

13. CULTURAL AND PALEONTOLOGICAL RESOURCES

13.1. Introduction

AEA is undertaking studies addressing the effects of the proposed Project on cultural and paleontological resources. Information from these studies will be used to assist in identifying appropriate protection, mitigation, and enhancement measures that will be proposed in the AEA License Application.

The Cultural Resources Study Plan (Section 13.5) outlines the purpose and framework for evaluating the potential effects of the Project on “historic properties.” Historic properties are prehistoric or historic districts, sites, buildings, structures, or objects – including properties of traditional religious and cultural importance to an Indian tribe – that are distinguished from other cultural resources in that they are included in or eligible for inclusion in the National Register of Historic Places (National Register). Section 106 of the National Historic Preservation Act (NHPA) requires the Federal Energy Regulatory Commission (FERC) to take into account the effects of licensing a hydropower project on any historic properties in the Project’s Area of Potential Effect (APE). Under Section 106, moreover, FERC must provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on the Project’s effects on historic properties. To help ensure compliance with Section 106, FERC requires License Applications to include a report discussing cultural resources in the proposed Project’s APE that may be affected by the proposed Project.

The Cultural Resources Study Plan proposes to identify, inventory, document, record, and evaluate cultural resources within the proposed APE. “Cultural resources” is a more general term than historic properties and includes both tangible and intangible aspects of cultural systems. A cultural resource study plan typically investigates archaeological sites and objects from the past that may lie within the proposed study area. Material cultural resources such as stone tool artifacts are used to identify and evaluate sites. Non-material cultural resources such as traditional place names and ethnogeography are important for identifying sites and especially for evaluating site significance. Non-material evidence of past human activity is now unattainable in vast regions of Alaska, but, in the Project study area, Alaska Native entities still have strong contemporary and traditional ties to the land. As shown in Figure 13.1-1, Cook Inlet Region, Inc. (CIRI) has extensive landholdings in the vicinity of the impoundment and the Chulitna and Gold Creek corridors. Ahtna, Incorporated (Ahtna) holds land along the northern portion of the Denali corridor near Cantwell. In addition to these large contiguous parcels, the two Native corporations – created under the Alaska Native Claims Settlement Act (ANCSA) of 1971 – have also selected smaller parcels under that act’s Section 14(h)(1) addressing traditional village and cemetery sites. Much of the proposed Project area is located in the western portion of the traditional territory of the Ahtna Athabascans, which included the upper Susitna River drainage upstream from Talkeetna and the upper Nenana River. The study area also encompasses the periphery of the traditional territory of the Dena’ina Athabascans, including part of the Talkeetna Mountains and middle Susitna River (Kari and Fall 2003; de Laguna and McClellan 1981; Kari 2008). As addressed further in the discussion of ethnogeographic resources (Section 13.5.2.2), linguistic data from this area has been accumulating for over 30 years and will be incorporated into the Cultural Resources Study Plan.

The Paleontological Resources Study Plan (Section 13.6) outlines a framework for evaluating the potential effects of the Project on paleontological resources. The Alaska Historic Preservation Act (AHPA) requires the Alaska Department of Natural Resources (ADNR) to locate, identify, and preserve information on paleontological resources. The AHPA also authorizes ADNR, prior to the undertaking of public construction or improvements by a governmental agency of the State, to survey the affected area for such resources and investigate and record information pertaining to those resources found. In addition, the Bureau of Land Management (BLM) assesses potential impacts to paleontological resources for federal actions on public lands under the Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA). The framework outlined in the Paleontological Resources Study Plan meets these requirements, ensuring that paleontological resources that may be affected by the proposed Project are properly located, documented, and evaluated.

13.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

13.2.1. Cultural Resources

NHPA Section 106 requires FERC to take into account the effect that licensing a hydropower project may have on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. These historic properties can include archaeological sites and isolated finds (both precontact/prehistoric and post-contact/historic); properties of religious and cultural significance to an Indian tribe (as defined at 36 CFR § 800.16(m)), including traditional cultural properties (TCPs); and built environment resources (material resources of an architectural or engineering nature). Because FERC's licensing of a hydroelectric project is an undertaking that may have an effect on historic properties, and because it is not always possible to identify all project-related effects that may occur over the long term of a license, FERC typically enters into a programmatic agreement (PA) with the state historic preservation officer, which requires, in turn, license applicants to develop and implement a Historic Properties Management Plan (HPMP) to guide the consideration and management of effects on historic properties during the term of the license. The Alaska Historic Preservation Act (AHPA) requires similar considerations for historic properties on state land.

The construction and operation of the Project is expected to have both direct and indirect effects on cultural resources. Changes to the character or use of such resources may occur through ground disturbance associated with construction of the dam and associated linear facilities (e.g., roads and transmission lines); through inundation within the impoundment; and (over the license term) potentially through reservoir shoreline erosion and gradual development of recreational facilities and trails. In addition, downstream impacts to historic properties are possible due to Project-induced stream-flow variation. Changing patterns of subsistence and recreational land use brought about by the Project also have the potential to affect historic properties.

Determining whether construction and operation of the proposed Project will affect any historic properties requires: systematic inventory of cultural resources within the APE for the Project; National Register eligibility determinations on cultural resources that may be affected by the Project; and assessment of potential Project-related effects on all National Register-eligible cultural resources. The 2013 and 2014 cultural resource investigations will continue the inventory and evaluation process beyond that of 1978-1985 to include the revised geography of

the current Project's direct and indirect APEs. All inventoried cultural resources that may be affected by the proposed Project will be evaluated for National Register eligibility. Eligible historic properties will be analyzed for potential Project-related effects. These investigations will be conducted in consultation with the Alaska State Historic Preservation Officer (SHPO), ACHP, federal land management agencies, Alaska Native entities, local agencies, and landholders. Restricted consultation/distribution lists may be necessary to protect sensitive locational information on cultural resources.

13.2.2. Paleontological Resources

Under FLPMA and NEPA, federal actions that may impact or result in a loss of paleontological resources on federal public or split-estate lands are evaluated, and necessary mitigation is identified.

The construction and operation of the Project may have both direct and indirect effects on paleontological resources. Surface-disturbing activities could cause direct adverse impacts to paleontological resources through the damage or destruction of fossils or the disturbance of the stratigraphic context in which they are located. Indirect adverse impacts may be created from increased accessibility to fossils, potentially leading to looting or vandalism activities. (BLM IM 2009-011).

Paleontological resources are protected in Alaska under the AHPA. (AS 41.35.010-41.35.240). The AHPA states that it is the policy of the State to "preserve and protect the historic, prehistoric, and archaeological resources of Alaska from loss, desecration, and destruction so that the scientific, historic, and cultural heritage embodied in these resources may pass undiminished to future generations." (AS 41.35.010). To this end, the legislature has found and declared that "the historic, prehistoric, and archaeological resources of the state are properly the subject of concerted and coordinated efforts exercised on behalf of the general welfare of the public in order that these resources may be located, preserved, studied, exhibited, and evaluated." (*Id.*). Under the regulations implementing the AHPA, "historic, prehistoric and archaeological resources" are defined to include paleontological resources." (11 AAC 16.900(24)). AS 41.35.070 requires, among other things, that:

- ADNR locate, identify, and preserve information regarding historic and prehistoric archaeological sites, locations, and remains
- Prior to any public construction or public improvement by the State, a governmental agency of the State, or a private person under contract with or licensed by the State or governmental agency of the State, the Department may survey the affected area to determine if the area contains historic, prehistoric, or archaeological values
- Upon a determination that historic, prehistoric, or archaeological sites, locations, or remains will be adversely affected by public construction or improvement, the proposed undertaking may not be commenced until the Department has performed the necessary investigation, recording, and salvage of the site, location, or remains (with such work to be performed expeditiously so as not to unduly impair, impede, or delay the project)
- Upon the discovery of any prehistoric, historic, or archaeological sites, locations, remains, or objects during the undertaking of public construction or improvements, the Department must be notified and its concurrence requested so that the construction or

improvement may continue, the Department shall survey the area to determine whether there is data that should be preserved in the public interest, and, if so, the Department will collect and preserve the data

If any known or previously undiscovered paleontological resources are encountered during construction or operation, the SHPO and a qualified paleontologist will be contacted to determine appropriate actions.

Determining whether construction and operation of the proposed Project will affect any paleontological resources requires appropriate studies within the area affected by the Project.

13.3. Resource Management Goals and Objectives

Federal, state, and borough agencies, as well as Alaska Native entities, have formal laws, regulations, and/or policies that may be relevant to analysis of Project impacts on cultural resources and inform the development of a HPMP. Other laws, regulations, and/or policies are relevant to the analysis of Project impacts on paleontological resources.

Federal Laws include:

- Historic Sites Act of 1935 (16 U.S.C. § 1982)
- National Historic Preservation Act of 1966 (as amended in 2006) (16 U.S.C. § 470)
- National Environmental Policy Act of 1969 (42 U.S.C. §§ 4321-4347)
- Archaeological Data Preservation Act of 1974 (16 U.S.C. § 469)
- American Indian Religious Freedom Act of 1978 (42 U.S.C. § 1996)
- Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa – 470ll)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001 et seq.)
- Federal Lands Management Policy Act (43 U.S.C. §§ 1701 – 1784)
- Paleontological Resources Preservation Act (16 U.S.C. §§ 470aaa – 470aaa-11)

Federal Regulations include:

- 18 CFR Part 5: FERC Integrated License Application Process
- 18 CFR Part 380: Regulations Implementing the National Environmental Policy Act
- 36 CFR Part 60: National Register of Historic Places
- 36 CFR Part 79: Curation of Federally-Owned and Administered Archaeological Collections
- 36 CFR Part 800: Protection of Historic Properties
- 43 CFR Part 7: Protection of Archaeological Resources
- 43 CFR Part 10: Native American Graves Protection and Repatriation Act

Federal Executive Orders (E.O.) include:

- E.O. 11593: Protection and Enhancement of the Cultural Environment (1971)
- E.O. 13007: Indian Sacred Sites (1996)

Federal Agency Guidance includes:

- Bureau of Land Management IM 2009-011, Guidelines for Assessment and Mitigation of Potential Impacts to Paleontological Resources (2009)

State Laws include:

- AS 41.35: Alaska Historic Preservation Act

State Regulations include:

- 11 AAC 16.010 – 11 AAC 16.900: Alaska Historic Preservation Act

13.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

The Proposed Study Plan (PSP) for cultural and paleontological resources was developed using input from Technical Workgroup meetings with agencies and licensing participants, and was then posted to the AEA Susitna-Watana website for comment by all parties. Four Technical Workgroup meetings were held during the months leading up to November 14, 2012 (August 8, September 7, September 24, and October 17), and several dozen telephone calls and emails were exchanged with interested parties including in particular BLM, SHPO, and Matanuska-Susitna Borough. Topics included elements of the PSP as well as matters pertaining to the 2012 investigations and arrangements for site visits. Summary tables of comments and responses from formal comment letters filed with FERC through November 14, 2012 are provided in Appendix 1. Copies of the formal FERC-filed comment letters are included in Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from PSP filing (July 16, 2012) through release of Interim Draft Revised Study Plans, is provided in Appendix 3. Copies of meeting summaries from release of the PSP through the interim draft RSP are included in Appendix 4, organized chronologically.

13.5. Cultural Resources Study

13.5.1. General Description of the Proposed Study

The study area proposed herein consists of both a direct and indirect APE. The direct APE includes areas of anticipated direct effects, particularly areas subject to ground disturbance from Project construction. The direct APE encompasses the reservoir impoundment area, construction camp, and three potential access/transmission corridors (Figure 13.5-1). The impoundment area as defined here consists of the proposed normal 23,546-acre maximum reservoir surface area plus an additional 25 vertical feet above that elevation equating to the 2,075 foot elevation upstream from the proposed Watana Dam. The three proposed access/transmission corridors differ in length. The *Chulitna Corridor* is approximately 42.7 miles long; the *Denali Corridor* is approximately 41.4 miles long; and the *Gold Creek Corridor* is approximately 49.2 miles long.

The indirect APE consists of those areas outside of the direct APE that may experience Project-induced human activity, particularly dispersed recreation. These include: the Upper Susitna River corridor from the upper extent of the inundation zone to the Denali Highway Bridge, Fog Lakes, areas around the inundation zone within local drainages that flow into the reservoir, existing trails and camps, and Bureau of Indian Affairs (BIA) ANSCA 14(h)(1) sites (in addition to those within the direct APE). In consultation with interested parties during summer and fall 2012, the direct and indirect APEs were refined based on: a recalculation of the impoundment area using the 2,075-foot elevation (25 feet above proposed normal maximum pool level to account for potential shoreline changes caused by the reservoir filling and operation), reconsideration of watersheds and topographic features as natural boundaries to new human travel beyond the direct APE, preliminary results of the 2012 archeological field reconnaissance and consequent modeling of likely areas for cultural resources, and identification of known trails where uses may increase as an indirect result of the Project. The APE as updated for this revised study plan combines the current definitions of the direct and indirect APE to design the sampling strategies and priorities for the 2013-2014 field studies. As explained in Section 13.5.3 below, the APE may be further adapted based on results from AEA's ongoing environmental and engineering studies.

A total of 104 known cultural resource sites (90 prehistoric, eight Euroamerican historic, and six Alaska Native historic) are currently identified within the direct APE (Figure 13.5-2 (Hays et al. 2012)). The proposed corridors and camp facilities have a combined total of 40 previously-documented sites (all precontact/prehistoric except for two historic). The 2,075-foot impoundment area has a total of 64 known cultural resource sites (62 prehistoric and two historic). Additional sites likely exist within unsurveyed portions of the APE. Known sites will be relocated in 2013 and 2014 and coordinates will be recorded with a survey-grade, hand-held GPS unit. Other standard site data will be recorded and previously described site conditions will be verified.

Phase I (Inventory) surveys will be conducted in areas of the direct and indirect APEs not previously surveyed or in areas within the APE that the 2012 locational model identifies as high potential for containing cultural resources. A combination of low and slow aerial reconnaissance from a helicopter and systematic pedestrian transect survey will be employed during Phase I surveys. Phase II (Evaluation) studies will be conducted for sites within the direct APE only, based on the conclusions of the Phase I surveys, to assess eligibility and analyze effects to

eligible historic properties that may be adversely affected by the Project. Both Identification and Evaluation Phase surveys will follow established professional guidelines, including the Alaska Office of History and Archaeology *Historic Preservation Series No. 11* (OHA 2003).

As noted above, the direct APE may include TCPs. As described in National Register Bulletin #38, a TCP is a property, i.e., a place, that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. Determining whether a property qualifies as a TCP requires systematic review and evaluation similar to that devoted to archaeological properties, with additional considerations.

The ethnogeographic portion of the study includes consultation with Ahtna and Dena'ina elders to integrate Alaska Native perspectives on historical land use and cultural values into the cultural resource investigation. Through a partnership with Ahtna, Inc., the regional corporation for the Ahtna people, the ethnogeographic component of the Cultural Resources Study will document Ahtna perspectives and ethnographic context for significance of the cultural resources sites potentially affected by the Project. Included will be traditional Ahtna land use and settlement patterns, seasonal migrations, religious and sacred sites, and traditional foot trail systems. Ahtna language place name records on file (Kari 2008; Kari 2012) will be consulted, and linguistic analysis of Ahtna place names, including archival taped sources and confirmation interviews with Ahtna Elders, will provide insight into the geographic information (notably hydrology) encoded in the Ahtna terms and narratives for important places. For the Dena'ina communities of Chickaloon and Knik, AEA will build on existing Upper Cook Inlet Dena'ina places names work (Kari and Fall 2003, supplemented by additional interviews with knowledgeable Dena'ina elders. In consultation with Doyon, Limited and other tribal officials, similar interviews may be used to record historic use in the Project area by Doyon region residents, particularly those from Nenana.

Study Goals and Objectives

The goals of the 2013-2014 Cultural Resources Study plan are to systematically inventory cultural resources within the APE (36CFR 800.4(b)), evaluate the National Register eligibility of inventoried cultural resources within the APE that may be affected by the Project (36 CFR § 800.4(c)), and assess Project-related effects on National Register-eligible historic properties within the APE (36 CFR § 800.5).

Specific objectives are to:

- Consult with the SHPO, BLM, and Alaska Native entities during implementation of the 2013-2014 cultural resources survey
- Inventory cultural resources within the APE
- Evaluate National Register eligibility of cultural resources within the APE that may be affected by the Project
- Determine the potential Project-related effects on National Register-eligible historic properties within the APE
- Develop information needed to prepare a HPMP for the Project

The TCP study will be informed through the ethnogeographic study, which has as its goals the identification, inventory, and evaluation of landscape features and resources within the APE that have been and continue to be important to the Ahtna people. The objective is to use ethnographic

landscape and place name data to help identify TCPs according to procedures set forth under 36 CFR Part 800, and determine their significance according to National Register criteria (36 CFR § 60.4). Traditional land use patterns of the study area by the Ahtna were based on a migratory cycle that followed fish, game, and plant harvesting opportunities. A complex system of travel and trapping cabins, trails, fish camps, trade routes, portage areas, trap lines, hunting ranges, seasonal camps, and winter villages has been in use for many generations. Some of these use patterns continue today, incorporating modern subsistence harvest technologies and transportation while maintaining traditional use areas by family and clan. Subsistence activity and land use have also been affected in recent times by subsistence regulation, aboriginal land title changes (ANCSA and the Alaska National Interest Lands Conservation Act [ANILCA]), schooling, child protection, and medical care laws and regulations. The ethnogeographic study addresses the following topics, with emphasis on Ahtna tribal practices, supplemented by information on Dena'ina and Lower Tanana tribal practices as appropriate:

- Land use patterns in the study area, including the seasonal migration patterns of the late 19th and early 20th centuries, and how they relate to the system of trails, trap lines, hunting and fishing sites, winter villages, and religious sites
- Types of wild resources exploited and traditional ecological knowledge about historic animal and fish populations in the area
- Traditional stewardship (i.e., traditional management practices)
- Contemporary values associated with the landscape
- Transcription and translation of language texts that pertain to the Project APE
- Hydrological concepts embedded in place names, directional system, and landscape narratives

13.5.2. Existing Information and Need for Additional Information

Cultural resource investigations conducted within the study area between 1978 and 1985 for prior project designs (referred to as “early 1980s-era”) documented almost 300 cultural properties believed to span the last 11, 000 years. Site types in the inventory include historic and precontact archaeological sites, historic buildings and ruins, and other cultural features. About one-third of the sites are in or near the location of the proposed Watana Dam and impoundment. Approximately 90 percent have stone tools and other prehistoric artifacts, about 10 percent are historic sites consisting of building ruins and/or scatters of commercially manufactured items (metal cans, bottles, etc.), and less than 1 percent are fossils of animals or plants. The more recent Native sites are from the Athabascan Indians who inhabited the area historically and hold the majority of the area’s Alaska Native place names in their linguistic dialect (Ahtna); the older sites fade into a more generalized adaptation shared by Alaska’s ancient interior peoples. Historic sites in the Project area reflect mining, prospecting, hunting, trapping, fishing, and recreational pursuits, as well as simply remote Alaska living.

13.5.2.1. Archaeological Resources

Between 1978 and 1985, archaeologists conducted cultural resources surveys, testing, and site excavations for the then-proposed Alaska Power Authority Susitna Hydroelectric Project and ancillary facilities (construction camps, transmission lines, and access roads). Although the project proposed in the 1980s had a different footprint than the currently proposed Project, there

is considerable overlap. For the 1980s project, annual and summary reports from the early 1980s-era described over 270 sites that required some form of analysis and curation of associated artifacts (e.g., Dixon 1985; Dixon et al. 1985; Greiser et al. 1985, 1986). Another 22 previously known sites were revisited and documented. Of the sites found, 111 were discovered through subsurface testing (amounting to approximately 28,000 shovel tests). Of those known sites, 87 percent have prehistoric/ precontact remains, two percent have postcontact/protohistoric remains, 10 percent have historic and modern remains, and one site has paleontological remains. Advances in geoarchaeological techniques and modeling of the region's stratigraphy in the last 30 years, especially those focusing on volcanic ash or tephra deposits, prompts re-examination of the conclusions reached in the 1980s. Revisions are anticipated in the understanding of site locations and distributions through time and space and how they relate to historic Native land use, the Project area's cultural chronology from a regional perspective, and its place in the greater scheme of North American prehistory.

More than a quarter-century of modern archaeological research has been carried out in Alaska since the original Susitna project work, aided by new methods and technology including GPS and GIS, geoarchaeology, geochronology, stratigraphic analysis, lithic and faunal analysis, and ice-patch research. Research in south-central and Interior Alaska river drainages has demonstrated that the prehistoric cultural chronology and dynamics are far more complex than was previously believed (i.e., Dixon 1985). Modern advances in radiometric dating techniques in particular require re-examination of the radiocarbon dates from the Project area. Accurate dating is essential to determine site significance, which can depend on cultural affiliation, archaeological tradition, and microstratigraphic layers that may represent multiple occupations and/or components spanning hundreds or thousands of years. Sites evaluated for National Register eligibility that have well-preserved organics or multiple components will be radiometrically dated to assist in the eligibility evaluation. Conditions that allow preservation of organic archaeological materials are relatively rare in the study area.

The cultural resources data gap report (Bowers et al. 2012) reviewed and summarized the cultural resource literature for the Project area prepared during the 1978 to 1985 environmental studies. Data gaps identified include inadequacies in the locational information for sites due largely to limitations in field and mapping methods. The cultural chronology within the APE warrants re-examination due to more modern dating techniques (e.g., accelerated mass spectrometry [AMS] radiocarbon [^{14}C], optically stimulated luminescence [OSL]) and newer geoarchaeology (in this case tephra) studies. Investigations of prehistoric land use patterns in Interior Alaska have progressed to the testing of more sophisticated locational models applicable to the Project's cultural resources field studies (VanderHoek 2011). Partial inventories of Alaska Native place names exist that were not available during the early 1980s-era studies, and they, too, can now be incorporated into locational models and field survey strategies.

13.5.2.2. *Ethnogeographic Resources*

The Project area includes lands important to CIRI and the Dena'ina tribal communities, Ahtna, Inc., and the Ahtna tribal communities, and potentially the Lower Tanana-speaking tribal community in Nenana. Based on linguistic data (Krauss et al. 2011) the Ahtna traditional use area included the Susitna-Watana Project impoundment and lands to the west (Figure 13.5-3) — further west than the Ahtna regional corporation boundary (Figure 13.1-1). Alaska Native regional corporation boundaries drawn by ANCSA in 1971 shifted the CIRI boundary east into

the area historically used by the Ahtna. Recognizing the interconnections of corporations and tribes, the ethnogeographic study will concentrate on the Ahtna traditional use area, supplemented by interviews with knowledgeable Dena'ina elders (particularly from Chickaloon and Knik), and as appropriate with Lower Tanana elders from Nenana. Overall, the cultural resource study is intended to broadly address the significance of past land use regardless of ethnicity or antiquity, and will document historic properties and TCPs that may be affected by the project whether resulting from prehistoric or contemporary practices of Ahtna or Dena'ina. As a practical matter, Ahtna tribal practices are less represented in the published scientific literature yet there remain Ahtna language speakers familiar with the study area, and thus the RSP addresses this imbalance while including both Dena'ina and Lower Tanana data sources.

The early 1980s-era studies in the Project area did not recognize TCPs because they did not exist as a formal concept within historic preservation law or regulation. Now, investigation addressing TCPs is required for compliance with Section 106 of the NHPA. There were little data collected about Alaska Native place names in the prior studies (e.g., Dixon et al. 1985; Greiser et al. 1985, 1986), and the information that was collected does not meet current professional standards and is not in modern geospatial format (see Bowers et al. 2012; Simeone et al. 2011). However, in the years since the early 1980s-era studies, Ahtna place names data have been collected by James Kari, William Simeone, and others (e.g., Kari 1983, 1999, 2008, 2010, 2011, 2012).

Ethnographic data – in the form of interviews, archival documents, and linguistic data (place names) – can help define the value or cultural significance of a site to the Ahtna, Dena'ina, and Lower Tanana peoples, which in turn will help determine whether TCPs exist in the Project area. The data will also contribute to the locational model for identifying potential archaeological sites. For example, ethnographic data documenting annual or seasonal activity (including the type of resource used, where harvested, method of harvest, and season of harvest) may help in detecting archaeological sites. Ethnographic data also better enable development of historical and cultural context for a site, which is necessary to determine its significance and possible eligibility to the National Register. Ethnographic data aides in the interpretation of sites and artifacts on a variety of levels, addressing such topics as: (1) how a site or artifact was used; (2) how a site fits into Alaska Native and non-Native history; (3) whether a site's content can be applied to the explanation of the area's cultural history; and (4) if a site has religious or other significance not apparent from its physical attributes.

The ethnogeographic study builds on previous research by principal investigators Dr. William Simeone and Dr. James Kari, and will be modeled after the approaches of Simeone and Kari (2002, 2004) and Simeone and Valentine (2007). As with both those studies, the ethnogeographic study for the Project will combine ethnographic, historical, and linguistic research to document traditional Ahtna land use patterns, stewardship practices, and Ahtna traditional knowledge for use by state and federal agencies in making management decisions. The approach to be taken in applying the Susitna data to TCPs parallels aspects of a similar effort addressing Ahtna TCPs sponsored by the BLM as part of the East Alaska Resource Management Plan (Kari and Tuttle 2005).

13.5.3. Study Area

The study area or APE for the Project is composed of an area of direct effect and an area of indirect effect—the geographic region in which the character or use of historic properties may be affected directly or indirectly by construction and operation of the Project. The APE for both

direct and indirect effects is identified using several types of information, including Project engineering (transportation corridors and potential visitor infrastructure), known or likely human use patterns, and topographic features that may act as boundaries to visitor travel beyond the project footprint. If licensing studies conducted in 2013 indicate that there may be Project-related effects to cultural resources in areas currently outside the APE, the APE may be further adapted to encompass these areas. Any recommended changes to the APE will be included in AEA's Initial Study Report, which will be prepared and distributed in February 2014. Currently, the total area within the study area is approximately 248,707 acres.

13.5.3.1. Area of Potential Direct Effect

Direct effects to cultural resources are those consequences directly attributable to construction and operation of the Project, including inundation. The APE for direct effects encompasses the Watana Reservoir, a buffer around the reservoir footprint up to the 2,075-foot contour, Watana Dam and Camp Facilities area, three potential access and transmission alignments (Chulitna, Denali, and Gold Creek corridors), and facilities associated with construction and operation of the Project. The proposed direct APE, developed in consultation with the SHPO, federal and municipal agencies, Alaska Native entities, and other interested parties, is depicted in Figure 13.5-1.

13.5.3.2. Area of Potential Indirect Effect

Indirect effects to cultural resources are those that occur beyond the direct effects from implementing the Project, such as looting of archaeological sites and damage from off-road vehicle use after the Project has been completed. The proposed indirect APE, developed in consultation with the SHPO, federal and municipal agencies, Alaska Native entities, and other interested parties, is depicted in Figure 13.5-1. As proposed, the Project would inundate the middle Susitna with water upriver of the dam site to the 2,050-foot contour. This would create an approximately 39-mile long lake which will be accessible to the general public. In addition, it is expected that overland use via existing trails by hunters, fisherman, trappers, and recreationists will likely increase as an indirect effect of the proposed Project since access and other developed facilities available for public use will likely be constructed in the immediate Project area. AEA plans to study possible indirect effects that may result from the construction and operation of the proposed Project. The indirect APE is comprised of:

- 1) Areas likely to be affected by induced dispersed recreational activity extending from existing trails, including all-terrain vehicle (ATV) trails and recent campsites observed during the 2012 field investigations
- 2) Areas near or related to known sites in the statewide Alaska Heritage Resources Survey (AHRS) inventory, BIA's ANCSA 14(h)(1) site inventory, and recent use-areas like airstrips, bridges, mines, and cabins that are adjacent to APE mapped trails and recreation use areas, based on the premise that these areas may also be locations where future increased human travel may occur
- 3) Areas adjacent to APE-mapped trails and recreation areas with known high cultural resource potential as determined by the site locational modeling and 2012 aerial and pedestrian reconnaissance, based on the premise that these areas may also be locations where future increased human travel may occur

13.5.4. Study Methods

13.5.4.1. Previous Survey Strategies, Methods, and Definitions

Cultural resource investigations conducted within the study area between 1978 and 1985 documented almost 300 cultural properties spanning the last 11,000 years. Site types in the inventory include historic and protohistoric archaeological sites, historic buildings and ruins, and other cultural features. Many of these sites are within, and would be inundated by, the proposed Watana Reservoir. Subsequent archaeological investigations following the initial surveys have located and recorded additional cultural resources and expanded knowledge of known sites (cf. Betts 1987; Blong 2011; Dilley 1988; Wygal 2009; VanderHoek et al. 2007).

The information collected in the late 1970s and early to mid-1980s—the “early 1980s-era” data—forms the bulk of the spatial data within the study area and resulted from two separate projects: the first by Dixon et al. (1980, 1985); and the second by Greiser et al. (1985, 1986). Methods used in the 1979 to 1984 fieldwork by Dixon et al. (Figure 13.5-4) included the delineation of “survey locales” by close examination of U.S. Geological Survey (USGS) topographic maps in combination with a survey strategy using additional environmental and artifact variables as analytical units. These variables were defined within a framework of research questions addressing the cultural historical sequence of this region. The survey locales were visited and the terrain within them that was judged higher in site potential was examined by pedestrian survey. In some places, shovel tests were placed in areas deemed of higher site potential. If sites were located either by observation of surface artifacts or by subsurface discovery, concentrated testing then took place. Areas considered of lesser site potential (determined by examination of maps and by on-the-ground judgments) were not surveyed or tested. Concentrated testing meant that the archaeologists set up a grid at a point of site discovery, and then dug shovel tests along transects at specified intervals outward from the discovery point (Figures 13.5-4, 13.5-5). Thus systematic grids of shovel tests (round holes approximately 12 inches [in] in diameter) and at least one square 16-in or 36-in test unit was excavated for each artifact discovery. Locations at which concentrated testing occurred were: variable within a survey locale, mainly within the impoundment, and occurred only at sites; major portions of survey locales were not subjected to concentrated testing and in some cases were not walked because terrain was deemed unsuitable.

Methods used in 1985 in the second of the two projects (Figure 13.5-4) included delineation of survey “units” by a random sampling method that was more explicitly predictive (Greiser et al. 1985). Two major variables, terrain and vegetation—each of which had numerous subgroups—were statistically assessed for associations with known sites across the project area; results were used to stratify areas into lesser or greater degrees of site potential. Then 160-acre survey units were randomly chosen from within a sample of the population of units defined by a grid of the project area. Pedestrian survey across the 160-acre units consisted of linear transects spaced at predetermined intervals that were walked regardless of topography. Though the method was systematic, few sites were located using this approach. Topographic features of higher site potential within the project area but outside a randomly selected survey unit were not surveyed.

Both of the methods described above have merit, and current survey strategies typically use aspects of both. Advanced GIS tools and the cumulative archaeological experience in field

survey methods over the last 30 years contribute to today's methods. GIS-based models provide a more effective means of spatially stratifying the Project area, enabling archaeologists to determine which areas appear to have lower or higher site potential; in 2013 and 2014 both types of areas will be tested to verify the assumptions on which models are based. The 1980s-era work used similar approaches but did not have the benefit of modern GIS or GPS technology.

The early 1980s-era datasets represent a significant amount of field effort and thought, and they are especially useful for refining expectations about site discovery, artifact preservation, and stratigraphic contexts. Site discovery is one of the more straightforward processes in cultural resource management. In contrast, evaluating a site and determining whether it is eligible for listing in the National Register is often not straightforward, and may require revisiting and reassessing other sites within the APE that may be affected by the Project. Because of major differences in how site locations were recorded and the resulting variations in accuracy (GPS versus a pencil point on a paper map), as well as changes during the nearly 30 years since site discovery, matching site data collected during early 1980s-era work and current field observations can be difficult. The cultural resource investigations for the Project will be accomplished using best practices for modern archaeology. The usefulness of the early 1980s-era data will depend in large part on how accurately the old sites can be matched to current field observations.

13.5.4.2. Locational Model and Survey Strategy

Archaeological survey strategy development typically begins with two things: 1) a review of relevant literature and previous archaeological work in the study area, often performed in an office, museum or archive setting; and 2) a close examination of the topography and other environmental variables, done using observations collected in the field and GIS techniques in the office. These information sources in concert help define expectations about cultural resources within the study area, which in turn helps determine survey strategies (Figure 13.5-5).

This is a holistic pursuit and requires consideration at a regional scale of factors such as climate or ecoregional variability, as well as scrutiny of specific details at the site and artifact level. Details such as elevations at which sites typically occur, or resources closely associated with sites, as evidenced by organic remains (bones, for example), may indicate why people chose to dwell at a particular location. The general goal of a survey strategy is to locate archaeological sites; thus, an understanding of why an area is more desirable than another is important. However, determining those factors that make a location more desirable are complex. Models help to explore this complexity.

Survey strategies today often employ models to assist in defining locations that may have a greater potential for site discovery. The treatment of these cultural resources is governed by federal and state law. Section 106 of the NHPA is the most commonly cited statute, but other directives are also in place to help guide management of cultural resources. The larger goal is to locate cultural resources and determine if they are eligible for inclusion on the National Register.

Survey types consist of either aerial or pedestrian transects. Given the remoteness of the study area, aerial surveys are conducted by helicopter at low airspeed and altitude across large expanses of land. Areas of high potential within these expanses are recorded by GPS and camera and are returned to later for ground survey and testing. Aerial surveys are also necessary in areas where geographic boundaries prohibit access by survey crews. Examples in the study area

include steep valleys and river crossings, high elevations, and barrier waterfalls. Ground surveys are conducted in areas having a high potential for cultural resources. Methods used to optimally cover large areas of land (e.g., 40 acres) typically involve a crew of 6 people in a row each spaced 10 to 15 meters (m) apart. The crew walks parallel transects over the land inspecting the ground surface, trees, understory vegetation, and microtopography. Testing can either occur during ground surveys or later during a testing phase. Any resources encountered are recorded in field books, on forms, in GPS units, and photographically.

Survey strategy development is part of most field archaeology, and spatial modeling using GIS techniques provides a flexible means for combining many spatially defined variables onto one surface. The surface illustrates the combined variables with quantitative measures, which can then be used to stratify or characterize a study area in a number of ways. Models are not snapshots of reality, but rather a process which explores one of a number of possible scenarios. Models are one of several techniques from a larger toolbox used to develop survey strategies. Specifically, that toolbox also includes examination of available satellite imagery, USGS maps, and information on known cultural resources, as well as professional archaeological fieldwork.

The 2012 model used to develop a survey strategy for the Project was based upon several digital datasets of varying spatial and chronological scales that are listed in Table 13.5-1. Datasets in many cases provide multiple variables for creating the model surface. For example, Digital Elevation Model data (elevation) are used to derive slope and aspect within the model area, and precipitation and temperature datasets provide monthly averages useful for creating variables of summer and winter extremes. The Source column in Table 13.5-1 lists agencies mainly responsible for collecting data and producing rasters or shapefiles. There is an increasing number of excellent websites specifically tailored for the distribution of downloadable data, such as the Statewide Digital Mapping Initiative (SDMI) based at University of Alaska Fairbanks, the USGS's Alaska Geospatial Data Clearinghouse, and the State of Alaska Department of Natural Resources' own Alaska State Geo-Spatial Data Clearinghouse. Table 13.5-2 lists the variables examined in the modeling process.

In general, the modeling process for a locational model (designed to assist archaeologists in site discovery) can be broken into 10 steps. These steps are described using vocabulary developed for GIS analysis:

STEP 1. Gather data (downloadable, in most cases) for creating layers of geospatial and other information; these will be independent variables (i.e., vegetation, elevation, wildlife presence, etc.), and dependent variables (i.e., known archaeological site types and locations).

STEP 2. Determine the spatial extent of the model area based on an APE (ideally encompassing as many representative ecosystems as possible) and create a *model polygon*. *Clip* all layers to this area, and *buffer* lines, points or polygons to desired sizes.

STEP 3. Polygons with variables having dichotomous information (presence/absence) should be reclassified as 1 for presence, 0 for absence; values will be numerical. Rasters with continuous variables need to be grouped using Layer Properties>Symbology with Manual grouping. *Merge* the vector datasets with the model area poly to get total coverage of the model area.

STEP 4. Rasterize all layers. Create two rasters of the model polygon (usually 30 m size grids), one with values of 0, and one with values of 1 across the whole grid (these are used later in the process). The idea is to standardize the grid structure for future calculations.

STEP 5. Extract all raster values of the dependent data points (sample of known sites, usually AHRS data) by using Spatial Analyst>Generalize>Extract Values to Points in ArcMap Toolbox. Generate a sample random point dataset of suitable size for statistical purposes and extract all raster values for that dataset as was done for the known dataset.

STEP 6. Copy the extracted values into Excel spreadsheets and code the data; categorize values to reduce numbers (i.e., group elevation values by 100 m intervals and identify with a code number). Place coded data into statistical software such as Statistical Package for the Social Sciences (SPSS) as data tables.

STEP 7. Run frequencies and cross tabulations. It is easiest to split types of sites (historic, prehistoric) into separate tables accompanied by a comparable number of random sites (i.e., prehistoric sites and similar number of random sites in a table, historic sites and random sites in another table, etc.) prior to calculating frequencies and cross tabulations. Examine results of variable association with the dependent data, and compare variable associations with results for random points (this is best done using Pearson chi-square tests).

STEP 8. Weight (reclassify) the rasters using the results of the statistical runs. Make sure “no data” is equal to zero and the area of the model is covered completely when reclassifying rasters (use 16 bit or higher signed raster types). For rasters which do not cover the whole model use *mosaic to new raster*, combining the variable raster with the model raster in Map Algebra>Raster Calculator (either multiply using the model raster with values of 1 or add using the model raster with values of 0). Generally, a reclassification requires recalculation.

STEP 9. Combine the rasters in Raster Calculator to produce a final model surface.

STEP 10. Examine the surface; use the results to assist in survey design or other analysis, in understanding the area in general, and to address research questions.

The purpose of a locational model of this type produced is to use a sample of known site distributions to inform archaeologists about site potential in nearby areas that have not been previously examined for cultural resources. The method is probability-based in that statistically significant relationships between variables form the basis for placing importance on those variables. The experience and judgment of archaeologists involved in the modeling process is an important component since decisions regarding how to spatially define the model area, which variables to include, and how to categorize and apply model results are the responsibility of the modeler. The Project model has been applied to the APE to stratify the modeled surface into higher and lower potential areas for sites. Survey will be focused on areas judged of higher potential for sites, though areas judged of lower potential also will be sampled.

This type of model is most effectively used for locating buried (subsurface) protohistoric or prehistoric cultural resources, because land use shifted after Euro-American contact in many areas of Alaska, and because historic era resources such as collapsed cabins, mining tailings, etc., are often more readily identifiable through aerial survey or historic records.

Problems with locational models are related to the resolution of datasets; fine-grained data are not always available for meaningfully characterizing an area. The Project model has a visualized resolution of 30 m, but some datasets such as temperature and precipitation are based on coarser grids (rasters). In addition, variables based on modern datasets may imperfectly characterize prehistoric environments, especially those with considerable time depth. However, the environmental parameters associated with the known archaeological sites (regardless of the actual chronological age of the site) are defined in modern terms, making locations across a region comparable. Difficulties most likely occur at sites associated with extinct resources (bison, for example), or at locations desirable for socio-cultural reasons such as spiritual ties or other reasons not associated with quantifiable variables. Ethnogeographic datasets can, however, be incorporated into models when they are available in coded form.

Complementing the model development are the results of the brief 2012 field season, which are also incorporated into the comprehensive 2013-2014 study plan. During three weeks of 2012 a crew of three evaluated how difficult it would be to relocate, map, and record existing cultural resource sites within the direct APE. Inconsistent site location coordinates in the AHRS database limited relocation of known sites to two or three per day. The 2012 effort indicates that coordinates for all AHRS sites in the direct APE must be updated, for which it is estimated six crews of six people will be necessary. To ensure the most consistent and reasoned application of the model, field crews will be briefed on the criteria for defining high and low potential areas as part of their initial project orientation.

13.5.4.3. Culturally Modified Trees

Culturally modified trees (CMTs) are quantifiable data that can only be detected from ground surveys, though ethnogeographic studies can help identify where CMTs might be found and interpret their meaning. In Alaska's interior, traditional Native tree modification typically takes the form of blazing, bark removal, and occasionally weaving or braiding of branches. Sometimes CMTs mark a trail, route direction, or fork, but more often tree bark was harvested for uses such as canoe manufacture, basketry, house construction, and cache pit lining. Typically the location, number of CMTs, modification type (e.g., scar, plank removal, bark removal, burn), dimensions, aspect, sketch, and a description of the CMT are recorded on a field form. Since 2001, in consultation with the SHPO, groves with 25 or more CMTs are recorded in the AHRS inventory.

13.5.4.4. Lake Coring

Lakes and ponds can contain a paleoenvironmental record spanning hundreds and thousands of years. Under stable conditions, their surfaces collect airborne sediments that then sink and ultimately settle on the basin floor. By sampling lacustrine (lake) bottom sediments it is possible to characterize past environmental conditions during the Holocene and very late Pleistocene. Lake sediments typically contain pollen spores, volcanic ash (tephra), wind-blown silt (known as aeolian silt, or loess), and sand. Insect exoskeletons, aquatic microorganisms, vegetation, and other botanical and faunal remains in various states of preservation contribute to basin sediments. Through time, the resulting lacustrine beds preserve a record of the area's sedimentation history and vegetation succession. Accurate information on the study area's paleoenvironment helps place the archaeological record in its proper context, and can contribute temporal depth to analyses of contemporary flora and fauna.

Two important factors bearing on lacustrine coring methods are time of year and water body depth. The best season to core lake beds is spring, when thick ice provides a stable work platform and allows the coring equipment to remain relatively parallel to the water column. Also, by mid-spring, the longer days provide safe and suitable working light. Without adequate ice, a floating platform must be constructed and anchored into place after break-up, creating numerous logistical problems. Water depth is the second most important factor when lake coring, with a water depth of 15'-20' being optimal. Deeper lakes require extensions on the coring device that increase the fieldwork effort, which is why shallow water bodies are preferred sample locations. Livingstone piston corers are the most common and least expensive devices used to core lakes and ponds.

Three to five lakes at varying elevations in the study area will be cored, preferably shallow water bodies near cultural resources. If bathymetric data is available it will be used to screen-out lakes and ponds unsuitable for coring; if not, then additional reconnaissance effort will be required to map lake bottoms.

Lake coring will be conducted in the spring of 2014, involving a crew of between three and five specialists flown to each of the lakes to be sampled in the study area. A fixed-wing aircraft on skis will be used to transport the crew and cores (due to weight restrictions and core sample lengths -- multiple cores measuring 1 m each -- a helicopter is not advisable). The fieldwork is estimated to take from three to five days. An ice auger will be used to cut a hole for inserting the piston core extensions. Samples of the lacustrine sediments will be taken in one meter increments depending on the sediment depth, with the ideal being a complete column from the uppermost lake sediments down to bedrock. Glacially-derived kettle lakes common in the study area provide favorable coring conditions. Analyses will be conducted by outside laboratories other than AEA. Analyses to be conducted include: 1) radiocarbon dating consisting of 25-30 samples; 2) Carbon-Nitrogen isotope ratio; 3) oxygen isotope ratio; 4) pollen identification; and 5) tephra geochemical characterization. The duration of laboratory preparation, analysis, synthesis, and results is expected to extend into 2015. An interim report of radiocarbon results and preliminary tephrochronology will be completed by 2014 and included in the Updated Study Report.

13.5.4.5. Survey Strategy and Phasing of Field Investigations in the Direct APE

The study methods to be implemented in 2013 and 2014 focus on cultural resource identification (inventory) and evaluation (OHA 2003). Described here are the accepted professional practices commonly applied in contemporary archaeological and broader cultural resource investigations. The known properties within the APE to be evaluated include precontact/prehistoric archaeological sites, including isolated finds, TCPs, historic sites, and any other buildings, structures, objects or districts of an architectural nature that may be eligible for listing on the National Register. Discrimination of TCPs requires historic and ethnohistoric interviews, translation, and field investigation. Surveys may also be needed in areas where access was denied to archaeological crews in 1978-1985; and subsurface testing may be required at high-potential areas that were identified but not tested during previous fieldwork.

An aerial survey will be conducted prior to full field crew deployment in 2013 and in 2014. Aerial survey in this case will be used to verify proposed survey segments (Figure 13.5-5), examine helicopter landing zones, examine the direct APE as defined in this document, and provide planning data for the 2013-2014 field seasons.

The field investigations will be executed in two phases. Phase I (identification) surveys in 2013 and 2014 will address the direct APE including the camp, corridors, and impoundment area (Figure 13.5-1). The Alaska OHA and SHPO have defined standards and guidelines for these surveys. The Identification Phase is defined as, “reconnaissance level surveys . . . in the planning stages of a project. They are used to determine if an intensive survey or testing is warranted, but alone cannot normally be used to satisfy complete compliance. These studies entail development of research designs, archival and background research, field survey, analysis, and reporting. All surveys should include pedestrian (walkover) examinations of the ground surface and might include subsurface testing” (OHA 2003).

Phase I survey in the direct APE will differ in coverage, intensity, and access in comparison to Phase I surveys in the indirect APE (see subsection 13.5.4.5 for indirect APE survey strategy). Survey in the direct APE will consist of pedestrian transects (described below), which record high potential areas; these areas are tested as conditions and logistics allow (e.g., helicopter access, daylight/weather, size of landform, etc.). The majority of effort in 2013 and 2014 will be devoted to the direct APE.

Two types of survey will be conducted on the direct APE: aerial (Type A) and pedestrian (Type B). Aerial surveys are conducted by helicopter at low airspeed and altitude across large expanses of land. Areas of high potential within these vast expanses are recorded by GPS and camera and returned to later for pedestrian survey and testing. Aerial surveys are also necessary in areas where geographic boundaries prohibit access by survey crews. Examples in the study area include steep valleys and river crossings, high elevations, and barrier waterfalls. Pedestrian surveys will be conducted in areas that have high potential for cultural resources, and particularly where there is high potential for deep aeolian sediments (especially during the 2013 field season). Methods used to optimally cover large areas of land (e.g., 40 acres) are to space a crew of six people 10 to 15 m apart in a line. The crew travels in a parallel line across the land inspecting the ground surface, trees, understory vegetation, and micro-topography for cultural resources.

Testing within a designated test area (regardless of whether or not it was identified by helicopter-based survey or pedestrian-based survey) consists of at least six, 50 x 50 centimeter (cm) test pits dug to a maximum of 1 m depth below ground surface. Tests are hand-excavated using a shovel and trowel and screened through 1/4 in or 1/8 in mesh. Tests are spaced five to 10 m apart based on the size of the landform. Tests are aligned in a systematically oriented, recorded, and replicable grid pattern. Grid size, number of tests, grid spacing, and grid orientation are all dictated by the size and shape of the landform being investigated. If cultural resources are encountered during Phase I they will be recorded as AHRS sites; restricted site information will be reported in the summary field report.

Phase II Evaluation surveys will be initiated on sites recommended in the Phase I assessment for further work in 2013 and 2014. If it is determined that a site will not be affected by the Project then no further survey will be recommended. Evaluations will require that one or more crews return to selected sites to collect data for evaluating National Register eligibility of sites potentially affected by the Project. Evaluation of known sites can require, but is not limited to: intensive survey; delineation; establishment and mapping of site boundary; scaled drawings; structural measurements; architectural assessment; dendrochronology; tephrochronology; radiocarbon dating; artifact analysis; and recommendations.

Sites within the impoundment up to the 2,075-foot elevation may be affected, especially the upper 100 feet (ft) where sites may be affected by shoreline erosion, scouring, sedimentation, and seasonal flow variations. OHA (2003) defines the Evaluation Phase as requiring; “evaluation of historic buildings and structures and/or investigation of adequate portions of archaeological sites to evaluate the significance of the property. These studies entail development of research designs, archival and background research, field studies, analysis, and reporting. When there are three or more buildings or structures, it should be determined if the resources constitute an historic district. Archaeological evaluation projects must include excavation as a major component of field sampling.” Sampling theory is composed of a number of contrasting or complimentary methods yielding results from a subset of a greater whole. The goal is to achieve an accurate result from the subset or sample that can be used to extrapolate the same result to the larger whole. “Adaptive sampling” allows modification of the sample design or strategy during the Evaluation Phase based on positive or negative results (Orton 2000:34).

The sample will be selected from all the sites recorded during the Identification Phase. This sample will be fully evaluated to determine eligibility during the Evaluation Phase. Until all sites have been identified, the sample size is unknown. The eligibility of a site to the NRHP may be based on four criteria: A) sites that are associated with events that have made a significant contribution to the broad patterns of our history; or B) sites that are associated with the lives of significant persons in our past; or C) sites that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D) sites that have yielded or may be likely to yield, information important in history or prehistory (NPS 2012). The sample will also be based on site-specific criteria (e.g., within the direct APE, multicomponent, contain human remains, has organic preservation, intact tephra deposits, etc.). Because the cultural resource investigation is being done within an anthropological framework, and because Anthropology relies on the comparative method, adequate sample sizes of sites and specimens are critical for making the comparisons that will lead to defensible interpretations of the archaeological record with the APEs.

Many sites in areas that may be affected by the Project, such as the proposed inundation zone, will need Phase II surveys. Some affected sites will meet more than one of the criteria listed above, thus reducing the sample size. The greatest amount of effort will be focused on the impoundment area. Phase II survey will be conducted, in the direct APE only, in 2013 and 2014.

Results of the inventory survey will be presented in a Phase I report with recommendations for Evaluation Phase II testing and analysis of affected sites. The Project team will immediately begin processing site evaluation data as they are gathered. Lab analysis and report writing will be conducted concurrently with execution of the field survey. The required Phase II evaluation report will be prepared in 2014 for submittal by AEA to SHPO, BLM, and FERC. The results of this survey will help inform preparation of the HPMP. As is common after the application has been obtained, the HPMP may reserve subsequent seasons for completing evaluations, as necessary, and for developing management measures for historic properties within the APE (see FERC 2002).

13.5.4.6. Survey Strategy and Phasing of Field Investigations in the Indirect APE

The study methods applied to the indirect APE will differ from those described above for the direct APE. The methods will follow accepted professional practices for cultural resource

investigations, but will differ in the amount of testing, aerial and ground survey intensity, and site recordation. The indirect APE defined above and shown on Figure 13.5-1 is the portion of the study area that may see increased human access and activity due to Project development.

Phase I survey in the indirect APE will be mainly conducted by aerial survey. Pedestrian survey will also be necessary in the indirect APE where the Project has been determined to have a potential effect on cultural resources. But the amount of ground survey in the indirect APE will be less than in the direct APE. This discrimination will require supplemental engineering and geotechnical Project data such as proposed locations of ancillary facilities. It is understood that once these types of ancillary facilities are clearly defined then they will be incorporated into the direct APE. Until such facilities are defined then they will be surveyed as part of the indirect APE. Other indirect areas include trails and navigable waters providing access to the direct APE. The indirect APE addresses the impacts of activity in proximity to the impoundment but outside the direct APE.

The two types of survey to be conducted in the indirect APE are termed aerial (Type A) and pedestrian (Type B) (described in more detail above in subsection 13.5.4.4). The majority of the indirect APE will need to be aerially surveyed by helicopter with one crew at low air speed and altitude. Pedestrian survey will be conducted in areas of the indirect APE that have a high potential for containing cultural resources. Pedestrian survey consists of one crew of six or more spread along a line 10 to 15 m apart. Type B surveys will likely constitute a small proportion of survey area compared with Type A survey areas.

Subsurface testing will be conducted in areas that have at least been pedestrian surveyed. Testing consists of digging 50 x 50 cm test pits to a depth of 1 m when possible. Testing will be systematic. Testing intensity will be defined by the high potential landform shape, size, and safe accessibility. Normally, at least six tests will be excavated in any given test area. A grid will be laid out and tests will be performed every five to 10 m. If cultural resources are encountered during testing they will be recorded as AHRS sites and restricted site information will be reported in the summary field report.

