WESTERN ALASKA
ACCESS PLANNING STUDY

CORRIDOR PLANNING REPORT

January 2010

Prepared by:
DOWL HKM

Prepared for:
The State of Alaska
Department of Transportation and Public Facilities

WESTERN ALASKA ACCESS PLANNING STUDY

CORRIDOR PLANNING REPORT

DOT&PF Project No. 60800

Prepared for:

State of Alaska
Department of Transportation and Public Facilities
Northern Region Planning
2301 Peger Road
Fairbanks, Alaska 99709
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Prepared by:

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In Association with:

Northern Economics, Inc.
Petrotechnical Resources Alaska
Hawley Resource Group
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Allied GIS, Inc.

January 2010

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APPENDICES

LIST OF ACRONYMS

AADT .... average annual daily traffic
ACEC .... area of critical environmental concern
ACV .... air cushion vehicle
ADF&G .... Alaska Department of Fish and Game
AIDEA .... Alaska Industrial Development and Export Authority
ANCSA .... Alaska Native Claims Settlement Act
ANILCA .... Alaska National Interest Lands Conservation Act
ARRC .... Alaska Railroad Corporation
BLM .... Bureau of Land Management
Btu .... British thermal units
Catalog, the .... Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes
CSU .... conservation system unit
DCCED .... Alaska Department of Commerce, Community, and Economic Development
DNR .... State of Alaska Department of Natural Resources
DOLWD .... Alaska Department of Labor and Workforce Development
DOT&PF .... State of Alaska Department of Transportation and Public Facilities
EIS .... Environmental Impact Statement
FHWA .... Federal Highway Administration
GIS .... Geographic Information System
GVEA .... Golden Valley Electric Association
ICAP .... Indirect Cost Allocation Plan
ILMA .... Interagency Land Management Agreement
LNG .... liquefied natural gas
M&O .... maintenance and operations
MMBtu .... million British thermal unit
n.d. .... no date
NEPA .... National Environmental Policy Act
NPS .... National Park Service
NWR .... national wildlife refuge
OHA .... State of Alaska Office of History and Archaeology
PCE .... Power Cost Equalization
R.S. .... Revised Statute
ROW .... right-of-way
SHPO .... State Historic Preservation Office
T&E .... threatened and endangered
TUS .... transportation and utility system
U.S. .... United States
USACE .... United States Army Corps of Engineers
USFWS .... United States Fish and Wildlife Service
USGS .... United States Geological Survey
WAAPS .... Western Alaska Access Planning Study

WESTERN ALASKA
ACCESS PLANNING STUDY

CORRIDOR PLANNING REPORT

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

SELECTED CORRIDOR

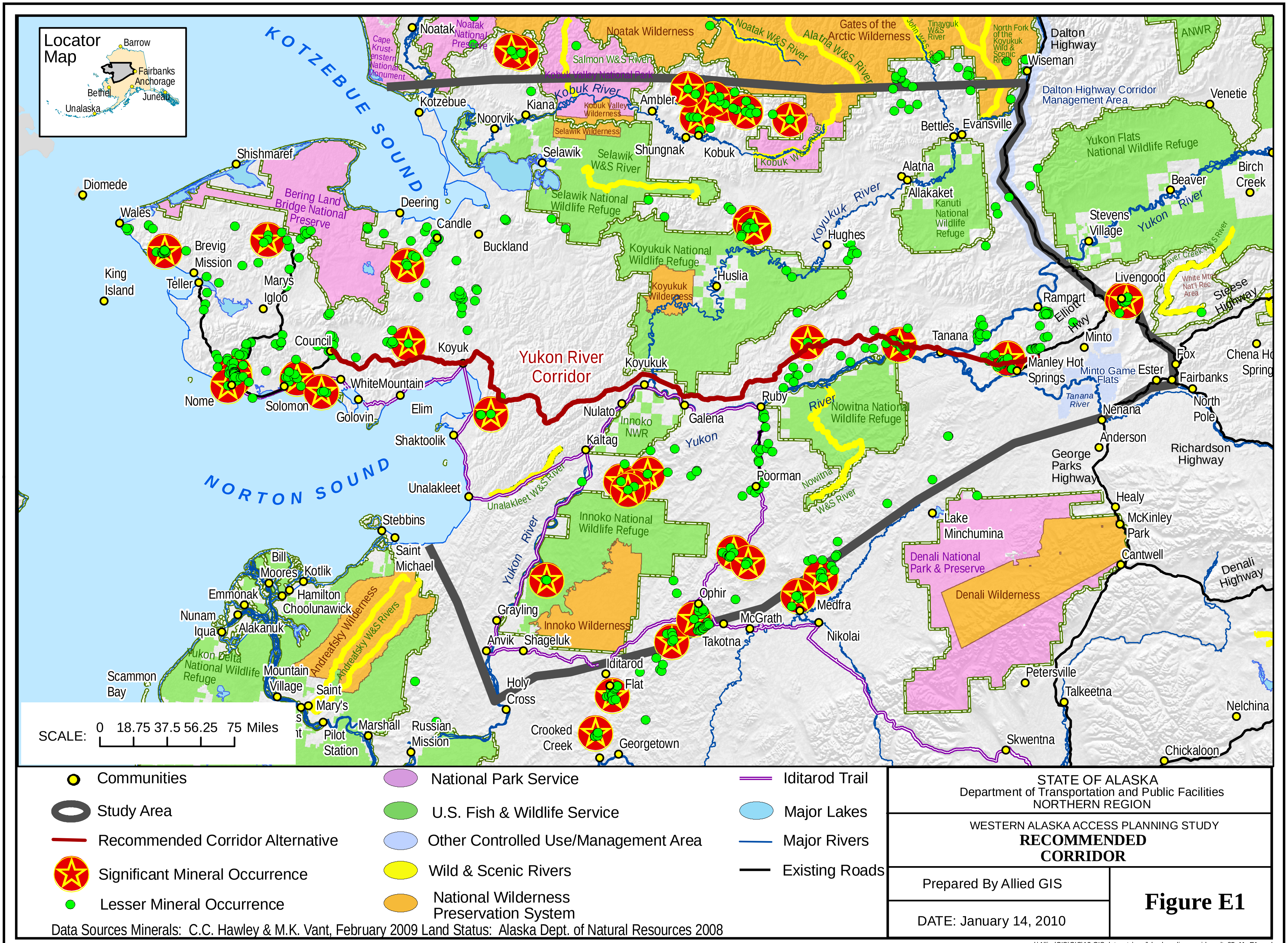
Overland access from Interior Alaska to the Seward Peninsula has long been a key element of Alaska's transportation planning maps. Previous corridors for the Dalton, Parks, and Glenn Highways were developed to address national security, for economic development, and to improve community access to goods and services. Similar benefits can be demonstrated today for extending road access to Western Alaska. The Western Alaska Access Planning Study evaluates the location and benefits of various corridor alignments to Western Alaska and recommends the Yukon River Corridor, shown in **Figure E1**. The proposed corridor, approximately 500 miles in length, begins just outside of Manley Hot Springs on the Elliott Highway and terminates at the Nome-Council Highway. The corridor generally parallels the Yukon River for much of its length, giving it the designation of the Yukon River Corridor.

The Yukon River corridor has an estimated total project cost of $2.3 to $2.7 billion. The cost range includes construction costs of the road, bridges, and maintenance stations, as well as engineering, environmental mitigation, and right-of-way acquisition costs and a 20% contingency. It would likely be built in stages based on funding availability, with each stage having independent utility.

Primary benefits of the road would be improved efficiencies, sustainability, and/or reliability of:

- Passenger transportation
- Fuel delivery
- Freight/mail delivery
- Mining support
- Energy/power infrastructure

Completion of this planning study provides a sound foundation for future tasks. Future tasks to advance the Yukon River Corridor include advanced route mapping, engineering and environmental field studies, engineering analysis, project implementation planning, and public involvement.


Locator Map
Barrow
Fairbanks
Anchorage
Juneau
Bethel
Unalaska
KOTZEBUE SOUND
NORTON SOUND
Yukon River Corridor
Noatak
Noatak National Preserve
Noatak Wilderness
Gates of the Arctic Wilderness
Noatak W&S River
Alatna W&S River
Salmon W&S River
Kobuk Valley National Park
Kobuk River
Kobuk Valley Wilderness
Selawik Wilderness
Selawik W&S River
Selawik National Wildlife Refuge
Bering Land Bridge National Preserve
Cape Krusenstern National Monument
Koyukuk National Wildlife Refuge
Koyukuk Wilderness
Kanuti National Wildlife Refuge
Yukon Flats National Wildlife Refuge
Dalton Highway Corridor Management Area
Dalton Highway
ANWR
White Mtn Nat'l Rec Area
Steese Highway
Elliott Hwy
Minto Game Flats
Tanana River
Nowitna National Wildlife Refuge
Nowitna W&S River
Innoko NWR
Innoko National Wildlife Refuge
Innoko Wilderness
Unalakleet W&S River
Andreafsky Wilderness
Andreafsky W&S Rivers
Yukon Delta National Wildlife Refuge
Denali National Park & Preserve
Denali Wilderness
George Parks Highway
Richardson Highway
Denali Highway
Koyukuk River
Yukon River
Kotzebue
Kiana
Noorvik
Selawik
Ambler
Shungnak
Kobuk
Bettles
Evansville
Wiseman
Venetie
Alatna
Allakaket
Hughes
Huslia
Beaver
Birch Creek
Stevens Village
Livengood
Rampart
Minto
Manley Hot Springs
Tanana
Fox
Ester
Fairbanks
Chena Hot Springs
North Pole
Nenana
Anderson
Healy
McKinley Park
Cantwell
Lake Minchumina
Petersville
Talkeetna
Skwentna
Nelchina
Chickaloon
Ruby
Poorman
Galena
Koyukuk
Nulato
Kaltag
Ophir
McGrath
Takotna
Medfra
Nikolai
Iditarod
Flat
Crooked Creek
Georgetown
Holy Cross
Grayling
Anvik
Shageluk
Unalakleet
Shaktoolik
Koyuk
Elim
White Mountain
Golovin
Solomon
Nome
Council
Candle
Buckland
Deering
Shishmaref
Diomede
Wales
Brevig Mission
Teller
King Island
Marys Igloo
Stebbins
Saint Michael
Kotlik
Bill Moores
Hamilton
Emmonak
Choolunawick
Alakanuk
Nunam Iqua
Scammon Bay
Mountain Village
Saint Mary's
Pilot Station
Marshall
Russian Mission
SCALE: 0 18.75 37.5 56.25 75 Miles
Communities
Study Area
Recommended Corridor Alternative
Significant Mineral Occurrence
Lesser Mineral Occurrence
National Park Service
U.S. Fish & Wildlife Service
Other Controlled Use/Management Area
Wild & Scenic Rivers
National Wilderness Preservation System
Iditarod Trail
Major Lakes
Major Rivers
Existing Roads
Data Sources Minerals: C.C. Hawley & M.K. Vant, February 2009 Land Status: Alaska Dept. of Natural Resources 2008
STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION
WESTERN ALASKA ACCESS PLANNING STUDY
RECOMMENDED CORRIDOR
Prepared By Allied GIS
DATE: January 14, 2010
Figure E1
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Corridor Selection Process

The corridor selection process included the following steps:

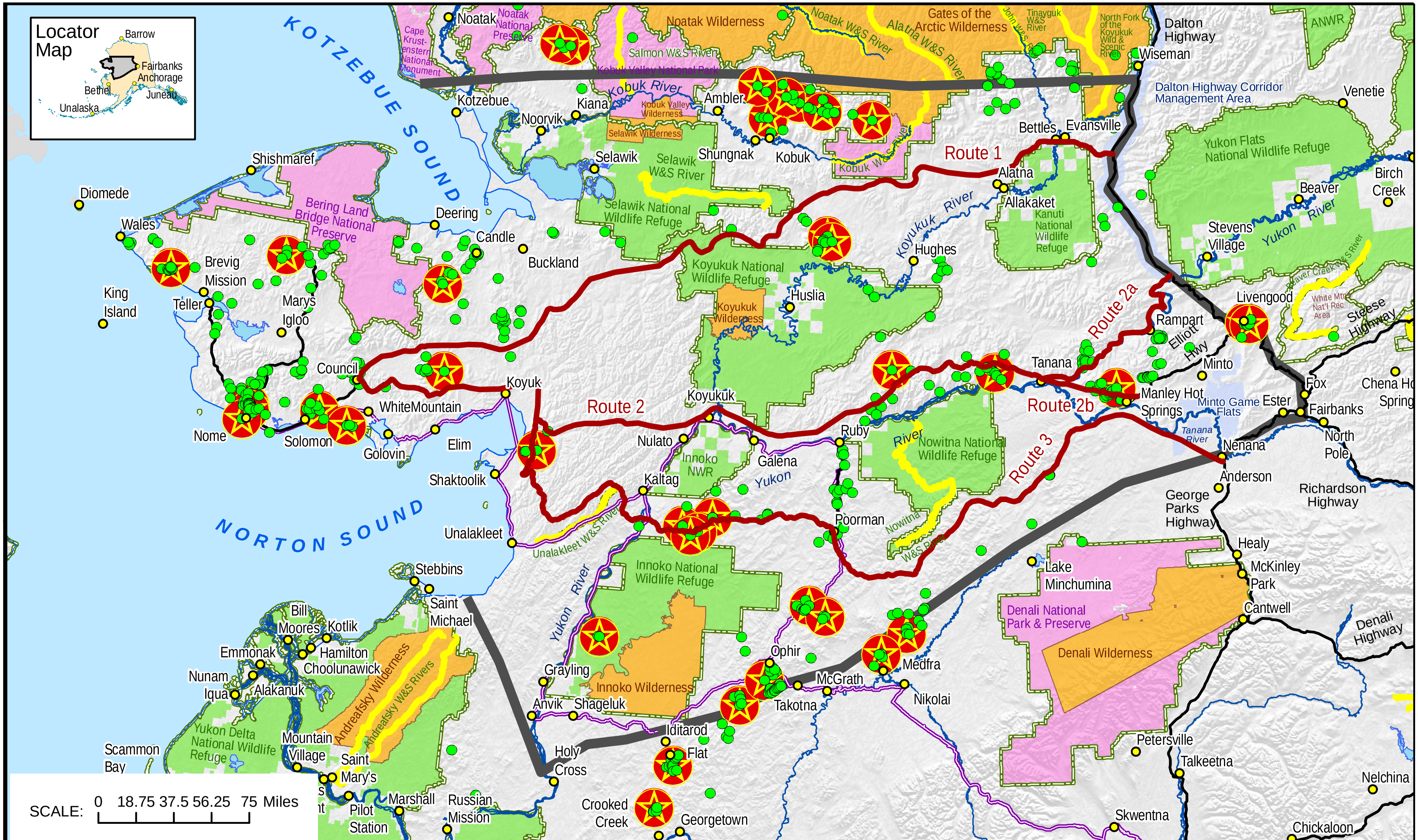
1. ***Review prior studies and historical corridors*** - over 200 documents were reviewed, including more than 80 transportation and engineering studies, and historical corridor mapping.
2. ***Identify corridor evaluation criteria*** - criteria included access to communities and mineral resources, environmental and land use constraints, and costs.
3. ***Define and evaluate preliminary corridor alternatives*** - evaluated four corridors considered in the north (Route 1), center (Routes 2a and 2b), and south (Route 3) of the study area.
4. ***Evaluate and refine the final two candidate corridors*** - evaluated Routes 1 and 2b.
5. ***Recommend corridor and next project development tasks*** - recommended Route 2b, the Yukon River Corridor.

Corridor Alternatives

The project team examined and modified historical routes to target community and resource development access while avoiding critical environmental and land management restrictions to the extent practical. East-west routes were narrowed down to four alternatives as shown in **Figure E2** and described as follows:

- Alternative ***Route 1*** in the north of the study area begins near Jim River on the Dalton Highway and trends roughly southwestward from its start point to its terminus at the Nome-Council Highway. This alternative was identified primarily for its ability to access the northern communities within the study area and the rich mineral district in the Ambler area.

- Alternative ***Route 2a*** begins just north of the Yukon River on the Dalton Highway and trends southwestward from its start point to Tanana, where it strikes out almost directly westward to its terminus at the Nome-Council Highway. Route 2a was identified primarily for its ability to access the communities and mineral resources along the Yukon River and to take advantage of the Yukon River bridge on the Dalton Highway.



Communities
Study Area
Preliminary Corridor Alternatives
Significant Mineral Occurrence
Lesser Mineral Occurrence
National Park Service
U.S. Fish & Wildlife Service
Other Controlled Use/Management Area
Wild & Scenic Rivers
National Wilderness Preservation System
Iditarod Trail
Major Lakes
Major Rivers
Existing Roads

Data Sources Minerals: C.C. Hawley & M.K. Vant, February 2009 Land Status: Alaska Dept. of Natural Resources 2008

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NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY
PRELIMINARY CORRIDOR ALTERNATIVES

Prepared By Allied GIS

DATE: January 14, 2010

Figure E2

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- Alternative ***Route 2b*** begins just outside of Manley Hot Springs on the Elliott Highway and trends almost directly westward from its start point to its terminus at the Nome-Council Highway. This alternative uses nearly 70 miles of existing road to reach Western Alaska. Like Route 2a, Route 2b was identified primarily for its ability to facilitate access to the communities and mineral resources along the Yukon River.

- Alternative ***Route 3*** begins near Nenana on the Parks Highway and trends westward from its start point, sweeping widely to the south to avoid mountainous terrain and federal conservation lands, then turning north near the Seward Peninsula and terminating at the Nome-Council Highway. Route 3 was identified primarily for its ability to facilitate access to the communities and mineral resources in the southern portion of the study area.

Alternatives Evaluation

Preliminary Evaluation - The project team evaluated four preliminary alternatives and selected Routes 1 and 2b for further consideration because they provided the greatest resource and community access, at the least cost, and with the fewest overall environmental and land use conflicts.

Refined Evaluation - The project team conducted a more detailed evaluation of Routes 1 and 2b, including route refinement, further engineering evaluation, potential for energy and intermodal connectivity, and costs. Although both alternatives present distinct advantages, Route 1 has several disadvantages. Route 1 crosses portions of the Koyukuk and Selawik National Wildlife Refuges, a serious weakness due to the lengthy and cumbersome process for permitting transportation access across these lands. Although Route 1 would provide access to the rich Ambler mining district, it would provide only limited community access. Additionally, it is a more circuitous route that runs 200 miles north of Fairbanks before turning west and then southwest to the Seward Peninsula.

Recommended Alternative

After careful analysis, the project team recommended Route 2b, the Yukon River Corridor, because it most directly meets the project purpose, has significant potential benefits, and minimizes environmental and land management impacts. Advantages and challenges of this recommended corridor are summarized on Page VII. The Yukon River Corridor provides the most direct access between Fairbanks and Nome, it accesses numerous communities and resources along the way, it is well-suited for phased construction, it has potential for intermodal links to barge traffic on the Yukon River and connections to Donlin Creek and the Ambler mining district, and it avoids sensitive federal conservation lands.

Project Costs

At a length of 500 miles, the Yukon River Corridor has an estimated total project cost of $2.3 to $2.7 billion. This cost range includes construction costs of the road, bridges, and maintenance stations, as well as engineering, environmental mitigation, and right-of-way acquisition costs, and a 20% contingency.

At this early planning stage, limited engineering and geotechnical information is available to develop precise cost estimates, so a cost range and large contingencies are included. As more mapping and in-field geotechnical and engineering investigations are completed in later phases, the estimated costs will become more precise. Some of the greatest cost uncertainties, to be addressed in later engineering phases, include:

- Cost effects of construction through approximately 135 miles of rolling terrain, 65 miles of mountainous terrain, and 185 miles of estimated wetlands
- Soil conditions in the corridor and the availability of construction material sources in close proximity to the corridor
- Further definition of the number and types of bridges to be constructed
- The effect of economies of scale and project phasing on costs of individual segments
- Anticipated construction climate at the time of construction (inflation, competition from other major projects such as the gas pipeline)

Annual routine maintenance costs for the Yukon River Corridor road and associated maintenance facilities are estimated at $14.9 million per year, and the annual cost for road resurfacing and rehabilitation is estimated at $25 million per year.

Yukon River Corridor (Route 2b)

Advantages	***Challenges***
• Access to communities and resource sites along Yukon River • Greatest population served of alternatives • Does not cross any federal conservation lands • Potential to enhance intermodal transportation system (Yukon River barges) • Uses approximately 70 miles of existing highway • Potential to link to Ambler mining district within the study area and to Donlin Creek Mine outside the study area • Fewest land and environment impacts • Creates shortest travel distance between Fairbanks and Nome • Appropriately situated for phased construction	• Significantly less mineral value in proximity to corridor than some other alternatives • Higher estimated cost to construct than some other alternatives • Topography (steep grades, mountainous terrain) • New Yukon River crossing required

ECONOMIC BENEFITS

Economic benefits were estimated for selected case study communities and mines accessible from the Yukon River Corridor to give a generalized indication of the benefits of the corridor. Other communities and mines accessible from the corridor would likely experience similar benefits to those for the case study targets, thus total regional benefits would exceed those presented for the case study communities and mines. Case study communities include Tanana, Ruby, Galena, Koyukuk, Koyuk, and Nome. Case study mines include Ambler, Donlin, Illinois Creek, and a placer mine example. The project team's anticipated and estimated economic benefits are summarized as follows under the headings of Communities, Mines, Energy/Power Infrastructure, and Other Socioeconomic Effects.

Communities

- ***Fuel, Freight, and Mail*** - A road would enable fuel, freight, and mail deliveries year-round by truck and at potentially lower transportation costs. ***Fuel, freight, and mail transport costs for the six case study communities would decrease by about $19.1 million per year if road transportation were used.*** This is a savings of $3,900 per person per year if a road were available, although not all of the savings would accrue to the residents of the case study communities; some savings would go to the United States Postal Service, for example. There are five additional communities with a combined population of approximately 770 within 20 miles of the Yukon River Corridor. While the benefits of the corridor would decline as one moves further away from the road, extrapolating the $3,900 annual savings per person to the population of the non-case study communities would yield an additional savings of $3 million per year.

Table E1: Estimated Annual Cargo, Fuel, and Bypass Mail Savings ($)

Category	Community Savings ($)						
	Tanana	**Ruby**	**Galena**	**Koyukuk**	**Koyuk**	**Nome**	**Total**
Fuel Savings	124,000	113,000	733,000	49,000	56,000	0	1,075,000
Cargo	152,000	85,000	665,000	79,000	367,000	7,838,000	9,186,000
Bypass Mail	215,000	420,000	498,000	130,000	452,000	7,150,000	8,865,000
Total	**491,000**	**618,000**	**1,896,000**	**258,000**	**875,000**	**14,988,000**	**19,126,000**

Source: Northern Economics, Inc., estimates, 2009, from data provided by Logistic Solution Builders, n.d.; Jansen, 2009; Sweetsir, 2009; Ruby Marine, 2009; Sweeney, 2009.

- ***Passenger Transportation -*** A road would provide more affordable and flexible options for year-round passenger travel between communities and regional hubs and to the Interior and Seward Peninsula Highway systems. ***Passenger cost savings by road will be largest for longer distance trips and where more passengers are travelling together.***

Mines

- A road would support the exploration, development, and operations of mining projects by providing a less expensive method of shipping supplies and fuel into the mines and transporting mining concentrates out of the mines. ***Transport of freight and fuel into the case study mines and concentrate out could save an estimated $120 million per year.***

Table E2: Comparison of Potential Mine Transportation Annual Cost Savings

	Inbound		Outbound	Total
	Freight	Fuel	Concentrate	
Without Corridor Cost ($)	136,200,000	57,000,000	121,600,000	314,800,000
With Corridor Cost ($)	54,870,000	38,880,000	100,900,000	194,650,000
Savings ($)	**81,330,000**	**18,120,000**	**20,700,000**	**120,150,000**

Source: Northern Economics, Inc., estimates based on North Pacific Mining, 1993; CH2M Hill, 2004; Jansen, 2009; Logistics Solution Builders, n.d.; Sweetsir, 2009; Ruby Marine, 2009; Sweeney, 2009; Office of Coast Survey, 2009; Hawley, 2009; Hughes, 2009; Fueg, 2009; Donlin Creek Mine, LLC, 2009.

Energy/Power Infrastructure

- ***Community Fuel Costs - Conversion from barged diesel fuel to trucked propane would save an estimated $13.5 million per year for case study communities, or about $2,700 per person per year.***

Table E3: Annual Fuel Cost Savings with Trucked Propane

Scenario	Community Savings ($)						
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome	Total
Current MMBtu[1] Consumed	30,000	20,000	160,000	10,000	40,000	850,000	1,110,000
Barged Diesel Cost per MMBtu ($)	20.67	23.48	21.48	30.81	18.74	17.48	18.416
Trucked Propane Cost per MMBtu ($)	5.11	5.51	5.58	5.65	6.05	6.47	6.27
Cost Change per MMBtu ($)	-15.56	-17.97	-15.9	-25.16	-12.69	-11.01	-12.15
Total Annual Savings	**466,800**	**359,400**	**2,544,000**	**251,600**	**507,600**	**9,358,500**	**13,487,900**

Source: Northern Economics, Inc., estimates based on Alaska Village Electric Cooperative, 2009; Sweetsir, 2009; Logistic Solution Builders, n.d.

Note 1: MMBtu - million British thermal units

- ***A road corridor would reduce the costs of building pipeline and electrical transmission infrastructure by between 30% and 50%.*** For example, a road corridor could reduce the costs of a pipeline to Donlin Creek from Manley Hot Springs by between $800 million to $1 billion and the cost on an electrical transmission line by $100 million to $200 million. Communities along the pipeline or electrical route would see significant fuel/power cost reductions.

Rail Infrastructure

The potential for a rail connection to Western Alaska was investigated, but the road corridor was determined to be more practical and cost effective to construct at this time. A rail would likely require a significantly different and longer alignment at a higher construction cost per mile than the road. However, an existing road in proximity to a future rail line would contribute to substantially lower construction and maintenance costs for the rail.

Other Socioeconomic Effects

While there could be some negative subsistence and social disruption effects, potential socioeconomic benefits will be substantial, and will vary across the study area.

- Increased resource development—in particular, mining—will increase standard of living, jobs, per capita income, and financial self-sufficiency. ***Based on experience at the Red Dog Mine, case study mines would yield 1,590 new jobs with an average wage of $7,000 per month.***
- Road access could ***increase access to public services*** such as education, health care, and emergency/safety services (police, fire, rescue).
- Road access would ***reduce costs of other community capital improvements***.
- A road could provide ***increased resident access to subsistence areas***.

NEXT STEPS

The following steps are recommended to advance the Yukon River Corridor reconnaissance engineering phase.

- ***Public Involvement* -** Obtain broad public and stakeholder input on the project, particularly from Native communities, organizations, and tribal governments, and mine owners who will benefit from the project.

- ***Advance Route Mapping* -** Conduct LIDAR or other aerial photo based mapping for use in corridor refinement, preliminary engineering, and environmental studies.
- ***Field Studies* -** Begin engineering field investigations (geotechnical, topographic) of the route and conduct environmental investigations.
- ***Engineering Analysis* -** Use the field studies and mapping to further define the corridor, design criteria, and costs.
- ***Implementation Planning* -** Further define segment construction phasing, right-of-way acquisition, funding, and related implementation issues.

1.0 INTRODUCTION

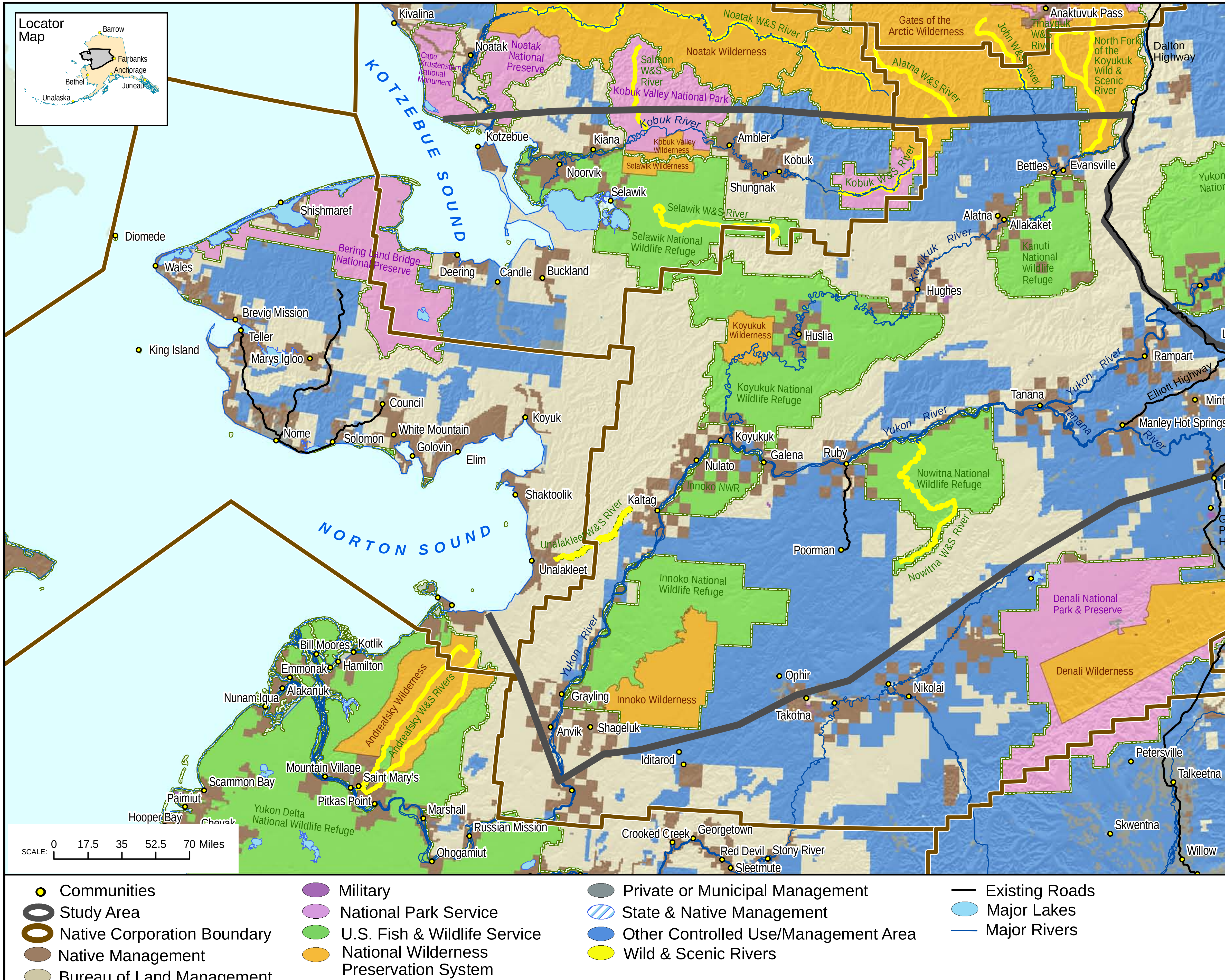
The Western Alaska Access Planning Study (WAAPS) evaluates the location and benefits of a recommended road corridor through Western Alaska that would connect the isolated highway system of the Seward Peninsula with the contiguous Interior Alaska highway system. The purpose of this connection is to facilitate community and resource development in the study area of Western Alaska, shown in **Figure 1**.

In August 2008, the State of Alaska Department of Transportation and Public Facilities (DOT&PF) began this study. The study consists of two primary planning efforts. The data collection and inventory effort was completed in March 2009 and is published separately as the Inventory Report. The corridor alternatives analysis was completed in January 2010 and is published herein as the Corridor Planning Report.

The Inventory Report is essentially a reference document presenting a large amount of information on historic transportation studies and resources within the WAAPS study area. The consulting team researched information about potential corridors, identified resource development potential within the region, and prepared an economic analysis of resources within the study area. Minerals, oil and gas, agriculture, forestry, community economic activity, fisheries, recreation, and tourism resources were evaluated within the region, and minerals were determined to be the dominant resource with sufficient potential value to influence corridor location. The Inventory Report concluded that a road connection would provide needed infrastructure for:

- Resource exploration and development
- Community development
- Transmission of natural gas and/or electrical power to mineral resource areas and communities

The corridor planning portion of the WAAPS study consists of an engineering and economic analysis of corridor alternatives, building on the information developed for the Inventory Report. The Corridor Planning Report evaluates potential road corridor locations, evaluates the benefits of a proposed corridor, and identifies actions needed for future phases of the study, including construction. It reviews corridors from historical studies and identifies and evaluates four preliminary corridor alternatives to connect the Interior highway system to the Seward Peninsula highway system. A refined analysis of the two best alternatives leads to selection of a recommended corridor. The report culminates with an economic analysis of the recommended corridor and a discussion of implementation issues.



STATE OF ALASKA
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WESTERN ALASKA ACCESS PLANNING STUDY
STUDY AREA MAP

Prepared By Allied GIS

DATE: January 14, 2010

Figure 1

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2.0 CRITERIA AND CONSTRAINTS

A wide variety of evaluation criteria and constraints could affect the feasibility of a road corridor. Prior to identifying potential corridor alternatives, these various criteria and constraints were investigated with two purposes in mind:

1. To assist with siting corridor alternatives by identifying areas desirable to reach with a road and areas to avoid.
2. To establish screening criteria by which the road corridor alternatives would be measured and compared.

Criteria and constraints considered within the WAAPS study area are discussed in the following sections under the headings of: Communities, Mineral Resources, Land Ownership and Management, Environment, and Engineering and Costs. The criteria selected for use in the preliminary corridor alternatives screening analysis were developed based on the following primary principles:

- To identify corridor alternatives that could maximize access to the population in the study area,
- To identify corridor alternatives that could maximize access to mineral resources in the study area,
- To identify corridor alternatives that could minimize negative environmental and land use impacts, and
- To identify corridor alternatives that could minimize construction and maintenance and operations (M&O) costs.

Additionally, preliminary screening criteria were selected based on availability of quantifiable data that could be used to compare alternatives. Some criteria that were originally considered in the constraints analysis were not ultimately used in the screening process due to inadequate data. For example, subsistence and cultural or historical resources were initially proposed as evaluation criteria, but the existing data for these criteria is insufficient to adequately evaluate the impact of a road corridor on these resources. Subsistence and cultural or historical resources will be addressed and studied in greater detail in later phases of the project.

