Strategic Plan
Arctic Strategic Transportation and Resources Project
North Slope, Alaska

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Prepared for

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ACRONYMS

ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AES Alaska	ASRC Energy Services Alaska, Inc.
AHP	Analytical Hierarchy Process
ASRC	Arctic Slope Regional Corporation
ASTAR	Arctic Strategic Transportation and Resources
BLM	United States Bureau of Land Management
BMP	Best Management Practice
CBA	Cumulative Benefits Analysis
CWAT	Community Winter Access Trails
DCCED	Department of Commerce, Community and Economic Development
DGGS	Division of Geological and Geophysical Surveys
GIS	Geographic Information System(s)
IAP	Integrated Activity Plan
MCDA	Multi-criteria Decision Analysis
NEI	Northern Economics, Inc.
NGO	nongovernmental organization
NPR-A	National Petroleum Reserve – Alaska
NSB	North Slope Borough
OC	Olgoonik Corporation
OPMP	Office of Project Management and Permitting
PWC	Pairwise Comparison
RDI	Resource Data, Inc.
SME	subject matter expert
UIC	Ukpeaġvik Inupiat Corporation
USGS	United States Geological Survey
WDM	Weighted Decision Matrix
WDP	Workforce Development Plan

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1.0 Introduction

The Arctic Strategic Transportation and Resources Project (ASTAR), is an initiative of the Alaska Department of Natural Resources (ADNR), in partnership with the North Slope Borough (NSB) and in collaboration with area communities and other key stakeholders. ASTAR is intended to encompass the entire North Slope region, including the National Petroleum Reserve – Alaska (NPR-A), Arctic National Wildlife Refuge, and other federal lands and waters. ASTAR seeks to identify, evaluate, and advance community infrastructure and regional connectivity projects that offer the greatest cumulative benefits to the North Slope region.

1.1 Overview of the ASTAR Strategic Plan

While a strategic plan is expected to primarily be a forward-looking document, this "plan" is intended to be a guide to the tools developed during the course of ASTAR and their potential use for future projects. In addition, by identifying tangible cumulative benefits for specific infrastructure projects, ASTAR is intended to inform current and future discussions among local, state, and federal agencies regarding land management activities in the region.

During the course of the project, the ASTAR Team assessed a range of potential community infrastructure and regional connectivity projects including roads, sanitation, ports, and marine facilities. Cumulative benefits analysis (CBA) was used to advance projects that provide the greatest benefits to North Slope people and communities rather than the standard federal approach of assessing projects for potential impacts (cumulative impacts analysis), which often focus on negative rather than positive outcomes. Initial identification of potential funding sources, project sponsors, obstacles and challenges, and analyzing permitting and data gaps were also undertaken by the ASTAR Team.

This document provides summaries and excerpts of many of the documents and deliverables created for ASTAR. Complete versions of document referenced in each section are attached as appendices to this Strategic Plan. It is ASTAR's objective that this strategic plan, it's appendices, and the digital tools and databases created during the course of the ASTAR project be used as sources for future studies, planning, and project development for the North Slope and potentially across Alaska.

1.2 ASTAR Team

The ADNR contracted with two contractors, ASRC Energy Services Alaska, Inc. (AES Alaska) and Resource Data Inc. (RDI). In addition, AES Alaska engaged several subcontractors to provide subject matter expertise in key areas of study. These included Northern Economics, Inc. (NEI) for economic and workforce development expertise; PND, Inc. for road and bridge engineering; 3rd Rock Consulting and AKGeoservices for geology and terrain unit mapping; and UMIAQ for stakeholder engagement support. The individual entities are collectively referred to throughout the ASTAR documents as the ASTAR Team.

1.3 ASTAR Documents and Deliverables

From March 2018 to June 2020 the ASTAR Team produced a wide variety of documents, maps, and digital tools, including those listed below. Deliverables attached to this document are labeled as appendices.

- Project Execution Plan
- Assessment of Tools for Cumulative Benefits Analysis (Appendix A-1)
- RDI ASTAR Methodology (Appendix A-2)

- RDI Data Management Plan (Appendix B)
- ASTAR Story Map and Website
- Permitting and field support for DGGS Field Investigations
- DGGS Field Investigation Reports (Appendix C)
- Stakeholder Engagement Plan (Appendix D)
- Stakeholder Engagement Database
- ASTAR Digital Project Library and Project Fact Sheets
- Workforce Development Plan (WDP) (Appendix E)
- Terrain Unit Mapping and Analysis Report (Appendix F)
- Cataloguing of historic shothole samples held at the State of Alaska Geologic Materials Center
- Development of a comprehensive shothole database
- Passenger and Freight Transportation Study (Appendix G)
- Studies of various potential transportation routes to connect communities from the Colville River to Wainwright (Appendix H)
- Economics and Socioeconomics Digital Library (Appendix I)

1.4 Cumulative Benefits Analysis

As a major component of meeting project goals, ASTAR collaborated with North Slope communities and other stakeholders in an effort to identify infrastructure projects and services that offer the greatest cumulative benefits for the region. In the context of ASTAR, CBA seeks to identify projects with the maximum benefit for a broad spectrum of stakeholders and which have local support. To this end, ASTAR endeavored to identify, develop, and implement CBA tools and methods to classify and evaluate infrastructure projects for their ability to meet local needs as well as accrue the most benefits on a regional basis.

Assessment of cumulative benefits required the development of benefits criteria that could be applied across a variety of project types in order to maintain the comparative evaluation capability desired in such a process. Establishment of six criteria was determined after multi-party consultation. These Benefit Criteria are as follows:

- Enhances Workforce Development
- Improves Access to Education Opportunities
- Improves Health and Safety Conditions
- Lowers Costs of Goods and Services
- Preserves or Enhances Subsistence Traditions
- Supports Community Connectivity

Objectives for CBA tools were identified at project outset and included:

- Must be informed by stakeholder input
- Must define a methodology to identify the best projects (or project areas) with greatest benefits
- Must be able to analyze projects for benefits (including benefits associated with minimizing cultural, social, and environmental impacts)
- Must be user friendly – can’t be overly elaborate or complicated
- Must allow for spatial and non-spatial inputs (e.g. important or sensitive cultural, social, environmental, and cost data) that define constraints, factors, and benefits of potential infrastructure projects

- Must include input from subject matter experts (SMEs)
- Must include factors to rank and weight evaluation criteria based on perceived degree of importance and stakeholder viewpoints

Examination of available resources to meet these objectives was conducted by ASTAR Team. The results were presented to ADNR in a study entitled *Assessment of Potential Tools for Cumulative Benefits Analysis* (July 2018) (Appendix A-1). This study involved performing a literature review of potential information sources on decision-making processes or software tools to support benefits analysis; compiling potentially relevant publications and media into a digital library and developing annotated bibliographies for each entry; and preparing a report to describe the work activities performed, the literature and media identified, and initial recommendations for tools to support ASTAR's CBA. RDI's ASTAR Methodology found in Appendix A-2 provides additional insights into the CBA process.

More than twenty different tools and decision-making processes were considered during the course of the research, and of those, ten were considered potentially applicable to meet ASTAR project objectives. Potentially applicable tools and processes included:

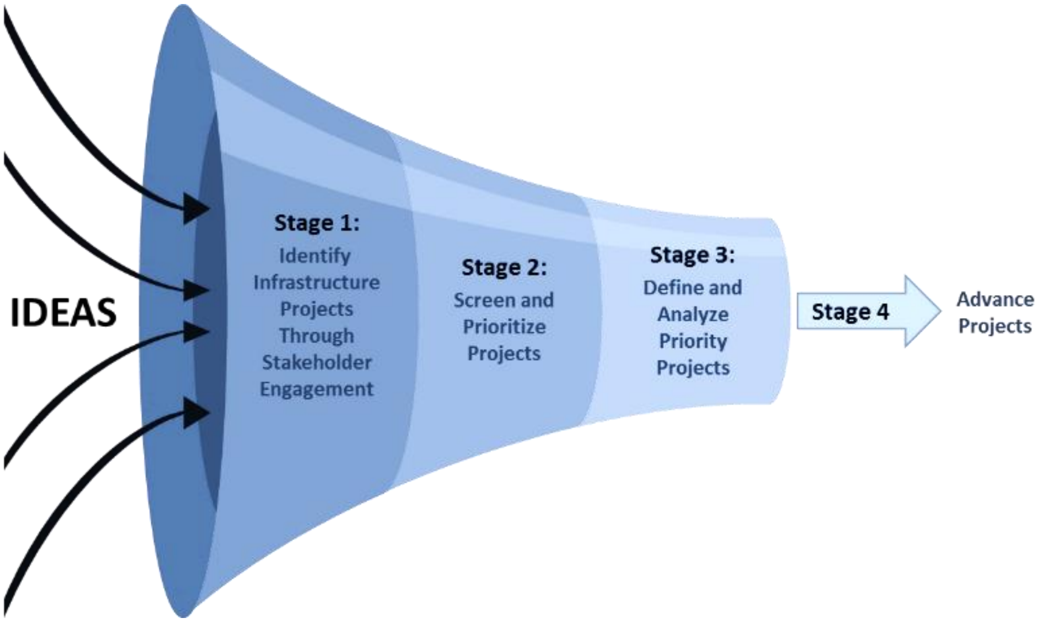
- Stakeholder Survey Form with Likert Scales
- Multi-Criteria Decision Analysis (MCDA)
- Strengths, Weaknesses, Opportunities, Threats Analysis
- Decision Matrix Method
- Project Ranking by Advisory Group Decision Method
- Weighted Decision Matrix
- Pairwise Comparison (PWC) of Inputs
- SME Consultation
- Analytic Hierarchy Process (AHP)
- Geographic Information System (GIS) Analysis (including ESRI's ModelBuilder®, MCDA, Overlay Analysis, Least-Cost Path Analysis, and ESRI's GeoPlanner®)

A number of these tools were subsequently incorporated into processes used in stakeholder engagement (Section 3.1) and route analysis (Section 6.2) performed for ASTAR. For example, PWC surveys and AHP were employed in community engagement exercises to ascertain the relative importance of each Benefit Criteria as well as specific community-based projects. Additionally, SME consultation, MCDA, Decision Matrix Method, and GIS analysis were utilized for the North Slope route analysis studies discussed in Section 6.2. Further discussion of other tools for ASTAR CBA development based on these methods is contained in Section 2.2.

AHP was utilized in several components in CBA analysis and requires a brief summary of its concepts. AHP provides a method for transforming a problem into a hierarchy composed of an overall objective, criteria for analysis, and the evaluation of alternatives. This decision-making process is both mathematically and psychologically based in that it uses matrices and formulas to derive numerical values from inputs, whether discrete data or those based on human judgement. AHP accomplishes this through the use of PWC that sifts out preferences among criteria and alternatives which can ultimately be used to rank them and identify the decision that best suits the objective and understanding of the problem.

