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

**Population Ecology of Willow Ptarmigan in Game
Management Unit 13
Study Plan Section 10.17**

Final Study Plan

Alaska Energy Authority



July 2013

10.17. Population Ecology of Willow Ptarmigan in Game Management Unit 13

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). Included within the RSP was the Population Ecology of Willow Ptarmigan in Game Management Unit 13 Study, Section 10.17. RSP Section 10.17 focuses on collecting the necessary data to evaluate the potential effects of the proposed Project on willow ptarmigan, the predominant species of upland game bird in the Project area and surrounding areas. RSP 10.17 described the goals, objectives, and proposed methods for willow ptarmigan data collection and analysis.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 10.05 was one of the 13 approved with modifications. In its February 1 SPD, FERC recommended the following:

Based on experience gained in capturing ptarmigan in the study area in 2012, Alaska DFG recommends that the number of capture sites be increased to between 4 and 6 and that capture of ptarmigan be conducted primarily by the use of Coda net gun and noose carpets. Alaska DFG states that the additional capture locations would provide a more comprehensive understanding on willow ptarmigan movement throughout the proposed hydroelectric site and would not increase costs. Also, based on several overflights of the study area, Alaska DFG is now confident access into areas previously thought to be inaccessible will be feasible. Testing of the Coda net gun, mist nets, and noose carpets found that both the net gun and noose carpets were very effective, efficient, and safe for the birds, more so than mist nets. Therefore, Alaska DFG does not recommend using mist nets for this study. Alaska DFG does not expect project cost will increase with the use of net guns and noose carpets.

Alaska DFG's recommended changes would ensure efficient use of resources, and its proposed methods are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and should be adequate to collect the information necessary to address project effects (section 5.9(b)(4)). Therefore, we recommend that AEA modify the study plan to include Alaska DFG's recommended modification.

In accordance with the February 1 SPD, AEA addressed the recommended modifications in this Final Study Plan for Section 10.17.

10.17.1. General Description of the Proposed Study

The Ptarmigan Study, which will be conducted by the Alaska Department of Fish and Game (ADF&G), will be a two-year investigation, beginning in spring 2013 and continuing through winter 2014 to inform the FERC licensing process. To take full advantage of the expected life span of the radio telemetry tags that will be deployed for the study, ADF&G may continue to track tagged birds further (into 2016), but the data obtained in 2013 and 2014 will be sufficient for the FERC licensing effort.

Study Goals and Objectives

The goal of this study is to provide the necessary data to evaluate the potential effects of the proposed Project on Willow Ptarmigan, the predominant species of upland game bird in the Project area and surrounding areas. The area of interest consists of Subunits 13A and 13E of Game Management Unit (GMU) 13 (Figure 10.17-1).

The study has four objectives:

- Determine the seasonal distribution of Willow Ptarmigan in the Project area.
- Determine the seasonal migratory patterns of Willow Ptarmigan that occur in the Project area.
- Estimate the abundance of ptarmigan in the Project area during the breeding season and during the fall.
- Estimate seasonal survival of Willow Ptarmigan.

The data gathered during the study will be integrated to determine potential effects of the Project on Willow Ptarmigan.

10.17.2. Existing Information and Need for Additional Information

The Willow Ptarmigan is the most common and widespread ptarmigan in Alaska, constituting an estimated 65–70 percent of all ptarmigan statewide, followed by Rock Ptarmigan at 25–30 percent, and White-tailed Ptarmigan at <10 percent (Taylor 1994). All three ptarmigan species occur in GMU 13 (Taylor 2000).