2.1 Communities and Mineral Resources

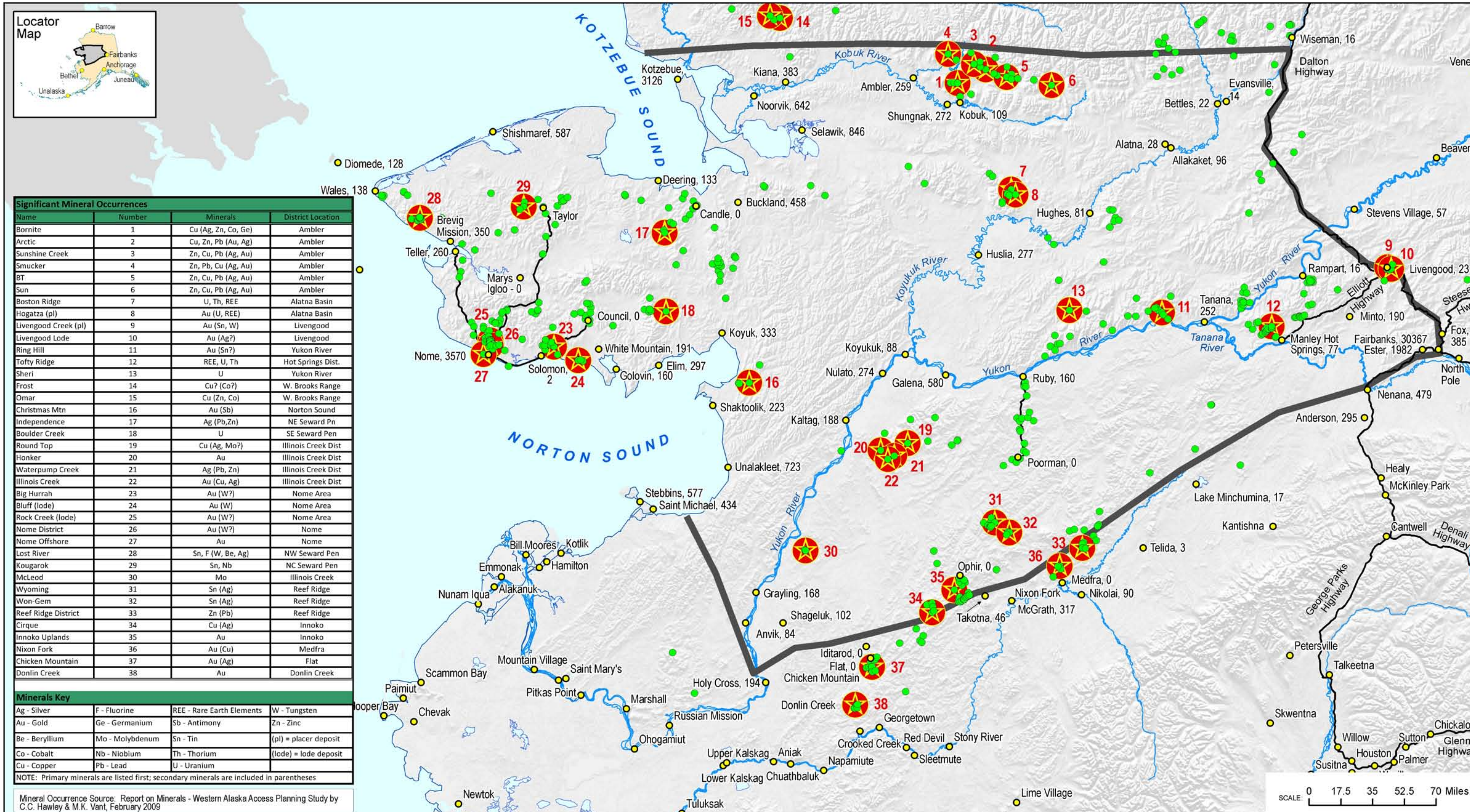
The purpose of a road corridor through Western Alaska is to facilitate community and resource development within the region. Communities and resource areas were initially mapped and described separately in the Inventory Report. In the Corridor Planning Report, communities and primary mineral resource nodes within or near the study area were mapped together (**Figure 2**) to depict areas with the greatest potential population to be served by a new road and areas with the highest mineral resource potential. While non-mineral resources were considered initially, they were not evaluated for corridor planning purposes because minerals were the only resource determined to be of sufficient value to drive corridor siting decisions. It was assumed that most populated communities and mineralized areas near the corridor will be connected to the corridor by secondary access roads.

A wide range of information was considered, and ultimately five distinct, measurable criteria were selected for use in the corridor alternatives screening exercise. These criteria are described in the sections that follow. Supplemental information gathered on communities and mineral resources may be found, respectively, in Appendix A and Appendix B. Corridor alternatives are presented in Chapter 3, and the data values for the communities and mineral resources criteria are presented in Chapter 4.

2.1.1 Communities

Communities are shown on **Figure 2** and are labeled with 2008 Alaska Department of Commerce, Community, and Economic Development (DCCED) certified or estimated population. Communities can be found primarily at the foot of the Brooks Range along the northern boundary of the study area, along the Koyukuk and Yukon Rivers, in the Kuskokwim foothills along the southern boundary of the study area, and along the coast of the Seward Peninsula and Norton Sound.

Connecting isolated communities to the state highway system and to their regional hub communities with a road corridor would encourage economic development and improve access to goods and services for these communities. In order to identify corridor alternatives that optimize community development opportunities and facilitate improved community access in Western Alaska, three criteria were devised for screening purposes.



Significant Mineral Occurrences			
Name	Number	Minerals	District Location
Bornite	1	Cu (Ag, Zn, Co, Ge)	Ambler
Arctic	2	Cu, Zn, Pb (Au, Ag)	Ambler
Sunshine Creek	3	Zn, Cu, Pb (Ag, Au)	Ambler
Smucker	4	Zn, Pb, Cu (Ag, Au)	Ambler
BT	5	Zn, Cu, Pb (Ag, Au)	Ambler
Sun	6	Zn, Cu, Pb (Ag, Au)	Ambler
Boston Ridge	7	U, Th, REE	Alatna Basin
Hogatza (pl)	8	Au (U, REE)	Alatna Basin
Livengood Creek (pl)	9	Au (Sn, W)	Livengood
Livengood Lode	10	Au (Ag?)	Livengood
Ring Hill	11	Au (Sn?)	Yukon River
Tofty Ridge	12	REE, U, Th	Hot Springs Dist.
Sheri	13	U	Yukon River
Frost	14	Cu? (Co?)	W. Brooks Range
Omar	15	Cu (Zn, Co)	W. Brooks Range
Christmas Mtn	16	Au (Sb)	Norton Sound
Independence	17	Ag (Pb,Zn)	NE Seward Pn
Boulder Creek	18	U	SE Seward Pen
Round Top	19	Cu (Ag, Mo?)	Illinois Creek Dist
Honker	20	Au	Illinois Creek Dist
Waterpump Creek	21	Ag (Pb, Zn)	Illinois Creek Dist
Illinois Creek	22	Au (Cu, Ag)	Illinois Creek Dist
Big Hurrah	23	Au (W?)	Nome Area
Bluff (lode)	24	Au (W)	Nome Area
Rock Creek (lode)	25	Au (W?)	Nome Area
Nome District	26	Au (W?)	Nome
Nome Offshore	27	Au	Nome
Lost River	28	Sn, F (W, Be, Ag)	NW Seward Pen
Kougarok	29	Sn, Nb	NC Seward Pen
McLeod	30	Mo	Illinois Creek
Wyoming	31	Sn (Ag)	Reef Ridge
Won-Gem	32	Sn (Ag)	Reef Ridge
Reef Ridge District	33	Zn (Pb)	Reef Ridge
Cirque	34	Cu (Ag)	Innoko
Innoko Uplands	35	Au	Innoko
Nixon Fork	36	Au (Cu)	Medfra
Chicken Mountain	37	Au (Ag)	Flat
Donlin Creek	38	Au	Donlin Creek

Minerals Key			
Ag - Silver	F - Fluorine	REE - Rare Earth Elements	W - Tungsten
Au - Gold	Ge - Germanium	Sb - Antimony	Zn - Zinc
Be - Beryllium	Mo - Molybdenum	Sn - Tin	(pl) = placer deposit
Co - Cobalt	Nb - Niobium	Th - Thorium	(lode) = lode deposit
Cu - Copper	Pb - Lead	U - Uranium	
NOTE: Primary minerals are listed first; secondary minerals are included in parentheses			

Mineral Occurrence Source: Report on Minerals - Western Alaska Access Planning Study by C.C. Hawley & M.K. Vant, February 2009

- Community, Population (DCCED 2008)
- Study Area
- Significant Mineral Occurrence
- Lesser Mineral Occurrence
- Existing Roads
- Major Lakes
- Major Rivers

Note: Refer to Appendix B for further details on mineral occurrences and values.

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WESTERN ALASKA ACCESS PLANNING STUDY
COMMUNITIES AND MINERAL RESOURCE OCCURRENCES

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DATE: January 14, 2010

Figure 2

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<u>Community Criterion 1</u>: Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities - The objective of this criterion is to favor alternatives that have the potential to benefit the greatest population near the corridor. Fifty miles was selected as an upper-limit distance within which communities could most likely benefit from being in proximity to the corridor. It is not expected that road access would be constructed between all of the corridors and communities within 50 miles of the corridor. Rather, some communities farther from the corridor would benefit from improved access to the highway system using snowmobiles, dog sleds, or short flights by air to reach the new corridor.

<u>Community Criterion 2</u>: Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities - The objective of this criterion, much like Community Criterion 1, is to favor alternatives that have the potential to benefit a greater population and more feasibly facilitate community development and improve access. A 20-mile access road would be more viable to construct than a 50-mile access road, thereby making this criterion especially significant in identifying corridors that could potentially connect to communities with road access.

<u>Community Criterion 3</u>: Total distance between Fairbanks and Nome along corridor - The objective of this criterion is to favor alternatives that minimize the total distance between the major economic hubs at either end of the corridor, Fairbanks and Nome. The greatest benefit of providing road access to Fairbanks and Nome would be realized by the shortest travel distance to reach them.

The community criteria were measured with ArcGIS software. Communities already accessible from Fairbanks via the existing Interior contiguous highway system or from Nome via the Seward Peninsula highway system were not included in the tally of population within 50 or 20 miles of each corridor. Although communities accessible via the Seward Peninsula highway system would benefit from a road corridor connection to the Interior highway system, the populations of these communities were not included in the totals because no new access roads would be required to reach these communities.

2.1.2 Mineral Resources

The WAAPS study area contains a significant portion of Alaska's mineral endowment. The area has produced millions of ounces of gold and silver and millions of pounds of tin and has demonstrated resource potential that greatly exceeds the historic totals in quantity and value. In addition to gold, silver, and tin, the study area holds copper, lead, zinc, and rare metals. Large parts of the region are remote with limited surface transportation accessibility. This remoteness has inhibited exploration, discovery, evaluation, and development of the region's vast mineral wealth. Data is limited for much of the region's mineral resource because only a select number of mineral sites have been adequately explored to produce estimates of mineral volumes and values.

Mineral occurrences are shown as circled stars or green dots on **Figure 2**. The circled stars represent significant mineral occurrences. A "significant occurrence," as described in the Inventory Report, is considered sufficiently large and valuable to influence location of resource access corridors and development of smaller deposits. The primary and secondary minerals expected to be found at each significant occurrence, as well as the name of the mineral district in which the occurrence lies, are provided in the table inset in the map. This information is also included in Appendix B.

Over 400 lesser mineral occurrences are depicted by the green dots on **Figure 2**. Many of these lesser occurrences lie within close proximity to the significant occurrences and are part of the same rich mineral districts. Very little data exists to determine resource value estimates of these lesser mineral occurrences, so the lesser occurrences were not quantified in the corridor screening process. Access roads built from the corridor to significant mineral sites would likely benefit these lesser occurrences, as the roads would facilitate exploration and development that might be unfeasible otherwise.

Oil, gas, and coal resources are not included on **Figure 2**; these hydrocarbon resources have been estimated at such low potential and value within the study area as to preclude influence on corridor alignment. **Figure 2** shows several east-west trending "belts" of mineral resources within the study area with concentrations of mineral occurrences along the foothills of the Brooks Range, along the Koyukuk and Yukon Rivers, along the southern boundary of the study area, and on the Seward Peninsula. The most significant—and potentially the most valuable—concentration of mineral occurrences within the study area can be found in the Ambler District. Donlin Creek, which is outside the study area, is potentially the most valuable occurrence shown.

The State of Alaska's mineral policy includes a directive that mineral development and the entry into the market place of mineral products be considered in developing a statewide transportation infrastructure system (A.S. 44.99.110). In order to identify corridor alternatives that optimize opportunities for mineral exploration and development, two criteria were devised for screening purposes.

Resources Criterion 1: Total estimated gross value of significant mineral resources within 100 miles of corridor - The objective of this criterion is to favor alternatives with the greatest estimated gross value of significant mineral resources potentially available within 100 miles of the corridor. The figure of 100 miles was selected as an upper-limit distance within which mining companies could potentially build access roads from significant mineral occurrences to connect with the corridor.

Resources Criterion 2: Total estimated gross value of significant mineral resources within 50 miles of corridor - The objective of this criterion is to favor alternatives with the greatest estimated gross value of significant mineral resources potentially available within 50 miles of the corridor. The figure of 50 miles was selected as a more viable distance within which mining companies could potentially build access roads from mineral sites to connect with the corridor.

ArcGIS software was used to identify significant mineral occurrences within 50 and 100 miles of each corridor. Mineral occurrences accessible via the existing Interior contiguous highway system were not included. Resource values were determined with a combined method of well-developed and documented estimates for some occurrences and modeled values of other occurrences. This method is summarized in Appendix B, and a summary of estimated and modeled values for the significant mineral occurrences mapped on **Figure 2** is presented in **Table 1**. The table includes all significant mineral occurrences within and near the study area and not just those used to estimate resource values within proximity to the corridor alternatives.

Table 1: Estimated Gross Mineral Values for Significant Mineral Occurrences Within and Near the Western Alaska Access Planning Study Area

Map Number	Site Name	Minerals	Total Estimated Gross Value in Dollars
1	Bornite	Cu (Ag, Zn, Co, Ge)	$4,116,500,000
2	Arctic	Cu, Zn, Pb (Au, Ag)	$10,080,600,000
3	Sunshine Creek	Zn, Cu, Pb (Ag, Au)	$886,100,000
4	Smucker	Zn, Cu, Pb, Ag (Au)	$3,747,500,000
5	BT	Zn, Cu, Pb (Ag, Au)	$751,000,000
6	Sun	Zn, Cu, Pb (Ag, Au)	$4,659,000,000
7	Boston Ridge	U, Th, REE	$1,030,000,000
8	Hogatza (pl)	Au (U, REE)	$116,000,000
9	Livengood Creek (pl)	Au (Sn, W)	$463,900,000
10	Livengood Lode	Au (Ag?)	$12,524,000,000
11	Ring Hill	Au (Sn?)	$101,200,000
12	Tofty Ridge	REE, U, Th	See note 6
13	Sheri	U	$1,030,000,000
14	Frost	Cu? (Co?)	Not modeled
15	Omar	Cu (Zn, Co)	$36,000,000
16	Christmas Mtn	Au (Sb)	$101,200,000
17	Independence	Ag (Pb, Zn)	$404,700,000
18	Boulder Creek	U	$50,000,000
19	Round Top	Cu (Ag, Mo?)	$3,824,900,000
20	Honker	Au	$232,000,000
21	Waterpump Creek	Ag (Pb, Zn)	$81,700,000
22	Illinois Creek	Au (Cu, Ag)	$308,000,000
23	Big Hurrah	Au (W?)	$92,700,000
24	Bluff (lode)	Au (W)	$209,000,000
25	Rock Creek (lode)	Au (W?)	$784,200,000
26	Nome District	Au (W?)	$1,010,400,000
27	Nome Offshore	Au	$463,500,000
28	Lost River	Sn, F (W, Be, Ag)	$1,080,000,000
29	Kougarok	Sn, Nb	$169,300,000
30	McLeod	Mo	$339,900,000
31	Wyoming	Sb	Not modeled
32	Wonder-Gemini	Sn (Ag)	$150,900,000
33	Reef Ridge District	Zn (Pb)	$180,000,000
34	Cirque	Cu (Ag)	$64,000,000
35	Innoko Uplands	Au	$97,800,000
36	Nixon Fork	Au (Cu)	$92,700,000
37	Chicken Mountain	Au (Ag)	$653,100,000
38	Donlin Creek	Au	$36,459,000,000

Minerals Key
Ag - Silver
Au - Gold
Be - Beryllium
Co - Cobalt
Cu - Copper
F - Fluorine
Ge - Germanium
Mo - Molybdenum
Nb - Niobium
Pb - Lead
REE - Rare Earth Elements
Sb - Antimony
Sn - Tin
Th - Thorium
U - Uranium
W - Tungsten
Zn - Zinc
(pl) = placer deposit
(lode) = lode deposit
Ag - Silver
Au - Gold
Be - Beryllium
Co - Cobalt
Cu - Copper

Notes:

1. Primary minerals are listed first; secondary minerals are included in parentheses.
2. Estimated Gross Value calculated from industry-reported data on volume and grade or from geologically-modeled volumes and grades.
4. Current values for common metals derived from a 3-month average ending July 15, 2009:
   • Au = $927.70/oz • Ag = $13.79/oz • Cu = $2.2997/lb
   • Pb = $0.7462/lb • Zn = $0.6985/lb
5. Current values for less common metals from metalprices.com on July 15, 2009:
   • Mo = $11.00/lb • Sb = $2.50/lb
   • Sn = $6.00/lb • U as U308 = $50.00/lb
6. Current unit values for Th, Nb, and REE not yet determined.

2.2 Land Ownership and Management

The land ownership and management criteria evaluate the difficulty of obtaining permits and right-of-way (ROW) for the corridor. Land ownership and management considerations include ownership status, permitting or purchasing processes and constraints, approximate acquisition timeframes, and probability of success. An overview of these considerations is provided within this section, and additional details involved with ROW permitting and acquisition are provided in Appendix C.

General land ownership within the study area includes federal lands, Native lands, other private lands, and state lands. The majority of the lands within the study area are federally and state owned, and within federal and state lands, there are designated areas of special use/management. Designated areas within federal lands include the conservation system units (CSUs). **Figure 3** depicts the general land ownership and management status within the study area. **Table 2** summarizes the land interests required, primary agencies involved, timeframes, and probability of success of obtaining land interests for the various land status types.

Table 2: Permit and Right-of-Way Acquisition

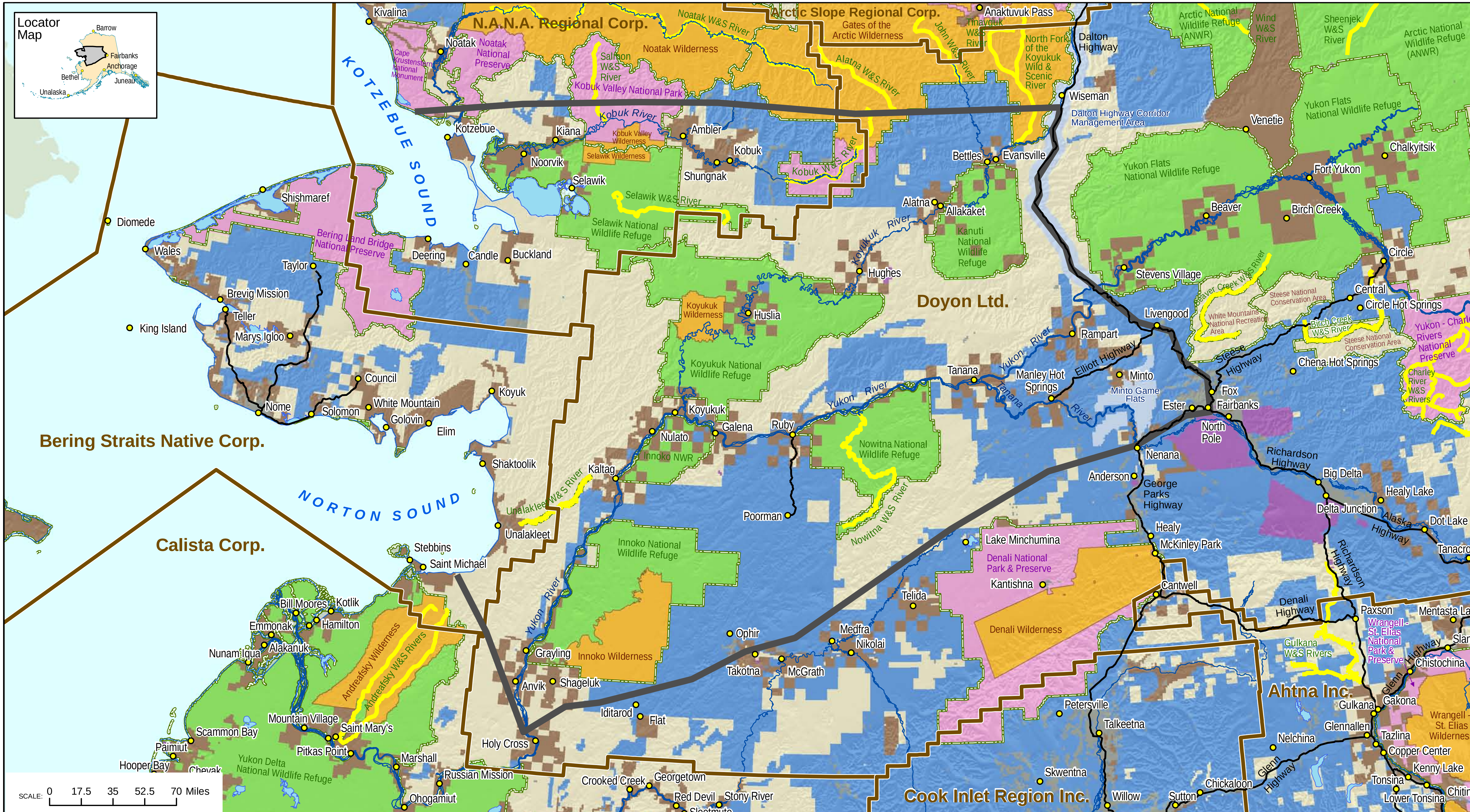
Land Status	Interest to be Acquired	Primary Agency Involvement	Approximate Acquisition Timeframe	Probability of Success
Federal CSUs - National Parks, Preserves, Monuments, or Wildlife Refuges	Transportation and Utility System (TUS) ROW Permit	United States Fish and Wildlife Service (USFWS), National Park Service (NPS), Bureau of Land Management (BLM), and/or United States Army Corps of Engineers (USACE)	6-10 years	Poor
Other Federal Lands (non-CSU Lands)	ROW Permit	BLM	18-48 months	Good
Native Lands (Private)	Fee simple or ROW Easement	Each Native ownership entity	6-18 months	Good
Other Private Lands	Fee simple or ROW Easement	Private owner	6-18 months	Good
State Lands	Interagency Land Management Assignment (ILMA) or ROW Permit/Lease	State of Alaska Department of Natural Resources (DNR)	6-18 months	Very Good

2.2.1 Federal Conservation System Units - National Parks, Preserves, Monuments, or Wildlife Refuges

About one-quarter of the land within the study area is federally owned, managed, and protected as CSUs. The National Park Service (NPS), United States Fish and Wildlife Service (USFWS), and United States Army Corps of Engineers (USACE) manage CSU lands designated as wildlife refuges, wilderness areas, wild and scenic rivers, or national parks, preserves, and monuments. Protected federal lands within the study area, depicted in **Figure 3**, include the following:

- Bering Land Bridge National Preserve
- Gates of the Arctic National Park and Preserve & Wilderness Area
- Kobuk Valley National Park & Wilderness Area
- Noatak National Preserve
- Cape Krusenstern National Monument
- North Fork of the Koyukuk Wild & Scenic River
- Kobuk Wild & Scenic River
- Selawik Wild & Scenic River
- Nowitna National Wildlife Refuge
- Innoko National Wildlife Refuge & Wilderness Area
- Kanuti National Wildlife Refuge
- Koyukuk National Wildlife Refuge & Wilderness Area
- Selawik National Wildlife Refuge & Wilderness Area
- Nowitna Wild & Scenic River
- Unalakleet Wild & Scenic River

Title XI of Alaska National Interest Lands Conservation Act (ANILCA) governs the procedures for permitting a Transportation and Utility System (TUS) in and across federal CSU lands. Of all the land statuses within the study area, rights across any CSU lands will be the most difficult to obtain, and the permitting process is especially difficult to navigate because of the many steps and agencies involved. Given the sheer volume of agency and public involvement necessitated by the process, it is anticipated that the entry application would become a politically charged issue that could be faced with extensive agency, political, and public opposition. In addition, the entire TUS is disapproved if any portion of it is disapproved by an appropriate agency. The State of Alaska has never successfully navigated through the TUS permitting process, and the probability of being granted such a permit is poor. Additionally, if the state should prove successful, the issued permit would only be valid for 20 years. After that time, the DOT&PF would need to reapply for a new permit, regardless of whether any improvements had been constructed within the permitted area.



- Communities
- Study Area
- Native Corporation Boundary
- Native Management
- Bureau of Land Management
- Military
- National Park Service
- U.S. Fish & Wildlife Service
- National Wilderness Preservation System
- Private or Municipal Management
- State & Native Management
- State Management
- Other Controlled Use/Management Area
- Wild & Scenic Rivers
- Existing Roads
- Major Lakes
- Major Rivers

Landstatus Source: Alaska Dept. of Natural Resources

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LAND OWNERSHIP

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Figure 3

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When a proposed TUS crosses a designated wilderness area, the permitting procedures become even more complex and time-intensive, ultimately involving the President of the United States (U.S.) and the U.S. Congress for approval. It is most likely that the permit application would be denied. It is therefore recommended that all alternatives avoid crossing any wilderness area.

2.2.2 Other Federal Lands

A significant portion of the land within the study area is federally owned and not within a CSU. The Bureau of Land Management (BLM) is the primary land manager of these non-CSU federal lands. Some of the federal lands include state- or Native-selected lands that have not yet been conveyed. Non-CSU federal lands - those not within a national park, preserve, monument, or wildlife refuge - are subject to typically less intensive procedures for ROW permitting. Applications for a ROW permit across these non-CSU federal lands within the study area will be processed by the BLM and reviewed by multiple agencies.

An 18- to 48-month permitting timeframe assumes a best case situation, in which no difficulties are encountered. Difficulties that may be encountered during the application process include additional coordination with an entity that has selected federal lands, land withdrawals, non-compliance of the proposed DOT&PF use of the land with existing land use management plans or classifications, agency and/or public opposition to the proposed use, or inability to come to an agreement on allowed terms of use and fees. Most of these difficulties can be overcome; however, the acquisition timeframe would extend to accommodate their resolution.

2.2.3 Native Lands

Native lands are private lands. The Alaska Native Claims Settlement Act (ANCSA) mandated the creation of regional and village Native corporations to receive title to approximately 10% of the land in Alaska as part of the settlement of certain aboriginal land claims. Most of the ANCSA lands within the WAAPS study area are owned in split-estate; the surface rights (estate) are owned by individual village corporations with the sub-surface estate belonging to the regional corporation. Three regional Native corporations own lands within the study area: (1) Doyon, Limited; (2) Bering Straits Native Corporation; and (3) NANA Regional Corporation.

The 6- to 18-month acquisition timeframe assumes a best case situation, in which no difficulties are encountered. Difficulties that may be encountered during the acquisition process include overcoming concerns regarding a loss of subsistence lands, non-compliance of the requested DOT&PF land use with restrictions in Native land management plans, lack of an organized and/or active Village or Regional corporation board, and opposition from community residents, village elders, or the Village Council/Regional corporation board. Most of the potential issues and concerns could probably be overcome with time.

2.2.4 Other Private Lands

Other private lands within the study area are minimal and are owned by private individuals, municipalities, boroughs, and individual Native entities (allottees). These private lands are concentrated near established cities, villages, and along the populated portions of the existing highways and roads.

ROWs across private lands are primarily acquired by negotiation under the rules and regulations of the acquiring agency and the lead funding agency as appropriate. Should negotiations fail, the agency may choose to acquire the necessary rights via entering into eminent domain proceedings. The possible constraints of acquiring private lands could include local governing land use restrictions such as zoning, deed restrictions, and clouds on title. Most of the issues that arise when acquiring private lands are not insurmountable; the acquisition timeframe would extend to accommodate resolution of the issues.

Procedures for acquiring ROWs across Native allotments are cumbersome at best, requiring extensive survey, appraisal, and Bureau of Indian Affairs coordination. Because of the procedural difficulties with Native allotments it is recommended that any corridor avoid crossing Native allotment lands.

2.2.5 State Lands

The state selected lands for conveyance from the federal government for three specific needs - settlement, resources, and recreation. The State of Alaska Department of Natural Resources (DNR) Division of Mining, Land, and Water is the primary manager of state-owned lands within the WAAPS study area. The DNR develops area plans and management plans for the use of state lands and classifies the land for various uses including: (1) sale and lease of the land to the public; (2) lease and issuance of permits to use land for recreation, commercial, and industrial purposes; (3) the sale of sand and gravel and other materials; and (4) easements for temporary use of state land and access roads.

ROWs across state lands managed by DNR are normally granted to the DOT&PF via an Interagency Land Management Assignment (ILMA). There are a number of steps involved in the ILMA application process, but the probability of success is very high. The application must go through agency, public, and possibly coastal management review. Difficulties that may be encountered include non-compliance of the proposed DOT&PF use of the land with existing land use management plans, agency, and/or public opposition to the proposed use, and in rare cases, inability to come to an agreement on allowed terms of use. Most of these difficulties can be overcome; however, the acquisition timeframe would need to extend to accommodate their resolution.

A small percentage of land within the study area is managed by the Alaska Department of Fish and Game (ADF&G) and subject to controlled use and management. These areas include the Minto Flats State Game Refuge and the Dalton Highway Corridor Management Area. The permitting process to cross state controlled use/management land may involve more steps, agencies, and time than for other state land. An application for a right of way across the game refuge would come under considerable scrutiny as the refuge's primary purpose is to protect habitat and wetlands. It is possible that an application for a ROW across the refuge would be denied. The Dalton Highway Corridor Management Area is a controlled use/management area primarily related to hunting and access. An application for a ROW across this management area would most likely be deemed allowable, if use of the land is consistent with the existing corridor management plan.

2.2.6 Land Ownership and Management Criteria

Based on the general assessment above, three criteria were selected to evaluate the difficulty of obtaining ROWs or permits for corridor alternatives. Due to the difficulty, timeframe, and poor probability of success anticipated for obtaining ROW to cross federal lands within a CSU, and the anticipated difficulties and measure of uncertainty in obtaining ROW within other federal or Native lands, the following criteria were established for use in the screening process:

Land Ownership/Management Criterion 1: Miles through national parks, preserves, monuments, or wildlife refuges - The objective of this criterion is to favor alternatives that minimize travel through national parks, preserves, monuments, and wildlife refuges due to the potential environmental, cost, effort, and schedule impacts associated with permitting construction in these conservation system units.

Land Ownership/Management Criterion 2: Miles through federal-owned lands (including state- and Native-selected land that has not been transferred) - The objective of this criterion is to favor alternatives that minimize total mileage through federal-owned lands due to the cost, effort, and schedule impacts associated with permitting, construction, and ROW acquisition through these lands.

Land Ownership/Management Criterion 3: Miles through Native-owned lands - The objective of this criterion is to favor alternatives that minimize total mileage through Native-owned lands due to the cost, effort, and schedule impacts associated with permitting, construction, and ROW acquisition through these lands.

Due to the limited occurrence of other private lands and the anticipated ability to avoid these areas, no criterion for other private lands was selected for screening corridor alternatives. State lands are equally advantageous for any corridor alternative, thus no criterion was selected to distinguish alternatives based on state lands crossed.

2.3 Environmental Constraints

To identify and characterize environmental screening criteria, environmental constraints in the study area and associated regulatory restrictions were evaluated. Resource categories that presented constraints were evaluated for data availability, spatial distribution of the resource, and how adequately impacts could be quantified. This evaluation did not involve any fieldwork, however, the best available data was used.

As part of the environmental constraints analysis, consideration was given to fish and wildlife habitat, regulated habitat, streams and wetlands, subsistence, known historical and cultural resource sites, R.S. 2477 routes, and contaminated sites. Six environmental criteria were selected from these considerations for use in the corridor alternatives analysis: caribou, threatened and endangered (T&E) species, anadromous streams, total stream crossings, wetlands, and the Iditarod Trail. The selected criteria, as well as environmental resources not used in the screening evaluation, are discussed in the following sections.

2.3.1 Caribou

Although caribou are not a protected species, they are of considerable conservation interest because of their use in subsistence and/or recreational activities. The ADF&G has identified the winter range, outer range, and migratory habitat of the Western Arctic Caribou Herd as occurring partially within the study area (**Figure 4**). Additionally, a subset of the winter range in the Nulato Hills has been designated by the BLM as an area of critical environmental concern (ACEC) and ROW avoidance area in its Final Kobuk-Seward Peninsula Resource Management Plan. The intent of this designation is "to protect the core winter range of the Western Arctic Caribou Herd and to provide specific guidelines for management of the land to protect values and habitat identified within these lands." A ROW avoidance area is defined in the Final Resource Management Plan as "an area where ROW should be avoided, but may be allowed with special stipulations."

Environmental Criterion 1: Miles through caribou wintering areas - The objective of this criterion is to apply a measurement for how well each alternative minimizes impacts to the region's caribou population by avoiding critical wintering area to the greatest extent possible.

2.3.2 Threatened and Endangered Species

The USFWS and the National Marine Fisheries Service are the primary federal agencies monitoring and documenting species listed as threatened or endangered under the Endangered Species Act. Two such species occur within the study area, the Spectacled Eider and the Steller's Eider. Although both would require field surveys to determine presence or absence within a particular area, the USFWS considers a three mile band along the coast of Western Alaska as potential breeding habitat for the Spectacled Eider. Additionally, critical habitat has been designated by the USFWS within a concentrated area near Norton Sound (**Figure 4**). Critical habitat is a specific area that may require special considerations or protections and generally carries more stringent regulatory restrictions since the land, rather than the species, is protected.

Environmental Criterion 2: Miles through designated T&E species critical habitat - The objective of this criterion is to apply a measurement for how well each alternative minimizes impacts to T&E species and designated critical habitat.

