Appendices to the FEIS

The appendices in the DEIS are incorporated by reference into this FEIS, as follows:

Appendices B, and D to I are incorporated without change.

The following Appendices has been revised for the FEIS and replaced:

Appendix A – FEIS Distribution List

Appendix C - WEST's Baseline Studies for the Lower Snake River Wind Resource Area Columbia and Garfield Counties, Washington

The following Appendix has been amended with a new figure:

Appendix E – Visual Simulations

Finally, the following appendices are being added:

Appendix J: Rare Plants Survey Report

See attached.

Appendix K: Cultural Resources Survey Methodology

See attached.

A FEIS Distribution List

Appendix A
Distribution List

Copies of this FEIS or Notices of Availability have been distributed to the following agencies, organizations, and individuals for review and comment as noted below.

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C WEST'S Baseline Studies for the Lower Snake River Wind Resource Area Columbia and Garfield Counties, Washington

Baseline Wildlife Studies for the Lower Snake River Wind Resource Area Columbia and Garfield Counties, Washington

Final Report
April 2007 – January 2009

Prepared for:

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Portland, Oregon 97258

Prepared by:

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September 15, 2009

EXECUTIVE SUMMARY

Renewable Energy Systems, Ltd. and Puget Sound Energy have proposed a wind-energy facility in Columbia and Garfield Counties in southeastern Washington. Renewable Energy Systems, Ltd. and Puget Sound Energy contracted Western Ecosystems Technology, Inc. to conduct surveys and monitor wildlife resources throughout the Lower Snake River Wind Resource Area to provide information on the baseline conditions that would be useful in assessing potential impacts of wind-energy facility construction and operation on wildlife. The Lower Snake River Wind Resource Area is comprised of four separate study areas: Tucannon, Oliphant, Kuhl Ridge, and Dutch Flat. The following document contains results for fixed-point bird use surveys, raptor nest surveys, acoustic bat surveys, and incidental wildlife observations conducted within each of the four study areas.

The principal objectives of the study were to (1) provide site specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed wind-energy facility, (2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats, and (3) recommend further studies or potential mitigation measures, if warranted.

The objective of the fixed-point bird use surveys was to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly raptors. Fixed-point surveys were conducted from April 9, 2007, through January 14, 2009 at 57 points established throughout the four study areas. Points at Tucannon, Kuhl Ridge, and Dutch Flat were surveyed from January 24, 2008 through January 14, 2009 on an approximate weekly basis, with each point surveyed at least twice a month during the spring (March 16 through May 31), summer (June 1 to August 15), fall (August 16 to October 31), and winter (November 1, 2007 to March 15). The Oliphant study area was surveyed earlier (April 9, 2007 through March 25, 2008), and surveys points within Oliphant were visited weekly. A total of 1,655 20-minute fixed point surveys were completed at the Lower Snake River Wind Resource Area from April 9, 2007 to January 14, 2009.

Within the Lower Snake River Wind Resource Area, a total of 17,608 individual birds within 5,164 separate groups were recorded during fixed-point bird use surveys, representing a total of 89 species. Passerines comprised 80.6% of all bird observations, and raptors accounted for 8.6% of observations. The highest overall bird use occurred in the winter (7.00 birds/plot/20-min survey), followed by fall (6.47), summer (5.72), and spring (5.68). Use by waterbirds, waterfowl, and shorebirds was low across all seasons, ranging from zero to 0.16 birds/plot/20-min survey. Raptor use was highest during the spring (0.91 birds/plot/20-min survey) and lowest during the winter (0.56). A total of 1,516 raptors comprising 15 species were recorded during fixed-point surveys, with red-tailed hawk, American kestrel, and northern harrier the most frequently observed species. Upland gamebird use was highest in spring (0.30 birds/plot/20-min survey) and lowest in fall (0.12). Overall, passerines were the most abundant bird type observed during all seasons with the highest use occurring in winter (5.57 birds/plot/20-min survey), compared to summer (3.89), spring (3.85), and fall (3.36).

During the study, 3,014 single or groups of large birds totaling 10,651 individuals were observed flying during fixed-point bird use surveys. Overall, 18.7% of the bird types observed flying were recorded within the zone of risk for typical turbines that could be used in the proposed wind resource area, 80.3% were below the zone of risk, and 1.0% were observed flying above the zone of risk. The bird type most often observed flying within the turbine zone of risk was waterfowl (74.0%). More than half (59.6%) of flying raptor observations were of individuals below the zone of risk, 35.9% were within the zone of risk, and 4.5% were observed flying above the zone of risk. Raptor subtypes most frequently observed flying within the zone of risk were other raptors (60%), eagles (52.8%), and buteos (44.9%). Waterbirds, shorebirds, vultures, upland gamebirds, doves/pigeons, passerines, other birds, and unidentified birds were typically recorded below the estimated zone of risk.

For bird species with at least 30 observations of groups flying, seven were observed flying within the likely ZOR during at least 50% of the observations: Swainson's hawk (87.2%), golden eagle (78.8%), red-tailed hawk (75.6%), common raven (62.6%), rough-legged hawk (57.7%), unknown passerine (55.6%), American goldfinch (55.4%). Based on use (measure of abundance) of the study area by each species and flight characteristics observed for that species, red-tailed hawk had the highest probability of turbine exposure, with a relative exposure index of 0.12, followed by American goldfinch (0.10), and horned lark (0.08). The only other raptor species with calculated exposure indices were Swainson's hawk (0.02) and golden eagle (also 0.02).

Based on fixed-point bird use data collected for the Lower Snake River Wind Resource Area, mean annual raptor use was 0.71 raptors/plot/20-minute survey. This annual rate was compared with 36 other wind-energy facilities that implemented similar protocols and had data for three or four seasons. Mean raptor use at the Lower Snake River Wind Resource Area fell near the middle when compared to these other facilities, ranking eleventh.

A regression analysis of raptor use and mortality for 13 modern wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 69.9%; Figure 5.2). Using this regression to predict raptor collision mortality at the Lower Snake River Wind Resource Area yields an estimated fatality rate of 0.09 raptors/MW/year, or nine raptor fatalities per year for each 100 megawatt of wind-energy development. Based on species composition of the most common raptor fatalities at other western wind-energy facilities and species composition of raptors observed at the Lower Snake River Wind Resource Area during the surveys, the majority of the fatalities of diurnal raptors will likely be red-tailed hawks.

The objective of the aerial raptor nest surveys was to locate nests that may be subject to disturbance or displacement effects from the facility construction or operation. The search for raptor, corvid, and other large bird nests included the Lower Snake River Wind Resource Area and the area encompassed by an approximate 2-mile buffer. The survey was conducted from a helicopter within Oliphant area on April 24, 2007 and in Kuhl Ridge, Dutch Flats, and Tucannon areas from April 4 to 8, 2008. A total of 129 active raptor nests were located in, or within two miles of, the Lower Snake River Wind Resource Area, resulting in an active raptor nest density of 0.40 nest/mi^2. The majority of these (79%) were red-tailed hawk nests.

The objective of the acoustic bat surveys was to estimate the seasonal and spatial use of the study area by bats. Bat activity was monitored using Anabat™ SD-1 ultrasonic detectors at eight sampling locations on a total of 185 nights during the period April 30 to October 31, 2008. A total of 1,472 bat passes were recorded during 1,219 detector nights. Averaging bat passes per detector-night across locations, a mean of 1.08 bat passes per detector-night was recorded. Bat activity was highest at Station OL2, which recorded 5.13 bat passes per detector night (64.5% of all bat passes). Bat activity was similar at the other stations, ranging from 0.33 bat passes per detector night at Station TU1 to 0.86 at Station DF2.

Overall, the majority (66.0%) of the calls were > 35 kHz in frequency (e.g., *Myotis* bat species), and the remaining calls were < 35 kHz (e.g., big brown bat, hoary bat). Species identification was only possible for the hoary bat, which made up 2.2% of all passes. Activity levels for bat passes peaked in mid-July to mid-August, with another smaller peak occurring in September. Activity levels for hoary bats were highest in mid- to late-August, suggesting this species migrates through the study area at this time of year.