Ptarmigan hunting is a very popular activity in the fall and winter months in GMU 13 due to the accessibility of the unit from the state highway system. Since 1997, ADF&G has conducted ptarmigan surveys in spring along the Denali, Parks, and Richardson highways to quantify the relative abundance of territorial males. All survey efforts have centered on road-accessible areas within GMU 13. Those surveys suggest that Willow Ptarmigan along the road system portions of GMU 13 are declining in abundance or have remained at low abundance since 2000 (Bill Taylor, pers. comm.). Due to this continued low abundance, ADF&G recommended that the Alaska Board of Game reduce the bag limit of ptarmigan from 10 per day to 5 per day in Subunits 13A, 13B, and 13E between December 1 and March 31, and this recommendation took effect during the 2005–2006 regulatory year. Continued low abundance resulted in further harvest restrictions in Subunit 13B, and beginning in 2009, the ptarmigan season has been closed after November 30 each year. ADF&G has been unable to commit additional resources to better understand the life history of GMU 13 ptarmigan populations and there is little information on the habitat value of the Project area for ptarmigan.

Ptarmigan that winter in the Project area may be either resident or migratory birds. To better predict the potential effects of the proposed Project on Willow Ptarmigan, information needs to be collected to determine the annual ranges of ptarmigan that may use habitats in GMU 13. In particular, information is needed to evaluate the relative importance of the Project area to resident and migratory ptarmigan and the seasonal ranges of migratory birds need to be delineated.

10.17.3. Study Area

Willow Ptarmigan will be captured within a 15-mile buffer around the proposed dam site and reservoir and the access and transmission corridor alternatives (Figure 10.17-1). Capture

locations will be in the headwaters of several major river drainages. The study area is composed of alpine habitats at higher elevations and subalpine spruce habitats at lower elevations. Areas in which Willow Ptarmigan will be captured are roadless, although periodic, but infrequent, all-terrain vehicle use can occur year-round.

The areas selected for capture have been identified previously as locations with relatively high breeding densities of Willow Ptarmigan. Initial capture efforts will focus on three areas, including upper Fog Creek (tributary to the upper Susitna River), upper Busch Creek (tributary to Goose Creek), and the pass between upper Jay and Coal creeks.

Radio-tagged Willow Ptarmigan are expected to remain within 50 miles of the original capture site, although movements may exceed that distance in some cases (Irving et al. 1967). Aerial surveys to locate birds with radios will be conducted in appropriate habitats within 50 miles of the original capture locations.

10.17.4. Study Methods

10.17.4.1. Capture and Radio-tagging of Ptarmigan

Beginning in April 2013, 50–100 Willow Ptarmigan will be captured annually at four to six sites within Subunits 13A and 13E (Figure 10.17-1) and fitted with radio-transmitter necklaces. All four to six sites are within 15 miles of either the proposed reservoir inundation zone or the access corridors. Alternative capture sites may be needed based on conditions each spring, depending on factors such as ptarmigan abundance, snow depth, and fixed-wing airplane access. Potential alternative capture sites (Figure 10.17-1) will be considered during field operations in the spring and summer of 2013.

Capture sites and future alternative sites have and will be identified based on several criteria:

- Willow Ptarmigan abundance
- Proximity to the future reservoir or access routes
- Ease of access using either fixed-wing or helicopter
- Observed springtime conditions (i.e., snow depth, and habitat availability during the capture time period)

During the breeding season in April and May of each year, several two-person teams will be deployed to various capture locations using wheel-ski equipped fixed-wing aircraft. Teams will attempt to capture 25–50 Willow Ptarmigan during the spring effort. Several teams will again be deployed in mid-August to September, using fixed-wing aircraft, in an effort to capture an additional 25–50 adult and fledged juveniles before brood dispersal occurs (Weeden and Watson 1967).

