge Engineering Conference Proceedings: U.S. Transportation Research Board,* Washington, DC, Research Record 950, v. 2, p. 169-183.

Bolger, D.T., W.D. Newmark, T.A. Morrison, and D.F. Doak. 2008. The need for integrative approaches to understand and conserve migratory ungulates. *Ecology Letters* 11, 63–77.

Brabets, T.P. 2001. Hydrologic Data and a Proposed Water-Quality Monitoring Network fir the Kobuk River Basin, Gates of the Arctic National Park and Preserve, and Kobuk Valley National Park, Alaska. Water-Resources Instigations Report 01-4141.

Child, 1973. *The reactions of barren-ground caribou (Rangifer tarandus granti) to simulated pipeline and pipeline crossing structures at Prudhoe Bay, Alaska.* Alaska Cooperative Wildlife Research Unit, Univ. of Alaska, Fairbanks.

Devinney, E. 2005. *User Conflicts in a Subsistence Landscape: Issues in the Upper Kobuk River, Alaska*. 65th Annual Meeting of the Society for Applied Anthropology, April 5-10, 2005, Santa Fe, New Mexico.

Di Toro, D.M., H.E Allen, H.L. Bergman, J.S. Meyer, P.R. Paquin, and R.C. Santore. 2001. Biotic ligand model of the acute toxicity of metals. 1. Technical basis. *Environmental toxicology and chemistry*, 20(10), 2383-2396.

DOWL HKM (DOWL). 2011. *Ambler Mining District Access Preliminary Hydrology Reconnaissance Memorandum.* Prepared for Alaska Industrial Development and Export Authority, Anchorage, Alaska. September.

DOWL HKM (DOWL). 2014a. *Ambler Mining District Industrial Access Road Preliminary Wetland Delineation and Functions and Values Assessment*. Prepared for Alaska Industrial Development and Export Authority, Anchorage, Alaska. May.

DOWL HKM (DOWL). 2014b. *Ambler Mining District Industrial Access Road Preliminary Visual Impact Analysis*. Prepared for Alaska Industrial Development and Export Authority, Anchorage, Alaska. November.

DOWL HKM (DOWL). 2016a. *Ambler Mining District Industrial Access Project (AMDIAP) National Park Service (NPS) SF-299 Supplemental Narrative*. Prepared for Alaska Industrial Development and Export Authority (AIDEA). Revised June 2016.

DOWL HKM (DOWL). 2016b. *Ambler Mining District Industrial Access Project (AMDIAP) Corridor SF-299 Supplemental Narrative*. Prepared for Alaska Industrial Development and Export Authority (AIDEA). Revised June 2016.

Dudka, S. and D.C. Adriano. 1997. Environmental impacts of metal ore mining and processing: a review. *Journal of Environmental Quality*, 26(3), 590-602.

Durand, J., R. Lusardi, R. Suddeth, G. Carmona, C. Connell, S. Gatzke, J. Katz, D. Nover, J. Mount, P. Moyle, and J. Viers. 2009. *Conceptual ecosystem model of sub-Arctic river response to climate change: Kobuk River, Alaska.* Report submitted to the Alaska Dept. of Fish and Game, Fairbanks, Alaska, USA.

Eisler, R. 2000. *Handbook of Chemical Risk Assessment: Health hazards to humans, plants and animals*. Vol I. Metals. Lewis Publishers. Boca Raton FL.

Envirowest Environmental Consultants. 1990. *Fish habitat enhancement, a manual for freshwater, estuarine, and marine habitats.* Vancouver, B.C. Canada: Government of Canada. 324p.

Federal Highway Administration (FHWA). 2019. Geotechnical Memorandum 10-19: Ambler Mining District Industrial Access Project. Federal Highways Administration, Western Federal Lands Highway Division. February 26.

Forman, R.T.T. and L.E. Alexander. 1998. Roads and their major ecological effects. *Annu. Rev. Ecol. Syst.* 1998. 29:207–31

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. *American Fisheries Society Special Publication* 19: 297-323.

Hansmann, E.W. and H.K. Phinney. 1973. Effects of logging on periphyton in coastal streams of Oregon. *Ecology*, 54(1), 194-199.

Harper, D. and J. Quigley. 2000. *No net loss of fish habitat: an audit of forest road crossings of fish-bearing streams in British Columbia. 1996 - 1999.* Habitat and Enhancement Branch, Fisheries and Oceans Canada, Vancouver, British Columbia V6B 5G3 2319.

Hasselbach L., J.M. Ver Hoef, J. Ford, P. Neitlich, E. Crecelius, S. Berryman S, B. Wolk, and T. Bohle. 2005. Spatial patterns of cadmium and lead deposition on and adjacent to National Park Service lands in the vicinity of Red Dog Mine, Alaska. *Sci Total Environ* 348: 211–230.

Hedrick, L.B., S.A. Welsh, J.T. Anderson, L.S. Lin, Y. Chen, and X. Wei. 2010. Response of benthic macroinvertebrate communities to highway construction in an Appalachian watershed. *Hydrobiologia*, 641(1), 115-131.

Houben, A.J., T.D. French, S.V. Kokelj, X. Wang, J.P. Smol, and J.M. Blais. 2016. The impacts of permafrost thaw slump events on limnological variables in upland tundra lakes, Mackenzie Delta region. *Fundam. Appl. Limnol.* Vol. 189/1 (2016), 11–35.

Ives, S.L. and C.T. Schick. 2017. *Assessment of Potential Changes in Wetland and Riverine Functions for the Proposed Ambler Mining District Industrial Access Project in Gates of the Arctic National Park, Alaska*. ABR, Inc—Environmental Research & Services. Prepared for Alaska Industrial Development and Export Authority. Anchorage, AK.

Joly, K., and Cameron, M. D. 2015. Caribou vital sign annual report for the Arctic Network Inventory and Monitoring Program: September 2014-August 2015. Natural Resource Report NPS/ARCN/NRR—2015/1090. National Park Service, Fort Collins, Colorado.

Joly, K., F.S. Chapin III, and D.R. Klein. 2010. Winter habitat selection by caribou in relation to lichen abundance, wildfires, grazing, and landscape characteristics in northwest Alaska. *Ecoscience* 17(3): 321-333.

Joly, K., Miller, S. D., and Shults, B. S. 2012. Caribou monitoring protocol for the Arctic Network Inventory and Monitoring Program. Natural Resource Report NPS/ARCN/NRR—2012/564. National Park Service, Fort Collins, Colorado. 99pp

Joly, K., M.D. Cameron, and M.S. Sorum. 2016. *Caribou, grizzly bear, and moose activity along proposed routes to the Ambler Mining District, Alaska*. August. Natural Resource Report NPS/GAAR/NRR—2016/1283. National Park Service, Fort Collins, Colorado.

Jones, J.R., J.D. LaPerriere, and B.D. Perkins. 1989. Limnology of walker lake and comparisons with other lakes in the Brooks Range, Alaska, USA. National park service Alaska region Anchorage. Natural Resources Final Report. AR-89/21.

Jorgenson, M. Torre, J.E., Roth, P.F., Miller, M.J., Macander, M.S., Duffy, A.F., Wells, G.V., Frost, and E.R. Pullman. 2009. "An Ecological Land Survey and Landcover Map of the Arctic Network." Natural Resource Technical Report ARCN/NRTR-2009/270. Fort Collins (CO): National Park Service. https://irma.nps.gov/App/Reference/Profile/663934.

Kane, D.L. E.K. Youcha, S.L. Stuefer, H. Toniolo, J.W. Homan, W.E. Schnabel, R.E. Gieck, E. Lamb, T. Tschetter, G. Myerchin-Tape. 2015. *Environmental Studies of Ambler Transportation Corridor, Alaska.* Prepared for Alaska Industrial Development and Export Authority. December.

LaPerriere, J.D. 1999. Water Quality Inventory and Monitoring—Gates of the Arctic National Park and Preserve, 1992-1995. Final Report. Unit Cooperative Agreement No. 14-48-009-1582. Research Work Order No. 4.

LaPerriere, J.D., J.R. Jones, and D.K. Swanson. 2003. Limnology of lakes in Gates of the Arctic National Park and Preserve, Alaska. *Lake and Reservoir Management*, *19*(2), 108-121.

Lawler, J. 2004. *Demography and Home Ranges of Dall's Sheep in the Central Brooks Range, Anaktuvuk Pass*, Alaska. Final Report. Technical Report NPS/AR/NRTR-2004-43.