Phase II Evaluations will not be conducted in the indirect APE. If it is determined later that a site may be affected by changes in Project design, scope, and/or location, then those sites will be recommended for evaluation in field studies beyond the 2013-2014 seasons.

13.5.4.7. Mapping-Related Activities

- Map recently identified prehistoric resource locations. Sites will be relocated and mapped with a survey-grade Trimble GeoXT 6000 Series in North American Datum of 1983 (NAD83) with real-time accuracy of 50 cm (scheduled for completion in 2013-2014).
- Add to or adjust locational data on prehistoric settlement patterns and land use (scheduled for completion in 2013-2014).
- Add to or adjust locational data on historic settlement patterns and transportation routes (scheduled for completion in 2013-2014).
- Compile additional relevant environmental datasets from the 2012 field season for use in future locational model (scheduled throughout 2013-2014).

- Map TCPs within the APE, creating a geodatabase with TCP locations and place names. Locations will be depicted based on historical and cultural information. Depending on the nature of some resources, special restrictions may need to be placed on access to information (scheduled throughout 2013-2014).
- Prepare maps using the latest GIS files with Ahtna place names (Kari 2012) and expanding and annotating the current Ahtna/Dena'ina place name inventory into the geodatabase being developed for cultural resource sites (scheduled throughout 2013-2014).

13.5.4.8. *Ethnogeography-Related Activities*

- Hold a regional elders conference as a venue to inform communities of the upcoming research work, including information on other AEA sponsored research, such as fisheries and wildlife studies, subsistence studies, etc. The conference is planned to be held in the Ahtna region (since most Native contributors are from that region) with invitations to others, and scheduled so as not to interfere with the Alaska Federation of Natives (AFN) annual meeting. A conference in early March of 2013 will avoid traditional Ahtna and Dena'ina subsistence activity windows and the date will be scheduled concurrent with other community meetings or gatherings for maximum efficiency and courtesy.
- Identify, inventory, and compile archival data sources of the Ahtna language, with particular focus on the Jake Tansy recordings on land use and travel, some of which appear in Kari (2010). Recorded stories pertinent to the upper Susitna River from other Ahtna narrators, including Jim Tyone, Jack Tyone, John Shaginoff, Henry Peters, and Fred John will be evaluated, along with the few known Shem Pete recordings and narrative segments that pertain to the Talkeetna Mountains and the upper Susitna River (scheduled throughout 2013-2014).
- Identify and inventory additional data from collections of tapes and transcripts recorded in the English language by the BIA, the Institute for Social and Economic research (ISER), Ahtna, Inc., and other researchers, including Frederica de Laguna and Constance West (scheduled throughout 2013-2014).
- Identify knowledgeable Ahtna individuals to interview for current ethnographic information on potential TCPs in the study area (scheduled throughout 2013-2014).
- Collect interview data on contemporary land use and the cultural landscape (scheduled throughout 2013-2014).
- Develop interview protocol with the assistance of knowledgeable Ahtna individuals to guide effective interviewing (scheduled throughout 2013-2014).
- Interview 30 to 50 Ahtna persons of different ages (estimate two hours per interview (scheduled throughout 2013-2014).
- Document the results of interviews, and transcribe tapes (scheduled throughout 2013-2014).
- Develop data on three types of trails: BLM layer, field observation layer, and historic foot trail layer.

13.5.4.9. *Synthesis and Analysis Activities*

- Develop historic contexts. This task will be largely dependent on the outcome of 2012 planning studies, fieldwork, analysis, and agency consultation. This task will be implemented in 2013.
- Update cultural chronology. This task will be largely dependent on the outcome of 2012 planning studies and 2013-2014 fieldwork and analysis. For this reason, the work will be deferred until after field studies are complete. This will require collecting and analyzing samples at a number of sites for archaeometric analysis, radiocarbon dating, optically stimulated luminescence OSL dating, and tephrochronology (see Bowers et al. 2012).
- Develop archaeological locational model prior to fieldwork. Digital data will be examined statistically to assess strength of associations between known dependent variables (site locations) and independent variables, such as elevation and other environmental variables (15 to 20 or more variables can be assessed). The model output is a map of the study area with negative to positive values depicted in 30 m (98 ft) by 30 m (98 ft) units that grade from dark to light; areas with negative or lower values are least likely to hold sites, and areas with higher, positive values are most likely to hold sites. The information generated is useful for developing survey strategies across the APE and particularly unsurveyed areas, but it is also applicable to surveyed areas that appear to need further exploration.
- Transcribe and translate place name terms and narratives, with initial translation performed by Dr. Kari (scheduled throughout 2013-2014).
- Proofread and correct initial and secondary translations by language specialists or Ahtna elders (scheduled throughout 2013-2014).
- Synthesize data sets to prepare an Interim Study Report by early February 2014 and a final comprehensive report to be submitted as the Updated Study Report by early February 2015. Combine the archaeological results; locational model; historic and contemporary land use patterns; Ahtna perspectives on the land and resources; Ahtna-language place names; and narratives about important locations. Identify additional studies and reports if needed (scheduled for 2014).

13.5.4.10. *Inadvertent Discoveries*

Protocols for the inadvertent discovery of human remains, graves, and/or burial items are described in the attached Plan for Unanticipated Discoveries of Cultural Resources and Human Remains (see Attachment 13-1). This document outlines the methods for confirming field discoveries, requirements for communicating discovery information, and contacts for state officials, federal agents, and affected Alaska Native entities.

13.5.4.11. *Archaeological Internship and Additional Workforce*

AEA's cultural resources study will include an internship program to provide an opportunity for Alaska Native entities to participate in the fieldwork and work alongside registered professional

archaeologists for the 2013 and 2014 seasons. Duties, desired experience, and preferred educational background are outlined below.

Primary Responsibilities:

- Assisting in conducting Phase I reconnaissance survey
- Assisting in conducting Phase II site evaluations
- Using standard archaeological field techniques, these include:
 - Walking transects (up to 5 miles per day, possibly more) and working 6-12 hours per day in the boreal forest
 - Taking notes and photographs
 - Digging shovel and trowel test pits
 - Screening sediments
 - Carrying a pack and equipment (weighing up to 35 pounds)

Knowledge and Skill Requirements:

- Course work in history, social sciences, and earth sciences
- Experience/training in specialized areas is preferred (e.g., anthropology, geology, ecology)

AEA also plans to invite Matanuska-Susitna Borough archaeologists, when available, to work with the archaeological crews in the field.

13.5.5. Consistency with Generally Accepted Scientific Practice

The research methods discussed in this proposed Cultural Resources Study (Section 13.5) are consistent with professional practices and FERC's study requirements under the Integrated Licensing Process (ILP). Inventory, evaluation, and determination of effect are well-established steps under NHPA Section 106 and the ACHP's implementing regulations at 36 CFR Part 800. Additionally, the quality of work and qualifications of workers will adhere to the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716).

This Cultural Resources Study will be undertaken in accordance with the implementing regulations of NHPA Section 106, FERC's ILP regulations, the Secretary of the Interior's (Secretary) Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716), the Secretary's Professional Qualification Standards (48 FR 22716), and the ACHP's general guidelines for identification and testing procedures as set forth in *Treatment of Archeological Properties, A Handbook*. Unless otherwise specified, field notes, samples, artifacts, and other collected data will be curated with the University of Alaska Museum in Fairbanks in accordance with the requirements set forth in 36 CFR Part 79. Site information, other than the site's AHRS number and National Register eligibility, will be maintained as confidential as provided for under NHPA Section 304, as amended (16 U.S.C. § 470w-3).

In addition, all field crew members will receive approximately two hours of classroom/laboratory instruction on tephra identification and its importance, as well as approximately two hours of classroom/laboratory instruction on soil stratigraphy, as part of the routine pre-field training for archaeological survey crews.

Because FERC's standard practice in hydropower licensing processes is to enter into a (PA) with the SHPO, AEA expects FERC to circulate a draft PA following the completion of the cultural resources study, and likely shortly after its issuance of the draft environmental impact statement.

13.5.6. Schedule

In 2012, a crew of three archaeologists worked within the direct APE to derive estimates for the time and effort needed to relocate, map, and record known cultural resource sites. Two to three known sites were relocated per day, so it is estimated that six six-person crews will be necessary to adequately inventory all known sites in the direct APE. The 2012 field survey determined that the known site coordinates are inaccurate and will need to be updated in the AHRS database as a result of the cultural resource inventory. Results of the 2012 field season have been incorporated into the 2013-14 Revised Study Plan.

Fieldwork performed in 2013-2014 (Table 13.5-3) will include the following components:

- **Site Surveys (Inventory Phase).** Applying the GIS-based locational model developed early in the study, the 2013-2014 field efforts will begin within the impoundment area. Survey will take place in the proposed Gold Creek, Chulitna, and Denali Corridors. To the extent possible, the study will make use of the 1978-1985 Phase I survey data (e.g., Bowers et al. 2012; Dixon et al. 1985; Greiser et al. 1985, 1986).
- **Site Testing (Evaluation Phase).** The 2013-2014 field efforts will initiate systematic site testing, with the goal of developing recommendations of eligibility to the National Register for a sample of sites within the direct APE. This will primarily include the Watana impoundment zone, and to a lesser extent the proposed Gold Creek, Chulitna, and Denali Corridors.

Study products to be delivered in 2013-2015 will include:

- **Interim Reporting.** The progress of the cultural resource investigations will be presented to the Technical Workgroup on a quarterly basis during 2013 and 2014.
- **ArcGIS Spatial Products.** Shapefiles of the 1980s and current cultural resources data will be compiled into a geodatabase for the study area. All map and spatial data products will be delivered in the two-dimensional Alaska Albers Conical Equal Area projection, and NAD 83 horizontal datum consistent with ADNR standards. Naming conventions of files and data fields; spatial resolution; and metadata descriptions must meet the ADNR standards established for the Project.
- **Final Reports.** Reports completed at the beginning of 2014 and 2015 will summarize the results of each field season and will be submitted to resource agency personnel and other licensing participants along with spatial data products. This will include recommendations for additional study in subsequent field seasons and will cover Identification and Evaluation Phases of the Project studies. Reports will follow FERC and SHPO protocols (36 CFR Part 800); will follow professionally-accepted standards; and will include site descriptions, site evaluations (Recommendations of Eligibility), and Determinations of Effect. The reports will be filed with FERC to fulfill the study report requirements of 18 CFR section 5.15(c) and (f) of the ILP regulations.

During the licensing process AEA, in consultation with the SHPO and BLM, will develop an HPMP specifying procedures for the continued identification, evaluation, and protection of historic properties.

13.5.7. Relationship with Other Studies

The cultural resource study's interdependency with other studies is depicted in Figure 13.5-6. Both the Ethnogeography/TCP effort and the archaeological inventory expect to be informed by information resulting from other studies – to be in hand by Q4 2013. A set of three questions has been included in the Traditional Knowledge surveys as part of the Subsistence Study (Section 14), specifically to illicit comments about potential TCPs. The questions are general, derived from the legal definition of a TCP, and designed to draw-out details from the narrator. In turn, the ethnogeography investigation is expected to have developed oral history accounts about caribou migrations and possibly other natural resource patterns by Q2 2014, which is information of value to the Subsistence study group (Figure 13.5-6).

Three study groups will yield information of use to the archaeological inventory, within the cultural resource study. The Recreational Resources study will contribute information on trails and predicted recreation localities within the study area, the Geology and Soils study will contribute information bearing on erosion and mass-wasting processes, and the Geomorphology study will provide information on the age of landforms. The cultural resource investigations will produce data sets on site nature and location, so reports are expected to be of limited distribution and largely not shared with other study groups (Figure 13.5-6).

13.5.8. Level of Effort and Cost

The work described above will take place during the 2013 and 2014 field seasons, with initiation of evaluations of National Register eligibility in 2013-2014. Costs proposed here are in addition to the 2012 reconnaissance effort. For the combined 2013 and 2014 effort, the costs of cultural resource investigations (including field studies, data collection and mapping, analysis, and reporting) have been estimated to cost \$7.2-\$8.2 million.

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13.5.10. Tables

Table 13.5-1. Datasets used in Project Model 1

Dataset	Source	Access
Archaeological site type and location	Alaska Heritage Resources Survey (AHRS)- Alaska Office of History and Archaeology	Permit
Revised Statute 2477 Historic Trails	Alaska Dept. of Natural Resources	Public
Digital elevation models (DEM)	United States Geological Survey	Public
Surface geology, lode deposits, sediment basins	United States Geological Survey, Alaska Dept. of Natural Resources	Public
Ecoregion	United States Geological Survey	Public
Hydrography	United States Geological Survey, Alaska Dept. of Natural Resources	Public
Vegetation	U of California, Berkeley, Ducks Unlimited	Public
Wetlands	United States Fish and Wildlife Service	Public
Wildlife (fowl, fish, mammals)	Alaska Department of Fish and Game & Alaska Department of Natural Resources	Public
Permafrost	National Snow and Ice Data Center	Public
Temperature and Precipitation	National Snow and Ice Data Center	Public

Table 13.5-2. Classified variables examined in Project locational modeling.

Variables	Classes
Site type	classes 1 through 4 (Random, Prehistoric, Native Historic, Euro-American Historic)
DEM	classes 1 through 23 (100-meter increments)
Slope	classes 1 through 9 (5-degree increments)
Aspect	classes 1 through 9 (45-degree increments)
Surficial geology	16 classes (dataset codes)
Possible tool-stone location	presence/absence (1, 0)
Coal deposits	presence/absence (1, 0)
Metalliferous-lode deposits	presence/absence (1, 0)
Vegetation	classes 0 through 23 (dataset codes)
Distance to lake	classes 1 through 4 (within 100, 500, 1000 meters, & > 1000 meters)
Distance to stream	classes 1 through 4 (within 100, 500, 1000 meters, & > 1000 meters)
Distance to anadromous waters	classes 1 through 4 (within 100, 500, 1000 meters, & > 1000 meters)
Caribou ranges	presence/absence (1, 0 - summer, winter, calving, migration routes)
Moose ranges	presence/absence (1, 0 - summer, winter, calving, rutting)
Dall's sheep ranges	presence/absence (1, 0 - summer, winter)
Dall's sheep licks	presence/absence (1, 0)
Duck & geese ranges	presence/absence (1, 0 - nesting, molting, summer, winter, migration routes)
Swan ranges	presence/absence (1, 0 - nesting, molting, summer, winter, migration routes)
Seabird colonies	presence/absence (1, 0)
Eagle/raptor concentrations	presence/absence (1, 0)
Precipitation	classes 1 through 6, January (20 millimeter increments) & July (30 millimeter increments)
Temperature	classes 1 through 5, January (3-degree C increments) & July (1 degree C increments)
Permafrost	classes 1 through 8 (dataset codes)

Table 13.5-3. Schedule for implementation of the cultural resource study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Reconnaissance level field study			—										
Modeling and sample design development from 2012 field reconnaissance				—	—								
Pre-field preparation (logistics, equipment, maps, safety, training and aerial reconnaissance of direct and indirect APES)					—								
Archeological Field studies – Inventory (priority on the impoundment, followed by corridors)						—							
Archeological Field studies – Initiation of Evaluation (priority on the impoundment, followed by corridors)							—						
Ethnogeographic Study, planning, coordination with tribes, Elders conference					—								
Ethnogeographic Fieldwork						—	—						
Draft Ethnogeographic study report, circulated for community review, Elders conference								—					
Initial Study Report								—	▲				
Additional modeling from 2013 field study results, integrate results from ethnogeographic study, develop sample design for 2014								—	—				
Lake coring										—			
Pre-field preparation (logistics, equipment, maps, safety training)									—				
Field studies –Inventory (corridors and trails)										—	—		
Field studies – Evaluation (all project components)											—	—	
Updated Study Report												—	▲

Legend:

- Planned Activity
- ▲ Initial Study Report (February 2014)
- ▲ Updated Study Report (February 2015)

13.5.11. Figures

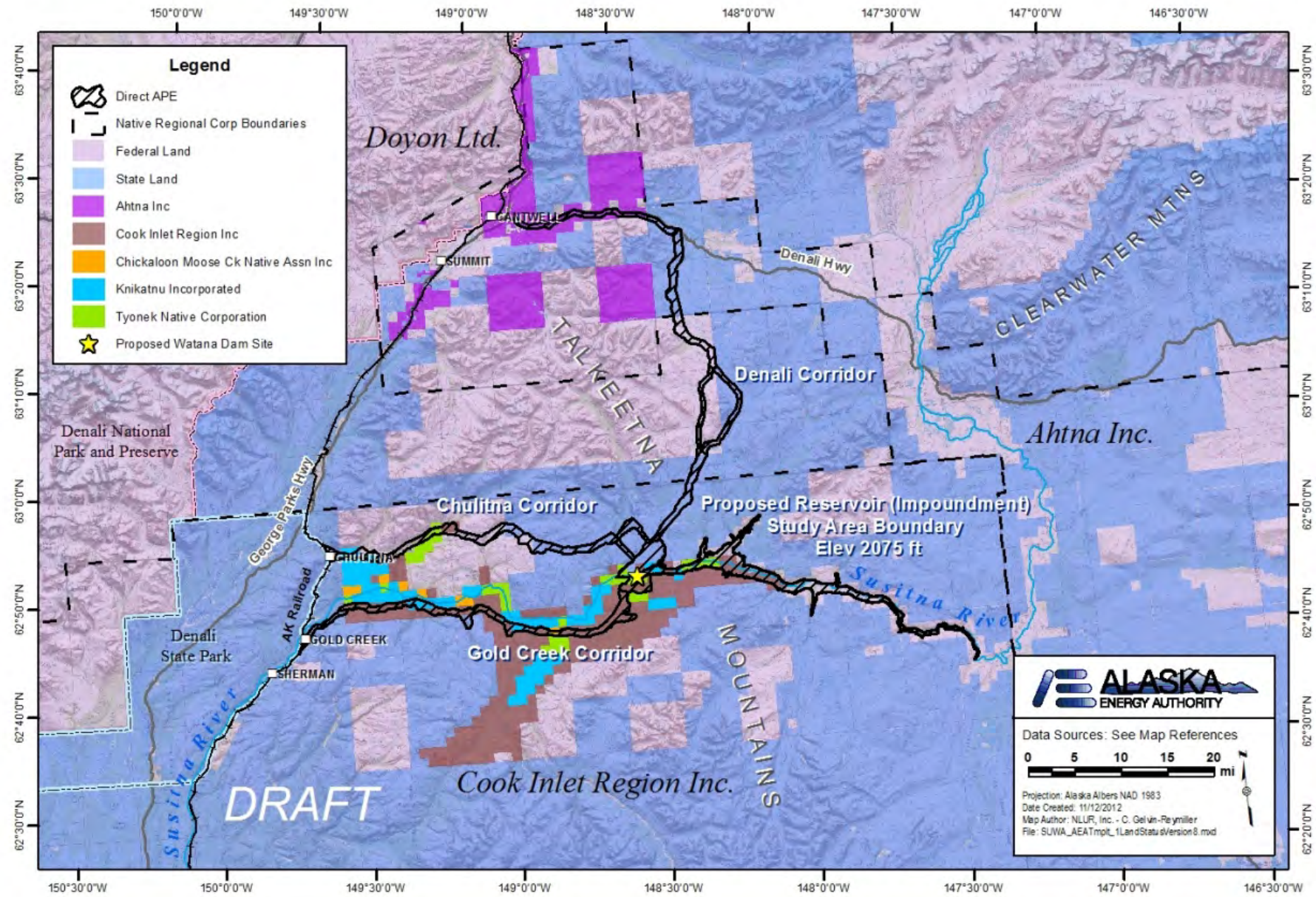


Figure 13.1-1. Property ownership in the vicinity of the study area.

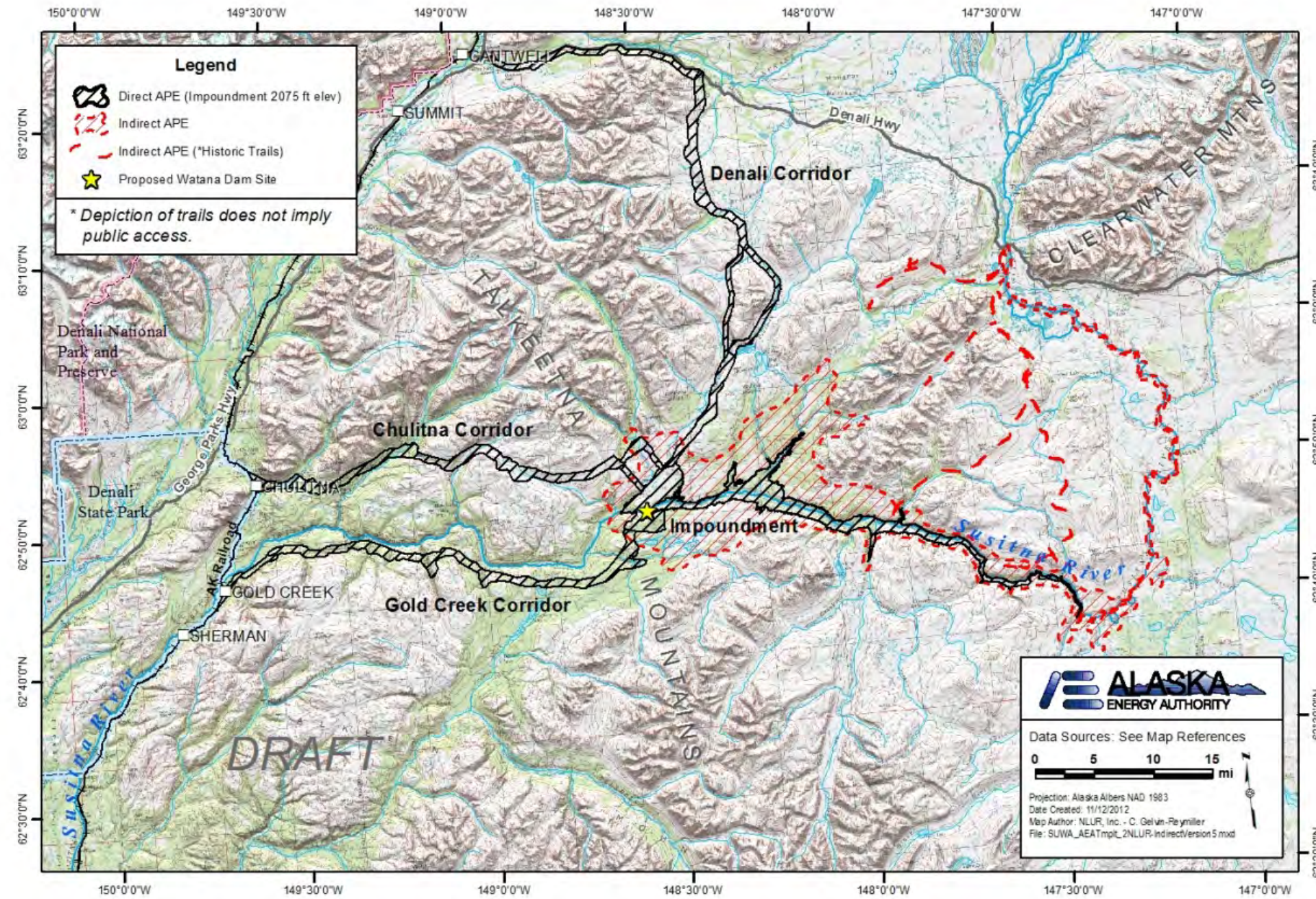


Figure 13.5-1. Direct and indirect APEs for the cultural resource study.

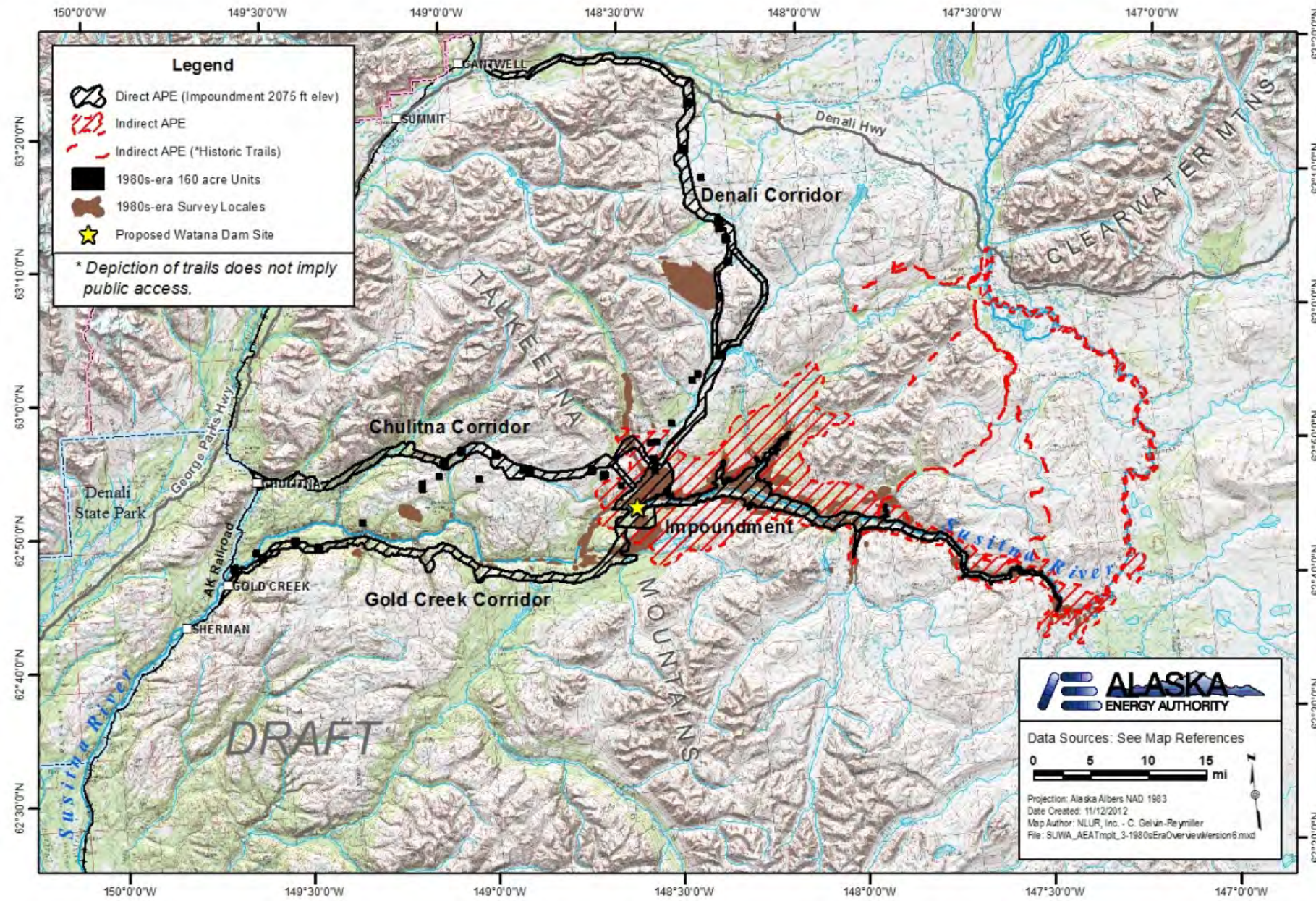


Figure 13.5-2. Survey coverage accomplished in the late 1970s and early 1980s.

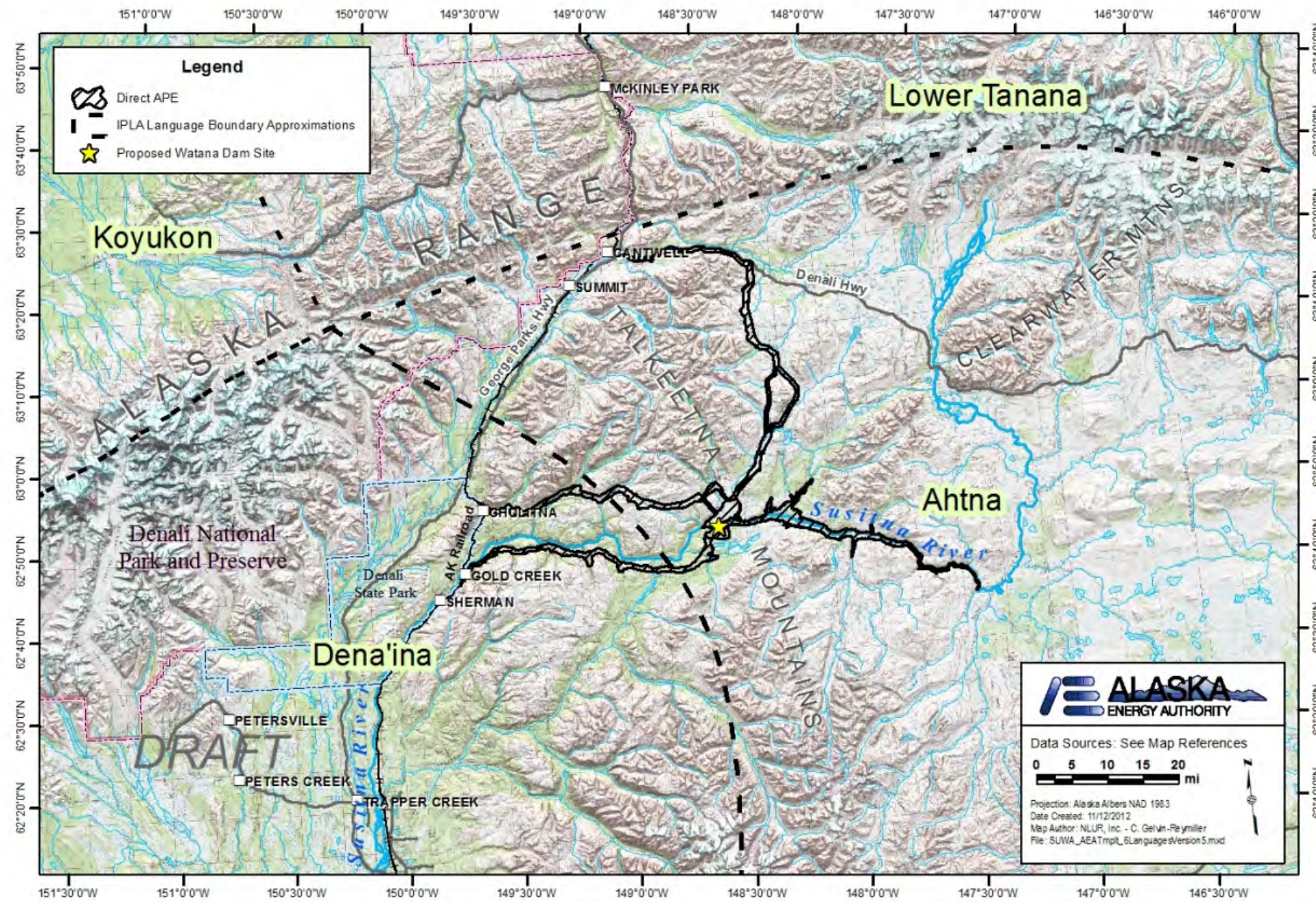


Figure 13.5-3. Traditional Native language areas in the vicinity of the study area.

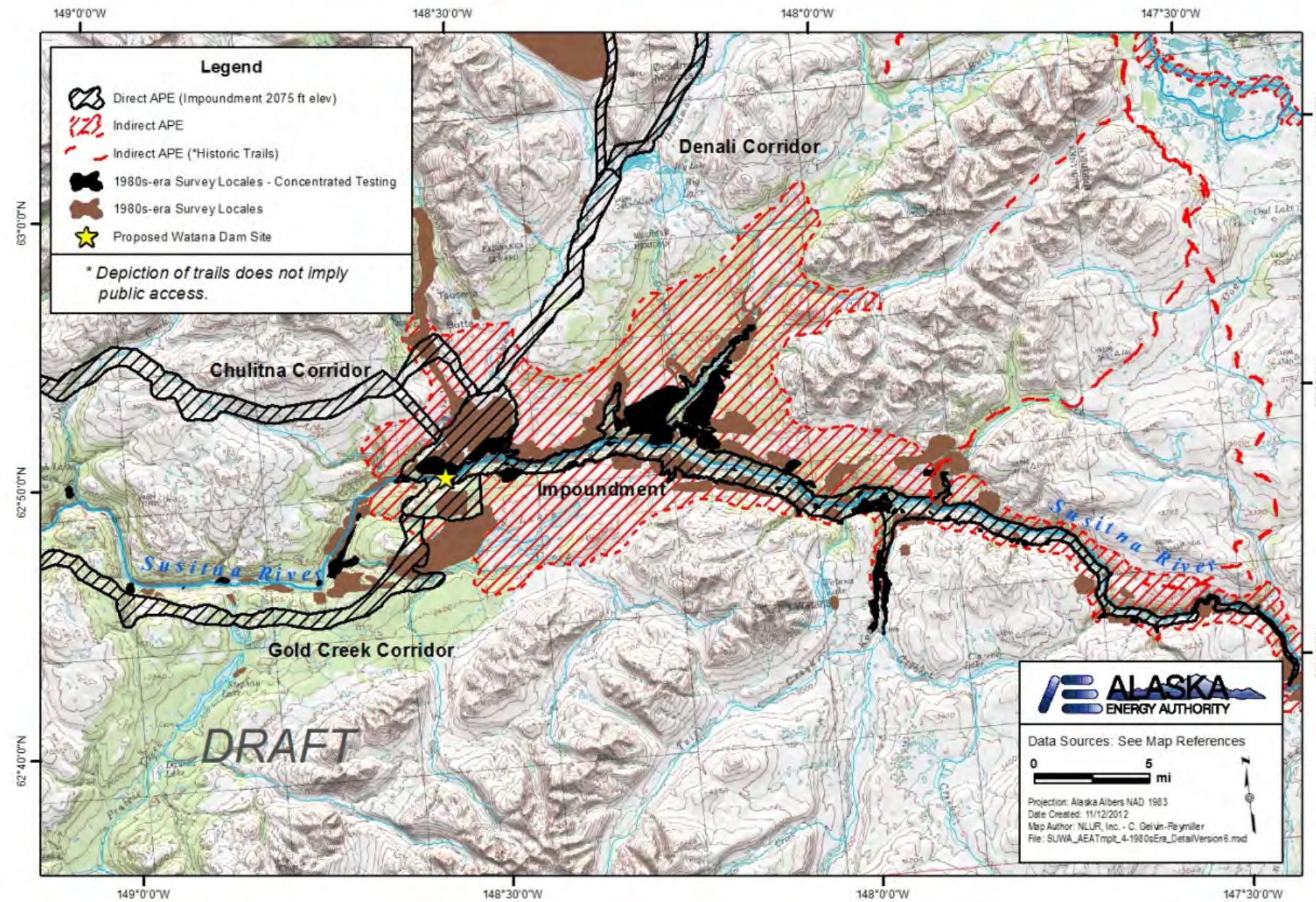


Figure 13.5-4. Detail of testing accomplished in the late 1970s and early 1980s.

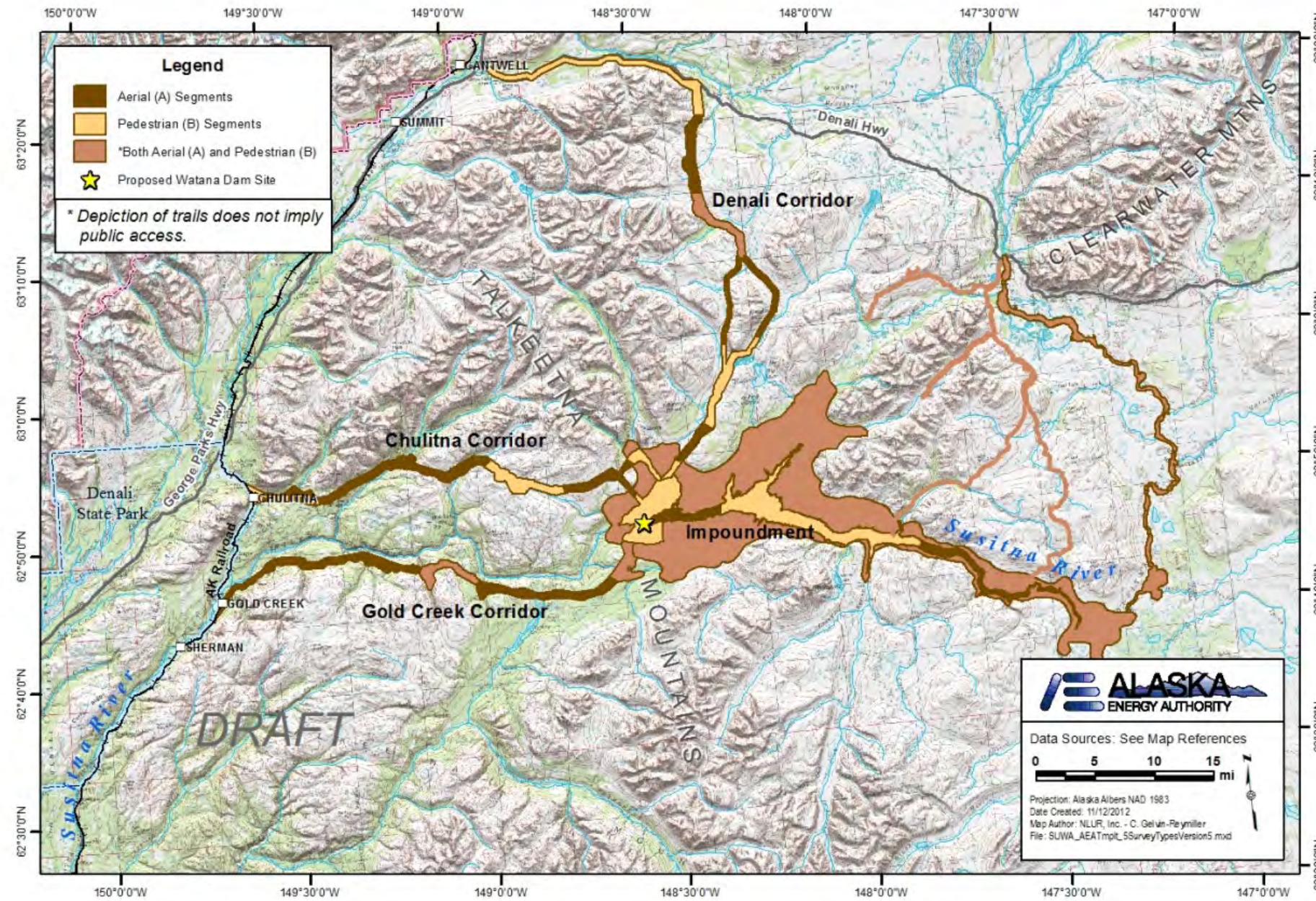


Figure 13.5-5. Proposed survey methods in the direct and indirect APEs.

STUDY INTERDEPENDENCIES FOR CULTURAL RESOURCES STUDY

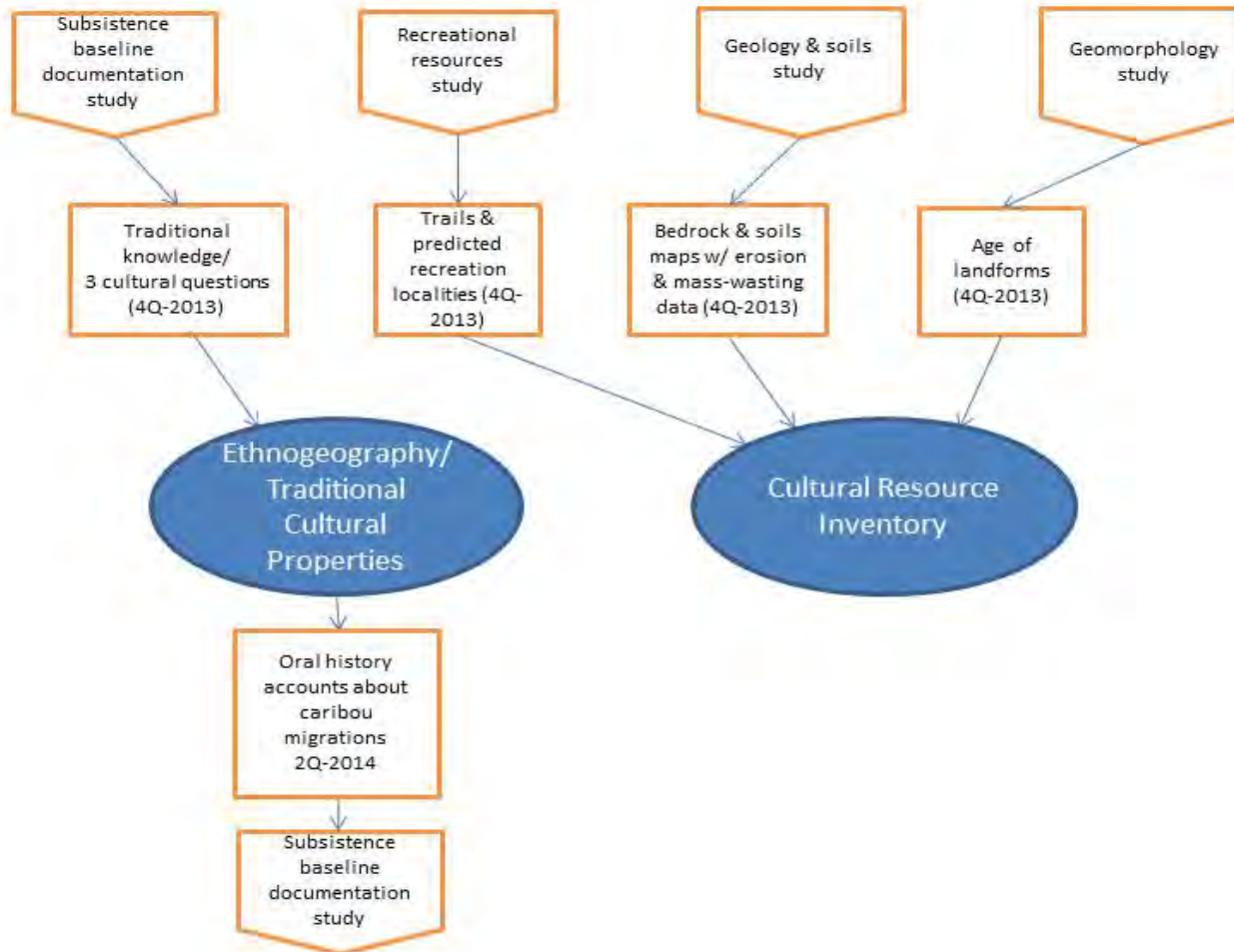


Figure 13.5-6. Study interdependencies for the cultural resources study.

13.6. Paleontological Resources Study

13.6.1. General Description of the Proposed Study

AEA is undertaking studies to determine the effects of the proposed Project on paleontological resources. Information from these studies will be used to identify appropriate protection, mitigation, and enhancement measures to be proposed in the AEA License Application.

This study plan outlines the purpose and framework for evaluating the potential effects of the Project on paleontological resources. The AHPA requires the ADNR to locate, identify, and preserve information on paleontological resources. The AHPA also authorizes ADNR, prior to the undertaking of public construction or improvements by a governmental agency of the State, to survey the affected area for such resources and investigate and record information pertaining to those resources found. In addition, the BLM assesses potential impacts to paleontological resources for federal actions on public lands under the FLPMA and the NEPA.

The paleontological resources study plan outlines and describes AEA's proposal to locate, document, and evaluate paleontological resources within the affected area. The plan discusses the nexus between paleontological resources and FERC's licensing of the Project (see section 13.2.2 above), states the goals and objectives, identifies laws, regulations, and policies that may apply to the paleontological resource investigations, and explains how the proposed work is embedded within accepted scientific perspectives and practices.

Study Goals and Objectives

All work is intended to meet the requirements of the AHPA, FLPMA, NEPA, and their respective regulations.

Thomas Bundtzen and Pacific Rim Geological Consulting (Fairbanks), under contract with AEA, are currently performing a geologic literature review of the Project area, relying as much as possible on the legacy records from the 1980s. With this information, AEA is developing a geodatabase of the likely locations of significant paleontological resources. The results of this initial review will be completed by December 2012, and will be used to help make any appropriate final refinements to the study plan and its implementation in 2013 and 2014.

Following the 2012 literature study, lands within the Study area will be classified into five classes, using BLM's Potential Fossil Yield Classification (PFYC) system (http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/im_attachments/2009.Par.38537.File.dat/IM2009-011_att1.pdf). This system has five levels of classes, from Class 1 (geologic units that are not likely to contain significant fossils) to Class 5 (geologic units that have a high potential to yield scientifically significant fossils on a regular basis)

(http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-009.print.html).

Locations in the study area classified as Class 3 (moderate or unknown potential), Class 4 (high potential), and Class 5 (very high potential) may require field survey and testing by a qualified professional paleontologist/geologist. Areas designated as having significant paleontological potential will be revisited and mapped with survey-grade GPS and incorporated into the paleontological geodatabase.

13.6.2. Existing Information and Need for Additional Information

The potential for Pleistocene as well as much earlier vertebrate faunal remains in the study area needs to be reviewed, given that: a) Thorson et al. (1981) found approximately 29,000-year-old mammoth remains at the confluence of the Susitna and Tyone Rivers, and b) significant occurrences of dinosaur (Hadrosaur) fossils have been reported from the Talkeetna Mountains (Pasch and May 1997). During 1973, the State Geological Survey (DGGs) discovered a new Tertiary sedimentary basin that contained abundant plant flora in Watana Creek, Talkeetna Mountains D-3 quadrangle (Smith, Lyle, and Bundtzen in Hartman (1974)). Much of the Permian system at the stage level has been documented by fossil localities in the Clearwater Mountains south of the Denali Highway in the Talkeetna Mountains D-2 quadrangle (Kline, Bundtzen, and Smith (1990) and along the flanks of Mount Watana (Csejtey 1973; Csejtey et al.1978).

13.6.3. Study Area

The study area for the initial paleontological literature study encompasses a broad region around the Project area, which is co-terminus with the external boundary of the direct and indirect study area for the Cultural Resource Study Plan (Section 13.5) (Figure 13.6-1). As a starting point, the initial literature study will focus on lands within the study area that may contain fossil localities and that may be covered by existing records. Non-fossil-bearing rock units, such as metamorphic and igneous rocks, and some areas where bedrock is overlain by glacial till, will not be addressed in existing records and therefore will not be considered as part of the literature study. Rock types that are not fossil-bearing include: 1) Jurassic-to-Tertiary granitic plutons, which cover about 15 percent of lands within the study area; 2) high rank, regionally metamorphosed core complexes, which cover about 10 percent of lands within the study area; and 3) thick glacial cover sequences in broad valley basins, which cover about 20 percent of lands within the study area.

Once areas of moderate to very high (Class 3 to 5) potential landforms are determined based on the literature study, these locations will be overlaid on the Project's footprint. Areas identified as moderate to high that could be directly impacted by the Project, i.e., lands within the reservoir, dam and camp facilities area, borrow sites, and the three potential road and transmission corridors (Chulitna, Denali, and Gold Creek corridors) (Figure 13.6-1) will be surveyed. Thus, study area for further potential study (*e.g.*, paleontological field survey) encompasses only those areas: (1) where significant paleontological resources occur as surface outcrops; and (2) that may be impacted by the construction and/or operation of the Project.

13.6.4. Study Methods

1. Identify potential impacts to paleontological resources. AEA will determine the geologic units that may be impacted by the proposed Project and the associated PFYC classes. Information about known localities and previous paleontological research will be consulted in making these determinations, requiring examination of mapped rock units and archived paleontological records at the USGS and other agencies.

Based on the PFYC class and additional resource information, AEA will evaluate the risk of impacting significant paleontological resources.

2. Determine the need for field survey and monitoring efforts. Field surveys, on-site monitoring, spot-checking during critical construction, and locality avoidance are all approaches to address potential impacts to paleontological resources.

The proposed Project is expected to impact multiple geologic units with differing PFYC classes. The need for field survey and monitoring efforts will vary by location and will be determined largely upon the basis of the PFYC classification for the particular location, as follows:

- For areas that are designated PFYC Class 1 or 2 and contain no known paleontological resources, no further assessment is typically needed.
- For areas designated PFYC Class 3a (moderate or unknown potential)—where vertebrate and scientifically significant invertebrate or plant fossils are known to occur intermittently, or where existing study data is lacking—further on-site preliminary assessment by a qualified paleontologist may be appropriate.
- For areas designated PFYC Class 4b (buried bedrock with high potential) or Class 5b (buried bedrock with very high potential), possible impacts to bedrock units will be assessed. If the protective layer may be removed, impacting the bedrock unit below, pre-work field surveys and/or on-site monitoring during disturbance or spot-checks at key times may be appropriate. If, however, the proposed Project activity will not penetrate the protective soil or alluvial layer, such further actions may not be necessary.
- For areas designated Class 4a (exposed bedrock with high potential) or Class 5a (exposed bedrock with very high potential), in most situations pre-activity field surveys of potentially impacted locations will be undertaken.

3. Field Surveys. As noted above, field surveys will generally be undertaken for Class 4 and 5 units, especially exposed bedrock areas (Class 4a and 5a). Class 3 units may or may not require a survey. Local conditions, such as vegetated areas or pockets of bedrock exposure, may affect the need and intensity of field surveys.

Discussions will be held with BLM and ADNR to determine where and to what extent paleontological surveys will be required prior to ground-disturbing Project-related activity. If surveys of areas likely to contain fossil remains are required, they will be conducted during 2013 and 2014.

Field investigations will be supported by helicopter and fixed wing aircraft. A team of two geologists will visit existing sites and examine potential new sites using standard geological field methods. The specialists will be guided by existing federal and state geological mapping of the study area.

Sample locations will be plotted using GPS. To AEA's knowledge, nearly all past fossil localities were located prior to widespread use of GPS and GIS technology.

Samples will be bagged to prevent abrasion and damage. Depending on the type and quality of fossil material present, splits of samples will be sent to appropriate university or private sector paleontologists for identification and analysis. Where collection efforts are required on federal public lands, permits under the Paleontological Resources Protection Act will be secured as appropriate.

If paleontological resources discovered during construction could be affected by the continuation of Project-related activity, appropriate consultation and other measures will be taken. Any necessary mitigation for paleontological resources will be addressed on a case-by-case basis.

13.6.5. Consistency with Generally Accepted Scientific Practice

Field investigations will be consistent with generally accepted scientific practices. During his career with ADNR, Dr. Bundtzen has made numerous fossil collections and has worked with the USGS, universities, and the private sector to obtain fossil identifications, age estimates, and interpretations. More than 100 of his fossil locales have been archived at the Museum of the North in Fairbanks.

13.6.6. Schedule

Work performed in 2013-2014 will include the following components (Table 13.6-1):

- Applying the GIS-based classification scheme developed in 2012 within the study area.
- Systematic testing in areas of high potential indicated by the classification scheme in 2013-2014.

Study products to be delivered will include

- **Initial Study Report (February 2014).** An Initial Study Report will be prepared and presented to the interested parties to provide initial results and information on study progress. The Report will include up-to-date compilation and analysis of the data and ArcGIS spatial data products.
- **ArcGIS Spatial Products.** Shapefiles of the 1980s and current paleontological resources data will be compiled into a geodatabase for the study area. All map and spatial data products will be delivered in the two-dimensional Alaska Albers Conical Equal Area projection, and NAD83 horizontal datum consistent with ADNR standards. Naming conventions of files and data fields; spatial resolution; and metadata descriptions will meet the ADNR standards established for the Project.
- **Updated Study Report (February 2015).** An Updated Study Report will be completed by early February 2015. The report will summarize the results of each field season and will be presented to resource agency personnel and other licensing participants along with spatial data products. Reports will follow FERC and BLM protocols and will follow professionally-accepted standards. The reports will be filed with FERC to fulfill the study report requirements of 18 CFR section 5.15(c) and (f) of the Commission regulations.