The mean number of bat passes per detector per night was compared to existing data at six wind-energy facilities where both bat activity and mortality levels have been measured. The level of bat activity documented at the Lower Snake River Wind Resource Area was lower than activity observed at facilities in Minnesota and Wyoming, where bat mortality was relatively low, and was much lower than activity recorded at facilities in West Virginia, Iowa, and Tennessee, where bat mortality was highest. Assuming there is a relationship between bat activity and bat mortality, relatively low levels of bat mortality can be expected to occur in the study area, with the majority of fatalities occurring in mid-July through September.

No Federal endangered, threatened, or candidate species were observed within the Lower Snake River Wind Resource Area; however, seven State species of concern were observed during all surveys and incidental observations. These included one State threatened species (ferruginous hawk), one State sensitive species (bald eagle), and five State candidates for listing (golden eagle, Vaux's swift, vesper sparrow, merlin, and sage thrasher). Additionally, seven State monitored species were observed: Swainson's hawk, grasshopper sparrow, great blue heron, western bluebird, prairie falcon, turkey vulture, and osprey.

The data collected during baseline wildlife surveys suggest that the Lower Snake River Wind Resource Area is not within a high bird use area or major spring migration pathway. No obvious flyways or concentration areas were observed, and no strong association with topographic features within the study area was noted for raptors or other large birds. Based on data collected during this study, raptor use of the study area is consistent with existing wind-energy facilities in the Pacific Northwest and Columbia Plateau Ecoregion, and is substantially lower than that observed at the Altamont Pass and Solano County projects in California. The studies at this site suggest that avian and bat mortality at the Lower Snake River Wind Resource Area would likely be similar to that documented at other wind-energy facilities located in the Pacific Northwest and Columbia Plateau Ecoregion, where fatalities have been relatively low. Overall, results of the studies to date do not suggest that a wind development at the proposed site would have significant impacts to avian and bat species.

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1.0 INTRODUCTION

Renewable Energy Systems, Ltd. (RES) and Puget Sound Energy (PSE) have proposed a wind-energy facility in Columbia and Garfield Counties, Washington (Figure 1.1). RES/PSE contracted Western Ecosystems Technology, Inc. (WEST) to conduct surveys of wildlife resources throughout the Lower Snake River Wind Resource Area (LSRWRA) to provide information on the baseline conditions that would be useful in assessing potential impacts of wind-energy facility construction and operation on wildlife. The LSRWRA is comprised of four separate wind resource areas: Tucannon, Oliphant, Kuhl Ridge, and Dutch Flat (Figure 1.1).

The principal objectives of the study were to: (1) provide site-specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed wind-energy facility; (2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats; and (3) recommend further studies or potential mitigation measures, if warranted. The protocols for the baseline studies are similar to those used at other wind-energy facilities within the Pacific Northwest and Columbia Plateau Ecoregion (CPE), and follow guidance of the National Wind Coordinating Collaborative (Anderson et al. 1999) and the Washington Department of Fish and Wildlife (WDFW 2009). The survey protocols have been developed based on WEST's experience studying wildlife at proposed wind-energy facilities throughout the US; and were designed to help assess potential impacts to bird (particularly raptors) and bat species.

Baseline surveys were conducted from April 9, 2007, through January 14, 2009, at the four wind resource areas within the larger LSRWRA. Study components included fixed-point bird use surveys, raptor nest surveys, acoustic bat surveys, and incidental wildlife observations. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities to aid in the impact assessment. The ability to estimate potential bird mortality within the proposed LSRWRA is enhanced by operational monitoring data collected at existing wind-energy facilities. For several wind-energy facilities throughout the CPE, standardized data on fixed-point surveys were collected in association with standardized post-construction (operational) monitoring, allowing comparisons of bird use with bird mortality. Comparison with these CPE studies provides an impact assessment tool based on regional information.

In the following report, results of avian and bat surveys are presented for the overall LSRWRA. Additional detail regarding avian use data for the individual study areas is presented within the attached Appendices.

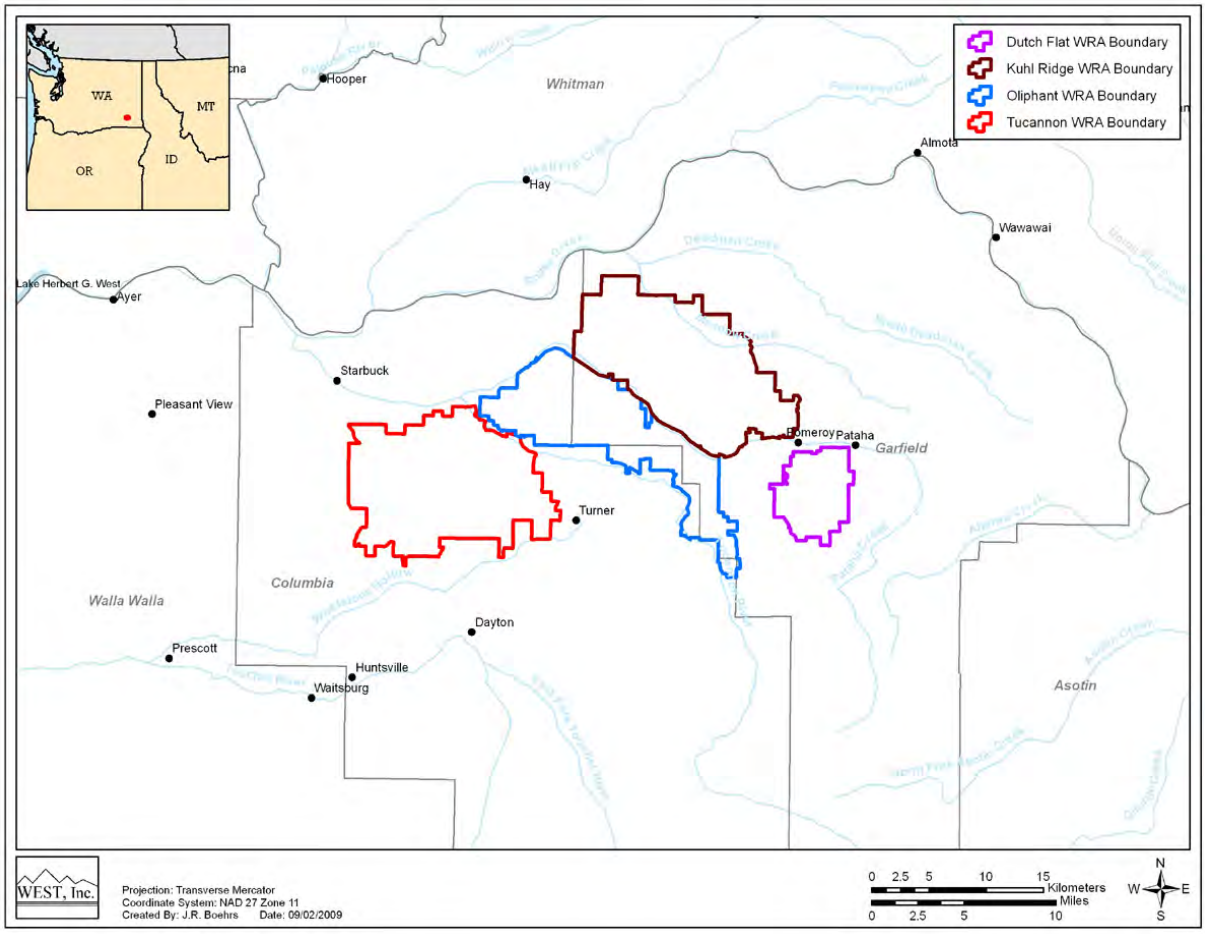


Figure 1.1 Location of the Lower Snake River Wind Resource Area.

