10.15. Waterbird Migration, Breeding, and Habitat Use

10.15.1. General Description of the Proposed Study

The waterbird study will be conducted over two years (2013 and 2014) and will include aerial surveys of waterbodies during spring and fall migration, a study of diurnal and nocturnal migration using visual and radar sampling, as well as breeding-pair surveys, stream surveys for Harlequin Ducks, and brood-rearing surveys. Waterbirds may use lakes, ponds, rivers, and flooded wetland areas throughout the Project area to varying degrees during migration. Aerial surveys for staging and migration will follow a lake-to-lake pattern and also will parallel river courses. The migration study will employ intensive monitoring of migrating birds during both daytime and night-time hours at a site located near the proposed dam and associated camp infrastructure. Surveys for breeding waterbirds (primarily waterfowl) will use a combination of full-coverage lake-to-lake surveys in most of the study area and breeding-pair transect surveys in the easternmost portion of the study area, following the current USFWS Standard Operating Procedures for Aerial Waterfowl Breeding Ground Population and Habitat Surveys (USFWS and CWS 1987). Aerial surveys for Harlequin Ducks will focus on river and stream habitats during the prenesting and brood-rearing seasons. Brood-rearing surveys will be conducted by surveying open water and shoreline habitats of lakes and ponds in the study area.

10.15.1.1. Study Goals and Objectives

The goal of the waterbird study is to collect baseline data on waterbirds migrating through and breeding in the Project area to enable assessment of the potential impacts of the Project and to inform the development of appropriate protection, mitigation, and enhancement measures. As used here, "waterbirds" is applied broadly to include swans, geese, ducks, loons, grebes, cranes, cormorants, herons, gulls, and terns. Shorebirds frequently are included in the general category of waterbirds, but they are addressed separately for this Project under the landbird and shorebird study plan (Section 10.16) because the ground-based survey methods for shorebirds are similar to those used for landbirds. This study plan includes breeding surveys for the Harlequin Duck, a species of conservation concern that requires specific stream-survey techniques.

This study has three objectives:

- Document the occurrence, distribution, abundance, habitat use, and seasonal timing of waterbirds migrating through the Project area in spring and fall;
- Document the occurrence, distribution, abundance, productivity, and habitat use of waterbirds breeding in the Project area; and
- Review available information to characterize food habits and diets of piscivorous waterbirds documented in the study area as background for the *Mercury Assessment and Potential for Bioaccumulation Study* (Section 5.7).

The information gained from this study will be used to evaluate waterbird habitat loss and alteration quantitatively, in conjunction with the separate wildlife habitat mapping and habitat evaluation studies (see Sections 11.5 and 10.19, respectively), and to estimate the number of migrating and breeding waterbirds that may be affected by the Project.

10.15.2. Existing Information and Need for Additional Information

Existing information on the distribution and abundance of waterbirds in the Project area during the breeding and migration seasons is mostly based on studies conducted in 1980 and 1981 for the APA Susitna Hydroelectric Project (Kessel et al. 1982). Data from those studies were used to quantify the level of use of waterbodies by migrating and breeding waterbirds. A relative "importance value" was determined for each waterbody surveyed in each migration season, incorporating the number of species, the number of birds, and the density of birds found on the waterbody in relation to the overall numbers and densities recorded on the surveys (Kessel et al. 1982). Those study results provide a good knowledge base concerning waterbird use of the Project area three decades ago but, because the population numbers of numerous species have changed in the past 30 years, new waterbird surveys are needed to elucidate the current distribution and abundance of breeding and migrating waterbirds in the Project area.

More recent survey data on breeding waterbirds in the upper Susitna River basin has been collected annually during USFWS waterfowl breeding population surveys (Mallek and Groves 2011a), but only a few transects of the Stratum 2–Nelchina survey area (Mallek and Groves 2011b) are located in the Project area. Those transects occur east of the proposed reservoir near the Oshetna River, an area of low topographic relief where the density of lakes, ponds, and wetlands is relatively high.