The literature review in Appendix A-1 provided insight into a number of issues regarding development of a CBA tool. No single, readily available tool was identified that could comprehensively meet the ASTAR objectives. However, a project framework, along with a number of individual tools and methods to support the framework, was distilled out from the research. The goal of the framework was to establish a process that inherently identifies projects with the most benefits and local support as project analysis moves to further stages of refinement, essentially resulting in projects that offer the most cumulative benefit rising to the top of the list. The ASTAR project framework is composed of four distinct stages as illustrated in Figure 1.4-1and described below.

Figure 1.4-1 ASTAR Project Framework



Stage 1 - Identify Infrastructure Projects through Stakeholder Engagement. The initial stage of the project framework seeks to solicit stakeholder input and preferences; identify infrastructure projects to meet those preferences; and gather information relevant for later project evaluation.

Stage 2 - Identify Projects that Offer the Most Cumulative Benefit Potential. Successful stakeholder engagement will result in hundreds of projects identified in Stage 1. Given ASTAR's goal of identifying projects with the most cumulative benefit potential and community support, projects need to be evaluated to identify those which have the potential to benefit the greatest number of stakeholders. Accordingly, Stage 2 involves prioritizing projects to be advanced for additional analysis in Stage 3. Projects moved to Stage 3 will be those determined to offer the most potential cumulative benefit for regional stakeholders; have local support; and demonstrate that they will provide benefits to a wide spectrum of stakeholders.

Stage 3 - Define and Analyze Priority Projects Identified in Stage 2. Projects advanced to Stage 3 are exposed to more rigorous desktop analysis by subject matter experts to characterize the project, describe or quantify expected benefits, and identify feasible alternatives, important constraints, data gaps, and other key factors affecting project success. This involves analyzing the priority projects in detail to adopt an analysis strategy; further define factors and constraints; select scoring criteria and weighting methods; and perform alternatives analysis.

Stage 4 - Collect relevant field data for Priority Project Areas. Collect relevant field data (i.e. gravel surveys, Lidar, lake surveys) that will help project proponents and potentially affected communities better understand the opportunities and constraints of future infrastructure development.

Guidelines were also developed to assist in the understanding of CBA concepts as well as provide guidance in completing PWC surveys. Specifically, documents defining each Benefit Criteria and 0 to 5 values used in PWC surveys were prepared and distributed as part of stakeholder engagement efforts.

2.0 Data Sources and Data Management

2.1 ASTAR Data Collections and Management

The following subsections provide an overview of the data collected and managed by the ASTAR Team. A more comprehensive treatment of data management can be found in the ASTAR Data Management Plan in Appendix B.

2.1.1 Stakeholder Database

An ASTAR Stakeholder Engagement Database was created using SplendidCRM Community Edition, an Open Source web application that includes a database and user interface for managing the community meeting details. Within this system each North Slope community was set up as a separate account to enable greater functionality and connectivity among data inputs.

2.1.2 Project Library

The Project Library is the catalog of potential resource and infrastructure projects evaluated by the ASTAR Team. Project ideas were collected during community engagement meetings, a review of community comprehensive plans, and a review of other regional infrastructure development studies. They were added to the project library data entry spreadsheet then uploaded to the project library database. After each community meeting, the Project Library was updated to incorporate the revisions and additions provided through stakeholder engagement. The Project Library was developed as a custom module for projects and added to the SplendidCRM Stakeholder Engagement Database. In addition, the Project Library was made accessible via a web-based user interface where projects can be added, edited, or deleted.

Project Fact Sheets were created using information from the Project Library database as well as spatial data stored in the project geodatabase from which project-specific maps could be generated. A one-page summary of each project was produced, each of which included an inset map that identified the general location for the potential projects. In order to keep up-to-date with the changes to the Project Library, Project Fact Sheets were created using an automated (python) script that pulled the data from the Project Library, joined the project data to the mapped location of the project, then generated the sheet from a GIS mapping file (ESRI ArcMap .mxd format) using ESRI's Data Driven Pages and dynamic text technology. Project Fact Sheets were provided during the second round of community meetings and are also available from the ASTAR Story Map website described in section 2.1.3.

2.1.3 Story Map

The ASTAR Story Map website was developed using ESRI online resources. This site is a public facing web map application that describes the ASTAR Project and consists of the following pages:

ASTAR Home page

https://www.arcgis.com/apps/Cascade/index.html?appid=ab8be9349a08477ebfb66d017e0aec8d

What is ASTAR: This section includes the ASTAR mission, goal, and summary of the project.

Lands: This section defines the area of interest for the ASTAR project and includes several maps depicting land ownership.

Communities: This section includes a general overview of each of the North Slope communities. This section includes a link to the ASTAR Connecting Communities Story map.

Culture: This section focuses on the importance of the subsistence lifestyle to the North Slope Community.

Opportunities: This section includes a graphic of conceptual community connections, potential port locations, and potential shipping lanes through the north Passage. This section includes a link to the ASTAR Project Opportunities story map.

ASTAR Connecting Communities

https://soa-dnr.maps.arcgis.com/apps/Cascade/index.html?appid=2d6920ba0a5243349688e672f9544f79

The Connecting Communities story map highlights each community and provides demographic, economic, and infrastructure information. Figure 2.1.3-1 is a screenshot of the story map create for Anaktuvuk Pass.

ASTAR Project Opportunities

https://storymaps.arcgis.com/stories/679c8d2767c4469f83ee7bd8dbcf0711

This story map includes information from the ASTAR Project Library. It groups the information into four sections as shown below. Each section includes an interactive map with pop-up project content and links to the project fact sheets.

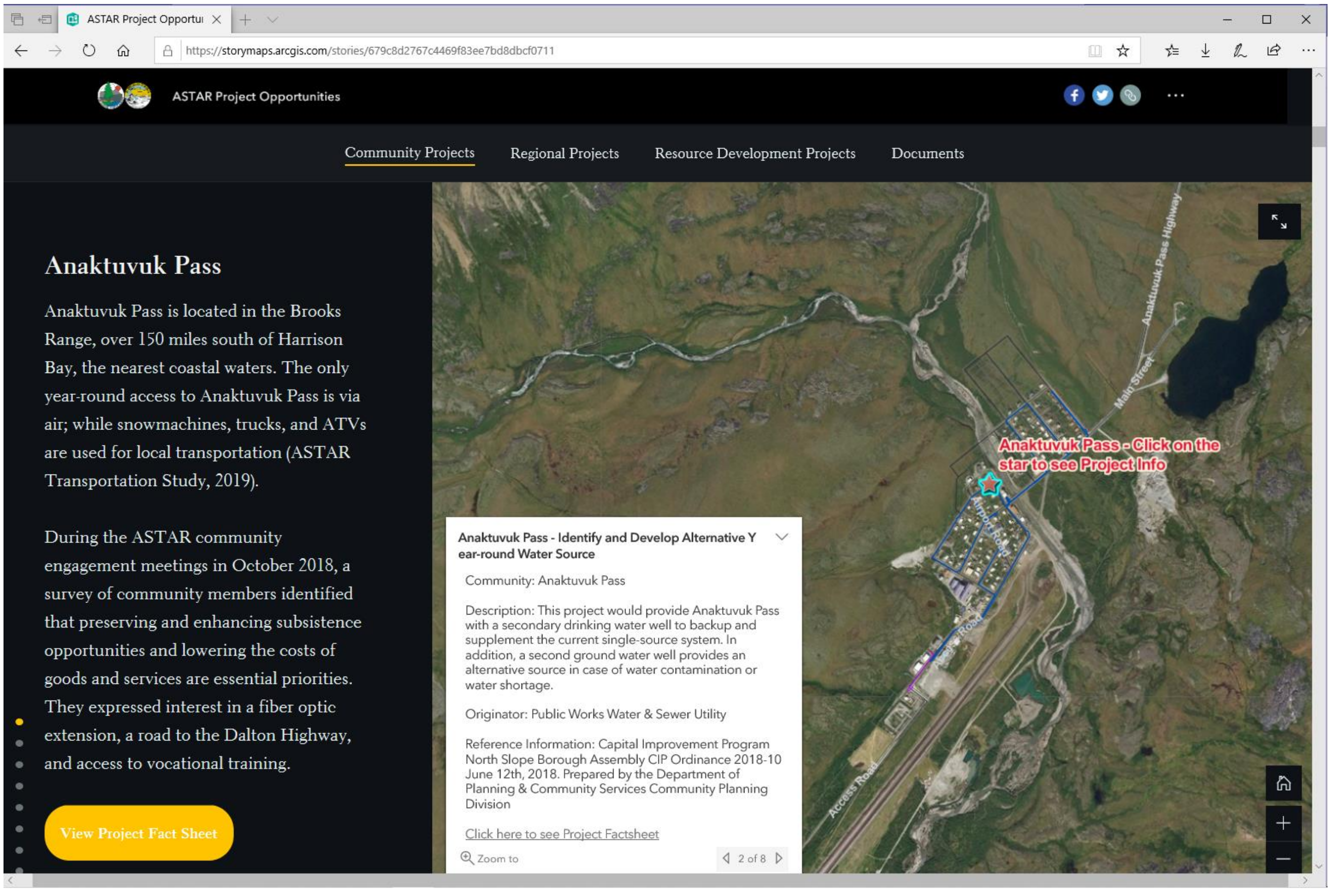
Community Projects: This section features each of the eight North Slope communities and their project data from the Project Library are featured in an interactive web map app.

Regional Projects: A project is classified as Regional if it provides benefits to many communities or provides a connection between communities.

Resource Development Projects: Resource Development projects are large-scale projects that are driven by industry.

Documents: The documents section includes links to the many studies and reports created by the ASTAR project.

Figure 2.1.3-1 Example from ASTAR Story Map Website



2.1.4 ASTAR Cumulative Benefits Analysis Tool

As discussed in Section 1.3, the ASTAR CBA is a process that combines a methodology with various tools that was designed to identify infrastructure projects that provide the greatest benefit to regional stakeholders. This process is collectively referred to as the ASTAR CBA Tool. The goal of this process is to facilitate project identification and progression wherein projects which offer the greatest cumulative benefit are identified and selected for further analysis and potential data collection.

One digital component of the CBA Tool is a custom application created by the ASTAR Team as an additional module to the Stakeholder Engagement and Project Library database in SplendidCRM. It was designed to support the CBA methodology by including the following steps and tools. These digital tools have been shared with the NSB and the communities on laptops sent to leadership in each community.

Identify Projects through Stakeholder Engagement

- **Stakeholder Evaluation Survey:** Used input from community-specific survey forms to determine the benefit criteria to use and assigned these benefits with values of 1-6 in the database.
- **Stakeholder Engagement Database:** Keeps track of communities and contacts made during stakeholder engagement events. Communities are thereby associated to projects.
- **Project Library:** Stores information about potential infrastructure projects, including fields for assigning the project benefit ratings. A project can be associated to one or more communities.