2.0 STUDY AREA

The LSRWRA is located between the towns of Pomeroy, Starbuck, and Dayton in southeastern Washington. The LSRWRA consists of four, smaller wind resource areas identified as Tucannon, Oliphant, Kuhl Ridge, and Dutch Flats (Figure 2.1). Three existing operational wind energy facilities, Hopkins Ridge, Marengo I, and Marengo II, are located immediately to the south of the LSRWRA (Figure 2.1). The LSRWRA falls within the Columbia Plateau Ecoregion (physiographic province), and is adjacent to the Blue Mountains sub-province to the southeast (Franklin and Dyrness 1988). The landscape of this region consists of incised rivers, extensive plateaus and ridges, and basaltic outcrops and cliffs. The elevation of the LSRWRA ranges from approximately 525 to 1,760 feet (160-1,760 meters [m]; Figure 2.2). The Tucannon River and Pataha Creek corridors bisect the LSRWRA from the northwest to the southeast. The majority of the lands in the study area are privately owned.

The LSRWRA abuts the transition zone between grassland/shrub-steppe and coniferous vegetation zones. Dominant vegetation of the LSRWRA is a mix of dryland agriculture, rangeland (grassland and/or shrub steppe), and Conservation Reserve Program (CRP). Dryland agriculture is planted primarily in wheat (*Tricutum* spp.). Rangeland consists of steppe types that are primarily grass dominated areas with predominantly native bunchgrasses (e.g., Idaho fescue [*Festuca idahoensis*] and bluebunch wheatgrass [*Agropyron spicatum*]) and exotic annuals such as the introduced cheatgrass (*Bromus tectorum*). Typical shrubs include sagebrush (*Artemisia* spp.) and rabbitbrush (*Chrysothamnus* spp.). Rangeland also consists of areas located in drainages, ravines, and some slopes of north/northeasterly aspect that harbor larger shrubs such as wild rose (*Rosa* spp.), chokecherry (*Prunus virginiana*), Indian plum (*Oemleria cerasiformis*), hawthorn (*Crataegus* spp.), serviceberry (*Amelanchier* spp.), and snowberry (*Symphoricarpos* spp.). The majority of rangeland is grazed by domestic livestock, primarily cattle. Trees are sparse within the study area, with bands and small islands of deciduous trees scattered patchily across the LSRWRA upland areas. Coniferous trees become more prevalent in the southeastern region of the LSRWRA, primarily on lower elevation slopes and more limited in uplands. Stands of deciduous trees, some conifers, and riparian shrubs and wetlands of various sizes exist along the Pataha Creek and Tucannon River floodplains.

According to the National Landcover Dataset (USGS NLDC 2001; Table 2.1; Figure 2.3), the dominant cover type is cropland which comprises 65,640.40 acres (102.56 mi^2), or 51.1% of the LSRWRA. A further 30.5% (39,127.10 acres [61.14 mi^2]) is grassland, and 15.3% (19,722.00 acres [30.82 mi^2]) is scrub-shrub. The remaining 3.1% of the LSRWRA is comprised of small amounts of development (2.1%; 2,731.91 acres [4.27 mi^2]), pasture/hay (0.8%; 1,013.22 acres [1.58 mi^2]), forest (0.2%; 166.95 acres [0.26 mi^2]), and woody and emergent wetland (0.1%; 80.89 acres [0.13 mi^2]).

Table 2.1 The land cover types, coverage, and composition within the Lower Snake River Wind Resource Area.

Habitat	Acres	% Composition
Developed, Low Intensity	2,610.50	2.0
Developed, Medium Intensity	118.77	0.1
Developed, High Intensity	2.64	<0.1
Deciduous Forest	17.02	<0.1
Evergreen Forest	118.60	0.1
Mixed Forest	31.33	<0.1
Scrub-Shrub	19,722.00	15.3
Grassland	39,127.10	30.5
Pasture/Hay	1,013.22	0.8
Crops	65,640.40	51.1
Woody Wetlands	54.72	<0.1
Emergent Wetlands	26.17	<0.1
Total	**128,482.46**	**100**

Data from the National Landcover Database (USGS NLCD 2001).

The study area includes the proposed wind power development area and an adjacent buffer of variable width, depending on the study component. The primary study area includes the proposed development area, or the location where wind turbines and associated facilities such as met towers, substations, roads, operations and maintenance facilities, collector lines, power lines, and construction permit areas for gravel/borrow material, plant sites, equipment storage or lay-down areas, and parking areas. At the time of the study set-up, a conceptual facility design and a list of participating landowner (leased lands) were used to define the boundaries of the primary study area. All avian use surveys, acoustic bat surveys, general wildlife observations, and vegetation surveys occurred within the primary study area. The raptor nest study area included the primary study area and the surrounding area within two miles (3.2 km).

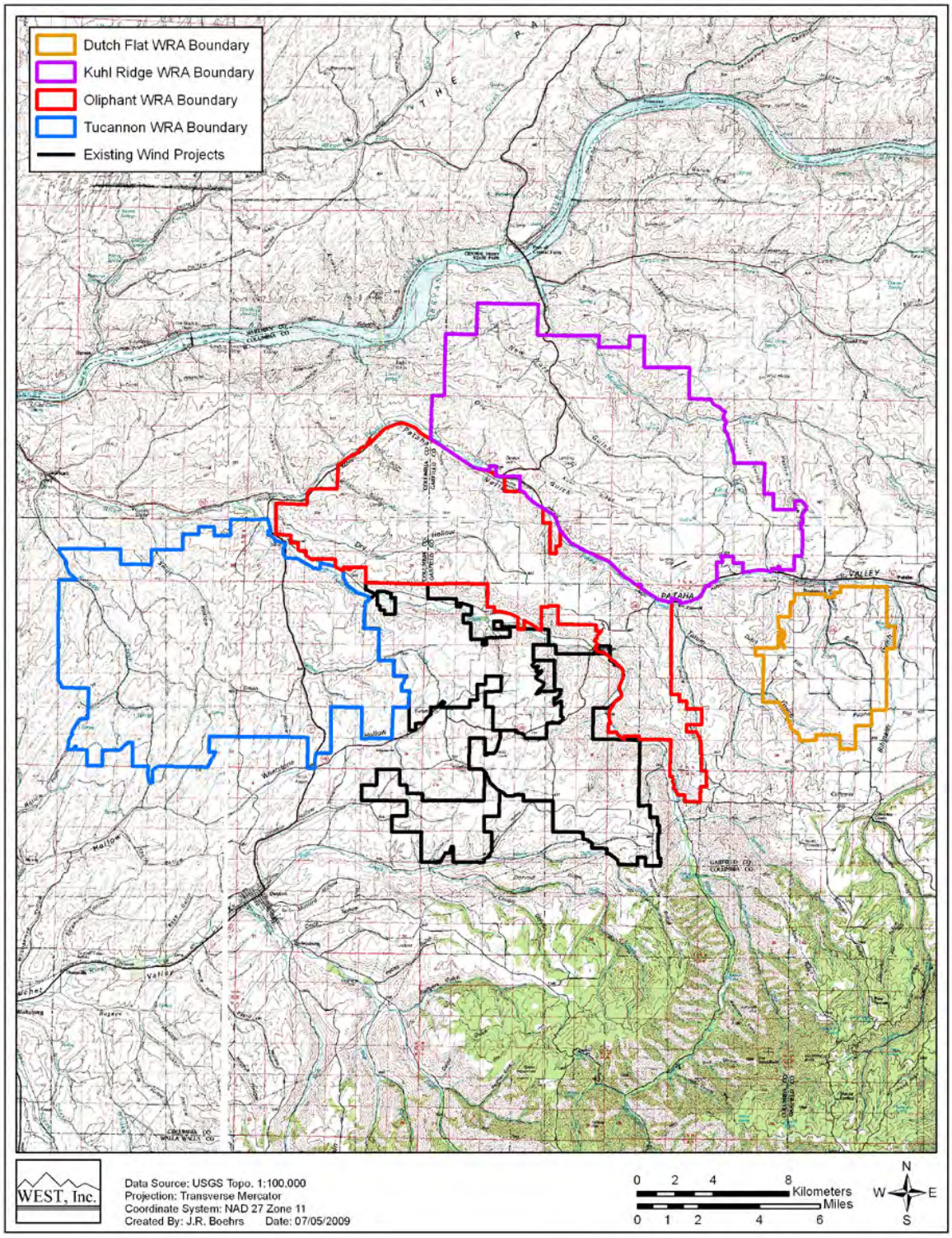


Figure 2.1 Study areas comprising the larger Lower Snake River Wind Resource Area; shown with existing wind project areas to the south.