When capture efforts begin in April, male Willow Ptarmigan will be located visually or by using a playback recording of a territorial male Willow Ptarmigan (Taylor 1999; Peyton 1999; Savage et al. 2011). Playback recordings will be used effectively under low wind conditions (≤ 5 miles per hour) with no precipitation during early morning or late evening hours. Once ptarmigan are known to be in the vicinity, a styrofoam decoy and remotely powered caller will be placed within the defensive range (<100 meters [328 feet]) of a territorial male. A noose carpet will be deployed around the decoy and remotely powered caller in an attempt to capture the territorial male when he responds defensively to the call and decoy. In accordance with comments

received from ADF&G, mist nets will not be used in this study. If circumstances allow during spring capture efforts, a hand-held Coda net gun (www.codaenterprises.com) with a 12-square-foot net and 3-inch mesh will be used opportunistically to capture territorial male birds on the ground. This method has been used from a helicopter to capture short-eared owls in northern Alaska and has proven to be safe and effective (T. Booms, ADF&G, pers. comm.). The use of decoys and calls is a novel adaptation to attempt to increase the number of captures typical of previous netting methods (>30 ptarmigan annually; Skinner et al. 1998; Kaler et al. 2010). No attempt to capture nesting or brood-rearing females will occur.

Post-breeding resident and migrant birds will be targeted for capture during a second annual capture effort in mid-August through September. Flocks of ptarmigan will be located visually, noose carpets will be strategically placed around or in the vicinity, and ptarmigan of all age/sex classes will be flushed into noose carpets and/or captured with a Coda net gun. Fall captures will be similarly outfitted with radio-transmitter necklaces.

At least two people will be present for any single capture event to remove birds from noose carpets/Coda gun nets, handle, and release birds as quickly as possible. After capture, Willow Ptarmigan will be restrained in a capture bag or by holding their wings against their bodies. Birds will be instrumented with a necklace-mounted A3950 VHF radio transmitter with a 10-inch whip antenna (Raymond 1999; Paragi et al. 2012; Figure 10.17-2) from Advanced Telemetry Systems (ATS, www.atstrack.com). The entire radio and necklace package will weigh up to 10.7 grams (0.4 ounce) (1.7 percent of the body mass based on known weights of hunter-harvested Willow Ptarmigan; Hudson 1986; Thirgood et al. 1995). Radios will transmit in the frequency range of 148.000 Mhz. The transmitter is secured by a rubber-sheathed wire fitted over the bird's neck and crimped on either end to ensure its fit (Figure 10.17-2). The transmitter will be adjusted to compensate for crop expansion. No tissue samples will be collected from captured Willow Ptarmigan. Birds will be handled for 5–10 minutes and released at their point of capture.

Age and sex, based on plumage characteristics (Bergerud et al. 1963; Weeden and Watson 1967; Braun and Rogers 1971; Hudson 1986) will be recorded for each bird captured. Individually numbered leg bands will be placed on each radio-tagged bird. These tags will be useful for ground observations and to identify human-harvested birds or prey remains that may be found during field efforts. A Global Positioning System (GPS) receiver will be used to record the location of capture. Date, time, and weather conditions also will be recorded. If a territorial male is captured, an attempt will be made to identify and record the location(s) of his territory post(s).

Radio tags will not be removed at the conclusion of the study, nor will tags drop off. There is little evidence to suggest that radio tags have a negative effect on the survival or breeding success of ptarmigan and other galliformes (Thirgood et al. 1995; Palmer and Wellendorf 2007; Terhune et al. 2007). Radio-tagged Willow Ptarmigan will be closely monitored within 24 hours of capture to document capture myopathy or other obvious handling-induced stresses. All potential capture and marking methods will be fully evaluated and compliant with Alaska Interagency Animal Care and Use Committee (IACUC) certification. ADF&G will ensure compliance with all IACUC policies.

10.17.4.2. Relocation of Radio-tagged Ptarmigan

Radio-tagged ptarmigan will be relocated during aerial surveys conducted throughout the year to record habitat use, movements, and mortality. Birds will be tracked and relocated using a fixed-

wing airplane equipped with wheel-skis, which will decrease search time and increase the area that can be covered. The first aerial survey will be performed within 10 days of capture to document survival rates of the birds recently radio-tagged. At least six additional aerial surveys will be performed annually: two in late summer (August–September), two in mid-winter (November–February), and two in early spring (late March to mid-April).