Screen and Prioritize Projects

- Stakeholders completed a PWC survey of Benefit Criteria to determine the relative importance of the benefits to that stakeholder group (e.g., individual North Slope communities). These surveys were collected through group consensus during the round 2 stakeholder engagement meetings and then entered into the Benefit Survey module of the CBA Tool in SplendidCRM. These ratings were then assigned to the rating fields in the Project Library.
- Once a PWC survey was entered into the CBA Tool and associated to a community, the CBA tool then executed an analysis of PWC using AHP. (See Section 1.2.) The result of the AHP analysis was a list of benefit criteria ranked by importance to that community.
- Once the benefits were ranked by importance to the community, and the project benefit ratings completed, a Weighted Decision Matrix (WDM) process was used to generate a Project Score.
- The results of all analyses completed during ASTAR are available in the Benefit Analyses module in the tool. Here the user can review the results from any number of PWC/WDM combinations. It lists the project scores in order of highest to lowest score for all projects associated with a community. In this way, the end-user is supplied with a list of projects prioritized by the amount of perceived benefits they provide as quantified by the community ranking of those benefits.

2.1.5 GIS Data Inventory

The ASTAR Data and GIS Management team compiled an inventory of GIS datasets for the North Slope for nine categories of data from over twenty data sources. Information was filled in for each dataset to keep track of the types and sources of the data, spatial reference system, and other information that was easily obtained. Over 350 unique GIS datasets are included in the inventory. The inventory was then evaluated to identify data gaps for data collection/procurement efforts. Acquired data was then housed on ASTAR-provided storage resources and prepared for inclusion in stakeholder engagement maps, story maps, as inputs to route analyses, and for creation of map figures for various ASTAR studies.

The nine data inventory categories were:

- Biological
- Cultural
- Environmental
- Infrastructure
- Natural Resources
- Physical Features
- Political
- Regulatory
- Transportation

Data in the GIS inventory was gathered from the following publicly available sources:

- State of Alaska sources:
  - Alaska Oil and Gas Conservation Commission
  - Alaska State Geo-Spatial Data Clearinghouse
  - Department of Commerce, Community and Economic Development (DCCED)
  - DCCED Division of Community and Regional Affairs
  - Department of Environmental Conservation
  - Department of Fish and Game
  - ADNR
  - ADNR Division of Geological and Geophysical Surveys (DGGS)
  - Department of Transportation and Public Facilities (ADOT&PF)

- Federal sources:
  - Federal Aviation Administration Airports Geographic Information Systems
  - National Aeronautics and Space Administration
  - National Geospatial Intelligence Agency-National Science Foundation
  - National Oceanic and Atmospheric Administration
  - United States Bureau of Land Management (BLM)
  - United States Fish and Wildlife Service
  - United States Geological Survey (USGS)
- Arctic Landscape Conservation Cooperative
- ArcGIS Online
- CircumArctic Rangifer Monitoring and Assessment Network
- Marine Exchange of Alaska
- National Hydrography Dataset
- National Snow and Ice Data Center
- National Wetlands Inventory
- North Slope Science Initiative
- NSB

2.2 ASTAR Project Selection Analysis Tool

As described in Section 1.4 above and illustrated in Figure 1.4-1, Stage 3 of the ASTAR CBA Methodology focused on infrastructure development projects determined to best meet local needs, goals, and objectives; have local support; and provide benefits to a wide spectrum of stakeholders. Projects advanced to Stage 3 were exposed to more rigorous desktop analysis by SMEs to characterize the project; describe or quantify expected benefits; and identify feasible alternatives, important constraints, data gaps, and other key factors affecting project success. This involved analyzing the priority projects in detail to adopt an analysis strategy; further define factors and constraints; select scoring criteria and weighting methods; and perform alternatives analysis.

This approach was adopted and implemented by AES Alaska for a proof of concept to identify potential route corridors for a permanent road between the communities of Utqiaġvik and Atqasuk. This is summarized in the *ASTAR Atqasuk to Utqiaġvik All Season Access Road Report* (Appendix H-1). The proof of concept was adopted and refined during additional route studies to improve upon methodology, analysis approach, and tools for use in future project studies beyond the lifespan of ASTAR. The additional studies performed using the CBA Methodology that lead to these improvements are discussed in Section 6.2 and attached to this document in Appendix H.

Subsequently, the ASTAR Team was tasked with creating the ASTAR Site Selection Analysis tool that would allow users with access to ArcGIS Desktop Software and a Spatial Analyst extension to perform their own site selection analysis. The tool can be used to solve multi-criteria problems such as site suitability and least-cost path analysis for route alignment.

The ASTAR Site Selection Analysis tool has been made available to the NSB and the communities on laptops sent to leadership in each community.

Detailed steps for using the tool itself are contained in a guidance document provided with the tool. In summary, the processing steps require the user to define their objective, identify their area of interest, define criteria to inform the analysis, and collect relevant data. From there, the tool uses multi-step processing to create a project workspace for the area of interest, refine the projects, buffer the data, reclassify the data based on a common scale employing user-defined criteria, and generate intermediate and final cost rasters using maximum and weighted overlay algorithms. The reclassification of the data to a common scale is accomplished by entering specified syntax into a form in the tool or by uploading a pre-populated excel file containing the required syntax. The excel upload functionality is especially helpful for complicated datasets that require dozens of reclassification queries. During processing the data is exported to a common folder structure and naming convention. The final output of the tool is a cost surface raster where each cell represents suitability of each location based on the data input; classification of input data on a scale of "Highly Favorable" to "Not at All Favorable"; and weights assigned to aggregated data categories. These final outputs can then be used in subsequent GIS analysis.

2.3 Summary of Field Investigations (Jeff coordinate information w/DGGS)

The reports summarizing the field investigations conducted by DGGS during the 2019 summer field season can be found in Appendix C.

3.0 Cultural Setting

3.1 Stakeholder Engagement

This section reviews the stakeholder engagement rounds and activities during the life of the ASTAR Project. Between the partnership of the ADNR and the NSB, rounds of meetings and workshops were facilitated in each North Slope community to identify local and regional infrastructure opportunities. The Stakeholder Engagement Plan found in Appendix D was completed early in the ASTAR project timeline, and provides further detail on how stakeholder engagement was conducted in various rounds.

The objective of this section is to provide ASTAR stakeholders with a better understanding of how the team created and applied North Slope community benefits criteria with the guidance of community leaders in rating infrastructure projects that provide the most cumulative benefit and best enhance the quality of life for the region. The ASTAR benefits criteria were created with the aid of the NSB Comprehensive Plans, and included:

- Improves Health & Safety Conditions
- Enhances Workforce Development
- Supports Community Connectivity
- Improves Access to Education Opportunities
- Preserves or Enhances Subsistence Traditions
- Lowers Cost of Goods and Services

The Round 1 meetings were facilitated from September to December 2018. Round 1 meetings were coordinated with the NSB's Areawide Comprehensive Plan rollout meetings in each of the villages. The ASTAR project was introduced to the public and leadership via community meetings. Additionally, the benefits criteria evaluation survey was conducted in this round to measure overall community opinion to examine the chosen benefits criteria.

In Round 2, the team facilitated community leadership workshops on two surveys. These were the Community Projects Library Binders and PWC surveys. The Projects Library Binders were created to identify, evaluate, and advance infrastructure projects that offer the greatest cumulative benefits to the region. The projects library is part of the larger CBA tool intended to analyze priority infrastructure projects through stakeholder input. The PWC survey allowed the leadership, through consensus building, to compare the ASTAR benefits criteria in pairs and make decisions as to which of the two was more important and by how much.

After Round 2, the ASTAR Team analyzed results, filled in data gaps, and identified projects that offer the most cumulative benefits to the region. Additionally, the ASTAR Team developed a variety of tools, analyses, reports, and data for each community organization. The tools were intended to help communities identify projects they prioritized, help locate resources (i.e., gravel), or help determine an infrastructure's potential location. The data deliverables were designed with the idea that ASTAR intended to empower each community to develop conclusions and opinions using their own value system. Lastly, a single laptop was designated for each community. The laptops are intended to be used by community leadership in applying the ASTAR tools, data, and analysis, which were included on the laptops hard drive. These deliverables were mailed to each community in the summer of 2020.

Round 3 meetings were to be scheduled for the second quarter of 2020 however the COVID-19 pandemic and resulting travel and business shutdowns limited the contact between the ASTAR Team and the communities. If future funding allows, the ASTAR Team would desire to meet with community leadership (in person or electronically) to verify that infrastructure projects recommended by the tools and analysis agreed with stakeholders' priorities and needs (data verification). Additionally, training workshops should be conducted to educate community leaders on how results were identified and how to use the tools and data effectively.

3.2 Workforce Development Plan

The ASTAR Project team developed the WDP to assist in aligning the ASTAR mission with the economic needs of those communities located within the ASTAR Project Area. The WDP identified project types by count and category, regional workforce needs, and workforce development strategies. For specific information, please see the WDP in Appendix E.

The WDP had the following goals:

1. Anticipate areas of future industry growth in the NSB by reviewing ASTAR project libraries.
2. Identify key occupations in the future and assess the ability of the current workforce to meet those demands.
3. Summarize the existing workforce development resources to provide goals and strategies for developing a responsive and adaptive workforce in the future.

One of ASTAR's objectives involved compiling and evaluating infrastructure projects to identify those that offer the greatest benefit to NSB communities. The projects identified were organized in a series of Project Library Binders, one for each community, plus one binder for regional projects, which provide titles and descriptions for each project. The projects were identified from stakeholder meetings, comprehensive plans, and other organizations to reflect a broad picture of potential future development in the NSB. A total of 168 projects were identified for each geographic area and assigned to one of four main categories: road construction, utility construction, building construction, and other civil construction.

Based on the ASTAR project libraries, a needs assessment of those projects, and other data sources, the long-term workforce development strategies for the ASTAR region are:

- Promote local hiring practices when construction projects move forward.
- Provide information to the public on jobs, potential earnings, required training, and references to educational programs. Outreach could include job fairs, a dedicated website, a Facebook page, radio advertisements, or other media.
- Monitor funding and appropriation of NPR-A funds to anticipate needs in the labor market.
- Monitor the status of major infrastructure projects such as additional telecommunications networks or the Alaska LNG pipeline.

- Forge relationships with labor unions and potential employers to provide technical career pathways (apprenticeships) and networking opportunities for NSB residents.
- Utilize existing resources to assist rural communities with workforce development, including the Alaska Works Partnership and the Alaska Apprenticeship Training Coordinators Association.
- Cooperate with the healthcare industry and other stakeholders to combine efforts for bringing improved internet connectivity to rural communities.