The population of Trumpeter Swans is an example of a waterbird species whose population has changed substantially in the last 30 years (Conant et al. 2007). A complete census of Trumpeter Swans on their breeding grounds in Alaska began in 1968 and was repeated at 5-year intervals between 1975 and 2005 (Conant et al. 2007). Together, two survey areas (Unit 3–Gulkana and Unit 5–Cook Inlet) include the entire Susitna River basin (Conant et al. 2007). The population of Trumpeter Swans summering in Alaska has increased since 1975 and breeding has expanded into peripheral habitat. No census was conducted in 2010, so information on the distribution and abundance of Trumpeter Swans in the Project area is out of date and new surveys are needed.

Waterbird productivity was evaluated in 1981 using ground surveys of waterbodies within proposed impoundment areas and access routes associated with the APA Susitna Hydroelectric Project. Those surveys provide historical data for the area 30 years ago, but need to be updated. Current surveys addressing waterbird productivity need to be conducted in areas of proposed facility locations, road and transmission corridors, and any areas affected by the Project within and near the inundation zone.

No current information exists on the distribution and abundance of Harlequin Ducks in the middle and upper Susitna River basin. The Harlequin Duck is a species of conservation concern that nests and raises broods almost exclusively in mountain stream drainages. New surveys need to be conducted to assess the distribution and abundance of Harlequin Ducks breeding in the Project area.

10.15.3. Study Area

The study area for waterbirds will encompass lakes, ponds, rivers, streams, and flooded wetlands within a 3-mile buffer area around the Project area (Figure 10.15-1). The minimum waterbody size to be surveyed will be and will be included in the RSP. The 3-mile buffer includes nearly all of the 65 waterbodies surveyed for the original APA Susitna Hydroelectric Project in the 1980s

(Kessel et al. 1982), most of which occur in relatively discrete groupings (e.g., see PAD Figure 4.6-16; AEA 2011). The study-area boundary will be extended farther than 3 miles wherever necessary to include all of the waterbodies surveyed by Kessel et al. (1982), such as Clarence Lake and nearby waterbodies south of the Susitna River between Kosina Creek and the Oshetna River, as well as additional waterbodies upstream from the upper end of the reservoir inundation zone.

All rivers and streams flowing through the study area will be surveyed for breeding Harlequin Ducks; these stream surveys will extend outside of the study-area buffer where necessary to cover suitable habitats farther upstream.

A rectangular area has been delineated east of the upper end of the reservoir inundation zone (Figure 10.5-1) in an area of low topographic relief with a high density of waterbodies. That block will be sampled during breeding-pair surveys using a transect sampling approach, rather than attempting to cover all of the waterbodies completely in a lake-to-lake pattern.

10.15.4. Study Methods

10.15.4.1. Spring and Fall Migration

10.15.4.1.1. Aerial Surveys

Waterbirds use a broad range of lakes, ponds, rivers, and flooded wetlands throughout the Project area during migration. The most effective means of assessing the distribution and abundance of waterbirds over such a large area is aerial survey. Because of the distribution of waterbodies in relatively discrete, irregularly spaced groupings in most of the study area, a lake-to-lake survey pattern is the most efficient survey approach, in which each lake is circled to count waterbirds on the shore and in the water. Waterbirds often use rivers for staging during early spring when lakes are covered by ice, so surveys are flown parallel to the river course.

Aerial surveys of waterbirds in Alaska are conducted with either a fixed-wing aircraft or a helicopter, with the choice of platform depending, in part, on the topography of the survey area. Because of the canyons and mountainous terrain in the Project area, a small piston helicopter (such as a Robinson R-44) is the preferred waterbird survey platform to ensure good visibility and safety in maneuvering.

To characterize the period of migration adequately and avoid missing migration peaks for various species of waterbirds, surveys will be conducted at 5-day intervals during the spring (late April to early June) and fall (late August to mid-October) migration periods, resulting in 10–11 surveys in spring and 12–13 surveys in fall, weather permitting. Each survey is expected to take approximately two days to complete.

