

**Susitna-Watana Hydroelectric Project  
(FERC No. 14241)**

**Distribution, Abundance, and Habitat Use by Large  
Carnivores Study  
Study Plan Section 10.8**

**Final Study Plan**

Alaska Energy Authority



July 2013

## 10.8. Distribution, Abundance, and Habitat Use by Large Carnivores

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Section 10.8 of the RSP described the Distribution, Abundance, and Habitat Use by Large Carnivore Study. The Large Carnivores Study is a two-year (2013–2014) effort that combines (a) desktop analyses of existing data on bears and wolves from historical studies and recent and ongoing population-monitoring studies by the Alaska Department of Fish and Game (ADF&G), with (b) new field sampling focused on bears using riparian areas along spawning streams used by anadromous fish downstream from the proposed dam. RSP 10.8 provided goals, objectives, and proposed methods for data collection regarding large carnivores, including brown bears, black bears, and wolves.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 10.8 was one of the 31 studies approved with no modifications. As such, in finalizing and issuing Final Study Plan Section 10.8, AEA has made no modifications to this study from its Revised Study Plan.

### 10.8.1. General Description of the Proposed Study

The Large Carnivores Study is a two-year (2013–2014) effort that combines (a) desktop analyses of existing data on bears and wolves from historical studies and recent and ongoing population-monitoring studies by the Alaska Department of Fish and Game (ADF&G), with (b) new field sampling focused on bears using riparian areas along spawning streams used by anadromous fish downstream from the proposed dam. Some of the information needed for this study was acquired as part of the preliminary studies begun in 2012 (AEA 2012).

#### Study Goal and Objectives

The goal of the study is to obtain sufficient information on three dominant predators and game animals in the region—brown bear, black bear, and wolf—to use in evaluating Project-related effects and identifying any appropriate protection, mitigation, or enhancement measures.

Project development will inundate or modify habitats used seasonally by brown bears, black bears, and wolves. In addition, the associated development infrastructure and human activities in the area during construction and operation could have indirect effects on bears and wolves through changes in prey populations—including moose, caribou, and salmon—and changes in disturbance and human hunting patterns. Data collected through this Large Carnivores Study will provide information on the value of lost, created, or altered habitats for bears and wolves in the study area.

Four primary objectives have been identified for this study:

- 1) Estimate the current populations of brown bears, black bears, and wolves in the study area, using existing data from ADF&G.
- 2) Evaluate bear use of streams supporting spawning by anadromous fishes in habitats downstream of the proposed dam that may be altered by the Project.

- 3) Describe the seasonal distribution of, and habitat use by, wolves in the study area using existing data from ADF&G.
- 4) Synthesize historical and current data on bear movements and seasonal habitat use in the study area, including the substantial body of data gathered by radio-tracking during the 1980s, as a continuation of the 2012 wildlife studies (AEA 2012).

### **10.8.2. Existing Information and Need for Additional Information**

Existing information for bears and wolves is further detailed below. This study will supply baseline data essential to assess potential Project-induced impacts and facilitate the evaluation of protection, mitigation, and enhancement measures, as appropriate.

#### **10.8.2.1. Bears**

For the original Alaska Power Authority (APA) Susitna Hydroelectric Project in the 1980s, Miller et al. (1997) estimated brown bear and black bear densities in the region using a mark-resight technique. In the spring of 2000, 2001, and 2003, ADF&G used aerial line-transect sampling (Becker 2001; Becker and Quang 2009) to estimate brown and black bear population sizes in their 26,490-square-kilometer Talkeetna Study Area. That large area extended from the East Fork of the Yentna River to the northeastern portion of the Susitna River drainage and included most of the Project area. The portion of the reservoir inundation zone located upstream from the mouth of Kosina Creek was not covered in that survey, however.

