Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Waterbird Migration, Breeding, and Habitat Use Study
Study Plan Section 10.15

Final Study Plan

Alaska Energy Authority

July 2013

10.15. Waterbird Migration, Breeding, and Habitat Use Study

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 10.15 of the RSP described the Waterbird Migration, Breeding, and Habitat Use Study. This section focuses on aerial surveys of water bodies during spring and fall migration, a study of diurnal and nocturnal migration using visual and radar sampling, breeding-pair surveys, stream surveys for Harlequin Ducks, and brood-rearing surveys. RSP 10.15 described the goals, objectives, and proposed methods for data collection on waterbirds.

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 10.15 was one of the 13 studies approved with modifications. In its February 1 SPD, FERC recommended the following:

FWS recommends that the study be modified to clarify that visual observations (both diurnal and nocturnal) to be conducted along each of the four transects would done by a separate observer during each sampling session. In other words, four observers would be used to collect data during each sampling session. FWS also recommends that the study be modified to clarify that the maximum number of possible 1-hour radar sampling sessions would be conducted each night because the start and stop time is not currently specified in the study plan.

AEA states in the study plan that the migration study (which also will provide data for the Landbird and Shorebird Migration, Breeding and Habitat Use Study [study 10.16]) would require a crew of four biologists working day and night shifts over a period of 120 days in 2013. While AEA's study plan suggests that it plans to conduct the study as recommended by FWS, the plan is not explicit. Using four biologists to concurrently document birds observed in each direction would ensure better correlation and interpretation of visual observations with radar data. Although the study plan does not explicitly state the start and stop times for radar sampling sessions, the plan is clear as to the sampling framework and that efforts are intended to maximize sampling sessions.

We recommend that AEA implement the study with FWS' proposed modification for clarifying the use of four observers during visual observations. No modification of the study plan is needed regarding maximizing the number of radar sessions because AEA's study plan already provides for maximizing the number of radar sessions.

In accordance with the February 1 SPD, AEA addressed the recommended modifications in this Final Study Plan for Section 10.15.

10.15.1. General Description of the Proposed Study

The Waterbird Migration, Breeding, and Habitat Use Study will be conducted over two years (2013 and 2014) and will include aerial surveys of water bodies during spring and fall migration, a study of diurnal and nocturnal migration using visual and radar sampling, 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 spring and fall migration. Aerial surveys for staging and migration will follow a lake-to-

lake pattern and will also parallel river courses. The migration study will employ intensive monitoring of migrating birds during both daytime and nighttime hours at a site located near the proposed dam and associated camp infrastructure. Surveys of 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. Aerial surveys for Harlequin Ducks will focus on river and stream habitats during the pre-nesting 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.

Study Goals and Objectives

The goal of the Waterbird Migration, Breeding, and Habitat Use 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 Migration, Breeding, and Habitat Use Study (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.
- 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 Vegetation and Wildlife Habitat Mapping Study and the Evaluation of Wildlife Habitat Use Study (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 Alaska Power Authority (APA) Susitna Hydroelectric Project (Kessel et al. 1982). Data from those studies were used to quantify the level of use of water bodies by migrating and breeding waterbirds. A relative "importance value" was determined for each water body surveyed in each migration season, incorporating the number of species, the number of birds, and the density of birds found on the water body 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; however, 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 U.S. Fish and Wildlife Service (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 water bodies 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 3-mile buffer includes nearly all of the 65 water bodies 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 Pre-Application Document [PAD] Figure 4.6-16; AEA 2011). The study area boundary has been extended farther than 3 miles in several places to include water bodies surveyed by Kessel et al. (1982), such as Stephan Lake, Clarence Lake, and other unnamed water bodies south of the Susitna River between Kosina Creek and the Oshetna River, but six large lakes surveyed (Kessel's numbers 131–136) between the mouths of the Tyone and Maclaren rivers will be omitted because they are located well upstream from the area that may be affected by the Project.