2.3.3 Anadromous Streams

Fish passage structures can have a significant bearing on project costs and on the environmental significance of a transportation project, especially for a project of the scale detailed in this study. The *Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes* (the Catalog) and its associated atlas currently contain about 16,000 streams, rivers, or lakes around the state which have been specified as being important for the spawning, rearing, or migration of anadromous fish. It is estimated that at least an additional 20,000 or more anadromous water bodies have not been identified or specified. Anadromous streams within the WAAPS study area included in the Catalog are shown on **Figure 5.**

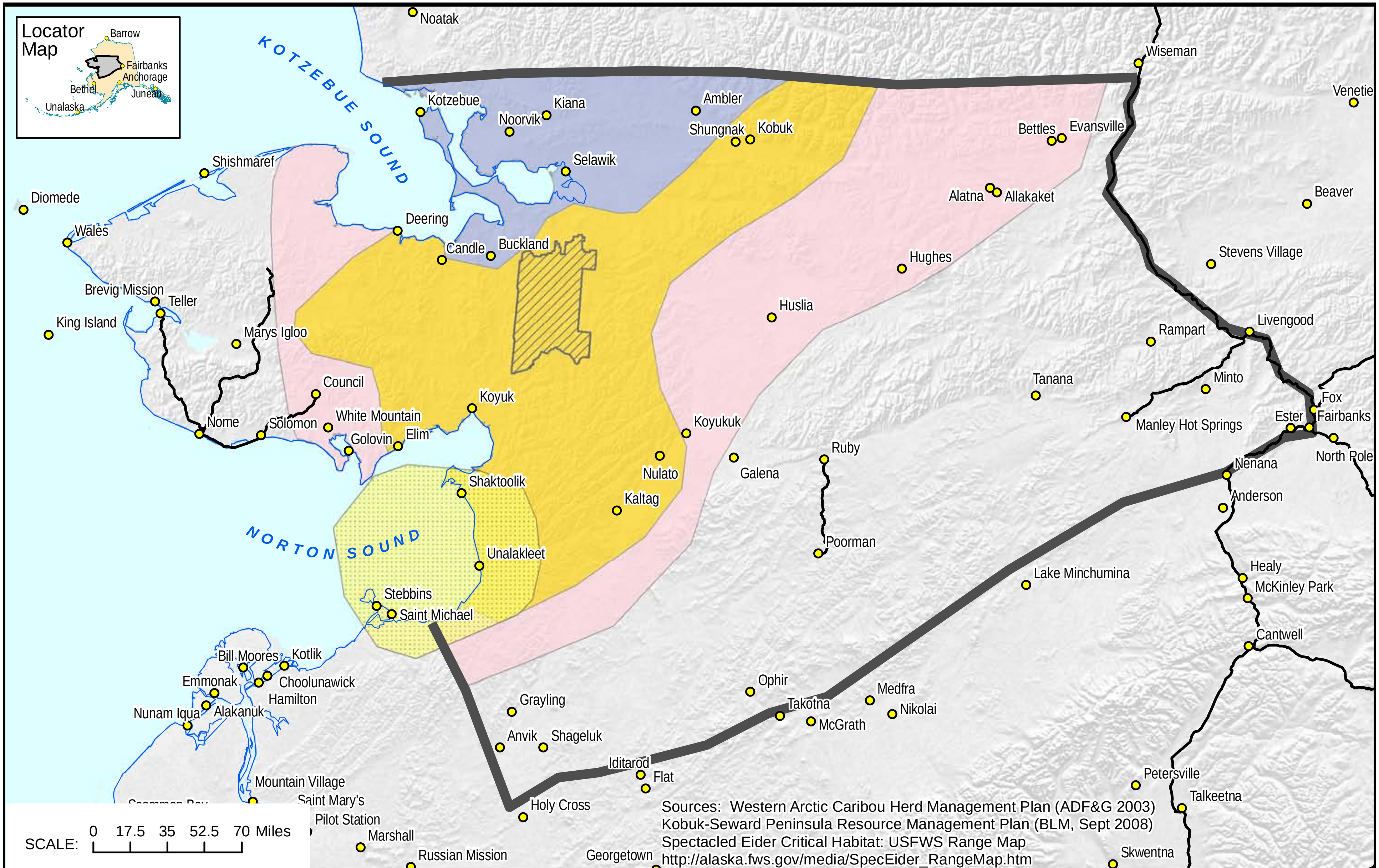
To maintain viable and healthy fish populations, all life stages of fish must be able to freely migrate in these water bodies. The ADF&G and DOT&PF have developed a Memorandum of Agreement for the Design, Permitting, and Construction of Culverts for Fish Passage. This Memorandum of Agreement details the State of Alaska's commitment to maintenance and conservation of its fisheries resources and outlines specific guidelines for culvert installations and replacements that minimize fish passage impacts.

Environmental Criterion 3: Number of streams in the catalog of anadromous waters crossed - The objective of this criterion is to apply a measurement for how well each alternative minimizes impacts to waters important to anadromous fishes by minimizing the number of anadromous stream crossings. This criterion addresses both the importance of waters to anadromous fish species and the potential impact to project cost.

2.3.4 River and Stream Crossings

In addition to anadromous streams, creeks and rivers that are not cataloged as anadromous by ADF&G are ubiquitous to the landscape. Using U.S. Geological Survey (USGS) quad maps to identify streams and rivers, the total number of stream and river crossings was determined for each corridor.

Environmental Criterion 4: Total stream crossings - The objective of this criterion is to apply a measurement for how well each alternative minimizes impacts to rivers and streams by minimizing the total number of waterway crossings.



- Communities
- Study Area
- Spectacled Eider Critical Habitat
- Nulato Hills Area of Critical Environmental Concern

Caribou Range
- Migratory Habitat
- Outer Range
- Winter Range
- Existing Roads

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CARIBOU HABITAT AND USFWS DESIGNATED CRITICAL HABITAT FOR THREATENED AND ENDANGERED SPECIES

Prepared By Allied GIS

DATE: January 14, 2010

Figure 4

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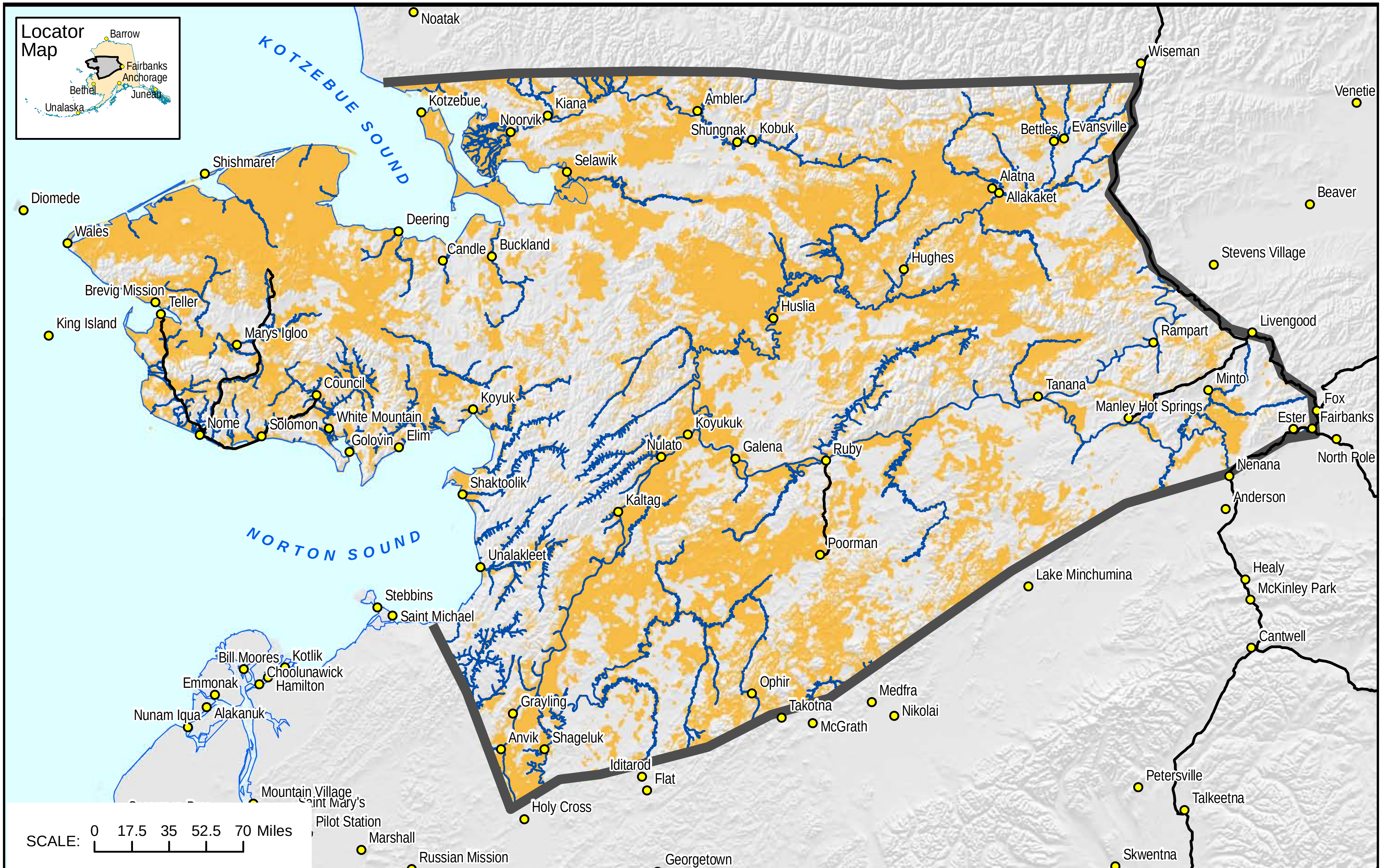

- Communities
- Study Area
- Cataloged Anadromous Streams
- High Probability Wetland Areas
- Existing Roads

Sources: Statewide Vegetation/Land Cover. Available at: http://agdc.usgs.gov/data/projects/fhm/#G
ADF&G Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes

Method: Because over 80% of the study area has not been mapped for wetlands, an office-based approach was used to determine areas with a high probability of containing jurisdictional wetlands. (See Section 2.3.5 for more detail.)

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WETLANDS AND
ADF&G CATALOGED ANADROMOUS STREAMS

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Figure 5

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2.3.5 Wetlands

The USFWS's National Wetlands Inventory mapping is typically a reasonable source of gross-scale wetlands information; however, the National Wetlands Inventory data available covers less than 20% of the study area. Therefore, vegetation data—which is available for the entire study area—was used to identify high-probability wetland areas throughout the study area. Vegetation data was represented by the Statewide Vegetation/Land Cover Raster Data Set (Fleming, 1996). Each vegetation class in the study area was evaluated for the percent probability that wetlands may occur, using available vegetation mapping, USGS maps, and soils maps (**Table 3**). The functions and values of wetland types that generally occur within these vegetation classes was then described as being low, moderate, or high value. As **Table 3** shows, most of the study area can be assumed to have wetlands of varying extent and value. A field survey will be needed as part of a future phase for this project to more accurately determine wetland boundaries as well as functions and values.

Table 3: Modeled Probability and Value of Wetlands based on Vegetation Class

Vegetation Class	Estimated Probability of Wetlands Occurring	Functions and Values of Potential Wetlands
Glaciers and Snow	0	N/A
Alpine Tundra and Barrens	<25%	Low
Low Shrub/Lichen Tundra	<25%	Low
Closed Mixed Forest	<25%	Low
Spruce and Broadleaf Forest	<25%	Low
Open and Closed Spruce Forest	<25%	Low
Open Spruce and Closed Mixed Forest Mosaic	<25%	Low
Closed Spruce and Hemlock Forest	<25%	Low
1991 Fires	<25%	Low
1990 Fires and Gravel Bars	<25%	Low
Dwarf Shrub Tundra	25-50%	Moderate
Tall Shrub	25-50%	Moderate
Tall and Low Shrub	25-50%	Moderate
Tussock Sedge/Dwarf Shrub Tundra	75-100%	High
Spruce Woodland/Shrub	75-100%	High
Moist Herbaceous/Shrub Tundra	75-100%	High
Open Spruce Forest/Shrub/Bog Mosaic	75-100%	High
Ocean	Water of the U.S.	High
Fresh Water	Water of the U.S.	High
Wet Sedge Tundra	100%	High

The study area was mapped according to low (<25%), moderate (25 to 50%), and high (75 to 100%) probability wetland areas. **Figure 5** shows areas classified as high-probability wetlands (those areas with 75% or greater potential to be wetlands) less any terrain of greater than 10% slope, since wetlands are unlikely to occur in steep mountainous areas. This map is not intended to represent all wetlands within the study area, as detailed aerial photo analysis and wetlands field surveys were not included in the scope of work for this phase of the project and would be essential for accurately determining wetlands.

Environmental Criterion 5: Miles through high-probability wetland areas and other waters of the U.S. - The objective of this criterion is to apply a measurement for how well alternatives minimize impact to areas identified as highly likely to contain wetlands. Clean Water Act guidelines prevent the issuance of wetland permits if a 'practicable upland alternative' is identified. However, in areas that are dominated by wetlands, there may be no upland alternatives available. In these situations, the USACE requires avoidance of the higher value wetlands.

2.3.6 The Iditarod Trail

The Iditarod National Historic Trail is listed on the National Register of Historic Places, and has been designated by Congress in recognition of its significance as a scenic, recreational, or historic transportation route. As a road crossing could impact certain aspects of the trail's historic characteristics, the number of times each corridor alternative crossed the Iditarod Trail was measured. The location of the Iditarod Trail within the WAAPS study area is shown on **Figure 7** in Chapter 3.

Environmental Criterion 6: Number of times corridor crosses Iditarod Trail - The objective of this criterion is to apply a measurement for how alternatives impact the Iditarod Trail.

2.3.7 Environmental Resources Considered, But Not Used In Screening Analysis

Although many other environmental resources were considered in the initial evaluation of constraints, some were determined to be nonviable as screening criteria. These resources were dropped from the screening analysis primarily due to lack of available data that could be readily mapped to aid in the screening process and/or the finding of no impact to decision making.

<u>Wildlife</u>: State and federal agency management plans and reports were reviewed to determine whether any important wildlife habitats were mapped or designated in the study area. Aside from the caribou habitat and the eider critical habitat noted previously, no other protected wildlife habitat was identified within the study area. Many species of birds and mammals are widespread across the project area; however, any corridor has a nearly equal chance of encountering wildlife as another. Therefore, additional wildlife habitat constraints, beyond those noted previously, were not included in the alternatives screening criteria.

<u>Subsistence Resources</u>: Although subsistence issues are recognized in this constraints analysis as a critical consideration, the current lack of community-specific data and input precludes the prudent use of this criterion in decision-making. ADF&G subsistence specialists for the Northwest Arctic, Northern, and Upper Koyukuk and Yukon River regions that were consulted for this project stressed the importance of community involvement in determining important subsistence areas that would need to be taken into consideration for this project. However, they were unable to provide any geographically specific areas that would need to be avoided, or considered in this corridor alternatives screening analysis.

Given that there has been no comprehensive subsistence mapping for the WAAPS study area and that Alaskan communities exhibit differing harvest and use patterns for all subsistence resources, it was not possible to develop a quantifiable screening criterion for subsistence. Closely related to wildlife habitat, subsistence use areas are widespread across the project area, and any corridor has a nearly equal change of encountering these areas as another. Individual communities will need to be consulted on a case-by-case basis, as part of any future NEPA alternatives analysis.

<u>Historic and Cultural Resources</u>: The Alaska Heritage Resources Survey is an inventory of all *reported* historic and prehistoric sites within the State of Alaska, maintained by the State of Alaska Office of History and Archaeology (OHA). This inventory of cultural resources includes objects, structures, buildings, sites, districts, and travel ways, with a general provision that they are over 50 years old. Although this database documents more than 22,000 sites across Alaska, this is considered a small fraction of the potential number of sites in the state, and particularly for the study area. OHA and the State Historic Preservation Office (SHPO) were consulted and although sites have been identified throughout the entire study area, very few sites have been surveyed and mapped within the WAAPS study area. OHA and the SHPO estimate that less than one-tenth of potential sites are reported for the study area due to the sheer size of the area considered, and because of its remoteness (Joan Dale, OHA, personal communication).

Due to the lack of mapped data, OHA and the SHPO do not believe that cultural resources could be used as a screening criterion for this initial phase. They recommended that a preferred corridor be selected first, followed by survey investigations and consultations with Native organizations to locate sites along the corridor that would need to be avoided during the road design phase. Specific avoidance and/or mitigation would then be determined on a case-by-case basis.

The NPS administers the National Register of Historic Places, comprised of the official federal list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. There are 21 registered historic places indentified within the study area near Nome and four additional sites in the northwest study area. It is likely that historic and archaeological sites, once identified by field survey, could be avoided through road alignment modifications during the design phase with the exception of the Iditarod Trail, discussed previously.

R.S. 2477 ROW: The Revised Statute (R.S.) 2477 from the Mining Act of 1866 granted a public ROW across unreserved federal land to provide for continued access across these lands as they were transferred from federal to state or private ownership. Since 1992, the DNR Division of Mining, Land, and Water has been documenting and researching possible R.S. 2477 routes throughout the state. To date, the DNR has identified more than 2,000 routes and determined that approximately 647 of these routes qualify as R.S. 2477s. Although these trail ROWs were accepted and acknowledged by the state in 1998 (Alaska Statute AS 19.30.400), the U.S. Department of Interior has not validated or recognized these ROWs, nor has the extent of the right to use and improve these historic trails been defined. Perfecting these ROWs has and will continue to be a contentious and potentially litigious subject. In addition, it is unlikely that an R.S. 2477 ROW, even if validated by the federal government, would grant sufficient rights to permit and construct improvements contemplated in this study. Therefore, although there are recognized R.S. 2477 trail ROWs within the study area, this reconnaissance study does not recommend evaluating these ROWs for the purposes of screening criteria.

Contaminated Sites: Potential contaminated sites were examined for the study area using the State of Alaska Department of Environmental Conservation contaminated sites database. The State of Alaska Department of Environmental Conservation database documents status information (open, closed, conditionally closed) for contaminated sites and leaking underground storage tank sites. Based on the information provided in the database, there do not appear to be any contaminated sites that would be unavoidable by corridor alignments. A detailed All-Appropriate Inquiry/Phase I Environmental Site Assessment is recommended for the recommended alternative when more detailed environmental documentation is developed.

2.4 Engineering and Costs

Engineering criteria and constraints were identified to aid in corridor alignment decisions and in producing construction and M&O cost estimates for road corridor alternatives. Engineering design designations, standards, and criteria include such items as road and ROW width, slope and grade, typical sections, drainage, stream crossings and bridges, and other data critical to efficient construction and maintenance.

To establish engineering criteria for a new road in subarctic conditions, a large number of sources were consulted. The project team supplemented its professional evaluation with input from Northern Region DOT&PF planners and designers, DOT&PF bridge designers, University of Alaska Fairbanks permafrost experts, and recent engineering reports on other Northern Region roads and bridges.

2.4.1 Engineering Design Criteria and Cost Estimate Assumptions

Major assumptions for aspects of road and bridge design, construction, and maintenance are presented in **Table 4**. Additional details on cost estimates and design assumptions can be found in Appendix D.

One of the most critical aspects of the road corridor alternatives is the estimated cost to construct and maintain each. For this reason, the following two criteria were selected for use in the preliminary screening process:

<u>Engineering and Cost Criterion 1</u>: Total estimated construction cost - The objective of this criterion is to favor alternatives that minimize total estimated construction cost. A corridor should be feasible to construct and should not result in excessive cost to construct, as compared to other possible alternatives.

<u>Engineering and Cost Criterion 2</u>: Estimated annual M&O costs - The objective of this criterion is to favor alternatives that minimize estimated annual M&O costs. A route should not result in excessive M&O costs, as compared to other alternatives.

Table 4: Design Assumptions for Western Alaska Road Corridor

Category	Assumption	Source/Rationale
General Project Information		
Project Overview	Road from Interior Highway System to Seward Peninsula	Project scope
Purpose	To connect the contiguous Interior highway system with the isolated Seward Peninsula highway system and to facilitate community and resource development in the region	Project scope
Terrain	Varies considerably within region; terrain classified as flat (0%-5% grade), rolling (5%-10%), or mountainous (>10%)	Digital elevation modeling produced by ArcGIS software
Road Design Criteria and Assumptions		
Functional Classification	Rural Other Principal Arterial	AASHTO GDVLVLR[1] An arterial link from the Rural Major Collectors on the Seward Peninsula to the Interior arterial highway system
Projected AADT (Average Annual Daily Traffic)	≤ 400	2008 Annual Daily Traffic Report, Northern Region for Dalton Highway (Dalton Highway AADT = 290)
Roadway Surface Width	30-foot total width (24-foot roadway with 3-foot shoulders)	Consistent with other existing and planned Northern Region roads of the same functional classification
Typical Section	6-foot total section 8 inches crushed aggregate surface over 64 inches embankment; 24 inches excavation, 4:1 side slopes, and geogrid lining (see Appendix D, page D1 for figure)	Permafrost potential throughout the region led to the conservative assumption of a thick typical section to preserve frozen ground and delay degradation of the road section
Construction Item Unit Prices	\$25/cubic yard for embankment material (Borrow); \$40/cubic yard for crushed surfacing (Aggregate Surface Course); \$10,000/acre for clearing and grubbing; \$20/cubic yard for excavation; \$8/square yard for geogrid	Historic Northern Region project costs with considerations given to the scale of the project, the remote construction conditions, and the assumed availability of materials

Category	Assumption	Source/Rationale
Material Sites	Portions of the route will likely have material sites available at ~10-mile intervals; other portions will not have readily available material sites, and construction materials will have to be transported greater distances	General geologic and terrain mapping of the study area
Base Construction Cost per Mile	$2.2 million	Calculated from the typical section (see Appendix D, page D2 for cost calculations)
Influence of Terrain on Cost per Mile	$3.1 million per mile in rolling terrain; $4.7 million per mile in mountainous terrain	Construction through more difficult terrain assumed to create additional costs due to increased labor and materials
Bridge Design and River/Stream Crossing Criteria and Assumptions		
Bridge Width	33 feet 30-foot roadway plus two 1.5-foot rails	DOT&PF Bridge Design Section recommendation
Bridge Span	Estimated from USGS topographic maps	For major river crossings only (Koyukuk, Yukon)
Bridge Cost Estimates	$350 per square foot	Based on DOT&PF Bridge Design Section recommendation with factors specific to WAAPS project included (see Appendix D, page D3 for cost calculations)
Significant Drainage Structures	Significant drainage structures assumed to be Minor River Crossings at $3.2 million each or Stream Crossings at $1.7 million each	See Appendix D, page D3 for cost calculations
Small Drainage Structures	Costs for small pipes and minor drainage work subsidiary to embankment costs	At this preliminary planning level, minor drainage structures are assumed incidentals
Cost Contingencies		
Contingencies Applied to Total Cost of Construction Items, In Order	Roadway Items @ 15% (bridges only) Miscellaneous Contingency @ 20% Mobilization @ 10% Engineering/Environment/ROW @ 15% Indirect Cost Allocation Plan (ICAP) for Overhead and Administration @ 4.88%	Consistent with State Transportation Improvement Program Phase 4 Funding Template (see Appendix D, pages D3 and D6 for further details)
M&O Assumptions		
Annual Routine Road Maintenance Costs	$24,000 per mile	Based on fiscal year 2008 costs for Dalton Highway, averaged over six maintenance stations (see Appendix D, page D4 for M&O cost considerations)
New Maintenance Camp Construction	$15.5 million per station $13.5 million to construct, $2 million to equip	See Appendix D, page D4 for M&O cost considerations
Annual Facilities Maintenance	~$300,000 per camp	Based on $1.9 million Dalton Highway facilities budget in fiscal year 2008 for six maintenance stations (see Appendix D, page D4 for M&O cost considerations)

[1] AASHTO GDVLVLR is the American Association of State Highway and Transportation Official Guidelines for Geometric Design of Very Low-volume Local Roads (ADT ≤400)

2.5 Summary of Preliminary Screening Criteria

The sixteen criteria selected for use in the preliminary screening process are presented in **Table 5**. The preliminary corridor alternatives are presented in Chapter 3 following this section. Chapter 4 includes the criteria weighting and scoring process and the screening results of the preliminary corridor alternatives.

Table 5: Preliminary Alternatives Screening Criteria

Communities **Maximize the population potentially served by corridor**
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities
Total distance between Fairbanks and Nome along corridor
Resources **Maximize the estimated gross value of resources accessible from corridor**
Total estimated gross value of significant mineral resources within 100 miles of corridor
Total estimated gross value of significant mineral resources within 50 miles of corridor
Land Ownership/Management Criteria **Minimize the difficulty of ROW acquisition & adverse impacts to land use**
Miles through national parks, preserves, monuments, or wildlife refuges
Miles through federal-owned lands
Miles through Native-owned lands
Environmental Criteria **Minimize adverse impacts to environment**
Miles through caribou wintering areas
Miles through designated threatened and endangered (T&E) species critical habitat
Number of streams in the catalog of anadromous waters crossed
Total stream crossings
Miles through high-probability wetland areas and other waters of the U.S.
Number of times corridor crosses Iditarod Trail
Engineering and Cost Criteria **Maximize construction and operation feasibility, minimize cost**
Total estimated construction cost
Estimated annual M&O costs

3.0 PRELIMINARY CORRIDOR ALTERNATIVES

The large study area considered by this project initially presented a multitude of corridor possibilities to reach Western Alaska from the Interior highway system. Corridor alternatives developed for this project started with a review of historically considered corridors, an evaluation of community and resource locations within the study area, and a review of critical land ownership/management, environmental, and engineering constraints. Using these considerations as guidelines, the corridor possibilities have been narrowed down to four preliminary corridor alternatives connecting the existing Interior highway system with the Seward Peninsula. Each of these alternatives was evaluated in an initial screening process, detailed in Chapter 4, by which the various criteria identified in Chapter 2 are applied and evaluated. The following sections document the process by which initial alternatives were identified and present the four preliminary corridor alternatives.

3.1 Historical Corridors

The existing Interior highway and rail systems do not extend into the WAAPS study area, thus residents of the region are entirely dependent on marine or air transportation. Studies to extend an overland transportation corridor to the Seward Peninsula date at least as far back as 1865, when the Western Union Telegraph Company investigated the potential of a route across the peninsula for their Russian-American telegraph line. Since then, the potential of linking the Seward Peninsula with the highway/rail system has been studied repeatedly by government and private (mining) agencies alike. This transportation link has been considered so many times before primarily because of its potential to provide remote, isolated communities with improved access and to open up vast areas to resource/mineral exploration and development.

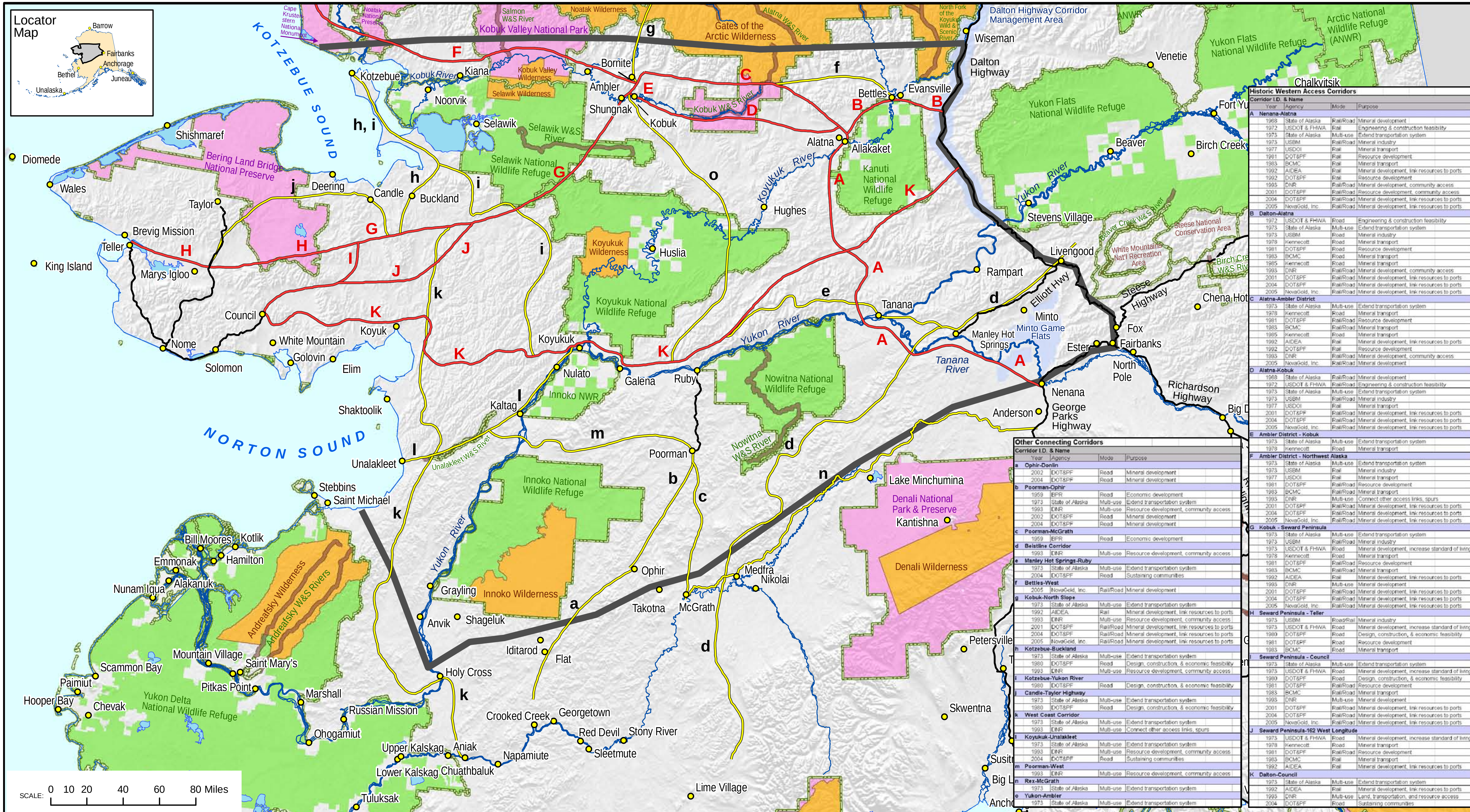
An extensive collection of prior studies was compiled, reviewed, and included in a bibliography as part of the Inventory Report. Within these prior studies, a multitude of routes and corridors were identified for their potential to connect Western Alaska to the Interior transportation system. The most significant routes and corridors within the study area were mapped together to provide the project team with an initial idea of potential corridor locations and critical routing decisions. The mapped results of this effort are shown on **Figure 6** with a bibliography index of the studies containing historic corridor mapping included in Appendix E.

Eleven major historic western access corridors and fifteen other connecting routes were identified. The major corridors trend generally east-west and tend to be those considered and mapped in multiple studies. In general, the connecting routes were studied less frequently and provide connection possibilities between major corridors in both the east-west and north-south directions.

Historic corridor alignments were also reviewed during the development of the WAAPS corridor alternatives for their potential to reach communities and resources, their construction feasibility, and their potential to provide critical information (e.g., geology, material sites, design and construction considerations, etc.) for corridor evaluation. An important consideration to note is that many historic corridors pass through lands whose status has since been affected by ANCSA (1971) and ANILCA (1980). Critical land ownership and management constraints used during the development of WAAPS corridor alternatives were not necessarily taken into consideration in previous studies and corridor layouts.

3.2 Preliminary Corridor Alternatives

Corridor alternatives developed for this project began with a review of historical corridors and an evaluation of community and resource locations within the study area. Historical corridors were reviewed primarily to establish an understanding of overland routes considered feasible in past studies. The locations of communities and resources were evaluated to identify potential areas desirable to reach with a new corridor. Land ownership/management and environmental constraints were then applied to the study area to identify areas that ideally should be avoided because of purpose, policy, or restrictions associated with the area. The goal during the development of alternatives was to define alternatives that best address community and resource development goals while avoiding critical areas identified by the environmental and land ownership/management constraints to the greatest extent possible. Through this process, the wide array of corridor possibilities was narrowed down to four preliminary corridor alternatives connecting the existing Interior highway system with the Seward Peninsula.