Construction projects will be the largest source of new employment in the NSB, due to an increase in expected NPR-A mitigation funding. If these projects are led by contractors from Southcentral Alaska, the NSB should encourage them to hire local workers as heavy equipment operators, craftsmen, and skilled laborers. This will provide opportunities for NSB residents to improve their education and skills (human capital), while earning much higher wages than they could in other industries. Additionally, the borough should provide information to the public to help them learn what jobs are available and what education and skills are required for occupations. Marketing efforts could include job fairs and outreach on the internet or radio.

4.0 Terrain Unit Analysis

Terrain unit analysis involves analyzing satellite imagery, elevation models, and historic geologic mapping to interpret the geology of the upper 20 to 30 feet of the earth surface. The purpose of the ASTAR terrain unit mapping was to support infrastructure development and route selection across the NSB region. The mapping products will be used to support geotechnical engineering and design, identify granular material source potential, and to identify geohazards. An added benefit of this mapping effort is that the data will be available in digital format and accessible to the public via a web map portal. The Terrain Unit Analysis Report is attached to this document as Appendix F.

The ASTAR terrain unit mapping effort began in the northern part of the NPR-A, and expanded to include all of the North Slope communities from the Canadian border near Kaktovik all the way to Point Hope; a subset was also mapped to include Anaktuvuk Pass. The total area mapped is larger than Maine, at over 31,000 square miles. Over 200 terrain units were identified primarily distinguished by mode of deposition, and bedrock was determined from existing geologic maps.

ArcGIS software was utilized to create the digital terrain unit map, and mapping was generally conducted at a scale of 1:30,000. At this scale, features larger than 500 feet across are discernible, but to preserve detail, they were often mapped at a larger scale (i.e. 1:12,500). This provides a more polished product when viewed at the smaller scale.

Existing geologic maps that were used for reference included publicly available geologic maps completed by DGGS and the USGS. Previous terrain analysis completed by Golder Associates, Inc. for Shell Exploration & Production Co. (Shell) was available for a portion of the mapping area. Use of existing terrain analysis data was authorized by Shell. The previous terrain analysis was created with variable quality imagery and elevation data, and was published at a scale of 1:100,000. During the course of this mapping effort, the referenced polygons were updated to a mapping scale of 1:30,000. Unpublished data was also used to aid with geologic interpretation. The unpublished data included field notes and shot hole data from geophysical surveys in the NPR-A which were compiled and provided by DGGS as part of the ASTAR project.

Terrain unit mapping differs from traditional surficial geologic mapping in that it interprets three dimensional soil profiles to approximately a 30-foot depth. Also, with detailed analysis, more discrete units were identified from previously undifferentiated units. Descriptions were developed for each terrain unit associated with distinct engineering properties and material source probabilities. Engineering properties attributed to the terrain units include:

- Frost heave potential
- Thaw settlement potential
- Thawed bearing strength
- Suitability as a material source
- Useable material
- Potential uses for material

Geologic hazards were mapped as point features in an effort to identify the general distribution of these features within the project area. Hazards were identified based on review of satellite imagery and digital elevation models. Interpreted hazard features were often mapped at a scale of 1:12,500. Geologic hazards identified in the Shell mapping are also included; many of these points were mapped at a much greater scale than the current mapping presented herein. In some instances where hazards are closely grouped, a single point is used to represent the features with respect to the mapping scale of 1:30,000. Geologic hazards identified include:

- Slope Instabilities: landslides/slope failure
- Thaw Slumps: commonly identified along riverbanks and along lakes where ice-rich soils have or are currently experiencing thermal degradation, common within ice-rich silt (Qsi) unit.
- Pingos: conical mounds with steep sides that appear ice-rich.

5.0 Infrastructure Analysis

5.1 Erosion Analysis (DGGS – Jeff will coordinate)

The erosion analysis report can be found in Appendix C-3.

5.2 Regional Projects Library Projects

Regional projects libraries were developed, presented in stakeholder engagement, and analyzed throughout the ASTAR project. During Rounds 1 and 2 of stakeholder engagement, stakeholders rated North Slope infrastructure projects and the ASTAR Team analyzed the data and returned updated projects library results back to the community leadership.

Each community regional projects library had summaries that the ASTAR project collected from the NSB Comprehensive Plans, stakeholder meetings, and other recognized developments. Within the projects library there were individual fact sheets that provided a paragraph description, infrastructure category, benefitted community, project benefits, and its reference citation. The projects libraries were created to identify, evaluate, and advance infrastructure projects that offer the greatest cumulative benefits to the region. The projects libraries were part of the larger CBA tool that intended to analyze priority infrastructure projects through stakeholder input.

In Round 1, the ASTAR Team completed a literature review, identified benefit criteria required to meet the needs of the communities; created and implemented a survey to evaluate those benefits preferences; developed a community engagement database; participated in community outreach meetings; and created a project library from a variety of sources to facilitate the process of project analysis. Products for use in Round 2 were also created during round 1 activities. The team compiled a document library of NSB community comprehensive plans, capital improvement plans, historical resource and transportation studies, and other reference material. They reviewed these documents to identify transportation and resource projects that would improve the quality of life and benefit the regional stakeholders.

At Round 2 workshops, community leadership participated in a project benefit rating assessment activity. They then completed a benefit criterion PWC survey using a group consensus method. The PWC method was selected because, when combined with the AHP, it captures both objective and subjective elements of a decision-making process.

In a group, the attendees reviewed the project factsheets, and project ratings were assigned to each project to show how much of each kind of benefit is provided by the project. The Project List, Project Factsheets, and Project Rating Criteria were provided to the meeting participants. Each project was assigned a rating from a common scale of 0-5 with using the project rating criteria. Additionally, during this survey, leadership guided the ASTAR Team in adding, removing, and editing projects that the team may not have known about.

In Round 3, The ASTAR Team analyzed results, filled in data gaps, and identified projects that offer the most cumulative benefits to the region. Along with tools, data, and analysis, the team submitted a community summary report describing their prioritized projects in which they had applied their experience and values from the Round 2 workshops. Furthermore, the team intended to return to community leadership to verify that infrastructure projects recommended by the tools and analysis agreed with stakeholders' priorities and needs (data verification). Additionally, training workshops are to be conducted to educate community leadership how results were identified and how to effectively use the tools and data.

5.3 Priority Community Projects

Round 2 survey results were analyzed with the guidance from North Slope communities to develop a list of community-prioritized projects. Table 5.3-1 display examples of prioritized projects from throughout the North Slope region. Community ASTAR Summaries were developed and submitted back to community leadership for review and feedback.

In a group, the community leadership reviewed the project fact sheets, and project ratings were assigned to each project to show how much of each kind of benefit is provided by the project. The Project List, Project Fact Sheets, and Project Rating Criteria were provided to the community leaders. Each project was assigned a rating from a common scale of 0-5 with using the project rating criteria, which was explained in section 3.1 Stakeholder Engagement. After the project ratings were assigned, the benefit criteria PWC Survey was completed. The PWC Survey method is used to sift out preferences among criteria and identify the criteria that best suit the objectives of the community. A single benefits criteria PWC Survey was collected using group consensus. The results of the PWC Survey were analyzed using AHP. Depending on the community, the results indicate a strong preference for specific benefits criteria (e.g., Enhances Workforce Development). The PWC Survey/AHP results were then combined with the assigned project ratings. The result was a list of scored projects that identify which are the most beneficial from the community leadership perspective.

Table 5.3-1 Priority Community Projects

Community	Project Name
Anaktuvuk Pass	Develop Local Gravel Sources
Atqasuk	Airport Resurfacing
Point Hope	Gravel Source
Point Lay	Internet Connectivity Improvement
Utqiaġvik	High School Renovations CTE Addition
Wainwright	Road to the DEW Line

6.0 Transportation Analyses

6.1 North Slope Passenger and Freight Transportation Study

The North Slope Passenger and Freight Transportation Study (Appendix G) focused on how freight and passengers are transported to and from the remote communities of the NSB, summarizes the economic value of the existing transportation network, identifies issues with the current network, and offers potential solutions and recommendations for improvements. The communities of Utqiaġvik, Atqasuk, Wainwright, Point Lay, Point Hope, Nuiqsut, Kaktovik, and Anaktuvuk Pass have unique transportation requirements due to their isolation from a contiguous road network and lack of significant marine infrastructure. Transportation to these communities is multimodal, involving a combination of marine, air, and overland methods. Air transport is the only method providing year-round service, and thus is a common means of passenger trips, but it is costly and subject to inclement weather. Deadhorse, the oil and gas industry hub, is connected to the Alaska Highway System via the Dalton Highway, which is accessible year-round, but no permanent roads directly connects to any of the other communities.

The report discusses specific issues associated with each mode of transportation for each community and the oil and gas industry. Cargo barges deliver supplies to Utqiaġvik, which lacks a safe harbor, during ice-free months. A road connection has long been sought to the regional hub by the inland community of Atqasuk, situated on a shallow river with no year-round overland connections. In Wainwright, located off the Chukchi Sea, residents would like to see a docking facility built and aircraft traffic moved to an airstrip farther from town. Similarly, both Point Lay and Point Hope lack ports, and barge offloading is time-consuming and sometimes risky. Point Hope is subject to flooding and needs an evacuation road. Nuiqsut is positioned in the middle of Prudhoe Bay inland oil development, on the western edge of a shallow channel of the Colville River. It can access the Dalton Highway by ice road and is seeking the construction of a year-round road to the main channel of the Colville River to facilitate boat launches. Kaktovik, situated on an island in the Beaufort Sea, has a shallow haul-out and no public boat ramp or dock. Anaktuvuk Pass is inland and lacks access to a large river or permanent roads. During winter, a vast network of trails connects many of Alaska’s northernmost communities which can be traveled by snowmachine or track vehicles.

For the oil and gas industry, overland travel is significantly challenged by the need to cross the Colville River. Marine transport is the only form of transportation available for certain large freight. Even air and road traffic can be halted by unsafe winter conditions.

The improvement of multimodal infrastructure would bring the greatest benefits to the North Slope. The report identifies opportunities that would best meet regional needs, goals, and objectives; have local support; and demonstrate that they will provide benefits to a wide spectrum of stakeholders. While improved shore-based infrastructure is important to each coastal community, these needs are somewhat marginal when compared to introducing a deep-water port to the region. A deep-water port would decrease operating costs in the Arctic; provide for efficient delivery of bulk goods; offer protected moorage to support offshore oil and gas endeavors, mineral resource extraction vessels, and cruise ships; and afford vessel repair and maintenance support.

At nearly 95,000 square miles, the NSB is almost as big as Oregon, the 10th largest state in the United States. Because the NSB is so large – and geographic location is a key driver for potential opportunities – for analysis purposes of the report, the borough was divided into separate regions. In the Northern Region communities of Utqiaġvik, Atqasuk, and Wainwright, the need for improved marine infrastructure combined with a connecting road network was identified as a regional opportunity likely bringing the most benefit to the greatest number of residents.