Lenat, D.R., D.L. Penrose, and K.W. Eagleson. 1981. Variable effects of sediment addition on stream benthos. *Hydrobiologia*, 79(2), 187-194.

Maitland, B.M., M. Poesch, A.E. Anderson, and S.N. Pandit. 2016. Industrial road crossings drive changes in community structure and instream habitat for freshwater fishes in the boreal forest. *Freshwater Biology* (2016) 61, 1–18.

Marsh, Gary. 2018. A *Compendium of Questions & Answers Relating to Wild & Scenic Rivers: A Technical Report of the Interagency Wild and Scenic Rivers Coordinating Council*. August.

Markon, C., S. Gray, M. Berman, L. Eerkes-Medrano, T. Hennessy, H. Huntington, J. Littell, M. McCammon, R. Thoman, and S. Trainor. 2018. *Alaska*. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. US Global Change Research Program, Washington, DC, USA, pp. 1185–1241.

Meyer, M.E. and R.G. Sullivan. 2016. *Enjoy the View – Visual Resources Inventory Report, Gates of the Arctic National Park and Preserve*. September.

Myers-Smith, I.H., R. Thompson, and F.S. Chapin III. 2006. Cumulative impacts on Alaskan arctic tundra of a quarter century of road dust. *Ecoscience* 12: 503-510.

National Park Service (NPS). 2006. *Management Policies 2006*.

National Park Service (NPS). 2013. *Kobuk River Wild and Scenic River Value Statement*. July.

National Park Service (NPS). 2014. Gates of the Arctic National Park and Preserve General Management Plan Amendment / Wilderness Stewardship Plan / Environmental Assessment. December.

National Park Service (NPS). 2015. *National Park Service NEPA Handbook*. September.

National Park Service (NPS). 2016. "NPS Subsistence: Preserving a Way of Life." Available online: https://www.nps.gov/gaar/learn/historyculture/subsistence.htm. Accessed January 28, 2018.

National Park Service (NPS). 2017a. *State of the Park Report for Gates of the Arctic National Park and Preserve*. State of the Park Series No. 49. National Park Service, Washington, DC.

National Park Service (NPS). 2017b. "Understanding Sound." Available online: https://www.nps.gov/subjects/sound/understandingsound.htm. Accessed June 7, 2018.

National Park Service and US Forest Service (NPS and USFS). 1982. "Final Revised Guidelines for Eligibility, Classification and Management of River Areas." Federal Register 39454, Vol. 47, No. 173. September 7, 1982.

Neitlich, P.N., J.M. Ver Hoef, S.D. Berryman, A. Mines, L.H. Geiser, L.M. Hasselbach, and A.E. Shiel. 2017. Trends in spatial patterns of heavy metal deposition on National Park Service lands along the Red Dog Mine haul road, Alaska, 2001-2006. PloS One 12 (5), e0177936.

O'Donnell, J.A., C.E. Zimmerman, M.P. Carey, and J.C. Koch. 2017. "Potential Effects of Permafrost Thaw on Arctic River Ecosystems." Available online: https://www.nps.gov/articles/aps-16-1-10.htm. Accessed January 31, 2019.

Pace, K., J. Tricker, A. Baltensperger, and P. Landres. 2017. Mapping Wilderness Character in Gates of the Arctic National Park and Preserve – Draft. April.

Panda, S.K., V.E. Romanovsky, and S. Marchenko. 2016. *High-resolution permafrost modeling in the Arctic Network national parks, preserves and monuments*. Natural Resource Report NPS/ARCN/NRR—2016/1366. National Park Service, Fort Collins, Colorado.

Pandey, G. 2014. Heavy metals causing toxicity in animals and fishes. *Research Journal of Animal, Veterinary and Fishery Sciences*. Vol. 2(2), 17-23.

Peplow, D. and R. Edmonds. 2005. The effects of mine waste contamination at multiple levels of biological organization. *Ecological Engineering* 24 (2005) 101–119.

Rattenbury, K.L. and J.H. Schmidt. 2011. Dall's Sheep in Gates of the Arctic National Park and Preserve, Alaska: 2010 Survey Report. NPS/GAAR/NRDS—2011/198. October.

Ritchie, J.C. 1972. Sediment, fish, and fish habitat. *Journal of Soil and Water Conservation* 27: 124-125.

Rivers.gov. nd. "Wild & Scenic River Questions & Answers." Available online: https://rivers.gov/info/q-and-a-answers.cfm?id=37. Accessed July 31, 2019.

Roch, M., R.N. Nordin, A. Austin, C.J.P. McKean, J. Deniseger, R.D. Kathman, J.A. McCarter, and M.J. R. Clark. 1985. The Effects of Heavy Metal Contamination on the Aquatic Biota of Buttle Lake and the Campbell River Drainage (Canada). *Archives of Environmental Contamination and Toxicology* 14: 347-362 (1985).

Speeter G. 2015. Geotechnical investigation, Ambler Mining District Access, Phase 2, Gates of the Arctic National Park and Jim River Landslides. State of Alaska, Department of Transportation and Public Facilities, Northern Region Report No.: AKSAS 63812.

Stewart, B.C., K.E. Kunkel, L.E. Stevens, L. Sun, and J.E. Walsh. 2013. *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, Part 7.* Climate of Alaska. NOAA Technical Report NESDIS 142-7. January.

Sutherland, A.B. and J.L. Meyer. 2007. Effects of increased suspended sediment on growth rate and gill condition of two southern Appalachian minnows. *Environmental Biology of Fishes*, 80(4), 389-403.

Swanson, D.K. 2016. *Soil temperatures in Alaska's Arctic National Parks, 2011-2015, and implications for permafrost stability.* Natural Resource Report NPS/ARCN/NRR—2016/1109. National Park Service, Fort Collins, Colorado.

Tetratech. 2009. Red Dog Mine Extension: Aqqaluk Project. Final Supplemental Environmental Impact Statement. October 2009.

Trombulak S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology* 14: 18–30.

Turner, Kent. 2003. Proposed Spill Site Recovery Program. Winter 2003 Cape Krusenstern National Monument, Alaska. https://dec.alaska.gov/media/15464/2003spillrecoverymemo-033103.pdf.

US Geological Survey, National Geospatial Program (USGS). 2018. USGS National Hydrography Dataset (NHD) Best Resolution 20180912 for Alaska State or Territory FileGDB 10.1 Model Version 2.2.1: U.S. Geological Survey.

US Global Change Research Program. 2009. *Global Climate Change Impacts in the United States.* Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.). Cambridge University Press.

Viadero Jr, R.C. and R.H. Fortney. 2015. Water-Quality Assessment and Environmental Impact Minimization for Highway Construction in a Mining Impacted Watershed: The Beaver Creek Drainage. *Southeastern Naturalist*, 14(sp7), 112-120.

Wang, G., Shi, F., Chen, P.P., Sui, J., 2015. Impact of bridge pier on the stability of ice jam. *Journal of Hydrodynamics* 27, 6, 865–871.

Wilson, R. R., L. S. Parrett, K. Joly, and J. R. Dau. 2016. Effects of roads on individual caribou movements during migration. *Biological Conservation* 195:2-8.

Wofford, J., R. Gresswell, and M. Banks. 2005. Influence of barriers to movement on within-watershed genetic variation of coastal cutthroat trout. *Ecological Applications*. 15(2):628-637.

Woolington, J. 1997. Letter from Jim Woolington of the Alaska Department of Fish and Game to Patty Rost of the National Park Service Regarding Hunter Harvest Numbers for Dall Sheep. October 24, 1997.