Historic Western Access Corridors

Corridor I.D. & Name	Year	Agency	Mode	Purpose
A Nenana-Alatna				
	1968	State of Alaska	Rail/Road	Mineral development
	1972	USDOT & FHWA	Rail	Engineering & construction feasibility
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USBM	Rail/Road	Mineral industry
	1977	USDOI	Rail	Mineral transport
	1981	DOT&PF	Rail	Resource development
	1983	BCMC	Rail	Mineral transport
	1992	AIDEA	Rail	Mineral development, link resources to ports
	1992	DOT&PF	Rail	Resource development
	1993	DNR	Rail/Road	Mineral development, community access
	2001	DOT&PF	Rail/Road	Resource development, community access
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
B Dalton-Alatna				
	1972	USDOT & FHWA	Road	Engineering & construction feasibility
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USBM	Road	Mineral industry
	1978	Kennecott	Road	Mineral transport
	1981	DOT&PF	Road	Resource development
	1983	BCMC	Road	Mineral transport
	1985	Kennecott	Road	Mineral transport
	1993	DNR	Rail/Road	Mineral development, community access
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
C Alatna-Ambler District				
	1973	State of Alaska	Multi-use	Extend transportation system
	1978	Kennecott	Road	Mineral transport
	1981	DOT&PF	Rail/Road	Resource development
	1983	BCMC	Rail/Road	Mineral transport
	1985	Kennecott	Road	Mineral transport
	1992	AIDEA	Rail	Mineral development, link resources to ports
	1992	DOT&PF	Rail	Resource development
	1993	DNR	Rail/Road	Mineral development, community access
	2005	NovaGold, Inc.	Rail/Road	Mineral development
D Alatna-Kobuk				
	1968	State of Alaska	Rail/Road	Mineral development
	1972	USDOT & FHWA	Rail/Road	Engineering & construction feasibility
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USBM	Rail/Road	Mineral industry
	1977	USDOI	Rail	Mineral transport
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
E Ambler District - Kobuk				
	1973	State of Alaska	Multi-use	Extend transportation system
	1978	Kennecott	Road	Mineral transport
F Ambler District - Northwest Alaska				
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USBM	Rail	Mineral industry
	1977	USDOI	Rail	Mineral transport
	1981	DOT&PF	Rail/Road	Resource development
	1983	BCMC	Rail/Road	Mineral transport
	1993	DNR	Multi-use	Connect other access links, spurs
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
G Kobuk - Seward Peninsula				
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USBM	Rail/Road	Mineral industry
	1973	USDOT & FHWA	Road	Mineral development, increase standard of living
	1978	Kennecott	Road	Mineral transport
	1981	DOT&PF	Rail/Road	Resource development
	1983	BCMC	Rail/Road	Mineral transport
	1992	AIDEA	Rail	Mineral development, link resources to ports
	1993	DNR	Multi-use	Mineral development
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
H Seward Peninsula - Teller				
	1973	USBM	Road/Rail	Mineral industry
	1973	USDOT & FHWA	Road	Mineral development, increase standard of living
	1980	DOT&PF	Road	Design, construction, & economic feasibility
	1981	DOT&PF	Road	Resource development
	1983	BCMC	Road	Mineral transport
I Seward Peninsula - Council				
	1973	State of Alaska	Multi-use	Extend transportation system
	1973	USDOT & FHWA	Road	Mineral development, increase standard of living
	1980	DOT&PF	Road	Design, construction, & economic feasibility
	1981	DOT&PF	Rail/Road	Resource development
	1983	BCMC	Rail/Road	Mineral transport
	1993	DNR	Multi-use	Mineral development
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
J Seward Peninsula-162 West Longitude				
	1973	USDOT & FHWA	Road	Mineral development, increase standard of living
	1978	Kennecott	Road	Mineral transport
	1981	DOT&PF	Rail/Road	Resource development
	1983	BCMC	Rail	Mineral transport
	1992	AIDEA	Rail	Mineral development, link resources to ports
K Dalton-Council				
	1973	State of Alaska	Multi-use	Extend transportation system
	1992	AIDEA	Rail	Mineral development, link resources to ports
	1993	DNR	Multi-use	Land, transportation, and resource access
	2004	DOT&PF	Road	Sustaining communities

Other Connecting Corridors

Corridor I.D. & Name	Year	Agency	Mode	Purpose
a Ophir-Donlin				
	2002	DOT&PF	Road	Mineral development
	2004	DOT&PF	Road	Mineral development
b Poorman-Ophir				
	1959	BPR	Road	Economic development
	1973	State of Alaska	Multi-use	Extend transportation system
	1993	DNR	Multi-use	Resource development, community access
	2002	DOT&PF	Road	Mineral development
	2004	DOT&PF	Road	Mineral development
c Poorman-McGrath				
	1959	BPR	Road	Economic development
d Beistline Corridor				
	1993	DNR	Multi-use	Resource development, community access
e Manley Hot Springs-Ruby				
	1973	State of Alaska	Multi-use	Extend transportation system
	2004	DOT&PF	Road	Sustaining communities
f Bettles-West				
	2005	NovaGold, Inc.	Rail/Road	Mineral development
g Kobuk-North Slope				
	1973	State of Alaska	Multi-use	Extend transportation system
	1992	AIDEA	Rail	Mineral development, link resources to ports
	1993	DNR	Multi-use	Resource development, community access
	2001	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2004	DOT&PF	Rail/Road	Mineral development, link resources to ports
	2005	NovaGold, Inc.	Rail/Road	Mineral development, link resources to ports
h Kotzebue-Buckland				
	1973	State of Alaska	Multi-use	Extend transportation system
	1980	DOT&PF	Road	Design, construction, & economic feasibility
	1993	DNR	Multi-use	Resource development, community access
i Kotzebue-Yukon River				
	1980	DOT&PF	Road	Design, construction, & economic feasibility
j Candle-Taylor Highway				
	1973	State of Alaska	Multi-use	Extend transportation system
	1980	DOT&PF	Road	Design, construction, & economic feasibility
k West Coast Corridor				
	1973	State of Alaska	Multi-use	Extend transportation system
	1993	DNR	Multi-use	Connect other access links, spurs
l Koyukuk-Unalakleet				
	1973	State of Alaska	Multi-use	Extend transportation system
	1993	DNR	Multi-use	Resource development, community access
	2004	DOT&PF	Road	Sustaining communities
m Poorman-West				
	1993	DNR	Multi-use	Resource development, community access
n Rex-McGrath				
	1973	State of Alaska	Multi-use	Extend transportation system
o Yukon-Ambler				
	1973	State of Alaska	Multi-use	Extend transportation system

- Communities
- Study Area
- Historic Western Access Corridors
- Other Historic Connecting Routes
- Existing Roads
- Major Lakes
- Major Rivers

Historic Corridors and Connecting Routes are approximate in location as they are from a variety of datasets and data formats.
Landstatus Source: Alaska Dept. of Natural Resources

Acronyms

AIDEA	Alaska Industrial Development and Export Authority
BCMC	Bear Creek Mining Company
BPR	Bureau of Public Roads
DNR	Department of Natural Resources
DOT&PF	Alaska Department of Transportation and Public Facilities
FHWA	Federal Highway Adminstration
USBM	United States Bureau of Mines
USDOI	United States Department of the Interior
USDOT	United States Department of Transportation

STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY

HISTORIC CORRIDORS IDENTIFIED IN PRIOR STUDIES

Prepared By Allied GIS

DATE: January 14, 2010

Figure 6

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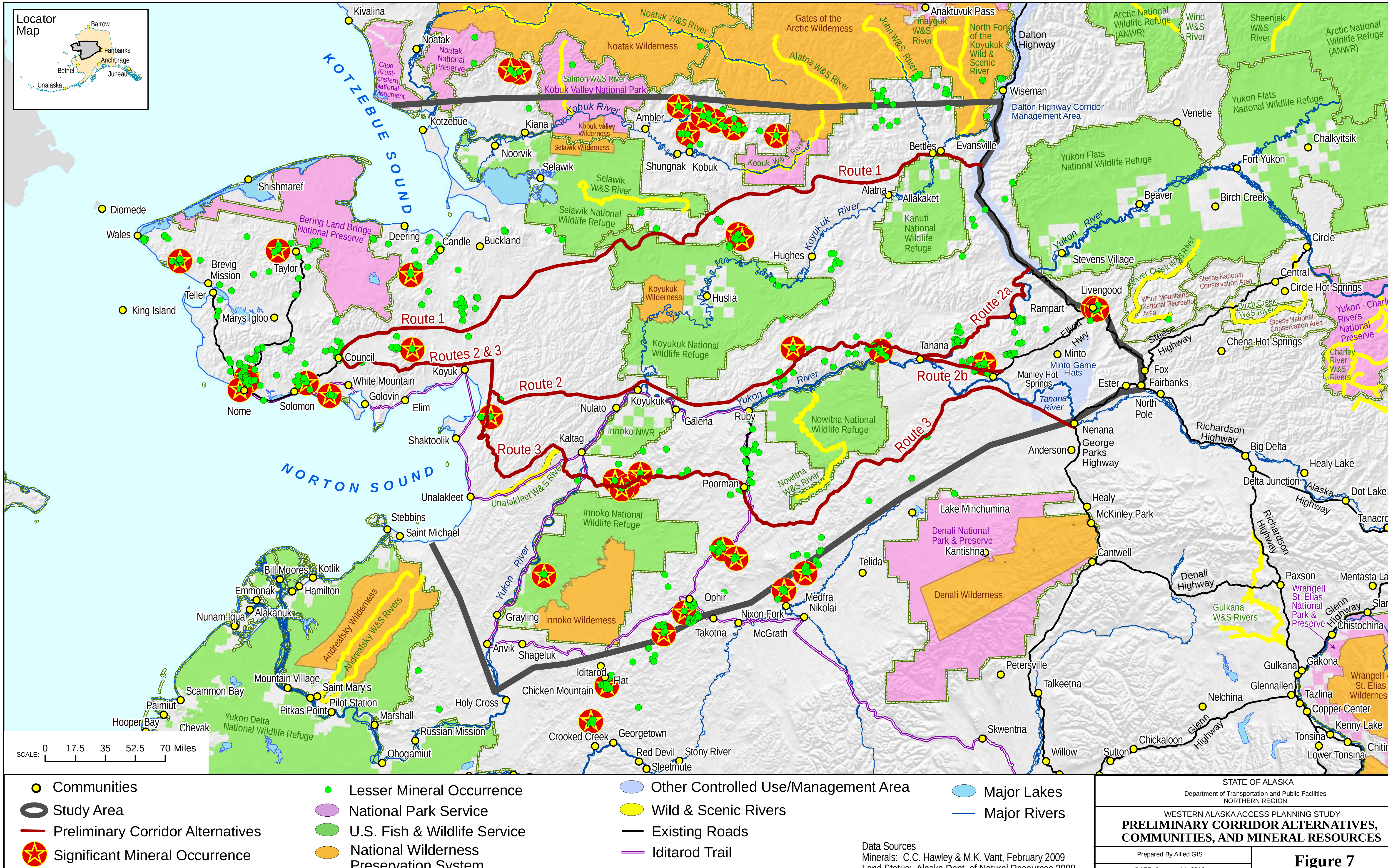
In the maps that follow, the four preliminary corridor alternatives are mapped to show their relation to:

- Communities and Mineral Resources (**Figure 7**)
- Land Management and Ownership (**Figure 8**)
- Environmental Constraints
    - Caribou (**Figure 9**)
    - Threatened and Endangered Species (**Figure 9**)
    - Anadromous Streams (**Figure 10**)
    - Wetlands (**Figure 10**)

The four preliminary corridor alternatives are described individually in the sections that follow (Sections 3.3 through 3.6). A comparison of the four alternatives is provided in Chapter 4. The measured values for the screening criteria were collected with the assistance of ArcGIS software. Within each individual corridor alternative description, data is presented for the 16 criteria used in the screening analysis. Data was actually collected for 40 discrete criteria, but the 16 screening criteria represent those that provide distinction between the corridor alternatives. Data not used in the screening process primarily consists of measurements which show little variation between corridor alternatives or values which are better represented by one of the 16 screening criteria selected. The summary of data collection is included in Appendix F, and other support documentation for the data collection can be found in Appendix A (Communities), Appendix B (Mineral Resources), and Appendix D (Cost Estimate Calculations).



STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY

PRELIMINARY CORRIDOR ALTERNATIVES, COMMUNITIES, AND MINERAL RESOURCES

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DATE: January 14, 2010

Figure 7

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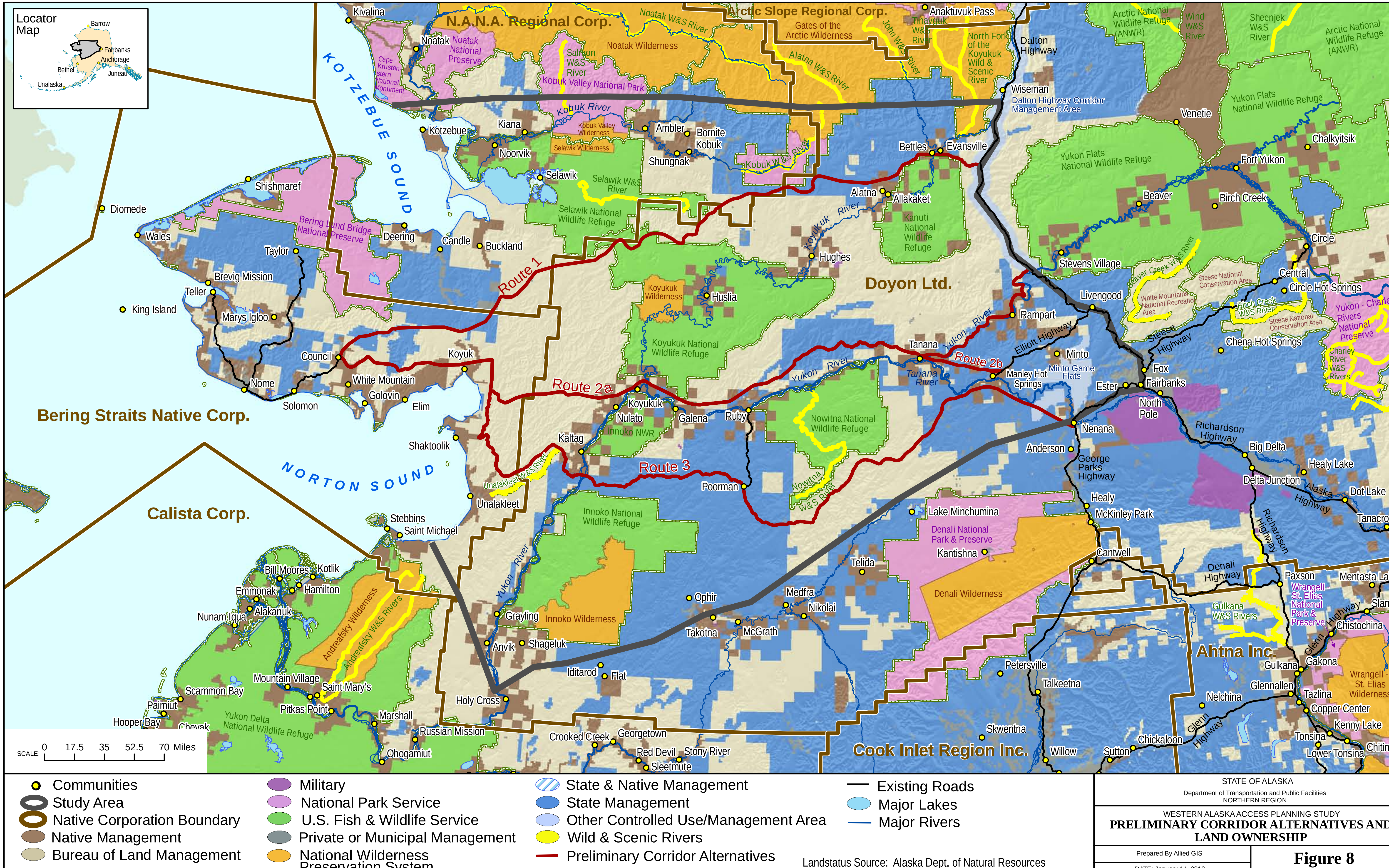

Locator Map
Barrow
Fairbanks
Anchorage
Bethel
Juneau
Unalaska
N.A.N.A. Regional Corp.
Arctic Slope Regional Corp.
Doyon Ltd.
Bering Straits Native Corp.
Calista Corp.
Ahtna Inc.
Cook Inlet Region Inc.
KOTZEBUE SOUND
NORTON SOUND
Route 1
Route 2a
Route 2b
Route 3
Kivalina
Noatak
Kotzebue
Kiana
Noorvik
Selawik
Ambler
Bornite
Kobuk
Shungnak
Shishmaref
Diomede
Wales
Taylor
Deering
Candle
Buckland
Brevig Mission
Teller
King Island
Marys Igloo
Council
Nome
Solomon
White Mountain
Golovin
Elim
Koyuk
Shaktoolik
Unalakleet
Stebbins
Saint Michael
Kotlik
Bill Moores
Emmonak
Hamilton
Alakanuk
Nunam Iqua
Mountain Village
Saint Mary's
Pitkas Point
Scammon Bay
Paimiut
Hooper Bay
Chevak
Marshall
Russian Mission
Ohogamiut
Holy Cross
Anvik
Grayling
Shageluk
Iditarod
Flat
Crooked Creek
Georgetown
Red Devil
Stony River
Sleetmute
Kaltag
Nulato
Koyukuk
Galena
Ruby
Poorman
Huslia
Hughes
Alatna
Allakaket
Bettles
Evansville
Wiseman
Anaktuvuk Pass
Dalton Highway
Dalton Highway Corridor Management Area
Tanana
Rampart
Manley Hot Springs
Minto
Minto Game Flats
Livengood
Stevens Village
Beaver
Birch Creek
Fort Yukon
Venetie
Chalkyitsik
Circle
Central
Circle Hot Springs
Chena Hot Springs
Fox
Fairbanks
Ester
North Pole
Nenana
Anderson
George Parks Highway
Healy
McKinley Park
Cantwell
Lake Minchumina
Kantishna
Telida
Ophir
Medfra
Nikolai
Takotna
McGrath
Petersville
Talkeetna
Skwentna
Willow
Sutton
Chickaloon
Nelchina
Glennallen
Gulkana
Gakona
Tazlina
Copper Center
Kenny Lake
Tonsina
Lower Tonsina
Chitina
Chistochina
Slana
Mentasta Lake
Paxson
Tanacross
Dot Lake
Healy Lake
Big Delta
Delta Junction
Richardson Highway
Alaska Highway
Steese Highway
Elliott Highway
Denali Highway
Glenn Highway
Yukon River
Tanana River
Koyukuk River
Kobuk River
Noatak National Preserve
Noatak Wilderness
Cape Krusenstern National Monument
Kobuk Valley National Park
Kobuk Valley Wilderness
Selawik Wilderness
Selawik National Wildlife Refuge
Selawik W&S River
Salmon W&S River
Noatak W&S River
Gates of the Arctic Wilderness
Alatna W&S River
John W&S River
Tinayguk W&S River
North Fork of the Koyukuk Wild & Scenic River
Kobuk W&S River
Bering Land Bridge National Preserve
Koyukuk Wilderness
Koyukuk National Wildlife Refuge
Kanuti National Wildlife Refuge
Innoko NWR
Innoko National Wildlife Refuge
Innoko Wilderness
Nowitna National Wildlife Refuge
Nowitna W&S River
Unalakleet W&S River
Andreafsky Wilderness
Andreafsky W&S Rivers
Yukon Delta National Wildlife Refuge
Denali National Park & Preserve
Denali Wilderness
Wrangell - St. Elias National Park & Preserve
Wrangell - St. Elias Wilderness
Gulkana W&S Rivers
Arctic National Wildlife Refuge (ANWR)
Wind W&S River
Sheenjek W&S River
Yukon Flats National Wildlife Refuge
Beaver Creek W&S River
White Mountains National Recreation Area
Steese National Conservation Area
Birch Creek W&S River
Yukon - Charley Rivers National Preserve
Charley River W&S Rivers
SCALE: 0 17.5 35 52.5 70 Miles
Communities
Study Area
Native Corporation Boundary
Native Management
Bureau of Land Management
Military
National Park Service
U.S. Fish & Wildlife Service
Private or Municipal Management
National Wilderness Preservation System
State & Native Management
State Management
Other Controlled Use/Management Area
Wild & Scenic Rivers
Preliminary Corridor Alternatives
Existing Roads
Major Lakes
Major Rivers
Landstatus Source: Alaska Dept. of Natural Resources
STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION
WESTERN ALASKA ACCESS PLANNING STUDY
PRELIMINARY CORRIDOR ALTERNATIVES AND LAND OWNERSHIP
Prepared By Allied GIS
DATE: January 14, 2010
Figure 8
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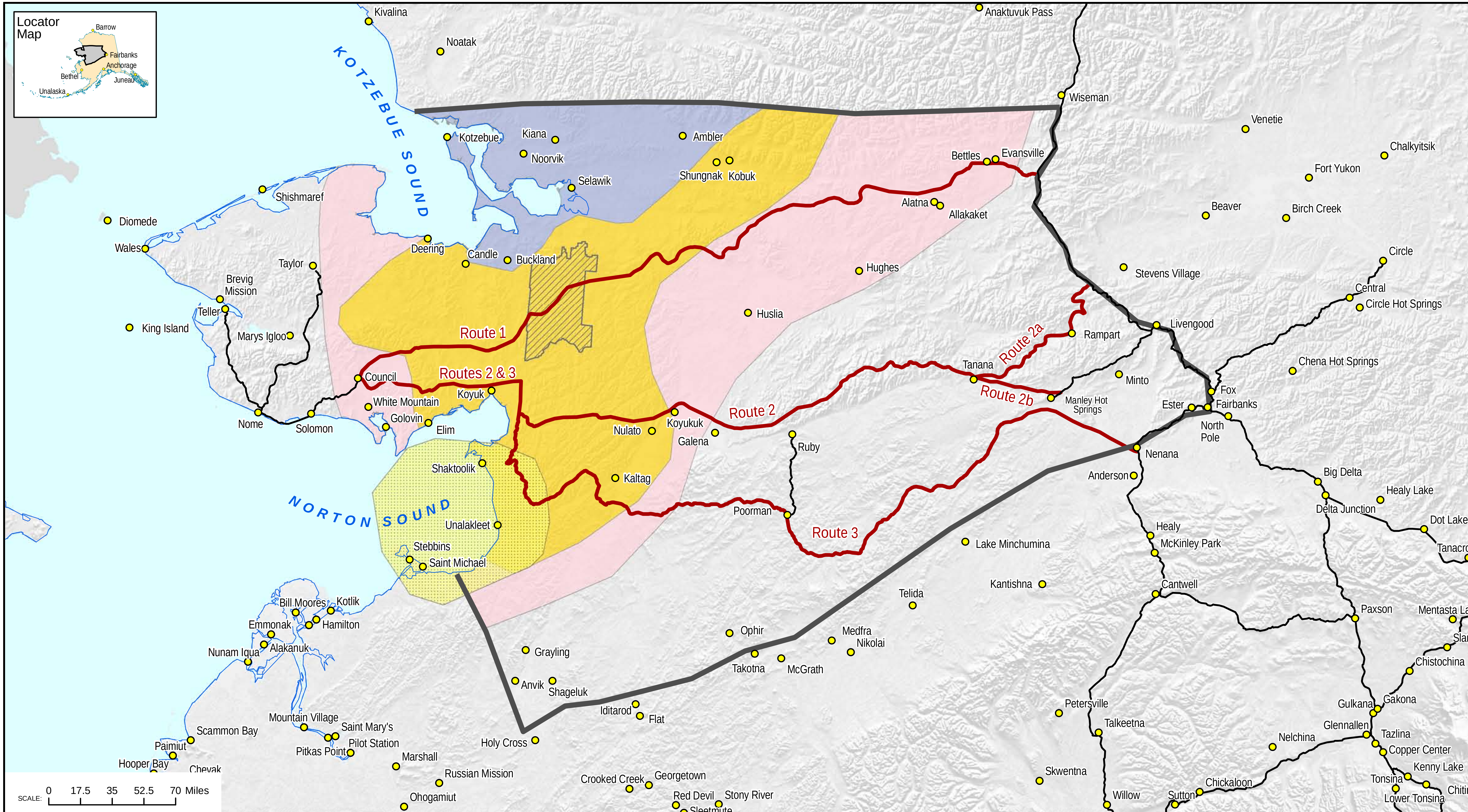


Communities

Study Area

Preliminary Corridor Alternatives

Spectacled Eider Critical Habitat

Nulato Hills Area of Critical Environmental Concern

Existing Roads

Caribou Range

Migratory Habitat

Outer Range

Winter Range

Sources: Western Arctic Caribou Herd Management Plan (ADF&G 2003)
Kobuk-Seward Peninsula Resource Management Plan (BLM, Sept 2008)
Spectacled Eider Critical Habitat: USFWS Range Map
http://alaska.fws.gov/media/SpecEider_RangeMap.htm

STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

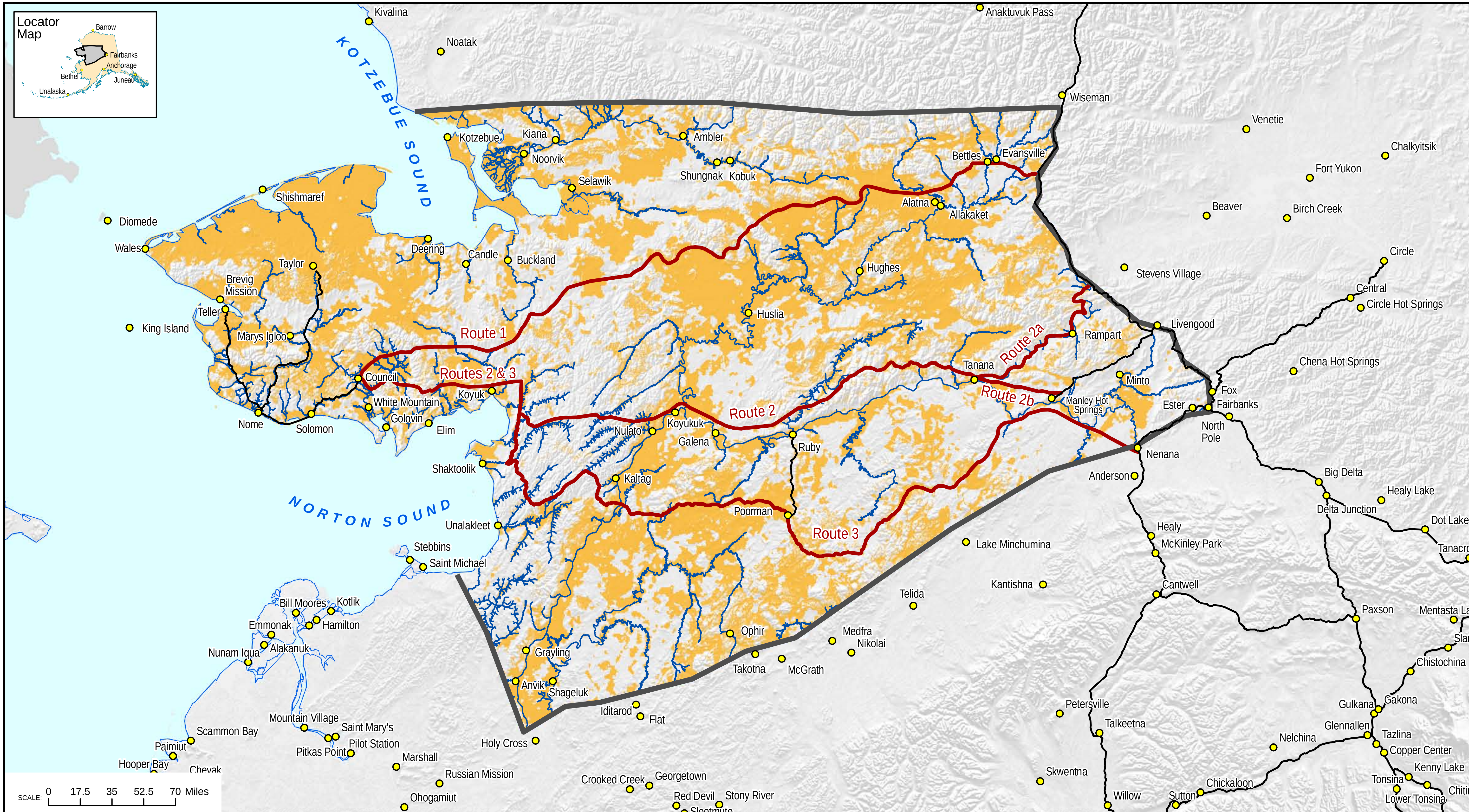
WESTERN ALASKA ACCESS PLANNING STUDY
PRELIMINARY CORRIDOR ALTERNATIVES, CARIBOU HABITAT AND USFWS DESIGNATED CRITICAL HABITAT FOR THREATENED AND ENDANGERED SPECIES

Prepared By Allied GIS

DATE: January 14, 2010

Figure 9

D:\AlliedGIS\GIS\13 GIS Datasets\mxd\nei_caribou_eider_Corridor_11x17l-9.mxd



- Communities
- Study Area
- Cataloged Anadromous Streams
- Preliminary Corridor Alternatives
- Existing Roads
- High Probability Wetland Areas

Method: Because over 80% of the study area has not been mapped for wetlands, an office-based approach was used to determine areas with a high probability of containing jurisdictional wetlands. (See Section 2.3.5 for more detail.)

Sources: Statewide Vegetation/Land Cover. Available at: http://agdc.usgs.gov/data/projects/fhm/#G
ADF&G Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes

STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY

PRELIMINARY CORRIDOR ALTERNATIVES, WETLANDS, AND ADF&G CATALOGED ANADROMOUS STREAMS

Prepared By Allied GIS

DATE: January 14, 2010

Figure 10

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3.3 Preliminary Corridor Alternative: Route 1

3.3.1 General Corridor Description

Length of New Road:	440 miles
Starting Point:	Near Jim River on the Dalton Highway
Ending Point:	The existing terminus of the Nome-Council Highway, near Council
Major River Crossing:	Koyukuk River
Terrain:	Approximately 360 miles through flat terrain (0 to 5% slope); approximately 50 miles through rolling terrain (5 to 10% slope); approximately 30 miles through mountainous terrain (>10% slope)

Route 1 was selected as a corridor alternative primarily for its ability to facilitate access to the northern communities within the study area and to the rich mineral district in the Ambler area. Route 1 begins near the Jim River near Milepost 138 on the Dalton Highway. The corridor trends roughly southwest from its start point to its terminus at the Nome-Council Highway.

The corridor is routed so as to avoid the Kanuti NWR and the "boot" of the Gates of the Arctic National Park and Preserve. Although the crossing of federal CSUs was avoided to the greatest extent possible, Route 1 crosses through the Koyukuk NWR. The project team determined that, to reach the Seward Peninsula via a northern corridor, there was no reasonable alternative to crossing the refuge.

The criteria and constraints presented in Chapter 2 are outlined in the following sections, as they specifically apply to preliminary corridor alternative Route 1.

3.3.2 Communities

Community Criteria	Data Value
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	7.5 people/mile
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	9.5 people/mile
Total distance between Fairbanks and Nome along corridor	713 miles

Figure 7 shows community locations in relation to Route 1. There are 13 communities with a combined population of 2,338 within 50 miles of Route 1. Approximately 311 miles of secondary access roads would need to be constructed, which is a ratio of 7.5 people per mile of

access road, to reach all 13 communities within 50 miles. There are five communities with a combined population of 351 within 20 miles of Route 1. Most of the population accessible from Route 1 lies outside of the 20-mile distance most feasible for the construction of access roads. Approximately 37 miles of secondary access roads would need to be constructed, which is a ratio of 9.5 people per mile of access road, to reach all five communities within 20 miles of the corridor. Refer to Appendix A for specific information on communities near Route 1. Although the length of new road for Route 1 is 440 miles, the total road distance between Fairbanks and Nome is much longer, primarily because Route 1 begins about 200 miles north of Fairbanks.

3.3.3 Resources

Resources Criteria	Data Value
Total estimated gross value of significant mineral resources within 100 miles of corridor	$27.5 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$21.4 billion

Figure 7 shows mineral occurrence locations in relation to Route 1. There are 15 significant mineral resource occurrences with a total estimated gross value of approximately $27.5 billion within 100 miles of Route 1. This large number can be attributed primarily to the Ambler mining district. There are nine significant mineral resource occurrences with a total estimated gross value of approximately $21.4 billion within 50 miles of Route 1. Most of the Ambler mining district lies within 50 miles of this corridor alternative. Refer to Appendix B for more information on mineral resources near Route 1.

3.3.4 Land Ownership and Management

Land Ownership/Management Criteria	Data Value
Miles through national parks, preserves, monuments, or wildlife refuges	32 miles
Miles through federal-owned lands	228 miles
Miles through Native-owned lands	42 miles

Figure 8 shows land ownership and management status of lands crossed by Route 1. Route 1 travels through 32 miles of the Koyukuk NWR and is the only preliminary corridor alternative to cross a federal CSU. Nearly half the total length of the corridor (228 miles) crosses through federal-owned lands. Less than a tenth of the total corridor length (42 miles) traverses Native-

owned lands, which could equate to a relatively small number of landowners involved in ROW negotiation.

3.3.5 Environmental Criteria

Environmental Criteria	Data Value
Miles through caribou wintering areas	199 miles
Miles through designated T&E species critical habitat	None
Number of streams in the catalog of anadromous waters crossed	11
Total stream crossings	326
Miles through high-probability wetland areas and other waters of the U.S.	236 miles
Number of times corridor crosses the Iditarod Trail	None

Route 1 crosses through 199 miles of caribou wintering area (**Figure 9**). Roughly 40 miles of this total length are through the Nulato Hills ACEC, which has been designated as core winter range of the Western Arctic Caribou herd. Route 1 is the only corridor alternative to cross the Nulato Hills ACEC. Route 1 does not cross any designated T&E species critical habitat (**Figure 9**). Route 1 crosses eleven streams recorded in the catalog of anadromous waters (**Figure 10**), which is a relatively low number considering the length of the corridor. Route 1 crosses approximately 326 total streams and 236 miles of land modeled as high-probability wetlands (**Figure 10**). Since more than 80% of the terrain traversed by Route 1 is flat (0 to 5% slope), the presence of wetlands can be expected along much of the corridor. Route 1 does not cross the Iditarod Trail (**Figure 7**).

3.3.6 Engineering and Costs

Engineering and Cost Criteria	Data Value
Total estimated construction cost	$2.08 billion
Estimated annual M&O costs	$11 million

The flat terrain crossed by Route 1 (over 80% of its length) is a key factor in the estimated construction cost, as only approximately 20% of the corridor is anticipated to require the increased effort and costs involved with construction through more difficult (rolling or mountainous) terrain. Appendix D contains detailed cost estimates. Key components of the estimated construction cost for Route 1 include:

Road Construction	358 miles flat, 52 miles rolling, 30 miles mountainous (terrain profile in Appendix D)	$1.73 billion
Bridges	1 major crossing, 10 minor crossings, 94 stream crossings	$220 million
Maintenance Facility Capital Costs	8 maintenance stations	$124 million
	Total estimated construction cost for Route 1 =	***$2.08 billion***

3.4 Preliminary Corridor Alternative: Route 2a

3.4.1 General Corridor Description

Length of New Road: 510 miles

Starting Point: Just north of the Yukon River on the Dalton Highway

Ending Point: The existing terminus of the Nome-Council Highway, near Council

Major River Crossing: Koyukuk River

Terrain: Approximately 280 miles through flat terrain (0 to 5% slope); approximately 110 miles through rolling terrain (5 to 10% slope); approximately 120 miles through mountainous terrain (>10% slope)

Route 2a was selected as a corridor alternative primarily for its ability to facilitate access to the communities and mineral resources along the Yukon River. Route 2a begins just north of the Yukon River near Milepost 56 on the Dalton Highway. This launch point for the corridor was selected to evaluate a Yukon River Corridor without the need for a new Yukon River crossing. The corridor trends southwest from its start point to Tanana, where it strikes out almost directly west to its terminus at the Nome-Council Highway.

The corridor is routed to avoid a new Yukon River crossing and federal CSUs. The option of routing the corridor alignment closer to the Yukon River was explored, but terrain constraints prohibited a closer parallel alignment with the river. Route 2a encounters long sections of difficult terrain between Tanana and Galena and between Koyukuk and Koyuk. The mountains through which Route 2a passes significantly increase anticipated construction costs and efforts.

The criteria and constraints presented in Chapter 2 are outlined in the following sections, as they specifically apply to preliminary corridor alternative Route 2a.

3.4.2 Communities

Community Criteria	Data Value
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	18.5 people/mile
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	35.5 people/mile
Total distance between Fairbanks and Nome along corridor	709 miles

Figure 7 shows community locations in relation to Route 2a. There are 12 communities with a combined population of 2,762 within 50 miles of Route 2a. Approximately 151 miles of secondary access roads would need to be constructed, which is a ratio of 18.5 people per mile of access road, to reach all 12 communities within 50 miles. There are nine communities with a combined population of 2,191 within 20 miles of Route 2a. Most of the population accessible from Route 2a is within the 20-mile distance most feasible for the construction of access roads. Approximately 62 miles of secondary access roads would need to be constructed, which is a ratio of 35.5 people per mile of access road, to reach all nine communities within 20 miles of the corridor. Refer to Appendix A for specific information on communities near Route 2a. The total distance between Fairbanks and Nome on Route 2a is nearly 200 miles longer than the length of new road because Route 2a begins about 120 miles north of Fairbanks.