In spring 2003 and 2004, ADF&G conducted aerial line-transect sampling (Becker and Quang 2009) to estimate the population sizes of black and brown bears in a 21,528-square-kilometer area encompassing Game Management Unit (GMU) Subunits 13A and 13B (GMU 13AB Study Area). That area was bounded on the west and north by the Susitna River and extended from Kosina Creek to the Gakona River. That survey area included the part of the reservoir inundation zone that was not included in ADF&G's Talkeetna Study Area. Brown bear and black bear densities varied substantially across these large areas, showing a pronounced gradient from higher densities in the west to much lower densities in the east. The density gradient was larger for black bears than for brown bears (ADF&G, unpublished data).

The original APA Susitna Hydroelectric Project included studies of the population size and density, demography, seasonal movements, dispersal, den locations, and predation rates on moose calves by both brown and black bears from 1980 to 1985 (ABR 2011). No studies of bears were conducted downstream from Devils Canyon. The density of brown bears in the upstream area was estimated to be 29.7 bears/1,000 square kilometers over an area of 12,127 square kilometers, which was defined as the area within the mean home-range diameter from the Susitna River for brown bears (Miller 1987). Approximately 12 percent of the relocations ( $n = 1,720$ ) of radio-collared brown bears occurred in the area that would have been inundated by the APA Susitna Hydroelectric Project's Low Watana reservoir; bears used that area twice as frequently as expected both in the spring and for all months combined. This pattern of use was evident for males and most females, but not for females accompanied by cubs of the year. Bears spent the highest proportion of time in the Watana inundation zone during June, when they foraged on south-facing slopes for roots, new vegetation, and overwintered berries, and preyed on moose calves. Females with young cubs tended to stay at higher elevations, possibly to reduce the risk of predation on cubs by male brown bears (Miller et al. 1997).

Brown bears preyed on moose calves from late May to early June, with predation rates declining substantially by mid-July (Ballard et al. 1990). In addition to moose calves, the Susitna bear population had access to salmon, which is unusual for brown bears in Interior Alaska. Bears, especially males, moved to the Prairie Creek drainage, a tributary to the Talkeetna River located southwest of Stephan Lake (between the Devils Canyon and Watana dam sites) during July and early August to feed on spawning Chinook salmon (LGL 1985). Despite the availability of protein-rich animal foods, berry production appeared to be a major factor limiting brown bear productivity in the Susitna study area (LGL 1985). Miller (1987) estimated berry abundance and canopy coverage within and above both impoundment zones proposed for the original APA Susitna Hydroelectric Project. Horsetails (*Equisetum* spp.), an important spring food, were more abundant outside the impoundment zones, but some sites with abundant horsetails would have been inundated by the proposed reservoir (Helm and Mayer 1985). An ADF&G study of brown bear movements and demography in GMU Subunit 13A is nearing conclusion; that study area is located south of the proposed reservoir inundation zone for this Project.

The density of black bears in black bear habitat comprised of spruce forest and shrublands along the Susitna River was estimated to be 90 bears/1,000 square kilometers in the 1980s (Miller 1987); that density estimate has not been updated since (Tobey 2008). Although black bears in the upper basin occasionally ate moose calves, berries appeared to be their most important food source (LGL 1985). Black bears spent most of their time in forested areas along creek bottoms, but moved out into adjacent shrublands during late summer as they foraged for berries, particularly in the area between Tsusena and Deadman creeks (Miller 1987). In May and June, 52 percent and 46 percent, respectively, of all locations of radio-collared bears occurred in areas that would be flooded by the proposed impoundment (Miller 1987).

The ADF&G management objective for brown bears in GMU 13 is to maintain a minimum population of 350 animals (Tobey and Schwanke 2009). The management objective for black bears in GMU 13 is to maintain the existing population of black bears with a sex structure that will sustain a harvest of at least 60 percent males (Tobey 2008). Bears in GMU 13 are of interest both as predators of caribou and moose and as important game species.

The Project could result in wildlife habitat loss and alteration, blockage of movements of mammals, disturbance, and changes in human activity and access due to construction and operation of the Project. Bears often pose management challenges for large development projects in Alaska because of their attraction to areas of human activity and associated waste-handling facilities.