APPENDIX C: GUIDELINES FOR DEVELOPING TERMS AND CONDITIONS AND APPLICANT-PROPOSED MITIGATION MEASURES

GUIDELINES FOR DEVELOPING TERMS AND CONDITIONS

In accordance with Section 201 (4) of the Alaska National Interest Lands Conservation Act (ANILCA), the National Park Service (NPS) must issue permits for a right-of-way for an industrial access road to provide access to the Ambler Mining District (the proposed Ambler road) through the Western Unit (Kobuk Preserve) of Gates of the Arctic National Park and Preserve (GAAR). These permits will include terms and conditions to protect resources and to govern activities within NPS lands. As stated in Section 1107 of ANILCA:

"The Secretary… shall include in any right-of-way issued pursuant to an application under this title, terms and conditions which shall include, but not be limited to--

> (1) requirements to insure that, to the maximum extent feasible the right-of-way is used in a manner compatible with the purposes for which the affected conservation system unit, national recreation area, or national conservation area was established or is managed;
>
> (2) requirements for restoration, revegetation, and curtailment of erosion of the surface of the land;
>
> (3) requirements to ensure that activities in connection with the right-of-way will not violate applicable air and water quality standards and related facility siting standards established pursuant to law;
>
> (4) requirements, including the minimum necessary width, designed to control or prevent--
>
> > (A) damage to the environment (including damage to fish and wildlife habitat);
> >
> > (B) damage to public or private property; and
> >
> > (C) hazards to public health and safety;
>
> (5) requirements to protect the interests of individuals living in the general area of the right-of-way who rely on the fish, wildlife and biotic resources of the area for subsistence purposes; and
>
> (6) requirements to employ measures to avoid or minimize adverse environmental, social or economic impacts."

In accordance with Section 1107 of ANILCA, terms and conditions related to the protection and mitigation of park resources are provided in this document. Additional administrative and operational terms and conditions will be required and will be addressed separately.

As required, the Alaska Industrial Development and Export Authority (AIDEA or the applicant), a public corporation of the State of Alaska, submitted an application to the NPS for the requested right-of-way and to construct the proposed Ambler road within GAAR (DOWL 2016). Included in the application were mitigation measures proposed by the applicant; a summary of these mitigation measures is presented in attachment A of this document. The applicant is in the preliminary stages of design, noting in the application that "detailed calculations needed to … ensure adequate hydraulic capacity at river and stream crossings have not yet been completed. Hydrologic predictions… would be completed as part of later design phases" (DOWL 2016). In addition to hydrologic data, the applicant still needs to collect significant data to determine the best location for the proposed Ambler road within the general corridor identified in the application. Therefore, for most resources, the proposed terms and conditions focus on goals and objectives to protect resources rather than prescribing specific mitigation measures. However, the NPS explicitly suggests that that all material sites and associated features (airstrip, construction camp, long-term maintenance facility) be located outside of NPS lands. Through analysis on the park resources,

the NPS recognizes the impacts of these facilities, including gravel extraction, equipment maintenance, and having a small population of workers potentially living within the Kobuk Preserve could be great and affect many resources. For these reasons, and based on NPS policy, the NPS suggests that these support features for the proposed Ambler road be located outside of the preserve.

RESOURCE TOPICS REQUIRING TERMS AND CONDITIONS

PERMAFROST AND HYDROLOGY

Much of the ground in the Kobuk Preserve is underlain by permafrost. The road construction on permafrost soils could change the thermal regime and lead to permafrost degradation, which could significantly alter the ecosystem in the Kobuk Preserve. Permafrost degradation can also cause constructability and maintenance issues. Surface flow patterns in northern Alaska are strongly influenced by the presence of permafrost, which restricts the percolation of water through the soil. Permafrost in this area is lightly frozen and is vulnerable to thaw. Construction of the proposed Ambler road on thaw-unstable permafrost could cause additional thawing. Changes in permafrost increase the potential for slope instability as the active layer grows and the permafrost decreases. Measures will be taken to protect the permafrost and hydrology in GAAR.

Goals of Terms and Conditions

The applicant will take measures to protect the thermal regime below the road so that the rate of change mirrors undisturbed areas outside of the road prism. In areas identified as having moderate or high risk of susceptibility to geologic hazards, initial construction activity will be limited to times when the ground is frozen to minimize impacts.

As noted in their application, the applicant will take measures to protect hydrologic integrity and continuity. Bridges and culverts need to be sized appropriately and designed to accommodate all flow regimes, such as breakup, slush flows, and flood events. Once constructed, drainage structures need to be monitored and maintained to ensure adequate function. When there are signs that a culvert is not functioning properly (e.g., settlement, corrosion, abrasion, coating loss, perforations, cracks, joint separation, misaligned seams, shape changes, deflection, or undermining), corrective actions need to be implemented in a timely fashion.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS and Federal Highway Administration (FHWA) staff will be involved during all phases. As new data are collected to better understand the existing permafrost and hydrology, NPS and FHWA staff will work with the applicant to avoid sensitive areas or areas with moderate or high risk of geologic hazards. The NPS and FHWA will assist in the development of data collection efforts (pre-design), participate in design reviews, and help develop monitoring plans (during and post-construction).

Data Gaps and Study Needs

- Geotech studies for soil type, permafrost, and construction suitability
- Sample material sites and cut areas for mineralized aggregates with the potential to produce “acid rock” or “acid and metalliferous” runoff and naturally occurring asbestos
- Continued soil temperature monitoring under and adjacent to the proposed Ambler road

- Multi-year flow studies prior to construction to determine flow regimes and flood elevations (consider Kane et al. 2015 as guide, including studies of flow, ice breakup, max river elevation, and storm effects)
- Identify and define stream channels and areas with sheet flow. Sheet flow often comes from groundwater flow exiting hillsides, and this can lead to aufeis formation in winter.
- Collect flow data for larger streams and rivers. Data collection means and methods on the Kobuk River must be consistent with its designation as a Wild and Scenic River.
- Map boundaries of and characterize floodplains and streams (habitat mapping above and below road crossing, which will aid in road design and avoid impacts)

Monitoring (Construction and Post Construction) and Required Plans

Monitoring of various parameters will be required during construction and for the life of the road. Monitoring plans will need to be developed and submitted for review and approval by the NPS. As noted above, changes to permafrost can impact road stability, hydrology, wetlands, and many other resources. Understanding where and how the thermal regime is affected by the construction and operation of the road will help inform decisions on measures to minimize impacts and preserve existing conditions. Protection of the permafrost will need to be addressed during design of the road prior to construction.

Monitoring of drainage structure performance and hydrologic continuity will be required for the life of the road. A monitoring plan will need to be developed and submitted for review and approval by the NPS. The plan should include annual monitoring and event-specific monitoring (spring break up, floods, etc.). Timely corrective action will be required if culverts are found to not be functioning properly.

WETLANDS AND FLOODPLAINS

The proposed Ambler road would cross a large number of rivers and streams and a substantial number of wetlands. As noted above, the presence of permafrost restricts the percolation of water through the soil, creating the conditions that allow for the extensive wetlands in the project area. Shallow surface water flow paths and saturated zones above the permafrost table are common in the project area. With the construction of the road, natural drainage will be disrupted. Depending on drainage structure design, installation, and maintenance, sheet flow could be concentrated into point flow as it crosses the road. Proper location, design, installation, and maintenance of culverts are important to preserve hydrologic function and avoid changes in wetland type and function from one side of the road to the other. Surface waters maintain wetlands within the project area, and ultimately, preserving natural flow patterns across the project area will be critical to preserving the wetlands and aquatic environments.

Goals of Terms and Conditions

The NPS will work with the applicant to avoid and minimize impacts to wetlands and floodplains throughout the design, construction, and operation phases of the project. Where the proposed road alignment crosses floodplains, the applicant shall evaluate the floodplains to determine floodplain extent and 100-year flood elevation. This information will be used to inform the location and the design of the crossing structure to minimize impacts to wetlands, floodplains, and hydrology.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

NPS and FHWA staff will be involved during all phases. The NPS and FHWA will be provided opportunities to participate in and provide comments on the design and construction documents at every

formal review throughout the process. The analysis will be conducted by subject matter experts and design professionals familiar with work of this type in the project environment, with a goal of minimizing impacts to wetlands, floodplains, and hydrology. The outcome of the resolution of the comments will be incorporated into the engineering drawings and approved by the NPS before construction activity begins.