Rather than specifying a minimum water body size to be surveyed for the lake-to-lake surveys, the most efficient flight path through each water body group, and linking to other water body groups, will be determined by an experienced waterbird biologist before the surveys begin, to maximize the number of water bodies covered. That same route will be repeated on each

migration and breeding-pair survey using Global Positioning System (GPS) navigation; brood surveys will concentrate on the subset of those water bodies located within 1 mile around the locations and alignments of proposed Project infrastructure, including access road and transmission corridors. The survey route will be developed by reviewing U.S. Geological Survey (USGS) 1:63,360-scale topographic maps and high-resolution aerial or satellite imagery, as available, and a GPS route file will be created for navigational use during the survey. It is anticipated that all water bodies 2 hectares (5 acres) or more in size will be surveyed, as well as many smaller ponds located between those larger water bodies. This approach will provide more complete survey coverage than selecting a random sample from all water bodies in the study area. All water bodies sampled will be entered into a Geographic Information System (GIS) database to permit measurement of their area for use in calculating waterbird density.

All rivers and streams flowing through the study area buffer will be surveyed for breeding Harlequin Ducks. These stream surveys will extend outside the 3-mile study-area buffer where necessary to cover suitable habitats farther upstream. Habitat suitability will be evaluated during the first pre-nesting survey for use in planning the three subsequent surveys.

A rectangular area has been delineated east of the upper end of the reservoir inundation zone ("transect block" in Figure 10.5-1) in an area of low topographic relief with a high density of water bodies. The transect block will be sampled during breeding-pair surveys using a transect sampling approach, rather than attempting to cover all of the water bodies 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 water bodies 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 in the water and on the shore. Waterbirds often use rivers and streams for staging during early spring when lakes are covered by ice, so surveys will be flown parallel to river and stream courses.

Aerial surveys of waterbirds in Alaska typically are conducted using 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 (Robinson R-44) is the preferred waterbird survey platform to ensure good visibility, survey efficiency, and safety in maneuvering.

To adequately characterize the period of migration 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 (mid-August to mid-October) migration periods, resulting in 10–11 surveys in spring and 13–14 surveys in fall, weather permitting. Each survey is expected to take

approximately 2 days to complete. The spring migration surveys will transition directly into the breeding-pair surveys with no break in timing, as is described below (Section 10.15.4.2.1).

A single, experienced 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. The survey results will be used to evaluate species composition and the timing of migration and to identify water bodies important to migrating waterbirds. Flight lines will be recorded on each survey using a GPS receiver.

10.15.4.1.2. Migration Study

To acquire current information on the volume and flight directions of birds migrating through the study area, an intensive study of bird migration will be conducted using a combination of visual surveys and radar monitoring. 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 Waterbird Migration, Breeding, and Habitat Use Study plan, it is important to note that the sampling design will also provide data for the Landbird and Shorebird Migration, Breeding, and Habitat Use Study (Section 10.16).

Diurnal visual observations will be conducted during daylight hours (sunrise to sundown) from late April to early June and from mid-August to mid-October. Using binoculars and spotting scopes, four observers will record data simultaneously along visual transect lines (oriented in the cardinal directions—north, east, south, west) during 25-minute sampling sessions, separated by 5-minute 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), flight direction, flight behavior, minimal flight-altitude category, and an estimate of actual minimal flight altitude.