A single observer will record all data on a hand-held digital recorder, which will be transcribed later into a computer database for analysis. Data will be summarized by species, species-group, lake-group or river segment, date of survey, and survey area, and the survey results will be used to evaluate species composition and the timing of migration, and to identify waterbodies important to migrating waterbirds.

10.15.4.1.2. Migration Study

To acquire current information on the volume and flight directions of birds migrating through the study area, a study of bird migration will be conducted using a combination of diurnal visual surveys and nocturnal radar monitoring and audiovisual surveys. The sampling site for the migration study will be established on the benchland just northeast of the proposed dam site, in the vicinity of the proposed Project camp. Although this study component is described here in the waterbirds study plan, it is important to note that the sampling design also will provide data for the landbird/shorebird study (Section 10.16).

Diurnal visual observations will be conducted during daylight hours (sunrise to sundown) from late April to early June and from late August to mid-October. Using binoculars and spotting scopes, observers will record data along four visual transect lines (oriented in the cardinal directions) during 25-min sampling sessions, separated by 5-min break periods during which weather data will be recorded. Data recorded for each bird observation will include date; time; species (or taxon); flock size; transect crossed; distance crossed (distance from observer); ordinal flight direction; flight behavior; minimal flight-altitude category; and an estimate of actual minimal flight altitude. When possible, specific movements of notable bird observations within a radius of ~5 km (~3 mi) from the observers will be drawn on a map of the sampling area.

For the nocturnal sampling, a portable marine radar that functions in both surveillance and vertical modes will be set up at the sampling site. This radar can be operated at a variety of ranges and pulse lengths, allowing sampling of larger-bodied birds at longer ranges and smaller-bodied birds at shorter ranges. At shorter pulse lengths, echo resolution is improved (giving more accurate information on target identification, location, and distance), whereas echo detection is improved at longer pulse lengths (increasing the probability of detecting a target). Hourly sampling schedules will be subdivided to use a combination of short pulse lengths for smaller-bodied targets such as landbirds and shorebirds with longer pulse lengths for larger-bodied birds.

Radar data will be collected in several 1-hour sampling sessions throughout the night (from shortly after sunset to just before sunrise) and diurnal radar sampling sessions will be conducted during the day (shifting 3-hour blocks from morning to evening). Each 1-hour radar session will be subdivided into different sampling periods to include collection of weather data and adjust the radar to surveillance mode; monitoring in surveillance mode to collect data on passage rates (number of targets/session); monitoring in surveillance mode to collect data on flight speed and direction data; a break to record weather data and adjust the radar to vertical mode; and monitoring to collect data on flight altitude and flight speed. Targets will be plotted on the radar screen multiple times as they travel along the radar beam, allowing calculation of flight speed.

Nocturnal audiovisual surveys will be conducted during the first 2 hours of nocturnal radar sampling in both spring and fall, and will include two sessions of visual sampling separated by short periods during which weather data will be recorded. The observer will use binoculars during crepuscular periods and night-vision goggles during dark hours, aided by spotlights outfitted with infrared filters to illuminate targets flying overhead. For each bird or flock of birds detected visually, the following data will be collected: species or taxon, ordinal flight direction, flight altitude, and flight behavior.

Weather data recorded before each radar or visual sampling session will include wind direction, average wind speed, cloud cover, ceiling height, light conditions, precipitation, air temperature, and barometric pressure.

Data collected in this study on flight volume, altitudes, and directions among all species and taxa will be compared with data collected in similar studies at Tok in the upper Tanana River valley and Gakona in the Copper River valley (Cooper et al. 1991a, 1991b; Cooper and Ritchie 1995), the Tanana Flats and Alaska Range foothills near Healy (Day et al. 2007; Shook et al. 2006, 2010), and Fire Island (Day et al. 2005), at minimum.

10.15.4.2. Breeding Season

10.15.4.2.1. Breeding-pair Surveys

Two different survey approaches will be used for breeding-pair surveys, depending on the location of the waterbodies being surveyed. In most of the study area, the same lake-to-lake complete-count approach will be used as during the migration surveys, with no break in timing between the spring migration and breeding survey periods. In the designated transect survey block in the easternmost portion of the study area, however, a sampling approach will be used to survey 400-meter-wide strips along transects spaced at 1-mile intervals, providing sample coverage of approximately 25 percent of the survey block.

