Susitna-Watana Hydroelectric Project (FERC No. 14241)

Landbird and Shorebird Migration, Breeding, and Habitat Use Study (10.16)

2014 Study Implementation Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

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Anchorage, Alaska

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
AKNHP	Alaska Natural Heritage Program
AOU	American Ornithologists' Union
APA	Alaska Power Authority
AVC	Alaska Vegetation Classification
CIRWG	Cook Inlet Region Working Group
FERC	Federal Energy Regulatory Commission
GINA	Geographic Information Network of Alaska
GIS	geographic information system
GPS	global positioning system
ISR	Initial Study Report
n	sample size
Project	Susitna-Watana Hydroelectric Project
RSP	Revised Study Plan
SD	standard deviation
SPD	study plan determination
USR	Updated Study Report

1. INTRODUCTION

This study, Landbird and Shorebird Migration, Breeding, and Habitat Use, Section 10.16 of the Revised Study Plan (RSP) approved by the Federal Energy Regulatory Commission (FERC) for the Susitna-Watana Hydroelectric Project, FERC Project No. 14241, focuses on characterizing baseline conditions (occurrence, distribution, abundance, and habitat use) for breeding landbirds and shorebirds in the Project area. The migration component of this study was conducted as part of the waterbird studies (see Study Completion Report Study 10.15, Waterbird Migration, Breeding, and Habitat Use).

A summary of the development of this study, together with the Alaska Energy Authority's (AEA) implementation of it through the 2013 study season, appears in Part A, Section 1 of the Initial Study Report (ISR) filed with FERC in June 2014. As required under FERC's regulations for the Integrated Licensing Process the ISR describes AEA's "overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)).

Since filing the ISR in June 2014, AEA has continued to implement the FERC-approved plan for the Landbird and Shorebird Study. For example:

- The second season of field surveys for the study was conducted in May and June 2014.
- The cumulative, error-corrected field data for this study for the two study years (2013 and 2014) have been uploaded to the Project server at the Geographic Information Network of Alaska (GINA).
- On October 21, 2014 AEA held an ISR meeting for the Landbird and Shorebird Study along with meetings for each of the other Project wildlife studies.

In furtherance of the next round of ISR meetings and FERC's Study Plan Determination (SPD) expected in 2016, this report describes AEA's overall progress in implementing the Landbird and Shorebird Study during calendar year 2014. Rather than a comprehensive reporting of all field work, data collection, and data analysis since the beginning of AEA's study program, this report is intended to supplement and update the information presented in Part A of the ISR for the Landbird and Shorebird Study through the end of calendar year 2014. It describes the methods and results of the 2014 effort, and includes a discussion of the results achieved.

The common names of bird species are capitalized throughout this report, in keeping with the formal nomenclature recognized by the American Ornithologist's Union in the Check-list of North American Birds (AOU 1998, 2014).

2. STUDY OBJECTIVES

As established in the RSP (Section 10.16.1), the goal of this study is to collect baseline data on the occurrence, distribution, abundance, and habitat use of breeding landbirds and shorebirds in the Project area to enable assessments of the direct, indirect, and cumulative impacts on these birds from construction and operation of the proposed Project. This study was designed to

provide data on species of conservation concern, both landbirds and shorebirds, that are known or expected to occur in the Project area (see AEA 2011), as well as numerous other species that are protected under the federal Migratory Bird Treaty Act.

The study has four specific objectives:

- Collect data on the distribution and abundance of landbirds and shorebirds during the summer breeding season.
- Identify habitat associations for landbirds and shorebirds.
- Evaluate changes in distribution, abundance, and habitat use of landbirds and shorebirds through comparison with historical data.
- Characterize the timing, volume, direction, and altitude of landbirds and shorebirds migrating through the dam and camp facilities area (reported in Study Completion Report Study 10.15, Waterbird Migration, Breeding, and Habitat Use).

3. STUDY AREA

As established in the RSP (Section 10.16.3), the study area for the ground-based point-count surveys includes the areas of the proposed Watana Reservoir (at predicted maximum pool elevation) and the Watana Dam and Watana Camp sites; three alternative Susitna-Watana Transmission Line/Access corridors, and a 2-mile buffer surrounding each of those areas. The Chulitna Corridor runs east-west north of the Susitna River connecting to the Alaska Intertie and the Alaska Railroad at Chulitna Pass. Another east-west alternative, the Gold Creek Corridor, runs south of the Susitna River to the Alaska Intertie and the Alaska Railroad at Gold Creek station. A third alternative, the Denali Corridor, runs north-south and would connect the Project dam site with the Denali Highway at one of two points and then would run west along the existing Denali Highway to connect to the Alaska Intertie near Cantwell.

As explained in the ISR Overview Section 1.4, AEA decided to pursue the study of an additional alternative north-south corridor alignment for transmission and access from the dam site to the Denali Highway. Referred to as the "Denali East Corridor Option," this corridor was added to the study area for this study beginning in 2014. For this study, the study area addition also included a 2-mile buffer surrounding the center lines of the new corridor (see ISR Study 10.16, Part C, Section 7.1.2).

In addition, Section 1.4 of the ISR Overview noted that AEA was considering the possibility of eliminating the Chulitna Corridor from further study. In September 2014, AEA filed with FERC a formal proposal to implement this change. Thus, this report reflects a change in the study area to no longer include the Chulitna Corridor. The study area is depicted in Figure 3-1.

As established in the RSP (Section 10.16.3), because lacustrine habitats were surveyed only when they occurred near point-count plots, the transect surveys for landbirds and shorebirds in lacustrine habitats were conducted in the same study area used for the point-count surveys, as described above (Figure 3-2).

As established in the RSP (Section 10.16.3), the study area for the transect surveys for landbirds and shorebirds in riverine habitats encompasses the prominent rivers and streams in the area of the proposed Watana Reservoir (at predicted high water) and in areas surrounding the site of the proposed Watana Dam and Watana Camp plus a 2-mile buffer around those areas (Figure 3-2).

As established in the RSP (Section 10.16.3), the survey area for colonially nesting swallows includes suitable riverine cliff and bluff nesting habitats within the area of the proposed Watana Reservoir (at predicted maximum-pool elevation), the Watana Dam site and Watana Camp, and a 2-mile buffer surrounding those areas (see Figure 3-3 in ISR Study 10.16).

4. METHODS AND VARIANCES IN 2014

The landbird and shorebird study methods include the following components. References to specific, relevant sections of the RSP and ISR are noted below:

- Conduct ground-based point-count surveys to collect field data on the occurrence, distribution, and abundance of landbirds and shorebirds in the study area during the summer breeding season. The second season of point-count surveys was conducted in 2014 and those survey results are presented in this report (see Section 5.1 below).

- Collect habitat-use data for landbirds and shorebirds during the point-count surveys to inform the Evaluation of Wildlife Habitat Use (Study 10.19), which will be the first step in quantifying habitat change (i.e., gain/loss and alteration) for landbirds and shorebirds from the proposed Project. As was done in 2013, habitat-use data were collected again during the second season of point-count surveys; preliminary habitat-use analyses are presented in this report (see Sections 5.1.1.2 and 5.1.2.2 below).

- Conduct focused linear walking surveys in riverine and lacustrine habitats, targeting species typical of fluvial, riparian, and lacustrine habitats, which often are under-represented in standard point-count surveys. The second season of riverine- and lacustrine-focused surveys was conducted in 2014 and the results of those surveys are presented in this report (see Section 5.2 below).

- Conduct aerial surveys of colonially nesting swallows in riparian habitats within the inundation zone of the proposed Watana Reservoir. Nesting swallow surveys were not conducted in 2014 (see Section 4.3 below). The results of the swallow surveys conducted in 2013 are presented in the ISR (Study 10.16, Part A, Section 5.3).

- Review the literature on the foraging habits and diets of piscivorous and partly piscivorous landbird and shorebird species (e.g., Belted Kingfisher, American Dipper, Spotted Sandpiper), which will be used to inform the Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7). This study task was completed in 2013 and is described in the ISR (Study 10.16, Part A, Section 4.6).

- Conduct visual migration-watch surveys and radar sampling in the immediate vicinity of the dam, powerhouse, and camp facilities (reported in ISR Study 10.15, Waterbird Migration, Breeding, and Habitat Use). This study task was completed in 2013 as part

of the Waterbird Study (Study 10.15) and is reported in the ISR and Study Completion Report for Study 10.15.

- Compare historical (Alaska Power Authority [APA] Susitna Hydroelectric Project) data from the 1980s for landbirds and shorebirds with the current data from this study, to evaluate any changes in distribution, abundance, and habitat use over the intervening 30 years. Many species of migratory birds have suffered population declines in recent decades, so these comparisons may also provide information on the population status of those species in the Project area. This study task will be completed and the results presented in the Updated Study Report (USR), as is explained in the variance for this task in the ISR (Study 10.16, Part A, Section 4.5.1).

4.1. Point-count Surveys

4.1.1. Plot-allocation Procedure

The study team determined locations for the point-count plots surveyed in the study area in 2014 following the procedures described in the RSP (Section 10.16.4.1.1) and modified in the ISR (Study 10.16, Part A, Sections 4.1.1 and 4.1.1.1, and Part B); variances to the plot-allocation methods implemented in 2014 are described below in Section 4.1.1.1. Complete details on the plot-allocation methods are described in the ISR (Study 10.16, Part A, Sections 4.1.1 and 4.1.1.1, and Part B). The steps in that process that are specific to the plot-allocation procedure in 2014 are described below.

As in 2013, the locations of point-count plots in 2014 were determined using a two-stage, stratified systematic/random sampling design in which vegetation type was used as one of two primary sampling strata. The vegetation mapping prepared for the APA Project (Kreig and Associates 1987), which was determined to be reasonably accurate at the Level-III categories of Viereck et al. (1992) (see ISR Study 11.5), was used as the primary source for mapped vegetation types in the study area. Because the Kreig and Associates (1987) mapping does not cover all portions of the study area (the northern and western portions of the Denali Corridor in particular are not covered), it was supplemented with new vegetation mapping for the Project completed for ISR Study 11.5 in 2014. However, the addition of the Denali Corridor East Option to Project plans resulted in a new section of the study area that was not covered by either the APA Project vegetation mapping or the vegetation mapping prepared for the current Project. To provide vegetation map data for this new area, recently completed and coarse-scale vegetation mapping available through the Alaska Natural Heritage Program (AKNHP; Boggs et al. 2013) was determined to be the best available data layer to use as the vegetation sampling strata for the Denali Corridor East Option. Before using in the allocation of point-count plot locations, both the APA Project and AKNHP vegetation types were cross-walked to Level-III vegetation classes of Viereck et al. (1992) so as to match the Level-III vegetation mapping prepared for the current Project (see ISR Study 11.5).

In 2014, the sampling frame used for the allocation of point-count plots included all state, federal, and native corporation lands (i.e., Cook Inlet Region Working Group [CIRWG] lands) within the 2-mile buffer study area described above in Section 3, Study Area. To avoid the allocation of point-count plots on or within 0.5-mile of private lands or Alaska Railroad

Corporation lands, researchers used a 0.5-mile buffer surrounding all known private land parcels and all Alaska Railroad Corporation lands. The most up to date land status layer for the Project that was available as of early May 2014 (SuWa Ownership–20130910 HDR) was used to identify private land parcels and Alaska Railroad Corporation lands within the landbird-shorebird study area.

The remaining steps in the plot-allocation process used in 2014 to determine the locations of sampling grids and point-count plots in the study area are as described in the ISR (Study 10.16, Part A, Section 4.1.1, and Part B). As in 2013, a total of 100 point-count grids and 1,500 point-count plots were allocated in the study area in 2014.

4.1.1.1. Variances

Three variances from the plot-allocation procedure described in the RSP (Section 10.16.4.1.1) and modified in the ISR (Study 10.16, Part A, Sections 4.1.1 and 4.1.1.1, and Part B) were implemented in 2014.

In 2013 no point-count plots were allocated in the Denali Corridor East Option portion of the study area because that corridor option was added to the Project after the 2013 field surveys were completed. In contrast, in 2014 the sampling frame used in the point-count plot-allocation procedure specifically included those portions of the study area encompassing the Denali Corridor East Option. As noted above in Section 4.1.1, additional vegetation mapping data (which were not available in May 2013) were used as sampling strata in the plot-allocation procedure in 2014 so that point-count plots could be allocated in the northern and western portions of the Denali Corridor and in the Denali Corridor East Option. This variance, which was also described as a proposed study plan modification (ISR Part C Section 7.1.2), was necessary to update the study area based on Project changes and allow the allocation of point-count plots in portions of the study area that were not sampled in 2013.

Second, as described above in Section 3, the Chulitna Corridor was eliminated from further consideration in 2014. Accordingly, and in contrast to 2013 during which point-count plots were surveyed in the Chulitna Corridor, in 2014 the study team did not include the Chulitna Corridor portions of the study area described in the RSP in the point-count plot-allocation sampling frame. This variance, which was also described as a proposed study plan modification (ISR Part C Section 7.1.2), was necessary to update the study area based on Project changes.

Third, in 2014 a more conservative approach to avoid sampling on private lands and Alaska Railroad Corporation lands was implemented (a 0.5-mile buffer surrounding all known private land parcels and all Alaska Railroad Corporation lands was used to avoid the allocation of point-count plots on those lands). No buffer around those lands was used in the plot allocation in 2013. This variance was necessary to ensure that field crews would not conduct surveys or inadvertently stray onto private lands or Alaska Railroad Corporation lands during the field work.

4.1.2. Field Surveys

In 2014, the study team implemented the field survey methods for the point-count surveys as described in the RSP (Section 10.16.4.1.2) and the ISR (Study 10.16, Part A, Section 4.1.2) with no variances. The field methods are described in detail in the ISR (Study 10.16, Part A, Section 4.1.2). Specific elements of the field methods that were unique to the survey work in 2014 are described below.

A staff of 8 biologists conducted the field surveys in 2014, working in 4 separate crews of 2 biologists each. This is as opposed to 8–10 biologists working in 4–5 field crews in 2013. Also in 2014, a minimum of 3 days of training in horizontal distance estimation and refresher training in bird identification (by sight, song, and call) for all observers was conducted either immediately prior to the field surveys (in Anchorage) or during the field surveys, as a new observer worked alongside a trained observer before being allowed to record point-count observations. This is as opposed to the minimum of 2 days of field training used in 2013.

In 2014, field surveys began on May 20 and continued through June 18, for a total of 30 survey days. During this period, only one survey day was lost to inclement weather (snow and rain). The 2013 survey period was similar and ran from May 23 to June 20, for a total of 28 survey days. In 2014, biologists attempted to vary the geographic locations, general habitat types, and average elevation of the plots surveyed on a daily basis. However, because lingering snowpack in the study area in 2014 limited access and delayed the arrival of breeding birds in alpine and some subalpine habitats, the field surveys necessarily were focused in lower elevation areas during approximately the first week of the sampling period.

In 2014, point-count survey data were recorded electronically in the field using a customized avian point-count app created by ABR staff to run on Android tablet computers. Exactly the same field data elements were recorded as in 2013, but the electronic data entry in the field in 2014 eliminated the need for post-field data entry and helped streamline the data QA/QC process. The remaining elements of the field survey methods used during the point-count surveys in 2014 are as described in the ISR (Study 10.16, Part A, Section 4.1.2).

As in 2013, the landbird and shorebird study team also provided data on incidental sightings of other birds, mammals, and frogs to the researchers conducting other wildlife studies for the Project in 2014.

4.1.2.1. Variances

No variances from the field methods for the point-count surveys described in the RSP (Section 10.16.4.1.2) occurred in 2014.

4.1.3. Data Analysis

4.1.3.1. Occurrence, Abundance, and Habitat Use

In 2014, the study team implemented the data analysis methods described in the RSP (Section 10.16.4.1.3) and the ISR (Study 10.16, Part A, Section 4.1.3.1) with no variances. As in 2013, the point-count survey data (uncorrected for detectability; see ISR Study 10.16, Part A, Section

4.1.3.2) were summarized to assess the observed occurrence, abundance, and habitat use of landbird and shorebird species within the study area. The data analysis methods used for the 2014 survey data are described in detail in the ISR (Study 10.16, Part A, Section 4.1.3.1).

4.1.3.2. Distance Analysis and Density Calculations

Distance analyses and calculations of estimated densities for landbirds and shorebirds were not conducted using the 2014 survey data. Preliminary densities were calculated in 2013 and the results indicated that the volume of data collected in the first study year was adequate to calculate densities for the common species; densities were calculated for 38 of 53 (72%) of the landbird species recorded during the point-count surveys in 2013, but observations of the naturally uncommon shorebird species were too few to calculate densities (ISR Study 10.16, Part A, Section 5.1.1.3). For the USR, the full data set for all study years will be combined and both removal and distance analyses, as described in the RSP (Section 10.16.4.1.3), will be used to improve the density estimates for landbirds and shorebirds. At that point, the Study Plan objective of providing density estimates for use in the assessment of impacts from the proposed Project will have been achieved.

4.1.3.3. Variances

No variances from the methods used for the analysis of the point-count data described in the RSP (Section 10.16.4.1.3) and the ISR (Study 10.16, Part A, Section 4.1.3) occurred in 2014.

4.2. Riverine- and Lacustrine-focused Surveys

In 2014, the study team implemented the methods for the riverine-focused surveys as described in the RSP (Section 10.16.4.2) and the ISR (Study 10.16, Part A, Section 4.2); three variances to the field methods were implemented in 2014 (see Section 4.2.1 below). Details on the methods used for the riverine-focused transect surveys are described in the ISR (Study 10.16, Part A, Section 4.2) and in Section 4.2.1 below. Specific elements of the field methods that were unique to the survey work in 2014 are described below.

In contrast to the 2013 surveys, which could not be conducted throughout the entire study area (see ISR Study 10.16, Part A, Section 4.2.1), in 2014 riverine transect surveys were conducted in all portions of the riverine-focused survey study area except for small parcels of private land (Figure 3-2); this included sampling on CIRWG lands in the area of the Watana Reservoir and Watana Dam site.

In 2014, only walking transect surveys were conducted in riverine habitats. This is opposed to 2013 during which point-count surveys were also conducted systematically along the riverine transects. Point-count surveys along riverine transects were not conducted in 2014 because it was found in 2013, as described below on Section 4.2.1, that stream noise inhibited bird detections.