3.4.3 Resources

Resources Criteria	Data Value
Total estimated gross value of significant mineral resources within 100 miles of corridor	$7.8 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$5.6 billion

Figure 7 shows mineral occurrence locations in relation to Route 2a. There are 16 significant mineral resource occurrences with a total estimated gross value of approximately $7.8 billion within 100 miles of Route 2a. The Ambler mining district is not within 100 miles of this corridor. There are eight significant mineral resource occurrences with a total estimated gross value of approximately $5.6 billion within 50 miles of Route 2a. Refer to Appendix B for more information on mineral resources near Route 2a.

3.4.4 Land Ownership and Management

Land Ownership/Management Criteria	Data Value
Miles through national parks, preserves, monuments, or wildlife refuges	None
Miles through federal-owned lands	231 miles
Miles through Native-owned lands	144 miles

Figure 8 shows land ownership and management status of lands crossed by Route 2a. Route 2a does not cross any federal CSUs. Almost half the total length of the corridor (231 miles) crosses through federal-owned lands. Approximately 30% of the total corridor length (144 miles) traverses Native-owned lands, which could equate to a relatively large number of landowners involved in ROW negotiation.

3.4.5 Environmental Criteria

Environmental Criteria	Data Value
Miles through caribou wintering areas	172 miles
Miles through designated T&E species critical habitat	None
Number of streams in the catalog of anadromous waters crossed	25
Total stream crossings	359
Miles through high-probability wetland areas and other waters of the U.S.	152 miles
Number of times corridor crosses the Iditarod Trail	None

Route 2a crosses through 172 miles of caribou wintering area (**Figure 9**), but does not cross the core winter range designated by the Nulato Hills ACEC. Route 2a does not cross any designated T&E species critical habitat (**Figure 9**). Route 2a crosses 25 streams recorded in the catalog of anadromous waters, 359 total streams, and 152 miles of land modeled as high-probability wetlands (**Figure 10**). Nearly 45% of the terrain traversed by Route 2a is rolling or mountainous; the presence of wetlands is likely more prevalent in the portions of the corridor that traverse flat terrain. Route 2a does not cross the Iditarod Trail (**Figure 7**).

3.4.6 Engineering and Costs

Engineering and Cost Criteria	Data Value
Total estimated construction cost	$2.88 billion
Estimated annual M&O costs	$12 million

The 230 miles of rolling or mountainous terrain crossed by Route 2a is a key factor in the estimated construction cost, as approximately 45% of the corridor is anticipated to require the increased effort and costs involved with construction through this more difficult terrain. Appendix D contains detailed cost estimates. Key components of the estimated construction cost for Route 2a include:

Road Construction	280 miles flat; 110 miles rolling; 120 miles mountainous (terrain profile in Appendix D)	$2.42 billion
Bridges	1 major crossing, 14 minor crossings, 147 stream crossings	$323 million
Maintenance Facility Capital Costs	9 maintenance stations	$140 million
	Total estimated construction cost for Route 2a =	***$2.88 billion***

3.5 Preliminary Corridor Alternative: Route 2b

3.5.1 General Corridor Description

Length of New Road: 450 miles

Starting Point: Near Manley Hot Springs on the Elliott Highway

Ending Point: The existing terminus of the Nome-Council Highway, near Council

Major River Crossing: Yukon River, Koyukuk River

Terrain: Approximately 260 miles through flat terrain (0 to 5% slope); approximately 100 miles through rolling terrain (5 to 10% slope); approximately 90 miles through mountainous terrain (>10% slope)

Route 2b, like Route 2a, was selected as a corridor alternative primarily for its ability to facilitate access to the communities and mineral resources along the Yukon River. Route 2b begins just outside of Manley Hot Springs on the Elliott Highway, taking advantage of nearly 70 miles of existing road. This launch point for the corridor was selected to evaluate the benefits of using existing road weighed against the need to construct a new Yukon River crossing. The corridor trends almost directly west from its start point to its terminus at the Nome-Council Highway. From Tanana to the terminus of the corridor, Route 2b follows the same alignment as Route 2a.

The corridor is routed so as to avoid federal CSUs. Route 2b encounters long sections of difficult terrain between Tanana and Galena and between Koyukuk and Koyuk. The mountains through which Route 2b passes significantly increase anticipated construction costs and efforts.

The criteria and constraints presented in Chapter 2 are outlined in the following sections, as they specifically apply to preliminary corridor alternative Route 2b.

3.5.2 Communities

Community Criteria	Data Value
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	15 people/mile
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	36 people/mile
Total distance between Fairbanks and Nome along corridor	665 miles

Figure 7 shows community locations in relation to Route 2b. There are 12 communities with a combined population of 2,762 within 50 miles of Route 2b. Approximately 182 miles of secondary access roads would need to be constructed, which is a ratio of 15 people per mile of access road, to reach all 12 communities within 50 miles. There are eight communities with a combined population of 2,175 within 20 miles of Route 2b. Most of the population accessible from Route 2b is within the 20-mile distance most feasible for the construction of access roads. Approximately 60 miles of secondary access roads would need to be constructed, which is a ratio of 36 people per mile of access road, to reach all eight communities within 20 miles of the corridor. Refer to Appendix A for specific information on communities near Route 2b. The length of new road for Route 2b is just slightly more than Route 1, but the distance between Fairbanks and Nome using Route 2b is nearly 50 miles shorter than using Route 1.

3.5.3 Resources

Resources Criteria	Data Value
Total estimated gross value of significant mineral resources within 100 miles of corridor	$7.8 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$5.6 billion

Figure 7 shows mineral occurrence locations in relation to Route 2b. There are 16 significant mineral resource occurrences with a total estimated gross value of approximately $7.8 billion

within 100 miles of Route 2b. The Ambler mining district is not within 100 miles of this corridor. There are eight significant mineral resource occurrences with a total estimated gross value of approximately $5.6 billion within 50 miles of Route 2b. Refer to Appendix B for more information on mineral resources near Route 2b.

3.5.4 Land Ownership and Management

Land Ownership/Management Criteria	Data Value
Miles through national parks, preserves, monuments, or wildlife refuges	None
Miles through federal-owned lands	200 miles
Miles through Native-owned lands	120 miles

Figure 8 shows land ownership and management status of lands crossed by Route 2b. Route 2b does not cross any federal CSUs. Approximately 40% of the total length of the corridor (200 miles) crosses through federal-owned lands. Approximately 25% of the total corridor length (120 miles) traverses Native-owned lands, which could equate to a relatively large number of landowners involved in ROW negotiation.

3.5.5 Environmental Criteria

Environmental Criteria	Data Value
Miles through caribou wintering areas	172 miles
Miles through designated T&E species critical habitat	None
Number of streams in the catalog of anadromous waters crossed	20
Total stream crossings	314
Miles through high-probability wetland areas and other waters of the U.S.	145 miles
Number of times corridor crosses the Iditarod Trail	None

Route 2b crosses through 172 miles of caribou wintering area (**Figure 9**), but does not cross the core winter range designated by the Nulato Hills ACEC. Route 2b does not cross any designated T&E species critical habitat (**Figure 9**). Route 2b crosses 20 streams recorded in the catalog of anadromous waters, 314 total streams, and 145 miles of land modeled as high-probability wetlands (**Figure 10**). Over 40% of the terrain traversed by Route 2b is rolling or mountainous; the presence of wetlands is likely more prevalent in the portions of the corridor that traverse flat terrain. Route 2b does not cross the Iditarod Trail (**Figure 7**).

3.5.6 Engineering and Costs

Engineering and Cost Criteria	Data Value
Total estimated construction cost	$2.61 billion
Estimated annual M&O costs	$11 million

The 190 miles of rolling or mountainous terrain crossed by Route 2b is a key factor in the estimated construction cost, as over a third of the corridor is anticipated to require the increased effort and costs involved with construction through this more difficult terrain. Appendix D contains detailed cost estimates. Key components of the estimated construction cost for Route 2b include:

Road Construction	260 miles flat; 100 miles rolling; 90 miles mountainous (terrain profile in Appendix D)	$2.08 billion
Bridges	2 major crossings, 13 minor crossings, 132 stream crossings	$406 million
Maintenance Facility Capital Costs	8 maintenance stations	$124 million
	Total estimated construction cost for Route 2b =	***$2.61 billion***

3.6 Preliminary Corridor Alternative: Route 3

3.6.1 General Corridor Description

Length of New Road: 620 miles

Starting Point: Near Nenana on the Parks Highway

Ending Point: The existing terminus of the Nome-Council Highway, near Council

Major River Crossing: Yukon River

Terrain: Approximately 450 miles through flat terrain (0 to 5% slope); approximately 120 miles through rolling terrain (5 to 10% slope); approximately 50 miles through mountainous terrain (>10% slope)

Route 3 was selected as a corridor alternative primarily for its ability to facilitate access to the communities and mineral resources in the southern portion of the study area. Route 3 begins near Nenana on the Parks Highway. The corridor trends indirectly west from its start point, sweeping widely to the south to avoid mountainous terrain and federal CSUs. Once Route 3 nears Norton Sound, it heads north and meets with the alignment of Routes 2a and 2b, where it then heads west to its terminus at the Nome-Council Highway.

The corridor is routed so as to avoid federal CSUs. Doing so requires a diversion of significant length to avoid the Nowitna NWR and a smaller diversion to avoid the Unalakleet Wild and Scenic River. Route 3 is, to a large extent, able to avoid most mountainous terrain, with very little of its total length through areas of greater than 10% slope.

The criteria and constraints presented in Chapter 2 are outlined in the following sections, as they specifically apply to preliminary corridor alternative Route 3.

3.6.2 Communities

Community Criteria	Data Value
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	9.5 people/mile
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	22.5 people/mile
Total distance between Fairbanks and Nome along corridor	742 miles

Figure 7 shows community locations in relation to Route 3. There are 14 communities with a combined population of 3,417 within 50 miles of Route 3. The communities of Unalakleet and Shaktoolik on Norton Sound account for nearly 30% of this population. Approximately 365 miles of secondary access roads would need to be constructed, which is a ratio of 9.5 people per mile of access road, to reach all 14 communities within 50 miles. There are five communities with a combined population of 1,232 within 20 miles of Route 3. More than 60% of the population accessible from Route 3 lies outside of the 20-mile distance most feasible for the construction of access roads. Approximately 55 miles of secondary access roads would need to be constructed, which is a ratio of 22.5 people per mile of access road, to reach all five communities within 20 miles of the corridor. Refer to Appendix A for specific information on communities near Route 3. The length of new road required and the total distance between Fairbanks and Nome along Route 3 are the longest of all corridor alternatives.

3.6.3 Resources

Resources Criteria	Data Value
Total estimated gross value of significant mineral resources within 100 miles of corridor	$7.4 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$5.3 billion

Figure 7 shows mineral occurrence locations in relation to Route 3. There are 19 significant mineral resource occurrences with a total estimated gross value of approximately $7.4 billion within 100 miles of Route 3. The Ambler mining district is well outside of 100 miles from this corridor. There are 13 significant mineral resource occurrences with a total estimated gross value of approximately $5.3 billion within 50 miles of Route 3. Refer to Appendix B for more information on mineral resources near Route 3.

3.6.4 Land Ownership and Management

Land Ownership/Management Criteria	Data Value
Miles through national parks, preserves, monuments, or wildlife refuges	None
Miles through federal-owned lands	284 miles
Miles through Native-owned lands	64 miles

Figure 8 shows land ownership and management status of lands crossed by Route 3. Route 3 does not cross any federal CSUs. Approximately 45% of the total length of the corridor (284 miles) crosses through federal-owned lands. Approximately 10% of the total corridor length (64 miles) traverses Native-owned lands, which could equate to a relatively small number of landowners involved in ROW negotiation.

3.6.5 Environmental Criteria

Environmental Criteria	Data Value
Miles through caribou wintering areas	223 miles
Miles through designated T&E species critical habitat	54 miles
Number of streams in the catalog of anadromous waters crossed	26
Total stream crossings	431
Miles through high-probability wetland areas and other waters of the U.S.	232 miles
Number of times corridor crosses the Iditarod Trail	3

Route 3 crosses through 223 miles of caribou wintering area (**Figure 9**), but does not cross the core winter range designated by the Nulato Hills ACEC. Route 3 crosses through 54 miles of designated T&E species critical habitat (**Figure 9**) and is the only alternative that crosses through this habitat. Route 3 crosses 26 streams recorded in the catalog of anadromous waters, 431 total streams, and 232 miles of land modeled as high-probability wetlands (**Figure 10**). Over 70% of the terrain traversed by Route 3 is flat; wetlands can be expected along much of the total length of the corridor. Route 3 is the only preliminary corridor alternative that crosses the Iditarod Trail, crossing the trail three times (**Figure 7**).

3.6.6 Engineering and Costs

Engineering and Cost Criteria	**Data Value**
Total estimated construction cost	$3.21 billion
Estimated annual M&O costs	$15 million

Over 70% of the terrain traversed by Route 3 is flat, but this corridor alternative is the longest of the four alternatives. The overall length of the corridor, the 170 miles of rolling or mountainous terrain, and the high number of river and stream crossings are key factors in the estimated construction cost of Route 3. Appendix D contains detailed cost estimates. Key components of the estimated construction cost for Route 3 include:

Road Construction	450 miles flat; 120 miles rolling; 50 miles mountainous	$2.54 billion
Bridges	1 major crossing, 35 minor crossings, 160 stream crossings	$496 million
Maintenance Facility Capital Costs	11 maintenance stations	$171 million
	Total estimated construction cost for Route 3 =	***$3.21 billion***

4.0 PRELIMINARY CORRIDOR ALTERNATIVES SCREENING

Six project team members representing transportation planning, engineering, environmental, and ROW viewpoints assembled to weight and score the preliminary corridor alternatives using the communities, resources, land use, environmental, engineering, and cost criteria. Of utmost importance in the weighting and scoring was determining to what degree each of the preliminary alternatives meets the stated purpose of the proposed road to facilitate resource and community development in Western Alaska. Resources and communities provide the primary general reasons to advance an alternative for continued consideration. The environmental, land ownership/management, engineering, and cost criteria identify the disadvantages of each corridor and reasons why an alternative should potentially *not* be considered further.

4.1 Criteria Weighting

The group representing the multidisciplinary viewpoints collectively assigned weighting to each criteria category and to each individual criterion. Weighting of the criteria categories was assigned, either negatively or positively, in the range of “1” to “4,” with “1” indicating low impact to project decision-making and “4” indicating high impact to decision-making. The weights assigned to the categories of Communities and Resources are positive; this indicates that the impacts of these criteria are advantageous to the corridor alternatives and when applied to the raw scores will produce a more positive weighted score. The weights assigned to the categories of Land Ownership/Management, Environmental, and Engineering and Costs are negative - this indicates that the impacts of these criteria are disadvantageous to the project and when applied to the raw scores will produce a negative weighted score. The cumulative score reflects the positive impacts of access to communities and resources minus the disadvantageous impacts associated with land ownership/management, the environment, and costs.

The weights assigned to each category are presented in **Table 6**. Weights assigned to each individual criterion are presented in Appendix F.

Note that the weight assigned to each category is not intended to indicate the relative importance of each category. Rather, *the weight indicates the relative impact of each category to decision-making about the project*. This distinction is critical, as the project team recognizes that environmental criteria are of vital importance in the consideration of any corridor alternative.

However, with the limited environmental information available at this preliminary stage in the project, there is little distinction between alternatives under this category, thus the impact of environmental criteria to decision-making analysis was determined to be small when compared to other criteria.

Table 6: Criteria Category Weighting

Criteria Category	Weight	Rationale
Communities	4	Access to communities is one of the primary purposes of this project, so this category was weighted heavily positive.
Resources	4	Access to resources is the other primary purpose of this project, so this category was also weighted heavily positive.
Land Ownership/ Management	-2	Land ownership and management impacts were determined to be unfavorable and somewhat significant, so were weighted accordingly negative.
Environmental	-1	Environmental impacts associated with the project were determined to be unfavorable, yet very little distinction exists between alternatives in this category, so this category was weighted slightly negative.
Engineering and Costs	-3	The costs and constructability associated with the project were considered significant to project feasibility, and higher costs are unfavorable, so this category was weighted fairly heavily negative.

4.2 Criteria Scoring

The project team used a blend of quantitative and qualitative measures to compare the strengths and weaknesses of the preliminary corridor alternatives. Data collected for each criterion was used as a quantitative tool to evaluate each corridor alternative. The scoring of the criteria was more qualitative in nature, as criteria were scored according to priorities held by each of the multidisciplinary viewpoints represented in the scoring process. Scoring for the preliminary corridor alternatives was assigned to each criterion by each of the six team members in the range of “0” to “5” with the following directives for the categories:

Communities and Resources
“0” = data indicates ***least beneficial value*** to the project
“5” = data indicates ***most beneficial value*** to the project

Land Ownership/Management, Environmental, and Engineering and Costs
“0” = data indicates ***least negative impact*** to the project
“5” = data indicates ***most negative impact*** to the project

4.3 Screening Criteria Data

The summary of data collected for each of the 16 screening criteria for the four preliminary corridor alternatives is presented in **Table 7**. Using this data, the team of six professionals representing planning, engineering, environmental, mineral resource, communities, and land management viewpoints scored the preliminary corridor alternatives by the methods presented in Section 4.2.

4.3.1 Scoring Results

The results of the scoring process are presented in **Table 8**. Team members' individual weighted scores for each criterion were averaged to produce a final weighted score. The scores are subtotaled under each category to highlight the most and least favorable corridor alternatives in terms of community, environmental and land ownership/management, or construction and cost considerations. The cumulative sum of the scores, in effect, subtracts the total negative impacts from the total positive attributes. Alternatives 1 and 2b had the highest scores and represent the best balance of the community and resource development benefits with the least adverse impacts to the environment and land ownership/management, and the least cost to construct and operate. Historical studies of transportation corridors in the region, as well as more recent experience within the region, reinforce the results of this evaluation process.

A summary of the data and team scoring for the 16 preliminary screening criteria can be found in Appendix F.

Table 7: Screening Criteria Data Summary, Preliminary Corridor Alternatives

Preliminary Alternative Screening Criteria	Route 1 (440 miles)	Route 2a (510 miles)	Route 2b (450 miles)	Route 3 (620 miles)
Communities **Maximize the population potentially served by corridor**				
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	7.5 people/mile	18.5 people/mile	15 people/mile	9.5 people/mile
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	9.5 people/mile	35.5 people/mile	36 people/mile	22.5 people/mile
Total distance between Fairbanks and Nome along corridor	713 miles	709 miles	665 miles	742 miles
Resources **Maximize the estimated gross value of resources accessible from corridor**				
Total estimated gross value of significant mineral resources within 100 miles of corridor	$27.5 billion	$7.8 billion	$7.8 billion	$7.4 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$21.4 billion	$5.6 billion	$5.6 billion	$5.3 billion
Land Ownership/Management Criteria **Minimize the difficulty of ROW acquisition and adverse impacts to lands**				
Miles through national parks, preserves, monuments, or wildlife refuges	32	0	0	0
Miles through federal-owned lands	228	231	200	284
Miles through Native-owned lands	42	144	120	64
Environmental Criteria **Minimize adverse impacts to environment**				
Miles through caribou wintering areas	199	172	172	223
Miles through designated T&E species critical habitat	0	0	0	54
Number of streams in the catalog of anadromous waters crossed	11	25	20	26
Total stream crossings	326	359	314	431
Miles through high-probability wetland areas and other waters of the U.S.	236	152	145	232
Number of times corridor crosses Iditarod Trail	0	0	0	3
Engineering & Cost Criteria **Maximize construction and operation feasibility, minimize cost**				
Total estimated construction cost	$2.1 billion	$2.9 billion	$2.6 billion	$3.2 billion
Estimated annual M&O costs	$11 million	$12 million	$11 million	$15 million

Table 8: Scoring Results, Preliminary Corridor Alternatives

	Weighted Average Scores			
Preliminary Alternatives Screening Criteria	**Route 1**	**Route 2a**	**Route 2b**	**Route 3**
Communities				
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	0.8	2.2	1.9	0.8
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	5.0	14.0	14.5	9.0
Total distance between Fairbanks and Nome along corridor	1.4	1.4	2.1	1.0
Subtotal - Communities	**7.2**	**17.6**	**18.5**	**10.8**
Resources				
Total estimated gross value of significant mineral resources within 100 miles of corridor	4.8	2.2	2.2	1.7
Total estimated gross value of significant mineral resources within 50 miles of corridor	14.5	6.0	6.0	6.0
Subtotal – Resources	**19.3**	**8.2**	**8.2**	**7.7**
Subtotal – Communities & Resources Criteria	**26.5**	**25.8**	**26.7**	**18.5**
Land Ownership/Management Criteria				
Miles through national parks, preserves, monuments, or wildlife refuges	-5	0	0	0
Miles through federal-owned lands	-1.6	-1.6	-1.3	-2.1
Miles through Native-owned lands	-0.8	-1.8	-1.7	-0.9
Subtotal – Land Ownership/Management	**-7.4**	**-3.4**	**-3.0**	**-3.0**
Environmental Criteria				
Miles through caribou wintering areas	-0.8	-0.4	-0.4	-0.8
Miles through designated T&E species critical habitat	0	0	0	-0.9
Number of streams in the catalog of anadromous waters crossed	-0.2	-0.3	-0.3	-0.3
Total stream crossings	-0.3	-0.3	-0.2	-0.4
Miles through high-probability wetland areas and other waters of the U.S.	-0.6	-0.4	-0.4	-0.6
Number of times corridor crosses Iditarod Trail	0	0	0	-0.8
Subtotal – Environment	**-1.9**	**-1.4**	**-1.3**	**-3.8**
Engineering & Cost Criteria				
Total estimated construction cost	-4.2	-9.6	-7.1	-12.1
Estimated annual M&O costs	-1.0	-1.6	-1.0	-2.3
Subtotal – Engineering & Costs	**-5.2**	**-11.2**	**-8.1**	**-14.4**
Subtotal – Land, Environment, Engineering, & Cost Criteria	**-14.5**	**-16.0**	**-12.4**	**-21.2**

	Route 1	**Route 2a**	**Route 2b**	**Route 3**
Subtotal – Communities & Resources Criteria	**26.5**	**25.8**	**26.7**	**18.5**
Subtotal – Land, Environment, Engineering, & Cost Criteria	**-14.5**	**-16.0**	**-12.4**	**-21.2**
Cumulative Score	**12.0**	**9.8**	**14.3**	**-2.7**
Alternative advanced for further refined analysis?	**YES**	**NO**	**YES**	**NO**

4.3.2 Selected Alternatives

The intent of the scoring process was to remove preliminary corridor alternatives from further consideration which:

- Did not provide sufficient access to communities and/or resources; and/or
- Imposed unacceptable negative impacts to land ownership/management or the environment; and/or
- Imposed unacceptably high construction and/or M&O costs.

On the basis of the screening exercise conducted by the project team, two corridor alternatives were selected for refined analysis: Route 1 and Route 2b.

Advantages and challenges of the preliminary corridor alternatives selected for refined analysis are presented in the following summaries. The scoring for the alternatives presented in **Table 8** reflects the various advantages and challenges of each.

Route 1

Advantages	**Challenges**
• Proximity to rich Ambler mining district • Access to communities in northern portion of study area • Least cost to construct and maintain • Fewest topographical challenges	• Crosses through Koyukuk NWR • Crosses through Nulato Hills ACEC • Start point is furthest from Fairbanks of alternatives

Route 2b

Advantages	Challenges
• Access to communities and resource sites along Yukon River • Greatest population served of alternatives • Potential to enhance intermodal transportation system (Yukon River barges) • Uses approximately 70 miles of existing highway • Least overall measured negative impact to land and environment • Shortest travel distance between Fairbanks and Nome	• Significantly less mineral value in proximity to corridor than Route 1 • New Yukon River crossing required • Higher cost to construct than Route 1 • Topography (steeper grades, mountainous terrain)

4.3.3 Alternatives Dropped From Further Analysis

After evaluating the preliminary corridor alternatives, Route 2a and Route 3 were removed from further analysis. Advantages and challenges of the dropped alternatives are presented in the following summaries. Although Route 2a shares many of the same advantages and challenges as Route 2b, it has a higher estimated construction cost and demonstrates no clear advantage over Route 2b in any other aspect. Route 3 is subject to the largest number of challenges among the alternatives.

Route 2a

Advantages	Challenges
• Access to communities and resource sites along Yukon River • Potential to enhance intermodal transportation system (Yukon River barges) • No new Yukon River crossing required	• High cost to construct (higher than both Route 1 and Route 2b) • Significantly less mineral value in proximity to corridor than Route 1 • Longer travel distance between Fairbanks and Nome than Route 2b

Route 3

Advantages	**Challenges**
• Access to communities along Norton Sound and in the southern portion of study area • Proximity to resources in the southern portion of study area, Donlin mining district	• Significantly less mineral value in proximity to corridor than Route 1 • Highest cost to construct and maintain of alternatives (longest corridor alternative) • Crosses through Spectacled Eider critical habitat • Crosses Iditarod Trail three times • Longest travel distance between Fairbanks and Nome

5.0 REFINED CORRIDOR ALTERNATIVES

Routes 1 and 2b, selected through preliminary screening, were further evaluated in a refined analysis, and a proposed corridor was recommended. Criteria considered in the preliminary screening process were applied more rigorously to the selected alternatives, and a number of additional criteria were considered in the refined evaluation. This more detailed evaluation included revision of the corridor alignments, revised construction and maintenance cost estimates, feasibility and cost estimates of community road connections, geotechnical and materials evaluation, and analysis of ROW ownership and acquisition/permitting requirements.

5.1 Refined Corridor Alignments

The first task in the refined analysis consisted of revising the alignments of corridor alternatives Route 1 and Route 2b. Using USGS topographical mapping at a scale of one inch = four miles, corridor alignments were refined to avoid steep topography and wetlands areas to the extent possible. These adjustments resulted in longer corridors (due to routing alignments around rather than directly through terrain or wetlands) with fewer miles through the more difficult terrain. The refined corridor alternatives Route 1 and Route 2b are shown on **Figure 11** with communities, resources, and federal CSUs. The refined corridor alignments shown overlaid on topographic maps can be found in Appendix G. The USGS topographic mapping is suitable for this level of planning, but aerial mapping and fieldwork are essential to further define the most logical and feasible corridor alignment as design proceeds in future phases of the work.

Route 1: The revised alignment of Route 1 is 450 miles in length (as compared to 440 miles for the preliminary alternative alignment). The generally flat terrain crossed by this corridor alternative presented few topographical challenges to avoid with realignment of the corridor. The most significant adjustment made to the alignment of Route 1 is in the Zane Hills near the Selawik NWR (refer to Figure G3 in Appendix G). The only reasonable passage through the Zane Hills appears to be through Zane Pass, which causes Route 1 to cross through a small portion of the Selawik NWR and adds length to the corridor. Closer to the corridor's terminus at Council, additional length is realized by realignment of the corridor to avoid wetlands and cross rivers at points further upstream (Figure G7, Appendix G).

Route 2b: Route 2b provided substantially greater realignment opportunities due to the mountainous terrain crossed by much of the corridor. The revised alignment of Route 2b is 500 miles in length (as compared to 450 miles for the preliminary alternative alignment), and the additional length is primarily attributed to circumnavigating steep terrain. The first significant realignment to Route 2b occurs at its start point on the Elliott Highway. As shown in Figure G13 in Appendix G, to avoid the Manley Hot Springs Dome and surrounding terrain, Route 2b would more appropriately begin approximately 8 miles further east on the Elliott Highway than the preliminary alternative alignment suggested. Major corridor realignment was conducted in the Kokrines Hills area between Tanana and Ruby (Figures G10-G12, Appendix G). The rugged topography in this area restricts feasible corridor options, and Route 2b gains additional length and more stream crossings by following logical drainages to gain passage through this stretch. The same situation presents itself in the Nulato Hills near Norton Sound (Figures G8-G9, Appendix G); passage through this rugged terrain is most feasible following drainages, which contributes to additional corridor length and more stream crossings.

5.2 Refined Cost Estimates - Construction and Maintenance

One of the most critical aspects of the proposed road corridor is its cost to construct and maintain. Revised cost estimates were produced for the two refined alternatives using the new refined alignments with longer total road lengths. The discussion on M&O was expanded to include considerations for road resurfacing and rehabilitation and facilities maintenance not accounted for in routine maintenance cost estimates. The same cost assumptions used in the preliminary cost estimates for construction and routine maintenance were also used in the refined estimates. Those assumptions and calculations can be found in Appendix D.

The WAAPS road will require resurfacing and rehabilitation over its lifetime. This road, like other gravel roads in northern Alaska, is anticipated to be especially challenging to maintain in good condition. The gravel road will cross significant expanses of tundra and permafrost, and at critical times of the year, thawing and drainage events can quickly degrade sections of the road. Heavy truck traffic and grading will also contribute to loss of gravel surfacing. These challenges and higher remote costs make road renewal particularly expensive—estimated at about $750,000 per mile for major rehabilitation in the 2003 DOT&PF *Nome Area Tourism Demand, Potential, and Infrastructure Study*.

Assuming the design life of the road is 20 years, an optimum resurfacing and rehabilitation program would address an average of 5% of the road length each year. The actual amount of resurfacing and rehabilitation performed annually is dependent on legislative funding and varies from year to year. For comparison, the Dalton Highway received $10 million in funding for resurfacing and rehabilitation in fiscal year 2008 and $13 million in fiscal year 2009. The Dalton Highway is approximately 420 miles long. Assuming a rough estimate of $1 million per mile for resurfacing and rehabilitation (projecting the 2003 figure of $750,000 per mile to 2009 dollars by adding 4% annual inflation), this funding only covers resurfacing and rehabilitation for 10 to 13 miles of road (less than 3% of its length) each year.

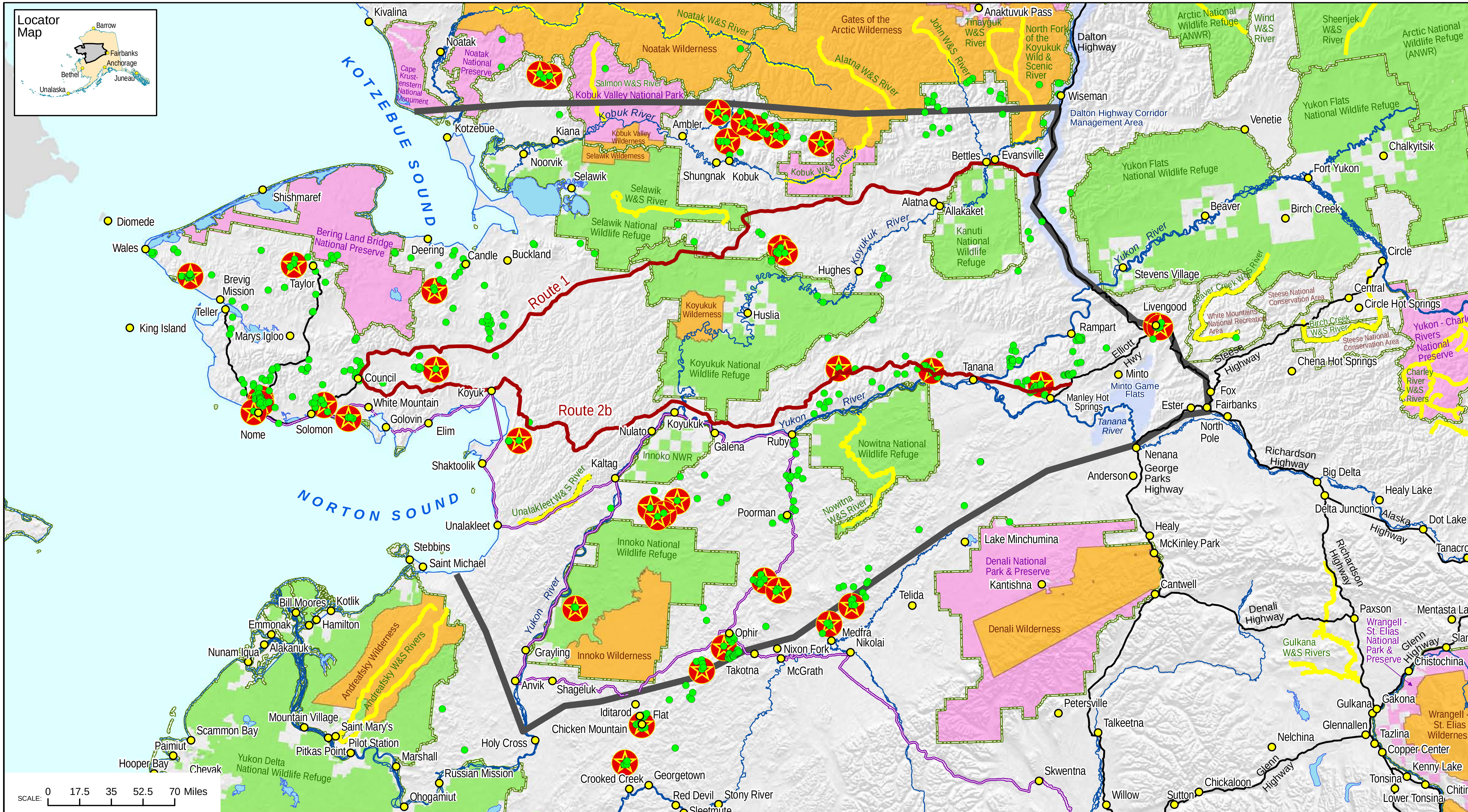
Facilities maintenance is also dependent upon legislative funding and varies from year to year. The Dalton Highway received $1.9 million in facilities maintenance funding in fiscal year 2008 for its six maintenance stations, an average of $320,000 per maintenance station.

For purposes of this project, a design life of 20 years and an optimum resurfacing and rehabilitation program (addressing 5% of road length each year at $1 million per mile) are assumed for resurfacing and rehabilitation cost estimates. Annual facilities maintenance is assumed at the fiscal year 2008 level of $320,000 per maintenance station. A summary of cost estimates for the refined alternatives, Routes 1 and 2b, is presented in **Table 9**. Appendix D contains detailed cost estimates.

