

West Susitna Access Reconnaissance Study West Susitna Access to Resource Development

Transportation Analysis Report

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Acronyms

AAC	Alaska Administrative Code
AASHTO	American Association of State Highway and Transportation Officials
ADF&G	Alaska Department of Fish and Game
ADL	Alaska Division of Land
AEA	Alaska Energy Authority
AIDEA	Alaska Industrial Development and Export Authority
AMHT	Alaska Mental Health Trust
ANCSA	Alaska Native Claims Settlement Act
ARDF	Alaska Resource Data File
ARTEC	Alaska Railbelt Transmission and Electric Company
AS	Alaska Statute
ASCMCRA	Alaska Surface Coal Mining Control and Reclamation Act
ATV	all-terrain vehicle
bbbl	barrels
BIF	best interest finding
BLM	U.S. Bureau of Land Management
bpd	barrels per day
CEA	Chugach Electric Association
CBM	Coalbed Methane
CIE	Cook Inlet Energy, LLC
CIRI	Cook Inlet Region, Inc.
CWA	Clean Water Act
DEM	digital elevation model
DGGS	Division of Geologic and Geophysical Surveys
DNR	Alaska Department of Natural Resources
DOF	Division of Forestry
DOG	Division of Oil and Gas
DOT&PF	Alaska Department of Transportation and Public Facilities
DPOR	Department of Parks and Outdoor Recreation
EIS	environmental impact statement
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FMU	Forest Management Unit
GIS	Geographic Information System
GMU	Game Management Unit
KPB	Kenai Peninsula Borough

KPEDD	Kenai Peninsula Economic Development District
LNG	liquid natural gas
mcf	million cubic feet
MEA	Matanuska Electric Association
Mgal	million gallons
ML&P	Municipal Light and Power
MLW	Mining, Land and Water
MOA	Municipality of Anchorage
MSB	Matanuska-Susitna Borough
MW	megawatt
NHCC	National Highway Construction Cost Index
NPR-A	National Petroleum Reserve – Alaska
NWI	National Wetlands Inventory
OPMP	Office of Project Management and Permitting
PGDHS	A Policy on Geometric Design of Highways and Streets
PGE	platinum group elements
ROD	Record of Decision
RM	river mile
SRR	State Recreation River
SRS	State Recreational Site
syngas	synthetic gas
UCG	underground coal gasification
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

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EXECUTIVE SUMMARY

The Alaska Department of Transportation and Public Facilities' (DOT&PF) Roads to Resources Initiative originated the West Susitna Access Reconnaissance Study in early 2013. The purpose of this reconnaissance-level study is to evaluate and consider the need for surface access to resource development opportunities west of the Susitna River in Southcentral Alaska.

The Study Area is located in Southcentral Alaska, generally west of the Parks Highway, south of Denali National Park and Preserve, east of the Alaska Range, and north of Cook Inlet (including the Beluga/Tyonek area). The area covers nearly 6.2 million acres.

While nearly the size of Vermont, the Study Area has a diverse natural resources base. These natural resources include hardrock minerals, placer gold, coal, oil and gas, forestry/timber, agriculture, alternative energy options, and recreational resource opportunities, such as sportfishing and hunting. Surface access to most of this area, however, is minimal or non-existent.

This study aims to identify locations that may benefit from a proposed surface connection and evaluates the potential access routes. The objectives of this study report are to:

- Identify resource development opportunities west of the Susitna River.
- Identify one or more potential crossings of the Susitna River.
- Identify one or more potential transportation corridors to access identified resources.

The majority of the Study Area is not accessible by the existing road network. Access within most of the Study Area occurs primarily by air or river travel, or by snowmachine or ice roads during the winter months. Other types of travel modes include skiing and foot travel. Providing surface access to some of these natural resource-dense areas could facilitate further exploration, development, and use of these resources. Natural resource development in Alaska helps to create jobs and stimulate the economy. Creating access to resources also enables residents and visitors to use the land recreationally.

The first part of this study consisted of inventorying natural resources and existing infrastructure in the Study Area. Based on a constraints and opportunities analysis approach, ten broad preliminary corridor segments were delineated based on the locations of identified resource opportunities, environmental constraints, Susitna River crossing locations, and previously identified alignments. Initial centerlines were laid out within these corridor segments. Through a refinement process, several segments were dismissed for a variety of reasons, including redundancy, engineering challenges, prohibitive costs, etc. The remaining alignments were refined and combined to create four different access routes and one variant for consideration for providing access into the Susitna basin. Features of the proposed access routes are summarized in Table ES-1. The proposed access routes were evaluated based on a number of considerations, including “strengths” (e.g., acreages of resources made accessible) and “weaknesses” (e.g., engineering challenges). Both quantitative and qualitative measures were used to compare the access routes.

The study team also collected additional existing information to help quantify the resource potential of the areas to be accessed. Potential resource values have been incorporated into the respective resource sections of this report, primarily in Section 2. There are some limitations to the assumed resource values. For instance, the use of lease acreage and claims as a proxy for resource potential should not be taken to imply that all of that acreage would be developed, as most of the holdings are for exploration at this time. Likewise, acreages designated by DNR as potential for agricultural use may not be fully utilized for crops. In terms of mineral potential, a caveat is that this runs the risk of

under- or over-stating the actual potential of other areas that are not currently leased for exploration. A thorough economic benefits and impacts analysis has not been completed for this project. However, a separate document has also been prepared that considers the economic benefits of proposed access into the West Susitna Study Area (see Appendix F).

Given the wide variety of potential resource development opportunities within the Study Area, there is no single target point (destination) for the proposed access routes. As such, several possible routes have been identified, each having different origins and destinations, as indicated in the following table. Depending on the priority, availability of funding, and timing of access needs, multiple routes could be chosen and combined or added to other routes in subsequent phases. For example, for the routes destined for the mining area in the Tordrillo Mountains, another one of the alignments could be added to provide access to the Beluga area if both locations are shown to warrant access.

Table ES-1. Proposed Access Routes Summary

	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
General origin	Petersville Rd	Oil Well Rd	Little Su River Rd	Little Su River Rd	Willow area
General destination	Upper Skwentna mineralized area	Upper Skwentna mineralized area	Upper Skwentna mineralized area	Beluga/ Tyonek	Oil Well Rd
Amount of resources accessed					
<i>Hardrock minerals</i>	Medium	High	Highest	Lowest	Low
<i>Placer gold mining</i>	Medium	High	Highest	Lowest	Lowest
<i>Coal</i>	Medium	Medium	High	Highest	Lowest
<i>Oil and gas</i>	Lowest	Medium	Medium	High	Highest
<i>Forestry/timber</i>	Low	High	Highest	Low	Medium
<i>Agriculture</i>	Lowest	Lowest	Medium	Lowest	Highest
<i>Recreation</i>	Low	Lowest	Medium	Highest	Low
Length (miles)	78.8	71.6	107.9	63.8	33.5
New Bridges (#)					
<i>Conventional</i> ¹	9	12	20	11	1
<i>Long Span</i> ²	4	6	4	2	2
<i>Total</i>	13	18	24	13	3
New bridge crossings greater than 1,000 feet	1,150 (Yentna)	1,200 (Yentna) 1,200 (Hayes)	1,200 (Hayes) 1,640 (Susitna)	1,640 (Susitna)	1,200 (Susitna)
New Culverts (#)					
<i>Large</i> ³	12	12	14	6	2
<i>Small</i> ⁴	37	26	40	12	11
<i>Minor Drainage</i> ⁵	316	292	440	260	136
Cost Estimate (millions)					
<i>Subtotal</i> ⁶	\$147.6	\$188.3	\$187.4	\$106.9	\$72.2
<i>Total</i> ⁷	\$376.4	\$504.3	\$453.2	\$257.8	\$216.9
<i>Total per mile</i> ⁸	\$4.6	\$6.3	\$4.2	\$4.0	\$5.2

* A Goeller scorecard is a commonly used method of comparatively displaying pros and cons. The Goeller scorecard was used in this reconnaissance study to display the impacts of the reconnaissance-level proposed access routes. This method displays the impacts of each option, which is expressed in its 'natural' units. In this study, examples of natural units are feet, miles, number of creek crossings, acreages, and monetary value. In the tables, each row represents one impact and each column represents an access route option. Colored shading is used to comparatively indicate the more or less favorable metrics. The color shading was intended to make it easier for a decision-maker or reader to identify patterns or to come to conclusions. In some cases, values were relatively similar so there may be more than one option shaded the same color within the same row. No behind-the-scenes normalization or ranking was applied.

Green = Proposed access route(s) with the fewest number of roadway miles, bridges, culverts, and/or costs. Also, indicates highest amount of resources made accessible.

Red = Proposed access route(s) with the greatest number of roadway miles, bridges, culverts, and/or costs. Also, indicates least amount of resources made accessible.

Assumptions:

¹ Conventional bridges are considered less than 300 feet in length.

² Long span bridges are 300 feet or longer.

³ A culvert approximately 96 feet or longer.

⁴ Small culverts and minor drainage culverts have an assumed length of approximately 50 feet.

⁵ An additional four culverts per mile to accommodate minor drainage patterns.

⁶ Subtotal cost estimate for new proposed access roadways includes clearing, earthwork, structures, stream and river crossings (including culverts), guardrail and retaining walls, and miscellaneous items such as topsoil, seeding, geotextile and signing.

⁷ Total cost estimate includes drainage measures, erosion and pollution, surveying, environmental studies and permits, existing road upgrades, construction, mobilization, right-of-way (ROW) acquisition, contingency, design, and utilities.

⁸ Total per mile includes only the proposed access routes and does not include existing roadways or cost to upgrade them.

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1 INTRODUCTION

1.1 Study Overview

In January 2013, the Alaska Department of Transportation and Public Facilities (DOT&PF) contracted with HDR Alaska, Inc. and its consultant team to conduct the *West Susitna Access Reconnaissance Study*. The purpose of this study is to evaluate and consider the need for surface access to resource development opportunities west of the Susitna River in Southcentral Alaska. The Study Area is natural-resources dense, and this study aims to identify locations that may benefit from a proposed surface connection. The objectives of this study are to:

- Identify resource development opportunities west of the Susitna River.
- Identify one or more potential crossing(s) of the Susitna River.
- Identify one or more potential transportation corridor(s) to access identified resources.

This report is intended to be a reconnaissance-level study based on existing, available information. No field investigations were performed. While agencies and other resource-industry stakeholders were contacted to supplement existing information, a public involvement and stakeholder engagement process was not a part of this reconnaissance-level study at this time. Should this project move forward, a public involvement and stakeholder engagement process would be implemented and subsequent environmental processes and analyses would be pursued.

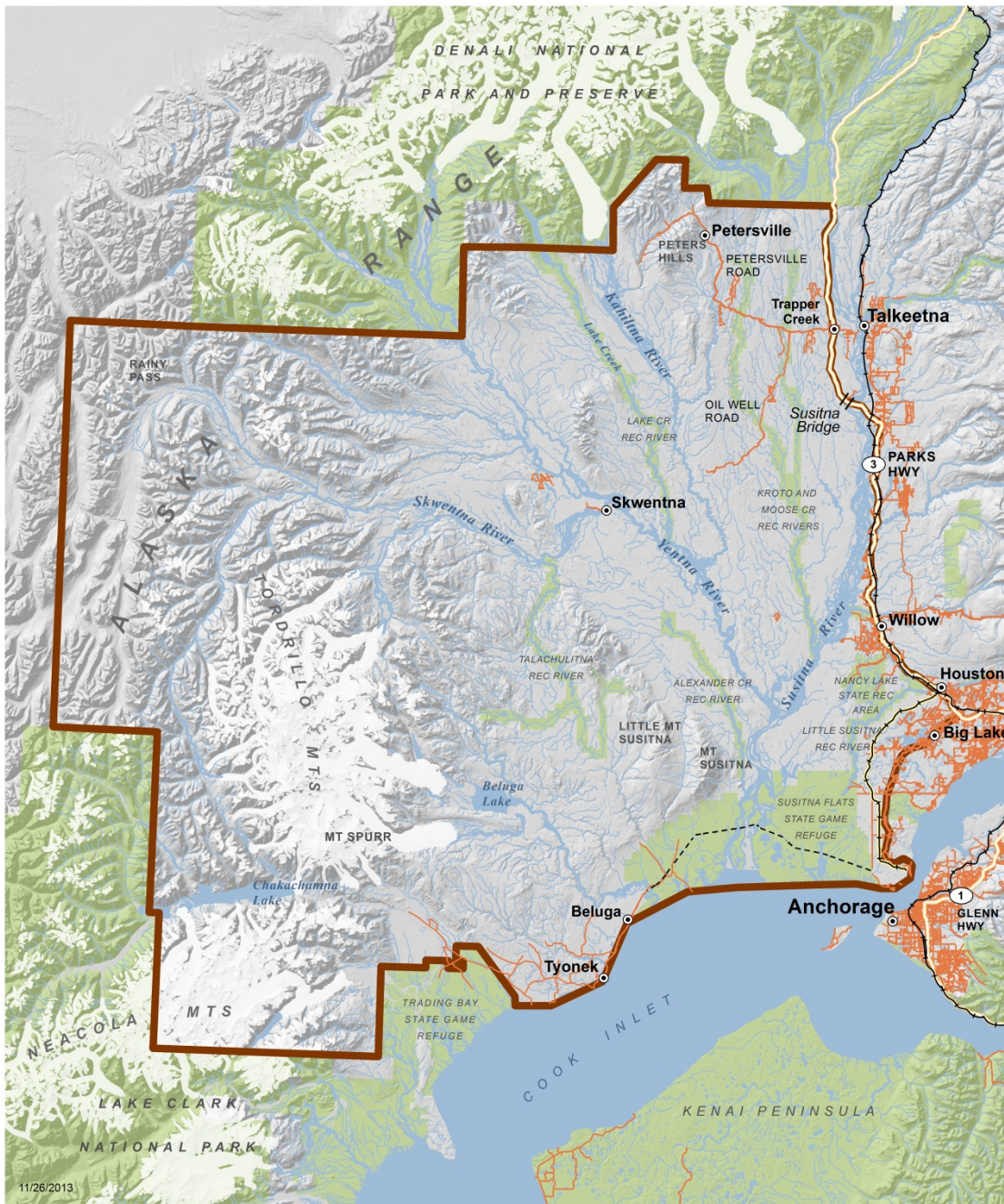
1.2 Study Setting

The Study Area, depicted in Figure 1-1 and Figure 1-2, is located in Southcentral Alaska, generally west of the Parks Highway, south of Denali National Park and Preserve, east of the Alaska Range, and north of Cook Inlet (including the Beluga/ Tyonek area). At nearly 6.2 million acres, the Study Area is roughly the size of Vermont.

Figure 1-1. Study Area in State Context



Figure 1-2. Study Area



Study Area

West Susitna Access to Resource Development



A diverse natural resources base is found in the Study Area, particularly west of the Susitna River. The study team identified the following opportunities for resource exploration, development and access in the Study Area: hardrock minerals, placer gold mining, coal, oil and gas, forestry/timber, agriculture, alternative energy, and recreation. These resources and activities are further discussed in the Resources Inventory, Section 2.

Surface access to most of this area is minimal or non-existent. The majority of the Study Area is not accessible by the existing road network. Access within the Study Area occurs mostly by air, river, or by snowmachine or ice roads during the winter months. Other types of travel modes include skiing and foot travel. Providing surface access to some of these natural resource-dense areas could facilitate further exploration, development, and use of these resources. Natural resource

development in Alaska helps to create jobs and stimulate the economy. Creating access to resources also enables residents and visitors to use the land recreationally.

“Economic growth and stability in Alaska hinges partially, if not primarily, on the availability of a mix of affordable and sustainable energy sources.”

–Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska (DNR- DGGS 2012)

A number of previous studies have identified corridor alignments into and through the Study Area. These studies and alignments were reviewed as part of this study.

1.3 Background Information

1.3.1 Use of Public Lands

Alaska Statute (AS) 38.04.065 Land Use Planning and Classification and 11 Alaska Administrative Code (AAC) 55.010-.030 requires that the Alaska Department of Natural Resources (DNR) “shall, with local governmental and public involvement under AS 38.05.945, adopt, maintain, and, when appropriate, revise regional land use plans that provide for the use and management of State of Alaska-owned lands.” One of DNR’s purposes is to identify important land resources and determine how their lands can be used for the “maximum public benefit.” Often, multiple uses are allowed on these public lands.

Why Plan for the Use of Public Land?

“Through the management of public lands, the state, borough, and federal governments greatly influence the physical development patterns and the general quality of life in the Susitna Area. Major development projects such as mining, timber harvests, or agriculture influence local job opportunities. Land sold for residential or private recreational use clearly affects the character of community life, as does land retained for hunting, fishing, and other public uses.”

– Susitna Area Plan (DNR 1985)

DNR has prepared a number of management plans applicable to the Study Area; some of these include: the *Susitna Matanuska Area Plan* (2011), the *Southeast Susitna Area Plan* (2008), the *Susitna Basin Recreation Rivers Management Plan* (1991), the *Susitna Forestry Guidelines* (1991), and the *Susitna Area Plan* (1985). Access is addressed in these plans. For instance, the 1985 *Susitna Area Plan* addresses transportation and access as follows:

“The final major goal of the plan is to open more land in the region to a variety of public and private uses. This is achieved in part by the pattern of land use designations in the plan. This pattern is specifically arranged to combine designated uses in a manner that makes benefits of road construction greater than the cost. For example, in the region south of Petersville Road, forestry

areas are designated to encourage construction of pioneer roads that will open adjacent land to use for public and private recreation and agriculture.” (p.11)

In furtherance of its DNR’s mission relative to the Susitna Basin a number of detailed resource investigations are ongoing. The DNR-Division of Geological and Geophysical Surveys (DGGS) is currently conducting a mapping project in the Beluga/Tyonek area and another mapping project in the Susitna River basin that will help to determine resource potential.¹ For this effort, baseline geologic data for potential energy systems from surface rock exposures is being collected. The product of this work will be a geologic map and series of technical reports on their field findings. An overview report of the fieldwork in the Susitna basin was published in April 2013, which summarizes the ten reconnaissance field trips that were conducted in the Susitna basin in June 2011.² The work has been done in partnership with Alaska DNR-Division of Oil and Gas (DOG), U.S. Geological Survey (USGS), and the University of Alaska Fairbanks. According to the April 2013 report, the information is intended to increase the understanding of the basin’s hydrocarbon potential, a “key component of DGGS’s multi-year In-State Gas Program.” The 2011 summer reconnaissance fieldwork and subsequent analysis is part of a multi-year, multi-agency research effort to investigate the resource potential of the Susitna sedimentary basin. As the data is developed, interpretive technical reports will be produced addressing the stratigraphy, reservoir quality, coal quality and gas potential, hydrocarbon seal integrity, subsurface structure, and uplift history of the basin. The intent is to promote new exploration investment and support responsible resource and land-use management.³

Of the nearly 6 million acres of land in the Study Area, a majority of the land is classified as State land and considered an opportunity for access route locations.⁴ Land status is addressed in a number of sections in this document: specifically in Section 4.4 in terms of both constraints and opportunities for access route locations and in Section 6.2, as part of the land type located within the proposed access route corridors. Utilizing State lands would be preferable for access route locations because of its lower cost to the state, fewer impacts to private property, and less bureaucratic requirements for using federal property. At this reconnaissance-level of study, the access routes were aligned based on a constraints and opportunities analysis. At this time, access routes were not realigned and re-routed based on a detailed analysis of land ownership. Should this project move forward, a more detailed consideration of land status is warranted.

1.3.2 Roads to Resources Initiative Overview

Alaska has a diverse natural resource base. Some of the natural resource deposits or prospects in Alaska are world-renowned and are considered to be some of the largest in the world. However, surface access to most of these resource development opportunities around the State is minimal or non-existent. Providing access to these natural resources increases the opportunity for job creation and economic growth, which in turn supports funding for essential State programs and boosts the state’s treasury.

¹ DNR-DGGS. March 26, 2013. Personal communication with DNR-DGGS Geologist Robert Gillis.

² DNR-DGGS. April 2013. Status of A Reconnaissance Field Study of the Susitna Basin, 2011. By Robert Gillis et al.

³ DNR-DGGS. January 2012. *Annual Report 2011*.

⁴ Land ownership is generalized, based on spatial data from the DNR 2013 General Land Status database, which approximates land status at the section level. Data limitations exist and ownership types are aggregated for planning purposes only. An in-depth analysis of land status and ownership has not been conducted at this reconnaissance-level study. Due to limitations of the data, actual status and ownership of any land should be verified in subsequent project development.

In 2003, to facilitate resource exploration and development of minerals, coal, and oil and gas, the State of Alaska initiated its Industrial Roads Program, also known as the “Roads to Resources” program. This initiative was created to help identify possible partnerships between the State and the resource industry to identify possible surface access needs and opportunities. Encouraging resource development and making exploration, development, and production opportunities more accessible, would in turn increase financial feasibility. This would ultimately benefit Alaska’s economic development by providing increased revenue and employment opportunities.

In recent years, the larger Roads to Resources initiatives have generally focused on roads in Alaska’s arctic region: the roads to Umiat, Ambler, and Tanana. These projects are much further along in the project development process compared to the *West Susitna Access Reconnaissance Study*, which was initiated in early 2013.

- The proposed road to Umiat, also known as the *Footbills West Transportation Access Project*, would facilitate oil and gas exploration and development in the northern foothills of the Brooks Range and improve access to the National Petroleum Reserve-Alaska (NPR-A) via Umiat. An approximate 75-mile road from the Dalton Highway to the Gubik Gas fields is proposed. Eventually the road would be extended across the Colville River to the State airport in Umiat.
- The road to Ambler, also known as the *Ambler Mining District Access Project*, would consist of a 200 to 370 mile road from the mining district to either a port in western Alaska or to a Dalton Highway connection. The road would provide access primarily to mining resources. A number of corridors were identified several years ago, and subsequent environmental baseline studies are occurring. During its 2013 session, the Alaska State Legislature appropriated \$8.5 million for this industrial road to connect with the Dalton Highway. Management of this project shifted from DOT&PF to the Alaska Industrial Development and Export Authority (AIDEA) in 2013.
- A road has been proposed to Tanana from the existing Elliott Highway. The proposed road would extend from the existing road network near Manley Hot Springs and follow along the existing Tofty Road to the Yukon River near the village of Tanana. The road would provide access between remote villages and larger hub communities. The DOT&PF submitted an easement application to DNR in December 2012 for a 300-foot wide approximately 36 mile corridor.⁵

One other non-arctic Roads to Resources initiative proposes to upgrade the existing Klondike Highway near Skagway to accommodate increased industrial uses. It is the only Roads to Resources roadway that was previously already in existence, and its intent is to enhance the pavement and bridge structures to accommodate an anticipated large increase in the transport of ore from Canadian mines to the Port of Skagway.

Other smaller-scale Roads to Resources initiatives⁶ include:

- Niblack Mine access – Prince of Wales
- Bokan Mountain Mine access – Prince of Wales
- Granduc Mine – Hyder Salmon Road

⁵ State of Alaska. Online Public Notices. <http://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=168193> (accessed July 16, 2013).

⁶ http://dnr.alaska.gov/commis/priorities/Slides/Ed_Fogels.pdf

- Katlian Quarry – Baranof Island
- Miscellaneous access roads in southeast Alaska
- Nome and Seward Peninsula – access for several mine prospects

This West Susitna Access Study report will provide a foundation for subsequent work, should funding become available and if the project were to move forward. Other project development activities would include field studies, agency consultation, public involvement, alignment refinement, and an environmental review process.

1.4 General Study Methodology

This study was prepared using the following approach:

- **Review existing literature and relevant studies** to identify resources and access opportunities in the Study Area. Information was obtained based on a cursory literature search of available, existing information and industry knowledge.
- **Conduct interviews** with a variety of industry organizations, land owners and other stakeholders, such as relevant State divisions, to verify and yield additional information and data.
- **Inventory natural resources** in the Study Area.
- **Inventory existing infrastructure** in the Study Area.
- **Identify Susitna River crossing location options and possible transportation corridors** based on identified opportunities and constraints related to the identified resources
- **Identify next steps** for further project development.

1.5 Report Contents

This report is generally structured in a way that depicts the methodology used for this study.

- **Section 1** of this report provides background information and explains the general approach methodology used to conduct the study.
- **Section 2** presents an inventory of known natural resources in the Study Area.
- **Section 3** identifies the existing transportation and energy infrastructure in the Study Area.
- **Section 4** describes previously-identified alignments and explains the methodology for developing the access routes through an opportunity and constraints analysis.
- **Section 5** presents the proposed access routes, and **Section 6** evaluates them.
- **Section 7** summarizes the findings of the study and suggests the next steps for further project development.

The following documentation has supported the development of this study:

- Appendix A Preliminary Design Criteria Report
- Appendix B Proposed Access Routes Map Index
- Appendix C Geotechnical Reconnaissance Report
- Appendix D Cost Estimate Details
- Appendix E Annotated Bibliography
- Appendix F Economic Considerations

2 RESOURCE INVENTORY

This section documents the potential natural resource development opportunities, exploration projects, and other resource areas that could benefit from surface access on the west side of the Susitna River. One of the reasons for conducting a resource inventory is to help identify the termini; in other words, if a surface access road is warranted, where would the road begin and end.

2.1 Data Collection and Interviews

Resource information was obtained based on a literature search of available, existing information and industry/area knowledge. Subsequent interviews verified and yielded additional information and data. Projects already occurring in the Study Area are in various stages, between proposed, exploratory, or even further along in project development. It is important to note that leases (number and acreage) are not fixed and are constantly changing.

The resource categories inventoried in this study are:

- Mineral Resources
- Oil and Gas Resources: Exploration and Production Activities
- Forestry/Timber and Agricultural Resources
- Alternative Energy Resources
- Recreation Resources

In addition to data collection through literature research, the study team conducted interviews or attempted outreach with the industry representatives and other stakeholders listed below. Some of the interviews were extensive and provided detailed information, while other entities contacted provided only general information. The following contacts were made:

- Alaska Department of Fish and Game (ADF&G), Marla Carter and staff
- Alaska DNR, Division of Agriculture, Resource specialist Erik Johnson
- Alaska DNR, Division of Forestry (DOF), Palmer Area Forester Rick Jandreau
- Alaska DNR-DGGS, Geologist Robert Gillis, Engineering Geology Section Chief De Anne Stevens, and Mineral Resources Section Geological Scientist and Acting Chief Melanie Werdon
- Alaska DNR, Division of Mining, Land and Water (MLW), Division of Land Planning Unit Manager Ray Burger and Division of Land Natural Resource Specialist Liz Sherwood
- Alaska DNR, DOG, staff
- Alaska DNR, Division of Parks and Outdoor Recreation (DPOR), Matanuska-Susitna (Mat-Su)/Copper Basin area Park Superintendent Wayne Biessel and Susitna Ranger District Chief Ranger John Wilber
- Alaska Energy Authority, Susitna-Watana Hydroelectric Project Engineering Manager Bryan Carey
- Alaska Mental Health Trust (AMHT) Land, Energy & Minerals Senior Manager Rick Fredericksen
- Alaska Oil and Gas Commission, Statistical Technician Jenni Hunt
- Apache Alaska Corporation, Lisa Parker
- Aurora Gas, LLC, George Pollock

- Beluga Coal Company/Barrick Gold Corporation, Senior Advisor Cy Wilsey
- Cook Inlet Energy, LLC, President JR Wilcox
- Cook Inlet Region, Inc. (CIRI), Lands Manager Dara Glass and staff
- Kenai Peninsula Borough (KPB), Land Management Division, Land Agent Dan Conetta
- Kenai Peninsula Economic Development District (KPEDD), Programs Manager Carrie Coeuy
- Kiksa Metals Corporation, CEO Jason Weber
- Linc Energy, Inc., General Manager Corri Feige and Special Projects Manager Marty Rutherford
- Matanuska-Susitna Borough (MSB), Transportation and Environmental Manager Brad Sworts
- Millrock Resources, Inc., CEO Greg Beisher
- On-Line Exploration, President and Vice-President Jim and Devin Adler, respectively
- PacRim Coal, LP, Project Manager Dan Graham

The study team attempted to reach out to other organizations, although some declined to be interviewed; these include Alaska Energy Corporation; Donlin Gold, LLC; Hilcorp Alaska, LLC; and ConocoPhillips Alaska, Inc. The study team also attempted to reach out to the following entities, although no contacts were made or information requests were not returned: Ormat Technologies, Inc., and tourism-related groups including the Anchorage Chamber of Commerce and Mat-Su Convention and Visitors Bureau.

The lengthier interviews consisted of asking approximately 30 questions. Table 2-1 summarizes interviewees' responses to the question regarding the usefulness of an access road from the Parks Highway to their prospective sites or lands interests. Other information is integrated directly into each resource subsection of the report.

The study team did not contact individual claim owners. It is possible that individual claims may also be more attractive economically with increased access.

Table 2-1. Entities Contacted and/or Participated in the Resources Interviews

Entity	Brief description of entity and resource interest. <i>Response to question regarding usefulness of an access road from the Parks Highway to prospective site?</i>
<i>HARDROCK MINERALS AND COAL INTERESTS</i>	
Kiska Metals Corporation	Resource interest: Copper, gold, silver. Whistler project and other prospects. 144,000 acres. <i>“Kiska considers an access road very useful and is strongly supportive.”</i>
Millrock Resources, Inc.	Gold and copper exploration. Estelle, Cristo, Distin prospects. 56,000 acres. An access road would be <i>“very useful, but recognize that the State should not build roads to exploration projects but to more advanced projects with identified resources.”</i> A preferred route would be to Tyonek.
On-Line Exploration Services, Inc.	Gold, copper, molybdenum, possibly iron. Prospects: Estelle, Molly, Beaver Creek, Kichatna. 14,225 acres. <i>“...supportive of an all season road as being very helpful to keep exploration costs down”</i> and <i>“considers road access to be invaluable.”</i>
PacRim Coal, LP	Coal for export. Chuitna Coal Project. 20,450 acres. <i>“Considers an access road very useful and is strongly supportive.”</i> Has previously considered rail or road links, but is cost prohibitive if self-financed.
Beluga Coal Company	17,580 acres of coal leases with 8,000 acres of fee-simple leases with CIRI. No current active exploration. An access road would be <i>“quite useful.”</i>
Linc Energy, Inc.	Underground Coal Gasification exploration. Two licenses covering 98,700 acres. An access road would be <i>“100% helpful”</i> and <i>“strongly endorsed.”</i>
Cook Inlet Region, Inc. (CIRI)	Multiple projects and land holdings in the Beluga/ Tyonek area. <i>Prefers development of a deep water port rather than surface road access.</i>
Donlin Gold, LLC	Advanced gold exploration project. Project mostly outside of Study Area. <u>Declined interview request.</u> Stated they did not wish <i>“to be included in the roads for resources program.”</i>
<i>OIL AND GAS INTERESTS</i>	
Apache Alaska Corporation	Conducting 3-D seismic exploration operations and exploratory drilling. <i>“...would be pluses and minuses to a West Susitna access road to the region; the road would make the area more useful and more economically efficient and not restricted by weather (e.g., barging and ice, flying and visibility).”</i>
Aurora Gas, LLC	Approximately 45,000 acres of leases. In operations and development drilling phases. Just completed drilling two new wells. <i>“Access is a priority”</i> and a West Susitna access road <i>“would be very useful.”</i> <i>“We will take any way we can get stuff there as long as it is timely, cost effective, and consistent delivery all season. We do not care about alignments. It is access, which is the priority. We would work around right of ways.”</i>
Cook Inlet Energy, LLC	Currently in exploration phase. Approximately 680,000 gross acres and five potential targets. A West Susitna access road <i>“would allow us to execute exploration programs significantly faster and cheaper. It would lower development costs and operating costs. It would shorten development time and lengthen field life, which would in turn have a positive effect on project economics and the size of our recoverable reserves. In short, it would be a powerful stimulus to oil & gas exploration and production in the area.”</i>
ConocoPhillips Alaska, Inc.	Part owner in the Beluga River natural gas field. <u>Declined interview request.</u> <i>“ConocoPhillips has a neutral position on the importance of accessing the West Susitna region by land. While land access could be useful, it is not considered critical for operation of the BRU or future development.”</i>
Hilcorp Alaska, LLC	Operates a number of units in the Study Area. <u>Declined interview request.</u> <i>“While Hilcorp would consider land access to the West Susitna Region useful, there are currently no projects that would be directly impacted by road access.”</i>

Entity	Brief description of entity and resource interest. <i>Response to question regarding usefulness of an access road from the Parks Highway to prospective site?</i>
<i>OTHER INTERESTS</i>	
Alaska Department of Fish and Game (ADF&G)	<i>“ADF&G generally supports access to fish and wildlife resources, but also realizes that regulatory changes may need to be considered in the future to adjust to changes in public use and harvests.”</i>
Alaska Department of Natural Resources (DNR), Division of Agriculture	Approximately 50,000 acres classified as potential agricultural opportunities, as adopted in the Susitna Matanuska Area Plan adopted in 2011.
DNR-Division of Forestry (DOF)	Proposed Susitna State Forest includes 33 parcels totaling approximately 763,200 acres. Proposed forests managed for a long-term timber supply for local processors.
DNR- Division of Geologic and Geophysical Surveys (DGGS)	Conducting a mapping project in the Beluga/Tyonek area and is collecting baseline geologic data for potential energy systems from surface rock exposures. Published a brief overview report in April 2013 summarizing recent reconnaissance field data collection in the Susitna Basin. <i>“All properties would benefit from road access.”</i>
DNR-Division of Mining, Land and Water (MLW)	Prepared the 2011 Susitna Matanuska Area Plan, which addresses land management policies for major resources in the Susitna Basin.
DNR-Division of Oil and Gas (DOG)	Provided information on producing gas units in the Susitna Basin.
DNR-Division of Parks and Outdoor Recreation (DPOR)	<i>“There would be a great deal of interest for people to go there just to explore as it would provide access to an area that is currently difficult to access.”</i>
Alaska Mental Health Trust Land	AMHT has extensive oil and gas leases and coal leases in the southwest portion of the Study Area. <i>Supportive of surface access, in light of current logistical challenges of accessing area (e.g., lack of barging in the winter).</i>
Matanuska-Susitna Borough	Supports agriculture and forestry/timber opportunities on MSB lands. Has previously identified alignments between existing road network to the Little Susitna River.
Kenai Peninsula Borough	KPB lands are located near Tyonek/Beluga. <i>Is satisfied with existing road network on their lands.</i>
Kenai Peninsula Economic Development District	Recently prepared a Cook Inlet Infrastructure Study. <i>“Surface access to the Tyonek region would be very beneficial.”</i>

2.2 Mineral Resources

Alaska's mining industry includes exploration, mine development, and mineral production. This section discusses hardrock mineral exploration activities, placer gold mining activities, and coal exploration and development activities in the Study Area. Figure 2-1 and Figure 2-2 depict mineral resource activities in the Study Area. In the Study Area, most of the mineral resources are held under mining claims; however there are some leases (generally in the Petersville area).

At the second annual Alaska Strategic and Critical Minerals Summit⁷ held on November 30, 2012, DNR Commissioner Daniel Sullivan presented the following values in terms of what mining brings to the State of Alaska:

- In 2011, the gross mineral production value from Alaska totaled \$3.8 billion, up 16 percent since 2010.
- Mineral ore production had an export value of \$1.8 billion in 2011, nearly 40 percent of Alaska's total exports.
- In 2011, mineral exploration investment in Alaska totaled \$365 million - accounting for about one-third of the total spent on exploration in the U.S.
- \$2.8 billion has been spent on mineral exploration in Alaska since 1981.

What are the State of Alaska's goals for *Subsurface Resources* in the Susitna Matanuska Area?

Opportunities for Mineral Exploration and Development. Provide opportunities through State land management for the exploration and development of mineral resources.

Economic Opportunities. Provide economic opportunities and stability by managing State lands for the efficient and environmentally sound:

- transfer of minerals from uplands to transport vessels;
- disposal of tailings;
- development of State land and submerged land mining sites; and,
- siting of infrastructure to support development of mineral resources.

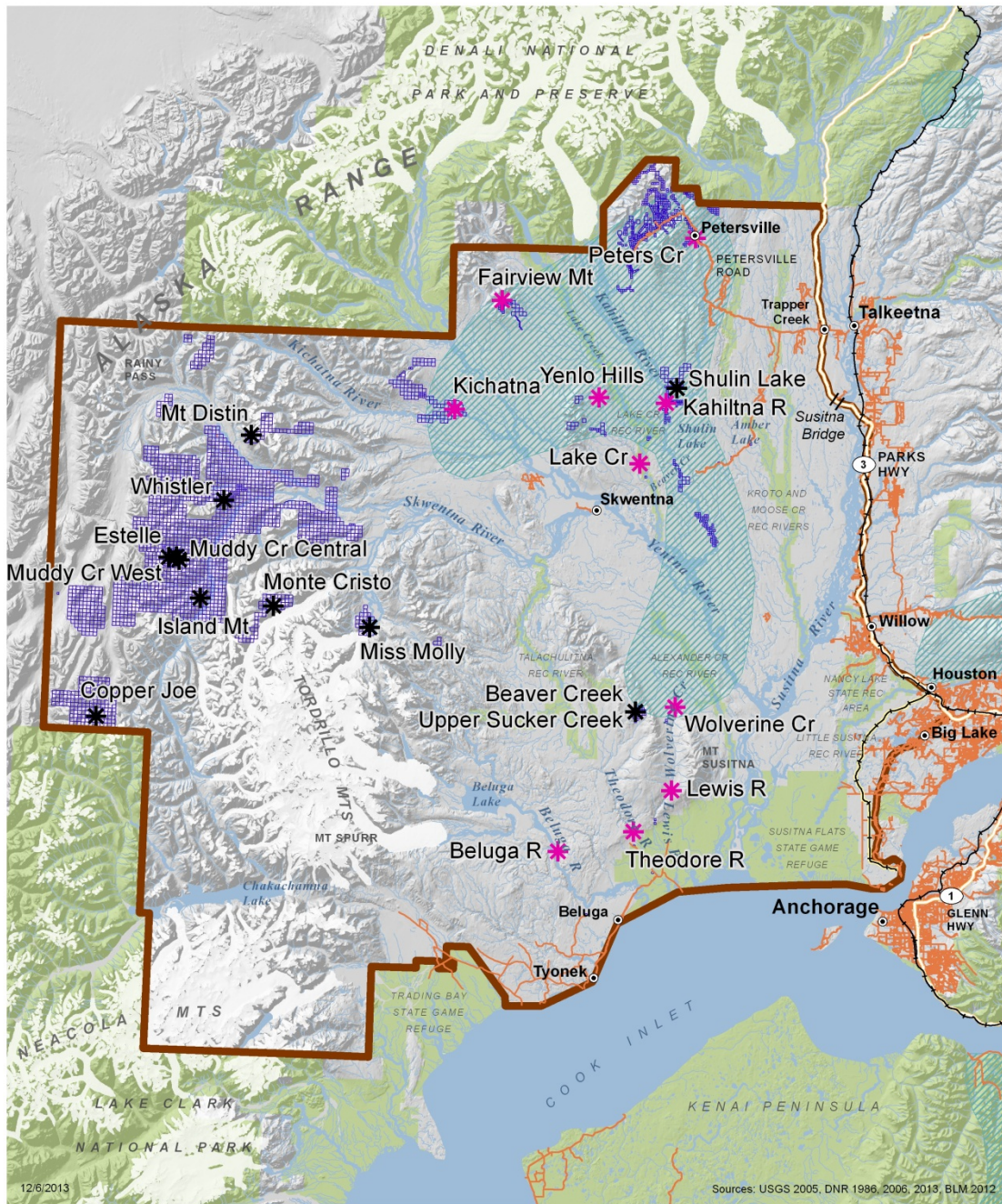
Environmental Quality and Cultural Values. When developing subsurface resources, protect the integrity of the environment and affected cultural features to the extent feasible and prudent.

- excerpted from the *Susitna Matanuska Area Plan for State Lands*

(DNR-DMLW 2011: 2-48)

⁷ Alaska 2nd Annual Strategic and Critical Minerals Summit. November 30, 2012. Presentation slides: http://dnr.alaska.gov/commis/priorities/2012_minerals_summit_slides.html.

Figure 2-1. Mineral Resources: Hardrock and Gold Placer Mining



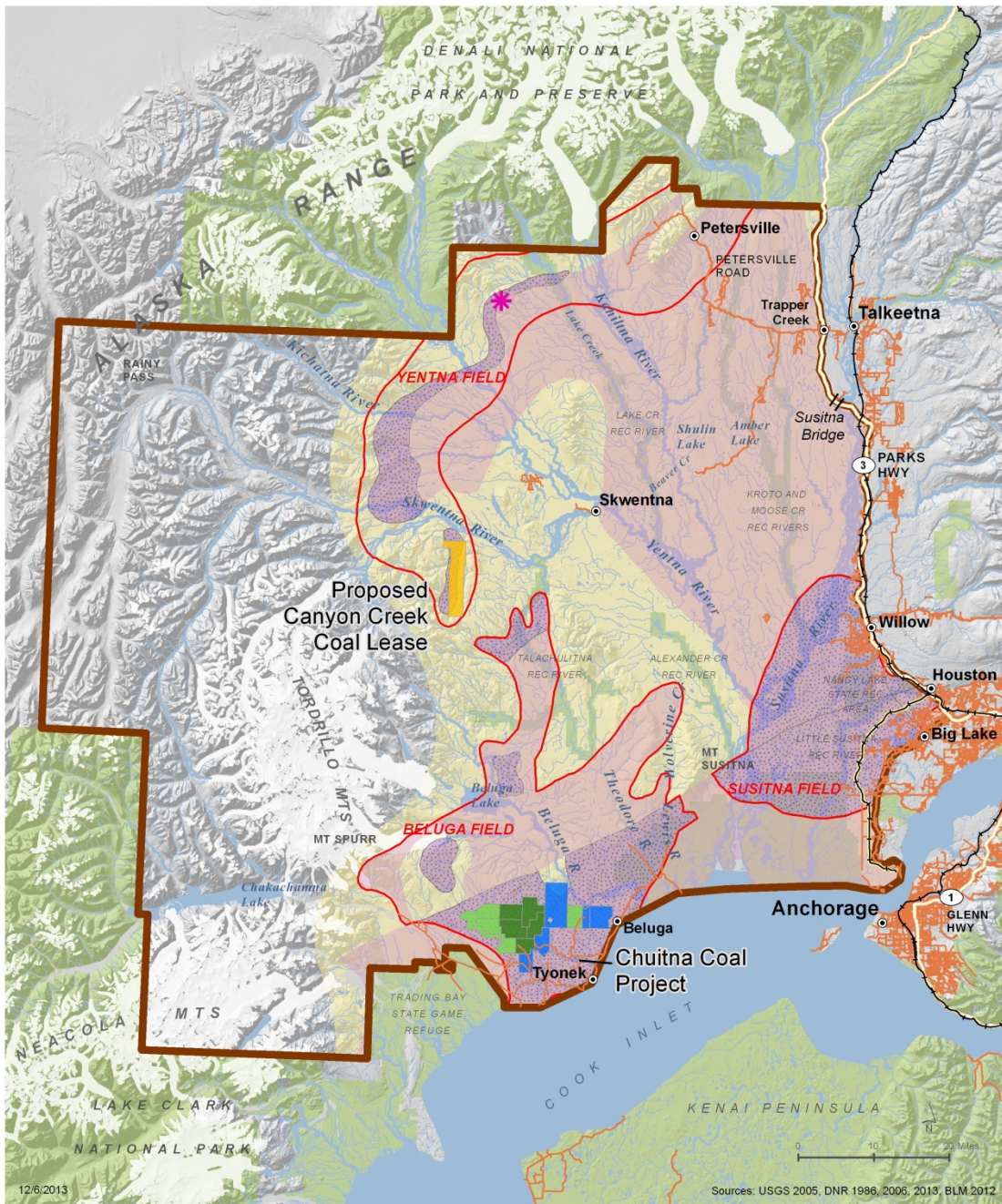
Mineral Resources: Hardrock and Gold Placer Mining

West Susitna Access to Resource Development

- State Mining Lease/Claim
- Placer District
- Gold Placer Claim
- Active Mine or Prospect
- Study Area
- Park or Refuge



Figure 2-2. Mineral Resources: Coal



Mineral Resources: Coal

West Susitna Access to Resource Development

Mining Permits/Leases	Linc Energy (Alaska), Inc	Ranks of Coal	Coal Field Boundary	Study Area
Beluga Coal Company	Pacrim Coal, LP	Subbituminous Coal Beds of Minable Thickness - Min. 30 in.	Susitna Coal Basin	Park or Refuge
DNR DMLW Mining Statewide		Subbituminous Coal - Resource Potential Less Certain		

2.2.1 *Hardrock Mineral Exploration Activities*

There are more than 3,000 active mining claims in the Study Area. The highest concentration of claim activity is in the northern portion of the Tordrillo Mountains in the Alaska Range near Rainy Pass area. Commodities include copper, gold, silver, molybdenum, iron, platinum group elements (PGE), and possibly diamonds. The larger hardrock mineral exploration activities are shown in Table 2-2.

Table 2-2. Major Hardrock Mineral Exploration Activities in the Study Area

Company	Project/Prospect Name	Resources/Commodities	Size (acres)
Kiska Metals Corporation*	Whistler mainly, also Island Mountain and Muddy Creek	Copper, gold, silver	144,000
Millrock Resources, Inc.*	Estelle, Cristo, Distin	Copper, gold	119,150
Intercept Alaska, Inc.	A single claim block (JL claims)	Copper, gold	17,760
Kennecott Exploration Company	Copper Joe	Copper, gold, molybdenum	16,000
On-Line Exploration Services, Inc.*	Estelle, Molly, Beaver Creek, Kichatna	Copper, gold, molybdenum, possibly iron	14,225
Alaska Earth Sciences (AES)	Four claim blocks (55 claims)	Primarily copper and gold; silver	8,750
Shulin Lake Mining Company	Moderate-sized claim block (57 claims)	Gold, PGE, possibly diamonds	4,860

Source: DNR-DGGS Alaska Mineral Resources Map:
www.dggs.alaska.gov/webpubs/dggs/mp/oversized/mp149_sh001.pdf

* Companies that were interviewed.

The study team conducted interviews with three mineral resource exploration companies that have some of the larger and more active prospects in the Study Area. These are Kiska Metals Corporation, Millrock Resources, Inc., and On-Line Exploration Services, Inc. Interviews have been summarized in this section, particularly with respect to existing activities, identified transportation needs, and site facility/infrastructure needs. Information about other major hardrock mineral exploration activities and claim holders is included in this section as well. Even though the proposed Donlin Gold Mine is located outside of the Study Area, a component of that proposed project extends into the Study Area and is therefore included in this discussion.

Kiska Metals Corporation

Kiska is currently in the exploration stage and their resource interest is copper, gold, and silver. Kiska holds a large number of claims in the Rainy Pass area, having acquired 921 claims from 2003 to 2011, which covers an area of 144,000 acres. Kiska's largest prospect is Whistler, which covers most of the 144,000 acres. Other prospects include Island Mountain and Muddy Creek. Kiska said in a best-case-scenario, they are at least five years from production. Kiska has not formally applied for any mine permits. For the Whistler prospect, economic modeling estimates production at a rate of 11 million tons per year for 13 years, with the possibility of expanded operations based on sufficient and suitable material to mine and process on adjacent properties. While the conceptual mine life is estimated to be 13 years, Kiska said they would like to develop sufficient reserves for a 17- to 20-year mine life.

Table 2-3 contains a summary of the resource estimates for Kiska’s Whistler deposit, as directly reported in technical documentation prepared in compliance with National Instrument (NI) 43-101.⁸

Table 2-3. Kiska’s Whistler Deposit Resource Estimates, 2011

Resource Category	Tonnes and Grade					Total Contained Metal			
	Tonnes (Mt)	Gold (g/t)	Silver (g/t)	Copper (%)	Gold Eq ² (g/t)	Gold (Moz)	Silver (Moz)	Copper (Mlbs)	Gold Eq ³ (Moz)
Open Pit Resource									
Indicated ¹	79.2	0.51	1.97	0.17	0.88	1.28	5.03	302	2.25
Inferred ¹	145.8	0.40	1.75	0.15	0.73	1.85	8.21	467	3.35

Source: Moose Mountain Technical Services. March 17, 2011. Kiska Metals Corporation Whistler Resource Estimate, Table 19-10 Pit Delineated Resource at Base Case Prices and Costs.

g/t = grams per tonne; M = million; oz = ounces; lbs = pounds.

¹ Reported within a conceptual pit shell (45 degree pit slope angle) and based on a cut-off grade of \$7.5/t adjusted for metallurgical recovery and offsite costs.

² Gold equivalent grade calculation was based on 75 percent recovery for gold and silver; 85 percent recovery for copper; USD \$990 per ounce gold, USD \$15.40 per ounce silver and USD \$2.91 per pound of copper.

³ Totals may vary due to rounding.

During an interview on March 19, 2013, Kiska said it would consider an access road very useful and is strongly supportive of it. Kiska emphasized that a road would be of major assistance for activity, citing that its main advantage would be to lower capital expenses for financing. Kiska said current constraints to development are access and capital markets. Kiska said they will need an all-season road for construction material, mining fleet and fuel delivery, and concentrate removal. Four concentrate-removal round trips and three light-service vehicle trips per day are expected.

Current on-site facilities include a 50-person camp facility, fuel storage and a 3,500-foot-long airstrip. An access road, if present today, would reduce the existing costs of transporting in fuel, material and people. In addition, concentrates must be removed from the site to smelting facilities off-site. At this time, Kiska said they are uncertain whether crews would access the site via an access road or as a fly-in operation. Kiska has initially modeled power needs for a 45-megawatt (MW) power line from Tyonek, but access to other power options remains a consideration, including access to any nearby gas pipelines that might be developed.

Millrock Resources, Inc.

Millrock is currently in the exploration stage and their resource interest is primarily gold and copper. Millrock has a number of prospects located in the Yentna Mining District region near the Rainy Pass area, most notably Estelle, Distin, and Cristo (Figure 2-1). The Estelle prospect is for gold, and Cristo is for possibly gold and base metals. Millrock has 763 claims in the Study Area covering 119,150 acres.⁹ Teck-Cominco is a partner on the Estelle prospect area, though Millrock owns 100 percent of all their other prospects. Millrock has not applied for any mine leases and no resource estimates have been made public.

⁸ NI 43-101 is used within Canada for reporting the “Standards of Disclosure for Minerals Projects.”

⁹ The Alaska Resource Data Files (ARDF) contains information regarding mining, prospects, and mineral occurrences in Alaska. Available at: <http://ardf.wr.usgs.gov/> (accessed March 2013).

Millrock considers the lack of access roads and power in the immediate area as constraints or limiting factors on their development activity. At this exploration stage, all construction, fuel, and mining equipment needs are supplied by air or ice roads. Millrock indicated that while a West Susitna access road would be “very useful, the State should not build roads to exploration projects but to more advanced projects with identified resources.” Millrock stated a road access to their prospect would lower the costs of exploration. Millrock said their preferred road route would be to Tyonek and not necessarily to the existing road system (e.g., Parks Highway), though they would strongly be in favor of a road connection regardless of the route.

Millrock has camp facilities at the nearby Whistler project airstrip. If exploration is successful, a range of facilities and buildings would be required, including a camp for onsite worker housing. If exploration is successful power would also be needed and access to any nearby gas pipelines would also be beneficial.