Data Gaps and Study Needs, Monitoring (Construction and Post Construction) and Required Plans

- Waterways and waterbodies in the NPS project area are generally pristine with no evidence of development or modification by man. Fish surveys for the presence of resident or anadromous fish populations have been sporadic and sparse; however, the results of these surveys are consistent—if there is habitat, fish populations are present. Absent waterbody and site-specific information that resident or anadromous fish are not present at the site or in reaches upstream of the site, the design assumption for construction of a hydraulic project or use, or any construction related activity (including use of equipment in the bed) shall be that anadromous fish populations exist, and the appropriate State and federal statutes governing these activities apply. These statutes include, but are not limited to, Section 10 of the Rivers and Harbors Act, Section 404 of the Clean Water Act, and Alaska Statutes, Title 16.05.8. All activities within or across and all in-stream activities affecting an anadromous waterbody require State and federal approval. These approvals shall be in place prior to any activity in or across such waterbodies.
- With the exception of project construction, maintenance, or operation activities occurring within the construction daylight limits plus the 10-foot buffer on either side of the daylight limits, any activity requiring the use of vehicles or equipment in wetland areas or waterbodies will require prior approval from the NPS. Prior to conducting activities involving vehicles or equipment working in wetlands, a plan must be developed and submitted for approval that describes measures that will be implemented to avoid and minimize impacts to wetlands or waterbodies. Approval of such plans will not be unreasonably withheld.
- Preserving the existing hydrologic continuity across the road will be important in minimizing impacts to wetlands, preserving the existing thermal regime in areas of permafrost soils, and reducing the potential for erosion and the associated potential impacts to water quality. Drainage structures will be selected with these goals in mind. Drainage structures will be located, designed, and sized appropriately for peak flow events with due consideration for aufeis formation in the winter and slush flow events during breakup, as well as peak flows generated by precipitation events. Once construction is complete, the project drainage structures will be monitored and maintained no less frequently than on an annual basis to verify and ensure proper performance. Repair or replacement of non-functioning culverts shall occur within 15 months of discovery. Fish passage drainage structures shall be monitored and inspected for performance of the fish passage function by a qualified professional at least annually. Maintenance and repair of the structure to preserve the fish passage function shall occur as soon as possible and the work will be consistent with the original or new permit conditions.
- Vegetation removal practices will be detailed in a Vegetation Management Plan. The Vegetation Management Plan will address clearing activities within the right-of-way and include measures to control and prevent the introduction and migration of invasive plant species. The Plan will be subject to review and approval by the NPS. Activities within the Plan will include, but not be limited to, the following specifications:
    - Trees outside the approved clearing limits will not be damaged by the clearing process.
    - Cleared vegetation, including slash piles and timber piles, will be removed from any wetland areas. Downed woody debris will be removed from the wetlands.

- The use of herbicides or other chemical means for vegetation management will not be allowed without specific review and approval by NPS
- Any chipped wood will not be scattered in any wetland area or within 150 feet of a wetland area.
- There will be no vegetation burning within the boundaries of GAAR.

- The NPS, FHWA, and NPS consultants acting on behalf of the NPS, shall have the right and opportunity to be onsite during the construction, operation, and maintenance of the project to verify compliance with the permit terms and conditions. A mutually agreeable monitoring plan will be developed prior to the start of construction that will define roles and responsibilities and provide a mechanism for promptly addressing activities that are found to be out of compliance with permit requirements and approved plans.
- Storm Water Pollution Prevention Plans (SWPPP) and other plans required by state and federal law will be approved and best management practice (BMP) measures will be in place, consistent with the plan prior to the start of work activities.
- The design of structures and engineered features within the floodplain will incorporate methods for minimizing flood damage, as contained in the National Flood Insurance Program *Floodplain Management Criteria for Flood-Prone Areas* (44 CFR 60.3) and in accordance with any state or local requirements for flood-prone areas. Floodplain impact avoidance and minimization measures that may be incorporated include the following:
  - Avoid construction or clearing vegetation within floodplains and floodplain buffers.
  - Modify structures to provide sufficient elevation above the flood crest (e.g., place structures on columns, walls, piles, or piers).
- Other than the direct approach to the bridge crossing the Kobuk Wild River, no project elements, including permanent or temporary access roads, trails or other development will be allowed within the 0.25 mile boundary of the Kobuk River.

Once right-of-way permits are issued and use and occupancy fees are available, the NPS will initiate further efforts to identify critical wetland areas, collect flow data and delineate floodplains, and work collaboratively with State of Alaska Department of Fish and Game (ADF&G) to evaluate perennial streams in the project area for the presence of resident or anadromous fish populations. The goal of these efforts and collection of other baseline monitoring data will be to inform the design process and aid in determination of impact avoidance and minimization measures.

WATER QUALITY

Water quality in GAAR is exceptionally high. Changes due to road construction activities, as well as traffic on the proposed Ambler road, could impact the water quality of the Kobuk Preserve. Permafrost degradation, particularly in regions with high ice content, has a strong effect on water quality. While measures will be required to prevent permafrost degradation, projects like this typically impact permafrost, resulting in impacts to water quality. Therefore, measures to protect water quality are needed. Increased nitrogen, total dissolved solids, turbidity, and dissolved sources of organic carbon are all common impacts to water quality following permafrost degradation. Prior studies in the region indicate that permafrost thaw can drive considerable suspended sediment flux in rivers during periods of active thermally induced erosion. Erosion and runoff from construction and operation of the road can increase sedimentation in streams and water bodies. Given the types of chemicals and other materials that could be used at the mine, potential exists for impacts on water quality from spills due to road accidents.

Goals of Terms and Conditions

Water quality of streams, rivers, and other water bodies within GAAR, directly or indirectly, affected by the proposed Ambler road must be maintained at current conditions.

- Consider alternatives for dust abatement that avoid or minimize impacts to water quality and nearby vegetation.
- Consider truck wash stations at the Dalton Highway and mine sites to minimize transport and spread of ore concentrate dust and invasive plants.
- Prohibit the use of sulfide-bearing rock with acid generating runoff potential in the construction, maintenance, or operation of the road.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases – pre-design baseline studies, review of proposed designs to avoid or minimize impacts to water quality, and construction and post-construction monitoring.

Data Gaps and Study Needs

- Multi-year studies to develop adequate baseline water quality condition information before construction begins.
- Baseline studies for water chemistry and turbidity.
- Water quality monitoring during construction and operation.
- Potential material sites for aggregates that could be used on the road in NPS lands will be sampled and analyzed for the presence of acid generating potential.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring will be required during construction and for the life of the road, a monitoring plan will need to be developed and submitted for review and approval by the NPS. Additional plans needed to protect water quality include:

- Stormwater pollution and prevention plan
- Spill prevention control and countermeasures
- Document road settlement areas, slope instability locations, and heavy erosion sites during and following construction

FISH

The rivers and streams in the Kobuk Preserve support several important fisheries including large arctic char and chum salmon runs and contain sheefish spawning grounds. Concerns for fish habitat include environmental changes caused by the road or potential climate driven changes that may be accelerated due to road construction, such as permafrost degradation, increased turbidity from poor soil stability and erosion along the road corridor, changes in riparian vegetation due to shrub encroachment, and impacts of increased sedimentation on essential fish habitat. Loss of access to upstream habitat due to poorly designed, installed, or malfunctioning fish passage drainage structures is a big concern. Fish could also be

affected by temporary water withdrawals, depending on the location, frequency, and quantity of water removed.

Goals of Terms and Conditions

Measures will be taken to protect feeding, reproduction, and fish passage. Time-of-year restrictions will be needed, especially for in-water construction. The NPS will adopt and require that ADF&G fish passage standards and permit conditions be met. Water withdrawals required for road construction and operation must have appropriate Alaska Department of Natural Resources Water Resources Program permits and comply with the permit terms and conditions.

- Waterways and waterbodies in the NPS project area are generally pristine with no evidence of development or modification by man. Fish surveys for the presence of resident or anadromous fish populations have been sporadic and sparse; however, the results of these surveys are consistent—if there is habitat, fish populations are present. Absent waterbody and site-specific information that resident or anadromous fish are not present at the site or in reaches upstream of the site, the design assumption for construction of a hydraulic project or use, or any construction related activity (including use of equipment in the bed) shall be that anadromous fish populations exist, and the appropriate State and federal statutes governing these activities apply. These statutes include, but are not limited to, Section 10 of the Rivers and Harbors Act, Section 404 of the Clean Water Act, and Alaska Statutes, Title 16.05.8. All activities within or across and all in-stream activities affecting an anadromous waterbody require State and federal approval. These approvals shall be in place prior to any activity in or across such waterbodies.
- Fish passage drainage structures will be monitored and inspected for performance of the fish passage function by a qualified professional at least annually. Maintenance and repair of the structure to preserve the fish passage function shall occur as soon as possible and the work will be consistent with the original, or new permit conditions.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases. NPS staff will consult on the development of baseline studies, review proposed designs to avoid or minimize impacts to fish, and consult on the development of construction and post-construction monitoring plans and approve plans prior to implementation. The NPS will review annual monitoring reports.

