10.10. Terrestrial Furbearer Abundance and Habitat Use

10.10.1. General Description of the Proposed Study

Terrestrial furbearer studies were initiated in 2012 and, as outlined here, will continue in 2013 and 2014. The terrestrial furbearer study will be conducted as part of a graduate thesis project supervised by Professor Laura Prugh of the University of Alaska Fairbanks (UAF). Data and reports pertinent to the goals of this Project will be provided by Dr. Prugh, whereas elements of the larger UAF thesis project lie outside the context of impact assessment and mitigation and are not included in this study plan or in the FERC licensing process.

10.10.1.1. Study Goals and Objectives

The goal of this study is to provide current information on the abundance and habitat use of four species of terrestrial furbearers (coyote, red fox, lynx, and marten) for use in evaluating potential Project-related impacts and identifying appropriate mitigation. The potential impacts of the Project include habitat loss and fragmentation, increased human harvest and disturbance, and changes in prey populations (AEA 2011). Accurate population estimates and habitat-use data are important for adequately determining the amount of habitat loss and identifying the relative likelihood and magnitude of changes in harvest. This information will be used to assess the potential effects of the Project on furbearer populations, which will inform development of any necessary protection, mitigation, and enhancement measures, which may include management and monitoring plans.

Red fox, lynx, and marten are ecologically important and valuable furbearers. Coyotes also are ecologically important but they are not as highly valued as furbearers. Although coyotes are widely distributed throughout Alaska, little is known about their abundance or ecological effects. The coyote is considered to be a "human commensal" species, benefiting from human activities such as road construction and agriculture (Young and Jackson 1951). Coyotes may increase in abundance as a result of the Project, and because they prey on a wide variety of large and small game, and compete with and prey on foxes and lynx, changes in coyote abundance could have effects on other wildlife resources.

Trapper surveys show that Alaskans who trap in Game Management Units (GMUs) 11 and 13 are particularly concerned about the impact of coyotes on Dall's sheep populations (Schwanke 2010). Several studies have found that coyotes are a major predator of Dall's sheep lambs (Hoefs and McTaggart-Cowan 1979, Scotton 1998, Arthur and Prugh 2010). Although preliminary results from a study of Dall's sheep survival in GMU subunit 13D showed little evidence of coyote predation (Lohuis 2011), the area where that study was conducted contains more escape terrain than does the study area. Terrain in the study area (located in GMU subunit 13E) is more similar to the area studied by Arthur and Prugh (2010) in the northern foothills of the central Alaska Range, where the coyote was the main predator of Dall's sheep lambs.

This study has five specific objectives:

1) Develop population estimates of coyotes and red foxes through fecal genotyping and genetic capture-recapture analyses using scats collected along trails and rivers throughout the study area during winter months (January–March) in 2013 and 2014;

2) Develop a population estimate of marten through DNA-based capture-recapture analysis using hair samples collected in the reservoir inundation zone using hair-snag tubes;
3) Develop a population estimate of lynx through DNA-based capture-recapture analysis using hair samples collected throughout the study area using hair-snag plates;
4) Assess prey abundance in the study area by conducting snowshoe hare pellet counts and estimating vole density using mark-recapture estimates from live trapping; and
5) Compile habitat-use data for the furbearer species being studied, using aerial track surveys.

The habitat-use data and species population estimates will be used to assess the potential impacts of the Project on these populations, and to develop any necessary potential PM&E measures.

10.10.2. Existing Information and Need for Additional Information

The original APA Susitna Hydroelectric Project study program collected data on use of the Project area by marten (Gipson et al. 1982, 1984; Buskirk 1983, 1984; Buskirk and MacDonald 1984; Buskirk and McDonald 1989) and red fox (Hobgood 1984), but no information was collected on coyotes or lynx, aside from incidental sightings. The APA Susitna Hydroelectric Project studies indicated that marten may be impacted by the reservoir, because a substantial amount of their preferred habitat (mature spruce forest) occurs within the inundation zone. ADF&G has not conducted population estimates of small furbearers in GMU 13. Trapping reports indicate that populations have experienced normal annual and cyclic fluctuations, but no indications of long-term increases or decreases have been apparent (Schwanke 2010).