In 2014, the riverine-focused surveys were conducted between May 28 and June 17 after the high water from spring flooding had subsided. This is in contrast to 2013, a year of late winter break-up when the riverine-focused surveys were substantially delayed because of shorefast ice and

high-water conditions, and occurred primarily between June 15 and June 19 (a pilot survey to test the methodology was conducted on 25 May 2013).

On the riverine-focused surveys in 2014, the riverine corridors surveyed generally were the larger, named tributary streams to the Susitna River and the Susitna River itself. The riverine survey transects were located using *ArcGIS 10.2* along stream corridors in the area of the Watana Reservoir, Watana Dam site, and a 2 mi buffer surrounding those areas (Figure 3-2). Researchers selected 13 riverine survey transects in areas where foot travel was known (from the 2013 survey work) to be reliably safe. The riverine survey transects facilitated sampling all safely accessible portions of riverine habitat within the riverine-focused survey study area.

In 2014, two observers conducted each riverine-focused survey. One observer recorded all birds (primarily shorebirds and waterbirds) using stream waters and adjacent, open, littoral habitats, while the second observer recorded all birds (primarily landbirds) using vegetated riparian and upland habitats occurring adjacent to the sampled stream. For the survey of stream waters and adjacent littoral habitats, which was the primary focus of the riverine-focused surveys (see ISR Study 10.16, Part A, Section 4.2), line-transect distance-sampling techniques were employed (Buckland et al. 2001; 2004). For each bird or group of birds observed, the approximate distance and angle (0° to 180°) to the bird(s) from either side of the transect line (the stream shoreline) was recorded, along with the habitat being used at the time of observation. Transect lines were determined in the field by each observer for each riverine transect and were defined as straight lines running along the stream shoreline from the observer to a clearly visible landmark (e.g., large boulder, cut bank, or downed log) in the distance. When stream courses changed direction, a new landmark was chosen and the transect line was shifted accordingly, so that the transect lines were an aggregation of straight line segments paralleling stream shorelines. The distance and angle data recorded during these surveys will be used to facilitate distance analyses and possible density calculations, which will be conducted for and reported in the USR. For this report, the data are presented as total numbers of each species observed per linear km of stream length surveyed (uncorrected for detectability).

In the survey of vegetated riparian and upland habitats adjacent to each sampled stream, the second observer recorded all birds detected and the habitat being used at the time of observation, when known. Because line-transect distance-sampling methods can only be used reliably for birds that are observed visually in open habitats, those methods were not used in the vegetated habitats surveyed adjacent to stream waters. The data recorded in those riparian and upland habitats are reported as total numbers of each species observed per linear km of stream length surveyed (uncorrected for detectability).

Global Positioning System (GPS) track logs for each riverine-focused survey were used to determine the lengths of stream segments surveyed, and in the case of islands surveyed in the Susitna River, the lengths of the island shorelines surveyed. The remaining elements of the riverine-focused survey methods used in 2014 are as described in the ISR (Study 10.16, Part A, Section 4.2, and Part C, Section 7.1.2).

In 2014, the lacustrine-focused transect surveys were conducted as described in the RSP (Section 10.16.4.2) and the ISR (Study 10.16, Part A, Section 4.2) with no variances. Details on the methods used for the lacustrine-focused transect surveys are described in the ISR (Study 10.16,

Part A, Section 4.2). The portions of those field methods that were specific to 2014 are described below.

In contrast to the 2013 surveys, which could not be conducted throughout the entire study area (see ISR Study 10.16, Part A, Section 4.2.1), in 2014 lacustrine transect surveys were conducted in all portions of the lacustrine-focused survey study area except for small parcels of private land (Figure 3-2). Specifically, lands unsampled in 2013 (the northern and western portions of the Denali Corridor West Option, the Denali Corridor East Option, and CIRWG lands in the area of the Watana Reservoir, Watana Dam site, and in the Gold Creek Corridor) were sampled in 2014.

In 2014, the lacustrine-focused surveys were conducted between May 20 and June 18, which is the same period during which point-count surveys were conducted, as described above in Section 4.1.2, Field Surveys. In this report, the data from the lacustrine-focused surveys are presented as the total numbers of birds recorded during the survey effort and then the proportions of those observations are presented for each of the habitats the birds were observed in.

4.2.1. Variances

As described below, three variances to the riverine-focused surveys were implemented in 2014.

The first variance implemented in 2014 was originally described as a proposed modification to the Study Plan in the ISR (Study 10.16, Part C, Section 7.1.2). In the RSP (Section 10.16.4.2), the field methods indicate that point counts and walking transect surveys would be conducted during the riverine-focused surveys, and during the field work in 2013 both survey efforts were performed. The detections of breeding songbird species vocalizing in vegetated riparian habitats during the point-count surveys, however, were hindered in many cases because of river noise. Moving the point-count locations away from stream banks was only effective in some cases in reducing river noise. In situations with narrow riparian corridors, moving the point-count locations was not possible without the observers moving out of riparian habitats, which would have defeated the purpose of the survey. Because of these limitations and because the primary targets of the riverine-focused surveys are those landbird and shorebird species that use fluvial and riverine habitats and are typically under-sampled in standard point-counts (e.g., Belted Kingfisher, American Dipper, Semipalmated Plover, Solitary Sandpiper, Spotted Sandpiper, Wandering Tattler), not breeding songbirds in vegetated riparian habitats (RSP Section 10.16.4.2), the point-count component of the riverine-focused surveys was eliminated in 2014. The 2013 data from the walking transect surveys in riverine habitats were compared to the point-count data, and it was clear that the same sets of riparian songbird species were recorded in both survey efforts, so there will be no loss of information on species occurrence in riparian habitats by this elimination of the point-count survey component. As a result of this variance, the lengths of the stream segments on the walking transect surveys will be increased by eliminating the time spent conducting point counts. This greater survey coverage will result in more accurate linear density estimates for birds using riverine habitats, and hence, will improve achievement of the study objectives.

The second variance to the riverine-focused surveys implemented in 2014 also was originally described as a proposed modification to the Study Plan in the ISR (Study 10.16, Part C, Section 7.1.2). In the RSP (Section 10.16.4.2), the metric described to represent bird abundance for the

riverine-focused surveys was birds per unit time spent during the survey. This was changed in 2014, partly in response to informal comments made by the USFWS on the draft version of the ISR for Study 10.16. In this report, the metric used to represent bird abundance for the riverine-focused surveys is linear densities (birds per km of stream length). This change was made so that reviewers will be able to evaluate the total number of birds recorded as opposed to a relative measure of abundance such as birds per unit time; hence, the revised metric better serves to achieve the study objectives. Additionally, representing the riverine-focused survey data as linear densities will allow for a rough calculation of the number of riverine-adapted birds that could be affected by the proposed Project.

The third variance implemented in 2014 involves the addition of line-transect distance-sampling methods (Buckland et al. 2001; 2004) to the riverine-focused surveys. In contrast to an uncorrected count of the numbers of birds recorded along the riverine-focused survey transects, as described in the RSP (Section 10.16.4.2) and in the ISR (Study 10.16, Part A, Section 4.2, and Part C, Section 7.1.2), in 2014 the study team added line-transect distance-sampling methods to the riverine-focused surveys to facilitate the possible correction of the field data for detectability and the calculation of densities. These methods (described above in Section 4.2) involved recording of distances and angles to each bird or group of birds observed in stream waters and adjacent littoral habitats. This variance will allow for improvement in the quality of the study results because the field data from 2014 can be analyzed with distance-sampling methods to correct for detection probability, and may allow for the estimation of a corrected number of birds that could be affected by the inundation of riverine habitats from the proposed Project. Line-transect distance-sampling methods were not possible in the vegetated riparian and upland habitats sampled adjacent to the streams because of restrictions in visibility, so the numbers of birds recorded in those habitats will remain uncorrected for detection probability. This variance will not affect analyses involving the combined data from both study years or any comparisons in results between study years. For those analyses, the study team will use uncorrected, linear densities (see Section 4.2 above), which can be calculated from the field data for both study years.

4.3. Survey of Colonially Nesting Swallows

No field surveys were conducted for colonially nesting swallows in 2014. The study team determined (see Section 7.1.3 below) that the survey data collected in 2013 are adequate to meet the study objectives, and a second year of swallow surveys was not necessary.

4.4. Migration Survey

No additional field surveys for the migration survey task were conducted in 2014. This study component was conducted in 2013 as part of the Waterbird Study (Study 10.15) and is reported in the ISR and Study Completion Report for Study 10.15.

4.5. Comparison with Historical Data

The methods described in the RSP (Section 10.16.4.5) and modified in the ISR (Study 10.16, Part A, Section 4.5) for comparing current and historical (1980s APA Project) data on landbirds and shorebirds will be implemented during preparation of the USR, as is explained in the

variance for this task in the ISR (Study 10.16, Part A, Section 4.5.1); this change is also listed as a proposed modification in ISR Study 10.16, Part C, Section 7.1.2.

4.6. Mercury Assessment Support

This literature review portion of this task was completed in 2013 and is described in the ISR (Study 10.16, Part A, Section 4.6).

5. RESULTS

The cumulative, error-corrected field data collected for this study in both 2013 and 2014 are available at:

http://gis.suhydro.org/SIR/10-Wildlife/10.16-Breeding_Land_and_Shore_birds/

See Table 5.1-1 for details.

The results of each of the 2014 breeding landbird and shorebird survey efforts (point-counts, riverine-focused, and lacustrine-focused surveys) are presented separately below. The focus of the results is on the observations of landbirds and shorebirds, although observations of other bird species groups (especially waterbirds) are reported for the riverine- and lacustrine-focused surveys because those surveys were designed specifically to assess the use of those habitats by species that are typically under-sampled in point-count surveys. Observations of waterbirds and raptors that were made in 2014 during the landbird and shorebird surveys are reported in the Study Completion Report for waterbirds and the 2014 Study Implementation Report for raptors (Studies 10.15 and 10.14, respectively). A complete list of the 103 bird species recorded during all three survey tasks for the landbird and shorebird study in 2014 is presented in Appendix A; the species list is organized phylogenetically (AOU 2014) and includes common and scientific names, breeding status, and relative abundance information for each species.

This report summarizes the work conducted in 2014, including the landbird and shorebird species observed, an initial assessment of their relative abundance, and a preliminary analysis of habitat associations. Final habitat-association information for landbirds and shorebirds will be prepared for the USR using the final habitats mapped for the study area in the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Study 11.5).

5.1. Point-count Surveys

In 2014, the study team conducted 1,207 point-count surveys along 100 transects in the study area (Figure 3-1) between May 20 and June 18, 2014. Point-count plots were spread throughout the study area as much as possible (see Section 4.1.1 above). Across all species groups (landbirds, shorebirds, waterfowl, and raptors), 14,101 individual birds of at least 103 different species were recorded during the point-count surveys, including 60 landbird, 14 shorebird, 27 waterbird, and 2 raptor species. Averages of 7.0 ± 2.7 (mean ± SD) species and 11.7 ± 5.0 individual birds were recorded across all point-count plots. No birds were detected on 2 plots (0.002 percent of all plots surveyed).

Because the wildlife habitat map for the study area is not yet complete, a preliminary assessment of habitat use by breeding birds was conducted for this report. For this analysis, the Alaska Vegetation Classification (AVC) Level-III vegetation types (Viereck et al. 1992) recorded at each point-count plot in the field were used as the primary habitats (focal habitats) sampled at each point-count location. Twenty-two focal habitat types were sampled at the 1,207 point-count plots surveyed in 2014 (Table 5.1-2).

5.1.1. Landbirds

5.1.1.1. Abundance

During the point-count surveys in 2014, researchers recorded 57 landbird species (Table 5.1-3) and calculated averages of 6.7 ± 2.6 (mean ± SD) landbird species and 10.8 ± 4.7 individual landbirds per plot. Most of the birds observed were assumed to be nesting in the study area, based on observations of nests or repeated observations of display activities, territorial behavior (e.g., singing), or alarm and mobbing reactions typical of nesting birds.

Using the raw point-count data (uncorrected for detectability), the most frequently observed landbird species (each accounting for 5 percent or more of the total landbird point-count observations) were Fox Sparrow, Common Redpoll, White-crowned Sparrow, Savannah Sparrow, Wilson's Warbler, Ruby-crowned Kinglet, and Yellow-rumped Warbler; combined, these species accounted for 59 percent of the total landbird observations (Table 5.1-3). Seven landbird species (Dark-eyed Junco, Varied Thrush, Gray-cheeked Thrush, American Robin, American Tree Sparrow, Blackpoll Warbler, and Northern Waterthrush) each accounted for 2.3 to 4.6 percent of the total landbird point-count observations; combined, these species accounted for 26 percent of all landbird observations. Another 21 species (each accounting for 0.1 to 1.9 percent of the total landbird point-count observations) when combined accounted for 15 percent of all landbird observations. Lastly, 21 species each accounted for less than 0.1 percent of the total landbird point-count observations); combined, those 21 species accounted for less than 1 percent of all landbird observations.

5.1.1.2. Habitat Associations

Landbirds were observed in each of the 22 habitat types sampled in the study area in 2014, including forests and woodlands; scrub (tall, low, and dwarf types); herbaceous meadows; riverine habitats; and partially vegetated and barren areas at higher elevations (Appendices B and C). Landbird abundance was highest in Needleleaf Woodlands in which a total average occurrence of 8.9 landbirds (of all species) per point count was recorded (n = 284 plots; Appendix C). Open Needleleaf Forest, Open Tall Shrub, Closed Tall Shrub, and Closed Low Shrub also had relatively high landbird abundance, with total average occurrence values for landbirds of all species of 8.7, 8.2, and 8.0 (n = 299, 50, and 50 plots), respectively. Landbird species richness was highest in Open Needleleaf Forest and Open Low Shrub, in which 35 and 32 landbird species were observed, respectively (Appendix C). Landbird abundance was lowest in Dry Graminoid Meadow and Lacustrine Waters where total average occurrence values for all landbird species were 2.0 and 0.0 (n = 1 plot for both habitat types), respectively. Landbird species richness also was lowest in Dry Graminoid Meadow and Lacustrine Waters (0.0 and 2.0 landbird species recorded, respectively). Of the individual species, Savannah Sparrows were

observed in the greatest number of habitat types (*n* = 18; Appendices B and C). Other common species of landbirds occurred in 14–17 different habitat types, whereas the species observed least frequently occurred in only 1–3 habitats each.

5.1.2. Shorebirds

5.1.2.1. Abundance

The study team recorded 14 shorebird species in the study area in 2014 (Table 5.1-4) and calculated an average of 0.4 ± 0.6 (mean ± SD) shorebird species and 0.5 ± 1.1 individual shorebirds per plot during the point-count surveys. Most shorebirds were assumed to be nesting in the area, based on observations of nests or repeated observations of aerial display activities and territorial behavior, or alarm and mobbing reactions typical of nesting birds. A few exceptions included observations of migratory Pectoral Sandpipers and Long-billed Dowitchers.

Based on the raw point-count data (uncorrected for detectability), Wilson's Snipe was the most common shorebird species in the study area, accounting for 60 percent of all shorebird observations (Table 5.1-4). Nine shorebird species (Lesser Yellowlegs, American Golden-Plover, Least Sandpiper, Red-necked Phalarope, Whimbrel, Spotted Sandpiper, Semipalmated Plover, Solitary Sandpiper, and Long-billed Dowitcher) were much less common, accounting for 1–10 percent of all shorebird point-count observations in the study area. Four other species (Greater Yellowlegs, Wandering Tattler, Surfbird, Pectoral Sandpiper) were rarely encountered, together accounting for less than 3 percent of all shorebird point-count observations in the study area.

5.1.2.2. Habitat Associations

Shorebirds were observed in 15 of the 22 focal habitat types sampled in the study area in 2014, but they were most common in the open habitats (Appendices D and E). Shorebird abundance was highest in Wet Graminoid Meadow and Moist Graminoid Meadow, both of which had total average occurrence values of 0.6 shorebirds (of all species) per point count (*n* = 36 and 23 plots, respectively) (Appendix E). Species richness of shorebirds was highest in Wet Graminoid Meadow and Open Low Shrub (6 shorebird species were recorded in each habitat; Appendix E). No shorebirds were detected in 8 habitats. Of the individual species, Wilson's Snipe was observed in the greatest number of habitat types (*n* = 11; Appendices D and E). All other shorebird species were found in 6 or fewer habitats. Spotted Sandpiper, Wandering Tattler, Greater Yellowlegs, Surfbird, Long-billed Dowitcher, and Red-necked Phalarope were found in only 1 habitat type each.

5.2. Riverine- and Lacustrine-focused Surveys

The study team conducted 15 riverine- and 89 lacustrine-focused transects in the study area in May and June 2014 (Figure 3-2). Lacustrine-focused surveys were completed during the point-count surveys and consequently were spread throughout the entire study area for the landbird and shorebird study (see Sections 4.1.1 and 4.2 above) whereas the riverine-focused surveys were located within the area of the proposed Watana Dam and Watana Reservoir and a 2-mile buffer surrounding those areas. Similar to the methods used for the point-count surveys, the habitat

being used by each bird observed was recorded, whenever possible, during the riverine- and lacustrine-focused surveys. Habitats were recorded in the field as AVC Level-III or, whenever possible, Level-IV vegetation types (Viereck et al. 1992). For the preliminary analyses conducted for this report, the broader Level-III vegetation types, which primarily represent vegetation structure, were used.

5.2.1. Riverine-focused Surveys

The 15 riverine-focused transects were sampled during a 21-day period between May 28 and June 17, 2014. The transects were sampled after the majority of shorefast ice melted and high-water conditions had subsided. The riverine-focused transects were located along portions of the Susitna River mainstem and the major tributary streams in the proposed Watana Reservoir and Watana Dam site area, plus a 2-mi buffer surrounding those areas. Two transects were located along tributary streams (Deadman and Watana creeks), 8 transects were located along the mainstem of the Susitna River, and 5 were located along portions of tributary streams (Kosina, Tsusena, Goose, and 2 unnamed creeks) and portions of the Susitna River (Figure 3-2; Appendix F).