#### 10.8.2.2. *Wolf*

Most of GMU 13 (except Subunit 13D, south of the Glenn Highway), including the upper Susitna River basin, currently is managed by ADF&G under a predator control program instituted in response to the State's intensive management law, passed in 1994. Since 2006, the number of wolves in GMU 13 has been within the current management goal range of 135–165 wolves (3.3–4.1 wolves/1,000 square kilometers) after the end of the hunting and trapping seasons (Schwanke 2009). In neighboring GMU 14, the wolf population was estimated at 100–130 animals in fall 2004 and 145–180 in fall 2007, well above the management objective of a minimum population of 55 wolves (Peltier 2006, 2009). GMU 14 currently is not included in the State's predator control program.

The wolf study for the original APA Susitna Hydroelectric Project was conducted during 1981–1983 in the Nelchina and upper Susitna River basins, building on regional studies that began in the 1970s (see ABR 2011 for details). That study provided data on pack size, territory boundaries, den and rendezvous sites, and feeding habits, based on radio-tracking of collared animals. During the study period, 13 different packs and a lone individual used areas in or adjacent to the Devils Canyon and Watana impoundment zones proposed for the APA Susitna Hydroelectric Project. Wolf packs used almost the entire upper Susitna basin, except areas above 4,000 feet elevation; elevational use varied seasonally, probably in response to availability of prey species. In each year, 5–6 wolf packs used the areas that would have been inundated by the APA Susitna Hydroelectric Project. Den and rendezvous sites usually were located on well-drained knolls and hillsides with sandy, frost-free soils and mixed, semi-open stands of spruce, aspen, and willow. The most important potential impact on wolves from the APA Susitna Hydroelectric Project was predicted to be reduced winter availability of primary prey species (moose and caribou) in the impoundment zones. In addition, habitat loss due to inundation and facilities development would have caused wolves to adjust territory boundaries, potentially resulting in intraspecific strife.

Wolves have been studied extensively in GMU 13 since the mid-1970s and are the subject of ongoing surveys for ADF&G's intensive management program. The number of wolves and packs using the Project area currently is unknown, although it appears to be substantially lower than during the original APA Susitna Hydroelectric Project studies because of current predator control efforts in GMU 13 and 16. Research in recent years has focused on ADF&G's Nelchina study area in GMU Subunit 13A, located south of the proposed reservoir.

### **10.8.3. Study Area**

GMU 13 is an intensive management area where predator control measures have been implemented by the State of Alaska to increase caribou and moose populations. In GMU 13, predator control measures have included land-and-shoot harvest of wolves and liberalized regulations for the harvest of wolves and bears.

The study area for spatial modeling of bear density will consist of a large region that encompasses the proposed Project area, including the reservoir inundation zone, the access and transmission corridors, and other Project features (Figure 10.8-1). The study area includes the entire area of GMU Subunit 13E plus parts of adjacent Subunits 13A, 16A, and 16B, to provide a broad regional context for the analysis of bear densities. The subunits adjacent to Subunit 13E were included in the previous ADF&G surveys (described below) that provided the source data for the spatial density modeling that will be developed for this study, and can be included in the modeling analysis with little additional effort.

Fieldwork in 2013 and 2014 will be limited to surveys of bear use of anadromous fish spawning streams in the Middle Segment of the Susitna River and its tributaries downstream from the proposed Watana dam site that contain spawning runs of anadromous fishes, as far downstream as the confluence of the Susitna River and the Chulitna River, all of which are located within GMU Subunit 13E.

No field studies are proposed for wolves. The wolf study will involve analysis of existing ADF&G data from GMU Subunits 13E and 13A, and possibly from adjacent Subunits 14B, 16A, and 20A, pending further consultation with ADF&G during study implementation.

## 10.8.4. Study Methods

### 10.8.4.1. Bears

#### 10.8.4.1.1 Population Estimation

A multi-faceted approach will be used to address the need for current information on bears in the Project area. Re-analysis of 1980s data and synthesis with current data from other previous or ongoing ADF&G telemetry studies and other regional management studies will provide data on bear populations, movements, and habitat use in the study area (AEA 2012a).