Surveys for breeding waterbirds, primarily waterfowl, will follow the USFWS Standard Operating Procedures for Aerial Waterfowl Breeding Ground Population and Habitat Surveys (USFWS and CWS 1987). The transect lines are aligned to cover the largest possible number of waterbodies and wetlands. The placement of the transect lines, which will be oriented along the long axis of the survey block, will be determined systematically before the survey using aerial imagery or topographic maps and a GIS.

Breeding-pair surveys typically are conducted in a fixed-wing aircraft; however, it is likely that small piston helicopter will be used for all aerial surveys of waterbirds in this study. Flight altitude will be low (125–200 feet above ground level, with the lower altitude being used for the transect surveys) to permit observation of birds without having to rely on binoculars, although binoculars will be used where necessary to confirm species identity. In the lake-to-lake surveys, a single observer will record data over the entire area of the waterbodies surveyed. In the transect surveys, two observers will search for waterbirds in a 200-meter (656 feet) swath on each side of the aircraft (total strip width of 400 meters, or 1,312 feet) while the pilot navigates the transect lines using a GPS receiver. Observations will be recorded on hand-held digital recorders and with GPS waypoints for later transcription and transfer to a computer database for analysis. Survey data will be used to calculate the estimated densities of each species of waterfowl and identify areas important to breeding waterfowl.

The timing of the breeding-pair surveys will be determined by evaluating the chronology of break-up and spring melt conditions each year, which will be monitored throughout the spring migration surveys. Breeding-pair surveys typically are flown in early June when pairs are present on territories but females are not yet spending time on nests. Survey timing can affect results because the nesting phenology of dabbling ducks is slightly earlier than diving ducks, and some dabbling duck species can be missed if the survey occurs too late, after the cryptically colored females are on nests and more brightly colored males have left the area. Two surveys, spaced about 10 days apart, will be conducted to target the expected peaks of breeding for dabbling and diving ducks. Each survey is expected to take approximately two days to complete.

10.15.4.2.2. Harlequin Duck

In inland areas of Alaska, Harlequin Ducks predominantly use mountain streams for foraging and nest in adjacent shoreline habitats. Male Harlequin Ducks are only present on breeding streams during a short period in spring while courting females. Accordingly, prenesting surveys to quantify the number of nesting pairs occupying a stream must be conducted in that short timing window. After hatching, successful females are visible on streams with their broods, and failed breeders often group together.

Surveys for prenesting and brood-rearing Harlequin Ducks will be flown in a helicopter with two observers seated on the same side. Surveys will be generally flown in an upriver direction with the helicopter positioned over the bank to provide an unobstructed view of the entire width of the watercourse. Observations will be recorded on hand-held digital recorders and with GPS waypoints for later transcription and transfer to a computer database for analysis. Survey data will be used to calculate linear densities (ducks per kilometer) and to identify streams used by breeding Harlequin Ducks.

To account for annual variability in the occurrence of peak numbers of breeding pairs and brood-rearing females on a stream, two years of prenesting and brood-rearing surveys will be conducted. Two prenesting surveys, spaced 7–10 days apart, will be flown in late May–early June each year and two brood-rearing surveys, spaced 7–10 days apart, will be conducted in late July–early August each year. Each survey is expected to take approximately two days to complete. Surveys will follow the entire length of tributary streams where suitable nesting habitat is present, even if it means flying outside of the 3-mile study area buffer.

10.15.4.2.3. Brood Surveys

Information on waterbirds breeding in specific areas that may be affected by Project infrastructure or activities will be collected by biologists conducting helicopter surveys of suitable lakes, ponds, streams, and flooded wetland complexes. As with the other waterbird surveys, the platform of choice will be a small piston helicopter. These surveys will be conducted at least twice during the brood-rearing period, with the first survey occurring in mid-July and the second approximately a week later, to record the presence of adults accompanied by broods of juveniles. A third survey may be flown, depending on the developmental stages of juveniles observed on the second brood survey. The brood surveys will focus on the waterbody groups within 1 mile around the locations and alignments of proposed Project infrastructure, excluding portions of the study area located farther than 1 mile away, as well as the waterbodies in the transect-survey block east of the reservoir inundation zone.