Study Needs

Baseline data collection will be needed to determine what species are present in the project area, when they are present, and what life stages are present. Prior to construction, all streams impacted by the proposed Ambler road will be surveyed to determine if resident or anadromous fish are present and what design standards are appropriate for drainage structures to ensure fish passage requirements are addressed.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring will be required during construction and post-construction for the life of the road. Monitoring will include annual and event-specific (spring break up, floods, etc.) monitoring to verify performance of fish passage culverts. Immediate correction is required if passage features are found to not function properly. Monitoring plans will be developed in consultation with and approved by the NPS prior to implementation.

SOILS AND VEGETATION

The Kobuk Preserve contains largely undisturbed upland habitats including boreal forest; needle-leaved, broad-leaved, and mixed forests; tall and low upland shrubs; and upland meadows (DOWL 2014). Land disturbance associated with construction activities will remove native vegetation, leaving unvegetated, disturbed areas vulnerable to wind and water erosion. Indirect impacts will include the potential for changes in species composition due to the disturbance; colonization by non-native invasive plant species that could potentially outcompete native species; and changes in plant physiology from deposition of road dust.

Goals of Terms and Conditions

Actions will be taken to minimize impacts to soils and native vegetation. Dust mitigation will be required to prevent damage to native plants and contamination of soils. During restoration, only native seeds/plants will be used. The NPS will provide an approved species list and review restoration and planting plans. Truck wash stations at the Dalton Highway and mine sites will help to prevent invasive species introduction into GAAR and to prevent mine contaminants from being transported into GAAR. Use of certified weed-free straw, coconut mats, and other materials will be required for stormwater pollution prevention plan BMPs. Finally, a reclamation bond will be required to fund rehabilitation.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases – pre-design baseline studies of plants, review of proposed designs to avoid or minimize impacts to soils and vegetation, and construction and post-construction monitoring.

Data Gaps and Study Needs

- Baseline vegetation survey along the alignment within GAAR.

Monitoring (Construction and Post Construction) and Required Plans

- Annual monitoring of vegetation to document changes, noting changes in vegetation composition, presence of invasive species, and impacts associated with dust.
- The NPS will actively participate in the development and implementation of an invasive species prevention and monitoring plan and program for the entire project. This may include vehicle and equipment inspections at the Dalton Higheay intersection checkpoint, washdown facilities and monitoring for the introduction and migration of invasive plant species along the road corridor or other measures deemed appropriate by the land management agencies and the applicant.
- Restoration and monitoring plans will need to prepared and submitted for review and approval by the NPS. Restoration plans will include soil stabilization and revegetation of areas disturbed during construction and by operation and maintenance activities. The goal is to control erosion and avoid the introduction of invasive species. The plan will include measures to remove invasive species should they be found in GAAR.
- Vegetation removal practices will be detailed in a Vegetation Management Plan. The Vegetation Management Plan will address clearing activities within the right-of-way and include measures to control and prevent the introduction and migration of invasive plant species. The Plan will be subject to review and approval by the NPS. Activities within the Plan will include, but not be limited to, the following specifications:

- Trees outside the approved clearing limits will not be damaged by the clearing process.
- Cleared vegetation, including slash piles and timber piles, will be removed from any wetland areas. Downed woody debris will be removed from the wetlands.
- The use of herbicides or other chemical means for vegetation management will not be allowed without specific review and approval by NPS
- Any chipped wood will not be scattered in any wetland area or within 150 feet of a wetland area.
- A description of the manner and means for brushing and clearing of vegetation along the roadside and shoulders, as well as around drainage structures.
- There will be no vegetation burning within the boundaries of GAAR.

WILDLIFE

Construction of the proposed Ambler road and the traffic associated with it will impact wildlife, wildlife habitat, food sources, and movement. The presence of the proposed Ambler road could lead to habitat fragmentation and influence wildlife movements. ANILCA requires the protection of habitat for and the populations of fish and wildlife. The Kobuk Preserve is currently undeveloped, and experiences consumptive use of the resources by subsistence and recreational user groups. Population dynamics and the natural life cycles of wildlife and fish species are largely uninterrupted. Caribou and anadromous fish migrate extensively. Development of the proposed Ambler road will influence animal movements and alter important habitat.

Goals of Terms and Conditions

Measures will be taken to reduce wildlife impacts to feeding, denning, reproduction, migration activities, and adverse wildlife interactions. Time-of-year restrictions for construction and operation will be needed for some species to protect sensitive life stages and activities. Measures will be taken to address nuisance wildlife situations, such as beaver damming at drainage structures, and avoidance measures to prevent wildlife habituation to people and people related activities.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases. NPS staff will consult on the development of baseline studies, review proposed designs to avoid or minimize impacts to wildlife, and consult on the development of construction and post-construction monitoring plans and approve plans prior to implementation. The NPS will review annual monitoring reports.

Data Gaps and Study Needs

Baseline data collection for location, population density, and activities will be needed for some large and small mammal species.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring will be required during construction and post-construction. Monitoring plans will be developed in consultation with the NPS and approved by the NPS prior to implementation. The NPS will work with the applicant to develop plans for addressing problems associated with nuisance wildlife and for preventing habituation to people and human-related activities.

BIRDS

Approximately 120 bird species have been documented in GAAR, including a variety of waterfowl, raptors, grouse, shorebirds, and passerines. A list of avian species most likely to be impacted by the Ambler road was compiled and analyzed; this list contained 46 species. Few comprehensive bird studies have been conducted within the project area and additional information is needed.

Goals of Terms and Conditions

Develop measures to reduce impacts to feeding, nesting, reproduction, migration and to reduce adverse wildlife interactions. Once water withdrawal requirements are clearly defined, impacts to water birds from these withdrawals must be considered and measures implemented to protect the birds. In accordance with the Migratory Bird Treaty Act, time-of-year restrictions will be needed for some construction activities, as well as for vegetation clearing and some maintenance activities associated with operation of the road.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases. NPS staff will consult on the development of baseline studies, review proposed designs to avoid or minimize impacts to birds, and consult on the development of construction and post-construction monitoring plans and approve plans prior to implementation. The NPS will review annual monitoring reports.

Study Needs

Baseline data collection will be needed to understand what species are present, when they are present in the project area and what life stages are present. Surveys will be needed along the road corridor for terrestrial birds, and on major lakes, rivers, and streams for water birds.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring will be required during construction and post-construction. Monitoring plans will be developed in consultation with and approved by the NPS prior to implementation.

SUBSISTENCE ACTIVITIES

In 1980, Congress formally recognized the social and cultural importance of protecting subsistence for both Native and non-Native rural residents when it passed ANILCA. In 1981, ten communities near GAAR were designated by the NPS as *Subsistence Resident Zone Communities.* Alatna, Allakaket, Ambler, Anaktuvuk Pass, Evansville/Bettles, Hughes, Kobuk, Nuiqsut, Shungnak, and Wiseman were identified as communities with a significant concentration of subsistence users who have customarily and traditionally used resources within Gates of the Arctic National Park. Resident zone status allows all permanent residents within these communities to participate in subsistence activities on national park lands.

Subsistence activities occur throughout the year and are often concentrated along rivers, which flow out of the mountains that connect low-lying communities. Subsistence activities include hunting, fishing, trapping, and gathering of plants, as well as wood for heating homes. Historically, the most important resource to the inhabitants in the area was caribou. The movement of caribou was a primary factor influencing the subsistence strategy of people in the central Brooks Range prior to contact with outsiders. Even today, caribou migrate seasonally and provide local people with sustenance. Other resources used

by local people include fish, moose, Dall's sheep, bears, waterfowl, marmot, ptarmigan, hare, furbearers, a variety of plant life, and even a few mineral deposits (NPS 2014). The presence of a road through the Kobuk Preserve will directly affect subsistence resources.

Goals of Terms and Conditions

The NPS will continue its relationship with the *Subsistence Resident Zone Communities* and will support the development of an Ambler road oversight committee (a standing working group) with representatives from communities, agencies, the applicant and other stakeholders.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

There are potential impacts to subsistence communities associated with all phases of the project. The NPS will need to be involved during all phases for actions that relate to subsistence activities on NPS lands.

Study Needs

Community consultation will continue throughout the design, construction and operation of the proposed Ambler road to ensure that *Subsistence Resident Zone Communities* views and concerns are understood and considered throughout the life of the road.

Monitoring (Construction and Post Construction) and Required Plans

The NPS will support the development of an Ambler road oversight committee (a standing working group advising actions related to subsistence) and participate in the working group activities.