A portable marine radar that functions in both surveillance and vertical modes will be set up at the sampling site and will be powered by a portable generator. The radar (Furuno Model FR-1510 MKIII; Furuno Electric Company, Nishinomiya, Japan) is a standard X-band marine radar transmitting at 9.410 GHz through a 2-m-long slotted wave guide (antenna) with a peak power output of 12 kW. The antenna has a beam width of 1.23° (horizontal) × 25° (vertical) and a side lobe of ±10–20°. Range accuracy is 1% of the maximal range of the scale in use or 30 m (whichever is greater) and bearing accuracy is ±1°. This radar can be operated at a variety of ranges (0.5–133 km) and pulse lengths (0.07–1.0 μsec). A pulse length of 0.07 μsec will be used while operating at the 1.5-km range to sample the flight activity of small-bodied birds (e.g., songbirds). A longer pulse length (0.3 μsec) will be used while operating at the 6-km range to sample the flight activity of large-bodied birds (e.g., waterfowl, cranes, raptors). At shorter pulse lengths, echo resolution is improved (giving more accurate information on target identification, location, and distance); whereas, at longer pulse lengths, echo detection is improved (increasing the probability of detecting a target). An echo is a picture of a target on the radar monitor; a target is one or more birds (or bats) that are flying so closely together that the radar displays them as one echo on the display monitor. The radar has a digital color display with several useful features, including true north correction for the display screen (to determine flight directions), color-coded echoes (to differentiate the strength of return signals), and on-screen plotting of a sequence of echoes (to depict flight paths). Because targets are plotted with every sweep of the

antenna (i.e., every 2.5 sec) and because ground speed is directly proportional to the distance between consecutive echoes, ground speeds of plotted targets can be estimated to the nearest 5 km/h with a hand-held scale.

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 sampling session will consist of (1) one 10-min period to collect weather data and adjust the radar to surveillance mode; (2) one 10-min period with the radar in surveillance mode (1.5-km range) for collection of information on migration passage rates or small-bodied birds; (3) one 10-min period with the radar in surveillance mode (1.5-km range) for collection of information on ground speed, flight direction, tangential range (minimal perpendicular distance to the radar laboratory), transect crossed (north, south, east, and west), and the number of individuals (if known) of small-bodied birds; (4) one 10-min period with the radar in surveillance mode (6-km range) for collection of information on both passage rates of large-bodied birds and information on their groundspeed, flight direction, tangential range (minimal perpendicular distance to the radar laboratory), transect crossed (north, south, east, and west), and the number of individuals (if known); (5) one 5-min period to adjust the radar to vertical mode; and (5) one 15-min period with the radar in vertical mode (1.5-km range) to collect information on flight altitudes and flight behavior. All hours of radar data will be recorded using an automated image frame-grabber device (Model VGA2USB, Epiphan Systems Inc., Ottawa, Ontario, Canada) that will enable continuous collection of a record of high-quality lossless radar images, with a resolution identical to that of the radar monitor.

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 sampling period will be adjusted as daylength changes during the migration periods. The observers 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. Four observers will record data along visual transect lines (oriented in the cardinal directions—north, east, south, west) during each sampling session. For each bird or flock of birds detected visually, the following data will be collected: species or taxon, 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, 2011), and Fire Island (Day et al. 2005), at minimum.

10.15.4.2. Breeding Season

10.1.1.1.1. Breeding-pair Surveys

Two different survey approaches will be used for breeding-pair surveys, depending on the location of the water bodies being surveyed. In most of the study area, the same lake-to-lake

survey 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 generally follow standard USFWS protocols (USFWS 1987; USFWS and CWS 1987). The survey lines in the transect block will be aligned to cover the largest possible number of water bodies and wetlands. The placement of the transect lines, which will be oriented systematically along the long axis of the survey block, will be determined before the survey using aerial imagery or topographic maps and GIS.

Breeding-pair surveys are typically conducted in a fixed-wing aircraft; however, it is likely that a 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 water bodies surveyed. In the transect surveys, one observer will search for waterbirds in a 200-meter (656-foot) swath on each side of the aircraft (total of two observers searching a 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 voice recorders 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 late May or early June, depending on location and elevation, 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 earlier than that of 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 the 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. The two breeding-pair surveys will be timed to coincide with the peak presence of pairs and males of dabbling ducks and diving ducks, respectively, to account for the differences in migration timing and turnover of those two general categories of ducks. Each survey is expected to take approximately two days to complete. Weather and visibility conditions will be recorded during surveys to assess the quality of the information recorded, and surveys will not proceed unless conditions are suitable. Standard protocols (USFWS and CWS 1987, Smith 1995) will be followed to convert raw survey counts to indicated total population indices and species-specific correction factors will be applied to the indices to derive population estimates of each species detected in the transect strips for which correction factors are available.