The Western Region, consisting of Point Lay and Point Hope, was unique in the fact that improvements to the Northern Region might favor a connecting road to Point Lay. Point Hope is extremely isolated, but there are opportunities to connect to a potential port at Cape Thompson or Kivalina and the Delong Mountain Terminal. Kaktovik is the only community in the Eastern Region, and a connecting road to Deadhorse was identified as bringing benefit to that community as well as providing access for oil and gas development. The community of Anaktuvuk Pass in the Southern Region would be best served with an annual snow trail providing seasonal access for its residents to transport cargo overland.

The Central Region is comprised of Nuiqsut and the oil and gas industry. Opportunities include establishing an all-season gravel road from Deadhorse, both temporary and permanent crossings for the Colville River, a road continuing from the west bank of the Colville River to Atqasuk, or even a North Slope railroad connecting Nenana to Deadhorse. Oil Search Alaska is proposing to build a road on the east side of the Colville River connecting to a boat launch for local residents.

Community and stakeholder engagement is needed to address the needs of each community and support the development of the oil and gas industry with infrastructure development. Data gaps must be addressed for all proposed modes. Planning potential port and dock locations will require bathymetric data. Unmanned aircraft (drones) could reduce the cost of air transportation, but these investments require successful testing of a pilot program. Any potential overland routes will be contingent on the area designations and required operating procedures of the 2019 BLM Integrated Action Plan (IAP) / Environmental Impact Statement Record of Decision. A thorough materials site investigation program will be required to delineate sufficient quantities of gravel to construct the proposed roads.

Finally, the infrastructure projects must acquire appropriate funding. Without connected land infrastructure, and the multimodal commerce to support it, it is unlikely that new port facilities developed in the ASTAR region by state and local government would receive federal aid. The federal Airport Improvement Program releases federal grants to airports. Much of the state's capital spending on highways takes advantage of federal funds administered by the U.S. Department of Transportation's Federal Highway Administration.

6.2 North Slope Route Analysis

Due to time constraints, the ASTAR Team was only able to develop route studies for four potential transportation corridors. Selection of the particular corridors was influenced by access to existing data, current transportation routes in use, and needs articulated by communities and the NSB. Several other corridors and connections were identified and listed as potential areas of additional study in Section 7.0 of this document. In addition to the specific potential transportation routes reviewed by the ASTAR Team and summarized below, additional information on the Community Winter Access Trails (CWAT) program of the NSB is included.

6.2.1 Atqasuk to Utqiaġvik All Season Access Road

This report found in Appendix H-1 presents the results of a desktop analysis of a proposed all-season gravel access road extending from Atqasuk to Utqiaġvik, Alaska. Land transportation beyond Atqasuk, a community within the boundaries of the NPR-A, is limited because it is not connected by road to other communities. The Atqasuk Comprehensive Plan (NSB 2017) identifies a gravel road to Utqiaġvik as a priority infrastructure project desired by the local residents.

The objective of this desktop analysis was to provide the ASTAR stakeholders with a better understanding of potential benefits that could influence future development of the proposed road, as well as important engineering, environmental, regulatory, and stakeholder inputs that affect routing. Additionally, this desktop study can assist stakeholders and the NSB in identifying and filling potential data gaps necessary to support future phases of the project.

A two-lane road is proposed to connect existing road networks, with termini by Landfill Access Road in Atqasuk; and at Emaiksoun Road or the Barrow Gas Field road system in Utqiaġvik. The all-season gravel road would traverse roughly 64 to 74 miles and cross several significant rivers and streams depending on the route selected (e.g. Nigisaktuvik River, Inaru River, and Niklavik Creek). The project area, including potential route alternatives and existing winter trails, is shown on Figure 6.2.1-1.

This project was evaluated using the CBA process developed specifically for ASTAR. This evaluation found the proposed project provides numerous regional benefits, enhances community connectivity, and receives broad local support. Year-round road access offers the possibility of increased economic opportunities, more frequent social and cultural connections, lower costs for goods and services, enhanced subsistence traditions, improved health and safety, access to education opportunities, and enhanced training and workforce development.

To assist in identifying feasible routes for an all-season road, a group of SMEs was convened to research, gather, and analyze available information characterizing the project area and describing features and benefits of the project. Both spatial and non-spatial data and background information were gathered. Spatial data were captured in a GIS database. The data and information were summarized by SMEs in technical memoranda which address the following key topics:

- Land Status
- Hydrology
- Geoscience
- Existing Infrastructure
- Engineering
- Cultural Resources
- Paleontological Resources
- Subsistence Patterns
- Wetlands
- Threatened and Endangered Species
- Fish and Fish Habitat
- Avian Resources and Habitat
- Construction Cost

Spatial data were incorporated into a GIS cost-weighted raster analysis that identified potential route alternatives that aligned with likely river crossings and account for features and constraints identified in the technical memoranda:

- Corridor A – Coastal Route
- Corridor B – Central Route
- Corridor C – Eastern Route

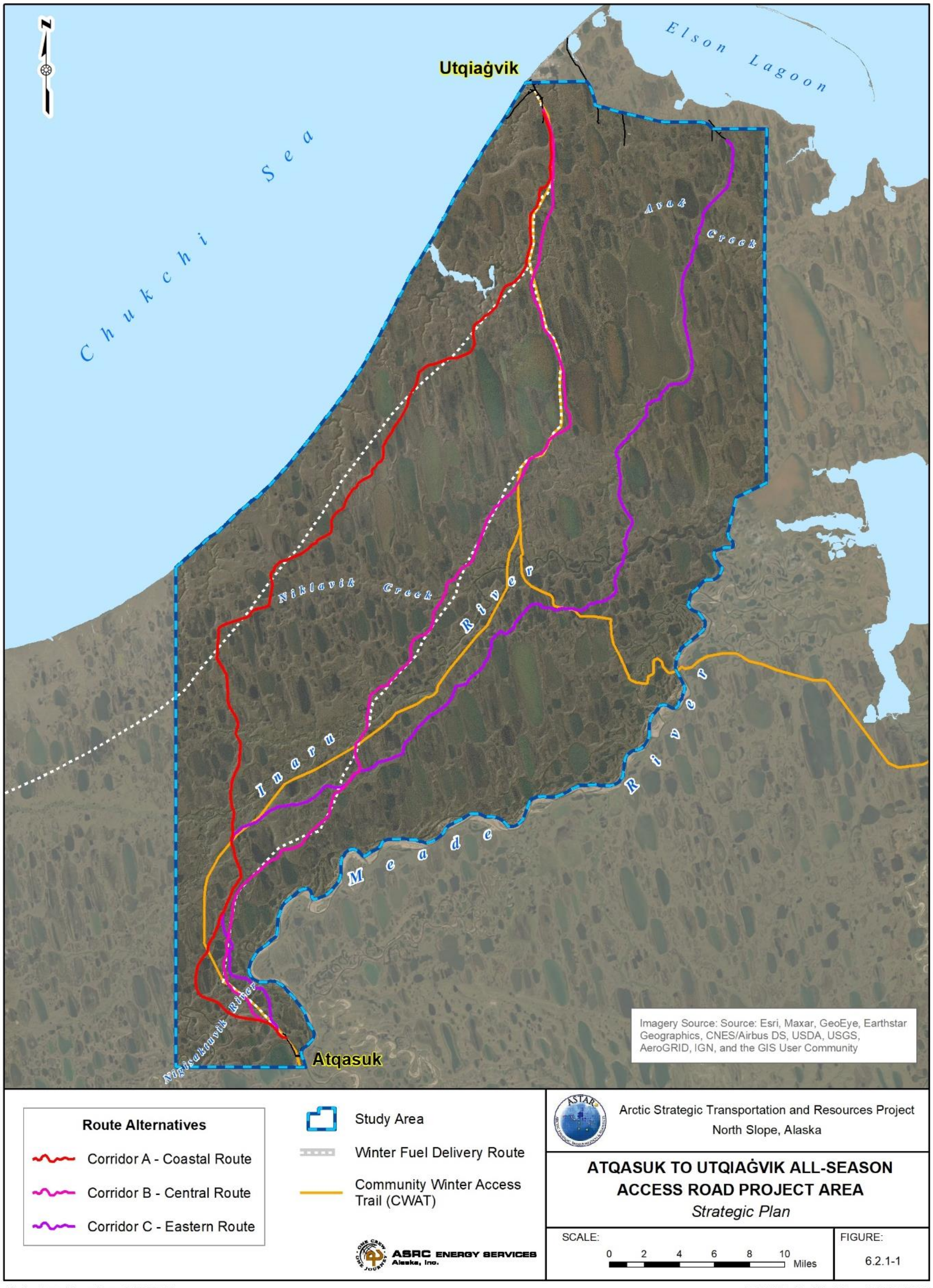
Alignment of all three corridors were informed by the results of the GIS cost-weighted analysis, as well as SME consultation, aerial imagery, and other GIS datasets, such as the National Hydrography Dataset for crossing locations and alignment. The cost-weighted analysis generally favored a path along the Chukchi coast (Corridor A), so additional analysis forcing path alignment towards specific river crossing locations was required to produce distinct alignments. Corridor B was produced by hybridizing the cost-weighted path, Community Winter Access Trail alignments, and heads-up digitizing. Corridor C is strictly the product of the GIS cost-weighted analysis with no post-process modifications.

Each criterion was analyzed from eight societal and landowner viewpoints: Federal Government, State Government, Local Government (NSB), community residents, village corporations (Ukpeaġvik Inupiat Corporation [UIC] and Atqasuk Corporation), regional corporation (Arctic Slope Regional Corporation [ASRC]), environmental nongovernmental organizations (NGOs), and pro-development NGOs. The Weighted Decision Matrix scored Corridor A – Coastal Route as the most advantageous option, followed by the Corridor B, and then Corridor C in descending order. Corridor B is the least costly alternative. When compared with the other route alternatives, Corridor A best sets the stage for a road extension to Wainwright, allowing year-round connection between the three communities, and strengthening the case for a regional marine port or dock facility

The road corridors presented in this report were developed without the benefit of stakeholder engagement. Before advancing the project further, a stakeholder engagement plan should be developed and implemented to solicit input specific to the project, and use the input to refine the project description and analysis.

The BLM was in the process of revising the IAP for the NPR-A during ASTAR. When the revision is completed, the IAP should be reviewed to assess whether any changes to stipulations or Best Management Practices (BMPs) affect the proposed Atqasuk to Utqiaġvik Road. The study concludes by recommending follow-on studies and activities to fill data gaps and advance the project.

Figure 6.2.1-1. Atqasuk to Utqiaġvik All Season Access Road Project Area



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6.2.2 Road Network for Utqiaġvik, Atqasuk, and Wainwright

This report found in Appendix H-2 results of a desktop analysis for an all-season gravel access road network connecting the northern Alaskan communities of Utqiaġvik, Atqasuk, and Wainwright. A year-round road network would broaden and diversify the region's transportation system and create economic, cultural, and subsistence opportunities for local residents of these communities.