ARCHEOLOGICAL RESOURCES

The proposed Ambler road will cross areas of cultural importance. Construction activities could damage or destroy archeological resources and the development of the road could impact traditional cultural landscapes in areas that are currently devoid of modern development.

The lands and waters of what is now GAAR have supported human activities for many thousands of years. There are archeological and ethnographic resources within GAAR that are historically important and important to contemporary users of lands. The specific nature and extent of cultural resources is unknown at this point, but previous research suggests it is substantive and significant. Evaluation of cultural resources will continue in the context of the National Historic Preservation Act Section 106 process, which is ongoing as part of the BLM EIS process.

Goals of Terms and Conditions

Terms will be addressed as part of the Section 106 process. BLM is the lead federal agency for Section 106. NPS is an invited signatory on a legally binding programmatic agreement that describes detailed stipulations, roles and responsibilities, and inventory, monitoring, and reporting procedures designed to that will take into account effects of this undertaking in historic properties and to consult with Tribes, other agencies, local governments, the public and interested parties.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases.

Study Needs

Study needs are detailed in a Cultural Resources Management Plan tiered from the Ambler Road Section 106 Programmatic Agreement. They include alignment-specific surveys will be needed prior to construction to document existing resources that could be impacted by construction.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring will be required during and post-construction, consistent with the Programmatic Agreement and Cultural Resources Management Plan.

WILD AND SCENIC RIVER

The proposed Ambler road will cross the Kobuk River, which is designated as a wild river. The construction and operation of the road across the river have the potential to impact the free-flowing character, water quality, and the five Outstandingly Remarkable Values (ORVs) of the Kobuk River. Water quality in the Kobuk River is considered to be unaffected by people. Water quality and free flowing character are the fundamental values of all wild rivers, including the Kobuk River. The ORVs identified as important for the Kobuk River include scenery, recreation, fisheries, geology, and cultural values (traditional routes and historic use).

Goals of Terms and Conditions

Measures will be required to maintain the status of the Kobuk River as a wild river. Development actions taken need to be consistent with these requirements:

- Project footprint will need to stay outside of the 0.25-mile Wild and Scenic River boundary (except for the approaches to the Kobuk River bridge).
- The need for riprap should be eliminated by locating abutments out of the flood zone or if needed, riprap should be placed above the ordinary high water mark. Where it cannot be eliminated, local material (from sources near the park) should be used to blend more closely with local rock substrate.
- No permanent or temporary access, outside of the footprint of the road approach to the bridge, shall be constructed to the river.
- Other than the direct approach to the bridge crossing the Kobuk Wild River, no project elements, including permanent or temporary access roads, trails or other development will be allowed within the 0.25 mile boundary of the Kobuk River.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases. The NPS and FHWA will be provided opportunities to participate in and provide comments on the design and construction documents at every formal review throughout the process. The analysis will be conducted by subject matter experts and design professionals familiar with work of this type in the project environment, with a goal of minimizing impacts to the Kobuk wild river. The outcome of the resolution of the comments will be incorporated into the engineering drawings and approved by the NPS before construction activity begins.

Study Needs

Other than a determination of the flood zone and monitoring for flow conditions and water elevations under different flow regimes to inform the bridge design, no specific studies are required for Wild and Scenic River. Studies for other resources will provide information needed to guide the protection of this resource.

Monitoring (Construction and Post Construction) and Required Plans

No specific monitoring is required for Wild and Scenic River, monitoring requirements for other resources will provide information needed to guide the protection of this resource. Design plans will ensure that the road location, bridge spans and piers, abutment protection plan, and construction do not affect the status as a national wild river and minimize impacts to the outstandingly remarkable values of the river.

VISITOR EXPERIENCE

GAAR is one of the largest and best-preserved wilderness areas in the United States. The remote location, challenging access, and current NPS management all combine to provide visitors with the opportunities described in the enabling legislation. The introduction of an industrial road to this area will cause changes to the wilderness character and the current visitor experience. Aside from the physical presence of the road, viewsheds will be impacted by traffic-related dust plumes and headlights. Engine noise and sounds associated with construction and maintenance related activities add a human element to an otherwise largely natural soundscape. Regardless of management controls on traffic, the physical presence of the proposed Ambler road will alter the nature of the visitor experience. The wild and undeveloped character with opportunities for solitude will be diminished compared to the current condition.

Goals of Terms and Conditions

Measures will be required to minimize impacts to visitor experience during construction, and post-construction. Areas will be re-vegetated to minimize impacts to viewshed for important vistas, especially along the Kobuk River. Structure colors will be selected to reduce the visual impacts of bridges. Clearing for the ROW will be minimized to the extent possible to reduce the visual impact of the ROW. The NPS soundscapes division will provide standards for noise levels in national parks and measures to reduce noise associated with road usage. An increase in air traffic, helicopter use, and drone use will impact visitor experience. These activities will be considered during design and measures to avoid or reduce impacts will be identified.

After the park was established, the NPS imposed a ban on all-terrain vehicle (ATV) use on parks lands. Consistent with this existing ban, off-road vehicle use for any reason will be prohibited within the right-of-way. This prohibition is not intended to affect the use of licensed motor vehicles or construction equipment within the right-of-way for construction, maintenance, or operation of the road. Any activity or use associated with the construction, maintenance, or operation of the road that wants to occur outside of the right-of-way will require specific authorization from the NPS. Such authorizations will be considered on a case-by-case basis.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases. During design and development of construction plans, NPS staff will evaluate potential safety hazards to NPS visitors and employees. Measures to protect

NPS visitors and employees will be required. NPS staff will also review designs and construction plans to identify measures to avoid or minimize impacts to viewsheds and soundscapes.

Study Needs

A study of local river conditions and the design of crossing structures for boater safety will be needed.

Monitoring (Construction and Post Construction) and Required Plans

Visitor use will be monitored following construction. Monitoring will be annual for at least 10 years to determine if, and how, the road presence affects visitor use and experience. As development occurs in the Ambler Mining District and the traffic volume and demographics of road users change, the NPS may need to develop a visitor use management plan for the Kobuk Preserve to accommodate additional or different uses and visitor experiences.

HUMAN HEALTH AND SAFETY

The NPS is required to ensure that visitor and employee health and safety are protected and that proposed actions inside national parks are consistent with NPS policies and regulations regarding human health and safety.

Goals of Terms and Conditions

Measures will be required to protect the health and safety of NPS visitors and employees. Actions required to protect human health and safety inside GAAR include:

- Prohibit the use of gravel materials containing naturally occurring asbestos in the construction, maintenance or operation of the road through Preserve lands.
- Temporary, short-term closures will be used as needed to protect visitors from construction activities; the goal is to keep GAAR open to visitors and minimize disruption to visitation as much as possible.
- If needed to protect boater safety, potentially close portions of the Kobuk River during construction of the bridge; closures must be short-term and temporary, and must be scheduled so visitors can adjust trips; or require allowance for safe passage of river users through the construction site except for brief closures during certain hazardous activities.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during design and construction.

Data Gaps and Study Needs

Potential material sites for aggregates that could be used on the road in NPS lands will be sampled and analyzed for the presence of naturally occurring asbestos.

Monitoring (Construction and Post Construction) and Required Plans

Monitoring for visitor safety during construction will be required.

Monitoring for naturally occurring asbestos particulates will occur as part of the fugitive dust monitoring program.

AIR QUALITY

As noted above for other resources, the natural resources of GAAR are pristine, unaffected by recent human development activities. Road construction activities and use of the road will have some effect on air quality through vehicle and stationary source emissions as well as generate airborne particulates (fugitive dust). Airborne contaminants, including metals such as zinc, copper, and lead, can change water quality and pose a risk to aquatic biota (e.g., fish, aquatic insects), which inhabit lakes, streams, ponds and wetlands. Avoiding and minimizing the impacts to air quality is important to protect the people and natural resources within GAAR and the surrounding communities.

Goals of Terms and Conditions

Measures will be required to protect the air quality of the region. Actions include:

- Minimize fugitive dust generation through the use of appropriate road palliatives or surfacing materials.
- Require vehicles carrying hazardous materials or ore concentrates to have the loads in closed containers during transport.
- Establish thresholds for the maximum dust propagation (related to distance dust travels and duration of plume) with the applicant to ensure dust levels stay below these levels during road construction and operation.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during all phases.