10.1.1.1.2. Harlequin Duck Surveys

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, pre-nesting 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 pre-nesting and brood-rearing Harlequin Ducks will be flown in a helicopter with two observers seated on the same side. Surveys generally will be flown in an upriver direction with the helicopter positioned over the bank to provide an unobstructed view of the entire width of the watercourse. 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. The extent of suitable habitat will be defined during the first pre-nesting survey. 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 pre-nesting and brood-rearing surveys will be conducted. Two pre-nesting 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, with the exact timing to be determined using information on environmental conditions and breeding phenology each year.

10.1.1.1.3. 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 water body 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.

Two observers will circumnavigate water bodies in a small helicopter to search for waterbirds 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). Any nest locations of piscivorous waterbirds will be recorded for collection of feathers for analysis of baseline mercury levels for the Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7).

10.15.4.3. Information for Mercury Assessment

To provide tissue samples for laboratory analysis of mercury levels, feathers of piscivorous waterbirds (e.g., loons, grebes, mergansers, terns) will be collected, after the nesting season, from any nests of those species that are located during aerial surveys for this study or surveys for

other Project studies. It is anticipated that some nests of loons, grebes, and Arctic Terns will be found because of their selection of nest sites on islands or shorelines, but merganser nests are unlikely to be found because they nest in tree cavities that would be difficult to locate without radio telemetry. Therefore, to supplement the collection of feathers from nests, prey remains will be collected from nest sites of Peregrine Falcons located in or near the study area. Peregrine Falcons are predators of a variety of birds, including waterbirds, and examination of prey remains is a commonly used technique to investigate their food habits. A permit will be required from the USFWS to collect any migratory bird parts.

In addition to collection of feather samples for laboratory analysis, the scientific literature will be reviewed to compile and synthesize information on the food habits and diets of piscivorous waterbirds in freshwater aquatic systems to support the risk assessment being conducted as part of the Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7). This information was recommended by USFWS in comments on the Pre-Application Document for the Project (letter from USFWS to AEA dated May 31, 2012).

10.15.4.4. Reporting and Deliverables

Study products will include the following:

- **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 February 2014 and the Updated Study Report will be completed in February 2015. The Updated Study Report will summarize the results for both years.

10.15.5. Consistency with Generally Accepted Scientific Practice

The Waterbird Migration, Breeding, and Habitat Use 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 in North America* (USFWS and CWS 1987). These same techniques have been used successfully to survey for migrant and breeding waterbirds on other large-scale projects in Alaska (e.g., PLP 2011). Stream surveys of Harlequin Ducks by helicopter have been used effectively in numerous studies in Alaska and Canada (McCaffery and Harwood 1994; Morgart 1998; Kneteman and Hubbs 2000; Paton 2000; Savage 2000; MacDonald 2003; 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, 2011).

10.15.6. Schedule

The migration study using coordinated radar and visual sampling is proposed for the spring (late April–early June) and fall (mid-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 (Table 10.15-1). The timing of some surveys, particularly in spring and summer, will depend on ice break-up and the nesting phenology for the year. Approximately 10–11 spring migration/breeding-pair surveys will be flown between late April (start date determined by the timing of river break-up and lake moat formation each year) and mid-June at intervals of 5 days. Two breeding-pair transect surveys will be flown in the first half of June. At least two brood surveys (possibly three, depending on the developmental stages of juveniles on the second survey) will be flown beginning in mid-July each year. Two pre-nesting surveys for Harlequin Ducks will be flown in late May/early June and two brood-rearing surveys will be flown in late July/early August. Fall migration surveys will begin in mid-August and will continue until mid-October at intervals of 5 days. After each aerial survey, data will be transcribed, reviewed, and entered into a database for final quality assurance/quality control (QA/QC) review. Data analysis will be conducted progressively throughout summer and fall to allow for rapid completion in November and December. The Initial Study Report will be completed by February 2014 and the Updated Study Report will be completed by February 2015. Study updates will be provided during Technical Workgroup meetings, which will be held quarterly during 2013 and 2014.