Range of radio tags will be tested before deployment. However, temperature may affect transmission range (T. Paragi and B. Taylor, ADF&G, pers. comm.). Therefore, to ensure a systematic search pattern, aerial surveys will be flown using a preselected 5-mile grid and flown at an altitude of 1,500–2,000 feet within Subunits 13A and 13E.

An ATS 4520 receiver will be used to locate radio-tagged birds. Two 4-element Yagi antennas will be mounted to each strut of the aircraft. A GPS receiver mounted at the windshield of the aircraft and connected to the ATS 4520 receiver will provide a location for each data record. Upon completion of each aerial survey, receivers will be downloaded to a field laptop or Local Area Network (LAN) at the ADF&G office in Palmer for future analysis and specific location determination of each tagged bird.

10.17.4.3. Aerial Transect Surveys

During September and March each year, aerial transect surveys will be flown to assess the abundance and density of ptarmigan using line-transect or repeat-count techniques (Royle and Dorazio 2008; Thomas et al. 2010). In addition to abundance, these surveys will provide data on the overall distribution of all ptarmigan (not just radio-tagged individuals) in Subunits 13A and 13E.

10.17.4.4. Analysis of Radio Telemetry Data

After the radio receivers have been downloaded, data will be transferred to a Microsoft Access database for analysis. Maps will be created using Geographic Information System (GIS) software (ArcMAP) for each aerial survey day, indicating the location of each relocated Willow Ptarmigan. These data will be catalogued and used for spatial analyses.

Movement and survival rates of tagged birds will be estimated using multistate models (Brownie et al. 1993). Occupancy models of aerial survey data will be used to estimate the probability that an area is used and to identify changes in the probability of use between fall and spring surveys (Nichols et al. 2008).

The combination of telemetry transmitters and large-scale aerial surveys will provide both specific information on individual movements and habitat use and general information on species distribution. These survey techniques are being developed and implemented for another study of ptarmigan north of the Brooks Range (K. Christie, pers. comm.).

10.17.5. Consistency with Generally Accepted Scientific Practice

Habitat availability and use analyses allow an ecosystem approach to impact assessment, and GIS-based analysis has become a standard and straightforward method of evaluating the impacts of habitat loss and alteration. Ptarmigan captures will be conducted by adapting fairly standard capture methods to the situation. With continuous improvements in technology, particularly in battery and transmitter weights, radio telemetry is an important and increasingly standard method

of obtaining movement data even for small birds and mammals. All potential capture and marking methods will be fully evaluated and compliant with Alaska Interagency Animal Care and Use Committee (IACUC) certification. ADF&G will ensure compliance with all IACUC policies. There is little evidence to suggest that radio tags have a negative effect on the survival or breeding success of ptarmigan and other galliformes (Thirgood et al. 1995; Palmer and Wellendorf 2007; Terhune et al. 2007). Radio-tagged Willow Ptarmigan will be closely monitored within 24 hours of capture for signs of capture myopathy or other obvious handling-induced stresses.

10.17.6. Schedule

As is summarized in Table 10.17-1, aerial transect surveys will begin in March 2013 and ptarmigan tagging and tracking will begin in April 2013 and will continue through the end of 2014. ADF&G may continue to track tagged ptarmigan through 2016, corresponding to the anticipated lifespan of the radio transmitters. Project milestones will follow the same monthly schedule each year, unless noted otherwise. Aerial transect surveys will be flown in March and September. Capture of ptarmigan and deployment of radio tags will be conducted in April, May, and August, and radio-tracking will be conducted from August 2013 through May 2014 and from August through December 2014. Updates on the study progress will be provided during Technical Workgroup meetings which will be held quarterly in 2013 and 2014. The Initial Study Report will be completed by February 2014, and the Updated Study Report will be completed by February 2015.