Two observers will circumnavigate waterbodies to search for waterbirds, particularly those with broods. All waterbirds seen will be recorded on field data sheets and brood ages for waterfowl (primarily ducks) will be estimated by classifying them into one of seven age classes based on chick plumage patterns. Survey data will be used to calculate densities of broods and to estimate nest-initiation dates by back-dating (subtracting the estimated age of young and the average incubation period).

10.15.4.3. Food Habits and Diets of Piscivorous Waterbirds

The scientific literature will be reviewed to compile and synthesize information on the food habits and diets of piscivorous waterbirds (e.g., loons, grebes, mergansers, terns) in freshwater aquatic systems to support the pathways analysis being conducted as part of the *Mercury Assessment and Potential for Bioaccumulation* (Section 5.7), which was recommended by the USFWS in response to the request for comments on the Pre-Application Document for the Project (letter from USFWS to AEA dated 31 May 2012).

10.15.4.4. Impact Assessment

The primary impact mechanisms of the Project on waterbirds may include the following:

- Permanent direct and indirect habitat loss and alteration;
- Temporary direct and indirect habitat loss and alteration;
- Direct behavioral impacts, such as attraction or avoidance, resulting from vehicular use, noise, and increased human presence associated with Project construction or operation;
- Indirect behavioral impacts to wildlife, such as attraction or avoidance, resulting from changes in vehicular use, noise, and increased human presence associated with increased subsistence or recreational access that may be facilitated by Project development;
- Mortality due to increased subsistence and recreational harvest that may be facilitated by improvements in human access that result from Project development;
- Changes in mortality due to predation that may result from changes in the abundance and distribution of waterfowl predators, including both mammalian and avian carnivores; and
- Direct mortality due to strikes with vehicles, powerlines, towers, or other Project facilities; exposure to contaminants; and attraction to garbage and human activity.

Impacts associated with habitat loss and alteration, attraction and avoidance, and direct mortality will occur primarily in the Project area, including the impoundment area, access and transmission corridors, and other facility footprints. Impacts associated with increased harvest and changes in predator abundance may occur over a larger area in which changes in both competing mammalian predators and prey species abundance may occur.

Data on the distribution, abundance, productivity, and habitat use of waterbirds in the study area will be used to assess Project impacts on these populations. Impacts of direct and indirect habitat loss and alteration can be assessed through geospatial analysis. When plotted on the wildlife habitat map, developed under the botanical resources study plans, the locations of breeding, brood-rearing, and staging waterbirds will allow identification of high value or critical seasonal habitats for each species. Using GIS software, the direct and indirect impacts of the Project can be evaluated for each waterbird species by overlaying the reservoir impoundment, related infrastructure areas, and access road and power transmission corridors onto the habitat map to calculate loss of preferred or critical habitats. Additional indirect impacts of habitat loss and alteration and behavioral reactions (such as avoidance) can be estimated by applying various buffer distances, as determined from the literature on the effects of similar projects. In this way, the GIS analysis will be combined with information from the literature to estimate the geographic extent, frequency, duration, and magnitude of Project effects on waterbird populations. Density estimates for breeding and brood-rearing waterbirds in each habitat and linear densities of Harlequin Ducks can be used to estimate numbers of birds potentially affected

by habitat loss and alteration and by behavioral reactions that may result in avoidance. Location data for each species can be used to assess risks from powerline and other bird strikes for various alternative Project configurations. Any necessary PM&E measures will be developed by examining the distribution and abundance of species among habitats in relation to the geographical extent and seasonal timing of various Project activities.