Population estimates can be obtained from existing data collected recently in ADF&G's two line-transect study areas (described above in Section 10.8.2.1) by using complex distance models with a new gamma-like detection function (Becker, in prep.) that is consistent with point independence models (Borchers et al. 2006). By themselves, however, these estimates will not allow more detailed inference about the number of bears in areas potentially affected by the Project. The addition of spatial line-transect modeling (Hedley and Buckland 2004) will allow computation of estimates that are both more accurate and more precise. The analytical objective is to obtain density estimates from specialized multiple-covariate, mark-resight distance models (Becker, in prep.) along small transect sections. These estimates will then be fitted with a detailed spatial model (Miller et al., in prep.) that incorporates potential explanatory variables such as elevation, aspect, habitat, and east-west and north-south gradients to derive a spatially explicit density model, from which sub-estimates can be obtained (e.g., parts of both bear survey areas that may be affected by the Project). The spatial models of Hedley and Buckland (2004) must be modified (Miller et al., in prep.) to work correctly with the more complex distance models (Becker, in prep.) used to model the initial bear densities. The spatial model must be robust because of the potential for nonlinearity between the spatial covariates and bear density (Miller et al., in prep.).

The analytical work will require writing a Geographic Information System (GIS) program to subdivide the 1,238 35-kilometer-long transects from the Talkeetna Study Area and the 1,221 30-kilometer-long transects from the GMU 13AB Study Area into small (1-kilometer) segments that retain all relevant geospatial information. This work will be performed by the ADF&G Division of Wildlife Conservation. The next step is to develop an R-based program to fit a spatial model to the two datasets and then to run this code on the datasets to obtain the population estimates. This work will be done by Dr. David L. Miller, University of Rhode Island, Department of Natural Resources Science, who will work on the analysis and report preparation with Earl Becker, ADF&G Division of Wildlife Conservation.

#### 10.8.4.1.2 Downstream Surveys

ADF&G has concluded that adequate data generally are available for brown bears and black bears in the Project area to evaluate the potential impacts of the Project, but "information on downstream use of habitat and the importance of salmon in bear diets in conjunction with impacts to salmon would aid in identifying potential impacts to bears downstream of the dam" (letter from M. Burch, ADF&G, to AEA dated November 22, 2011). ADF&G does not consider bear dens to be "sensitive" locations, however, because they are seldom reused (letter from M. Burch, ADF&G, to AEA, dated December 20, 2011).

A survey of bear use of fish-spawning streams in the Middle Segment of the Susitna River and associated tributaries downstream from the proposed Watana dam site will be conducted to assess the use of those resources by bears in the Project area. The surveys will use DNA analysis from hair samples to quantify the minimum number of bears using the downstream area and will use stable-isotope analysis of hair samples to characterize the diet of bears in the sampled area. Hair-snag stations such as single-catch snares (Beier et al. 2005) will be deployed along salmon spawning streams in the Susitna River drainage downstream from the dam site and upstream from Talkeetna, extending up tributary drainages that support spawning runs of anadromous fish. The size and design of the hair-snag sampling array will be based on the expected densities of bears, logistical considerations for access to the area, and comparison with similar studies in central Alaska, in consultation with ADF&G biologists.

DNA analysis of bear hair samples will provide information on the sex and species of bear, a minimum estimate of the number of different individuals using the sampling area, and stable isotope signatures. The isotopic signature will be used to classify the proportion of the diet made up of salmon, terrestrial meat, or vegetation (Fortin et al. 2007). ADF&G experts will be consulted by AEA during the sampling design and analysis phases of the downstream bear study.

Evaluation of berry resources in the reservoir inundation zone will be accomplished during the concurrent mapping efforts for vegetation and wildlife habitats and for wetlands (Sections 11.5 and 11.7, respectively) to assess the distribution and abundance of berry plants as forage for bears.