Data Gaps and Study Needs

Determination of appropriate propagation thresholds and monitoring methodologies.

Monitoring (Construction and Post Construction) and Required Plans

Dust deposition rates and dust composition adjacent to the road will be monitored during and post-construction. Monitoring plans will be developed in consultation with and approved by the NPS prior to implementation. The NPS will review annual monitoring reports.

ADMINISTRATIVE TERMS AND CONDITIONS

Below are initial administrative terms and conditions, additional administrative and operational terms and conditions will be required and will be addressed separately.

Goals of Terms and Conditions

- NPS staff and partners to have access to road for official business.

- Construct the road to the one-lane, year-round road with full mitigations within GAAR prior to allowing use for access to the Ambler Mining District. (no use of the phase I pioneer road for traffic permitted within GAAR).
- Construct portions outside GAAR before beginning work inside GAAR.
- Time-of-year restrictions on traffic and use to protect permafrost, wetlands, fish, and wildlife (discussed above under specific resource topics).
- In-water restrictions during construction to protect fish and other aquatic organisms and aquatic habitat; and to preserve the wild status of the Kobuk River.
- Ensure that the NPS and FHWA are involved in decisions and in design refinements that relocate or move road to avoid safety issues or minimize environmental concerns that affect NPS lands.
- Consistent with the ban on use of off-road vehicles in GAAR, ensure no off-road vehicles will be permitted to be used for any reason within the right-of-way on NPS lands.within GAAR.

NPS/FHWA Involvement in Design, Permitting, Construction and Post Construction

The NPS will need to be involved during design, permitting and construction.

Study Needs

No specific studies are required.

Monitoring (Construction and Post Construction) and Required Plans

No specific monitoring plans are required.

REFERENCES

DOWL HKM (DOWL). 2016. *Ambler Mining District Industrial Access Project (AMDIAP) National Park Service (NPS) SF-299 Supplemental Narrative*. Prepared for Alaska Industrial Development and Export Authority (AIDEA). Revised June 2016.

Kane, D.L. E.K. Youcha, S.L. Stuefer, H. Toniolo, J.W. Homan, W.E. Schnabel, R.E. Gieck, E. Lamb, T. Tschetter, G. Myerchin-Tape. 2015. *Environmental Studies of Ambler Transportation Corridor, Alaska.* Prepared for Alaska Industrial Development and Export Authority. December.

National Park Service (NPS). 2014. Gates of the Arctic National Park and Preserve General Management Plan Amendment / Wilderness Stewardship Plan / Environmental Assessment. December.

APPLICANT-PROPOSED MITIGATION MEASURES

The following mitigation measures are identified by the applicant in their Standard Form 299 (SF299): Application for Transportation and Utility Systems and Facilities on Federal Lands (DOWL 2016).

ENVIRONMENTAL PROTECTION REQUIRED BY AGENCIES

- Construction activities would be managed to minimize disruption to the surrounding environment. Mitigation and compliance with regulations and policies to minimize or prevent impacts would be strictly adhered to during and after the construction. The applicant would obtain all required individual approvals and permits with other federal, state, and local agencies prior to construction activities. Table 7 in the SF299 (DOWL 2016) presents a list of permits, consultations, or activities requiring review or approval from agencies.

PERMAFROST AND HYDROLOGY

- Design measures would be incorporated based on geologic and hydrologic studies to freely convey surface water across the road surface and minimize impacts on groundwater flows.
- Determining the best method to control permafrost thawing in specific areas would require more detailed thermal modeling along the selected alignment. Improving the accuracy of thermal modeling requires a detailed understanding of the soil profiles, as subsurface materials have varying thermal conductivities. More geotechnical field studies and detailed thermal modeling would be completed and more specific measures to be incorporated in specific areas would be identified during final design after the appropriate federal and state agencies approve the alignment.
- The northern alignment itself was selected by the applicant to avoid areas with a high potential for aufeis formation, which can lead to ponding of surface runoff that acts as a heat sink and degrades permafrost.
- The planned construction of the road would primarily use fill techniques with minimal cutting of native soils. Cut areas would be examined further during design phases to evaluate the risk of intercepting groundwater flows. High-risk areas would be mitigated by adjusting the roadway profile to reduce or eliminate the required cut or by incorporating appropriate drainage measures to collect and convey the exposed water.
- Cut slopes exposing ice-rich permafrost are particularly susceptible to erosion and would be stabilized using a mat of riprap or porous, granular material placed on a geotextile fabric. The porous rock material and geotextile fabric would cover the exposed ice-rich soils and extend to the toe of the embankment slope, allowing water to flow through subsurface soils beneath the roadway embankment.
- Bridges and culverts would be installed at all identified drainage crossings, including rills and ephemeral channels, to maintain hydrologic connectivity, minimize changes to watershed basin areas, and reduce the likelihood of water impoundment degrading permafrost. An adequate number of culverts or bridges would maintain hydrologic continuity and existing drainage patterns within wetland complexes, ephemeral channels, and perennial stream channels.
- The collection of upstream runoff in ditches would be minimized to reduce the effects of diverting surface waters to adjacent drainageways, maintain existing flow patterns and quantities,

and reduce the potential for permafrost degradation. Roadside ditches would only be used in limited cut areas where permafrost presence is unlikely. The elevated (fill) aspect of the road would avoid impacts to shallow groundwater sources. If there are site-specific concerns about damming shallow groundwater or wetting of the embankment, coarse materials could be placed at the lowest levels of the embankment to facilitate groundwater movement across the system.

- Embankment thicknesses would be increased where permafrost is likely and cut sections would be avoided to the greatest extent practical to minimize permafrost exposure. Since permafrost degradation typically begins at the toe of the fill slope and spreads under the embankment, fill slopes should be as flat as possible (constructing benched berms alongside the embankment is a common approach). During phase I and phase II, fill slopes at culverts would be flattened to provide sufficient burial cover over the culverts to protect the pipes. The flatter fill slopes and more gradual transition from the roadway embankment to existing ground would help reduce permafrost degradation at stream crossings. Flattening the fill slopes would be weighed against the increased footprint of the roadway.
- Culverts and bridges would be sized to adequately span (at a minimum) the bankfull width of the natural channel to minimize changes to stream flow velocities during base and flood flows and to maintain natural channel functions, such as sediment/debris transport and wildlife passage. Stream banks would be stabilized at road crossings to minimize the potential for erosion and downstream sedimentation.
- All culverts judged necessary to maintain hydrologic connectivity and fish passage during full buildout of the project (phase III) would be installed during construction of phase I. Culverts installed during phase I would be of the ultimate length required for the phase III two-lane road, eliminating the need to excavate in stream channels, divert stream flows, or extend culverts during subsequent phases of the project.
- Design techniques such as installing multiple culverts in parallel or installing a subsurface layer of porous, rocky substrate are two options for facilitating shallow groundwater flow beneath the roadway embankment. Subsurface drains or pipes could be incorporated into the roadway design to better facilitate groundwater transport beneath the road embankment.
- Methods for reducing permafrost degradation generally function by reducing the thermal conductivity near the surface or by improving heat extraction through conduction, condensation, evaporation, or convection. Potential methods for addressing permafrost concerns include embankment insulation, air convention embankment, thermosyphons, sunsheds, snowsheds, or air ducts. For example, 6 inches of rigid insulation board could be installed under culvert bedding material for increased insulation.
- Plowing snow off of the road shoulders and embankment slopes would better facilitate dissipation of heat out of the roadway embankment and reduce the likelihood of permafrost degradation.

WATER QUALITY

- Riprap would be placed around the culvert ends at all phases of construction to protect and stabilize the embankment slope, reducing erosion of embankment material and minimizing the risk of embankment failure at the crossing during flood events.
- A stormwater pollution prevention plan would be developed for construction and would identify best management practices (BMPs) to be implemented to reduce the potential for water quality impacts. BMPs would be developed for road operation and maintenance activities to minimize potential impacts on water quality. Measures would include barriers to capture and filter

stormwater at construction area boundaries, stabilization of disturbed areas as quickly as feasible, and designation of specific areas for fueling and maintaining equipment to reduce the potential for unintentional releases.

- Trucks hauling concentrate from the mining district to the Dalton Highway would be covered to prevent ore concentrate from escaping the haul trucks and to minimize the potential for adverse effects on streams from concentrate transport.
- A spill prevention and response plan would be developed to guide construction and operation activities. The plan would identify measures to reduce the potential for fuel spills, locations of spill response materials, and training of construction and maintenance staff on spill response. AIDEA would require a concentrate recovery plan similar to the one developed for the Red Dog Mine to address concentrate spills.