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

13.6.7. Relationship with Other Studies

Study interdependencies for the Paleontological Resources Study are presented in Figure 13.6-2. The paleontological resource investigations will produce data sets including information on site nature and location. The study expects to utilize data from the Geology and Soils Characterization Study (section 4.5) and the Geomorphology Study (Section 6.5) to further develop and inform this study. To help protect the integrity of paleontological resources, paleontological resources reports are expected to be of limited distribution and largely not shared with other study groups. Figure 13.6-2 depicts the intended flow of data amongst related Project programs.

13.6.8. Level of Effort and Cost

The work described above will take place primarily during 2013 and 2014, with the Updated Study Report to be completed by early February 2015. It is estimated that 2013-2014 fieldwork and pertinent reporting will cost approximately \$70,000.

13.6.9. Literature Cited

- Csejtey, Bela, 1973, Paleozoic island arc in Talkeetna Mountains, in, United States geological Survey Program abstracts, U.S. Geological Survey Circular 683, page 45. (reports on upper Paleozoic fossils)
- Csejtey, Bela, Nelson, W.H., Jones, D.L., Silberling, N.J., Dean, R.M., Morris, M.S., Lanphere, M.A., Smith, J.G., and Silberman, M.L., 1978, Reconnaissance geologic map of the Talkeetna Mountains Quadrangle, the northern part of the Anchorage Quadrangle and the southwest corner of the Healy quadrangle, Alaska: U.S. Geological Survey Open File report, 78-558A, scale 1:250,000 60 pages. (Reports on numerous new fossil localities)
- Kline, J.T., Bundtzen, T.K., and Smith, T.E., 1990, Preliminary geologic map of the Talkeetna Mountains D-2 Quadrangle: Alaska Division of Geological and Geophysical Surveys Public Data File Report 90-24, scale 1:63,360. (reports new Permian and Triassic fossil localities)
- Pasch, Anne D., and Kevin C. May. 1997. First Occurrence of a Hadrosaur (Dinosauria) from the Matanuska Formation (Turonian) in the Talkeetna Mountains of South-Central Alaska. Short Notes on Alaska Geology 1997, pp. 99-109, Alaska Division of Geological and Geophysical Surveys, Anchorage.
- Smith, T.E., Lyle, W.M., and Bundtzen, T.K., Newly Discovered Tertiary Sedimentary Basin Near Denali, in, Hartman, D.C., 1974, 1973 Annual Report of the Department of Natural Resources, Division of geological and Geophysical Surveys, page 19.
- Thorson, Robert M., E. James Dixon, George S. Smith, and Allan R. Batten. 1981. Interstadial Proboscidean from South Central Alaska. Quaternary Research 16:404-417.

Paleontological Legislation:

http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/paleontological_regulations.html

<http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=200910&RIN=1004-AE13>

Paleontological Classification systems:

http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-009.html

13.6.10. Tables

Table 13.6-1. Schedule for implementation of the Paleontological Resources Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Modeling and sample design development				—									
Pre-field preparation (logistics, equipment, maps, safety, training and aerial reconnaissance of direct and indirect APEs)					—								
Paleontological Field studies – (priority on the impoundment, followed by corridors)						—							
Initial Study Report								—	Δ				
Additional modeling from 2013 field study results and develop sample design for 2014									—				
Pre-field preparation (logistics, equipment, maps, safety training)									—				
Field studies – Continuation from 2013 field season										—			
Updated Model and Study Report											—		▲

Legend:

- Planned Activity
- Δ Initial Study Report (due February 2014)
- ▲ Updated Study Report (due February 2015)

13.6.11. Figures

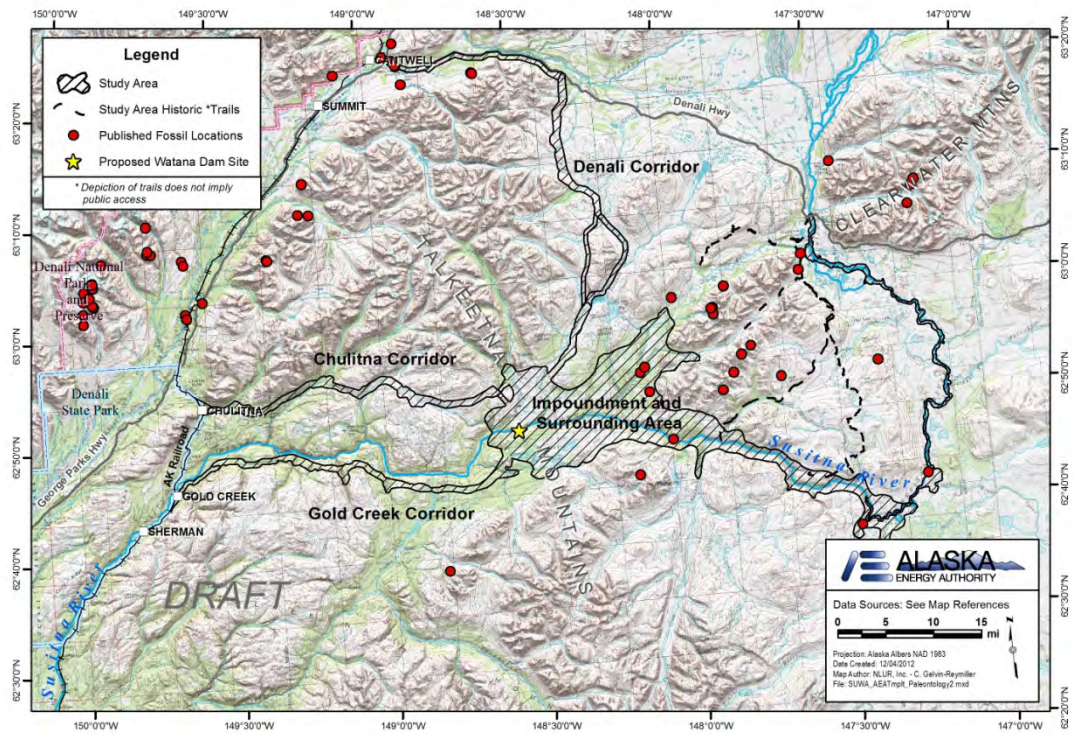


Figure 13.6-1 Study Area for Paleontological Resources Study.

STUDY INTERDEPENDENCIES FOR PALEONTOLOGICAL RESOURCES STUDY

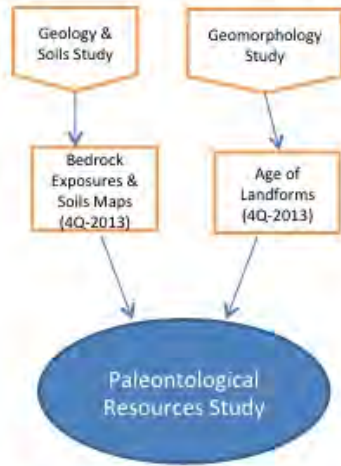


Figure 13.6-2. Study interdependencies for the Paleontological Resources Study.

13.7. Attachments

ATTACHMENT 13-1. PLAN FOR UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES AND HUMAN REMAINS.

ATTACHMENT 13-1
PLAN FOR UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES
AND HUMAN REMAINS

Plan for Unanticipated Discovery of Cultural Resources and Human Remains

Susitna-Watana Hydroelectric Project

FERC No. 14241



Alaska Energy Authority



[Review Draft: 6/20/12]

**PLAN FOR UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES AND HUMAN
REMAINS DURING THE 2012 SUSITNA-WATANA HYDROELECTRIC PROJECT
FIELD INVESTIGATIONS
(Provisional – June 20, 2012)**

The first part of this plan (pages 1-3) is addressed to non-cultural resource contractors and other personnel involved with the Susitna-Watana Hydroelectric Project and establishes procedures in the event that unreported or unanticipated cultural resources and/or human remains are found in the field. The field reporting procedures differ depending on: a) whether cultural materials or human remains are encountered; and b) whether the discoverers are involved in a non-destructive effort or whether ground disturbance is involved. Reports of finds will then be forwarded by the Cultural Resources Program or Study Lead as per the remainder of this plan according to c) whether the finds are on federal, state, or private land¹. Prior to fieldwork, AEA and contracted personnel will receive environmental training including the following guidance for identifying and reporting cultural resources or human remains discovered in the field. This plan briefly describes cultural resources in the study area, how to distinguish them from insignificant items and trash, and what to do if you find them during your fieldwork (all “ifs” are underlined).

Cultural Resources in the Study Area

The general study area contains historic and prehistoric remains going back as much as 10,000 years, and over 250 sites are known from previous studies. Of those, about 90% had stone tools and other prehistoric artifacts, about 10% were historic sites consisting of building ruins or scatters of commercially manufactured items (metal cans, bottles, etc.), and only a couple were fossil discoveries (animal or plant remains). The more recent prehistoric sites are from the Athabaskan Indians who inhabited the area historically and hold the majority of the area’s Native place names in their linguistic dialect -- Ahtna, while the older sites fade into a more generalized adaptation shared by most of Alaska’s ancient interior peoples. Historic sites in the Susitna-Watana area reflect remote land use like mining, prospecting, hunting, trapping, and recreational pursuits, in addition to simple homesteading.

How to Distinguish Cultural Resources

Prehistoric sites most commonly contain stone tools, which are the main indicator for field personnel. Rocks free of flaws that fracture easily and predictably (like flint or obsidian) were typically struck and pressured into form, resulting in tools and discarded flakes with distinctively faceted surfaces – shallow concave scars on tools as well as the corresponding positive bulbs on removed flakes (imagine the rippled conical chunk of glass your son, daughter, – or you – once popped out of a plate glass window with a BB gun). This is the major diagnostic you need to have in mind for prehistoric sites. Discriminating between an artifact and a naturally shattered rock relies a lot on context. A few suspicious stone shards among a rocky talus slope of identical mineralogy are probably not cause for concern. An interesting multi-flaked sharp stone plus a few others nearby (perhaps with detachment bulbs) on a flat overlook would more likely be a cultural

¹ As set forth by the National Historic Preservation Act (NHPA), as amended (16 USC 470) and implementing regulations (36 CFR 800), Archaeological Resources Protection Act (ARPA), Native American Graves Protection and Repatriation Act (NAGPRA) and Alaska Statutes 11.46.482 (a)(3), 12.65.5, 18.50.250, and 41.35.200.

occurrence. Many of these locales have already been found and recorded as formal archaeological sites; likely more remain to be discovered.

Historic sites can have more variability than prehistoric sites in terms of surface and subsurface features and their degree of preservation. Building ruins ranging from roofed examples to those fast entering the archaeological record are part of the cultural resource inventory. Scatters of metal cans and glass bottles legally can be cultural resources, too, if they are 50 or more years old (using that criterion, hypothetically, archaeologist Ivar Skarland's field camp from his 1953 investigations of the then-proposed Devils Canyon dam impoundment could be historically significant). Unvegetated deposits of loose rock at the base of mineralized outcrops – often reddish or yellowish, may indicate historic prospecting, as might the remains of water diversion systems. As with the prehistoric inventory, many of these sites have already been discovered, and likely more remain to be found.

What to Do if You Find Cultural Features or Artifacts

Regardless of whether you are involved in a non-destructive field program or one involving ground disturbance, stop work immediately in the vicinity and don't disturb the features or artifacts further. If you are involved in a ground-disturbing activity then contact immediately either Cultural Resource Program Lead Charles M. Mobley or Study Lead Justin Hays (below). Information you will be requested to provide is primarily description of the finds and location including GPS coordinates. If you are involved in a non-destructive field program, then you are requested to report the description and location of the suspected cultural resource including GPS coordinates to Mobley or Hays within five days. Digital photographs accompanying the report are especially recommended but no photographs or site-specific location information should be released to the press or other individuals other than the Cultural Resource Program or Study Leads. Contact either:

Charles M. Mobley
Cultural Resources Program Lead
(907) 653-1937 office
(907) 632-1933 cell
mobley@alaska.net
Charles M. Mobley & Associates
200 W. 34th Avenue #534
Anchorage, Alaska 99503

OR

Justin Hays
Cultural Resources Study Lead
(907) 474-9684 office
(907) 750-9857 cell
jmh@northernlanduse.com
Northern Land Use Research, Inc.
234 Front Street
Fairbanks, Alaska 99709

How to Distinguish Human Remains

Animal bones are statistically more common than human remains by far, so probabilities favor your find not being human. Ask the biologist or hunter on your crew for an opinion. If the bones are cut or sawn then let's assume they're not human. Human skulls and our all-one-piece jaws are relatively unique and easily identified. For the other bones, try to imagine each one in your body where you think it should fit – does it? If not, it's less likely human.

Context is important. If the bones are scattered around a not-too-old fire ring, for example, then they're likely animal. If they're tumbling out of a rock cairn, they're more likely human.

What to Do if You Find Human Remains

Regardless of whether you are involved in a non-destructive field program or one involving ground disturbance, stop work immediately in the vicinity and don't disturb the bones further. Contact immediately either Cultural Resource Program Lead Charles M. Mobley or Study Lead Justin Hays, by telephone or email (below). Information you will be requested to provide is primarily description of the bones and location including GPS coordinates. Digital photographs accompanying the report are especially recommended but no photographs or site-specific location information should be released to the press or other individuals other than the Cultural Resource Program or Study Leads. Contact either:

Charles M. Mobley
Cultural Resources Program Lead
(907) 653-1937 office
(907) 632-1933 cell
mobley@alaska.net
Charles M. Mobley & Associates
200 W. 34th Avenue #534
Anchorage, Alaska 99503

OR

Justin Hays
Cultural Resources Study Lead
(907) 474-9684 office
(907) 750-9857 cell
jmh@northernlanduse.com
Northern Land Use Research, Inc.
234 Front Street
Fairbanks, Alaska 99709

Forwarding Reports of Discoveries from the Field

After the field report has been made to Mobley or Hays the field finders' responsibilities are over other than to be available for further consultation if necessary. The following steps will then be set in motion:

1. The Cultural Resources Program or Study Lead will compare the find's GPS coordinates and description with the known site inventory to determine if it actually reflects a new discovery or an already-recorded site.
2. If the discovery involves human remains or is determined to be an unrecorded cultural property, the Cultural Resources Program or Study Lead will immediately notify AEA's Environmental Manager of the find and its potential significance.

Betsy McGregor, AEA Environmental Manager
(907) 771-3957 office
(503) 312-2217 cell
BMcGregor@aidea.org
411 W. 4th Avenue, Ste. 1
Anchorage, Alaska 99501

3. AEA's Environmental Manager will coordinate with a cultural resources consultant who will travel to the location and evaluate the find as warranted to determine if indeed human bones have been discovered, or if a new cultural site has been found.

4. If the materials found are human remains, then the protocols outlined in the subsequent two sections entitled **Protection of Human Remains** (distinguished according to land ownership) will be followed. If a cultural site is at imminent risk from a proposed ground-disturbing activity, the procedures specified in the following two sections entitled **Protection of Cultural Remains** (again distinguished according to land ownership) below will be followed. If the materials are already recorded cultural sites and not in jeopardy, no further action will be taken.

Protection of At-Risk Cultural Materials on Private and State-Managed Land

a) AEA's Environmental Manager will promptly notify the Environmental Inspector to flag the at-risk site with a 20-meter buffer as appropriate. This buffer may be larger if there is the possibility of more resources in the area or in the case of slopes or cut-banks where ongoing construction may impact the site.

b) AEA's Environmental Manager will direct the cultural resources consultant to begin a more detailed assessment of the find's significance and the potential effect of construction.

c) AEA's Environmental Manager will promptly notify the Alaska State Historic Preservation Officer (SHPO) or State Archaeologist of the find. Contact either:

Judith Bittner, SHPO
(907) 269-8721
judy.bittner@alaska.gov
Alaska Dept. of Natural Resources
Office of History and Archaeology
550 West 7th Avenue Ste. 1310
Anchorage, Alaska 99501-3565

OR

David McMahan, State Archaeologist
(907) 269-8723
dave.mcmahan@alaska.gov
Alaska Dept. of Natural Resources
Office of History and Archaeology
550 West 7th Avenue Ste. 1310
Anchorage, Alaska 99501-3565

d) The landowner will be promptly notified.

e) The cultural resources consultant will document the site circumstances, potential significance, and risk of harm. If the cultural resources consultant assesses the find as not significant or lacking integrity, then the consultant will notify the AEA Environmental Manager who will then inform the SHPO. Upon SHPO agreement of a finding of no effect, AEA will request approval to resume construction. A brief report of the find will be provided to the SHPO within one week of its recording. If the archaeological consultant recommends that the find may be significant, then the following steps will be implemented.

f) AEA's Environmental Manager will notify other parties, such as appropriate Alaska Native organizations, as directed by the SHPO.

Alaska Native Regional Corporations:

- Ahtna, Incorporated (Ahtna)
Michelle Anderson, President
PO BOX 649, Glennallen, Alaska 99588

Glennallen Office: (907) 822-3476

Fax: (907) 822-3495

Anchorage Office: (907) 868-8250

Fax: (907) 868-8285

Email: manderson@ahtna.net

- Cook Inlet Region Incorporated (CIRI)
2525 C Street Suite 500, Anchorage, Alaska 99503
P.O. Box 93330, Anchorage, Alaska 99509-3330
(907) 274-8638
Fax: (907) 279-8836

- Doyon, Ltd. (Doyon)
1 Doyon Place, Suite 300
Fairbanks, Alaska 99701-2941
(907) 459-2000
(888) 478-4755 (toll-free)
(907) 459-2060 (fax)

- Doyon, **Limited - Anchorage Office**
11500 C Street, Suite 250
Anchorage, Alaska 99515-2692
(907) 563-5530 or (907) 375-4220
(907) 375-4205 (fax)

A more complete contact list is attached as Appendix A.

g) If the find is significant and continuing work may damage more of the site, then AEA's Environmental Manager will request recommendations from the SHPO and other parties regarding appropriate measures for site treatment. These measures may include: formal archaeological evaluation of the site; visits to the site by the SHPO and other parties; preparation of a mitigation plan by AEA for approval by the SHPO; implementation of the mitigation plan; and/or approval to resume construction following completion of the fieldwork component of the mitigation plan.

h) If further analysis indicates that the find lacks significance, then AEA's Environmental Manager will consult with the SHPO and other appropriate parties to request approval for resumption of construction.

i) AEA's Environmental Manager will notify the on-site Field Coordinator who will grant clearance to the Contractor to start construction.

Protection of At-Risk Cultural Materials on Federal Lands

a) AEA's Environmental Manager will promptly notify the Environmental Inspector to flag the at-risk site with a 20-meter buffer as appropriate. This buffer may be larger if there is the possibility

of more resources in the area or in the case of slopes or cut-banks where ongoing construction may impact the site.

b) AEA's Environmental Manager will direct the cultural resources consultant to begin a more detailed assessment of the find's significance and the potential effect of construction.

c) AEA's Environmental Manager will promptly notify the appropriate federal land managing agency and Alaska State Historic Preservation Officer (SHPO) of the find. Contact both:

John Jangala, Archaeologist
(907) 822-7303
jjangala@blm.gov
Glennallen Field Office
Bureau of Land Management
P.O. Box 147
Glennallen, Alaska 99588-0147

Judith Bittner, SHPO
(907) 269-8721
judy.bittner@alaska.gov
Alaska Dept. of Natural Resources
Office of History and Archaeology
550 West 7th Avenue Ste. 1310
Anchorage, Alaska 99501-3565

d) The cultural resources consultant will document the site circumstances, potential significance, and risk of harm, and then notify the AEA Environmental Manager who will in turn then inform the Bureau of Land Management (BLM) archaeologist and the SHPO. If the cultural resources consultant assesses the find as not significant or lacking integrity, and the BLM and SHPO agree on a finding of *no effect*, then AEA will request approval to resume construction. A brief report of the find and an AHRs site form will be provided to the BLM and SHPO within two weeks of its recording. If the archaeological consultant recommends that the find may be significant, then the following steps will be implemented.

e) AEA's Environmental Manager will notify other parties, such as appropriate Alaska Native organizations, as directed by the SHPO.

Alaska Native Regional Corporations:

- Ahtna, Incorporated (Ahtna)
Michelle Anderson, President
PO BOX 649, Glennallen, Alaska 99588
Glennallen Office: (907) 822-3476
Fax: (907) 822-3495
Anchorage Office: (907) 868-8250
Fax: (907) 868-8285
Email: manderson@ahtna.net
- Cook Inlet Region Incorporated (CIRI)
2525 C Street Suite 500, Anchorage, Alaska 99503
P.O. Box 93330, Anchorage, Alaska 99509-3330
(907) 274-8638

- Doyon, Ltd. (Doyon)
1 Doyon Place, Suite 300
Fairbanks, Alaska 99701-2941
(907) 459-2000
(888) 478-4755 (toll-free)
(907) 459-2060 (fax)

- Doyon, **Limited - Anchorage Office**
11500 C Street, Suite 250
Anchorage, Alaska 99515-2692
(907) 563-5530 or (907) 375-4220
(907) 375-4205 (fax)

A more complete contact list is attached as Appendix A.

f) If the find is assessed as significant and continuing work may damage more of the site, then AEA's Environmental Manager will request recommendations from the appropriate federal land managing agency, SHPO, and other parties regarding appropriate measures for site treatment. These measures may include: formal archaeological evaluation of the site; visits to the site by the SHPO and other parties; preparation of a mitigation plan by AEA for approval by the appropriate federal land managing agency and SHPO; implementation of the mitigation plan; and/or approval to resume construction following completion of the fieldwork component of the mitigation plan.

g) If further analysis indicates that the find lacks significance, then AEA's Environmental Manager will consult with the federal land managing agency, SHPO and other appropriate parties to request approval for resumption of construction.

h) AEA's Environmental Manager will notify the on-site Field Coordinator who will grant clearance to the contractor to start construction.

Protection of Human Remains on Private and State-Managed Land

a) AEA's Environmental Manager will promptly notify the Environmental Inspector to flag the at-risk site with a 20-meter buffer as appropriate. This buffer may be larger if there is the possibility of more resources in the area or in the case of slopes or cut-banks where ongoing construction may impact the site.

b) AEA's Environmental Manager will notify a peace officer of the state (police, Village Public Safety Officer, or Alaska State Trooper [AST]) and the Alaska State Medical Examiner (SME) immediately of the discovery, as stipulated in Alaska Statute 12.65.5. In addition to a local peace officer (if in a local jurisdiction), notification should include the AST Criminal Investigation Bureau. If the human remains appear recent (less than 50 years old) in the judgment of the archaeologists, the AST and SME will determine whether the remains are of a forensic nature and/or subject to criminal investigation. The AST and SME contacts are:

Sgt. Kid Chan
(800) 478-9333
(907) 269-5058
choong.chan@alaska.gov
(cc: Stephanie Johnson at steph.johnson@alaska.gov)
Alaska State Troopers
Missing Persons Bureau
5700 East Tudor Road
Anchorage, AK 99507

Talkeetna Post - Alaska State Troopers
(907) 733-2256
HC89 Box 8576
Talkeetna, AK 99676

Dr. Gary Zientek, Deputy Medical Examiner
(907) 334-2200
gary.zientek@alaska.gov
Alaska State Medical Examiner
5455 Dr. Martin Luther King Jr. Ave
Anchorage, Alaska 99507

c) The landowner will be promptly notified.

d) The Alaska SHPO will also be notified of any discovery unless circumstances indicate that the death or burial is less than 50 years old and that there is need for a criminal investigation or legal inquiry by the coroner.

Judith Bittner, State Historic Preservation Officer
(907) 269-8721
judy.bittner@alaska.gov
Alaska Dept. of Natural Resources
Office of History and Archaeology
550 West 7th Avenue Ste. 1310
Anchorage, AK 99501-3565

e) Written authorization in the form of a Burial Transit Permit from the Alaska State Bureau of Vital Statistics (BVS) shall be obtained prior to any excavation or re-interment of any human remains. In addition, clearance from the appropriate Alaska Native organization must be obtained prior to excavation or re-interment of Alaska Native remains. The BVS contact is:

Phillip Mitchell, Section Chief
(907) 465-3391
BVSResearch@alaska.gov
Phillip.mitchell@alaska.gov
Alaska Bureau of Vital Statistics
5441 Commercial Boulevard
P.O. Box 110675
Juneau, AK 99801

- f) If the human remains are found to be historic in nature, a qualified professional physical anthropologist with experience in the analysis of human remains will examine them in situ to determine racial identity. The physical anthropologist shall document, analyze, and photograph the remains so that an independent assessment of racial identity can be made. The physical anthropologist shall be afforded no more than 30 days time to conduct his or her analysis.
- g) If the unanticipated discovery consists of Alaska Native human remains, AEA will consult with the Alaska SHPO, FERC, and appropriate Alaska Native organizations regarding the appropriate measures to respectfully handle such a discovery. If it can be determined adequately that the identified human remains have affinity to any federally recognized tribe(s), a reasonable effort will be made by AEA to identify, locate, and notify these tribes. The appropriate Alaska Native Regional Corporations also will be contacted by AEA. A comprehensive contact list is attached as Appendix A.
- h) AEA's Environmental Manager will notify other parties, as directed by the SHPO.
- i) If the human remains are not Native American, and a determination has been made by the AST and Alaska SME that a death investigation is not warranted, then AEA, in consultation with the Alaska SME, will identify, locate and inform descendants of the deceased.
- j) After permission to resume construction has been issued by the SHPO, AEA's Environmental Manager will notify the on-site Field Coordinator who will grant clearance to the contractor to restart construction.

Protection of Human Remains on Federal Land

- a) AEA's Environmental Manager will promptly notify the Environmental Inspector to flag the at-risk site with a 20-meter buffer as appropriate. This buffer may be larger if there is the possibility of more resources in the area or in the case of slopes or cut-banks where ongoing construction may impact the site.
- b) AEA's Environmental Manager will notify a peace officer of the state (police, Village Public Safety Officer, or Alaska State Trooper [AST]) and the Alaska State Medical Examiner (SME) immediately of the discovery, as stipulated in Alaska Statute 12.65.5. In addition to a local peace officer (if in a local jurisdiction), notification should include the AST Criminal Investigation Bureau. If the human remains appear recent (less than 50 years old) in the judgment of the archaeologists, the AST and SME will determine whether the remains are of a forensic nature

and/or subject to criminal investigation. The appropriate federal land managing agency will also be contacted in case the human remains are related to a crime scene. The contact of the AST and SME are:

Sgt. Kid Chan
(800) 478-9333
(907) 269-5058
choong.chan@alaska.gov
(cc: Stephanie Johnson at steph.johnson@alaska.gov)
Alaska State Troopers
Missing Persons Bureau
5700 East Tudor Road
Anchorage, AK 99507

Talkeetna Post - Alaska State Troopers
(907) 733-2256
HC89 Box 8576
Talkeetna, AK 99676

Dr. Gary Zientek, Deputy Medical Examiner
(907) 334-2200
gary.zientek@alaska.gov
Alaska State Medical Examiner
5455 Dr. Martin Luther King Jr. Ave
Anchorage, Alaska 99507

John Jangala, Archaeologist
(907) 822-7303
jjangala@blm.gov
Glennallen Field Office
Bureau of Land Management
P.O. Box 147
Glennallen, Alaska 99588-0147

c) The Alaska SHPO will also be notified of any discovery unless circumstances indicate that the death or burial is less than 50 years old and that there is need for a criminal investigation or legal inquiry by the coroner. The SHPO contact is:

Judith Bittner, State Historic Preservation Officer
(907) 269-8721
judy.bittner@alaska.gov
Alaska Dept. of Natural Resources
Office of History and Archaeology
550 West 7th Avenue Ste. 1310
Anchorage, AK 99501-3565

d) Written authorization in the form of a Burial Transit Permit from the Alaska State Bureau of Vital Statistics shall be obtained prior to any excavation or re-interment of any human remains. In addition, clearance from the appropriate Alaska Native organization must be obtained prior to excavation or re-interment of Alaska Native remains. The BVS contact is:

Phillip Mitchell, Section Chief
(907) 465-3391
BVSResearch@alaska.gov
phillip.mitchell@alaska.gov
Alaska Bureau of Vital Statistics
5441 Commercial Boulevard
P.O. Box 110675
Juneau, AK 99801

e) If the human remains are found to be historic in nature, AEA, as directed by the appropriate federal land managing agency, will determine the origin of the human remains. A qualified professional physical anthropologist with experience in the analysis of human remains will examine them in situ to determine racial identity. The physical anthropologist shall document, analyze, and photograph the remains so that an independent assessment of racial identity can be made. The physical anthropologist shall be afforded no more than 30 days to conduct his or her analysis. The appropriate federal land managing agency will follow NAGPRA and the implementing regulations set forth in 43 CFR 10, for Alaska Native remains.

f) For Alaska Native remains, the appropriate federal land managing agency will retain the responsibility for determining and contacting the appropriate Alaska Native groups. In this case, NAGPRA dictates that work in the immediate vicinity of the remains cannot proceed until 30 days after the reply from the federal agency in charge or appropriate Alaska Native group that the documents regarding the finding were received, unless a written and binding agreement is issued from the federal agency in charge and the affiliated Native American group(s) (NAGPRA 25 USC 3002 Sec 3(d)). The remains will then be assessed and treated based on the guidance of the federal agency in charge and the appropriate Alaska Native group as defined by NAGPRA.

g) If the human remains are not Native American, and a determination has been made by the AST and Alaska SME that a death investigation is not warranted, then AEA, as directed by the appropriate federal land managing agency in consultation with the Alaska SME, will identify, locate, and inform descendants of the deceased.

h) AEA's Environmental Manager will notify other parties, as directed by the appropriate federal land managing agency.

i) After permission to resume construction has been issued by the appropriate federal land managing agency, AEA's Environmental Manager will notify the on-site Field Coordinator who will grant clearance to the Contractor to restart construction.

Contacts for AEA's Cultural Resource Program

Charles M. Mobley
Cultural Resources Program Lead
(907) 653-1937 office
(907) 632-1933 cell
mobley@alaska.net
Charles M. Mobley & Associates
200 W. 34th Avenue #534
Anchorage, Alaska 99503

OR

Justin Hays
Cultural Resources Study Lead
(907) 474-9684 office
(907) 750-9857 cell
jmh@northernlanduse.com
Northern Land Use Research, Inc.
234 Front Street
Fairbanks, Alaska 99709

APPENDIX A: CONTACTS FOR ALASKA NATIVE ENTITIES

Though communities potentially affected by the Project have different histories and cultures, they are characterized by strong past and present ties to the land and its resources. The successful completion of the Consultation and Coordination phase of the National Historic Preservation Act (NHPA) Section 106 process requires an efficient and effective consultation process that addresses the laws and regulations within the context of local custom and practice. Several Alaska tribal entities recognized by the U.S. Department of Interior and established through the Alaska Native Claims Settlement Act (ANCSA) of 1971, are broadly located near the study area. In Alaska, consultation typically occurs with the 229 federally-recognized tribes, the 13 Alaska Native Regional Corporations, and some 200 Alaska Native Village Corporations created by the ANCSA (the Regional and Village Corporations are recognized as “Indians tribes” for NHPA purposes).

There are four Regional Native Alaskan corporations that have interests within or near the Project area (see Table 1). In addition, twenty-two tribes recognized by the Bureau of Indian Affairs under 25 CFR 83.6(b) are located within or near the Project area, including those indicated in Table 2. Table 3 includes a list of recognized and non-recognized ANCSA village; group and urban corporations; and village organizations that also have interests.

Table 1. List of Regional Native Corporations with interests within the vicinity of the Susitna-Watana Hydroelectric Project.

<p>Ahtna, Incorporated (Ahtna) Michelle Anderson, President PO BOX 649, Glennallen, Alaska 99588 Glennallen Office: (907) 822-3476 Fax: (907) 822-3495 Anchorage Office: (907) 868-8250 Fax: (907) 868-8285 Email: manderson@ahtna.net</p>	<p>Doyon, Ltd. (Doyon) 1 Doyon Place, Suite 300 Fairbanks, Alaska 99701-2941 (907) 459-2000 (888) 478-4755 (toll-free) (907) 459-2060 (fax)</p>
<p>Cook Inlet Region Incorporated (CIRI) 2525 C Street Suite 500, Anchorage, Alaska 99503 P.O. Box 93330, Anchorage, Alaska 99509-3330 (907) 274-8638</p>	<p>Doyon, Limited - Anchorage Office 11500 C Street, Suite 250 Anchorage, Alaska 99515-2692 (907) 563-5530 or (907) 375-4220 (907) 375-4205 (fax)</p>

Table 2. List of Tribes recognized by the Bureau of Indian Affairs under 25 CFR 83.6(b) within the vicinity of the Susitna-Watana Hydroelectric Project.

<p>Cheesh-Na Tribal Council/Mount Sanford bal Consortium P.O. Box 357 Gakona, Alaska 99586 907-822-5399 Fax 907-822-5810</p>	<p>Knik Tribe P.O. Box 871565 Wasilla, AK 99687 907-373-7991 Fax 907-373-2161 kniktribe@mtaonline.net</p>
<p>Chickaloon Native Village P.O. Box 1105 Chickaloon, AK 99674-1105 907-745-0707 Fax 907-745-7154 cvadmin@chickaloon.org http://www.chickaloon.org</p>	<p>Mentasta Traditional Council P.O. Box 6019 Mentasta Lake, AK 99780-6019 907-291-2319 Fax 907-291-2305 kmartin@tribalnet.com</p>
<p>Native Village of Chitina P.O. Box 31 Chitina, AK 99566-0031 907-823-2215 Fax 907-823-2233 aceak2000@yahoo.com</p>	<p>Native Village of Cantwell P.O. Box 94 Cantwell, AK 99729 907-768-2591 Fax 907-768-1111 hallvc@yahoo.com</p>
<p>Gulkana Village P.O. Box 254 Gakona, AK 99586 907-822-3746 Fax 907-822-3976 lclaw@gulkanacouncil.org http://gulkanacouncil.org/</p>	<p>Eklutna Native Village 26339 Eklutna Village Road Chugiak, AK 99567-6339 907-688-6020 Fax 907-688-6021 nve@eklutna-nsn.gov http://www.eklutna-nsn.gov</p>
<p>Healy Lake Village P.O. Box 74090 Fairbanks, AK 99706-0300 907-876-0638 Fax 907-876-0639 jpolstonhitc@live.com</p>	<p>Native Village of Gakona P.O. Box 102 Gakona, AK 99586 907-822-5777 Fax 907-822-5997 gakonavc@cvinternet.net www.nvgakona.com</p>
<p>Kenaitze Indian Tribe P.O. Box 988 Kenai, AK 99611-0988 907-283-3633 Fax 907-283-3052 kenaitze@alaska.net http://www.kenaitze.org/</p>	<p>Native Village of Kluti-Kaah P.O. Box 68 Copper Center, AK 99573-0068 907-822-5541 Fax 907-822-5130 nvkktops@cvinternet.net</p>

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Table 2. List of Tribes recognized by the Bureau of Indian Affairs under 25 CFR 83.6(b) within the vicinity of the Susitna-Watana Hydroelectric Project (continued).

<p>Native Village of Tazlina P.O. Box 87 Glennallen, AK 99588-0087 907-822-4375 Fax 907-822-5865 tazlinajulie@cvinternet.net ▪</p>	<p>Northway Village P.O. Box 516 Northway, AK 99764 907-778-2287 Fax 907-778-2220 dnnvc@yahoo.com</p>
<p>Native Village of Tetlin P.O. Box 797 Tetlin, AK 99779 907-883-2021 tetlin@earthlink.net ▪</p>	<p>Seldovia Village Tribe P.O. Drawer L Seldovia, AK 99663 907-234-7898 Fax 907-234-7865 svt@svt.org http://www.svt.org/</p>
<p>Native Village of Tyonek P.O. Box 82009 Tyonek, AK 99682-0009 Phone 907-583-2271 Fax 907-583-2442 E-mail tyonek@aitc.org ▪</p>	<p>Native Village of Tanacross P.O. Box 76009 Tanacross, AK 99776 907-883-5024 Fax 907-883-4497 jerry_isaac@hotmail.com</p>
<p>Nenana Native Association P.O. Box 369 Nenana, AK 99760 907-832-5461 Fax 907-832-1077 nibor652004@yahoo.com ▪</p>	<p>Village of Dot Lake P.O. Box 2279 Dot Lake, AK 99737-2279 907-882-2695 or 907-322-2694 Fax 907-882-5558 dotlake@aitc.org ▪</p>
<p>Ninilchik Village P.O. Box 39070 Ninilchik, AK 99639 907-567-3313 Fax 907-567-3308 ntc@ninilchiktribe-nsn.gov/ http://www.ninilchiktribe-nsn.gov/ ▪</p>	<p>Village of Salamatoff P.O. Box 2682 Kenai, AK 99611 907-283-7864 Fax 907-283-6470 ▪</p>

Table 3. List of recognized and non-recognized ANCSA village; group and urban corporations; and village organizations that have interests within the vicinity of the Susitna-Watana Hydroelectric Project.

Alexander Creek, Incorporated 8128 Cranberry Anchorage, AK 99502 (907) 243-5428	Knikatnu, Incorporated P.O. Box 872130 Wasilla, AK 99687-2130 907-376-2845 Fax 907-376-2847 knikcorp@gci.net
Caswell Native Association HC 89, Box 83 Willow, AK 99688 (907) 495-1263	Little Lake Louise Corporation (907) 250-2098
Chitina Native Corporation P.O. Box 3 Chitina, AK 99566-0031 907-823-2223 Fax 907-823-2202 chitina_native@cvinternet.net http://www.chitinanative.com	Lower Tonsina Corporation Unavailable
Chickaloon-Moose Creek Native Association, Incorporated P.O. Box 875046 Wasilla, AK 99687 907-373-1145 Fax 907-373-1142 cmena@alaska.net http://www.chickaloon.org	Kenai Natives Association, Inc. 215 Fidalgo Ave. #101 Kenai, AK 99611-7776 907-283-4851 Fax 907-283-4854
Dot Lake Native Corporation 3500 Wolf Run Fairbanks, AK 99709 907-882-2755 Fax 907-882-2775	Nabesna Native Group, Inc. Unavailable
Eklutna, Incorporated 16515 Centerfield Dr. #201 Eagle River, AK 99577 907-696-2828 Fax 907-696-2845 receptionist@eklutnainc.com http://www.eklutnainc.com	Mendas Cha-ag Native Corporation Gary Lee, President 457 Cindy Dr. Fairbanks, AK 99701

Table 3. List of recognized and non-recognized ANCSA village; group and urban corporations; and village organizations that have interests within the vicinity of the Susitna-Watana Hydroelectric Project (continued).

Gold Creek-Susitna NCI P.O. Box 847 Talkeetna, AK 99676-0847 (907) 733-2329	Seldovia Native Association, Incorporated P.O. Drawer L Seldovia, AK 99663-0250 907-234-7625 Fax 907-234-7637 info@snai.com http://www.snai.com
Montana Creek Native Association P.O. Box 100379 Anchorage, AK 99510	Tanacross, Incorporated P.O. Box 76029 Tanacross, AK 99776 907-883-4130 Fax 907-883-4129 http://www.tanacrossinc.com
Ninilchik Natives Association, Incorporated P.O. Box 39130 Ninilchik, AK 99639 907-567-3866 Fax 907-567-3867 nnai@nnai.net http://www.nnai.net	Tetlin Native Corporation Gary David Sr., President P.O. Box 657 Tok, AK (907) 883-6652 (907) 505-0253
Northway Natives, Incorporated P.O. Box 401 Northway, AK 99764 907-778-2298 Fax 907-778-2266	Toghotthele Corporation P.O. Box 249 Nenana, AK 99760 907-832-5832 Fax 907-832-5834 Toghotthele@hotmail.com
Point Possession, Incorporated Feodoria Pennington, President 1321 Oxford Dr. Anchorage, AK 99503 (907) 563-1848	Twin Lake Native Group, Incorporated Unavailable
Salamatkof Native Association, Incorporated 100 N. Willow Street Kenai, AK 99611 907-283-3745 Fax 907-283-6470 info@salamatof.com http://www.salamatof.com/	Tyonek Native Corporation 1689 C Street, Suite 219 Anchorage, AK 99501 907-272-0707 Fax 907-274-7125 http://www.tyonek.com/
Slana Native Corporation - Unavailable	

14. SUBSISTENCE RESOURCES

14.1. Introduction

The purposes of the Subsistence Resources Study are to document traditional and contemporary subsistence harvest and use and to collect baseline data to facilitate the assessment of potential impacts of Project construction and operation on subsistence harvest and use. This study will provide information that will serve as the basis for compliance with the Federal Energy Regulatory Commission's (FERC's) National Environmental Policy Act (NEPA) obligations, along with other required approvals and analyses including those of the Bureau of Land Management (BLM) under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA), and also will address State of Alaska needs regarding subsistence resources management.

For purposes of this study plan, traditional use will be defined as the values and practices related to subsistence that are passed down through generations of subsistence users and that inform and guide contemporary subsistence practices. Contemporary use will be defined as recent harvest and use patterns that characterize the resources and areas that are being utilized by communities.

14.2. Nexus Between Project Construction/Existence/Operations and Effects on Resources to be Studied

Construction and operation of the Project could have potential direct or indirect effects on subsistence harvest and use by changing access to subsistence resources and/or affecting resource abundance or availability. If a portion of a community's subsistence use areas are within the Project area, then a direct effect on subsistence use could occur through removal of the use area due to the Project facilities or by impeding access to use areas. Increased human activity in the upper Susitna River basin may indirectly affect subsistence uses, for instance, by impacting wildlife behaviors or creating additional competition for subsistence resources.

Successful subsistence harvests depend on both continued availability of subsistence resources in adequate numbers and health, and on continued access to those resources. Subsistence resource availability is affected by such factors as resource mortality or health changes, displacement from traditional harvest locations, and contamination (including actual and/or perceived contamination of resources and habitat or habituation of resources to development activities). Access to subsistence resources may be affected by such factors as construction of new roads and other infrastructure and establishment of a new reservoir. Changes in access can result in increased access to subsistence resources by harvesters. Increased access to an area may also result in more competition for resources from outsiders and/or from community or nearby community residents who did not previously use the area or who use the area differently as a result of changes induced by Project development. A decrease in access may decrease competition in the potentially affected area and introduce additional competition in new areas because harvesters can no longer access previously used hunting, fishing, or gathering areas (displaced users). A decrease in resource availability may potentially result in increased competition among harvesters as they try to meet their harvest needs from a depleted or displaced resource stock. It is important that these activities and resources are understood along

with potential Project impact sources, to adequately assess potential impacts to subsistence uses and, if needed, identify potential protection, mitigation, and enhancement measures.

14.3. Resource Management Goals and Objectives

The results of this Subsistence Resources Study and other related studies will inform FERC's NEPA analysis for the FERC licensing process and other agency approvals, as well as BLM's obligations under Title VIII of ANILCA and State of Alaska needs regarding subsistence resources management.

Alaska and the federal government regulate subsistence hunting and fishing in the state under a dual management system. The federal government recognizes subsistence priorities for rural residents on federal public lands, while Alaska considers all residents to have an equal right to participate in subsistence hunting and fishing when resource abundance and harvestable surpluses are sufficient to meet the demand for all subsistence and other uses. Much of the land occupied by the proposed Project is owned or managed by the Alaska Department of Natural Resources (ADNR), BLM, and private land owners, including Alaska Native Corporations established under the Alaska Native Claims Settlement Act (ANSCA).

ANILCA recognizes that "the situation in Alaska is unique" regarding food supplies and subsistence practices. Title VIII of ANILCA establishes subsistence protections on federal lands, including land selected by, but not yet conveyed to, the State or Alaska and Native Corporations, for Alaska's rural Alaska Native and other residents. Under section 803 of ANILCA, the term "subsistence uses" is defined as "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade" (16 USC 3113). Where a "customary or traditional use" is identified for a given resource, the Secretary of the Interior must ensure that "rural residents engaged in subsistence uses shall have reasonable access to subsistence resources on public lands" (16 USC 3113).

Section 810 of ANILCA specifies that before making any decision to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands, a federal land management agency must first evaluate the effects of such a decision on subsistence use and needs (16 USC 3120). If, upon completion of such review, the agency finds that the proposed action may "significantly restrict" subsistence, additional requirements with respect to the proposed withdrawal, reservation, lease, permit or other use of public lands are triggered (16 USC 3120).

In 1990, the U.S. Department of the Interior and the U.S. Department of Agriculture established a Federal Subsistence Board to administer the Federal Subsistence Management Program (55 FR 27114). The Federal Subsistence Board, under Title VIII of ANILCA and regulations at 36 CFR 242.1 and 50 CFR 100.1, recognizes and regulates subsistence practices for rural residents on federal lands. Federal regulations recognize subsistence activities based on a person's residence in Alaska, defined as either rural or nonrural. Only individuals who permanently reside outside federally designated nonrural areas are considered rural residents and qualify for subsistence harvesting on federal lands under federal subsistence regulations. Nonrural residents may harvest fish and game on most federal lands (unless these are closed to non-federally qualified subsistence uses), but these harvests occur under state regulations. Federal subsistence

regulations do not apply to certain federal lands, regardless of residents' rural designations. These include lands withdrawn for military use that are closed to general public access (50 CFR Part 100.3). Nonrural areas in Alaska include the areas around Prudhoe Bay, Fairbanks North Star Borough, Wasilla/Palmer, Anchorage, Kenai, Homer, Valdez, Seward, Juneau, and Ketchikan. Nonrural areas in relation to the proposed Project are shown on Figure 14.5-1.

The Alaska Board of Fisheries and the Alaska Board of Game have adopted regulations enforced by the State for subsistence fishing and hunting on all State of Alaska lands (except nonsubsistence areas) and waters, and lands conveyed to ANCSA entities. State subsistence uses are regulated under Alaska Statutes (AS) 16 and Title 5 of the Alaska Administrative Code (AAC) (05 AAC 01, 02, 85, 92, and 99). Under Alaska law, when there is sufficient harvestable surplus to provide for all subsistence and other uses, all Alaskan residents qualify as eligible subsistence users.

Under Alaska law, subsistence refers to the practice of taking wild fish or game for subsistence uses (AS 16.05.258). Defined under state law as the “noncommercial customary and traditional uses” of fish and wildlife, subsistence uses under state law include:

consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumptions, and for the customary trade, barter, or sharing for personal or family consumption.

(AS 16.05.940 33).

The State distinguishes subsistence harvests from personal use, general hunting, sport, or commercial harvests based on where the harvest occurs and the resource being harvested, not where the harvester resides (as is the case under federal law). More specifically, state law provides for subsistence hunting and fishing regulations in areas outside the boundaries of “nonsubsistence areas,” as defined in state regulations (5 AAC 99.015). According to these regulations, a nonsubsistence area is “an area or community where dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area of community” (5 AAC 99.016).

Activities permitted in these nonsubsistence areas include general hunting and personal use, sport, guided sport, and commercial fishing. There is no subsistence priority in these areas; therefore, no subsistence hunting or fishing regulations manage the harvest of resources. Nonsubsistence areas in Alaska include the areas around Anchorage, Matanuska-Susitna (Mat-Su) Valley, Kenai, Fairbanks, Juneau, Ketchikan, and Valdez (Wolfe 2000). The Anchorage–Mat-Su–Kenai nonsubsistence area is located closest to the Project area (Figure 14.5-2).

14.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

Consultation efforts since filing of the Proposed Study Plan (PSP) include discussions with Alaska Native entities and other licensing participants at the Project Technical Workgroup Meetings and other meetings with the Alaska Department of Fish and Game (ADF&G) held since July 2012. The Subsistence Resources Study plan was presented to the Southcentral Alaska Subsistence Regional Advisory Council (RAC) and the Wrangell St. Elias National Park and Preserve Subsistence Resource Commission (SRC) on October 15 and October 30, respectively.

Summary tables of comments and responses from formal comment letters filed with FERC through November 14, 2012 are provided in Appendix 1. Copies of the formal FERC-filed comment letters are included in Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from PSP filing (July 16, 2012) through the release of interim draft Revised Study Plans (RSPs), is provided in Appendix 3. Copies of meeting summaries from release of the PSP through the interim draft RSP are included in Appendix 4, organized chronologically.

14.5. Subsistence Resources Study

14.5.1. General Description of the Proposed Study

Through a combination of household harvest surveys, mapping interviews, and traditional and local knowledge interviews, the Subsistence Resources Study will collect baseline data and document traditional and contemporary subsistence harvest and use to facilitate the assessment of potential impacts of the Project construction and operation on subsistence harvest and use.

Study Goals and Objectives

The overall goal of this study is to demonstrate whether and, if so, the extent to which communities harvest and use subsistence resources within or near the Project area, use Project area lands to access other lands for subsistence harvest and use, and/or harvest and use resources that migrate through the Project area and are later harvested in other areas.

The objectives of the Subsistence Resources Study are as follows:

1. Document whether and, if so, the extent to which communities within the Susitna River watershed, as well as communities outside the Susitna River watershed that have subsistence use areas in the watershed, use areas that are within the Project area for subsistence harvests.
2. Document whether and, if so, the extent to which communities within the Susitna River watershed, as well as communities outside the Susitna River watershed that have subsistence use areas in the watershed, use Project area lands to access other lands or waters for subsistence harvest.
3. Document whether and, if so, the extent to which communities within the Susitna River watershed, as well as communities outside the Susitna River watershed that have subsistence use areas in the watershed, use resources that migrate through the Project area and are harvested in other areas.
4. Collect and document traditional and local knowledge of communities within the Susitna River watershed, or who have subsistence use areas within the watershed, to assist in assessing the potential impacts of construction and operation of the proposed Project on subsistence harvest and use. This information will be directly shared with the program leads for other resources, as appropriate.
5. Evaluate Project development plans to identify likely sources of potential impacts on identified subsistence uses.
6. Provide the necessary information needed to support preparation of an ANILCA 810 evaluation.

The data developed through this study will be evaluated along with data from biological and wildlife and cultural resources studies to supplement the subsistence information and put it into context with other related resource conditions.

14.5.2. Existing Information and Need for Additional Information

The intent of the Subsistence Resources Study is to facilitate the assessment of potential Project impacts to subsistence uses by providing current and representative data that will characterize the existing environment of subsistence uses in the proposed Project area. Critical to this assessment

is the establishment of baseline indicators of subsistence use that can be used to assess the potential effects of the Project. Existing baseline indicator information that characterizes the subsistence environment is available in the form of harvest data, mapping of subsistence use areas, and traditional knowledge studies. Existing information from harvest data can be used to determine which subsistence resources are harvested by communities either in or outside the Project area and which subsistence resources that migrate through the Project area are harvested in other areas. In addition, harvest data provide information about harvest amounts, harvest participation, and other baseline harvest indicators in potentially affected communities. Existing information from subsistence use area mapping studies can be used to identify which communities utilize areas within the Project area for subsistence harvests or use Project area lands to access other lands for subsistence harvests. Traditional knowledge studies will help provide the cultural basis for why and how community residents engage in subsistence activities and how cultural values and practices are incorporated into and inform present-day subsistence activities. Traditional knowledge studies also provide information about resources and the environment, all of which is relevant to identifying potential Project impacts and, if necessary, potential protection, mitigation, and enhancement measures. Obtaining pertinent Alaska Natives' statements of subsistence use policy and goals requires identification of each Alaska Native entity potentially involved and documentation and identification of each entity's specific policies or mission statements related to subsistence. This task could be performed during the literature review.

Updated information regarding harvests must be collected for communities lacking current data. Harvest amounts and species that are harvested change over time and are subject to annual variation. Timely data are needed in order to determine what resources are being used by a community to establish baseline conditions and assess effects.

ADF&G harvest surveys contain a one-year mapping component and are useful for comparing multiple data sets; however, as a stand-alone study, the one-year mapping component does not take into account annual variation in use areas. Without multiple one-year use area data sets, it is useful to conduct subsistence mapping that covers a more extensive time period (e.g., a mapping interview that documents residents' last 10-year use area) so that some annual variation is accounted for and the assessment of effects to use areas and user access can consider the variability in use over time and varying resource conditions.

Traditional knowledge is relevant regardless of the time period it was collected, as it is information that is intended to be passed down through generations of subsistence users. Traditional knowledge interviews can potentially identify cultural resources and potentially inform the Project design and/or the assessment of impacts and, if necessary, development of protection, mitigation, and enhancement measures.