On-Line Exploration Services, Inc.

On-Line has several prospects in the Study Area that are currently in the exploration stage with unknown production start dates. The lode-prospects are gold and copper at Estelle (approximately 875 acres); molybdenum at Molly (4,372 acres); copper and gold with possibly iron at Beaver Creek (1,578 acres); and placer-gold only at K N Resources Kichatna (7,400 acres). Estelle and Molly are 100 percent owned by On-Line; exploration on the other two prospects is managed by On-Line. None of these lode prospects have had any previous mining, with one exception. A record of minor placer production has occurred at the Kichatna placer prospect.

At this exploration stage all exploration equipment, fuel, and camp supplies are transported by air or ice roads, but On-Line was supportive of an all-season road and said it would help keep exploration costs down. On-Line said the constraints or limiting factors on activity include access to roads, power, financing, and support resources such as helicopters during peak season for exploration. On-Line considers road access to be invaluable. A surface road would lower the costs of exploration through reduced costs of fuel equipment and personnel.

On-Line currently has an airstrip located at the Molly and Kichatna prospect locations, and has proposed a runway length expansion from 3,500 feet to 5,000 feet. Other infrastructure needs include power and gas or electric. On-Line also identified the need for access to fiber optic lines for communications.

Kennecott Exploration Company

Kennecott Exploration Company holds the Cooper Joe claim block, which is located about 20 km southwest of the Whistler block. The Copper Joe claim block covers 16,000 acres and the resource interests are copper, gold, and molybdenum. Kiska reports that they have entered into a non-binding letter of intent with Kennecott to acquire a 100 percent interest in the Copper Joe Property.

Intercept Alaska, Inc.

Intercept Alaska, Inc. has a single claim block covering 17,760 acres west of Kiska’s Whistler prospect. No drilling has been reported at the claim block. Resource interest is for gold and copper.

Alaska Earth Sciences

Alaska Earth Sciences has four claim blocks (consisting of 55 claims) in the Study Area totaling 8,750 acres. The blocks are located 10 to 20 km northwest of the Whistler block, with one claim

block located east of the Molly claim block. Resource interest is for copper, gold, and silver. Alaska Earth Sciences also provides logistical support for a number of other projects in the Study Area, including CIRI's underground coal gasification (UCG)¹⁰ project at the Beluga Coal Field, the Mt. Spurr geothermal project, and Linc Energy's drilling program in the Beluga Coal Field.

Shulin Lake Mining Company

A moderate-sized claim block (57 claims over an area of 4,860 acres) exists in the Shulin Lake area. The area is reported as having significant concentrations of heavy mineral sands containing some gold and PGE values¹¹. Some of the claims appear to be held for placer minerals, but Shulin Lake Mining Company has marketed the property as having diamond potential^{12, 13}, and at least 22 drill holes were completed on the property. No follow up work has been reported after 2005.

Teryl Resources Corporation

Teryl Resources is a junior precious metals exploration company listed on the TSX Venture Exchange with properties in the Fairbanks area. Teryl maintains a small claim block peripheral to Kiska's claims located approximately 14 miles east of the Whistler prospect. Teryl's claims cover an area of 3,680 acres and partially surround a smaller claim block held by Mark Farrar.

Individual claim holders

Three individuals are listed as claim holders around the Whistler area. Mark Farrar has 14 claims (1,872 acres). The earliest claims were staked in 2004 with additions in 2009 and 2010 before being encircled by Teryl in late 2010. Three more claims were added in 2011 adjacent to two claims held by David Fikill.

Donlin Gold, LLC

The proposed footprint of the actual Donlin gold mine is located outside the Study Area to the west of the Alaska Range. However, components of the Donlin project may pass through the Study Area in the future if the project is constructed as proposed. Donlin Gold, LLC is proposing a number of project elements including an open pit that is 2.2 miles long by 1 mile wide by 1,850 feet deep, a camp, an approximate 300-mile buried natural gas pipeline that would run through the Study Area, and other infrastructure (e.g., airstrip, access road, new barge landing, power plant, conveyor systems, mill, labs, and wastewater treatment plant). The proposed natural gas pipeline would be constructed from Cook Inlet, at the west end of the Beluga Gas Field, to the mine site, which is located approximately 10 miles north of the village of Crooked Creek on the Kuskokwim River west of the Alaska Range. Gold mining operations at the mining site would consist of energy-intensive processes, and past discussions have occurred as to how the 120-140 MW of power would be obtained at the site. Previous ideas to meet the energy needs have included barging the diesel upstream to the mine site, building a coal plant, and purchasing gas from the Cook Inlet area (which is the primary option currently under consideration). The permitting and environmental phase of

¹⁰ UCG is an in-situ gasification process that converts coal into gas without the use of traditional surface or underground mining methods. A mixed gas feedstock is produced through the controlled combustion of underground coal seams.

¹¹ ARDF, TL048

¹² ARDF, TL078

¹³ DNR-DMLW Coal Program. October 8, 2013. Comments provided during a review of a draft of this report indicate the diamond claims have not been confirmed and may be speculative.

this project began in January 2013. Donlin Gold, LLC declined a request for an interview for this study.

2.2.2 Placer Gold Mining Activities

Placer gold was found in the Susitna basin in the early 1900s.¹⁴ Alaska does not distinguish between lode and placer claims, so some speculation is necessary as to the activities conducted on mining claims. The inferred State placer claims in the Study Area cover an area of 45,133 acres and are held by 113 DNR-identified claim holders. The four largest claim holders by acreage are K N Resources, LLC (7,400 acres), Jim D Espinola (7,234 acres), Daniel R. Freitas, (2,862 acres), and Diamond Gold Corporation (2,123 acres). This section includes a general description of the placer gold prospects and claims in the Study Area.

Petersville/ Peters Creek

There are 94 individual claim holders to 499 claims and leaseholds over an area of approximately 20,957 acres and 13 State mining leases over an area of 3,976 acres who likely are involved in placer mining in the Petersville area. A number of claims overlap or are “overstaked,” which increases the apparent acreage. In addition, there are 4 federal claims predating statehood, whose claimants have elected to maintain their claims. The Petersville area is already served by public road access from the Parks Highways and by temporary ice roads during the winter for planned seasonal delivery of larger quantities of material.

Kichatna River

Since 2009 a large claim block has developed in the Kichatna River drainage, located approximately 25 miles west northwest of Skwentna between the Yentna and Skwentna River drainages. Two groups (K N Resources, LLC and Jim D Espinola) have almost equally claimed a total of 14,634 acres. The only known prospect within or close to the claim blocks is an historic placer prospect with undetermined production¹⁵. Assessment work claimed by one of the groups references prospecting, brush clearing, and line cutting in preparation for geophysical surveys, but no drilling. It is thought that these claims are being held for their placer potential.

Kahiltna River

Daniel Freitas holds 72 claims along the Kahiltna River downstream from Shulin Lake, covering an area of 2,862 acres, all of which appear to be placer claims. The claims comprise two blocks separated by approximately 13 miles. Between these two claim blocks is a third, 21-claim block covering 1,600 acres, also targeting heavy mineral deposits along the Kahiltna River centered on the confluence of the Kahiltna River and Beaver Creek. A trend of four small claim blocks extends from the confluence of Beaver Creek northeasterly towards Amber Lake. Small-scale production is reported from placer mines in the vicinity of Daniel Freitas’ southern claim block¹⁶.

¹⁴ Bureau of Public Roads. August 1959. *A Description of Proposed Road Routes in Alaska: Talkeetna-McGrath-Ruby*. Compiled and written by Rose Komatsubara and William DeArmond, under the direction of Elmer Biggs, Acting Planning and Research Engineer. p.15.

¹⁵ ARDF, TL49

¹⁶ ARDF, TL27, 28, and 29

Lake Creek

Four different parties hold eight claims along and adjacent to Lake Creek. There is no evidence for more than minor assessment work on these claims.

Yenlo Hills

Two parties hold 23 claims covering an area of 2,340 acres. Half the claims were added in the past two years. One of the claimants, Diamond Gold Corporation, reports bedrock-hosted Au-bearing veins on their Yenlo claims exposed by trenching¹⁷.

Fairview Mountain

There are 3 placer gold prospects in the Fairview Mountain area, which lies 6 miles southwest of Lake Chelatna. The most northerly is Pass Creek, which has recorded production of gold and PGE back to the turn of the last century (ARDF, TL24). There are three groups that hold 16 claims covering 401 acres. The 2 other prospects in the Fairview Mountain area are Mills and Twin Creeks, both southerly flowing drainages and with historic placer production¹⁸. Four individuals hold 2,066 acres as State mining claims.

Wolverine Creek

Wolverine Creek is the northerly flowing drainage between Mt. Susitna and Little Mt. Susitna, and is part of the planned route for the Donlin Creek gas pipeline. Two active claims currently remain on Wolverine Creek, a recorded placer prospect location, but in earlier affidavits referenced, up to 11 claims exist till 1990¹⁹. There is no recorded production.

Lewis Creek, Beluga and Theodore Rivers

Placer gold was reported as actively mined prior to 1918. As recently as the 1980s a significant number of placer claims were held along the Lewis, Beluga, and Theodore River drainages. At present only five remaining claims exist, and annual affidavits indicate no active production is occurring.

2.2.3 Coal Exploration and Development Activities

Alaska possesses a significant amount of the world's remaining coal resources. The majority of Alaska's coal is located on the North Slope, followed by the Cook Inlet region and other areas.²⁰ The only active coal mine in Alaska, the Usibelli Coal Mine, is located outside the Study Area; it has been active for more than 40 years.

A study prepared by the USGS in 2004 divided the estimated coal resources in Alaska into three major provinces: Northern Alaska-Slope, Central Alaska-Nenana, and Southern Alaska-Cook Inlet²¹ (which includes the Study Area). Of the two latter provinces, the report found that only a small fraction of the identified coal resources has been produced (over 40 million short tons or 36 million

¹⁷ ARDF, TL75

¹⁸ ARDF, TL59 and TL26

¹⁹ ARDF, TY006

²⁰ DNR-DGGS. 2012. *Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska*. Edited by Robert Swenson et al.

²¹ USGS. 2004. *Alaska Coal Geology, Resources, and Coalbed Methane Potential*.

metric tons) of the more than 13.5 billion short tons (12.25 billion metric tons) that are estimated to occur in these two provinces.

DNR-DGGS has requested the recognition that while this study considers the recent exploration and development activities, there is the potential for coal development beyond the currently active prospects. Table 2-4 highlights the estimated coal resources potential in or near the Study Area. See also Figure 2-2.

Table 2-4. Estimated Coal Resources Potential in or near the Study Area

Coal Province and Field	Coal Rank	Identified Resources (Short tons)	Hypothetical Potential Sale Value (\$)	Hypothetical Resources (Short tons)	Hypothetical Potential Sale Value (\$)
Cook Inlet-Susitna Province					
Beluga Field	Subbituminous	10 billion	\$153.4 billion	30 billion	\$460.2 billion
Yentna Field	Subbituminous	1 billion	\$15.3 billion	2.5 billion	\$38.3 billion
Susitna Field	Subbituminous	110 million	\$1.7 billion	2.3 billion	\$35.3 billion

Source: DNR-DGGS. October 8, 2013. Comment provided by Jim Clough during a review of a draft of this report. Potential sale revenue was calculated by multiplying the resource quantity by the average sales price of coal nationwide in 2012 (an average state sales price was not available). This was recorded as being \$66.04/short ton (Bituminous), \$15.34/ short ton (Subbituminous), and \$80.21/short ton (Anthracite). For those fields that are thought to have multiple coal ranks, an average was used (per U.S. Energy Information Administration (EIA) 2012 Annual Coal Report; available at: <http://www.eia.gov/coal/annual/>).

There are a variety of types of proposed coal development projects in the Study Area, which are at varying stages of project development. Due to past and present mining activity, the geology of this region is moderately well understood.²² Active leases for surface coal reserves exist in the Study Area. The State is considering the decision to hold a coal lease sale in the area of Canyon Creek, which is depicted on Figure 2-3. The Cook Inlet region is also being evaluated for underground coal gasification (UCG) potential. UCG eliminates the need to mine and transport the coal to a power plant, as well as the costs associated with reclaiming the surface-mined coal areas.²³

Coal projects or areas of interest in the Study Area include:

- Alaska Energy Corporation’s proposed Canyon Creek Coal lease
- PacRim Coal, LP’s Chuitna Coal mine project in the Beluga coal field – in advanced permitting stage
- Beluga Coal Company– active leases for surface coal reserves in the Beluga coal field
- Linc Energy Alaska, Inc., Cook Inlet Region, Inc. (CIRI)/Stone Horn Ridge, LLC – UCG testing in the Beluga coal field
- Coal-to-liquid plant considerations

Portions of the Study Area hold potential for development of coalbed methane (CBM). In what has more recently become a viable energy resource in the Lower 48, CBM is hindered by many unique challenges and has not yet proven to be economically viable. See Section 2.3.2 on CBM resources within the Study Area.

²² DNR-DGGS. 2012. *Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska*. Edited by Robert Swenson et al.

²³ Ibid.

For coal resources, the study team conducted interviews with following companies: PacRim Coal, LP; Beluga Coal Company, and Linc Energy, Inc. The study team also discussed the study with Cook Inlet Region Incorporated (CIRI), Knikatnu, Inc., Tyonek Native Corporation, and Chickaloon-Moose Creek Native Association at a meeting held on April 11, 2013. Interviews have been summarized in this section, particularly with respect to existing activities, identified transportation needs, and site facility/infrastructure.

Alaska Energy Corporation (Proposed Canyon Creek Coal Leases)

In 2012 the State of Alaska entered a regulatory best interest finding (BIF)²⁴ in favor of holding a competitive coal lease in the Canyon Creek area. DMLW issued the BIF based on Alaska Energy Corporation's interest in exploring coal resources in the Canyon Creek area. The proposed lease area covers approximately 13,175 acres and is located 30 km southwest of Skwentna, within the center of the Study Area. DNR estimated the total of the Measured, Indicated, and Inferred Resources within the proposed Canyon Creek coal lease area as approximately 257.9 million short tons of sub-bituminous coal. In July 2013, DNR issued a "Final Finding and Decision" to offer the coal lease.²⁵

The proposed Canyon Creek Coal leases are located about 40 miles north of the proposed Chuitna Coal Project, and about 15 miles east of the Whistler prospect. The DNR-DMLW's *2012 Preliminary Decision Competitive Coal Lease Sale in the Canyon Creek Area, Alaska*²⁶ includes a chapter (Chapter 7) devoted to potential routes for the transport of coal. Figure 2-3 depicts the location of the Canyon Creek proposed lease area and potential transportation routes relative to Kiska's Whistler project as depicted in that report.

²⁴ DNR-DMLW. 2012. *Preliminary Decision: Competitive Coal Lease Sale in the Canyon Creek Area, Alaska*. <http://dnr.alaska.gov/mlw/mining/CanyonCreekPBIF.pdf> (accessed March 2013).

²⁵ DNR-DMLW. 2013. *Final Finding and Decision*. http://dnr.alaska.gov/mlw/mining/coal/canyon_creek/Notice_of_Final_Decision_for_Canyon_Creek_Coal_Lease_Sale.pdf (accessed July 2013).

²⁶ DNR-DMLW. 2012. *Preliminary Decision: Competitive Coal Lease Sale in the Canyon Creek Area, Alaska*. <http://dnr.alaska.gov/mlw/mining/CanyonCreekPBIF.pdf>

Figure 2-3. Previously Identified Transportation Routes Relative to the Proposed Canyon Creek Coal Lease Area and Kiska's Whistler Project

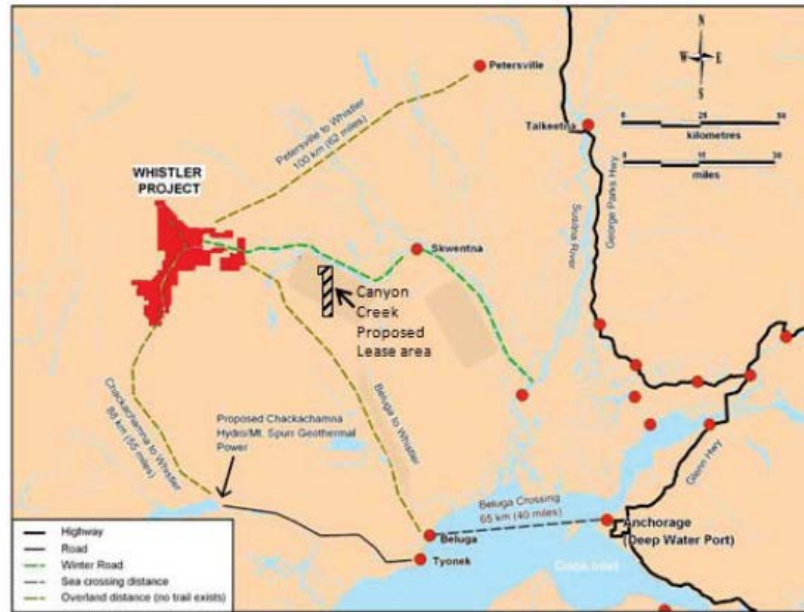


Figure 6.2- Location of the Whistler Project Area and potential transportation routes relative to the Canyon Creek Proposed Lease area (Kiska Metals 2012).

Source: DNR-DMLW. 2012. Preliminary Decision: Competitive Coal Lease Sale in the Canyon Creek Area, Alaska.

A limited amount of drilling has occurred in the past, though additional drilling would be required to prove the coal reserves.²⁷

PacRim Coal, LP (Chuitna Coal Project)

PacRim holds a coal lease to 20,450 acres located 12 miles northwest of Tyonek on the north side of Cook Inlet. Within their coal lease, PacRim has identified 300 million tons of minable resource referred to as the Chuitna Coal Project. This deposit has a long history of development activities: exploration in 1968, leases in 1972, and drilling and permitting in the 1980s. The permitting process was reinitiated in 2005; however, a permit application for the mine has not been submitted for the project as of the end of 2013. At present the project is in the supplemental environmental impact statement (EIS) phase, with permitting plans for an open pit mine with an estimated annual production of 12 million tons.²⁸ Historical proposed start dates for production are as early as late 2014 to 2016. Approximately 5,000 acres would be used for mining operations, with 1,000 acres of support facilities. After an initial 2-year construction phase, the proposed life of the mine is 25 years, followed by reclamation. PacRim anticipates the project will employ up to 500 people during construction, with 250 people onsite and 350 people total during operations.

²⁷ Alaska Coal Association. December 2012. *State of the State's Coal Industry*. Presented to the Resource Development Council. www.akrdc.org/membership/events/breakfast/1213/graham.pdf (accessed March 2013).

²⁸ DNR-DMLW. Chuitna Coal Project Description. Large Mine Permitting webpage. <http://dnr.alaska.gov/mlw/mining/largemine/chuitna/> (accessed July 2013).

PacRim said they have significant transportation needs. At present, all supplies for construction and operation are planned to be barged in. During operation, in excess of 10 million gallons (Mgal) of fuel will be needed, which is also anticipated to be barged in. PacRim considered rail and road links, but those were determined to be uneconomical if self-financed. An access road would significantly reduce barge traffic and allow crew changes by bus or private vehicles. Air transport can be limited during bad weather, which makes planning difficult. Barges are very expensive as well.

In its present planned configuration, the site is designed to operate as an independent operation without road connectivity. Operations consist of transporting the coal from the mine site by an 8-mile conveyor to Ladd Landing and then a 2-mile conveyor offshore to a ship load out platform.²⁹ Limited mine and transportation facilities currently exist at the site. PacRim uses a camp at the Beluga airstrip and accesses their site via helicopter. Proposed facilities include an onsite camp, deepwater port/loading facility, vehicle workshop area, coal and fuel storage, warehouse, road access from tidewater, conveyor system, crusher, and wash facilities. For power, PacRim plans to build a six-mile tie-in to the Beluga power plant and access the gas pipeline for heating needs.

Beluga Coal Company

The Beluga Coal Company is owned by Barrick Gold Corporation³⁰ and CIRI. The Beluga Coal Company holds a total of 17,580 acres of coal leases either adjacent to or in close proximity to PacRim's leases. Development activity on the Beluga Coal Company holdings is not as advanced as its PacRim's. Most recently, in 2008, they applied for exploration permits on their Beluga coal leases. No published resource estimates are available, but the geologic continuity suggests similar development opportunities exist as on the PacRim leases. There is no active exploration or development. The project is currently on "care and maintenance" status and is anticipated to remain in this status for the foreseeable future.

Beluga Coal has transportation needs for all levels of exploration and currently uses barges into Tyonek to access the project. Barging is the only current viable transportation mode.

Quantities and schedule of production are unknown at this time. Coal would likely be sent directly to ships from near the mine site area and not be transported on the road system for export. Other infrastructure needs include power and camp facilities.

Linc Energy, Inc.

Linc Energy, Inc. is exploring UCG projects near Tyonek and Beluga that consist of an in-situ method of producing a mixed gas feedstock through the controlled combustion of underground coal seams. Linc has two coal exploration licenses³¹ on Alaska Mental Health Trust (AMHT) Authority lands adjacent to and east of PacRim's Chuitna Coal Project. These two licensed areas are called the Kenai and Tyonek, as depicted on Figure 2-4. Presently, these two exploration licenses constitute a total of 98,700 acres under the lease. The Tyonek exploration license will be converted partially or entirely into a three-year coal lease area starting in 2014. Linc has until 2017 to decide its selection in the Kenai bloc, where the terms are for a seven-year lease interval. Exploration is

²⁹ DNR-DMLW Coal Program. October 8, 2013. Comments provided during a review of a draft of this report.

³⁰ Barrick Gold Corp. also owns 50% of the Donlin Creek project.

³¹ Linc Energy, Inc.'s 2011 exploration permit application describes exploration methods/activities and existing environmental conditions. Available at: <http://dnr.alaska.gov/mlw/mining/coal/linc-tyonek/LincEnergy-Tyonek-Area-Exploration-Application-10192011a.pdf> (accessed March 2013).

currently ongoing, with additional coal core drilling planned for the summer of 2013. Linc said they anticipate commencement of production in 2016 to 2017. However, according to the DNR-DMLW, the anticipated 2016 production schedule is unlikely since Linc has not started baseline studies or completed sufficient geotechnical work to meet the Alaska Surface Coal Mining Control and Reclamation Act (ASCMCRA) requirements. UCG synthesis gas (syngas) production is anticipated in 2016. Linc said there are sufficient coal resources for more than 70 years of production. All estimates to date are economic modeling constrained and set at 35 years. Access logistics and cost are the limiting factors on activity.

All fuel equipment and supplies currently have to be either flown in or barged. This material could all feasibly be brought to the project by road if one were available. For workforce access, Linc said they would prefer site access by road.

Three products will be produced and are expected to be transported off-site by pipeline. During peak construction, Linc said they could potentially have 1,000 people onsite, but even during operations they would expect 200 people onsite. Linc said they will need electric power for the start-up phases of gas-to-liquids or synthetic natural gas facilities, or syngas-cleanup facilities. An operating liquids facility will generate excess electricity and steam. The site is expected to be in operation for 30 to 50 years.

Cook Inlet Region, Inc. (CIRI)

CIRI is a major landholder in the Beluga/Tyonek area. Stone Horn Ridge, a joint venture of CIRI and Laurus Energy, Inc., is seeking to develop UCG on CIRI-owned land north of Beluga. Stone Horn Ridge is moving to develop a UCG project (to access coal energy without mining) and to initiate commercial operations and production as soon as 2015. However, according to the DNR-DMLW, the anticipated 2015 production schedule is also unlikely due to a lack of baseline studies and sufficient geotechnical work necessary to meet the ACMCRA requirements.

Other Identified Coal-to-Liquid Plans

- A Beluga Coal Gasification Feasibility Study was prepared in 2006 for the National Energy Technology Laboratory, which was to determine the economic feasibility of developing and siting a coal-based integrated gasification combined-cycle plant in the Cook Inlet region of Alaska for the co-production of electric power and marketable by-products.³²
- In late 2010, Tyonek Native Corporation signed an agreement with Accelergy to develop a coal-to-liquids plant on Tyonek land on the west side of Cook Inlet. The facility would produce aviation fuel, gasoline, and diesel.
- The Alaska Natural Resources to Liquids LLC has previously partnered with the AIDEA to promote plans for an 80,000-barrels-per-day (bpd) coal-to-liquid plant near the Beluga Coal fields near the communities of Tyonek and Beluga.

³² Research & Development Solutions, LLC (RDS)/Science Applications International Corp. (SAIC). 2006. *Beluga Coal Gasification Feasibility Study*. Prepared for National Energy Technology Laboratory. Available at: www.netl.doe.gov/technologies/coalpower/gasification/pubs/pdf/Beluga%20Coal%20Gasi%20Feasibility%20Study%2015_06.pdf (accessed March 2013).

2.3 Oil and Gas Resources

2.3.1 Current Exploration and Production Activities Snapshot

Active oil and gas exploration continues to occur in Northern Cook Inlet. According to DNR, recent drilling has proven new reserves in existing fields. Cook Inlet oil production peaked at 230,000 bpd in 1970, dropping to about 10,800 bpd in FY 2012.³³ As of early December 2013, there are 398 leases in Cook Inlet totaling 1.12 million acres, of which about one-third are on-shore and two-thirds are off-shore.³⁴ Figure 2-4 depicts the on-shore oil and gas leases and activities in the Study Area.

There are nine producing oil and gas units and fields in the Study Area (in Northern Cook Inlet and the Susitna Basin), as detailed in Table 2-5.³⁵ Table 2-5 shows the cumulative production since the inception for each of the units found in the Study Area. The Beluga River Unit is a major supplier for local electric utilities and home gas usage in the Anchorage area.

Table 2-5. Oil and Gas Units/Fields in the Study Area, as of November 2013

Unit/ Field	Current Ownership (%)	Inception	Size (acres)	Number of Wells*	Cumulative Production		
					Condensate (barrels [bbl])	Water (bbl)	Gas (millions of cubic feet [MCF])
Ivan River **	Hilcorp: 99.8 uncommitted: 0.2	1990	2,295	6	0	33,872	84,283,767
Stump Lake	Hilcorp: 100	1990	4,880	1	0	505	6,647,923
Beluga River ***	ConocoPhillips: 50 MOA: 33.33 Hilcorp 16.67	1963	8,227	26	0	1,966,167	1,269,300,564
Lewis River	Hilcorp: 100	1984	620	3	0	13,113	14,313,420
Pretty Creek **	Hilcorp: 100	1986	4,600	2	0	17,252	9,540,022
Three Mile Creek	Aurora Gas: 50 Cook Inlet Energy: 50	2005	3,320	2	0	28,719	2,381,336
Lone Creek (CIRI)	Aurora Gas: 100	2003	n/a	3	0	33,467	9,933,627
Moquawkie (CIRI)	Aurora Gas: 100	1967	n/a	5	0	7,582	4,914,788
Nicolai Creek	Aurora Gas: 100	1968	470	6	1	56,764	8,034,348

Source: Personal communication with Alaska Oil and Gas Conservation Commission (AOGCC).

Note: AOGCC maintains production data. Production numbers are as of October 31, 2013.

* Number of completed wells that have been completed and not been plugged and abandoned, as of December 11, 2013.

** There are two gas storage leases in the Study Area: Ivan River and Pretty Creek.

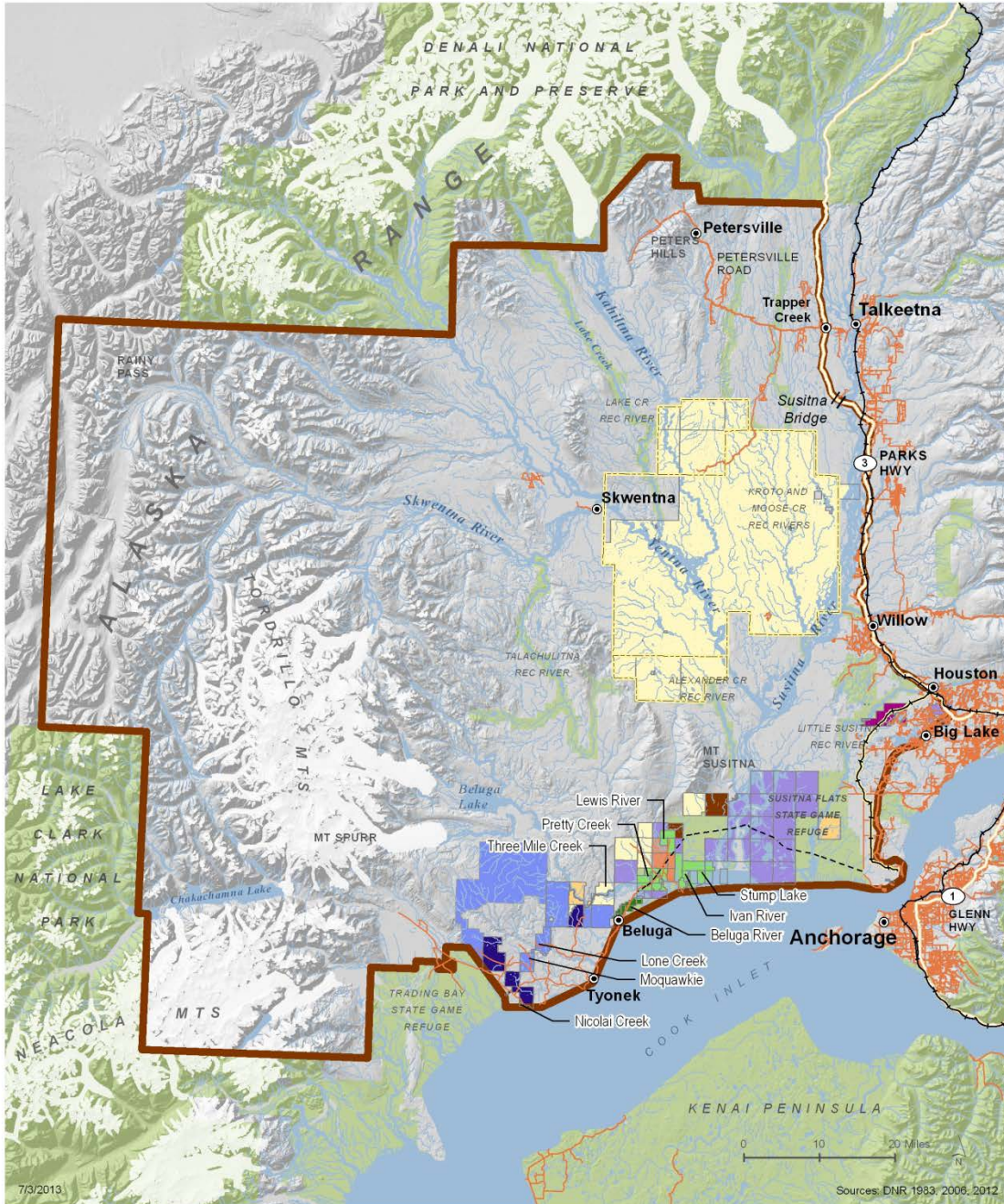
***Cumulative production for Beluga River is approximately 1.3 trillion cubic feet.

³³ Resource Development Council Webpage. *Alaska's Oil & Gas Industry Background*. Available at: www.akrdc.org/issues/oilgas/overview.html (accessed March 2013).

³⁴ DNR-DOG. December 2013. *Active Oil and Gas Lease Inventory* Webpage. Available at: <http://dog.dnr.alaska.gov/Publications/OGInventory.htm> (accessed December 2013).

³⁵ DNR-DOG. 2012. *Cook Inlet Land and Lease Working Interest Ownership* Map. Available at: http://dog.dnr.alaska.gov/Publications/Documents/CookInlet/Maps/Working_Interest_Ownership_Cook_Inlet_2012Dec.pdf (accessed March 2013).

Figure 2-4. Oil and Gas Resources



Oil and Gas Permits/Leases

West Susitna Access to Resource Development

Aurora Gas	Escopeta Oil & Gas Corp.	Pacific Energy AK Operation	Susitna Exploration License Area
Apache Alaska Corp.	Conocophillips AK, Inc	Hilcorp Alaska	Study Area
Aurora Exploration	Cook Inlet Energy	Linc Energy AK, Inc.	Park or Refuge
		Storm Cat Energy Corp.	

Apache Alaska Corporation

As of early 2013, Apache is conducting on- and off-shore programs in the Northern Cook Inlet region. Apache's programs consist of conducting extensive 3-D seismic operations in large areas using nodal technology for offshore, onshore, and transition zone acquisition. The land-based seismic analysis has been conducted on land owned by Tyonek Native Corporation and subsurface land owned by CIRI, as well as on State-owned lands. On-shore, Apache is drilling their first Cook Inlet well (Kalachabuna #2, or K2) on CIRI acreage located northeast of Nicolai Creek on the southern end of the Study Area.³⁶ Apache said these efforts will help identify potential locations for drilling in the future. Another well, Kalachabuna 1, was drilled in 1980 by a different company at the time.

Apache said they need product before a pipeline, and they do not currently have alignments for roads or infrastructure identified. Apache said they have a good working relationship with the Native Village of Eklutna and Tyonek Native Corporation. According to Apache, the Native Village of Eklutna advocates that Apache use existing infrastructure and not build a road, citing their concern that opening this area with a road would ruin the value and the subsistence lifestyle for residents.

The current workforce accesses the area by air, unless traveling by land directly from Tyonek. Apache recognizes there would be pluses and minuses to a West Susitna access road to the region. The road would make the area more useful and economically efficient, and access would not be restricted by weather (e.g., barging and ice, flying and visibility).

Apache currently has temporary camp facilities and a drill waste disposal pit near Tyonek. Apache said they have approximately 60 workers onsite. There is a potential for an 80-person camp in the future, should multiple locations for additional exploratory drilling be identified. When possible and feasible, Apache uses existing facilities. Apache said the area is pretty good for its power needs.

Based on results from testing, the existing drilling will be wrapped up in summer 2013. At this time, Apache is not sure where this project will go next. They have no concentrate or finished product, but would hope to transport gas and oil by pipeline. There are no estimated volumes at this time. Operations would be years away.

Aurora Gas, LLC

Aurora Gas, LLC is in the operations and development drilling phases. Aurora stated they have four units in the southern portion of the Study Area and recently drilled two new wells. The units are Three Mile Creek Field, Lone Creek, Moquawkie Unit, and Nicolai Creek Unit. Aurora is targeting shallow gas in these units and Apache bought the deep rights. The size of Aurora's lease area is approximately 45,000 acres. Aurora said they are in partnership with Cook Inlet Energy, Inc. on the Three Mile Creek wells. Aurora said production could vary annually, but they plan to be in production for 10-15 years. Aurora said there are more leases to drill after obtaining the seismic data from Apache.

Aurora said that access is a priority and a West Susitna access road would be very useful. Fuel comes in by barge or is flown in at a greater expense. There are no roads. Aurora said they need all forms

³⁶ DNR-DOG. December 2012. *Cook Inlet Oil and Gas Activity Map*. Available at: http://dog.dnr.alaska.gov/GIS/Data/ActivityMaps/CookInlet/Cook_Inlet_Oil_and_Gas_Activity_Map_20121206.pdf (accessed March 2013).

of transport. Like Apache, Aurora experienced transportation infrastructure difficulties when the Chuit bridge was washed out in 2012. This impacted their activities at Lone Creek and the Three Mile Creek locations. The implications of the bridge washout meant employees who are residents of Tyonek had to be flown into the project sites, which resulted in additional costs of lodging, rental vehicles, etc.

Aurora has a few existing production facilities, including a well house, with additional new well facilities on the way. Long-term infrastructure needs include a 40-person camp. Aurora said they are self-contained for power.

Cook Inlet Energy, LLC

Cook Inlet Energy, LLC (CIE)³⁷ provides oil and gas extraction services and currently has two active exploration operations north of Beluga called Olson Creek and Otter. CIE also has a large land position in the Susitna basin. CIE has approximately 680,000 gross acres and five potential targets at this time. According to DNR records, CIE has a 30 percent stake in the Three Mile Creek lease (gas production facilities). Natural gas production and/or oil could begin as early as 2014, although CIE is still in the exploration phase and planned annual production is not yet determined. The projects would be developed only if economically viable, which presupposes certain minimum production rates. An economically viable project would typically have a life of at least 20-30 years.

In early 2013, CIE constructed a trail from Willow to the Yentna River with a snow road and ice bridge over the river. CIE said property owners and visitors in the Skwentna/Yentna/Deshka area appreciated and made extensive use of the snow road because it provides a route to points west that is safer and shorter than running over the Susitna and Yentna rivers. CIE said the new trail saved travelers to Skwentna 34 miles round trip from Willow.

CIE said they fly or barge in most of their fuel and supplies to the Beluga area. Drill rigs and other equipment get barged in at Tyonek. In the Susitna area, access has been overland by way of ice bridges and snow roads. CIE currently has no air support capabilities in the Susitna area, but said they would develop landing areas prior to drilling. CIE said they will need to bring in supplies for pipelines and surface facilities. Crews would be brought in by fixed-wing aircraft. CIE plans to barge out large volumes of drilling mud and cuttings. Building roads and pads requires heavy equipment.

Currently, crews are either local or coming in via air. If a road were available, crews might drive in from Tyonek or the Mat-Su Valley. CIE has been actively improving and expanding a gravel road and pad system in the Olson Creek/Otter area, including a gravel pit and a new bridge across Olson Creek.

CIE has partnered with other companies, such as CIRI, to help improve infrastructure on the west side of Cook Inlet. CIRI's affiliate, Stone Horn Ridge, is using the Coffee Creek pad for their UCG exploration and is in the same area as Olson Creek and Otter. CIE has two pads and a drill rig in the Olson Creek/Otter area.

CIE may construct facilities, pipelines, and/or camp(s) at Olson Creek, Otter, and/or their prospects in the Susitna Basin. CIE said they would benefit from the expansion of utilities, such as

³⁷ The company was incorporated in 2009 and operates as a subsidiary of Miller Energy Resources, Inc., according to Bloomberg Businessweek, available at: <http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=108801500> (accessed March 2013).

power and telecommunications, and would need to make major investments in local transportation infrastructure and pipelines. A gas pipeline connecting the Susitna Basin area to the existing natural gas grid is a significant hurdle.

ConocoPhillips Alaska, Inc.

In Southcentral Alaska, ConocoPhillips owns 100 percent interest in the Kenai Liquefied Natural Gas (LNG) facility and operates the Tyonek Platform in the North Cook Inlet field and the Beluga River natural gas field. The Beluga River natural gas field falls within the Study Area, whereas the North Cook Inlet field does not.

The Beluga River natural gas field serves major customers in Southcentral Alaska, including local utilities and industrial consumers. Net natural gas production averaged nearly 20 million cubic feet per day in 2011. ConocoPhillips Alaska, Inc. has a 50 percent stake in the Beluga River Unit, and co-ventures Municipality of Anchorage (MOA)-Municipal Light and Power (ML&P) and Hilcorp have 33.3 percent and 16.67 percent, respectively.

ConocoPhillips declined the request for an interview. However, they said they have a neutral position on the importance of accessing the West Susitna region by land. They said “while land access could be useful, it is not considered critical for operation of the Beluga River Unit or future development.”

Hilcorp Alaska, LLC

Hilcorp has interest in multiple on-shore units in the Study Area in northern Cook Inlet, including Lewis River; Ivan River (with a gas storage lease); Pretty Creek (with a gas storage lease); Stump Lake; and Beluga River Unit, in part with ConocoPhillips Alaska, Inc., and the MOA. Hilcorp’s stake in the Beluga River Unit is 16.67 percent.

Hilcorp only recently entered the Cook Inlet market when they acquired all of Chevron, Union Oil Co. of California’s assets in 2012. The recent acquisition of Marathon’s assets further expanded Hilcorp’s holdings to 70 percent of the gas production in Cook Inlet.

Hilcorp declined the request for an interview. However, Hilcorp said while they consider land access to the West Susitna region useful, they currently have no projects that would be directly impacted by road access.

- Oil funds more than half the State budget – 56 percent in fiscal year 2012 – and about 90 percent of State general funds
- “The balance sheet of Alaska history is simple: One Prudhoe Bay is worth more in real dollars than everything that has been dug out, cut down, caught, or killed in Alaska since the beginning of time.” – Terrence Cole, Alaska Historian

- Alaska Economic Trends June 2013

(Alaska Department of Labor and Workforce Development;

<http://labor.alaska.gov/trends/jun13.pdf>)

2.3.2 Other Oil and Gas Resources Potential

Oil and gas exploration within Alaska's Railbelt Energy Region, which encompasses most of Alaska's major population centers, has received significant focus in recent years as a means to bring more affordable energy to the region. The DNR-DGGS has recently published a summary of findings on exploitable fossil fuel (e.g., coal [as discussed in Section 2.2.3] and conventional and unconventional oil and gas) and geothermal energy resources in the Railbelt region.³⁸ This section briefly summarizes available information regarding oil and gas resource potential as it relates to the Study Area (geothermal energy is addressed in Section 2.6).

Conventional Oil and Gas. The Railbelt region contains several important basins that hold oil and gas potential. Within the Study Area, the Cook Inlet and Susitna basins contain resource potential. The Cook Inlet basin, which encompasses the very southern part of the Study Area, has been producing oil and gas since the late 1950s, though production from existing fields has been declining.³⁹ Ongoing exploration and active leases, however, suggest the potential for additional discoveries, and significant focus in recent years has been on identifying recoverable gas reservoirs to supply future energy to southcentral Alaska. The USGS has estimated that the Cook Inlet Region has 599 million barrels of oil (*est. value \$63.3 billion*⁴⁰) and 13.7 trillion cubic feet of natural gas (*est. value \$76 billion*⁴¹) to be discovered.⁴² The State of Alaska is attempting to incentivize new exploration by offering major tax credits to private industry.

By comparison, the Susitna basin to the north has experienced relatively little exploration and has no proven economic oil and gas resources. To date, only two wells have been established west of the Susitna River, in 1964 and 1980.⁴³ Portions of the Susitna basin are eligible for new drilling due to two adjacent exploration licenses issued on State lands in 2003.

Coalbed Methane (CBM). The potential for CBM gas recovery within the Study Area is strong. The USGS recently estimated more than 4.5 trillion cubic feet of coalbed gas (*est. value \$25 billion*⁴⁴) remains undiscovered in the greater Cook Inlet area.⁴⁵ However, the recoverable amount of coalbed

³⁸ DNR-DGGS. 2012. Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska. Edited by Robert Swenson et al. p. 94-112.

³⁹ DNR-DGGS. 2012. Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska. Edited by Robert Swenson et al.

⁴⁰ The estimate of \$63.3 billion is based on the forecasted price for fiscal year 2014 for North Slope Oil of \$105.68 per barrel.

⁴¹ Potential sale revenue was determined by applying the September 2013 natural gas citygate price (citygate is a point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system). According to the EIA, this value was \$5.55/thousand cubic feet. The estimate of \$76 billion is based on \$5.55/thousand cubic feet for citygate value, per U.S. EIA natural gas prices. Available at: http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SAK_m.htm (as accessed December 2013).

⁴² Stanley, Richard G. et al. 2011. Assessment of Undiscovered Oil and Gas Resources of the Cook Inlet Region, South-Central Alaska, 2011. Prepared by the Cook Inlet USGS Assessment Team. Available at: <http://pubs.usgs.gov/fs/2011/3068/> (Accessed December 2013)

⁴³ DNR-DGGS. 2012. Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska. Edited by Robert Swenson et al.

⁴⁴ Coalbed gas is considered a component of natural gas. For purposes of deriving an estimated value, the \$5.55/thousand cubic feet natural gas price was applied, per U.S. EIA pricing. Available at: http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SAK_m.htm (as accessed December 2013)

⁴⁵ Stanley, Richard G. et al. 2011. Assessment of Undiscovered Oil and Gas Resources of the Cook Inlet Region, South-Central Alaska, 2011. Prepared by the Cook Inlet USGS Assessment Team. Available at: <http://pubs.usgs.gov/fs/2011/3068/> (Accessed December 2013)

gas, especially within the Study Area, is likely much less due to large regions located offshore that are unlikely to be economically developed.⁴⁶ The resource potential is greatest in regions with higher rank coals (bituminous and semi-anthracite coals located outside the Study Area). Regardless, subbituminous coal rank areas (see Figure 2-2) located within the Study Area represent regions with CBM potential. While these areas are vast in size, CBM production in the Study Area is non-existent. A 3-year, collaborative study between DGGs, DOG, and USGS is currently underway to learn more about the Susitna Basin's hydrocarbon potential.⁴⁷ Field investigations seek to determine from the coal sampled in the region its potential as a primary fuel source and the capacity of the coalbeds to produce and store methane gas. This study is an important component of the DGGs' multiyear In-State Gas Program. The Tyonek area may hold the greatest potential for CBM resource production within the Study Area due to existing infrastructure of petroleum development.

Other (Unconventional) Natural Gases. Other natural gases potentially present within the Study Area include tight gas sands, shale gas, and gas hydrates. These unconventional gases appear to have greater geologic potential of occurring in the lower Cook Inlet region to the south of the Study Area, and do not hold strong economic potential at present.⁴⁸

⁴⁶ DNR-DGGs. 2012. Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska. Edited by Robert Swenson et al. p. 105.

⁴⁷ DNR-DGGs. April 2013. Status of A Reconnaissance Field Study of the Susitna Basin, 2011. By Robert Gillis et al.

⁴⁸ DNR-DGGs. 2012. Fossil Fuel and Geothermal Energy Sources for Local Use in Alaska. Edited by Robert Swenson et al.

2.4 Forestry/Timber Resources

The State of Alaska owns nearly 2 million acres of identified timberlands in the Mat-Su valley, some of which are located within the Study Area.⁴⁹ The 2011 Susitna Matanuska Area Plan, which covers a portion of the Study Area, addresses forest resources in the Susitna Matanuska area as follows:

Extensive forest resources exist within the planning area. These are scattered throughout the eastern, central, and western portions of the planning area, and total approximately 683,000 acres. The plan identifies these areas and specifies the areas considered appropriate for inclusion in the sustained yield calculations that are made by the Division of Forestry. Those areas with forest resource potential that are designated Forestry in the area plan are considered appropriate for inclusion in a state forest, should the legislature consider the creation of a state forest within the planning area. (p. 1-9)

A large amount of land in the Study Area is currently under consideration for legislative designation as a State Forest. House Bill 79/Senate Bill 28 was introduced to the State Legislature in 2013 and was delayed for review until the next session Figure 2-5. The bill would create a new State Forest in the Susitna Valley and expand DNR authority to offer negotiated timber sales statewide.⁵⁰ The proposed 763,000-acre Susitna State Forest, if adopted, would become Alaska's fourth State forest, joining the Tanana Valley, Haines, and Southeast State Forests.

The DNR-Division of Forestry plans to construct an ice road in early 2014 to provide access to proposed timber harvest units along Fish Creek, in the southeastern portion of the Study Area. This approximate 7-mile-long ice road would be extended from the existing West Susitna Parkway, as depicted on Figure 2-6. The proposed road would be located primarily on MSB-owned land but would follow section line easements to the greatest extent possible. An approximate 150-foot-long ice bridge would be constructed over the Little Susitna River. The project is being developed consistent with the 2007 Alaska Forest Resources and Practices Regulations. Depending on funding and need for forest management and timber sale production, the DNR-Division of Forestry may

What are the State of Alaska's goals for *Forest Resources* in the Susitna Matanuska Area?

Personal Use Timber. Provide timber to meet the needs of Alaskans. Subject to limits of funding, staffing, and sustained yield, this program will be provided on a demand basis when the operational costs of administering this program are satisfactory.

Economic Opportunities. Provide for economic opportunities and stability in the forest products industry by allowing the use of State uplands in areas designated Forestry. Also, to benefit the state's and borough's economies by providing royalties to the State from stumpage receipts, and adding to the state's economy through wages, purchases, jobs, and business.

Support Timber Industry. Continue to perform reviews of private timber harvests for adherence to the Alaska Forest Resources and Practices Act and provide the timber industry with information, technical expertise, and management guidance for utilizing forest resources.

- excerpted from the Susitna Matanuska Area Plan for State Lands
(DNR-DMLW 2011: 2-21)

⁴⁹ Mat-Su Resource Conservation & Development Council and MSB. December 2008 Update. *Mat-Su Comprehensive Economic Development Strategy*.

⁵⁰ DNR-DOF. January 22, 2013. *Briefing Paper: HB 79/SB 28: Susitna State Forest and Negotiated Timber Sales*. Available at: http://forestry.alaska.gov/pdfs/whats_new/HB79-SB28_Briefing_paper_1-22-13_v2.doc.

build a single-lane all-season road to the timber areas. (Note: the Fish Creek Management area, also shown on this figure, is further discussed in Section 2.5, Agricultural Resources).

A number of other commercial timber opportunities have been identified. Areas designated for timber sales have been identified in the *MSB Five-Year Timber Harvest Schedule*. According to the *2008 Mat-Su Comprehensive Economic Development Strategy*, the primary use of the timber currently produced in the MSB is for woodchips exported to markets in Asia. It is also possible that once the land for the Chuitna Coal Mine is reclaimed, then there is a vision for commercial timber opportunities.⁵¹

The DNR forest lands with commercial potential in the Susitna basin are fairly remote. In earlier years, the DNR determined that, based on soil and existing vegetation, remote lands with the highest capability for forestry are located between the Yentna and Susitna Rivers south of Petersville Road; in the Lewis, Theodore, and Beluga River drainages southwest of Mt. Susitna; and between Lake Creek and Donkey Slough.⁵²

The DNR 1991 Susitna Forestry Guidelines⁵³ proposes a three-phase approach to introducing additional timber activity into the Susitna Valley. Phase 1, which is currently underway, includes utilizing the area on the east side of the Susitna River and the Chijuk Creek area, and lands surrounding Mt. Susitna. Phase 2 involves lands east of the Kahiltna River. Phase 3 includes all other State-owned lands.

DNR area planning documents for the Susitna Matanuska area delineates the area into a number of sub-regions. Sub-regions relative to the West Susitna Study Area include the following sub-regions: Petersville Region, Sunflower Basin Region, Susitna Lowlands Region, Mt. Susitna Region, Beluga Region⁵⁴, and the Alaska Range Region. Each of these sub-regions is delineated on Figure 2-5 and summarized in Table 2-6 and the paragraphs that follow.

According to the MSB's 2007 Market Analysis and Timber Appraisal Report, the average timber value per acre was \$85.23 (for year 2007). As the value of a dollar in 2007 is equal to \$1.09 in 2013, the anticipated value per acre in 2013 dollars is \$92.90. This assigned dollar value per acre represents an aggregate of high and lower quality timber. With a total of approximately 701,000 acres of potential forest for harvest identified in the Study Area, the expected monetary value in 2013 dollars would be approximately \$65 million. This amount only represents the direct value of the timber in 2013 dollars and does not incorporate indirect value such as birch lumber used in cabinetry, spruce used for log home construction, wood chips or personal use firewood. Additionally, these areas would have limitations on the amount of harvestable timber per year to ensure appropriate management practices are adhered. As both the MSB and the State have harvest limits on their identified timber areas to ensure proper management of this resource, resources have been quantified collectively. It is possible with increased access harvest limits could be re-evaluated, but at this time the State has a limit of 3,000 acres per year and the MSB identifying roughly 1,000 acres to be harvest over a 5-year period of time. DNR-Division of Forestry suggests that approximately 3,000 acres of forest land per year would be available for harvest in the total acreage proposed for the Susitna State Forest, which includes but is not limited to the Study Area. According to DNR-

⁵¹ Alaska Mental Health Trust, Trust Land Office. March 15, 2013. Personal communication with AMHT Energy and Minerals Senior Manager Rick Fredericksen.