10.17.7. Relationship with Other Studies

As is depicted in Figure 10.17-3, the ptarmigan study will not require information inputs from other Project studies. The efforts conducted for this study will consist primarily of capture, tagging, and tracking of radio-tagged birds and aerial transect surveys of distribution and abundance. Radio-tracking data will be used to create a geodatabase of locations (with sex and season attributes), which will be used to evaluate regional occupancy and to conduct multistate modeling of seasonal range use, movements, and survival. Information on movements will be used to delineate the seasonal ranges of ptarmigan using the study area. Data from aerial transect surveys will provide additional details on the distribution and abundance of ptarmigan in the study area in late winter and fall. Location data from both radio-tracking and transect surveys will identify high-value habitats for ptarmigan in the study area, which will be used to inform the Evaluation of Wildlife Habitat Use (Section 10.19). The aggregate data obtained on abundance, density, seasonal distribution, and movements will be used to assess the potential impacts of the Project and to develop PM&E measures, as appropriate.

The Ptarmigan Study is designed to provide relevant information for assessing potential direct, indirect, and cumulative effects of the Project, which may include the following:

- Permanent habitat loss caused by Project facilities, including the reservoir, powerhouse, and other permanent Project facilities.
- Temporary loss or alteration of habitats affected by clearing, dust fallout, gravel spray, persistent snow drifts, impoundments, thermokarst, contaminant spills, and other indirect effects of Project construction and operation.

- Behavioral disturbance of ptarmigan by Project construction and operation activities, including vehicle and heavy equipment traffic, geophysical investigations, and other human activities in the Project area.
- Indirect habitat loss through displacement of birds that avoid Project facilities or transportation routes.
- Increased predation on birds or their eggs that may result from attraction of predators to anthropogenic foods or artificial structures (such as perches on power poles or power lines, for example).
- Injury and mortality of birds from collisions with aircraft, vehicles, or structures (such as power lines, for example).
- Injury and mortality of birds due to contact with or ingestion of contaminants (including fuels), including potential indirect effects on forage plants.
- Increased harvest of ptarmigan resulting from improvements in access to humans.

During the impact assessment that will be conducted for the FERC License Application in 2015, data on the distribution, abundance, movements, productivity, and habitat use of Willow Ptarmigan in the study area will be used to assess Project impacts through geospatial analysis and evaluation of the responses of the species to other similar projects, as documented in the scientific literature. Using GIS software, species abundance data recorded among different habitat types will be combined with the spatially explicit wildlife habitat map of the Project area that will be developed under the botanical resources study plans to assess direct and indirect impacts of habitat loss and alteration and behavioral disturbance. The direct and indirect impacts of the Project will be evaluated by overlaying the Project features (including the reservoir impoundment, related infrastructure areas, and access road and power transmission corridors), and the seasonal ranges of ptarmigan on the Project habitat map. Seasonal ranges will be delineated with radio telemetry, using the recorded movements of a sample of birds to which radios have been attached. By plotting ptarmigan locations on the habitat map, high-value or high-density habitats can be identified. Indirect impacts will be estimated by applying various buffer distances on Project features, as determined from the available information on the anticipated effects of construction disturbance and habitat-related changes due to infrastructure and development, and identifying areas of high-value habitats that are affected. The GIS analysis will be combined with results from the telemetry study and transect surveys, as well as from the scientific literature, to estimate the geographic extent, frequency, duration, and magnitude of Project effects on ptarmigan. Any necessary protection, mitigation, and enhancement (PM&E) measures will be developed, as appropriate, by examining the distribution and abundance of Willow Ptarmigan among habitats in relation to the geographic extent and seasonal timing of Project activities.

10.17.8. Level of Effort and Cost

This study is a multi-year effort that will be conducted by ADF&G. The estimated cost of the study over both years is \$415,000.

10.17.9. Literature Cited

Bergerud, A. T., S. S. Peters, and R. McGrath. 1963. Determining sex and age of Willow Ptarmigan in Newfoundland. *Journal of Wildlife Management* 27: 700–711.