#### 10.8.4.2. *Wolf*

ADF&G's Division of Wildlife Conservation has expressed the opinion that ongoing monitoring work will be sufficient (ADF&G memorandum to AEA; November 22, 2011), so no additional field surveys are deemed necessary for the Project. Hence, desktop analyses of existing ADF&G data will be used to meet the study objectives for wolves.

Historical reports from the original APA Susitna Hydroelectric Project study will be reviewed and synthesized, where possible, with data from other recent and current monitoring by ADF&G of wolves in GMU Subunits 13A, 13B, 13E, 14B, 16A, and 20A, as a continuation of AEA's wildlife studies (AEA 2012a), initiated in 2012. Mapping of wolf pack territories and movements from existing ADF&G telemetry datasets will provide useful background information, although delineation of current pack territories will not be possible without tracking collared individuals, and the applicability of the available data to the study area needs to be evaluated. Although the findings of the wolf study conducted for the original APA Susitna Hydroelectric Project program remain relevant and could be used for the current Project analyses, the original telemetry data for wolves are no longer available and therefore cannot be reanalyzed using newer geospatial techniques.

### 10.8.5. Consistency with Generally Accepted Scientific Practice

Distance sampling using line transects surveyed from small airplanes (Becker and Quang 2009) is the primary method currently employed by ADF&G to obtain regional estimates of bear population density in southern Alaska. Mark-recapture analysis of genetic markers and stable isotope analysis from hair samples have been widely used in recent years. Analyses of hair

samples to examine bear diets and population size have been used previously in Alaska (Fortin et al. 2007; Gardner et al. 2010).

#### **10.8.6. Schedule**

This study is a multi-year effort (Table 10.8-1), part of which began in 2012; re-analysis and synthesis of existing bear and wolf data gathered through 2011 is currently being conducted (AEA 2012a). Incorporation of new data and additional analyses will be conducted incrementally as recent and current data are obtained from ADF&G databases. Field surveys of bear use of salmon streams downstream from the proposed dam site will be conducted during mid to late summer in 2013 and 2014 to coincide with the timing of spawning runs of salmon. Evaluation of berry resources in the reservoir inundation zone will be accomplished during concurrent mapping efforts for vegetation, wetlands, and wildlife habitats. Data analysis, QA/QC, and reporting will be conducted in the fall and winter months after recent and current data are transferred from ADF&G and fieldwork is completed in late summer. The Initial Study Report and Updated Study Report will be completed within 1 and 2 years, respectively, after FERC's Study Plan Determination (i.e., February 1, 2013). Technical Workgroup meetings will be planned on a quarterly basis in 2013 and 2014.

#### **10.8.7. Relationship with Other Studies**

As is depicted in Figure 10.8-2, the Large Carnivores Study will benefit from other sources of information, including the Fish Distribution and Abundance in the Lower and Middle Susitna River Study (Section 9.6), the Vegetation and Wildlife Habitat Mapping Study (Section 11.5), and various ongoing ADF&G management projects not sponsored by AEA. The fish distribution study will supplement the State's Anadromous Waters Catalog by helping to identify fish spawning areas downstream from the proposed dam, which will in turn define the sampling areas for collection of hair samples from bears visiting those streams. The hair samples will provide the material needed for DNA analyses to enumerate the minimum number of bears using the streams and for stable isotope analyses to characterize their diets. These results then will be used to assess potential impacts and to inform development of protection, mitigation, and enhancement, as appropriate.

The Vegetation and Wildlife Habitat Mapping Study will provide the information needed to evaluate berry abundance in the proposed reservoir inundation zone. These results will also be used to assess potential impacts and to inform development of protection, mitigation, and enhancement, as appropriate. The information on berry abundance will contribute to the Evaluation of Wildlife Habitat Use (Section 10.19) to identify areas and habitats that are used heavily by bears for foraging in late summer and early fall.