⁵² DNR, ADF&G, and MSB in cooperation with U.S. Department of Agriculture (USDA). June 1985. *Susitna Area Plan*. <http://dnr.alaska.gov/mlw/planning/areaplans/susitna/>

⁵³ DNR, Division of Land, Land & Resources Section. December 1991. *Susitna Forestry Guidelines*.

⁵⁴ The Beluga Region is unique to the 1985 Susitna Area Plan.

DOF, this acreage is likely to be advertised for private bid in several hundred acre tracts and would likely be on a multi-year contract.⁵⁵

Table 2-6. Forest Resources in the Study Area per DNR Planning Regions

DNR Planning Region	Size (acres)	Specifically-Identified Areas for Potential Forest Harvest	Hypothetical Applied Direct Economic Value (\$)**
Petersville	71,000	Peters Creek, Moose Creek and Kroto Creek areas	\$6.6 million
Sunflower Basin	15,000	Near Kahiltna River and Lake Creek Corridor	\$1.4 million
Susitna Lowlands	319,000	Far western edge of Susitna Lowlands; Skwentna River, Alexander Creek, Trail Ridge, west of Lake Creek	\$29.6 million
Mt. Susitna	219,000	Alexander Creek, Skwentna River, Mount Susitna	\$20 million
Beluga*	32,000	n/a	\$3.0 million
Alaska Range	45,000	Limited. Eastern areas of the Region at lower elevations	\$4.2 million
<i>All planning regions in Study Area</i>	<i>701,000</i>	<i>Assumed total harvest, if acreage is fully realized</i>	<i>\$65 million</i>

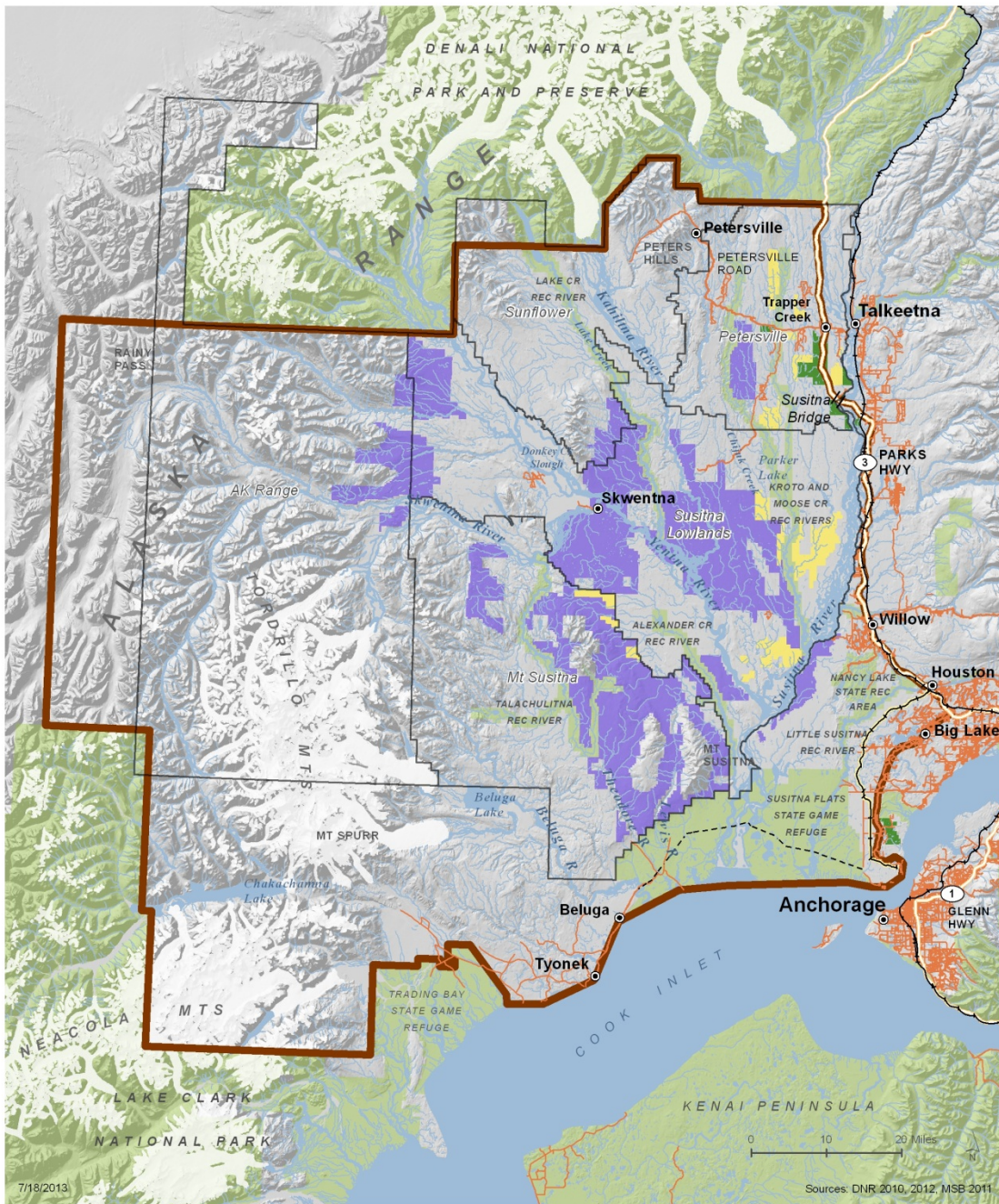
Source: DNR 1985 Susitna Area Plan, 2011 Susitna Matanuska Area Plan.

*Planning regions were redrawn between the 1985 and 2011 DNR plans. The Beluga planning region is specific to the 1985 Susitna Area Plan. The study team recognizes that the 1985 Susitna Area Plan was superseded by the 2011 Susitna Matanuska Area Plan. However, some information from the 1985 study, such as existing inventories, was considered relevant background to retain and be cited in the West Susitna Access Reconnaissance study, particularly since part of the scope is to identify known resources in the Study Area.

** An assumed value per acre in 2013 dollars is \$92.90. This applied economic direct value was based on a market analysis conducted in 2007 in which an average value for timber per acre was available in addition to incorporating inflation. This value does not include indirect or spilloff economic benefits.

⁵⁵ DNR-DOF. December 12, 2013. Personal communication with DNR-DOF Mat-Su Area Forester Richard Jandreau.

Figure 2-5. Timber and Agricultural Resources

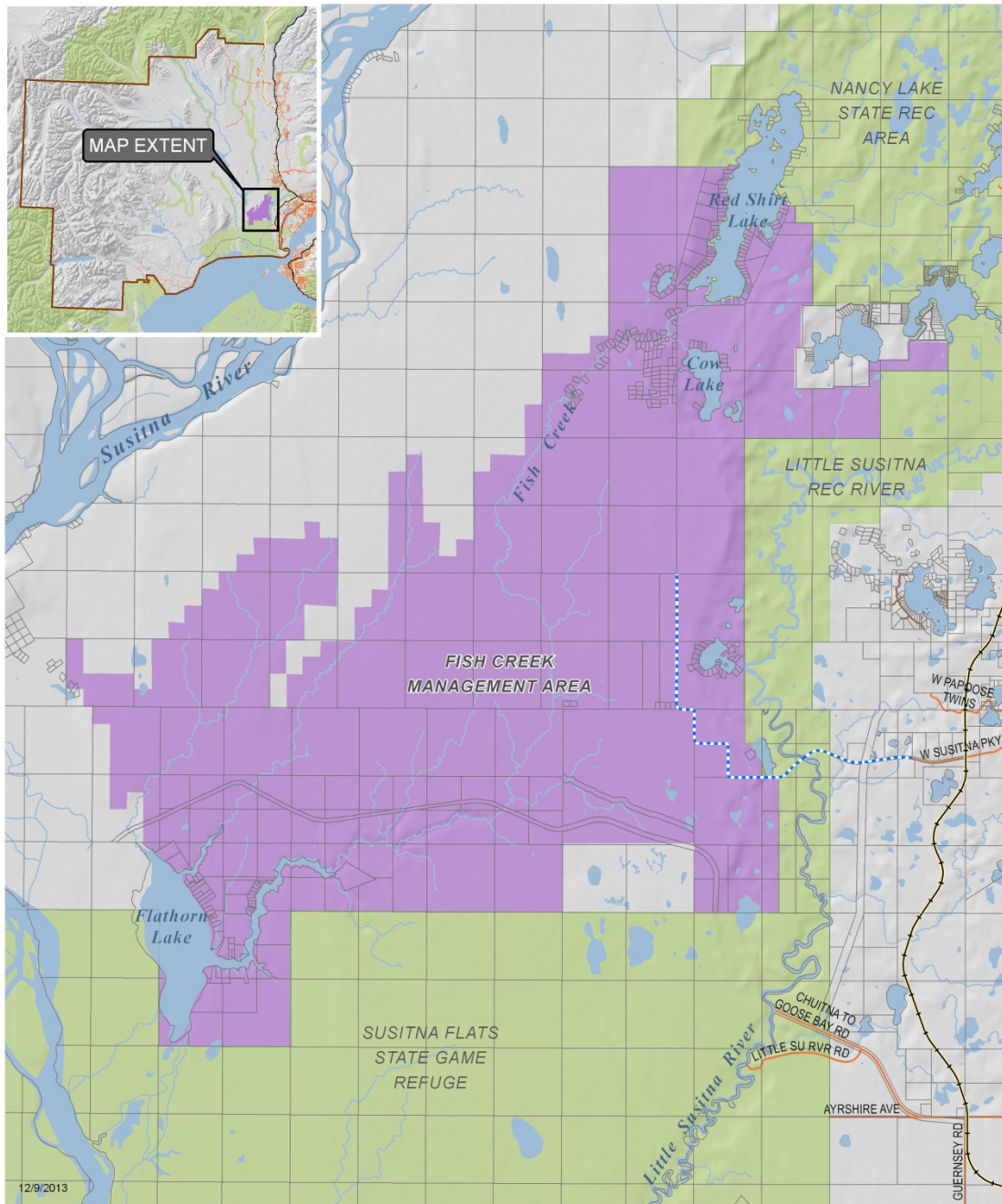


Timber and Agricultural Resources

West Susitna Access to Resource Development

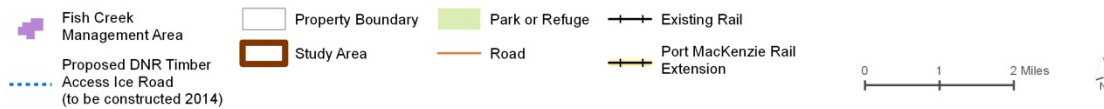
- | | | | | |
|---|--|-------------------|----------------|-------------------------------|
| Proposed Susitna State Forest (DNR 2012) | Mat-Su Borough 5-Year Timber Harvest | Study Area | Highway | Existing Rail |
| Potential Agricultural Project Areas (DNR 2010) | Susitna Matanuska Area Plan (SMAP) Units | Transmission Line | Secondary Road | Port MacKenzie Rail Extension |
| | | | | Park or Refuge |

Figure 2-6. Fish Creek Management Area with Proposed DNR 2014 Ice Road



Fish Creek Management Area

West Susitna Access to Resource Development



- **Petersville Region.** Approximately 71,000 acres of State land in this area has been identified for forest resource management.⁵⁶ This land has been designated as Forestry, with specific locations being considered for timber harvest. Primarily located in the southwestern portion of the subarea (Peters Creek-Kroto Creek area), secondary use forestry tends to be designated along Kroto Creek and Moose Creek.⁵⁷
- **Sunflower Basin Region.** In this subarea, timber use historically was limited to personal use activities (house logs and fuelwood).⁵⁸ However, there is a small potential for commercial forestry near the major rivers. Specific areas along the Kahiltna River maintain forest resources and are part of the DNR-DOF's Priority 1 areas.⁵⁹ Forestry is also designated as a secondary use area in locations such as the Lake Creek Corridor.⁶⁰
- **Susitna Lowlands Region.** Inaccessibility makes most forest development in this sub-region difficult. However, through improved access, 319,000 acres of State and borough land has the potential for timber management; half of that land has a high or moderate potential to be commercial timber. Historically, designated potential timber lands were located primarily between the Yentna and Susitna Rivers south and west of Parker Lake, along Trail Ridge, and between Lake Creek and the Yenlo Hills.⁶¹ Of this land, 141,400 acres were proposed for legislative or administrative designation to provide for long-term timber management. An additional 465,000 acres of land were retained in public ownership, including 125,000 acres of timberland along the Yentna and Susitna Rivers and Alexander, Kroto, and Moose Creeks, where public recreation and fish and wildlife habitat are the primary uses and forestry could provide a secondary use. In the 2011 Susitna Matanuska Area Plan, upland spruce-hardwood forest was identified near the Kahiltna River, with lowland spruce-hardwood occupying most other areas in the region. Timber resources of "merchantable value" are determined to be primarily located at the far western edge of the Susitna Lowlands Region and between the Skwentna River and Alexander Creek.⁶²
- **Mt. Susitna Region.** Forestry resources occur throughout the region, totaling approximately 219,000 acres.⁶³ Comprised of deciduous forest, evergreen forest, and mixed forest (depending on soils and hydrology), forested lands within the area are located primarily in the central lowlands, west of Alexander Creek and south of the Skwentna River.⁶⁴ The Mt. Susitna area encompasses 150,000 acres of potential commercial forestry.⁶⁵ The potential for commercial forestry is located primarily within the southeastern portion of the subarea in the lowlands along the Talachulitna River, as well as on the lower slopes of Mt. Susitna and the Little Susitna and Beluga rivers. Areas designated in 1985 as having a high priority for personal use timber harvesting include past and proposed settlement areas such as: High Mt. Lakes; Trinity-Movie Lakes; Hiline Lake; Sunday Lake Remote; Quartz Creek; Lands south of the Skwentna River; and lands south of Mt. Susitna. Presently, it is

⁵⁶ 2011 *Susitna Matanuska Area Plan*

⁵⁷ 1985 *Susitna Area Plan*

⁵⁸ Ibid.

⁵⁹ 2011 *Susitna Matanuska Area Plan*

⁶⁰ 1985 *Susitna Area Plan*

⁶¹ 1985 Ibid.

⁶² 2011 *Susitna Matanuska Area Plan*

⁶³ 2011 Ibid.

⁶⁴ 2011 Ibid.

⁶⁵ 1985 *Susitna Area Plan*

not anticipated that forest resources within the area will be harvested for large-scale commercial purposes.⁶⁶ The 2011 Susitna Matanuska Area Plan attributes this lack of commercial harvesting to absence of road and bridge access.

- **Beluga Region.** The 1985 plan designated forestry as a primary land use on approximately 32,000 acres. However, this land is also valuable wildlife habitat and maintains coal reserves. The land will be used only for timber harvest until the area is utilized for coal development.
- **Alaska Range Region.** Although some of the eastern areas of the Alaska Range Region contain merchantable timber (spruce and poplar) at lower elevations⁶⁷, forestry opportunities in this subarea are limited by slow growth rates and uncertainty associated with timber regeneration.⁶⁸

⁶⁶ 2011 *Susitna Matanuska Area Plan*

⁶⁷ 2011 *Susitna Matanuska Area Plan*

⁶⁸ 1985 *Susitna Area Plan*

2.5 Agricultural Resources

Agriculture has long had a presence in the Mat-Su Valley and was one of the area’s first economic drivers. However, agriculture’s role in the Mat-Su economy has lessened over the years, with a total value of agricultural production in 2007 at \$11.8 million.⁶⁹ According to the *2008 Mat-Su Comprehensive Economic Development Strategy*, four dairies operate in the Mat-Su Valley and a variety of other agricultural products are produced, such as:

- Agricultural products: vegetables, beef, dairy, potatoes, oats, hay, and greenhouse plants
- Agricultural-based products: honey, vodka, birch syrup, and candy

A number of factors have had a negative impact on agricultural production, including a limited climate, development completion, and the rising cost of fertilizer. However the Mat-Su Valley residents still value and support agriculture in the area. Some suggest that a major hindrance in the expansion of agriculture is the lack of access to potential agricultural lands in the region. This area encompasses the last large area of State-owned agricultural land in Southcentral Alaska.⁷⁰ DNR-identified agricultural areas are depicted on Figure 2-5.

As stated earlier, DNR area planning documents for the Susitna Matanuska area delineates the area into a number of sub-regions and addresses resources within these areas, as summarized on the following page and in Table 2-7.

Table 2-7. Agricultural Resources in the Study Area per DNR Planning Regions

DNR Planning Region	Size (acres)	Specifically-Identified Areas for Potential Agricultural Uses	Hypothetical Applied Direct Economic Value (\$) **
Petersville	20,000	Near existing roadways; near Moose Creek	\$16.1 million
Sunflower Basin	n/a	Lake Creek area; Kahiltna River	n/a
Susitna Lowlands	38,000	Kashwitna Knobs area, west of the Susitna River	\$30.6 million
Mt. Susitna	7,000	Scattered tracts in lowlands west of Alexander Creek	\$5.6 million
Beluga*	n/a	Scattered tracts	n/a
Alaska Range	n/a	None. Limited potential due to soils, topography and climate	n/a
<i>All planning regions in Study Area</i>	<i>65,000</i>	<i>Assumed total harvest, if acreage is fully realized</i>	<i>\$52.4 million</i>

Source: DNR 1985 Susitna Area Plan, 2011 Susitna Matanuska Area Plan.

*Planning regions were redrawn between the 1985 and 2011 DNR plans. The Beluga planning region is specific to the 1985 Susitna Area Plan.

** An assumed value per acre is \$806.45. This applied economic direct value was based on the 2012 USDA State Agricultural Census, given approximately \$25 million of income was produced from crops on nearly 31,000 acres.

⁶⁹ 2008 *Mat-Su Comprehensive Economic Development Strategy Update*

⁷⁰ 2011 *Susitna Matanuska Area Plan*

According to the U.S. Department of Agriculture (USDA), more than 80% of the 680 farms in Alaska are family owned and operated.⁷¹ Based upon information collected by the USDA as part of an agricultural census in 2012, the final gross earnings for the approximately 680 farms including crops, animals and services and forestry was approximately \$41 million, with approximately \$25 million of this income produced from crops on nearly 31,000 acres.⁷²

Potential Agricultural Uses in the DNR Planning Regions:

- **Petersville Road Vicinity.** The 2011 Susitna Matanuska Area Plan set aside 20,000 acres of State land for agriculture. In the 2011 plan, five of the seven agricultural parcels are located within one mile of existing roadways, while the remaining two flank the west side of Moose Creek. The primary location of the State agricultural lands for this subarea is within the Moose and Rabidux Creek areas.⁷³ Historical documentation indicates that while some of the areas within the sub-region are deemed suitable for agriculture, some areas are characterized by poor soil conditions and little potential for grazing, making agricultural opportunities in this area sparse.⁷⁴
- **Sunflower Basin Region.** Historical planning documents indicate there is very little opportunity for agriculture in this area, citing lack of road access and remoteness as limiting factors.⁷⁵ However, soils suitable for agriculture are scattered throughout the region. Concentrated areas with viable soil are the Lake Creek State Recreation River (SRR) and the floodplain of the Kahiltna River.⁷⁶ However, because agriculture use is not permitted within the SRR, only areas adjacent to the Kahiltna River are suitable and available for agricultural use.⁷⁷
- **Susitna Lowlands Region.** Within the Susitna Lowlands region, 38,000 acres of State-owned land is set aside for agriculture, which is almost half of the entire amount set aside for all of the Mat-Su Valley.⁷⁸ Most of the State-designated agricultural land within the Susitna Lowlands is concentrated where soils are suitable for agriculture, which results in one large area west of the Susitna River.⁷⁹ It is the inaccessibility of this subarea that limits its agricultural production. The 1985 area plan indicated there were approximately 18,000 acres of land designated as having commercial agricultural potential in the Kashwitna Knobs area. In addition, 10,640 acres were also identified as potential agricultural homesteads west of Kroto Creek and southeast of Lockwood Lake.⁸⁰
- **Mt. Susitna Region.** Historical planning documents cite the lack of road access to the sub-region as the reason for large-scale agricultural development being infeasible.⁸¹ Despite the fact that there are few areas with cultivable soils in this area, some areas have been identified

⁷¹ USDA. 2013. USDA Economic Research Service webpage State Fact Sheets, updated as of November 6, 2013.

Available at: http://www.ers.usda.gov/data-products/state-fact-sheets/state-data.aspx?StateFIPS=02&StateName=Alaska#P62b07c1d25cc4018a91953cb08af3466_2_39iT0 (accessed 12/13/2013)

⁷² 2013 Ibid.

⁷³ 2011 Ibid.

⁷⁴ 1985 *Susitna Area Plan*

⁷⁵ 1985 *Susitna Area Plan*

⁷⁶ 2011 *Susitna Matanuska Area Plan*

⁷⁷ 2011 Ibid.

⁷⁸ 2011 Ibid.

⁷⁹ 2011 Ibid.

⁸⁰ 1985 *Susitna Area Plan*

⁸¹ 1985 Ibid.

along the northern and eastern periphery of the subarea and scattered throughout the western portion of the Mt. Susitna area.⁸² Most of the areas suitable for agriculture occur within the SRR area, where agriculture is a prohibited use.⁸³ Small, scattered areas of land suitable for agriculture lie outside of the SRR area.⁸⁴ With a total footprint of approximately 7,000 acres, these small tracts are located predominately in the lowlands west of Alexander Creek.⁸⁵ In the 2011 Susitna Matanuska Area Plan, it was determined that agricultural development in the Mt. Susitna region is unlikely due to the relatively scattered distribution of the tracts, their remote location, and the lack of road access.

- **Beluga Region.** There are several pockets of publicly owned cultivable soils in this sub-region, as well as several large blocks of cultivable soils on native lands. However, aspirations for the land are associated more with coal use.
- **Alaska Range Region.** There is little potential for agriculture in this subarea due to its soils, topography, and climate.⁸⁶

Access to the west side of the Susitna River would open access to several areas determined to have agricultural soils and agricultural potential. Specifically, the DNR-Division of Agriculture cites potential access being opened to a larger area known as the Fish Creek Management Area. This area designated a 7,000 acre unit (Lower Fish Creek) as Agriculture and another 11,000 acres were previously designated as Agriculture before the 2009 update (the lands are now designated as “Resource Management”).⁸⁷ Figure 2-6 depicts the Fish Creek Management Area boundary. A 337-acre unit was also identified unit adjacent to the Fish Creek Management Area as being designated for future agricultural use.⁸⁸

⁸² 1985 Ibid.

⁸³ 2011 *Susitna Matanuska Area Plan*

⁸⁴ 2011 Ibid.

⁸⁵ 2011 Ibid.

⁸⁶ 1985 *Susitna Area Plan*

⁸⁷ DNR-Division of Agriculture. October 8, 2013. Comments provided during a review of a draft of this report.

⁸⁸ 2008 *Southeast Susitna Area Plan for State Lands*

2.6 Alternative Energy Resources

Some of the main alternative energy resource opportunities in Alaska include hydroelectric power, geothermal energy, wind power, solar power, and tidal power. Within the Study Area, two types of alternative energy resource projects have been historically studied. These are the Mount Spurr Geothermal and the Chakachamna Hydroelectric projects. See Figure 2-7.

2.6.1 Geothermal Resources: Mount Spurr Geothermal Leases

Geothermal exploration is increasing in the state.⁸⁹ For several decades, the State has held geothermal lease sales near the Mount Spurr volcano, which is located about 80 miles west of Anchorage on the west side of Cook Inlet. The Alaska DNR held geothermal lease sales in the 1980s and 1990s, though there was little interest at that time. In 2008, the Alaska DNR held geothermal lease sales for Mount Spurr's southern flank. The leases covered more than 36,000 acres spread over 16 leases. Ormat Technologies, Inc., a geothermal power company, purchased 15 of the 16 leases offered.⁹⁰ Ormat initially estimated a 50-megawatt baseload of power from a geothermal power plant could be developed at Mount Spurr.

Since 2008, Ormat has been conducting exploration in the area and assessing the resource. Ormat drilled several test wells in 2010 and 2011, though the results found the formation temperature was half of what was needed for a viable geothermal project. In early 2013, Ormat indicated they will shift their targets to drill sites farther west near the volcano's crater, where subsurface temperatures may be appropriate. As of spring 2013, the project entered a hiatus as Ormat looked into options for a future power plant. Ormat plans to resume drilling in 2014.⁹¹

In recent years, additional State funds have been contributed to the project, through the Alaska Energy Authority (AEA), for instance. The State approved \$18 million for the project in FY2012.⁹²

2.6.2 Hydropower Resources: Chakachamna Hydroelectric Project

Over the years, the State of Alaska has considered a number of potential sites for hydropower projects for serving the needs of Southcentral Alaska's communities. The two most notable hydropower projects in Southcentral Alaska are the Susitna-Watana Hydroelectric project and Chakachamna Hydroelectric project. The Susitna-Watana Hydroelectric project site is located on the Susitna River 184 river miles upstream from Cook Inlet and the Chakachamna Hydroelectric project is located approximately 85 miles west of Anchorage on Chakachamna Lake. Both of these projects have been under consideration for a long time. The Susitna-Watana Hydroelectric project location is outside of the Study Area, whereas the Chakachamna hydroelectric project is located within the Study Area.

A proposed hydropower project at Chakachamna Lake has been under consideration for more than 70 years, with a variety of agencies leading the effort, including the Department of Interior, U.S. Army Corps of Engineers (USACE), and the Alaska Power Authority. In 2006, the Federal Energy Regulatory Commission (FERC) granted TDX Power, Inc. a 3-year preliminary permit under

⁸⁹ Alaska Energy Authority and Renewable Energy Alaska Project (REAP). August 2011. *Renewable Energy Atlas of Alaska*. ftp://ftp.aidea.org/AEAPublications/2011_RenewableEnergyAtlasofAlaska.pdf (accessed March 2013).

⁹⁰ Chat Attermann purchased the other lease. All leases expire October 31, 2018.

⁹¹ Baily, Alan. Anchorage Daily News. May 10, 2013. *Ormat says Spurr geothermal project still in the works*. Available at: www.adn.com/2013/05/10/2898490/ormat-says-spurr-geothermal-project.html

⁹² http://omb.alaska.gov/ombfiles/12_budget/CapBackup/proj56386.pdf (accessed March 2013).

Section 4(f) of the Federal Power Act to study the potential for a 300- MW project. The project would have entailed the inter-basin transfer of water from a lake-tap near the outlet of Chakachamna Lake through an approximate 11-mile-long hard-rock tunnel to an underground powerhouse that would discharge to the McArthur River.

The AEA prepared a report in 2010 that considered the two possible project site locations. The report included a risk analysis comparison of the two projects and recommended that the Susitna-Watana project be the primary project for the State to pursue. As such, the State is moving forward on the project and several dozen studies have occurred or are currently underway as part of the FERC process. The AEA plans to file a license application to FERC in 2015 for the Susitna-Watana project.⁹³ The State is no longer pursuing a hydroelectric project at Chakachamna Lake.

2.6.3 Woody Biomass Resources: Susitna Valley High School Project and the MSB

AEA has increasingly considered the use of woody biomass as an alternative energy resource. This is especially true for small Alaskan communities who, unconnected to the power grid or road system, are forced to have fuel barged or flown in. Use of woody biomass resources has the potential to reduce energy prices substantially in these communities. However, the increase in biomass projects creates an increase in demand for wood resources because biomass generators and wood pellet manufacturers create demand for low-grade timber, which makes previously uneconomical timber tracts profitable for loggers.⁹⁴

As of the summer of 2013, 19 biomass heating projects are operated in that state, with 50 communities expressing interest in starting biomass programs.⁹⁵ Within the Study area, one community has received grant money to implement a biomass project (Talkeetna) and the other is undergoing the application process (Tyonek). In 2011, the Susitna Valley High School, located in Talkeetna, was awarded the Woody Biomass Utilization Grant by AEA. The school had been destroyed by a fire in 2007 and reconstruction efforts aimed to provide heating the school with locally available firewood. The primary purpose of the project was to reduce the heating costs that have been rising over time as a result of increases in heating oil prices.⁹⁶ However, the community returned the grant money after learning that a renewable core wood system would not meet the design requirements of the new school.⁹⁷ In 2008, the Native Village of Tyonek submitted a *Preliminary Feasibility Assessment for High Efficiency, Low Emission Wood Heating in Tyonek*. This study assessed the feasibility of implementing biomass systems at the tribal center, snack bar, Boys and Girls Club, Justin Time General Store, and as part of the district heating system. The study found the most practical solution for the community of Tyonek would be to install a centralized heating plant that would then distribute heat to nearby buildings via hot water and insulated underground plastic

⁹³ AEA. Susitna-Watana Hydro. Project Description. Available at www.susitna-watanahydro.org/project/project-description/ (accessed March 2013).

⁹⁴ Alaska Economic Trends. October 2010. Alaska's Mining Industry *Alaska's Timber Industry*.

⁹⁵ Petersen, Karen. June, July, and August 2013. *An Overview of Biomass in the State of Alaska*. Western Forester. Vol. 58 No. 3. Pages 14-15. http://www.forestry.org/media/docs/westernforester/2013/WF_June_July_Aug2013.pdf

⁹⁶MSB. 2010. Susitna_Valley_High_School_Biomass_Final. Available at ftp://ftp.aidea.org/ReFund_RoundIV_Recommendations/REFundRound4/2_Project_Specific_Docs/economic_analyses_summaries/WordReports/623%20Susitna%20Valley%20HS%20Biomass_final_110310.docx. (accessed November 2013).

⁹⁷ Alaska Energy Authority. November 27, 2013. Personal communication with Devany Plentovich, Program Manager - Biomass/CHP, Alaska Energy Authority.

tubing.⁹⁸ The community of Tyonek is still working with AEA to acquire a grant and implement the project.

In addition to the projects mentioned above, there is the potential for an increased demand for wood resources as new core wood systems from Europe (a pellet system with a bulk silo) make biomass use in residential homes more economical.⁹⁹

Timber inventories are an important element in determining the viability and sustainability of biomass energy projects. A biomass supply and cost profile was conducted for MSB-owned lands, as detailed in the National Association of Conservation Districts' Woody Biomass Desk Guide & Toolkit document.¹⁰⁰ The profile concluded that a supply of biomass resources was available locally. The MSB owns forest managements units (FMUs) within the Study Area, as listed in Table 2-8 and shown on Figure 2-7. The following FMUs are located within the Study Area and were analyzed in the Biomass Supply and Cost Profile: Matanuska-Susitna Borough-owned Lands, Alaska: Rabideux Creek, Moose Creek, and Susitna River Corridor. Table 2-8 summarizes these specific FMUs.¹⁰¹

Table 2-8. MSB-Owned Forest Management Units in the Study Area with Measurable Woody Biomass Yields

MSB- Owned Forest Management Units	Operable Forest Land Acres	Assumed Fuelwood Yield (dry ton/acre/year)	Total Yield (dry ton/acre/year)
Rabideux Creek	1,568	1.0	1,568
Moose Creek	0	1.0	0
Susitna River Corridor	2,330	1.0	2,330

Source: National Association of Conservation Districts n.d. Woody Biomass Desk Guide & Toolkit. Appendix D: Biomass Supply and Cost Profile: Matanuska-Susitna Borough-owned Lands, Alaska.

* According to the Woody Biomass Desk Guide & Toolkit (p. 15), pulp wood and commercial-grade timber can be used as an energy or bioproducts feedstock. When used this way, the fiber is called fuelwood.

* Other MSB FMUs are located in the Study Area, but have not been analyzed for quantities of fuelwood (e.g. Chijuk, Montana Creek, Fish Creek).

Unless a project requires 5,000 gallons of fuel or more, all that is needed is a wood stove or a pellet stove; otherwise it would not be economical. However, there are new core wood systems from Europe that will be cheaper and it is hoped that this pellet system with a bulk silo would be used in more residential homes. Early trials in Juneau have found that residential woody biomass systems provide a 40 percent savings on the price of fuel.

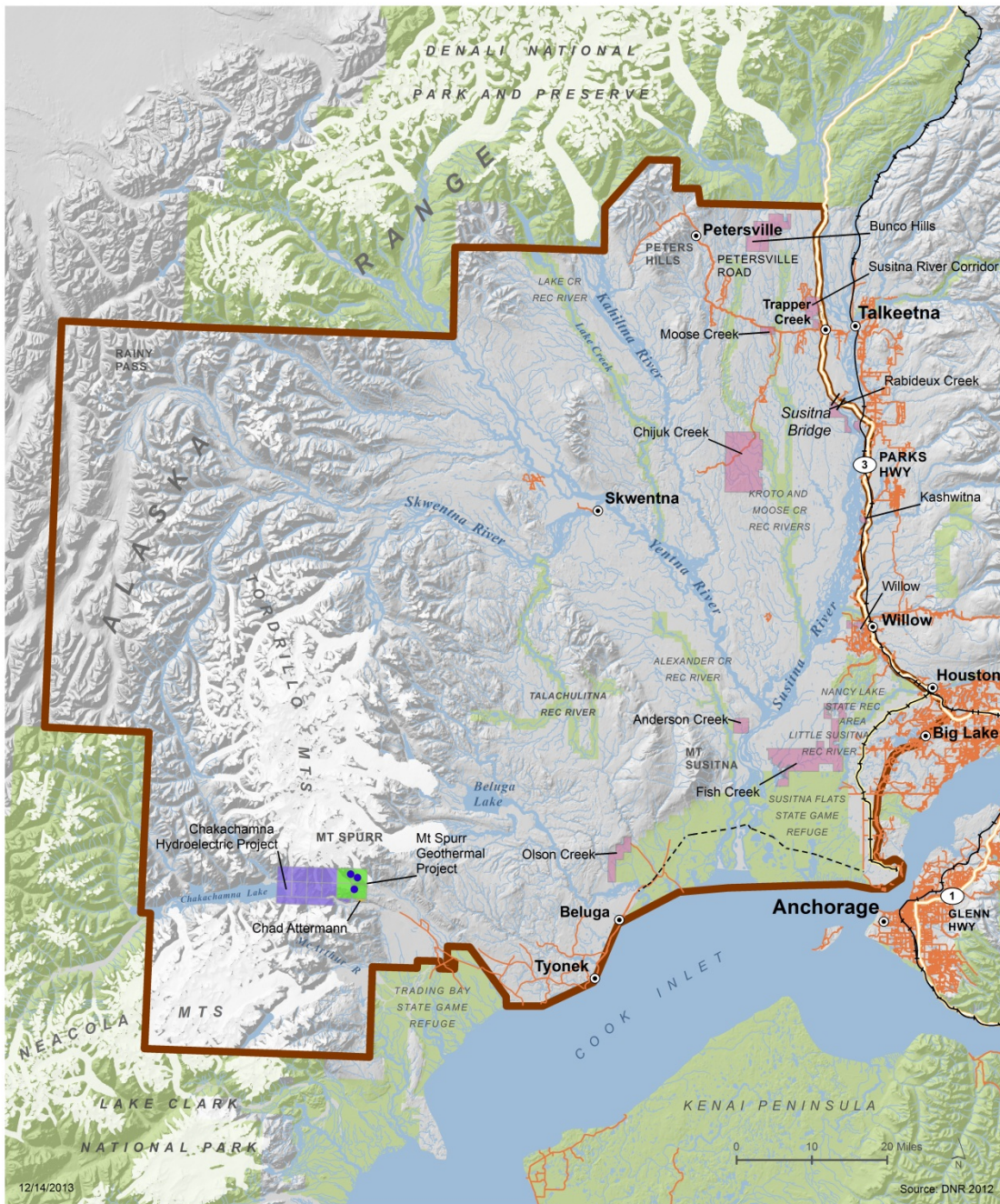
⁹⁸ Parrent, Daniel. 2008. Juneau Economic Development Council. *Preliminary Feasibility Assessment for High Efficiency, Low Emission Wood Heating in Tyonek*.

⁹⁹ Plentovich, 2013

¹⁰⁰ National Association of Conservation Districts n.d. Woody Biomass Desk Guide & Toolkit. Appendix D: Biomass Supply and Cost Profile: Matanuska-Susitna Borough-owned Lands, Alaska. Available at: <http://www.nacdnet.org/resources/guides/biomass/pdfs/AppendixD.pdf> (accessed November 2013).

¹⁰¹ National Association of Conservation Districts n.d. Woody Biomass Desk Guide & Toolkit. Appendix D: Biomass Supply and Cost Profile: Matanuska-Susitna Borough-owned Lands, Alaska.

Figure 2-7. Alternative Energy Resources



Alternative Energy

West Susitna Access to Resource Development

- | | | | |
|-------------------|---|-----------------------|---------------------------------|
| Geothermal Lease | ● Well | --- Transmission Line | — Existing Rail |
| Chad Attermann | ▭ Study Area | — Highway | — Port MacKenzie Rail Extension |
| Ormat Nevada Inc. | ▭ Park or Refuge | — Secondary Road | |
| Orni 46 LLC | ▭ MSB Natural Resource Management Units | | |

2.7 Recreational Resources

Recreation is a popular use of State lands in Alaska. A majority of the land within the more than 6 million acres that make up the Study Area is State land, and much of that is considered remote (see Table 4-2). Within the Study Area, the large acreages of undeveloped lands contribute to vast recreational opportunities. The Study Area is well endowed with recreational resources opportunities, from its low-lying areas consisting of fish-filled lakes and rivers to the foothills and mountains of the Alaska Mountain Range. The Study Area is bounded by federally managed recreational lands to the north and southwest: Denali National Park and Preserve and Lake Clark National Park and Preserve, respectively. See Figure 2-8.

A sampling of recreational resource opportunities and experiences in the Study Area includes:

- Recreational characteristics of wilderness and remote lands
- State-designated recreational areas and rivers
- Private lands and remote cabins
- Consumptive uses, such as sportfishing, hunting, and firewood harvesting
- Wildlife viewing
- Winter recreation
- Tourism, such as wilderness lodges and sportfishing

When it comes to recreation, there is a balancing act between providing access for the visitor and preserving the resource. A publicly accessible access road into the Study Area would provide new recreational opportunities to the public. This could be perceived as having either a positive or negative impact or both. Currently remote and largely undisturbed areas would see increased human use and associated noise, activity, and development. Some people have remote recreational properties and private cabins in the Study Area because of its isolated nature.

Initial correspondence with ADF&G specifically for this study indicates that the ADF&G generally supports access to fish and wildlife resources, but also realizes that regulatory changes may need to be considered in the future to adjust to changes in public use and harvests and the increased pressure on such resources.¹⁰²

What are the State of Alaska's goals for *Recreation and Scenic Resources* in the Susitna Matanuska Area?

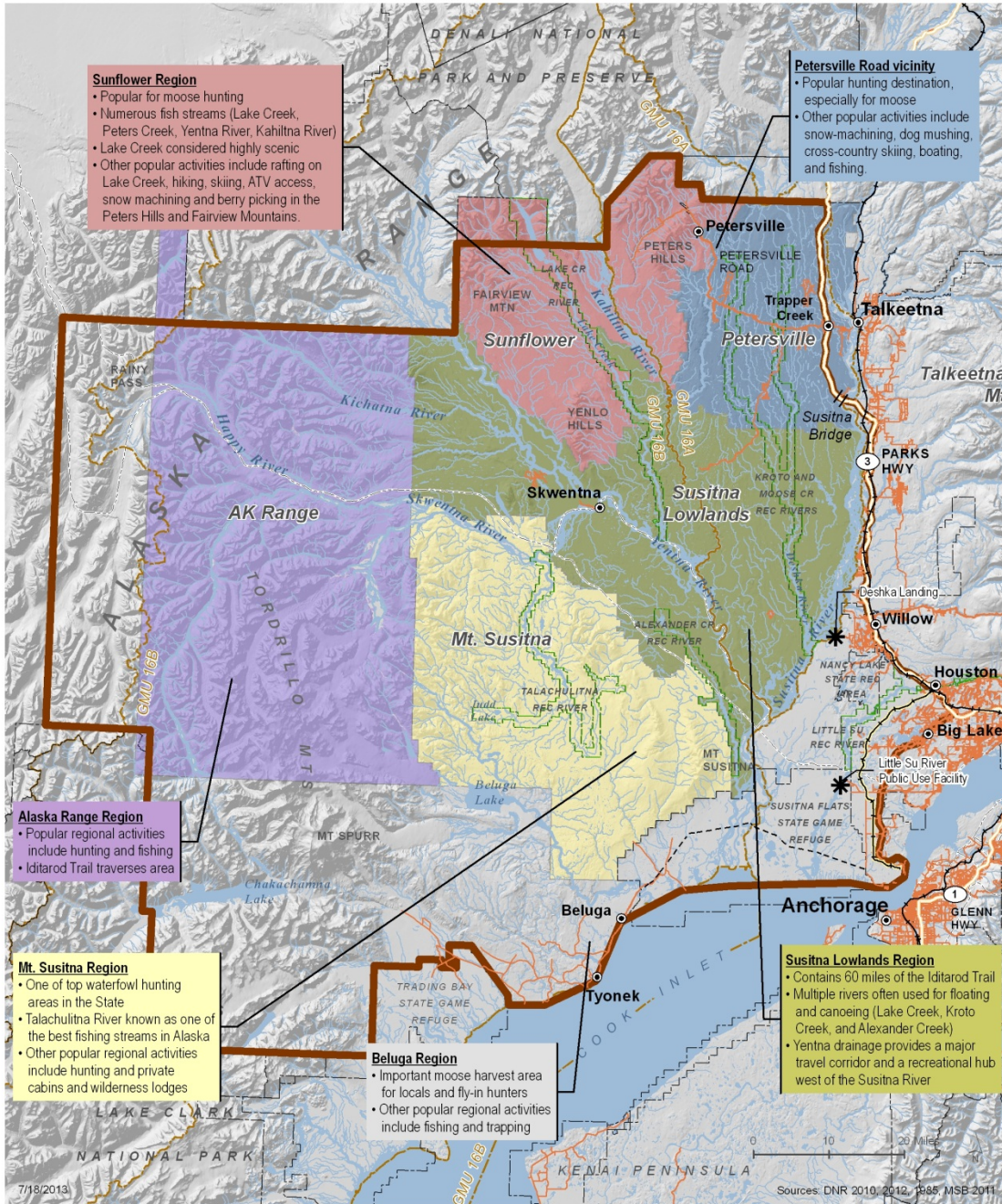
Recreation Opportunities. Lands will be provided for accessible outdoor recreational opportunities with well-designed and conveniently located recreational facilities. In addition, undeveloped lands should be provided for recreation pursuits that do not require developed facilities. These opportunities shall be realized by:

- Providing recreation opportunities on State land and water that serves multiple purposes such as habitat protection, timber management, and mineral resource extraction;
- Protection of recreation resources including public access, visual resources, fish and wildlife important for recreation, and, where appropriate, the isolation and unique wilderness characteristics of the planning area;
- Management of recreation to avoid or minimize user conflict, provide for a quality experience for all user groups, and protect the natural values and attributes of the area within which the recreation occurs; and,
- Protection of ecosystems and habitat from damage caused by inappropriate recreation use.

- excerpted from the *Susitna Matanuska Area Plan for State Lands*
(DNR-DMLW 2011: 2-30)

¹⁰² ADF&G. April 29, 2013. Letter from ADF&G Habitat Biologist Marla Carter.

Figure 2-8. Recreational Resources by DNR Planning Regions



Recreational Resources

West Susitna Access to Resource Development

Susitna Matanuska Area Plan (SMAP) Units within the Study Area

- AK Range
- Sunflower

- Mt Susitna
- Petersville
- Susitna Lowlands

- State-designated Recreational River
- Park or Refuge
- Study Area

- ADF&G Game Management Unit (GMU)
- Highway
- Secondary Road

- Existing Rail
- Port MacKenzie Rail Extension
- National Historic Iditarod Trail

Access for recreation. A majority of the Study Area, particularly west of the Susitna River, is considered remote. A wide variety of recreational opportunities occur despite limited access. The Study Area's eastern boundary is the only portion accessible by the existing road system network. Presently, most recreational users access the area by flying in; using all-terrain vehicles (ATVs) or snowmachines; using a variety of boating options such as kayaking, canoeing, or floating some of the rivers; or by simply hiking or skiing to their desired destination. Despite the scarcity of groomed trails, the area becomes more accessible during the winter as rivers, lakes, and wetlands freeze over, forming provisional trail corridors. The area also encompasses mining routes and abandoned seismic trails that are heavily used, especially by snowmachines during the winter months. Given the remoteness of the area, amenities for recreational users are sparse, and the number of designated trails is limited. As a result, access to formal trails consists primarily of roadside parking areas, boat landings, and frozen lakes.¹⁰³

Private cabins, many accessible only by air, are also found in the Study Area. Fly-in wilderness lodges offer guiding and recreational opportunities. Lakes provide float plane access, in addition to providing for sockeye salmon production and general public recreation.

Settlement lands and recreation. Another consideration for providing access into the Susitna basin is settlement lands. The DNR, under the direction of the Alaska Constitution, State laws and the Alaska Legislature, has the authority to sell State land for settlement and private ownership.¹⁰⁴ The DNR makes land available for private ownership through a sealed-bid auction program (primarily for sale of subdivision and other surveyed parcels) and by granting remote recreational cabin sites, whereby an applicant may stake a parcel of land in an area designated for remote staking for recreational use. State settlement lands identified for development typically adjoin current or projected residential areas and are relatively close to access and necessary infrastructure. In areas where State settlement lands abut borough lands, land disposal programs are coordinated between the two entities to ensure that economies of scale are achieved and infrastructure costs are reduced. In accordance with AS 38.04.010, year-round settlement areas are focused where services exist or can be provided with reasonable efficiency.

As part of the 2011 Susitna Matanuska Area Plan, settlement areas are identified for seasonal residences for recreation, year-round residences for community expansion, and as potential commercial or industrial development.¹⁰⁵ According to the 2011 plan, there are 32 units designated for settlement within the Study Area, consisting of nearly 435,000 acres. Presently within the Study Area, settlement lands sell for approximately \$837 per acre on average.¹⁰⁶ Under this assumption, the approximate value of the settlement lands would be approximately \$364 million. Settlement designation for these lands resulted from consideration as to whether the unit: had reasonable access by road, water, or air; consisted of topography that would be suitable for development; and posed

¹⁰³ MSB. Community Development, Trails webpage. Available at www1.matsugov.us/communitydevelopment/index.php?option=com_content&view=article&id=195&Itemid=255 (accessed March 2013)

¹⁰⁴ DNR-ML&W. Alaska State Land Offerings. Current Land Offerings webpage. Available at: <http://dnr.alaska.gov/mlw/landsale/> (accessed on December 11, 2013)

¹⁰⁵ 2011 *Susitna Matanuska Area Plan*

¹⁰⁶ This estimate is very approximate due to the fact that price will vary depending on the exact location of the property (e.g. lakefront). Alaska DNR Division of ML&W. Land Sales. Southcentral Region Subdivision. (Webpage viewed 12/11/13)

< http://dnr.alaska.gov/mlw/landsale/otc/regions_subdiv.cfm?region=SOUTHCENTRAL/ >.

minimal conflict with recreation, scenic values, important fish and wildlife resources, or resource development. Compatibility with adjacent land uses and the plan designations were also considered.

An area currently being considered for concentrated development is the Fish Creek/Point MacKenzie area. Under the current Fish Creek Management Plan (see Figure 2-6 for geographic location), several areas (in the Moraine Ridge and Flat Horn Lakes Management Units) are designated for residential settlement. The development plan for this management unit is to allow minimal land sales that promote the current remote residential use of the area.¹⁰⁷

Within the Study Area, the MSB is also in the conceptual stage of pursuing two future settlement projects: Point MacKenzie and Fish Creek town sites. The proposed location of the Point MacKenzie site would be on Borough-owned property. The proposed Fish Creek town site would require a joint effort between the MSB and DNR due to the different land ownership status. Presently, the area considered for the Fish Creek town site would extend from near Red Shirt Lake to slightly north of West Little Susitna River Road and from west of the Little Susitna Area to east of the Big Susitna River. The Point MacKenzie town site under consideration would be located east of Point Mackenzie Road, northwest of Cook Inlet, south of the Goose Bay State Game Refuge, and north of the northern Port District Boundary.¹⁰⁸

Organized recreational activities. A number of organized recreational activities occur in the Study Area as well. The Iditarod trail, which traverses the Study Area, hosts several recreational activities, such as: the Iditarod race; the Irondog off-road snowmobile race (running from Big Lake to Nome); and the Iditasport (a race that includes skiing, biking, walking/running, and/or snowshoeing). Other multi-sport races include the Susitna 100 or the Little Su 50k, a winter race that also includes skiing, biking, or running/walking/snowshoeing.

Iditarod Trail. There are several trails and historic sites within the MSB that are identified as part of the Iditarod National Historic Trail System (INHTS). The Iditarod Race Trail is a part of the INHTS. The Iditarod Race Trail is split into a northern route (used during even years) and a southern route (used during odd years). It was determined that both the northern and the southern route should be used in order to allow more communities to participate in the event and to relieve neighboring communities of the presence of mushers, press, and volunteers every other year.¹⁰⁹ Within the Study Area, the race trail remains the same: beginning in Willow and passing through Yentna, Skwentna, and Finger Lake before exiting through the Study Area over Rainy Pass.

The Iditarod Race Trail and the INHTS have different management prescriptions in the 2011 Susitna Matanuska Area Plan. According to the plan, the race trail is protected by a 200-foot publicly-owned corridor. Re-routing the trail to reduce its impacts on adjacent land uses, or to preserve it for its continued use, is permitted via consultation with the State Office of History and Archaeology and the Iditarod Trail Committee.¹¹⁰ The INHTS is composed of several trails (some well defined and some not) and historic sites. Permits and leases along the INHTS also require consultation with the State Office of History and Archaeology. The State of Alaska and the U.S.