Table 9: Refined Cost Estimates

Refined Corridor Alternative	Route 1	Route 2b
Estimated Construction Costs		
Proposed new length of road	450 miles	500 miles
Road Construction Cost ($B)	$1.76	$2.20
Bridge Construction Cost ($B)	$0.22	$0.40
Maintenance Facilities Capital Cost ($B)	$0.12	$0.14
Total Construction Cost ($B)	**$2.10**	**$2.74**
Estimated Annual M&O/Rehabilitation Costs		
Routine Maintenance ($M)	$11.0	$12.0
Facilities Maintenance ($M)	$2.6	$2.9
Resurfacing and Rehabilitation ($M)	$22.5	$25.0
Total Annual M&O/Rehab Cost ($M)	**$36.1**	**$39.9**

Notes: $B = billion dollars
$M = million dollars



- Communities
- Study Area
- Refined Corridor Alternatives
- Significant Mineral Occurrence
- Lesser Mineral Occurrence
- National Park Service
- U.S. Fish & Wildlife Service
- National Wilderness Preservation System
- Other Controlled Use/Management Area
- Wild & Scenic Rivers
- Existing Roads
- Iditarod Trail
- Major Lakes
- Major Rivers

Data Sources
Minerals: C.C. Hawley & M.K. Vant, February 2009
Land Status: Alaska Dept. of Natural Resources 2008

STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY

REFINED CORRIDOR ALTERNATIVES

Prepared By Allied GIS
DATE: January 14, 2010

Figure 11

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5.3 Community Accessibility

In the preliminary screening process, communities were analyzed using a ratio of population to the measured straight line distance between communities and the corridor alternatives. This refined evaluation considers the feasibility and costs of constructing secondary access roads to the communities within 20 miles of each refined corridor. It is assumed that access roads in excess of 20 miles are less likely to be constructed and are not considered in this evaluation.

Route 1 - Community Accessibility

Community	2008 DCCED Population	Straight Line Distance from Route 1 (miles)	Accessibility Issues
Bettles	22	1	None
Evansville	14	2	None
Alatna	28	7	To avoid river crossing, access road would need to be approx. 10 miles
Allakaket	96	10	Koyukuk River crossing
White Mountain	191	18	Access more feasible from Nome-Council Highway than from Route 1

Route 2b - Community Accessibility

Community	2008 DCCED Population	Straight Line Distance from Route 2b (miles)	Accessibility Issues
Koyuk	333	1	None
Tanana	252	2	None
Galena	580	5	None
Koyukuk	88	6	None
Nulato	274	9	None
White Mountain	191	10	Stream crossings, wetlands
Ruby	160	16	Yukon River crossing, use Grayling Creek Pass through the hills
Golovin	160	17	Stream crossings, wetlands
Elim	297	18	Stream crossings

Unless otherwise indicated, it is assumed that the secondary access roads to reach communities will be of the approximate length measured as straight line distance. In practicality, the access roads will likely be somewhat longer than the direct distance due to terrain avoidance, but unless a significant obstacle has been noted in the accessibility issues, these small variations are not accounted for in the following cost estimates.

Road construction costs are estimated for a 24-foot-wide gravel road, assuming the same typical section as for the main corridor. Using the same pay item unit prices presented in Appendix D for a 24-foot-wide road surface, the cost per mile for access roads (assuming flat terrain) is $3 million/mile. This cost includes contingency, mobilization, engineering, and administration/overhead. Using the same bridge design assumptions presented in Appendix D for a 24-foot-wide road, bridge costs are $91.4 million for the Yukon River, $22.8 million for the Koyukuk River, $2.6 million for minor river crossings, and $1.4 million for stream crossings.

Route 1 - Access Road Cost Estimates

Community	2008 DCCED Population	Straight Line Distance from Route 1 (miles)	Accessibility Issues	Access Road Cost
Bettles	22	1	None	$3 million
Evansville	14	2	None	$6 million
Alatna	28	10	1 stream crossing	$31.4 million
Allakaket	96	10	Koyukuk River	$52.8 million
White Mountain	191	14 (from Nome-Council Highway)	1 minor river crossing, 5 stream crossings	$51.6 million
TOTALS	351	37	**N/A**	**$144.8 million**

Route 2b - Access Road Cost Estimates

Community	2008 DCCED Population	Straight Line Distance from Route 2b (miles)	Accessibility Issues	Access Road Cost
Koyuk	333	1	None	$3 million
Tanana	252	2	None	$6 million
Galena	580	5	1 stream crossing	$16.4 million
Koyukuk	88	6	None	$18 million
Nulato	274	9	3 stream crossings	$31.2 million
White Mountain	191	10	1 minor river crossing	$32.6 million
Ruby	160	16	Yukon River crossing, 3 stream crossings	$143.6 million
Golovin	160	17	2 minor river crossings, 3 stream crossings	$60.4 million
Elim	297	18	2 minor river crossings, 4 stream crossings	$64.8 million
TOTALS	2,335	84	**N/A**	**$376 million**

The total estimated cost to construct access roads to all communities within 20 miles of Route 2b is more than twice the cost to construct access roads to all communities within 20 miles of Route 1. However, Route 2b access roads will reach 9 communities with a total population of 2,335 versus the 5 communities with a total population of 351 reached by Route 1. The average cost per person for access roads from Route 1 is approximately $413,000. The average cost for per person for access roads from Route 2b is approximately $161,000. Although costs of the major river (Yukon and Koyukuk) crossings are included in the estimates, bridges across the major rivers are not likely to be constructed to access single communities. Ferry crossings are more viable (though not evaluated in this study), thus the costs to reach Ruby from Route 2b and Allakaket from Route 1 would likely decrease substantially without the bridge costs. In general, community connector costs noted above are conservative and would likely be reduced with more detailed planning.

5.4 Geotechnical Analysis

A geotechnical analysis of the two refined corridor alternatives was conducted to provide planning level information regarding suspected geologic conditions and hazards associated with each of the proposed alternatives. The information also provides a general discussion about availability of materials that may be suitable for road construction. No fieldwork was conducted as part of this analysis. The complete geotechnical analysis can be found in Appendix H.

No significant distinction between Routes 1 and 2b in geologic conditions, hazards, construction materials availability, or permafrost is identified by the geotechnical analysis. The analysis was conducted using existing geologic and permafrost mapping, which provide little specific information for the study area. Extensive fieldwork will be required to more adequately define the geologic characteristics of a road corridor.

Both alternatives encounter variable geology along their lengths, including substantial glacial, alluvial, and colluvial deposits, as well as bedrock. Route 2b crosses through extensive areas of mountain colluvium and alluvium (coarse and fine bedrock rubble). Although prevalent along the corridor, the suitability of this rock for use in road construction will require field investigation and testing. Route 1 crosses through much more variable geologic deposits along its length, including many fine-grained glacial or eolian deposits. Although these fine-grained deposits are not likely suitable for use in road construction, Route 1 encounters many alluvial and colluvial deposits, which may provide suitable construction materials at reasonable intervals along the corridor.

In addition to variable geologic conditions, both corridors are located within the discontinuous permafrost zone, underlain by moderately thick to thin permafrost in areas of fine-grained deposits. Some discontinuous or isolated masses of permafrost may also be encountered in areas of course-grained deposits. Geotechnical fieldwork will further define permafrost conditions along the road corridor.

5.5 Right-of-Way Permitting/Acquisition Constraints

The following discussion presents, compares, and contrasts general land ownership, anticipated ROW acquisition constraints, and estimated ROW acquisition costs for the refined corridor alternatives. A ROW width of 500 feet is assumed. This width would accommodate the road and possible future utilities, pipelines, and/or rail lines.

Route 1: This corridor alternative initially crosses state lands, approximately the first five miles of which are located within the Dalton Highway Corridor Management Area. Route 1 continues across Native lands owned by the Village of Evansville and Doyon, Limited and the Village of Allakaket and Doyon, Limited. To the west of Alatna, the proposed route traverses approximately 85 miles of what is primarily state-owned land and continues on to cross a stretch of federal lands approximately 200 miles long, a small portion of which are subject to active state and/or Native land selections and 36 miles of which are located within the Koyukuk and Selawik NWRs. After exiting the Koyukuk NWR, the route traverses primarily through state lands with approximately the last four miles of the corridor crossing into Native lands owned by the Village of Council and the Bering Straits Native Corporation.

In total, this corridor crosses approximately 232 miles of federal lands (36 of which are through CSUs), 41 miles of Native lands, and 177 miles of state land. The ROW acquisition process for this route is most constrained by the fact that it will require TUS Permits to cross the Selawik and Koyukuk NWRs. As explained previously in this study, the TUS permitting process is lengthy, intensive, most likely politically charged, and has never been successfully completed in Alaska. Acquiring a permit to cross lands within the refuges would be difficult, may not be feasible, and would impact the project schedule due to the lengthy process.

In regards to other lands within the corridor, acquisition from the Native corporations could take upwards of 18 months to 2 years to complete. The process of getting an ILMA to cross the Dalton Highway Corridor Management Area is also expected to be time-consuming.

Given the route miles outlined in **Table 10** and assuming a ROW corridor width of 500 feet, Route 1 will require acquisition of land and/or ROW permits across approximately 27,300 acres. There will be no land acquisition cost associated with obtaining an ILMA over DNR managed state lands or a ROW permit to cross federal lands. However, the DOT&PF will incur land costs to acquire the 2,500 acres of Native lands within this route. Preliminary research of unimproved land sales within Western Alaska has yielded prices ranging from $300 to $1,500 per acre. In consideration of the fact that the land acquisition for a preferred route will not be occurring for many years and markets tend to appreciate over time, an estimate of $600 to $2,000 per acre is appropriate. Utilizing these dollars per acre, ROW land acquisition for Route 1 is expected to cost anywhere from approximately $1.5 to $5 million (**Table 11**). It is important to note that this figure is land cost only for *unimproved* lands. Additional costs will include the value of improvements, title research, appraisal, cost-to-cure, relocation costs, labor and expenses to acquire the ROW and relocate any occupants, possible condemnation costs, and a myriad of other costs and expenses that are normally associated with the ROW acquisition phase of a project.

Route 2b: This route begins near Manley Hot Springs and meanders through state, federal (primarily Native-selected), and Native lands to a point west of Koyukuk where it enters a stretch of federal lands approximately 100 miles long. Once through the federal lands, the route primarily crosses Native and state lands to its terminus at Council. This route crosses much more Native land than Route 1. Negotiations will be with a multitude of Native corporations to include the Villages of Manley Hot Springs, Tanana, Galena, Koyuk, Nulato, Elim, White Mountain, and Council and the Regional corporations of Doyon, Limited, and the Bering Straits Native Corporation.

In total, Route 2b crosses approximately 237 miles of federal lands, 123 miles of Native lands, and 140 miles of state land. It is possible that the required ROWs for Route 2b could be acquired in less than five years.

Given the route miles presented in **Table 10** and a ROW corridor width of 500 feet, Route 2b would require acquisition of land and/or ROW permits across approximately 30,400 acres of land, approximately 7,500 acres of which is Native land. Utilizing the land acquisition cost estimate of $600 to $2,000 per acre, ROW land acquisition for Route 2b is expected to cost anywhere from $4.5 to $15 million. Once again, this figure is land cost only for *unimproved* lands. Additional costs will include the value of improvements, title research, appraisal, cost-to-cure, relocation costs, labor and expenses to acquire the ROW and relocate any occupants, possible condemnation costs, and a myriad of other costs and expenses that are normally associated with the ROW acquisition phase of a project.

Comparison The following tables serve to compare and contrast the information presented above in a side-by side manner.

Table 10: Land Ownership by Corridor Alternative

	Route 1		Route 2b	
	Route Miles	% of Total Miles	Route Miles	% of Total Miles
Federal Land (not within CSU)	196	43.6	237	47.4
Federal Land within NWR	36	8.0	0	0
Native Village/Regional Corporation Lands	41	9.1	123	24.6
State Land	177	39.3	140	28.0
Totals	**450**	**100**	**500**	**100**

* U.S. Department of the Interior, BLM and DNR Division of Mining, Land, and Water 2009: Based on land status data at a section level, not individual parcels.

Table 11: Estimated Right-of-Way Required and Land Acquisition Costs by Alternative

	Route 1		Route 2b	
	Acres to be Permitted or Acquired	Estimated Unimproved Land Cost	Acres to be Permitted or Acquired	Estimated Unimproved Land Cost
State Land	10,700	No purchase	8,500	No purchase
Federal Land (not within CSU)	11,900	No purchase	14,400	No purchase
Federal Land Within NWR	2,200		0	
Native Village/Regional Corporation Lands	2,500	$1.5 to $5.0 million	8,500	$4.5 to $15.0 million
Totals	**27,300**	**$1.5 to $5.0 million[1]**	**30,400**	**$4.5 to $15.0 million[1]**

Note 1: The estimated cost to acquire land assumes that no land purchase will be required for the permits to cross state and federal lands. There will be substantial costs incurred as part of the overall permitting process, separate from purchase of land and not included in the above table. These costs are included in the total project construction costs as part of the Engineering/Environment/ROW contingency.

As demonstrated by the data presented in **Tables 10 and 11**, Route 1 has a slight advantage over Route 2b based on cost and amount of land acres to be acquired. However, in consideration of the difficulty that will be encountered to permit crossing of the NWRs for Route 1, Route 2b clearly becomes the more favorable alternative. Additionally, the cost to purchase land is anticipated to be a small portion of the overall cost of the permitting process, and both alternatives would incur substantial costs as part of the permitting process.

5.6 Refined Alternatives Comparison Summary

Routes 1 and 2b are compared and summarized in **Table 12**. This summary includes data collected for the sixteen screening criteria and data presented in the preceding discussion for refined alternatives. Some conclusions from this side-by-side comparison, in light of the constraints presented thus far in the study include:

- Route 2b benefits a greater total population.
- Route 2b benefits a greater number of people per mile of access road required to reach those people.
- Route 2b crosses fewer miles of caribou winter range, whereas Route 1 crosses more mileage and crosses the Nulato Hills ACEC core winter range.
- Route 2b does not cross any federal conservation lands; Route 1 crosses the Koyukuk NWR and the Selawik NWR. The permitting process to gain ROW across federal conservation lands such as these has never been successfully completed in Alaska.
- The estimated gross mineral value within 50 and 100 miles of Route 1 far exceeds the mineral value in proximity to Route 2b.
- Route 1 has a lower construction cost than Route 2b.
- Route 1 crosses fewer anadromous streams than Route 2b.

Table 12: Summary Comparison of Refined Alternatives

Refined Corridor Alternatives	Route 1 (450 miles)	Route 2b (500 miles)
Communities		
Total population within 50 miles of corridor	2,338	2,748
Ratio of total population of communities within 50 miles of corridor to cumulative distance between the corridor and those communities	7.5 people/mile	15.5 people/mile
Total population within 20 miles of corridor	351	2,335
Ratio of total population of communities within 20 miles of corridor to cumulative distance between the corridor and those communities	9.5 people/mile	28 people/mile
Estimated cost to construct secondary access roads to all communities within 20 miles of corridor	$145 million	$376 million
Total distance between Fairbanks and Nome along corridor	724	708
Resources		
Total estimated gross value of significant mineral resources within 100 miles of corridor	$27.5 billion	$7.8 billion
Total estimated gross value of significant mineral resources within 50 miles of corridor	$21.4 billion	$5.6 billion
Land Ownership/Management Criteria		
Miles through national parks, preserves, monuments, or wildlife refuges	36	0
Miles through federal-owned lands	232	237
Miles through Native-owned lands	41	123
Environmental Criteria		
Miles through caribou wintering areas	215	194
Miles through designated T&E species critical habitat	0	0
Number of streams in the catalog of anadromous waters crossed	11	52
Total stream crossings	317	329
Miles through high-probability wetland areas and other waters of the U.S.	244	185
Number of times corridor crosses Iditarod Trail	0	0
Engineering & Cost Criteria		
Total estimated construction cost	$2.1 billion	$2.7 billion
Estimated annual M&O costs (routine road and facilities maintenance)	$13.6 million	$14.9 million
Estimated annual resurfacing and rehabilitation costs	$22.5 million	$25 million

5.7 Recommended Corridor

Route 2b, the Yukon River Corridor (**Figure 12**), is the recommended alternative because it meets the project purpose and has the greatest potential benefits. The proposed corridor is approximately 500 miles in length, beginning just outside of Manley Hot Springs on the Elliott Highway and terminating at the Nome-Council Highway. The corridor generally parallels the Yukon River for much of its length, giving it the designation of the Yukon River Corridor. Advantages and challenges and key characteristics of this recommended alternative are presented on the following pages. Chapter 6 examines the socioeconomic effects and expected benefits of the Yukon River Corridor.

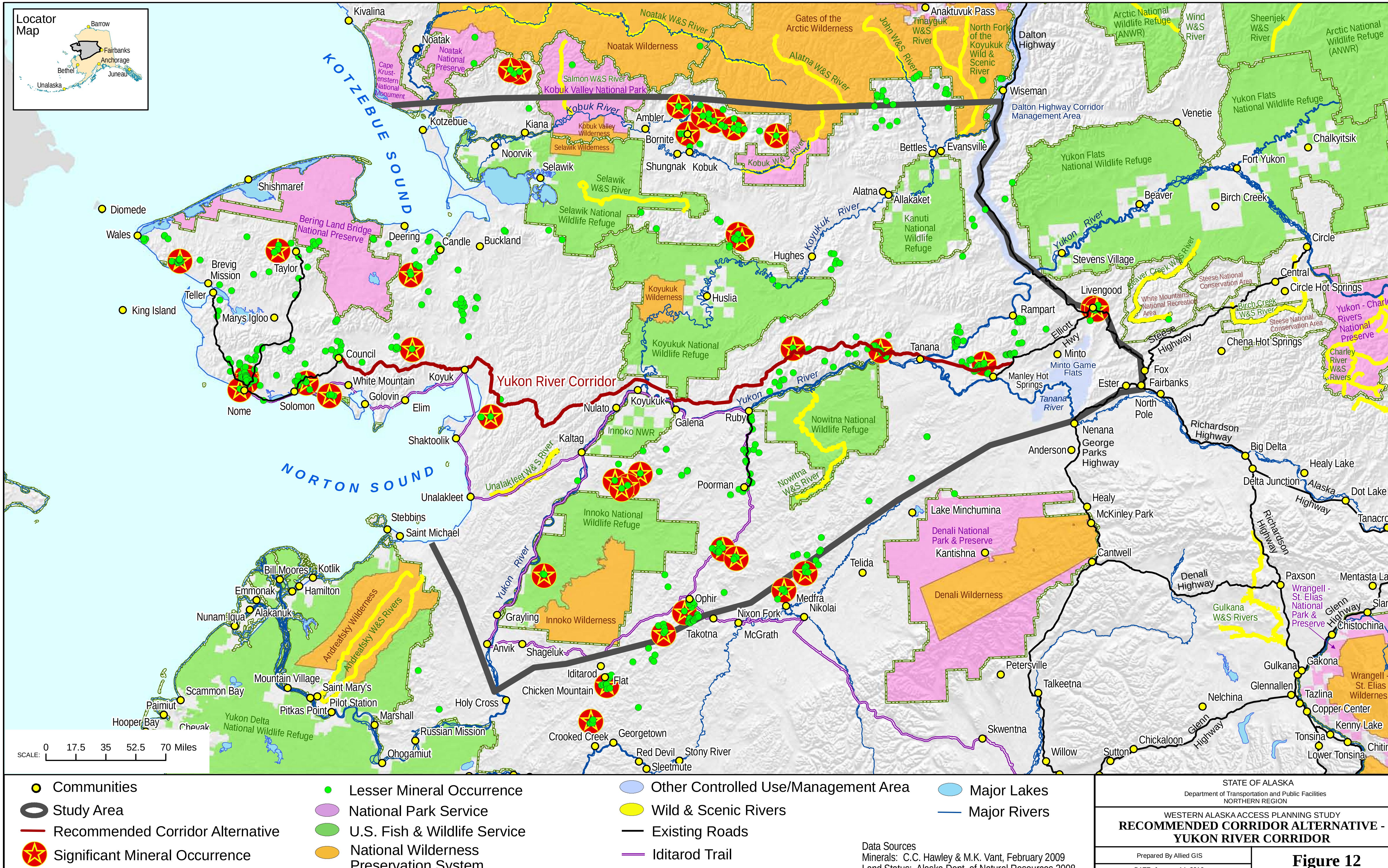
Advantages and challenges of the Yukon River Corridor:

Advantages	Challenges
• Access to communities and resource sites along Yukon River	• Significantly less mineral value in proximity to corridor than Route 1
• Greatest population served of alternatives	• Higher estimated cost to construct than Route 1
• Does not cross any federal conservation lands	• Topography (steep grades, mountainous terrain)
• Uses approximately 70 miles of existing highway	• New Yukon River crossing required
• Potential to link to the Ambler mining district and Donlin Creek Mine outside the study area	
• Fewest land and environment impacts	
• Creates shortest distance between Fairbanks and Nome	
• Potential to enhance intermodal transportation system (Yukon River barges)	
• Appropriately situated for phased construction	

Table 13: Key Characteristics of the Yukon River Corridor

Population Benefitted	• 2,748 people in communities within 50 miles, without existing road access • 2,335 people in communities within 20 miles, without existing road access • 4,180 people on Seward Peninsula Highway system
Mineral Resource Value (July 2009 mineral prices)	• $7.8 billion gross estimated value within 100 miles • $5.6 billion gross estimated value within 50 miles
Road Length	• 500 miles of new road • 708 miles Fairbanks to Nome
Land Ownership	• 237 route miles through federal land • 123 route miles through Native land • 140 route miles through state land
Environmental Aspects	• 194 miles through caribou wintering range • 52 anadromous streams crossed • 329 total stream crossings • 185 miles through high-probability wetland areas
Road Design	• 30-foot gravel surface • 6-foot typical section - 8 inches crushed aggregate over 64-inch embankment, 4:1 side slopes
Terrain	• 300 miles flat terrain • 135 miles rolling terrain • 65 miles mountainous terrain
Construction Costs	• $ 2.2 billion total road construction cost • $ 0.4 billion total bridge construction cost • $ 0.1 billion total maintenance facility construction cost • $ 2.7 billion total project construction cost[1]
Annual M&O Costs	• $14.9 million for routine road and facilities maintenance • $25.0 million for road resurfacing and rehabilitation

Note 1: The total project construction cost of $2.7 billion is a conservative estimate including a large contingency. The total project cost is estimated in the range of $2.3 to $2.7 billion, depending on many factors that are not well defined at this early planning stage.



STATE OF ALASKA
Department of Transportation and Public Facilities
NORTHERN REGION

WESTERN ALASKA ACCESS PLANNING STUDY

RECOMMENDED CORRIDOR ALTERNATIVE - YUKON RIVER CORRIDOR

Prepared By Allied GIS

DATE: January 14, 2010

Figure 12

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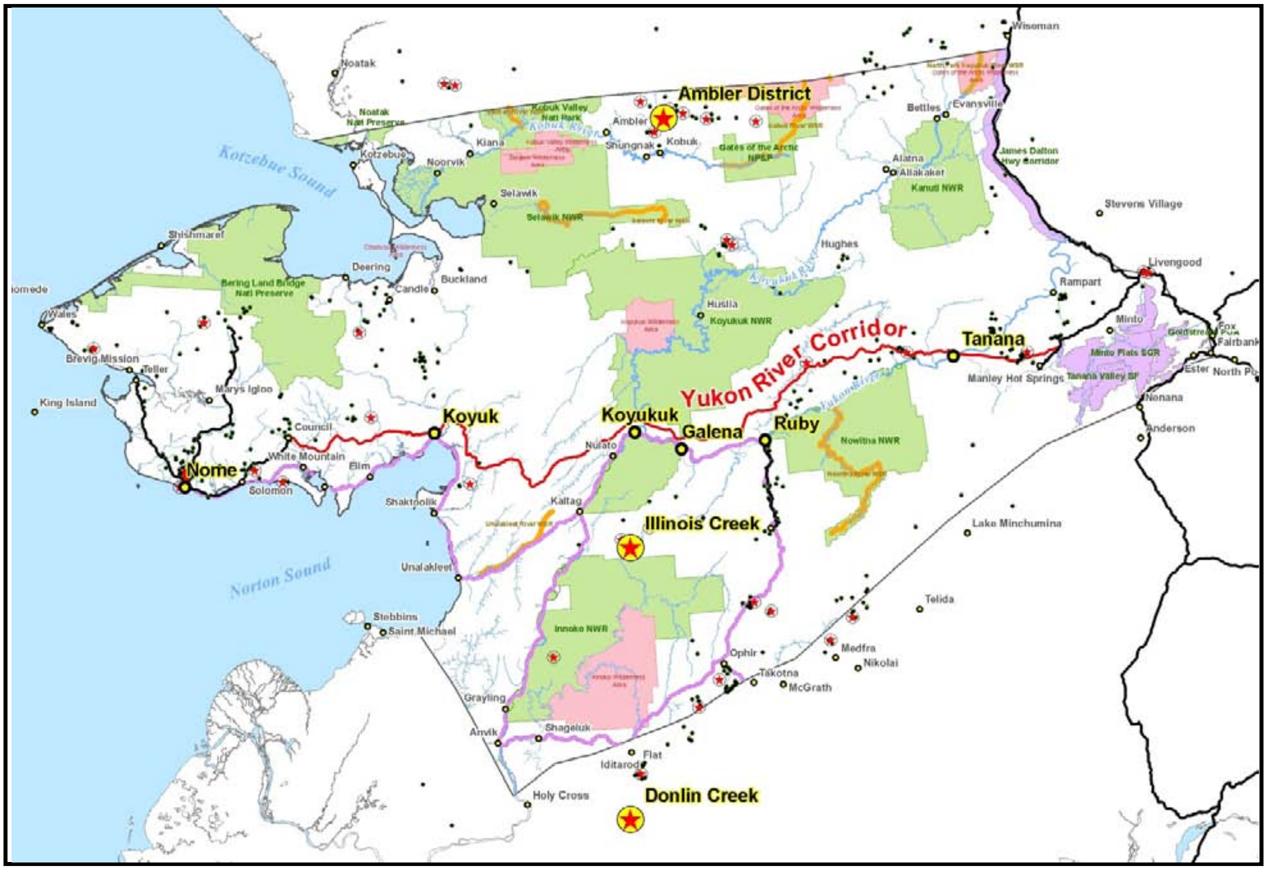
6.0 SOCIOECONOMIC EFFECTS ANALYSIS

6.1 Purpose and Approach

The socioeconomic effects analysis uses a case study approach to quantitatively and qualitatively look at the expected socioeconomic effects of the project for selected communities in the region, as well as benefits to several mines. The first sections of the socioeconomic analysis focus on six benefit areas: personal travel, fuel, freight, mining, energy infrastructure, and bypass mail/air cargo. For each area, the study team conducted multiple interviews with industry experts and local stakeholders to determine possible economic effects of a road connection.

In addition to the six benefit areas, the analysis examines other potential socioeconomic effects of a road connection, including impacts on employment and income, population, public services, and subsistence. Both positive and negative aspects of the project with respect to these additional impact areas are discussed. The intent is to illustrate the range of complex and potentially conflicting socioeconomic effects of the proposed project.

The study team selected six communities along the recommended Yukon River Corridor as case study communities: Tanana, Galena, Ruby, Koyukuk, Koyuk, and Nome. In addition, the analysis looked at the road's effect on the Donlin Creek, Ambler, and Illinois Creek mineral deposits, as well as estimating the effect of the road on a "generic" placer mine. Focusing on specific communities and mines allowed the study team to provide specific examples of the socioeconomic effects and to provide a better overall assessment of the possible community-level and mining socioeconomic impacts of a road connection. The team anticipates that other communities and mines in this corridor, as well as communities and mines in alternative corridors, would experience similar potential benefits and costs to those effects described for the case study communities. **Figure 13** shows the location of the case study communities and mineral deposits along the preferred Yukon River Corridor.



Source: DOWL HKM, 2009

Figure 13: Yukon River Corridor and Case Study Communities and Mines

6.2 Summary Findings

This study concludes that the Yukon River Corridor would result in significant benefits to, and socioeconomic changes in, the communities located along the road corridor. For example, the analysis estimates that cargo and bypass mail delivery costs could decrease roughly $18.1 million per year while the diesel and fuel oil transportation savings could save another $1.1 million dollars per year. At the same time, conversion to an economy based on trucked propane as opposed to diesel and heating fuel could replace the $1.1 million savings per year with savings of $13.5 million per year. These estimated benefits only include the six case study communities; the study estimates base savings from changes in how cargo, mail, and fuel are delivered at roughly $3,900 per capita within these communities. Other communities located on the road or within a reasonable distance from the road would likely experience similar savings, with some reductions in per capita savings the farther the community is from the road. There are five additional communities with a combined population of approximately 770 within 20 miles of the corridor. While the benefits of the corridor would decline as one moves further away from the road, extrapolating the $3,900 annual savings per person to the population of the non-case study communities would yield an additional savings of $3 million per year. Lastly, large infrastructure projects built along the road corridor, such as the development of high power transmission lines, a gas pipeline, or rail, could experience one-time construction-phase savings of hundreds of millions of dollars per project. The following sections detail the study's conclusions.

6.2.1 Distillate Fuel (Heating and Diesel Fuels)

- Most communities will switch from receiving fuel shipments by barge to obtaining fuel by truck. While barge transportation provides the least cost method of shipping large quantities of fuel over long distances, such as to Nome, truck is less expensive for shorter distances, and the fact that fuel can be obtained throughout the year with truck delivery will substantially reduce the effect of inventory carrying costs and cash flow issues. However, barge transportation may continue to be used by those entities that can obtain zero interest loans for bulk fuel purchases. Entities that do not have access to this program and that have a high cost of capital would switch to fuel delivery by truck. The study estimates that within the six case study communities, the switch from barge to truck would save roughly $1.1 million per year. Other communities in proximity to the corridor would likely experience similar savings.

Table 14: Estimated Annual Fuel Cost Savings, Six Case Study Communities

Scenario	Community Savings ($)						
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome	Total
Without Corridor Cost ($)	155,000	162,000	1,061,000	71,000	173,000	2,166,000	3,788,000
With Corridor Cost ($)	31,000	49,000	328,000	22,000	117,000	2,166,000	2,713,000
Savings ($)	124,000	113,000	733,000	49,000	56,000	0	1,075,000

Source: Northern Economics, Inc., estimates based on Bureau of Transportation Statistics, 2009; Office of Coast Survey, 2009; Ruby Marine, 2009; Sweeney, 2009; Sweetsir, 2009; Jensen, 2009; and Logistic Solution Builders, n.d.

- Truck deliveries of fuel will likely replace airborne deliveries as transportation by truck will be cheaper than deliveries by air tankers. In the case study communities, these deliveries only occur in emergency situations, so it is difficult to quantify the estimated savings except to say that the savings would be substantial on an incident-by-incident basis.

6.2.2 Freight and Bypass Mail

- Perishables and non-durable consumables could continue to move via bypass mail in many cases. However, the bypass mail program will truck mail to hub locations located on the new road and then fly goods from the hubs to outlying villages. This change will likely enhance Galena's role as a regional hub and lower the amount of traffic out of airports in Fairbanks and Unalakleet. While the road will result in savings for the bypass mail program, communities may notice a decrease in the quality of perishables, which are currently delivered with one or two day service via air transport.

- The road would enable trucking firms to compete with aviation traffic for high value items and time sensitive deliveries.

- Except for oversize equipment and materials, much of the current deck cargo on barges would move to truck delivery with the availability of a road.

- The study estimates that total savings associated with freight and the bypass mail program will total nearly $18.1 million per year within the six case study communities. Total savings within the entire region will likely be higher.

Table 15: Estimated Annual Cargo and Bypass Mail Costs Savings, Six Case Study Communities[1]

Scenario	Community Savings ($)						
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome	Total
Without Corridor Cost ($)	459,000	584,000	1,529,000	252,000	1,028,000	20,258,000	24,110,000
With Corridor Cost ($)	92,000	79,000	366,000	43,000	209,000	5,270,000	6,059,000
Savings ($)	367,000	505,000	1,163,000	209,000	819,000	14,988,000	18,051,000

Source: Northern Economics, Inc., estimates based on Bureau of Transportation Statistics, 2009; Office of Coast Survey, 2009; Ruby Marine, 2009; Sweeney, 2009; Sweetsir, 2009; Jensen, 2009; Logistic Solution Builders, n.d.

6.2.3 Mining

- If the corridor is built and a river crossing or a ferry is available at Ruby, there could be interest in building a mining road from the Donlin/Flat mineral districts to Poorman. This crossing, and the road, would allow the project to bring fuel and supplies into

[1] The study notes that the Yukon River Corridor Road would also result in savings for the Bypass Mail program with regards to mail sent to Manley Hot Springs. This town, located on the road system, receives bypass mail via air because the roads leading to the community are in such poor condition.

Donlin at a much lower cost than bringing a year's worth of fuel up the Kuskokwim River on a barge during the summer shipping season. Other mines in the region could also seek to build spur roads to connect to the Yukon River Corridor to obtain similar benefits and to ship some concentrates via the road. The study estimates that the road corridor would lower potential annual mine transportation costs by roughly $120 million, reducing costs from $315 million (without road) to $195 million (with road).

- The study estimates that the development of Donlin, Ambler, the equivalent of Illinois Creek, and the equivalent of 15 placer mines could employ nearly 1,600 people in a study area with roughly 6,500 workers.
- The state's experiences at the Red Dog Mine and other mines show that mining wages are significantly higher than the pre-mine local average. The Alaska Department of Labor and Workforce Development (DOLWD) data from early 2009 indicate that mining jobs average roughly $7,000 per month in wages compared to the statewide average for all industries of $3,800 per month and local averages of $2,900 (Nome Census Area) and $2,600 (Yukon Koyukuk Census Area).

6.2.4 Energy and Infrastructure

- The study concludes that trucked propane fuel would be cheaper than barged distillate fuel and a road corridor would eliminate the need for long-term storage of fuel currently found in these communities. The study estimates that complete conversion to trucked propane would save roughly $13.5 million per year within the six case study communities.[2] This estimate is the estimated energy cost savings and does not include the cost of conversion.

[2] This scenario eliminates the savings of converting from barged diesel to trucked diesel. Thus, it is important to realize that all of the savings discussed in this report are not additive.

Table 16: Annual Fuel Cost Savings with Trucked Propane

Scenario	Community Savings ($)						
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome	Total
Current MMBtu Consumed	30,000	20,000	160,000	10,000	40,000	850,000	1,110,000
Barged Diesel Cost per MMBtu ($)	20.67	23.48	21.48	30.81	18.74	17.48	18.416
Trucked Propane Cost per MMBtu ($)	5.11	5.51	5.58	5.65	6.05	6.47	6.27
Cost Change per MMBtu ($)	-15.56	-17.97	-15.9	-25.16	-12.69	-11.01	-12.15
Total Annual Cost Savings ($)	**466,800**	**359,400**	**2,544,000**	**251,600**	**507,600**	**9,358,500**	**13,487,900**

Source: Northern Economics, Inc., estimates based on Alaska Village Electric Cooperative, 2009; Sweetsir, 2009; Logistic Solution Builders, n.d.