10.15.4.5. Reporting and Deliverables

Study products will include:

- **Electronic copies of field data.** A geospatially-referenced relational database will be developed that incorporates all historic and current data, including nesting and brood-rearing locations for each species. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards to be established for the Project.
- **Study Reports.** The Initial Study Report will be completed in December 2013 and the Updated Study Report will be completed in December 2014. The Updated Study Report will summarize the results for both years.

10.15.5. Consistency with Generally Accepted Scientific Practice

The waterbird study will be conducted using standard waterfowl aerial survey techniques, including those described in the current USFWS Standard Operating Procedures for Aerial Waterfowl Breeding Ground Population and Habitat Surveys (USFWS and CWS 1987). These same techniques have been used successfully to survey for migrant and breeding waterbirds on other large-scale projects (e.g., PLP 2011).

The diurnal visual and nocturnal radar techniques proposed in this plan have become standard methods for studying bird migration (e.g., Gauthreaux 1980; Cooper et el. 1991a, 1991b; Gauthreaux and Belser 2003), including in Alaska (Cooper et al. 1991a, 1991b; Cooper and Ritchie 1995; Day et al. 2005, 2007; Shook et al. 2006, 2010).

10.15.6. Schedule

The migration study using visual and radar sampling is proposed for the spring (late April–early June) and fall (late August–mid-October) migration periods in 2013, with the decision to conduct a second year of sampling being dependent on the results obtained in 2013.

For the other study components described above, the same seasonal schedule will be followed in both 2013 and 2014. The timing of some surveys, particularly in spring and summer, will depend on ice break-up and the nesting phenology for the year.

Late April–mid-June:	Approximately 10–11 spring migration/breeding-pair surveys at intervals of 5 days (depending on time of river breakup and lake moat formation), plus two breeding-pair transect surveys in the first half of June. Two prenesting surveys for Harlequin Ducks in late May/early June.
July:	Brood surveys (two or three, beginning in mid-month); Harlequin Duck brood-rearing survey (4th week).

August:	Harlequin Duck brood-rearing survey (1st week); begin fall migration surveys in second half of month.
Late August to mid-October:	Fall migration surveys at intervals of 5 days.
November:	After each aerial survey, data will be transcribed, reviewed, and entered into a database for final QA/QC review. Data analysis will be conducted progressively throughout summer and fall to allow for rapid completion in November.
November–December:	Data analysis and report preparation.
February:	Initial Study Report (2014) and Updated Study Report (2015) issued by AEA.

10.15.7. Level of Effort and Cost

The bulk of the costs associated with this study are for the field sampling, data analysis, and reporting; helicopter support costs have not been included in this estimate. The aerial survey portion of the study will require an estimated minimum of 86 person-days, not including weather delays or changes in study design, as indicated below:

- Migration Surveys = 20 person-days in spring; 26 person-days in fall;
- Breeding-pair Surveys = 12 person-days (assuming 2 surveys per year);
- Harlequin Duck Prenesting Surveys = 8 person-days;
- Harlequin Duck Brood-rearing Surveys = 8 person-days;
- Waterbird Brood-rearing Surveys = 12 person-days.

The ground-based migration study employing diurnal visual and nocturnal radar and audiovisual sampling will require a crew of four biologists working day and night shifts and is estimated to cost approximately $600,000 in 2013. The projected cost of the aerial-survey portion of this study is approximately $300,000 annually. Hence, the total cost is estimated at $900,000 in 2013 and $300,000 in 2014, for a 2-year total of $1.2 million. The decision to continue the ground-based migration monitoring task in 2014 will be based on the results obtained in 2013.