¹⁰⁷ MSB. 2009. *Fish Creek Management Plan*

¹⁰⁸ MSB. Point Mackenzie Town Site Location Map. Projects in Process. Available at: www.matsugov.us/planning/plans/projects (accessed on December 12, 2013)

¹⁰⁹ The Iditarod Trail. *The Most Common Question Asked About the Trail* Webpage. Available at: <http://iditarod.com/about/the-iditarod-trail/> (accessed December 2, 2013)

¹¹⁰ 2011 *Susitna Matanuska Area Plan*

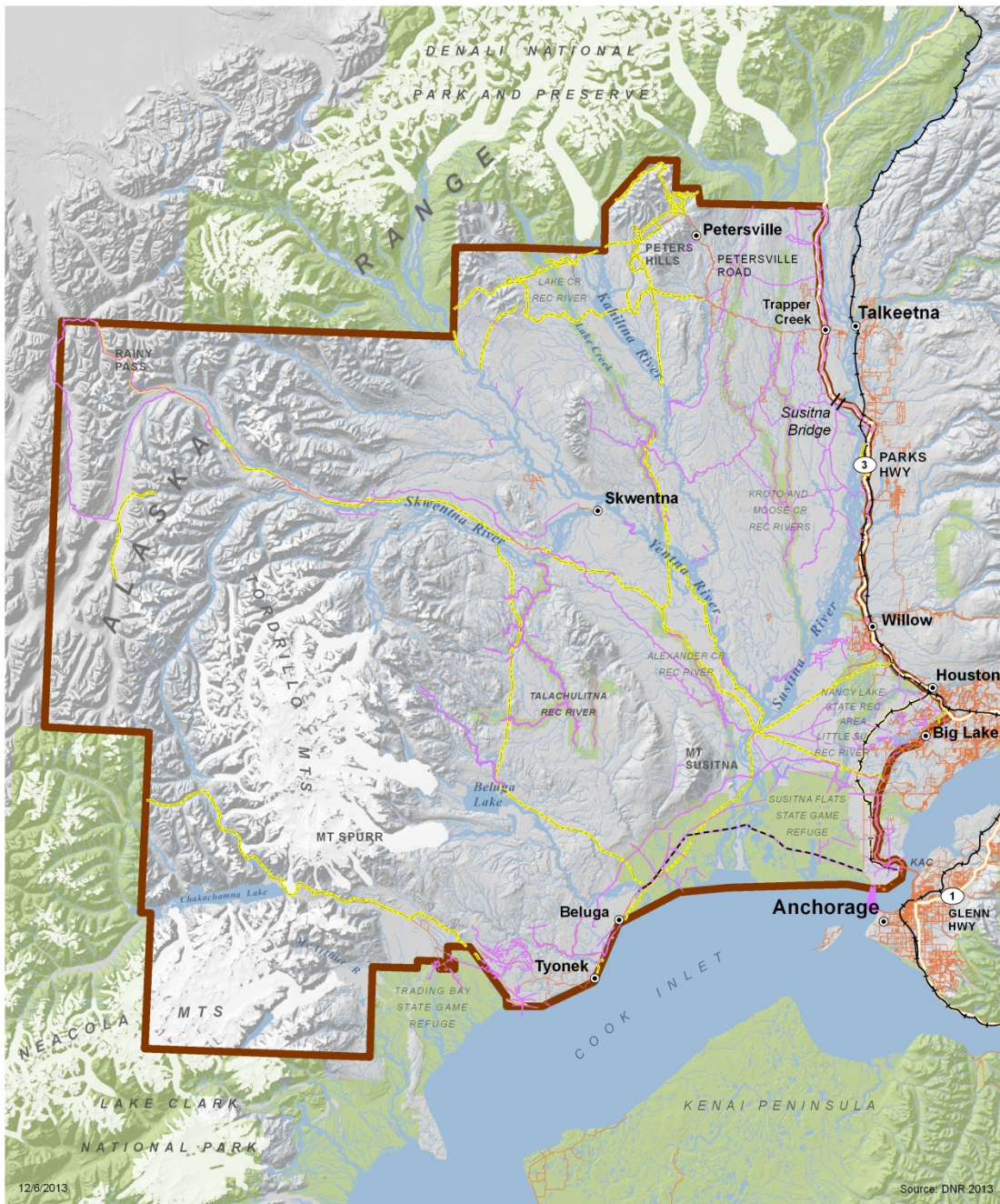
Department of the Interior have signed a memorandum of agreement covering management of the INHTS under terms of the Comprehensive Management Plan for the trail system.

Trails. There is an active trail community (e.g., dog mushing, snow machining, skiing, etc.) in and/or near the Study Area vicinity, especially in the eastern portion of the Study Area. Although the Study Area lacks a formally-developed trail network (excluding winter trails), there are many trails formed under Revised Statute (RS) 2477 located within the Matanuska-Susitna area. Figure 2-9 depicts RS 2477s and other DNR easements in the Study Area. Under RS 2477, U.S. states and territories were allowed unrestricted rights-of-way (ROW) over federal lands absent of existing reservations or private entries. The law remained in effect until Congress repealed it in 1972. Although the authority to establish new RS 2477 ROW in Alaska ended in 1968, under Public Land Order 4582, pre-existing rights were maintained.¹¹¹ Many of these RS 2477 ROWs are currently utilized for public recreation, be it cross-country skiing, snow machining, dogsledding, or driving four-wheel ATVs. RS 2477s are also used by a variety of people, including oil and gas and mining companies and everyday access, primarily in the winter, for local residents and recreation users of the area.

The MSB prepared an *Asset Management Plan* in 2001 that proposes a number of recreation enhancements in the Study Area. One of the types of improvements identified was to develop a linked trail system that utilizes stream corridors or other “natural undevelopable lands.” Two such proposed areas located within the Study Area are (1) a 75-mile loop system and (2) a 150-mile regional outer loop corridor system. The 75-mile loop trail would be located in the southeastern portion of the Study Area and would incorporate portions of the Little Susitna River Corridor, the Iron Dog Trail/ Big Lake Recreational Corridor, and the Knik Arm/ Palmer Hay Flats area. The 150-mile loop trail would be located in the southern portion of the Study Area and would incorporate portions of the Susitna River Recreational Center, the Petersville Road Scenic Byway, the Lake Creek Recreational Corridor, the Lower Susitna – Yentna public use area, and the Susitna Flats State Game Refuge.

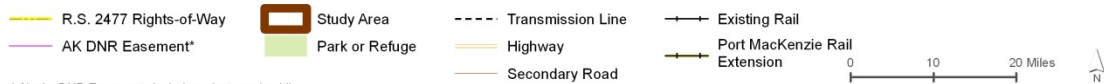
¹¹¹ DNR-DMLW. RS 2477 webpage: Available at: <http://dnr.alaska.gov/mlw/trails/rs2477/index.cfm> (accessed November 2013)

Figure 2-9. Existing Easements of R.S. 2477 Rights-of-Way



Existing Easements and R.S. 2477 Rights-of-Way

West Susitna Access to Resource Development



* Alaska DNR Easements includes private and public easements and rights-of-way granted by the State of Alaska.



Public Use Facilities. Deshka Landing is the only boat launch open to the public on the lower Susitna River. The facility is State-owned but is run by a concessionaire. In the eastern portion of the Study Area is the road-accessible Little Susitna River. The Little Susitna River Public Use Facility is also located east of the Susitna River, at “River Mile 28.5.” The public use facility offers boat access, with a boat launch and trailer parking, camping facilities, and a dump station for recreational vehicles. A new State law also designated two areas of public land within the Study Area near the Petersville Road for recreational mining and other general public recreation.¹¹²

Patented mining claims. As of May 8, 2013, more than 100 nine to ten-acre lots have become available for private ownership in the Cache Creek mining district area, located approximately 35 miles west into the Old Petersville and Cache Creek Area. Part of the historical gold mining area, these lots are federally patented land and allow for recreational gold mining.¹¹³

State-designated recreational areas and rivers. The Susitna River and its tributaries support the second largest salmon-producing system within Cook Inlet. In addition to the Susitna River, the Study Area encompasses a number of State recreational areas and rivers. The following State Recreational Sites (SRSs) are located east of the Susitna River: Big Lake North SRS, Big Lake South SRS, Nancy Lake SRS, Montana Creek SRS, and Willow Creek SRS.

The Study Area includes five State-designated Recreational Rivers, as detailed in the *Susitna Basin Recreation Rivers Management Plan*:

- Alexander Creek
- Talachulitna River
- Deshka River (Kroto Creek and Moose Creek)
- Lake Creek
- Little Susitna River

These rivers are State-designated for their recreational importance, high public use values, and a need for active management to protect resources from degradation and overuse. These rivers and their tributaries support the five species of Pacific salmon and numerous resident fish species, most importantly rainbow trout, grayling, and Dolly Varden.

Sport fishing and hunting. Even though the west side of the Susitna basin is not road accessible, a significant amount of effort is directed at the fisheries, which are accessed by boat and air. About 70,000 angler days are expended annually west of the Susitna River, compared to 95,000 angler days annually on the road-accessible rivers east of the Susitna River.¹¹⁴ Much of this effort is incorporated in remote lodge operations, but also includes a large number of private cabin owners. Chinook and coho salmon and rainbow trout fishing are the largest sport fisheries with the heaviest activity occurring on Deshka River, Lake Creek, and Talachulitna River. About 5,000 Chinook are harvested on the Deshka River annually and about 3,000 each year at Lake Creek. ADF&G’s Division of Sport Fish suspects in-river exploitation of Chinook salmon to be greatest at Lake Creek. Currently the Lake Creek area supports close to 60 guides, which is more than any other area within this unit. About 14,000 coho salmon are harvested annually among all west-side tributaries. Area rainbow trout regulations are already fairly conservative with minimal harvest allowed. Many areas are catch-

¹¹² DNR-DMLW. 2012. *Petersville Recreation Mining Area* factsheet.

http://dnr.alaska.gov/mlw/factsht/mine_fs/petersvi.pdf (accessed May 2013).

¹¹³ <http://www.detectorprospector.com/mining-claims-for-sale/alaska-mining-claims-for-sale-or-lease.htm>

¹¹⁴ ADF&G. April 29, 2013. Letter from ADF&G Habitat Biologist Marla Carter.

and-release only. For example, most of Lake Creek and Deshka River are already catch-and-release only. The Talachulitna River has been catch-and-release only for rainbow trout since 1977. About 30,000 rainbow trout are caught annually, mainly among these 3 systems, about 14,000 coming from Lake Creek alone, due in part to the large amount of guiding on this system.

The major tributaries draining into west Cook Inlet that support king salmon production are presently closed to Chinook salmon fishing due to low Chinook salmon returns over the past 7 years to the Chuit, Theodore, and Lewis Rivers.¹¹⁵ There is limited coho and rainbow trout fishing opportunity on these three rivers as well as several streams within the Beluga River drainage. Coho and sockeye sport fishing harvests and opportunity increases dramatically to the south of Tyonek. The fish resources on the west side of the Susitna River are highly sought after for both recreation and subsistence.

Overall, road access would provide more opportunity for sport fishing. Access would also accelerate future regulatory change needed to ensure fisheries remain sustainable under conditions of increased use. Fisheries currently exploited at a moderate rate now, would likely become more restrictive with regulations similar to those presently governing the east Susitna River/Talkeetna areas.

The southeastern portion of the Study Area encompasses the Susitna Flats State Game Refuge (SGR), which was established by the Alaska Legislature in 1976 to protect fish and wildlife habitat and populations, particularly waterfowl nesting, feeding, and migration areas; moose calving areas; spring and fall bear feeding areas; and salmon spawning and rearing habitats. The SGR also provides public uses of fish and wildlife, such as waterfowl, bear, and moose hunting; wildlife viewing and photography; and general outdoor recreation. By early May, as many as 100,000 waterfowl use the SGR as a feeding and resting area before heading on to their breeding and nesting grounds. Approximately 10 percent of the annual waterfowl harvest in the state occurs on the SGR with about 15,000 ducks and 500 geese taken. Rivers within the SGR are also popular for sportfishing, with the Theodore and Lewis rivers supporting more than 7,000 user-days a year. Overland access into the SGR is limited, with most access by float plane or boat during open water months and by snowmachine in winter. A portion of the “Beluga Highway,” which supports oil and gas production, extends approximately 10 miles into the SGR from the community of Beluga.

The entire Study Area is located within ADF&G’s Game Management Units (GMUs) 16A and 16B, which provide habitat for many wildlife species including moose, black and brown bears, wolves, and several species of furbearers. All species are managed on a sustained yield basis. Access into GMU 16 for hunting is mainly by aircraft, boats, and snowmachines. According to ADF&G, current moose populations are estimated at around 2,600 for Unit 16A and 6,700 for Unit 16B, and are approaching the desired management objectives. Populations of predators, such as black and brown bear, appear steady. The moose harvest from 2007-2011 averaged 110 moose in Unit 16A (harvest goal 190-360) and 162 moose from Unit 16B (harvest goal of 310-600).¹¹⁶

“A road through the Susitna basin would open up a vast sportsman’s paradise to the public, for this region contains some of the finest big game country in Alaska.”

–A Description of Road Routes in Alaska
(Bureau of Public Roads 1959: p.12)

ADF&G implements management programs in the Study Area intended to increase moose population size and harvest by reducing predation by wolves and black and brown bears. According

¹¹⁵ ADF&G. Division of Sport Fish. October 2, 2013. Comments provided during a review of a draft of this report.

¹¹⁶ ADF&G. April 29, 2013. Letter from ADF&G Habitat Biologist Marla Carter.

to ADF&G, human effort is expected to increase in Unit 16 due to liberalized seasons and bag limits and increasing moose abundance. Moose hunting pressures in other nearby units (e.g., GMU 20A) may likely lead to increased hunting in the Study Area. As a result, ADF&G is in the process of mapping access areas into the Susitna basin as part of relieving hunting pressures in other areas.¹¹⁷

ADF&G's Division of Wildlife Conservation continues to believe that winter access to the Study Area for wildlife, recreation, and other use is generally good using snowmachines.¹¹⁸ Currently, during hunting season, those seeking moose, bear, and other species use boats and aircraft. Surface roads in the less accessible, higher elevation areas would tend to improve access for moose, bear, and ptarmigan hunters. Roadways in the lower, generally more accessible areas would increase access opportunities for some users while at the same time increase competition for those currently accessing the area using other means. ADF&G suggested locating roads in the areas with little current access to wildlife resources. During autumn hunting seasons, the most inaccessible areas are those farther from the major rivers and lakes.¹¹⁹

Subsistence plays a key role for several communities within the Study Area. Specifically, subsistence use and harvest of fish, birds, mammals, wood, berries, and other wild plants is widely practiced in the communities of Tyonek and Beluga. Between 2005 and 2006, 217 pounds of 9 different subsistence resources were acquired per person by residents of Tyonek and 204 pounds of 15 different subsistence resources were acquired per person in Beluga. Ninety-six percent of Tyonek households used wild resources during that time period and 100 percent of Beluga residents attempted subsistence harvest.

The primary subsistence resource for both communities is salmon, which is acquired during the summer months. Secondary resources include large land mammals such as moose, and non-salmon fish such as rainbow trout, eulachon, and Dolly Varden. Migratory birds are also hunted by both communities. Both communities also harvest small game animals such as beavers, porcupines, and snowshoe hares.

Residents of both communities have previously expressed concern about the potential impacts associated with an increased population of the area and the resulting competition for subsistence resources. Increasing access has the potential to strain these resources.

-Harvest and uses of wild resources in Tyonek and Beluga, Alaska, 2005-2006, Technical Paper No. 321
(ADF&G-Division of Subsistence, Juneau: 2007)

Recreation opportunities by geographic location. Several locations within the Study Area draw a concentrated number of recreational users, including the Petersville Road vicinity, as well as other regions delineated and described in DNR's 1985 *Susitna Area Plan* and August 2011 *Susitna Matanuska Area Plan*. These include: Sunflower region, Susitna Lowlands region, Mt. Susitna region, Beluga region, and the Alaska Range region. Each of these sub-regions addresses recreation opportunities as described in the following paragraphs.

- **Petersville Road vicinity.** Petersville Road is located in the northeastern portion of the Study Area. A popular hunting destination, this area is also used for snowmachining, dog mushing, cross-country skiing, boating, and fishing. Hunting and fishing opportunities

¹¹⁷ DNR. June 17, 2013. Personal communication with Ed Fogels, DNR Deputy Commissioner.

¹¹⁸ ADF&G-Division of Wildlife Conservation. October 2, 2013. Comments provided during a review of a draft of this report.

¹¹⁹ ADF&G-Division of Wildlife Conservation. October 2, 2013. Comments provided during a review of a draft of this report.

abound, with the Petersville Road area being one of the most heavily used moose hunting locations in the Susitna Basin.

- **Sunflower Region.** The Sunflower Region is located in the northern portion of the Study Area. The area is popular for moose hunting. Improved public access and habitat enhancement have been encouraged in this area to promote big-game (moose, black bear, and brown bear) hunting and salmon fishing. Mining areas provide the most-populated hunting locations due to their provision of airstrips and roads. The Sunflower Region also encompasses the headwaters of numerous major anadromous streams, such as Lake Creek, Peters Creek, Yentna River, and Kahiltna River. Lake Creek has been designated as a State Recreation River. According to the 1991 *Susitna Basin Recreational Rivers Management Plan*, the scenic qualities of Lake Creek are perhaps the highest of all the Recreation Rivers. Other recreational opportunities, in addition to hunting and fishing, include rafting on Lake Creek; and hiking, skiing, snow machining, and berry picking in the Peters Hills and Fairview Mountains. There are two major trail systems in the sub-area, both of which are heavily used by ATVs accessing hunting grounds: one originating 5 miles north of Petersville, and the other at the junction of Petersville Road and Petersville Creek.
- **Susitna Lowlands Region.** The Susitna Lowlands Region is located in the southeastern portion of the Study Area. Most of the lowlands are not easily accessible. The sub-area, primarily reached by air or trail, contains no year-round roads. Primary trails include: 60 miles of the Iditarod Trail; a winter trail that runs south from Oilwell Road and connects with the Iditarod Trail; and a 30-mile winter tractor trail originating from the Parks Highway near Trapper Creek and heading south to the Delta Island area. Despite their inaccessibility, the Lake Creek, Kroto Creek, and Alexander Creek corridors are often utilized for floating and canoeing. Alexander Lake is known for its pike fishing.
- **Mt. Susitna Region.** The Mt. Susitna Region is located in the southwestern portion of the Study Area. This region contains one of the best-known waterfowl hunting areas in the State, located near the western half of the Susitna Game Flats. The Talachulitna River, designated as a State Recreation River, is considered one of the best fishing streams in Alaska. Peaks in recreation and fishing activity correspond with the king and coho salmon runs on the Talachulitna River. The more popular fishing areas are the mouth, tributary junctions, the confluence with Talachulitna Creek, and the outlet of Judd Lake. The northern portion of the area is also a popular hunting spot. Public recreation tends to be focused around Mt. Susitna, on the Alexander and Susitna rivers, and within the Talachulitna River and Creek corridors. There are a number of lodges on the Talachulitna River and some private cabins around Judd Lake.¹²⁰
- **Beluga Region.** The Beluga Region, located at the southernmost portion of the Study Area, is considered an important moose harvest area for local residents and fly-in hunters. Past discussions indicate there may be an interest in improving public access to promote additional hunting and control the local moose population. Fishing and trapping are also popular in the area. Important salmon streams in the area include the Chuitna, Nicolai, and Beluga rivers.
- **Alaska Range Region.** The Alaska Range Region is located in the western portion of the Study Area. Hunting and fishing are the two primary forms of recreation in the Alaska

¹²⁰ 2011 *Susitna Matanuska Area Plan*

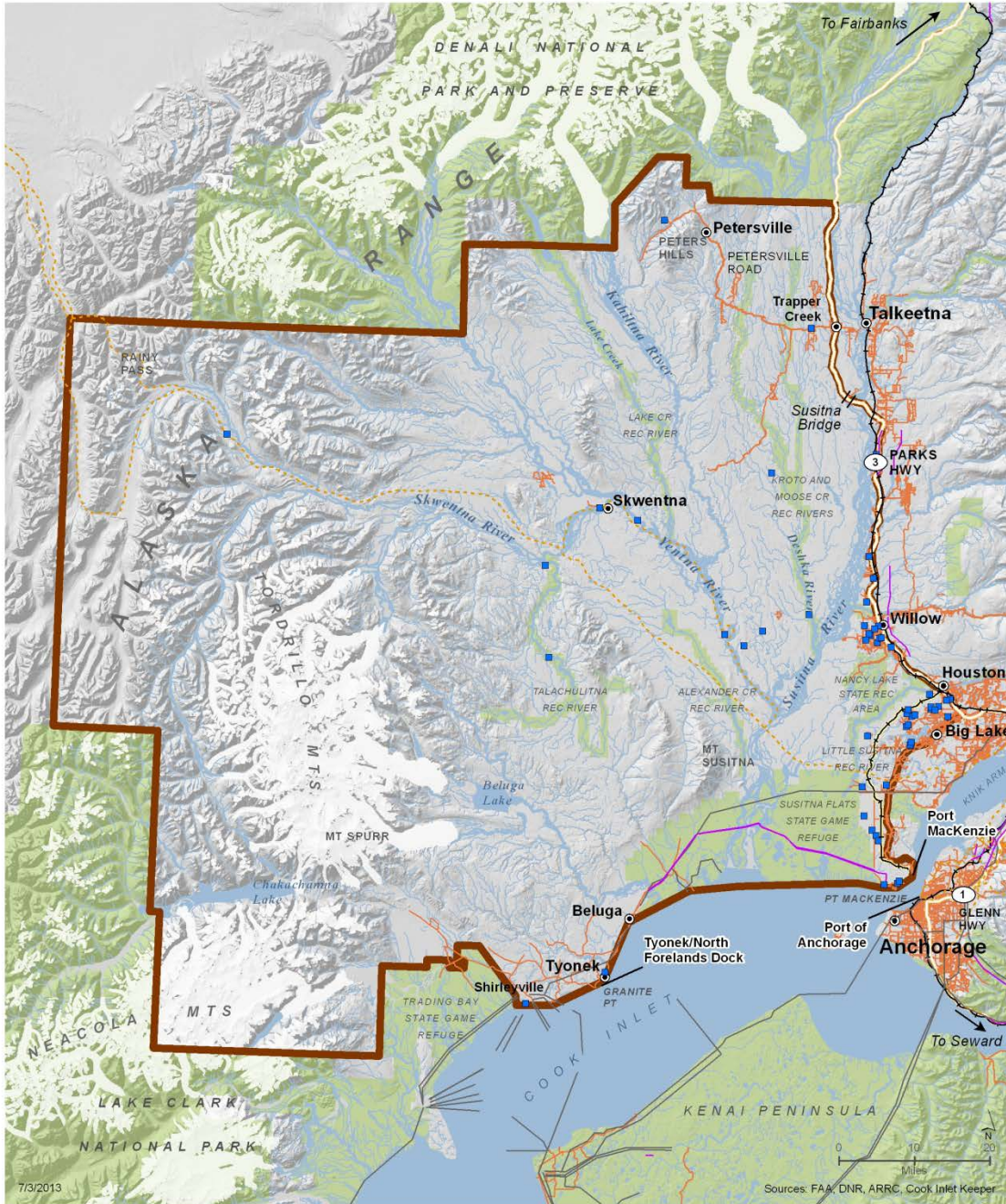
Range sub-area. Moose, sheep, caribou, and black and brown bear are all hunted in the area. Anadromous fish streams, such as the Kichatna River, the Skwentna River, the Happy River, and their tributaries, produce salmon for the Cook Inlet fisheries. In addition to fishing and hunting, the Iditarod Trail traverses the sub-area, and flight trips are often taken to view the Alaska Range.

3 INFRASTRUCTURE INVENTORY

Largely remote, the Study Area is relatively absent of developed transportation and energy infrastructure as shown on Figure 3-1. While the Parks Highway traverses the eastern border of the Study Area, there are no formal road systems that provide year-round access to the areas west of the Susitna River. Year-round access to the area is provided primarily via air. There is a fairly extensive network of winter routes that provide access into the Study Area by snowmachines. Rivers provide both a source of recreation as well as a transportation corridor.

The lack of transportation infrastructure also extends to energy transmission within the Study Area. Although the State's largest power generation facility, Beluga Power Plant, is located in the southern portion of the Study Area, most of the energy is transmitted out of the Study Area. As a result, there are few pipelines and transmission networks present north of the Cook Inlet shore within the Study Area. Despite lacking a highly developed infrastructure network, the Study Area does provide the necessary baseline infrastructure to support extension and expansion of these networks. An inventory of the existing infrastructure is detailed in this section.

Figure 3-1. Existing Infrastructure



Existing Infrastructure

West Susitna Access to Resource Development

- | | | | |
|-------------------------------------|----------------|-------------------------------|----------------|
| Airport, Heliport, or Seaplane Base | Iditarod NHT | Existing Rail | Study Area |
| Transmission Line | Highway | Port MacKenzie Rail Extension | Park or Refuge |
| Pipeline | Secondary Road | | |

3.1 Transportation Infrastructure

This section presents the existing transportation infrastructure, briefly describing the roadways, airports, railroads, and ports that service the Study Area.

3.1.1 Roadways

The existing transportation infrastructure within the Study Area is primarily concentrated in the eastern boundary connecting to the Parks Highway infrastructure and related community development of Big Lake, Knik-Goose Bay, and Willow, or in the Petersville region in the northeastern portion of the Study Area.

Considering the size of the Study Area, very few roads exist. Existing road networks tend to be concentrated in areas already more-heavily populated or that support power generation and transmission. A query of the MSB roads Geographic Information System (GIS) database shows there are approximately 400 miles of roads within the Study Area. The MSB roads GIS database contains a classification of each road type. Based on this classification, a summary of approximate length of roads by road type are as follows: 44 miles of highway (Parks Highway), 45 miles of major roads, 30 miles of medium roads, 268 miles of minor roads, and 20 miles of primitive roads. Excluded from this summary, but present within the GIS database, are the approximately 70 miles of private and unconstructed roads. Additional spatial data for roads obtained from the DNR shows a network of secondary roads within the Beluga/Tyonek area in the southern portion of the Study Area, as well as in the Skwentna vicinity.

Parks Highway. The Parks Highway is part of the National Highway System and Interstate Highway system and is the most heavily-used roadway within the Study Area. Running in a north-south direction along the Study Area's eastern boundary, it parallels much of the Alaska Railroad. The Parks Highway provides access to the nearby communities of Talkeetna, Willow, and Houston, and Wasilla with Anchorage and Fairbanks. It is the main thoroughfare in the Mat-Su Valley. As a result, the Parks Highway serves as the primary road from which other smaller roads propagate into the Study Area.

West of Big Lake/Point MacKenzie. Approximately 40 percent¹²¹ of the roads within the Study Area lie in the region south of Houston, west of Big Lake, and north of Cook Inlet. This includes the following two major roads within the Study Area: Point MacKenzie Road and Big Lake Road. Much of the existing road infrastructure in this area spills over from the communities of Big Lake and Houston, or was constructed to provide access to Point MacKenzie.

West side of Cook Inlet: Beluga/Tyonek. Road infrastructure in Beluga and Tyonek is fairly limited. There are approximately 132 miles of roads in the vicinity, which are generally primitive or unpaved. These roads do not connect to any other road system in the state, and many of them were constructed to access oil and gas exploration areas. The Tyonek road system, comprised of only gravel roads, does tie into the Beluga/Lewis River road system; however, this connects to the limited road network associated with the Granite Point area.¹²² In the area abutting the northern shore of Cook Inlet, almost all of the bridges are owned and maintained by the State.¹²³ The bridge across the Chuit River washed away in a flood as recently as 2012, and a temporary bridge was required.

¹²¹ Excludes the Parks Highway and also the approximate 70 miles of private and unconstructed roads.

¹²² CH2MHILL. 2013. *Cook Inlet Facility Assessment*. Prepared for Kenai Peninsula Economic Development District.

¹²³ CH2MHILL. 2013. *Cook Inlet Facility Assessment*. Prepared for Kenai Peninsula Economic Development District.

Petersville vicinity. Approximately 28 percent¹²⁴ of the roadways are located within the Petersville/Trapper Creek area, including the 37-mile-long Petersville Road. The presence of roads in this area can be directly attributed to gold mining operations in the early 20th century.¹²⁵ With a decline of the gold mining industry, portions of the roads deteriorated and may now be impassable. The Petersville Road is such an example. The majority of the roads in this location are categorized as minor, primitive, or not constructed. However, the State recently set aside an area for recreational gold mining called the Petersville State Recreation Mining Areas. Improvements to the road network may be considered or implemented as part of the Petersville Recreation Mining Area planning process (per AS 41.23.630).¹²⁶

3.1.2 Aviation Access

Within the Study Area, there are a wide variety of landing strip types and sizes, ranging from small, privately-owned, dirt airstrips to large waterbodies designated for floatplane landings for the public.

There are 61 Federal Aviation Administration (FAA)-identified landing locations within the Study Area. Of these locations, the majority are on land, with 23 percent being located on a waterbody. While waterbody landing locations are typically publicly accessible, private landing strips are more prevalent, comprising 75 percent of the total landing sites in the Study Area (see Table 3-1).

In terms of public access on waterbodies, aircraft use of a lake or river deems it navigable. However, shorelines of the waterbody can be controlled by a private entity. This means that while any aircraft can use the water, they cannot touch the shore without the landowner’s permission. Some shore owners have filed with the FAA that they own the water landing area because they own a dock. This is why some of the water landing areas identified in Table 3-1 are actually shown as private.

In addition to the FAA-identified landing locations, there is an abundance of unregistered airstrips located within the Study Area. For instance, a quick glance of aerial images of the Study Area revealed 11 airstrips that were not documented on the FAA Master List: 7 near the Kahiltna River west of the Petersville area, 3 along the Yenta River, and 1 near the Deshka River. These likely represent just a few of many undocumented airstrips that exist in the Study Area and are likely used by private parties for recreational access or to access private property or cabins.

Table 3-1. FAA-Identified Airstrips and Helicopter Landing Locations in the Study Area

Name	Private/Public ¹	Dimensions (in feet)	Surface (and condition when applicable)
Beluga	Private	5,002 X 100	Gravel-good
Beluga	Private	40 X 40	Gravel
Nikolai Creek	Private	4,100 X 75	Gravel
Tyonek	Private	3,000 x 90	Gravel
Rainy Pass	Public	2,100 x 25	Dirt-poor

¹²⁴ Excludes the Parks Highway and also the approximate 70 miles of private and unconstructed roads.

¹²⁵ Bureau of Public Roads. August 1959. *A Description of Proposed Road Routes in Alaska: Talkeetna-McGrath-Ruby*. Compiled and written by Rose Komatsubara and William DeArmond, under the direction of Elmer Biggs, Acting Planning and Research Engineer. Page 21.

¹²⁶ DNR-Office of Project Management and Permitting (OPMP). October 8, 2013. Comments provided during a review of a draft of this report.

Name	Private/Public ¹	Dimensions (in feet)	Surface (and condition when applicable)
Carpentiers Strip	Private	1,200 x 30	Gravel
Falcon Lake Strip	Private	2,000 x 30	Gravel
MacKenzie Country Airpark	Private	1,650 x 85	Turf
Point Mac	Private	3,000 x 30	Gravel
Point MacKenzie	Public	30 x 30	Turf
Robin's Landing	Private	2,500 x 40	Gravel
Sleepers Strip	Private	1,600 x 60	Gravel
Turinsky Airstrip	Private	2,000 x 120	Gravel
Nancy Lake	Public	6,000 x 60	Water
Beaver Lake	Public	5,000 X 400	Water
Big Lake	Public	2,435 x 70	Gravel-good
Brockler Lake	Public	1,200 x 100	Water
Brown's Homestead	Private	1,100 x 58	Turf
Cowell's	Private	20 x 20	Wood
Cubdivision	Private	1,200 x 100	Gravel
Fisher	Private	1,200 x 80	Gravel
H&H Field	Private	675 x 30	Gravel
Hoppe's	Private	1,150 x 200	Water
Horseshoe Lake	Private	5,500 x 200	Water
Jones Landing	Public	1,267 x 75	Water
Kramer	Private	850 x 70	Turf-Gravel
Kucera	Private	5,000 x 200	Water
Kucera Residence	Private	1,200 x 25	Gravel
Marion	Private	3,400 x 200	Water
Owen Field	Private	1,300 x 75	Turf
Saddleback Island	Private	50 x 50	Mats
Team Levine	Private	50 x 50	Concrete
Twin Lake	Private	1,000 x 80	Turf
West Beaver	Private	1,300 x 60	Turf
West Beaver	Private	3,800 x 500	Water
Farewell	Public	4,600 x 30	Gravel -Dirt-poor
Farewell Lake	Public	5,000 x 500	Water
Tin Creek	Public	2,000 x 12	Gravel-Poor
Goose Bay	Public	3,000 x 75	Gravel-Good
River John	Private	1,850 x 50	Dirt
Skwentna	Public	3,400 x 75	Gravel-Good
Talachulitna River	Private	1,800 x 50	Gravel
Talaheim	Private	950 x 35	Dirt
Little Susitna	Private	2,600 x 50	Dirt
C.T.S.	Private	1,300 x 200	Turf
Ernies Airstrip	Private	1,875 x 70	Turf-Gravel
HoneyBee Lake Aero Park	Private	2,000 x 30	Gravel
Jewell	Private	1,950 x 150	Turf
Kashwitna Lake	Private	4,000 x 500	Water

Name	Private/Public ¹	Dimensions (in feet)	Surface (and condition when applicable)
Laub	Private	1,080 x 100	Turf
Long Lake	Private	5,000 x 600	Water
Long Lake	Private	1,800 x 40	Gravel
Minuteman Lake	Public	1,500 x 50	Water
Minuteman Strip	Private	1,200 x 40	Gravel
Rustic Wilderness	Private	2,200 x 45	Gravel
Shirley Lake	Private	1,800 x 30	Turf
Skid Marks	Private	1,400 x 100	Dirt
Thomas Strip	Private	1,650 x 30	Gravel
Willow	Public	4,400 x 75	Gravel-Good
Willow SPB	Public	3,600 x 400	Water
Yentna Bend Strip	Private	1,000 x 150	Turf-Dirt

¹ Lakes are public and managed by DNR; however, docks are private and connected to private properties along the lakes. This applies to all private lake listings.

Source: Airport IQ 5010: Airport Master Records and Reports. FAA Aeronautical Information Services. Accessed May 2, 2013.

Airships.¹²⁷ While not a part of the existing transportation infrastructure, it bears mentioning that in recent years the DOT&PF and resource-development industry stakeholders have expressed interest in the potential use of airships for transporting large and heavy supplies, fuel, equipment, and other materials in and out of remote areas. Airships, large lighter-than-air aircraft, are currently under development in a half dozen countries and are expected to be on the market within five years. They are capable of carrying heavy cargo (tens of tons). Though it canceled its trip, the Florida-based Skyship Services Inc. was planning to bring its 200-foot Skyship 600 blimp to Alaska during summer 2013 to demonstrate its capabilities. The use of airships is a possible consideration for moving heavy loads to mining sites and moving concentrates from the mines.

3.1.3 Railroads

The Alaska Railroad travels along the eastern boundary of the Study Area. Heading north out of Seward towards Fairbanks, the railroad parallels the Parks Highway until it diverges slightly to the east of the highway 12 miles south of Talkeetna. Three depots are located near the Study Area, in Anchorage, Wasilla, and Talkeetna. Construction is currently underway for the Port MacKenzie rail extension, which includes approximately 32 miles of new rail line that will connect Port MacKenzie the Alaska Railroad System and the interior rail corridor to Port MacKenzie on Cook Inlet. The rail line would travel north from the port facility at Port MacKenzie and connect to the existing rail system just south of Houston, providing additional rail infrastructure within the Study Area. Construction began in 2012, and three segments are currently under construction. Depending on funding, the new rail extension is expected to be completed by 2016 or 2017. This may help support the goal of the 2010 Point MacKenzie Comprehensive Plan to promote development of a rail siding at the end of Holstein Road in order to support local agriculture.

¹²⁷ Cargo Airships for Northern Operations website. Available at <http://event.arc.nasa.gov/airships/> (accessed May 2013)

3.1.4 Port Facilities

The Cook Inlet basin contains many on- and off-shore oil and gas deposits, as well as coal deposits. The development, production, and/or exploration of such resources have necessitated marine infrastructure and facilities. Two notable existing docks in the Study Area are Port MacKenzie and Tyonek/North Forelands Dock. Other barge landing areas exist near Beluga/Tyonek.

Port MacKenzie. Port Mackenzie is located at the head of Cook Inlet along Knik Arm across from Anchorage and is considered a deep draft port.¹²⁸ The facility includes a 14.7-acre barge dock, a 1,200-foot-long deep-draft dock, and 14 square miles of adjacent lands available for lease. The deep-draft dock is equipped with a conveyor system capable of loading bulk commodities such as wood chips or coal. Rail infrastructure improvements in the area include the Port MacKenzie rail extension project, which is currently under construction and will bring rail service to these dock facilities. The *Port MacKenzie Master Plan Update*¹²⁹, as adopted in February 2011, states the goal for future port operations is to include bulk natural resources and other cargo movement of coal, petroleum products, oil and gas field modules, natural gas pipeline construction materials, forest products, limestone products, and other minerals. The 2013 KPED report cites this facility as having limited use to oil and gas exploration and production activities in Cook Inlet because there is no road connecting the facility to the lease areas on the west side of Cook Inlet.

North Foreland Facility Dock at Tyonek. The North Foreland Facility is located on the west side of Cook Inlet near Tyonek and is considered a light draft port.¹³⁰ The facility consists of a T-shaped dock that extends 1,500 feet from shore.¹³¹

Barge facilities near Beluga/Tyonek. A 2013 Cook Inlet Infrastructure Report prepared for the KPED states that most of the bulk cargo and heavy equipment used by residents and industry on the west side of Cook Inlet is shuttled by barge and offloaded at one of four barge-landing areas in the Beluga/Tyonek vicinity. The report cites the following four barge landing locations, three of which are located within the Study Area:

- The Ladd Landing site is located north of the mouth of the Chuitna River, between Beluga and Tyonek. This landing has been used extensively by Chugach Electric Association (CEA) to supply the Beluga power plant; by operators of the natural gas fields, coal, and other mineral exploration efforts; and by residents of Beluga.
- The City of Tyonek also has a barge landing site, which is used for unloading bulk cargo, equipment, and fuel.
- A third barge landing site, located 1 mile west of Granite Point, between Shirleyville and the Granite Point Pump Station, is a privately owned facility that supports the oil and gas industry, fishing, mining, and recreational use.
- A fourth barge landing site is located south and outside of the Study Area at the mouth of the Drift River and directly west of the City of Kenai. It is used primarily to support oil tanker operations at the Drift River Terminal.

¹²⁸ Cape International, Inc. and Nuka Research and Planning Group, LLC. January 2012. *Cook Inlet Vessel Traffic Study*.

¹²⁹ MSB. Adopted 2011. *Port MacKenzie Master Plan Update*. http://matsugov.us/docman/doc_view/3226-port-mackenzie-master-plan-updatefinal?tmpl=component&format=raw.

¹³⁰ Cape International, Inc. and Nuka Research and Planning Group, LLC. January 2012. *Cook Inlet Vessel Traffic Study*.

¹³¹ CH2MHILL. 2013. *Cook Inlet Facility Assessment*. Prepared for Kenai Peninsula Economic Development District.

3.1.5 Other Proposed Transportation Infrastructure

The Knik Arm Bridge and Toll Authority (KABATA) is proposing the Knik Arm Crossing project, which consists of a proposed 1.74-mile toll bridge across Cook Inlet's Knik Arm to provide another surface transportation link between Anchorage and the MSB. In addition to the new bridge, the project would require 18 miles of supporting roads be constructed to integrate into the existing transportation infrastructure. Supporting roads located within the MSB would include a "Mat-Su approach" called the "Northern Access route." This route begins at MP 9.5 of the Point MacKenzie Road, where an intersection would be developed at the northwestern entrance to the Port MacKenzie District.¹³² From this intersection, a new controlled access, two-lane, 3.5-mile long alignment would be constructed. The new alignment would head north of Lake Lorraine and continue east toward the Knik Arm bluff. The route would terminate on the eastern side of the Port MacKenzie District at a location approximately 7,200 feet north of Port MacKenzie Dock and 1,500 feet south of Anderson Dock. At this location, a toll plaza and multiuse facility for road maintenance equipment would be constructed and controlled access would be provided to and from Port MacKenzie and Anderson Dock. During Phase 2 of construction, this route would be upgraded to a four-lane divided highway (with two travel lanes in each direction) and would include frontage roads and a pedestrian pathway.

The Final FEIS¹³³ for the project was published in the Federal Register in January 2008. A Record of Decision (ROD) was then signed by FHWA in December 2010. Since the ROD was signed, KABATA has submitted a number of permit applications to move the project forward.

3.2 Energy Infrastructure

The Study Area has very little energy infrastructure, particularly in areas not connected to the road system. However, the State's largest power generation facility, the Beluga power plant, is located on the west side of Cook Inlet within the Study Area and provides significant transmission infrastructure to the rest of the power transmission grid in Southcentral Alaska. This section includes existing and proposed energy infrastructure, related to natural gas facilities and pipelines servicing the nearby populated areas of Southcentral Alaska.

3.2.1 Pipelines

ENSTAR is the primary natural gas service provider to the MOA and MSB region. ENSTAR transports natural gas from the Beluga gas fields east to these regions with a 20-inch pipeline. Numerous gas fields near Beluga are connected by pipeline as well, including Nicolai Creek, Lone Creek, Pretty Creek, Lewis River, and Stump Lake.

3.2.2 Fuel Storage Facilities

The Granite Point Tank Farm near Tyonek consists of four storage facilities.¹³⁴ The capacities of these four storage facilities are 3,000 barrels (bbls), 10,000 bbls, 30,000 bbls, and 55,200 bbls. A 5-million-gallon bulk fuel storage plant is planned for construction at Port MacKenzie as part of their

¹³² KABATA website. Available at: <http://knikarmbridge.com/> (accessed December 2013)

¹³³ Final EIS summary document. Available at: <http://www.knikarmbridge.com/FEIS%20CD%202/FEIS/FEIS%20Summary/FEIS%20Summary-ALL.pdf> (accessed December 2013)

¹³⁴ ADEC Spill Prevention and Response webpage. www.dec.alaska.gov/spar/perp/cookinletpor/documents/070210cipporrisklayers.pdf.

upgrades and improvement projects.¹³⁵ The Port of Anchorage, located outside the Study Area, has the largest capacity in Southcentral Alaska and is able to store up to 23 million gallons.¹³⁶

3.2.3 Power Generation Facilities and Electrical Distribution

Chugach Electric Association (CEA) is an electric utility that generates, transmits, and distributes electricity to retail and wholesale customers in Southcentral Alaska. Of its five power plants, the Beluga Power Plant, which generates 385 megawatts,¹³⁷ is the only one located within the Study Area. Seven of the units at the Beluga Power Plant are powered by natural gas, and one by a steam turbine. In its system, the majority of the kilowatt-hours that CEA generates come from natural gas units (92 percent), with 8 percent from hydroelectric resources.

Power generation continues to grow in Southcentral Alaska, with the most recent expansion coming online in early 2013. In conjunction with the MOA-ML&P, CEA brought online a new 183-MW natural gas-fired plant located in Anchorage as part of the Southcentral Power Project.¹³⁸ This facility has three gas turbine-generators and one steam turbine-generator.

The Matanuska Electric Association (MEA) is currently in the planning, design, and procurement stage for a new 171-MW natural gas-/diesel-fired plant at Eklutna (located outside of the Study Area). This is scheduled to begin operation as early as 2015.¹³⁹ New facilities may also be added to the Cook Inlet infrastructure, depending on the locations of new gas discoveries and the potential routing of a North Slope gas pipeline.¹⁴⁰ According to the 2013 *Cook Inlet Facility Assessment* report, such infrastructure would include a facility that would convert gas to LNG for export and associated terminal and docking facilities.

A major transmission line originates at the Beluga Power Plant near Tyonek and reaches a bulk substation near Port MacKenzie. CEA sells some of the energy from these lines to the MEA, which is the primary electric service provider in the Mat-Su area. CEA is partnered with four other electric associations in Southcentral Alaska that makes up the Alaska Railbelt Transmission and Electric Company (ARTEC).¹⁴¹

3.2.4 Other Proposed Energy Infrastructure Sources or Needs

Most of the following energy infrastructure projects have been proposed but have not been implemented in the Study Area. Although it is unlikely that all of these projects will be adopted and acted on, they are worth noting in terms of interest and previous studies. These proposals are still in the preliminary review stage, so locations and design specifications are subject to change.

Other Proposed Energy Infrastructure Sources affecting the Study Area

Natural gas has been the Cook Inlet region's primary energy source, though its availability has steadily declined in recent years. A number of alternative energy resources have been considered over the years as possible means to meet the region's existing power needs and to support other

¹³⁵ Cape International, Inc. and Nuka Research and Planning Group, LLC. January 2012. *Cook Inlet Vessel Traffic Study*.

¹³⁶ Northern Economics Inc. April 2008. *Port of Anchorage Transportation Cost Comparison Study*.
<http://www.muni.org/Departments/port/TIGERIIBCA/2%20Cost%20Comparison%20Study.pdf>

¹³⁷ CEA Facilities webpage: www.chugachelectric.com/inside-chugach/the-company/facilities.

¹³⁸ CEA Projects webpage: www.chugachelectric.com/inside-chugach/projects/southcentral-power-project

¹³⁹ CH2MHILL. 2013. *Cook Inlet Facility Assessment*. Prepared for Kenai Peninsula Economic Development District.

¹⁴⁰ Ibid.

¹⁴¹ Five utilities who from the Kenai Peninsula to Fairbanks collectively deal with Railbelt energy needs and challenges.

proposed projects that would require power. Some of the proposed alternative energy sources or projects are located within or near the Study Area; the ones briefly mentioned below include geothermal, hydropower, wind power or other natural gas resources.

Geothermal. Geothermal potential occurs within the Study Area near Mt. Spurr. In early 2013, geothermal leases on Mt. Spurr were renewed. The extent of project development is only exploration at this time.

Hydropower. No major, existing hydropower operations are located within the Study Area. However, the potential Susitna-Watana Hydro Project, if developed, would be partially situated in the Study Area. Presently, plans include construction of a dam on the Susitna River (upstream and outside of the Study Area), reservoir, and related facilities on the Susitna River. As part of the project, transmission lines would also be constructed that would connect the dam to the existing Railbelt transmission system. The project is expected to have an installed capacity of 600 MW, an annual energy production of 2,800,000 MWh, and a project life of more than 100 years.¹⁴² It is anticipated that a license application will be filed for the project by the end of 2015.

The Chakachamna hydroelectric project was a previously-considered project within the Study Area. However, this project is no longer under consideration as the State's preferred hydroelectric project. Focus has shifted to the Susitna-Watana Hydro Project.

Wind Power. Located near the Study Area in Cook Inlet, the Fire Island Wind project began operation in September 2012. It is expected to generate up to 17.6 MW of electricity for CEA in Anchorage. Within the Study Area, residents near Tyonek previously considered installing a wind turbine. According to AMHT, the Village of Tyonek is pursuing grant funding for possible wind energy projects.¹⁴³ These projects demonstrate the potential for wind power generation within the Cook Inlet area.

Other Natural Gas Resources. A number of proposed infrastructure projects intended to provide energy to Southcentral Alaska would, to some degree, potentially influence the infrastructure or power needs within the Study Area. The following projects are not directly located within the Study Area, but are worth mentioning as they may affect the demand for infrastructure within the Study Area:

- **Alaska Pipeline Project.** TransCanada and ExxonMobil began working together in 2009 to develop the Alaska Pipeline Project. The proposed pipeline project would connect Alaska's North Slope natural gas resources to new markets. The Alaska Gasline Inducement Act (AGIA) was enacted into law by the State of Alaska in May 2007, with the purpose of helping expedite the development of a natural gas pipeline. A competitive bid and review process occurred, and TransCanada was selected by the State in August 2008 as the exclusive recipient of the AGIA license.
- **Alaska Stand Alone Gas Pipeline.** The Alaska Stand Alone Gas Pipeline project, being proposed by the State of Alaska, would construct a 24-inch diameter, high-pressure natural gas pipeline from Alaska's North Slope to Cook Inlet. The proposed project would construct a 737-mile pipeline that would tie into the existing ENSTAR pipeline

¹⁴² AEA. Susitna-Watana Hydro. Project Description. Available at www.susitna-watanahydro.org/project/project-description/ (accessed March 2013).

¹⁴³ Alaska Mental Health Trust, Trust Land Office. March 15, 2013. Personal communication with Rick Fredericksen, AMHT Energy and Minerals Senior Manager.

infrastructure and include a Cook Inlet Natural Gas Liquid Extraction Plant. North Slope natural gas would be transported to in-state Alaska markets and be accessed from off-take points for the Fairbanks Area and other locations along the route. The USACE was the lead federal agency. The Final EIS was made available for public review at the end of 2012.

- **Gas to Liquids.** Alaska Natural Resources to Liquids, LLC was one of several “gas-to-liquids” proposals that would convert North Slope natural gas to liquid hydrocarbon fuels (e.g., diesel and gasoline) and then transport them via a new pipeline or through the existing Trans Alaska Pipeline System to Valdez.

Other Proposed Energy Infrastructure Needs affecting the Study Area

Other private entities have proposed to construct additional pipeline infrastructure and connect to the energy network within the Study Area. Proposed projects include:

- The Donlin Gold Project, as currently proposed, would require a 14-inch pipeline to be constructed to transport natural gas from the existing 20-inch natural gas pipeline near Beluga, through the Study Area, to the proposed mine site located approximately 313 miles away, west of the Alaska Range. The proposed Donlin pipeline would cross the Alaska Range north of Rainy Pass and westward beyond the Study Area to terminate at the mine site.
- Another project is proposed by Aurora Gas as part of their 2013 drilling program. As proposed, a new 4-inch pipeline would be constructed approximately 10 miles south of Tyonek and one mile from Shirleyville Camp to connect the newly-drilled Nicolai Creek #13 well to the existing Nicolai Creek #1, 2, and 9 production facilities. In addition to the pipeline, a new access road, pad, and pad facilities would also be constructed, providing additional infrastructure to the area.

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4 ALTERNATIVES DEVELOPMENT

The objective of this study is to identify possible routes to connect to areas of resources (mineral, timber, oil, gas, etc.) identified in the Alaska Range and its southeast foothills, as presented earlier in this document. This section discusses the methodology used to develop the corridor segments, alignments, and proposed access routes.

The scope of this study addressed only a hard surface road access option. Rail access could be another option but was not considered or evaluated as part of this study at this time.

4.1 Corridor Development Methodology

Alternatives development for this study occurred in a six-step process:

1. Inventory resource opportunities for access in the Study Area
2. Consider previously identified alignments or corridors
3. Identify Susitna River crossing location(s)
4. Identify environmental constraints and opportunities
5. Identify broad preliminary corridor opportunities and refine alignment centerlines
6. Evaluate proposed access routes for strengths and weaknesses

- Step 1. Inventory resource opportunities in the Study Area

The project team reviewed existing literature and conducted interviews to determine the location of resource opportunities (and constraints) for a potential access road into the Susitna Basin. The result of this process is the identification of possible logical termini – the origin and destination for the proposed corridors. At the outset of the study, the beginning point was the Parks Highway system; however, as the study progressed, other possible origin locations were identified, which included the Beluga/Tyonek region, the Alaska railroad, or Port MacKenzie. The other possible termini for surface transportation access were the identified resource opportunities, most specifically the mineral deposits generally located either southeast of Rainy Pass or in the Beluga/Tyonek region. The subsequent corridors between these termini provide access to additional resource opportunities (e.g., timber, agriculture, recreation, etc.). The objective of providing access is not to connect to any one particular resource deposit, but to provide access to an area where multiple resources could be accessed by a transportation system. Resource opportunities are described in the resource inventory, Section 2.

- Step 2. Consider previously identified alignments or corridors

Several access corridors into or through the Susitna Basin have been previously identified by a number of agencies over the past 50 years. Information was gleaned from these reports, and the previously identified routes were considered in determining the location for access corridors as part of this current study.

- Step 3. Identify Susitna River crossing location(s)

There are very few locations where the Susitna River can be reasonably crossed, based on a number of factors including river stability, required crossing length, and approach topography. Once the crossing location(s) of the Susitna River were identified, the corridors were routed to connect to these crossing locations.

- Step 4. Identify environmental constraints and opportunities

The team identified environmental opportunities and constraints for the location of an access road. Whereas opportunity identification helps to determine where the road could feasibly and reasonably be located, constraints identification helped to determine where placement of the road should be avoided from an engineering or permitting perspective. Constraints included natural barriers or factors such as topography, rivers, wetlands, and other features such as non-State lands (e.g., private lands).

- Step 5. Identify broad preliminary corridors and refine alignment centerlines

Broad preliminary corridors were identified based on the location of natural resources, constraints, and opportunities. Based on these broad corridors, alignment centerlines were refined and combined to create potential access routes for evaluation.