The information collected in this study will help to support the assessment of environmental impacts under NEPA as well as an ANILCA 810 subsistence evaluation. Section 810 of ANILCA requires certain federal agencies, when determining whether to permit the use, occupancy, or disposition of public lands, to evaluate:

- The effect of use, occupancy, or disposition to be authorized on subsistence uses and needs
- The availability of other lands for the purposes sought to be achieved

- Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 USC 3120)

The existing information and additional information collected in the form of harvest surveys, subsistence mapping interviews, and traditional and local knowledge interviews will help provide the baseline data that describes the use, occupancy, and disposition of subsistence uses and needs in order to assess the potential effects of the Project on subsistence use.

Existing information has been summarized in the Subsistence Resources Data Gap Analysis (Simeone, Russell, and Stern 2011). Additionally, ADF&G has identified communities outside the non-subsistence area in need of updated harvest information. AEA reviewed the communities selected in the data gap analysis and preliminarily identified by ADF&G for this Project and documented whether the communities had existing subsistence baseline use area data and recent (within last three years) harvest data. See Attachment 14-1 for the results of AEA's review of the data gap analysis and ADF&G-identified communities. After the subsistence study plan has been filed, AEA will systematically compile existing subsistence data for the selected study communities as part of the baseline description of subsistence uses (see Section 14.5.4.1, Task 1: Compilation of Existing Data).

14.5.3. Study Area

To help inform the selection of study communities and define the study area for this study, AEA reviewed the Subsistence Resources Data Gap Analysis (Simeone, Russell, and Stern 2011) and communities identified by ADF&G as needing updated harvest information. See Attachment 14-1 for the results of AEA's review of the data gap analysis and ADF&G identified-study communities.

For purposes of this study plan, the study area includes the Project area, as well as locations within the Susitna River watershed where the proposed Project could affect natural resources and access conditions upstream and downstream of the Susitna River as well as its associated tributaries. The study area includes the proposed reservoir, road and transmission corridors (including a portion of one corridor adjacent to the Denali Highway that extends outside the watershed), and other Project facility sites (Figure 1.2-1).

AEA developed a list of study communities in order to adequately address potential impacts to subsistence users who use the study area for subsistence activities. This included communities that are located outside the study area but have documented use within the study area. AEA developed the following criteria for inclusion as a study community:

1. The community is located within the Susitna River watershed
2. The community is located outside of the Susitna River watershed but has previously documented subsistence use areas that extend into the watershed; or
3. The community is one of the communities preliminarily identified by ADF&G as needing updated harvest information

Based on the above criteria, AEA has identified 37 study communities whose subsistence uses could potentially be affected by the proposed Project (Table 14.5-1; Figure 14.5-3).

14.5.4. Study Methods

To meet the study objectives and demonstrate whether and, if so, the extent to which communities harvest and use subsistence resources within or near the Project area, use Project area lands to access other lands for subsistence harvest and use, or harvest and use resources that migrate through the Project area and are later harvested in other areas, this Subsistence Resources Study plan proposes to complete the following tasks:

1. Compilation of Existing Subsistence Data
2. Household Harvest Surveys
3. Household Surveys in State-Designated Nonsubsistence Areas
4. Subsistence Mapping Interviews
5. Traditional and Local Knowledge Interviews
6. Study Report Preparation

The methods used to implement the above tasks are described in the following sections.

14.5.4.1. *Task 1: Compilation of Existing Subsistence Data*

AEA will compile existing data describing the subsistence uses of communities that may be affected by the proposed Project. Communities will include the 37 study communities listed in Table 14.5-1. In addition, to the extent that the ADF&G Winfonet database (i.e., land mammal harvest database) is available, AEA will assess this information to determine whether residents of additional communities use the area for subsistence purposes. Analysis of the Winfonet database will be conducted in coordination with the wildlife resource study. Methods for the compilation of existing data are as follows:

- Use ADF&G's Community Subsistence Information System (CSIS), and identify and compile existing harvest data for the 37 communities listed in Table 14.5-1.
- Compile available subsistence use area data for the 37 communities listed in Table 14.5-1.
- Compile available baseline indicator data (e.g., timing of harvest activities) from available sources.
- Request access to ADF&G's Winfonet database. These data can provide the following information:
 - identification of subsistence users and communities in Alaska who travel to the proposed Project area to participate in land mammal harvest activities; and
 - additional information about study communities' (including those located in nonsubsistence areas) subsistence activities in the Project area.
- Create tables and maps describing the information compiled from the CSIS, Winfonet database, and additional sources.
- Incorporate results of the data review and compilation within the context of the proposed Project into Task 6.

14.5.4.2. *Task 2: Household Harvest Surveys*

ADF&G's Division of Subsistence will document one year of subsistence harvest and use by households in and around selected census designation place (CDP) communities located in the study area and outside the State-designated nonsubsistence areas (Figure 14.5-2). ADF&G has

identified the following 12 communities as needing updated harvest data: Chase, Cantwell, Susitna, Skwentna, Glennallen, Gulkana, Mendeltna, Nelchina, Paxson, Tazlina/Copperville, Tolsona, and Tonsina. Other communities in the Copper River and Susitna River watersheds were included in ADF&G's assessment but already have household harvest surveys planned or recently updated in conjunction with other, non-Susitna related efforts. These communities include Chistochina, Chitina, Copper Center/Silver Springs, Gakona, Kenny Lake/Willow Creek, McCarthy, Mentasta, Slana/Nabesna Road, Tyonek, and Beluga.

AEA conducted a review to determine whether additional study communities located in the Susitna River watershed needed updated harvest data, i.e., if harvest data are not available for those communities from within the past three years. Table 14.5-2 depicts all Susitna River watershed study communities that are located outside State-designated nonsubsistence areas. Talkeetna and Trapper Creek are located within a nonsubsistence area but are close to the nonsubsistence area boundary. Because of residents' close proximity to the boundary, members of these communities likely travel outside the nonsubsistence area regularly for subsistence purposes; therefore, they are also included in Table 14.5-2. None of the nine communities listed in Table 14.5-2 have harvest data from the last three years. Two of the communities listed in Table 14.5-2 are not CDPs and were therefore not selected for harvest surveys. Of the five remaining communities, only two (Lake Louise and Mendeltna) are outside State-designated nonsubsistence areas. Therefore, this study plan adds Lake Louise and Mendeltna to the scope of work for updated harvest surveys. Based on the results shown in Table 14.5-2, this study would involve household harvest surveys in the following 13 communities:

1. Chase
2. Cantwell
3. Glennallen
4. Gulkana
5. Lake Louise
6. Mendeltna
7. Nelchina
8. Paxson
9. Susitna
10. Skwentna
11. Tazlina/Copperville
12. Tolsona
13. Tonsina

Specific study methods to conduct this task include the following:

- Development of a survey instrument to produce updated comprehensive baseline information about subsistence hunting, fishing, and gathering and other topics that address subsistence needs and are compatible with information collected in past household interviews.
- Community consultation to identify community liaisons and seek study support.
- Household surveys to record the following information: demographic information; involvement in use, harvest, and sharing of fish, wildlife, and wild plants in the study year (i.e., 2012 or 2013); estimate of amount of resources harvested in the study year; information about employment and cash income; assessments of changes in subsistence

harvest and use patterns based on data available from past study years; and location of fishing, hunting, and gathering activities in the study year.

- Key informant interviews to document traditional knowledge about changes in the environment, hunting and harvesting patterns, and resource availability; key subsistence resources and use areas; and the effects of regulations on hunting and fishing.
- Household surveys conducted in each community by community liaisons contracted and trained by ADF&G, with the goal of interviewing a representative of each year-round household in all the study communities. Participation in the surveys will be voluntary and all individual and household level responses will be confidential. ADF&G staff will conduct the harvest mapping component of the survey with each household. Surveys will be timed to avoid seasonal activities to allow for best participation.
- Collaborative review and interpretation of study findings through data analysis, the production of standard tables and figures, and community review meetings.
- Communication of findings to communities through community review meetings and four-page study finding summaries mailed to all households in each community; and
- Addition of final data to the CSIS and production of a final report summarizing the results of the systematic household surveys and mapping for each study year, including long-term trends for communities with harvest data available in the CSIS.

Attachments 14-2 and 14-3 provide the draft survey instrument for the household harvest surveys and the draft protocol for key informant interviews. Administration of the surveys will be adapted to specific community subsistence patterns.

14.5.4.3. Task 3: Household Harvest Surveys in State-Designated Nonsubsistence Areas

As discussed above, AEA will conduct household harvest surveys in 13 CDP communities that are located outside State-designated nonsubsistence areas; are located in the Susitna River watershed or use the Susitna River watershed for subsistence; and have not had updated subsistence harvest studies within the previous three years (since 2009). In addition, AEA has identified Talkeetna and Trapper Creek for updated household harvest surveys (see Table 14.5-2). These two additional communities are located within a State-designated nonsubsistence area (Figure 14.5-2) and are therefore generally not included in ADF&G Division of Subsistence harvest studies. However, because of their proximity to the subsistence/nonsubsistence boundary and to the Project area, agency and public concern raised during Technical Workgroup meetings, and the lack of recent (last three year) harvest data for these communities, AEA selected Talkeetna and Trapper Creek for additional household harvest surveys.

ADF&G's Division of Subsistence will document one year of harvest and use by households in Talkeetna and Trapper Creek. Methods for the nonsubsistence area household surveys will be consistent with the methodology for surveys in communities identified under Task 2 and include:

- Development and use of a survey instrument and household harvest survey methodology comparable to that used in Task 2 so that data collection, entry, and analysis are compatible with existing methodology (see survey methods described in Section 14.5.4.2)
- Coordination with communities to seek study support and communicate findings

- Collaborative review and interpretation of study findings through data analysis, reporting, and community review meetings
- Incorporation of results of analysis, discussion and reporting of community-level survey, and mapping results within the context of the proposed Project into Task 6

14.5.4.4. *Task 4: Subsistence Mapping*

AEA will conduct subsistence mapping interviews in selected study communities to document last 10-year subsistence use areas as well as related baseline indicators. Because a primary application of subsistence use area data in impact analyses is to determine whether a direct impact (i.e., caused by the action and occurring at the same time and place as the action) may occur, the study plan is focused on selecting communities whose residents conduct activities in or near the Project area (Figure 1.2-1). AEA assumes that the closer a community is to the Project area, the more likely that community will be to experience subsistence use area impacts of Project construction and operation. Therefore, the study communities closest to the Project area, including the reservoir, reservoir study area, or any of the three potential road options, were selected for inclusion in the subsistence mapping studies.

Eight communities (Cantwell, Chase, Healy, Talkeetna, Lake Louise, McKinley Park, Trapper Creek, and Petersville) were identified for possible inclusion in the subsistence mapping studies due to their proximity to the Project. Four of these communities (Cantwell, Healy, Lake Louise, and McKinley Park) have documented subsistence use area data showing use of the Project area. Available use area data for these four communities are all at least 10 years old. For the remaining four communities (Chase, Talkeetna, Trapper Creek, and Petersville), subsistence use area data are not available. AEA will refine the list of identified subsistence mapping communities based on additional information (e.g., consultation with communities and agencies, adequacy of existing data, need for updated data, or suitability of community for subsistence mapping efforts).

The subsistence mapping studies will use the following methods to document subsistence use areas and related baseline indicators for the selected study communities:

- Coordinate with tribal governments and Alaska Native entities as appropriate to seek community support for the interviews
- Identify active and knowledgeable harvesters in each study community through consultation with coordinating organizations and by asking study participants to nominate other active and knowledgeable harvesters
- Work with coordinating organizations or local liaisons to contact respondents and schedule interviews
- With two staff members present, conduct subsistence mapping interviews with active and knowledgeable harvesters to document resource-specific subsistence use areas within the last 10 years, along with related indicators (e.g., harvest timing, transportation method) on a U.S. Geological Survey (USGS) 1:250,000 map
- Conduct post-field data processing, including editing of notes, data entry, digitizing of mapped data, and quality control checks of all data entry and digitizing
- Conduct analysis and prepare community and resource-specific maps of subsistence use areas and related indicators
- Conduct analysis and prepare tables and figures describing baseline indicators

- Review findings with study communities
- Incorporate results of analysis from the subsistence mapping interviews, supplemented by respondent observations, within the context of the proposed Project, into Task 6

Attachment 14-4 provides the draft protocol for the subsistence mapping interviews. The protocol is subject to change through consultation with study communities.

14.5.4.5. Task 5: Traditional and Local Knowledge Interviews

AEA will conduct workshops with knowledgeable residents in selected study communities to document traditional and local knowledge about the physical, biological, and social environment as it relates to the proposed Project. To select study communities for the traditional and local knowledge research, AEA considered the following criteria:

- The study community is located within the Susitna River watershed; or,
 - The study community's use area is located within the Susitna River watershed;
- and
- At least 50 percent of the community is Alaska Native; or
 - A federally recognized tribe is affiliated with the community.

AEA's criteria were based on consideration of the likelihood that the community has knowledge about the Project area (proximity of community or use area to the Susitna River watershed), as well as consideration of the presence of long-term knowledge held by at least a portion of the community (Alaska Native population or affiliation of a federally recognized tribe). As depicted in Table 14.5-3, the following eight communities meet the criteria for inclusion in the traditional and local knowledge studies:

- Cantwell
- Chickaloon
- Chitina
- Copper Center
- Eklutna
- Gakona
- Gulkana
- Tyonek

The traditional and local knowledge studies will use the following methods to document knowledge of the physical, biological, and social environment with the selected study communities:

- Coordinate with tribal governments and Alaska Native entities as appropriate to seek community support for conducting the interviews
- Consult with program leads for other resources (e.g., cultural resources, wildlife, fish, vegetation, water quality, air quality, socioeconomics) to identify key topics and questions for the traditional and local knowledge workshops
- Develop a workshop protocol, incorporating input from program leads for other resources, that covers the following basic topics:
 - Physical Environment

- Biological Environment
- Social Environment, including health
- Issues and Concerns
- Work with coordinating organizations in each community to schedule and arrange workshops and to identify knowledgeable residents to participate in the workshops
- With two staff members present, conduct multiple traditional and local knowledge workshops in each selected community to document knowledge about the physical, biological, and social environment
- Following the workshops, identify key respondents for follow-up Traditional Cultural Property (TCP) and Health Impact Assessment (HIA) interviews by AEA;
- Conduct post-field data processing by editing notes and compiling and organizing quotes by topic and subtopic
- Review findings with study communities
- Incorporate results of the traditional and local knowledge workshops in each selected community, supplemented by respondent observations, within the context of the proposed Project into Task 6

Attachment 14-5 provides the draft protocol for the traditional knowledge community workshops. The protocol is in draft form and is subject to further refinement through consultation with study communities.

Table 14.5-5 summarizes the communities selected for each field-based task: traditional knowledge workshops, subsistence mapping, and household harvest surveys.

14.5.4.6. Task 6: Study Report Preparation

AEA will prepare an Initial Study Report by February 2014 that documents progress to date and describes the methodology and field results of Tasks 1-5. AEA will prepare an Updated Study Report by February 2015 that details the methodology, analysis, and synthesis of all data collected for Tasks 1-5.

14.5.5. Consistency with Generally Accepted Scientific Practice

The ADF&G Division of Subsistence will conduct harvest and use studies using standard Division of Subsistence methodology involving systematic household surveys conducted by community-based survey technicians in cooperation with Division of Subsistence resource specialists. Methods for subsistence mapping and undertaking traditional and local knowledge interviews will be similar to those employed on other recent projects involving federal approvals. These include traditional knowledge interviews to support the EPA's National Pollutant Discharge Elimination System (NPDES) permit (SRB&A 2011); subsistence mapping and traditional knowledge interviews to support the NEPA EIS for the Red Dog Mine Extension, Aqqaluk Project (EPA 2009); and subsistence mapping for Bureau of Ocean Energy Management (BOEM) oil and gas leases on the Outer Continental Shelf (SRB&A 2009). Related to projects under FERC's purview, traditional knowledge interviews were recently conducted in 2012 for the Alaska Pipeline Project and it is proposed that the subsistence interview process for the Susitna-Watana Hydroelectric Project would employ similar methods as those accepted for use for that project.

AEA will be guided by the research principles adopted by the Interagency Arctic Research Policy Committee (1990). These principles include informing community organizations of planned research in their communities, gaining community consent, informing all project participants of all positive and negative implications of participating in the study, and protecting the anonymity of study participants. AEA will coordinate with each community to conduct research and provide each study participant with an informed consent form to read and sign. The informed consent will note any risks and benefits of the study, agree to protect the anonymity of participants, and agree to show data only in an aggregated form.

14.5.6. Schedule

Table 14.5-4 presents the anticipated schedule for the Subsistence Resources Study plan by primary tasks. Key dates (e.g., meetings, deadlines) are also presented for each calendar year. Also, Initial and Updated Study Reports documenting actions taken and data collected to date will be issued in February 2014 and 2015, respectively.

14.5.7. Relationship with Other Studies

The flow of information into and out of the Subsistence Resources Study is anticipated to occur over the two year study period through an iterative process. As relevant data are collected, they will be disseminated from the Subsistence Resources Study to the Health Impact Assessment (Section 15), Cultural and Paleontological Resources (Section 13), Fish and Aquatic Resources (Section 9), Wildlife Resources (Section 10), Social Conditions and Public Goods and Services (Section 15), and others as requested. Relevant data could include traditional knowledge specific to each resource (e.g., information about wildlife habitat, cultural important places), harvest amounts, subsistence use areas, and timing of harvest activities. These interdependencies are identified in Figure 14.5-4. The milestone data deliveries of the 2013 Initial Study Report, which will incorporate results of the Traditional and Local Knowledge workshops, and the Updated Study Report will be delivered and disseminated to all licensing participants in Q1 of 2014 and Q1 of 2015 respectively. Analysis and synthesis of data in the Subsistence Resources Study will incorporate and integrate results from other studies (Figure 14.5-4).

Data collected and compiled through the Subsistence Resources Study tasks (Sections 14.5.4.1 through 14.5.4.5), will be used in the License Application to conduct an impact analysis and, if necessary, identify potential protection, mitigation, and enhancement measures. The analysis will include assessment of potential impacts to subsistence use areas, user access, resource availability, resource competition, costs and time associated with subsistence activities, and culture. AEA will review other resource studies as appropriate to inform the analysis of potential changes to the environment that might yield insight into the types and levels of potential impacts on subsistence uses. AEA will review the findings of the Socioeconomic and Transportation Resources (Section 15) to incorporate data on potential changes in demographics, nutrition, employment levels, and other relevant information. The findings of the Fish and Aquatic Resources (Section 9), Wildlife Resources (Section 10), and Botanical Resources (Section 11) may inform impacts to subsistence uses related to changes in resource abundance, health, or distribution/migration. In addition, information provided by community residents during the traditional and local knowledge workshops will inform the impact analysis.

14.5.8. Level of Effort and Cost

For information related to level of effort, see Table 14.5-4 for a description of tasks that will occur by month. Section 14.5.4, “Study Methods,” provides additional information regarding the level of effort for each task. The estimated effort to implement this study plan, including field studies, data collection, analysis, and reporting over the two-year study period for Tasks 1-6 is approximately \$2.3 million.

14.5.9. Literature Cited

- Braund, Stephen R. & Associates (SRB&A). 2011. Chukchi and Beaufort Seas National Pollutant Discharge Elimination System Exploration General Permits Reissuance: Report of Traditional Knowledge Workshops – Point Lay, Barrow, Nuiqsut, and Kaktovik. Prepared for Tetra Tech and U.S. Environmental Protection Agency. Anchorage, Alaska.
- Braund, Stephen R. & Associates (SRB&A). 2010. Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow. United States Department of the Interior Minerals Management Service, Alaska OCS Region, Environmental Studies Program. MMS OCS Study Number 2009-003. Interagency Arctic Research Policy Committee. 1990. <http://www.ankn.uaf.edu/IKS/conduct.html>
- Simeone, William, Adam Russell, and Richard Stern. 2011. Watana Hydroelectric Project Subsistence Data Gap Analysis. Report prepared for the Alaska Energy Authority, Anchorage. Report prepared by Northern Land Use Research, Inc., Fairbanks.
- U.S. Environmental Protection Agency (EPA). 2009. Red Dog Mine Extension: Aqqaluk Project. Final Supplemental Environmental Impact Statement. Seattle, WA.
- Wolfe, R. 2000. Subsistence in Alaska: A Year 2000 Update. Alaska Department of Fish and Game Division of Subsistence. Juneau, Alaska.

14.5.10. Tables

Table 14.5-1. Study Communities.

Number	Study Community	Community in Watershed	Use Area in Watershed	ADF&G Identified Study Community
1	Beluga		X	
2	Cantwell		X	X
3	Chase	X	No Data	X
4	Chickaloon		X	
5	Chistochina			X
6	Chitina		X	
7	Copper Center		X	
8	Copperville		No Data	X
9	Denali Hwy Households	X	No Data	
10	Eklutna		X	
11	Gakona		X	
12	Glennallen		X	X
13	Gulkana		X	X
14	Healy		X	
15	Kenny Lake		X	
16	Lake Louise	X	X	X
17	McCarthy		X	
18	McKinley Park		X	
19	Nelchina		No Data	X
20	Mendeltna	X	No Data	
21	Mentasta Lake			X
22	Nabesna			X
23	Parks Hwy Households (Chulitna, Gold Creek, Hurricane/Broad Pass)		No Data	
24	Paxson		X	X
25	Petersville	X	No Data	
26	Skwentna	X	X	X
27	Slana			X
28	Susitna	X	No Data	X
29	Talkeetna	X	No Data	
30	Tazlina		No Data	X
31	Tolsona		No Data	X
32	Tonsina		X	X
33	Trapper Creek	X	No Data	
34	Tyonek		X	
35	Wasilla ¹	X	No Data	
36	Western Susitna Basin		X	
37	Willow	X	No Data	

¹Wasilla includes the outlying CDPs of Big Lake, Buffalo-Soapstone, Fishhook, Houston, Knik-Fairview, Meadow Lakes, Point MacKenzie, and Tanaina.

Stephen R. Braund & Associates, 2012.

Table 14.5-2. Susitna Watershed Household Harvest Survey Added Study Communities.

Study Community ¹	Census Designated Place	Existing ADF&G Study Community	Additionally Selected for Household Harvest Surveys	Selected Nonsubsistence Household Surveys	for Area Harvest
Chase	X	X			
Denali Hwy Households					
Mendeltna	X		X		
Lake Louise	X		X		
Parks Hwy Households (Chulitna, Gold Creek, Hurricane/Broad Pass)					
Skwentna	X	X			
Susitna	X	X			
Talkeetna ²	X			X	
Trapper Creek ²	X			X	

¹Table includes only communities located within the Susitna River watershed outside of a State designated nonsubsistence area, with the exception of Talkeetna and Trapper Creek.
²Talkeetna and Trapper Creek, while located in a State designated nonsubsistence area, are included in this table because of their proximity to the nonsubsistence area boundary. Residents from these communities are presumed to travel outside the nonsubsistence area regularly to participate in subsistence activities.

Stephen R. Braund & Associates, 2012.

Table 14.5-3. Traditional Knowledge Criteria and Selected Study Communities.

Study Community	Community in Watershed	Documented Use Area in Watershed	50 Percent or more Alaska Native Population	Federally Recognized Tribe	Selected Traditional Knowledge Study Community
Beluga		X			
Cantwell		X		X	X
Chase	X	No Data			
Chickaloon		X		X	X
Chistochina			X	X	
Chitina		X		X	X
Copper Center		X	X	X	X
Denali Hwy Households	X	No Data	No Data		
Eklutna		X	No Data	X	X
Gakona		X		X	X
Glennallen		X			
Gulkana		X	X	X	X
Healy		X			
Kenny Lake		X			
Lake Louise	X	X			
McCarthy		X			
McKinley Park		X			
Mendeltna	X	No Data			
Mentasta Lake			X	X	
Nabesna					
Parks Hwy Households (Chulitna, Gold Creek, Hurricane/Broad Pass)	X	No Data	No Data		
Paxson		X			
Petersville	X	No Data			
Skwentna	X	X			
Slana					
Susitna	X	No Data			
Talkeetna	X	No Data			
Tonsina		X			
Trapper Creek	X	No Data			
Tyonek		X	X	X	X
Wasilla ¹	X	No Data			
Western Susitna Basin		X	No Data		
Willow	X	No Data			

¹Wasilla includes the outlying CDPs of Big Lake, Buffalo-Soapstone, Fishhook, Houston, Knik-Fairview, Meadow Lakes, Point MacKenzie, and Tanaina.

Stephen R. Braund & Associates, 2012.

Table 14.5-4. Schedule for implementation of the Subsistence Resources Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Subsistence Study Plan		—	—	—									
Task 2: ADF&G Household Surveys Pre-field Planning - Year 1			—	—									
Task 1: Compilation of Existing Data					—	—	—						
Task 2: ADF&G Household Survey - Year 1					—								
Task 2: ADF&G Reporting and Community Review - Year 1					—	—	—	—					
Task 2: ADF&G Household Surveys Pre-field Planning - Year 2								—					
Task 3: Household Surveys in Nonsubsistence Areas					—								
Task 5: Traditional and Local Knowledge Interviews					—	—							
Task 1-3, 5: Prepare 2013 Study Report and Community Reviews							—	—					
Initial Study Report							—	—	△				
Revise Study Plans (as needed)							-----	-----					
Task 2: ADF&G Household Survey - Year 2									—				
Task 2: ADF&G Reporting and Community Review - Year 2									—	—	—	—	
Task 4: Subsistence Mapping Interviews									—	—			
Task 4-5: Additional 2014 Subsistence Data Collection as needed									-----	-----			
Task 2-5: Prepare 2015 final Updated Study Report and Community Reviews											—	—	▲
Consultation	—	—	—	—									

Legend:

- Planned Activity
- Follow up activity (as needed)
- △ Initial Study Report
- ▲ Updated Study Report

Table 14.5-5. Study Communities Selected for Traditional Knowledge, Subsistence Mapping, and Household Harvest Surveys.

Number	Study Community	Traditional Knowledge Study Community	Subsistence Mapping Community ²	Study	Household Survey Community	Harvest Study
1	Beluga					
2	Cantwell	X	X		X	
3	Chase		X		X	
4	Chickaloon	X				
5	Chistochina					
6	Chitina	X				
7	Copper Center	X				
8	Copporville				X	
9	Denali Hwy Households					
10	Eklutna	X				
11	Gakona	X				
12	Glennallen				X	
13	Gulkana	X			X	
14	Healy		X			
15	Kenny Lake					
16	Lake Louise		X		X	
17	McCarthy					
18	McKinley Park		X			
19	Mendeltna				X	
20	Mentasta Lake					
21	Nabesna					
22	Nelchina				X	
23	Parks Hwy Households (Chulitna, Gold Creek, Hurricane/Broad Pass)					
24	Paxson				X	
25	Petersville		X			
26	Skwentna				X	
27	Slana					
28	Susitna				X	
29	Talkeetna		X		X	
30	Tazlina				X	
31	Tolsona				X	
32	Tonsina				X	
33	Trapper Creek		X		X	
34	Tyonek	X				
35	Wasilla ¹					
36	Western Susitna Basin					
37	Willow					

¹Wasilla includes the outlying CDPs of Big Lake, Buffalo-Soapstone, Fishhook, Houston, Knik-Fairview, Meadow Lakes, Point MacKenzie, and Tanaina.
²AEA will refine the list of identified subsistence mapping communities based on additional information (e.g., consultation with communities and agencies, adequacy of existing data, need for updated data, or suitability of community for subsistence mapping efforts).

Stephen R. Braund & Associates, 2012.

14.5.11. Figures

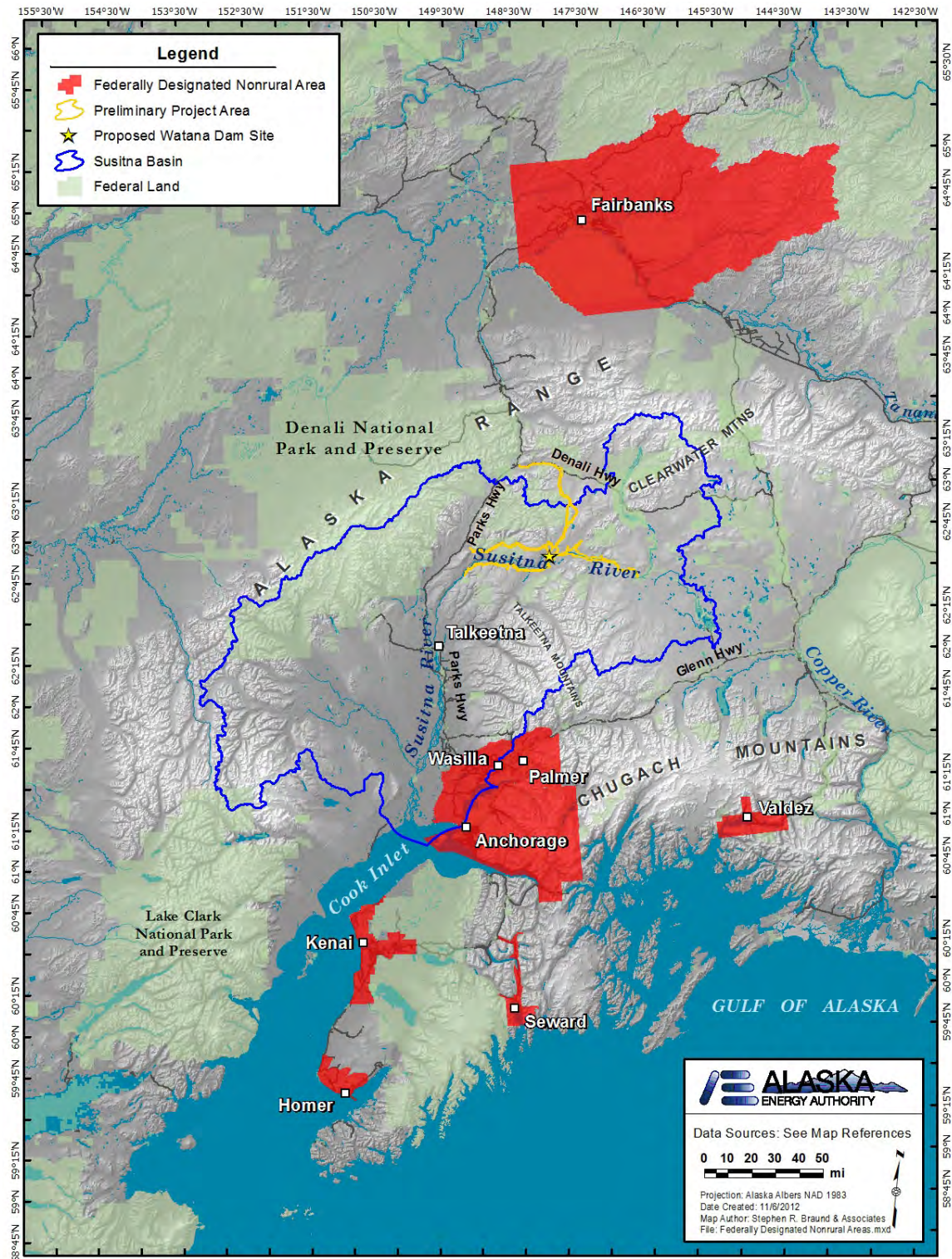


Figure 14.5-1. Federally Designated Nonrural Areas.

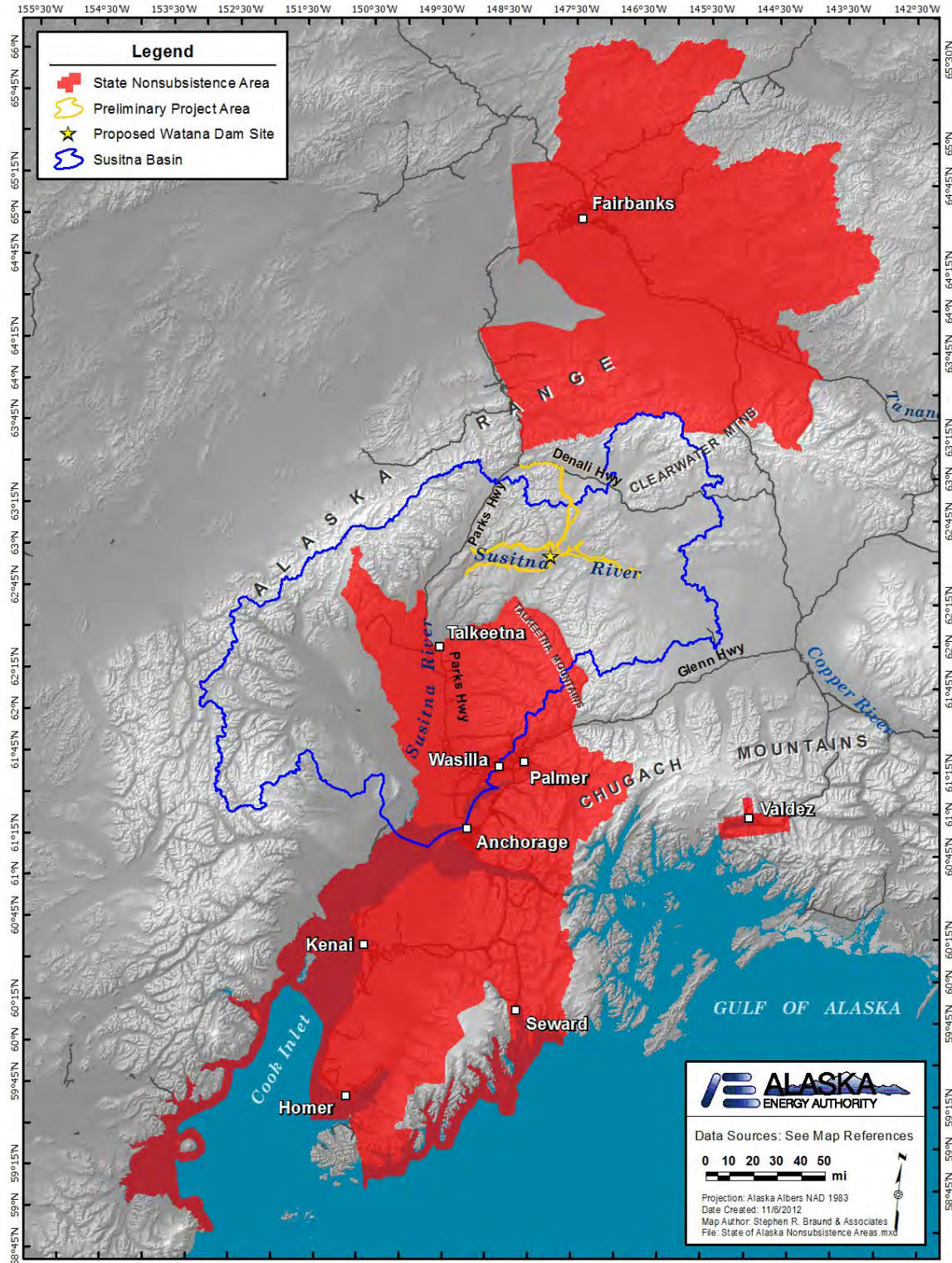


Figure 14.5-2. State of Alaska Designated Nonsubsistence Areas.

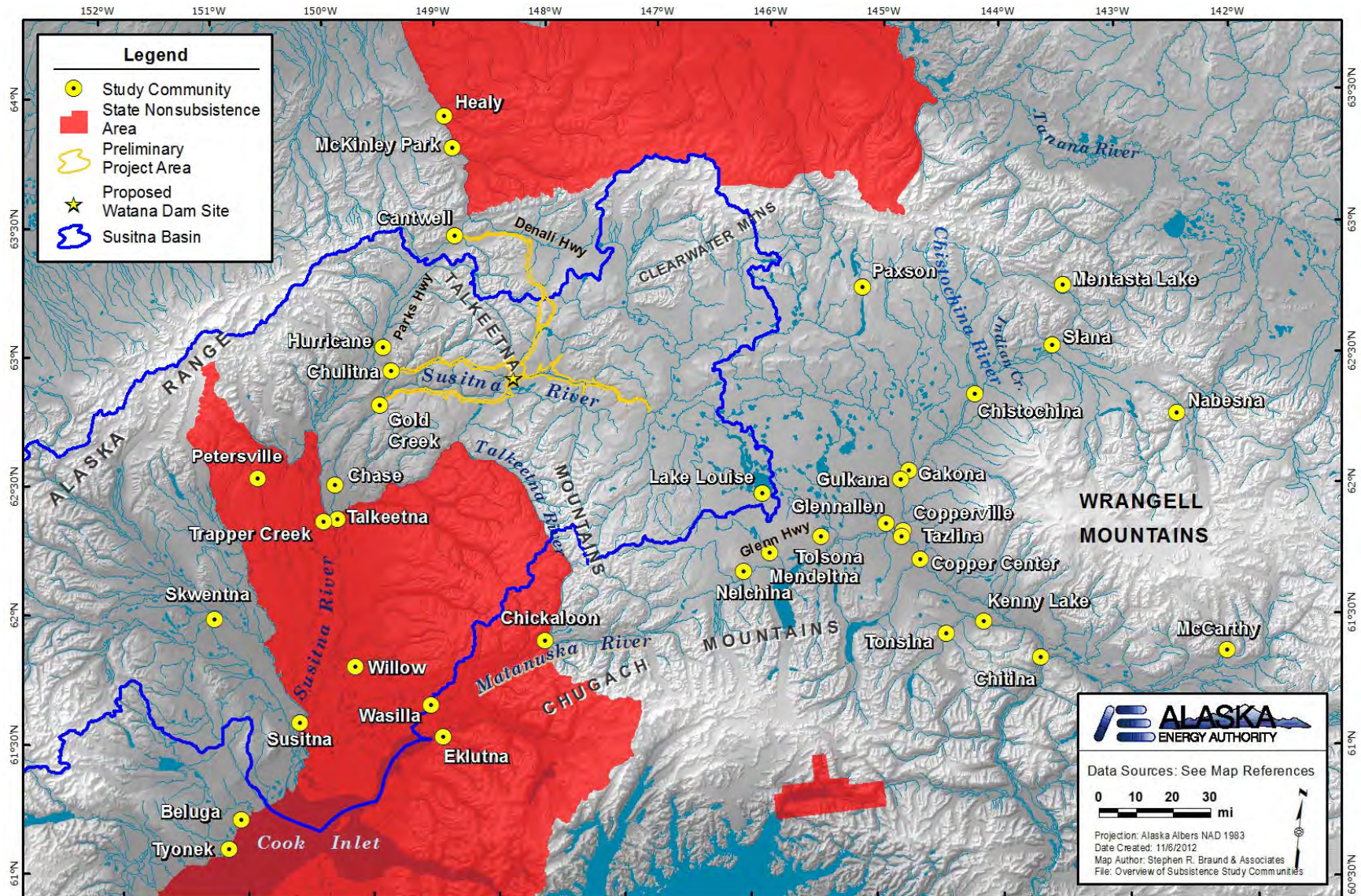


Figure 14.5-3. Overview of Subsistence Study Communities.

STUDY INTERDEPENDENCIES FOR SUBSISTENCE BASELINE DOCUMENTATION STUDY

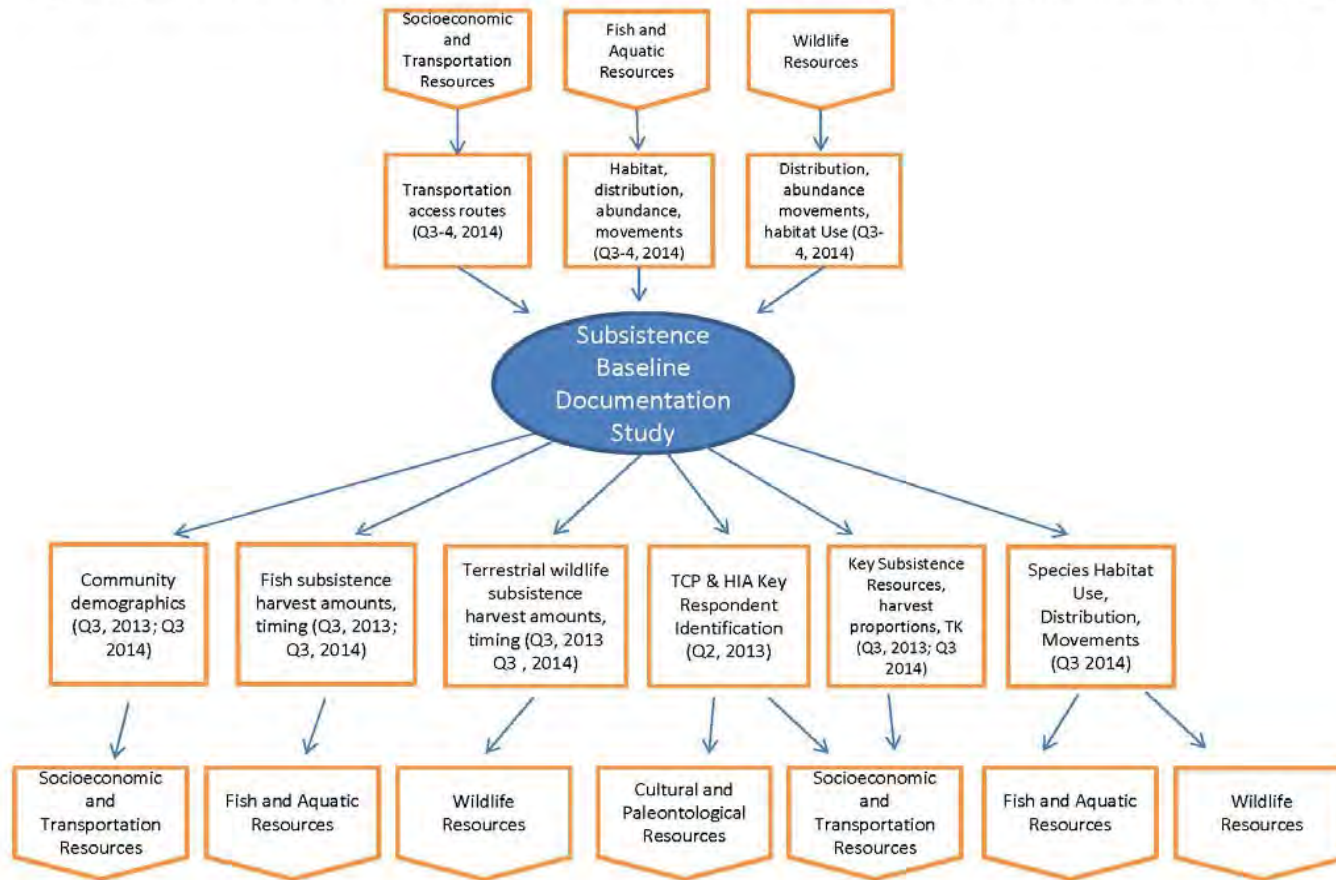


Figure 14.5-4. Study interdependencies for subsistence baseline documentation study.

14.6. Attachments

- ATTACHMENT 14-1. REVIEW OF COMMUNITIES AND SUBSISTENCE USE AREAS IN THE SUSITNA RIVER WATERSHED.
- ATTACHMENT 14-2. HOUSEHOLD HARVEST SURVEY INSTRUMENT (DRAFT).
- ATTACHMENT 14-3. HOUSEHOLD HARVEST SURVEY KEY INFORMANT INTERVIEW PROTOCOL (DRAFT).
- ATTACHMENT 14-4. ACTIVE HARVESTER SUBSISTENCE MAPPING INTERVIEW PROTOCOL (DRAFT).
- ATTACHMENT 14-5. TRADITIONAL KNOWLEDGE WORKSHOP PROTOCOL (DRAFT).

ATTACHMENT 14-1
REVIEW OF COMMUNITIES AND SUBSISTENCE USE AREAS IN THE
SUSITNA RIVER WATERSHED

Review of Communities and Subsistence Use Areas in the Susitna River Watershed

The study team reviewed the communities included in the Alaska Department of Fish and Game (ADF&G) scope of work and in the subsistence data gap analysis prepared by Northern Land Use Research, Inc. (NLUR). In addition, the study team identified four other communities that are located, or whose use areas are located, in the Susitna River watershed. These include Chickaloon, Eklutna, Healy, and Lake Louise. Because subsistence use area study is available for the Western Susitna Basin (communities not specified), this region was included in the review. The study team reviewed a total of 42 communities (including a regional use area for the Western Susitna Basin and dispersed households along the Parks Highway and Denali Highway). These communities are listed in Table 1 and depicted on Map 1. The study team reviewed each community for its proximity to the Susitna River watershed, and for the proximity of the community's subsistence use areas (if available) to the Susitna River watershed. In addition, the study team identified whether recent (last three year) harvest data are available for each community. As noted in Table 1, harvest data as collected by ADF&G do not provide all subsistence baseline indicators that are important for characterizing baseline subsistence uses or assessing potential impacts on subsistence uses. Additional baseline indicators not generally available through ADF&G harvest data include multi-year subsistence use areas, comprehensive seasonal round, transportation methods, trip duration, trip frequency, and traditional knowledge including harvester observations of resource change.

As shown in Table 1, the study team identified 14 communities located within the Susitna River watershed, and 18 communities whose use areas are located within the Susitna River watershed. Subsistence use area data are not available for 19 communities. A total of 30 communities are either located within the Susitna River watershed or have use areas that are located within the Susitna River watershed. Map 1 counts do not include the Western Susitna Basin use areas, Denali Highway dispersed households, and Parks Highway dispersed households.

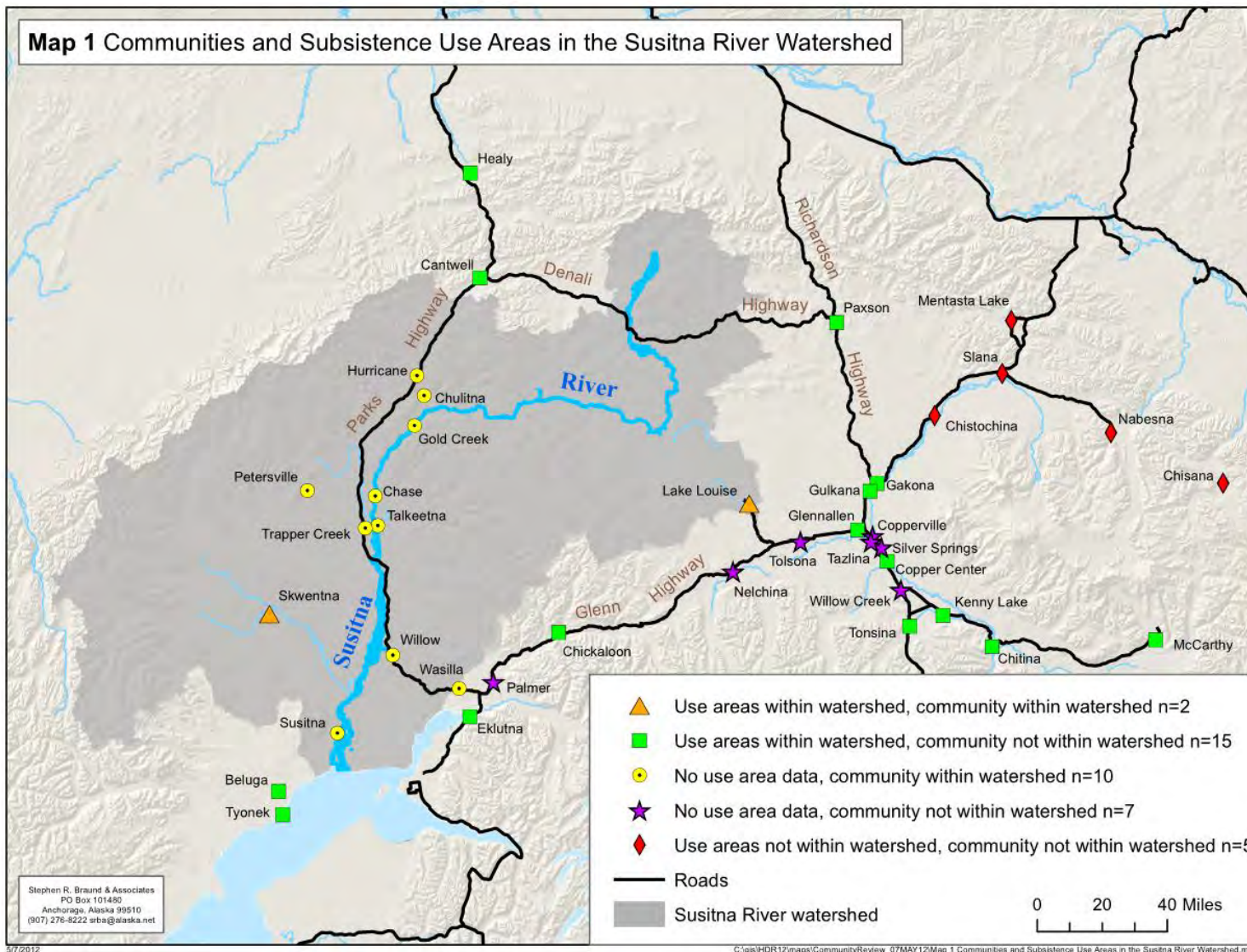
Recent (last three year) harvest data are currently available for only 11 of the 42 communities in Table 1. In their scope of work, ADF&G included communities that are not located in the Susitna River watershed and whose use areas are not included in the Susitna River watershed. These include Chistochina, Mentasta, Nabesna, and Slana. In addition, ADF&G included communities that are not located in the Susitna River watershed for which no use area data are available. These include Copperville, Nelchina, Silver Springs, Tazlina, Tolsona, and Willow Creek.

In their subsistence data gap analysis, NLUR included communities that are not located in the Susitna River watershed and whose use areas are not included in the Susitna River watershed. These include Chisana, Chistochina, Mentasta, and Slana. In addition, NLUR included communities that are not located in the Susitna River watershed for which no use area data are available. These include Copperville, Palmer, Silver Springs, and Tazlina.

Table 1. Communities and Subsistence Use Areas in the Susitna River Watershed

	Community	Reason for Study Community Consideration			Proximity to Susitna River Watershed					Harvest Data Last 3 Years (2009 or Later) ¹	Notes
		ADF&G SOW	NLUR Data Gap	Added Based on Community or Use Area in Watershed	Community in Watershed	Approximate Distance (in Miles) of Community from Watershed	Use Area in Watershed	Approximate Distance (in Miles) of Use Area from Watershed	Community and/or Use Area in Watershed		
1	Beluga	x				11	x	0	x		
2	Cantwell	x	x			5	x	0	x		
3	Chase	x	x		x	0	No Data	No Data	x		
4	Chickaloon			x		14	x	0	x		
5	Chisana		x			143		95			
6	Chistochina	x	x			53		25		x	
7	Chitina	x				85	x	0	x	x	
8	Chulitna		x		x	0	No Data	No Data	x		
9	Copper Center	x	x			45	x	0	x	x	
10	Copperville	x	x			35	No Data	No Data	No Data		
11	Denali Hwy Households & Lodges		x		x	n/a	No Data	No Data	x		Portion of Denali Highway is in watershed.
12	Eklutna			x		9	x	0	x		
13	Gakona	x	x			35	x	0	x	x	
14	Glennallen	x	x			30	x	0	x		
15	Gold Creek		x		x	0	No Data	No Data	x		
16	Gulkana	x	x			35	x	0	x		
17	Healy			x		32	x	0	x		
18	Hurricane/Broad Pass		x		x	0	No Data	No Data	x		
19	Kenny Lake	x				62	x	0	x	x	
20	Lake Louise			x	x	0	x	0	x		
21	McCarthy	x	x			127	x	0	x	x	
22	Mentasta	x	x			71		52		x	
23	Nabesna	x				107		52		x	
24	Nelchina	x				10	No Data	No Data	No Data		
25	Palmer		x			8	No Data	No Data	No Data		
26	Parks Hwy Dispersed Households		x		x	n/a	No Data	No Data	x		Parks Highway transects watershed
27	Paxson	x	x			23	x	0	x		
28	Petersville		x		x	0	No Data	No Data	x		
29	Silver Springs	x	x			37	No Data	No Data	No Data	x	
30	Skwentna	x			x	0	x	0	x		Use Areas for Upper Yentna
31	Slana	x	x			70		42		x	
32	Susitna	x			x	0	No Data	No Data	x		
33	Talkeetna		x		x	0	No Data	No Data	x		
34	Tazlina	x	x			37	No Data	No Data	No Data		
35	Tolsona	x				14	No Data	No Data	No Data		
36	Tonsina	x				56	x	0	x		
37	Trapper Creek		x		x	0	No Data	No Data	x		
38	Tyonek	x				17	x	0	x		
39	Wasilla		x		x	0	No Data	No Data	x		
40	Western Susitna Basin			x	n/a	n/a	x	0	x		Use area data are not provided at a community-specific level
41	Willow		x		x	0	No Data	No Data	x		
42	Willow Creek	x				48	No Data	No Data	No Data	x	

¹Includes harvest data collected during ADF&G household harvest surveys. Harvest data generally include subsistence baseline indicators related to harvest amounts, harvest effort, harvest success, harvest participation, harvest sharing, and harvest diversity. Additional subsistence baseline indicators not generally available through ADF&G harvest data include subsistence use areas, seasonal round, transportation methods, trip duration, trip frequency, and traditional knowledge including harvester observations of resource change. This document does not review the availability of additional subsistence baseline indicators for the potential study communities.