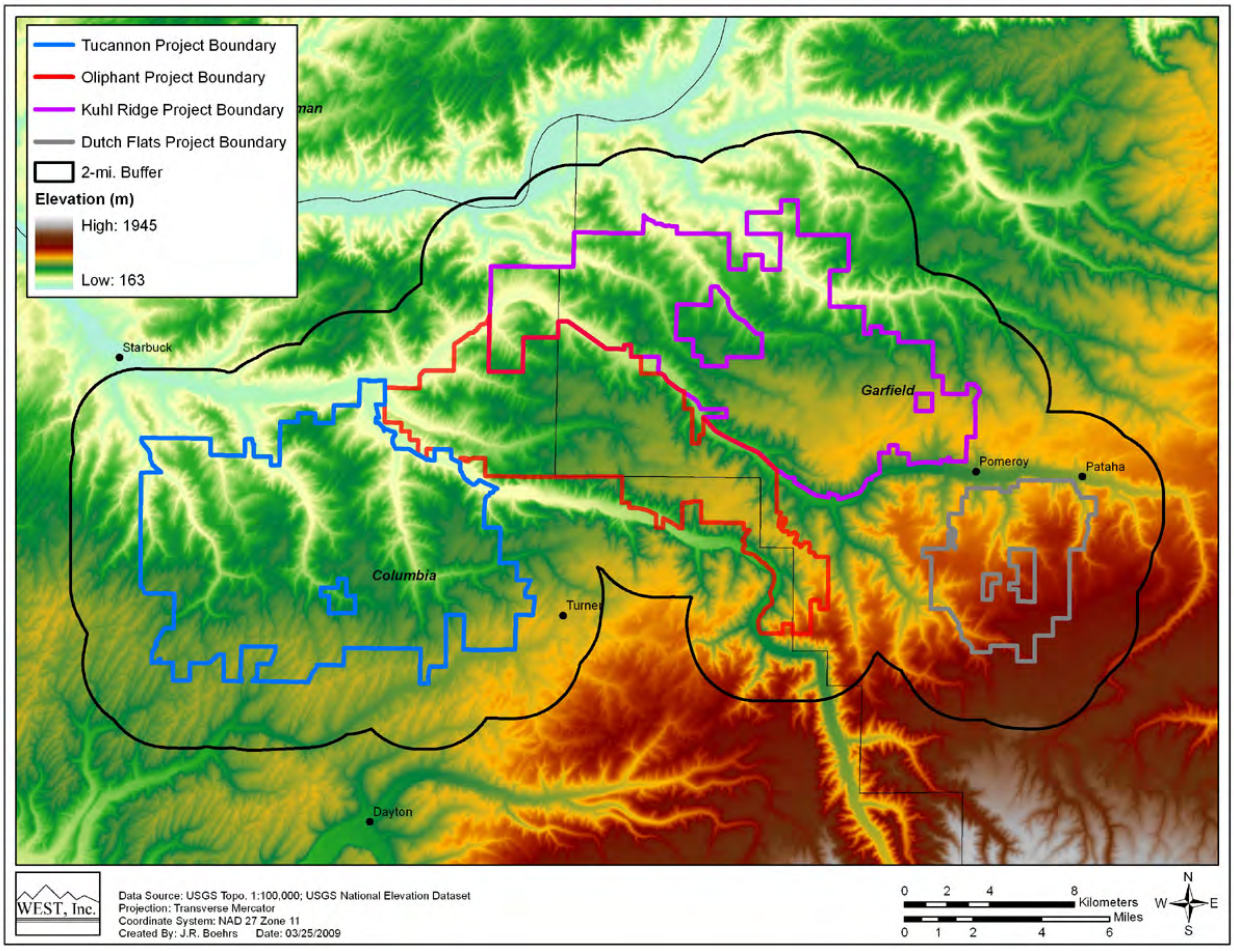


Figure 2.2 Digital elevation model of the Lower Snake River Wind Resource Area.

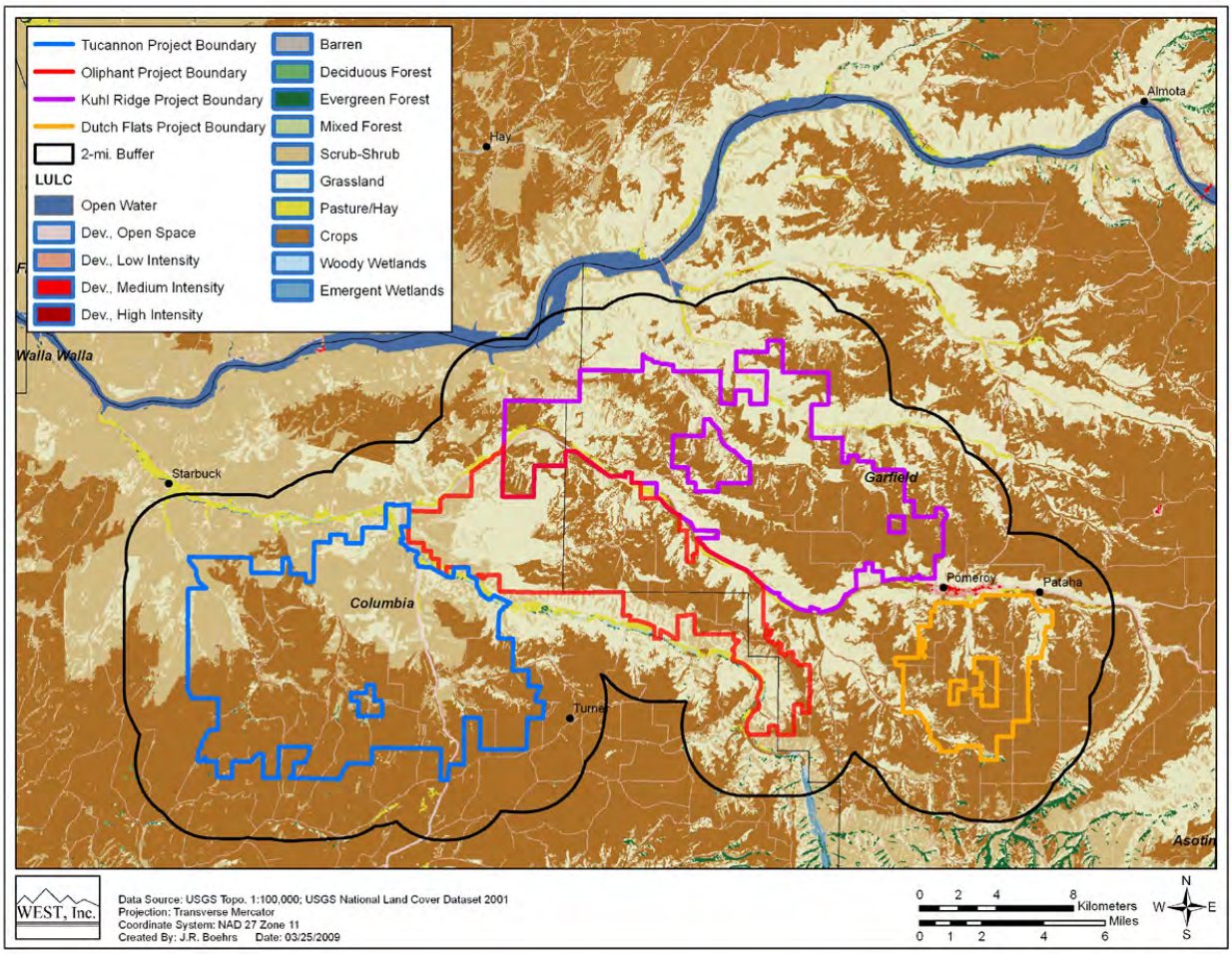


Figure 2.3 Land cover types within the Lower Snake River Wind Resource Area.