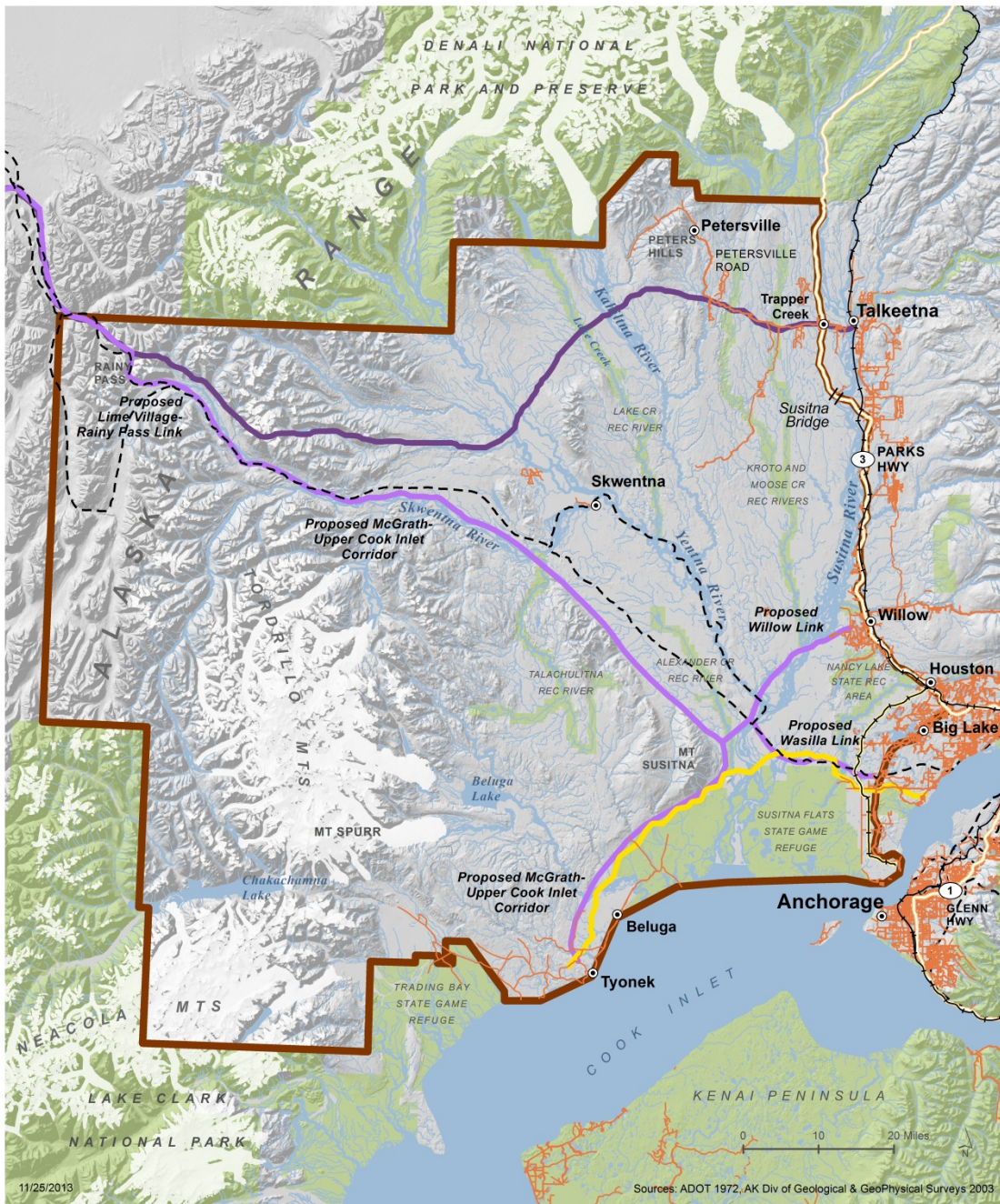
- Step 6. Evaluate proposed access routes for strengths and weaknesses

The project team evaluated the strengths (opportunities) and weaknesses (constraints) of the identified alignments.

4.2 Previously Identified Alignments in the Study Area

As data was collected and literature was reviewed during the resource inventory task, three previously identified alignments into the Study Area were discovered. These previously identified alignments are described briefly in this section and shown on Figure 4-1.

Figure 4-1. Previously Identified Alignments



Previously Identified Alignments

West Susitna Access to Resource Development

- | | | | | |
|--|----------------------------------|----------------|-------------------------------|----------------|
| Possible road routes (ADNR DGGS 1992) | National Historic Iditarod Trail | Highway | Existing Rail | Park or Refuge |
| Chitina River to Goose Bay Alignment (ADOT 1972) | Study Area | Secondary Road | Port MacKenzie Rail Extension | |
| Talkeetna-McGrath-Ruby Route (Bureau of Public Roads 1959) | | | | |

4.2.1 McGrath-Upper Cook Inlet Corridor, DNR-DGGS 1992

In 1992, the DNR-DGGS compiled a series of digital maps for the State depicting transportation corridors to areas with high resource potential and areas that required land links between critical locations. The corridors were identified by the State Pipeline Coordinators Office via a Corridor Selection Steering Committee. Many of the centerlines had been a part of their long-range planning documents for many years while some routes were identified at the time of the State's Land Selection project. These DGGS maps were compiled based on previously published and unpublished reports, and interpretations of aerial photographs and satellite imagery. Nearly 200 sources of technical information were used and nearly 400 geologic maps were produced through this corridor evaluation project. These maps were published and made available in 2003.¹⁴⁴

“Access to Alaska’s mineral lands is a strategic issue for the mineral industry and the state and federal governments. During previous campaigns undertaken by the state of Alaska to choose stateland entitlement lands, many potential access corridors were identified and linked in a conceptual long-range transportation grid. This grid is the basis for much of the state’s current transportation planning and is consulted when considering access to new mineral discoveries.”

- Survey of Geology, Geologic Materials, and Geologic Hazards in Proposed Access Corridors, Alaska. (DNR-DGGS 2003)

<http://137.229.113.112/webpubs/dggs/mp/text/mp129.pdf>

The DGGS maps depict 10-mile-wide corridors that straddle the centerlines of the proposed access routes. These routes were identified to connect strategically important centers of population, ports, pinch points, and resource-rich lands. The routes were identified based on favorable terrain and avoiding natural hazards so that available geologic-materials resources could also be selected.

Two geologic maps (in the Tyonek and Talkeetna quadrangles) depict DNR-DGGS corridors in the Study Area. These two corridors are:

- A proposed McGrath-Upper Cook Inlet Corridor that begins in the Beluga/Tyonek region and travels east of Mount Susitna before turning northwest and traveling through Rainy Pass to McGrath.
- A proposed Willow or Wasilla Link that connects to the McGrath-Upper Cook Inlet Corridor as an alternative to the Beluga/Tyonek termini.

4.2.2 Chuitna River to Goose Bay Corridor, Department of Highways 1972

The State of Alaska Department of Highways (the precursor to the Alaska DOT&PF) prepared a series of ROW maps dated May 1972 showing an alignment that goes west from Goose Bay across the Susitna River to the Beluga area. The DNR Alaska Division of Land (ADL) 575888 record indicates the Department of Highways had submitted an application in 1972 requesting a ROW corridor of 400 feet and 65 miles in length for the Chuitna River to Goose Bay project. The ADL record indicates that a number of land disposal activities have been recorded over the years for the subject lands, including land conveyances to Native corporations and several sections deleted from this ROW corridor as land was transferred. The case file was closed in 2008 and then reopened shortly thereafter. The application for the ROW corridor was never formally acted upon.

¹⁴⁴ DNR-DGGS. May 17, 2013. Personal communication with De Anne Stevens, DNR-DGGS Engineering Geology Section Chief.

As drawn on the 1972 maps, the alignment crosses approximately 61 sections. As of March 2013, 9 of those sections contain Mental Health Trust land, 16 contain Municipal Entitlement land, and one section had been conveyed per Alaska Native Claims Settlement Act (ANCSA). Based on communications with DNR in March 2013, approximately 43 percent of the corridor is not on state-patented or state-selected land.

4.2.3 Talkeetna-McGrath-Ruby Proposed Road Route, Bureau of Public Roads 1959

The Bureau of Public Roads prepared a report in 1959 depicting a proposed road route from Talkeetna to McGrath and Ruby. The alignment starts near Talkeetna and Petersville and travels through the Study Area and on through Rainy Pass. The document describes the existing conditions in 1959, the proposed transportation routes, and how construction of the proposed routes may aid in the development of the area's natural resources. At the time of the report, only the Alaska Railroad tracks were in place (as the Parks Highway had not yet been constructed).

4.3 Susitna River Crossing Location

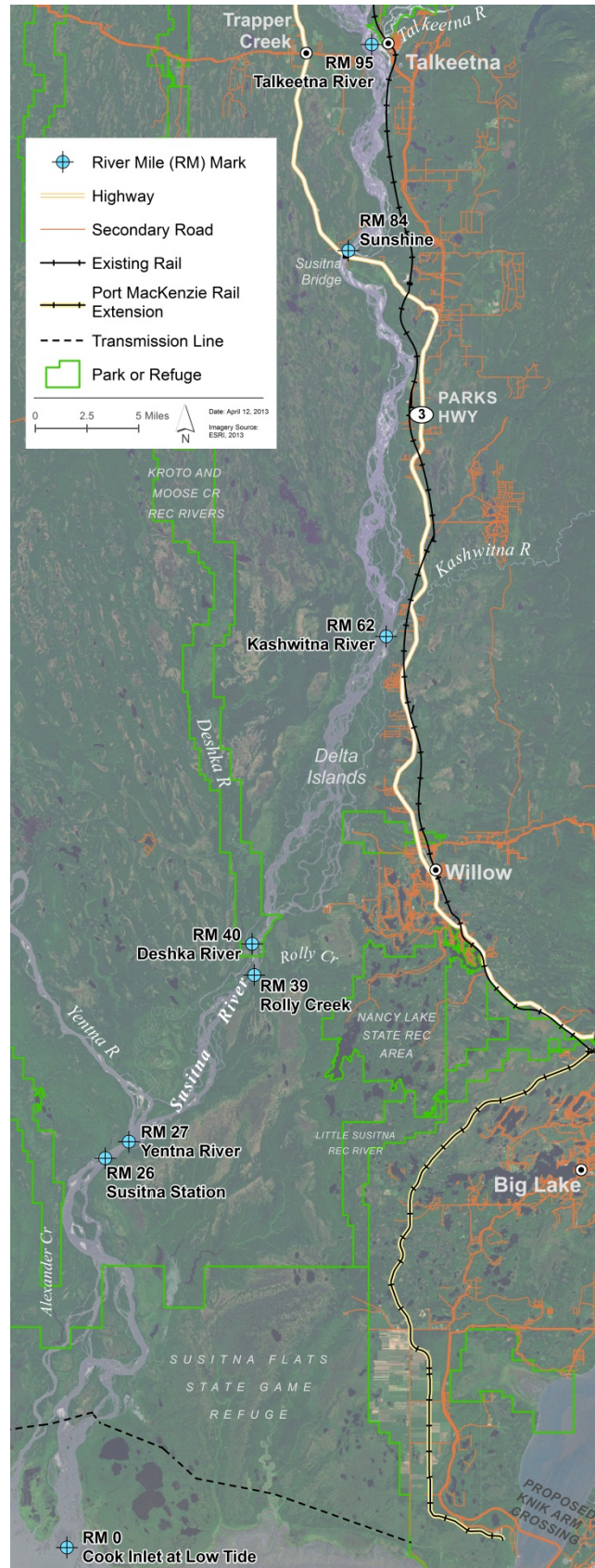
4.3.1 Introduction

The Susitna River originates in glaciers of the Alaska and Talkeetna Mountain ranges and flows about 320 miles in a southerly direction before entering northern Cook Inlet. The river is generally differentiated into the lower river and the upper river at the confluence of the Susitna River, Talkeetna River, and Chulitna River at Talkeetna. The only existing road crossing of the Lower Susitna River is the Parks Highway crossing at Sunshine, approximately 12 river miles downstream of Talkeetna.

A literature and aerial photograph review was completed to evaluate potential crossing locations of the lower Susitna River. The results of the review are described in this section. The river miles (RMs) referenced are based on river mapping, with RM 0 approximately at the confluence of the Susitna River and Cook Inlet at low tide and RM 95 in Talkeetna. For reference only, other notable RMs include the Kashwitna River (RM 62); Deshka River (RM 40); Rolly Creek (RM 39); Yentna River (RM 27); and Susitna Landing (RM 26) (also known as Susitna Station). Figure 4-2 depicts these locations. The project team assessed the entire lower Susitna River (RM 0 to RM 95) for potential crossings, as described in the following sections.

Numerous clear water tributaries enter the east side of the Lower Susitna River, and generally enter perpendicular to the river. In contrast, tributaries on the west side flow roughly parallel to the river and enter the main stem below Willow Creek. West side tributaries include the Deshka River, Lake and Alexander Creeks, and the Yentna River and its tributaries. Much of this west side drainage north of the Yentna River flows north to south.

Figure 4-2. Lower Susitna River Vicinity



4.3.2 Crossing Location Options and Analysis

Identifying where to cross the Susitna River is a key element in establishing the location and practicality of potential access corridors in the Study Area. Crossing width, approach topography, geotechnical aspects, stream hydrology, and bank stability are considerations to factor into determination of a crossing location.

The study team identified potential crossing locations and rated them as suitable, marginal, or unsuitable. A suitable location is defined as a location where the river is stable, the banks are high enough for abutments, and the crossing length is relatively short. Alternatively, an unsuitable location is anticipated to be unstable with low banks and a relatively long crossing length. A marginal location is rated somewhere in between. Only “suitable” locations were recommended for crossing locations at this preliminary level of evaluation.

Three possible locations were identified for crossing the Susitna River between Talkeetna and tidewater. Of the three locations, only two locations were determined to be suitable: (1) Sunshine at RM 84 and (2) Susitna Landing at RM 26. There is also a marginally suitable third location at the Deshka River (RM 40). These three locations are summarized in Table 4-1 and further described in the following section.

Table 4-1. Potential Susitna River Crossing Locations

Susitna River Mile (RM)	Crossing Name	Crossing Width (feet)	Comments
84	Sunshine	1,000	High stable banks, single channel. Good crossing location with the existing bridge.
40	Deshka River	3,000 to 5,000	Low unstable banks, primarily single channel, ongoing channel migration. Will require extensive bank stabilization. Marginal crossing location.
26	Susitna Landing*	2,000	Stable banks, bedrock control, single channel. Good crossing location.

*Also called Susitna Station.

RM 95 (Talkeetna) to RM 62 (Kashwitna River). Downstream of the Three River Confluence at Talkeetna, the Susitna River is braided with multiple channels interlaced through a sparsely vegetated floodplain. The floodplain consists of river-deposited alluvial sediments that are easily moved by the river. The area is subject to major channel and floodplain changes during flood events. The main channel is intermittently controlled laterally where it flows against terraces. Since the active floodplain is very wide, the presence of terraces has little significance except for determining the general orientation of the river system. An exception is where the terraces constrict the river to a single channel at the Parks Highway Bridge at Sunshine at RM 84. See Figure 4-3.

The existing crossing at Sunshine is the only suitable crossing location in this reach.

Figure 4-3. Susitna River: Talkeetna (RM 95) to Kashwitna River (RM 62)



RM 62 (Kashwitna River) to RM 40 (Deshka River). Downstream of the Kashwitna River confluence the Susitna River branches out into multiple channels separated by islands with established vegetation. This reach of the river has been named Delta Islands because it resembles the distributary channel network common with large river deltas. The Delta Islands section has a very broad floodplain, approximately 1 mile wide, with little lateral control. The floodplain consists of river-deposited alluvial sediments that are easily moved by the river. The area is subject to major changes during flood events. See Figure 4-4.

There are no suitable crossing locations in this reach.

Figure 4-4. Susitna River: Kashwitna River (RM 62) to Deshka River (RM 40)



RM 40 (Deshka River). Terraces constrict the Susitna River for a short distance between the downstream end of the Deshka River and the upstream end of Kroto Slough. Despite the constriction, there is significant channel movement in this reach. A crossing would be possible at this location but significant bank stabilization will be required.

This is a marginal site for a road crossing.

RM 39 (Rolly Creek) to RM 27 (Yentna River). This reach of the Susitna River is composed of multiple split channels. This reach is actively migrating within a broad floodplain. For much of this reach, the river is paralleled by Kroto Slough on the west side, and the Yentna River enters at RM 27. See Figure 4-5.

There are no suitable crossing locations in this reach.

Figure 4-5. Susitna River: Rolly Creek (RM 39) to Yentna River (RM 27)



RM 26 (Susitna Landing). Susitna Landing is the historic landing area on the river and has been in use since the early 1900s. It is located at a straight reach of river with one of the few bedrock controls on the entire lower river. The river banks are stable. Water velocity is low due to the low gradient of the river. The location is just downstream of the Yentna River (RM 27).

This is a suitable site for a road crossing.

RM 26 (Susitna Landing) to RM 0 (Cook Inlet). This reach of the river is composed of multiple split channels. Downstream of RM 20 the river is tidally influenced and branches out into delta distributary channels. See Figure 4-6.

There are no suitable crossing locations in this reach.

Figure 4-6. Susitna River: Susitna Landing (RM 26) to Cook Inlet (RM 0)



4.4 Environmental Constraints

4.4.1 Constraints Analysis

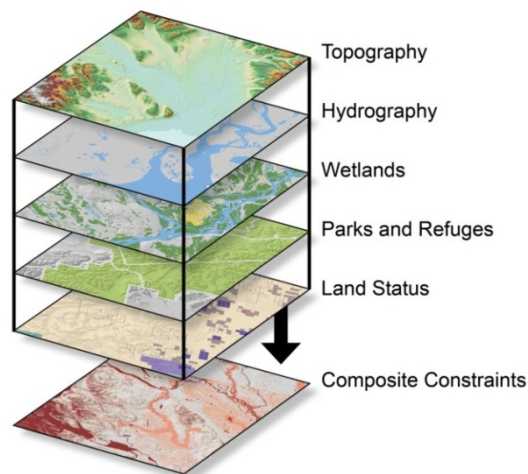
To identify and evaluate corridor opportunities for an access road into the Susitna basin to reach resources, the project team developed a composite environmental constraints map. The purpose of this mapping process is to identify potential corridors based on constraints considered to be less suitable for locating an access road (and conversely identifying areas more conducive to an access road). This method allows the identification of broad preliminary corridors and then more specific alignments that avoid or minimize the potential environmental impacts or engineering constraints of a proposed access road. The constraints analysis process is depicted in Figure 4-7. Baseline environmental features are displayed on Figure 4-8 through Figure 4-11.

Using available data, each environmental constraint was considered separately and then all were considered collectively to determine if there were opportunities to avoid or minimize the potential impacts of the project. The composite constraints map revealed areas more conducive to potential corridors.

To develop this overall understanding of the Study Area's constraints, the project team used a modern version of an overlay process introduced in the 1960s by landscape architect Ian McHarg. McHarg developed this process so that a project's environmental impacts could be considered in the early stages of project development. The process entails mapping environmental resources separately and then combining them in a layering process to develop a map that reveals the overall environmental constraints of an area.

The evaluation process starts with the identification of the factors or resources to be considered. For each factor, a GIS layer was created, with dark gradations representing areas with the most constraints (least suitable for roadway access) and the lightest gradations representing the areas with the fewest constraints (more suitable for roadway access). The layers were digitally superimposed on each other to form a composite constraints map. The darkest areas were those with the most overall constraints, and the lightest were those with the fewest constraints. The layering process enabled the project team to identify broad preliminary corridors while attempting to avoid environmental constraints.

Figure 4-7. Composite Constraints Development Process



4.4.2 Constraints

The project team identified the following environmental factors that had readily available information for environmental evaluation in a GIS format. The factors used to develop the composite constraints map are: topography, hydrography (waterbodies, anadromous fish streams, wetlands), parks and refuges, and land status.

Individual constraints are displayed on Figure 4-12 through Figure 4-16. Steep slopes and major waterbodies and streams were carried forward in all the constraints figures as these areas were deemed as extremely prohibitive for an access road.

Composite constraints are depicted on Figure 4-17. The previously identified alignments were overlaid on the composite constraints map, as depicted on Figure 4-18. The previously studied alignments did a pretty good job of missing major constraints.

Topography/slope. The elevation in the Study Area greatly varies from sea level at Cook Inlet, to several hundred feet near the Parks Highway to the slopes and mountains of the Alaska Range, as shown on Figure 4-12. Slopes were derived in GIS using a 30-meter digital elevation model (DEM) of the Study Area. The slope function calculates the rate of change of elevation for each DEM cell. Slopes for the Study Area are classified by slope value and graphically depicted in a light gray (flat terrain) to dark red (steep terrain) color scheme.

Hydrography/waterbodies and anadromous fish streams. A large number of the streams in the Study Area originate from glaciers. Large glaciers, such as the Kahiltna, flow down into the Susitna Basin. The Study Area is characterized by major river valleys and countless smaller streams. See Figure 4-13.

Waterbodies such as lakes and rivers are generally environmentally sensitive areas. Within the Study Area, they can be considered an opportunity for access as well as a constraint for the development of an access road. Water crossings were considered important to avoid when possible due to permitting requirements and the expense of culverts or bridges. The information on waterbodies in the Study Area came from the USGS National Hydrography Dataset. The resulting map is depicted in Figure 4-13.

Fish, particularly salmon, are an important resource in Alaska for economic, subsistence, and recreational purposes as part of the ecosystem. As a result, the State has developed regulations designed to protect fish habitat, particularly those streams that support anadromous fish. Activities that can impact anadromous fish streams, such as culvert and bridge construction or stream bank disturbances, require an ADF&G Title 16 Permit. The project team mapped anadromous fish streams as identified by the ADF&G Anadromous Fish Stream Catalog¹⁴⁵.

Wetlands. Under most circumstances, wetlands and other “waters of the U.S.” are regulated by the USACE under authority of Section 404 of the Clean Water Act (CWA) or under authority of Section 10 of the Rivers and Harbors Act of 1899. By federal law (CWA) and associated policy, it is necessary to avoid project impacts to wetlands wherever practicable, minimize impact where impact is not avoidable, and in some cases compensate for the impact. Construction in Waters of the U.S., including wetlands, requires a permit process whereby any work proposed in wetlands must comply with the CWA. Before a permit to work in a wetland is granted by the USACE, the project

¹⁴⁵ Alaska Department of Fish and Game. 2013. *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes—Southcentral Region*. <http://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=main.home>

proponent must demonstrate that no practicable alternatives exist that would avoid impacts to wetlands altogether and still meet the overall project purpose. Alternatives are typically evaluated to determine whether wetlands have been avoided where possible.

The USFWS National Wetlands Inventory (NWI) mapped wetlands in the general project area in 1984 (see Figure 4-14). NWI mapping is an effective tool for large-scale planning and wetland analysis but is generally not suitable for a Section 404 permit application. NWI mapping is based primarily on aerial photographic interpretation with limited ground verification, and therefore wetland boundaries tend to be overly simplistic, with many smaller wetlands not included in the mapping. A significant area of the Study Area does not have NWI mapping, as indicated on Figure 4-14. As a result, due to coarse data resolution and missing data, the wetlands in the Study Area are likely greatly underestimated.

Parks, refuges, and recreation areas. State parks and wildlife refuges represent important public recreation and wildlife resources. These public lands were designated for primary purposes ranging from protecting fish and wildlife habitat to providing public recreation opportunities. Recreational resources are discussed further in Section 2.7. The project team used information from the DNR Administrative Large Parcel dataset to identify State parks and refuges in the Study Area. Parks and refuges are shown in Figure 4-15.

The Iditarod National Historic Trail traverses the Study Area and might also be considered a constraint. In addition to this trail, due to historic uses in the Susitna basin, there are likely a number of historic and archaeological resources that may also be considered constraints. A historic and archaeological survey of the Study Area was conducted at this reconnaissance-level analysis.

Land status. Land status can be viewed as both an opportunity and a constraint because the motivation for owning land can vary. Some entities own land with the intent to make a profit from the development or sale of that land. For example, the State's Mental Health Trust Land Office, which manages trust lands, manages their lands to derive income to support mental health organizations. In addition, government-owned land tends to consist of large parcels. Buying land from a few owners is preferable to buying small amounts of land from multiple land owners because it simplifies the ROW acquisition process. Institutions that have lands for the primary purpose of generating income tend to be more willing sellers than private owners. For these reasons, land owned the Trust or a government agency (excluding land designated as a State park, recreation area, or game refuge) was considered an opportunity.

Spatial data depicting general land status for the State of Alaska, available from the DNR Information Resource Management Division, Alaska General Land Status database, January 2013, was used to assess land status within the Study Area. The dataset combines land ownership and status records from both the U.S. Bureau of Land Management (BLM) and DNR to produce a section level indicator of general land ownership. Land status classification is summarized at the section level; therefore limitations exist with using this information. The general land ownership categories as defined within the dataset are summarized in Table 4-2 for the Study Area. The study team recognizes that additional land status analysis is important as access routes are further refined.

Table 4-2. General Land Ownership Status within the Study Area

Owner Category	Data Code	Size (acres)	% of Study Area	Viewed as Constraint or Opportunity
BLM	1500	441,509	7.2	Opportunity
Native Patented	2101	27,603	0.5	Constraint
Native Interim Conveyed (IC)	2102	11,440	0.2	Constraint
CIRI Patented	2111	1,909	0.0	Constraint
CIRI Interim Conveyed (IC)	2112	323,384	5.3	Constraint
State Patented	3101	4,333,123	70.8	Opportunity
State Tentatively Approved (TA)	3102	180,690	3.0	Opportunity
State and Native Owned	4100	8,829	0.1	Constraint
Privately Owned - BLM	5101	53,620	0.9	Constraint
State Land Disposals - Other than Municipal	5102	436,642	7.1	Constraint
State Land Disposals - Municipal Entitlements, Municipal Land Exchanges, Public & Charitable Use	5103	302,173	4.9	Opportunity
Total		6,120,922	100	

Source: GIS data from DNR 2013.

When possible, additional information and interpretation of each owner type is provided below in an attempt to better define the individual categories. Due to limitations of the data, actual ownership of any land should be verified using legal documents such as contracts, leases, etc., and/or Master Title Plats (federal land), Status Plats (state land), or municipal/borough plats in subsequent project development.

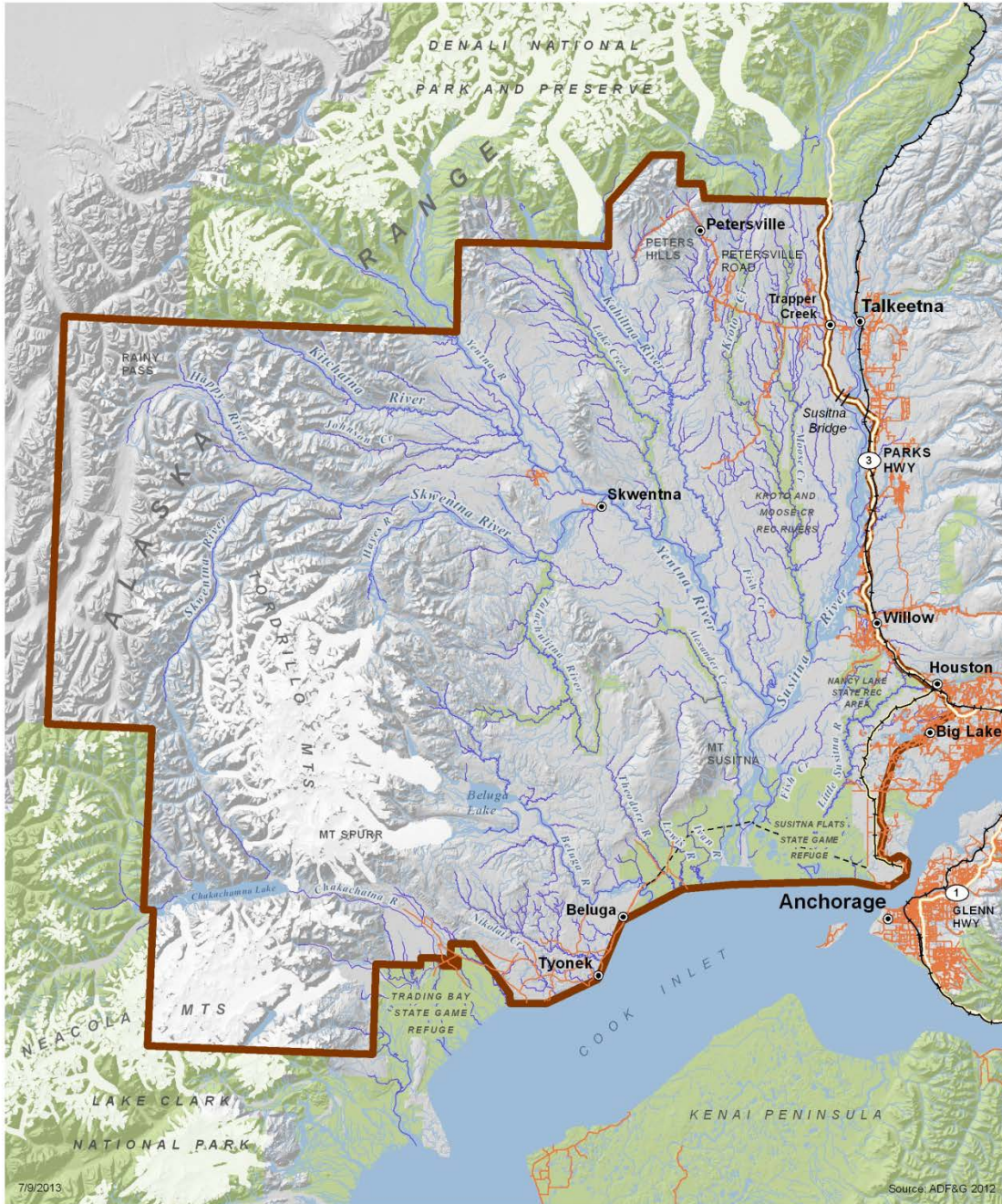
- **BLM:** This ownership type represents federally-owned land under management of BLM for various purposes such as national conservation areas, wilderness areas, national scenic and historic trails, grazing, and abandoned mines. Within the Study Area, there is only one National Historic Trail: the Iditarod. There are no National Conservation Areas, BLM Wilderness Areas, or National Scenic Trails.¹⁴⁶ There are various levels of interest possible (e.g., subsurface mineral estate underlying federal, State or private lands, or surface estate, etc.).
- **Native patented:** This ownership type generally consists of land for which a Native corporation or village received a patent. Additionally, interpretation may include land patented as a Native allotment to an individual or group of individuals by means of a “Certificate of Native Allotment.”
- **Native Interim Conveyance:** Land designated as an entitlement to a Native corporation or village under ANCSA. Interests in the land are binding but subject to pending plat of survey and issuance of final patent.

¹⁴⁶ DNR-Office of Project Management and Permitting (OPMP). October 8, 2013. Comments provided during a review of a draft of this report. In subsequent project development, DNR-OPMP requested additional information be considered in terms of whether the BLM land has been designated for a particular purpose or if it is managed for multiple uses.

- **CIRI patented:** Cook Inlet Region, Inc. land for which the Native corporation CIRI holds a patent. Interests are typically subsurface but occasionally include surface rights as well.
- **CIRI Interim Conveyance:** Land designated as an entitlement to the corporation under ANCSA. Interests in the land are binding but subject to pending plat of survey and issuance of final patent.
- **State tentatively approved:** Lands that have been approved for conveyance to the State but for which the State has not yet received final patent. These lands could have been offered and even conditionally sold via quitclaim deed to private individuals (the sale cancelled/refunded if the State is not granted patent). The State of Alaska DNR typically manages these lands.
- **State patented:** Lands that have been conveyed to the State of Alaska for various purposes (e.g., Mental Health Grants, Community Grants, School Land Settlements, University Grant, General Grant, Mineral Estate, Railroad Transfer, etc.) and at varying levels of interest (e.g., surface, subsurface, or both). Interpretation may also include land patented by the State to an individual or group of individuals.
- **State- and Native-owned:** Interpreted as land owned by both the State of Alaska and a native corporation or village; individually defined above. More research is required.
- **Privately owned - BLM:** More research is required to determine specifics on this ownership type. It is assumed these lands are under private ownership.
- **State Land Disposals - other than municipal:** There are several types of land sales programs whereby State land is disposed of by DNR to private individuals under programs such as the sealed-bid auction program for the sale of subdivision and other surveyed parcels, over-the-counter sales, and remote recreational cabin site sales. Alaska Mental Health Trust Land office (by lease) and the University of Alaska Land Management office (by sale and/or lease) are also involved in disposal of State land.
- **State Land Disposals - Municipal Entitlements, Municipal Land Exchanges, Public and Charitable Use:** Under the General Grant Land law (AS29.65) local government acquires, at no cost, large undeveloped tracts of land from the state. Restrictions apply to disposal of this land by the municipality (i.e., it cannot be transferred except for a public purpose).

The above ownership types were aggregated to provide a more concise description of land ownership. Within the Study Area, the State of Alaska owns or has selected approximately 74 percent of the land (Codes 3101 and 3102). Of the remaining land, 7 percent is federally owned (Code 1500), 5 percent is Borough-owned land (MSB and KPB, Code 5103), 6 percent is owned by Native village and regional corporations (Codes 2101, 2102, 2111, and 2112), and 8 percent is in private ownership (Codes 5101 and 5102). Land status constraints are depicted on Figure 4-16.

Figure 4-8. Anadromous Streams

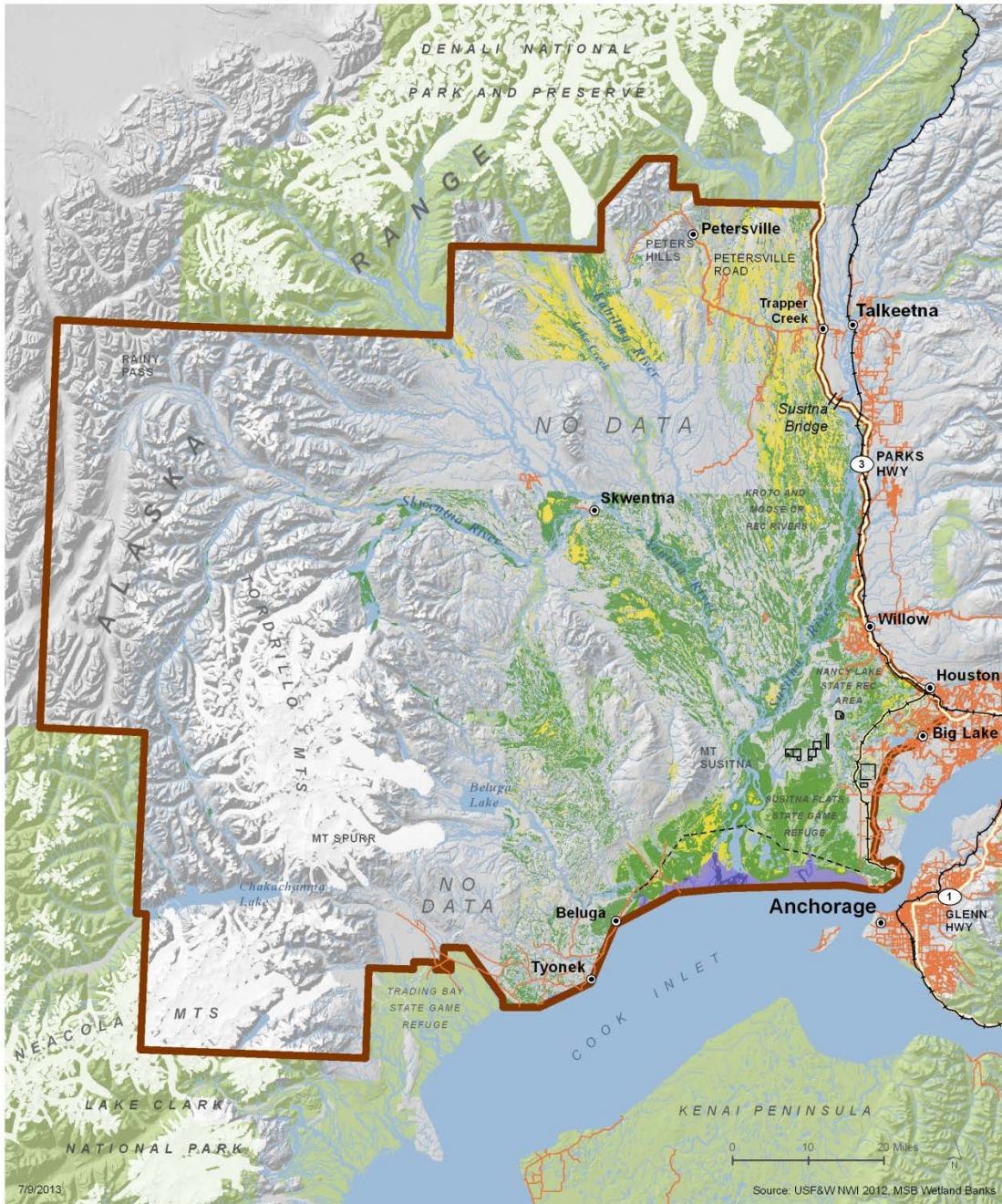


Anadromous Waterway

West Susitna Access to Resource Development



Figure 4-9. Wetlands

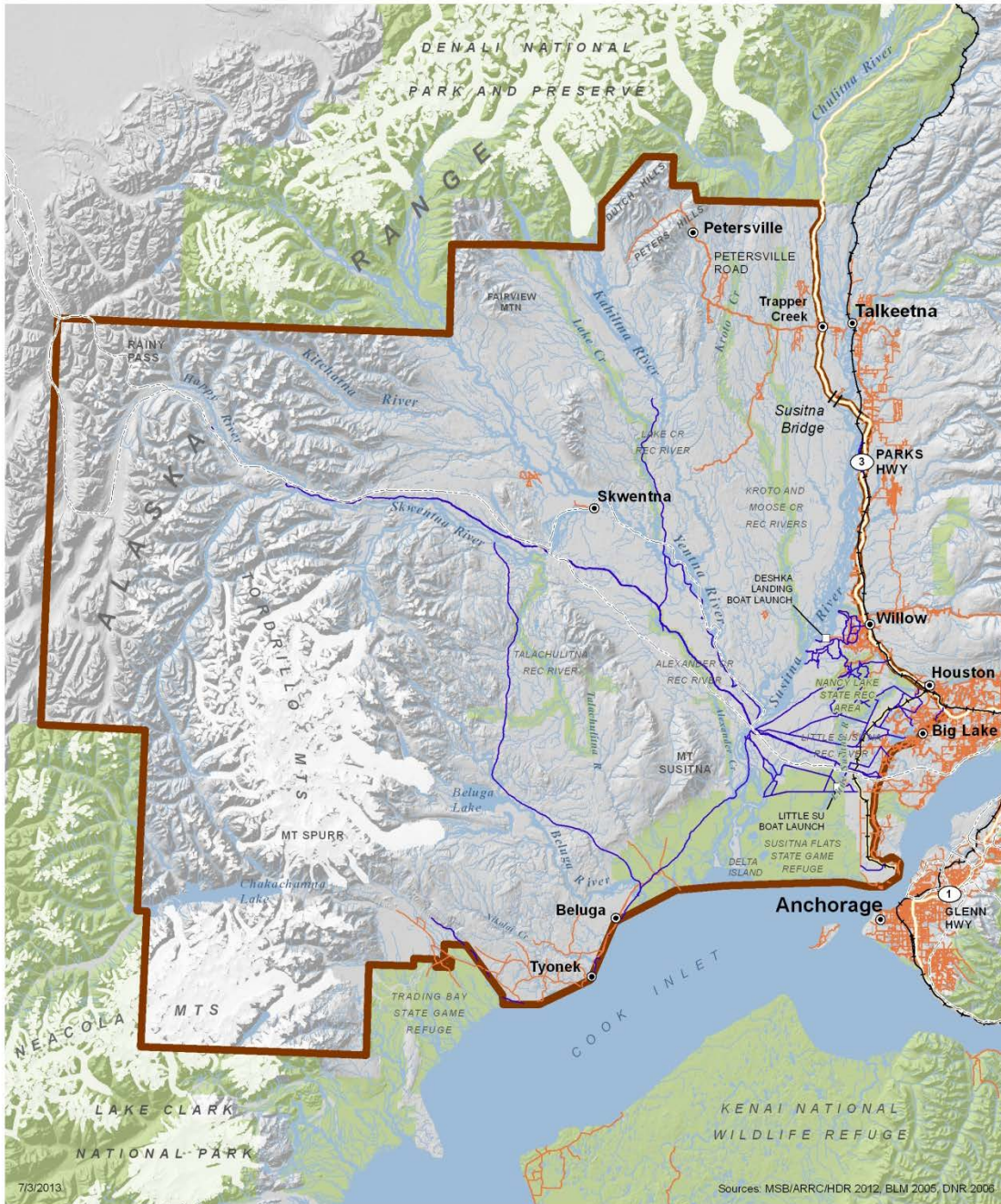


Wetlands

West Susitna Access to Resource Development



Figure 4-10. Parks and Refuges



Recreational Access Opportunities

West Susitna Access to Resource Development

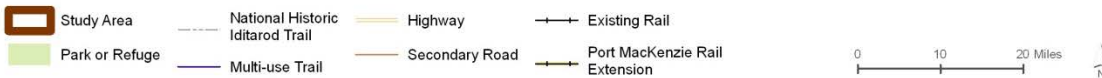
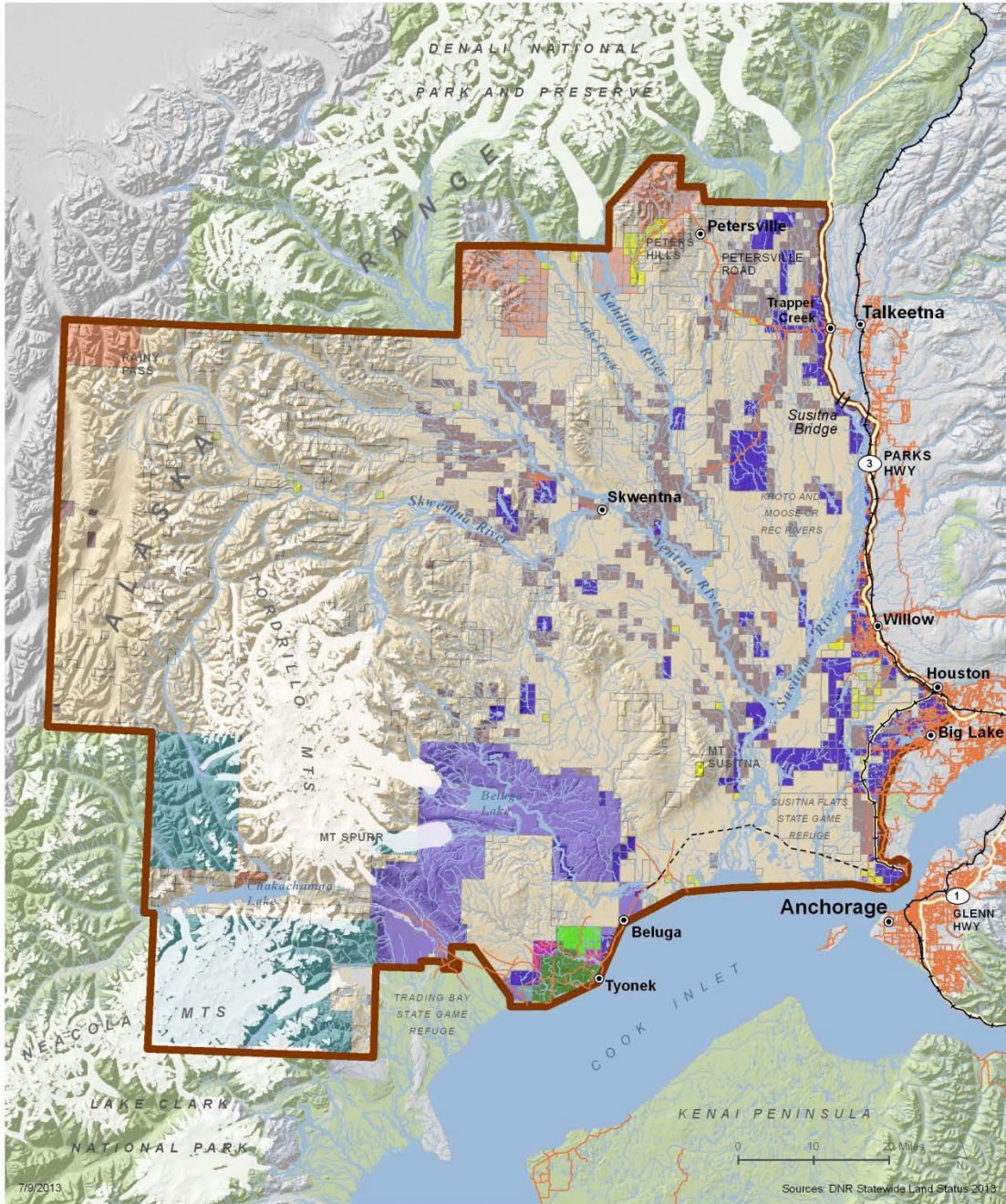


Figure 4-11. Land Status



General Land Status

West Susitna Access to Resource Development












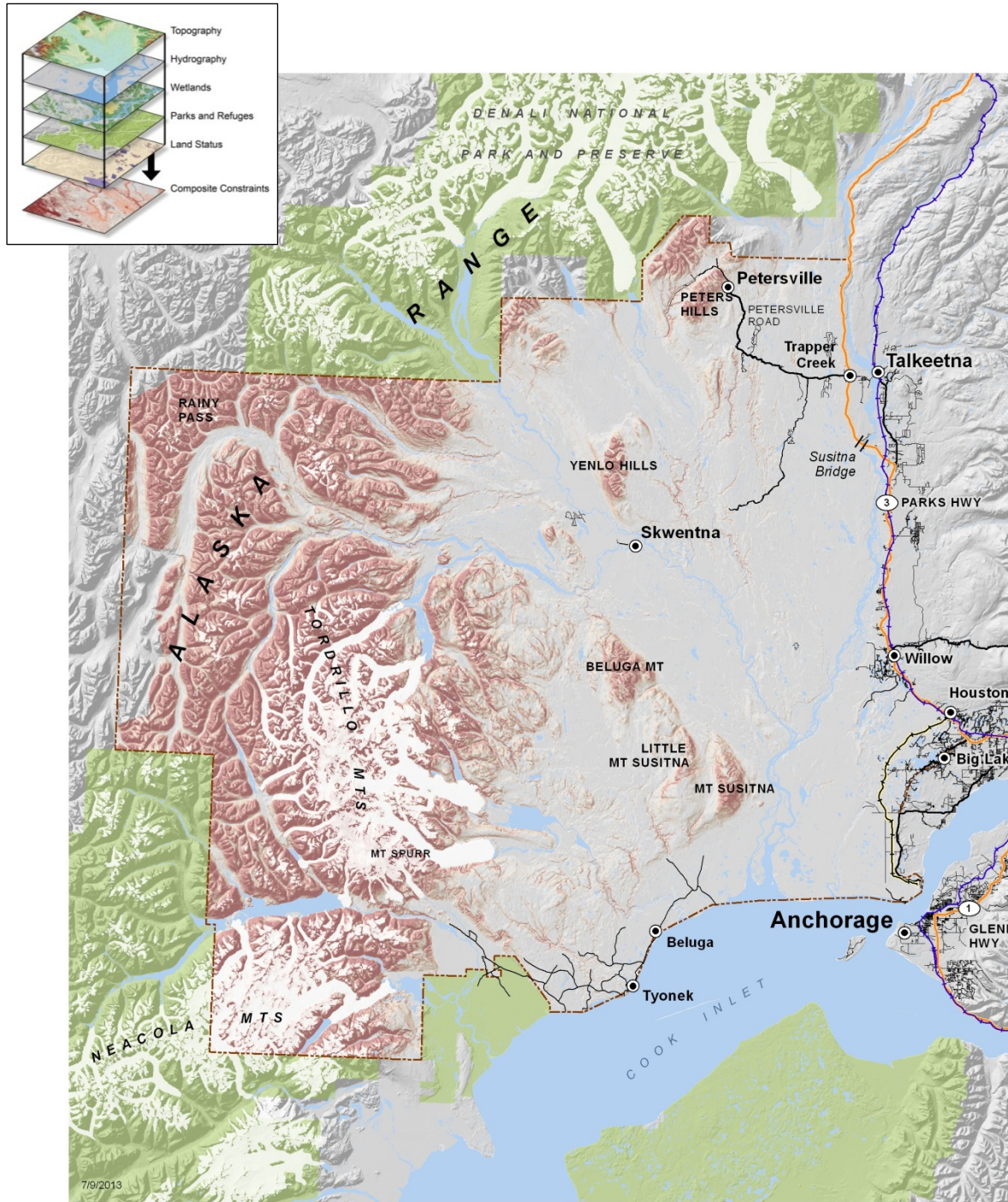
 BLM	 CIRI Interim Conveyed	 State and Native Owned	 Municipal, Public, Charitable Use
 Native Patented	 State Patented	 Private	 Study Area
 Native Interim Conveyed	 State Tentatively Approved	 State Land Disposals	

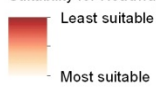
Figure 4-12. Constraints: Slope



CONSTRAINTS: Slope

West Susitna Access to Resource Development

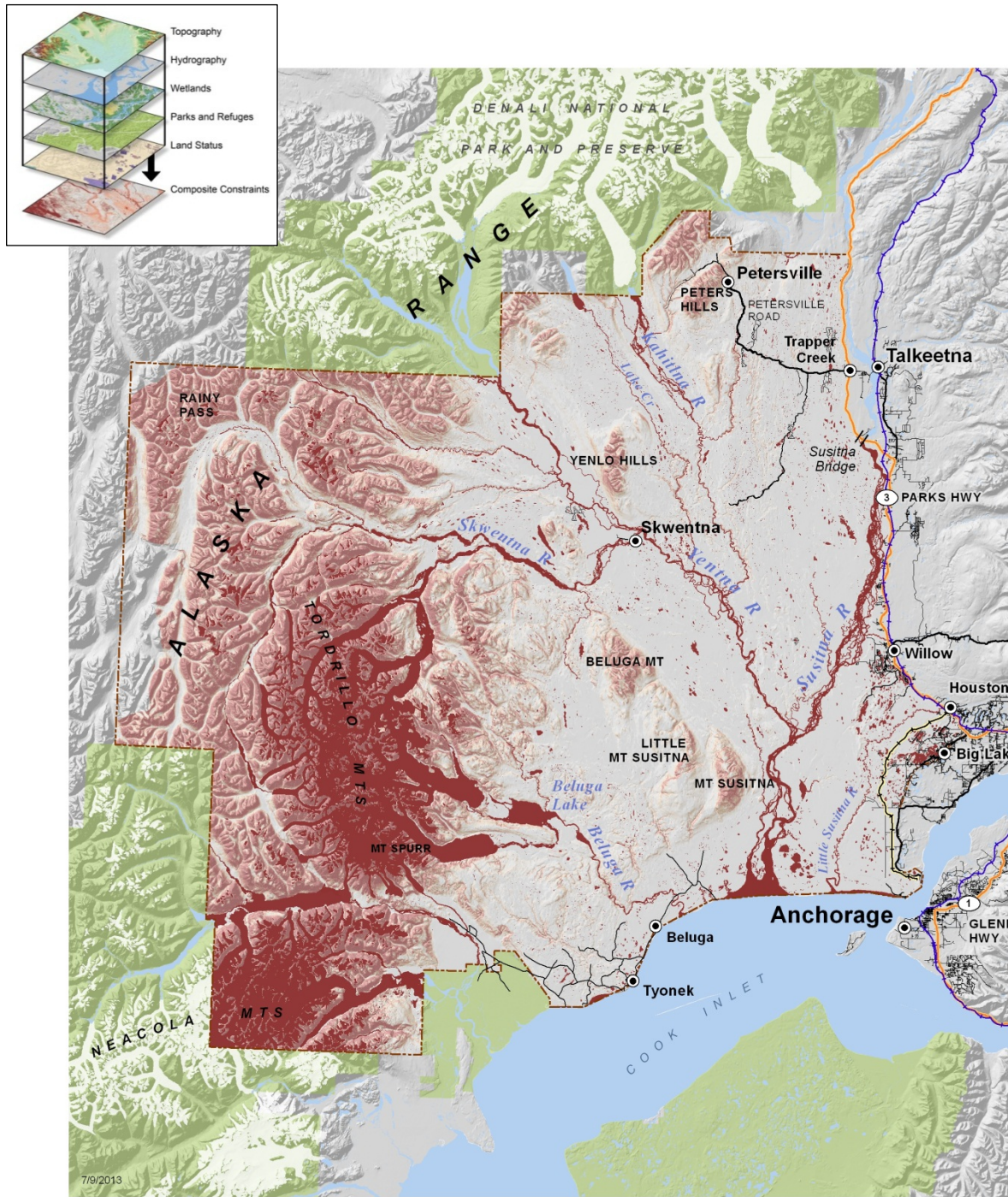
Suitability for Roadway Access



- Study Area
- Park or Refuge
- Highway
- Secondary Road
- Existing Rail
- Port MacKenzie Rail Extension