Existing data collected by ADF&G will be used to model the densities of brown bears and black bears in the region in which the Project area is located, as well as for population analyses of the wolf population in the Project area. Bear locations and numbers from two of ADF&G's regional line-transect surveys conducted within the last decade will be used for spatially explicit analysis and modeling of bear densities in a larger study area that encompasses the Project area. Similarly, the size of the wolf population and densities of wolves in the Project area will be estimated using existing ADF&G data from recent and ongoing studies. Data from these analyses will be used in the Evaluation of Wildlife Habitat Use (Section 10.19) to identify areas and

habitats that are used heavily by bears and wolves, and that information will be used to assess potential impacts and to evaluate PM&E measures, as appropriate.

The primary potential impacts on bears could be direct loss of habitat, changes in prey density and distribution, changes in berry production, changes in human use and hunting effort, and increased potential of mortality due to defense of life or property (DLP), or availability of anthropogenic food sources. Impacts on bears will depend, in part, on the proposed plan to control anthropogenic food sources. The primary potential impacts on wolves could be direct loss of habitat, changes in prey distribution and density, disturbance, and changes in hunting effort.

Telemetry data from the ADF&G will be used, in conjunction with bear survey data described above, to identify important habitats and high-use sites for bears and wolves in the Project area. Data on the distribution, abundance, movements, and habitat use by bears and wolves will be used to assess Project impacts. During the impact assessment that will be conducted for the FERC License Application in 2015, direct habitat loss can be estimated through geospatial analysis by overlaying the reservoir, access and transmission corridors, and other Project infrastructure on the Project habitat map (Section 10.19) to identify important habitats that would be lost. Additional indirect habitat loss and avoidance effects can be similarly estimated by applying various buffer distances, as determined from available information on anticipated effects. Data from the bear DNA study can be used to estimate the number of animals that might be affected at various high-use areas and to assess the dietary importance of those streams to the bear population downstream of the Watana Dam. The predicted effects on bears and wolves from this study will be useful for impact assessments for prey species, such as moose, caribou, and Dall's sheep. The Wildlife Harvest Analysis (Section 10.20) will provide baseline data for evaluation of changes in harvest and other mortality that may result from improved access. Data on the seasonal distribution, abundance, and movements of bears and wolves among habitats in relation to the geographic extent and seasonal timing of various Project activities can be used to identify any necessary protection, mitigation, or enhancement measures, as appropriate.

### **10.8.8. Level of Effort and Cost**

Sightability of bears from aerial surveys over forests is low and the large Project area makes direct observations from the ground problematic. Stable-isotope analysis of bear hair provides an indirect estimate of the major components of bear diets without requiring capture and handling of bears. Approximately one to two weeks of field time by a crew of two biologists will be required in mid-summer to establish the hair-snag grid between the proposed dam site and Talkeetna. The hair-snag stations will then be checked at weekly intervals during late summer, when use of the streams by bears is expected to be highest. The seasonal timing of sampling visits may be adjusted on the basis of results from fish surveys for the Project.

Collection of data on berry distribution and abundance in the reservoir impoundment zone will be conducted during the vegetation and wetland field surveys (see Sections 11.5 and 11.7), eliminating the need for separate field surveys.

The spatial modeling of bear density, which will be conducted in 2013 only, is estimated to cost approximately \$65,000.

The study cost of the large carnivore study (including bears and wolves) in 2013 is estimated at approximately \$200,000, including the bear density modeling. The cost of the large carnivore

study in 2014 is estimated to be less because the bear density modeling will not be included. The total two-year cost of the overall study is estimated at approximately \$325,000.

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**10.8.10. Tables**

**Table 10.8-1. Schedule for implementation of the Large Carnivore Study.**

Activity	2012			2013				2014				2015
	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Acquisition and analysis of recent and current data on bears and wolves from ongoing ADF&G projects & databases	—											
Spatial modeling of bear population density by ADF&G, using existing data				—								
Field surveys of bears along spawning streams downstream from proposed dam (hair sampling for DNA & stable isotope analyses)					—				—			
Evaluation of berry abundance in reservoir inundation zone (from vegetation and wildlife habitat mapping field surveys)					-----				-----			
Data QA/QC and analyses					—				—			
Initial Study Report								—△				
Updated Study Report												—▲

Legend:

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

10.8.11. Figures

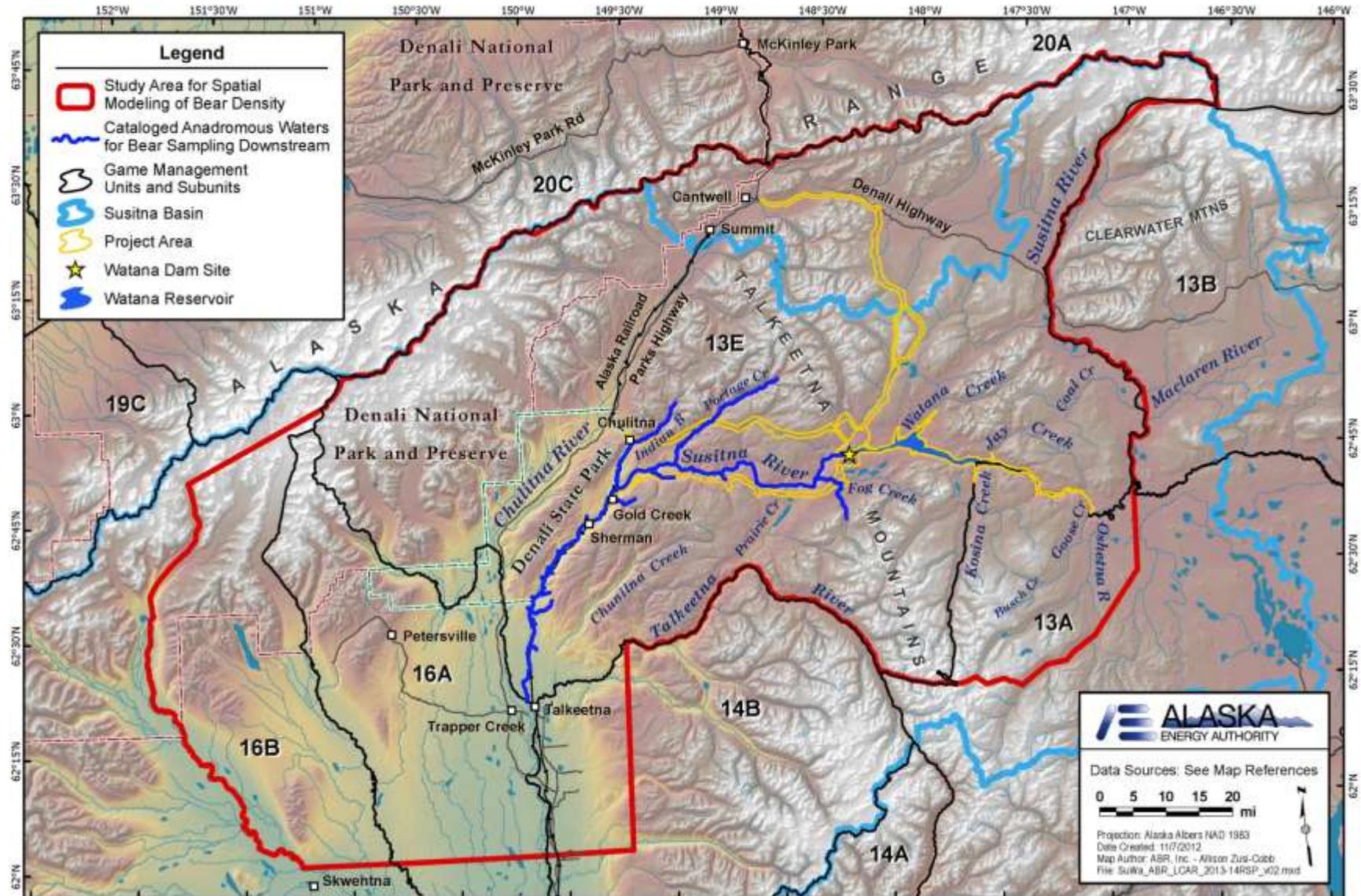


Figure 10.8-1. Study area for large carnivores.