The objective of this desktop analysis was to provide ASTAR stakeholders with a better understanding of potential benefits that could influence future development of the proposed road network, as well as important engineering, environmental, regulatory, and stakeholder inputs that may affect routing. Additionally, this desktop study can assist stakeholders in identifying and filling potential data gaps necessary to support future phases of the project.

This desktop analysis leverages the *Atqasuk to Utqiaġvik All Season Access Road,* (AES Alaska, 2019) found in Appendix H-1. The previous study concluded that Corridor A – Coastal Route appeared to be the most favorable alignment, offering greater benefits than other options, and setting the stage for a road extension to Wainwright. The study also pointed out that linking together the three communities could open opportunities for development of a regional port for freight and fuel deliveries.

The proposed project as depicted in Figure 6.2.2-1 comprises a network of two-lane gravel roads that provide a year-round overland transportation link between the existing community road systems of Utqiaġvik, Atqasuk, and Wainwright. Given that the 2019 study already evaluated options for connecting Utqiaġvik and Atqasuk, this report examined route alternatives that extend the road system to Wainwright. In addition, considering all three communities resulted in minor adjustments to portions of the original alignment for Corridor A. The all-season gravel road extending to Wainwright would traverse roughly 63 to 69 miles from Corridor A (depending on the connection point) to the Olgoonik Corporation (OC) Road in Wainwright.

For all three villages, year-round road access offers the potential for increased economic opportunities, increased social and cultural connections, lower costs for goods and services, enhanced subsistence traditions, improved health and safety, greater access to education opportunities, and greater opportunities for training and workforce development.

To assist in identifying feasible routes for connecting to Wainwright, a group of SMEs was convened to research, gather, and analyze available information characterizing the project area and describing features and benefits of the project. Both spatial and non-spatial data and background information were gathered. Spatial data were captured in a GIS database. The data and information were summarized by SMEs in technical memoranda. The memoranda address the following key topics that affect the project:

- GIS Raster Analysis
- Land Status
- River Hydrology
- Geology/Geotechnical
- Existing and Proposed Infrastructure
- Roadway Engineering
- Vehicle Bridges
- Cultural Resources
- Paleontological Resources
- Construction Cost
- Subsistence Patterns
- Wetlands
- Threatened and Endangered Species
- Terrestrial Mammals
- Fish and Fish Habitat
- Avian Resources and Habitat
- Environmental Compliance & Permitting

Spatial data were incorporated into a GIS cost-weighted raster analysis. The analysis was used to identify potential route alternatives that align with likely river crossings and account for features and constraints identified in the other technical memoranda. The following corridors were identified as preliminary route alternatives for the road extending to Wainwright:

- Corridor D – Coastal Route Extension
- Corridor E – Middle Route
- Corridor F – Southern Route

Using information in the technical memoranda, the features and benefits of each route alternative were summarized, and the corridors were compared in a matrix with scoring based on degree of favorability. The scoring matrix was weighted by considering eight different stakeholder viewpoints: Federal Government, State Government, Local Government (NSB), community residents, village corporations (UIC; Atqasuk Corporation; OC), regional corporation (ASRC), environmental NGOs, and pro-development NGOs. The weighted scores were then summed to identify favorable route alternatives.

Corridors D and E could help set the stage for development of a regional port facility. Corridor D has the greatest potential for material sources as it is routed near or parallel to ancient beach deposits. In comparison to the other route alternatives, Corridor D is the most advantageous route for preserving high-value wetlands; potential eider nesting habitat and yellow-billed loon habitat; and for complying with BLM NPR-A BMPs for lake and river setbacks.

Corridor E negotiates the poorly drained terrains of numerous thaw lake deposits. Material sources along this route are anticipated to be of poor quality, and this route will likely require substantially more fill to construct. In comparison to the other route alternatives, Corridor E is the least advantageous route for preserving high-value wetlands; potential eider nesting habitat and yellow-billed loon habitat; and for complying with BLM BMPs for lake and river setbacks. The longest route, Corridor E has the longest total travel distance from Wainwright to Atqasuk and the highest construction cost estimates.

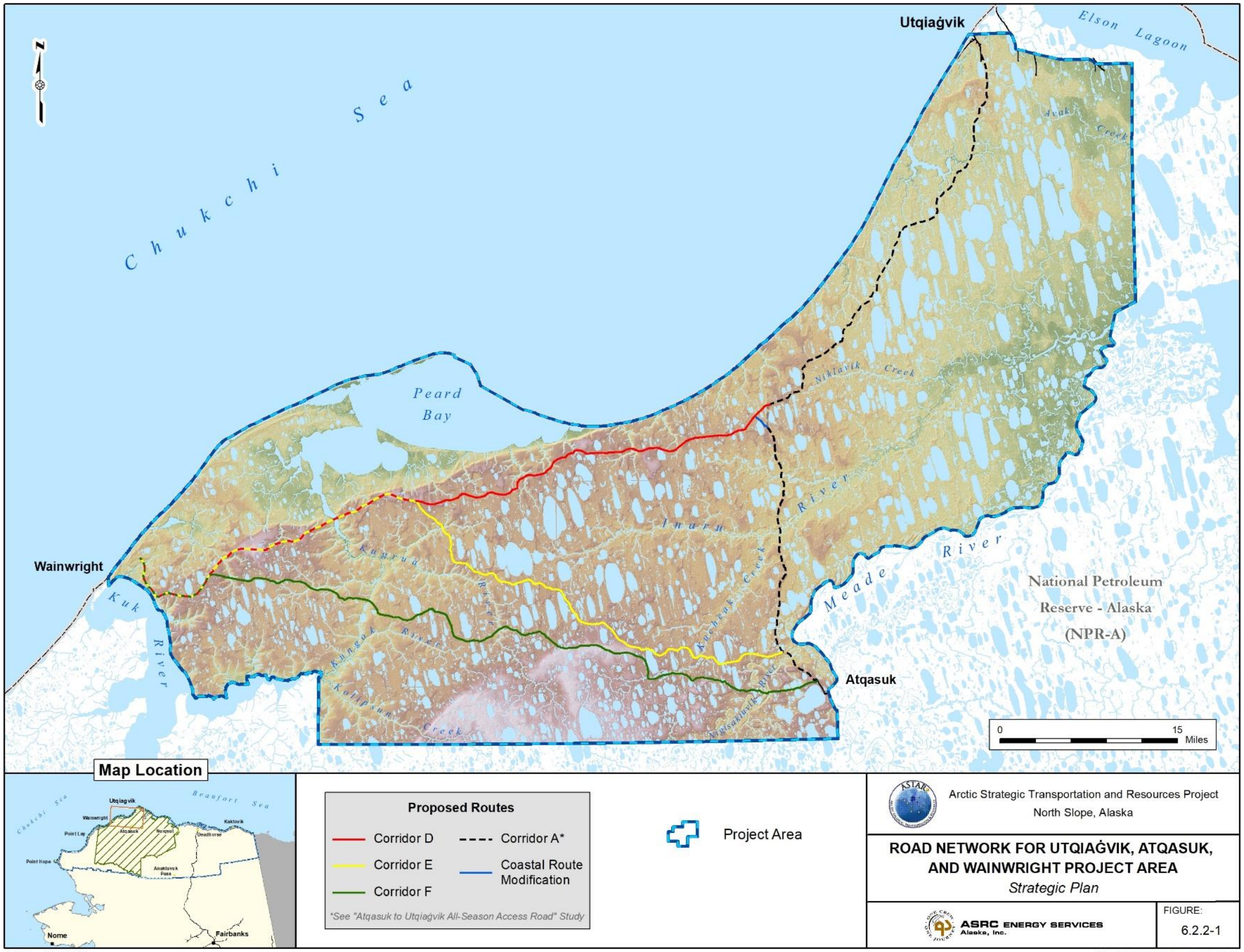
Similar to Corridor E, Corridor F remains encumbered by the thaw lake deposits, resulting in poor material site potential and greater fill requirements. It has the most stream crossings of all the routes, and impacts to high-value wetlands will require a greater permitting effort. Despite these drawbacks, Corridor F has the lowest construction cost estimate.

Based on the outcome of our preliminary analysis and comparison, Corridor D – Coastal Route Extension is the most favorable alternative for connecting to Wainwright, followed by Corridors E – Middle Route and F – Southern Route in descending order. The Coastal Route Modification was also proposed as an alternative connector for joining Corridor D to Corridor A.

The road corridors and analysis presented in this report were developed without the benefit of stakeholder engagement. Before advancing the project further, a stakeholder engagement plan should be implemented to solicit specific input for refining the project description and evaluation. Despite the preliminary information presented in this desktop study, the stakeholder’s preferences could significantly alter the study outcome and preferred routing.

In addition, the new IAP for the NPR-A should be reviewed when it is finalized by BLM to assess whether any changes to stipulations or BMPs affect the proposed route alternatives. The study concludes by recommending follow-on studies and activities to fill data gaps and advance the project.

Figure 6.2.2-1. Road Network for Utqiaġvik, Atqasuk, and Wainwright Project Area



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6.2.3 Colville River Crossing Route Study

This report found in Appendix H-3 presents results of a desktop analysis for a proposed Colville River crossing route that connects the existing gravel road network east of the Colville River to the isolated road system west of the Colville River in the NPR-A. A year-round road and associated crossing would broaden and diversify the region's transportation network and create economic opportunities for federal, state, and local government; the oil and gas industry; and local residents of the Village of Nuiqsut.

The objective of this desktop analysis was to provide ASTAR stakeholders with a better understanding of potential benefits that could influence future development of the proposed road and river crossing, as well as important engineering, environmental, regulatory, and stakeholder inputs that may affect routing. Additionally, this desktop study can assist stakeholders in identifying and filling potential data gaps necessary to support future phases of the project.

The project as depicted in Figure 6.2.3-1 comprises a 2-lane gravel road that will provide a year-round overland transportation link between the existing road networks on the east and west sides of the Colville River, effectively connecting infrastructure in Nuiqsut and the NPR-A with the Spine Road in Kuparuk, and ultimately with the Alaska Highway System via the Dalton Highway. At the Colville River, the project will include a crossing location that allows for a summer barge and a winter ice bridge. Corridors 1 to 3 appear suitable for a cable hoverbarge. A future permanent bridge may be planned when economically feasible. Depending on the route, the all-season gravel road would traverse roughly 17 to 48 miles, with termini at the Tarn-Meltwater Road on the east end, and at Alpine CD-4, Nuiqsut, Greater Moose's Tooth Unit, or the Bear Tooth Unit on the west end.

For the village of Nuiqsut, year-round road access offers the potential for increased economic opportunities, increased social and cultural connections, lower costs for goods and services, enhanced subsistence traditions, improved health and safety, access to education opportunities, and greater opportunities for training and workforce development.