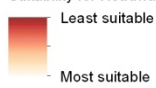
Figure 4-13. Constraints: Slope + Waterbodies and Streams



CONSTRAINTS: Water Bodies

West Susitna Access to Resource Development

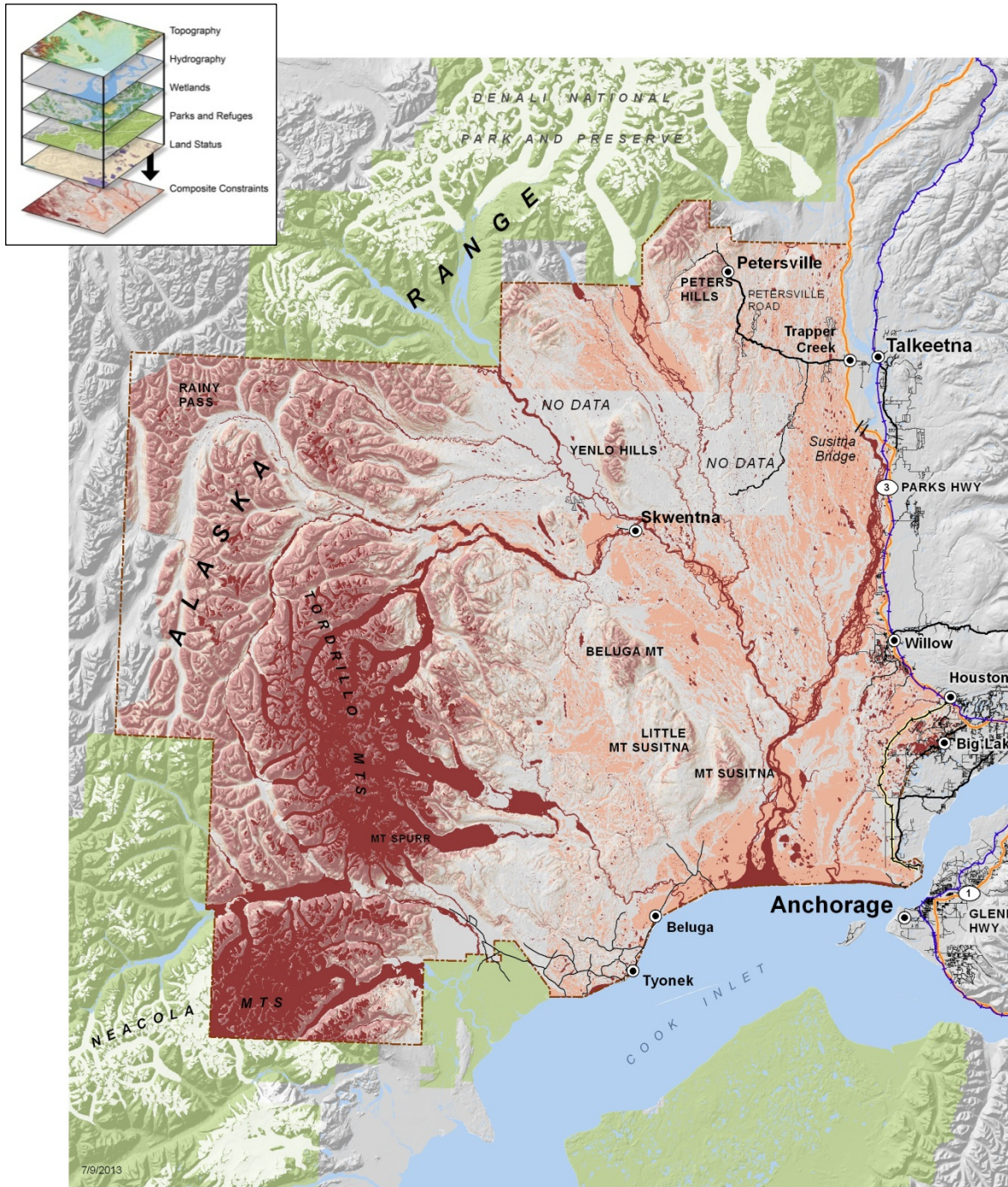
Suitability for Roadway Access



- Study Area
- Park or Refuge
- Highway
- Secondary Road
- Existing Rail
- Port MacKenzie Rail Extension



Figure 4-14. Constraints: Slope, Waterbodies, and Streams + Wetlands



CONSTRAINTS: Wetlands

West Susitna Access to Resource Development

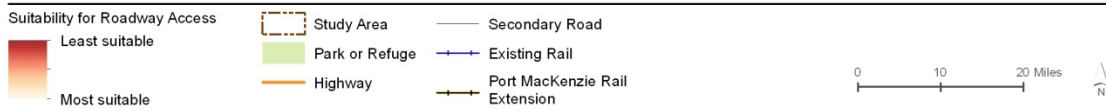
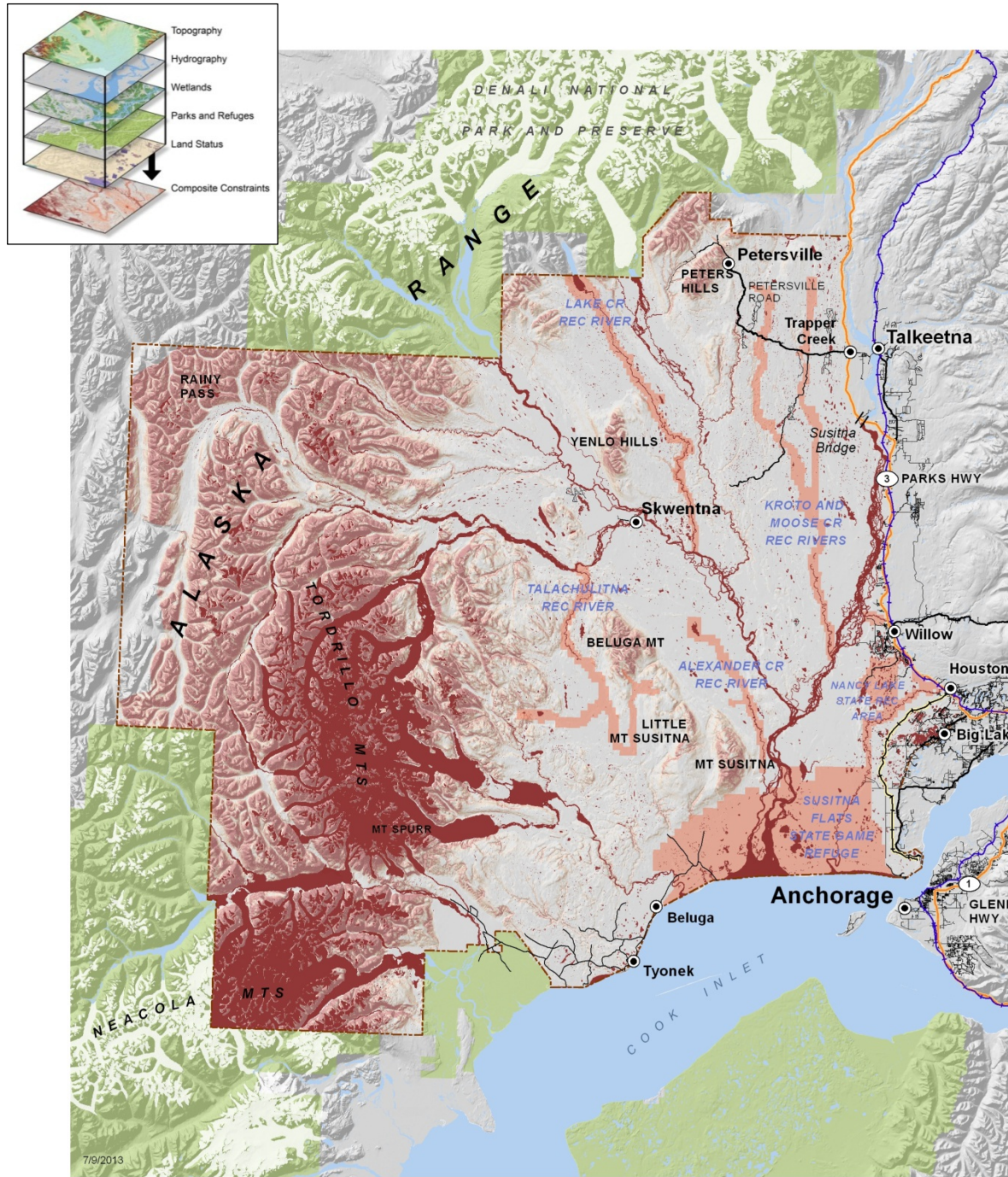


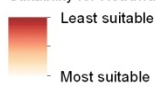
Figure 4-15. Constraints: Slope, Waterbodies, and Streams + Parks and Refuges



CONSTRAINTS: Park or Refuge

West Susitna Access to Resource Development

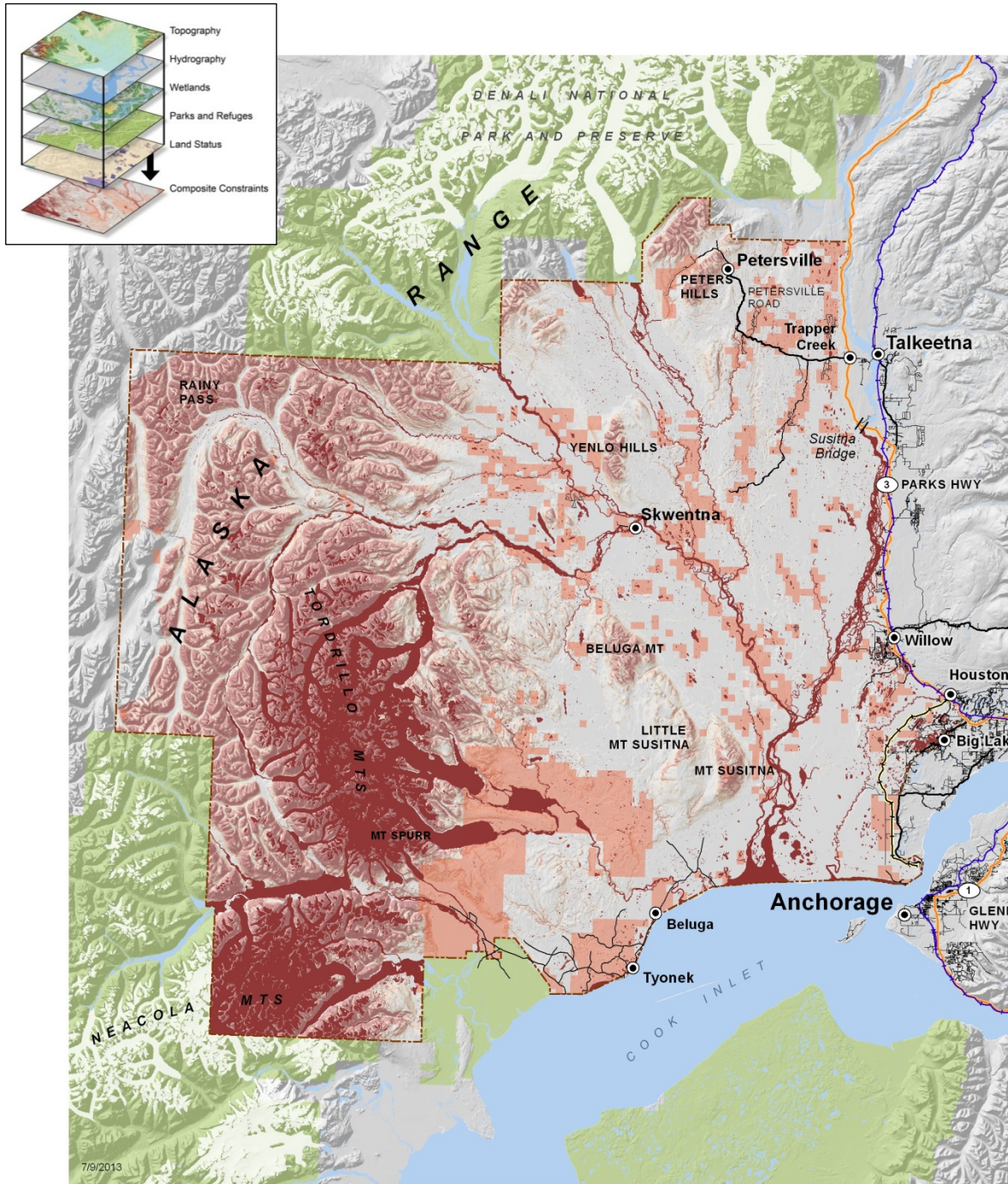
Suitability for Roadway Access



- Study Area
- Park or Refuge
- Highway
- Secondary Road
- Existing Rail
- Port MacKenzie Rail Extension



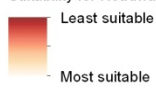
Figure 4-16. Constraints: Slope, Waterbodies, and Streams + Land Status



CONSTRAINTS: Land Status

West Susitna Access to Resource Development

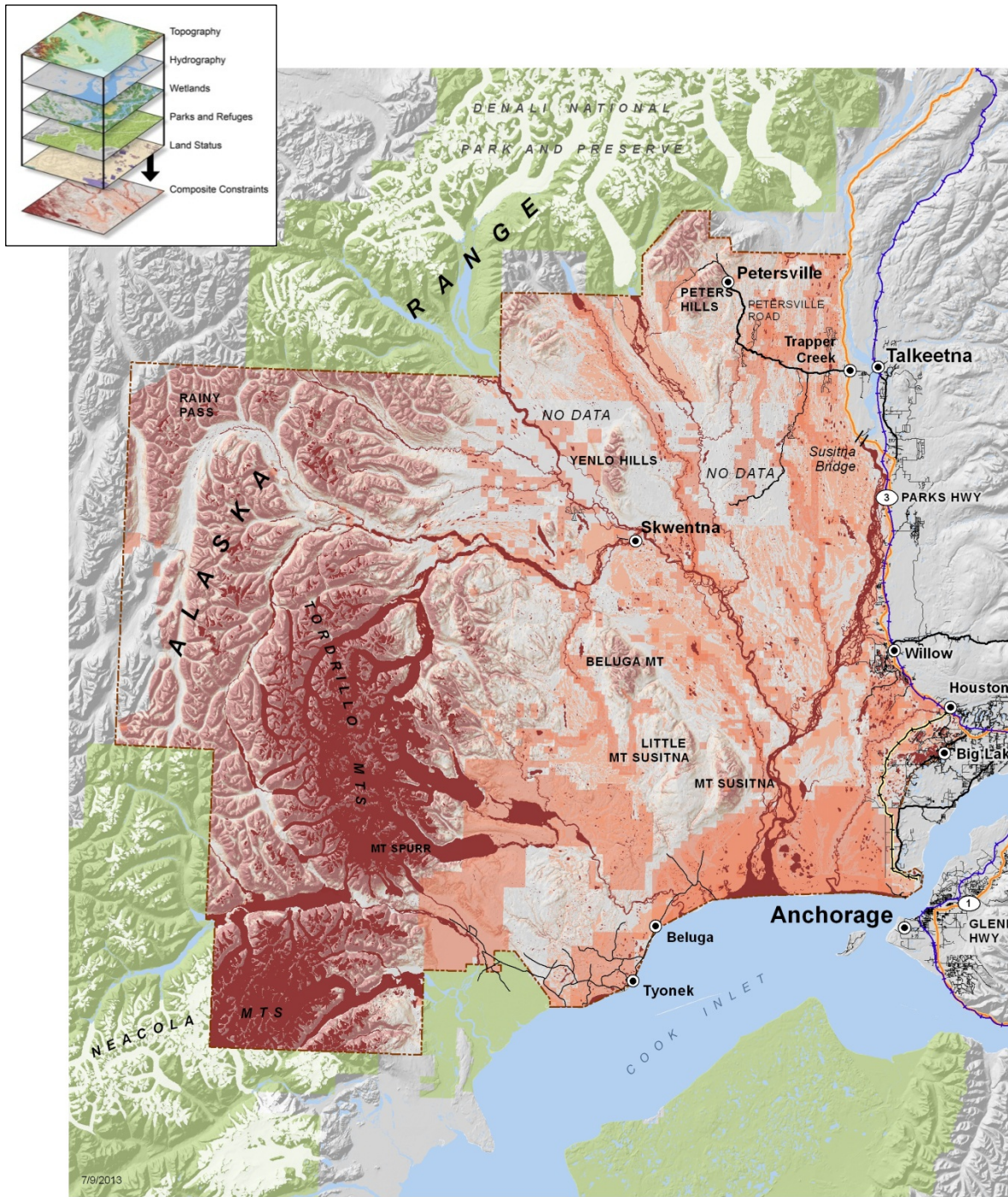
Suitability for Roadway Access



- Study Area
- Park or Refuge
- Highway
- Secondary Road
- Existing Rail
- Port MacKenzie Rail Extension



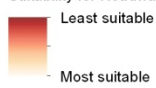
Figure 4-17. Composite Constraints



CONSTRAINTS: Composite

West Susitna Access to Resource Development

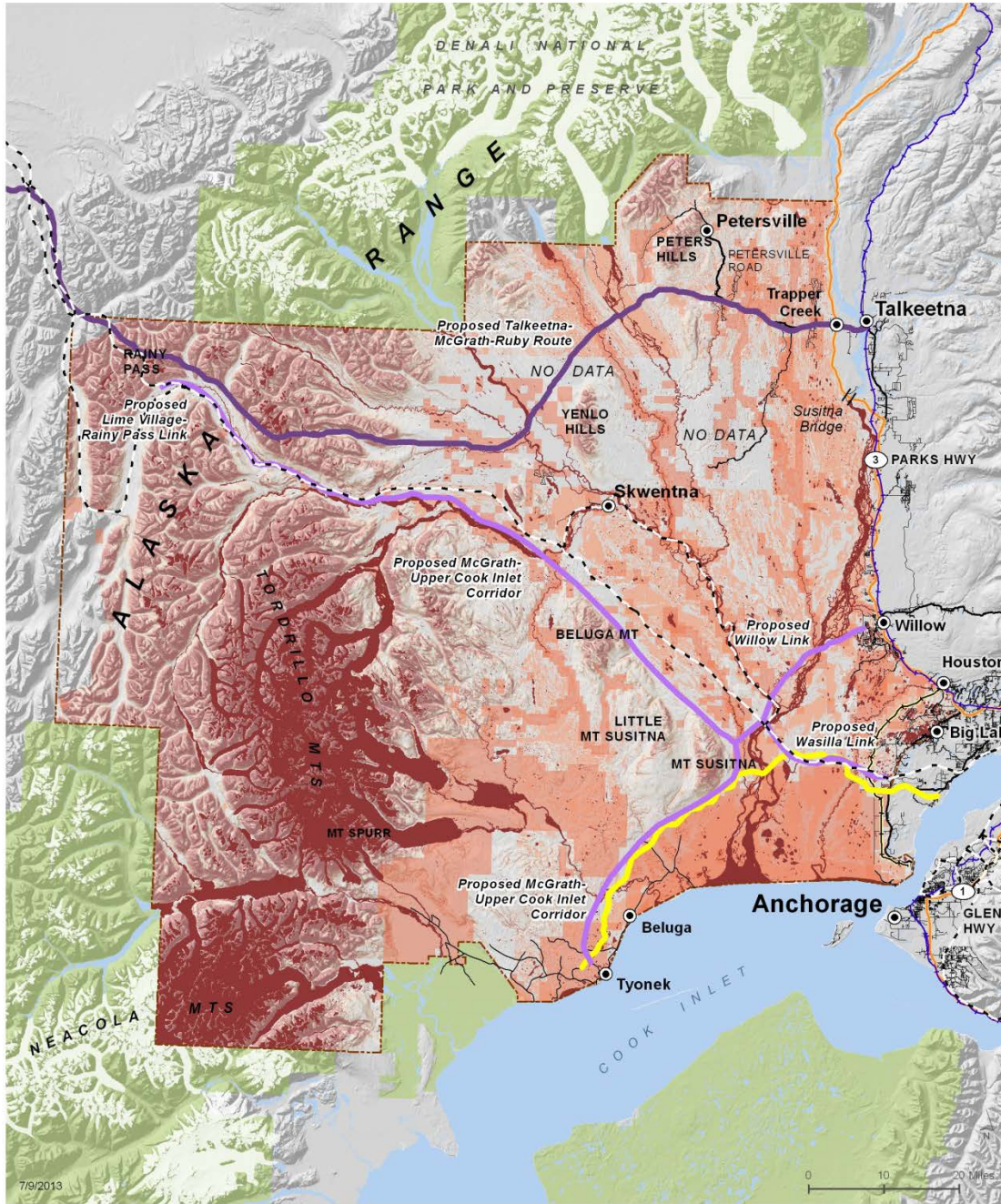
Suitability for Roadway Access



- Study Area
- Park or Refuge
- Highway
- Secondary Road
- Existing Rail
- Port MacKenzie Rail Extension



Figure 4-18. Composite Constraints and Previously Identified Alignments



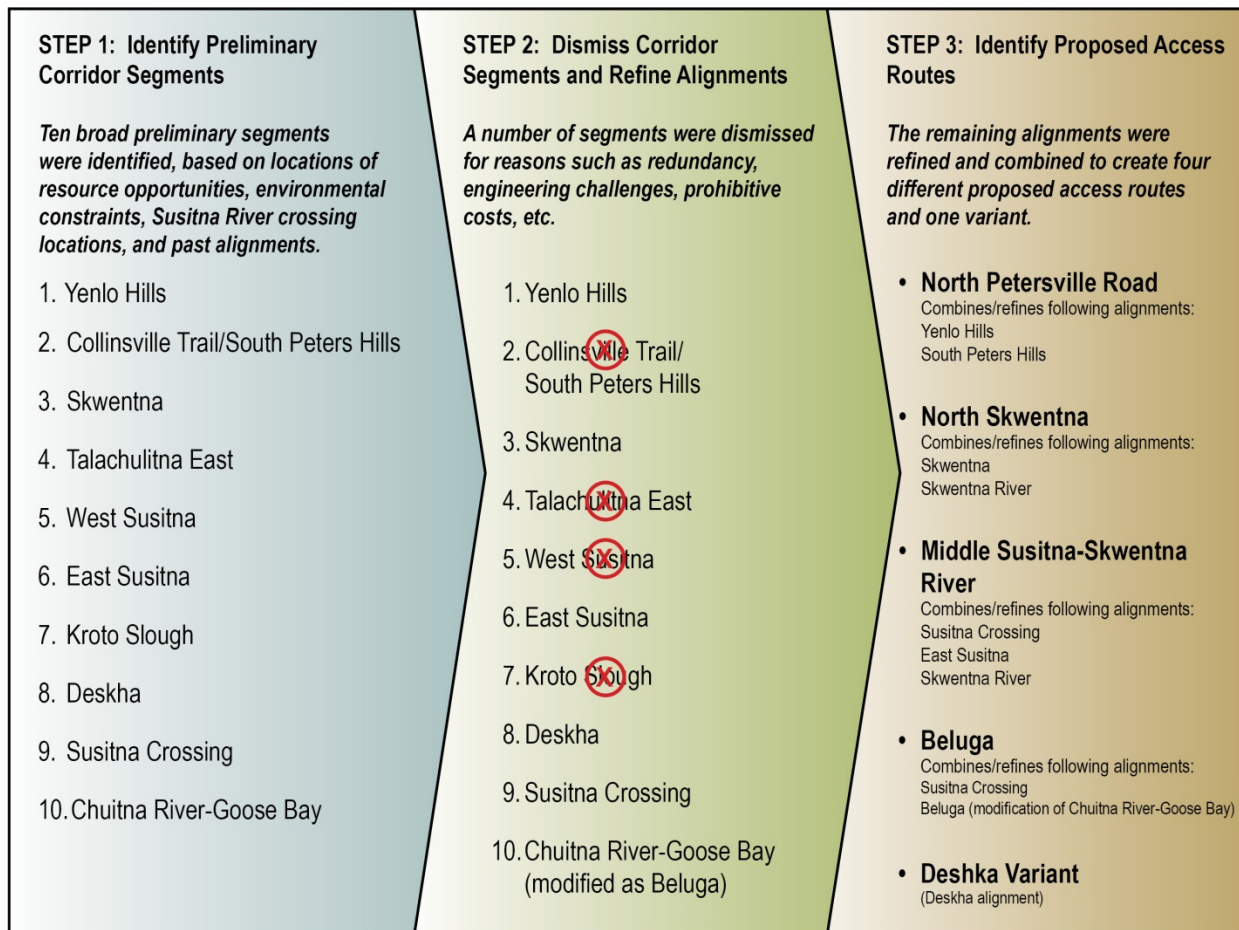
Previously Identified Alignments and Constraints Composite *West Susitna Access to Resource Development*



4.5 Preliminary Corridors

Developing preliminary corridor segments and centerline alignments was a multi-step process, as shown in Figure 4-19. As part of refining the initial 10 corridor segments (see Figure 4-20), preliminary conceptual engineering was conducted. Initial centerline alignments were laid out within the initial corridor segments in AutoCAD using USGS 15-minute, 1:63,360-scale quadrangle base maps to provide contour mapping for the Study Area. Standard roadway design criteria were used as specified in the Preliminary Design Criteria Technical Report. Additionally, the effort was assisted by use of aerial imagery available from Google Earth™. The goal was to provide a geographic range of corridor options that could access identified resources.

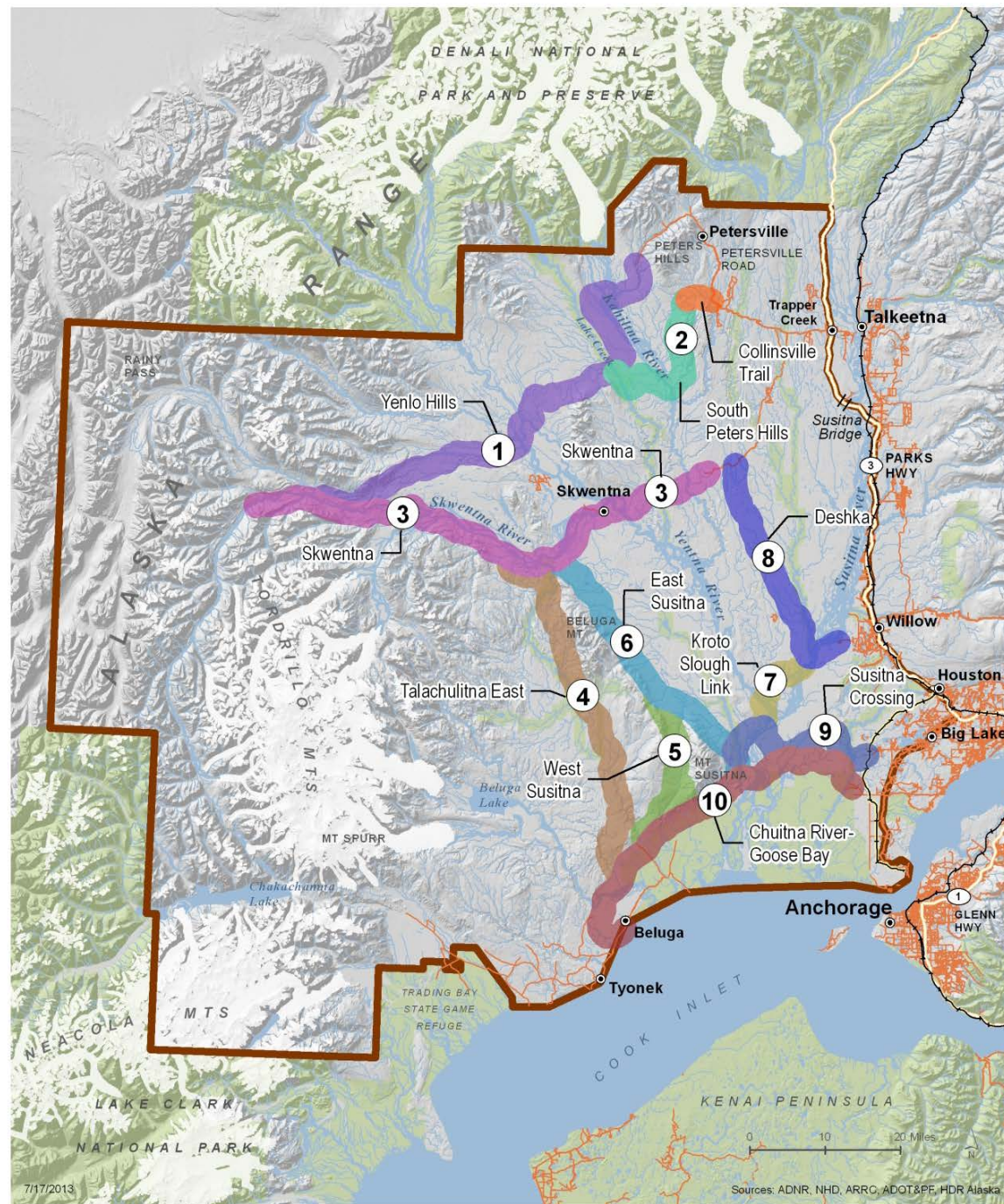
Figure 4-19. Access Route Development Process



4.5.1 Step 1: Preliminary Corridor Segments

Once the locations of the resource opportunities, environmental constraints, suitable Susitna River crossing locations, and past alignments were identified, 10 broad preliminary corridor segments were identified, as depicted on Figure 4-20. The broad preliminary corridor segments were based primarily on avoiding environmental constraints such as topographic features (mountains, steep slopes, and hills), waterbodies or wetlands, and river or stream crossings. Preliminary corridor segments were identified based on sound engineering judgment using available data.

Figure 4-20. Preliminary Corridor Segments



Preliminary Corridor Segments West Susitna Access to Resource Development



(1) Yenlo Hills Corridor Segment. This segment connects the Upper Skwentna mineralized area (the mineral deposits generally located southeast of Rainy Pass) with the road network at the Cache Creek mining district located near Petersburg. This route crosses the Skwentna River, Johnson Creek, Yentna River, Lake Creek, and Kahiltna River. The route crosses wetlands in the Kahiltna and Yentna River valleys. It ascends and descends the northern flank of the Yenlo Hills. Near the western end the route passes near a couple of wilderness lodges located near Red and Finger Lakes. The road along Cache Creek would need to be upgraded.

(2) Collinsville Trail/South Peters Hills Corridor Segment. This segment is an attempt to shorten the distance of the Yenlo Hills segment. Instead of looping north along Cache Creek, it crosses south of the Peters Hills. It makes use of an old mining track called the Collinsville Trail, then passes down the west side of Little Peters Hills. This route crosses the Kahiltna River at a better location than the Yenlo Hills segment. It still has issues of crossing lumpy bedrock terrain and some wetlands.

(3) Skwentna Corridor Segment. This segment leaves the Upper Skwentna mineralized area and travels along the south side of the Skwentna River to connect with an extension from Oil Well Road. It crosses the Hayes River, Talachulitna River, Yentna River, Lake Creek and Kahiltna River. Portions of this route cross wetlands and pass through terrain consisting of lumpy bedrock and scattered kettle lakes.

(4) Talachulitna East Corridor Segment. This segment skirts the lower slopes of Mount Susitna and Beluga Mountain to avoid the wetlands prevalent in the Talachulitna River drainage. The north portion of the route between the Talachulitna River crossing and Skwentna River will be more difficult to construct due to lumpy bedrock terrain interspersed with many kettle lakes.

(5) West Susitna Corridor Segment. This segment was created in case the route around the east side of Mount Susitna ran into too many construction issues. The alignment crosses the saddle separating Mt. Susitna and Little Mt. Susitna; it is anticipated that this saddle experiences heavy snow drifting and avalanche potential.

(6) East Susitna Corridor Segment. This segment skirts the lower slopes of the east side of Mt. Susitna and Beluga Mountain and maintains a lower elevation than the other segments (Talachulitna East and West Susitna) going north from Beluga. This segment crosses fewer wetlands and avoids more of the lumpy terrain the Talachulitna East Alignment crosses.

(7) Kroto Slough Link Segment. This segment is used to link the Parks Highway access through Deshka Landing to Beluga. It travels along the north side of Kroto Slough and crosses the Yentna River 3 miles upstream from its confluence with the Susitna River. The portion of the alignment east of the Yentna River crosses wet soils. This link would connect the Deshka segment with the Susitna Crossing segment.

(8) Deshka Corridor Segment. This segment leaves the road network at Deshka Landing, west of Willow, to cross the Susitna River just downstream of the mouth of the Deshka River. It then turns north to roughly parallel the Deshka River to connect with the southern end of Oil Well Road. The north end of Oil Well Road connects to Petersburg Road. The whole length of the Deshka segment on the west side of the Susitna River crosses soils with a high water table, if not true wetlands.

(9) Susitna Crossing Corridor Segment. This segment crosses the Susitna River at one of the most stable river bank locations along the southern portion of the river. It crosses just north of Flat Horn Lake to connect to Goldsteak Drive, west of Big Lake.

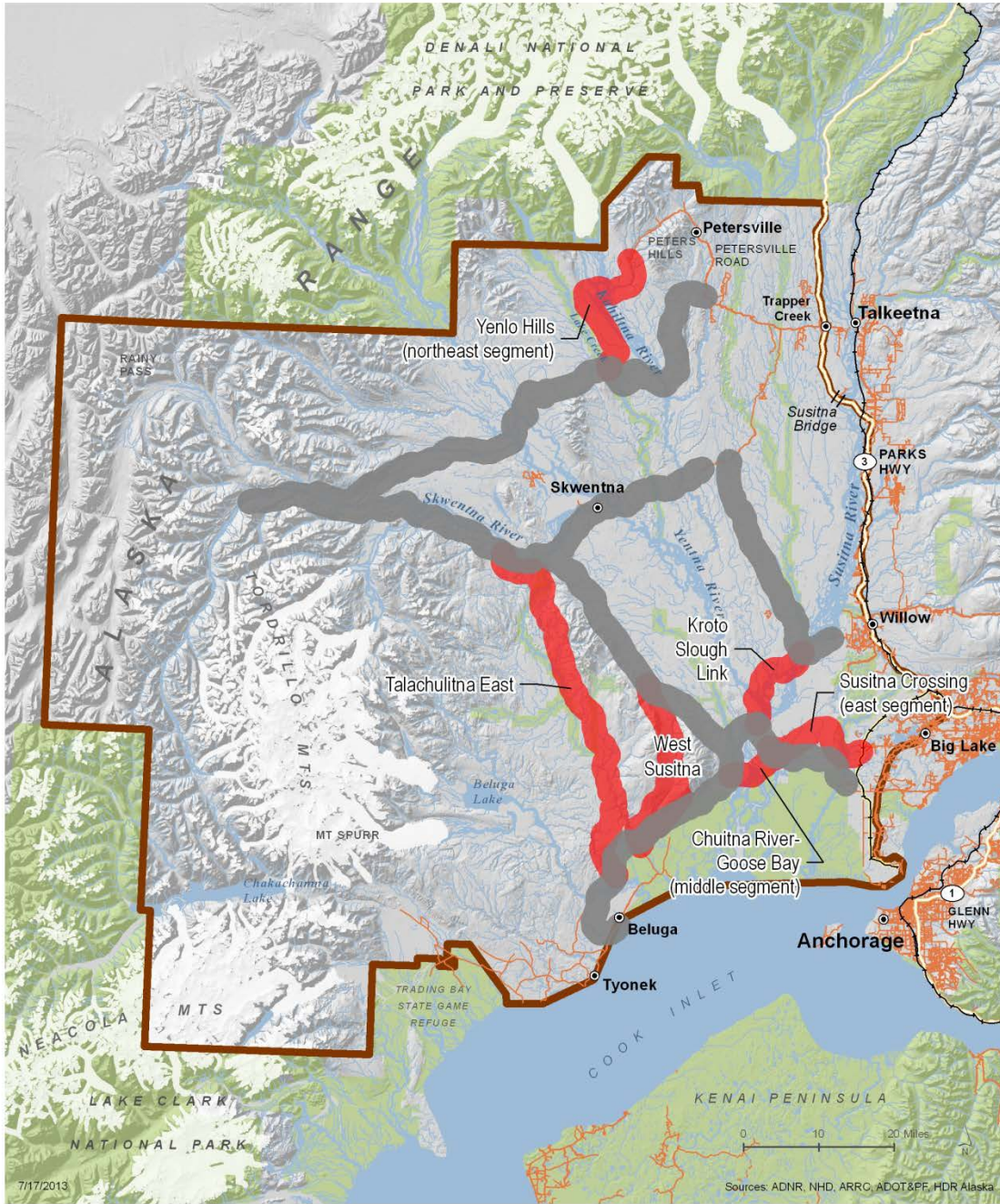
(10) Chuitna River-Goose Bay Corridor Segment. This is the corridor alignment previously identified by DOT in 1972. The main issue with this route is that it crosses the Susitna River in a braided area with many moving gravel bars. A better crossing of the Susitna River is located 8 miles upstream at the Susitna Crossing (as described earlier in Section 4.3). This alignment originally extended to the road network at Goose Bay, but since then the road network has been extended to the Little Susitna River where the project team shows it ending.

4.5.2 Step 2: Preliminary Corridor Segment Screening - Dismissed Segments

For the level of effort for this reconnaissance-level study, and as part of the preliminary corridor refinement process, several of the initial 10 preliminary corridor segments were dismissed for a variety of reasons. These reasons include redundancy compared with other similar alignments, engineering challenges, wetlands, and additional bridge requirements and associated costs with structures. See Figure 4-21 for the dismissed corridor segments. The corridor segments considered but dismissed are as follows:

- Only one of the two options departing the region near the end of the Petersville Road was retained for further analysis as part of the Yenlo Hills corridor segment. This region is characterized by lots of wetlands.
- Only one of the three options connecting from the Beluga area northwestward towards the Upper Skwentna mineralized area near Rainy Pass will be retained for further analysis. The Talachulitna East corridor segment and West Susitna corridor segment were dropped in this area and the East Susitna corridor segment was retained. The two dismissed segments were dropped because both options added extra, unnecessary miles from the crossing of the Susitna River compared with the West Susitna segment.
- The Kroto Slough link segment was eliminated from further analysis; the corridor crosses very wet terrain.
- The Chuitna River-Goose Bay route, the route previously identified by DOT in 1972, crosses the Susitna River in a location this study did not identify as a reasonable river crossing. Therefore, this specific route will not be carried forward. Instead, the corridor route will be modified to cross the Susitna River in a more reasonable location, as identified as part of this study. The alignment carried forward in this portion of the Study Area will be a combination of the Susitna Crossing segment and the Chuitna River-Goose Bay segment. In the next section and subsequent analysis in this report, this alignment will be known as the Beluga alignment west of the Susitna River crossing.

Figure 4-21. Preliminary Corridor Segments Considered but Dismissed



Preliminary Corridor Segments Considered but Dismissed

West Susitna Access to Resource Development

- | | | | |
|--|--|--|--|
| — Corridor segment dismissed from further study | — Highway | — Existing Rail | Study Area |
| — Corridor segment recommended for further study | — Secondary Road | — Port MacKenzie Rail Extension | Park or Refuge |

The seven remaining corridor alignments provide a geographical span of potential roadway access opportunities (see Table 4-3 and Figure 4-22). These seven corridor alignments are also depicted on USGS quad sheets (see Appendix B). These remaining corridor alignments have been combined in several ways to make several potential resource access route options, as described in this section. It should be noted that there are alternate ways to connect the segments together to create alternatives.

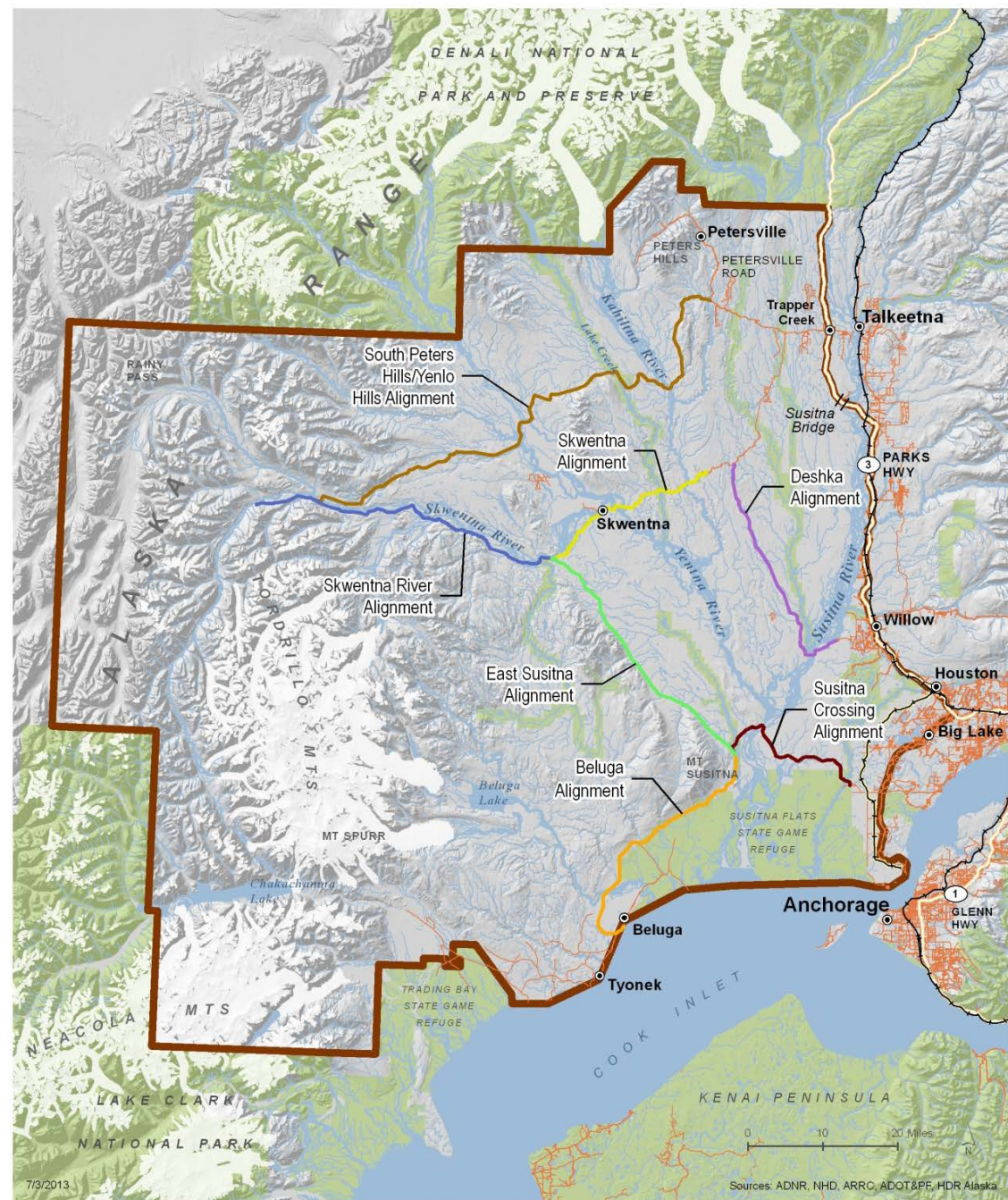
The benefit of having a range of alternatives is the option to do multi-phased construction, whereby multiple termini and resources may be accessed throughout the Study Area and alternative segments sequentially built based on priority, availability of funding, and timing of access needs. For instance, should accessing the Upper Skwentna mineralized area southeast of the Rainy Pass area be paramount, the South Peters Hills/Yenlo Hills Alignment could be the first phase of road access into the West Susitna region. Subsequent phases could then be built to the south, providing connection to the Beluga/Tyonek region. Alternatively, West Susitna access could be implemented in the reverse order, beginning with the Beluga/Tyonek region and subsequent development to the north later.

Table 4-3. Refined Corridor Alignments

Corridor Alignment Name	Approximate Length (miles)
South Peters Hills/Yenlo Hills	79
Skwentna River	44
Skwentna	27
East Susitna	37
Deshka	34
Susitna Crossing	26
Beluga ¹	38

¹ The Beluga alignment is a slightly altered version of the initial Chuitna River-Goose Bay corridor segment.

Figure 4-22. Refined Corridor Alignments



South Peters Hills/Yenlo Hills Alignment. The South Peters Hill/Yenlo Hills Alignment begins at Petersville Road, roughly at the location where it nears Peters Creek and veers north. This alignment would cross Peters Creek and trend west for about 3.5 miles, then travel southward on the western side of the Little Peters Hills to a crossing of the Kahiltna River. From the Kahiltna River crossing, this alignment trends generally westward, crossing Lake Creek and the Lake Creek Recreation River area, passing north of the Yenlo Hills, to a crossing of the Yetna River. From the Yetna River crossing, the alignment generally trends in a southwesterly direction to the Skwentna River. This alignment is roughly 79 miles in length and reaches a maximum elevation of approximately 1,800 feet.

Skwentna River Alignment. The Skwentna River Alignment begins at the theoretical junction of the Skwentna Alignment and the East Susitna Alignment. It provides access from the Skwentna River valley to the Upper Skwentna mineralized area, traveling in an east to west direction on the south side of the Skwentna River. From its beginning, this alignment travels about 2 miles to a crossing with the Talachuitna River. The alignment then climbs gradually along the south side of the Skwentna for nearly 15 miles to a crossing of the Hayes River. The alignment continues westward across a braided floodplain for another approximately 17.5 miles to the theoretical junction with the South Peters Hills/Yenlo Hills Alignment, then crosses the Chickak River and continues for another 7 miles to the terminus of the alignment. This alignment is roughly 44 miles in length.

Skwentna Alignment. The Skwentna Alignment begins at its highest elevation of about 800 feet at the southern end of Oilwell Road and travels west for approximately 4 miles before reaching a crossing of the Kahiltna River. It then traverses another 4 miles to a crossing of Lake Creek. From this crossing, the alignment continues westward to a crossing of the Yetna River, passing near the community of Skwentna. It then travels in a southwesterly direction, staying on the south side of the Skwentna River to the approximate confluence of the Talachuitna River and Skwentna River. This alignment is roughly 27 miles long and reaches a maximum elevation of about 1,500 feet.

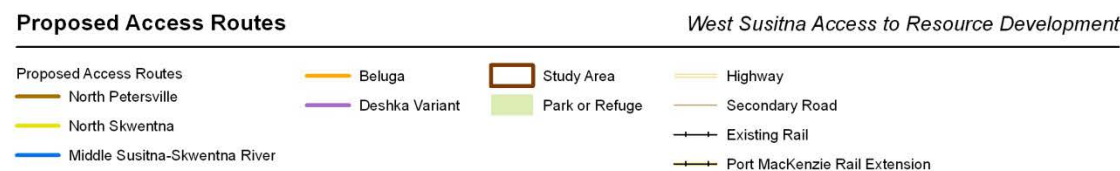
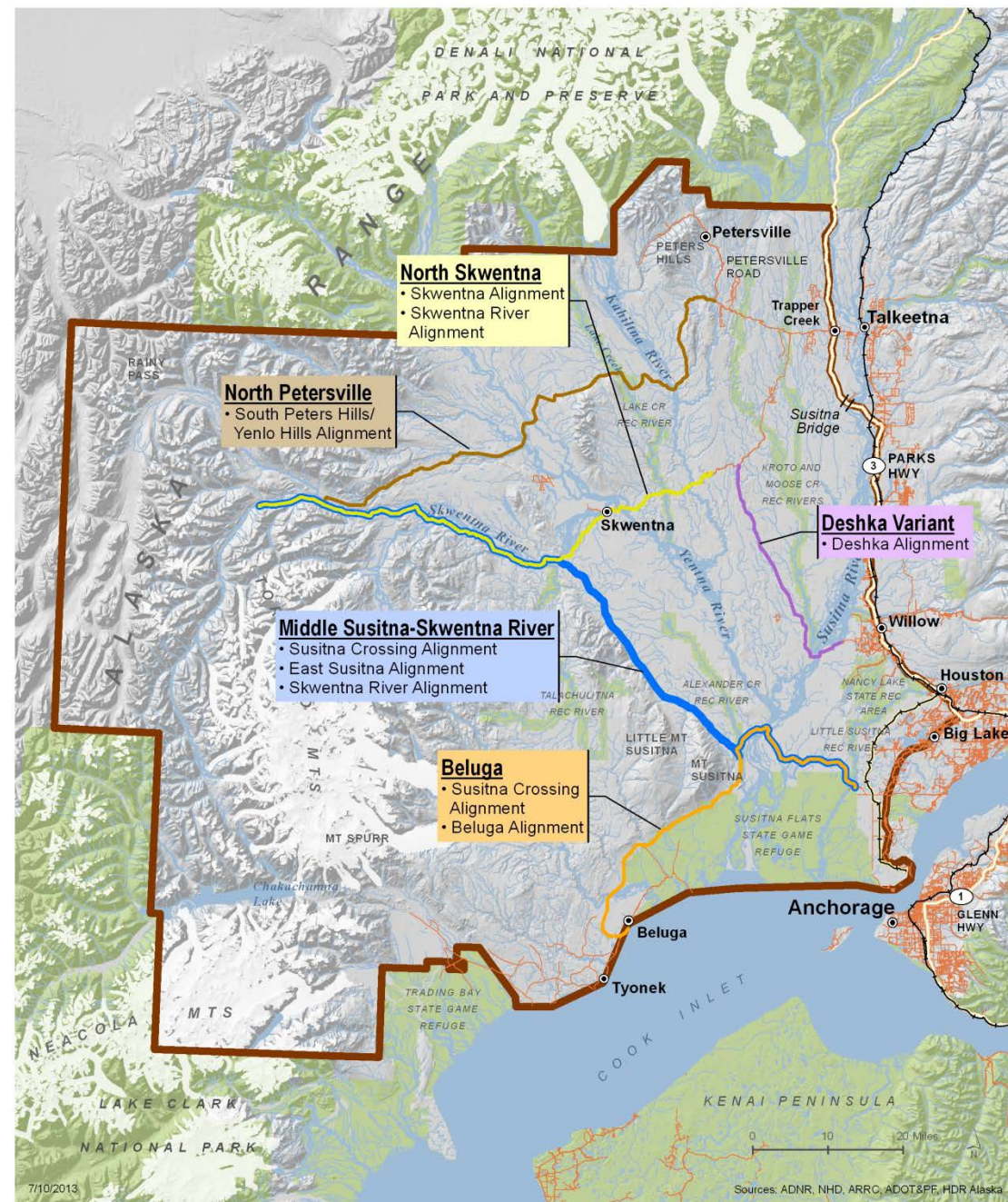
East Susitna Alignment. The East Susitna Alignment begins at the theoretical junction of the Susitna Crossing Alignment and the Beluga Alignment. It provides access from the eastern side of Mt. Susitna and the lower Susitna Valley to the Skwentna River. This alignment begins on the eastern side of Mt. Susitna and travels in a northwesterly direction and crosses many smaller creeks flowing from the eastern slopes of Mt. Susitna, Little Mt. Susitna, and Beluga Mountain. The alignment descends from the slopes of Beluga Mountain to lower-lying terrain and ends at the Skwentna River. The alignment is approximately 37.5 miles in length and reaches a maximum elevation of 560 feet.