3.0 METHODS

The study at LSRWRA consisted of the following research components: 1) fixed-point bird use surveys; 2) aerial raptor nest surveys; 3) acoustic bat surveys; and 4) incidental wildlife observations. For the purposes of the analysis, seasons were defined as follows: spring, March 16 through May 31; summer, June 1 through August 15; fall, August 16 to October 31; and winter, November 1 to March 15.

3.1 Fixed-Point Bird Use Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly raptors. Fixed-point surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). The points were selected to survey representative habitats and topography of the study area, while also providing relatively even coverage with no overlap of survey plots (see below). All birds seen during fixed-point surveys were recorded. Raptors and other large birds, species of concern, and species not previously seen in the study area that were observed between fixed-point surveys were recorded. Global Positioning System (GPS) coordinates were recorded for species of concern for subsequent mapping.

A total of 57 points were selected within the four separate wind resource areas to achieve optimal coverage of the study area and habitats within the study area (Figure 3.1). Each survey plot was an 800-m radius circle centered on a point. All species of birds observed during fixed-point surveys were recorded, and all large birds observed perched within or flying over the plot were recorded and mapped. Small birds (e.g., sparrows) within 100 m of the point were recorded, but not mapped. Observations of birds beyond the 800-m radius were recorded, but were not included in the statistical analyses. A unique observation number was assigned to each observation.

The date, start, and end time of the survey period, and weather information such as temperature, wind speed, wind direction, and cloud cover were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. The behavior of each bird observed, and the vegetation type in which or over which the bird occurred, were recorded based on the point of first observation. Approximate flight height and flight direction at first observation were recorded to the nearest five-meter interval. Other information recorded about the observation included whether or not the observation was auditory only and the 10-min interval of the 20-min survey in which it was first observed.

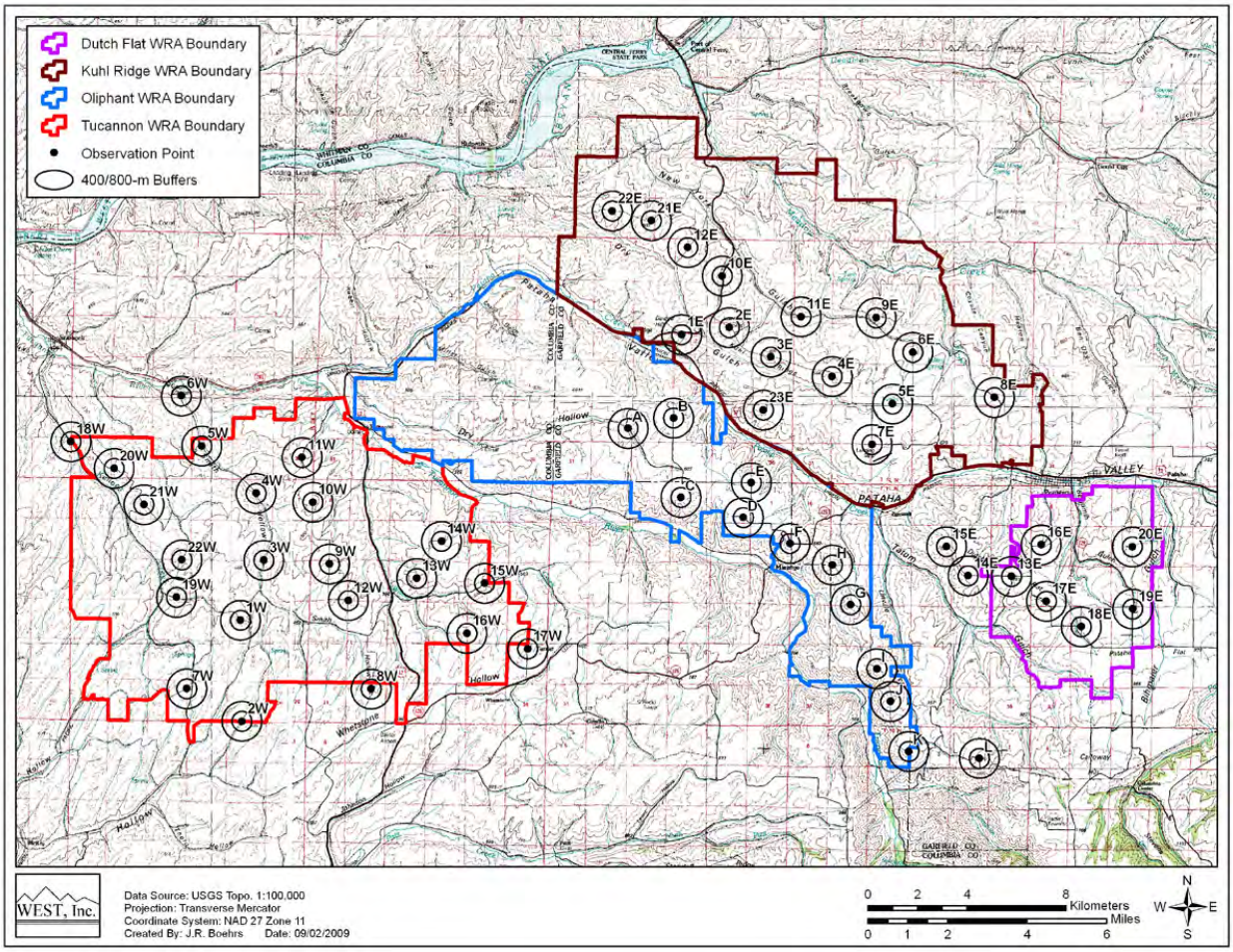


Figure 3.1 Avian use survey points within the Lower Snake River Wind Resource Area.

Locations of raptors, other large birds, and species of concern seen during fixed-point bird use surveys were recorded on field maps by observation number. Flight paths and perched locations were digitized using ArcGIS 9.3. Any comments or unusual observations were recorded in the comments section of the data sheet.

Sampling intensity was designed to document bird use and behavior by habitat and season within the study area. Points at Tucannon, Kuhl Ridge, and Dutch Flat were surveyed from January 24, 2008 through January 14, 2009 on an approximate weekly basis with each survey point visited at least twice a month during the spring (March 16 through May 31), summer (June 1 to August 15), fall (August 16 to October 31), and winter (November 1, 2007 to March 15). The Oliphant study area was surveyed earlier (April 9, 2007 through March 25, 2008) than the other three wind resource areas, and surveys points within Oliphant were visited weekly. All surveys were conducted during daylight hours and survey periods varied to approximately cover all daylight hours during a season.

3.2 Aerial Raptor Nest Surveys

The objective of the aerial raptor nest surveys was to locate nests that may be subject to disturbance and/or displacement effects from the wind-energy facility construction and/or operation. The search for raptor, corvid, and other large bird nests included the LSRWRA and the area encompassed by an approximate 2-mile buffer (Figure 3.2). Surveys within Oliphant were conducted from a helicopter on April 24, 2007; surveys in Kuhl Ridge, Dutch Flats, and Tucannon were conducted from April 4 to 8, 2008. Search paths were recorded with a real-time differentially-corrected Trimble Trimflight III GPS at 5-second intervals; coordinates were set as Universal Transverse Mercator (UTM) North American Datum (NAD) 27.