In all, 1,758 individual birds of 50 different species were recorded during the riverine-focused surveys, including 34 landbird, 8 waterbird, 5 shorebird, and 3 raptor species. Averages of 19.2 ± 6.75 (mean ± SD) species and 117.2 ± 68.1 individual birds were recorded per transect. An average of 21.0 ± 14.4 shorebirds and 10.9 ± 11.4 waterbirds were recorded per transect, primarily in riverine waters and open shoreline habitats. Most landbirds occurred in adjacent, vegetated riparian and upland habitats, and an average of 84.0 ± 54.4 landbirds was recorded per transect. Overall, landbirds were the most abundant species group (72 percent of all observations), followed by shorebirds (18 percent), waterbirds (9 percent), and raptors (1 percent). Across all transects and species, an average linear density of 12.6 birds per km of stream length was recorded (Appendix F). The average density of individuals observed per km of stream length across all 15 transects ranged from a minimum of 0.01 for the least common species (Lesser Yellowlegs, Common Goldeneye, and Tree Swallows) to a maximum of 2.2 for the most abundant species (Spotted Sandpiper). The linear densities for all species on tributary streams of the Susitna River was higher than for the Susitna River (16.5 birds/km and 11.4 birds/km, respectively; Appendix F).

Across all 15 transects, an average of 9.0 landbirds per km was recorded during the riverine-focused surveys (Appendix F). The most common species observed were Northern Waterthrush, Blackpoll Warbler, Fox Sparrow, and Wilson's Warbler. These four species combined accounted for 47 percent of all observations during the riverine-focused surveys, and each species individually accounted for at least 5 percent of all landbird observations. Swallows accounted for 7 percent of all landbird observations. Landbirds were most frequently observed in Mixed Open Forest, Open Needleleaf Forest, and a variety of riparian shrub habitats adjacent to riverine water bodies (Appendix G). Swallows, Belted-Kingfishers, American Dippers, and Northern Waterthrush were observed foraging above or in riverine waters.

For shorebirds, across all 15 transects an average of 2.3 birds per km was recorded during the riverine-focused surveys (Appendix F). Spotted Sandpiper was by far the most abundant shorebird species and accounted for 96 percent of the shorebird observations and 17 percent of

all bird observations made. Spotted Sandpipers were observed most frequently using riverine waters and riverine shoreline habitats, but they were also found in low riparian shrub and herbaceous habitats located along tributary streams and the Susitna River (Appendix G).

Lastly, for waterbirds, an average of 1.2 birds per km was recorded across all 15 transects (Appendix F). Harlequin Duck was the most commonly recorded species during the riverine-focused surveys, followed by Herring Gull, Common Merganser, and Red-Breasted Merganser. These 4 species combined accounted for over 80 percent of all observations of waterbirds. All waterbirds observed were found either in riverine waters, in rocky, riverine shoreline habitat, or were observed flying low over the sampled streams (Appendix G).

5.2.2. Lacustrine-focused Surveys

The 89 lacustrine-focused surveys were completed within the same study area used for the point-count surveys over a period of 25 days between May 20 and June 18, 2014. Thirty-seven of the surveys were located within or near the area of the proposed Watana Reservoir, 2 in the area of the Watana Dam and Camp, 36 in the Denali Corridor, and 14 in the Gold Creek Corridor (Figure 3-2). The surveys ranged from 1 to 67 minutes in length and the size of the lacustrine water bodies ranged from 0.005 ha (50 m^2) to approximately 420 ha (4.2 km^2) in area.

Overall, 674 individual birds of 59 different species were recorded during the lacustrine-focused surveys, including 24 waterbird, 22 landbird, and 12 shorebird species. Averages of 2.8 ± 2.9 (mean ± SD) species and 7.5 ± 11.8 individual birds were recorded per survey. Nineteen of the water bodies surveyed (21 percent) had zero detections. Waterbirds, the most abundant species group observed, accounted for 53 percent of all observations (n = 361), followed by shorebirds, which accounted for 30 percent (n = 205) of all observations. Landbirds were less abundant and comprised 16 percent (n = 106) of all observations.

The most abundant landbirds found near lacustrine water bodies were Rusty Blackbird, Savannah Sparrow, Wilson's Warbler, Yellow-rumped Warbler, and Fox Sparrow, which together comprised over half of all landbird detections on the lacustrine-focused surveys (Table 5.2-1). Tree Swallows comprised 6 percent of all landbirds observed and were found foraging in the air directly above water bodies. Landbirds were generally found in Wet Herbaceous Graminoid, Open Low Shrub, and in Open Needleleaf Forests near the shorelines of lacustrine water bodies, and were also found foraging directly along the shorelines of ponds and lakes (Table 5.2-1).

Red-Necked Phalarope was the most abundant shorebird species observed on the lacustrine-focused surveys, composing 40 percent of all shorebird observations (Table 5.2-1). Other common shorebird species included Lesser Yellowlegs, Least Sandpiper, Solitary Sandpiper, and Pectoral Sandpiper, which together accounted for over 40 percent of all shorebird detections. Shorebirds were found in lacustrine habitats 56 percent of the time and in adjacent Wet Graminoid Meadow habitats 30 percent of the time (Table 5.2-1).

The most abundant waterbird species recorded during the lacustrine-focused surveys were Mew Gulls, Lesser Scaup, Northern Pintail, Mallard, and Northern Shoveler, which together accounted for almost 50 percent of all waterbird observations (Table 5.2-1). Mew Gull abundance was high

on one survey (Survey T31-15-3) because of the presence of 2 aggregations of 54 birds on the margins of a large lacustrine water body; this single survey accounted for 82 percent of all Mew Gull observations (n = 66). Observations of Mew Gulls on the lacustrine surveys, however, were generally low; the species was detected on only 9 percent of all lacustrine surveys. Waterbirds were observed almost exclusively in lacustrine waters (94 percent of waterbird observations) (Table 5.2-1).

6. DISCUSSION

The field surveys for landbirds and shorebirds in 2014 were executed as planned while incorporating the variances described above in Section 4.1.1.1 for the allocation of point-count plots in the study area, and the three variances described in Section 4.2.1 implemented to improve the riverine-focused surveys. The weather during the survey period was generally good and the study team conducted 1,207 point counts, which is more than 400 point counts above the goal of 800 point counts per year noted in the RSP (Section 10.16.8). This study represents one of the most extensive point-count surveys yet conducted in Interior Alaska, in terms of both the large area surveyed and the intensity of sampling. The 2014 data analyses presented in this report (see below) indicate that, when combined with the first year of data from 2013, the two years of data will be of sufficient quantity and quality to meet the study objectives (see Section 7.1.2 below).

The landbird and shorebird study is related to several other on-going Project studies, the most important being the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna River Basin (Study 11.5). The completed wildlife habitat mapping for Study 11.5 will be used as the basis for the final analyses of landbird and shorebird habitat use and also as a covariate in the final analyses to determine densities for landbirds and shorebirds. In turn, the abundance and habitat-use data from the landbird and shorebird study will be used in the Evaluation of Wildlife Habitat Use (Study10.19). The data from Study 10.19 then will be used in the impact assessments for landbirds and shorebirds.

6.1. Point-count Surveys

6.1.1. Landbirds

During the point-count surveys in 2014, landbirds were by far the most abundant bird group recorded, accounting for 94 percent of all observations. Within landbirds, sparrows were the most abundant species group observed in the study area, composing over 39 percent of all landbird observations. Warblers and thrushes were also common in the study area, accounting for about 18 percent and 15 percent, respectively, of all landbird observations. In contrast, grouse and ptarmigan, chickadees, and woodpeckers were recorded infrequently, accounting for only 1.0, 0.7, and 0.2 percent, respectively, of all landbird observations. These ratios are typical of other studies of landbirds in Alaska, in which migrants (e.g., sparrows, warblers, thrushes) greatly outnumber resident species such as grouse and ptarmigan, chickadees, and woodpeckers.

The 2014 results for landbirds compare favorably with what was found in 2013 in the study area. In 2013, as in 2014, landbirds were the most abundant bird group recorded and accounted for 87

percent of all point-count observations (ISR Study 10.16, Part A, Section 6.1.1). Similar to 2014, within the broad landbird group, sparrows also were the most abundant species group in 2013, accounting for more than 40 percent of all landbird observations. As in 2014, warblers and thrushes also were common in the study area in 2013, and comprised roughly 20 percent and 18 percent, respectively, of all landbird observations. In 2013, as in 2014, again the resident species groups (grouse and ptarmigan, chickadees, and woodpeckers) were recorded infrequently, accounting for only 1.3, 0.8, and 0.2 percent, respectively, of all landbird observations.

Substantial changes in abundance ratios of the broad species groups considered here, however, are unlikely to occur between consecutive years as such changes would involve rather large shifts in the avifauna in the study area. Changes of that magnitude are possible perhaps over several decades as conditions in the study area change, and the study team will fully evaluate possible avifauna changes in the study area in the USR (when making comparisons of the current data to the historical APA Project data collected in the 1980s). As might be expected, there were some changes in abundance levels between 2013 and 2014 at the level of individual landbird species and those detailed results also will be presented in the USR.

6.1.2. Shorebirds

During the point-count surveys in 2014, shorebirds accounted for only 5 percent of all observations recorded. This low frequency is not surprising, however, given that most breeding shorebirds depend on open habitats for nesting and brood-rearing, whereas the study area is strongly dominated by forests. Most shorebird species also defend large breeding territories and naturally occur in low densities.

Wilson's Snipe was the most common shorebird species observed, and many observations of this species were made during aerial flight displays (winnowing), which occurred above a diversity of habitat types. Spotted Sandpipers were uncommon overall during the point-count surveys, but were regularly recorded along streams during the riverine-focused transect surveys (see Section 6.2 below). American Golden-Plovers were also uncommon and were found most often in open, higher elevation, montane habitats. Other shorebirds that breed in the boreal forest zone (e.g., Solitary Sandpiper, Least Sandpiper, Lesser Yellowlegs) were detected infrequently during the point-count surveys. This is likely due to the relatively low breeding densities of these species (Cooper 1994; Moskoff 1995; Tibbitts and Moskoff 1999), and the relatively small amount of suitable habitat available for these species in the study area, rather than low detectability.

As was the case with landbirds, the 2014 results for shorebirds also compare favorably with what was found in 2013. As in 2014, shorebirds were found to be uncommon in the study area in 2013 (ISR Study 10.16, Part A, Section 6.1.2); they comprised only 5 percent of all the point-count observations in both 2013 and 2014. In 2013, as in 2014, Wilson's Snipe was by far the most common shorebird species recorded and Spotted Sandpipers were uncommon except during the riverine-focused surveys (see Section 6.2 below). Other regularly occurring shorebird species in the study area (American Golden-Plover, Solitary Sandpiper, Least Sandpiper, and Lesser Yellowlegs) were uncommon in 2013 as they were in 2014.

As noted above for landbirds, however, substantial shifts in the abundance levels of shorebirds as a group between consecutive study years are not expected. The study team will evaluate possible

long-term avifaunal changes by comparing the current abundance data for shorebirds with the historical APA project data collected in the 1980s in the USR. The study team also will evaluate possible changes between study years at the level of individual shorebird species in the USR.

6.2. Riverine-and Lacustrine-focused Surveys

As in 2013, the riverine- and lacustrine-focused surveys in 2014 proved to be effective methods to record the occurrence of some landbird and shorebird species that are not commonly recorded in standard point-count surveys. The riverine-focused transect surveys in particular facilitated the detection of several species that occur in riverine environments where observations of birds by ear using point counts can be difficult. The data from the lacustrine-focused surveys provided information on the use of lacustrine water bodies by landbirds and shorebirds, and also provided additional information on the use of smaller lakes and ponds by waterbirds, which complements the data collected during the aerial waterbird surveys (see Study Completion Report Study 10.15).

With the riverine- and lacustrine-focused surveys, the study team increased the number of observations of several uncommon habitat specialists, such as Spotted Sandpipers, American Dippers, and Rusty Blackbirds. Spotted Sandpipers were found to be common in riverine shoreline habitats throughout the study area. The riverine-transect surveys also allowed the study team to double the number of American Dipper observations, which were otherwise observed only at two point-count plots. During the lacustrine-focused surveys, researchers were able to document Rusty Blackbirds using open needleleaf forests and adjacent lacustrine habitats. A second study season of the riverine- and lacustrine-focused surveys was valuable for increasing the information on the occurrence of these and other species that are often under-recorded during standard point-count surveys.

Across all species, the linear densities of birds per km of stream length recorded during the riverine-focused surveys along the Susitna River were lower than the densities of birds along tributary streams. However, the abundance of shorebirds (strongly dominated by Spotted Sandpipers) was notably higher on the riverine surveys along the Susitna River than on tributary streams, indicating that shorebirds in general are more attracted to the shoreline habitat along the Susitna River than along tributary streams (Appendix F). During the riverine-focused surveys, many waterbirds were observed flying low over stream courses, indicating that the streams act as corridors for travel during the breeding season.

In general, the 2014 observations of landbirds and shorebirds on the riverine- and lacustrine-focused surveys compare favorably with what was found in 2013 (see ISR Study 10.16, Part A, Sections 5.2.1 and 5.2.2). For landbirds, on the riverine-focused surveys four species (Northern Waterthrush, Blackpoll Warbler, Fox Sparrow, and Wilson's Warbler) were the most abundant landbird species in both 2013 and 2014, and, as a group, comprised over 40 percent of all observations in both study years. This is not surprising given that each of these species uses tall-scrub habitats during the breeding season (which are commonly found in riparian areas along streams), and two species (Northern Waterthrush and Blackpoll Warbler) also are commonly associated with riparian habitats in particular during the breeding season.

For shorebirds, on the riverine-focused surveys Spotted Sandpipers were by far the most abundant shorebird species recorded in both 2013 and 2014, and comprised over 95 percent of the shorebird observations (and 17 percent of all observations) in both study years. Spotted Sandpipers were found to favor littoral habitats more strongly along the Susitna River, as opposed to littoral habitats along clear-water tributary streams, in both study years.

On the lacustrine-focused surveys, a group of four landbird species (American Robin, Rusty Blackbird, Bohemian Waxwing, and Savannah Sparrow) were commonly found using lacustrine-margin habitats in 2013 and comprised nearly half of all the landbird observations. In 2014, the group of commonly recorded landbird species using lacustrine-margin habitats was comprised of five species, which comprised over half of all the landbird observations. Rusty Blackbird and Savannah Sparrow remained in that group of commonly recorded landbird species in 2014 while American Robin and Bohemian Waxwing dropped out. Three different species (Wilson's Warbler, Yellow-rumped Warbler, and Fox Sparrow) were found to occur within the group of five commonly recorded landbird species using lacustrine-margin habitats 2014. Most likely these shifts in landbird abundance between years are due to different proportions of lacustrine-margin habitats at the water bodies surveyed in the two survey years, and this possibility will be evaluated in the USR.

For shorebirds, on the lacustrine-focused surveys Red-necked Phalaropes were the most abundant shorebird species recorded in both 2014 and 2013; they comprised 25 percent of the shorebird observations in 2013 and 40 percent in 2014. Other common shorebird species included Lesser Yellowlegs and Least Sandpiper in both study years. In 2013, the list of commonly occurring shorebird species recorded on the lacustrine-focused surveys included Wilson's Snipe. In contrast, in 2014 Wilson's Snipes were less frequently recorded and Solitary Sandpipers and Pectoral Sandpipers replaced them on the list of commonly recorded shorebird species. As with landbirds, these inter-year differences in abundance of shorebird species on the lacustrine-focused surveys may be due to differences in the availability of habitats, in this case primarily littoral habitats along water body shorelines, and the study team will evaluate this possibility in the USR.

7. CONCLUSION

The 2013 and 2014 field survey efforts, including the variances and modifications described in the ISR (Study 10.16, Part C, Section 7.1.2), were successfully implemented. Over the two study years, greater than 60 percent more point-count plots above the goal listed in the RSP (Section 10.16.8) were collected. Point-count data are now available for all portions of the study area. The riverine-focused surveys and the colonially nesting swallow surveys also were successful and all the safely accessible habitat targeted by those surveys in the Watana Reservoir and Watana Dam site study area was surveyed. Lastly, the lacustrine-focused surveys were successfully conducted and provide data on the use of lacustrine water bodies by landbirds and shorebirds throughout the study area; these data will augment the information being collected on use of lacustrine water bodies by waterbirds (Study 10.15). The data from these survey efforts in 2013 and 2014 are adequate to achieve the study objectives of providing distribution, abundance, and habitat-use information for landbirds and shorebirds in the study area, and to compare those data with similar historical data collected for the APA Project in the 1980s. The data from this study also

will provide the information needed to calculate minimum estimates of the number of landbirds and shorebirds that could be affected by development of the proposed Project.

7.1. Decision Points from Study Plan

There were no decision points in the FERC-approved Study Plan to be evaluated for this study following the completion of 2014 work.

7.2. Modifications to the Study Plan

The study team has completed two years of point-count surveys, riverine- and lacustrine-focused surveys, and a single year of nesting swallow surveys following the methods described in the Study Plan and modified first in the ISR (Study 10.16, Part C, Section 7.1.2) and then in this study (see Sections 4.1.1.1 and 4.2.1 above). As explained below, AEA is proposing no further field surveys and will complete this study by completing the analysis with the cumulative dataset from 2013 and 2014.

The three modifications described below represent alterations from the activities proposed in the ISR (Study 10.16, Part C, Section 7) to complete this study and provide justification for why AEA maintains that no additional field surveys are needed to meet the Study Plan objectives.

7.2.1. Point Count Surveys

The RSP (Sections 10.16.4.1 and 10.16.6) indicates that two years of point-count surveys will be conducted in the study area and that the point-count plots will be spread throughout the study area based on a random plot-allocation procedure. However, some portions of the study area could not be surveyed in 2013 (see ISR Study 10.16, Part A, Section 4.1.1.1).After a review of the two years of data collected for the point-count surveys, AEA determined that an additional year of field surveys areas not sampled in 2013, as proposed in the ISR (Study 10.16, Part C, Section 7), is likely to yield diminishing returns for the effort involved, and that the two years of data already collected will be sufficient to meet the study objectives and assess impacts to breeding landbirds and shorebirds from the proposed Project.

First, the volume of data collected for the point-count surveys in both 2013 and 2014 greatly exceeded the yearly goal described in the Study Plan. The goal listed in the RSP (Section 10.16.8) was to collect data at 800 point-count plots in each study year. In 2013 and 2014, the study team conducted 1,364 and 1,207 point counts, respectively; these values are over 550 and 400 point counts above the Study Plan goal (over 70 and 50 percent more point counts, respectively) in each year. Over the two years, the study team has conducted 2,571 point counts spread throughout the study area (Figure 7.1-1), which is a very large sample size and represents one of the most intensive point-count studies conducted within a local area in Alaska. This large sample size and the distribution of point-count plots throughout the study area will give the study team sufficient data to use in the various analyses (see below) that will be required to inform the impact assessments for landbirds and shorebirds for the proposed Project.