Deshka Alignment. The Deshka Alignment provides access from the MSB road system across the Susitna River and up the valley between the Yetna and Kahiltna rivers and Kroto Creek to a point located on Oilwell Road. This alignment begins at Deshka Landing Road and travels about 3.5 miles to the southwest to a crossing of the Susitna River. The alignment then travels north-northwest for roughly 30 miles until it reaches Oilwell Road. This alignment is approximately 33.5 miles in length and reaches a maximum elevation of 600 feet.

Susitna Crossing Alignment. The Susitna Crossing Alignment provides access from the MSB road system to a location on the western side of the Susitna River. It begins from the Little Susitna River Road and crosses the Little Susitna River, then travels in a northwesterly direction, crossing several smaller streams, for roughly 16 miles to a crossing of the Susitna River. From this crossing, the alignment then turns to the southwest and travels another 6.5 miles and ends at the theoretical junction of the Beluga and East Susitna alignments. This alignment is approximately 26 miles in length and reaches a maximum elevation of about 150 feet.

Beluga Alignment. The Beluga Alignment provides access from the coastal community of Beluga and the Cook Inlet up to the eastern slopes of Mt. Susitna. This alignment begins at the southern end of the Beluga Airport and then wraps to the south around the large wetland complex before veering to the north and crossing the Beluga River. From the Beluga River the alignment trends generally to the north and northeast for roughly 9.5 miles to a crossing of the Theodore River. The alignment continues traveling in a northeast direction, remaining on more level terrain and crossing several smaller streams as it traverses the base of Little Susitna and Mt. Susitna and zigzags across the northwest boundary of the Susitna Flats State Game Refuge. The alignment then wraps around the southeastern side of Mt. Susitna before ending at the theoretical junction of the Susitna Crossing and East Susitna alignments. This alignment is approximately 38 miles long and reaches a maximum elevation of about 430 feet.

Figure 4-23. Proposed Access Routes



4.5.3 Step 3: Proposed Access Routes

The remaining alignments were refined and combined to create four different proposed access routes and one variant, as depicted on Figure 4-23. Appendix B contains a mapbook series of these remaining alignments drawn on USGS quad maps.

North Petersville Road

The North Petersville Road access route would be 78.8 miles long. This route originates from the existing Petersville Road and provides access to the western section of the Study Area, particularly the mining area west of the Upper Skwentna River (the Upper Skwentna mineralized area). A major bridge crossing of the Yentna River would be required. This route would require 13 bridge structures.

North Skwentna

The North Skwentna access route would be 71.6 miles long. It originates from Oil Well Road and also provides access to the Upper Skwentna mineralized area. This option would require two major bridge structures over the Yentna and Hayes rivers, in addition to 16 other bridges.

Middle Susitna-Skwentna River

The Middle Susitna-Skwentna River access route would be 107.9 miles long and is the longest route. It originates from the Little Susitna River Road and provides access to the mining area north of the Tordrillo Mountains. This route requires the highest number of bridges (24) of all the route options, including a 1,640-foot-long bridge over the Susitna River.

Beluga

The Beluga access route would be 63.8 miles long and is the shortest route. It originates from the Little Susitna River Road and provides access to the resources in the Beluga/Tyonek area. This route requires 13 bridge structures, including a 1,640-foot-long bridge over the Susitna River.

Deshka Variant

The Deshka variant option would be 33.5 miles long. It was included in this study to evaluate the possibility of providing access to nearby existing infrastructure, as well as providing road access particularly to lands with agricultural and timber/forestry potential.

5 ENGINEERING OF RESOURCE ACCESS ROUTES

Ten preliminary corridor segments were developed based on previously identified alignments, the constraints analysis, and engineering and environmental considerations, as detailed in Section 4. Further refinement of the preliminary corridor segments resulted in seven individual corridor alignments. For purposes of this study and determining access routes to identified termini, these alignments have been combined and refined, resulting in four access routes and one variant option, as presented in Section 4.5.3. Depending on the priority, funding, and timing of access needs, multiple routes could be chosen and combined or added to other routes in subsequent phases.

5.1 Preliminary Design Criteria

The road design criteria for the West Susitna access study were generated from the following published guidelines (in addition to professional engineering judgment):

- American Association of State Highway and Transportation Officials (AASHTO) 2004 *A Policy on Geometric Design of Highways and Streets* (PGDHS), as supplemented by the current edition of the Alaska DOT&PF's *Highway Preconstruction Manual* (PCM)
- AASHTO's 2001 Guidelines for Geometric Design of Very Low-Volume Local Roads
- U.S. Forest Service's Roadway Preconstruction Handbook

Table 5-1 summarizes the design criteria assumed at this time for a West Susitna access road. Anticipating the myriad of uses and vehicles that this new access road could see (e.g., public access for recreation, resource recovery, etc.), a 24-foot-wide, two-lane gravel access road (2'-10'-10'-2') was considered the facility, with the idea that the ultimate facility may be significantly wider based on further investigations or interest in the Study Area. See Appendix A for more details, as included in the Preliminary Design Criteria report. The dimension guidelines in Table 5-1 include the needs for both resource recovery and providing public access.

Table 5-1. West Susitna Access Design Criteria Summary

Functional classification	Rural Resource Recovery Road
Purpose:	Provide resource transport
Traffic volume	< 400 AADT
Number of Lanes	Two lanes
Design Vehicle	Tractors with double (belly-dump) trailers (WB-120 Trucks)
Design Speed	20-40 MPH depending on terrain
Surface	Unpaved
Traveled way width	10 feet (for two lanes)
Shoulder width	2 feet
Bridge width	Two lanes
Maximum Grade	7-16% (depending on terrain)
Curve Radius	380-feet @ 40 MPH
Stopping Sight Distance	250-feet @ 40 MPH
Vertical curves	Crest K = 29 @ 40 MPH Sag K = 35 @ 40 MPH
Clear Zone	0 to 6 feet or more up to 10 feet
Sideslopes	Foreslopes 4:1 Backslopes 2:1
Turnouts	n/a

AADT = Annual average daily traffic; MPH = miles per hour

5.1.1 Functional Classification

The suggested functional classification of an access road into the West Susitna basin would be a two-lane gravel **Rural Resource Recovery Road**.¹⁴⁷ The corridor would initially be considered a very low-volume local road. The PGDHS defines a very low-volume local road as one with an average annual daily traffic volume of 400 PVD or less.

The dimensions of a Rural Resource Recovery Road would more than meet the roadway dimensions and needs required for a **Rural Local Road**¹⁴⁸ or **Rural Minor Access Road**¹⁴⁹. The Rural Local Road classification is included here to highlight that this type of roadway could serve as pioneer access for initial exploratory investigations for natural resources. With minimal traffic, such an initial phase access would be classified as a Rural Local Road with the understanding that it will eventually function as and become a Rural Resource Recovery Road. However, Rural Local Road dimensions do not satisfy the design criteria needs (e.g., total roadway width) required for providing public access, per the Rural Minor Access Road classification. Therefore, the Rural Resource Recovery Road is the most reasonable functional classification for the West Sustina access route corridors at this time. Also, design criteria appropriate for a Rural Resource Recovery Road in many areas are

¹⁴⁷ AASHTO. 2004. A Policy on Geometric Design of Highways and Streets (PGDHS), page 414

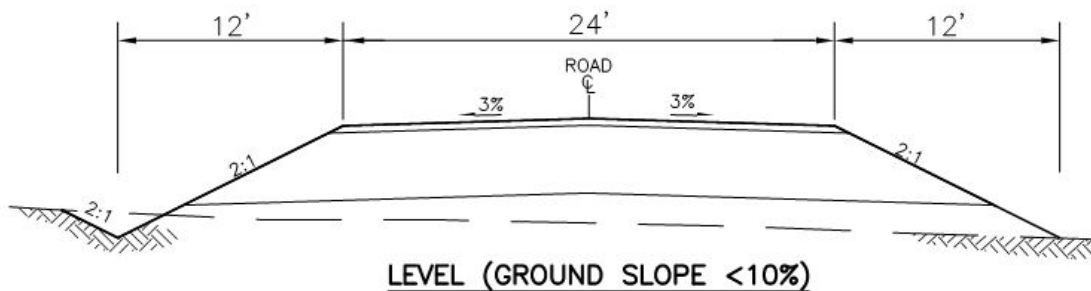
¹⁴⁸ PGHDS, page 416

¹⁴⁹ AASHTO. 2001. Guidelines for Geometric Design of Very Low-Volume Local Roads, page 6

not significantly different from those for recreational roads.¹⁵⁰ Oftentimes, resource development roads are ultimately used for other (e.g., recreational) purposes, assuming the volumes are still below 400 VPD. The Rural Resource Recovery Road classification for West Susitna access takes into account these varying usages.

The recommended road typical cross-section is a 24-foot-wide embankment (gravel, two lanes [2'-10'-10'-2']), as depicted in Figure 5-1. It is possible a wider road would ultimately be needed, depending on the type of vehicles used to transport the resource and access needs. At this time, it is not known which resources or equipment may be transported on this road, so we have assumed the road profile would suffice based on this reconnaissance-level effort.

Figure 5-1. West Susitna Access Typical Cross Section for a Rural Resource Recovery Road



The study team assumes the West Susitna access road could initially be classified as a very low-volume roadway (less than an average of 400 vehicles per day) to serve as a pioneer access route for exploratory investigations for natural resources. It is assumed that the roadway would be open to the public. In terms of public access, the road could also provide access to communities and recreational or hunting sites along the road. At this time and phase in the study, traffic volumes are assumed to still be below 400 vehicles per day and the road could meet the needs of a **Rural Resource Recovery Road**¹⁵¹ classification. Depending on resource development needs and public interest in accessing the lands found within the Study Area, traffic volumes could be more than 400 vehicles per day. With the uncertainty of resource development needs and public interest, it is difficult at this time to know with certainty traffic volumes. It is also possible a toll road could be a feature of the road, though there would not be limitations on the type of people who use it.

5.1.2 Other Design Considerations based on Interview-Identified Needs

While the data collection and resource industry interviews provided additional information, at this reconnaissance-level study, it is too early to project traffic generation and demand because not enough information exists about resource extraction quantities and transport needs. At this present time the amount, type, and schedule of concentrate removal and transport needs is not known. However, during the interviews conducted in early 2013 as part of the resource inventory task described in Section 2, the interviewees were asked the six transportation-specific questions listed below. Some of the answers provided, as they pertain to design criteria requirements, have been excerpted and included.

¹⁵⁰ PDGHS, page 414

Selected Questions:

- What transportation needs do you have for construction, fuel and mining equipment?
- Have access plans been explored? What kinds of modes have been considered or ruled out (rail, barge, air, pipeline, etc.)?
- What logistical challenges that you have experienced would be resolved by road access from the existing road system?
- What are typical vehicle types and/or sizes? Are there large, non-divisible loads that are overweight or over-sized?
- What type of concentrate or finished product will be taken from the site (estimated quantities and likely schedule)?
- What is the anticipated traffic (vehicle trips per day)? Will the workforce access the site by road or air?

Selected Answers:

- **Kiska** indicated they will need an all-season road for construction material, mining fleet and fuel delivery, and concentrate removal. Four concentrate-removal round trips and three light-service vehicle trips per day are expected. Kiska said pick-up trucks and standard tractor-trailers would be used to carry commercial loads. During production, vehicle traffic would include concentrate haul trucks. Kiska said their initial modeling suggests a single lane could be feasible, but a two-lane road is preferable. Kiska said their engineers suggest that occasional large, non-divisible loads are possible during construction, but during operation such loads would be less likely. Kiska said the Whistler mine would produce a gold-bearing copper sulphide concentrate. Daily concentrate production is estimated at 200 tonnes, requiring four daily round-trips using 52-tonne capacity concentrate haul trucks. For their workforce, Kiska estimates three light service trips daily. Crew changes would be either by road or by air.
- According to **On-Line**, the road would need to accommodate truck traffic, fuel haulage, and tractor-trailer rigs (standard commercial loads). If On-Line's project reached production, vehicle traffic would increase and include crew transportation vehicles and possibly larger concentrate haul trucks. On-Line said at present, during exploration, no product is produced from the site. If the project goes into production, concentrate removal down the access road will likely be required, depending on the commodities present. It is not possible at the present time to know the amount, type, and schedule of concentrate removal. For their workforce, On-Line anticipates remote sites, requiring on-site accommodations with fly-in crew changes. Possibly their Beaver Creek site could be a daily commute by crew bus.
- **PacRim** is planning to use air and barge for the Chuitna coal project. Rail and road links were considered, but are uneconomical if self-financed. Due to the project location, PacRim would use a barge option for large equipment. PacRim said coal would not be transported on the road system for export; all coal would be exported directly to ships from the mine site. PacRim said they anticipated 4 to 5 trucks per day for operations purposes. Workforce would be brought in by road and would require 150 round trips per week if private vehicles were allowed, far fewer if crew buses were used.
- **Apache** suggested giving the road an industrial classification. Apache said they have no concentrate or finished product, but they would hope to transport gas and oil by pipeline. There are no estimated volumes at this time. Operations would be years away.

- **Millrock** said during the exploration phase, typical vehicles on a roadway would be pick-up trucks and standard commercial loads. If the project reached production, vehicle traffic would increase and include crew transportation vehicles and possibly larger concentrate haul trucks. Millrock said at present, during exploration, no product is produced from the site. If the project goes into production, concentrate removal down the access road will likely be required, depending on the commodities present. For workforce access, Millrock anticipates an operation like Red Dog, with fly-in crew changes.
- **Linc Energy** said standard vehicles would be used for the bulk of their operations. Linc Energy said during construction of their plant facilities, there would be an expected need for large, non-divisible overweight loads; however, many of these would be brought by ocean-going ships and off-loaded close to the project area, minimizing distance traveled over the road system. Linc Energy said three products will be produced and all are expected to be transported off site by pipeline. The first product is UCG syngas transported to processing facilities on site or put into existing pipelines. Approximately 50 bcf/yr production is anticipated. The second product will be a synthetic fuel produced from the syngas, with estimated production ranging from 5,000 to 20,000 bbl/day. Final product would be CO₂ gas for enhanced oil recovery on the order of 7,000 or more tonnes per day. Linc Energy said they would prefer site access by road. During the peak construction phase, they said they could potentially have 1,000 people on site, but even during operations they would expect 200 persons on site. Access likely would be by crew cabs, rather than individual vehicles, but they said nothing is definite at present. Anticipated traffic is a function of number of persons on site and means of access.
- **Aurora** said the rig they move requires permit loads with a safety index of at least 200,000 load capacity for a single load.
- **Cook Inlet Energy** said typical vehicle types include tank trucks, drill rigs, cat machinery, and pick up trucks. Cook Inlet Energy said their drill rigs are at 95,000 pounds load weight. Cook Inlet Energy said their natural gas and/or oil would be transported by pipeline. Drilling waste would leave in sacks or bags. Cook Inlet Energy said the drilling and construction phases will have more traffic than the operations phase. Crews will either be local or arrive via air. But, if a road were available, they may drive in from Tyonek or the Matanuska-Susitna Valley. Cook Inlet Energy has been actively improving and expanding a gravel road and pad system in the Olson Creek / Otter area, including a gravel pit and a new bridge across Olsen Creek.

5.2 Additional Engineering Considerations

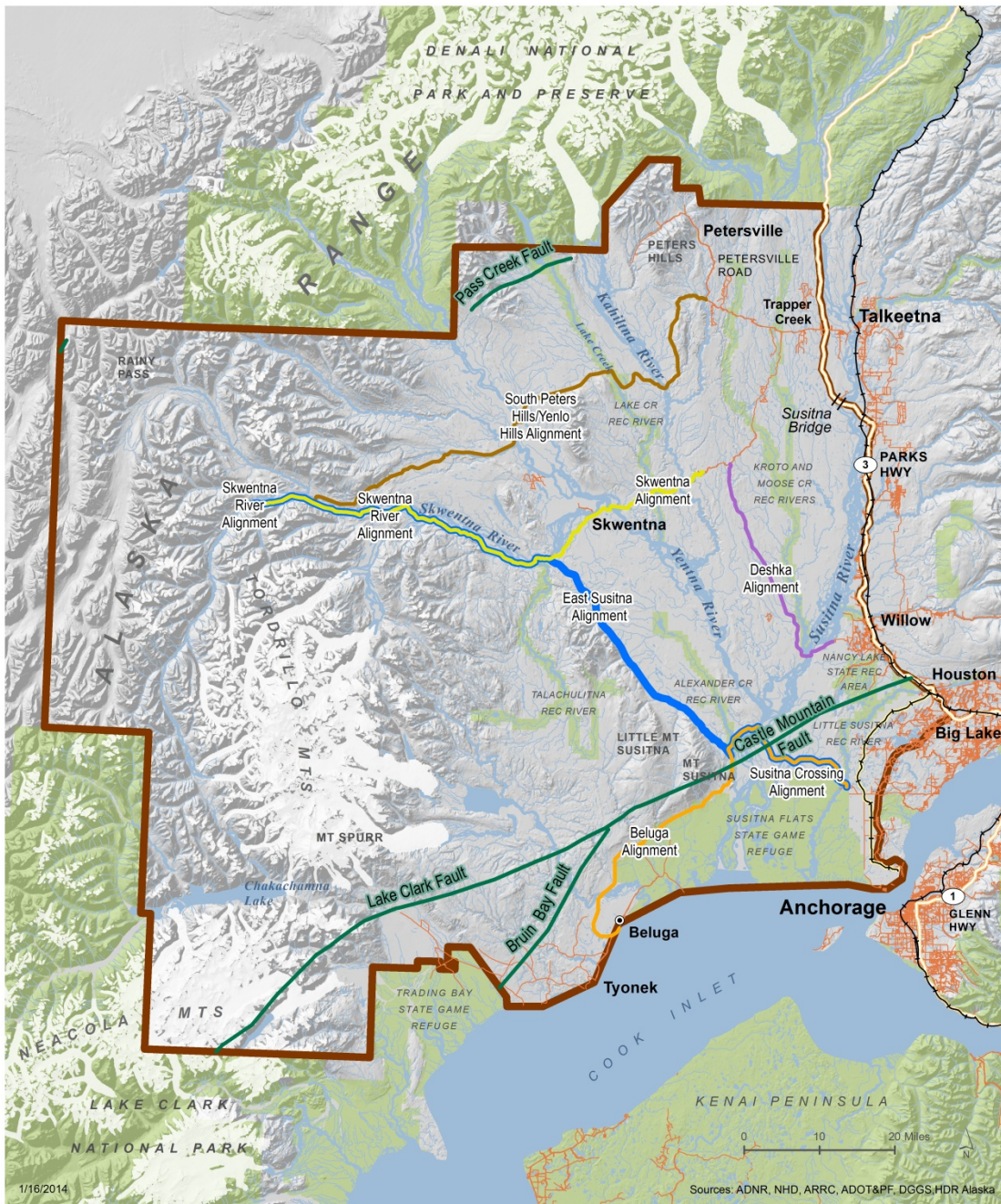
5.2.1 Seismicity

The Study Area is located in one of the most seismically active areas in the U.S. and is historically subject to relatively large earthquakes. Figure 5-2 depicts the fault locations in the Study Area. Within the Study Area, the Castle Mountain fault is located on the southern end of the Susitna lowlands. The Bruin Bay fault is also found in the Study Area; however, it is not considered an active fault system. The Bruin Bay fault is located along the base of Mount Susitna and trending northwest toward Beluga Mountain along the mountain front. The Lake Clark fault runs along the southeastern portion of the Study Area; it is not considered to be active. The relatively recent Pass Creek fault is centrally located in the Susitna lowlands with northeast to southwest trending surface expressions mapped west of Mt. Yenlo and the Kahiltna River.

If faulting is present and becomes active, seismicity could cause displacement along the roadway or associated structures. The potential for strong ground motions or associated liquefaction and slope failure should be a consideration in road location because some of these faults are considered to be Quaternary and active and are relevant to development and hazards mitigation. Additional explorations and evaluation should be conducted to more accurately locate or identify a fault in this location so that the alignment and associated features can be positioned so as not to straddle both sides of the fault's surface expression. Additionally, DNR-DGGS recommends that a neotectonic study may be required to map active surface traces of faults and to evaluate the local ground motions that may be generated by significant events. DGGS also recommends the scope of such a study should cover liquefaction, tectonic folding or warping of the ground surface, as well as secondary tectonic ground deformation (i.e., slope stability, lateral spread, and rock fall).¹⁵²

¹⁵² DNR-DGGS. October 8, 2013. Comments provided during a review of a draft of this report.

Figure 5-2. Proposed Access Routes and Fault Locations



Proposed Access Routes and Fault Locations

West Susitna Access to Resource Development

- | | | | |
|---|--|---|--|
| Proposed Access Routes | — Beluga | Study Area | — Highway |
| — North Petersville | — Deshka Variant | Park or Refuge | — Secondary Road |
| — North Skwentna | | | —+— Existing Rail |
| — Middle Susitna-Skwentna River | | | —+— Port MacKenzie Rail Extension |
| | | | — Major Faults Considered |

5.2.2 Hydrologic Considerations

Hydrology data are limited for the Study Area (other than near the Susitna River), likely a result of the relatively undeveloped and remote nature of the area. The Susitna River aside, creek crossings were identified from USGS mapping and Google Earth™. Bridge lengths were measured off Google Earth™, and quite often the imagery was fuzzy, so the bank-to-bank widths are estimates. Also, many of the small rivers or creeks are in a braided channel; the actual river or creek may only occupy a small fraction of the width of the channel. Bank-to-bank width was measured for the braided channels. Each proposed access route crosses major rivers and numerous drainages, requiring multiple bridge structures and culverts.

The hydrology of the Susitna River is fairly well documented. The location of the crossing over the Susitna River considered a number of hydrological factors, as discussed earlier in Section 4.3. The crossing of the Susitna River considered the floodplain extent. However, due to the hydrologically active nature of the region, the DNR-DGGS recommends obtaining current imagery and LIDAR to conduct a cursory flood hazard evaluation. Though beyond the scope of this reconnaissance-level study, additional hydrologic considerations that should be further considered include potential basin responses to intense storms, glacio-fluvial controls, sediment mobilization, and landslide and debris flows, particularly in regard to how these might affect road infrastructure.¹⁵³

Construction, and likely maintenance, of the road will require nearby water sources. During construction of the access road, water will be necessary for both dust control and aggregate compaction. The construction contractor will request a permit to pump water from a waterbody (such as a nearby creek or lake) that can sustain the draw-off of the water. After the road is constructed, the need for water will no longer exist unless a large repair area forms and the maintenance crew does not have its own source of water needed to compact the aggregate. If the road design requires seeding the sideslopes of the road, water would be required to keep the grass growing until it is accepted as self-sustaining. In the event that ice roads are used, sprayers would be required to build up the ice thickness until there is enough to support the anticipated loads. Maintenance would only be required after the ice road is damaged through melting.

5.2.3 Geological and Geotechnical Considerations

Numerous glaciers are found in the Alaska Range and extend down valleys to near the edges of the lowlands. Glacially carved bedrock, moraines, drumlins, and kettle lakes are some of the landforms in the Study Area that are constantly being reshaped by continuous erosional processes.

Regional geologic processes will have a substantive impact on the design and performance of transportation infrastructure in the Study Area. Such processes include stream icing, slope instability, flooding (through precipitation, liquefaction, lateral spreading, etc.). Many of these processes are complementary and should be evaluated separately as well as in relation to each other. The Study Area is likely subject to most, if not all, of these regional processes; however, some areas may be more prone than others. In general, the flooding, icing, and seismic influences will be more prevalent in low-lying areas and in areas near streams and floodways. Glacial outburst flooding will be difficult to predict, but can influence areas well outside of natural river floodways for relatively large distances below existing glaciers. Seismic influences will also more significantly impact areas adjacent to or on sloping ground, with greater severity on steeper gradients.

¹⁵³ DNR-DGGS. October 8, 2013. Comments provided during a review of a draft of this report.

Rock Borrow Availability

Rock material source availability addresses the proximity of rock materials to the corridors studied for this project. Rock materials will be an important resource for the construction of the proposed access road and associated facilities and structures. Material produced from quarries can be used in a wide variety of applications, including embankment development, concrete and/or asphalt aggregate, revetment, and surfacing material. The proximity of the rock materials is important because the distance that the material will need to be hauled during construction will have a direct impact on the cost of construction. If rock material is not available adjacent to the roadway, additional access roads may be needed to reach potential sources, which would also have an impact on the cost of the improvements and increase the footprint of the project. For successful completion of this project, it will be essential that the final corridor selected have multiple sources of rock material along its full length. These sources will ideally be located adjacent to the final road alignment and require minimal development of branch roads to access them.

Rock Borrow Quality

Borrow rock quality addresses the rock material types available along each corridor for construction of the road and associated facilities. Rock material quality is important to the project because some of the uses for the material will require it to be durable (i.e., resistant to mechanical degradation). In general, rock material used in the construction of this project will need to meet the various durability requirements set forth in DOT&PF standards, depending on its application (aggregate, rip-rap, etc.). The highest quality, most durable materials should be used in the production of aggregates and rip-rap, while lower quality materials can be used in embankment construction as shot-rock fill. Typically, intrusive igneous rocks such as granite and diorite yield very high durability values. Extrusive igneous rocks (such as basalt) and lightly metamorphosed rocks (such as phyllite) typically have somewhat lower durability characteristics. Highly metamorphosed rocks such as schist, as well as sedimentary rocks, usually have the lowest durability values. The selected corridor should have rock sources that produce high-durability materials that can be developed into rock materials of a wide variety of sizes. High-quality sources will reduce the construction costs by reducing the need to import higher durability materials from long distances.

Soil Borrow Availability

Soil borrow source availability addresses the proximity of soil materials to the corridors studied for this project. Soil borrow materials will be an important resource for the construction of the proposed access road and associated facilities and structures. Soil borrow materials will likely be most widely used to provide embankment fill materials and as structural fill for the roadway. It could also likely be used in producing fine aggregates and as structural fill around drainage structures, culverts, bridges, and in utility trenches. As with rock material sources, the proximity of the soil borrow sources to the proposed roadway will have a direct impact on construction costs. Sources that are farther from the proposed roadway will have longer haul times and will increase the footprint of the project. To complete the construction of this project, the final corridor selected will need multiple sources of soil borrow along its full length. As with the rock material sources, the soil borrow sources should be located adjacent to the final road alignment so that additional branch roads are not needed for access.

Soil Borrow Quality

Borrow soil quality addresses the soil material types available in the soil borrow sources along each corridor. While soil availability is important, the quality of the available material will also impact the cost of the project. Ideally, soil borrow used for this project will consist of clean (low fines content), well-graded sand and gravel. Such material will most likely be found in outwash and/or alluvial deposits as well as some moraine deposits. This material would lend itself well to development of structural sections for the road as well as structural fill around bridge and culvert foundations. Poorly graded soils or soils with higher fines content (such as those found in glacial till or moraine deposits) may also be utilized, but their applications will be limited to deep embankment development. Regardless of the gradation of the soil fill used, it should not contain free ice, organic detritus, or a significant amount of plastic fines. Higher quality soil borrow resources along the project corridor will help reduce construction cost. The high quality materials will require less processing (washing, screening, etc.), and if they are located at regular intervals along the alignment, they will not need to be imported from long distances. Ideally, the final selected corridor will have multiple, high-quality soil borrow sources along its full length.

Foundation Support

Foundation support addresses the overall likely subgrade support for structure foundations along the various corridors. From a foundation support standpoint, the most ideal condition is a foundation supported on shallow, competent bedrock. Less ideal conditions range from soft bedrock and/or dense soil support to thick deposits of soft and/or compressible mineral and organic soils that require deep foundations. Other less ideal conditions include thaw unstable permafrost and liquefiable soils. In general, the poorer the foundation support conditions, the deeper the foundation systems must be to transmit structural loads to the subsurface. The cost advantages to selecting a corridor with ideal foundation support conditions is obvious in that shallower foundations require significantly fewer materials and less effort to construct. Ideally, the corridor that is selected will traverse ground that lends itself to development of relatively shallow foundations on bedrock and/or dense, stable, mineral soils.

Permafrost Conditions

Permafrost conditions address the state and nature of frozen ground under the various corridors studied for this project. The proposed improvements will have an impact on the thermal regime along each corridor that will likely result in warming of the ground under and around the new road. Based on the location of this project, it is likely that the majority of the ground beneath each alignment is not frozen continuously throughout the year. If permafrost conditions exist in a given area, it is more favorable if the soil consists of materials that do not lose a significant amount of strength when thawed. Such conditions will likely include shallow bedrock and dense soils that have low fines content. Unfavorable conditions include poorly drained soils, fine-grained soils, and permafrost conditions with large amounts of segregated ice. Such soils are subject to long-term creep under foundation and/or slope loading and typically lose a significant amount of strength when thawed. Having favorable permafrost conditions along the selected corridor will have a cost benefit, as no measures (such as insulation and refrigeration) will need to be taken to maintain the thermal balance under the roadway and associated structures.

Subgrade Support

Subgrade support addresses the general support capabilities of the subsurface materials along each corridor considered for this project. In general, favorable subgrade support conditions consist of shallow bedrock and/or firm, well-drained mineral soils. Poor conditions include thaw unstable permafrost and thick deposits of soft and compressible (mineral or organic) soils. Favorable subgrade support conditions will have a positive impact on construction costs in several ways. Firm subgrade support typically provides more ideal construction conditions and presents fewer constructability challenges since conventional equipment can be used. Furthermore, firm subgrade support circumvents the need for costly subgrade improvement such as excavation and replacement of unsuitable soils, and typically results in thinner embankments and structural sections. Additionally, ideal subgrade support conditions allow for steeper embankment slopes that require less material to construct and result in a smaller project footprint.

Drainage

Drainage addresses the general surface and near-surface drainage characteristics of each corridor considered for this project. Well-drained conditions are usually found in free-draining soils and in topography that is sloped to allow for the conveyance of surface water. Poor drainage is typically encountered in flat terrain with soils that do not allow for infiltration of surface water (such as in peat bogs or in permafrost terrain). In general, well-drained ground conditions typically result in favorable support conditions for new roads and structures. Development of roadways in poorly drained areas results in higher costs associated with designing and constructing additional drainage provisions in the form of culverts and/or porous embankments. Additional costs may also be associated with development of embankments and structures with poor subgrade support in these areas.

5.3 Proposed Access Routes

The proposed access routes are described in this section and engineering considerations are summarized in Table 5-2. Depending on the priority, availability and timing of access needs, multiple routes could be chosen and combined or added to other routes in subsequent phasing. For example, the destination for the Middle Susitna-Skwentna River route is the mining area in the Tordrillo Mountains. If this route was selected and then later access to Beluga was desired, an approximate 38-mile alignment branching from the Middle Susitna-Skwentna River route could be added for an additional approximate \$103 million.

Table 5-2. Proposed Access Routes Engineering Considerations Summary

	North Petersville Road	North Skwentna	Middle Susitna- Skwentna River	Beluga	Deshka Variant
Alignment combination	South Peters Hills/ Yenlo Hills	Skwentna Skwentna River	Susitna Crossing East Susitna Skwentna River	Susitna Crossing Beluga	Deshka
General origin	Petersville Rd	Oil Well Rd	Little Su River Rd	Little Su River Rd	Willow area
General destination	Upper Skwentna mineralized area	Upper Skwentna mineralized area	Upper Skwentna mineralized area	Beluga/ Tyonek	Area south of Oil Well Rd
Length (miles)	78.8	71.6	107.9	63.8	33.5
Bridges (#)					
<i>Conventional</i> ¹	9	12	20	11	1
<i>Long Span</i> ²	4	6	4	2	2
<i>Total</i>	13	18	24	13	3
Bridges (>1,000 feet)	1,150 (Yentna)	1,200 (Yentna) 1,200 (Hayes)	1,200 (Hayes) 1,640 (Susitna)	1,640 (Susitna)	1,200 (Susitna)
Culverts (#)					
<i>Large</i> ³	12	12	14	6	2
<i>Small</i> ⁴	37	26	40	12	11
<i>Minor Drainage</i> ⁵	316	292	440	260	136
Cost Estimate (millions)					
<i>Subtotal</i> ⁶	\$147.6	\$188.3	\$187.4	\$106.9	\$72.2
<i>Total</i> ⁷	\$376.4	\$504.3	\$453.2	\$257.8	\$216.9
<i>Total per mile</i> ⁸	\$4.6	\$6.3	\$4.2	\$4.0	\$5.2

Assumptions:

¹ Conventional bridges are considered less than 300 feet in length.

² Long span bridges are 300 feet or longer.

³ A culvert approximately 96 feet or longer.

⁴ Small culverts and minor drainage culverts have an assumed length of approximately 50 feet.

⁵ An additional four culverts per mile to accommodate minor drainage patterns.

⁶ Subtotal cost estimate for new proposed roadways includes clearing, earthwork, structures, stream and river crossings (including culverts), guardrail and retaining walls, and miscellaneous items such as topsoil, seeding, geotextile and signing.

⁷ Total cost estimate includes drainage measures, erosion and pollution, surveying, environmental studies and permits, existing road upgrades, construction, mobilization, ROW acquisition, contingency, design, and utilities.

⁸ Total per mile cost includes only the proposed access routes and does not include existing roadways or cost to upgrade them.

5.3.1 North Petersville Access Route

The 78.8-mile North Petersville access route would originate from the existing Petersville Road and end in the mining area north of the Tordrillo Mountains. See Figure 5-3. This route consists of the South Peters Hills/Yenlo Hills alignment, as described in Section 1.1.1. From Petersville Road, the route would cross a number of major rivers and travel through the Lake Creek and Kroto and Moose Creek Recreation Rivers.

The North Petersville access route generally trends east to west and typically follows topographic highs where possible. Much of the eastern two-thirds of the route is characterized by low (less than 100 feet tall) topographical highs, separated by low, poorly drained, boggy areas. Given the variable terrain, it is anticipated that drainage along the route is generally good except for the interspersed wetland areas that will be crossed. The potential for permafrost along this route is likely the greatest in comparison to other routes in this study. Permafrost soils can be expected in higher elevations and on the north side of topographic high areas. Some of the low, poorly drained, boggy areas may also be underlain by permafrost soils.

The route would require the following 13 bridge structures, as numbered on the associated figure:

- | | |
|------------------------------------|---------------------------------|
| 1. 500-ft over Skwentna River | 8. 40-ft over an unnamed slough |
| 2. 30-ft over an unnamed creek | 9. 280-ft over Lake Creek |
| 3. 220-ft over Johnson Creek | 10. 50-ft over Shovel Creek |
| 4. 400-ft over Kitchatna River | 11. 50-ft over an unnamed creek |
| 5. 1,150-ft over Yentna River | 12. 420-ft over Kahiltna River |
| 6. 120-ft over Donkey Creek Slough | 13. 170-ft over Peters Creek |
| 7. 80-ft over Donkey Creek | |

Compared to other route options, this route provides access to an average amount of resources, as shown in Table 6-1.

5.3.2 North Skwentna Access Route

The 71.6-mile North Skwentna access route would originate from the existing Oil Well Road and end in the mining area north of the Tordrillo Mountains. See Figure 5-4. This route combines the Skwentna and Skwentna River alignments, as detailed in Section 1.1.1. This route goes through the Lake Creek and Talachulitna Recreation Rivers.

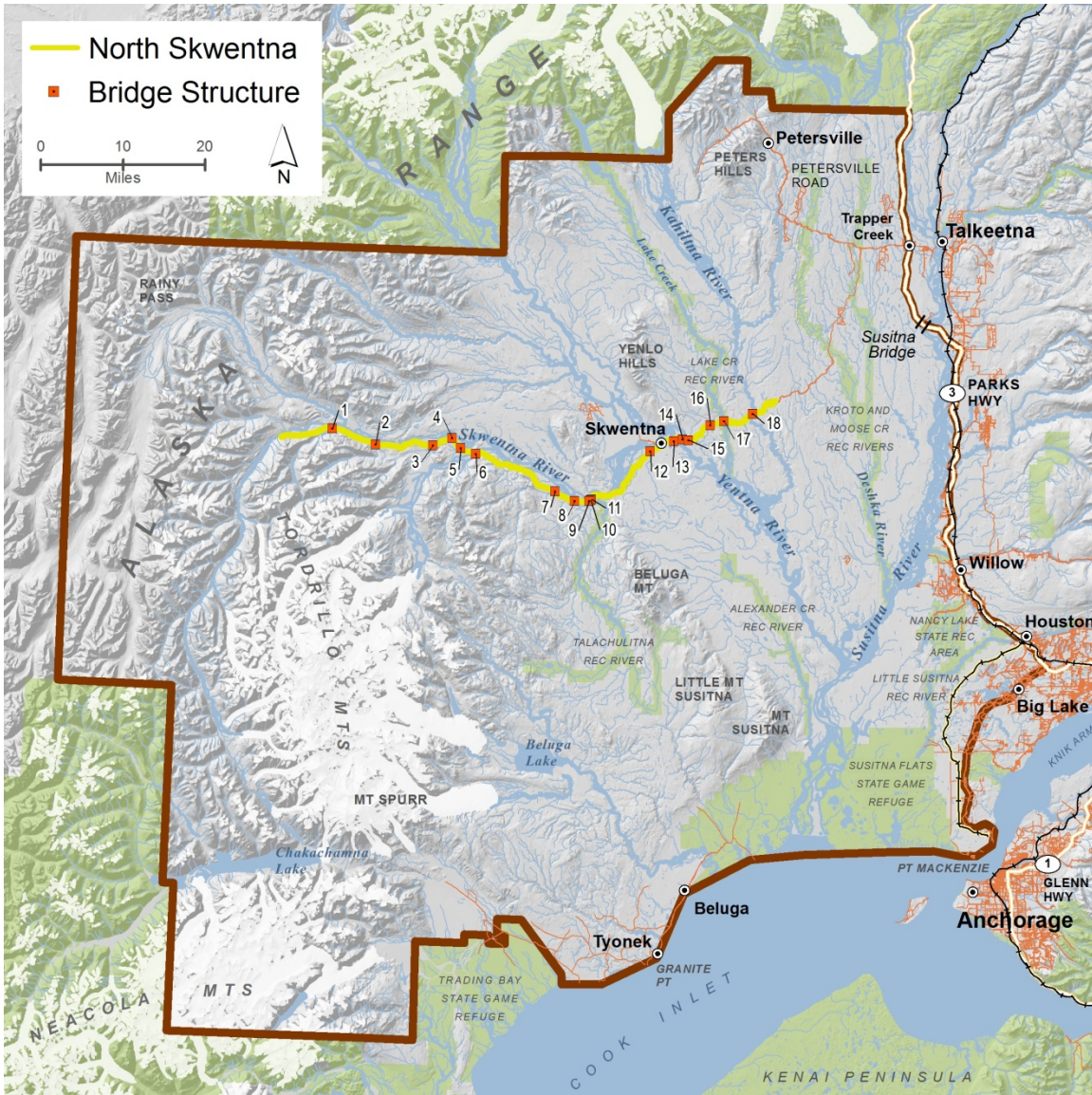
The eastern portion of this route (Skwentna alignment) generally runs east-west along lowlands around the Yentna and Skwentna Rivers. Low-lying, boggy areas are very prevalent along this portion. Subgrade support is anticipated to be highly variable, and drainage in the boggy areas may be a challenge in design and construction. The route crosses the Skwentna River and traverses well-drained, alluvial terraces between the Skwentna River and the mountainous terrain. Permafrost soils are not anticipated to be encountered along the eastern portion of the route, whereas they might be encountered as the route comes within close proximity to the mountainous terrain.

The route would require the following 18 bridge structures, as numbered on the associated figure:

- | | |
|----------------------------------|------------------------------------|
| 1. 300-ft over Chickak River | 10. 60-ft over an unnamed slough |
| 2. 440-ft over Old Man Creek | 11. 250-ft over Talachulitna River |
| 3. 90-ft over Red Salmon Creek | 12. 80-ft over Eightmile Creek |
| 4. 200-ft over an unnamed slough | 13. 1,200-ft over Yentna River |
| 5. 250-ft over an unnamed slough | 14. 80-ft over an unnamed creek |
| 6. 1,200-ft over Hayes River | 15. 320-ft over an unnamed slough |
| 7. 250-ft over Canyon Creek | 16. 160-ft over an unnamed slough |
| 8. 50-ft over an unnamed slough | 17. 270-ft over Lake Creek |
| 9. 90-ft over an unnamed slough | 18. 450-ft over Kahiltna River |

Compared to other routes, this route provides access to the greatest number of acres of hardrock mineral resources. This route also provides access to a great number of forestry/timber resources.

Figure 5-4. North Skwentna Proposed Access Route



5.3.3 Middle Susitna-Skwentna River Access Route

The Middle Susitna-Skwentna River access route would originate from the existing Little Susitna River Road and end in the mining area north of the Tordrillo Mountains. See Figure 5-5. Nearly 108 miles long, this is the longest access route proposed in this study. This route combines three alignments (Susitna Crossing, East Susitna, and Skwentna River), as detailed in Section 1.1.1. This route goes near the Susitna Flats State Game Refuge and the Alexander Creek, Talachulitna, and Little Susitna Recreation Rivers.

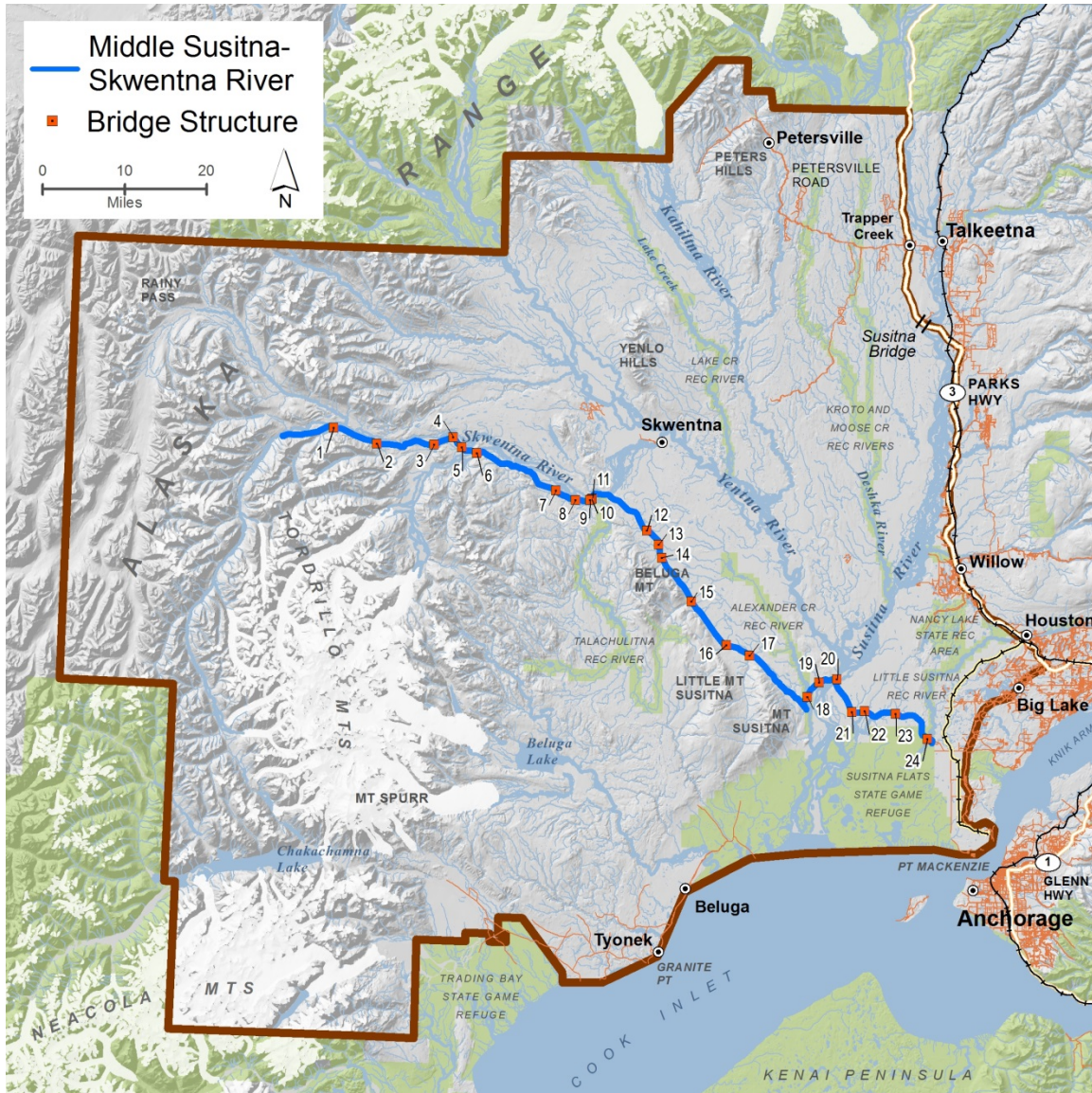
The western portion of this route (the Susitna Crossing alignment) travels east-west, with existing mapping showing the route crossing almost exclusively glacial moraine and kame deposits except for alluvial terrace deposits adjacent to Alexander Creek and the Susitna River. Based on USGS mapping, the land between the Little Susitna and Susitna Rivers contains many scattered, low-lying, poorly drained, boggy areas. To the west of the Susitna River crossing, mapping indicates the route (East Susitna alignment) goes through soil deposits that are variable ranging from glacial tills, outwash, and isolated alluvial deposits, which should yield a variety of soil materials with variable quality. The route then traverses well-drained, alluvial terraces between the Skwentna River and the mountainous terrain (Skwentna River alignment). Permafrost is not anticipated in the eastern portion of this route, but may be encountered in the mountainous terrain to the west of the Susitna River.

The route would require the following 24 bridge structures, as numbered on the associated figure:

- | | |
|------------------------------------|--------------------------------------|
| 1. 300-ft over Chickak River | 13. 50-ft over Deep Creek |
| 2. 440-ft over Old Man Creek | 14. 50-ft over Clear Creek |
| 3. 90-ft over Red Salmon Creek | 15. 40-ft over Bear Creek |
| 4. 200-ft over an unnamed slough | 16. 50-ft over Upper Sucker Creek |
| 5. 250-ft over an unnamed slough | 17. 80-ft over Wolverine Creek |
| 6. 1,200-ft over Hayes River | 18. 200-ft over Alexander Creek |
| 7. 250-ft over Canyon Creek | 19. 150-ft over Anderson Creek |
| 8. 50-ft over an unnamed slough | 20. 1,640-ft over Susitna River |
| 9. 90-ft over an unnamed slough | 21. 30-ft over an unnamed slough |
| 10. 60-ft over an unnamed slough | 22. 30-ft over an unnamed slough |
| 11. 250-ft over Talachulitna River | 23. 30-ft over Fish Creek |
| 12. 20-ft over an unnamed creek | 24. 170-ft over Little Susitna River |

Due to the length of this route, this route provides access to the greatest number of claims and acreages of a number of resources, including hardrock minerals, placer gold mining claims, and forestry/timber resources. See Table 6-1.

Figure 5-5. Middle Susitna-Skwentna River Proposed Access Route



5.3.4 Beluga Access Route

The Beluga access route would originate from the existing Little Susitna River Road and end near Beluga. Approximately 64 miles in length, this is the shortest access route proposed in this study (other than the Doshka variant, which is only 33.5 miles long). See Figure 5-6. This route combines the Susitna Crossing and Beluga alignments, as further described in Section 1.1.1. This route runs through the Susitna Flats State Game Refuge and the Alexander Creek and Little Susitna Recreation Rivers.

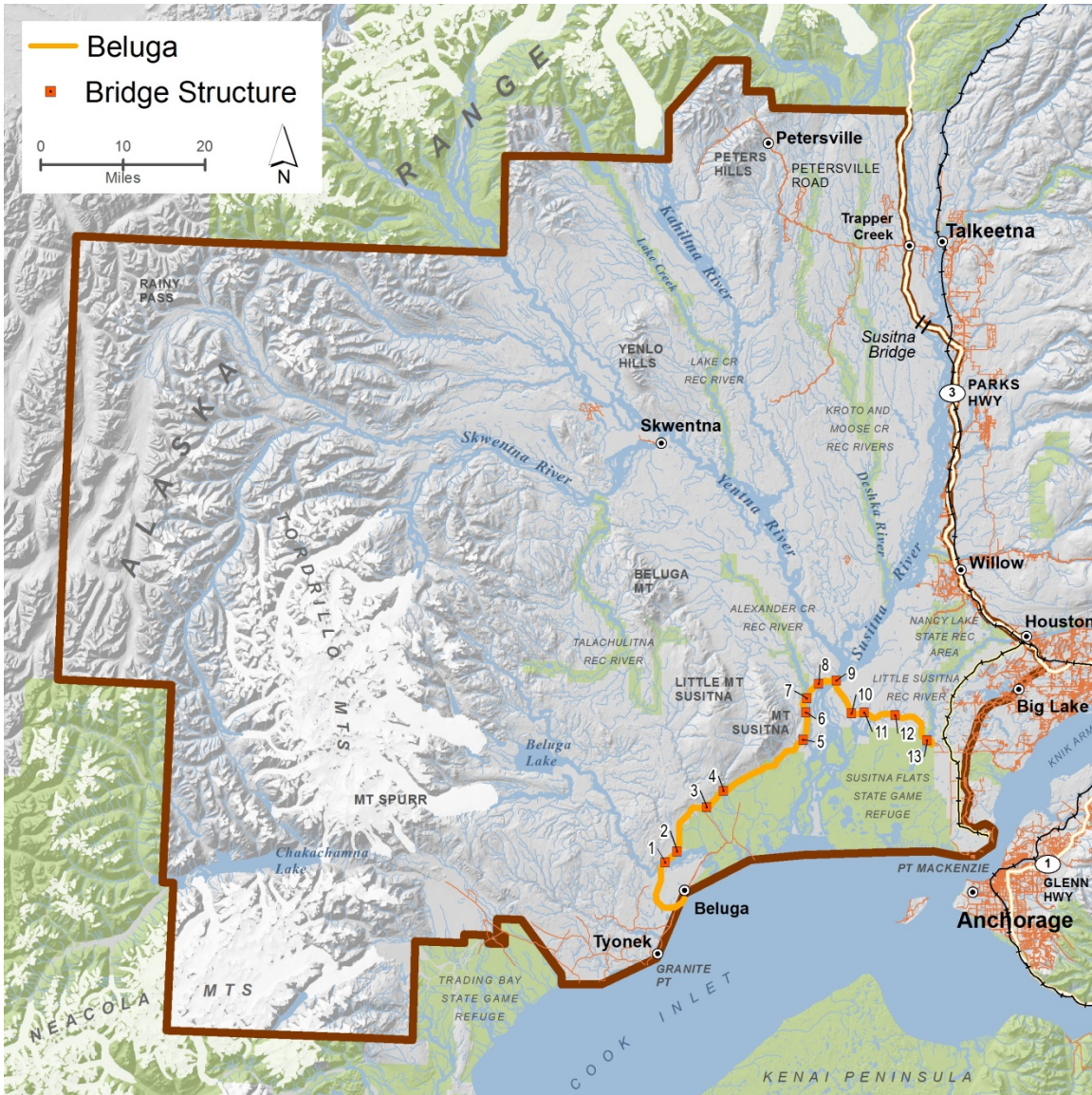
The western portion of this route (the Susitna Crossing alignment) travels east-west, with existing mapping showing the route crossing almost exclusively glacial moraine and kame deposits except for alluvial terrace deposits adjacent to Alexander Creek and the Susitna River. Based on USGS mapping, the land between the Little Susitna and Susitna Rivers contains many scattered, low-lying, poorly drained, boggy areas. Once west of the Susitna River, the ground traversed by the route appears to be relatively well-drained, except for the far southwest end of the alignment near the Beluga River. The Castle Mountain fault is mapped in this area and appears to follow a significant portion of the route west of the Susitna River. Permafrost soils are not anticipated along this route.