Aerial raptor nest surveys were scheduled after most species of raptor had finished courtship and were incubating eggs or brooding young. A focal species for the nest survey was ferruginous hawk (*Buteo regalis*) a state threatened species. Richardson (1996) reports that ferruginous hawks in Washington initiate their nesting activity in late-March and early-April. Surveys were also scheduled just prior to the onset of leaf-out to increase the visibility of nests within deciduous habitats. Nest searches were conducted by searching habitat suitable for most aboveground nesting species, such as cottonwood (*Populus* spp.), ponderosa pine (*Pinus ponderosa*), tall shrubs, and cliffs or rocky outcrops. During surveys, the helicopter was flown at an altitude of tree-top level to approximately 250 ft (approximately 75 m) aboveground. If a nest was observed, the helicopter was moved to a position where nest status and species could be determined. Efforts were made to minimize disturbance to breeding raptors, including keeping the helicopter a maximum distance from the nest at which the species could be identified, with distances varying depending upon nest location and wind conditions. Data recorded for each nest location included species occupying the nest, nest status (e.g., inactive, bird incubating, young present, eggs present, adult present, unknown or other), nest substrate (e.g., pine [*Pinus* spp.], poplar, cottonwood, juniper [*Juniperus* spp.], shrub, rocky outcrop, cliff, power line), nest type (e.g., stick, scrape, eyrie), nest size, number of young present, time and date of observation and the nest location (recorded with both a handheld Garmin GPS 12 unit and the differentially-corrected unit). The surveys were conducted by a biologist experienced in raptor nest surveys. Additional data about raptor nest sites that were visible from routes regularly traveled by observers were opportunistically gathered during other surveys in the study area. Some nest sites were ground-truthed when activity was unknown, for example, potential Swainson's hawk (*Buteo swainsoni*) nests.

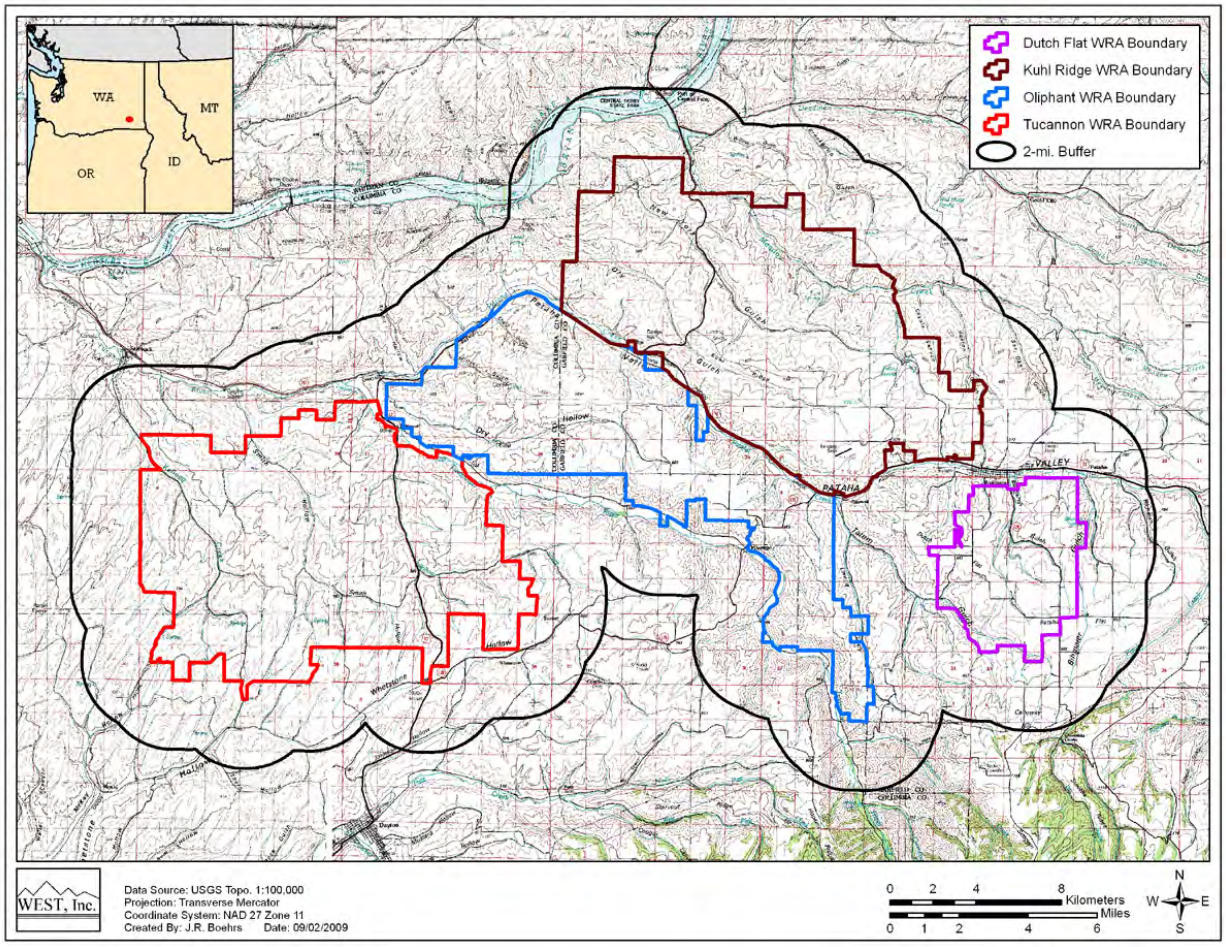


Figure 3.2 Study area map and 2-mile buffer used in the aerial raptor nest surveys within the Lower Snake River Wind Resource Area.

3.3 Acoustic Bat Surveys

The objective of the acoustic bat surveys was to estimate the seasonal and spatial use of the LSRWRA by bats. Bats were surveyed using Anabat™ SD-1 bat detectors (Titley Scientific™ Pty Ltd., NSW, Australia), which are a recommended method to index and compare habitat use by bats. The use of bat detectors for calculating an index to bat impacts has been used at several wind-energy facilities (Kunz et al. 2007a), and is a primary and economically feasible bat risk assessment tool (Arnett 2007). Bat activity was surveyed within the LSRWRA from April 30 to October 31, 2008, a period corresponding to the active season for bats and bat migration at this site. Detectors were placed at eight different locations within the LSRWRA, with two detectors within each of the four separate wind resource areas (see Figure 3.3 below for locations).

Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are then translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16 was used for the study. Bat echolocation detectors also detect other ultrasonic sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. Calls were recorded to a compact flash memory card with large storage capacity. The Anabat detectors were placed inside plastic weather-tight containers with a hole cut in the side of the container for the microphone to extend through. Microphones were encased in PVC tubing with drain holes that curved skyward at 45 degrees outside the container to minimize the potential for water damage due to rain. Containers were raised approximately 3.3 ft (approximately one m) off the ground to minimize echo interference and lift the unit above vegetation. All units were programmed to turn on each night an approximate half-hour before sunset and turn off an approximate half-hour after sunrise.