Second, one of the primary sources of information to be provided by this study for use in the impact assessments for landbirds and shorebirds are the habitat-use analyses, which are required

data inputs for the Evaluation of Wildlife Habitat Use (Study 10.19) (see RSP 10.16.7). The results from Study 10.19 will be used directly in the impact assessments for landbirds and shorebirds (see below). In the USR, the final habitat-use analyses for landbirds and shorebirds will be based on the final wildlife habitat types mapped for the landbird and shorebird study area in the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Study 11.5). With large sample sizes (a large number of observations of each landbird and shorebird species throughout the study area), the distribution of observations recorded across the range of mapped habitat types will more closely represent the actual habitat-use patterns for each species.

The large point-count sample sizes in this study will give researchers conducting the habitat-use evaluations (Study 10.19) more confidence in determining which mapped habitat types in the study area should be considered high, moderate, or low value for each landbird and shorebird species during the breeding season.[1] These categorical rankings of habitat value for each landbird and shorebird species and each mapped habitat type will be used to determine the amount of high-, moderate-, and low-value habitat for each landbird and shorebird species that will be lost or altered from Project development.

Because the wildlife habitat mapping for the study area (being conducted in Study 11.5) is not yet complete and final mapped habitat types are not available, the habitat-use data discussed below are based on the AVC Level-III vegetation types (Viereck et al., 1992) recorded at each point-count plot by observers in the field. The Level-III vegetation types provide a suitable proxy for the final mapped wildlife habitat types when evaluating sample sizes because landbirds and shorebirds were observed in 23 Level-III vegetation types during point-count surveys in the two study years (2013 and 2014), and a similar number of wildlife habitat types (approximately 20–25) is expected to be mapped in the landbird and shorebird study area. This is based on the results of other wildlife habitat mapping studies in similar forested and mountainous regions in Alaska in which 20–25 wildlife habitats were mapped (ABR 2008a,b; PLP 2011).

As shown in Appendix H, the combined point-count data for the two survey years shows a large number of observations of the more common landbird species spread across the 23 Level-III vegetation types sampled in the study area. Twenty-seven species, including four species of conservation or management concern (Gray-cheeked Thrush, Varied Thrush, Blackpoll Warbler, and Golden-crowned Sparrow, see Appendix A) have been observed 100 times or more across all habitats. Sample sizes of 100 or more will provide robust information for assessing habitat values across the final mapped wildlife habitat types in the study area because the habitat types used most often will be easily identified by repeated observations and those used the least by substantially fewer or no observations. Another 12 landbird and shorebird species were observed

[1] By necessity, the abundance metric to be used in the final habitat-use analyses for this study in the USR (average-occurrence figures; see ISR Study 10.16, Part A, Section 4.1.3.1) will be uncorrected for detection probability. Calculating corrected densities for individual bird species separately in a relatively large number of mapped habitat types—using removal and distance analyses, which account for detection probability (Farnsworth et al. 2002; Buckland et al. 2001; Buckland et al. 2004)—is not feasible and will only be possible for the more common species (see the main text). Therefore, to provide habitat-use data for all species and all mapped habitat types in the study area (which is required to derive accurate estimates of habitat loss and alteration from the proposed Project), uncorrected average-occurrence values will be used.

between 21 and 91 times. This group includes four species of conservation or management concern (American Golden-Plover, Lesser Yellowlegs, Olive-sided Flycatcher and Rusty Blackbird). Sample sizes within this range will not provide as much confidence to researchers when ranking habitat values across the range of mapped habitat types, although for the species with the larger sample sizes in this group (n = 50 or more), the habitats being used most often will be readily identified. With observation sample sizes less than 20, the ranking of habitat values across a set of 20–25 habitat types can be more challenging (depending on the species and its variability in habitat use) because there can be relatively low numbers of observations even in the habitat types used most often (see Appendix H). In these cases, the numbers observed in a particular habitat can sometimes be influenced by a few point-count plots. This is the nature of conducting multispecies surveys, however, and it can take many years of sampling to increase observation sample sizes for uncommon and rare species.

For example, a relatively large number of species (26) were observed less than 20 times across the two survey years (Appendix H). To increase sample sizes for those species to levels more appropriate for quantitative assessments of habitat use would involve an impractical amount of survey work and it could not been done in one field season. This is why AEA has determined that there will be diminishing returns from conducting a third year of point-count sampling in the landbird and shorebird study area. As described in RSP 10.19.4, for those species for which there are relatively few Project-specific observations, the habitat-value assessments in Study 10.19 will be conducted by relying on habitat-use information from the scientific literature in addition to the observations made directly in the Project area. What is encouraging about the large amount of point-count data collected by the study team in the two survey years for this study is that reasonable observation sample sizes already exist for eight species of conservation or management concern (see above).

Third, another data product from this study to be used in the impact assessments for landbirds and shorebirds is the estimation of densities for landbirds and shorebirds, corrected for detection probability, which will be conducted for the USR. Ideally densities would be calculated for each species in each of the alternative transmission line/access road corridors and for the proposed Watana Reservoir and Watana Dam site area. The distance analyses used to calculate densities, however, are notoriously dependent on large sample sizes; a general rule of thumb is that a minimum of 60 observations for a species are needed to fit detection functions adequately and calculate densities (Buckland et al. 2001; 2004). If calculating densities separately for each Project component proves unfeasible, the study team will calculate densities for each species based on a set of aggregated habitat types (derived from the mapping data of Study 11.5) and then extrapolate the density data by applying habitat-specific densities to the acreages of each aggregated habitat type occurring in each alternative corridor and in the proposed Watana Reservoir and Watana Dam site area.

These analyses likely will involve estimating densities by a small set of aggregated habitat types (e.g., forests, low and tall scrub combined, meadows, and barren and dwarf scrub combined) as well as employing detection groups (sets of species that share similar vocalization quality and behaviors that affect visual detections) to increase the observation numbers available to fit detection functions and calculate densities for a greater number of species. Detection groups were successfully used in the ISR (Study 10.16, Part A, Section 4.1.3.2) to calculate densities for 38 of the 53 (72%) landbird species observed in the first study year. Note, however, that even

with these methods it is not likely that densities can be calculated for some of the more uncommon species because low observation sample sizes for those species may still be constraining. In 2013, for example, low sample sizes prohibited any density calculations for the naturally dispersed and uncommon shorebird species (ISR Study 10.16, Part A, Section 5.1.2.3). It is encouraging that, after the second year of surveys, observation numbers by habitat have increased for some shorebird species (e.g., American Golden-Plover and Lesser Yellowlegs; Appendix H), which increases the likelihood that densities can be calculated for some shorebird species in the USR.

Even if densities cannot be calculated separately for each of the alternative transmission line/access road corridors and the proposed Watana Reservoir and Watana Dam site area, densities can certainly be calculated for the entire study area, as was done in the ISR (Study 10.16, Part A, Section 4.1.3.2). With density information for the full study area, estimates of the numbers of birds potentially affected by the proposed project can be generated to inform the impact assessments for landbirds and shorebirds. Because of the low observation sample sizes for uncommon species, which almost certainly cannot be remedied with a single additional year of field surveys (see the discussion regarding habitat-use analyses above), The study team expects that even with an additional year of point-count data there would still be some uncommon and rare species for which densities cannot be calculated. Such diminishing returns on the effort expended to conduct a third season of point-count surveys for this study suggest that it would be most practical to complete the study with the existing two-year data set.

7.2.2. Riverine- and Lacustrine-focused Surveys

The Study Plan indicates that two years of riverine- and lacustrine-focused surveys will be conducted in the study area (RSP 10.16.6) and that the surveys will occur along rivers and streams and along the margins of lacustrine water bodies located throughout the study area (RSP 10.16.4.2). However, some portions of the study area could not be surveyed in 2013 (see ISR Study 10.16, Part A, Section 4.2.1).The study team reviewed the two years of data from the riverine- and lacustrine-focused surveys and determined that another year of surveys in areas not surveyed in 2013, as proposed in the ISR (Study 10.16, Part C, Section 7), is not necessary to meet the study objectives and assess impacts to breeding landbirds and shorebirds from the proposed Project.

Within the riverine-focused survey study area (Figure 7.1-2), the safely accessible shorelines of all the larger clear-water tributaries of the Susitna River (both named and unnamed) and the shorelines of the Susitna River itself, including a sample of islands in the river, have been sampled with riverine-focused surveys. Some stream segments were sampled in both 2013 and 2014.

Using the line-transect distance-sampling data collected in 2014 on the riverine-focused surveys, researchers also may be able to correct for detection probability and calculate corrected densities for some species recorded in stream waters and adjacent littoral habitats (depending on the number of observations available). The 2014 data indicate that density calculations are possible for the two most commonly recorded species; Harlequin Duck and Spotted Sandpiper were observed 92 and 305 times, respectively, and both of these sample sizes are above the minimum rule of thumb requirement of 60 observations for distance analyses (Buckland et al. 2001; 2004).

Although uncorrected for detection probability, linear densities (birds per km of stream length) will be calculated in the USR for all landbirds and shorebirds recorded on the riverine surveys in both 2013 and 2014. These linear densities will be based on extensive sampling of streams in the study area (Figure 7.1-2) and will be useful for impact assessments by providing a minimum estimate of the numbers of landbirds and shorebirds that are known to use riverine habitats in the study area and which could be displaced by construction of the proposed Watana Dam and the filling of the Watana Reservoir.

For the lacustrine surveys, sufficient data on the use of lakes and ponds by landbirds and shorebirds have been collected in the study area in the two survey years to use in Project impact assessments for these species. Lacustrine water bodies were sampled throughout the study area (Figure 7.1-2) when they occurred nearby randomly allocated point-count plot locations (59 and 89 water bodies were surveyed in 2013 and 2014, respectively).

The lacustrine-focused survey data for the two years also indicate some consistent patterns in use. For example, Rusty Blackbird and Savannah Sparrow were two of the most frequently observed landbird species using lacustrine fringe habitats in both survey years; other common breeding landbird species, depending on the habitats occurring adjacent to the surveyed water bodies, included American Robin, Bohemian Waxwing, Wilson's Warbler, Yellow-rumped Warbler, and Fox Sparrow. For shorebirds, Red-necked Phalarope was by far the most numerically dominant species recorded using lacustrine habitats in both survey years. Other shorebird species that breed in the study area and were commonly recorded during the lacustrine surveys included Lesser Yellowlegs, Least Sandpiper, Solitary Sandpiper, and Wilson's Snipe. Additionally, the lacustrine survey data also provide information on the use of lacustrine water bodies in the study area during late May by small numbers of migrant shorebird species (Long-billed Dowitcher, Pectoral Sandpiper), which pass through the area to breed in tundra regions in northern Alaska.

Overall, the current two-year lacustrine survey data set provides an adequate understanding of how landbirds and shorebirds use lacustrine water bodies in the study area during the breeding season, and the information augments other data being recorded for the Project by researchers conducting the aerial waterbird surveys in Study 10.15. Many of the same waterbodies, and especially the larger lakes, have been sampled with both aerial surveys in Study 10.15 and ground-based surveys in this study. For both the riverine- and lacustrine-focused surveys, adequate data are available from the first two study years to provide estimates of the numbers of landbirds and shorebirds that use those habitats and that could be affected by development of the proposed Project.

7.2.3. Colonially Nesting Swallow Surveys

The RSP (Sections 10.16.4.3 and 10.16.6) indicates that two years of colonially nesting swallow surveys will be conducted in the study area and that the surveys will cover the appropriate (cliff and bluff) nesting habitat for colonially nesting swallows in the study area. AEA reviewed the data for the single year of colonially nesting swallow surveys (2013) and determined that a second year of field surveys, as indicated in the Study Plan and proposed in the ISR (Study 10.16, Part C, Section 7), is not necessary to meet the objectives of the swallow surveys and assess impacts to nesting swallows from the proposed Project.

The primary reasons for this are that in 2013 researchers used a much more efficient survey platform (helicopter-based as opposed to boat-based) and were able to survey a much larger area than indicated originally in the Study Plan. As described in the ISR (Study 10.16, Part A, Section 4.3), in 2013 the study team surveyed not only the area of the proposed Watana Reservoir (at predicted maximum-pool elevation) and the Watana Dam and Watana Camp sites (which was indicated in RSP Section 10.16.3 as the study area), but was able to survey a 2 mi buffer around those areas as well. Using a helicopter survey platform in 2013, all portions of the study area, including CIRWG lands, were surveyed for nesting swallow colonies. In that effort, the study team was successful in locating 25 nesting swallow colonies (both active and inactive) in the study area. Colonially nesting swallow habitat in the study area is limited to steep slopes and cut banks along the Susitna River and the lower stretches of its major tributary streams, and all of those areas were searched for nesting swallows in 2013.

The study team also was able to provide an estimate of the number of nesting swallow pairs (353) at colonies located below the reservoir maximum pool elevation that could be displaced by construction of the proposed Watana Dam and the filling of the Watana Reservoir. This information can be used directly in the assessment of impacts to colonially nesting swallows from the proposed Project. For these reasons, AEA has determined that there are likely to be diminishing returns, in terms of the information acquired for the effort expended, in conducting a second field survey for colonially nesting swallows.

8. LITERATURE CITED

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9. TABLES

Table 5.1-1. Server Location and File/Folder Names for the Field Data for Landbirds and Shorebirds Collected in 2013 and 2014.

Server Pathway or File/Folder Name	Description
http://gis.suhydro.org/SIR/10-Wildlife/10.16-Breeding_Land_and_Shore_birds/	Pathway to data files
10_16_LSBRD_Cumulative_Data_ABR.zip	Zip file containing point-count, riverine-, and lacustrine-focused field survey data in a Microsoft Access database and a geodatabase of geographic information system (GIS) data layers for the landbird and shorebird study
Photos (folder)	Field (JPEG) photos of point-count transects and plots and riverine transects organized in separate subfolders by study year, transect name, and survey date

Table 5.1-2. Number of Landbird/Shorebird Point-counts Conducted in the Focal Habitats Sampled in 2014.

Focal Habitat Type[1]	Number of Point-Count Plots
Barren	2
Partially Vegetated	3
Closed Broadleaf Forest	1
Open Broadleaf Forest	3
Closed Mixed Forest	1
Open Mixed Forest	36
Mixed Woodland	5
Closed Needleleaf Forest	8
Open Needleleaf Forest	299
Needleleaf Woodland	284
Dry Graminoid Meadow	1
Moist Graminoid Meadow	23
Wet Graminoid Meadow	36
Dry Dwarf Shrub	10
Ericaceous Dwarf Shrub	99
Open Dwarf Forest	18
Dwarf Forest Woodland	14
Closed Low Shrub	40
Open Low Shrub	223
Closed Tall Shrub	50
Open Tall Shrub	50
Lacustrine Waters	1
Total	1,207

Notes:

1. Level-III vegetation types following the Alaska Vegetation Classification (Viereck et al. 1992), with the addition of barren and partially vegetated habitats and lacustrine waters; the primary habitat surrounding each point-count plot was considered the focal habitat (see text).

Table 5.1-3. Number of Observations and Average Occurrence Values for Landbird Species Observed During Point-count Surveys, 2014.

Species	Total Number Detected	% of Landbird Observations	Average Occurrence[1]
Fox Sparrow	1634	12.52	1.354
Common Redpoll	1540	11.80	1.276
White-crowned Sparrow	1397	10.71	1.157
Savannah Sparrow	839	6.43	0.695
Wilson's Warbler	828	6.35	0.686
Ruby-crowned Kinglet	824	6.32	0.683
Yellow-rumped Warbler	693	5.31	0.574
Dark-eyed Junco	595	4.56	0.493
Varied Thrush	583	4.47	0.483
Gray-cheeked Thrush	571	4.38	0.473
American Robin	490	3.76	0.406
American Tree Sparrow	442	3.39	0.366
Blackpoll Warbler	342	2.62	0.283
Northern Waterthrush	301	2.31	0.249
Gray Jay	253	1.94	0.21
Swainson's Thrush	233	1.79	0.193
White-winged Crossbill	191	1.46	0.158
Arctic Warbler	168	1.29	0.139
Hermit Thrush	133	1.02	0.11
Orange-crowned Warbler	117	0.90	0.097
Lincoln's Sparrow	100	0.77	0.083
Golden-crowned Sparrow	95	0.73	0.079
Willow Ptarmigan	86	0.66	0.071
Boreal Chickadee	75	0.57	0.062
American Pipit	72	0.55	0.06
Olive-sided Flycatcher	58	0.44	0.048
Common Raven	54	0.41	0.045
Lapland Longspur	43	0.33	0.036
Rock Ptarmigan	42	0.32	0.035
Rusty Blackbird	40	0.31	0.033
Horned Lark	36	0.28	0.03
Alder Flycatcher	31	0.24	0.026
Bohemian Waxwing	23	0.18	0.019
Black-capped Chickadee	21	0.16	0.017
Yellow Warbler	21	0.16	0.017
Northern Flicker	10	0.08	0.008
Downy Woodpecker	9	0.07	0.007
Tree Swallow	8	0.06	0.007
Snow Bunting	7	0.05	0.006
American Dipper	5	0.04	0.004

Species	Total Number Detected	% of Landbird Observations	Average Occurrence[1]
American Three-toed Woodpecker	5	0.04	0.004
Northern Wheatear	5	0.04	0.004
Pine Grosbeak	5	0.04	0.004
White-tailed Ptarmigan	5	0.04	0.003
Northern Shrike	4	0.03	0.002
Spruce Grouse	2	0.02	0.002
Townsend's Solitaire	2	0.02	<0.001
Black-billed Magpie	1	0.01	<0.001
Belted Kingfisher	1	0.01	<0.001
Brown Creeper	1	0.01	<0.001
Pine Siskin	1	0.01	<0.001
Red-breasted Nuthatch	1	0.01	<0.001
Ruffed Grouse	1	0.01	<0.001
Say's Phoebe	1	0.01	<0.001
Townsend's Warbler	1	0.01	<0.001
Violet-green Swallow	1	0.01	<0.001
Total	13,047	100	10.807

Notes:

1. Average occurrence = total number of birds detected/total number of point counts conducted in the full study area.

Table 5.1-4. Number of Observations and Average Occurrence Values for Shorebird Species Observed During Point-count Surveys, 2014.