Major advances in the estimation of predator population sizes have occurred since the original APA Susitna Hydroelectric Project studies were conducted in the 1980s. A large body of literature has accumulated on the use of noninvasive genetic techniques to obtain population estimates for numerous species around the world. Many studies of wolves, bears, wolverines, coyotes, foxes, lynx, marten, river otters, and other species have successfully used noninvasive techniques to estimate population sizes (Mowat and Paetkau 2002, Waits and Paetkau 2005, Petit and Valiere 2006, Long et al. 2008).

Marten is the most economically valuable furbearer in GMU 13 (Schwanke 2010). Loss of habitat combined with increased access could lead to unsustainable levels of harvest and population declines in marten and other furbearers. Thus, current population estimates are needed to serve as a baseline for assessing the impact of the Project and for developing any necessary PM&E measures.

The wildlife data gap analysis completed for the Project (ABR 2011) recommended using a combination of aerial track surveys and noninvasive capture–recapture techniques to determine current habitat use, movement patterns, and population sizes of furbearer species. In general, aerial track surveys techniques are appropriate and will be adopted, in particular for assessing habitat use. However, aerial tracking methods may be inappropriate for estimating population sizes of small terrestrial furbearers and mark-recapture studies are preferred. The aerial snow-track survey method that provides estimates of population size is known as the survey-unit probability estimator (SUPE; Becker et al. 1998, 2004) and the SUPE model was recommended by ADF&G for the Project to obtain population information on wolverines. The method is appropriate and has been well-tested for large furbearers such as wolves and wolverines, which often travel over long distances in open habitats where tracks are possible to follow from the air. Similarly, beaver and muskrat sign are also easy to see from the air.

However, the SUPE method has several assumptions and requirements that make it impractical for population surveys of smaller terrestrial furbearers and the ADF&G, in comments on the gap analysis and preliminary study plans, recommended against its use for species other than wolverine for the following reasons. First, the method requires following the full length of a track from its end, where the animal is seen, back to its start, when the last snowfall ended. Small furbearers often travel in tightly meandering routes within dense brush or forests and their tracks can be obscured by snowshoe hare tracks. Coyotes prefer to travel on trails broken by other species (e.g., wolf and moose trails) because they have high foot loading and avoid traveling in deep snow (Murray and Boutin 1991), making their tracks easy to lose. Second, aerial tracking relies on weather conditions that are uncommon (a fresh snowfall followed by several days of calm weather) and an SUPE survey can take several days per species to conduct (Becker et al. 1998). Therefore, it is unlikely that weather conditions and availability of experienced personnel would allow sufficient time to complete SUPE estimates for other furbearers in the study area in addition to the planned SUPE estimates for wolves and wolverines. In addition, the SUPE has not been tested on smaller furbearers. Validations of SUPE population estimates in areas with known population sizes have occurred for wolves and cougars only, with mixed results (Vansickle and Lindzey 1991, Patterson et al. 2004, Choate et al. 2006). Thus, although aerial track transects may be useful for obtaining information on habitat use and movement patterns of smaller furbearer species, accurate estimation of population sizes requires different methods. As outlined below, mark-recapture methods are preferred for estimating population size of terrestrial furbearers smaller than wolves or wolverine.

10.10.3. Study Area

The terrestrial furbearer study area (Figure 10.10-1) will include all terrestrial areas that are safely accessible by snowmachine within a 10-kilometer (6.2-mile) buffer zone surrounding the areas that will be directly altered or disturbed by Project construction and operations, including facility sites, laydown/storage areas, the reservoir inundation zone, and access road and transmission-line corridors. Carnivores are wide-ranging animals that occur in low densities, so sampling will need to extend upstream on the Susitna River above the inundation zone and as far as 10 kilometer on either side of the inundation zone and access/transmission corridors. This wider sampling is needed to obtain adequate sample sizes to calculate population density estimates of furbearers, especially because this study will occur during the low phase of the hare cycle when coyote and lynx numbers will be at cyclic lows. Although density estimation of furbearers will require sampling over a larger study area, all samples will be georeferenced so that a total count of furbearers occupying the Project-affected area can be determined.

10.10.4. Study Methods

The methods for the study components are described below.