**STUDY INTERDEPENDENCIES FOR LARGE CARNIVORE STUDY**

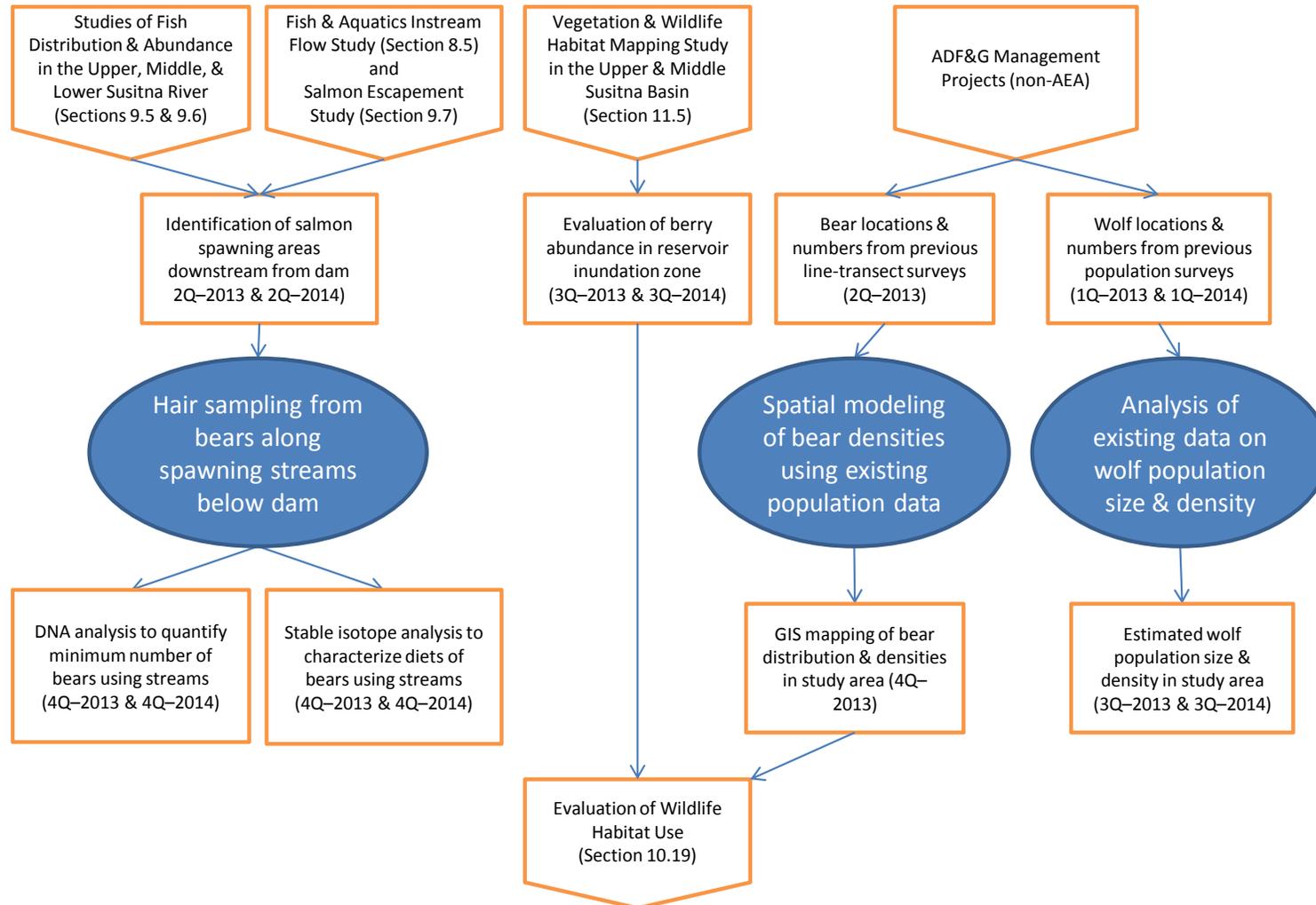


Figure 10.8-2. Study interdependencies for the large carnivore study.