- Braun, C. E., and G. E. Rogers. 1971. The White-tailed Ptarmigan in Colorado. Colorado Division of Game, Fish, and Parks, Technical Publication No. 27.
- Brownie, C., J. E. Hines, J. D. Nichols, K. H. Pollock, and J. B. Hestbeck. 1993. Capture-recapture studies for multiple strata including non-Markovian transitions. *Biometrics* 49: 1173–1187.
- Hudson, P. J. 1986. *Red Grouse: The biology and management of a wild gamebird*. The Game Conservancy Trust, Fordingbridge, UK. 250pp.
- Irving, L., G. C. West, L. J. Peyton, and S. Paneak. 1967. Migration of Willow Ptarmigan in Arctic Alaska. *Arctic* 20: 77–85.
- Kaler, R. S. A., S. E. Ebbert, C. E. Braun, and B. K. Sandercock. 2010. Demography of a reintroduced population of Evermann's Rock Ptarmigan in the Aleutian Islands. *Wilson Journal of Ornithology* 122: 1–14.
- Nichols, J. D., L. L. Bailey, A. F. O'Connell, N. W. Talancy, E. H. C. Grant, A. T. Gilbert, E. M. Annand, T. P. Husband, and J. E. Hines. 2008. Multi-scale occupancy estimation and modeling using multiple detection methods. *Journal of Applied Ecology* 45: 1321–1329.
- Palmer, W. E., and S. D. Wellendorf. 2007. Effect of radiotransmitters on Northern Bobwhite annual survival. *Journal of Wildlife Management* 71: 1281–1287.
- Paragi, T. F., J. D. Mason, and S. M. Brainerd. 2012. Summer habitat selection by Sharp-tailed Grouse in eastern interior Alaska. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration, Final Research Report, Grants W-33-8 and W-33-9, Project 10.01, Juneau.
- Peyton L. J. 1999. *Bird songs of Alaska*. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, NY.
- Raymond, R. L. 1999. Sharp-tailed Grouse habitat study in eastern Interior Alaska. Alaska Department of Fish and Game, Juneau.
- Royle, J. A., and R. M. Dorazio. 2008. *Hierarchical Modeling and Inference in Ecology: The Analysis of Data from Populations, Metapopulations, and Communities*. Academic Press, San Diego, CA. 444 pp.
- Savage, S. E., K. J. Payne, and R. T. Finer. 2011. Willow Ptarmigan pilot study, Alaska Peninsula, May 2011. Unpublished report, U.S. Fish and Wildlife Service. 40 pp.
- Silvy, N. J., and R. J. Robel. 1968. Mist nets and cannon nets compared for capturing prairie chickens on booming grounds. *Journal of Wildlife Management* 32: 175–178.
- Skinner, W. R., D. P. Snow, and N. F. Payne. 1998. A capture technique for juvenile Willow Ptarmigan. *Wildlife Society Bulletin* 26: 111–112.
- Taylor, W. P. 1994. Game Management Unit 13 ptarmigan hunter and harvest report, 1992–94. Unpublished report, Alaska Department of Fish and Game.
- Taylor, W. P. 1999. *Game Management Unit 13 ptarmigan population studies*. Alaska Department of Fish and Game. Juneau, AK.
- Taylor, W. P. 2000. *Game Management Unit 13 ptarmigan population studies*. Federal Aid in Wildlife Restoration, final research performance report, 1 August 1997–30 June 1999.

- Grants W-27-1 and W-27-2, Study 10.70. Alaska Department of Fish and Game, Juneau. 12 pp.
- Terhune, T. M., D. C. Sisson, J. B. Grand, and H. L. Stribling. 2007. Factors influencing survival of radiotagged and banded Northern Bobwhites in Georgia. *Journal of Wildlife Management* 71: 1288–1297.
- Thirgood, S. J., S. M. Redpath, P. J. Hudson, M. M. Hurley, and N. J. Aebischer. 1995. Effects of necklace radio transmitters on survival and breeding success of Red Grouse *Lagopus lagopus scoticus*. *Wildlife Biology* 1: 121–126.
- Thomas, L., S. T. Buckland, E. A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. R. B. Bishop, T. A. Marques, and K. P. Burnham. 2010. Distance software: design and analysis of distance-sampling surveys for estimating population size. *Journal of Applied Ecology* 47: 5–14.
- Weeden, R. B., and A. Watson. 1967. Determining the age of Rock Ptarmigan in Alaska and Scotland. *Journal of Wildlife Management* 31: 825–826.