10.10.4.1. Sample Collection

Snowmachine transects will be established along creeks and rivers throughout the study area (i.e., along road and transmission corridors and the inundation zone). Transect placement and length will depend on the terrain. Ideally, 4–5 transects, each approximately 30 km long, will be established along natural animal movement corridors in the study area, such as creeks and rivers. Transects along the Susitna River and Denali access corridor may be relatively long (40–50 km), with shorter transects extending up side drainages (e.g., Watana and Tsusena creeks). Transects will be placed to ensure roughly equal coverage of the study area and to avoid gaps where furbearers would not be encountered. Transects will be traveled daily on a rotating basis, so that each transect will be traveled every week, from late January to early April in 2013 and 2014, and all canid and felid scats will be collected. Scats will be collected with ziplock bags and then placed within autoclave bags to prevent cross-contamination. Scats will be stored frozen, which preserves DNA for analysis.

Unlike canids, lynx and marten do not preferentially travel on rivers and trails. Therefore, hair snags will be used to obtain genetic material from those species. Lynx habitat within the study area (i.e., areas with tree or shrub cover) will be divided into approximately 50 blocks. Each block will be 25 square kilometers (9.65 square miles) in size, approximately the average size of a lynx home range (Slough and Mowat 1996, Vashon et al. 2008). Two hair-snag plates will be placed in each block, in locations that are accessible and likely to be encountered by lynx in the area. Hair-snag plates will consist of an attractant that will cause lynx to rub and a barb to collect a hair sample (Zielinski et al. 2006). Hair-snag stations will be checked bi-monthly during late January–early April in 2013 and 2014, and all hairs found on barbs will be placed in coin envelopes and stored in a dry location to preserve the DNA. Because marten home ranges are small and a comprehensive survey of the entire study area would be impractical, the marten survey will be restricted to the inundation zone. This zone, which is approximately 125 square kilometers (48.3 square miles) in size, will be divided into 25 5-square-kilometer (1.9-square-mile) blocks, roughly corresponding in size to the home range of female marten reported in this area during the 1980s (3 to 6 square kilometers [1.2 to 2.3 square miles]; Buskirk 1983). Two hair-snag tubes will be placed within each block in locations likely to be used by marten, as described by Williams et al. (2009).

Snowshoe hare abundance will be determined by counting fecal pellets in 8–10 plots within the study area. Pellet counts correspond closely to snowshoe hare density (Krebs et al. 1987). The study area will be divided into 4–5 blocks of equal size, and two pellet-count plots will be randomly placed within each block, one in spruce forest and one in riparian habitat. Fifty circular plots with a radius of 0.5 meters (1.6 feet) will be spaced 15 meters (49.2 feet) apart at each site, and all pellets will be counted and cleared from the plots. In the first year of the study, pellets will be aged, based on appearance, to estimate whether they are more or less than a year old (Prugh and Krebs 2004).

The abundance of voles will be estimated by using live-trapping and mark–recapture methods in 8–10 plots. Two trapping grids will be established in spruce forest and in grassy meadow habitats. Each grid will consist of 50 live-trap sites spaced 10 meters (32.8 feet) apart. The traps will be operated for 1–5 nights. Captured voles will be weighed, ear-tagged, identified to species and sex, and released. The proportion of recaptured tagged individuals to unmarked individuals will be used to calculate an estimate of population abundance.

10.10.4.2. Genetic Analyses

The outer surface of each frozen scat will be scraped with a scalpel, and shavings will be placed in 2-ml vials. DNA from hair samples will be extracted using Qiagen® kits (a commercially available DNA assay). Mitochondrial analyses will be used to determine the species identification and sex of individuals that deposited each hair and scat sample. Genotypes will be determined by amplifying DNA at six loci. Amplification will be repeated two to three times to verify accuracy because DNA from feces and hairs sometimes is degraded and errors can occur (Miller et al. 2002).

10.10.4.3. Habitat Use

Habitat use will be evaluated by conducting helicopter surveys of tracks in snow. Experienced observers (such as ADF&G biologists or UAF graduate students) will fly predetermined transect lines at slow speed and will use GPS receivers to record the locations of tracks encountered. These locations will be overlaid on habitat maps using ArcGIS® software (ESRI, Redlands, California) to examine patterns of habitat use in the study area for each furbearer species. This design is based on the helicopter-based track surveys that were conducted in the Project area in the 1980s (Gipson et al. 1984). Surveys using fixed-wing aircraft are not feasible because the aircraft cannot be flown slowly enough to detect and record tracks of small furbearers in forested habitats (S. Buskirk, University of Wyoming, personal communication, 20 September 2012).