10.15.8. Literature Cited

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10.15.9. Figures

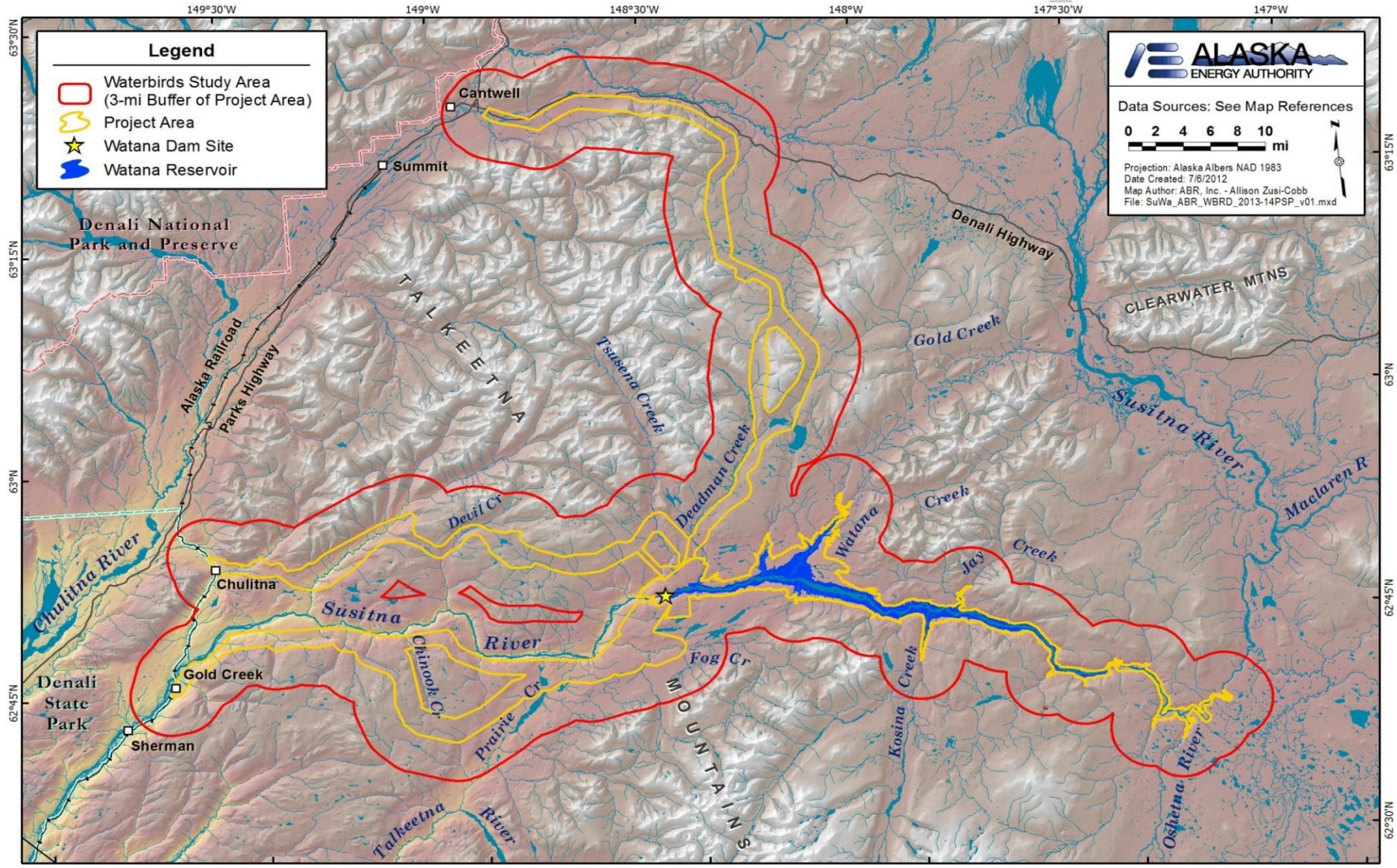

Figure 10.15-1. Waterbird study area. [TO BE REVISED WITH REFINED CORRIDOR ALIGNMENTS; WILL ADJUST 3-MILE BUFFER WHERE NECESSARY TO INCLUDE ADDITIONAL WATERBODIES SURVEYED BY KESSEL ET AL. 1982 (E.G., BETWEEN KOSINA CREEK AND OSHETNA RIVER) AND WILL DEPICT SURVEY BLOCK OFF EASTERN END OF RESERVOIR, WHERE BREEDING-PAIR TRANSECT SURVEYS WILL BE FLOWN; ALSO WILL TRUNCATE BUFFER AT ALASKA RAILROAD AND PARKS HIGHWAY]