Species	Total Detected	% of Shorebird Observations	Average Occurrence[1]
Wilson's Snipe	394	59.8	0.326
Lesser Yellowlegs	66	10.0	0.055
American Golden-Plover	50	7.6	0.041
Least Sandpiper	40	6.1	0.033
Red-necked Phalarope	36	5.5	0.030
Whimbrel	20	3.0	0.017
Spotted Sandpiper	11	1.7	0.009
Semipalmated Plover	9	1.4	0.007
Solitary Sandpiper	9	1.4	0.007
Long-billed Dowitcher	8	1.2	0.007
Greater Yellowlegs	6	0.9	0.005
Wandering Tattler	6	0.9	0.005
Surfbird	3	0.5	0.002
Pectoral Sandpiper	1	0.2	<0.001
Total	659	100	0.546

Notes:

1. Average occurrence = total number of birds detected/total number of point counts conducted in the full study area.

Table. 5.2-1. Total Number of Birds Observed (*n*) and Percentage of Observations Made by Habitat Type during Lacustrine-focused Surveys, 2014.

		Percent Occurrence[1] by Habitat Type[2]										
Species	*n*	Disturbance Complex	Lacustrine Water	Riverine Water	Moist Graminoid Meadow	Wet Graminoid Meadow	Closed Low Shrub	Open Low Shrub	Open Tall Shrub	Open Dwarf Forest	Open Needleleaf Forest	Needleleaf Woodland
Trumpeter Swan	2		100									
American Wigeon	9		100									
Mallard	17		100									
Northern Shoveler	14		100									
Northern Pintail	51		96.08		3.92							
Green-winged Teal	30		80			16.67		3.33				
Ring-necked Duck	6		100									
Greater Scaup	8		100									
Lesser Scaup	49		97.96			2.04						
Unidentified scaup	23		91.30			8.70						
Surf Scoter	9		100									
White-winged Scoter	5		100									
Long-tailed Duck	5		100									
Bufflehead	7		100									
Common Goldeneye	1		100									
Barrow's Goldeneye	6		100									
Unidentified goldeneye	6		50			33.33					16.67	
Red-breasted Merganser	1					100						
Unidentified waterfowl	2		100									

		Percent Occurrence[1] by Habitat Type[2]										
Species	***n***	**Disturbance Complex**	**Lacustrine Water**	**Riverine Water**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Closed Low Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Open Dwarf Forest**	**Open Needleleaf Forest**	**Needleleaf Woodland**
Red-throated Loon	3		100									
Pacific Loon	3		100									
Horned Grebe	1		100									
Red-necked Grebe	1		100									
Bonaparte's Gull	2		100									
Mew Gull	66		96.97			3.03						
Herring Gull	6		100									
Arctic Tern	2		100									
Waterbird Total	**335**		**94.93**		**0.60**	**3.88**		**0.30**			**0.30**	
Bald Eagle	2		100									
Raptor Total	**2**		**100**									
Semipalmated Plover	2		100									
Spotted Sandpiper	2					100						
Solitary Sandpiper	13		46.15		7.69	23.08					23.08	
Wandering Tattler	1		100									
Greater Yellowlegs	2		50			50						
Lesser Yellowlegs	37		29.73	5.41		54.05		8.11				2.70
Unidentified yellowlegs	2					100						
Whimbrel	2					100						
Least Sandpiper	17		11.76			35.29		52.94				

		Percent Occurrence[1] by Habitat Type[2]										
Species	***n***	**Disturbance Complex**	**Lacustrine Water**	**Riverine Water**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Closed Low Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Open Dwarf Forest**	**Open Needleleaf Forest**	**Needleleaf Woodland**
Pectoral Sandpiper	10					100						
Long-billed Dowitcher	1							100				
Wilson's Snipe	6			33.33		50					16.67	
Red-necked Phalarope	82		91.46			7.32			1.22			
Unidentified shorebird—small	5		100									
Unidentified shorebird	2							100				
Shorebird Total	**184**		**55.98**	**2.17**	**0.54**	**29.89**		**8.15**	**0.54**		**2.17**	**0.54**
Willow Ptarmigan	3				100							
Gray Jay	1	100										
Tree Swallow	4		100									
Unidentified swallow	1					100						
Arctic Warbler	4							50	50			
Swainson's Thrush	1				100							
Hermit Thrush	2							100				
American Robin	3							66.67			33.33	
Bohemian Waxwing	3										100	
Northern Waterthrush	1					100						
Orange-crowned Warbler	1							100				
Yellow Warbler	1								100			
Blackpoll Warbler	4							25			50	25

		Percent Occurrence[1] by Habitat Type[2]										
Species	***n***	**Disturbance Complex**	**Lacustrine Water**	**Riverine Water**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Closed Low Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Open Dwarf Forest**	**Open Needleleaf Forest**	**Needleleaf Woodland**
Yellow-rumped Warbler	9							55.56	11.11		33.33	
Wilson's Warbler	10						20	80				
American Tree Sparrow	1					100						
Savannah Sparrow	15		13.33		13.33	46.67		26.67				
Fox Sparrow	9							77.78			22.22	
Lincoln's Sparrow	5		20			20		60				
White-crowned Sparrow	2							50				50
Dark-eyed Junco	1							100				
Rusty Blackbird	21			4.76	4.76	23.81		9.52		9.52	38.10	9.52
Landbird Total	**102**	**0.96**	**8.65**	**0.96**	**6.73**	**15.38**	**1.92**	**37.50**	**3.85**	**1.92**	**18.27**	**3.85**
Total	**623**	**0.96**	**259.56**	**3.14**	**7.87**	**49.16**	**1.92**	**45.95**	**4.39**	**1.92**	**20.74**	**4.39**

Notes:

1. Percent-occurrence values for habitats exclude birds in flight that were transiting through the area and observations in which the habitat being used could not be determined.
2. Level-III vegetation types of the Alaska Vegetation Classification (Viereck et al. 1992).

10. FIGURES

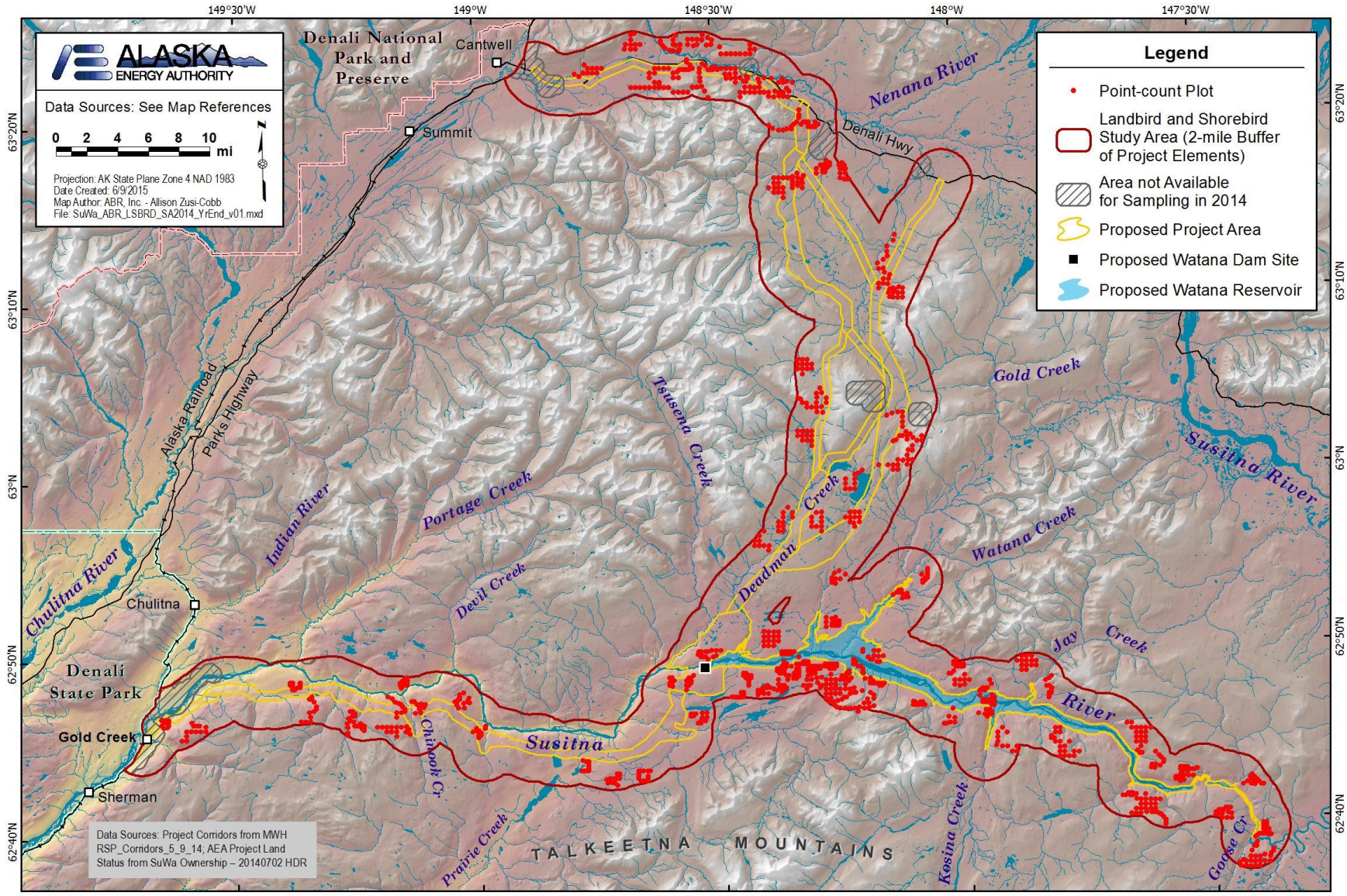

Figure 3-1. Study Area and Locations of Landbird and Shorebird Point-count Plots Sampled in 2014.

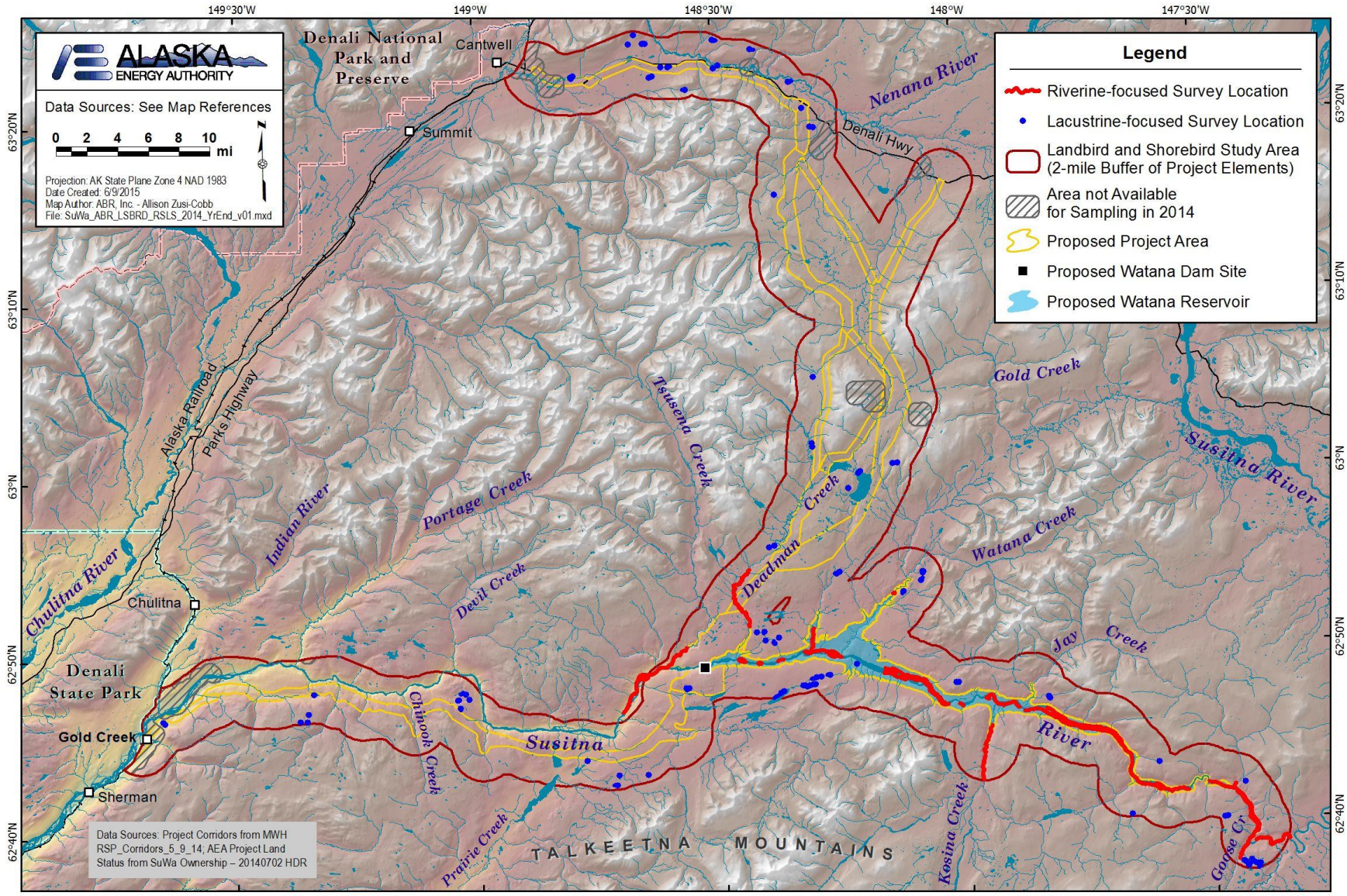

Figure 3-2. Study Area and Locations of Riverine- and Lacustrine-focused Survey Transects Sampled in 2014.

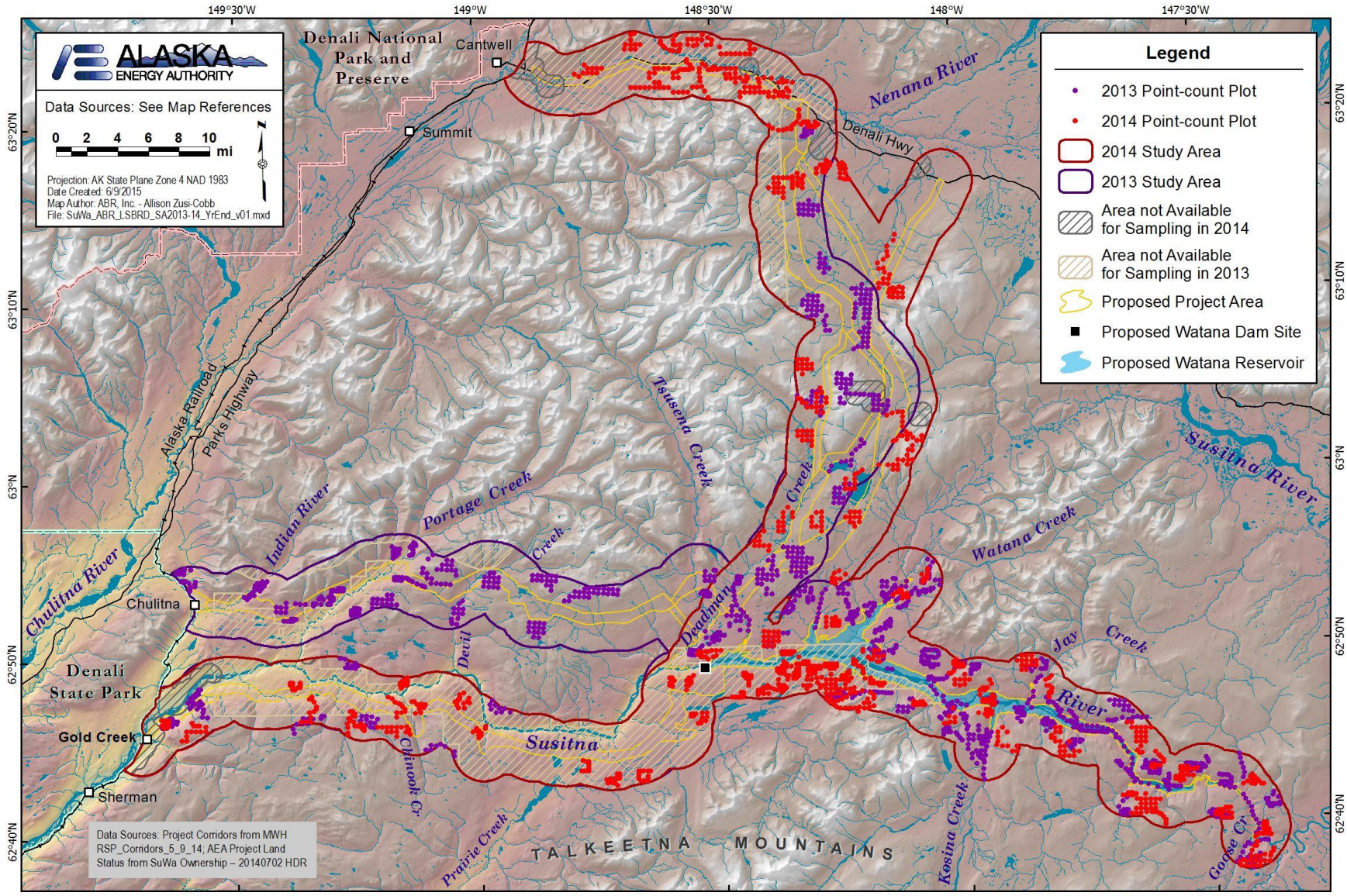

Figure 7.1-1. Study Areas for 2013 and 2014 and Locations of Point-count Plots Sampled in 2013 and 2014.