- A road would reduce the cost of constructing a gas pipeline or an electrical transmission line to Western Alaska. In particular, the availability of a road and some type of energy infrastructure in the region could substantially reduce the cost of living for the communities and reduce operating costs at potential mines. However, a large industrial load is necessary for the energy infrastructure to be feasible; community demand alone is not large enough to support the capital costs of such energy infrastructure.

- The study estimates that a road corridor would reduce the cost of building pipeline and electrical transmission infrastructure by between 30 and 50% per unit mile. Using simple estimates, the study concludes that the road corridor could reduce the cost of a pipeline to Donlin Creek from Manley Hot Springs by between $0.8 and $1.0 billion and the cost of an electrical transmission system by $100 to $200 million.

6.2.5 Passenger Travel

- It is unclear how a road corridor will change long distance personal travel. Undoubtedly, some people will choose to drive from the case study communities to communities that they currently reach by air travel, while others may choose to forego the additional expense of lodging, meals, and wear on their vehicles and continue to travel by air. As the magnitude of these changes is exceptionally unclear, the study does not estimate a savings associated with personal travel. What is clear is that personal travel patterns will change, and that the biggest change may be increased travel between communities within the corridor that are currently restricted to air travel, water travel (summer), or snowmachine travel (winter).

6.2.6 Other Socioeconomic Effects

- The potential socioeconomic effects of the proposed road connection on the case study communities will likely be complex. In addition, the direction and magnitude of these effects are likely to be mixed and unevenly distributed within and between communities depending on individual demographic, economic, and social circumstances.

- Resource development, specifically mining, has the potential to increase the region's standard of living and per capita income while reducing dependence on outside aid.

- Subsistence users along the road corridor will experience increased access to subsistence areas and the potential for increased competition from recreational user groups and subsistence users who have not traditionally used an area.

The remainder of this chapter outlines how the study reached these conclusions. The complete and fully referenced socioeconomic analysis of the proposed road connection is included in Appendix I.

6.3 Other Resources

This socioeconomic analysis focuses on the Yukon River Corridor's potential community-level social and economic effects and the corridor's potential to lower mineral resource development costs. Prior scoping-level analyses detailed in the WAAPS Inventory Report focused on the potential of a Western Alaska transportation corridor to benefit the development of other resources such as fisheries, agriculture and timber, oil and gas, and recreation and tourism. This research estimated that the gross estimated resource value of all of these categories combined, including mineral resources and community economic activity, is $45.6 billion in 2009 dollars over a 50-year study period. Within this total, mineral resources ($25 billion[3]) and community economic activity ($20.2 billion) accounted for $45.2 billion or 99.1%. For these reasons, the benefits study does not focus on the other resource benefits. However, additional discussion of these benefits can be found in the Inventory Report.

[3] The gross estimated mineral resource value from the 2009 Inventory Report is based on mineral prices that average a ten-year (1996-2005) low average price with a three-year (2006-2008) high average price.

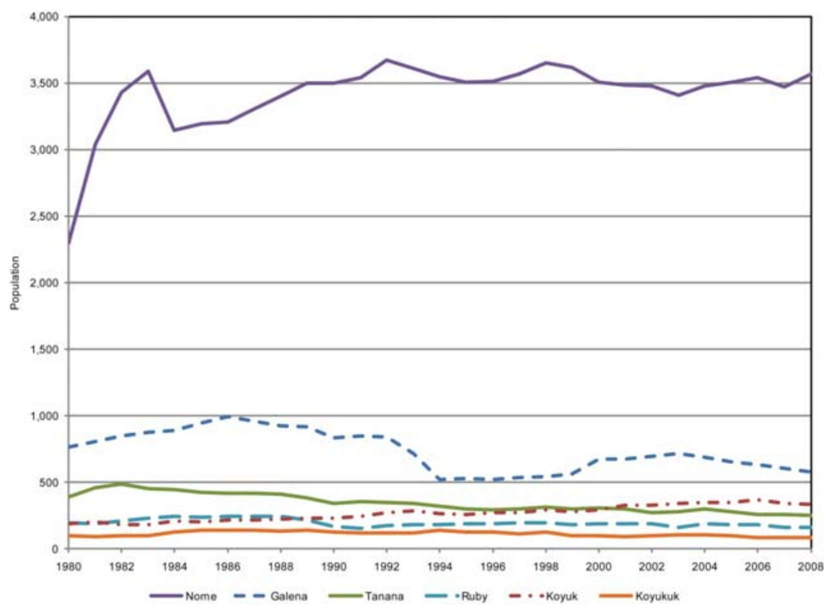
6.4 Case Study Community Existing Conditions and Profiles

6.4.1 Community Profiles

This section presents brief descriptions of the existing conditions within the six case study communities of Nome, Galena, Tanana, Ruby, Koyuk, and Koyukuk. The existing conditions as described are similar to those found in most communities of Northwest Alaska and reflect the region's high cost of living and minimal travel infrastructure. In general, transportation in the case study communities is limited to air and water travel with ground travel limited to snowmachines in the winter. Nome is the only community with access to a road network, but this system is limited and is not connected to another hub city or to any of the other case study villages.

6.4.2 Demographics

As indicated in **Figure 14**, the case study communities are relatively small; populations range from 85 to 600 people, with the exception of Nome, which has 3,600 residents. Alaska Natives make up the largest proportion of the population in all six communities, though Nome has a substantial Caucasian segment. The local government is the dominant employer in most case study communities; however, many individuals are self-employed owner-operators of businesses involved in fishing, trapping, crafts making, or other activities. Nome has a comparatively diverse economy, reflecting its position as a regional hub.



Source: DOLWD, 2009

Figure 14: Case Study Community Population, 1980 to 2008

6.4.3 Economics

Time series unemployment data for the individual communities are unavailable; however, data can be found for the two closest census areas: Nome and Yukon-Koyukuk. Both census areas have had significantly higher unemployment rates (i.e., 12.8% and 12.5%, respectively, in August 2009) than the rest of the state (i.e., 7.1% in August 2009) (DOLWD, 2009). It is important to note that the unemployment estimates do not include underemployed workers or discouraged workers—those who have given up looking for work because they could not find a job. It is likely that the persistent lack of employment opportunities in some of the case study communities has led many individuals to give up looking for work. Four of the six communities had a per capita income well below the state figure, and all the communities except Nome had a higher poverty rate.

Many of the residents of the case study communities are dependent to varying degrees on fish and game resources for their livelihood. In addition to fishing and hunting for cash income, subsistence activities continue to figure prominently in the household economies and social welfare of many Western Alaska residents, particularly among those living in the smaller villages. According to a 2009 survey, the cost of food in Nome is nearly 70% above the Anchorage level. In the outlying villages, grocery prices are even higher because of additional transportation costs. Therefore, subsistence remains vital to basic well-being.

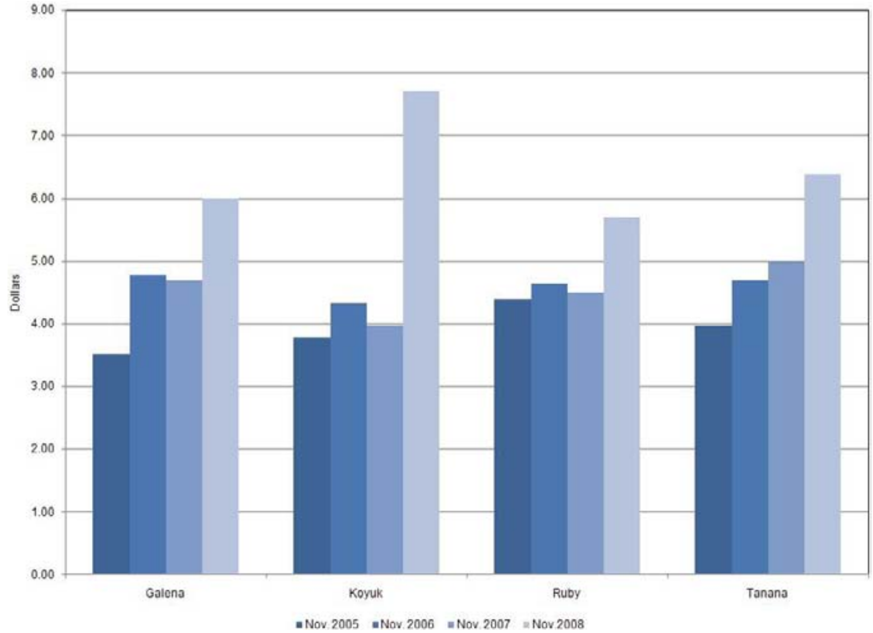
6.4.4 Public Infrastructure

6.4.4.1 Energy

All six of the case study communities are dependent on shipments of heating fuel and diesel from outside sources. This means that communities must store large volumes of fuel oil, as well as operate and maintain generators. To lower the residential cost burden associated with transporting and storing the fuel to these villages, each participates in the state power cost equalization subsidy program. Other subsidies are available to help low income and other rural residents obtain heating fuel for their homes.

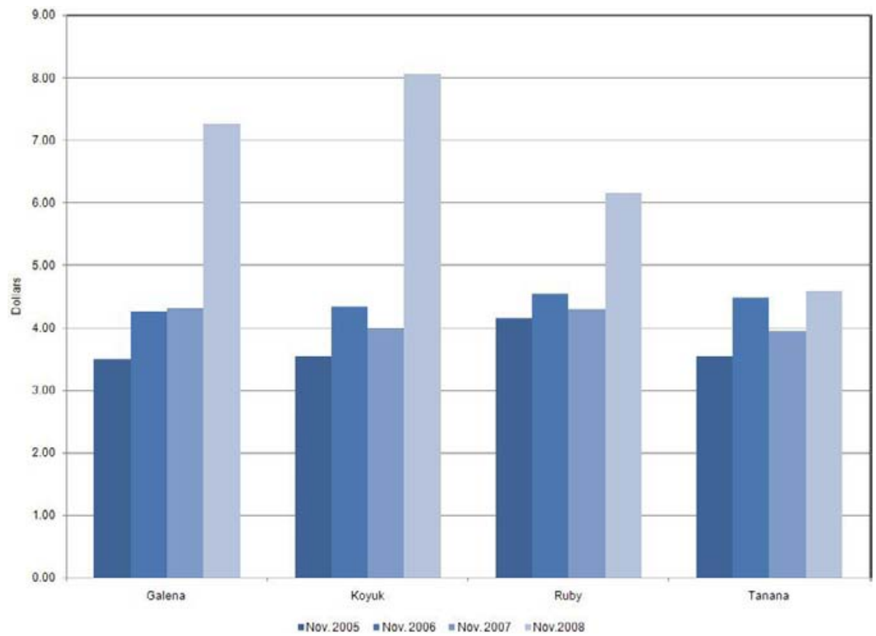
As is visible in **Figures 15 and 16**, the case study communities experienced a dramatic increase in fuel prices in 2008. Average winter fuel prices are likely to be 20 to 30% lower in winter

2009/2010 due to the decrease in oil prices, depending on whether or not the community has substantial fuel left over from last year.[4]



Source: Alaska Department of Commerce, Alaska Energy Authority

Figure 15: Case Study Community Gasoline Fuel Cost ($/Gallon)



Source: Alaska Department of Commerce, Alaska Energy Authority

Figure 16: Case Study Community Heating Fuel Cost ($/Gallon)

[4] If the community has substantial amounts of fuel left over from 2008 then the price residents will pay in 2009 will be a "blend" of the 2008 price and the new 2009 price of the fuel.

6.5 Personal and Commodity Transportation Effects

This section describes changes in personal and commodity (i.e., cargo, building materials, and consumables) transportation patterns and costs. In general, the vast majority of personal transportation occurs by airplane, while fuel moves by barge, and most cargo moves by bypass mail/air cargo. Vehicles, equipment, and other cargo that cannot move by air travel by barge. The Yukon River Corridor will change the movement of people and goods throughout the region.

6.5.1 Case Study Communities

Table 17 shows the estimated volume of freight and fuel that is annually transported by tug and barge to the case study communities, and the total transportation cost associated with these volumes. These volume and cost numbers should be considered as representative of the order of magnitude of such volumes and costs, since volumes to any community can increase substantially if a large construction project is underway. In addition, there are different commodity rates that could be used and result in different costs, and transportation for fuel and construction projects is often put out for competitive bid and published tariff rates would not apply. Fuel transportation costs shown here are based on interviews with industry and utility representatives, and an analysis of fuel costs for utilities along the Yukon River, which are often the largest purchasers of fuel in a community.

Table 17: Current Community Transportation Volumes and Costs, Barge

Commodity	Community					
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome
Freight						
Volume (pounds)	257,000	163,000	591,000	90,000	339,000	3,635,000
Transport cost ($ per pound)	0.19	0.21	0.22	0.24	0.44	0.26
Subtotal ($)	**49,000**	**34,000**	**129,000**	**22,000**	**148,000**	**948,000**
Fuel						
Volume (gallons)	200,000	185,000	1,200,000	75,000	302,000	6,321,000
Transport cost ($ per gallon)	0.77	0.88	0.88	0.95	0.57	0.34
Subtotal ($)	**155,000**	**162,000**	**1,061,000**	**71,000**	**173,000**	**2,166,000**
Total Barge Transport Cost ($)	**204,000**	**196,000**	**1,190,000**	**93,000**	**321,000**	**3,114,000**

Source: Estimates by Northern Economics, Inc., from information provided by Office of Coast Survey, 2009; Ruby Marine, 2009; Sweeney, 2009; Sweetsir, 2009.

The seasonal nature of tug and barge transportation in the study area substantially affects the transportation costs to the case study communities. All of the capital costs and other fixed costs must be amortized during the short summer shipping season, which increases the costs for each pound of freight or gallon of fuel transported. A longer shipping season would require less capital equipment and reduce the cost of transportation.

As noted earlier, most personal travel is by air, although skiffs are used in the summer and snowmachines in the winter to travel between communities. Bypass mail and air cargo are used extensively to transport food and other supplies to the case study communities. **Table 18** shows the estimated costs paid by the community for personal travel, bypass mail, and air cargo in 2008 from data collected by the Bureau of Transportation Statistics.

Table 18: Current Community Transportation Costs, Air

Transport Mode	Community					
	Tanana	**Ruby**	**Galena**	**Koyukuk**	**Koyuk**	**Nome**
Passenger Traffic ($)	810,000	350,000	2,850,000	400,000	990,000	31,480,000
Bypass Mail Cost ($)	240,000	460,000	670,000	150,000	580,000	9,240,000
Air Cargo ($)	170,000	90,000	730,000	80,000	300,000	10,070,000
Total Air Transport Cost ($)	1,220,000	900,000	4,250,000	630,000	1,870,000	50,790,000

Source: Northern Economics, Inc., estimated based on Bureau of Transportation Statistics, 2009.

Table 19 is a modified version of **Table 18**; passenger traffic costs have been removed and the barge freight category has been added to the table along with the bypass mail and air cargo categories to arrive at total transportation costs for each case study community. This change was made to facilitate comparison with truck transportation costs.

Table 19: Total Current Community Freight Transportation Costs

Transport Mode	Community					
	Tanana	**Ruby**	**Galena**	**Koyukuk**	**Koyuk**	**Nome**
Barge ($)	49,000	34,000	129,000	22,000	148,000	948,000
Bypass Mail Cost ($)	240,000	460,000	670,000	150,000	580,000	9,240,000
Air Cargo ($)	170,000	90,000	730,000	80,000	300,000	10,070,000
Total Freight Transport Cost ($)	459,000	584,000	1,529,000	252,000	1,028,000	20,258,000

Source: Northern Economics, Inc., estimates based on Bureau of Transportation Statistics, 2009; Office of Coast Survey, 2009; Ruby Marine, 2009; Sweeney, 2009; Sweetsir, 2009.

Table 20 presents information on potential transportation costs for freight and fuel if the Yukon River Corridor is constructed and truck transportation becomes available. As expected, truck transportation costs are considerably less expensive than the costs of air transportation. Substantial savings would accrue to the U.S. Postal Service and community residents and businesses using air cargo. Truck is also less expensive than barge for freight shipments, even to Nome. However, fuel deliveries by barge to Nome are less expensive than by truck although the truck transport cost is less for the other case study communities.

Table 20: Total Community Freight and Fuel Transportation Costs with Corridor

Commodity and Mode	Community					
	Tanana	**Ruby**	**Galena**	**Koyukuk**	**Koyuk**	**Nome**
Freight						
Barge freight volume (pounds)	257,000	163,000	591,000	90,000	339,000	3,635,000
Truck transport cost ($ per pound)	0.12	0.15	0.15	0.16	0.18	0.21
Subtotal ($)	31,000	24,000	89,000	14,000	61,000	751,000
Air Cargo						
Air cargo volume (pounds)	297,000	100,000	699,000	56,000	110,000	11,760,000
Truck transport cost ($ per pound)	0.12	0.15	0.15	0.16	0.18	0.21
Subtotal ($)	36,000	15,000	105,000	9,000	20,000	2,429,000
Bypass Mail						
Mail volume (pounds)	211,000	268,000	1,141,000	129,000	715,000	10,119,000
Truck transport cost ($ per pound)	0.12	0.15	0.15	0.16	0.18	0.21
Subtotal ($)	25,000	40,000	172,000	20,000	128,000	2,090,000
Subtotal ($)	92,000	79,000	366,000	43,000	209,000	5,270,000
Fuel						
Fuel volume (gallons)	200,000	185,000	1,200,000	75,000	302,000	6,321,000
Transport cost ($ per gallon)	0.15	0.26	0.27	0.29	0.39	0.49
Subtotal ($)	31,000	49,000	328,000	22,000	117,000	3,104,000
Total Transport Cost (No Barge) ($)	123,000	128,000	694,000	65,000	326,000	8,374,000

Source: Northern Economics, Inc., estimates, 2009, from data provided by Logistic Solution Builders, n.d.; Jensen, 2009.

The transport cost comparison assumes that under current conditions freight is barged from Anchorage directly to Nome and offloaded. Freight destined for Koyuk is then lightered to that community. Other freight is assumed to be trucked from Anchorage to Nenana, loaded onto a barge, and then transported to the respective communities on the Yukon River. Fuel is barged directly from Anchorage to Nome and then to Koyuk, or trucked from North Pole refineries to Nenana and then barged to Yukon River communities. Under the "with corridor" condition, the communities would receive shipments directly via truck.

The study estimates that total fuel, cargo, and bypass mail costs would drop by roughly $1.1 million, $9.2 million, and $8.865 million per year, respectively, if all of the case study communities availed themselves of the lowest cost options (**Table 21**).

Table 21: Estimated Annual Cargo, Fuel, and Bypass Mail Savings

Category	Community Savings ($)						
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome	Total
Fuel Savings ($)	124,000	113,000	733,000	49,000	56,000	0	1,075,000
Cargo ($)	152,000	85,000	665,000	79,000	367,000	7,838,000	9,186,000
Bypass Mail ($)	215,000	420,000	498,000	130,000	452,000	7,150,000	8,865,000
Total ($)	**491,000**	**618,000**	**1,896,000**	**258,000**	**875,000**	**14,988,000**	**19,126,000**

Source: Northern Economics, Inc., estimates, 2009, from data provided by Logistic Solution Builders, n.d.; Jensen, 2009.

The Yukon River Corridor would also enable the use of automobiles for personal travel. **Table 22** presents an estimate of the cost of vehicle travel from each case study community to the primary air travel destination as identified from Bureau of Transportation Statistics. In most instances, the distances are so great that the air fare is less than the full cost of operating a vehicle in these communities if the driver is the only occupant. Of course, many people only consider fuel costs, as opposed to considering the full operating cost of the vehicle, when thinking of an automobile trip, so this fact could result in more travel than would be expected from the comparison in **Table 22**. However, the average speed on the Yukon River Corridor road is anticipated to be about 35 miles per hour until reaching paved highway with an average speed of 60 miles per hour, so travel time from Nome or other communities on the Seward Peninsula to Anchorage or even Fairbanks is likely to deter some vehicle travel, especially in winter months.

Table 22: Estimated Air and Vehicle Travel Cost by Passenger

Information/Cost Item	Case Study Community					
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome
Primary destination	Fairbanks	Nome	Fairbanks	Fairbanks	Nome	Anchorage
One-way airfare ($)	188	195	182	266	95	116
Road miles to destination	218	348	375	418	158	1,088
Driving time for one-way trip (hours)	6.2	9.9	10.7	11.9	4.5	26.8
Full cost of operation ($)	0.82	0.82	0.82	0.82	0.82	0.82
Nights of lodging and meals @$125 per person	0	0	0	0	0	2
Cost per vehicle passenger ($)						
Driver only ($)	179	285	307	343	129	1,142
Two passengers ($)	89	143	154	171	65	571
Four passengers ($)	45	71	77	86	32	285

Source: Northern Economics, Inc, 2009, based on Published Air Fares, 2009; Internal Revenue Service, 2009.

The study area is very large and the distances from the Seward Peninsula to the Dalton Highway are long, so it is anticipated that most personal travel by vehicle on the corridor will be between communities within the study area. Tanana may be the exception, with travel being oriented to Fairbanks. It is unclear how the road corridor will change long distance personal travel. Undoubtedly, some people will choose to drive from the case study communities to communities that they currently reach by air travel, while others may choose to forgo the additional expense of lodging, meals, and wear on their vehicles and continue to travel by air. As the magnitude of these changes is exceptionally unclear, the study does not estimate a savings associated with personal travel. What is clear is that personal travel patterns will change, and that the biggest change may be increased travel between communities within the corridor that are currently restricted to water and air travel in the summer.

6.5.2 Potential Mines

The study area is rich with mineral resources, but with the exception of high-value gold mines and placer deposits, there have been few developments of the other mineral resources due to the remoteness, arctic and sub-arctic conditions, and lack of transportation infrastructure. **Table 23** shows the potential transportation costs to some known mineral resources using existing tug and barge operations, and hovercraft in the case of Ambler. Previous proprietary transportation studies completed by mining companies for the resources in the vicinity of Ambler and Illinois Creek used the transportation systems modeled in this analysis. The "generic" placer mine is representative of large placer mines that may exist or be discovered in the study area in the vicinity of the Yukon River Corridor or along the spur roads. They are assumed to be located 25 miles from the spur roads or the corridor. In their assumed locations, all fuel and freight is brought in via air carriers in the absence of a Yukon River Corridor.

Table 23: Potential Mine Annual Transportation Costs, Existing Transportation System ($)

Potential Mines	Inbound				Outbound	Total
	Freight		Fuel		Concentrate	
	Barge/ACV	Air	Barge/ACV	Air	Barge/ACV	
Ambler (1)	23,300,000	600,000	13,100,000	0	81,400,000	118,400,000
Donlin Creek (1)	92,700,000	14,400,000	39,400,000	0	0	146,500,000
Illinois Creek (1)	3,200,000	400,000	3,700,000	0	40,200,000	47,500,000
Placer Mines (10)		1,600,000		800,000	0	2,400,000
Total Cost ($)						**314,800,000**

Source: Northern Economics, Inc., estimates based on Office of Coast Survey, 2009; Miller, 2009; Ruby Marine, 2009; Hawley, 2009; Sweeney, 2009; Hughes, 2009; Sweetsir, 2009; Fueg, 2009; North Pacific Mining Corporation, 1993; Donlin Creek, LLC, 2009. Note: ACV is air cushion vehicle (e.g., hovercraft).

The mineral resources in the vicinity of the Ambler mine are assumed to have barge service to Kotzebue and then freight, fuel, and concentrates would be moved with a fleet of hovercraft with a 15-ton capacity. Donlin Creek transportation would be ocean-going barges to Bethel and then sets of smaller tugs and barges would take fuel and freight upriver to a landing where a 75-mile road would connect to the mine. The high value of the gold would mean that it would be flown to markets, and this would not change even if road access were available, so no attempt is made to estimate this air transportation cost. Illinois Creek is served by tug and barge from Nenana, and then a 76-mile road to the mine. Concentrates from Illinois Creek are assumed to be trucked to Nome and stored there until the summer shipping season.

Table 24 presents estimates for truck transport to and from these potential mine sites. Ambler would be accessed via an estimated 276 mile spur road from Tanana, and Donlin Creek would be accessed via a 263 mile spur road from Ruby, with a ferry crossing and winter ice bridge at the Yukon River, and then an approximately 75 mile road to the mine. A comparison of **Table 23** and **Table 24** shows that the "with corridor scenario" reduces annual transportation costs by roughly $120 million. While these savings are substantial, the cost savings alone may still be insufficient to result in an economically feasible project from an investor's perspective. It will likely take the combined savings of multiple road benefits (e.g., lower trucking costs, lower energy infrastructure costs) to make a difference in the development of some mineral resource locations.

Table 24: Potential Mine Annual Trucking Costs, ($)

Potential Mines	Inbound		Outbound	Total
	Freight	Fuel	Concentrate	
Ambler (1)	6,000,000	3,400,000	90,400,000	99,800,000
Donlin Creek (1)	46,500,000	34,100,000	0	80,600,000
Illinois Creek (1)	2,300,000	1,300,000	10,500,000	14,100,000
Placer Mines (10)	70,000	80,000	0	150,000
Total Cost ($)				**194,650,000**

Source: Northern Economics, Inc., estimates based on CH2M Hill, 2004; Jansen, 2009; Logistics Solution Builders, n.d.

Under the Ambler development concept, there is no road from Ambler west to the Kotzebue Sound region or to the Seward Peninsula due to the federal conservation lands in the area. Concentrates would need to be trucked back to Tanana and then to Nome or to a Southcentral Alaska port, which would be only slightly longer than the distance to Nome. This analysis anticipates that given such a choice, the mine developer would elect to truck to Southcentral Alaska where they could ship concentrates throughout the year.

The potential transportation cost savings could approach $120 million per year if these mine concepts or similar mines were operating. Additional savings could accrue to the mines by the ability to transport fuel and supplies throughout the year and thereby eliminate the need to stockpile a year's worth of fuel and supplies and incur the inventory carrying cost for that material. As an example, the Ambler, Donlin Creek, and Illinois Creek mine concepts described here would use an average of about 94 million gallons of distillate fuels per year. Assuming an average blended rate of $3.00 per gallon delivered at the mine site, this would require $282 million in capital or operating capital loans to acquire and transport. With an assumed cost of capital of 6%, the inventory carrying cost would be about $8 million per year. Similar orders of magnitude savings may be associated with the other supplies that need to be held in inventory.

6.6 Energy and Infrastructure Effects

As noted previously, for the case study communities, road access would lower the cost of energy by reducing the transportation cost for distillate fuels and also reduce the need to store large quantities of fuel until the barge arrives the following year. However, crude oil remains at a very high price and expectations are for the real price of crude to increase in the future. To address this issue, several entities have proposed the use of liquefied natural gas (LNG) or propane to reduce the cost of energy in the Fairbanks region and throughout rural Alaska. The following subsection addresses the potential use of LNG/propane in the study area.

6.6.1 LNG/Propane

Propane is widely used in the study area, primarily for cooking, although residents in some communities use propane for heating purposes as well. Typically, large bottles of propane are barged to each community and stored for use during the winter, although propane can be delivered by cargo aircraft as well. LNG is presently manufactured in the Point Mackenzie area in the Matanuska-Susitna Borough and trucked to Fairbanks where it is re-gasified and put into a natural gas distribution system that primarily serves the downtown core area of the city. LNG is not presently used within the study area.

In the near term, it is not anticipated that LNG will be a viable alternative fuel for use within the study area for two reasons. First, the technology for re-gasifying LNG and distributing natural gas requires skills that are not found in many rural communities. Second, the use of LNG would require a piped distribution system for the community, which would be a significant capital cost for a community and its residents. Given these reasons, the use of propane is more likely in the study area and this analysis focuses on propane.

Propane can be used to replace distillate fuels for electric power, cooking and water heating, and space heating. It is not anticipated that propane would replace diesel fuel for other equipment and vehicles. Propane has lower energy content than distillate fuels, with about 91,000 British thermal units (Btu) per gallon compared to 135,000 to 138,000 Btu per gallon of distillate fuels. A gallon of propane has about two-thirds of the energy content of a gallon of diesel fuel. This lower energy content means that to have the same energy available for heating or to run equipment, about 50% more gallons of propane must be transported to, and stored in, an off-road system community. Since propane tanks are pressure vessels and cost about 60% more than distillate tanks, the combination of substantial tank farm capital costs and transportation costs overwhelm the savings associated with lower propane price. For these reasons PND, Inc. (2005), found that propane was not a feasible alternative fuel in communities where nine months or more storage was required, unless there was a subsidy for the tank farm. Without a road, all of the case study communities fit this definition and are not likely candidates for propane conversion, even though they have some of the highest fuel costs in the state.

With a road corridor, the "propane story" changes substantially and propane provides significant cost savings to the case study communities. With the road, the importance of storage issues diminishes as the communities can receive regular shipments of propane instead of needing to take all of their propane during the summer barge delivery season. The Alaska Natural Gas Development Authority has made public its plans to develop a propane plant at Prudhoe Bay on the North Slope to produce propane, and truck the propane to Fairbanks and other locations. Seasonal barge shipping from Prudhoe Bay could also serve coastal Alaska. **Table 25** compares the cost per million British thermal units (MMBtu) for diesel delivered to communities by barge using the costs collected by the Power Cost Equalization (PCE) program of the Alaska Energy Authority in 2008. Local utilities are often the largest purchasers of diesel fuel, and their costs are among the lowest in any given community. The table uses those same PCE prices, subtracts the estimated barge transport cost, and then adds the estimated delivery cost by truck to estimate the cost per MMBtu that might be achieved with truck delivery.

Table 25: Comparison of Delivered Prices for Diesel Fuel and Propane

Transport mode	Case Study Community					
	Tanana	Ruby	Galena	Koyukuk	Koyuk	Nome
Barge						
2008 Diesel cost per gallon ($)	2.79	3.17	2.90	4.16	2.53	2.36
Diesel cost per MMBtu ($)	20.67	23.48	21.48	30.81	18.74	17.48
Truck						
Diesel cost per MMBtu ($)	16.06	18.85	16.92	25.88	17.34	18.58
Propane cost per MMBtu ($)	5.11	5.51	5.58	5.65	6.05	6.47

Source: Northern Economics Estimates from Alaska Village Electric Cooperative, 2009.

In all cases, propane is the most cost-effective fuel for the case study communities. Truck delivery would eliminate the need for storage for long periods of time and reduce the capital cost, making propane accessible and affordable to community residents and businesses. A natural gas pipeline or high voltage electrical transmission lines in proximity to the corridor could provide similar energy savings for community residents and businesses.

6.6.2 Energy Infrastructure

The study examined the potential for the Yukon River Corridor to benefit electrical power and broadband transmission lines, pipelines, and other utility/transportation links. Key informant interviews indicate that a constructed road offers significant benefits to the cost of construction and the cost of maintaining these types of systems compared to a greenfield environment (Petrie, 2009; Wyman, 2009). A construction pad, in the form of a road, is in place, and equally important is that the corridor generally will have a secure ROW and all needed permits to expedite utility transmission construction projects.

The study's key informant interviews indicate that construction cost savings associated with utilities can be significant—as high as 30 to 50% per unit mile. The most important and potentially immediate utility benefit of the proposed corridor is pipeline construction in the eastern sector of the route and towards Donlin Creek. If the Yukon River Corridor is extended west to a point across from Ruby, a pipeline could be laid along the north shore to a river crossing point to Ruby, where the pipeline could follow the Poorman Road south and west to the Flat and Donlin mining districts. Further, a gas line that runs southwest along the river to get below Kuskokwim River navigation challenges may provide a redistribution point for gas along the lower Kuskokwim River. An alternative to this approach is a pipeline from a barge center at Paimiut Slough on the Yukon River along a road to Kalskag for redistribution to Kuskokwim River and Bering Sea coast communities including Bethel.

A review of the Michael J. Baker 2009 In-State Gas Demand Study for the Alaska Natural Gas Development Authority indicated that "with road" construction costs for in-state natural gas transmission pipelines would average between $4.2 and $5.1 million per mile, depending on whether the analyzed portion of the pipeline was 12 or 24 inches in diameter (Baker, 2009). Construction of a pipeline from Manley Hot Springs to the Donlin Creek Mine would follow roughly 450 miles of road if the Yukon River Corridor road were built. At the unit costs mentioned in Baker, 2009, a natural gas pipeline to Donlin from Manley (which would also need to be connected to the larger natural gas system) would cost between $1.8 and $2.2 billion. By comparison, a pipeline built without the benefit of an existing road and corresponding ROW might cost as much as $2.6 to $3.2 billion, assuming a 40% cost reduction associated with the existence of the road.

The Yukon River Corridor road would lower the cost of electrical transmission projects within the corridor on a unit basis. For example, Golden Valley Electric Association (GVEA) indicates that their transmission line projects average roughly $500,000 per mile with existing road corridors, but can reach as high as $750,000 to $1,000,000 per mile when GVEA needs to utilize temporary ice roads, such as it did for the Northern Intertie Project (Wyman, 2009; Wright, 2009). The study's interviews with GVEA indicate that these cost differentials reflect the difference between a project that uses a seasonal ice road and one that can use a permanent year-round road system. Construction via an ice-road only allows a four month construction period and requires extensive logistical planning to pre-position labor, camps, materials, and construction equipment. A year-round construction season alleviates many of these logistical issues. At a minimum cost of roughly $1 million per mile, a transmission system from Manley Hot Springs to the Donlin Creek area would cost over $450 million if the project relied on seasonal ice roads. If the transmission project experienced the estimated benefits associated with a permanent road as described by the key informants, the cost of that project could be reduced by $100 to $200 million depending on the actual average cost per mile and the reduction received. Key informants noted that the "without road" costs of such a transmission system would be substantially higher than $1 million per mile under some scenarios. Work completed for the State of Alaska's 2009 Regional Integrated Resource Plan indicated that the remote transmission systems associated with the Susitna Hydro project could cost as much as $4.5 million per mile (Black and Veatch, 2009).

In summary, the road corridor is likely to result in substantial cost savings for infrastructure projects. However, it is impossible at this time to provide specific savings estimates, as there have not been detailed analyses of specific projects.

6.6.3 Rail Infrastructure

During this project, village leaders, resource development specialists, and others have asked if rail was being examined as part of the team's work. The team met with an array of rail experts, including several meetings with Alaska Railroad Corporation (ARRC) staff. Several discussions considered accessing the Ambler mining district from Nenana and the potential to extend the rail north from Fairbanks to Livengood to handle freight needs for that mining district. There was no discussion of rail to Donlin Creek, as other options are considered more practical.