10.15.7. Relationship with Other Studies

Except for current information each spring about river break-up conditions from the study of Ice Processes in the Susitna River (Section 7.6), which will be used to help determine the start date of spring migration surveys, the Waterbird Migration, Breeding, and Habitat Use Study will not require specific information inputs from other studies, but will provide information to several other studies (Figure 10.15-2). The various types of surveys conducted for this study will provide information that will be used in the assessment of Project impacts and development of appropriate protection, mitigation, and enhancement (PM&E) measures, which will be conducted in 2015 for the FERC License Application. The ground-based visual and radar surveys during spring and fall migrations in 2013 will be conducted concurrently with the Landbird and Shorebird Migration, Breeding, and Habitat Use Study (Section 10.16) to document the nature of migratory movements of a broad variety of birds near the proposed dam and associated facilities. Information regarding habitat use and abundance among different habitats will be incorporated into the habitat ranking matrix constructed for the Evaluation of Wildlife Habitat Use (Section 10.19), which will be used to assess the potential impacts and to develop PM&E measures, as appropriate, for the FERC License Application. Information on the food habits and diets of piscivorous waterbirds will be synthesized for use in the Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7), and nest locations of waterbird species found during breeding-season surveys will be recorded to enable collection of feather samples (after the nests are vacated) for baseline characterization of mercury levels by the Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7).

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.
- Direct mortality due to strikes with vehicles, power lines, 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.

During the impact assessment that will be conducted in 2015 for the FERC License Application, data on the distribution, abundance, and productivity of and habitat use by 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 by the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5), the locations of breeding pairs, brood-rearing groups, and staging birds will allow identification of high-value seasonal habitats for each waterbird 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 pairs and brood-rearing waterbirds in each habitat and linear densities of Harlequin Ducks can be used to estimate the number 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 power lines and other bird strikes for various Project alternatives. Industry standards and best practices (e.g., APLIC and USFWS 2005; APLIC 2006) and other literature reviews (e.g., Evans et al. 2007; Longcore et al. 2008; Gehring et al. 2009) will be consulted when designing and siting transmission lines and lighting Project facilities, to reduce the risk of attraction and collision of birds with Project infrastructure, while still complying with other federal and state requirements for facility lighting for aviation safety. Any necessary PM&E measures will be developed, as appropriate, by examining the distribution and abundance of species among habitats in relation to the geographical extent and seasonal timing of various Project activities.

10.15.8. 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 two surveys per year)
- Harlequin Duck pre-nesting 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 (which also will provide data for the Landbird and Shorebird Migration, Breeding, and Habitat Use Study, Section 10.16) will require a crew of four biologists working day and night shifts over a period of up to 120 days (total for spring and fall fieldwork) and is estimated to cost approximately $600,000 in 2013. The projected cost of the aerial-survey portion of the waterbird 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.

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10.15.10. Tables

Table 10.15-1. Schedule for implementation of the Waterbird Migration, Breeding, and Habitat Use Study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Spring migration surveys (ground-based visual & radar monitoring)		—				—			
Spring migration aerial surveys, transitioning to breeding-pair surveys; Breeding-pair transect surveys; Pre-nesting surveys for Harlequin Ducks		—				—			
Brood surveys in water bodies; Harlequin Duck brood surveys in streams			—				—		
Fall migration surveys (ground-based visual & radar monitoring)			—	—			—	—	
Fall migration aerial surveys			—	—			—	—	
Data QA/QC and analyses			—	—	—		—	—	—
Initial Study Report				—	Δ				
Updated Study Report								—	▲

Legend:

—— Planned Activity
Δ Initial Study Report
▲ Updated Study Report

10.15.11. Figures

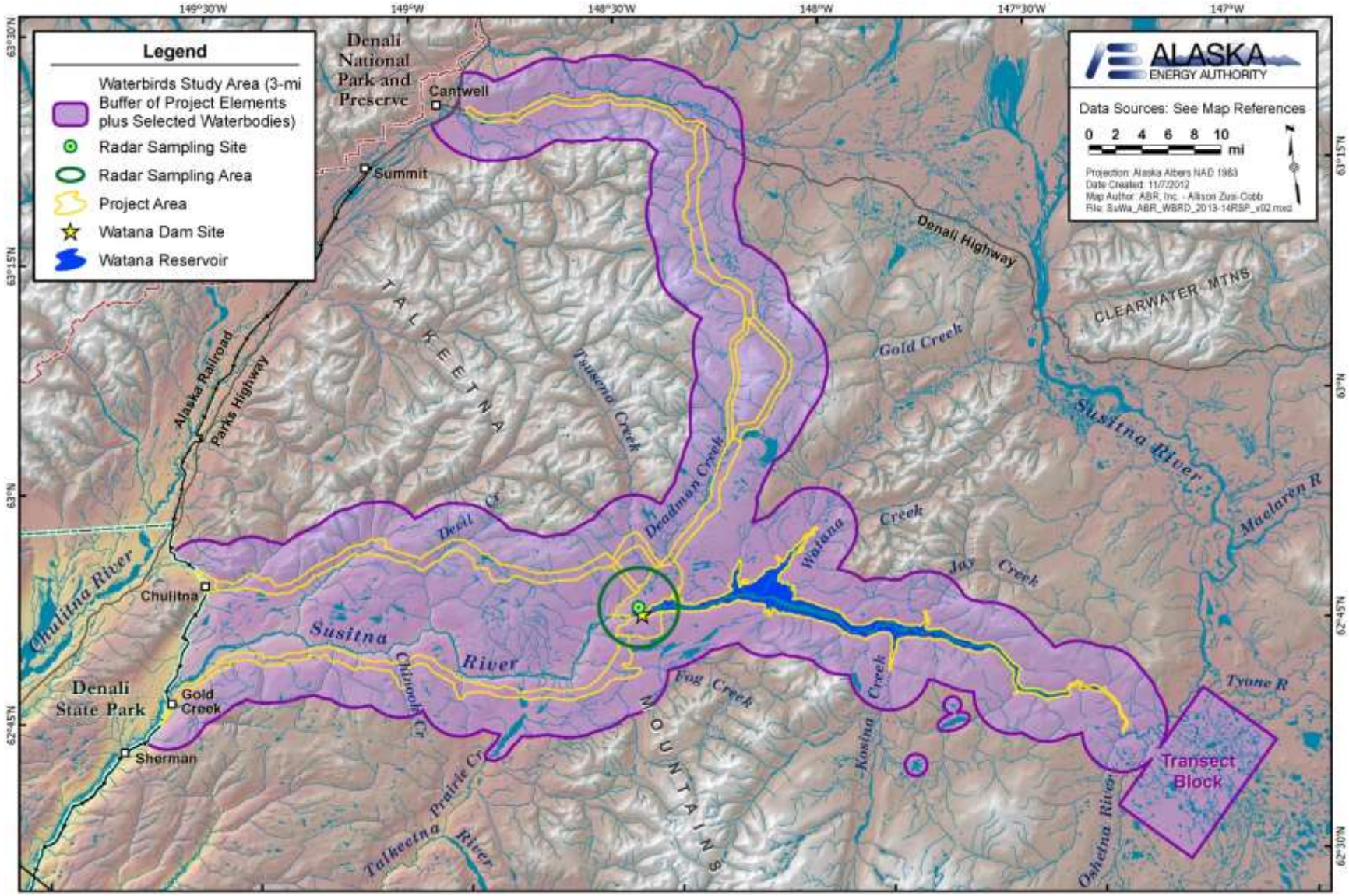

Figure 10.15-1. Waterbird Migration, Breeding, and Habitat Use Study area.