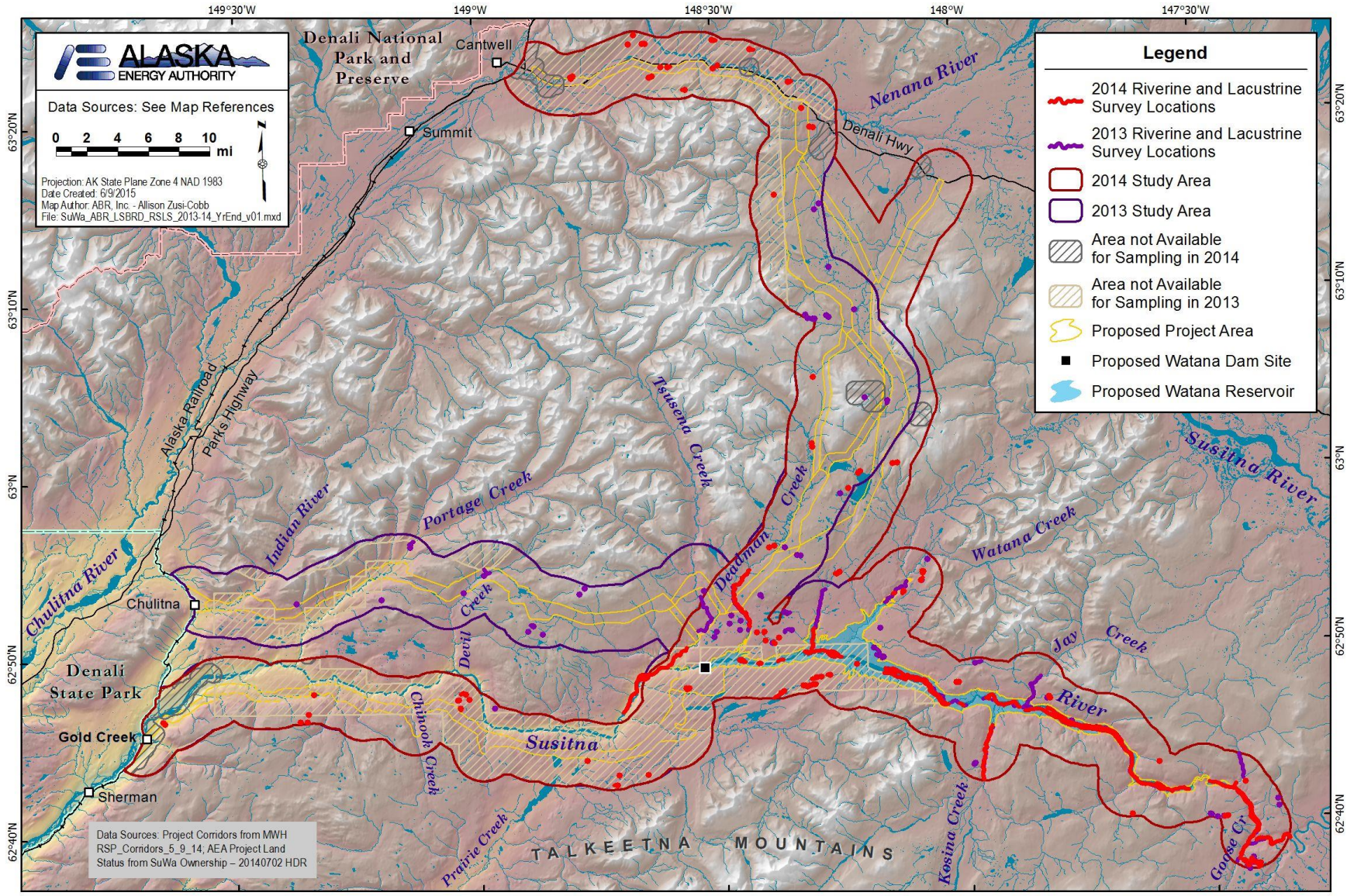

Figure 7.1-2. Study Areas for 2013 and 2014 and Locations of Riverine- and Lacustrine-focused Survey Transects Sampled in 2013 and 2014

APPENDIX A: COMMON AND SCIENTIFIC NAMES, BREEDING STATUS, AND RELATIVE ABUNDANCE OF AVIAN SPECIES RECORDED DURING THE LANDBIRD AND SHOREBIRD SURVEYS, 2014.

Common Name	Scientific Name	Breeding Status[1]	Abundance[2]
Trumpeter Swan[3]	*Cygnus buccinator*	Confirmed[4]	[see SCR 10.15]
American Wigeon[3]	*Anas americana*	Probable[4]	[see SCR 10.15]
Mallard[3]	*Anas platyrhynchos*	Confirmed[4]	[see SCR 10.15]
Blue-winged Teal[3]	*Anas discors*	Unlikely	[see SCR 10.15]
Northern Shoveler[3]	*Anas clypeata*	Confirmed[4]	[see SCR 10.15]
Northern Pintail[3]	*Anas acuta*	Confirmed[4]	[see SCR 10.15]
Green-winged Teal[3]	*Anas crecca*	Probable[4]	[see SCR 10.15]
Ring-necked Duck[3]	*Aythya collaris*	Probable[4]	[see SCR 10.15]
Greater Scaup[3]	*Aythya marila*	Confirmed[4]	[see SCR 10.15]
Lesser Scaup[3]	*Aythya affinis*	Confirmed[4]	[see SCR 10.15]
Harlequin Duck[3]	*Histrionicus histrionicus*	Confirmed[4]	[see SCR 10.15]
Surf Scoter[3]	*Melanitta perspicillata*	Confirmed[4]	[see SCR 10.15]
White-winged Scoter[3]	*Melanitta fusca*	Confirmed[4]	[see SCR 10.15]
Long-tailed Duck[3]	*Clangula hyemalis*	Probable[4]	[see SCR 10.15]
Bufflehead	*Bucephala albeola*	Confirmed[4]	[see SCR 10.15]
Common Goldeneye[3]	*Bucephala clangula*	Probable[4]	[see SCR 10.15]
Barrow's Goldeneye	*Bucephala islandica*	Confirmed[4]	[see SCR 10.15]
Common Merganser	*Mergus merganser*	Confirmed[4]	[see SCR 10.15]
Red-breasted Merganser	*Mergus serrator*	Confirmed[4]	[see SCR 10.15]
Ruffed Grouse	*Bonasa umbellus*	Probable	Rare
Spruce Grouse	*Falcipennis canadensis*	Confirmed	Rare
Willow Ptarmigan	*Lagopus lagopus*	Confirmed	Common
Rock Ptarmigan	*Lagopus muta*	Confirmed	Uncommon
White-tailed Ptarmigan[3]	*Lagopus leucura*	Possible	Rare
Red-throated Loon[3]	*Gavia stellata*	Confirmed[4]	[see SCR 10.15]
Pacific Loon	*Gavia pacifica*	Possible	[see SCR 10.15]
Horned Grebe[3]	*Podiceps auritus*	Confirmed[4]	[see SCR 10.15]
Red-necked Grebe	*Podiceps grisegena*	Confirmed[4]	[see SCR 10.15]
Bald Eagle	*Haliaeetus leucocephalus*	Confirmed[5]	[see ISR and SIR 10.14]

Common Name	Scientific Name	Breeding Status[1]	Abundance[2]
Golden Eagle[3]	*Aquila chrysaetos*	Confirmed[5]	[see ISR and SIR 10.14]
American Golden-Plover[3]	*Pluvialis dominica*	Confirmed	Uncommon
Semipalmated Plover	*Charadrius semipalmatus*	Confirmed	Uncommon
Spotted Sandpiper	*Actitis macularius*	Confirmed	Common
Solitary Sandpiper[3]	*Tringa solitaria*	Probable	Uncommon
Wandering Tattler	*Tringa incana*	Probable	Rare
Greater Yellowlegs	*Tringa melanoleuca*	Unlikely	Rare
Lesser Yellowlegs[3]	*Tringa flavipes*	Confirmed	Uncommon
Whimbrel[3]	*Numenius phaeopus*	Probable	Rare
Surfbird[3]	*Aphriza virgata*	Probable	Uncommon
Least Sandpiper	*Calidris minutilla*	Confirmed	Uncommon
Pectoral Sandpiper	*Calidris melanotos*	Unlikely	Rare
Long-billed Dowitcher	*Limnodromus scolopaceus*	Unlikely	Rare
Wilson's Snipe[3]	*Gallinago delicata*	Confirmed	Common
Red-necked Phalarope	*Phalaropus lobatus*	Probable	Uncommon
Bonaparte's Gull	*Chroicocephalus philadelphia*	Confirmed[4]	Rare
Mew Gull	*Larus canus*	Confirmed[4]	Uncommon
Herring Gull	*Larus argentatus*	Probable[4]	Common
Arctic Tern	*Sterna paradisaea*	Confirmed[4]	Uncommon
Belted Kingfisher	*Megaceryle alcyon*	Probable	Rare
Downy Woodpecker	*Picoides pubescens*	Possible	Rare
American Three-toed Woodpecker	*Picoides dorsalis*	Possible	Rare
Northern Flicker	*Colaptes auratus*	Possible	Uncommon
Peregrine Falcon[3]	*Falco peregrinus*	Confirmed[5]	[see ISR and SIR 10.14]
Olive-sided Flycatcher[3]	*Contopus cooperi*	Confirmed	Uncommon
Western Wood-Pewee[3]	*Contopus sordidulus*	Possible	Rare
Alder Flycatcher	*Empidonax alnorum*	Probable	Uncommon
Say's Phoebe	*Sayornis saya*	Unlikely	Rare
Northern Shrike[3]	*Lanius excubitor*	Possible	Uncommon
Gray Jay	*Perisoreus canadensis*	Confirmed	Common

Common Name	Scientific Name	Breeding Status[1]	Abundance[2]
Black-billed Magpie	*Pica hudsonia*	Possible	Rare
Common Raven	*Corvus corax*	Confirmed	Uncommon
Horned Lark	*Eremophila alpestris*	Confirmed	Uncommon
Tree Swallow	*Tachycineta bicolor*	Probable	Uncommon
Violet-green Swallow	*Tachycineta thalassina*	Confirmed	Uncommon
Bank Swallow	*Riparia riparia*	Confirmed	Uncommon
Cliff Swallow	*Petrochelidon pyrrhonota*	Confirmed	Rare
Black-capped Chickadee	*Poecile atricapillus*	Probable	Uncommon
Boreal Chickadee	*Poecile hudsonicus*	Confirmed	Uncommon
Red-breasted Nuthatch	*Sitta canadensis*	Possible	Rare
Brown Creeper	*Certhia americana*	Possible	Rare
American Dipper[3]	*Cinclus mexicanus*	Confirmed	Uncommon
Ruby-crowned Kinglet	*Regulus calendula*	Confirmed	Abundant
Arctic Warbler	*Phylloscopus borealis*	Confirmed	Uncommon
Northern Wheatear	*Oenanthe oenanthe*	Probable	Uncommon
Townsend's Solitaire	*Myadestes townsendi*	Possible	Uncommon
Gray-cheeked Thrush[3]	*Catharus minimus*	Probable	Common
Swainson's Thrush	*Catharus ustulatus*	Probable	Common
Hermit Thrush	*Catharus guttatus*	Probable	Uncommon
American Robin	*Turdus migratorius*	Confirmed	Common
Varied Thrush[3]	*Ixoreus naevius*	Confirmed	Abundant
American Pipit	*Anthus rubescens*	Probable	Uncommon
Bohemian Waxwing[3]	*Bombycilla garrulus*	Probable	Uncommon
Lapland Longspur	*Calcarius lapponicus*	Probable	Uncommon
Snow Bunting	*Plectrophenax nivalis*	Probable	Uncommon
Northern Waterthrush	*Parkesia noveboracensis*	Confirmed	Uncommon
Orange-crowned Warbler	*Oreothlypis celata*	Confirmed	Uncommon
Yellow Warbler	*Setophaga petechia*	Probable	Rare
Blackpoll Warbler[3]	*Setophaga striata*	Confirmed	Common
Yellow-rumped Warbler	*Setophaga coronata*	Probable	Abundant

Common Name	Scientific Name	Breeding Status[1]	Abundance[2]
Townsend's Warbler[3]	*Setophaga townsendi*	Possible	Rare
Wilson's Warbler	*Cardellina pusilla*	Probable	Common
American Tree Sparrow	*Spizella arborea*	Confirmed	Abundant
Savannah Sparrow	*Passerculus sandwichensis*	Confirmed	Abundant
Fox Sparrow	*Passerella iliaca*	Confirmed	Abundant
Lincoln's Sparrow	*Melospiza lincolnii*	Confirmed	Uncommon
White-crowned Sparrow	*Zonotrichia leucophrys*	Confirmed	Abundant
Golden-crowned Sparrow[3]	*Zonotrichia atricapilla*	Confirmed	Uncommon
Dark-eyed Junco	*Junco hyemalis*	Confirmed	Common
Rusty Blackbird[3]	*Euphagus carolinus*	Confirmed	Uncommon
Pine Grosbeak	*Pinicola enucleator*	Probable	Rare
White-winged Crossbill[3]	*Loxial eucoptera*	Possible	Uncommon
Common Redpoll	*Acanthis flammea*	Probable	Abundant
Pine Siskin	*Spinus pinus*	Probable	Uncommon

Notes:

1. Breeding status follows Andres et al. (1999): ***Confirmed***: definitive observation of nesting, including nest found, adults carrying nesting material and/or food, flightless young. ***Probable***: breeding behavior observations, including pair observed in suitable habitat, territorial or courtship behavior. ***Possible***: individual (male or female) heard or seen in suitable nesting habitat, but no further evidence was noted. ***Unlikely***: male or female observed but did not show evidence of breeding, was not in suitable nesting habitat, or was an obvious migrant (based on range or behavior).
2. Abundance categories adapted from Kessel et al.(1982): ***Abundant***: species occurs in all or nearly all suitable habitats in large numbers. ***Common***: species occurs in nearly all suitable habitats. ***Uncommon***: species occurs regularly, but uses little suitable habitat or not regularly observed in suitable habitat. ***Rare***: species occurs no more than a few times, irregularly, throughout the study area.
3. Species of conservation or management concern, consistent with the *Memorandum of Understanding between the Federal Energy Regulatory Commission and the U.S. Department of the Interior United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds"* (dated March 30, 2011).
4. Breeding status noted in waterbird study (SCR 10.15).
5. Breeding status noted in raptor study (ISR and SIR 10.14).

APPENDIX B: NUMBER OF LANDBIRDS RECORDED IN FOCAL HABITAT TYPES DURING POINT-COUNT SURVEYS, 2014.

	Focal Habitat Type[1]																				
Common Name	Barren	Partially Vegetated	Lacustrine Waters	Dry Graminoid Meadow	Moist Graminoid Meadow	Wet Graminoid Meadow	Dry Dwarf Shrub	Ericaceous Dwarf Shrub	Open Low Shrub	Open Tall Shrub	Closed Low Shrub	Closed Tall Shrub	Dwarf Forest Woodland	Mixed Woodland	Needleleaf Woodland	Open Dwarf Forest	Open Mixed Forest	Open Broadleaf Forest	Open Needleleaf Forest	Closed Broadleaf Forest	Closed Mixed Forest	Closed Needleleaf Forest	Total
Ruffed Grouse																			1				**1**
Spruce Grouse																	1		1				**2**
Willow Ptarmigan					1			6	33	7	4	4											**55**
Rock Ptarmigan							6	8	2														**16**
White-tailed Ptarmigan							1	1															**2**
Downy Woodpecker																			2				**2**
American Three-toed Woodpecker															1		1		1				**3**
Northern Flicker																			4				**4**
Olive-sided Flycatcher									1						20				13				**34**
Alder Flycatcher									2	4		1			3		2		3				**15**
Say's Phoebe							1																**1**
Northern Shrike									1														**1**
Gray Jay									2	4			5	1	68	2	2		103			2	**189**
Black-billed Magpie										1													**1**
Common Raven								1		1		1		1	3		1		3				**11**
Horned Lark					3		5	17	3														**28**
Tree Swallow						1			1							1							**3**
Black-capped Chickadee									1						10		1	1	4		1		**18**
Boreal Chickadee									2		2	1			30		7		22				**64**
Brown Creeper																	1						**1**
Ruby-crowned Kinglet									2	1		1	4	5	229	19	25		334		1	8	**629**
Arctic Warbler									25	17	21	24			11	1			1				**100**
Northern Wheatear								4															**4**
Gray-cheeked Thrush									44	25	24	28	3		109	4	5		92				**334**
Swainson's Thrush												6		5	61		33	1	74				**180**
Hermit Thrush									6	5		4			15	1	2	1	13				**47**
American Robin					3	1	2	7	32	3	2	3	5	1	151	4	4		77				**295**
Varied Thrush									1	4		6	1	4	116	1	20		210	1		3	**367**
American Pipit				1	2		6	42	4	1													**56**
Bohemian Waxwing													2		4				9				**15**
Lapland Longspur					9	8		11	6														**34**
Snow Bunting		2						3															**5**
Northern Waterthrush						1			4	7		12	5		63	6	14		61	1			**174**
Orange-crowned Warbler									13	9	7	14			11		8	1	8				**71**

	Focal Habitat Type[1]																					
Common Name	**Barren**	**Partially Vegetated**	**Lacustrine Waters**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Dry Dwarf Shrub**	**Ericaceous Dwarf Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Closed Low Shrub**	**Closed Tall Shrub**	**Dwarf Forest Woodland**	**Mixed Woodland**	**Needleleaf Woodland**	**Open Dwarf Forest**	**Open Mixed Forest**	**Open Broadleaf Forest**	**Open Needleleaf Forest**	**Closed Broadleaf Forest**	**Closed Mixed Forest**	**Closed Needleleaf Forest**	**Total**
Yellow Warbler									5	5		1			1	1							**13**
Blackpoll Warbler		1				1		2	30	28	17	33	2	2	80	4	12	3	81	1			**297**
Yellow-rumped Warbler						3			6	3	2	8	4	3	211	10	48	2	229	2		5	**536**
Townsend's Warbler																	1						**1**
Wilson's Warbler	3				2	1		6	144	73	40	73	1	1	133	5	5	1	69	1			**558**
American Tree Sparrow	1				1	2		14	182	27	50	23	3		20	2			9				**334**
Savannah Sparrow	2	5		1	26	29	1	82	228	19	47	17	10		104	17	1		57			1	**647**
Fox Sparrow								13	118	58	32	58	9	5	354	20	14	1	404			12	**1,098**
Lincoln's Sparrow						9			5	2		1	1		18	1			12				**49**
White-crowned Sparrow					6	7		38	292	40	59	30	18	2	333	18	3		214			1	**1,061**
Golden-crowned Sparrow					1			19	19	3	2	4											**48**
Dark-eyed Junco						1		2	24	21	1	6	2	1	167	3	19		232	1		8	**488**
Rusty Blackbird						4						1			5	1			11				**22**
Pine Grosbeak													1						4				**5**
White-winged Crossbill															40		2		92				**134**
Common Redpoll	4				1		2	22	49	44	8	39	5		141	4	33	1	141				**494**
Pine Siskin																			1				**1**
Total	**10**	**8**	**0**	**2**	**55**	**68**	**24**	**298**	**1,287**	**412**	**318**	**399**	**81**	**31**	**2,512**	**125**	**265**	**12**	**2,592**	**7**	**2**	**40**	**8,548**

Notes:

1. Focal habitats are the primary habitats surveyed at each point-count plot, represented by the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and partially vegetated areas and lacustrine waters (see text).
2. Only observations in which the habitat being used could be determined are included.