FLOODPLAINS

- All bridges would be designed to adequately convey at a minimum the 100-year peak flood without damage to the roadway embankment or adjacent channel reaches. Scour characteristics of rivers at bridge crossings would be evaluated to minimize long-term risk to bridge abutments and piers. Culverts would be designed to convey at a minimum the 50- or 100-year peak flood depending on site characteristics and perceived risk, as determined on a case-by-case basis.
- Culvert and bridge spans would be increased or overflow culverts would be installed as needed to improve floodplain connectivity and accommodate stream characteristics to reduce the likelihood of damming or erosion. Overflow culverts, typically set at higher elevations relative to the primary culvert, would be considered at stream crossings where aufeis formation is probable. The overflow culverts would improve the ability to keep water flowing across the roadway and prevent erosion and damming should flow through the primary culvert become impeded or blocked by ice. Overflow culverts would be considered at stream crossings where there is a high likelihood of large woody debris (e.g., fallen trees) blocking culverts, based on the prevalence of timbered banks and active stream erosion upstream of the crossing. Overflow culverts would be considered at broad, active floodplains, especially where the main stream channel is poorly defined, to better accommodate hydrologic connectivity across the floodplain.
- Where possible, crossings would be located where floodplains are narrow to reduce floodplain impacts. Approach terrain would be evaluated to minimize necessary cut and grading during construction. Locations with high terraces and bluffs along the stream channel avoided when possible.

WETLANDS

- Areas where the proposed roadway footprint requires the fill of wetlands and does not contain a defined channel, minor culverts (less than 3-foot diameter) would be installed approximately every 150 feet. These efforts would maintain hydrologic connectivity between bisected wetlands and minimize impacts to the physical, biological, and chemical processes from the construction of the proposed roadway.
- Design efforts to minimize impacts to wetlands and streams would include traversing upland habitats with less than 10% longitudinal grades; avoiding sloughs, ponds, and lakes, typically by a minimum of 50 feet; and locating river crossings at straight sections, avoiding braided or multiple channels, and crossing rivers at the narrowest point where feasible. Other design

minimization measures would include shifting the alignment to impact lower value wetlands and following existing roads or trails where possible.

SOIL AND VEGETATION

- Stabilization and restoration of sites disturbed during construction activities would occur in a timely manner as work is completed. Disturbed soils would be stabilized and revegetated with native plant materials to reduce visual impacts and the potential for soil erosion and sediment discharge. AIDEA would work with the Alaska Plant Materials Center and the NPS to develop a plan for obtaining native plant seed or cuttings to be used for restoration and reclamation needs.
- Additional soil stability and erosion measures, such as riprap armoring and installation of erosion control matting, would be incorporated as part of future design phases where conditions suggest erosion may be an issue. Geotextile fabric would be placed beneath the riprap if needed to prevent migration of fine particles or silt out of the underlying soils into surface water flows.
- Reclamation of the industrial access road and support facilities is proposed once material exploration and mine operations in the Ambler Mining District are completed and when a surface transportation corridor to the region is no longer necessary. A detailed reclamation plan would be developed. Reclamation measures would include removal of embankments, culverts, and bridges; re-grading of the roadway to establish more natural ground contours and drainage patterns; and re-vegetation of the area through seeding or planting of native vegetation. Appropriate native plant materials would be identified in cooperation with the Alaska Plant Materials Center and with the NPS.

FISH

- All perennial rivers and streams and well-established ephemeral channels are assumed to provide fish habitat and crossings would be designed to provide fish passage. Culverts would be designed and installed using stream simulation principles. Embedded culverts would be filled with substrate to replicate natural channel characteristics and function. Fish passage crossings would be designed to convey the 100-year peak flood (1% exceedance probability).
- For waterways to be crossed with culverts and which are deemed to be anadromous, ADF&G would review proposed work in fish habitat. The design would need to comply with ADF&G fish passage standards, which require prescribed velocities and capacities among other design factors, to minimize or mitigate for impacts to fish habitat from construction activities and operations.

WILDLIFE

- AIDEA would incorporate the abatement and wildlife interaction protocols used on the Delong Mountain Transportation System into operation of this road.
- Coordination and notification to drivers of currently observed animal patterns, including migration patterns, would increase awareness of potential animal and vehicle conflicts.
- Construction on the pioneer road would likely take place year-round, other than restrictions during spring breakup or bird nesting periods in compliance with the Migratory Bird Treaty Act.

CULTURAL RESOURCES

- Additional cultural resource field work would be conducted on the east end of the corridor and in GAAR upon completion of the scoping process.

WILD AND SCENIC RIVER

- Potential mitigation/minimization measures for the proposed road and bridge crossing would include designing the bridge to minimize effects on water flow and fish migration; use of clean temporary diversion structures (e.g., super sack containers) during construction activities, working in low-water conditions when the need for diversion and dewatering requirements are lessened, minimizing use of riprap by exploring bioengineering alternatives for bank protection and stabilization, placement of pilings to allow for unimpeded river traffic; and restricting in-water construction during critical migration and spawning movements. These measures would minimize potential negative impacts on soils, habitat, wildlife, subsistence, and recreation.
- Although the project would result in some work in the bed and on the banks of the river, the bridge would be designed to minimize impacts on river flow and to allow continued navigation on the river by boats and rafts.
- Effects on water quality during the construction period would be mitigated through appropriate sediment and erosion control measures, such as stabilizing disturbed areas as quickly as possible and completing in-water construction during winter months when river flows are at a minimum.

VIEWSHED

- Re-vegetation of fill slopes with native seed, trees, or shrubs could be used as a mitigation technique to reduce the contrast between the gravel road and the existing forest.

SOUNDSCAPE

- Options for reducing the truck traffic noise along the road are limited and include reducing the speed of the traffic, barriers, and using quieter trucks.
    - Reducing traffic speed can reduce L_{max} noise levels of a truck pass-by and the $L_{eq(h)}$ noise levels for multiple trucks during 1-hour of time. Traffic noise levels are reduced by approximately 1 to 2 dBA for every 5-mph reduction in speed, and therefore, a 10 to 20 mph reduction in speed would be needed to make a clearly noticeable reduction in noise.
    - Noise from heavy trucks is predominantly from the engine and exhaust system. Therefore, high-grade mufflers would be installed on all trucks using the road to reduce vehicle noise.
- During construction, contractors could use the following techniques to reduce construction noise:
    - Place stationary noise sources away from noise-sensitive locations.
    - Turn off idling equipment.
    - Drive equipment forward instead of backward; lift instead of drag materials; and avoid scraping or banging activities.
    - Use quieter equipment with properly sized and maintained mufflers, engine intake silencers, less obtrusive backup alarms (such as manually adjustable, self-adjusting, or

broadband sound alarms instead of traditional “beep-beep-beep” alarms), engine enclosures, or noise blankets.

- Purchase and use new equipment rather than using older equipment. New equipment tends to be quieter than older equipment due to new technology, improvements in mechanical efficiency, improved casing and enclosures, etc. Implement a regular maintenance and lubrication schedule to ensure that equipment is operating properly.

AIR QUALITY

- The University of Alaska Fairbanks Alaska University Transportation Center has been studying dust palliatives for several years and this project would incorporate the latest technologies for dust minimization and mitigation based on University of Alaska Fairbanks studies.
- Dust palliatives would be applied to the gravel road to reduce the potential for dust.
- Construction emissions would be minimized through use of standard BMPs related to dust suppression, equipment maintenance, and other factors.
- The use of naturally occurring asbestos (NOA) materials would be avoided unless no other suitable materials are available. In the event NOA materials are the only feasible option for road construction, AIDEA would follow ADOT&PF’s interim guidance and standards for NOA material use.
- Measures to control dust and asbestos dispersion include covering NOA materials with non-NOA materials, using dust palliatives, and other measures. Avoiding the use of NOA materials and following the interim guidance and standards in those areas where NOA materials must be used would be expected to result in a very low potential for asbestos in road dust.

RESTRICTIONS ON ROAD USE

- Only commercially licensed drivers would be allowed on the road.
- Vehicle access would be controlled and limited to professional drivers transporting materials to and from the mine, though local communities would have the potential to hire commercial transportation providers to deliver fuel or freight to staging areas where the communities could access it, probably in the winter.