ATTACHMENT 14-2
HOUSEHOLD HARVEST SURVEY INSTRUMENT (DRAFT)

COMPREHENSIVE SUBSISTENCE SURVEY

SUSITNA, ALASKA

January to December, 2012

This survey is used to estimate subsistence harvests and to describe community subsistence economies. We will publish a summary report, and send it to all households in your community. We share the community information with the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Park Service. We work with the Federal Regional Advisory Councils and with local Fish and Game Advisory Committees to better manage subsistence, and to implement federal and state subsistence priorities.

We will NOT identify your household. We will NOT use this information for enforcement. Participation in this survey is voluntary. Even if you agree to be surveyed, you may stop at any time.

HOUSEHOLD ID:		
COMMUNITY ID:	SUSITNA	330
RESPONDENT ID:		
INTERVIEWER:		
INTERVIEW DATE:		
START TIME:		
STOP TIME:		
	DATA CODED BY:	
	DATA ENTERED BY:	
	SUPERVISOR:	

COOPERATING ORGANIZATIONS

STEPHEN R. BRAUND
AND ASSOCIATES
PO BOX 1480
ANCHORAGE, AK 99510

907-276-8222

DIVISION OF PUBLIC HEALTH
HEALTH AND SOCIAL SERVICES
3601 C STREET, SUITE 540
ANCHORAGE, AK 99503

907-269-8000

DIVISION OF SUBSISTENCE
ALASKA DEPT OF FISH & GAME
333 RASPBERRY ROAD
ANCHORAGE, AK 99518

907-267-2353

HDR
2525 C STREET, SUITE 305
ANCHORAGE, AK 99503

907-644-2117

HOUSEHOLD MEMBERS HOUSEHOLD ID

Between JANUARY and DECEMBER, 2012...
 ...who lived in your household?

ID#	IS THIS PERSON ANSWERING QUESTIONS ON THIS SURVEY?	MALE OR FEMALE?	ALASKA NATIVE?	IN WHAT YEAR WAS THIS PERSON BORN?	WHERE WERE PARENTS LIVING WHEN THIS PERSON WAS BORN?	HOW IS THIS PERSON RELATED TO HOUSEHOLD HEAD 1?	HOW MANY YEARS HAS THIS PERSON LIVED IN SUSITNA?
	(circle)	(circle)	(circle)	(year)	(ak city or state)	(relation)	(number)
HEAD 1	Y N	M F	Y N				YRS
01							
<i>Enter spouse or partner next. If household has a SINGLE HEAD, leave HEAD 2 blank.</i>							
HEAD 2	Y N	M F	Y N				YRS
02							
<i>Enter children (oldest to youngest), grandchildren, grandparents, brothers, sisters, or anyone else living full-time in this household.</i>							
03	Y N	M F	Y N				YRS
04	Y N	M F	Y N				YRS
05	Y N	M F	Y N				YRS
06	Y N	M F	Y N				YRS
07	Y N	M F	Y N				YRS
08	Y N	M F	Y N				YRS
09	Y N	M F	Y N				YRS
10	Y N	M F	Y N				YRS
11	Y N	M F	Y N				YRS
12	Y N	M F	Y N				YRS
13	Y N	M F	Y N				YRS
14	Y N	M F	Y N				YRS
15	Y N	M F	Y N				YRS

HOUSEHOLD MEMBER PARTICIPATION

HOUSEHOLD ID

Between JANUARY and DECEMBER, 2012...
...did this person...

PERSON ID# FROM Page 2	Fish		Large Land Mammals		Small Land Mammals Furbearers		Birds & Eggs		Plants/Berries/Wood	
	Fish (circle)	Process (circle)	Hunt (circle)	Process (circle)	Hunt/Trap (circle)	Process (circle)	Hunt/Gather (circle)	Process (circle)	Gather (circle)	Process (circle)
Head 1	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Head 2	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
03	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
04	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
05	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
06	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
07	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
08	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
09	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
10	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
11	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
12	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
13	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
14	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N
15	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N

PERMANENT HH MEMBERS: 01

SUSITNA: 330

HARVESTS: COMMERCIAL SALMON FISHING

HOUSEHOLD ID

Do members of your household USUALLY participate in COMMERCIAL SALMON FISHING ?..... Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household participate in commercial salmon fishing?..... Y N

IF NO, go to the next harvest page.

If YES, continue on this page...

Please estimate the number of salmon ALL MEMBERS OF YOUR HOUSEHOLD REMOVED FROM COMMERCIAL HARVEST FOR PERSONAL USE OR SHARING in 2012. INCLUDE the fish you gave away, ate fresh, fed to dogs, lost to spoilage, caught as incidental catch while fishing for another species, or got by helping others. If harvested with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...		IN 2012, HOW MANY WERE REMOVED FOR YOUR OWN USE? (number)	IN 2012, HOW MANY DID YOU REMOVE FROM THE CATCH & GIVE AWAY TO CREW OR OTHERS? CREW OTHERS (number) (number)		ID NUMBER FROM PAGE 2	
	COMMERCIAL FISH FOR _____? (circle)	CATCH AS INCIDENTAL CATCH _____? (circle)		PERMIT HOLDER (number)	CREW (number)		
	Y N	Y N					
CHINOOK (KING) SALMON 113000000	Y N	Y N	IND	IND	IND		
SOCKEYE (RED) SALMON 115000000	Y N	Y N	IND	IND	IND		
COHO (SILVER) SALMON 112000000	Y N	Y N	IND	IND	IND		
CHUM (DOG) SALMON 111000000	Y N	Y N	IND	IND	IND		
PINK (HUMPIES) SALMON 114000000	Y N	Y N	IND	IND	IND		
UNKNOWN SALMON 119000000	Y N	Y N	IND	IND	IND		

HARVESTS: COMMERCIAL NON-SALMON FISHING

HOUSEHOLD ID

Do members of your household USUALLY participate in COMMERCIAL NON-SALMON FISHING ?..... Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household participate in commercial non-salmon fishing?..... Y N

IF NO, go to the next harvest page.

If YES, continue on this page...

Please estimate the number of commercially harvested non-salmon fish ALL MEMBERS OF YOUR HOUSEHOLD REMOVED FROM COMMERCIAL HARVEST FOR PERSONAL USE OR SHARING in 2012. INCLUDE the fish you gave away, ate fresh, fed to dogs, lost to spoilage, caught as incidental catch while fishing for another species, or got by helping others. If harvested with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...		IN 2012, HOW MANY WERE REMOVED FOR YOUR OWN USE? (number)	IN 2012, HOW MANY DID YOU REMOVE FROM THE CATCH & GIVE AWAY TO CREW OR OTHERS? CREW OTHERS (number) (number)		ID NUMBER FROM PAGE 2	
	COMMERCIAL FISH FOR _____? (circle)	CATCH AS INCIDENTAL CATCH _____? (circle)				PERMIT HOLDER (number)	CREW (number)
	Y N	Y N					
HALIBUT 121800000	Y N	Y N	LBS	LBS	LBS		
HERRING 120200000	Y N	Y N	GAL	GAL	GAL		
HERRING SPAWN ON KELP 120306000	Y N	Y N	GAL	GAL	GAL		
HERRING SAC ROE 120304000	Y N	Y N	GAL	GAL	GAL		
PACIFIC COD (GRAY) 121004000	Y N	Y N	IND	IND	IND		
PACIFIC TOM COD 121008000	Y N	Y N	IND	IND	IND		
SCULPIN 123000000	Y N	Y N	IND	IND	IND		
STARRY FLOUNDER 121406000	Y N	Y N	IND	IND	IND		
SMELT 120400000	Y N	Y N	GAL	GAL	GAL		
ROCKFISH 122600000	Y N	Y N	IND	IND	IND		
LAMPREY 122000000	Y N	Y N	IND	IND	IND		
LINGCOD 121606000	Y N	Y N	IND	IND	IND		

HARVESTS: COMMERCIAL MARINE INVERTEBRATE HARVEST

HOUSEHOLD ID

Do members of your household USUALLY participate in COMMERCIAL MARINE INVERTEBRATE HARVEST ?..... Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household participate in commercial marine invertebrate harvest?..... Y N

If NO, go to the next harvest page.

If YES, continue on this page...

Please estimate the commercially harvested marine invertebrates ALL MEMBERS OF YOUR HOUSEHOLD REMOVED FROM COMMERCIAL HARVEST in 2012. INCLUDE the marine invertebrates you gave away, ate fresh, fed to dogs, lost to spoilage, caught as incidental catch while fishing for another species, or got by helping others. If harvested with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...		IN 2012, HOW MANY WERE REMOVED FOR YOUR OWN USE? <i>(number)</i>	IN 2012, HOW MANY DID YOU REMOVE FROM THE CATCH & GIVE AWAY TO CREW OR OTHERS? <i>(number)</i>		ID NUMBER FROM PAGE 2	
	COMMERCIAL FISH FOR _____? <i>(circle)</i>	CATCH AS INCIDENTAL CATCH _____? <i>(circle)</i>		CREW	OTHERS	PERMIT HOLDER <i>(number)</i>	CREW <i>(number)</i>
	Y N	Y N		LBS	LBS	LBS	
TANNER CRAB 501012000	Y N	Y N	LBS	LBS	LBS		
DUNGENESS CRAB 501004000	Y N	Y N	LBS	LBS	LBS		
SHRIMP 503400000	Y N	Y N	GAL	GAL	GAL		
SQUID 503800000	Y N	Y N	GAL	GAL	GAL		
OCTOPUS 502200000	Y N	Y N	IND	IND	IND		
KING CRAB 501008000	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					
	Y N	Y N					

HARVESTS: SALMON

(NON-COMMERCIAL)

HOUSEHOLD ID

Do members of your household USUALLY harvest SALMON?..... Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST salmon?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many salmon ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012, including with a rod and reel. INCLUDE salmon you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch. Do not include fish caught and released.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID YOUR HOUSEHOLD...					UNITS <i>(ind, lbs)</i>
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	...CATCH WITH A FISH WHEEL?	...CATCH WITH A GILL NET OR SEINE?	...CATCH WITH A DIPNET?	...CATCH WITH ROD AND REEL?	...CATCH WITH OTHER GEAR?	
	<i>(circle)</i>					<i>(number taken by each gear type)</i>					
CHINOOK (KING) SALMON113000000	Y N	Y N	Y N	Y N	Y N						IND
SOCKEYE (RED) SALMON115000000	Y N	Y N	Y N	Y N	Y N						IND
COHO (SILVER) SALMON112000000	Y N	Y N	Y N	Y N	Y N						IND
CHUM (DOG) SALMON111000000	Y N	Y N	Y N	Y N	Y N						IND
PINK (HUMPIES) SALMON114000000	Y N	Y N	Y N	Y N	Y N						IND
LANDLOCKED SALMON <i>Kokane</i>116000000	Y N	Y N	Y N	Y N	Y N						IND
UNKNOWN SALMON119000000	Y N	Y N	Y N	Y N	Y N						IND
						<i>These columns should include all the harvests: salmon HARVESTED by members of this household in 2012.</i>					

ASSESSMENTS: SALMON

Between JANUARY and DECEMBER, 2012...

To conclude our salmon section, I am going to ask a few general questions about salmon.

Last year...

...did your household use LESS, SAME, or MORE salmon than in recent years?..... X L S M

X = do not use

If LESS or MORE...

WHY was your use different?.....

_____ 1

_____ 2

Last year...

...did your household GET ENOUGH salmon?..... Y N

If NO...

What KIND of salmon did you need?.....

How would you describe the impact to your household
of not getting enough salmon last year?.....

...minor? (1) ...major? (2) severe? (3)

HARVESTS: OTHER FISH

(NON-COMMERCIAL)

HOUSEHOLD ID

Do members of your household USUALLY harvest OTHER FISH ?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST other fish?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many other fish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012, including with a rod and reel. INCLUDE other fish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch. Do not include fish caught and released

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY DID YOUR HOUSEHOLD...				UNITS <i>(ind, lbs)</i>
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	...CATCH WITH GILL NET OR SEINE?	...CATCH WITH ROD AND REEL?	...CATCH WITH ICE FISHING?	...CATCH WITH OTHER GEAR?	
	<i>(circle)</i>					<i>(number taken by each gear type)</i>				
RAINBOW TROUT 126204000	Y N	Y N	Y N	Y N	Y N					IND
LAKE TROUT 125010000	Y N	Y N	Y N	Y N	Y N					IND
CUTTHROAT TROUT 126202000	Y N	Y N	Y N	Y N	Y N					IND
TROUT <i>Unknown</i> 126200000	Y N	Y N	Y N	Y N	Y N					IND
DOLLY VARDEN 125006000	Y N	Y N	Y N	Y N	Y N					IND
GRAYLING 125200000	Y N	Y N	Y N	Y N	Y N					IND
PIKE 125400000	Y N	Y N	Y N	Y N	Y N					IND
BURBOT <i>Ling Cod</i> 124800000	Y N	Y N	Y N	Y N	Y N					IND
ROUND WHITEFISH 126412000	Y N	Y N	Y N	Y N	Y N					IND
HUMPBACK WHITEFISH 126408000	Y N	Y N	Y N	Y N	Y N					IND
BROAD WHITEFISH 126404000	Y N	Y N	Y N	Y N	Y N					IND
LEAST CISCO 126406060	Y N	Y N	Y N	Y N	Y N					IND
UNKNOWN WHITEFISH 126400000	Y N	Y N	Y N	Y N	Y N					IND
SUCKER 126000000	Y N	Y N	Y N	Y N	Y N					IND

Continue on next page

These columns should include all the harvests: other fish HARVESTED by members of this household in 2012.

HARVESTS: OTHER FISH (NON-COMMERCIAL) HOUSEHOLD ID

...continued

Please estimate how many other fish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012, including with a rod and reel. INCLUDE other fish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch. Do not include fish caught and released.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID YOUR HOUSEHOLD...				UNITS <i>(ind, lbs)</i>
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	...CATCH WITH GILL NET OR SEINE?	...CATCH WITH ROD AND REEL?	...CATCH WITH ICE FISHING?	...CATCH WITH OTHER GEAR?	
	<i>(circle)</i>					<i>(number taken by each gear type)</i>				
HALIBUT 121800000	Y N	Y N	Y N	Y N	Y N					LBS
HERRING 120200000	Y N	Y N	Y N	Y N	Y N					GAL
PACIFIC COD (GRAY) 121004000	Y N	Y N	Y N	Y N	Y N					IND
PACIFIC TOM COD 121008000	Y N	Y N	Y N	Y N	Y N					IND
STARRY FLOUNDER 121406000	Y N	Y N	Y N	Y N	Y N					IND
SMELT 120400000	Y N	Y N	Y N	Y N	Y N					GAL
ROCKFISH 122600000	Y N	Y N	Y N	Y N	Y N					IND
LAMPREY 122000000	Y N	Y N	Y N	Y N	Y N					IND
LINGCOD 121606000	Y N	Y N	Y N	Y N	Y N					IND
	Y N	Y N	Y N	Y N	Y N					

These columns should include all the harvests: other fish HARVESTED by members of this household in 2012.

OTHER FISH

Between JANUARY and DECEMBER, 2012...

To conclude our other fish section, I am going to ask a few general questions about other fish.

Last year...

...did your household use LESS, SAME, or MORE other fish than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1

2

Last year...

...did your household GET ENOUGH other fish?..... Y N

If NO...

What KIND of other fish did you need?.....

How would you describe the impact to your household

of not getting enough other fish last year?.....

...minor? (1) ...major? (2) severe? (3)

HARVESTS: MARINE INVERTEBRATES/SHELLFISH

HOUSEHOLD ID

Do members of your household USUALLY harvest MARINE INVERTEBRATES/SHELLFISH ?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST marine invertebrates/shellfish ?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many marine invertebrates/shellfish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE marine invertebrates/shellfish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID YOUR HOUSEHOLD HARVEST? <i>(number taken)</i>	UNITS <i>(ind, lbs, gal)</i>
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?		
	<i>(circle)</i>						
DUNGENESS CRAB	Y N	Y N	Y N	Y N	Y N		LBS
-501004000							
KING CRAB	Y N	Y N	Y N	Y N	Y N		LBS
-501008000							
TANNER CRAB	Y N	Y N	Y N	Y N	Y N		LBS
-501012000							
RAZOR CLAMS	Y N	Y N	Y N	Y N	Y N		GAL
-500612000							
FRESHWATER CLAMS	Y N	Y N	Y N	Y N	Y N		GAL
-500604000							
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		

These columns should include all the harvests: marine invertebrates/shellfish HARVESTED by members of this household in 2012.

MARINE INVERTEBRATES/SHELLFISH

Between JANUARY and DECEMBER, 2012...

To conclude our marine invertebrates/shellfish section, I am going to ask a few general questions about marine invertebrates/shellfish.

Last year...

...did your household use LESS, SAME, or MORE marine invertebrates/shellfish than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1

2

Last year...

...did your household GET ENOUGH marine invertebrates/shellfish?..... Y N

If NO...

What KIND of marine invertebrates/shellfish did you need?.....

How would you describe the impact to your household

of not getting enough marine invertebrates/shellfish last year?.....

...minor?
(1)

...major?
(2)

severe?
(3)

HARVESTS: LARGE LAND MAMMALS

HOUSEHOLD ID

Do members of your household USUALLY hunt for LARGE LAND MAMMALS?.....Y N

Between JANUARY and DECEMBER, 2012...
 ...Did members of your household USE or TRY TO HARVEST large land mammals?.....Y N

IF NO to both questions, go to the next harvest page.
 If YES, continue on this page...

Please estimate how many large land mammals ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE large land mammals you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If hunting with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?													UNITS		
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	SEX	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER		UNKNOWN	
	(circle)					(enter number by sex and month of take)														(ind)	
MOOSE	Y N	Y N	Y N	Y N	Y N	M															IND
.....211800000						F															
.....211800001						?															
.....211800002						M															
.....211800009						F															
.....211800009						?															
CARIBOU	Y N	Y N	Y N	Y N	Y N	M														IND	
.....211000000						F															
.....211000001						?															
.....211000002						M															
.....211000009						F															
.....211000009						?															
BLACK BEAR	Y N	Y N	Y N	Y N	Y N															IND	
.....210600000																					
BROWN BEAR	Y N	Y N	Y N	Y N	Y N															IND	
.....210800000																					
DALL SHEEP	Y N	Y N	Y N	Y N	Y N															IND	
.....212200000																					
GOAT	Y N	Y N	Y N	Y N	Y N															IND	
.....211600000																					
DEER	Y N	Y N	Y N	Y N	Y N															IND	
.....211200000																					
	Y N	Y N	Y N	Y N	Y N															IND	

LARGE LAND MAMMALS

Between JANUARY and DECEMBER, 2012...

To conclude our large land mammals section, I am going to ask a few general questions about large land mammals.

Last year...
 ...did your household use LESS, SAME, or MORE large land mammals than in recent years?..... X L S M
 If LESS or MORE... X = do not use
 WHY was your use different?.....

Last year...
 ...did your household GET ENOUGH large land mammals?..... Y N
 If NO...
 What KIND of large land mammals did you need?.....

How would you describe the impact to your household
 of not getting enough large land mammals last year?..... ...minor? ...major? severe?
 (1) (2) (3)

HARVESTS: SMALL LAND MAMMALS OR FURBEARERS

HOUSEHOLD ID

Do members of your household USUALLY hunt or trap for SMALL LAND MAMMALS OR FURBEARERS for subsistence?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST small land mammals or furbearers?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many small land mammals or furbearers ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE small land mammals or furbearers you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If hunting or trapping with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?												UNITS		
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER		UNKNOWN	
	(circle)					(enter number by month of take)													(ind)	
BEAVER 220200000	Y N	Y N	Y N	Y N	Y N															IND
PORCUPINE 222600000	Y N	Y N	Y N	Y N	Y N															IND
SNOWSHOE HARE 221004000	Y N	Y N	Y N	Y N	Y N															IND
RED FOX 220804000	Y N	Y N	Y N	Y N	Y N															IND
CROSS FOX 220804020	Y N	Y N	Y N	Y N	Y N															IND
WOLF 223200000	Y N	Y N	Y N	Y N	Y N															IND
WOLVERINE 223400000	Y N	Y N	Y N	Y N	Y N															IND
LAND OTTER 221200000	Y N	Y N	Y N	Y N	Y N															IND
MUSKRAT 222400000	Y N	Y N	Y N	Y N	Y N															IND
WEASEL 223000000	Y N	Y N	Y N	Y N	Y N															IND
LYNX 221600000	Y N	Y N	Y N	Y N	Y N															IND
	Y N	Y N	Y N	Y N	Y N															IND

Continue on next page

HARVESTS: SMALL LAND MAMMALS OR FURBEARERS

HOUSEHOLD ID

....continued

Please estimate how many small land mammals or furbearers ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE small land mammals or furbearers you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If hunting or trapping with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?												UNITS		
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER		UNKNOWN	
	(circle)					(enter number by month of take)													(ind)	
MARTEN 222000000	Y N	Y N	Y N	Y N	Y N															IND
COYOTE 220400000	Y N	Y N	Y N	Y N	Y N															IND
MINK 222200000	Y N	Y N	Y N	Y N	Y N															IND
MARMOT 221800000	Y N	Y N	Y N	Y N	Y N															IND
GROUND SQUIRREL 222800000	Y N	Y N	Y N	Y N	Y N															IND
TREE SQUIRREL 222804000	Y N	Y N	Y N	Y N	Y N															IND
	Y N	Y N	Y N	Y N	Y N															IND
	Y N	Y N	Y N	Y N	Y N															IND

SMALL LAND MAMMALS OR FURBEARERS

Between JANUARY and DECEMBER, 2012...

To conclude our small land mammals or furbearers section, I am going to ask a few general questions about small land mammals or furbearers. Last year...

...did your household use LESS, SAME, or MORE small land mammals or furbearers than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

- 1
- 2

Last year...

...did your household GET ENOUGH small land mammals or furbearers?..... Y N

If NO...

What KIND of small land mammals or furbearers did you need?.....

How would you describe the impact to your household

of not getting enough small land mammals or furbearers last year?..... ...minor? ...major? severe?
(1) (2) (3)

HARVESTS: MIGRATORY WATERFOWL

HOUSEHOLD ID

Do members of your household USUALLY hunt for MIGRATORY WATERFOWL?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST migratory waterfowl?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many migratory waterfowl ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE migratory waterfowl you gave away, ate fresh, lost to spoilage, or got by helping others. If hunting with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD ?								
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	Spring			Summer		Fall		UNKNOWN	
						APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER		
	<i>(circle)</i>													
CANADA GEESE (CACKLERS)	Y N	Y N	Y N	Y N	Y N									
410404040														
CANADA GEESE (BIG LESSER)	Y N	Y N	Y N	Y N	Y N									
410404080														
CANADA GEESE (UNKNOWN)	Y N	Y N	Y N	Y N	Y N									
410404000														
WHITE-FRONTED GEESE <i>Specklebelly</i>	Y N	Y N	Y N	Y N	Y N									
410410000														
SPECTACLED EIDER	Y N	Y N	Y N	Y N	Y N									
410206060														
BRANT (SEA GEESE)	Y N	Y N	Y N	Y N	Y N									
410402000														
EMPEROR GEESE	Y N	Y N	Y N	Y N	Y N									
410406000														
SNOW GEESE	Y N	Y N	Y N	Y N	Y N									
410408000														
GEESE (UNKNOWN)	Y N	Y N	Y N	Y N	Y N									
410400000														
TUNDRA SWAN (WHISTLING)	Y N	Y N	Y N	Y N	Y N									
410604000														
SANDHILL CRANE	Y N	Y N	Y N	Y N	Y N									
410802000														
MALLARD	Y N	Y N	Y N	Y N	Y N									
410214000														
NORTHERN PINTAIL	Y N	Y N	Y N	Y N	Y N									
410220000														

Continue on next page.

HARVESTS: MIGRATORY WATERFOWL

...continued

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD ?							
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	Spring			Summer		Fall		UNKNOWN
						APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	
GOLDENEYE 410210000	Y N	Y N	Y N	Y N	Y N								
GREEN WINGED TEAL 410232060	Y N	Y N	Y N	Y N	Y N								
CANVASBACK 410204000	Y N	Y N	Y N	Y N	Y N								
BLACK SCOTER (BLACK DUCK) 410228020	Y N	Y N	Y N	Y N	Y N								
DUCKS (UNKNOWN) 410200000	Y N	Y N	Y N	Y N	Y N								
	Y N	Y N	Y N	Y N	Y N								
	Y N	Y N	Y N	Y N	Y N								
	Y N	Y N	Y N	Y N	Y N								
	Y N	Y N	Y N	Y N	Y N								

MIGRATORY WATERFOWL

Between JANUARY and DECEMBER, 2012...

To conclude our migratory waterfowl section, I am going to ask a few general questions about migratory waterfowl.

Last year...

...did your household use LESS, SAME, or MORE migratory waterfowl than in recent years?.....

X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1
2

Last year...

...did your household GET ENOUGH migratory waterfowl?..... Y N

If NO...

What KIND of migratory waterfowl did you need?.....

How would you describe the impact to your household

of not getting enough migratory waterfowl last year?.....

...minor? (1) ...major? (2) severe? (3)

HARVESTS: OTHER BIRDS

HOUSEHOLD ID

Do members of your household USUALLY hunt for OTHER BIRDS?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST other birds?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many other birds ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2012. INCLUDE other birds you gave away, ate fresh, lost to spoilage, or got by helping others. If hunting with others, report ONLY YOUR SHARE of the catch.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?												
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	Winter			Spring			Summer		Fall		Winter		UNKNOWN
						JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	
PTARMIGAN	Y N	Y N	Y N	Y N	Y N													
421804000																		
SPRUCE GROUSE	Y N	Y N	Y N	Y N	Y N													
421802020																		
RUFFED GROUSE	Y N	Y N	Y N	Y N	Y N													
421802060																		
SHARP-TAILED GROUSE	Y N	Y N	Y N	Y N	Y N													
421802040																		
	Y N	Y N	Y N	Y N	Y N													
	Y N	Y N	Y N	Y N	Y N													
	Y N	Y N	Y N	Y N	Y N													

OTHER BIRDS

Between JANUARY and DECEMBER, 2012...

To conclude our other birds section, I am going to ask a few general questions about other birds.

Last year...

...did your household use LESS, SAME, or MORE other birds than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1

2

Last year...

...did your household GET ENOUGH other birds?..... Y N

If NO...

What KIND of other birds did you need?.....

How would you describe the impact to your household of not getting enough other birds last year?.....

...minor? (1) ...major? (2) severe? (3)

HARVESTS: BIRD EGGS

HOUSEHOLD ID

Do members of your household USUALLY look for BIRD EGGS?.....Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO GATHER bird eggs?.....Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many bird eggs ALL MEMBERS OF YOUR HOUSEHOLD GATHERED in 2012. INCLUDE bird eggs you gave away, ate fresh, lost to spoilage, or got by helping others. If looking with others, report ONLY YOUR SHARE of the eggs.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2011, HOW MANY DID MEMBERS OF YOUR HOUSEHOLD HARVEST? <i>(number)</i>	UNITS/NOTES <i>(each, gallons, buckets, etc.)</i>
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?		
	<i>(circle)</i>						
GULL EGGS	Y N	Y N	Y N	Y N	Y N		
431212000							
GEESE EGGS	Y N	Y N	Y N	Y N	Y N		
430400000							
DUCK EGGS	Y N	Y N	Y N	Y N	Y N		
430200000							
EGGS (UNKNOWN)	Y N	Y N	Y N	Y N	Y N		
430000000							
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		

EGGS

Between JANUARY and DECEMBER, 2012...

To conclude our eggs section, I am going to ask a few general questions about resource name.

Last year...

...did your household use LESS, SAME, or MORE eggs than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1
 2

Last year...

...did your household GET ENOUGH eggs?..... Y N

If NO...

What KIND of eggs did you need?.....

How would you describe the impact to your household of not getting enough eggs last year?.....

...minor? (1) ...major? (2) severe? (3)

HARVESTS: PLANTS AND BERRIES INCLUDING WOOD

HOUSEHOLD ID

Do members of your household USUALLY harvest PLANTS AND BERRIES INCLUDING WOOD?..... Y N

Between JANUARY and DECEMBER, 2012...

...Did members of your household USE or TRY TO HARVEST plants and berries including wood?..... Y N

IF NO to both questions, go to the next harvest page.

If YES, continue on this page...

Please estimate how many plants and berries including wood ALL MEMBERS OF YOUR HOUSEHOLD HARVESTING in 2012. INCLUDE plants and berries including wood you gave away, ate fresh, lost to spoilage, or got by helping others. If harvesting with others, report ONLY YOUR SHARE of the harvest.

	IN 2012 DID MEMBERS OF YOUR HH...					IN 2012, HOW MANY DID MEMBERS OF YOUR HOUSEHOLD HARVEST? (number)	UNITS/NOTES (each, gallons, buckets, etc.)
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?		
	(circle)						
BLUEBERRY 601002000	Y N	Y N	Y N	Y N	Y N		
LOW BUSH CRANBERRY 601004000	Y N	Y N	Y N	Y N	Y N		
HIGH BUSH CRANBERRY 601006000	Y N	Y N	Y N	Y N	Y N		
RASPBERRY 601020000	Y N	Y N	Y N	Y N	Y N		
OTHER BERRIES (List) 601000000	Y N	Y N	Y N	Y N	Y N		
HUDSON BAY TEA Labrador Tea 602018000	Y N	Y N	Y N	Y N	Y N		
MUSHROOMS 602040000	Y N	Y N	Y N	Y N	Y N		
OTHER PLANTS (List) 602000002	Y N	Y N	Y N	Y N	Y N		
WOOD Firewood 604000000	Y N	Y N	Y N	Y N	Y N		
WOOD (Specify Use) 604000002	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		
	Y N	Y N	Y N	Y N	Y N		

PLANTS AND BERRIES

Between JANUARY and DECEMBER, 2012...

To conclude our plants and berries section, I am going to ask a few general questions about plants and berries.

Last year...

...did your household use LESS, SAME, or MORE plants and berries than in recent years?..... X L S M

If LESS or MORE...

X = do not use

WHY was your use different?.....

1

..... 2

Last year...

...did your household GET ENOUGH plants and berries?..... Y N

If NO...

What KIND of plants and berries did you need?.....

How would you describe the impact to your household
of not getting enough plants and berries last year?.....

...minor? ...major? severe?
(1) (2) (3)

ASSESSMENTS

HOUSEHOLD ID

SUBSISTENCE ASSESSMENTS: ALL RESOURCES

To conclude our harvest section, I am going to ask a few general questions about ALL WILD RESOURCES. Think about your entire harvest last year. Last year...

...overall did your household use LESS, SAME, or MORE wild resources than in recent years?..... X L S M
 If LESS or MORE... X = do not use

WHY was your use different?..... 1
 2

Last year...
 ...did your household GET ENOUGH wild resources?..... Y N

If NO...
 What KIND of wild did you need?.....
 Overall why do you think you did not get enough wild resources?..... 1
 2

How would you describe the impact to your household of not getting enough wild resources last year?.....
 ...not noticeable? (0) ...minor? (1) ...major? (2) severe? (3)

HEALTH IMPACT ASSESSMENTS

In a normal week, how many times a day on average are wild foods such as salmon, non-salmon fish, moose, caribou, birds, etc. served in your household?
 (circle ONE response)
 NONE Don't use (0) | LESS than once a day (1) | About ONCE a day (2) | 2 OR 3 times a day (3) | 3 OR MORE times a day (4)

If this household does NOT USE wild foods, go to the next page.
 Otherwise, continue below...

Please list the TOP FIVE WILD FOODS members of your household eat on a regular basis. Include wild foods that may not be available now, but are important at other times of the year. Please list most important foods first.

(Not necessary to fill out every line)

	Subsistence Food 1	Subsistence Food 2	Subsistence Food 3	Subsistence Food 4	Subsistence Food 5
TOP FIVE SUBSISTENCE FOODS	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

If your household CANNOT GET WILD FOODS, what do members of your household eat instead? Include alternate foods that may not be available now, but are important at other times of the year. Please list most important alternative foods first.

(Not necessary to fill out every line)

	Other Food	Other Food	Other Food	Other Food	Other Food
OTHER FOODS (1 TO 5)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
OTHER FOODS (6 TO 10)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

JOBS FOR EACH PERSON IN THE HOUSEHOLD, 16 YEARS OLD AND OLDER HOUSEHOLD ID

Between JANUARY and DECEMBER, 2012...

...Did any members of your household earn money from a JOB or from SELF EMPLOYMENT?..... Y N

For each member of this household born before 1997, please list EACH JOB held between JANUARY and DECEMBER, 2012.

For household members who did not have a job, write: "RETIRED," "UNEMPLOYED," "STUDENT," "HOMEMAKER," etc.

There should be at least ONE ROW for each member of this household born BEFORE 1997.

WORK SCHEDULE...

We ask about jobs and income because we are trying to understand all parts of the community economy. Many people use wages from jobs to support subsistence activities. If one person has more than one job, list each job on a separate line. (One person may have several lines.)

REMEMBER COMMERCIAL FISHING & TRAPPING IF APPLICABLE.

JOB #	WHO HAD THIS JOB?	WHAT KIND OF WORK DID HE/SHE DO IN THIS JOB?	FOR WHOM DID HE/SHE WORK IN THIS JOB?	JOB LOCATION?	IN 2012, WHAT MONTHS DID HE OR SHE WORK IN THIS JOB?	WORK SCHEDULE...					IN 2012, HOW MUCH DID HE/SHE EARN IN THIS JOB?
						FULL TIME	PART TIME	SHIFT - FULL TIME	ON-CALL, VARIES	SHIFT - PART TIME	
	person	job title	employer, SIC	community	circle each month worked	circle one					/ YR
1ST JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
1	6	910100000	SOC			SCHEDULE					
2ND JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
2	6	910100000	SOC			SCHEDULE					
3RD JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
3	6	910100000	SOC			SCHEDULE					
4TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
4	6	910100000	SOC			SCHEDULE					
5TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
5	6	910100000	SOC			SCHEDULE					
6TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
6	6	910100000	SOC			SCHEDULE					
7TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
7	6	910100000	SOC			SCHEDULE					
8TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
8	6	910100000	SOC			SCHEDULE					
9TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
9	6	910100000	SOC			SCHEDULE					
10TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
10	6	910100000	SOC			SCHEDULE					
11TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
11	6	910100000	SOC			SCHEDULE					
12TH JOB					J F M A M J J A S O N D	FT	PT	SF	OC	SP	\$ / YR
12	6	910100000	SOC			SCHEDULE					

If a person is SELF-EMPLOYED (selling carvings, crafts, bread, etc), list that as a separate job. Enter "sewer," "carver," "baker," etc. as JOB TITLE. Work schedule usually will be "ON CALL." For gross income from self employment ("profit"), enter revenue MINUS expenses.

If a person is UNEMPLOYED, specify retired, unemployed, disabled, student, or homemaker as the JOB TITLE.
TRAPPING for barter or sale IS a job. COMMERCIAL FISHING is recorded as "ON-CALL, VARIES" for work schedule.

WORK SCHEDULE
1 - Fulltime (35+ hours/week)
2 - Parttime (<35 hours/week)
3 - Shift (2 wks on/2 off, etc.)
4 - Irregular, on call

GROSS INCOME is the same as TAXABLE INCOME on a W-2 form.

OTHER INCOME

THIS PAGE IS ONLY FOR INCOME THAT IS NOT EARNED FROM WORKING

HOUSEHOLD ID

Between JANUARY and DECEMBER, 2012...

...Did any members of your household receive a dividend from the Permanent Fund or a Native Corporation?..... Y N

IF NO, go to the next section on this page.

If YES, continue below...

DIVIDENDS	ALASKA PERMANENT FUND DIVIDEND	DID ANYONE IN YOUR HH RECEIVE INCOME FROM _____ IN 2012? (circle one)		TOTAL AMOUNT ALL MEMBERS OF YOUR HH RECEIVED IN 2012? (dollars)	ALASKA PFD IN 2012		ALASKA NATIVE CORP DIVIDENDS IN 2012									
		Y	N		1 PFD = \$	2 PFDs = \$	3 PFDs = \$	4 PFDs = \$	5 PFDs = \$	6 PFDs = \$	7 PFDs = \$	8 PFDs = \$	9 PFDs = \$	10 PFDs = \$	11 PFDs = \$	Additional dividends?
				\$	/YR			1 share= \$0.00								
	32.							100 shrs= \$0								
				\$	/YR			150 shrs= \$0								
	13.							200 shrs= \$0								

Between JANUARY and DECEMBER, 2012...

...Did any members of your household receive OTHER income such as SENIOR BENEFITS or UNEMPLOYMENT?..... Y N

IF NO, go to the next page.

If YES, continue below...

	RECEIVED IN 2012? (circle one)	TOTAL AMOUNT IN 2012? (dollars)	scratch paper for calculations	
			Y	N
JOB BENEFITS	UNEMPLOYMENT	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	12.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
ASSISTANCE	WORKERS' COMPENSATION	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	8.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
ELDER BENEFITS	FOOD STAMPS (QUEST CARD)	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	11.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
CHILD BENEFITS	ADULT PUBLIC ASSISTANCE	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	3.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	ALASKA SENIOR BENEFITS (LONGEVITY)	\$ /YR	Depends on Income	\$125 per month for 12 months = \$1,500 per elder \$175 per month for 12 months = \$2,100 per elder \$250 per month for 12 months = \$3,000 per elder
	6.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	PENSION & RETIREMENT	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	5.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	SOCIAL SECURITY	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	7.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	SUPPLEMENTAL SECURITY	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	10.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	FOSTER CARE	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	41.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	CHILD SUPPORT	\$ /YR	\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
	15.		\$ _____ per week for _____ weeks =	\$ _____ per month for _____ months =
OTHER	ENERGY ASSISTANCE	\$ /YR		
	9.			
OTHER	OTHER (describe)	\$ /YR		

ATTACHMENT 14-3
HOUSEHOLD HARVEST SURVEY KEY INFORMANT INTERVIEW
PROTOCOL (DRAFT)

Household Harvest Survey Key Informant Interview Protocol (Draft)

SUSITNA BASIN 2013

Name of community:

Date:

Name of interviewer:

Name of respondent:

Age of respondent:

How long have you lived in this community?

Would you like to have your name included in the report? Yes No

Notes:

PROJECT OVERVIEW

We are currently conducting a survey in your community to document the harvest and use of wild resources for the calendar year 2013. We understand that one year doesn't represent the long-term pattern of resource use. As part of this survey we ask questions about how the harvest and use of wild resources is different than in recent years, say the past five years. In addition, this interview is intended to help us better understand long-term trends in harvest patterns over time, possibly over your lifetime. We appreciate you sharing this information with us as it will give us a much better understanding of the changes that have occurred in your area over time.

Note to interviewer. You do not have to ask all of these questions. You can simply ask the main questions and then use this protocol as a guide to understand the types of questions we are interested in.

WHERE, HOW, AND FROM WHOM, DID YOU LEARN YOUR SUBSISTENCE WAY OF LIFE?

FISH (SALMON/NON-SALMON) – What kinds of fish are important to your household and community? How has this changed over your lifetime?

- Difference between salmon and non-salmon fish for your community?
- Have your harvest locations for fish changed over time?
- Has harvest timing changed?
- What kind of gear/transportation did you use in the past? What about now?
- Have environmental changes affected harvest patterns over your lifetime?

LARGE LAND MAMMALS – What large animals are most important to your household and community? Has what you harvest and how you harvest changed over your lifetime?

- Has harvest timing changed? If so why?
- How have you changed the areas where you harvest over your lifetime, and why do you think this has occurred?
- What kind of transportation did you use in the past and how has this changed over time?

SMALL LAND MAMMALS/FURBEARERS – What small game and furbearers are most important to your household and community? How has your harvesting effort changed over your lifetime?

- What small game do you harvest to eat and which game do you harvest for fur?
- Has harvest timing changed? What about harvest locations?
- Do you harvest small game opportunistically or do you target small game?
- What kind of gear/transportation did you use in the past? What about now?

BIRDS AND EGGS – What birds are most important to your household and community? How has your harvesting effort changed over your lifetime?

- Are eggs important to your household or community?
- Has harvest timing changed?
- Are the places you go to find birds and eggs different now than in the past?

PLANTS/BERRIES/WOOD – What plants and berries are most important to your household and community? Has what you harvest and how you harvest changed over your lifetime?

- Has harvest timing changed?
- Do you use more or less wood for heat than in the past? Is it more or less difficult to find wood?
- Are the places you go to find plants, berries, or wood different now than in the past?
- What kind of transportation did you use in the past? What about now?
- How has environmental change affected the areas you use to harvest berries? What about the abundance of berries?

RESOURCES PARTICULAR TO YOUR COMMUNITY

- Are there resources that you feel are unique to your community, or hold a special value to your community?
- Are there particular times of year that you harvest these resources? What about sharing these resources within your community and with other communities?

FINAL COMMENTS

What do you feel has been the biggest change in your subsistence way of life, from the time you can remember until now?

Do you recall a time before regulations were enforced? How have your harvest practices and patterns changed since that time?

Is there anything else you would like to share?

ATTACHMENT 14-4
ACTIVE HARVESTER SUBSISTENCE MAPPING INTERVIEW
PROTOCOL (DRAFT)

Active Harvester Subsistence Mapping Interview Protocol (Draft)

Susitna-Watana Hydroelectric Project
 Alaska Energy Authority
 2013

Community: _____ Date of Interview: _____ Interviewers: _____
 Start Time: _____ End Time: _____

Section A: Respondent Information

For each individual completing the interview:

Respondent	1	2	3	4
Respondent ID				
Birth year				
Birth Residence				
Residence history				
Active Harvester?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section B: Community Trails and Travel Routes

Travel Routes (including routes to other villages)	Record the following information for Last 10 Year Travel Routes (√ box to indicate complete)				
Location	Line	Line	Line	Line	Line
Travel Method					

Section C: Last 10 Year Subsistence Mapping and Resource Change

Document last 10 year subsistence use areas for each of the following resource categories:

	Caribou	Moose	Other Large Land Mammals	Furbearers & SLM	Waterfowl	Upland Birds	Eggs	Salmon	Non-Salmon Fish	Berries & Plants	Other
Recorded Last 10 Year Use Areas and/or Traplines? (Check if Yes)											
Record baseline indicators for above mapped features											

Document last 10 year observed changes for the following resource categories and change types:

	Caribou	Moose	Other Large Land Mammals	Furbearers & SLM	Waterfowl	Upland Birds	Eggs	Salmon	Non-Salmon Fish	Berries & Plants	Other
Use											
Abundance											
Migration/ Distribution											
Health/ Quality											
For each of the above changes, record how and why the change is believed to have occurred											

Section D: Last Year Subsistence Activities

Between January 1, 2012 and December 31, 2012, did you **try to harvest...** [Check the appropriate boxes for each resource]

Caribou	Moose	Bear Sheep	Furbearers & SLM	Marine Mammals	Waterfowl	Upland Birds	Eggs	Salmon	Non- Salmon Fish	Marine Inverts.	Berries & Plants	Other

[Starting in January, record each of the subsistence activities the harvester engaged in between January 1, 2012 and December 31, 2012, by month. Document the following information for each activity identified. Use additional forms as needed.]

	Harvest Activity					
	1	2	3	4	5	6
Subsistence Resources Targeted [List and circle TARGET resource]						
Record baseline indicators for each harvest activity						

Section E: Issues and Concerns

Issues and Concerns

- Do you have any issues and concerns regarding your subsistence lifestyle and/or your community? (e.g., sport hunting and fishing, climate change, development)
- Do you have any issues and concerns regarding cultural resources?
- Are there comments you would like to express about the proposed project?
- Suggestions or overall message for the project?

Other

- Are there other active harvesters in the community that we should interview?

ATTACHMENT 14-5
TRADITIONAL KNOWLEDGE WORKSHOP PROTOCOL (DRAFT)

Traditional Knowledge Workshop Protocol (Draft)

Susitna-Watana Hydroelectric Project

Physical Environment

1. Terrestrial Environment (e.g., soils, permafrost, erosion)
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **soils or land** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
2. Watershed (e.g., rivers, lakes, and wetlands [e.g., swampy areas])
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **rivers, lakes, and wetlands** (swampy areas) in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
3. Storms, Winds, and Climate
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **storms, winds, or climate** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
4. Ice and Snow
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **ice and snow** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
5. Air Quality
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **air quality** in the Project area?
 - i. Specific places
 - b. *Additional questions to be provided by relevant resource authors*
6. Earthquakes and Volcanoes
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **earthquakes and volcanoes** in the Project area?
 - i. Specific places
 - b. *Additional questions to be provided by relevant resource authors*

Biological Environment

1. Vegetation
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **plants and trees** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
2. Wildlife
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **animals** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*
3. Fish
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **fish** in the Project area?
 - i. Specific Places?
 - b. *Additional questions to be provided by relevant resource authors*

Social Environment

1. Cultural Resources
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **culturally important places** in the Project area?
 - i. E.g., camps, cabins, and caches; old village sites; burials; place names; traditional use areas; traditional and contemporary trails and travel routes; important traditional lookouts; any other areas of importance?
 - b. *Additional questions to be provided by relevant resource authors*
2. Subsistence
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **subsistence** hunting, fishing, and gathering (e.g., berries, plants, firewood) activities in the Project area?
 - i. Specific places?
 - ii. For what resources?
 - b. Are there important areas for hunting or gathering or other cultural activities that you feel need to be protected or considered by the Project?
 - c. In general, when do you most actively use the Project area for subsistence harvesting activities?
 - d. Approximately what proportion of your community's subsistence harvest comes from the Project area?
 - e. *Additional relevant questions may be provided by resource authors*

3. Noise and Visual
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **noise and visual** effects?
 - i. Specific places?
 - b. *Additional questions to be provided by relevant resource authors*
4. Socioeconomics
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **social and economic** issues or topics?
 - b. *Additional questions to be provided by relevant resource authors*
5. *Health*
 - a. Is there anything the Susitna-Watana Hydroelectric Project should know about **health** issues or topics?
 - b. *Additional questions to be provided by relevant resource authors*

Additional Comments

1. Do you have any comments regarding potential benefits or impacts of the Susitna-Watana Hydroelectric Project? If so, what are your comments?
 - a. E.g., Land, Water, Air, Weather, Plants/Trees, Animals, Culturally Important Places, Subsistence, Noise/Views, Social and Economic
 - b. *Additional questions to be developed through dialogue with AEA and review of scoping comments*

15. SOCIOECONOMIC AND TRANSPORTATION RESOURCES

15.1. Introduction

This section outlines the study plans for socioeconomic, transportation, and air quality resources. The studies in these sections will address evaluation of regional economic effects as well as effects on social conditions and public goods and services.

15.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

The construction and operation of the Project has the potential to affect social resources, including the local and regional economies; provision of public services by local, state and federal governments; air emissions and local and regional air quality; community health and safety; and traffic levels and capacity of transportation resources including roads, airports, rail, and local river transportation. The type, intensity, and extent of effects on these social resources need to be understood during the licensing process so that appropriate measures, if necessary to mitigate any Project effect, can be considered for incorporation into the Project license.

Some of the potential socioeconomic effects of the Project during the construction phase are related to the large number of construction workers that would be employed to build the Project and their potential impact on communities, public services, infrastructure, and temporary housing. The construction workforce is likely to be drawn from a broad region of Southcentral and Interior Alaska. The number of certain skilled occupations required for the Project may exceed the number of workers available within the state, which could lead to some in-migration of out-of-state workers and their families for some occupations, or such workers might commute from their current residences in other states.

Additional socioeconomic effects that could occur during the construction phase include increased job opportunities and income associated with local employment and through local expenditures by AEA, contractors, other utilities, and non-local construction workers. Also during construction, local government taxes (e.g., sales tax, hotel/motel occupancy tax) would be generated on items and services purchased in communities in the vicinity of the Project.

Project construction will also require the transportation of people, equipment, and materials to and from the construction worksite, which could result in increased rail, air, and road traffic volumes, disruption of normal traffic patterns, and possibly, associated noise and congestion effects. Such conditions may temporarily disrupt the transportation patterns of tourists and local travelers, especially in summer, and may require additional police and emergency response calls for traffic and other incidents.

Project construction would also result in new air emission sources in the vicinity of the Project and could have effects on local community health.

Once the project is operational, the availability of a major new energy source would affect the economy of the Railbelt area. The economic literature suggests that benefits accrue to regional economies from electric utility system improvements. The Project will generate electricity for a significant portion of the state's residents. While the final capital cost, financing, and other

information needed to estimate the cost of this electricity is still uncertain, it is known that the cost will be relatively stable for the life of the Project. In contrast, the cost of electricity generated from fossil fuels may rise over time. Therefore, at some point in time, savings may accrue to residential and industrial consumers of the electricity generated by the Project. These savings in energy costs could expand the regional economy by stimulating business activity and creating more disposable income for consumers to spend on purchases of other goods and services.

Project construction and operation may change the level of production of commercial farming, grazing, logging, mining, and fishing operations in the study area. In addition, Project operation, together with Project features (i.e., reservoir and access roads), could change fishing, hunting, and other recreation and subsistence opportunities, including the availability and accessibility of recreational and subsistence resources, and the quality of the recreational and subsistence experience. In turn, these changes could have an impact on tourism and other sectors of the local and regional economies. Project features that stimulate residential location, tourism, and other types of economic development may affect surrounding property uses and values. These changes could also affect community health through changes in diets and lifestyles.

New residents may be attracted to the study area by the Project features (i.e., reservoir and access roads) as well as additional business activity stimulated by the Project. This immigration could affect the demand for both housing and municipal and state services, such as police, fire protection, medical facilities, and schools. Local governments could see additional expenditures for these services and additional revenues based on increased property taxes from new land development.

Project construction activities and operations are likely to result in increased transportation demands that could affect the operation, maintenance, and use of local roadways, Alaska Railroad Corporation (ARRC) facilities, and airports. Air emissions during both construction and operations could change air quality locally, or in the event that the Project affects operations levels at other regional power plants, regionally. Project-related changes in water levels and ice formation could affect local use of the river for winter transportation. Project-related changes in water temperatures and levels, along with development of the dam and reservoir complex and transmission and road system, could alter some of the bio-physical attributes of the Susitna River system around which some residents of the Matanuska-Susitna valley have adapted lifestyles.

15.3. Resource Management Goals and Objectives

The proposed Project would occupy federal lands currently administered by the U.S. Bureau of Land Management (BLM) but selected by the State of Alaska under the Alaska Statehood Act, state lands administered by the Alaska Department of Natural Resources (ADNR), and private lands owned by Alaska Native Corporations and others. The Project site is within the Matanuska-Susitna Borough (MSB), which has adopted an Economic Development Strategic Plan that contains policies designed to support economic growth in the area.