APPENDIX C: AVERAGE OCCURRENCE OF LANDBIRD SPECIES IN FOCAL HABITAT TYPES, CALCULATED FROM POINT-COUNT SURVEY DATA, 2014.

		Focal Habitat Type[2]																				
Common Name	*n*[3]	Barren	Partially Vegetated	Lacustrine Waters	Dry Graminoid Meadow	Moist Graminoid Meadow	Wet Graminoid Meadow	Dry Dwarf Shrub	Ericaceous Dwarf Shrub	Open Low Shrub	Open Tall Shrub	Closed Low Shrub	Closed Tall Shrub	Dwarf Forest Woodland	Mixed Woodland	Needleleaf Woodland	Open Dwarf Forest	Open Mixed Forest	Open Broadleaf Forest	Open Needleleaf Forest	Closed Broadleaf Forest	Closed Mixed Forest	Closed Needleleaf Forest	Total
Ruffed Grouse	1																			0.003				**<0.001**
Spruce Grouse	2																	0.028		0.003				**0.002**
Willow Ptarmigan	55					0.043			0.061	0.148	0.140	0.100	0.08											**0.046**
Rock Ptarmigan	16							0.600	0.081	0.009														**0.013**
White-tailed Ptarmigan	2							0.100	0.010															**0.002**
Downy Woodpecker	2																			0.007				**0.002**
American Three-toed Woodpecker	3															0.004		0.028		0.003				**0.002**
Northern Flicker	4																			0.013				**0.003**
Olive-sided Flycatcher	34									0.004						0.070				0.043				**0.028**
Alder Flycatcher	16									0.009	0.080		0.02			0.011		0.056		0.010				**0.013**
Say's Phoebe	1							0.100																**<0.001**
Northern Shrike	1									0.004														**<0.001**
Gray Jay	189									0.009	0.080			0.357	0.200	0.239	0.111	0.056		0.344			0.250	**0.157**
Black-billed Magpie	1										0.020													**<0.001**
Common Raven	11								0.010		0.020		0.020		0.200	0.011		0.028		0.010				**0.009**
Horned Lark	28					0.130		0.500	0.172	0.013														**0.023**
Tree Swallow	3						0.028			0.004							0.056							**0.002**
Black-capped Chickadee	18									0.004						0.035		0.028	0.333	0.013		1.000		**0.015**
Boreal Chickadee	64									0.009		0.050	0.020			0.106		0.194		0.074				**0.053**
Brown Creeper	1																	0.028						**<0.001**
Ruby-crowned Kinglet	629									0.009	0.020		0.020	0.286	1.000	0.806	1.056	0.694		1.117		1.000	1.000	**0.521**
Arctic Warbler	100									0.112	0.340	0.525	0.480			0.039	0.056			0.003				**0.083**
Northern Wheatear	4								0.040															**0.003**
Gray-cheeked Thrush	334									0.197	0.500	0.600	0.560	0.214		0.384	0.222	0.139		0.308				**0.277**
Swainson's Thrush	180												0.120		1.000	0.215		0.917	0.333	0.247				**0.149**
Hermit Thrush	47									0.027	0.100		0.080			0.053	0.056	0.056	0.333	0.043				**0.039**
American Robin	295					0.130	0.028	0.200	0.071	0.143	0.060	0.05	0.060	0.357	0.200	0.532	0.222	0.111		0.258				**0.244**
Varied Thrush	367									0.004	0.08		0.120	0.071	0.800	0.408	0.056	0.556		0.702	1.000		0.375	**0.304**
American Pipit	56				1.000	0.087		0.600	0.424	0.018	0.02													**0.046**
Bohemian Waxwing	15													0.143		0.014				0.030				**0.012**
Lapland Longspur	34					0.391	0.222		0.111	0.027														**0.028**
Snow Bunting	5		0.667						0.030															**0.004**
Northern Waterthrush	174						0.028			0.018	0.14		0.240	0.357		0.222	0.333	0.389		0.204	1.000			**0.144**
Orange-crowned Warbler	71									0.058	0.18	0.175	0.280			0.039		0.222	0.333	0.027				**0.059**
Yellow Warbler	13									0.022	0.1		0.020			0.004	0.056							**0.011**

		Focal Habitat Type[2]																					
Common Name	***n*[3]**	**Barren**	**Partially Vegetated**	**Lacustrine Waters**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Dry Dwarf Shrub**	**Ericaceous Dwarf Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Closed Low Shrub**	**Closed Tall Shrub**	**Dwarf Forest Woodland**	**Mixed Woodland**	**Needleleaf Woodland**	**Open Dwarf Forest**	**Open Mixed Forest**	**Open Broadleaf Forest**	**Open Needleleaf Forest**	**Closed Broadleaf Forest**	**Closed Mixed Forest**	**Closed Needleleaf Forest**	**Total**
Blackpoll Warbler	297		0.333				0.028		0.020	0.135	0.56	0.425	0.660	0.143	0.400	0.282	0.222	0.333	1.000	0.271	1.000			**0.246**
Yellow-rumped Warbler	536						0.083			0.027	0.06	0.05	0.160	0.286	0.600	0.743	0.556	1.333	0.667	0.766	2.000		0.625	**0.444**
Townsend's Warbler	1																	0.028						**<0.001**
Wilson's Warbler	558	1.500				0.087	0.028		0.061	0.646	1.46	1	1.460	0.071	0.200	0.468	0.278	0.139	0.333	0.231	1.000			**0.462**
American Tree Sparrow	334	0.500				0.043	0.056		0.141	0.816	0.54	1.25	0.460	0.214		0.07	0.111			0.030				**0.277**
Savannah Sparrow	647	1.000	1.667		1.000	1.13	0.806	0.100	0.828	1.022	0.38	1.175	0.340	0.714		0.366	0.944	0.028		0.191			0.125	**0.536**
Fox Sparrow	1098								0.131	0.529	1.16	0.8	1.160	0.643	1.000	1.246	1.111	0.389	0.333	1.351			1.500	**0.910**
Lincoln's Sparrow	49						0.250			0.022	0.04		0.020	0.071		0.063	0.056			0.040				**0.041**
White-crowned Sparrow	1061					0.261	0.194		0.384	1.309	0.8	1.475	0.600	1.286	0.400	1.173	1.000	0.083		0.716			0.125	**0.879**
Golden-crowned Sparrow	48					0.043			0.192	0.085	0.06	0.05	0.080											**0.040**
Dark-eyed Junco	488						0.028		0.020	0.108	0.42	0.025	0.120	0.143	0.200	0.588	0.167	0.528		0.776	1.000		1.000	**0.404**
Rusty Blackbird	22						0.111						0.020			0.018	0.056			0.037				**0.018**
Pine Grosbeak	5													0.071						0.013				**0.004**
White-winged Crossbill	134															0.141		0.056		0.308				**0.111**
Common Redpoll	494	2.000				0.043		0.200	0.222	0.220	0.880	0.200	0.780	0.357		0.496	0.222	0.917	0.333	0.472				**0.409**
Pine Siskin	1																			0.003				**<0.001**
Total Average Occurrence		**5.000**	**2.667**	**0**	**2.000**	**2.391**	**1.889**	**2.400**	**3.010**	**5.771**	**8.240**	**7.950**	**7.980**	**5.786**	**6.200**	**8.845**	**6.944**	**7.361**	**4.000**	**8.669**	**7.000**	**2.000**	**5.000**	**7.083**
No. Point-count Plots		**2**	**3**	**1**	**1**	**23**	**36**	**10**	**99**	**223**	**50**	**40**	**50**	**14**	**5**	**284**	**18**	**36**	**3**	**299**	**1**	**1**	**8**	**1,207**
Species Richness		**4**	**3**	**0**	**2**	**11**	**13**	**8**	**19**	**32**	**26**	**16**	**26**	**18**	**12**	**30**	**21**	**26**	**9**	**35**	**6**	**2**	**8**	**51**

Notes:

1. Average occurrence = total number of detections in each habitat/total number of point-count plots surveyed in each habitat.
2. Focal habitats are the primary habitats surveyed at each point-count plot, represented by the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and partially vegetated areas and lacustrine waters (see text).
3. *n* = total number of observations.
4. Only observations in which the habitat being used could be determined are included.

APPENDIX D: NUMBER OF SHOREBIRDS RECORDED IN FOCAL HABITAT TYPES DURING POINT-COUNT SURVEYS, 2014.

	Focal Habitat Type[1]																					
Common Name	**Barren**	**Partially Vegetated**	**Lacustrine waters**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Dry Dwarf Shrub**	**Ericaceous Dwarf Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Closed Low Shrub**	**Closed Tall Shrub**	**Dwarf Forest Woodland**	**Mixed Woodland**	**Needleleaf Woodland**	**Open Dwarf Forest**	**Open Mixed Forest**	**Open Broadleaf Forest**	**Open Needleleaf Forest**	**Closed Broadleaf Forest**	**Closed Mixed Forest**	**Closed Needleleaf Forest**	**Total**
American Golden-Plover	2				9		2	15	2														**30**
Semipalmated Plover	3							1															**4**
Spotted Sandpiper																	1						**1**
Solitary Sandpiper						1													1				**2**
Wandering Tattler	1																						**1**
Greater Yellowlegs						2																	**2**
Lesser Yellowlegs						5		1	8	1					7				4				**26**
Whimbrel					3				5														**8**
Surfbird							1																**1**
Least Sandpiper					1	6			5						1								**13**
Long-billed Dowitcher									6														**6**
Wilson's Snipe						5		1	22	3	2	1	3		30	2	3		14				**86**
Red-necked Phalarope						2																	**2**
Total	**6**	**0**	**0**	**0**	**13**	**21**	**3**	**18**	**48**	**4**	**2**	**1**	**3**	**0**	**38**	**2**	**4**	**0**	**19**	**0**	**0**	**0**	**182**

Notes:

1. Focal habitats are the primary habitats surveyed at each point-count plot, represented by the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and partially vegetated areas and lacustrine waters (see text).
2. Only observations in which the habitat being used could be determined are included.

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APPENDIX E: AVERAGE OCCURRENCE OF SHOREBIRD SPECIES IN FOCAL HABITAT TYPES, CALCULATED FROM POINT-COUNT SURVEY DATA, 2014.

		Focal Habitat Type[2]																				
Common Name	***n*[3]**	**Barren**	**Partially Vegetated**	**Lacustrine waters**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Dry Dwarf Shrub**	**Ericaceous Dwarf Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Closed Low Shrub**	**Closed Tall Shrub**	**Dwarf Forest Woodland**	**Mixed Woodland**	**Needleleaf Woodland**	**Open Dwarf Forest**	**Open Mixed Forest**	**Open Broadleaf Forest**	**Open Needleleaf Forest**	**Closed Broadleaf Forest**	**Closed Mixed Forest**	**Closed Needleleaf Forest**	**Total**
American Golden-Plover	30	1.000				0.391		0.200	0.152	0.009														**0.025**
Semipalmated Plover	4	1.500							0.010															**0.003**
Spotted Sandpiper	1																	0.028						**<0.001**
Solitary Sandpiper	2						0.028													0.003				**0.002**
Wandering Tattler	1	0.500																						**<0.001**
Greater Yellowlegs	2						0.056																	**0.002**
Lesser Yellowlegs	26						0.139		0.010	0.036	0.020					0.025				0.013				**0.022**
Whimbrel	8					0.130				0.022														**0.007**
Surfbird	1							0.100																**<0.001**
Least Sandpiper	13					0.043	0.167			0.022						0.004								**0.011**
Long-billed Dowitcher	6									0.027														**0.005**
Wilson's Snipe	86						0.139		0.010	0.099	0.060	0.050	0.020	0.214		0.106	0.111	0.083		0.047				**0.071**
Red-necked Phalarope	2						0.056																	**0.002**
Total Average Occurrence		**3.000**	**0**	**0**	**0**	**0.565**	**0.583**	**0.300**	**0.182**	**0.215**	**0.080**	**0.050**	**0.020**	**0.214**	**0**	**0.134**	**0.111**	**0.111**	**0**	**0.064**	**0**	**0**	**0**	**0.151**
No. Point-count Plots		**2**	**3**	**1**	**1**	**23**	**36**	**10**	**99**	**223**	**50**	**40**	**50**	**14**	**5**	**284**	**18**	**36**	**3**	**299**	**1**	**1**	**8**	**1207**
Species Richness		**3**	**0**	**0**	**0**	**3**	**6**	**2**	**4**	**6**	**2**	**1**	**1**	**1**	**0**	**3**	**1**	**2**	**0**	**3**	**0**	**0**	**0**	**13**

Notes:

1. Average occurrence = total number of detections in each habitat/total number of point-count plots surveyed in each habitat.
2. Focal habitats are the primary habitats surveyed at each point-count plot, represented by the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and partially vegetated areas and lacustrine waters (see text).
3. *n* = total number of observations.
4. Only observations in which the habitat being used could be determined are included.

APPENDIX F: LINEAR DENSITIES (BIRDS PER KILOMETER OF STREAM LENGTH) RECORDED DURING RIVERINE-FOCUSED TRANSECT SURVEYS ALONG THE SUSITNA RIVER AND TRIBUTARY STREAMS, 2014.

	Susitna River Transects[1]										Tributary Transects[2]				Combined Tributary/Susitna River Transects						
Common Name	**PRM 183-223**	**PRM 192**	**PRM 200-204**	**PRM 201-206**	**PRM 211-218**	**PRM 216-218**	**PRM 219-225**	**PRM 229–236**	**Susitna Average**		**Deadman Creek**	**Watana Creek**	**Tributary Average**		**Tsusena Creek/ PRM 180-184**	**Creek PRM 194/ PRM 194-196**	**Kosina Creek/ PRM 208-210**	**Creek PRM 228/ PRM 226-230**	**Goose Creek/ PRM 228-233**	**Tributary/ Susitna Average**	**Total**
Mallard			0.493						0.062												0.021
Blue-Winged Teal																0.335				0.067	0.021
Harlequin Duck	0.548	1.563		1.235		0.762	0.342	0.079	0.566		0.939	4	2.470		0.795	0.223	2.502	0.117	0.391	0.806	0.657
Common Goldeneye			0.328						0.041												0.014
Common Merganser	0.548			0.561		0.381			0.186												0.121
Red-breasted Merganser	0.411							0.079	0.061		0.104		0.052				0.152			0.030	0.071
Unidentified merganser																		0.117		0.023	0.007
Unidentified duck	0.685							0.158	0.105		0.104		0.052								0.093
Mew Gull	0.068		0.164	0.112					0.043												0.021
Herring Gull			0.328	0.561	0.233	0.095	0.171	0.079	0.183		0.104		0.052			0.112	0.227	0.117		0.091	0.143
Waterbird Total	**2.260**	**1.563**	**1.314**	**2.469**	**0.233**	**1.238**	**0.512**	**0.396**	**1.248**		**1.253**	**4**	**2.626**		**0.795**	**0.670**	**2.881**	**0.352**	**0.391**	**1.018**	**1.171**
Bald Eagle				0.068	0.171		0.095		0.042		0.209		0.104			0.112			0.152	0.053	0.064
Golden Eagle	0.079						0.095		0.022										0.076	0.015	0.021
Peregrine Falcon	0.079								0.010							0.223			0.152	0.075	0.036
Unidentified Raptor																		0.098		0.020	0.007
Raptor Total	**0.158**			**0.068**	**0.171**		**0.190**		**0.074**		**0.209**		**0.104**			**0.335**		**0.098**	**0.379**		**0.129**
Spotted Sandpiper	2.397	4.688	2.791	1.459	3.652	3.048	2.989	1.108	2.767		0.313	4	2.157		3.092	2.346	1.744	1.758	1.074	2.003	2.179
Solitary Sandpiper											0.104		0.052		0.177					0.035	0.029
Lesser Yellowlegs	0.068			0.112					0.023												0.014
Least Sandpiper	0.137								0.017						0.088					0.018	0.021
Wilson's Snipe															0.088					0.018	0.007
Unidentified shorebird				0.112					0.014												0.007
Shorebird Total	**2.671**	**4.688**	**2.791**	**1.684**	**3.652**	**3.048**	**2.989**	**1.108**	**2.829**		**0.418**	**4**	**2.209**		**3.445**	**2.346**	**1.744**	**1.758**	**1.074**	**2.074**	**2.250**
Bald Eagle				0.068	0.171		0.095		0.042		0.209		0.104			0.112			0.152	0.053	0.064
Golden Eagle	0.079						0.095		0.022										0.076	0.015	0.021
Peregrine Falcon	0.079								0.010							0.223			0.152	0.075	0.036
Unidentified Raptor																		0.098		0.020	0.007
Raptor Total	**0.158**			**0.068**	**0.171**		**0.190**		**0.074**		**0.209**		**0.104**			**0.335**		**0.098**	**0.379**		**0.129**
Willow Ptarmigan											0.104		0.052								0.007