The route would require the following 13 bridge structures, as numbered on the associated figure:

- | | |
|--------------------------------|--------------------------------------|
| 1. 650-ft over Beluga River | 8. 150-ft over Anderson Creek |
| 2. 50-ft over Olson Creek | 9. 1,640-ft over Susitna River |
| 3. 150-ft over Theodore River | 10. 30-ft over an unnamed slough |
| 4. 210-ft over Lewis River | 11. 30-ft over an unnamed slough |
| 5. 40-ft over Granite Creek | 12. 30-ft over Fish Creek |
| 6. 40-ft over Pierce Creek | 13. 170-ft over Little Susitna River |
| 7. 200-ft over Alexander Creek | |

Compared to other routes, this route provides access to the highest number of acres of coal resources and second highest acreage of oil and gas resources.

Figure 5-6. Beluga Proposed Access Route



5.3.5 Deshka Variant Access Route

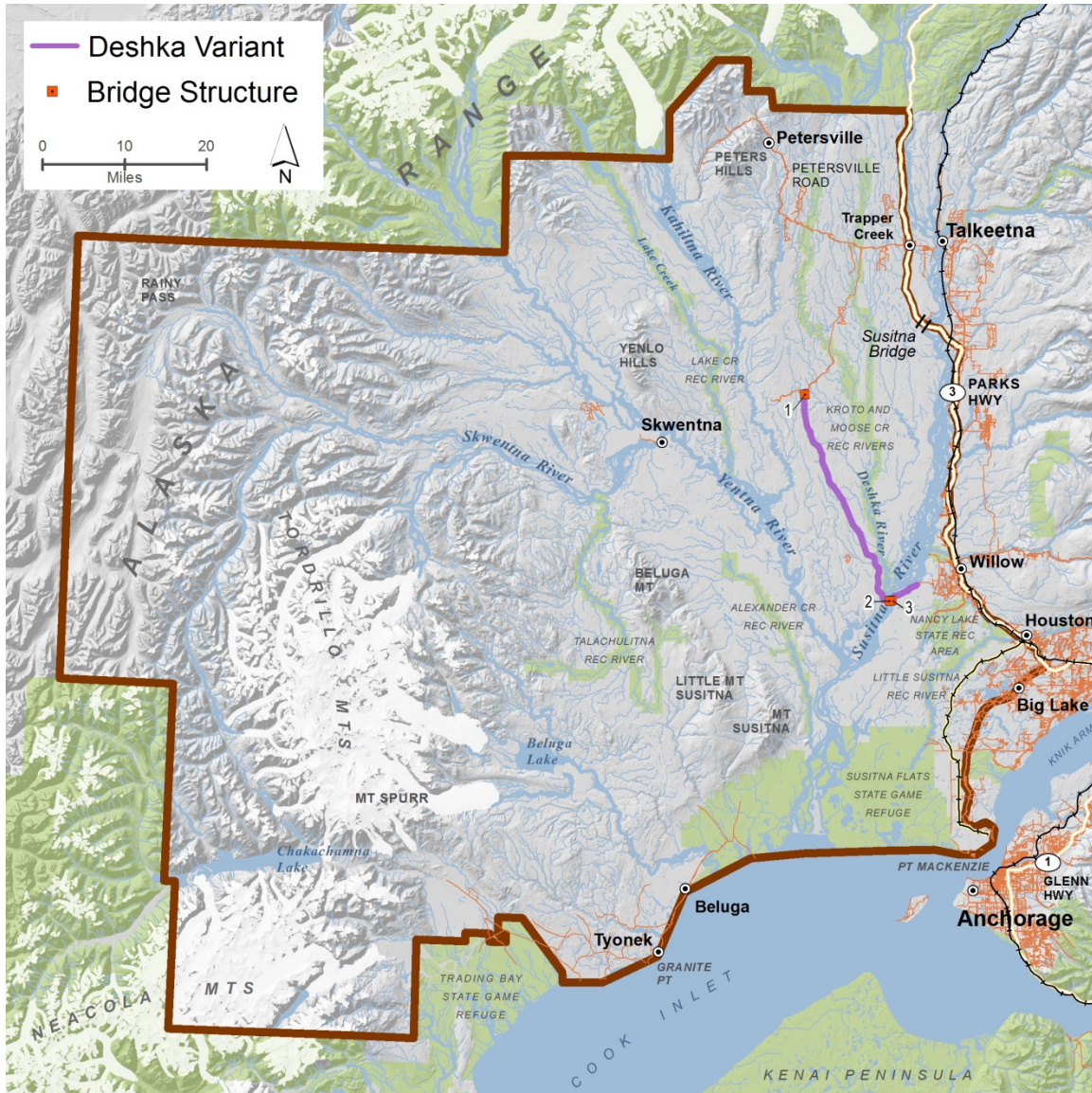
The 33.5-mile Deshka variant access route was included to provide access near existing infrastructure and specifically to potential agricultural and timber lands. See Figure 5-7. This variant originates near Deshka Landing, west of Willow, and traverses north to the existing Oil Well Road. Section 1.1.1 details this further. This route runs near the Kroto and Moose Creek Recreation Rivers as well as the Nancy Lake and Willow Creek State Recreation Area.

In general, this route follows relatively low relief ridges (less than 50 to 100 foot tall) that parallel the Deshka River. The variant would require two bridge structures over the Susitna River and one additional structure over an unnamed creek, as depicted on the associated figure.

1. 20-ft over an unnamed creek
2. 1,200-ft over Susitna River (Susitna River Bridge #2)
3. 900-ft over Susitna River (Susitna River Bridge #1)

Compared to other routes, this variant provides access to the most amounts of acres of oil and gas permit/leases and potential agricultural areas. It provides access to the least amount of hardrock minerals and coal acres.

Figure 5-7. Deshka Variant Access Route



5.4 Preliminary Cost Estimates

Preliminary cost estimates were prepared using the reconnaissance-level engineering and DOT&PF bid tabs for the Northern Region. Where data for a particular item was not available, similar information from the DOT&PF Central Region was used. Using the National Highway Construction Cost Index (NHCC) published by the Federal Highway Administration (FHWA), the average unit prices were adjusted from their date of bidding to 2013 dollars. Once all of the average unit prices had been normalized to 2013 dollars, they were plotted to determine whether a trend existed within the data set. For many of the items, a distinct trend emerged and made it possible to estimate the unit price as a function of the item quantity. Due to the scale of the project, quantities for some items exceeded the quantities for any of the available historic bid tab data. In these cases, the unit price for the highest quantity on record was substituted as a conservative estimate. Unit prices were rounded to the nearest cent. Figure 5-8 and Table 5-3 presents the preliminary cost estimates with assumptions following the table. See Appendix D for additional cost estimate details.

Figure 5-8. Reconnaissance-Level Total Cost Estimate Comparison

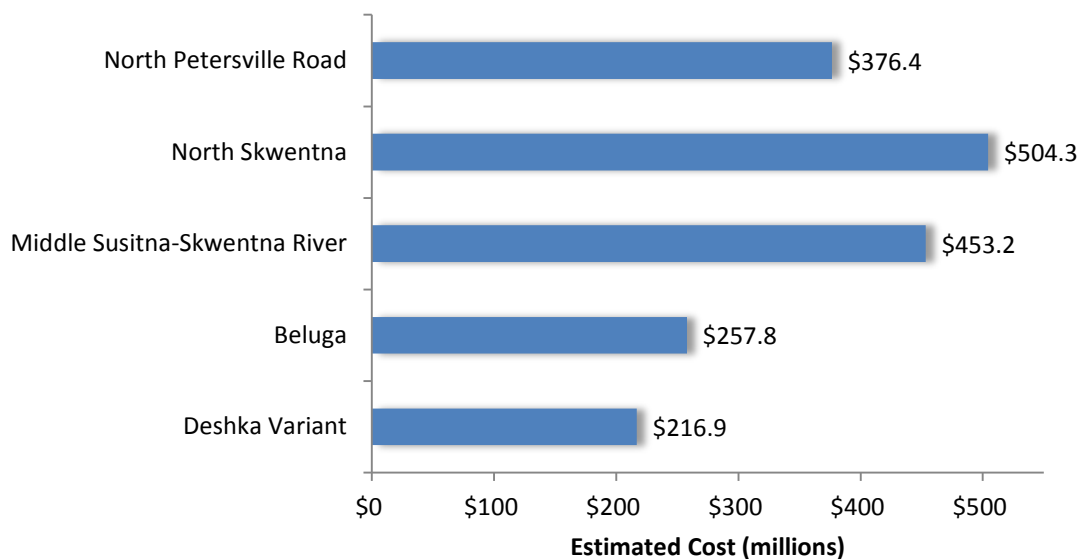


Table 5-3. Preliminary Cost Estimates (in millions)

	North Petersville Road	North Skwentna	Middle Susitna- Skwentna River	Beluga	Deshka Variant
Clearing	\$2.2	\$2.0	\$2.7	\$1.5	\$0.73
Earthwork	\$29.4	\$29.3	\$26.4	\$9.9	\$3.7
Structural Section	\$15.9	\$14.5	\$21.9	\$12.9	\$6.8
Stream/River Crossings (includes bridges and culverts)	\$83.7	\$125.9	\$119.4	\$74.9	\$57.3
Miscellaneous	\$16.3	\$16.6	\$17.0	\$7.6	\$3.7
<i>Subtotal</i>	<i>\$147.6</i>	<i>\$188.3</i>	<i>\$187.4</i>	<i>\$106.9</i>	<i>\$72.2</i>
Drainage Measures	\$14.8	\$18.9	\$18.8	\$10.7	\$7.3
Erosion and Pollution	\$4.5	\$5.7	\$5.7	\$3.3	\$2.2
Surveying	\$4.5	\$5.7	\$5.7	\$3.3	\$2.2
Construction Traffic Control	\$7.4	\$9.5	\$9.4	\$5.4	\$3.7
Contractor Furnished	\$1.5	\$1.9	\$1.9	\$1.1	\$0.8
Mobilization (10%)	\$14.8	\$18.9	\$18.8	\$10.7	\$7.3
<i>Subtotal</i>	<i>\$195.1</i>	<i>\$248.9</i>	<i>\$247.7</i>	<i>\$141.4</i>	<i>\$95.7</i>
Contingency (30%)	\$58.5	\$74.7	\$74.3	\$42.4	\$28.7
<i>Construction Subtotal</i>	<i>\$253.6</i>	<i>\$323.6</i>	<i>\$322.1</i>	<i>\$183.9</i>	<i>\$124.5</i>
Environmental study/ permitting (3%)	\$7.6	\$9.7	\$9.6	\$5.5	\$3.7
Construction Administration (15%)	\$38.1	\$48.6	\$48.4	\$27.6	\$18.7
Project Camp (2%)	\$5.1	\$6.5	\$6.5	\$3.7	\$2.5
<i>Subtotal</i>	<i>\$304.4</i>	<i>\$388.4</i>	<i>\$386.7</i>	<i>\$220.7</i>	<i>\$149.4</i>
Design (10%)	\$30.5	\$38.9	\$38.7	\$22.1	\$15.0
Utilities (0.5%)	\$1.6	\$2.0	\$2.0	\$1.2	\$0.8
ROW	\$5.7	\$1.4	\$4.2	\$1.5	\$0.05
<i>Subtotal</i>	<i>\$342.2</i>	<i>\$430.7</i>	<i>\$431.6</i>	<i>\$245.5</i>	<i>\$165.3</i>
ICAP	\$17.1	\$21.5	\$21.6	\$12.3	\$8.3
TOTAL for new access routes	\$359.4	\$452.3	\$453.2	\$257.8	\$173.6
Existing road upgrades	\$17.0	\$52.0	\$0	\$0	\$43.3
TOTAL	\$376.4	\$504.3	\$453.2	\$257.8	\$216.9
<i>Total per mile for new roadway *</i>	<i>\$4.6</i>	<i>\$6.3</i>	<i>\$4.2</i>	<i>\$4.0</i>	<i>\$5.2</i>

* Total per mile includes only the proposed access routes and does not include existing roadways or cost to upgrade them.

5.4.1 Assumptions for Cost Estimate Development

Once the unit price-quantity relationships were established, they were applied to planning level quantities to calculate and estimate the cost for each item. Additional assumptions were made in applying engineering judgment to many items that will not be directly measured at this stage of the project. The assumptions for each item are as follows.

Clearing

Assuming an average embankment width of 40 feet plus an additional 10 feet on either side, the clearing quantity is estimated at 7.3 acres per mile for all three terrain classifications.

Unclassified Excavation

Due to the coarseness of the available terrain data, modeling earthwork over representative sections gives a rough estimate at best. Instead, representative cross sections were drawn for each terrain type. In each typical section the roadway template remains constant but the terrain cross slope is varied as follows; 10% for level, 25% for rolling, 40% for mountainous. The resulting excavation and embankment cross section areas were then used as the basis for the per mile quantity. The portions of the alignment crossing each terrain type were added together then were multiplied by the respective quantity in that terrain type to arrive at the total quantity.

Embankment Borrow C

The quantities for embankment were estimated for each terrain type as described above. The large embankment quantity is an example of an item where quantity relevant cost information was unavailable from the bid tab data. In this instance the unit price for the largest quantity on record was used as a conservative estimate. This item also varies per mile cost based on terrain.

Borrow A and Aggregate Surface Course

These items have a constant quantity per mile across all terrain types using a roadway top width of 24 feet. The depth of Borrow A is 48 inches and aggregate surface course was estimated at a thickness of 4 inches.

Bridges

A width of 26 feet was assumed for all roadway bridges to accommodate the 24-foot top and bridge railing. Bridges were subdivided into two categories; conventional and long span. Both unit prices were based on engineering construction experience with recent projects in Alaska and the Lower 48. Lengths for each structure were estimated from USGS topographic maps and aerial photography and the proposed crossing geometry. Conventional bridges assume deck bulb-T construction which is very common throughout Alaska at a cost of \$350 per square foot. Bridges 300 feet or more are considered long span bridges. Recent national projects indicate that building such structures in fairly rugged conditions and remote areas warrants a cost of \$1000 per square foot.

Culverts

Following a preliminary assessment of visible stream crossings using USGS topographic maps and aerial photography, culvert types were subdivided into three categories: large culverts, small culverts and minor drainage culverts. An assumed culvert length of approximately 50 feet to daylight on either side of a four foot embankment with 2:1 side slopes was used for both the minor drainage culverts and small culvert classification. To account for the deeper embankments associated with

large culverts, a culvert length of approximately 96 feet was used to daylight on either side of a 20 foot embankment with 2:1 side slopes. The unit prices for the two categories of culvert are based on project experience in Southcentral Alaska.

ADF&G, Division of Habitat, provided the following initial input regarding culverts and bridges affecting anadromous fish streams. Pursuant to AS 16.05.841 and AS 16.05.871, (1) the preferred route should be sited to minimize the number of stream crossing(s) to the extent practical; (2) bridge construction is preferred over culvert installation for stream crossings greater than 20 feet in width; and (3) any culvert installation in fish-bearing waters should use a stream simulation design criteria to ensure the upstream and downstream movement of fish is maintained.

Retaining Walls

To reduce earthwork quantities in mountainous terrain gabion retaining walls were assumed. It is assumed that 0.25 of each mile in mountainous terrain will require walls on one side of the roadway. The average height of these walls is assumed to be 10 feet.

Guardrail

It is assumed that guardrail will only be needed along half of each mile of mountainous terrain. The number of end sections required is calculated on the assumption that the average length of each guardrail segment is 250 feet.

Topsoil and Seeding

Topsoil and seeding were estimated at 4.84 acres/mile. This represents an average of 20 feet of topsoil and seeding on either side of the edge of gravel.

Geotextile Fabric

Geotextile fabric will be required in areas with permafrost or soft soils. It has been assumed that permafrost and soft soils will be encountered in 25 percent of level terrain and 15 percent of rolling terrain areas.

Signing

Signing for this project is assumed to be minimal due to its backcountry nature. \$1000/lane-mile has been assumed to cover these costs.

ROW

An average cost per acre to acquire ROW was developed for each route based on comparable State sales closest to the proposed access routes. For each route, the road length was multiplied by a presumed 200 foot wide ROW to calculate the total number of acres needing to be acquired. (The 200-foot ROW width is a preliminary placeholder, and depending upon the route, access and staging needs, may require more or less than the 200 feet width). An average cost per acre based on comparative sales in the vicinity of the access route was multiplied by the total number of acres to get a ROW acquisition cost estimate for each route.

Table 5-4. Preliminary ROW Acquisition Cost Estimates

	North Petersville Road	North Skwentna	Middle Susitna- Skwentna River	Beluga	Deshka Variant
Acres to be acquired ¹	1910.3	1735.8	2615.8	1551.5	812.1
State sale comparable close to access route per acre	\$3,100 \$3,100 \$1,943	\$481 \$960 \$702	\$1,943 \$1,493 \$962	\$962 \$815	\$1,143 \$1,298 \$1,159
Subtotal average cost per acre	\$2,714	\$715	\$1,466	\$889	\$1,200
Total average cost per acre ²	\$3,000	\$790	\$1,600	\$980	\$1,320
Total ROW acquisition cost	\$5.7 million	\$1.4 million	\$4.2 million	\$1.5 million	\$45,000

¹Route length multiplied by a 200 foot ROW

²Total average cost per acre is rounded and includes 10% inflation.

A more detailed title search should be conducted in a subsequent phase should this project move forward. The acquisition cost does not take into account the cost (in time) to acquire the ROW.

Environmental/Permitting

A 3% line item was included to incorporate the costs to conduct some environmental baseline studies and coordinate permit acquisition.

Existing Road Upgrades

Two proposed West Susitna access routes would likely necessitate the need to upgrade two existing roadways: Petersville Road and Oilwell Road. The North Petersville Road access route branches off from milepost (MP) 18 of Petersville Road.¹⁵⁴ For the North Skwentna access route and Deshka Variant, Oilwell Road would need to be upgraded. Oilwell Road branches off from MP 6 of Petersville Road and continues for approximately 17 miles before becoming more of a trail than a road. Roadway conditions along these two roads vary greatly and are not fully known without field-verifying the conditions. Assumptions are inferred regarding these two roadways and required upgrades.

Petersville Road is classified as a minor collector road that is approximately 37 miles long. The DOT&PF maintains a portion of Petersville Road. Based on conversations with DOT&PF staff and professional judgment, we have assumed the first approximate 9.5 miles are paved and would require little to no upgrade. This paved portion is assumed to be 24-foot wide with gravel shoulders. No culvert information for this roadway segment is available at this time.

Between MP 9.5 and 18 of Petersville Road, the roadway is dirt and the road top ranges between 18-foot to 24-foot wide. For cost estimate purposes, we have assumed the existing roadway top averages 21-foot wide and would need to be widened to the proposed width of 24 feet. Along this 8.5-mile stretch, one 105-foot bridge would need to be replaced and we assumed six minor drainage culverts

¹⁵⁴ MP locations are approximate

would be needed per mile. Other assumptions include: no clearing; one-third of the existing embankment should be replaced with Borrow C and one-third of Borrow A would be replaced.

Oilwell Road conditions vary significantly and much of the existing conditions are unknown. The MSB maintains the first 12.5 miles of this roadway, with additional minor maintenance of the “trail” between MP 12.5 and MP 15, the site of the Kroto Creek bridge. According to MSB maintenance personnel, beyond MP 15 is a mere trail and how far it extends is unclear.¹⁵⁵

To prepare cost estimates for upgrading this road, Oilwell Road was broken down into four segments: (1) MP 0-12.6, (2) 12.6-16.76, (3) a 5.1-mile extension, and (4) a second extension by 4.7 miles. The North Skwentna access route would require all four Oilwell Road segment upgrades, while the Dëshka Variant branches off slightly early and would only require the three segment upgrades. Assumptions for upgrading the four Oilwell Road segments are as follows:

- **MP 0-12.6:**
 - The total cost estimate for upgrading this segment is approximately \$20.7 million, or about \$1.6 million per mile.
 - 25% of the length requires clearing
 - Includes rebuilding road, new embankment and all new structural section
 - Replaces three bridges that are the following length: one that is 65 feet and two that are 35 feet
 - Assumes six minor drainage culverts per mile
- **MP 12.6-16.76:**
 - The total cost estimate for upgrading this segment is approximately \$11.3 million, or about \$2.7 million per mile.
 - 50% of length requires clearing
 - Includes rebuilding road, new embankment and all new structural section
 - Replaces two bridges: one 75-feet long and one 45-feet long
 - Assumes six minor drainage culverts per mile
- **5.1-mile road extension**
 - The total cost estimate for upgrading this segment is approximately \$11.3 million, or about \$2.2 million per mile.
 - 50% of length requires clearing
 - Includes rebuilding road, new embankment and all new structural section
 - No bridges are needed along this segment
 - Assumes six minor drainage culverts per mile
- **4.7-mile road extension** (*required only for the North Skwentna access route*)
 - The total cost estimate for upgrading this segment is approximately \$8.7 million, or about \$1.8 million per mile.
 - 50% of length requires clearing
 - Includes rebuilding road, new embankment and all new structural section
 - No bridges are needed along this segment
 - Assumes six minor drainage culverts per mile

¹⁵⁵ MSB. December 2013. Personal communication with MSB roads maintenance staff Mike Lachelt

6 EVALUATION OF PROPOSED ACCESS ROUTES

This section presents a comparison of the proposed routes developed for providing access to resources in the Susitna River basin. Because this is a reconnaissance-level study, the comparative analysis is based on existing available information. Numbers provided in this quantitative analysis present a broad picture of potential impacts and large swaths of resources to which access is provided.

One purpose of this report is to evaluate and compare the strengths (opportunities) and weaknesses (impacts) of the proposed access routes. This section explores some of the strengths and weaknesses of each route by utilizing a disaggregate method to describe opportunities and impacts for each route based in “natural” units. These measurements include physical units, monetary terms, or other quantifiable engineering and environmental terms. At this point, these access routes have been developed only to a reconnaissance level and could shift significantly in the future based on further study and refinement when more data become available, and therefore could result in different impacts.

6.1 Resource Accessibility

One of the key considerations of the proposed routes is opening up access to the identified resources. To determine how many acres of resources would be made accessible, a 5-mile-wide buffer on either side of the centerline (10 miles total) was applied to each of the proposed access routes. The assumption was that if an access route were provided into these areas, an interested party (claim/lease holder or land owner) would add their own infrastructure up to within 5 miles from the proposed route centerline. The study team recognizes the 5-mile-wide buffer on either side as a reasonable distance from which interested landowners could connect their own infrastructure. It is also true that access connections to the main spine road could also be made. This may be especially true in the northwest portion of the Study Area where there are numerous mineral deposits and mining claim clusters that extend outside of the 10 mile corridor. However, to quantify resources that are made accessible using the data available in GIS, a specific distance needed to be chosen and 5 miles (10 mile buffer) was deemed reasonable.

Table 6-1 summarizes resources accessed within the 10-mile buffer by each access route. Figure 6-1 through Figure 6-3 depict this graphically for mining, oil and gas, forestry/timber, and agricultural resources. To quantify the amount of recreational resources made accessible, (State Recreation Rivers, State Recreation Areas and State Refuges within the Study Area were evaluated in GIS to calculate acreages accessed using the same buffer width.¹⁵⁶

¹⁵⁶ The study team recognizes the limitations in using this methodology to assess the amount of recreational resources made accessible. This approach discounts the importance of lands other than State Recreation Rivers, State Recreation Areas, and State Refuges in providing areas of hunting, fishing, wildlife viewing, and other types of outdoor recreation such as camping or access to recreational cabins. The study team recognizes the southern portion of the Study Area is more readily accessible by existing means, whereas the lands made accessible by the access routes in the middle of the Study Area would create new access opportunities for moose and ptarmigan hunting, for example. While not the most ideal methodology, there is not a readily comparable way to measure recreational access quantitatively using GIS.

Table 6-1. Summary of Amount of Resources Made Accessible within a 10-mile Buffer of Proposed Routes (“Route Strengths”)

Resources Accessed	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Hardrock minerals					
<i>Claims/Leases (#)</i>	404	676	688	8	68
<i>Acres of claims/leases accessed</i>	39,104	79,306	78,788	16,668	2,353
Placer gold mining					
<i>Claims (#)</i>	3	4	5	0	0
Coal					
<i>Acres of leases accessed</i>	119,655	103,438	264,258	288,278	81,624
Oil and gas					
<i>Permits/Leases (#)</i>	2	10	28	158	10
<i>Acres of permits/leases accessed</i>	7,245	70,599	87,760	109,919	183,392
Forestry/Timber Resources					
<i>Acres Accessed</i>	56,618	150,290	179,049	43,674	97,718
Agriculture					
<i>Acres Accessed</i>	0	0	7,262	0	21,132
Recreation ¹					
<i>Acres Accessed</i>	19,439	15,899	61,643	116,025	21,968

Analysis based on a 10-mile-wide corridor, 5 miles on either side of the proposed route centerline.

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

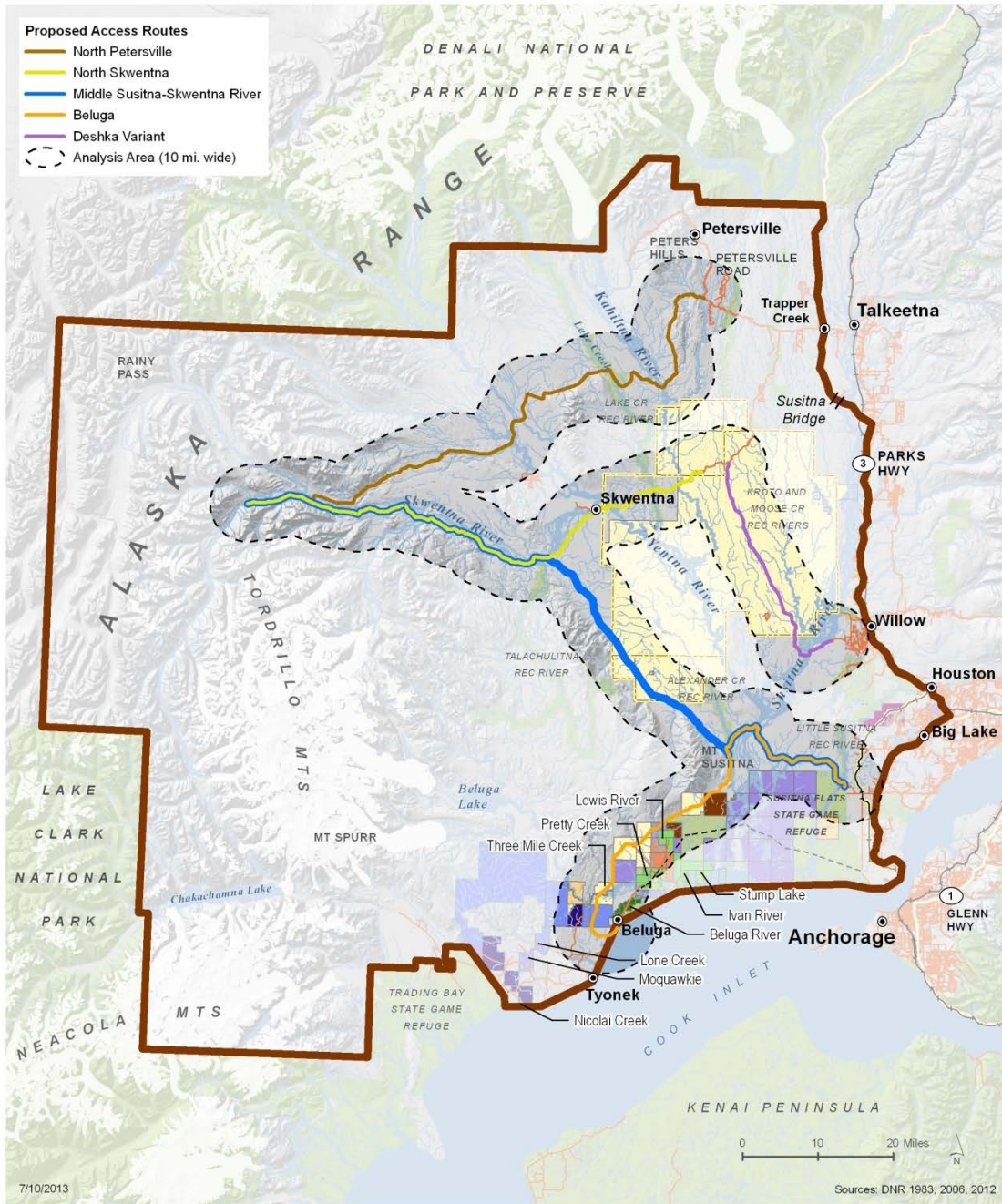
Green = Proposed access route(s) with the greatest number of claims, leases, or acres of resources accessed.

Red = Proposed access route(s) with the fewest number of claims, leases, or acres of resources accessed.

¹ Recreation resources accessed, as listed in the table, represents State-identified parks, refuges and recreation areas, as stated earlier. One could argue most of the land in the Study Area provides recreational opportunities.

Compared to other routes, the North Skwentna route provides access to the greatest number of acres of hardrock mineral resources. Due to the length of this route, the Middle Susitna-Skwentna River route provides access to the greatest number of claims and acreages of a number of resources, including hardrock minerals, placer gold mining claims, and the potential for forestry/timber resources. Compared to other routes, the Beluga Access route provides access to the greatest number of acres of coal resources and second greatest acreage of oil and gas resources.

Figure 6-2. Oil and Gas Resources within a 10-mile Buffer of Proposed Routes



Access Routes to Oil and Gas Permits/Leases

West Susitna Access to Resource Development



6.2 Land Status

The status of general land ownership was presented in Section 4.4 and Table 4-2. To determine a preliminary quantity of land that would be impacted by land owner, a 200-foot-wide ROW buffer (100 feet on both sides of the centerline) was applied within GIS. Land ownership is generalized, based upon the DNR 2013 General Land Status database, which approximates land status at the section level. Data limitations exist and ownership types are aggregated for planning purposes only. The acreage of land by land owner type for each access route is shown in Table 6-2.

Compared to other routes, the North Petersville Road and North Skwentna route options utilize the most State land within 100 feet on either side of their centerlines. As previously presented, utilizing state lands is viewed as a strength or opportunity.

Table 6-2. Land Status within a 200-foot-wide ROW of Proposed Access Routes

Land Type (by acres)	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Federal	-	-	-	-	-
State	1,510	1,275	1,717	640	484
Borough	17	-	461	704	113
Native	-	-	-	31	-
Private	383	462	388	97	216

Analysis based on a 200-foot-wide buffer, 100 feet on either side of the proposed route centerlines.

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

Green = Proposed access route(s) utilizing greatest amount of land identified as an opportunity.

Red = Proposed access route(s) utilizing greatest amount of land identified as a constraint.

6.3 Wetlands

Information on wetlands in the Study Area and available wetlands data was presented in Section 4.4. A significant portion of the Study Area has no NWI wetlands mapping. Routes going through the Study Area that are located in areas that have no available wetlands mapping include North Petersville Road, North Skwentna, and Deshka. Acres of wetlands impacted for each access route, based on available data, is shown in Table 6-3.

Table 6-3. Wetlands Potentially Impacted within a 200-foot-wide ROW of Proposed Access Routes

	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Wetlands impacted ¹ (acres)	42.1	215	217.5	123.7	137.2

Analysis based on a 200-foot-wide buffer, 100 feet on either side of the proposed route centerline.

Wetland impacts determined through GIS intersection analysis of NWI database and a 200-foot-wide corridor.

¹ Acreages are greatly underreported for the North Petersville access route, and to a lesser extent for the eastern portion of the North Skwentna access route and Deshka variant, due to a large area of no wetlands data within the NWI database.

6.4 Terrain Types and Road Grades

The terrain in the Study Area is characterized by relatively flat and rolling terrain to the east, which gains relief as it becomes more rolling and mountainous terrain farther west towards the foothills of the Alaska Range. Terrain and ground profiles along the access routes were classified as level, rolling, or mountainous, according to the values listed in Table 6-4 and shown in Figure 6-4. Profiles of the existing ground line were created along the centerline of the access route using GIS. A 200-foot buffer (100 feet on either side of the centerline) was created to give a representation of the terrain in proximity to the routes. Length and percent of the route for each terrain type classification is summarized in Table 6-5. Terrain type is considered for cost estimating and constructability purposes.

Table 6-4. Terrain Types

Terrain Type	Ground Profile Along the Access Route (% grade)
Level	< 10
Rolling	10-25
Mountainous	> 25

The North Skwentna access route runs through the greatest percentage of mountainous terrain compared to the other access routes. The Beluga access route and Deshka variant are mostly located in level terrain (67 percent and 84 percent of their routes, respectively) with only 5 percent and 3 percent, respectively, of their alignments going through mountainous terrain. The amount of mountainous terrain will likely affect the roadway construction cost and its operational efficiency. Should these routes be furthered for evaluation, the alignments should be refined to make better use of the level/flat terrain.

Table 6-5. Terrain Type by Proposed Access Route

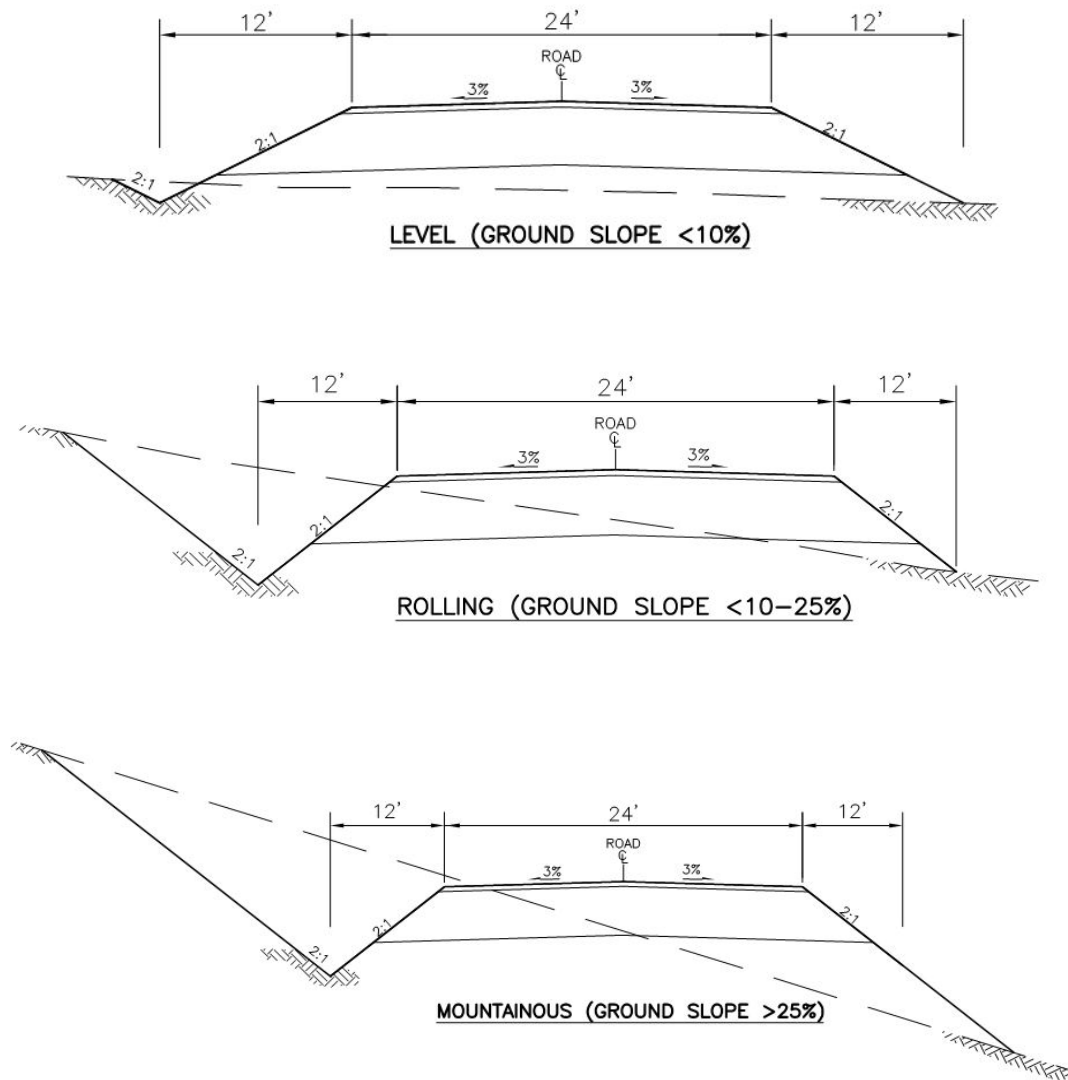
		North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Length (miles)		78.8	71.6	107.9	63.8	33.5
Terrain type						
Level	Miles	31.3	31.4	48.1	42.9	28.2
	% of route	40	44	45	67	84
Rolling	Miles	25.7	16.3	29.14	18.33	4.63
	% of route	33	23	27	29	14
Mountainous	Miles	21.92	24.1	31.15	2.91	0.85
	% of route	28	34	29	5	3

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

Green = Proposed access route(s) through the most amount of level terrain.

Red = Proposed access route(s) through the most amount of mountainous terrain.

Figure 6-4. Typical Road Cross Section by Terrain Type



6.5 Seismicity

The Study Area is located in one of the most seismically active areas in the country. In particular, the Beluga access route appears to follow a significant portion of the Castle Mountain fault in the southern end of the Susitna lowlands. Seismicity should be a consideration for any access route moved forward. A neotectonic study may be warranted to map active surface traces of faults and to evaluate the local ground motions that may be generated by significant events. Such a study would also cover liquefaction, tectonic folding or warping of the ground surface, as well as secondary tectonic ground deformation (i.e., slope stability, lateral spread, and rock fall).

6.6 Hydrologic Considerations

All the proposed access routes cross major rivers and numerous drainages, requiring multiple bridge structures and culverts, as highlighted in Table 6-6.

Table 6-6. Hydrologic Considerations by Proposed Access Route

	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Length (miles)	78.8	71.6	107.9	63.8	33.5
Bridges (#)					
<i>Conventional</i> ¹	9	12	20	11	1
<i>Long span</i> ²	4	6	4	2	2
<i>Total</i>	13	18	24	13	3
Bridges (>1,000 feet)	1,150 (Yentna)	1,200 (Yentna) 1,200 (Hayes)	1,200 (Hayes) 1,640 (Susitna)	1,640 (Susitna)	1,200 (Susitna)
Culverts (#)					
<i>Large</i> ³	12	12	14	6	2
<i>Small</i> ⁴	37	26	40	12	11
<i>Minor drainage</i> ⁵	316	292	440	260	136

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

Green = Proposed access route(s) with the least number of bridges and culverts required.

Red = Proposed access route(s) with the greatest number of bridges and culverts required.

Assumptions:

¹ Conventional bridges are considered less than 300 feet in length.

² Long span bridges are 300 feet or longer.

³ Culverts are approximately 96 feet or longer.

⁴ Small culverts and minor drainage culverts have an assumed length of approximately 50 feet.

⁵ An additional four culverts per mile to accommodate minor drainage patterns.

6.7 Geological and Geotechnical Considerations

Numerous glaciers are found in the Alaska Range and extend down valleys to near the edges of the lowlands. Glacially carved bedrock, moraines, drumlins, and kettle lakes are some of the landforms in the Study Area that are constantly being reshaped by continuous erosional processes. A reconnaissance-level geotechnical evaluation of the proposed access routes was performed for this study, as included in Appendix C and summarized briefly in this section.

A limited amount of quantifiable data is available to evaluate the geologic and geotechnical conditions, and therefore was evaluated on a qualitative basis. Table 6-7 represents the suitability for a road corridor based on a number of geologic and geotechnical considerations.

It is possible geotechnical challenges may arise for the following access routes:

- North Petersville Road access route: potential constraints due to Pass Creek fault
- Middle Susitna-Skwentna River access route: potential constraints due to Castle Mountain fault
- Beluga access route: Potential constraints due to Castle Mountain fault

Table 6-7. Geologic and Geotechnical Considerations by Proposed Access Route

	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Rock borrow availability	Medium	Eastern half poor Western half good	Eastern half poor Western half good	Poor	Poor
Rock borrow quality	Poor	Eastern half poor Western half good	Good	Good	Poor
Soil borrow availability	Good	Good	Eastern half medium Western half good	Eastern half medium Western half good	Good
Soil borrow quality	Medium	Good	Eastern half medium Western half good	Eastern half medium Western half good	Good
Foundation support	Medium	Eastern half poor Medium	Medium	Medium	Poor
Permafrost conditions	Medium	Good	Eastern half good Western half medium	Good	Good
Subgrade support	Medium	Eastern half poor Western half good	Eastern half poor Western half good	Eastern half poor Western half good	Poor
Drainage	Good	Eastern half poor Western half good	Eastern half poor Western half good	Eastern half poor Western half good	Poor

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

Green = Proposed access route(s) with the greatest (optimum) availability/quality of rock borrow and soil borrow, in addition to most suitable drainage, subgrade support, foundation support, and permafrost conditions.

Red = Proposed access route(s) with the least (poorest) availability/quality of rock borrow and soil borrow, in addition to most suitable drainage, subgrade support, foundation support, and permafrost conditions.

See the Table on page 9 in the Geotechnical Reconnaissance Report in Appendix C for greater detail for how the geotechnical considerations were ranked and evaluated.

Rock Borrow Availability

In general, rock borrow sources are readily available along the access routes as they go further westward. Routes toward the eastern portion of the Study Area have no significant sources of rock borrow material. The North Petersville Road route has readily available rock materials scattered relatively widely along the alignment, with more available in the west. The Beluga route and Deshka Variant have no significant sources of rock borrow material.

Rock Borrow Quality

There is a potential for relatively high quality soil materials to be available, especially in glacial outwash and frequent alluvial/terrace formations, as found in the eastern portion of the North Skwentna route. For the Beluga route, the only rock source available appears to be intrusive igneous rocks (granodiorite) on the northeast end at the foot of Mount Susitna, which should yield relatively durable, high quality materials.

Soil Borrow Availability

In general, soil borrow materials area readily available along all the proposed routes.

Soil Borrow Quality

As with the relative availability of soil borrow materials, the quality of soil borrow materials along the proposed routes seems potentially high.

Foundation Support

Overall, foundation support conditions are anticipated to be relatively favorable, though pile foundations will likely be needed to varying depths.

Permafrost Conditions

The potential for permafrost along the North Petersville route is likely the greatest in comparison to the other routes in this study. Permafrost soils can be expected in higher elevations and on the north side of topographic high areas. Some of the low, poorly drained, boggy areas may also be underlain by permafrost soils.

Subgrade Support

In general, subgrade support is anticipated to be highly variable along the routes, and drainage in the boggy areas may be a challenge in design and construction. Routes in the western portion of the Study Area are likely to encounter more optimum subgrade support conditions than the eastern portion of the Study Area.

Drainage

All proposed routes will require frequent crossings of wetland/boggy areas.

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7 SUMMARY AND NEXT STEPS

The product of this reconnaissance-level study was the identification of the locations of four possible access routes and one variant road option for providing access to resources within the Susitna basin. These proposed route locations were based on a review of existing literature, interviews with industry stakeholders, an inventory of natural resources and existing infrastructure, identifying reasonable crossing locations of major rivers (e.g., Susitna River), and a constraints and opportunities analysis. Table 7-1 presents a comparative summary of the proposed access routes' strengths/advantages and weaknesses/challenges as previously detailed in Section 6.

Table 7-1. Proposed Access Routes Strengths and Weaknesses Comparison

	North Petersville Road	North Skwentna	Middle Susitna-Skwentna River	Beluga	Deshka Variant
Length (miles)	78.8	71.6	107.9	63.8	33.5
Ranking for amount of resources accessed ¹					
<i>Hardrock minerals</i>	Medium	High	Highest	Lowest	Low
<i>Placer gold mining</i>	Medium	High	Highest	Lowest	Lowest
<i>Coal</i>	Medium	Medium	High	Highest	Lowest
<i>Oil and gas</i>	Lowest	Medium	Medium	High	Highest
<i>Forestry/timber</i>	Low	High	Highest	Low	Medium
<i>Agriculture</i>	Lowest	Lowest	Medium	Lowest	Highest
<i>Recreation</i>	Low	Lowest	Medium	Highest	Low
Ranking for utilizing "opportunistic" land ²	High	Medium	Highest	Medium	Medium
Ranking for optimum geologic considerations ³	Medium	Good	Good	Good	Poor
Ranking for required bridge/culvert structures ⁴	Low	Medium	Requires most bridges/culverts	Low	Lowest
Ranking for terrain type ⁵	Medium	Most mountainous	Medium	Most Level	Most Level
Planning-level Cost Estimate (millions)					
<i>Subtotal</i> ⁶	\$147.6	\$188.3	\$187.4	\$106.9	\$72.2
<i>Total</i> ⁷	\$376.4	\$504.3	\$453.2	\$257.8	\$216.9
<i>Total per mile</i> ⁸	\$4.6	\$6.3	\$4.2	\$4.0	\$5.2

As further detailed in the footnote of Table ES-1, colored shading was used to comparatively indicate the more or less favorable metrics.

Green = Proposed access route(s) with the fewest number of roadway miles, bridges, culverts, and/or costs. Also, indicates highest amount of resources made accessible. Route(s) goes through the most amount of level terrain, utilizing most optimum geologic conditions, and/or traversing most "opportunistic" land based on status.

Red = Proposed access route(s) with the greatest number of roadway miles, bridges, culverts, and/or costs. Also, indicates least amount of resources made accessible. Route(s) goes through the most amount of mountainous terrain, utilizing least optimum geologic conditions, and/or traversing least "opportunistic" land based on status.

Assumptions:

¹ Resources made accessible within a 10-mile buffer of the proposed centerline. See Table 6-1.

² Land status within 200-foot ROW that is ranked as either opportunistic (e.g., State lands) or a constraint (e.g., private). See Table 4-2 and Table 6-2.

³ Geological considerations include 8 features, as detailed in Table 6-7.

⁴ Hydrologic considerations include number of bridges and culverts required. See Table 6-6.

⁵ Percentage of route traversing terrain type, with level terrain viewed as an opportunity and mountainous as a constraint. See Table 6-5.

⁶ Subtotal cost estimate for new proposed roadways includes clearing, earthwork, structures, stream and river crossings (including culverts), guardrail and retaining walls, and miscellaneous items such as topsoil, seeding, geotextile and signing.

⁷ Total cost estimate includes drainage measures, erosion and pollution, surveying, environmental studies and permits, existing road upgrades, construction, mobilization, ROW acquisition, contingency, design, and utilities.

⁸ Total per mile includes only the proposed access routes and does not include existing roadways or cost to upgrade them.

7.1 Identified Data Gaps and Next Steps

This reconnaissance study provides a foundation for additional project development should the project be moved forward. Future tasks to further advance the possibility of an access road into the Susitna Basin west of the Susitna River include further engineering refinement, environmental field studies, origin/destination assessment, economic analysis, acquiring aerial photography or LIDAR, cost estimate refinement, and public involvement and stakeholder engagement. Many of the data sets used in this report contained incomplete information. In other cases, data was sparse.

Engineering refinement. Preliminary conceptual engineering alignments were identified based on engineering judgment using available data. Additional environmental, geotechnical, hydrologic, and topographic data would need to be obtained to further refine the alignments. For the access routes that would connect to and utilize existing roadways (e.g., Oil Well Road, Petersville Road, Little Susitna River Road, etc.), the preliminary cost estimates included an initial examination of the cost to upgrade these roads. However, further field reconnaissance would need to occur to determine actual road width and condition and number of culverts and/or bridges that may need to be upgraded or replaced to accommodate the dimensions of the proposed West Susitna access road. Additional coordination should occur with other interested parties who are already conducting and collecting existing baseline conditions in the area. For instance, recent efforts over the summer of 2013 by Donlin Gold, LLC included conducting fieldwork, such as delineating wetlands along their proposed pipeline corridor.

Affected land management agencies, such as divisions of the State of Alaska and local governments such as the Mat-Su Borough, should also be consulted and coordinated with as routes get further refined and a preferred route is chosen. This is particularly important as route locations would have a fundamental effect on the development of State lands throughout the Study Area. Several State of Alaska departments and divisions have suggested that it would benefit future planning efforts to have identified routes surveyed and reserved to the state for future access needs.

Environmental studies. To supplement the limited available data, a number of field studies and office-based studies are recommended to help further refine the proposed access routes and preferred stream crossing and drainage locations. At a minimum, additional studies should include:

- Soils and Geology
- Hydrology
- Vegetation
- Wetlands and waterbodies
- Fish streams and essential fish habitat
- Wildlife
- Land ownership
- Historic and archaeological resources
- Recreation

Refined origin/destination assessment and travel forecast. Additional analysis should be conducted to determine the most viable project termini based on a project purpose and need, additional details on the types of vehicles and level of traffic demand.


Economic analysis. An economic analysis should be conducted to determine the costs/benefits of constructing an access road into the Susitna basin. This examination would provide supporting information for the purpose and need for the project and would be a foundation for refining the

travel forecast. This would also include further refined analysis of the existing resources in the Study Area. This analysis would assess the value of resource extraction potential being lost due to lack of transportation access.

Aerial photography or LIDAR. Existing mapping is limited to USGS mapping, which is at best, suitable for high-level planning. More detailed aerial photography or LIDAR would be necessary for refining the proposed access routes, preliminary engineering (including cost estimates), and would support environmental studies.

Cost estimate refinement. As the alignments are further engineered, the cost estimates need to be refined.

Public involvement and stakeholder engagement. This reconnaissance-level report was prepared to determine possible locations for an access road into the Susitna basin to support potentially significant resource development opportunities. Should this project be furthered, seeking public input and comment from relevant stakeholders is a critical next step.



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