Local government provision of public services is regulated under Title 29 of the Alaska Statutes as well as a variety of city and borough codes and management plans. The goals and objectives for management and use of state and federal lands are documented in area management plans. These plans are designed to allow use of public lands that is compatible with the purposes and uses identified for the lands in the management plans.

Surface and aviation transportation resources in the Project area are managed under the MSB Long-Range Transportation Plan, as well as under the Alaska Department of Transportation & Public Facilities (ADOT&PF) Statewide Transportation Policy Plan. Rail facilities are managed under Federal Railroad Administration regulations and the state code. All of these agencies work together to ensure that appropriate types and levels of transportation facilities are available to provide for the safe and efficient movement of people and goods to support the state's economy and quality of life.

Air quality is regulated by the Alaska Department of Environmental Conservation (ADEC) and the Environmental Protection Agency (EPA). These regulations are designed to maintain air quality to support public health.

Public health issues in Alaska are monitored by the Alaska Department of Health and Human Services (DHSS), Division of Public Health. Although DHSS does not regulate public health effects from development projects, it does conduct Health Impact Assessments (HIAs) as a best management practice to ensure that decision-makers have information on potential human health effects from development projects.

15.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

Consultation efforts to date have included discussions with agency representatives, Alaska Native entities, and other licensing participants through informal consultation and at the Project Technical Workgroup Meetings held on August 8, 2012, September 20, 2012, and October 3 & 17, 2012.

Summary tables of comments and responses from formal comment letters filed with FERC through November 14, 2012 are provided in Appendix 1. Copies of the formal FERC-filed comment letters are included in Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from PSP filing (July 16, 2012) through release of Interim Draft RSPs, is provided in Appendix 3. Copies of meeting summaries from release of the PSP through the interim draft RSP are included in Appendix 4, organized chronologically. The term team used in these study plans refers to the AEA Project team which consists of consultants, AEA staff and some other State agency staff who are performing studies for AEA.

15.5. Regional Economic Evaluation Study

15.5.1. General Description of the Proposed Study

15.5.1.1. Study Goals and Objectives

The goal of the regional economics study plan is to assess potential changes in regional economic conditions in the study area resulting from the operation of the proposed Project and the power generated by the Project. Changes in regional economic conditions resulting from the non-power effects of the Project are included in the social conditions and public goods and services study plan.

The objectives of the study are listed below.

- Describe the effects of the Project on the regional economy resulting from improvements in the reliability of the electrical power grid.
- Describe the effects of the Project on the stability of electric prices over time.
- Determine the economic effects of the Project's power over time.

15.5.2. Existing Information and Need for Additional Information

A data gap analysis report of socioeconomics, recreation, air quality, and transportation was prepared in August 2011 (HDR 2011). That report along with the Alaska Energy Authority's (AEA's) 2011 Pre-Application Document (PAD) provides substantial information about the Project and socioeconomic resources in the Project vicinity. Information collected for the socioeconomic conditions and public goods and services component of the socioeconomic analysis will provide a portion of the data needed for the regional economic model to conduct the regional economic analysis. However, information regarding electric utility rates, power outages, and other data required for this regional economic analysis is not addressed in the Social Conditions and Public Goods and Services Study Plan, and is lacking in the data gap analysis and the PAD. Additional information needed for the regional economic modeling effort includes the following.

- Historical data on electric utility rates for Railbelt utilities.
- System Average Interruption Duration Index reliability minutes for Railbelt utilities.
- Information on the cost of power disturbances in the commercial and residential sectors within the study area.
- Information on how the cost and reliability of power may affect creation of new businesses or expansion of existing businesses.

A review of relevant published documents and information from public scoping meetings will be useful to further inform the study inputs and information collection. In addition, it is anticipated that interviews will be conducted with businesses in the Railbelt to ascertain the potential for changes in business opportunities as a result of the new energy source provided by the Project.

15.5.3. Study Area

The regional economic impacts of the new energy source provided by Project operations will be concentrated in the area collectively referred to as the Railbelt, which includes the Fairbanks

North Star Borough (FNSB), Denali Borough, MSB, Municipality of Anchorage (MOA), and Kenai Peninsula Borough (KPB).

15.5.4. Study Methods

The study methods discussed below are consistent with methods used for economic analysis completed during the licensing proceedings for other hydroelectric projects (Public Utility District No. 1 of Chelan County 1999; PacificCorp 2004; Sacramento Municipal Utility District 2005).

15.5.4.1. Data Collection and Analysis

The proposed Project would not start operations until 2023 under the current schedule. In addition, the Project is anticipated to continue operations for more than 50 years. Given the long time frame for operation of the Project, the effects of the power produced by the Project on the regional economy will be estimated by comparing future socioeconomic conditions with and without the Project.

The forecast of socioeconomic conditions with and without the Project will be based in part on estimates derived from a data and software program called REMI (Regional Economic Models, Inc.). The REMI model incorporates aspects of four major modeling approaches: input-output, general equilibrium, econometric and economic geography. Changes in supply, demand and prices are entered into the REMI model in order to identify the iterative economic and demographic effects of these changes. While the REMI model provides a wide range of output variables, the primary variables of interest in the socioeconomic impact analysis for the proposed Project are population, employment, labor income, output (sales), and housing. The REMI model extends economic and demographic forecasts through 2060, which is consistent with the temporal scope of the socioeconomic impact analysis. The REMI model can provide projections for all of the boroughs and census areas within the Railbelt, including the MOA, FNSB, KPB, MSB, and Denali Borough. The current REMI model also includes the Yukon-Koyukuk Census Area and Valdez-Cordova Census Area.

The REMI model assumptions will be obtained from an information collection process aimed at developing a consensus about reasonably foreseeable future economic activities in Alaska with and without the Project. The model assumptions will reflect combined information from published reports and interviews with industry and government representatives who have experience and expertise in the state's leading industries and economic policy areas. All key informants will be selected for their first-hand knowledge about Alaska's current socioeconomic environment, and for their understanding of the socioeconomic opportunities and obstacles that the state may encounter in the future. An attempt will be made to obtain a diverse set of representatives with different backgrounds and from different groups or sectors. This diversity will provide a broad range of perspectives.

In addition, it is anticipated that interviews will be conducted with business representatives in the Railbelt area to ascertain the potential for changes in business opportunities as a result of the new energy source provided by the Project. The categories of organizations to be interviewed, the information being sought from each organization or category, and examples of interview questions that will be used to develop REMI model assumptions are presented in the attachment to this study plan (Section 15, Attachment 15-1).

As part of its ongoing responsibilities separate and apart from licensing and developing the Project, AEA will provide information on power generation, transmission, and demand in the Railbelt, which will be used in the REMI model. As part of this effort, AEA will collect or develop information on the historic electricity rates and system average interruption duration index reliability minutes for Railbelt utilities, as well as power generation costs for the gas-fired plants that are presently under design or construction.

Other assumptions used in the REMI model will come from several different sources, and engineering feasibility studies that will provide information on Project construction and operations cost and the amount spent locally, the cost of power, amount of power available and similar information. The cost estimates, cost of power, and similar information from the engineering feasibility study will be evolving over time and it is anticipated that we will use the most current set of data available in the Regional Economic Evaluation Initial Study Report, and that the engineering data will change for the Regional Economic Evaluation Updated Study Report.

In addition, the interviews described above will provide information for developing assumptions regarding the future for both the With-Project and Without-Project alternatives. Data collected for the Social Conditions and Public Goods and Services Study will also provide information to be used in the regional economic modeling.

Updates to the assumptions will be provided during quarterly TWG meetings in 2013 and 2014, as well as in the Regional Economic Evaluation Initial Study Report.

Production costs will be modeled in a manner similar to that presented in *Measuring the Economic Impact of Improved Electricity Distribution in Connecticut (REMI, 2007)*, with modifications made to reflect the specific features of the Project and the Without Project alternatives.

Forecasts for the With-Project condition will be compared to the Without-Project condition. Under the Without-Project case, the mix of electrical generation sources will be based on production cost modeling with Railbelt utilities and an appropriate alternative that does not include a large hydroelectric project. The With-Project condition will be based on the large hydroelectric alternative in the RIRP, adjusted as necessary to fit with the current Project description.

15.5.4.2. Documentation of Regional Economic Evaluation

The results of the regional economic evaluation will be documented in the initial and updated study reports. The reports will include study objectives, study area, methods, and tabulated results.

15.5.5. Consistency with Generally Accepted Scientific Practice

Much of the socioeconomic background information will come from published sources, including local governments, boroughs, state agencies, and the federal government. The REMI model being used to forecast future economic conditions has been calibrated for Alaska and has recently been used in work completed for the Alaska Pipeline Project. The REMI model is used by federal, state, and local governments as well as universities and consulting firms.

15.5.6. Schedule

It is anticipated that completion of the work described above would require about six or seven months of effort during 2013 to provide the Initial Study Report in Q1 2014. The process described above should provide sufficient information for the licensing and environmental review of the Project. There could be some additional analyses or model runs in 2014 to update input parameters that perhaps have changed as a result of changes to the Project plans or other changes as determined by AEA in collaboration with licensing participants. Any additional work in 2014 will be reported in the Updated Study Report in Q1 2015 (Table 15.5.1).

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

15.5.7. Relationship with Other Studies

Completion of the Regional Economic Evaluation Study will require some input from the Social Conditions and Public Goods and Services Study (Section 15.6) and Project engineering feasibility studies as illustrated below (Figure 15.5-1). Much of the information collected for the Social Conditions and Public Goods and Services REMI model will also be required for the Regional Economic Evaluation Study and efforts will be coordinated so that the Social Conditions and Public Goods and Services Study provides that information to the Regional Economic Evaluation Study. Cost estimates, construction and operations employment, cost of power, and a number of other items will be required from the engineering and other feasibility studies that are underway as inputs to the REMI model.

15.5.8. Level of Effort and Cost

Conducting this analysis and preparing the report sections are estimated to require about 1,200 to 1,500 person-hours in 2013 and 2014. The effort in 2013 would occur over a six to seven month period including preparation of the Initial Study Report with additional effort in 2014 to incorporate information from other study plans. The estimated cost could range from about \$250,000 to \$400,000.

15.5.9. Literature Cited

Alaska Energy Authority (AEA) 2011. Pre-Application Document, Susitna-Watana Hydroelectric Project, FERC No. 14241.

HDR, Inc. (HDR) 2011. Susitna-Watana Hydroelectric Project, Socioeconomic, Recreation, Air Quality, and Transportation Data Gap Analysis. Unpublished, by the Alaska Energy Authority.

PacificCorp 2004. Klamath Hydroelectric Project High-Level Socioeconomic Analysis of the Landscape Options—Phase 2. FERC Project No. 2082.

Public Utility District No. 1 of Chelan County 1999. Rocky Reach Hydroelectric Project Socioeconomic Study Plan. FERC Project No. 2145.

Sacramento Municipal Utility District 2005. Upper American River Project, Chili Bar Socioeconomic Study Plan FERC Project No. 2101.

15.5.10. Tables

Table 15.5-1. Schedule for implementation of the Regional Economic Evaluation Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Gather/Review Existing Information					—								
Conduct Interviews					—								
Document Existing Conditions						—							
Develop Reasonably Foreseeable Future Action Assumptions						—							
Develop REMI Model and Analysis							—						
Initial Regional Economic Evaluation Study Report								—	Δ				
Incorporate Information from Other Studies								—	—	—			
Updated Regional Economic Evaluation Study Report												—	▲

Legend:

- Planned Activity
- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

15.5.11. Figures

STUDY INTERDEPENDENCIES FOR REGIONAL ECONOMIC EVALUATION STUDY

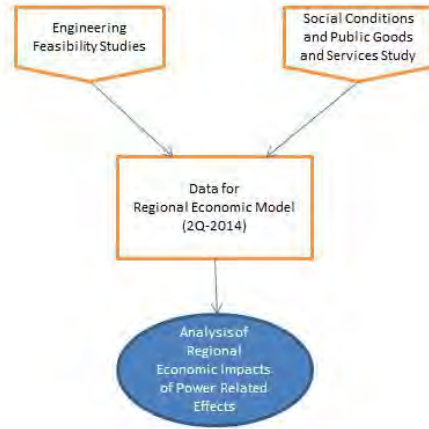


Figure 15.5-1. Study Interdependencies for the Regional Economic Evaluation Study.

15.6. Social Conditions and Public Goods and Services Study

15.6.1. General Description of the Proposed Study

15.6.1.1. Study Goals and Objectives

The study goal for the social conditions and public goods and services section of the socioeconomics study plan is to assess potential changes in population, housing, public goods and services, and other quality of life factors resulting from the construction and operation of the proposed Project and potential changes in regional economic conditions resulting from the non-power effects of the Project. Coordination with the other social resource analyses (e.g., recreation (Section 12.5), transportation (Section 15.9), and subsistence (Section 14.5)) from the outset is an essential component of this study plan.

The objectives of the study are listed below.

- Describe, using text and appropriate tables and graphics, existing socioeconomic conditions within the study area.
- Evaluate the effects of on-site manpower requirements, including the number of construction personnel who currently reside within the study area, who would commute to the site from outside the study area, or who would relocate temporarily within the study area.
- Estimate total worker payroll and material purchases during construction and operation.
- Evaluate the impact of any substantial immigration of people on governmental facilities and services, and describe plans to address the impact on local infrastructure.
- Determine whether existing housing within the study area is sufficient to meet the needs of the additional population.
- Describe the number and types of residences and businesses that might be displaced by the Project access road and transmission corridors.
- Describe, based on other studies, what bio-physical attributes of the Susitna River system may change as a result of the Project and what those changes might mean to commercial opportunities related to fishing, logging, agriculture, mining, and recreational activities, recreation and subsistence use values, quality of life, community use patterns, non-use environmental values, and social conditions of the area.

15.6.2. Existing Information and Need for Additional Information

A data gap analysis report of socioeconomics, recreation, air quality, and transportation was prepared in August 2011 (HDR 2011). That report along with AEA's 2011 PAD provides substantial information about the Project and socioeconomic resources in the Project vicinity.

Information provided for communities within the study area by the U.S. Census Bureau, the Alaska Department of Labor and Workforce Development (ADLWD), the Alaska Department of Commerce, Community and Economic Development (DCCED), MSB, Denali Borough, and other secondary sources includes the following:

- Current population and population density statistics
- Per capita income
- Number and composition of workforce (e.g., manufacturing; transportation and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services)
- Current unemployment rate (latest year of record)
- Number of units and vacancy rates for temporary housing (e.g., apartment rentals, hotels/motels, and campgrounds)
- Location and availability of local government public services (e.g., police, fire protection, medical services, utilities, and schools)
- Local tax revenues and sources of funding (e.g., personal property, sales, hotel/motel occupancy, etc.)

Information that will be needed to complete the analysis of the direct effects of the Project includes the following:

- Final location of the Project components
- Duration and schedule of construction phase
- Cost of materials and supplies during construction
- Approximate cost of materials and supplies during construction that will be spent locally, versus non-locally
- Size of total workforce, including how many workers will be hired locally versus non-locally (data from the ADLWD on employment by occupation will be used to estimate the percent of out-of-state workers)
- Total size of construction workforce by month, or peak number of workers and when that peak would occur
- Summary of construction workforce by craft or discipline
- Total construction wages or average construction pay, including benefits
- Total number of workers required for operation and maintenance of the Project, and total wages including benefits
- Approximate cost of materials, supplies, and services that will be purchased locally versus non-locally during operations
- For trucks that would be used, estimated number and size, number of trips per day and week to and from the Project site, travel route, and capacity of the roads on which the trucks will be traveling
- The number of residences or businesses that could be displaced by construction of the Project
- Number of acres of agricultural/pasture land or timberland that will be removed from production

Information that will be needed to complete the analysis of the indirect effects of the Project is described in Section **Error! Reference source not found.**

15.6.3. Study Area

Based on the current Project description, the principal study area for the analysis of impacts on social conditions and public goods and services includes communities in the Denali Borough and MSB that are located in relatively close proximity to the proposed Project facilities, including the

hydroelectric facility and access road and transmission line corridors. Most of the effects specific to these communities during the construction phase are related to the transportation and supply of construction materials, the number of construction workers that would work on the Project and their potential impact on population, public services and infrastructure, and temporary housing during construction. Within the Denali Borough, the principal community under consideration is Cantwell, as this is the closest community to the proposed Project. In the MSB, the closest communities are Trapper Creek, Chase, Talkeetna, and the “railroad community” located north of Chase.

A wide range of occupations is needed to construct and operate a large hydroelectric facility, and it is likely that workers in many regions of Alaska would benefit from the additional employment opportunities created by the Project. However, the largest concentration of workers with the required occupational skills is in highly populated Southcentral Alaska. The concentration of major engineering, construction, and manufacturing firms in the MOA makes it probable that this city would be most affected by construction period expenditures.

Transportation effects during the construction phase of the Project would occur in ports of entry for freight and along the subsequent transportation routes for supplies, equipment, and labor. Boroughs and census areas through which potential overland transportation routes pass include the MOA, FNSB, Valdez-Cordova Census Area, KPB, Yukon-Koyukuk Census Area, MSB, and Denali Borough.

During and after Project construction, there may be additional requirements for law enforcement and health and human services. The Alaska Department of Public Safety (ADPS) provides law enforcement in the unorganized areas of the state (census areas) and in areas of municipalities without police powers. State and Alaska Native programs provide most health and human services in Alaska.

Non-power effects of Project operations and features (i.e., reservoir and access roads) on local or regional economies, including changes in commercial opportunities related to fishing, hunting, boating, wildlife viewing, mountaineering, and other recreation, are likely to be concentrated in those communities in the Denali Borough and MSB that are located in relatively close proximity to the Project.

15.6.4. Study Methods

The study methods discussed below are consistent with socioeconomic analyses completed during the licensing proceedings for other hydroelectric projects (Public Utility District No. 1 of Chelan County 1999; PacificCorp 2004; Sacramento Municipal Utility District 2005).

15.6.4.1. Data Collection and Analysis

The proposed Project would not start operations until 2023 under the current schedule. The Project is anticipated to operate for more than 50 years, similar to other large hydroelectric developments around the world. The Project’s socioeconomic effects will be estimated by comparing future socioeconomic conditions with and without the Project, considering the long time frame for operation of the Project.

The forecast of socioeconomic conditions with and without the Project will be based in part on estimates derived from the REMI model described in the Regional Economic Evaluation Study

Plan (Section 15.5.4.1) as well as the direct effects associated with the Project. Subtracting the direct effects from the REMI model results will provide an estimate of the indirect effects of the Project. While the REMI model provides a wide range of output variables, the primary variables of interest in the socioeconomic impact analysis for the proposed Project are population, employment, labor income, output (sales), and housing. The REMI model extends economic and demographic forecasts through 2060, which is consistent with the temporal scope of the socioeconomic impact analysis. The REMI model can provide projections for all of the boroughs and census areas within the Railbelt, including the MOA, FNSB, KPB, MSB, and Denali Borough. The current REMI model also includes the Yukon-Koyukuk Census Area and Valdez-Cordova Census Area.

The forecast analysis performed by the REMI model will be guided by assumptions about reasonably foreseeable future actions that would have an important and measurable effect on Alaska's economy. The forecast for the MSB will be calibrated to be similar to the population forecast developed by the Borough and the Alaska Department of Transportation and Public Facilities. Additional information about the development of the REMI model assumptions is provided in the Regional Economic Evaluation Study Plan.

As the Project design is further refined, specific requirements for the types of construction specialties will be identified and compared with current expertise of regional construction companies to see which opportunities can be filled by Alaska firms. This evaluation will improve the model estimates of future economic activity and provide recommendations to increase the percentage of these opportunities captured by Alaska businesses.

The effect of potential immigration during Project construction and operations on municipal and state services, such as police, fire protection, medical services, and schools, will be assessed. For schools, the effect of the influx of additional school-age children on teacher-pupil ratios will be determined. In an attempt to identify changes to quality of life and overall natural resource uses trends and potential changes resulting from the Project, some survey questions will be added to the public survey proposed in the Recreation Resources and Aesthetic Study Plans (Section 12.5 and 12.6). The survey questions will be oriented toward identifying how the Susitna River corridor and upper basin is used and valued by local residents and to identify the importance of the various bio-physical aspects important to area residents. Once the types of Project-induced changes in riverine and basin resources are known, a further analysis will be undertaken to identify how such changes might alter the resources used and valued by the area residents. The results of the Project effects on subsistence, recreation, and transportation can be used to further evaluate the overall effects on the residents of the region.

A fiscal impact analysis will be conducted to evaluate incremental local government expenditures in relation to incremental local government revenues that would result from construction and operation of the Project. Incremental expenditures could include, but would not be limited to, additional school operating, road maintenance and repair, public safety, and public utility costs. Incremental revenues could include, but would not be limited to, additional property tax and hotel/motel occupancy tax revenues.

Transportation of construction equipment and materials through communities on the transportation routes to and from the Project could result in increased rail traffic and road traffic volumes, with associated noise and congestion effects. Such conditions might require additional police and emergency response calls for traffic and other incidents. These impacts will be

assessed based on the results of the Transportation Resources study. For example, estimates of changes in vehicle miles traveled can be converted into estimates of traffic incidents and injuries, which could place additional demands on police, emergency response, and medical services.

The economic impact of the Project on local tourism establishments (e.g., river sport fishing, whitewater boating, lodges) and the regional economy will be estimated using the results of the Recreation Resources and Aesthetic Studies (Section 12.5 and 12.6). Calculations will be based on information obtained from the recreation survey, including the estimated recreation-related expenditures per recreational day or trip and changes in the number of days or trips per year. The regional economic impact of changes in subsistence-related expenditures due to the proposed Project will be estimated using the results of the Subsistence Study. Approximate cash expenses to generate each pound of subsistence harvest will be based on published information.

The Project, including access roads, could affect surrounding property uses and values. These effects will be described by identifying the properties that are in or in close proximity to the Project area, including the access road(s) that will be built; determining the degree to which the use of the properties would change as a result of the Project; and estimating, to the extent practicable, the extent that property values may change as a result of the change in use.

If Project features (i.e., reservoir and access roads) stimulate residential development, spending by new residents in the local economy will generate new economic activity, including additional jobs and labor income. Interviews will be conducted with regional businesses to identify potential opportunities for residential development and estimate the economic impacts should this development occur.

To the extent that Project construction and operations will change the level of production of commercial farming, grazing, logging, mining, and fishing operations, these effects will be approximated by the change in production multiplied by the current price of the resource in question. Information on the quantity and value of market-based natural resources is available through state and federal resource management agencies.

Changes that result in increases or decreases in economic activity such as production of commercial resource extraction (e.g., commercial fishing production), or changes in spending for recreational goods and services will become inputs to the REMI model to calculate the regional economic impacts. The annual incremental change (i.e., from the Without-Project condition) in dollars for each activity with the Project will be estimated and then added or subtracted from the Without-Project condition to arrive at the Project condition. The analysis will also identify those effects that are short-term or temporary in nature, which will likely be associated with construction activities, and those that are long-term and primarily associated with operations of the Project.

The study will address changes in recreation by using a Random Utility Model (RUM) combining existing data, recreation preference functions from the published literature, and new data collected by the Recreation and Aesthetics Study (see Section 12.5 and 12.6). These data and preference functions will be applied to the affected recreation population using 2010 U.S. Census population data and existing recreation participation rates. Once the existing preference functions are identified, they will be used to represent the demand for various recreation sites via specification of demand functions which place preference functions in the context of recreation opportunities. Based on population data and participation rates, these demand functions will be used to predict visitation across both the study area and substitute recreation sites when site

characteristics are different than under Without-Project conditions. By evaluating differences in outcomes across Without-Project and With-Project behavioral simulations, the study will identify changes in site pressure and aggregated economic welfare (i.e., dollar-valued consumer satisfaction).

The approach for undertaking this analysis will use and be consistent with EPA's *Guidelines for Preparing Economic Analysis* (USEPA 2010). In addition, they will also follow the process for developing a systemic, socioeconomic and behavioral model of recreation demand as described in Bingham and Kinnell (2012). Bingham and Kinnell (2012) present a site-specific, dam management application of Deason, Dickie, Kinnell, and Shabman's 2010 Integrated Planning Framework. This work will be closely coordinated with the Recreation (Section 12.5) and Aesthetics (Section 12.6) Studies which will provide current estimates of recreation demand and collect much of the information that will be needed for the analysis.

Task 1. Identify recreation outcomes that are likely to occur under With-Project conditions.

In this task, the team will rely on the Recreation and Aesthetics Studies (Sections 12.5 and 12.6) to identify recreation outcomes that are likely to occur under With-Project conditions. At this stage we envision, the primary recreation activities to be considered include fishing, boating, hunting, and snow machining. Factors to be considered include all those features that affect the quality of a recreation trip, such as changes in access, solitude, crowding, harvest rates, and safety for snow machining.

Task 2. Assess currently available recreation data.

In this task, the team will review the information collected by the Recreation Resources and Aesthetics Studies (Sections 12.5 and 12.6) and collect other data as needed for the analysis. For example, the analysis for recreational fishing will evaluate the relevant angling population using population data from the 2010 Census Bureau and recreation participation rates from Alaska's Statewide Comprehensive Outdoor Recreation Plan (SCORP) (AKDNR 2009). The team will also incorporate the findings of the Recreation Resources Study (Section 12.5) to estimate the affected population.

Task 3. Identify and apply existing recreation utility functions from the literature.

In this task, the team will identify existing recreation utility functions from the literature. Site-calibrated transfers of an existing random utility model (RUM) study will be used to capture important behavioral responses (i.e., changes in trip-taking behavior as a result of changes to a fishery). The accuracy of this methodology is limited only by the analyst's ability to calibrate an already-estimated preference function to a different population using appropriate economic methodologies (Smith, van Houtven, and Pattanayak 2002).

For example, a fishing site has numerous attributes including, but not limited to, the cost/time of reaching the site, catch rates, availability of boat ramps and so forth. The distance/travel cost for recreators to reach all relevant sites is a particularly important site attribute. An angler who chooses a closer site with a

lower catch rate has “traded off” catch for distance/travel cost—providing an indication of the value of higher catch rates.

For recreational fishery benefits, AEA will develop the site-calibrated benefits transfer using a recreational fishing study conducted by Carson, Hanemann, and Wegge (2009). The nested logit model in this study uses weekly data on the sport fishing activities of 1,063 respondents over a 22-week period in 1986 to estimate the economic value of recreational fishing in Southcentral Alaska.

Calibrating the identified relationship to relevant sites, population, and fishery impacts provides the ability to estimate the economic benefits of the Project. To calibrate the results from the Carson, Hanemann, and Wegge (2009) study so that the estimates reflect angling activity near the proposed project, the analysis will be evaluated across the relevant angling population estimated in Task 2.

Task 4. Identify recreation demand by appropriately combining existing utility functions with site characteristics under Without-Project and expected With-Project conditions.

In this task, the team will identify recreation *demand* by appropriately combining these existing utility functions with site characteristics under Without-Project and expected With-Project conditions. The representation of recreation opportunities in a demand system allows identifying an individual’s (or like-minded and located group’s) likelihood of visiting a site under the specified site characteristics. Under this approach, Without-Project conditions and site visits are used to identify the econometric model. Under With-Project conditions, site characteristics will be different from Without-Project to reflect expected outcomes (i.e., changes in site availability, harvest rate, etc.). With this new set of opportunities, site choice simulations are conducted to identify expected changes in survey respondent’s visits across the directly affected site and *all relevant substitute sites*. This allows estimating visitation at sites under conditions that are not currently occurring at those sites. In addition, because these forecasts arise from simulations of a structural demand system, it is possible to recover sophisticated economic metrics such as changes in respondents’ consumer surplus (i.e., willingness to pay) by making comparisons across Without-Project and With-Project models.

Task 5. Identify aggregate demand using population data and participation rates.

In this task the team will identify *aggregate demand* using 2010 Census weights and participation rates. Once demand systems representing individuals or groups are aggregated up to the population using Census population weights, we will identify socioeconomic metrics of most interest including site pressure under With-Project conditions as well as changes in aggregate social welfare and differences in social welfare changes across groups of people.

In short, the benefits transfer approach will be used to apply recreation preference functions from the published literature. Benefits transfer involves the application of unit value estimates, functions, data, and/or models from one or more previously conducted valuation studies to estimate benefits associated with the resource under consideration (Black et al. 1998).

The benefits transfer approach will also be used to estimate changes in non-use values (existence value, bequest value, option value) and values associated with ecological functions in the study

area. Existing studies that could be used to derive estimates of non-use values and values associated with ecological functions for the study area include Colt (2001). Estimates of non-use values are typically obtained using the contingent valuation method, as this method is the only established technique for measuring these values (Black et al. 1998).

Following the methodology of Braund and Lonner (1982), information on the values, attitudes, and lifestyle preferences of residents in Talkeetna, Trapper Creek, Cantwell, Chase, and the area north of Chase will be collected through informal interviews with community residents, real estate professionals, MSB and Denali Borough officials, and other knowledgeable individuals. The interviews will be conducted using the Recreation Study Plan interview protocol as a template. Questions asked during these interviews will be oriented toward identifying how the Susitna River corridor and upper basin is used and valued by local residents. Therefore, all key informants will be selected for their first-hand knowledge about these topics. An attempt will be made to obtain a diverse set of informants with different backgrounds. This diversity will provide a broad range of perspectives. It is estimated that the number of people interviewed will be comparable to the 107 people interviewed by Braund and Lonner. Information collected from the informal interviews will be supplemented with data collected through the public survey proposed in the Recreation and Aesthetic Study, as well as secondary sources. The results of the analyses of Project effects on population, local economies, subsistence, recreation, and transportation will be used to evaluate the overall effects on the quality of life of residents of the region. Analysis results will be documented in the initial and updated study reports

15.6.4.2. Work Products

The results of the social conditions and public goods and services study will be documented in initial and updated study reports. The reports will include study objectives, study area, methods, and tabulated results.

15.6.5. Consistency with Generally Accepted Scientific Practice

Much of the socioeconomic background information will come from published sources, including local governments, boroughs, state agencies, and the federal government. The REMI model being used to forecast future economic conditions has been calibrated for Alaska and has recently been used in work completed for the Alaska Pipeline Project. The REMI model is used by federal, state, and local governments as well as universities and consulting firms.

15.6.6. Schedule

It is anticipated that completion of the work described above will require about six or seven months of effort in 2013 and will be summarized in an Initial Study Report in Q1 2014. There may be additional analyses or model runs in 2014 to incorporate information from the 2013 studies. These will be addressed in the Updated Study Report issued in Q1 2015 (see Table 15.6.1).

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

15.6.7. Relationship with Other Studies

The Social Conditions and Public Goods and Services Study will require input from several other studies as shown in Figures 15.6-1 through 15.6-4, below. The study will conduct an economic valuation of changes in recreational and subsistence fishing and hunting using information provided by the Recreation and Aesthetics Study (Section 12.5) and Subsistence Resources Study (Section 14.5), both of which will incorporate data from the Fish and Aquatic Resources Study (Analysis of Fish Harvest, Section 9.15) and Wildlife Resources Study (Wildlife Harvest Analysis, Section 10.20). The economic effects of changes in the level of production of commercial fishing operations will be based on data from the Fish and Aquatic Resources Study (Analysis of Fish Harvest, Section 9.15).

The study will conduct an economic valuation of changes in recreational activities that are not dependent on fish or wildlife, such as boating and snow machining, using information provided by the Recreation and Aesthetics Study (Sections 12.5 and 12.6).

The regional economic impact of changes in expenditures related to recreation and subsistence activities related will be estimated using the results of the Recreation (Section 12.5) and Aesthetics (Section 12.6) Study and Subsistence Resources Study (Section 14.5), both of which will incorporate data from the Fish and Aquatic Resources Study (Analysis of Fish Harvest, Section 9.15) and Wildlife Resources Study (Wildlife Harvest Analysis, Section 10.20).

The socioeconomic effects of changes in transportation patterns will be assessed based on the results of the Transportation Resources Study, which will incorporate demographic and economic forecasts provided by the Social Conditions and Public Goods and Services Study.

15.6.8. Level of Effort and Cost

The economic impact components will require an estimated 2,400 to 2,800 person-hours in 2013 and 2014. Limited secondary data for many of the communities in the study area will require telephone calls and executive interviews with businesses and other organizations to develop sufficient information to evaluate the socioeconomic effects of the Project on each community. This effort, including both the initial and updated study reports, would occur over a 8 to 9 month period. The estimated cost would range from about \$400,000 to \$500,000, depending on the final survey methodologies used.

The recreation, ecological services, and lifestyle preference components will require an estimated 2,400 to 3,600 person hours in 2013 and 2014. This work will require coordinating with other studies on their survey results, extraction of preference functions from existing studies, and collection of secondary data. The work may also require telephone calls, executive interviews, and focus groups. The estimated cost of this work ranges from \$400,000 to \$600,000.

The total estimated effort and cost for this study is 4,800 to 6,400 hours valued at \$800,000 to \$1.1 million.

15.6.9. Literature Cited

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15.6.10. Tables

Table 15.6-1. Schedule for implementation of the Social Conditions and Public Goods and Services Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Gather/Review Existing Information				—									
Document Existing Conditions					—								
Licensing participant Informal Interviews						—	—						
Initial Social Conditions and Public Good and Services Study Report								—	Δ				
Incorporate Information from Other Studies								—	—	—			
Updated Social Conditions and Public Good and Services Study Report												—	▲

Legend:

- Planned Activity
- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

15.6.11. Figures

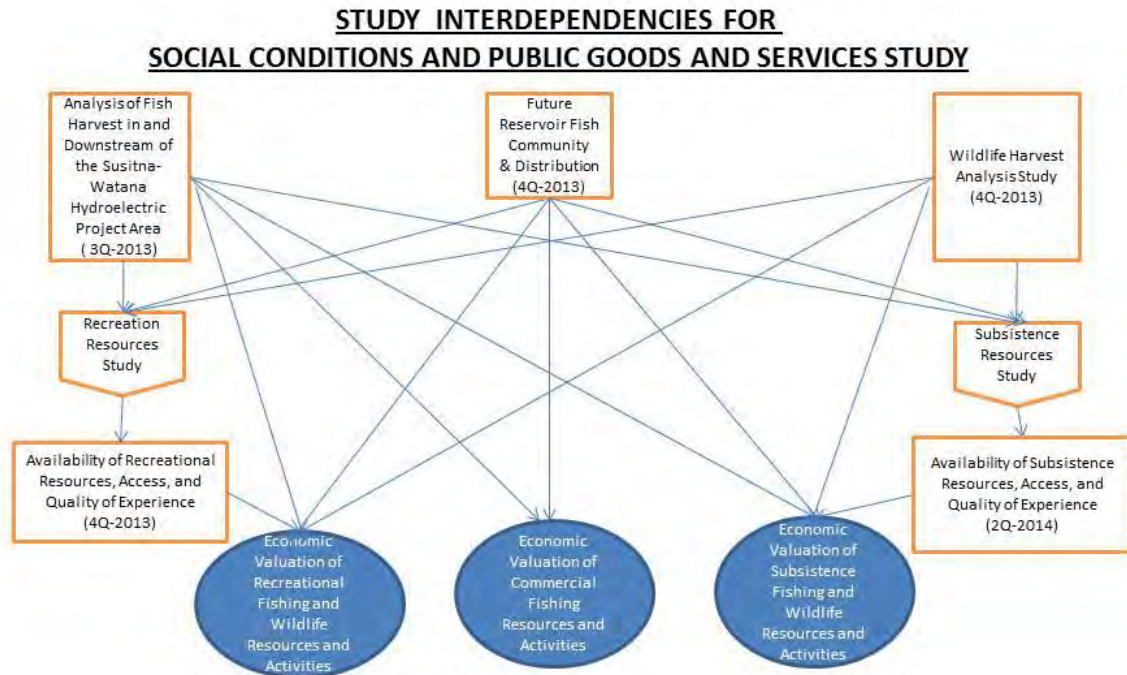


Figure 15.6-1. Fish and Wildlife Study Interdependencies for the Social Conditions and Public Goods and Services Study

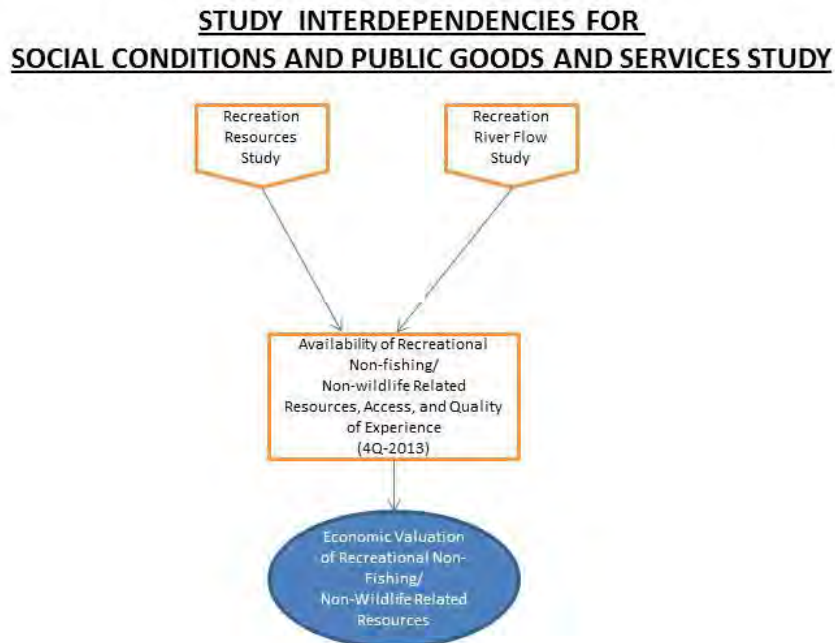


Figure 15.6-2. Recreation Study Interdependencies for the Social Conditions and Public Goods and Services Study.

**STUDY INTERDEPENDENCIES FOR
SOCIAL CONDITIONS AND PUBLIC GOODS AND SERVICES STUDY**

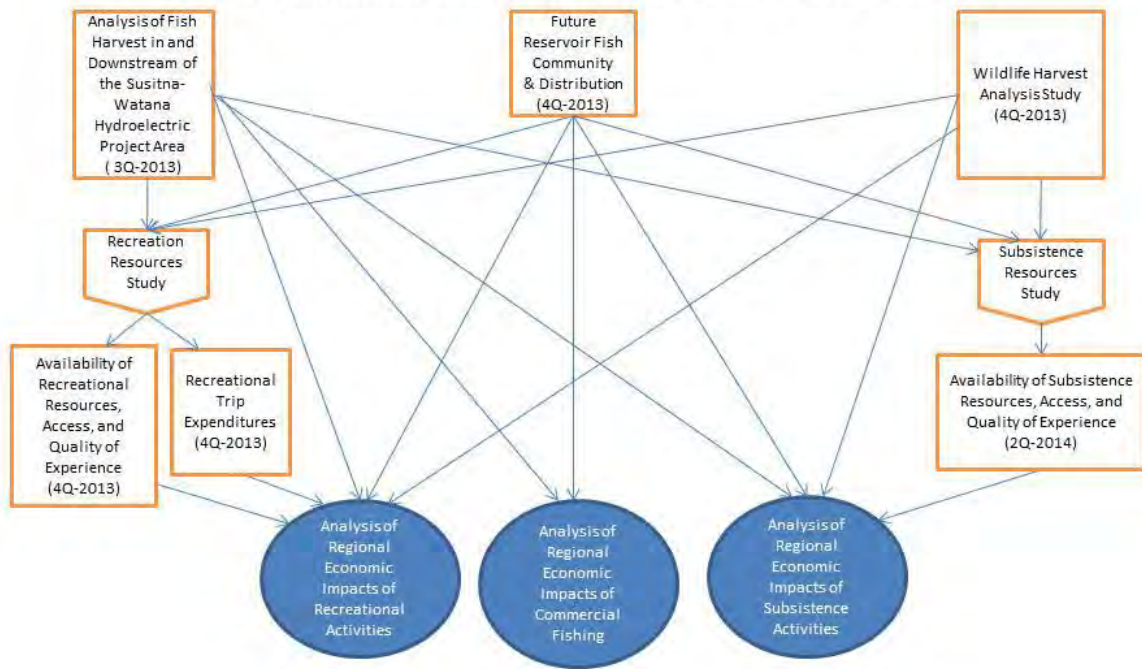


Figure 15.6-3. Fish and Wildlife Harvest Study Interdependencies for the Social Conditions and Public Goods and Services Study.

**STUDY INTERDEPENDENCIES FOR
SOCIAL CONDITIONS AND PUBLIC GOODS AND SERVICES STUDY**

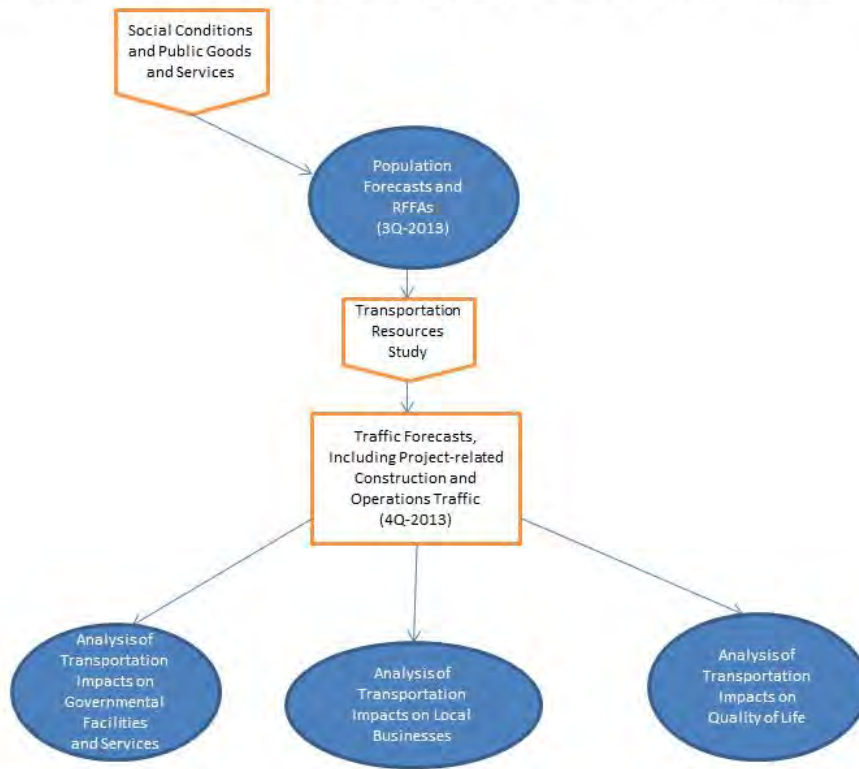


Figure 15.6-4. Social Conditions and Public Goods and Services Study Interdependencies with Transportation Study.

15.7. Transportation Resources Study

15.7.1. General Description of the Proposed Study

15.7.1.1. Study Goals and Objectives

The Transportation Resources Study will assess current transportation conditions in the Project area and evaluate potential Project demands relative to current capacity limits and safety requirements for road, railroad, aviation, port, and river traffic. The study will assess the short-term (construction) and long-term (operational) direct and indirect impacts of the Project, as well as of the cumulative impacts of the Project. The transportation effects of the Project (With-Project) will be compared to a Without-Project scenario.

Identifying traffic demands during Project construction and operation will allow the Project team and regulatory agencies to identify needed local and regional transportation operational requirements and infrastructure improvements to accommodate Project-related traffic transportation demands and, if necessary, mitigate potential adverse impacts on transportation capacity and public safety. Potential effects of the Project on local river use for winter transportation will also be evaluated.

Jurisdiction over public transportation infrastructure and operations is shared by ADOT&PF, ARRC, local governments, and federal transportation agencies. These entities all have similar management goals: to develop and maintain transportation facilities and services that are sufficient to safely and efficiently meet transportation demands.

The AEA Project team will use information from this study to identify and coordinate needed transportation infrastructure improvements with ADOT&PF, ARRC, MSB, the Denali Borough, and others. This report will also provide valuable information for the multidisciplinary analysis of the Project required under the National Environmental Policy Act (NEPA).

15.7.2. Existing Information and Need for Additional Information

The existing transportation resources in the Project area are well documented and studied. Included in this documentation are studies conducted by AEA and ADOT&PF specifically for the Project; reports developed for the Alaska Power Authority (APA) Project in the 1980s; and other documents publicly available from the MSB, the Denali Borough, ADOT&PF, ARRC, and the Federal Aviation Administration (FAA).

Tables 15.7-1 through 15.7-5 identify some key reports that will help provide a foundation for the Transportation Resources Study.

Additional information needed to complete the Transportation Resources Study is discussed below.

- Project Information

Proposed access corridor alternatives – the three corridors under consideration are the Denali, Chulitna, and Gold Creek corridors (also referred to as the Seattle Creek, Hurricane, and Gold Creek corridors in the Watana Transportation Access Analysis).

Approximate volumes of construction materials, construction equipment, and personnel that need to access the Project area during construction and operation

Expected modes of transportation for various materials, supplies, and personnel
Information on any other proposed Project transportation infrastructure, such as airstrips

- Existing Operations Information

Existing operations data for all modes of transportation

Information on existing operating and maintenance costs for the different modes of transportation

Existing capacity and any capacity issues

Legally recognized transportation easements

- Future Operations Information

Forecasts of operations for different modes of transportation

Information on planned or proposed non-Project transportation infrastructure improvements

15.7.3. Study Area

The proposed study area for the Transportation Resources Study extends north from Anchorage to Fairbanks and east to the Susitna River to cover all relevant traffic sources, traffic nodes (points where travelers or shippers may select different routes), and destinations for each mode of transportation. The primary sources and destinations of Project-related road and railroad traffic will be the Project site, the Port of Anchorage, Port MacKenzie, and local material sources. The majority of the aviation traffic will originate in populated areas at primary and smaller general aviation airports.

The proposed transportation resources study area includes the roadways listed below.

- New access roads to the Project site
- Roads to materials sites identified for project construction
- The Denali Highway, Mile Post (MP) 78-133, from the Susitna River crossing to the Parks Highway
- The Parks Highway, MP 35 to 356, from the Glenn Highway to Fairbanks (the junction with the Denali Highway is at MP 210)
- The Glenn Highway, MP 0 to 35, from downtown Anchorage to the Parks Highway
- MSB roads to access Port MacKenzie: Point MacKenzie Road, Knik Goose Bay Road, Burma Road (after completion of realignment and upgrade currently being designed), Big Lake Road, and Vine Road
- MOA streets that access the Port of Anchorage: A Street, C Street, 3rd Avenue, 4th Avenue, 5th Avenue, and 6th Avenue
- Other state highways and local roads near the Project site

The study area also includes the ARRC main line from MP 113 (Anchorage) to MP 478 (Fairbanks), giving consideration to the following areas:

- MP 113, Anchorage Yard (Ship Creek Intermodal Transportation Center)

- MP 173, Port MacKenzie branch line (under construction – roughly 40 miles long)
- MP 248, Curry Quarry
- Access corridor alternatives identified by the AEA Project design team
 - MP 263, Gold Creek
 - MP 274, Chulitna
 - MP 319, Cantwell
- MP 478, Fairbanks Yard

For aviation facilities, the study area contains two primary airports (Ted Stevens Anchorage International Airport and Fairbanks International Airport), plus several smaller general aviation airports (Lake Hood and Merrill Field in Anchorage, plus public airports in the MSB).

For river transportation, the study will evaluate transportation uses in and along the Susitna River corridor in summer and winter conditions for Project effects.

Lastly, the Transportation Resources Study will cover legally recognized private and public transportation easements that have not yet been developed. These easements may cross the Susitna River, and changes in ice formation may impact the use of these easements.

15.7.4. Study Methods

The proposed methodology consists of the five steps described below.

15.7.4.1. Collect and Review Data

The first step is developing a bibliography of existing documents, including recent transportation reports from AEA and the items mentioned in Section 15.7.2. AEA will evaluate the relevance of each document to the overall study. AEA will also compile information regarding transportation planning projects, design projects, and any scheduled construction projects near the Project site; these adjacent projects may already address potential impacts from the Project, but this will need to be verified.

15.7.4.2. Inventory Assets and Conduct Any Field Studies

AEA will develop a transportation asset inventory for the Project area focused on roads, railroads, bridges, ports, air infrastructure, easements, traffic levels, capacities, and crash and accident statistics. Some traffic data are available; depending upon the type and the age of the data, traffic counters may need to gather current data. Information on use of the river for winter transportation will be gathered from other studies (Recreation Boating/Access Study (Section 12.7), Subsistence Study (Section 14.5), Social Conditions and Public Goods and Services Study (Section 15.6), etc.) and obtained by interviewing knowledgeable sources.

15.7.4.3. Document Existing Conditions

Existing transportation infrastructure and traffic levels will be documented to establish baseline conditions for the various transportation resources. Much of this information is available from existing sources, but the information will be supplemented and updated with field collection or interviews as needed.

In particular, executive interviews with knowledgeable individuals and some property owners in the area will be used to collect data on the types, levels, areas, and seasons of river transportation use in the study area. Interviews will be conducted with the Alaska State Troopers; Denali State Park rangers; ADNR Division of Mining, Land, and Water; BLM personnel; planners and Department of Public Works employees for the Matanuska-Susitna Borough; local community councils; Native Alaskan corporations with land in the Project area; Alaska Railroad staff; western Cook Inlet gas producers; Nordic skiing, snow machine, and mushing clubs; guides and lodges; and local residents.

Surveys being conducted by the Recreation Boating/Access Study (Section 12.7) and the Subsistence Study (Section 14.5) will also include questions on access to study area sites to supplement the interviews conducted under this study. These surveys will include a combination of in-person and telephone interviews. Along with information from the recreation surveys and subsistence interviews, this information will be supplemented with information from field crews that encounter people in the study area. Results of the recreation surveys and interviews will be used to document river transportation uses, help understand possible relationships between river transportation and flow levels and ice conditions, and assist in explaining how new access opportunities might relate to existing transportation uses of the river corridor.

Interviews will be documented in an appendix of the Initial Study Report. .

15.7.4.4. *Forecast Future Conditions*

Future traffic forecasts, including Project-related construction and operations traffic, will be developed. These forecasts will address the following issues:

- Proposed transportation/transmission corridors
- Railroad loading and unloading facilities
- Proposed airport facilities
- Other facilities to support fueling, maintenance, and operations
- Possible staging areas
- Temporary improvements for construction
- Any scheduled improvements, such as improvements proposed for the Denali Highway

The study will use *Trip Generation, 8th Edition* (ITE 2008) to forecast future roadway traffic levels. *SimTraffic 8*, *Synchro 8*, and *HCS 2010* may be used to simulate and evaluate the current and future capacity of the road system. Existing aviation forecasts for existing public airports will be modified if needed, and forecasts for proposed new airports would be developed in accordance with FAA Advisory Circular 150/5070-6B and Forecasting Aviation Activity by Airport (July 2001). These methods of evaluating and predicting traffic levels are consistent with the standard practices of the transportation engineering community. For railroad and port traffic, AEA will work with ARRC operations staff and MSB and MOA port staff to project future activity levels and evaluate future capacity. Interviews with knowledgeable individuals will be used to develop forecasts of river use by various types of users.

15.7.4.5. *Evaluate Effects*

AEA will identify transportation capacity and safety concerns based on projected future road, railroad, port, aviation, and river traffic levels. All modes of transportation will be evaluated

before, during, and after Project construction. It will be easier to quantify transportation effects on some modes of transportation (road, rail, etc.); others may be more subjective and will rely on conducting interviews and surveys of various user groups (see Section 15.7.4.4).

After identifying and evaluating the effectiveness of scheduled improvements on projected future traffic levels, the team will identify and evaluate options to address any remaining capacity and safety concerns, if necessary. Some mitigation measures may consist of general best management practices, such as widening shoulders and adding guardrails on roadways to improve safety. Other mitigation measures may apply to a particular mode of transportation at a specific site and location. Examples include adding additional bridges, lanes, or passing lanes along the Parks Highway; adding apron space, improving navigation aids, or improving runway surfaces at existing airports; and improving or adding siding tracks along the existing ARRC mainline. Mitigation measures may include temporary measures, like building ice bridges.