	Susitna River Transects[1]										Tributary Transects[2]				Combined Tributary/Susitna River Transects						
Common Name	PRM 183-223	PRM 192	PRM 200-204	PRM 201-206	PRM 211-218	PRM 216-218	PRM 219-225	PRM 229–236	Susitna Average		Deadman Creek	Watana Creek	Tributary Average		Tsusena Creek/ PRM 180-184	Creek PRM 194/ PRM 194-196	Kosina Creek/ PRM 208-210	Creek PRM 228/ PRM 226-230	Goose Creek/ PRM 228-233	Tributary/ Susitna Average	Total
Belted Kingfisher											0.209		0.104						0.195	0.039	0.029
American Three-toed Woodpecker	0.068			0.112					0.023												0.014
Olive-sided Flycatcher					0.078				0.010		0.104		0.052				0.076			0.015	0.021
Western Wood-Pewee			0.164						0.021												0.007
Alder Flycatcher	0.274		0.493		0.544		0.085		0.174								0.379			0.076	0.143
Gray Jay				0.112	0.155	0.095			0.045						0.265	0.335		0.352		0.190	0.093
Common Raven					0.078	0.095			0.022						0.088					0.018	0.021
Tree Swallow																0.223				0.045	0.014
Violet-green Swallow																	0.379			0.076	0.036
Bank Swallow	1.575				1.943	0.095	0.256		0.484								0.455			0.091	0.414
Cliff Swallow	0.342				0.389				0.091												0.071
Unidentified swallow											0.313		0.157				0.910			0.182	0.107
Boreal Chickadee						0.095			0.012							0.223		0.117		0.068	0.029
Unidentified chickadee															0.088					0.018	0.007
American Dipper				0.224					0.028						0.088		0.076	0.117		0.056	0.036
Ruby-crowned Kinglet	0.205		0.328	1.235	0.389	0.857	0.085		0.387		0.522		0.261		2.120	1.117	0.076	0.234	0.293	0.768	0.543
Gray-cheeked Thrush		1.563		1.122					0.336		0.626		0.313		0.088	0.559	0.076		0.488	0.242	0.207
Swainson's Thrush	0.068		0.328	1.235	0.466	0.476	0.342	0.238	0.394		0.313		0.157		2.208	0.670	0.152	0.352	0.781	0.833	0.564
Hermit Thrush			1.314	0.898	0.311	0.286			0.351						0.530	0.112	0.455	0.586		0.337	0.293
American Robin	0.068								0.009		0.418		0.209			0.112				0.022	0.043
Varied Thrush	0.137		0.985	0.898		0.762	0.171	0.079	0.379		0.418		0.209		1.502	0.670	0.303	0.117	0.684	0.655	0.471
Unidentified thrush				0.337					0.042												0.021
Bohemian Waxwing																0.559	0.076		0.391	0.205	0.071
Northern Waterthrush	0.548	1.563	0.164	4.153	1.010		0.854	0.079	1.046		0.835		0.418		3.004	2.011	0.834	0.703	1.855	1.682	1.193
Orange-crowned Warbler															0.795					0.159	0.064
Yellow Warbler			0.493						0.062												0.021
Blackpoll Warbler	0.274		0.164	0.786	0.311	0.952	0.512	0.317	0.415		2.610	4	3.305		1.855	2.458	0.682	0.586	1.074	1.331	0.929
Yellow-rumped Warbler	0.274		0.328	0.786	0.389	1.429		0.238	0.430		0.731		0.365		1.855	0.782	0.834	0.117	0.098	0.737	0.600
Wilson's Warbler	0.205	1.563	0.328	1.010	0.699		0.769	0.554	0.641		0.209		0.104			1.117	0.910	1.407	0.586	0.804	0.586
Unidentified warbler											0.104		0.052								0.007
American Tree Sparrow													0.24								0.95
Savannah Sparrow	0.205		0.493		1.010	0.190	0.512		0.344		0.313		0.157		0.088		0.227	0.469	0.195	0.245	0.286

	Susitna River Transects[1]										Tributary Transects[2]				Combined Tributary/Susitna River Transects						
Common Name	PRM 183-223	PRM 192	PRM 200-204	PRM 201-206	PRM 211-218	PRM 216-218	PRM 219-225	PRM 229–236	Susitna Average		Deadman Creek	Watana Creek	Tributary Average		Tsusena Creek/ PRM 180-184	Creek PRM 194/ PRM 194-196	Kosina Creek/ PRM 208-210	Creek PRM 228/ PRM 226-230	Goose Creek/ PRM 228-233	Tributary/ Susitna Average	Total
Fox Sparrow	0.411		0.328	2.132	0.855	0.667	0.854	0.317	0.695		1.044		0.522		0.883	1.229	0.910	1.407	1.074	1.101	0.893
Lincoln's Sparrow					0.078	0.095	0.085		0.032												0.021
White-crowned Sparrow	0.479		0.328	0.673	0.622	0.381	0.342		0.353		1.670		0.835		0.177	0.559		0.352	0.781	0.374	0.464
Unidentified sparrow											0.313		0.157								0.021
Dark-eyed Junco	0.137		0.164	0.449	0.233	0.476	0.085	0.238	0.223			8	4		0.795	0.335	0.227	0.703	0.684	0.549	0.350
White-winged Crossbill					0.078		0.085	0.079	0.030							0.223				0.045	0.036
Common Redpoll	0.411		0.328	0.786	0.155				0.210		0.313		0.157		1.237	0.112				0.270	0.250
Unidentified redpoll						0.095			0.012								0.076			0.015	0.014
Landbird Total	**2.138**	**9.790**	**16.947**	**5.685**	**5.038**	**4.688**	**7.048**	**6.732**	**7.258**		**11.169**	**12**	**11.585**		**7.620**	**13.408**	**17.668**	**9.180**	**8.112**	**11.198**	**9.000**
Grand Total	**10.68**	**10.94**	**10.84**	**21.10**	**13.68**	**11.52**	**8.71**	**3.80**	**11.41**		**13.05**	**20.00**	**16.52**		**21.91**	**16.76**	**13.12**	**9.73**	**10.74**	**14.45**	**12.56**

Notes:

1. Susitna River transects labeled according to the Project River Miles (PRMs) encompassed on each transect.
2. Unnamed creeks labeled according to the PRM at the confluence with the Susitna River.

APPENDIX G: TOTAL NUMBER OF BIRDS OBSERVED (*n*) AND PERCENTAGE OF OBSERVATIONS MADE BY HABITAT TYPE DURING RIVERINE-FOCUSED TRANSECT SURVEYS, 2014.

		Percent Occurrence[1] by Habitat Type[2]																		
Species	***n***	**Disturbance Complex**	**Barren**	**Riverine Waters**	**Dry Forb Meadow**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Closed Low Shrub**	**Open Low Shrub**	**Closed Tall Shrub**	**Open Tall Shrub**	**Closed Dwarf Forest**	**Open Dwarf Forest**	**Open Broadleaf Forest**	**Closed Mixed Forest**	**Open Mixed Forest**	**Mixed Woodland**	**Closed Needleleaf Forest**	**Open Needleleaf Forest**	**Needleleaf Woodland**
Mallard	3			100																	
Blue-winged Teal	3			100																	
Harlequin Duck	92		1.09	98.91																	
Common Goldeneye	2			100																	
Common Merganser	13			100																	
Red-breasted Merganser	10		10	80				10													
Unidentified merganser	1			100																	
Unidentified duck	13			100																	
Mew Gull	3			100																	
Herring Gull	14		7.14	92.86																	
Waterbird Total	**154**		**1.95**	**97.40**				**0.65**													
Bald Eagle	8			25													62.5				12.5
Golden Eagle	1			100																	
Peregrine Falcon	5		20	80																	
Unidentified raptor	1																	100			
Raptor Total	**15**		**6.67**	**46.67**													**33.33**	**6.67**			**6.67**
Spotted Sandpiper	305		32.79	56.72	1.31	0.33	0.98	0.33		5.57		0.66		0.98						0.33	
Solitary Sandpiper	4			50					50												
Lesser Yellowlegs	2		50	50																	
Least Sandpiper	3			33.33								66.67									
Unidentified shorebird	1			100																	
Shorebird Total	**315**		**32.06**	**56.51**	**1.27**	**0.32**	**0.95**	**0.32**	**0.63**	**5.40**		**1.27**		**0.95**						**0.32**	
Willow Ptarmigan	1									100											
Belted Kingfisher	4			50																	50
American Three-toed Woodpecker	2																50		50		
Olive-sided Flycatcher	3																66.67				33.33
Western Wood-Pewee	1																100				
Alder Flycatcher	20											25					50	5		15	5
Gray Jay	13									7.69					15.38		69.23			7.69	
Common Raven	1			100																	

		Percent Occurrence[1] by Habitat Type[2]																		
Species	*n*	Disturbance Complex	Barren	Riverine Waters	Dry Forb Meadow	Dry Graminoid Meadow	Moist Graminoid Meadow	Wet Graminoid Meadow	Closed Low Shrub	Open Low Shrub	Closed Tall Shrub	Open Tall Shrub	Closed Dwarf Forest	Open Dwarf Forest	Open Broadleaf Forest	Closed Mixed Forest	Open Mixed Forest	Mixed Woodland	Closed Needleleaf Forest	Open Needleleaf Forest	Needleleaf Woodland
Tree Swallow	2													100							
Violet-green Swallow	5		100																		
Bank Swallow	58		12.07	87.93																	
Cliff Swallow	10			100																	
Unidentified swallow	15			86.67																	13.33
Boreal Chickadee	4																75			25	
Unidentified chickadee	1																100				
American Dipper	5		20	80																	
Ruby-crowned Kinglet	75																56		2.67	37.33	4
Gray-cheeked Thrush	29										3.45				3.45		27.59			41.38	24.14
Swainson's Thrush	77			1.30													54.55			38.96	5.19
Hermit Thrush	41														2.44		73.17			24.39	
American Robin	6			16.67						16.67							33.33				33.33
Varied Thrush	65										1.54						60	1.54		33.85	3.08
Unidentified thrush	3																33.33			66.67	
Bohemian Waxwing	6																33.33			66.67	
Northern Waterthrush	167			1.20						1.80	0.60	1.20			2.99		53.29	2.40	1.20	29.94	5.39
Orange-crowned Warbler	9																100				
Yellow Warbler	3											100									
Blackpoll Warbler	130	1.54							1.54	3.08		1.54			0.77		44.62		1.54	29.23	16.15
Yellow-rumped Warbler	83									2.41		1.20					60.24		2.41	22.89	10.84
Wilson's Warbler	81									3.70	1.23	1.23			3.70		46.91		1.23	30.86	11.11
Unidentified warbler	1																				100
Savannah Sparrow	40		5		2.5		2.5			45		2.5					12.5	5		17.5	7.5
Fox Sparrow	120								0.83		0.83	1.67	0.83		2.50	1.67	52.50		0.83	26.67	11.67
Lincoln's Sparrow	3																66.67				33.33
White-crowned Sparrow	65	1.54		4.62					3.08	6.15	3.08	9.23	1.54	3.08	1.54		15.38			36.92	13.85
Unidentified sparrow	3			33.33																	66.67
Dark-eyed Junco	48		4.17						2.08			4.17					52.08			33.33	4.17
White-winged Crossbill	3																66.67			33.33	
Common Redpoll	15																46.67			46.67	6.67

		Percent Occurrence[1] by Habitat Type[2]																		
Species	***n***	**Disturbance Complex**	**Barren**	**Riverine Waters**	**Dry Forb Meadow**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Closed Low Shrub**	**Open Low Shrub**	**Closed Tall Shrub**	**Open Tall Shrub**	**Closed Dwarf Forest**	**Open Dwarf Forest**	**Open Broadleaf Forest**	**Closed Mixed Forest**	**Open Mixed Forest**	**Mixed Woodland**	**Closed Needleleaf Forest**	**Open Needleleaf Forest**	**Needleleaf Woodland**
Unidentified redpoll	2																100				
Landbird Total	**1220**	**0.25**	**1.39**	**7.30**	**0.08**		**0.08**		**0.49**	**3.03**	**0.57**	**2.05**	**0.16**	**0.33**	**1.39**	**0.16**	**45.33**	**0.66**	**0.90**	**27.21**	**8.61**
Grand Total	**1704**	**0.74**	**42.07**	**207.87**	**1.35**	**0.32**	**1.03**	**0.97**	**1.13**	**8.43**	**0.57**	**2.83**	**0.16**	**1.28**	**1.39**	**0.16**	**78.66**	**7.32**	**0.90**	**27.53**	**15.27**

Notes:

1. Percent-occurrence values for habitats exclude birds in flight that were transiting through the area and observations in which the habitat being used could not be determined.
2. Habitat types are the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and disturbed areas and riverine waters (see text).

APPENDIX H: NUMBER OF LANDBIRDS AND SHOREBIRDS OBSERVED IN FOCAL HABITAT TYPES DURING POINT-COUNT SURVEYS IN BOTH STUDY YEARS (2013 AND 2014) COMBINED.

	Focal Habitat Type[1]																					
Common Name	Barren	Partially Vegetated	Dry Graminoid Meadow	Moist Graminoid Meadow	Wet Graminoid Meadow	Dry Dwarf Shrub	Ericaceous Dwarf Shrub	Wet Dwarf Shrub	Open Low Shrub	Open Tall Shrub	Closed Low Shrub	Closed Tall Shrub	Dwarf Forest Woodland	Open Dwarf Forest	Broadleaf Woodland	Needleleaf Woodland	Mixed Woodland	Open Broadleaf Forest	Open Needleleaf Forest	Open Mixed Forest	Closed Broadleaf Forest	Closed Needleleaf Forest	Closed Mixed Forest	Total
Fox Sparrow					1	2	26	7	225	125	93	109	27	34	1	629	19	12	888	61	2	30	6	**2297**
White-crowned Sparrow		4	1	11	11	2	85	7	522	82	194	41	42	41	1	506	4		469	14		8	1	**2046**
Yellow-rumped Warbler					7		3		18	13	10	24	9	13	5	332	25	14	536	191	3	13	26	**1242**
Savannah Sparrow	3	15	6	65	46	3	182	3	445	36	140	26	17	19		129	1		92	1		3		**1232**
Ruby-crowned Kinglet									7	3	6	2	8	26		353	15	3	633	68		24	8	**1156**
Varied Thrush									9	19	3	21	7	4	1	238	21	10	520	105	2	15	28	**1003**
Wilson's Warbler	4			2	7		16		230	101	86	128	3	5	2	193	7	6	168	34	1	1	8	**1002**
Dark-eyed Junco					1	1	5		35	29	12	12	6	11	2	278	11	5	476	84	2	14	8	**992**
American Tree Sparrow	1	1		8	9		38		485	50	164	40	5	2		35		4	33			1		**876**
Blackpoll Warbler		1			10		4		65	49	32	59	4	9	1	146	15	8	205	79	1	4	6	**698**
Gray-cheeked Thrush		1			2		12	1	97	53	42	55	6	7	2	195	2	1	186	23		4	2	**691**
Common Redpoll	4	0	0	1	0	2	24	0	63	51	11	49	8	4	1	169	5	8	188	58	0	1	6	**653**
American Robin		1		3	2	2	13	1	52	17	4	7	5	8		233	4		192	12	1	2	5	**564**
Swainson's Thrush					5					7		19	1		2	95	14	6	204	130		4	36	**523**
Northern Waterthrush					6				9	12	4	32	5	6	3	118	7	5	139	65	3	6	14	**434**
Gray Jay									4	4			5	6		91	4		196	12		2		**324**
Hermit Thrush		1			8		1		13	17	2	25		1	1	35	13	3	51	30			3	**204**
Wilson's Snipe					8		5	1	44	5	6	3	3	3		45	1	2	47	12	1	1	7	**194**
Arctic Warbler							2		69	22	39	30		1		12			5					**180**
White-winged Crossbill														2		43			130	2				**177**
Golden-crowned Sparrow		6	2	1	1		51	2	36	18	8	13			1	6	4	1	1	9				**160**
American Pipit	4	16	1	30	1	3	87	1	8	1						1								**153**
Boreal Chickadee									2		2	2				50			69	15		1	4	**145**
Orange-crowned Warbler									23	12	7	22			1	20	4	1	24	19			3	**136**
Horned Lark	2	19	3	28	1	9	59	1	6															**128**
Willow Ptarmigan	1			1	5		10		76	8	17	5				1		1	3					**128**
Lincoln's Sparrow					9				13	2	6	1	1	5		42			28	1				**108**
Olive-sided Flycatcher							1		1			2	1			39	2		45					**91**
Bohemian Waxwing									3	2			4	2		33			26					**70**
American Golden-Plover		7	2	22		5	32		1															**69**
Lapland Longspur				15	7	1	27		8															**58**
Lesser Yellowlegs					7		2		11	1						13			16	1		1		**52**
Rock Ptarmigan	2	6		9		7	19	2	2															**47**
Rusty Blackbird					8							1		3		9			16	2		1		**40**
Snow Bunting		21				2	12																	**35**

	Focal Habitat Type[1]																						
Common Name	**Barren**	**Partially Vegetated**	**Dry Graminoid Meadow**	**Moist Graminoid Meadow**	**Wet Graminoid Meadow**	**Dry Dwarf Shrub**	**Ericaceous Dwarf Shrub**	**Wet Dwarf Shrub**	**Open Low Shrub**	**Open Tall Shrub**	**Closed Low Shrub**	**Closed Tall Shrub**	**Dwarf Forest Woodland**	**Open Dwarf Forest**	**Broadleaf Woodland**	**Needleleaf Woodland**	**Mixed Woodland**	**Open Broadleaf Forest**	**Open Needleleaf Forest**	**Open Mixed Forest**	**Closed Broadleaf Forest**	**Closed Needleleaf Forest**	**Closed Mixed Forest**	**Total**
Black-capped Chickadee									1	1		1				13		2	4	11			1	**34**
Alder Flycatcher									3	4	1	1				3	2		3	10				**27**
Northern Flicker																5		2	13	2				**22**
Least Sandpiper				1	10				6					1		1			1			1		**21**
Yellow Warbler									6	6		1		1		1			3					**18**
Semipalmated Plover		11		1			2																	**14**
Pine Siskin																			1	12				**13**
Common Raven		1					1			1		1				3	1		3	1				**12**
Northern Wheatear		1		3			8																	**12**
Pine Grosbeak													1			1			5					**7**
Solitary Sandpiper					1											4			2					**7**
Spruce Grouse																			4	3				**7**
American Three-toed Woodpecker																2			3	1				**6**
Long-billed Dowitcher									6															**6**
Whimbrel				3					3															**6**
Downy Woodpecker																			4					**4**
Red-necked Phalarope					4																			**4**
Tree Swallow					1				1					2										**4**
Black-billed Magpie										1	1								1					**3**
Greater Yellowlegs					2																			**2**
Ruffed Grouse																			2					**2**
Townsend's Warbler																			1	1				**2**
Wandering Tattler							2																	**2**
White-tailed Ptarmigan						1	1																	**2**
Brown Creeper																				1				**1**
Gray-crowned Rosy-Finch		1																						**1**
Hairy Woodpecker																				1				**1**
Say's Phoebe						1																		**1**
Spotted Sandpiper																				1				**1**
Surfbird						1																		**1**
Total	**21**	**113**	**15**	**204**	**180**	**42**	**730**	**26**	**2,608**	**752**	**890**	**732**	**168**	**216**	**24**	**4,122**	**181**	**94**	**5,636**	**1,072**	**16**	**137**	**172**	**18,151**

Notes:

1. Focal habitats are the primary habitats surveyed at each point-count plot, represented by the Level-III classes of the Alaska Vegetation Classification (Viereck et al. 1992) with additions by ABR for barren and partially vegetated areas (see text).
2. Excludes the point-count data from riverine and lacustrine habitats because those habitats are assessed separately in the riverine- and lacustrine-focused surveys (see text).
3. Only observations in which the habitat being used could be determined are included.