10.10.4.4. Statistical Analyses and Data Interpretation

Once reliable genotypes are obtained, each genotyped sample is considered to be a “capture” event. Spatially explicit capture–recapture (SECR) population estimates and confidence intervals will be produced using the SECR package in program R (Efford et al. 2009, Efford 2011). By including location data in the density estimation, this recently developed method combines distance sampling and mark–recapture modeling techniques to better account for capture heterogeneity. Survival, recruitment, and population growth rates will be estimated between years using open mark–recapture estimators such as Cormack-Jolly-Seber and Pradel models in the RMark package (Laake and Rexstad 2008).

Nearly all methods to estimate population density assume the population is closed to births, deaths, immigration, and emigration. Violations of this assumption can inflate population estimates. Several measures will be implemented to address this issue. First, temporal subsets of data for which the assumption of population closure may be valid will be analyzed. For example, estimates can be obtained from samples collected during a single month, during which time the per-capita odds of a death, dispersal, or immigration event are relatively low. Traditional mark-recapture methods require several capture “sessions,” but accurate and precise estimates can be obtained using spatially explicit methods from a single session (Efford et al. 2009). Although estimates from temporal subsets may be less precise (resulting in wide confidence intervals) than estimates obtained from pooling samples during each winter season, they will allow evaluation of the potential bias in the pooled estimates.

Because lynx and coyote population dynamics are closely tied to the hare cycle, which is currently in the low phase, the number of detected individuals of these species may be low. However, the precision of mark–recapture estimates is based largely on recapture rates rather than on numbers of individuals captured (Pollock et al. 1990). Because a field crew will be working intensively in the study area and collecting samples continuously throughout the winter, recapture rates are expected to be quite high (0.7–0.8) and the population estimates fairly precise.

Natural cycling of snowshoe hare numbers and wolf control efforts by ADF&G in the study area may influence lynx and coyote abundance in the study area, making it difficult to isolate the effects of Project activities on these species. To assess these potentially confounding factors, abundance estimates and trends found in this study will be compared with findings from a similar study being conducted in nearby Denali National Park and Preserve (DNPP) and the Stampede corridor. Trends found in the DNPP/Stampede may indicate how furbearer populations are fluctuating in response to the hare cycle in the absence of wolf control and in the absence of Project activities. Hare-pellet counts will be conducted in the DNPP/Stampede area as well as in this study area. Comparing baseline furbearer surveys in the Project area with surveys in the DNPP/Stampede area may indicate how wolf control is affecting furbearers in this study area. Furbearer harvest records may provide information on harvest levels in each area. This comparison may be useful in subsequently determining which changes in furbearer populations may be due to the Project activities and which changes may have occurred due to other factors. Because marten and red foxes rely heavily on microtine rodents and other prey rather than hares (Buskirk and MacDonald 1984, Gipson et al. 1984), the hare cycle is not expected to be a confounding factor in the assessment of Project impacts on their populations.

10.10.4.5. Data Products

This terrestrial furbearer study will provide preconstruction baseline data for the study area, including habitat-use data for use in developing habitat evaluation criteria. The terrestrial furbearer study will provide a basis for impact assessment and for developing appropriate PM&E measures.

The following data will be produced from this study:

1) Population estimates, with confidence intervals, for coyote, red fox, lynx, and marten in 2013 and 2014;
2) Estimates of survival, recruitment, and population growth for coyotes, red foxes, lynx, and marten between 2013 and 2014;
3) Habitat use and selection data based on aerial track surveys;
4) Snowshoe hare abundance estimates from pellet-count data in spruce and willow habitats;
5) Vole density estimates from live-trapping in meadow and forest habitats; and
6) Genetic samples from furbearers in the study area, which will be stored for at least 5 years after the study is completed.

An Initial Study Report will be prepared in 2013 and an Updated Study Report will be prepared in 2014, each summarizing the study results produced in the two study years, including an examination of the population dynamics and habitat use of terrestrial furbearers in the study area. GIS mapping with layers showing the locations of study transects, furbearer snow tracks, and genetic samples collected during the study will also be created. The Updated Study Report will summarize the results for both years of study.