River transportation effects will be assessed based on expected changes in flow levels, ice formation, and ice stability using data from the In Stream Flow (Section 8.5) and Ice Processes (Section 7.6) Studies. Measures to mitigate potential effects on river transportation uses will be identified if necessary.

15.7.5. Consistency with Generally Accepted Scientific Practice

Transportation forecasts will be developed using standard forecasting tools for highway and aviation operations. Forecasts of roadway traffic levels will be based on the Institute of Transportation Engineers (ITE) *Trip Generation, 8th Edition* (ITE 2008). Other generally accepted models, including *SimTraffic 8*, *Synchro 8*, and *Highway Capacity Software (HCS)* can be used if needed to evaluate road capacity. Forecasts for aviation traffic will be in accordance with FAA *Advisory Circular 150/5070-6B Airport Master Plans and Forecasting Aviation Activity by Airport* (July 2001).

15.7.6. Schedule

As set forth in Table 15.7-6, the initial transportation study will be carried out over 12 months, with an Initial Study Report issued in in Q1 2014. An Updated Study Report would be issued in Q1 2015 to incorporate any new or changed information that becomes available based on other studies conducted in 2013 or changes in the proposed Project.

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

15.7.7. Relationship with Other Studies

As depicted in Figure 15.7-1, the Transportation Resources Study will require input from several other studies and will provide input into other studies. The baseline transportation documentation will incorporate information from the Recreation Boating/Access and Subsistence studies (Sections 12.7 and 14.5), as shown below. The traffic forecasts and impact assessment will require input from the AEA engineering team to get Project-related transportation data and from the Social Conditions and Public Goods and Services study on overall population trends that will

affect forecasts of transportation demand. Information on future levels of transportation demand from recreation and subsistence users will be assessed using information from the Recreation Boating/Access (Section 12.7) and Subsistence (Section 14.5) studies.

Baseline and forecast transportation information from the Transportation Resources Study will influence the baseline Air Quality, Social Conditions and Public Goods and Services, and Health Impact Assessment studies. Mitigation measures identified during the analysis would feed back into Project engineering and design studies.

15.7.8. Level of Effort and Cost

The research into local and regional transportation will require professional engineers and planners with experience relevant to each mode of transportation to conduct the field investigations and data analyses identified in Section 15.8.4 (Study Methods). Total study costs are estimated to be approximately \$250,000.

15.7.9. Literature Cited

Center for Microcomputers in Transportation (McTrans). Highway Capacity Software (HCS) 2010, Release 6.3 [computer software]. University of Florida, Gainesville, Florida.

Federal Aviation Administration (FAA). 2001. Forecasting Aviation Activity by Airport.

FAA. 2007. Advisory Circular 150/5070-6B, Airport Master Plans.

Institute of Transportation Engineers (ITE). 2008. Trip Generation, 8th edition: An ITE Informational Report. Washington, DC.

Trafficware. 2011. SimTraffic 8 [computer software]. Sugarland, Texas.

Trafficware. 2011. Synchro 8 [computer software]. Sugarland, Texas.

15.7.10. Tables

Table 15.7-1. General Resources for Transportation Resources Study.

Report Title	Year Published	Publishing Agency ¹	Area Covered
Susitna-Watana Hydroelectric Project, Socioeconomic, Recreation, Air Quality and Transportation Data Gap Analysis (Draft)	2011	AEA	MSB
Pre-Application Document: Susitna-Watana Hydroelectric Project FERC Project No. 14241	2011	AEA	MSB
Mat-Su Long Range Transportation Plan	2009	MSB	MSB
Mat-Su Long Range Plan	2013; in progress	MSB	MSB
Talkeetna Comprehensive Plan	1999	MSB	MSB
Big Game Guides and Transporters	2011	DCCED	Statewide
Susitna-Matanuska Area Plan	2010	ADNR	MSB
Railbelt Large Hydro Evaluation Preliminary Decision Document	2010	AEA	MOA, MSB, Denali Borough
Matanuska-Susitna Borough Comprehensive Development Plan	2005	MSB	MSB
Railbelt Electrical Grid Authority Study	2008	AEA	MOA, MSB, Denali Borough
Susitna Basin Recreation Rivers Management Plan	1991	ADNR, ADF&G	Susitna Basin Recreation Rivers Management Plan

Notes:

- 1 ADNR: Alaska Department of Natural Resources; ADF&G: Alaska Department of Fish and Game; DCCED: Department of Commerce, Community and Economic Development; MOA: Municipality of Anchorage.

Table 15.7-2. Road Resources for Transportation Resources Study.

Report Title	Year Published	Publishing Agency ¹	Area Covered
Watana Transportation Access Analysis	2012	ADOT&PF	MSB
Annual Traffic Volume Report, Northern Region, 2008-2010	2011	ADOT&PF	MSB, Denali Borough
Annual Traffic Volume Report, Central Region, 2007-2009	2010	ADOT&PF	MOA, MSB
State of Alaska Annual Vehicle Miles of Travel	2010	ADOT&PF	Statewide
Parks Highway Visioning Document	2008	ADOT&PF	MSB, Denali Borough
The George Parks Highway Scenic Management Byway Corridor Partnership Plan	2008	ADOT&PF	MSB, Denali Borough
Alaska's Scenic Byways: Parks Highway	2006	ADOT&PF	MOA, MSB, Denali Borough
Alaska Denali Highway Points of Interest	2008	BLM	Denali Borough
Memorandum on the Economic and Demographic Impacts of a Knik Arm Bridge	2005	KABATA	MOA, MSB

Notes:

1 BLM: Bureau of Land Management; KABATA: Knik Arm Bridge and Toll Authority.

Table 15.7-3. Rail Resources for Transportation Resources Study.

Report Title	Year Published	Publishing Agency	Area Covered
Alaska Statewide Rail Plan	2013; in progress	ADOT&PF	MOA, MSB, Denali Borough
Alaska Railroad 2011 Program of Projects	2011	ARRC	MOA, MSB, Denali Borough

Table 15.7-4. Aviation Resources for Transportation Resources Study.

Report Title	Year Published	Publishing Agency ¹	Area Covered
Alaska Aviation System Plan	2011	ADOT&PF	Statewide
Mat-Su Regional Aviation System Plan	2009	MSB	MSB
Ted Stevens Anchorage International Airport 2008 Master Plan Study Report (Draft)	2009	TSAIA	MOA
Wasilla Airport Master Plan Update 2010	2010	City of Wasilla	MSB
Palmer Municipal Airport Master Plan Update	2009	City of Palmer	MSB

Notes:

1 TSAIA: Ted Stevens Anchorage International Airport.

Table 15.7-5. Port Resources for Transportation Resources Study.

Report Title	Year Published	Publishing Agency	Area Covered
Port MacKenzie Master Plan	2012	MSB	MSB (Port MacKenzie)
Port of Anchorage Master Plan	1999	MOA	MOA (Port of Anchorage)

Table 15.7-6. Schedule for implementation of the Transportation Resources Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Data Collection and Review					—								
Asset Inventory and Field Studies						—	—						
Interviews						—	—						
Document Existing Conditions							—	—					
Forecast Future Conditions							—	—					
Evaluate Impacts								—	—				
Initial Study Report									—	Δ			
Updated Study Report											—	—	▲

Legend:

- Planned Activity
- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

15.7.11. Figures

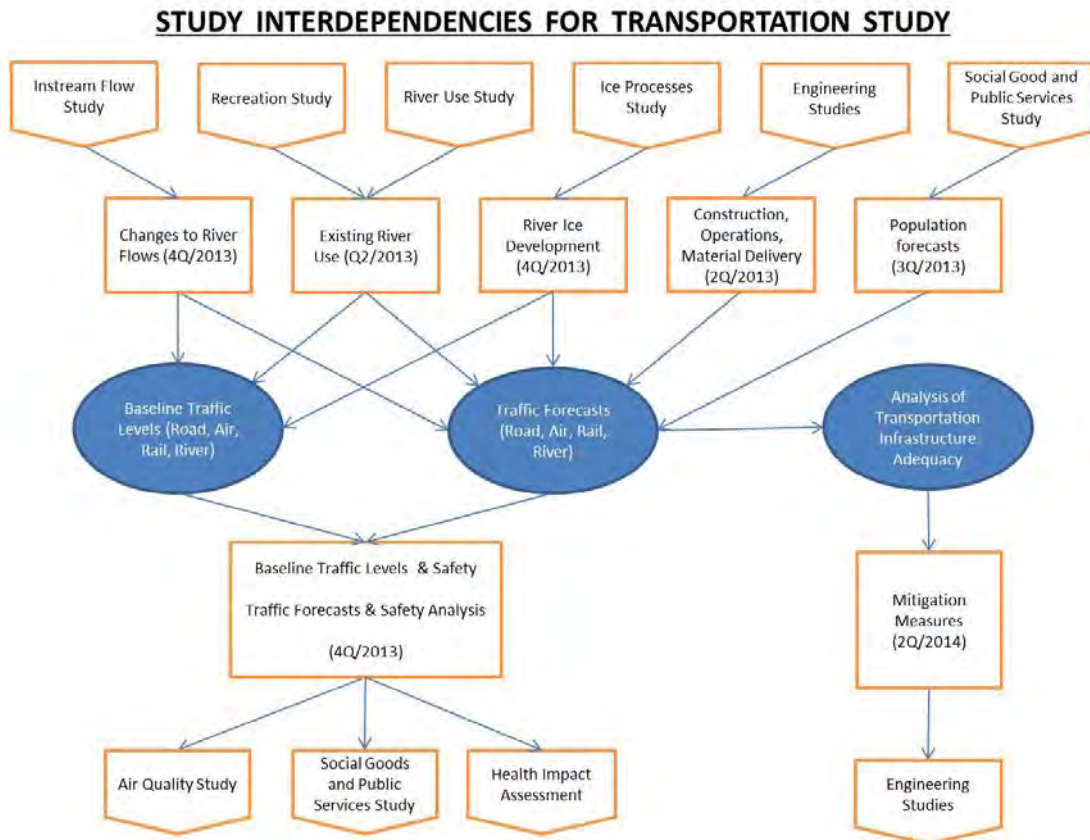


Figure 15.7-1. Transportation Resources Study Interdependencies with Other Studies.

15.8. Health Impact Assessment Study

15.8.1. General Description of the Proposed Study

15.8.1.1. Study Goals and Objectives

Health Impact Assessment (HIA) is a structured planning and decision-making process for analyzing the potential positive and negative impacts of programs, projects, and policies on the health of residents in impacted communities. In particular, four aspects of the Project may impact community health:

- The large size of this Project will require a large influx of construction personnel over several seasons which could impact the residents in various Railbelt communities.
- The development of the Project could lead to increased rail traffic and possibly additional traffic on the Parks and Denali Highways, potentially impacting communities and individuals using these transportation resources.
- It is possible that the creation of a large reservoir on the Upper Susitna River could produce conditions that could lead to changes in subsistence harvest locations or quantities, possibly leading to changes in nutritional uptake of subsistence users. Also a new reservoir could increase the bioaccumulation of naturally occurring mercury at a level that potentially affects public health. If this scenario occurs, it could potentially lead to consequences for local individuals, and even communities harvesting (and ingesting) aquatic resources in the Susitna River.
- The Project could lead to potential emission reductions from Railbelt fossil-fuel utility plants if the Project is operating and this could potentially lead to a reduction in emissions that affect public health in Railbelt communities.

Potential health considerations for construction and operational staff are not typically evaluated in HIA as they will be addressed in the occupational medicine and safety component of the various plans and specifications for construction activities and operational manuals for the Project.

The comprehensive HIA will use the methods and guidelines in the Alaska Department of Health and Human Service's (DHSS's) "Technical Guidance for HIA in Alaska," July 2011 (www.epi.hss.state.ak.us/hia/AlaskaHIAToolkit.pdf).

As part of the goals and objectives of an HIA the following activities are important to undertake:

- Identify potentially affected communities (PACs) and establish a community engagement plan.
- Through a review of the FERC scoping meetings and ongoing community engagement, identify public issues and concerns about how community health might be affected during construction and operation of the Project.
- Collect baseline health data at the state level, borough, or census area level, tribal level, and at the potentially affected community level, as possible.

- Identify data gaps and determine the most efficient method to fill those gaps, through community consultation and coordination with other studies, such as subsistence (Section 14.5), socioeconomics (Sections 15.5 and 15.6), and recreation (Section 12.5).
- Evaluate the baseline data against the Project description to initially determine the nature and extent of potential impact pathways, both positive and negative.
- Prepare an HIA baseline data report document which is transparent, scientifically rigorous, and understandable to the public.

15.8.2. Existing Information and Need for Additional Information

A variety of existing information sources is available and potentially useful to the HIA analysis. These information sources include reports from various Alaska state agencies including:

- Alaska Department of Health and Social Services
 - Bureau of Vital Statistics
 - Alaska Behavioral Risk Factor Surveillance Survey (BRFSS)
 - Youth Risk Behavior Study (YRBS)
 - Section of Epidemiology bulletins
 - Alaska Trauma Registry (ATR)
 - Cancer Registry
- State of Alaska Department of Labor and Work Force Development
 - Employment reports
- Alaska Department of Transportation and Public Facilities
 - Highway traffic statistics, particularly on large loads vehicles
 - Alaska State Trooper annual reports
- Alaska Department of Fish & Game
 - Harvest studies
 - Community Information System

The Alaska Native Tribal Health Consortium (ANTHC) prepares health status reports on a statewide and regional basis. The AEA HIA team will use these reports as baseline data:

- Alaska Native Health Status Report, August 2009
- Regional Health Profile for Interior Alaska, July 2011
- Regional Health Profile for Anchorage and Matanuska-Susitna, December 2011

In addition, pertinent reports from the U.S. Centers for Disease Control and Prevention and annual reports, such as County Health Rankings, prepared by the University of Wisconsin, are important resources that will be reviewed.

Review of the above data sources allows identification of data gaps which require additional information.

15.8.3. Study Area

The proposed HIA study area includes those communities potentially affected by construction and operation of the Project, such as Cantwell and communities along the Alaska Railroad corridor, as well as those communities further away but potentially affected by the movement of workers, materials, and supplies by using the criteria available in the Technical Guidance for HIA in Alaska (DHSS 2011). The study would also include communities identified in the Regional Economic and Air Quality studies that would experience changes in emissions resulting from reductions in fossil-fuel utility plant outputs as a result of the Project. In addition to the communities along transportation corridors and those identified in the Regional Economic and Air Quality studies, the HIA study will initially consider all the communities being studied in the Subsistence Study. Together all these communities have been initially identified as PACs for the Project analysis to help facilitate collecting baseline information that could be used in the analysis of Project effects. Some sample analysis factors that could be used to evaluate a communities possible nexus to the Project effects the following criteria are examined:

- Close geographic proximity to the Project,
- High likelihood for worker influx,
- Intense work force recruitment potential,
- High likelihood for change in key subsistence resources,
- High likelihood for change in transportation infrastructure,
- Potential for economic change including regional staging centers, and
- Existing high level of exposure to an environmental hazard that would be potentially exacerbated or improved by Project development.

15.8.4. Study Methods

The HIA will be divided into the following phases to systematically address data gaps identified during the overview process.

15.8.4.1. Project Overview and Issues Summary

The Project overview process will:

- develop Project-specific criteria for establishing the PAC's analysis framework (PACs for health may not be the same as for other social sciences and must be established);
- coordinate through community engagement, other social study areas, and other AEA licensing participant engagement programs to gather enough of the appropriate information to meet HIA needs; and,
- identify potential health concerns and issues related to the Project.

The result of this effort will be a "Project Overview and Issues Summary" that will be included in the Initial Study Report and will include a set of the geographical, time scale, and population boundaries of the assessment. The report will generally follow the overall strategies and methodologies presented in the "Technical Guidance for HIA in Alaska." For example, the State of Alaska HIA Program has identified the following eight health effect categories (HECs) that should be used to categorize the issues and concerns:

1. Social Determinants of Health (SDH),
2. Accidents and Injuries,
3. Exposure to Potentially Hazardous Materials,
4. Food, Nutrition, and Subsistence Activity,
5. Infectious Disease,
6. Water and Sanitation,
7. Non-communicable and Chronic Diseases, and
8. Health Services Infrastructure and Capacity.

These HECs are fully described in the “Technical Guidance for HIA in Alaska.” In addition, there may be community-level health concerns that are expressed holistically and do not fit this analytic structure. In addition, positive health benefits of a new renewable energy resource to the region will be identified. An HIA, however, cannot address every conceivable health effect or effects that are primarily nuisance impacts and rarely observed. Instead, the initial Project review process highlights health effects that have the possibility of producing intense impacts with persistent duration and broad geographical scope that are highly likely to occur. There must also be a clearly defined causal link between the Project and the anticipated health effect.

15.8.4.2. Phase 2: Baseline Data Collection

After the Project overview process is complete, it will be necessary to perform an analysis of available federal/state/regional/tribal/community/household level health data starting in the second half of 2013 and proceeding through 2014. Data collected by other Project studies will be included where such studies will produce baseline data that may be useful to the HIA. For example, AEA will use information from the Air Quality study concerning existing and future air quality levels, and from the socioeconomic studies for population projections and household characteristics, which have been shown to be key determinants of health. Coordination between studies will avoid unnecessary duplication of effort and community ‘survey fatigue.’

Subsistence issues and existing available community / household consumption and nutritional data are often critical for local communities. AEA HIA team will integrate some efforts with the Subsistence Resources Study (Section 14.5) to address how subsistence issues interact with the proposed Project location, size, linear features, and PACs. Community input and baseline harvest data and traditional and local knowledge (TLK) documented in the Subsistence Resources Study (Section 14.5) will be used to identify those subsistence foods and practices that are vital to residents of the area. This information will be used to identify potential impacts to the quality and quantity of, and access to, subsistence resources. Direct, indirect, and cumulative impacts to subsistence will be considered throughout HIA study.

Field studies are designed to fill data gaps. For example, 1) AEA will document community food sources in PACs during/in conjunction with the subsistence household harvest surveys 2) the AEA HIA practitioners will work alongside the AEA Subsistence Resource Study (Section 14.5) practitioners to document traditional and local knowledge regarding health in the subsistence TLK workshops. The AEA HIA team may conduct follow-up interviews regarding health with key respondents identified during TLK workshops and make observations on critical community services, such as water, sanitation, and health care facilities, including medical emergency services capabilities. Understanding capabilities and functionality of these services provides input to determining potential effects related to influx, construction activities, and roadway

traffic. Field studies and community visits will be coordinated with Subsistence Resource Study efforts (Section 14.5) to provide the information in an efficient manner.

The Subsistence Resources Study (Section 14.5) will document TLK. The AEA HIA team will conduct follow-up interviews regarding health with key respondents identified during TLK workshops.

The AEA HIA team will perform data collection tasks within the “subsistence resource study communities” according to identified data gaps. The Subsistence Resources Study (Section 14.5) includes a list of study communities designed to adequately address potential impacts to those who use the study area for subsistence activities. This includes communities that are located outside the study area but have documented use within the study area. The Subsistence Resources Study (Section 14.5) developed these criteria for inclusion as a study community:

- the community is located within the Susitna River watershed;
- the community is located outside of the Susitna River watershed but has previously documented subsistence use areas that extend into the watershed; or
- the community is one of the communities preliminarily identified by ADF&G as needing updated harvest information.

Based on the above criteria, the Subsistence Resources Study (Section 14.5) has identified 37 study communities whose subsistence uses could potentially be affected by the proposed Project. The HIA study will work through the subsistence data collection efforts to gather information from a food security/nutrition perspective. As part of the subsistence household surveys, ADF&G survey tools include a food security/nutrition section to help identify potential nutrition related considerations most of the communities being surveyed. The survey tool to be administered can be found in Attachment 14-2 of the Subsistence Resource study plan. Depending on results from the baseline studies in 2013, some additional communities that have not been surveyed specifically for the food security/nutrition aspects may need to be surveyed in 2014. If that is the case, then the ISR will include the rationale and methods to gather additional information to supplement the baseline study information and this will be discussed with Licensing Participants in 2013-2014 TWG meetings.

The output of the baseline data review, data gaps analysis, and field studies will be a “Baseline Community Health Data Assessment” chapter in the HIA which will be included in the Updated Study Report.

15.8.4.3. Phase 3: Identification of Potential Impact Mechanisms and Effects

The specific health impacts for the Project will be identified when all components of the Project have been defined as AEAs proposal in its License Application to FERC. The HIA analysis in 2013 and 2014 therefore will not necessarily serve as a final HIA for the Project; however the analysis, as needed, can be updated and included in the FERC License Application once the AEA Project proposal is finalized. For this study, the AEA HIA team will rate and rank the health impacts using a semi-quantitative model described in detail in the HIA Toolkit. The purpose of rating and ranking impacts is to enable interested parties to construct a health impact management framework.

The HIA will consider impacts that have beneficial or detrimental consequences to communities or individuals. Each health impact has several different dimensions, listed below.

- Significance
- Nature
- Timing and duration
- Extent
- Magnitude (intensity)
- Frequency

The HIA process may include the following components:

- In-depth review of available state, regional, tribal, and local health data;
- Comparison of study area data to state and regional health data;
- Analysis of special at-risk subpopulations (such as children under the age of five years, pregnant women, elderly, or other previously defined vulnerable groups);
- Consideration of key Project-specific toxicology issues, e.g., mercury loading associated with reservoir development and impacts on subsistence resources;
- Field survey visit and consultation with local health representatives, particularly from tribal organizations, if present;
- Seasonality considerations, i.e., summer versus winter differences in subsistence practices, water use, and associated disease-transmission dynamics;
- Variability of existing health care infrastructure across different affected areas;
- Coordination and alignment with existing State disease-control programs and strategies (e.g., TB, HIV/AIDS, hypertension, diabetes, substance abuse, etc.); and
- Detailed consideration of impacts to tribal peoples through the presentation of tribal health data and inclusion of the results of tribal health consultations in the HIA.

The information developed in this study is intended to be sufficient to be able to prepare a Health Management Plan (HMP), if needed in the licensing process, which may include:

- Types of health protection processes that may be needed;
- Traditional knowledge, perspectives, and activities that may represent uniquely tribal approaches to human wellness;
- Strategies available to lessen impacts and the timescales relating to health impacts;
- Temporary measures which can be put in place; and
- Local capacity to put the proposed strategies into practice.

15.8.4.4. Phase 4: HIA Document Preparation

An HIA document, with technical appendices as needed, written in accordance with the DHHS HIA guidelines will be issued in the Updated Study Report. The HIA will be updated to include relevant results from 2014 field studies as reported in the Initial Study Reports.

15.8.5. Consistency with Generally Accepted Scientific Practice

The HIA will follow the ADHHS technical guidance for HIAs (ADHSS 2011). These guidelines are the standard to which HIA is performed in the State of Alaska.

15.8.6. Schedule

An Initial Study Report for the HIA will be completed by Q1 2014. This initial report will document the project overview, issues summary, and baseline data collected. Results from other studies (Subsistence (Section 14.5), Air Quality (Section 15.9), Social Conditions and Public Goods and Services (Section 15.6) and any additional information and analysis conducted in 2014 will be summarized in the Updated Study Report in Q1 2015 (see Table 15.8-1).

15.8.7. Relationship with Other Studies

The HIA is dependent upon results from several other studies and will require input from several other studies as shown in Figures 15.8-1 through 15.8-5, below. As shown in Figure 15.8-1, the HIA HEC3 Exposure to Potentially Hazardous Materials will use baseline data collected via the Mercury Assessment and potential for Bioaccumulation Study (Section 5.7) to establish a baseline of current levels of contaminants of human health concern present in fish and in water. These data will be compared to human health risk based screening levels. Similarly, the HIA will use data generated by the modeling exercise portion of these studies in order to assess potential project impacts on contaminant levels in fish and water. Mercury will be a specific area of focus for this HEC given its potential for: adverse effects on human health; its bioaccumulative properties; and given that reservoir construction can elevate levels of mercury in fish through the release of natural and anthropogenic-sourced inorganic mercury from flooded vegetation and soils.

As shown in Figure 15.8-2, the HIA HEC3 Exposure to Potentially Hazardous Materials will also utilize baseline emissions data collected by the Air Quality and Transportation Studies as a resource for determining baseline air quality in the PACs. Data generated by the modeling of future air emissions portion of the by Air Quality Study will inform the assessment of Project driven risks to human health due to potential change in air quality.

As shown in Figure 15.8-3, the HIA HEC2 Accidents and Injuries will utilize traffic levels data (Road, Air, Rail, River) generated by the Transportation Study as a resource for establishing a traffic safety baseline in the PACs. Data generated by the traffic forecasting portion of the study will inform the assessment of project driven accidents and injury risk posed by changes in baseline traffic.

As shown in Figure 15.8-4, the HIA HEC1 Social Determinants of Health will use the Social Goods and Public Services Study as a resource for establishing baseline social determinants of health. Data regarding: hiring practices, cultural change; housing availability/inflation; economy, employment, and education; generated by the Engineering and Social Goods and Public Services Studies will be used inform the assessment of potential project driven changes in SDH.

As shown in Figure 15.8-5, the HIA HEC4 Food, Nutrition, and Subsistence section will use the Subsistence Resources Study to identify subsistence resources currently used in project area and as a resource to evaluate potential project impacts on identified subsistence uses in the PACs.

15.8.8. Level of Effort and Cost

Based on past HIA experiences in Alaska, the HIA study program is expected to cost approximately \$200,000.

15.8.9. Literature Cited

AEA 2011. Railbelt Large Hydroelectric, Presentation to the Alaska Senate Resources Committee and the House Energy Committee, by the Alaska Energy Authority, January 25, 2011.

DHSS 2011. Technical Guidance for Health Impact Assessment in Alaska, Alaska Department of Health and Human Services, Section of Epidemiology, Health Impact Assessment Program, July 2011.

15.8.10. Tables

Table 15.8-1. Schedule for implementation of the HIA.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Project Overview and Issues Summary					—	—							
Baseline Data Collection					—	—	—	—		-----			
Initial Study Report												Δ	
Potential Impact Mechanisms & Effects									—	—	—	—	
Updated Study Report													—▲

Legend:

- Planned Activity
- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

15.8.11. Figures

INTERDEPENDENCIES FOR HIA- BASELINE WATER QUALITY STUDY & MERCURY BIOACCUMULATION STUDY

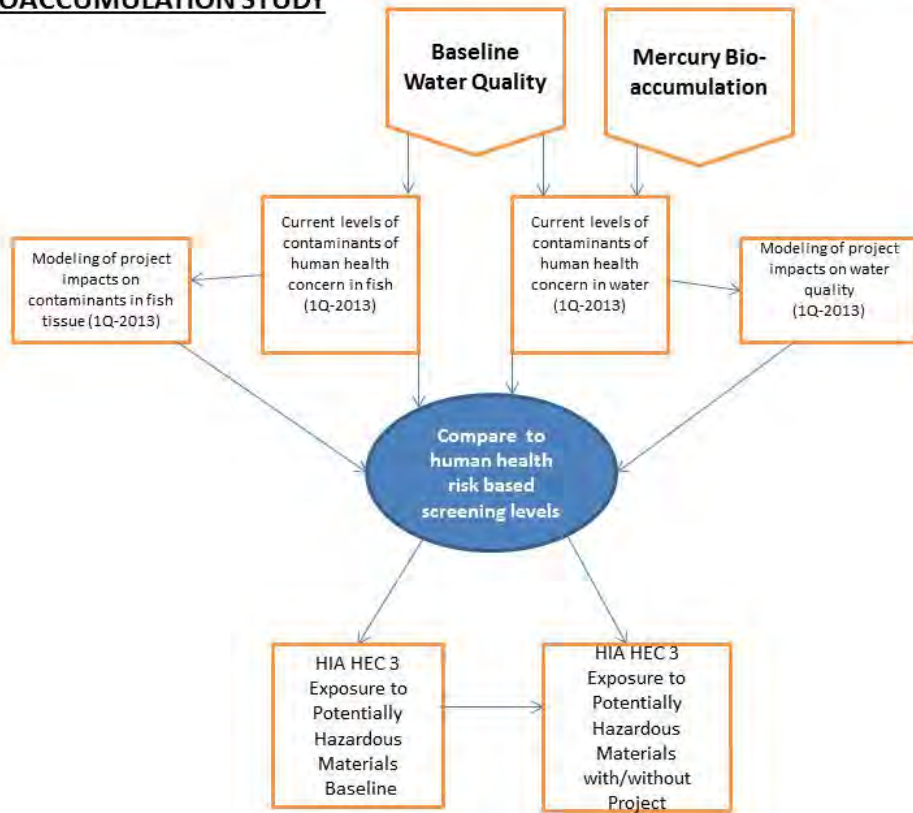


Figure 15.8-1. HIA Interdependencies for Baseline Water Quality and Mercury Bioaccumulation Studies.

INTERDEPENDENCIES FOR HIA- AIR QUALITY AND TRANSPORTATION STUDIES

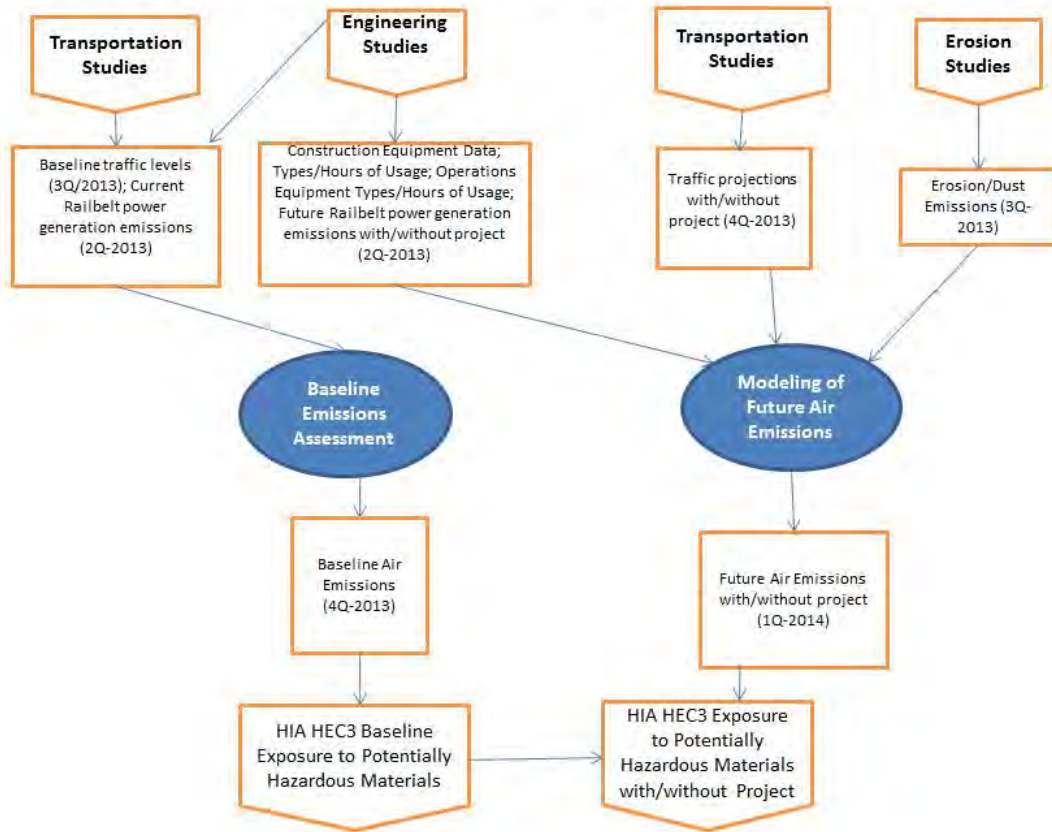


Figure 15.8-2. HIA Interdependencies with Air Quality and associated Transportation Study components.

INTERDEPENDENCIES FOR HIA- TRANSPORTATION STUDY

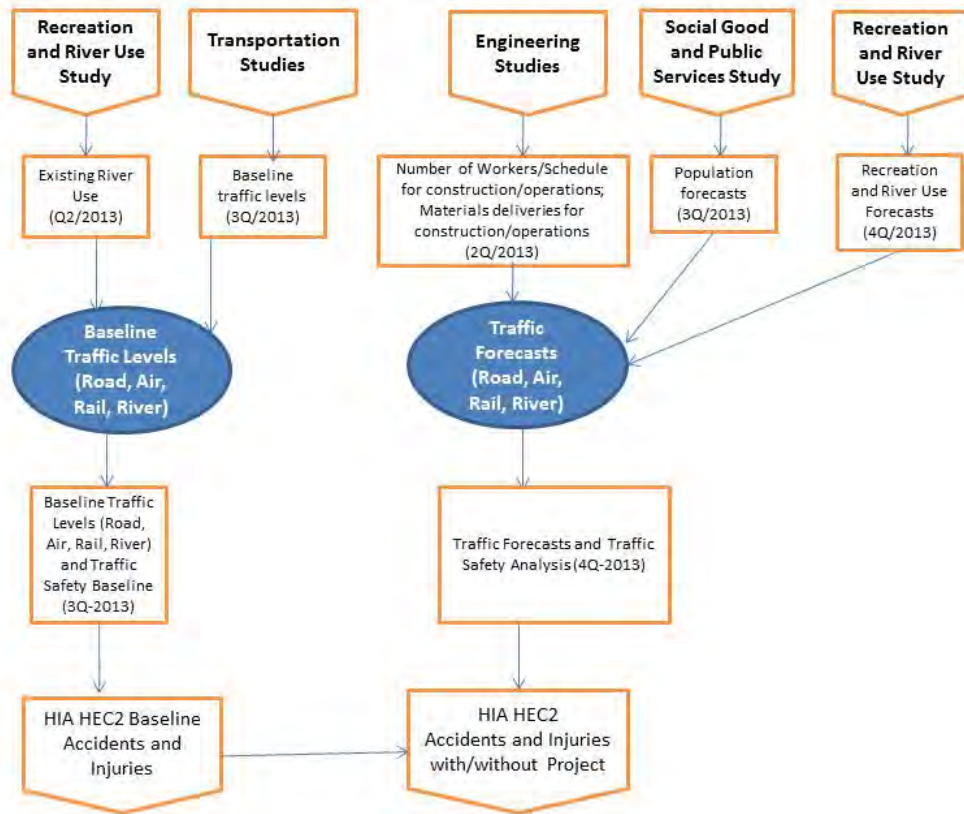


Figure 15.8-3. HIA Interdependencies with the Transportation Study.

INTERDEPENDENCIES FOR HIA-SOCIAL CONDITIONS AND PUBLIC SERVICES STUDY

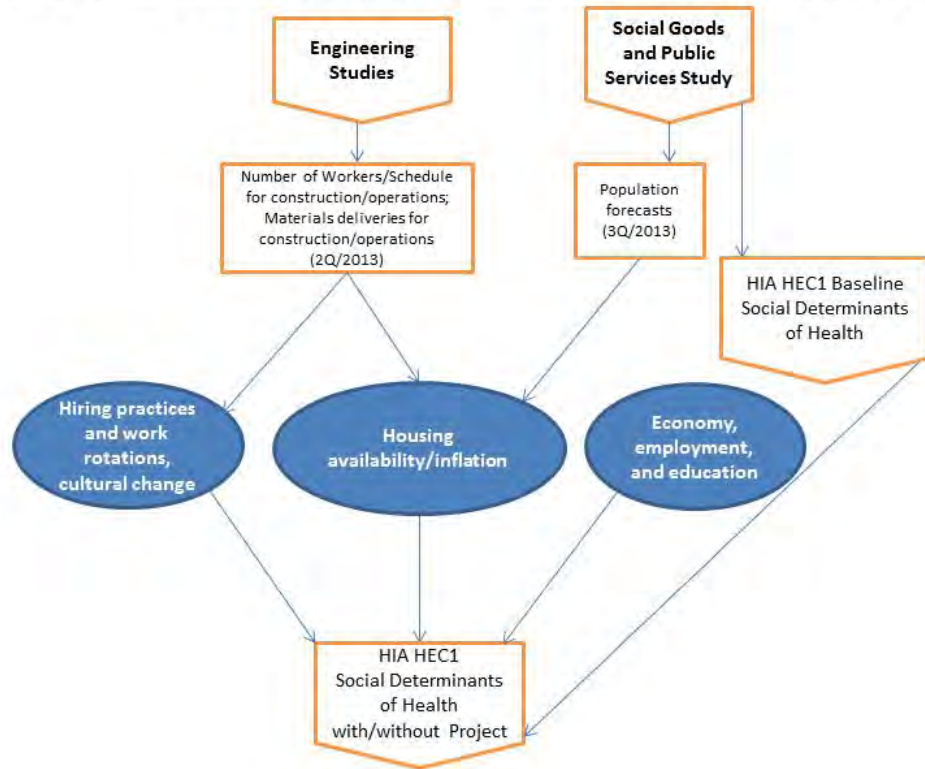


Figure 15.8-4. HIA Interdependencies with Social Conditions and Public Services Study.

INTERDEPENDENCIES FOR HIA-SUBSISTENCE RESOURCES STUDY

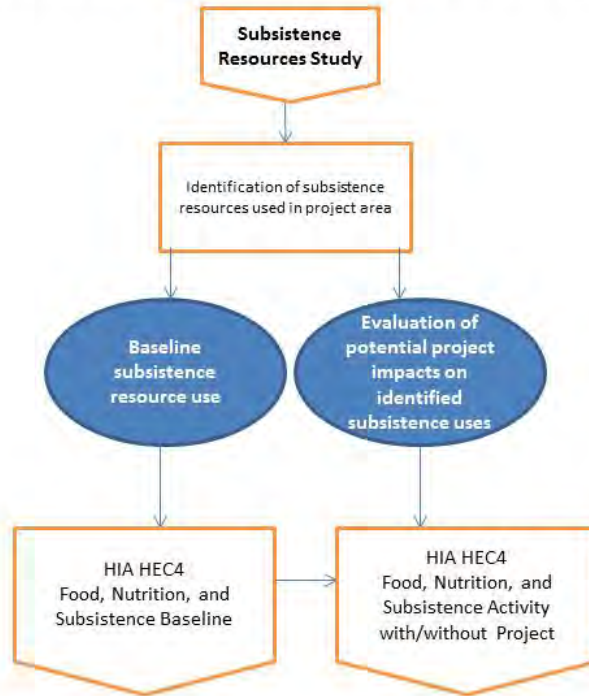


Figure 15.8-5. HIA Interdependencies with Subsistence Study.

15.9. Air Quality Study

15.9.1. General Description of the Proposed Study

The Air Quality Study will assess the current conditions of the study area against applicable state and national air quality standards and evaluate the Project's air quality impact against these standards. The analysis will evaluate both short-term (construction) and long-term (operational) impacts from the Project and how Project emissions compare to the Without-Project alternative. The analysis will also include an assessment of the indirect impact of the Project on existing fossil-fuel electricity generators in the area, which could result in improvements to regional air quality to the extent that Project generation replaces fossil fuel generation.

In addition to identifying potential emission sources and levels to assess the potential impacts of the Project on air quality, the results of the study will help, if necessary, in identifying potential options to reduce emissions during construction and operations to meet regulatory requirements and maintain public health and safety.

Study Goals and Objectives

The primary goal and objective of the air quality analysis is to ensure that the proposed Project does not violate National Ambient Air Quality Standards (NAAQS) per 40 CFR Part 50 and state air quality standards in Alaska Administrative Code (AAC) 18 AAC 50 (under the authority of Alaska Statutes (AS) 46.03 and 46.14). The national and state air quality regulations are designed to maintain and/or improve air quality by controlling or reducing emissions of air pollutants. The air quality impact analysis is subject to the state and national ambient air quality standards and state and national attainment designations (i.e., attainment, non-attainment, maintenance).

The following are the primary objectives of the Air Quality Study:

- Assess the current conditions of the area against applicable state and national air quality standards.
- Review and summarize existing air monitoring data in the area.
- Determine attainment status of the study area (i.e., unclassifiable/attainment, non-attainment, maintenance).
- Quantify short-term (construction) and long-term (operational) emissions.
- If applicable, analyze ground level impacts using air dispersion models.
- If applicable, evaluate indirect mobile source emissions from additional traffic generated.
- Compare Project emissions to the Without-Project alternative.
- Evaluate potential emission reductions from Railbelt fossil-fuel utility plants if the Project is operating.
- Develop information to be used in the identification of potential mitigation measures, if necessary, to reduce emissions during construction.

15.9.2. Existing Information and Need for Additional Information

There is little existing ambient monitoring data available in the vicinity of the Project site. The nearest state monitoring sites are located in the MSB urban core. The primary air quality concern in the area is particulate matter (PM₁₀ and PM_{2.5}) from fugitive dust, volcanic ash, wildfire smoke, and wood heating or other wood burning devices. There have been

supplemental monitoring projects conducted by ADEC within the MSB over the past several years along with ambient data collected by the National Park Service (NPS) that will also be reviewed. These supplemental studies mainly pertain to particulate matter. There are some limited data available from two sites in Denali National Park. AEA will investigate whether the state or NPS has any other relevant data that may be available and will summarize any available data to support the existing conditions section.

Existing data will be compared to applicable standards for criteria pollutants in a table. The study assumes ambient air monitoring will not be required, since the Project is not expected to be a significant source of emissions and there are no existing major sources of air emissions in the area. The area is designated unclassifiable/attainment under 18 AAC 50.015 for all criteria pollutants. EPA maintains a list of non-attainment areas for all six criteria pollutants on their Green Book website: (<http://www.epa.gov/oar/oaqps/greenbk/index.html>) and ADEC lists state attainment designations under 18 AAC 50.015.

An emissions inventory of Railbelt fossil-fuel utility plants will be generated and categorized by fuel source to evaluate the potential emissions reductions from such facilities if the Project is implemented. This inventory will be based on existing information in the RIRP or other updated information, if available.

Detailed information on Project construction and operations will be needed to estimate and evaluate the Project emissions for criteria pollutants for comparison to national and state standards. This includes levels of traffic by various modes and timeframes, construction equipment and activities, and operations equipment and schedules. A table comparing projected With-Project emissions with projected Without-Project emissions will be generated.

15.9.3. Study Area

The study area for the Air Quality Study will mainly comprise the immediate vicinity of the Project Study Area (Figure 1.2-1) and the greater Railbelt region.

While preparing the air quality analysis, particular attention will be made to the following:

- Environmentally sensitive areas
- Nearby dense population areas
- Issues raised by ADEC and other agencies such as the NPS or other licensing participants

15.9.4. Study Methods

EPA and ADEC have air quality standards that must be met for new sources of emissions of criteria pollutants. AEA will estimate emissions generated by the Project, including construction and operation emissions. The emissions, along with the type and size of equipment, will be compared to appropriate ADEC permit thresholds as outlined in 18 AAC 50 to determine the type of permit and air dispersion modeling required, if any. Denali National Park is designated as a Class I area under the federal Prevention of Deterioration (PSD) program. Emission estimates from the Project are expected to be below major source thresholds; therefore, a PSD and Title V permit are not anticipated for the Project.

The air quality study will assess the existing conditions of the area against applicable state and national air quality standards and evaluate the Project's air quality impacts against these

standards. The analysis will include evaluation of both short-term and long-term impacts from the Project and a comparison of Project emissions to the no-action alternative. An emissions inventory of Railbelt fossil fuel utility plants will be generated and categorized by fuel source to evaluate the potential emissions reduction from these facilities if the Project is constructed and in operation.

15.9.4.1. Document Existing Conditions

Air monitoring reports prepared by ADEC will be reviewed to assess the existing conditions of the area. There is little existing ambient monitoring data available for the vicinity of the Project site. The team will investigate whether the state and/or NPS has other project-specific monitoring data that may be available to help characterize the air quality within the study area. AEA will coordinate with ADEC and NPS and use the most relevant data available to support the existing conditions section. The monitoring data will be compiled and compared to applicable standards for criteria pollutants in a table. Criteria pollutants as defined by EPA are nitrogen dioxide (NO₂), sulfur dioxides (SO₂), carbon monoxide (CO), PM₁₀/PM_{2.5}, lead (Pb) and ozone (O₃).

The study area is currently unclassifiable/attainment under 18 AAC 50.015 and the EPA Green Book with respect to all criteria pollutants.

15.9.4.2. Estimate Project Emissions

Emissions from construction equipment and related activities will be estimated for comparison to appropriate state permitting criteria. Construction equipment emission factors will be obtained from the EPA's NONROAD model or similar model. Fugitive particulate matter emissions from the handling and storage of raw materials and wind erosion during construction will be quantified according to methodologies specified in EPA's Compilation of Air Pollutant Emission Factors (AP-42) or similar source of emission factors. Typical construction activities could include, but are not limited to, construction equipment, earth moving activities, construction worker commutes, material deliveries, earth hauling, and operation and maintenance activities. Detailed information on Project construction and operations will be needed to estimate and evaluate the Project emissions. This will include levels of traffic by various modes and timeframes, construction equipment and activities, and operations equipment and schedules.

In addition to construction activities, a Portland cement plant may be required on-site in order to construct the dam, however, it has not been determined at this time if such a source will be required along with any specifications on the size and operations of such a plant. If such a facility is proposed, the emissions will be compared to applicable federal PSD and Title V thresholds 40 CFR § 51.21(b)(1)(i)(a), 40 CFR § 51.21(b)(1)(i)(c)(iii)(c) and 40 CFR § 71.2, along with state minor source permitting thresholds as outlined in Article 5 of 18 AAC 50. Air quality dispersion modeling would also be conducted to demonstrate compliance with the NAAQS. If a state permit is required, air quality dispersion modeling may also be required and will be performed consistent with 18 AAC 50.215 dispersion modeling guidelines.

The Project is not located in an EPA or ADEC designated non-attainment area; therefore, General Conformity and Transportation Conformity will not apply. If the Project generates average daily traffic volumes that exceed a state or federal mobile source threshold for CO, PM₁₀/PM_{2.5}, or mobile source air toxics (MSATs) analyses, then a mobile source evaluation may

be required. This will be determined after consultation with appropriate state and federal personnel and a review of the transportation study.

15.9.4.3. Summarize Baseline Fossil Fuel Generation Emissions

The study will also include a summary of the baseline fossil fuel generation emissions in the area. The team will use the source data and references identified by HDR in the Section 7.3.1.2 of the Data Gap Analysis along with other applicable source data for generating the emissions inventory. It is assumed that no additional monitoring or data collection will be required at existing power generation sites.

15.9.4.4. Analyze and Compare With-Project Emissions to Without-Project Emissions

The study will include a comparison of future estimated With-Project emissions to emissions estimated for future Without-Project emissions. The estimate of Without-Project emissions will include the potential emissions from other Railbelt fossil fueled facilities to provide the equivalent annual generation power as the Project if the Project is not implemented, or the installation of new generation facilities for the future using a similar fuel mix to the current Railbelt facilities.

15.9.4.5. Identify Best Management Practices

Best management practices to reduce air emissions related to construction and operation of the Project will be identified, including evaluating dust mitigation measures based on studies conducted by ADEC and the Alaska University Transportation Center.

15.9.5. Consistency with Generally Accepted Scientific Practice

Air quality study estimates and forecasts will be developed using EPA's NONROAD model or EPA's Compilation of Air Pollutant Emission Factors (AP-42) for construction equipment and other non-automotive sources. If needed, EPA-approved methods would be used to estimate mobile source emissions.

15.9.6. Schedule

The schedule for the air quality analysis will be six to seven months as shown in the table below. The Initial Study Report will be issued in Q1 2014, and the Updated Study Report will be issued in Q1 2015.

In 2014 and 2015, licensing participants will have opportunities to review and comment on the study reports (Initial Study Report in early 2014 and Updated Study Report in early 2015). Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014.

15.9.7. Relationship with Other Studies

The Air Quality Study will require input from the Transportation Study (Section 15.7) and the Engineering Studies as shown below. Traffic levels and their effect on existing air quality will be documented. Information from the Project Engineering Studies will be used to estimate

construction and operations emissions. Information on air emissions will be used to evaluate potential health effects in the Health Impact Assessment Study (Section 15.8) and could be used in the Aesthetics Study (Section 12.6) (See Figure 15.9-1).

15.9.8. Level of Effort and Cost

Details regarding equipment to be used for construction and operations and operational information should be sufficient to perform an analysis of Project emissions. Information on emissions from other Railbelt power sources that may be offset by this Project would be needed to allow for a full analysis of potential costs and benefits.

Completion of the work described above would require seven to ten months of effort over the two year study period at an estimated cost of \$100,000.

15.9.9. Literature Cited

18 AAC 50, Alaska Administrative Code, Air Quality Control.

AS 46.03, Alaska Statutes, Title 46, Water, Air, Energy, and Environmental Conservation, Chapter 46.03 Environmental Conservation.

AS 46.14, Alaska Statutes, Title 46, Water, Air, Energy, and Environmental Conservation, Chapter 46.14 Air Quality Control.

EPA 40 CFR Part 50, National Ambient Air Quality Standards.

EPA Green Book Non-Attainment Areas for Criteria Pollutants.

HDR 2011. Susitna-Watana Hydroelectric Project, Socioeconomic, Recreation, Air Quality, and Transportation Data Gap Analysis. Unpublished, by the Alaska Energy Authority.

42 U.S.C. 7401, The Clean Air Act.

15.9.10. Tables

Table 15.9-1. Schedule for implementation of Air Quality Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Review Existing Information/Identify Needs					—								
Document Existing Conditions						—							
Summarize Baseline Fossil Fuel Emissions							—						
Initial Air Quality Study Report								—	Δ				
Estimate Future Emissions with/without Project									—	—			
Updated Study Report												—	▲

Legend:

— Planned Activity

- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report

15.9.11. Figures

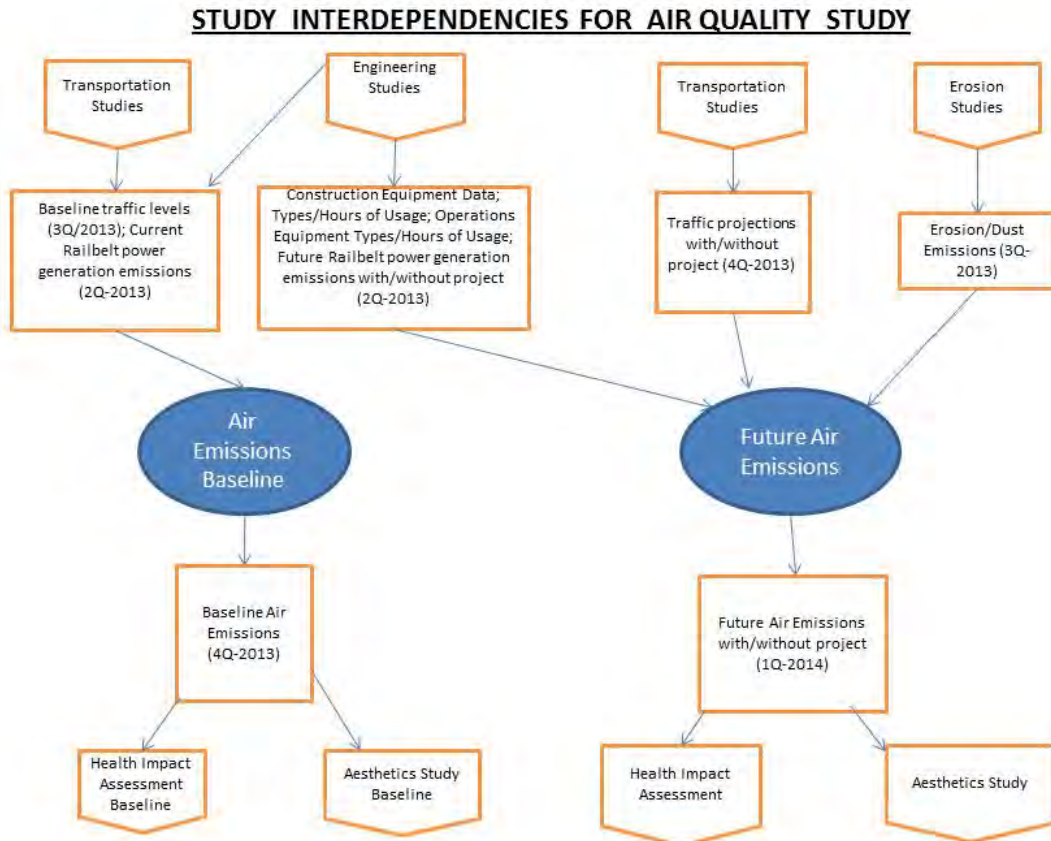


Figure 15.9-1. Air Quality Study Interdependencies with Other Studies.