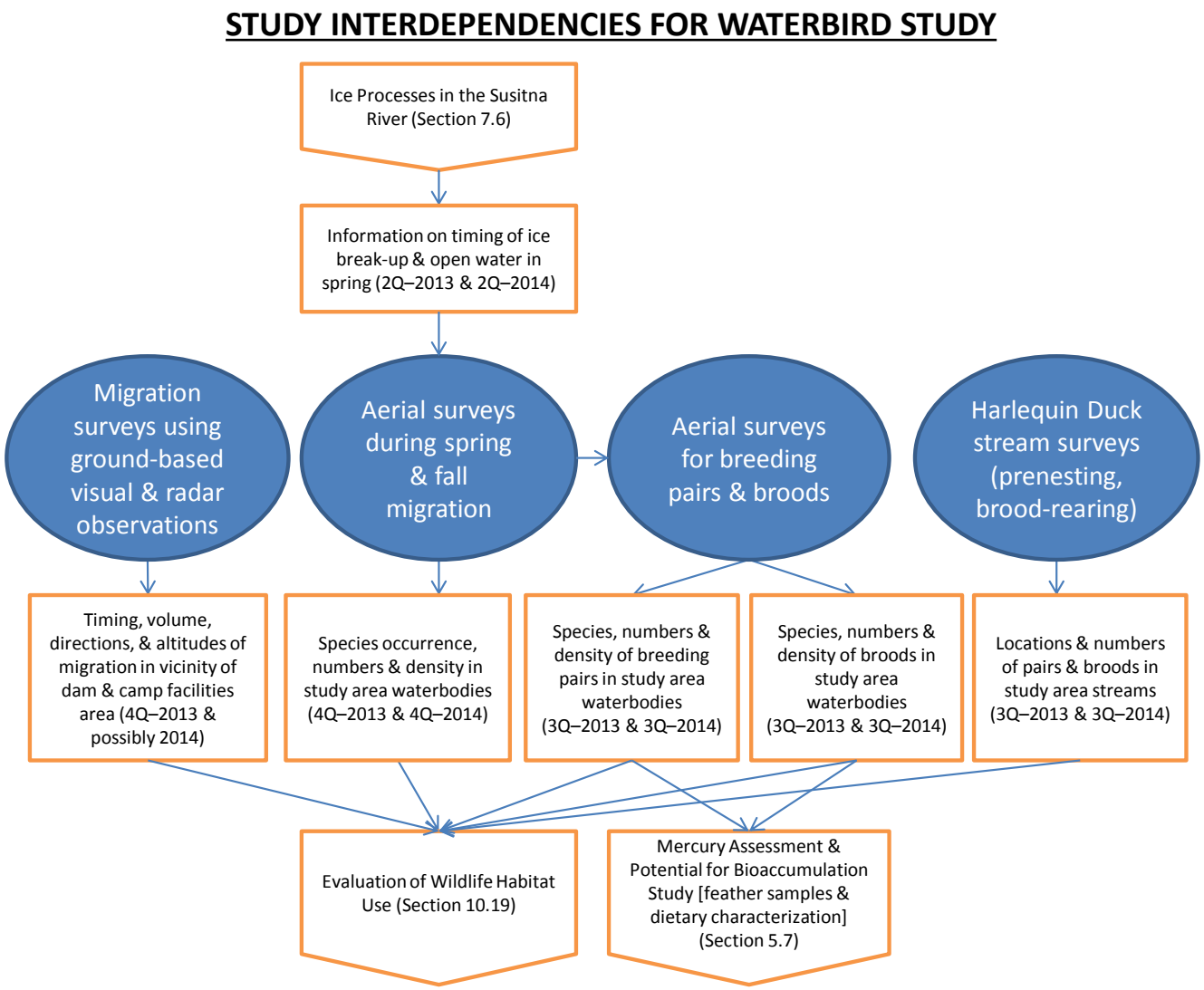

Figure 10.15-2. Study interdependencies for the waterbird study.