10.10.4.6. Impact Assessment

All four species of terrestrial furbearers are predators and could be affected both directly by Project activities and features and indirectly by effects on prey species. The primary impacts of the Project on terrestrial furbearers could include the following:

- Direct and indirect habitat loss and alteration, including potential effects on prey species;,
- Potential direct behavioral impacts to wildlife, such as attraction or avoidance, resulting from vehicular use, noise, and increased human presence associated with Project construction or operation;
- Potential indirect behavioral impacts to wildlife, such as attraction or avoidance, resulting from changes in hunting, vehicular use, noise, and increased human presence associated with increased subsistence or recreational access that may be facilitated by Project development;
- Potential direct mortality due to vehicle strikes, exposure to contaminants, and attraction to garbage and human activity;
- Potential changes in wildlife mortality rates due to increased subsistence and sport harvest facilitated by Project development; and
- Potential physical and/or behavioral blockage and alteration of movements due to reservoir water and ice conditions.

Data on the distribution, abundance, and habitat use of terrestrial furbearers in the study area can contribute to the assessment of Project impacts. Using GIS software, species abundance data recorded among different habitat types can be combined with the spatially explicit wildlife habitat map of the Project area that will be developed under the botanical resources study plans. Direct effects of habitat loss and alteration by the Project can be evaluated by overlaying the reservoir impoundment, related infrastructure areas, and access road and power transmission corridors onto the habitat map and then quantifying the acreage of habitats affected. Indirect effects also can be assessed by applying various buffer distances, estimated from the available information on the anticipated effects. Data collected in this study of terrestrial furbearers can be used in combination with information from the literature to conduct a GIS analysis of the geographic extent, frequency, duration, and magnitude of Project effects on terrestrial furbearer populations. For coyotes, foxes, lynx, and marten, population data from the terrestrial furbearer study will provide context for assessing the magnitude of potential population-level impacts of direct and indirect habitat loss. For snowshoe hares, pellet counts conducted by the terrestrial furbearer study will provide semi-quantitative assessment of population effects. Any necessary PM&E measures will be developed by examining the distribution and abundance of species among habitats in relation to the geographic extent and seasonal timing of various Project activities.

Separate studies of prey species in the Project area, including Dall's sheep, ptarmigan, and small mammals, will provide additional information on the impact of predatory terrestrial furbearers on prey species and will improve the assessment of potential Project-related impacts for all species. Existing data and any additional surveys by ADF&G to estimate wolf numbers in the region for ongoing state management programs will improve our understanding of the relationship between large and small furbearer populations and may help to assess whether future changes in furbearer abundance may be related to changes in wolf density, prey availability, or Project-related impacts.

10.10.5. Consistency with Generally Accepted Scientific Practice

Noninvasive genotyping is a well-established technique to obtain reliable population estimates of coyotes, red foxes, lynx, and marten. Fecal genotyping has successfully been used to monitor coyote population dynamics from 2000 to 2002 in the central Alaska Range (Prugh and Ritland 2005, Prugh et al. 2005, Prugh et al. 2008).

10.10.6. Schedule

This study includes data collection, analyses, and reporting during both 2013 and 2014. In August 2012, prey abundance data was collected in the study area. Hare pellet count grids were established and pellet counts were conducted. Vole trapping was also conducted within established trapping grids.

<u>2013</u>

January–March — Final selection of sampling sites; fieldwork to collect genetic samples and conduct track surveys.

April–August — Genetic analyses.

August — Snowshoe hare pellet counts and vole density estimates.

September–December — Initial data analyses and report preparation.

<u>2014</u>

February — Initial Study Report.

January–March — Fieldwork to collect genetic samples and conduct track surveys.

April–October — Genetic analyses.

August — Snowshoe hare pellet counts and vole density estimates.

<u>2015</u>

September–December — Final data analyses and report preparation.

February — Updated Study Report.

10.10.7. Level of Effort and Cost

This study will require two field seasons to assess furbearer abundance prior to Project construction. The first field season will involve substantial time spent scouting safe travel routes and establishing protocols. Fieldwork will be conducted by a crew of two personnel. Supervision, data analysis, writing reports, and attending meetings are expected to require one month of the study lead’s time per year. Genetic analyses will be conducted by an experienced technician. Several fixed-wing airplane trips will be needed during each winter field season for access to field sites and haul snowmachine fuel and miscellaneous field supplies. Approximately 18 hours of helicopter time will be required to conduct aerial track surveys each year. Materials to make hair-snag stations and other consumables for genetic analyses will be required. Genetic analyses for fecal and hair samples cost more than traditional genetic analyses (~$50/sample instead of ~$30) because samples need to be analyzed 2–3 times to check for errors due to low DNA quality or quantity. The total cost of the study is estimated to be $410,000 for both years, including aircraft support.