For the oil and gas industry, year-round road access lowers the operational costs for developments west of the Colville River, lowers the cost of exploration, and promotes development of otherwise stranded resources in NPR-A.

For the NSB, the State of Alaska, and the Federal Government, the road could provide cost-effective, reliable, year-round access to natural resources, increasing the life span of the Trans-Alaska Pipeline System and the immense oil and gas infrastructure investments already in place, providing economic benefits to the region, the state, and the nation.

To assist in identifying feasible routes for an all-season road, a group of SMEs was convened to research, gather, and analyze available information characterizing the project area and describing features and benefits of the project. Both spatial and non-spatial data and background information were gathered. Spatial data were captured in a GIS database. The data and information were summarized by SMEs in technical memoranda. The memoranda address the following key topics that affect the project:

- GIS Raster Analysis
- Land Status
- River Hydrology
- Surficial Geology
- Material Sites
- Existing and Potential Infrastructure
- Roadway Engineering
- Vehicle Bridges
- Ferry Crossing
- Cultural Resources
- Paleontological Resources
- Subsistence Patterns

- Wetlands
- Threatened and Endangered Species
- Terrestrial Mammals
- Fish and Fish Habitat
- Avian Resources and Habitat
- Environmental Compliance & Permitting
- Construction Cost

Spatial data were incorporated into a GIS cost-weighted raster analysis. The analysis was used to identify potential route alternatives that align with likely river crossings and account for features and constraints identified in the other technical memoranda. The following corridors were identified as preliminary route alternatives for the road:

- Corridor 1 – DS2L to CD-4
- Corridor 2 – Tarn to Nuiqsut Boat Launch
- Corridor 3 – DS2P to Willow
- Corridor 4 – DS2P to BT5

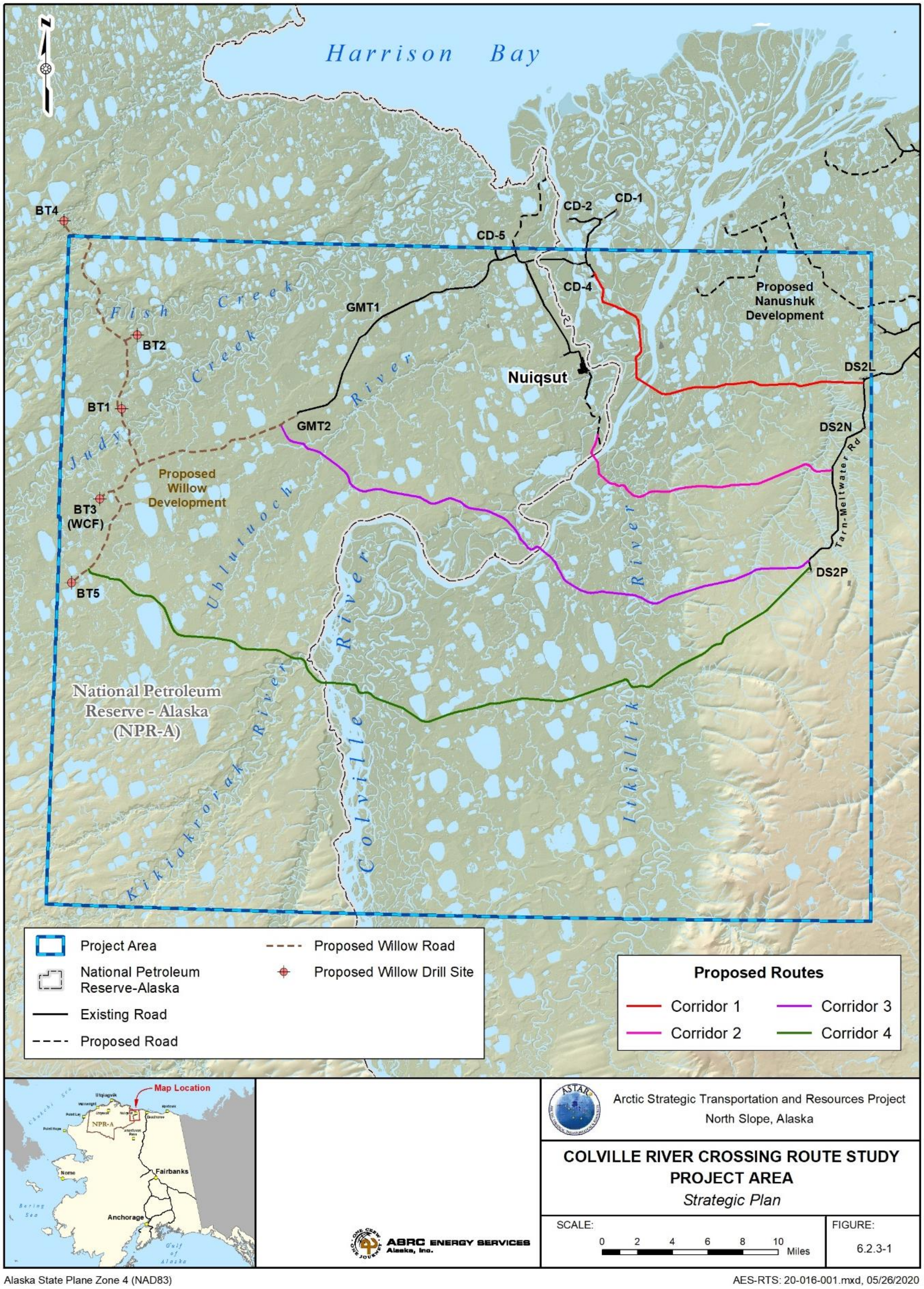
Using information in the technical memoranda, the features and benefits of each route alternative were summarized (Table 3.3-1 in the Colville River Crossing Route Study report), and the corridors were compared in a matrix with scoring based on degree of favorability. The scoring matrix was weighted by considering eight different stakeholder viewpoints: Federal Government, State Government, Local Government (NSB), community residents, village corporation (Kuukpik Corporation), regional corporation (ASRC), environmental NGOs, and pro-development NGOs. The weighted scores were then summed to identify favorable route alternatives.

Based on the outcome of our preliminary analysis and comparison, it appears that Corridors 1 and 2 are the most favorable alternatives for the Colville River Crossing (with nearly identical scoring totals), followed by Corridors 3 and 4 in descending order. Note however, that despite being a favorable alternative from many perspectives, Corridor 2 isn't likely to receive community support, given that it routes industry traffic through the village of Nuiqsut, thus Corridor 1 may be more attractive. Alternatively, if the community expresses a desire to increase the separation distance between the proposed road and Nuiqsut, then Corridors 3 and 4 may become more favorable.

The road corridors and analysis presented in this report were developed without the benefit of stakeholder engagement, thus outcomes could change. Before advancing the project further, a stakeholder engagement plan should be developed and implemented to solicit specific input to the project, and use the input to refine the project description and evaluation. Stakeholder involvement is one of the most critical components of project analysis, and despite the preliminary information presented in this desktop study, the stakeholder's preferences could significantly alter the study outcome and preferred routing.

In addition, the new IAP for the NPR-A should be reviewed when it is finalized by BLM to assess whether any changes to stipulations or BMPs affect the proposed route alternatives. The study concludes by recommending follow-on studies and activities to fill data gaps and advance the project.

Figure 6.2.3-1. Colville River Crossing Route Study Project Area



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6.2.4 Willow Development Roads to Atqasuk Route Study

This report found in Appendix H-4 presents results of a desktop analysis for an all-season gravel access road connecting ConocoPhillips Alaska Inc.'s proposed Willow Development to the northern Alaskan community of Atqasuk. It builds off the *Colville River Crossing Route Study* which terminated at Willow and the *Atqasuk to Utqiaġvik All-Season Access Road Study* which originated at Atqasuk. Including the *Road Network for Utqiaġvik, Atqasuk, and Wainwright*, these projects would provide a year-round road network connecting the northern Alaskan communities of Deadhorse, Nuiqsut, Atqasuk, Utqiaġvik, and Wainwright and would broaden and diversify the region's transportation system and create economic, cultural, and subsistence opportunities for local residents of these communities.

The objective of this desktop analysis was to provide ASTAR stakeholders with a better understanding of potential benefits that could influence future development of the proposed road, as well as important engineering, environmental, regulatory, and stakeholder inputs that may affect routing. Additionally, this desktop study can assist stakeholders in identifying and filling potential data gaps necessary to support future phases of the project.

The *Colville River Crossing Route Study* proposed four crossings connecting the Tarn-Meltwater Road on the east side of the Colville River with existing or proposed infrastructure on the west side of the river. A strong favorite was not determined due to uncertainty around Nuiqsut's preferences. In all cases the routes provide access to ConocoPhillips Alaska Inc.'s proposed Willow Development, which is where the *Willow to Atqasuk Route Study* starts. The *Road Network for Utqiaġvik, Atqasuk, and Wainwright Study* concluded that Corridor A – Coastal Route and Corridor D – Coastal Route Extension appeared to be the most favorable alignments, offering greater benefits than other options. The study also pointed out that linking together the three communities could open opportunities for development of a regional port for freight and fuel deliveries. With a route established from Atqasuk to Utqiaġvik and from oil field roads east of the Colville River to proposed development west of the river, this study focused on the remaining approximately 150-mile stretch through NPR-A. Figure 6.2.4-1 depicts the study area.

Year-round road access offers the potential for increased economic opportunities, increased social and cultural connections, lower costs for goods and services, enhanced subsistence traditions, improved health and safety, greater access to education opportunities, and greater opportunities for training and workforce development.