15.10. Attachments

ATTACHMENT 15-1. REGIONAL ECONOMIC EVALUATION
INTERVIEW PROTOCOL

ATTACHMENT 15-1
REGIONAL ECONOMIC EVALUATION INTERVIEW PROTOCOL

Regional Economic Evaluation Interview Protocol

Regional Economic Evaluation Interview Methods

A list of businesses and organizations that will be contacted is provided in Table 15.A-1. Semi-structured interviews will be used to explore the future of a number of economic activities in-depth. (Note that a list of proposed or planned projects and actions that have been discussed in the public arena will be developed and provided to each person prior to the interview.) Table 15.A-2 provides questions that will be used with specific focus on the Project and the study area. The interviews will focus on those activities expected to occur over the next thirty years, and for which the interviewee has specific knowledge. The likelihood of the future economic activities identified by these sources will be assessed and the information will be compiled into model assumptions.

Table 15.A-1 Companies/organizations that will be contacted and topics for discussion.

<u>Agency/Organization</u>	<u>Topics</u>
State Agencies	
Alaska Department of Commerce, Community & Economic Development	New or expanded industries that might develop with operation of the Project, rural and urban changes that may occur with and without the Project
Alaska Department of Fish & Game	Potential stocking of reservoir, potential changes in fish and game regulations including subsistence, potential changes in subsistence and sport and commercial harvests with and without the Project.
Alaska Department of Labor & Workforce Development	Occupational forecasts for construction workforce skills; general outlook for employment, unemployment, and population in the study area with and without the Project
Alaska Department of Natural Resources	Mineral deposits in proximity to the access road and the Project which might benefit from improved access and available hydroelectric power
Alaska Department of Revenue	Outlook for oil and gas and mining revenues, Permanent Fund and Permanent Fund Dividends, and potential for increased revenues from other taxes with and without the Project
Alaska Department of Transportation and Public Facilities	Potential for additional access improvements in study area with and without the Project, and Mat-Su Borough population forecasts
Alaska Industrial Development and Export Authority	Other proposed projects that may be planned in proximity to the Project or which are proposed to benefit from the additional power availability; also list of relevant questions shown in Table A-2.
Alaska Railroad Corporation	Outlook for rail traffic in the future without the Project , and effect of the Project on railroad revenues and capacity to provide additional cargo movements on a year-round basis
University of Alaska, Institute of Social and Economic Research	General outlook on State's economy; also list of relevant questions from Table A-2

<u>Agency/Organization</u>	<u>Topics</u>
Alaska Native Corporations	
Ahtna, Inc	List of relevant questions from Table A-2
Cook Inlet Region Inc	List of relevant questions from Table A-2
Doyon, Inc	List of relevant questions from Table A-2
Eklutna, Inc	List of relevant questions from Table A-2
Industry Associations	
Alaska Miners Association	List of relevant questions from Table A-2
Alaska Oil and Gas Association	List of relevant questions from Table A-2
Alaska Travel Industry Association	List of relevant questions from Table A-2
Associated General Contractors of Alaska	List of relevant questions from Table A-2
Fairbanks Economic Development Corporation	List of relevant questions from Table A-2
Resource Development Council	List of relevant questions from Table A-2
Anchorage Economic Development Corporation	List of relevant questions from Table A-2
The Alliance	List of relevant questions from Table A-2
Businesses	
Alyeska Pipeline Service Company	Confirm outlook on minimum crude oil flow through the pipeline
Northrim Bank	General outlook on state economy; list of relevant questions from Table A-2
Totem Ocean Trailer Express	General outlook on state economy and near-term resource extraction projects; effect of Project on marine transportation industry
Usibelli Coal Company	List of relevant questions from Table A-2
Utilities	
Railbelt Utilities	Confirmation of future generation plans without the Project, historic electricity rates, plans for transmission line expansion or extension and system average interruption duration index reliability minutes (as needed)
Copper Valley Electric Association	Confirmation of future generation plans without the Project, historic electricity rates, system average interruption duration index reliability minutes (as needed)
ENSTAR Natural Gas Company	Confirmation of potential changes in natural gas demand for the company and the effect of these changes on company revenues (as needed)

<u>Agency/Organization</u>	<u>Topics</u>
Local Governments/Associations	
Denali Borough	List of relevant questions from Table A-2
Fairbanks North Star Borough	List of relevant questions from Table A-2
Kenai Peninsula Borough	List of relevant questions from Table A-2
Matanuska-Susitna Borough	List of relevant questions from Table A-2
Municipality of Anchorage	List of relevant questions from Table A-2
Talkeetna Community Council, Inc	List of relevant questions from Table A-2
Federal Agencies	
Denali Commission	List of relevant questions from Table A-2
Federal Subsistence Board	List of relevant questions from Table A-2
U.S Bureau of Land Management	List of relevant questions from Table A-2
U.S Bureau of Ocean Energy Management	Outlook for Outer Continental Shelf oil production and additional flow through the TransAlaska Pipeline System

Table 15.A-2 Proposed Interview Questions.

<p>This set of questions is designed to elicit comments on the timing, and specific events within the list of projects/actions (Base-Case Scenario) provided to the person being interviewed.</p>
<p>1. Are there events in the list that you think will not occur?</p>
<p>2. Are there other reasonably foreseeable future events that could have a significant effect on the Railbelt or the State as a whole that are not included in this set of assumptions that you think we need to consider?</p>
<p>3. Are there major activities in your (community/organization/industry) that will affect residential, commercial, and industrial growth in the Railbelt or the State as a whole?</p>
<p>4. Do you have any comments on long-term forecasts for your industry or community/borough?</p>
<p>5. Are there specific events that if they happened could significantly affect your business or community?</p>
<p>6. How would you change the scenario assumed in the list of events to reflect a more optimistic yet potentially realistic prognosis for your (community/organization/industry)?</p>
<p>7. How would you change the base-case scenario to reflect a more pessimistic yet potentially realistic prognosis for your organization or industry sector?</p>
<p>8. Are there events in the list that you think will not occur?</p>
<p>This set of questions is designed to elicit comments on activities Without the Project and With the Project</p>
<p>1. Approximately, how many full-time equivalent jobs does your (borough/community/organization) currently generate?</p>
<p>2. For businesses: Approximately, how many full-time equivalent jobs does your industry currently generate within the state?</p>
<p>3. Assuming that the Project is built, if you were to make an estimate, where do you see your (borough/community/organization)'s total employment in Year XXXX? In Year XXXX?</p>
<p>4. For businesses: Where do you see total employment in your industry in Year XXXX and Year XXXX without the Project?</p>
<p>5. If the Project were built, do you think your (borough/community/organization) would see different growth patterns?</p>
<p>6. How, if at all, will the Project affect your (borough/community/organization)?</p>
<p>7. For businesses: How, if at all, will the Project affect your industry?</p>
<p>This set of questions is designed to elicit comments on transportation and land use growth patterns. Of Property Owners:</p>
<p>1. Do you have any general plans for your property without the Project in the next 20 years? If so, what things can you share about your plans to help us understand the type of development we might see without the Project?</p>
<p>2. How would your plans change as a result of the Project being built?</p>

This set of questions is designed to elicit comments on transportation and land use growth patterns. Of Property Owners and Agencies:
1. Assuming the Project is not constructed, what growth do you foresee in the (Borough or census area where respondent works or resides) in:
2. Industrial development? (type and where)
3. Commercial development? (type and where)
4. Residential development? (type and where)
5. If the Project is constructed, how do you see the type and locations of these types of development changing?
6. In what ways do you see the Project changing the (Borough or census area where respondent works or resides)'s competitive position for new or new types of industries or commercial development?
7. How do you think these changes affect property values in the (Borough or census area where respondent works or resides)?
8. How do you think these changes impact existing industries in the (Borough or census area where respondent works or resides)?
9. Do you foresee other specific impacts of the Project we should be aware of?
This set of questions is designed to elicit comments on transportation and land use patterns from relevant Agencies
10. How do you see the Project affecting access and development in the study area?
11. Do you have any plans we should be aware of that could affect where and how development occurs? If so, may we get a copy?
12. Given what we've discussed today are there reports or documents that your (company/organization) has generated that might be relevant to the assessment of effects of the Project, and that you would make available to us?

16. PROJECT SAFETY

16.1. Introduction

The Project, as currently envisioned, is anticipated to include a dam constructed using roller compacted concrete (RCC) construction methods. The Project works will also include a large reservoir, a spillway, cofferdams, diversion tunnels, integrated penstocks and powerhouse, railhead improvements, temporary construction housing and maintenance facilities, borrow and quarry areas, transmission lines, access roads, staging and stockpile areas, etc. The Project safety studies will provide information and analysis to demonstrate that proposed structures are safe and adequate to fulfill their stated functions.

16.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

Among the basic studies required to verify the design criteria for and the design of a large dam are the seismic hazard evaluation and the Probable Maximum Flood (PMF) studies.

Project construction, operation, and maintenance activities have the potential to be affected by, and to affect, seismic activity in the Project area, and extreme floods can also affect Project operations. Thus, the ability to safely pass extreme floods and safely survive a regional or local seismic event is of paramount importance in dam development. These studies will verify the design criteria to be used for the PMF inflow and the routing of the PMF and also verify the condition or nature of the seismic hazard such that appropriate design criteria are formulated.

16.3. Resource Management Goals and Objectives

The capability of Watana Dam to safely pass the most extreme floods, a FERC requirement, and the ability of the dam to survive a seismic event are basic elements of a comprehensive dam safety program under FERC's 18 CFR Part 12 regulations. Dam safety is a fundamental design criterion for the Watana Dam.

Additionally, The ADNR's Division of Geological and Geophysical Surveys (DGGS) evaluates potential geologic hazards to buildings, roads, bridges, and other installations and structures as part of its mission statement.

16.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants

Many residents of the upper Susitna Valley expressed concerns about the stability of the proposed dam during and after a seismic event. They have also expressed concern about the dam's ability to withstand extreme flood events.

AEA has informally consulted with the Alaska Division of Geological and Geophysical Surveys. A conference call was held among FERC, AEA, and MWH representatives on August 20, 2012 to discuss the structure of the Board of Consultants. An initial Board of Consultants meeting was held on November 1-2, 2012 in Bellevue, Washington.

16.5. Probable Maximum Flood (PMF) Study

16.5.1. General Description of the Proposed Study

16.5.1.1. Study Goals and Objectives

The general goals and objectives of the PMF study are as follows:

- develop a site-specific Probable Maximum Precipitation (PMP) to be used for the derivation of the PMF including both a temporal and spatial distribution of rainfall;
- model the runoff through the project drainage basin to produce the PMF inflow, including snowmelt considerations for the Project reservoir;
- route the PMF inflow through the Project to obtain the PMF outflow and maximum flood elevation at the dam; and
- use the Board of Consultants (BOC) for technical review during development and performance of the site-specific studies.

The FERC PMF study request (FERC 2012) contains references to assessing the stability of Project facilities during flood loading conditions, which will be addressed in detailed design documents, and requirements for several geologic and geotechnical assessments that relate to dam safety, which will be addressed in the Geology and Soils study plan. Geology and soils considerations would only be included in the PMF study to the extent that they affect flood runoff. Structural aspects of Project facilities will not be included in the PMF study.

16.5.1.2. Selection of the Inflow Design Flood

The Inflow Design Flood (IDF) is used in the design of the spillways and other structures that are affected by maximum flood levels. The adequacy of a spillway is evaluated by considering the hazard potential that would result from failure of the Project works during passage of flood flows. For dams of different sizes and hazard potentials, the IDF may range anywhere from the 100-year flood up to the PMF. Because of its size and downstream hazard potential, the selected IDF for Watana Dam will be the PMF.

The PMF is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the drainage basin under study. The PMF is normally generated by the PMP, which is defined as theoretically the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographic location at a certain time of year. The PMP development process will follow the storm-based approach and adhere to the guidance of being a "physically possible" scenario.

16.5.2. Existing Information and Need for Additional Information

A PMF study was developed about 30 years ago for the Watana Dam site (Acres 1982) at the time that feasibility reports were being prepared for the then proposed APA Susitna Hydroelectric Project. Although the PMF study report from the previous study is available, few calculations and little model input data, and no model output are available. This means that preparation of an updated PMF study is required. In addition to the availability of more years of meteorological and streamflow data since the time of the previous PMF study, new PMF

guidelines have been developed (FERC 2001) and additional data and more advanced methods are available for development of site-specific PMP.

Development of the PMP and PMF are based on a variety of historical data, including streamflow data, meteorological data, watershed data, and far-field information such as sea surface temperatures and storm patterns. Data availability is anticipated to be adequate for development of the PMP and PMF for Watana Dam.

16.5.3. Study Area

The study area will be the entire watershed tributary to the Watana Dam site, plus the additional drainage area between Watana Dam and the USGS gaging station at Gold Creek. The watershed drainage area is 5,180 square miles at the Watana Dam site and 6,160 square miles at the Gold Creek USGS gage. Extension of the study area to the Gold Creek USGS gage is necessary because this is where a long-term streamflow record is available for calibration and verification of hydrographs for the entire watershed tributary to the Watana Dam site.

16.5.4. Study Methods

The following sections describe the study methods and major tasks necessary to develop the PMP and PMF for Watana Dam.

16.5.4.1. Board of Consultants Review

A BOC has been established for technical review of many aspects of the dam design. The BOC review of the subject studies will be primarily focused on the development of the site-specific PMP but may include other aspects of the PMF study. The BOC will meet and review design progress at appropriate intervals and, if appropriate, will co-opt specialists for particular topic review. The study methods and tasks described herein may be subject to suggested alteration by the BOC.

16.5.4.2. Data Acquisition

A variety of historical recorded meteorological and hydrologic data are necessary to develop the PMP and PMF. Data acquisition should begin at the earliest possible time as some data (e.g., streamflow data on a time increment less than daily) could take months to retrieve. Additionally, the availability and area extent of next-generation radar (NEXRAD) data has been investigated for use in a site-specific PMP and will be extensively applied where appropriate. The types of data to be collected for storm periods at stations in the vicinity of the study area include, but are not limited to streamflow, precipitation, dry-bulb and wet-bulb temperature, snowpack and snow water equivalent, wind direction and speed, and humidity. Relevant watershed data will also be collected including the drainage area of sub-basins, the area within elevation bands for snowpack and snowmelt estimation, channel slopes, vegetation cover, lake area, and soil types. For the site-specific PMP, information far from the study area may be collected including sea-surface temperatures and synoptic storm information.

16.5.4.3. *Historical Data Analysis*

Historical data analysis will contribute to the PMP and PMF analysis in several ways, including being used to perform the following tasks:

- determine the major historic storms by analysis of total storm precipitation, intensity, duration, and areal extent;
- summarize historic peak flows for selection of major flood events for model calibration and verification;
- estimate flood frequency up to at least the 100-year flood from historical peak flow data;
- determine the 100-year snowpack and snow water equivalent for various elevation bands;
- develop a basis for antecedent watershed conditions prior to the PMP;
- summarize maximum seasonal temperature conditions associated with PMP-type storm; and
- summarize coincident data availability for major storm events.

16.5.4.4. *Review of Previous PMF Study Report*

In support of the previous design and licensing effort for the APA Susitna Hydroelectric Project, a PMF study was performed (Acres 1982). The 1982 PMF study included developing a site-specific PMP and used generally accepted methods at the time. It is notable that although many new data have become available in the 30-year interim since the previous PMF study, all of the five largest floods of record at the Gold Creek USGS gaging station were available for calibration and verification studies in 1982. Although few calculations and model input data, and no output are available, the 1982 study does contain useful information regarding final results and conclusions of the analysis, including numerous tables and figures. The 1982 PMF study report will be thoroughly reviewed to gain applicable insights to be used in the current PMF study.

16.5.4.5. *Field Visit*

A field visit is a recommended part of the PMF study (FERC 2001). Observations made during the field visit would include

- Manning's "n" and general hydrologic and hydraulic characteristics of river channels;
- special features within the drainage basin such as marshes, lakes, and closed basins that may delay or reduce runoff;
- constrictions such as bridge abutments that may influence flood routing characteristics;
- large natural constrictions that could act as hydraulic control structures; and
- areas that could result in locally different infiltration rates, including rock exposures, dense forest, or high altitude meadows.

16.5.4.6. *Flood Hydrology Model Selection*

At least three flood hydrology models are available, and a key task will be to select which to use to develop the PMF. These models include:

- Streamflow Synthesis and Reservoir Routing (SSARR). This model was developed by the U.S. Army Corps of Engineers (USACE), North Pacific Division. The SSARR

model was used for the 1982 Susitna PMF study. In addition to its use by the USACE, the SSARR model was used occasionally by consultants for flood simulation on major watersheds, particularly in the Pacific Northwest. The SSARR model is no longer in general use. The latest version of SSARR was modified in 1991 to run on IBM-compatible personal computers. The USACE has noted that there will be no further program updates or modifications to the SSARR files by the USACE, and no user support is available.

- Flood Hydrograph Package (HEC-1). This model was developed by the Hydrologic Engineering Center (HEC) of the USACE and was (possibly still is) the most widely used model in PMF studies. HEC-1 is one of the two rainfall-runoff models recommended for PMF studies (FERC 2001). Compared to other models, HEC-1 has the advantage of including the recommended energy budget snowmelt method as well as fully documented equations for calculating snowmelt in the model.
- Hydrologic Modeling System (HEC-HMS). This model was also developed by the HEC and is the Windows-based successor to HEC-1. HEC-HMS contains many of the same methods as HEC-1 and is the other model recommended for PMF studies (FERC 2001). Snowmelt in the HEC-HMS model is based on a method that uses temperature data only.

Flood hydrology model selection was reviewed with the BOC during the initial BOC meeting on November 2, 2012. With BOC input from that review, AEA proposes to use the HEC-1 Flood Hydrograph Package.

16.5.4.7. Flood Hydrology Model Initial Setup

The flood hydrology computer model initial setup will include sub-basin delineation, areas in elevation bands for use in snowmelt calculations, lake areas, areas in various soil groups, coincident base flow, and initial estimates of infiltration rates. Sub-basin delineation will be aligned with USGS stream-gaging station locations whenever possible to facilitate model calibration and verification. River channel geometry will be checked for areas that may warrant special consideration for storage-outflow routing. Topographic mapping will be developed using ArcGIS software.

16.5.4.8. Flood Hydrology Model Calibration and Verification

This task would include calibration and verification of the sub-basin unit hydrographs to the extent that available recorded streamflow and meteorological data allow. Calibration provides the important adjustments to hydrograph parameters that are initially estimated from standard equations or based on experience in similar watersheds. Two of the largest floods on record will be selected for calibration, with a third large historical flood used for verification. More storms will potentially be available if further calibration/validation is required. The calibration points at the outlets of the sub-basins will coincide with USGS stream-gaging stations to the extent possible. The selection of storm periods to use in model calibration and verification will include the availability of data at multiple stream-gaging stations. Activities under this task will also include estimating ungaged local runoff as necessary, base flow separation, and a final estimate of infiltration loss rates.

16.5.4.9. *Development of the Site-Specific PMP*

The applicable available National Weather Service (formerly the U.S. Weather Bureau) PMP guidance document is *Probable Maximum Precipitation and Rainfall-Frequency Data for Alaska*, Technical Paper No. 47 (Miller 1963). Technical Paper No. 47 is applicable to areas up to 400 square miles and durations up to 24 hours. Because the drainage area at the Watana Dam site is 5,180 square miles and current standards call for the PMP to have a duration of at least 72 hours, development of a site-specific PMP is necessary. The existing PMP studies can be used to make comparisons to the 1982 Susitna site-specific PMP and the Technical Paper No. 47 PMP at the highest-intensity central 400-square-mile area and 24-hour duration of the new site-specific PMP. Development of the site-specific PMP for the watershed tributary to the proposed Watana Dam site will require a substantially greater effort than is necessary for most other dams in the USA because of new storm analyses, sparse data availability and cool season considerations.

The site-specific PMP study will follow many of the methods (e.g., a storm-based approach) used to develop the current National Weather Service PMP hydrometeorological reports (HMR). The basic techniques for storm maximization and transposition are well-established. An additional 30 years of data and more advanced models and recent adjustments to methods are now available for development of site-specific PMP (e.g. radar aided storm analyses, quantification of orographic effects). Results will include both a temporal and spatial distribution of the PMP for durations appropriate to most accurately model the PMF. No predetermined maximum storm sequence length will be set so that the critical PMP sequence could be 96 hours or more. Long duration, high volume events will be among the candidate PMF cases evaluated to determine if they constitute the critical storm event for the determination of the PMF maximum reservoir elevation. In addition, guidance for alternative centerings of the PMP design storm will be determined based on the patterns of the actual storm events used to derive the PMP values. NEXRAD data will be used when available (generally after 1995) in all storm analyses.

AEA's storm search will include all twelve months of the year, so the months that are potentially PMP drivers will naturally result from this process. Based on an analysis of historic flow frequency, peak annual flood data, and anticipated seasonal reservoir levels, the PMP development is expected to be focused on the months of May through October. The site-specific PMP task will also include development of the 100-year precipitation temporal and spatial distribution during a season coincident with the probable maximum snowpack. Applied Weather Associates, a consultant with extensive experience in developing site-specific PMP will be retained to perform this task.

16.5.4.10. *Coincident Conditions for the PMF*

Developing coincident conditions would include the 100-year snowpack, the probable maximum snowpack, necessary temperature, dew point, and wind speed sequences, and other data for energy budget method as necessary. The 100-year precipitation will also be developed, because one of the potential combinations of coincident conditions that can result in the PMF is the probable maximum snowpack combined with the seasonally appropriate 100-year precipitation. A determination of the maximum reservoir level during the 50-year flood may also be required, as this may become the starting reservoir elevation for spillway operation.

16.5.4.11. Development of the PMF Inflow Hydrograph

The PMF will be developed at the proposed Watana Dam site by combining sub-area runoff and performing channel and reservoir routings for various cases and months. The energy budget snowmelt method will be used. Routing of the PMF through the reservoir may account for use of the fixed-cone outlet valves for discharges up to the 50-year flood and use of the spillway only after the expected maximum level of the 50-year flood has been exceeded, but final flood operating procedures are not yet finalized. This task also includes a sensitivity analysis to test the effects of variation in parameters with relatively high uncertainty that could potentially have more significant effects on the results. The PMF channel routing would be performed using the selected flood hydrology model.

16.5.4.12. Reservoir Routing of the PMF

Spillway capacity should be determined as part of the economical combination of spillway capacity and surcharge storage. Surcharge storage is defined as the storage between the maximum normal pool level (still water) and the maximum design flood water storage level. Determining the economical combination of surcharge storage/spillway capacity requires evaluation of the cost of increasing spillway capacity versus the cost of raising the dam height to provide the required freeboard (routed maximum flood level plus any required allowance for wind setup and wave run-up). Reservoir flood routing is used to determine the temporal and water level variation of the hydrograph as the flood passes through the reservoir. Increasing the spillway capacity will reduce the necessary surcharge storage (determined by flood routing), thereby lowering the required height of the dam. Alternatives analysis will be performed to optimize spillway capacity and flood surcharge. The PMF reservoir routing would be performed using the selected flood hydrology model.

It is expected that the volume and distribution of potential future sedimentation in the reservoir will form a PMF routing sensitivity case. AEA will evaluate the potential for glacial lake outburst floods (GLOF). If any are identified, AEA will compare the GLOF to the critical PMF inflow hydrograph and will route the GLOF to determine the peak reservoir level if the GLOF potentially forms the critical condition for spillway design.

16.5.4.13. Freeboard Analysis

Freeboard provides a margin of safety against the potential for overtopping of dams. Freeboard and flood control storage are required to provide the capacity to store and/or route the design storm through the reservoir considering inflows, precipitation on the reservoir basin, and wind generated waves without hazardous overtopping of the dam. Although freeboard selection involves more than simply the PMF water level, the freeboard selection will be made as part of the subject study, based on wind setup, wave action, uncertainties in analytical procedures, and uncertainties in Project function in combination with the most critical pool elevation (USACE 1991). The freeboard determination will be based on site-specific conditions that can be reasonably expected to occur simultaneously. Design criteria will be developed for logical combinations of reservoir levels/precipitation and wind conditions for freeboard determination. Wind setup and wave run-up would be determined with standard methods (USACE 1984 and USACE 2003).

Normal freeboard is defined as the difference in elevation between the top of the dam and the normal maximum pool elevation. Minimum freeboard is defined as the difference in pool elevation between the top of the dam and the maximum reservoir water surface that would result from routing the PMF through the reservoir. It is generally not necessary to prevent splashing or occasional overtopping of a dam by waves under extreme conditions particularly for a concrete dam. If studies demonstrate that the RCC dam can withstand wave overtopping without erosion of foundation or abutment material, then minimum (or no) freeboard will be selected for the PMF condition. In that case, only normal freeboard would be required. The study of freeboard will take into account unusual circumstances.

16.5.4.14. Reporting

Two reports will be prepared, one covering the development of the site-specific PMP, the other an overall PMF report for all aspects of the PMF study, including a summary of the site-specific PMP. The sections of the PMF report would generally follow the outline suggested by FERC for PMF studies (FERC 2001). AEA proposes to submit all reports and supporting information for this study only to the Commission and the Alaska Department of Geological and Geophysical Surveys pursuant to FERC's Critical Energy Infrastructure Information (CEII) regulations, which are designed to ensure that critical energy infrastructure is protected from security threats. Licensing participants who wish to review this information can request it from FERC pursuant to FERC's CEII regulations.

16.5.5. Consistency with Generally Accepted Scientific Practice

Accepted standard practices for PMF studies are available in the FERC *Engineering Guidelines*, Chapter 7, "Determination of the Probable Maximum Flood" (FERC 2001). Exceptions taken from these guidelines, if any, will be noted and justified. Hydrologists performing the studies will have prior experience using the FERC guidelines in preparation of other recent previous PMF studies.

Hydrometeorological reports are available and applicable for determining the PMP for most PMF studies in the USA. Because of this, the FERC *Engineering Guidelines*, Chapter 7 do not provide methods for preparation of the site-specific PMP that is necessary for the Watana Dam PMF. Applied Weather Associates, a consultant that is experienced in preparation of site-specific PMP under FERC jurisdiction, will perform the necessary study. Methods used in preparation of the site-specific PMP are very similar to those used in preparation of the most recent NOAA PMP hydrometeorological reports. The BOC will review the PMF Study with an emphasis on the site-specific PMP.

16.5.6. Schedule

A PMF study is typically a part of the Feasibility Report for a new dam. It is anticipated that the site-specific PMP and PMF study would begin during early 2013 and be completed in December 2013 (Table 16.5-1).

16.5.7. Relationship with Other Studies

As depicted in Figure 16.5-1, the PMF study will not require information inputs from other Project studies other than related engineering studies. The outputs of this study will also feed

back into the engineering studies to assist in sizing the spillways at the dam and other related Project features.

16.5.8. Level of Effort and Cost

The estimated level of effort for the study is as follows:

Activity	Effort
Site-Specific Probable Maximum Precipitation	16 full-time person months
Probable Maximum Flood	11 full-time person months
Total	27 full-time person months

This study is estimated to cost up to \$750,000.

16.5.9. Literature Cited

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Federal Energy Regulatory Commission (FERC), October 1993. *Engineering Guidelines, Chapter II, Selecting and Accommodating Inflow Design Floods for Dams*.

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Miller, John F., 1963. *Probable Maximum Precipitation and Rainfall-Frequency Data for Alaska, Technical Paper No. 47*, U.S. Weather Bureau, Department of Commerce, Washington D.C.

U.S. Army Corps of Engineers (USACE), March 1, 1991. *Inflow Design Floods for Dams and Reservoirs*, ER 1110-8-2(FR).

U.S. Army Corps of Engineers (USACE), 1984. *Shore Protection Manual*, Coastal Engineering Research Center, Waterways Experiment Station, Second Printing.

U.S. Army Corps of Engineers (USACE), July 31, 2003. *Coastal Engineering Manual, EM-1110-2-1100, Part II Coastal Hydrodynamics*.

16.5.10. Tables

Table 16.5-1. Schedule for Implementation of the PMF Study.

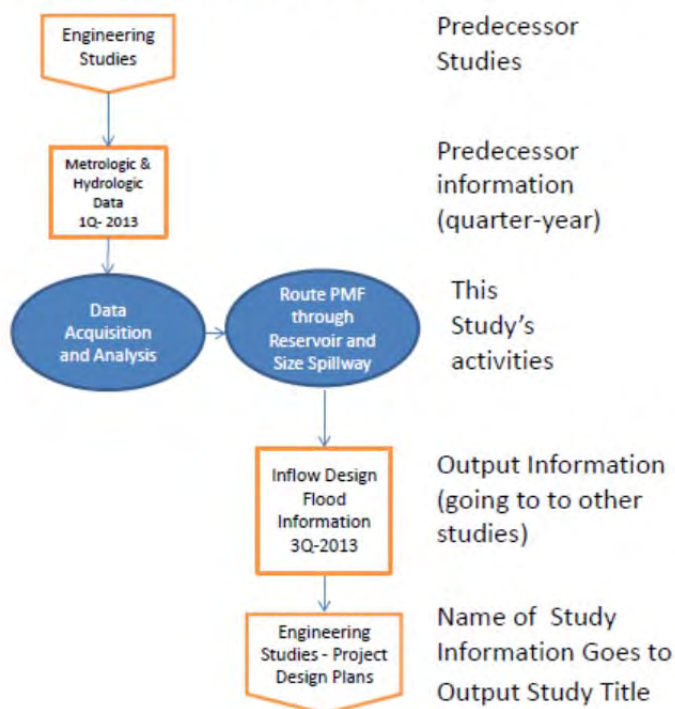
Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Data Acquisition and Analysis				=====									
Develop Probable Maximum Precipitation				=====	=====	=====	=====						
Model Setup, Calibration, and Verification					=====	=====							
Route PMF through Reservoir and Size Spillway							=====						
Initial Study Report													
Updated Study Report													

Legend: — Planned Activity
 Δ Initial Study Report
 ▲ Updated Study Report

16.5.11. Figures

Figure 16.5-1. Interdependencies for Probable Maximum Flood Study.

Study Interdependencies for Probable Maximum Flood Study



16.6. Site-Specific Seismic Hazard Study

16.6.1. General Description of the Proposed Study

16.6.1.1. Study Goals and Objectives

The goals of this study are to conduct deterministic and probabilistic seismic hazard evaluations to estimate earthquake ground motion parameters at the Project site, assess the risk at the site and the loads that the Project facilities would be subject to during and following seismic events, and propose design criteria for Project facilities and structures considering the risk level. The intent of the study is to fulfill specific objectives including, but not limited to the following:

- identify the seismic sources along which future earthquakes are likely to occur, including the potential for reservoir-triggered seismicity;
- characterization of the degree of activity, style of faulting, maximum magnitudes, and recurrence information of each fault;
- develop maps and tables depicting the spatial and geometric relations of the faults and seismic source zones together with specific distance parameters to evaluate ground motion parameters from each source;
- assemble available historical and instrumental seismicity data for the region, including maximum and minimum depth of events;
- determine the distance and orientation of each fault with respect to the site;
- estimate the earthquake ground motions at the proposed dam site, updating previous studies to include changes in practice and methodology since the 1980s;
- propose the seismic design criteria for the site;
- prepare a supporting design report that include the seismic criteria and results of dam stability analysis under seismic loading (this will be addressed as part of the dam analysis, not as part of the initial seismic characterization); and
- use a BOC for independent technical review and guidance during development of site-specific studies.

The FERC study request (FERC 2012) refers to assessing the stability of Project facilities during seismic events and performing a dynamic analysis that identifies any damage caused by the earthquake and shows that the dam can continue to resist applied static loading in the damaged condition with any possible resulting loading changes. This aspect of dam engineering will be carried out during the ongoing analytical phase and design process; it is not proposed that such dam analyses form part of the initial seismic hazard analysis studies. While the seismic studies are in progress, dam engineering analyses and design will also be in progress and the requirements and initial dam analysis results will be incorporated into the seismic study to the extent necessary before final designs are completed using the results of the seismic studies.

16.6.2. Existing Information and Need for Additional Information

Several geology and seismic characterization studies were conducted for the APA Project in the 1980s. The most important studies relating to the seismic characterization were

- site-specific seismic hazard evaluations, including fault trenching, geologic mapping and age-dating, microseismic network operations, and ground motion

- evaluations (Woodward Clyde Consultants 1980; and Woodward Clyde Consultants 1982); and
- evaluation of reservoir induced seismicity (RIS) (Harza-Ebasco 1985).

Other associated geological studies of the region and site have included

- regional mapping of surficial deposits (rock and soil) using aerial photography and geologic reconnaissance (Acres 1982a);
- studies of reservoir slope stability (Acres 1982a);
- subsurface explorations through geophysics, borings, test pits, and trenches (USACE 1975; USACE 1979; Acres 1982a; Acres 1982b; Harza-Ebasco 1983, Harza-Ebasco 1984); and
- laboratory testing of physical and strength properties of rock and soil (USACE 1979; Acres 1981; Acres 1982, Harza-Ebasco 1983; Harza-Ebasco 1984).

These previous studies and site investigations represent a dataset of substantial magnitude that will be beneficial to the proposed studies.

Despite the large amount of data, it is acknowledged that there are data gaps, and thus the proposed studies essentially are an update and expansion of the studies carried out in the 1980s by Woodward Clyde Consultants.

The following examples indicate topics or aspects of the region that will be addressed in the proposed studies:

- Since the 1980s there has been a magnitude 7.9 earthquake on the Denali fault.
- Regional probabilistic seismic hazard maps by the USGS (e.g., Wesson 2007) and the 2008 probabilistic seismic hazard analysis were prepared for the Port of Anchorage.
- The USGS has opined that the Denali fault is fairly well studied, but the Broad Pass fault, a pre-Quaternary thrust fault in the project area, has not been extensively studied. The USGS recommends that information be gathered to verify its existence and characterize its history.

16.6.3. Study Area

The study area for the seismic hazard evaluation is necessarily large in order to include potentially significant seismic sources throughout the region. The study area encompasses subduction-related sources (plate interfaces between the North American and Pacific Plates, which were the source of the 1964 earthquake, and intraslab sources within the down-going Pacific Plate) and all applicable Quaternary crustal seismic sources within about 125 miles (200 kilometers) of the site (Figure 16.6-1). Crustal seismic sources beyond these distances are not expected to provide significant ground motion contributions at the dam site relative to nearby sources. A more focused study area will include the dam site and reservoir areas, and a minimum area defined by an approximately 62-mile (100-kilometer) radius around the proposed dam location. The focused study area will therefore include much of the Talkeetna block and surrounding fault zones such as the Denali; Castle Mountain; Northern Foothills fold and thrust fault zone; Talkeetna fault; and Broad Pass Fault.

16.6.4. Study Methods

16.6.4.1. General

The study methods shall generally be in accordance with Chapter 13 of the FERC Engineering Guidelines for the Evaluation of Hydropower Projects. The site-specific seismic hazard evaluation for assessing the seismic risks and developing the seismic design criteria in support of licensing and detailed design will include of the following tasks:

- Update the understanding of geologic conditions and seismo-tectonic setting for the dam site area;
- Identify and characterize the seismic sources, including detailed geologic studies and lineament analyses;
- Identify whether a fault may be encountered beneath or adjacent to the dam and assess the activity of the feature and, if active, the likelihood for potential fault displacement or ground offset;
- Perform a deterministic and probabilistic seismic hazard assessment in order to define earthquake ground motions for structural analyses;
- Evaluate the potential for Reservoir Triggered Seismicity (RTS);
- Assess risks to Project structures and operation associated with seismic loading conditions; and
- Propose appropriate seismic design criteria.

These tasks and the associated study methods will generally be as presented below.

16.6.4.2. Board of Consultants Review

As requested by FERC (FERC 2012), a BOC will be established for technical review of the dam analyses and design. The BOC review will be primarily focused on appropriate aspects of the Seismic Hazard Evaluation, the determination of response spectra, and the crafting of design criteria. The BOC will meet and review study progress at appropriate intervals. The study methods and tasks described herein may be subject to suggested modification by the BOC.

16.6.4.3. Review of Project Documentation

A review will be conducted of the existing documentation, including all available previous applicable Project reports, to characterize the geologic, geotechnical, and seismic conditions in support of feasibility and licensing studies and detailed design so as to take maximum advantage of the large body of knowledge that already exists for the site. Documentation will include work from the studies performed in the 1970s and 1980s. A geologic and geotechnical database will be developed in order to build upon the earlier studies as they pertain to the current Project development.

16.6.4.4. Seismic Hazard Analysis

A deterministic and probabilistic seismic hazard evaluation will be undertaken to update the seismic hazard studies from the 1980s in order characterize the seismic sources, to define the earthquake ground motion parameters, and to develop seismic design criteria for the Project

structures. The methods follow general guidance defined according to Chapter 13 of the Federal Energy Regulatory Commission's Engineering Guidelines. Subtasks will include the following:

- Update evaluations of geologic, seismologic, and seismotectonic literature for the Project study area to identify data gaps and uncertainties that may require further evaluations.
- Update seismicity catalogue for evaluation of seismicity rates, depths, magnitudes, and focal mechanisms. This will include evaluation of recent and ongoing data collected by the Alaska Seismographic Network and augmented by the additional seismic stations installed in the Project area as part of the long term earthquake monitoring program.
- Develop a seismotectonic model that identifies and characterizes seismic sources of engineering significance to the Project.
- Conduct geologic studies using newly acquired Light Detection and Ranging (LiDAR) and Interferometric Synthetic Aperture Radar (IFSAR) datasets to aid in the identification and evaluation of potential seismic sources and geohazards.
- Collect field geologic data for characterization of potential seismic sources and surface displacement hazards.
- Perform surface fault displacement hazard analysis to evaluate the significance (likelihood and amount) of potential ground surface displacement from faulting in the area of the Project, including beneath the dam, if such a feature is present.
- Sensitivity studies will be performed on selected surface tectonic features, faults and lineaments, identified and being considered as potential seismic sources of engineering significance on the design of the Project.
- Monitoring and detection of local earthquakes to understand the seismic hazards in the Project area.
- Conduct ground motion analyses and assessments to estimate the expected ground motions at the Project facilities using a probabilistic seismic hazard analysis (PSHA) and deterministic seismic hazard analyses (DSHA) based on the seismic source characterization, and FERC guidelines.
- Develop seismic design criteria to develop appropriate seismic design parameters for use in dam analyses and considerations for construction.
- Perform Dynamic Analysis of the dam (in other studies).

Ground motion estimates from the PSHA and DSHA will be developed for a number of critical seismic sources using weighted ground motion prediction equations (GMPE's) appropriate for each source in the analyses. Results from the PSHA analyses will consist of hazard curves for a range of spectral response frequencies, uniform hazard spectra (UHS) for a range of return periods, and deaggregation of seismic source contributions for design-specific return periods and spectral frequencies. The purpose of the deaggregation is to provide parameters for the development of Conditional Mean Spectra (CMS). CMS will be generated using the methodology of Baker (2011). As recommended in FERC guidelines, the CMS will be extended so that the envelope of the CMS for a given return period equals the UHS. The PSHA will then be used to guide the selection of a deterministic event. Ultimately, the ground motion will be estimated through a risk-based approach, and AEA will work with FERC and BOC to establish the ground motion and criteria for the dam analysis.

Results of the site-specific seismic hazard assessment studies will be documented with Project reports.

16.6.4.5. *Long-Term Earthquake Monitoring System*

A long-term earthquake monitoring system will be installed for the purpose of continuously monitoring earthquakes that occur in the Project area, both pre- and post-construction, and to record strong shaking of the ground at the Project site during moderate to strong earthquakes. The long-term monitoring system will consist of four 6-component strong motion and broadband seismograph station at the Watana Dam site area and two 3-component broadband seismograph stations in the vicinity of the proposed dam site and reservoir area. The seismograph stations will be operated as part of the Alaska Seismographic Network by the University of Alaska. These stations will provide additional resolution on the seismicity rates and characteristics of earthquakes in the Project area.

16.6.4.6. *Reservoir Triggered Seismicity*

The potential for RTS to occur during and after filling of the reservoir will be evaluated. This examination of the potential for RTS will include information from the seismic hazard analysis including the potential possibility of faults capable of being triggered close to the site. The attributes that will be considered in evaluating the probability of RTS include reservoir depth; reservoir volume; the tectonic stress state; and the rock type and structure underlying the reservoir. The probabilities that are considered are conditional and represent the total chance for RTS to occur as a result of reservoir filling and operation. Conditional probabilities will be developed for each attribute, as well as for all attributes combined. For the multi-attribute analysis, each attribute will be considered independently and also in a discrete-dependent model focusing on depth and volume.

Additionally, a literature review, case study, and numerical analysis will be performed of RTS based on other projects with large, deep reservoirs in order to develop an understanding of the potential of RTS at the Susitna-Watana site.

The long-term earthquake monitoring system will provide a baseline of the rates and seismological characteristics of local seismic events prior to the impoundment of the reservoir. Seismicity data collected before and after installation of the long-term monitoring system will be used to perform seismological analyses to help define local seismotectonic characteristics. Such analyses would include activities such as development of local velocity models, focal mechanism and regional stress analysis, analysis of spatial patterns, and relationship of seismicity to reservoir operation. The ultimate purpose of this study is to assure that possible RTS earthquakes are accounted for by the dam seismic design parameters.

16.6.4.7. *Reservoir Slope Stability Study*

An assessment will be made of the reservoir rim stability based on the geologic conditions in the reservoir area, particularly in the reservoir drawdown zone. Geologic information from the previous study on reservoir slope stability (1982), as well as mapping, geotechnical investigations, and instrumentation monitoring will be used to assess the stability concerns of the reservoir rim not only under drawdown but also from seismic loads. Key factors in this study are the planned reservoir level and anticipated range of drawdown, soil conditions, presence of permafrost, topography and slope conditions.

16.6.4.8. *Engineering Analysis*

A dynamic analysis will be performed (separately under the engineering studies and design) to identify the performance of the major hydraulic structures under earthquake loading conditions. The analyses will optimize the design of the structures, assessing the potential damage that may occur during an earthquake event, and verify that the dam can continue safe operation in a damaged state until any necessary repairs are performed.

14.6.4.9 *Reporting*

Several technical reports will be prepared for each stage for the study for the BOC. A summary report will be prepared for the Initial Study Report and Updated Study Report. AEA proposes to submit technical reports and all supporting information for this study only to the BOC, FERC, and the Alaska Department of Geological and Geophysical Surveys pursuant to FERC's Critical Energy Infrastructure Information (CEII) regulations, which are designed to ensure that critical energy infrastructure is protected from security threats. Licensing participants who wish to review this information can request it from FERC pursuant to FERC's CEII regulations.

16.6.5. Consistency with Generally Accepted Scientific Practice

The seismic hazard analyses and development of seismic design criteria will be performed in accordance with general industry accepted scientific and engineering practices, following the guidance and procedures outlined in FERC Chapter 13. Recently, the industry has shifted towards selection of ground motions and criteria based on risk. AEA will work with FERC and BOC to establish the criteria for the dam analysis and ensure that each task complies with accepted scientific practice.

Independent senior technical staff and industry consultants will review the appropriateness of the field investigations and testing, seismic source characterization, deterministic and probabilistic seismic hazard assessment, selection of appropriate ground motions at the site and determination of critical seismic design criteria and decisions. Several working sessions and site visits will be scheduled to review the results of the field investigations and testing, characterize the seismic source, assess seismic hazards, select earthquake ground motions, perform a dynamic analysis, and determine design criteria and assumptions.

16.6.6. Schedule

The proposed study plan includes a seismic source evaluation using recently acquired LiDAR and INSAR data to delineate faults and lineaments in the study area, performing a paleoseismic analysis, reconnaissance geologic mapping, installation of a long-term earthquake monitoring system, assessment of slope stability for the proposed reservoir rim area, and conducting an assessment of reservoir triggered seismicity in 2012. For 2013-14, a field program is envisioned for investigating significant seismic sources or ground displacement features, updating seismic source characterization, and continuing collection of microseismic and strong motion data with the long-term earthquake monitoring system.

Deterministic and probabilistic seismic hazard assessment and engineering analysis will be performed through the 2012-2014 time period. A summary of the studies and results will be provided in the Initial Study Report in February 2014 and Updated Study Report in February 2015. The primary activities and planned schedule is shown in Table 16.6-1.

16.6.7. Relationship with Other Studies

As depicted in Figure 16.6-2, the Site-Specific Seismic Hazard Study will use some information from the Geology and Soils study related to basic geologic conditions and reference materials. The outputs of this study will feed back into the Engineering studies to assist in designing Project features to meet appropriate seismic design criteria.

16.6.8. Level of Effort and Cost

The level of effort for the studies outlined in this document, using a phased multiple year approach is estimated to be in excess of 50 person-months or approximately \$1.5 million.

16.6.9. Literature Cited

- Acres. 1982b. Susitna Hydroelectric Project 1980-81 Geotechnical Report, Volumes 1 through 3. Prepared for Alaska Power Authority.
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- Woodward-Clyde Consultants. 1982. Final Report on Seismic Studies for Susitna Hydroelectric Project. Prepared for Acres American, Inc.

16.6.10. Tables

Table 16.6-1. Schedule for implementation of the Site-Specific Seismic Hazard Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Paleoseismic (Lineament) Analysis		—	—	—									
Field Investigations						—	—	—					
Seismic Source Characterization	—					—	—	—					
Long-Term Local Earthquake Monitoring				—	—	—	—						—
Reservoir Triggered Seismicity				—	—			-----					
Initial Study Report								—Δ					
Reservoir Slope Stability Analysis					—	—							
PSHA					—			—	—	—			
Seismic Design Criteria										—	—		
Updated Study Report											—	—	▲

Legend:

- Planned Activity
- Follow up activity (as needed)
- Δ Initial Study Report
- ▲ Updated Study Report (end of 1Q15)

16.6.11. Figures

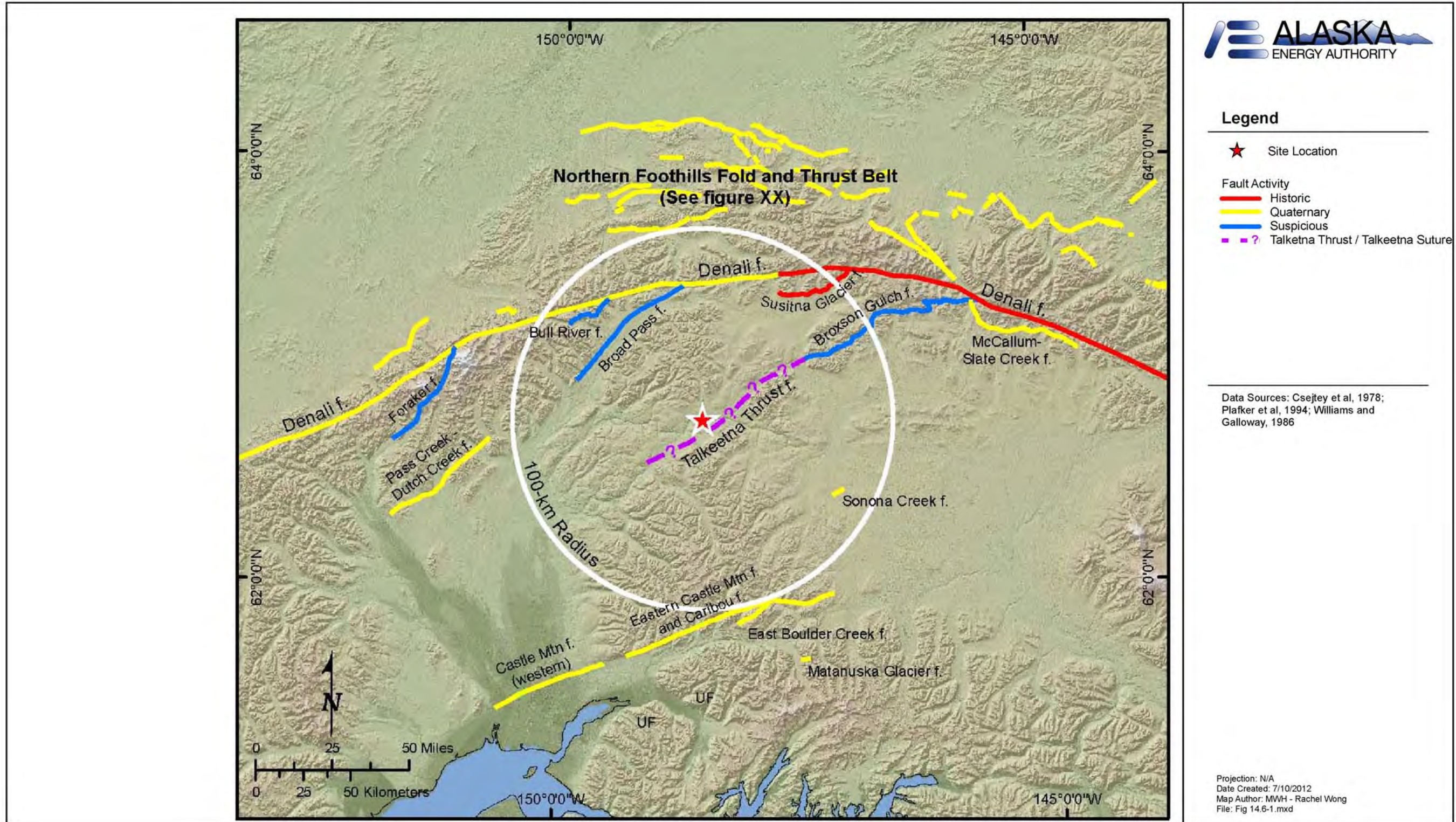


Figure 16.6-1. Regional Faults (Csejty et al, 1978; Plafker et al, 1994; Williams and Galloway, 1986).

Study Interdependencies for Probable Maximum Flood Study

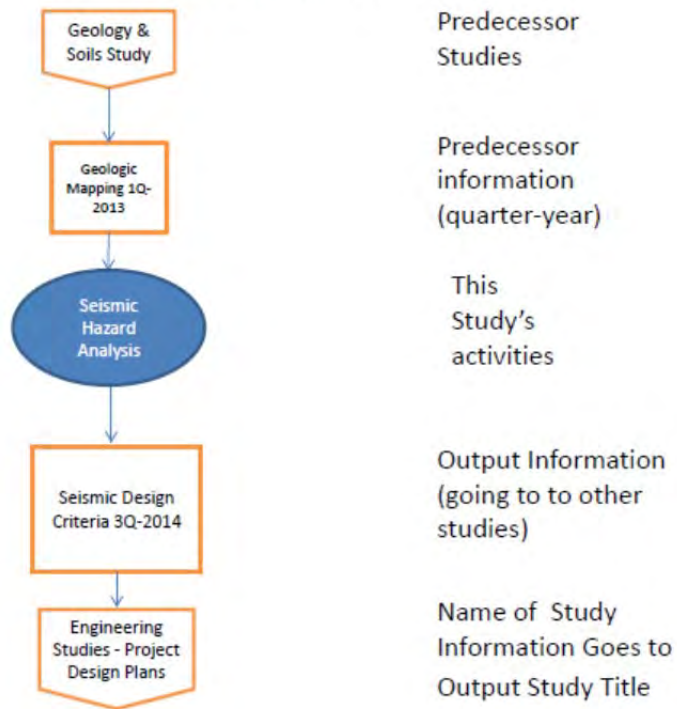


Figure 16.6-2. Interdependencies for Site-Specific Seismic Hazard Study.