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10.10.9. Figures

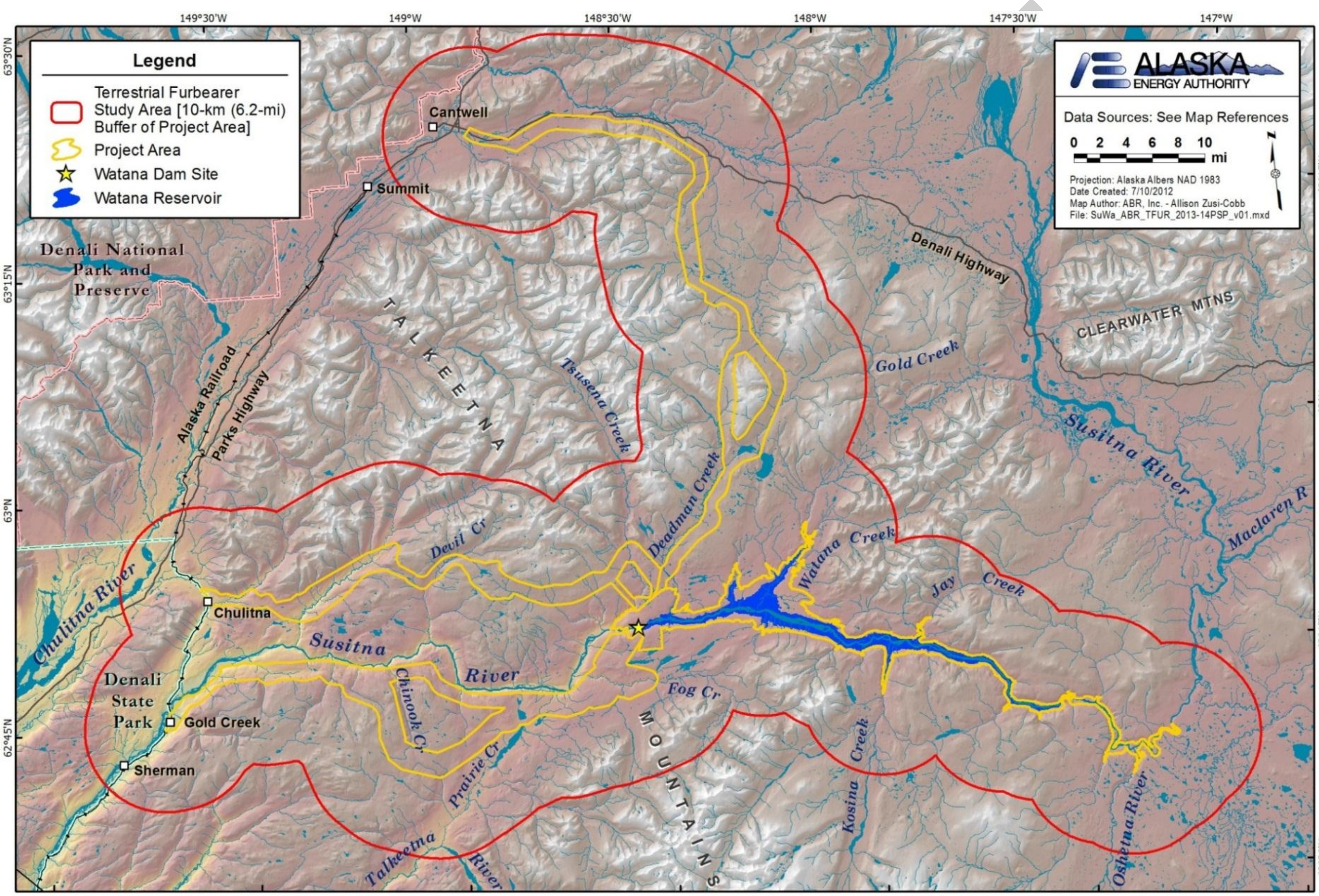

Figure 10.10-1. Terrestrial furbearer study area. [STUDY AREA WILL BE REVISED TO INCORPORATE REVISED ALIGNMENTS AND TO TRUNCATE BUFFER AT PARKS HIGHWAY AND ALASKA RAILROAD]