To assist in identifying feasible routes, a group of SMEs was convened to research, gather, and analyze available information characterizing the project area and describing features and benefits of the project. Both spatial and non-spatial data and background information were gathered. Spatial data captured in a GIS database included:

- GIS Raster Analysis
- Land Status
- River Hydrology
- Geology/Geotechnical
- Existing and Proposed Infrastructure
- Roadway Engineering
- Vehicle Bridges
- Cultural Resources
- Paleontological Resources
- Construction Cost
- Subsistence Patterns
- Wetlands
- Threatened and Endangered Species
- Terrestrial Mammals
- Fish and Fish Habitat
- Avian Resources and Habitat
- Environmental Compliance & Permitting

Spatial data were incorporated into a GIS cost-weighted raster analysis. The analysis was used to identify potential route alternatives that align with likely river crossings and account for features and constraints identified in the other technical memoranda. The following corridors were identified as preliminary route alternatives:

- Corridor G – Northern Route
- Corridor H – Middle Route
- Corridor I – Southern Route

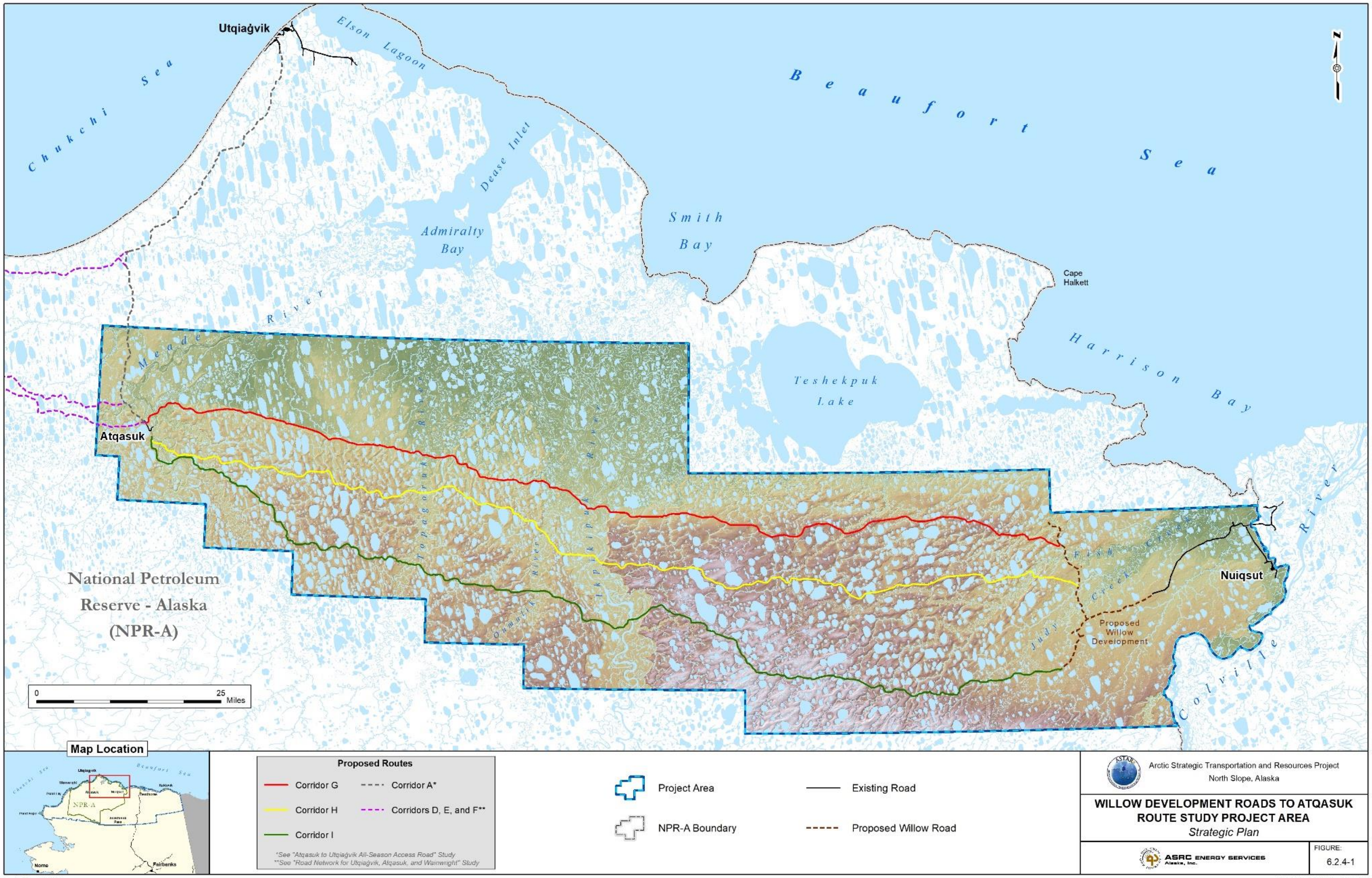
Using information in the technical memoranda, the features and benefits of each route alternative were summarized, and the corridors were compared in a matrix with scoring based on degree of favorability. The scoring matrix was weighted by considering eight different stakeholder viewpoints: Federal Government, State Government, Local Government (NSB), community residents, village corporations (UIC, OC, Atqasuk Corporation, Kuukpik Corporation), regional corporation (ASRC), environmental NGOs, and pro-development NGOs. The weighted scores were then summed to identify favorable route alternatives.

All three routes scored similarly, and it was difficult to determine a strong favorite. Out of a possible score of 400, Corridors G, H, and I scored 297, 307, and 313, respectively. Based on the outcome of the preliminary analysis and comparison, Corridor I – Southern Route is the most favorable alternative for connecting to Atqasuk, followed by Corridor G – Northern Route and Corridor H – Middle Route in descending order. While Corridor I is the longest route, it has more favorable river crossings. Material source potential across the project area remains largely untested, and route favorability may change upon location of suitable material sites. All corridors traverse a vast area of eolian sand; however, Corridor G traverses an ancient beach deposit that has higher potential to provide suitable materials for road construction. Other differentiators include the Corridor I having access to the existing airstrip at Inigok, and Corridor G arrives north of Atqasuk whereas Corridors H and I arrive from the south and route through the village.

The road corridors and analysis presented in this report were developed without the benefit of stakeholder engagement. Before advancing the project further, a stakeholder engagement plan should be implemented to solicit specific input for refining the project description and evaluation. Despite the preliminary information presented in this desktop study, the stakeholder's preferences could significantly alter the study outcome and preferred routing.

In addition, the new IAP for the NPR-A should be reviewed when it is finalized by BLM to assess whether any changes to stipulations or BMPs affect the proposed route alternatives. The study concludes by recommending follow-on studies and activities to fill data gaps and advance the project.

Figure 6.2.4-1. Willow Development Roads to Atqasuk Route Study Project Area



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6.3 Funding Opportunities for Transportation & Infrastructure Projects

In early 2018, the ASTAR Team developed a study to identify potential funding sources for infrastructure projects on the North Slope titled *ASTAR Economics/Socioeconomics Digital Library*. The full report is attached to this plan as Appendix I. and provides the following information:

- A list of public and private programs that advance funding and other types of assistance for the construction of infrastructure projects in Alaska
- Links to and brief descriptions of major online sources of economic and socioeconomic data that can be used to move infrastructure projects through the regulatory and planning processes
- A sample of methodological and applied studies that can assist in the planning and development of infrastructure projects

In the future, as proponents advance specific projects from concept to design, engineering, and eventually sanctioning, the *ASTAR Economics/Socioeconomics Digital Library* in Appendix I can be accessed to identify potential funding sources and as a resource for advancing funding opportunities for infrastructure projects.

7.0 Potential/Recommended Next Steps

While the ASTAR Team was able to complete initial analysis of four route corridors, several additional routes and studies were identified that could be advanced during an as-yet unfunded subsequent phase of ASTAR or by another interested party. Potential studies of infrastructure projects that could provide cumulative benefits to communities on the North Slope include:

- Dalton Highway to Kaktovik Route Study
- Road Network Study for Point Lay and Point Hope
- North Slope Dock and Port Study
- Integration of all ASTAR Route Studies into a Regional Study/Analysis

The route studies completed by the ASTAR Team did not receive the benefit of input from the village corporations, tribal entities, and residents of the potentially affected North Slope communities. Presentation of the route studies to stakeholders in order to elicit comments and traditional knowledge related to the subject project(s) would be a valuable exercise to further advance and refine the routes. Field investigations would also need to be conducted to confirm preliminary route assumptions and mapping.

Finally, once projects are more fully developed, a project proponent would need to pursue funding sources such as the NPR-A Impact Mitigation Grant Program administered by the DCCED.

8.0 References

As described in Section 1.1, this document provides summaries of and excerpts from documents and deliverables created for ASTAR. Complete versions of document referenced in each section are attached as appendices to this Strategic Plan. In order to maintain the context of the references in relation to each source document, all references are listed in the individual reports found in the appendices.

9.0 Contributors/Acknowledgements

The ASTAR Team acknowledges and thanks the following organizations and entities for their contributions.

- 3rd Rock Consulting
- ADNR Office of Project Management and Permitting
- ADOT&PF
- AKGeoservices
- Alaska Department of Health and Social Services
- Alaska Eskimo Whaling Commission
- Alaska Federation of Natives
- Alaska Waterways Safety Committee
- Arctic Slope Native Association
- ASRC
- ASRC Energy Services Alaska, Inc.
- Atqasuk Corporation
- City of Anaktuvuk Pass
- City of Atqasuk
- City of Kaktovik
- City of Nuiqsut
- City of Point Hope
- City of Utqiaġvik
- City of Wainwright
- Community of Anaktuvuk Pass
- Community of Atqasuk
- Community of Barrow / Utqiaġvik
- Community of Kaktovik
- Community of Nuiqsut
- Community of Point Hope
- Community of Point Lay
- Community of Wainwright
- Cully Corporation
- DCCED
- DGGS
- Ilisagvik Collage
- Inupiat Community of the Arctic Slope
- Kaktovik Inupiat Corporation
- Kuukpik Corporation
- Kuukpik Subsistence Oversight Panel
- Naqsragmiut Tribal Council
- Native Village of Atqasuk
- Native Village of Barrow
- Native Village of Kaktovik
- Native Village of Nuiqsut
- Native Village of Point Hope
- Native Village of Point Lay
- NEI
- North Slope Borough Planning Department
- NSB Assembly
- NSB Department of Public Works
- NSB Department of Wildlife
- Nunamiut Corporation
- OC
- PND, Inc.
- RDI
- Resource Development Council
- Tikigaq Corporation
- UIC
- UMIAQ
- Village of Wainwright
- Wainwright Steering Committee

Appendices

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Appendix A: ASTAR CBA Tool Methodology

- A-1 AES Assessment of Tools for CBA
- A-2 RDI ASTAR Methodology

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Appendix A-1 AES Assessment of Tools for CBA

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Appendix A-2 RDI ASTAR Methodology

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Appendix B: ASTAR Data Management Plan

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Appendix C: Report(s) on DGGS Field Investigations

- C-1 NPR-A Summer Geotech Studies
- C-2 LiDAR Studies
- C-3 DGGS Erosion Study

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Appendix C-1 NPR-A Summer Geotech Studies

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C-2 LiDAR Studies

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C-3 DGGS Erosion Study

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Appendix D: ASTAR Stakeholder Engagement Plan

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Appendix E: ASTAR Workforce Development Plan

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Appendix F: ASTAR Terrain Unit Analysis Report

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Appendix G: ASTAR Transportation Study

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Appendix H: ASTAR Project Route Studies

- H-1 Atqasuk to Utqiaġvik All Season Access Road Study
- H-2 Road Network Study for Utqiaġvik, Atqasuk, and Wainwright Study
- H-3 Colville River Crossing Route Study
- H-4 Willow Development Roads to Atqasuk Route Study

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Appendix H-1 Atqasuk to Utqiaġvik All Season Access Road Study

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Appendix H-2 Road Network Study for Utqiaġvik, Atqasuk, and Wainwright Study

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Appendix H-3 Colville River Crossing Route Study

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Appendix H-4 Willow Development Roads to Atqasuk Route Study

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Appendix I: Socioeconomic Analysis – Funding Sources for Potential Projects & Digital Library

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