10.17.10.Tables

Table 10.17-1. Schedule for implementation of the Willow Ptarmigan Study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
First field season: capture and tag birds		—	—						
Aerial radio-tracking surveys			—	—	—	—	—	—	
Aerial transect surveys	—		—		—		—		
Initial Study Report				—	△				
Second field season: capture and tag birds						—	—		
Telemetry analyses (occupancy modeling, multistate models)					—	—	—		
Updated Study Report								—	▲

Legend:

- Planned Activity
- △ Initial Study Report
- ▲ Updated Study Report

10.17.11.Figures

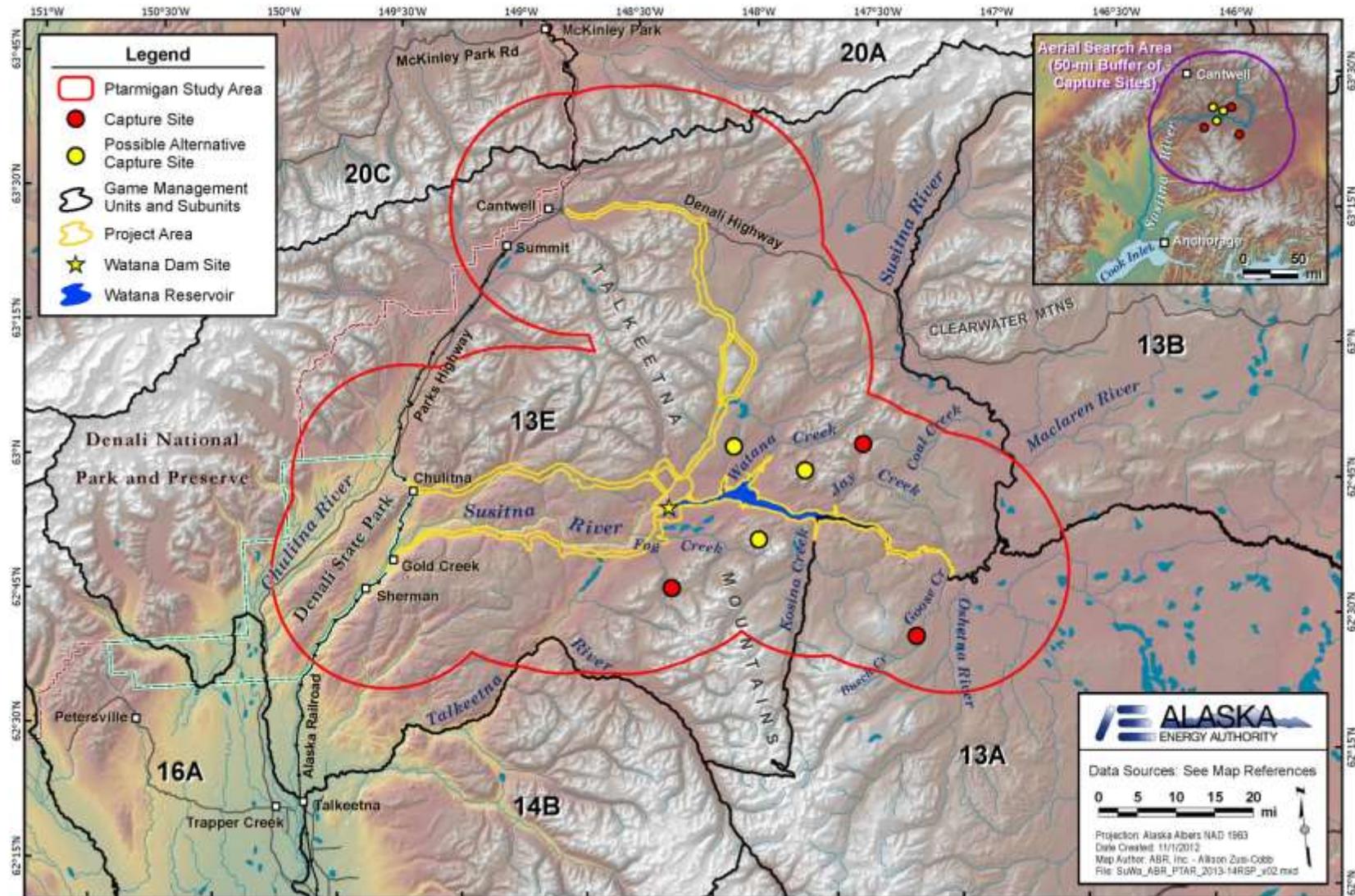


Figure 10.17-1. Willow Ptarmigan study area.



Figure 10.17-2. A Sharp-tailed Grouse equipped with an ATS 3950 radio tag identical to the model that will be used for Willow Ptarmigan.
[Photo by Scott Brainerd, ADF&G, 2012.]

STUDY INTERDEPENDENCIES FOR WILLOW PTARMIGAN STUDY

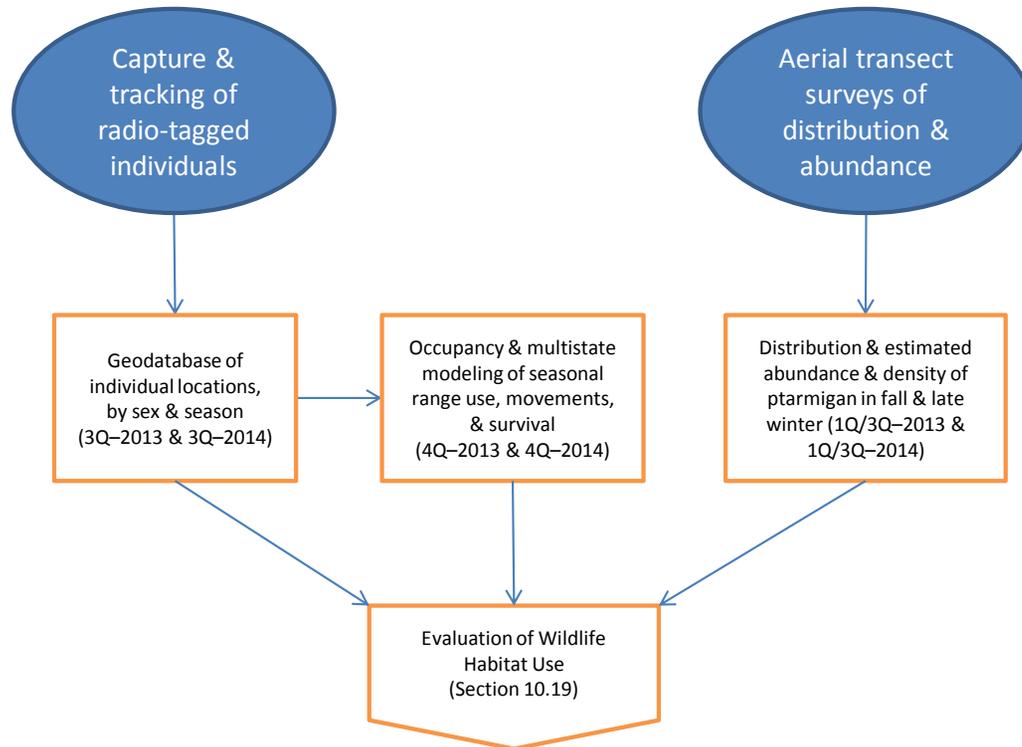


Figure 10.17-3. Study interdependencies for the Willow Ptarmigan study.