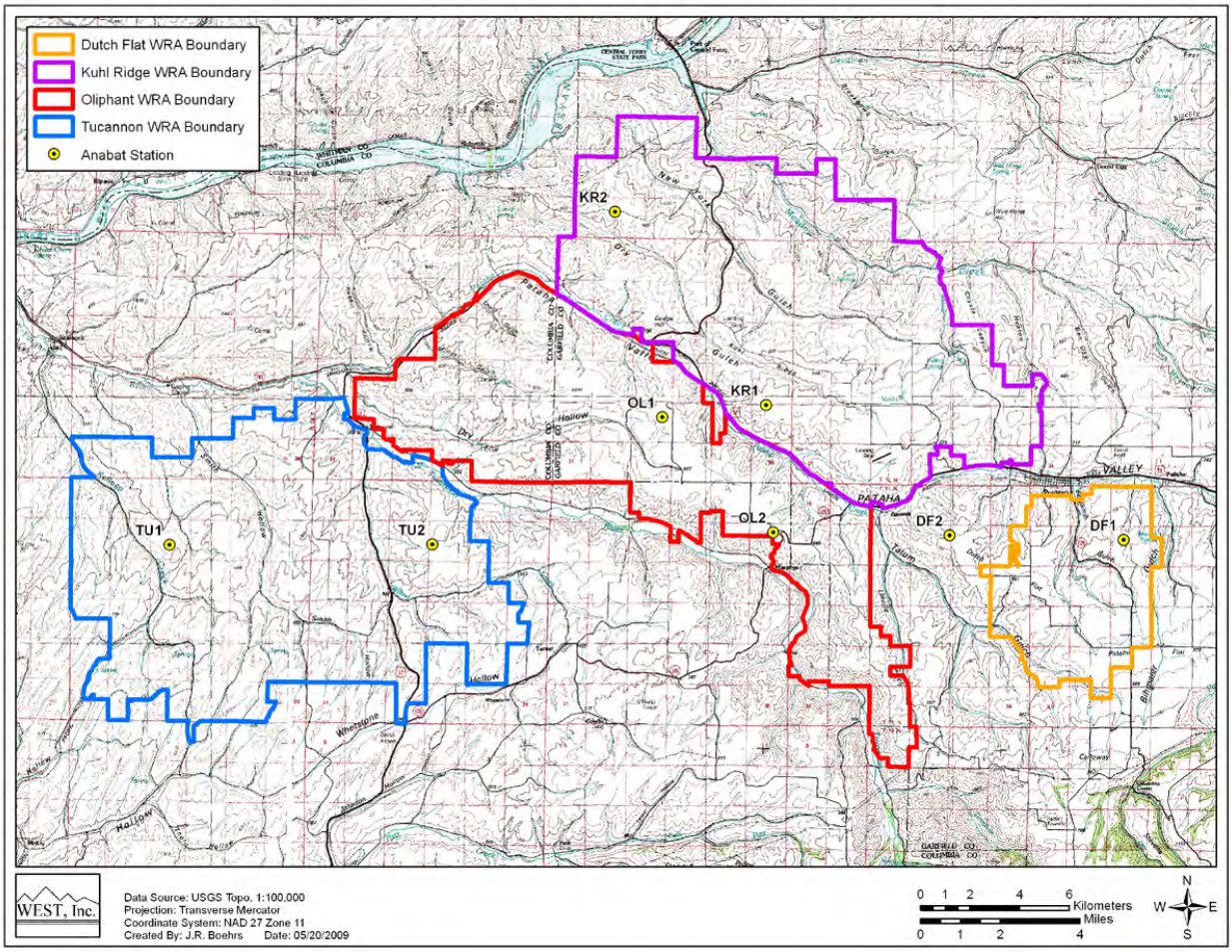


Figure 3.3 Anabat sampling locations at the Lower Snake River Wind Resource Area.

3.4 Incidental Wildlife Observations

The objective of recording incidental wildlife observations was to provide use and occurrence information about wildlife occurring outside of the standardized bird surveys that may be affected by the proposed wind-energy facility. Observations of big game species were also recorded during the fixed-point bird use surveys. Elk (*Cervis elaphus*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*) are known to occur on or near the LSRWRA. Observations of these species were plotted on data sheet maps and the number of individuals in each group recorded. Other incidental wildlife observations were made while observers were within the study area conducting the various surveys. All sightings of raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded. These observations were recorded in a similar fashion to those recorded during the standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), habitat, and, in the case of sensitive species, the location by GPS were recorded.

3.5 Statistical Analysis

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting their data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

3.5.1 Fixed-Point Bird Use Surveys

A list of all bird species observed during all surveys types was generated for the LSRWRA. The total number of unique species and the mean number of species observed per survey (i.e., number of species/plot/20-min survey) were calculated to illustrate and compare differences between seasons and locations (fixed-point survey plots).

Species lists, with the number of observations and the number of groups, were generated by season, including all observations of birds detected regardless of their distance from the observer. For the standardized fixed-point bird use estimates, only observations of birds detected within the 800-m radius plot were used. Estimates of bird use (i.e., number of birds/plot/20-min survey) were used to compare differences between bird types, seasons, study areas, and other wind-energy facilities.

The frequency of occurrence by species was calculated as the percent of surveys in which a particular species was observed. Species composition is represented by the mean use for a species divided by the total use for all species. Percent composition provides a relative estimate of the proportion of overall bird use attributable to each species and frequency of occurrence provides information on how often a species occurs in the study area. For example, a particular species might have high use estimates for the study area based on just a few observations of large flocks; however, the frequency of occurrence would indicate that it only occurred during a few of the surveys, therefore making it less likely to be affected by the wind-energy facility.

To calculate potential risk to bird species, the first flight height recorded was used to estimate the percentages of birds flying within the "likely zone of risk" (ZOR) for typical turbines. Because the type of turbines that will be used at the LSRWRA is currently unknown, the likely ZOR was defined as a flight height of between approximately 25 to 125 m (about 82 to 410 ft) above ground level (AGL), which is the approximate rotor swept area of typical turbines that could be used at the LSRWRA.

A relative index to collision exposure (R) was calculated for bird species observed during the fixed-point bird use surveys using the following formula:

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (observations within 800 m of observer) averaged across all surveys, P_f equals proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals proportion of all initial flight height observations of species *i* within the likely ZOR. This index does not account for differences in behavior other than flight heights and percent of birds observed flying.

The objective of mapping observed bird locations and flight paths was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the study area. Data were analyzed by comparing use among survey stations and association to topographic features. This information could be used to aid in turbine layout design or adjustments of individual turbines by micro-siting.

3.5.2 Acoustic Bat Surveys

The units of activity were number of bat passes (Hayes 1997). A pass was defined as a continuous series of two or more call notes produced by an individual bat with no pauses between call notes of more than one second (White and Gehrt 2001; Gannon et al. 2003). In this report, the terms bat pass and bat call are used interchangeably. The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector nights. Bat calls were classified as either high-frequency calls (≥35 kHz) that are generally given by small bats (e.g. *Myotis* sp., western pipistrelle [*Parastrellus hesperus*]) or low-frequency (<35 kHz) that are generally given by larger bats (e.g. silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*], hoary bat [*Lasiurus cinereus*], pallid bat [*Antrozous pallidus*], Townsend's big-eared bat [*Corynorhinus townsendii*], spotted bat

[*Euderma maculatum*], fringed bat [*Myotis thysanodes*]). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis. To establish which species may have produced the high- and low-frequency calls recorded, a list of species expected to occur in the study area was compiled from range maps (Harvey et al. 1999; BCI website).

The total number of bat passes per detector night was used as an index for bat use in the LSRWRA. Bat pass data represented levels of bat activity rather than the numbers of individuals present because individuals could not be differentiated by their calls. To predict potential for bat mortality (i.e. low, moderate, high), the mean number of bat passes per detector night (averaged across monitoring stations) was compared to existing data from wind-energy facilities where both bat activity and mortality levels have been measured.

4.0 RESULTS - LOWER SNAKE RIVER WIND RESOURCE AREA (OVERALL)

Eighty-nine bird species were identified during fixed-point bird use surveys at the LSRWRA between April 9, 2007, and January 14, 2009. One additional unique species was observed during raptor nest surveys resulting in 90 unique bird species observed at the LSRWRA. Eight unique mammal species were also observed incidentally. Results of the fixed-point surveys, raptor nest surveys, and incidental wildlife observations, as well as the specific numbers of species for each survey type, are discussed in the sections and chapters below. Results of the avian use surveys for each of the four individual wind resource areas are presented in Appendices A-D.

4.1 Fixed-Point Bird Use Surveys

A total of 1,655 20-min fixed-point bird use surveys were conducted between April 9, 2007, and January 14, 2009, within the LSRWRA (Table 4.1).

4.1.1 Bird Diversity and Species Richness

Eighty-nine unique species were observed over the course of all fixed-point bird use surveys, with a mean number of species observed per survey of 1.78 (Table 4.1). A total of 17,608 individual bird observations within 5,164 separate groups were recorded during the fixed-point surveys (Table 4.2). Cumulatively, seven species (7.9% of all species) comprised 71.7% of the observations: horned lark (*Eremophila alpestris*; 4,990 observations), European starling (*Sturnus vulgaris*; 2,990), common raven (*Corvus corax*; 1,239), rock pigeon (*Columba liva*; 1,197), red-tailed hawk (*Buteo jamaicensis*; 789), American goldfinch (*Carduelis tristis*; 771), and western meadowlark (*Sturnella neglecta*; 656). All other species comprised 2% or less of the observations individually.