Advantages of rail include:

- Rail puts travelers, especially visitors, on a scheduled, single route with secure stops at communities or other destinations. This is an important issue because some residents are concerned about the uncontrolled access a road would provide to people from outside the region.
- The ARRC has exceptional bonding and financing capacity that can finance large scale projects. A rail option is especially attractive to the mining industry because if the overall rail shipping rate is affordable, it fully contains all transportation costs. The mining industry is generally not interested in financing and constructing major infrastructure or operating long haul rail or trucking operations.

- Rail maintenance operations are on a closed system, meaning the railroad controls all of the transportation facilities and services. Under this tightly controlled arrangement there is less potential conflict with travelers and maintenance is easier.
- Rail heavy haul capabilities make moving large mine equipment and supplies in and ore out practical.
- Limited rail operations, the ability to manage runs to reduce impacts on animals and habitats, low carbon footprint per ton of shipping, and very limited air quality impacts from dust mean there may be fewer environmental impacts than a road system.
- Crossing environmentally sensitive areas with rail may be more amenable to federal managers as both a way to access resources and for visitor access.

The project team examined rail and found that many of the advantages also had their "other side of the coin" disadvantages. Disadvantages of rail include:

- Rail confines travelers to specific travel times and stops.
- Mineral districts, communities, and others have to develop connector roads or rail spurs to the rail line.
- The longer the route, especially for a single-train system, the less frequent the service.
- Passenger fares on a long route could be within the range of airfares, and the time cost of rail may make air travel more expeditious.
- Rail is subject to more terrain and grade limitations than a road. Routing to avoid steep grades would make a rail corridor to Western Alaska significantly different from and much longer than the Yukon River Corridor road.
- Rail construction and maintenance costs are higher on a per mile basis than those for road. These factors and the greater length of a rail corridor would contribute to a substantially higher cost of a rail to Western Alaska.
- DOT&PF's Resource Transportation Analysis found that shipping by rail to and from the arctic from all-season ports in Anchorage or Seward were cost prohibitive within anticipated world market mineral pricing.

- Rail must be built to full standards in the first instance; roads can initially be built to low-volume standards with future improvements in response to traffic levels and changes in vehicle fleet.
- When at a rail destination, the traveler still needs another vehicle to reach his or her ultimate destination.
- Rail bonding capacity, while significant, requires a project be financially practical within the context of the bonds, absent federal and/or state direct grants.

Examining the range of advantages and disadvantages, the project team determined that constructing a highway to Western Alaska is the more practical and cost-effective approach. In addition to lower construction and maintenance costs for the road, the existence of a road in proximity to a future rail line could contribute to markedly lower construction and maintenance costs of the rail.

6.7 Other Economic and Social Effects

This section examines other potential socioeconomic effects of the proposed road connection on the case study communities, including impacts on employment and income, population, public services, and subsistence. Both the positive and negative aspects of the project with respect to these impact areas are discussed.

6.7.1 Employment and Income

Given the high unemployment rate in the case study communities, it is likely that many residents would welcome the increased potential for economic development afforded by road construction in the study area. While increases in employment and income would be beneficial for the case study communities, development can also have negative effects on human and ecological health and social stability. The analysis focused on the effects of mining and tourism, the two economic sectors that are the most likely to experience a substantial expansion as a result of the proposed road connection.

6.7.1.1 Mining

The experience of the Red Dog Mine in the Northwest Arctic Borough suggests that mineral development could also increase jobs and personal income in the case study communities, particularly if there are local hire preferences and job training programs. Just one year after the Red Dog Mine became operational, the local average wage in the Northwest Arctic Borough rose above the state average, and per capita income has increased fairly steadily ever since (Fried and Windisch-Cole 2005; Tetra Tech, Inc., 2009). Not only does the mine offer well-paying jobs, it also provides stable year-round employment, a scarce phenomenon nearly everywhere in rural Alaska.

On the other hand, rapid economic growth can be a particular source of deteriorating health conditions and social strain, particularly within subsistence-based communities. Less time for hunting, a loss of hunting skills, and an increasing cost of hunting supplies have been cited as reasons for increased consumption of store-bought foods, high in saturated fats and refined sugar. These effects have, in some cases, contributed to an increase in the risk for chronic illnesses, such as diabetes, high blood pressure, obesity, and heart disease (Tetra Tech, Inc., 2009). Economic disparity within a village can be exacerbated by mine-related employment and dividends, and may alter the values underlying sharing networks fundamental to the subsistence socio-cultural system (Tetra Tech, Inc., 2009). Finally, road construction and the expected economic development that follows (including both mining and tourism) could also become a source of social tension and stress because there is likely to be disagreement between and within communities over the extent to which this development represents a threat or an opportunity.

Concerns have also been raised about the effects that mining may have on the natural assets that attract visitors to Alaska. Opponents argue that large-scale mining is incompatible with nature-based tourism opportunities that depend upon clean water, abundant fish and wildlife, and intact ecosystems (Alaska Wilderness Recreation and Tourism Association, 2005).

6.7.1.1.1 Mining Employment

Employment generated by the potential mines would be dependent upon the size and scopes of the individual operations. The proposed Donlin Creek project estimates a workforce of somewhere between 2,100 and 3,040 people needed for the exploration, construction, and operation phases of the mining project. The majority of these workers would be employed during the construction phase, with only 600 to 800 jobs required for operation (Donlin Creek, 2009). This study estimates that a Placer Mine would support a small workforce of between 10 and 20 people.

Two of the state's current mining operations, Red Dog and Greens Creek, both contribute significantly to employment in their respective regions, and may indicate the employment contributions that would be made by development at either Ambler or Illinois Creek. The Red Dog Mine (the state's largest operating mine) is one of the principal employers in the Northwest Arctic Borough, providing 475 jobs, and 80 temporary jobs on an annual basis (Red Dog, 2009). Its workforce represents approximately 17% of the borough's wage and salary employment (Fried and Windisch-Cole, 2005). Greens Creek Mine, located on Admiralty Island near Juneau, has an annual payroll totaling $26 million and lists 270 employees (Hecla Mining Company, 2009).

According to the DOLWD, the Nome Census Area had a total of 4,002 local workers employed in the area in 2008. The Yukon-Koyukuk Census Area had 2,475 local workers employed in the area for the same year (Alaska Local and Regional Information, 2009). Were a mine to open that employed a workforce somewhere between the size of Red Dog and Greens Creek, or approximately 370 full time employees, this would be equivalent to 9% of the 2008 local worker jobs in the Nome Census Area, and 15% of the 2008 local worker jobs in the Yukon-Koyukuk Census Area. Experience has shown that these positions would likely be higher paying jobs than those currently available in the region.

If the study assumes mid-range employment estimates and the number of mines noted in **Table 26**, the estimated mine employment would total roughly 1,590 jobs or employment for the equivalent of one-quarter of the region's workforce. In addition, these jobs would likely provide higher than average wages. DOLWD data from early 2009 indicates that mining jobs average roughly $7,000 per month in wages compared to the statewide average for all industries of $3,800 per month and local averages of $2,900 (Nome Census Area) and $2,600 (Yukon Koyukuk Census Area).

Table 26: Estimated Mine Employment

Mine	Number of Mines	Employment per Mine	Total Employment
Ambler (1)	1	370	370
Donlin Creek (1)	1	700	700
Illinois Creek (1)	1	370	370
Placer Mine (10)	10	15	150
Total Employment			**1,590**

Source: Northern Economics, Inc., estimates 2009.

6.7.1.2 Tourism

With the exception of Nome and Galena, the tourism industry currently plays a minor role in the economies of the case study communities. Construction of a road would facilitate additional tourism development in the region by improving direct access to recreation areas along the roadway. Larger numbers of tourists would create demand for service facilities along the road network, including food, lodging, fuel, and souvenirs. Moreover, an increase in visitors means new opportunities for outdoor recreation and tourist-related economic activities such as tour and guide services related to hunting, fishing, wildlife viewing, and river rafting. Overall, an expansion of the tourism industry can create new jobs, boost local businesses, diversify and bring new money into the region's economy, and contribute to the local tax base (DCCED, undated).

The presence of a road and resulting influx of visitors could also adversely affect eco-tourism and discourage high-end anglers and hunters. Part of the region's current appeal is its remote location and relatively pristine natural condition (McDowell Group, 2006). In addition, expanded tourism could make it more difficult for Alaska Native communities to preserve their social and cultural traditions, especially if there would be no way for communities to control the number of visitors.

6.7.2 Public Services

One of the largest barriers to the provision of basic services in Alaska is accessibility—services such as health care, police protection, and education are more difficult to receive in the more remote locations (Edwards, 2009). There are a number of ways in which the improved accessibility provided by the proposed road connection could result in a healthier, safer, and more comfortable living environment in the case study communities:

- the improved accessibility would improve law enforcement and facilitate evacuations for medical emergencies and natural disasters
- it would lower transportation costs of healthcare and social service workers
- it would facilitate the removal of solid, hazardous, and recyclable waste
- it would provide the potential to improve access to gravel sources and shared heavy construction equipment, which would improve the cost-effectiveness of community infrastructure construction and maintenance projects
- it could enhance inter-village social development and exchange, thereby increasing social cohesion among communities.

In contrast to these benefits, the road may also have potential negative effects on public services. The increased social disruption that may accompany rapid large increases in income can place a severe strain on the limited public facilities and services offered in the case study communities. A particular concern is that the proposed road connection could undermine enforcement of local alcohol control laws. Generally speaking, small communities in Alaska linked by road or ferry to larger towns where alcohol is sold have not tried to control alcohol through the local option law, apparently recognizing that enforcement is not practically possible (Berman and Hull, 1997; Berman and Hull, 2000; Berman et al., 2000).

6.7.3 Population and Out-Migration

The local mining or tourism jobs that the proposed road connection may create could ease population loss by stemming out-migration. Furthermore, the decrease in the cost of living due to the anticipated lower transportation and energy costs, together with the increase in public services and facilities (such as schools, public safety, and health care) that can accompany road construction and the economic development that follows, would be expected to reduce out-migration by making village life more affordable, safe, fulfilling, and comfortable.

On the other hand, mining operations located in remote areas without road connections may do little to reduce out-migration, and may even encourage it. Local-level employment data illustrates that employment at the Red Dog Mine may have facilitated community residents to relocate to Anchorage, in part because steady employment has given workers the financial means to relocate (Tetra Tech, Inc., 2009). It is also important to note that migration flows tend to follow transportation links. People follow transportation routes to places where there are jobs and where they have cultural ties (Martin et al., 2008). Unless the proposed road connection leads to the creation of appropriate, satisfying jobs for the residents of those communities, it may encourage a substantial number of village residents to migrate to more developed population centers such as Nome or Fairbanks.

6.7.4 Subsistence

Subsistence fishing and hunting continue to figure prominently in the household economies and social welfare of many Western Alaska residents, particularly among those living in the smaller villages (Wolfe and Walker, 1987). To some extent, subsistence harvesting helps offset unemployment and the high cost of living in Western Alaska. In addition to being an important source of nutrition, subsistence activities are central to the customs and traditions of many cultural groups in Alaska, including the Athabascans, Iñupiat, and other Alaska Natives in the case study communities.

Studies have repeatedly found that in the mixed economy of rural Alaska, local jobs and income are complements to participation in subsistence, not substitutes (Tetra Tech, Inc., 2009). The combination of subsistence and wage activities provides the economic basis for the way of life so highly valued in rural communities (USFWS, 2008). The jobs created by road construction and the anticipated economic development that follows would provide case study community residents with the cash income to purchase the equipment and supplies needed to effectively harvest subsistence resources.

Despite these benefits, it is likely that some residents will be concerned that the proposed road connection will threaten their subsistence practices. In recent years, there has been growing concern among many village residents in Western Alaska about the detrimental effects of increased visitor volume (in particular, the number of outside hunters) on subsistence uses of fish and wildlife resources (Northwest Arctic Borough Economic Development Commission and DCCED, undated; Northwest Arctic Borough, 2004). There are already several documented incidences of resource user conflicts within the region (BLM, 2007; Steinacher, 2006). Concerns are also likely to be raised about the possible effects of large-scale mining on subsistence resources, including disruption of wildlife movement and distribution patterns and contamination of subsistence resources (Tetra Tech, Inc., 2009).

7.0 IMPLEMENTATION

To advance the Yukon River Corridor, several next steps are recommended, both for the near term and for the extended project development timeline. The next phase should include public involvement, advanced route mapping, engineering and environmental field studies, preliminary engineering design and analysis, and implementation planning and should refine the proposed road alignment and provide the necessary information to begin the NEPA and permitting process for the Yukon River Corridor.

7.1 Next Steps

Primary purposes of the next phase, depending on funding available, would be to:

- Obtain public, stakeholder and agency input into the purpose, need, location, and other issues associated with the corridor.
- Better define the project, moving it from a general corridor to a more detailed route alignment.
- Prepare some of the necessary engineering and environmental fieldwork required for environmental permitting.
- Further define the phasing, land acquisition, funding, and other issues required to move ahead with project design and construction.

Public Involvement

The public, stakeholder groups and agencies need to review and comment on the work completed to date and provide guidance on the corridor location, phasing priorities, community and environmental benefits and impacts, resource development benefits and impacts, and implementation strategy. In particular, communities, Native entities, land owners, and mine owners in the region should be involved, as they will be most affected by the project.

Advance Route Mapping

Existing topographic mapping is generally limited to USGS mapping, which is suitable for high level planning, but not for detailed corridor definition. A first step in the next project phase would be to complete LIDAR mapping and aerial photography of the corridor and surrounding areas. This would provide the necessary detailed topographic information and high resolution mapping of on-the-ground features. With this information, the location of the corridor could be better defined so that more detailed engineering and environmental studies could be completed.

Field Studies

Additional engineering and environmental fieldwork would be essential to further define the detailed road route, material sources, and environmentally sensitive areas that should be avoided or addressed in permitting. Recommended field studies include survey, geotechnical and material sources investigations, wildlife and vegetation studies, subsistence use, cultural resources investigations, wetlands, and stream crossing documentation.

Engineering Analysis

The mapping and field data defined previously should be used to further define the corridor, design criteria for the route and individual segments, and detailed costs for individual segments. This effort should also include preliminary work to define ROW parcels, acquisition costs, and acquisition processes and timeframes for the final refined alignment.

Implementation Planning

Implementation planning would further define how the project should be funded, likely funding increments, project phasing, specifics on maintenance facility locations, which connectors to communities and resources should be built, and private sector participation/interest in building connector roads. Coordination on possible extensions of power and energy would occur as part of implementation planning.

Secondary and Tertiary Socioeconomic Effects

As noted in the main report, mail delivery in corridor communities will likely change from air to ground transportation; a change that could result in higher air passenger fares to those communities, or fewer air travel providers, given that the Bypass Mail Program effectively subsidizes rural air travel. It is not clear how residents and business will respond to this change or how the State of Alaska would adapt its infrastructure planning process. It would be beneficial for the State to better understand how regional travel may change with a road.

7.2 Construction Phasing and Other Road Links

The Alaska and Dalton Highways were constructed in a few years time by multiple construction units working year round, just behind their respective survey crews. The Parks Highway was constructed under a more typical but still aggressive extended summer construction schedule, with funding fully committed to the project. Construction is more complicated today because of funding, ROW, and environmental constraints that can add more steps to the design process and require staged construction. A practical approach to Western Alaska access road construction is likely to build road segments over many years, as funding is available and as ROW and environmental issues are resolved.

Project construction phasing and timing will be based on a variety of factors, including:

- Community location - segments should generally terminate and begin near existing communities
- Resource location and timing - segments should be partly based on their ability to connect to minerals and other resources that have near term development potential
- Power/energy transmission - segments that support energy/ power transmission would be candidates for early phasing
- Benefits and costs - priority should be given to segments that have higher overall benefits relative to costs
- ROW - in some cases ROW complexities may cause a segment to be deferred
- Maintenance and engineering - segments may be affected by location of planned maintenance stations, may need to avoid terminating at steep terrain areas, and may benefit from proximity to material sources
- Funding - funding availability will be a major factor in defining how much can be built at one time

In the 2004 Northwest Alaska Transportation Plan, a Yukon River Corridor was proposed, in a somewhat similar location to Route 2b, along with a spur road to Unalakleet, Saint Michael, and Shaktoolik. The Yukon River portion was proposed to be built in the following order:

1. Manley Hot Springs to Tanana
2. Galena to Kaltag
3. Tanana to Galena
4. Koyukuk to Koyuk
5. Koyuk to Council

In general, this suggests an east to west phasing of the project, mostly driven by connecting communities along the Yukon River to the Interior highway system and to the larger hub community of Galena.

Segments should also factor in separation between maintenance stations along the corridor. Based on Dalton Highway experience, maintenance stations would be located about every 50 to 70 miles, and to the extent possible, be located at or near existing communities. This suggests a station near Manley, one near Tanana, several between Tanana and Galena, one near Galena, one near Nulato/Koyukuk, several between Koyukuk and Koyuk, one near Koyuk, and one near Council.

During the next phase of work, DOT&PF should develop a general order of road segment development that will be refined further during the Environmental Impact Statement (EIS) phase. The segmentation plan should not only consider the factors noted previously, but also whether segments should initially be built to lower standards and then be upgraded to progressively higher standards as traffic volumes and vehicle types increase.

Should construction proceed, as the Yukon River Corridor is advanced westward, there are several other viable road links that may deserve consideration:

- **Tanana to Ambler -** The Ambler mining district could be connected to the Yukon River Corridor with an approximately 276-mile spur road. This link from the Yukon River Corridor would access a rich mining district that has remained largely inaccessible due to the surrounding federally protected lands. A link from Tanana to Ambler would not require crossing any of these federal CSUs. Chapter 6 discusses the potential benefits of the Yukon River Corridor to Ambler and other mine sites.

- **Ruby to Donlin -** The existing Ruby-Poorman Road, once tied into the Yukon River Corridor by ferry or a new bridge crossing, could be extended south to reach Ophir, McGrath, and eventually the Donlin Creek mineral district. The total road distance between the corridor and the Donlin area would be ~340 miles, with the length of new road required in the range of 200 miles. The benefits of the Yukon River Corridor to Donlin Creek are also considered in Chapter 6. This link has been considered in prior studies, as indicated by **Figure 6** (Chapter 3).

7.3 Construction Funding

Few 400-mile public roads remain to be built in the northern hemisphere. Access to major population centers is complete, and overland access for most national security purposes are in place. Costs per mile have escalated significantly over time, mature infrastructures need reconstruction attention, and capital funding sources have remained constant, all of which squeeze new construction funding requests. In general, financing construction projects in the cost estimate range of the Yukon River Corridor is a national effort based on national level decisions. Project financing for national priority projects would usually be achieved by some combination of public and/or private bonds, federal/state capital funding, an endowment, or a capitalized transportation authority. Depending on the urgency, construction would take 8 to 15 years, or possibly longer.

If the project does not become a national priority, it would most likely be funded through incremental annual capital spending by the state legislature. It is unlikely, absent a national security decision, that special, long range funding tools, including major bonding, infrastructure banks, endowment/authority capitalization structures, or other major financing tools would be available for this project. Luckily, access to the Seward Peninsula is exceptionally well suited to an incremental approach, connecting communities and resource development sites to existing transportation systems through relatively short road links.

The following is a brief review of a wide range of funding options.

ARRC Financing: Road sections that may be used in the foreseeable future for rail line development may be eligible for ARRC bond financing.

State Infrastructure Bank: The State of Alaska could choose to establish an infrastructure bank that funds capital projects with a return to the bank financing future projects.

Endowments: The State of Alaska can develop an endowment(s) to fund a transportation program or project. The state would set aside funds from the Permanent Fund or regular capital fund appropriations. The base fund generates interest which is then available for capital projects.

Alaska Industrial Development and Export Authority (AIDEA): AIDEA has the potential through direct State General Fund appropriations and bonding to fund construction projects with the goal of providing improved economic conditions to the state. The Red Dog Mine haul road and port, the Skagway Ore Terminal, and the Ketchikan Shipyard are examples of transportation infrastructure that can return funds to AIDEA through fees and revenues.

The Yukon River Corridor project probably has limited access to AIDEA funding, as the road is a public access with a generalized economic development goal and few major mineral sites that would warrant or be able to repay funds. One exception may be the Yukon River Bridge crossing near Tanana. This bridge, estimated to cost in the range of $110 million, would provide access to a long belt of gold and silver deposits along the north shore of the Yukon River, and mine operators may agree to enter into an annualized toll type fee structure.

A road segment accessing this gold belt may also be of benefit to the state. Private interests can agree to participate in financing a private road under agreement with the state, and then turn the road over to the state for public ownership and operations when the route is needed to access points further west toward Galena. This strategy would get economic development underway in the eastern sector of the route and would provide the state with a jumping off point for new road construction to the west.

Individual mining exploration companies are generally unable to fund road construction to their claims, but may well be able to finance an annual fee in lieu of taxes or tolls. In addition, AIDEA can accelerate the startup timing through finance decisions that mining companies would not be able to make individually.

State General Funds: The State of Alaska appropriates General Funds each year for capital projects and/or federal capital funds match. The funds generally take one to several years to obligate and expend, but appropriations themselves are made on an annual basis. Currently, there are no multi-year appropriations methods. Ideally, a State General Fund appropriation of $10,000,000 could be combined with a Federal Highway Administration (FHWA) appropriation for several years in a row to put into motion the priority segments that have independent utility, but also begin the construction of a Yukon River Corridor.

FHWA: Congress funds FHWA transportation programs out of the Highway Trust Fund, the repository of federal highway fuel tax receipts. States receive funding on a formula basis and through designated appropriations. Alaska has received substantial levels of funding based on the allocation formulas due to the state's extensive federal lands and other less critical formula criteria. Alaska has also experienced a high level of directed appropriations, making the overall FHWA funding a major presence in road construction and Alaska Marine Highway System repairs and upgrades.

Congress is currently building new highway legislation to set the stage for the next five years of surface transportation improvements and operations. It is clear from the early legislative work that Congress is taking a new approach to transportation funding. The focus is clearly now on repairing and upgrading the interstate system, particularly truck routes; investing in rail and marine short haul freight transport; improving urban area air quality, arterial networks, and mass transit systems. The overall interstate system is fully constructed and there is now a growing consensus to address the urban congestion issues that have emerged at interstate transportation nodes.

These transportation emphasis areas and their emerging funding formulas do not leave Alaska and other western states in a particularly strong position relative to major urban areas in terms of overall funding levels. In addition, the potential for substantial matching requirements may be an element of new highway legislation, which could further impact the State's capital projects appropriations.

Department of Defense Innovative Readiness Training: The Department of Defense Innovative Readiness Training program is active in Alaska and may provide limited funding. It provides health services and infrastructure engineering management services to rural Alaska as a way to provide training opportunities for military missions. The Innovative Readiness Training program worked to complete a 14-mile road in southeast Alaska and has been working on the survey of a route between two villages in southwest Alaska. While the program is active, it is also subject to annual reviews to determine resource allocations.

7.4 National Environmental Policy Act and Permitting

This section presents information on the environmental review process that would likely be required for this major road project. Any project that requires a major federal action, such as a federal permit approval or funding from a federal agency, would require compliance with the NEPA. As a major new road corridor, this project would likely require an EIS, the highest level of NEPA review. The NEPA process outlined here is based on the recommended Yukon River Corridor, which does not cross any ANILCA lands. Corridors crossing ANILCA lands would require additional federal review of subsistence effects and a separate ANILCA Title XI ROW application process.

The NEPA Process

The majority of the permit/approvals needed for the proposed project involve a federal agency. This section presents a summary of the possible NEPA compliance process for the WAAPS project. The information is based on projects of similar size and complexity to the proposed project. Possible opportunities for streamlining some activities are noted.

The NEPA process is the set of procedures used by a federal agency to analyze and document potential environmental impacts of a proposal and its alternatives. The process requires the following:

- Development of a clear and defensible purpose and need statement.
- Identification of a full range of reasonable and feasible alternatives, including the no action alternative.
- Documentation of the affected environment and the evaluation of potential consequences to both natural and social resources from the proposed action and no action alternatives.

If impacts are expected, measures must be considered that could avoid, minimize, and mitigate negative impacts.

- Efforts to inform and seek input from the public, state, and local agencies, and federal agencies.

The NEPA process varies in complexity depending on the project. A project with no significant impacts can be documented under an Environmental Assessment or Categorical Exclusion. More complex projects that may have significant impacts or that have a high level of controversy may require an EIS. An EIS can take years to complete, depending on the extent of data collection needed and the level of controversy. For major transportation projects, the FHWA allows for tiered environmental documentation. The first tier EIS can focus on broad issues such as general location, mode choice, and area-wide air quality and land use implications of the major alternatives. Once these issues are decided, more detailed analysis of segments of the project could be completed in an Environmental Assessment or an EIS, tiering off on the original EIS.

Lead and Cooperating Agencies

Identification of the lead agency under NEPA is a key early action. Typically, the lead agency is the one with significant ownership or permitting responsibilities or is the source of funding. For purposes of presenting NEPA and permitting guidelines, it is assumed that the FHWA would be the lead agency, but the USACE could also be the lead agency, depending on the road funding source. In addition, NEPA allows an agency or agencies with special knowledge or expertise on an issue or additional permitting requirements to be designated as a co-lead or cooperating agency. Because of the federal lands involved in the WAAPS project, the BLM and/or the USFWS are likely potential federal co-lead or cooperating agencies. Agencies with major permitting responsibility, for example, the USACE for wetlands permitting, may also be designated a co-lead or cooperating agency.

Environmental Documentation

The design and approach to preparing NEPA documents is important for expediting the process. Following are several areas in which clarity and thoroughness can help the overall review process.

Purpose and Need Statement. NEPA requires a discussion of the purpose and need for a proposed action. This statement establishes why an "action" (e.g., permitting and construction of a road corridor) that may cause environmental impacts is proposed. A clear purpose and need statement leads to a focused set of objectives that can provide boundaries on the range of alternatives and required analysis.

Proposed Action and No Action Alternatives. NEPA requires consideration of a full range of reasonable alternatives. As mentioned previously, a clear purpose and need statement helps guide the range of alternatives that should be considered in the environmental review. All alternatives considered must meet the purpose and need and should incorporate measures to reduce potential impacts. Alternatives that were raised or considered and not carried forward must be documented, along with the reasons that they were not considered to be reasonable.

Section 7 Consultation. Section 7 of the Endangered Species Act requires all federal agencies to consult with the National Marine Fisheries Service for marine and anadromous species, or the USFWS for fresh-water species and wildlife, if an alternative may affect listed species or their designated habitat.

Essential Fish Habitat Analysis. The Magnuson-Stevens Act requires federal agencies to consult with the National Marine Fisheries Service about actions that could damage Essential Fish Habitat.

Section 106 Consultation. Section 106 of the National Historic Preservation Act of 1966 (16 USC 470) requires projects that include federal participation to take into account the effects on any historic properties listed, or eligible for listing, on the National Register of Historic Places. The Act requires the federal agency consult with tribal governments, certified local governments, and other interested parties. In addition, Section 106 requires that the Advisory Council on Historic Preservation must be provided an opportunity to comment on the project. Federal regulations for implementing Section 106 are contained in Code of Federal Regulation 36 CFR 80, Protection of Historic Properties. The principle concern for cultural resources is the loss or degradation of prehistoric and historic archaeological sites, either through direct disturbance during construction or indirect disturbance due to changes in accessibility.

Cumulative Impacts. Cumulative Impacts can result from individually minor but collectively significant actions taking place over a period of time. As such, the cumulative impact analysis takes into account other projects that may impact the project area, regardless of the project sponsor or funding. Recently constructed projects and reasonably foreseeable future projects that would potentially impact the same environmental resources as the Proposed Action are evaluated for cumulative effects. The No Action alternative is not included in the analysis of cumulative impacts because it would not contribute to cumulative impacts.

The National Academy of Sciences Cumulative Impacts Study (2003), NEPA documents on other recent and current projects on the North Slope, and other similar literature could provide relevant background materials for the analysis of cumulative impacts.

Public Outreach. The way in which public outreach is approached and managed in a NEPA process directly affects the schedule. Public perception of the proposed WAAPS project influences the extent to which the NEPA process and other permitting processes can be expedited. It is important that the opportunities for public input be designed to draw in the widest range of stakeholders, to facilitate clear communication between the project team and the stakeholders, to obtain information on potential resource impacts and possible alternatives early in the process, and to communicate the analysis and decision processes throughout the project. To be effective and efficient, the public outreach program should include:

- Developing a concise public outreach plan with clear milestones and methods designed to facilitate acquisition of relevant information on environmental resources, resource impact concerns, potential alternatives, and possible mitigation measures.
- Managing public scoping to maximize its role in obtaining relevant information.
- Integration of traditional knowledge and environmental justice into the environmental review process.
- Structuring public hearings to obtain project-specific comments that will expedite the comment analysis and response process.

- Manage the comment analysis and response process to quickly extract information that could affect the environmental impact analysis, get this information to the appropriate team members, and document responses.
- Document the public outreach and the comment analysis and response process to build a defensible procedural record of the process.

NEPA Approval and Permitting Requirements

Table 27 summarizes the federal, state, and local agencies that are expected to have NEPA document review, approval, and/or permitting responsibilities for a transportation corridor such as the one being considered by the WAAPS project. As stated previously, this list assumes that no ANILCA lands would be crossed and that FHWA would be the lead agency.

Table 27: Preliminary Summary of Agency National Environmental Policy Act Responsibilities and Permitting Requirements

Agency	Regulation or Requirement	Description
Federal Agencies		
FHWA	NEPA Section 4(f) of the Department of Transport Act	NEPA document preparation (if funding agency). A publicly owned park, recreation area, wildlife refuge, or historic site may not be used unless there is no feasible and prudent alternative and all possible planning to minimize harm has been included.
U.S. Environmental Protection Agency	Overall compliance with federal environmental laws Clean Water Act	NEPA document review. Clean Water Act Section 404(b) wetland permit review. National Pollutant Discharge Elimination System industrial discharge permit if required.
USACE	Rivers and Harbors Act, Section 10 Clean Water Act, Section 404	NEPA document preparation or review, depending on whether lead or cooperating agency. Section 10 Permit authorizes construction of structures in navigable waters. Section 404 Permit authorizes fill in wetlands.
BLM	Federal land ownership and management	NEPA document preparation or review depending on whether lead or cooperating agency. Approval of ROW permit.
USFWS	Federal land ownership and management Endangered Species Act and Migratory Bird Act Endangered Species Act, Section 7 Consultation	NEPA document preparation or review depending on whether lead or cooperating agency. If there is a potential impact to species protected under Endangered Species Act or Migratory Bird Act, a biological assessment may be required. The outcome of the biological assessment determines whether a Section 7 consultation is required. Approval of ROW permit.
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	Endangered Species Act Magnuson-Stevens Act (Essential Fish Habitat)	NEPA document review. If there is a potential impact to species protected under Endangered Species Act, a biological assessment may be required. Coordination on the presence of essential fish habitat, impacts to essential fish habitat, and mitigation if required.

Agency	Regulation or Requirement	Description
U.S. Coast Guard	Navigability Determination Rivers and Harbors Act Section 9	NEPA document review. Review and determine if project would affect navigable water bodies. U.S. Coast Guard issues permits for bridges affecting navigable waters under Section 9 of the Rivers and Harbors Act. FHWA can determine a project is exempt if the waterway is not navigable by vessels more than 21 feet in length.
NPS	Section 6(f) Land and Water Conservation Fund Act	Recreation lands purchase or improved with Land and Water Conservation Act grants are to be avoided. If avoidance is not possible, impacts must be mitigated.
State of Alaska Agencies		
DNR - Office of Project Management and Permitting	Coastal Zone Management Plan consistency	NEPA document review. Responsible for the overall administration and operation of the Alaska Coastal Management Program.
DNR - Office of Habitat Management	Fishway Act Anadromous Fish Act	NEPA document review. Issues permits under Title 41.14.840 for work related to any fish streams if there is potential to impede fish passage. Issues permits under Title 41.14.870 Permit to work within catalogued anadromous streams; seasonal constraints to construction of bridge or culverts in any anadromous stream.
SHPO	Section 106 of the National Historic Preservation Act	Coordination on the presence or potential presence of and potential effects to cultural or historic sites.
Department of Environmental Conservation - Division of Environmental Health and Division of Air and Water Quality	Clean Water Act Clean Air Act Resource Conservation and Recovery Act	Construction General Permit - approval of stormwater pollution prevention plans. Short-term variance from Water Quality Standards for runoff and/or work in waters of the state. General permit for remote worker camps (waste disposal). Determination of compliance with National Ambient Air Quality Standards for particulate generation and emissions from construction equipment and vehicles. An operating permit may be needed. Review of potential hazardous materials (asbestos) or hazardous waste sites along routes. Approval of hazardous waste management plans.

Agency	Regulation or Requirement	Description
Local or Tribal Governments and Other Stakeholders		
Northwest Arctic Borough	Coastal Management Plan [11 AAC 114.250(b) - (i)] Home Rule Borough under Alaska Statute 29	Designate areas for subsistence, cultural resources, important habitats, and natural hazards. The specific designations include areas identified in the original Northwest Arctic Borough plan to protect special resources and uses. The Northwest Arctic Borough provides for planning, platting and land use regulation for the borough under Alaska Statute 29.
Cities of Tanana, Galena, Koyuk, Nulato, Elim, White Mountain	Cities under Alaska Statute 29	Tanana and Galena are first class cities and should provide for planning, platting and land use regulation under Alaska Statute 29. White Mountain is a second class city that provides for planning, platting and land use regulations under Alaska Statute 29.
ANCSA Corporations Regional: Doyon, Limited and the Bering Straits Native Corporation Village: Bean Ridge Corporation (Manley Hot Springs), Tozitna Limited (Tanana), Gana-A'Yoo Limited (Galena, Nulato), Koyuk Native Corporation, Elim Native Corporation, White Mountain Native Corporation, Council Native Corporation	Section 106 of the National Historic Preservation Act of 1966 (16 USC 470)	Section 106 consultations include ANCSA corporations as well as tribal governments. Regional and village ANCSA corporations are also major landowners in Northwest Alaska.
Federally Recognized Tribes	Section 106 of the National Historic Preservation Act of 1966 (16 USC 470) Millennium Agreement	Section 106 requires consultation with local tribes regarding the potential for effects to historic resources. This agreement provides a framework for constructive and meaningful government to government relationships to enhance cooperation between the state and the tribal governments. It calls for the state to inform the tribes at the earliest opportunity of proposed actions that may significantly affect them.

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