A total of 1,516 individual raptors were observed within the study area, comprising 15 species (Table 4.2). The most frequently observed raptors in the LSRWRA were red-tailed hawk (52.0% of all raptor observations), American kestrel (*Falco sparverius*; 12.3%), and northern harrier (*Circus cyaneus*; 12.1%), which were all observed in similar numbers across seasons. Accipiters were seldom observed (26 observations); most observations of accipiters were of sharp-shinned hawk (*Accipter striatus*; 20), primarily observed in the fall (13). Buteos were the raptor subtype most often observed at the LSRWRA, comprising 68.4% of all raptor observations; red-tailed hawk (789 observations) and Swainson's hawk (117) were the most frequently observed buteo species. Northern harriers and falcons were seen in lower numbers than buteos (184 and 200 observations, respectively), with American kestrel comprising the majority of falcon observations (187). Eagle observations consisted of bald eagle (*Haliaeetus leucocephalus*; three observations), golden eagle (*Aquila chrysaetos*; 41), and unidentified eagle (one). Owls and other raptors were infrequently observed (five and 19 observations, respectively); other raptor observations consisted of unidentified raptors (15) and osprey (*Pandion haliaetus*; four).

The majority of accipiters (73.1%) were observed at Tucannon (10 observations) and Oliphant (nine; see Appendices A-2, B-2, C-2 and D-2). Buteos were observed across the LSRWRA, with the most observations at Tucannon (433 observations), followed by Kuhl Ridge (303), Oliphant

(226), and Dutch Flats (75). Northern harriers were also observed across the LSRWRA, with most observations at Tucannon and Kuhl Ridge (60 observations at both), followed by Oilphant (44) and Dutch Flats (20). Most of the eagle observations (71.1%) were recorded at Oliphant (44 observations). More than half (54.5%) of all falcons were recorded at Oliphant (109 observations), followed by Tucannon (49), Kuhl Ridge (24), and Dutch Flats (18). The majority of owls also were observed at Oliphant (three observations), with one observation each at Tucannon and Dutch Flats; owls were not observed at Kuhl Ridge.

4.1.2 Bird Use, Composition, and Frequency of Occurrence by Season

Mean bird use, percent composition, and frequency of occurrence for all species and bird types were calculated by season (Table 4.3). The highest overall bird use occurred in the winter (7.00 birds/plot/20-min survey), compared to fall (6.47), summer (5.72), and spring (5.68).

Waterfowl

Water fowl were only recorded in the winter (0.16 birds/plot/20-min survey), and spring (<0.01; Table 4.3). Waterfowl accounted for 2.3% of all birds during the winter, and accounted for 1% or less of all surveys.

Raptors

Raptors had the highest use in the spring (0.91 birds/plot/20-min survey), followed by summer (0.79), fall (0.76), and winter (0.56; Table 4.3). Of the raptors, red-tailed hawk had the highest use across all seasons, with 0.50 birds/plot/20-min survey in spring, 0.41 in fall, 0.40 in summer, and 0.21 in winter. Raptors comprised 16.1% of the overall bird use in the spring, 13.9% in the summer, 11.8% in the fall, and 8.0% in the winter. Raptors were consistently observed throughout the year, ranging from observations occurring at 34.4% of surveys in the winter to 48.9% in the spring (Table 4.3).

Accipiters had a relatively low use, ranging from 0.01 birds/plot/20-min survey in the winter and summer, to 0.03 in the spring and fall (Table 4.3). Most use in all seasons was due to sharp-shinned hawk (<0.01 to 0.03 birds/plot/20-min survey). Accipiters comprised less than 1% of the overall bird use during each season and were observed during less than 2% of all surveys.

Buteos had the highest use among raptor subtypes in all seasons (Table 4.3). Use by buteos was lower in the winter (0.33 birds/plot/20-min survey), compared to fall (0.48), summer (0.54) and spring (0.55); more than half the buteo use in each season was due to red-tailed hawk. Buteos comprised between 4.7% and 9.6% of the overall bird use during each season and were observed during 23.4% of winter, 31.9% of spring, 30.2% of summer, and 25.7% of fall surveys.

Use by northern harriers was highest in the spring (0.18 birds/plot/20-min survey), but was similar in the winter, summer, and fall (0.07 to 0.09; Table 4.3). Northern harriers comprised less than 4% of the overall bird use during each season and were observed during 7.1% of winter, 16.7% of spring, 6.7% of summer, and 6.2% of fall surveys.

Eagles had a relatively low use, ranging from 0.06 birds/plot/20-min survey in the winter, to 0.01 in the summer (Table 4.3). The majority of use in all seasons was due to golden eagle (0.01 to

0.05 birds/plot/20-min survey). Eagles comprised less than 1% of the overall bird use during each season and were observed during less than 6% of all surveys.

Use by falcons was lowest in the winter (0.06 birds/plot/20-min survey), but higher in the spring (0.14), summer (0.16), and fall (0.14); most of the use by falcons in each season was due to use by American kestrel (Table 4.3). Falcons comprised less than 3% of the overall bird use during each season and were observed during 10% or less of all surveys.

Owls had relatively low use in the LSRWRA, being observed in only the winter and summer (0.01 birds/plot/20-min survey in both seasons; Table 4.3). Owls comprised less than 1% of the overall bird use during each season and were observed during less than 1% of all surveys.

Upland Gamebirds

Upland gamebirds had the highest use in spring (0.30 birds/plot/20-min survey), compared to summer (0.26), winter (0.14), and fall (0.12; Table 4.3). Upland gamebirds comprised less than 6% of all bird use across all seasons. Upland gamebirds were recorded during 3.7% of winter surveys, 24.7% of spring surveys, 17.4% of summer surveys, and 5.1% of fall surveys (Table 4.3).

Passerines

Passerines had the highest use by any bird type during all four seasons (Table 4.3). Passerine use was higher in winter (5.57 birds/plot/20-min survey) compared to summer (3.89), spring (3.85) and fall (3.36). Horned lark had the highest seasonal use across all seasons, ranging from 1.57 birds/plot/20-min survey in the fall to 2.82 in the winter. Passerines made up 52.0% of all bird use in the fall, and more than 65% of all bird use across the remaining seasons. Passerines were recorded during the majority of surveys in all seasons, ranging from 57.2% in winter to 82.8% in spring (Table 4.3).

4.1.3 Bird Flight Height and Behavior

Flight height characteristics were estimated for both individual bird species and bird types (Tables 4.4 and 4.5). The percentage of observations below, within, and above the likely ZOR of 25 to 125 m AGL were reported. Forty-eight species were observed flying within the likely ZOR, with seven species (snow goose [*Chen caerulescens*], bald eagle, white-throated swift [*Aeronautes saxatalis*], ferruginous hawk, cedar waxwing [*Bombycilla cedrorum*], unidentified raptor, and turkey vulture [*Cathartes aura*]) observed flying within the likely ZOR for all (100%) of the observations. Observations for these species were relatively uncommon and consisted of only one to three groups of flying birds. Twenty-seven species were observed flying in the likely ZOR for 50% or more of the observations, and 21 species were observed flying in the likely ZOR for less than 50% of the observations. For bird species with at least 30 separate groups observed flying, seven species were observed flying within the likely ZOR during at least 50% of the observations: Swainson's hawk (87.2%), golden eagle (78.8%), red-tailed hawk (75.6%), Brewer's blackbird (*Euphagus cyanocephalus*; 71.5%), common raven (62.6%), rough-legged hawk (*Buteo lagopus*; 57.7%), unknown passerine (55.6%), and American goldfinch (55.4%; Table 4.4).

Overall, 18.7% of the bird types observed flying were recorded within the ZOR, 80.3% were below the ZOR, and 1.0% were flying above the ZOR (Table 4.5). The bird type most often observed flying within the turbine zone of risk was waterfowl (74.0%). More than half (59.6%) of flying raptor observations were of individuals below the ZOR, 35.9% were within the ZOR, and 4.5% were observed flying above the ZOR. Raptor subtypes most frequently observed flying within the ZOR were other raptors (60%), eagles (52.8%), and buteos (44.9%). Waterbirds, shorebirds, vultures, upland gamebirds, doves/pigeons, passerines, other birds, and unidentified birds were typically recorded flying below the estimated ZOR (Table 4.5).

4.1.4 Bird Exposure Index

A relative exposure index (bird use multiplied by proportion of flying observations within the ZOR) was calculated for each species (Table 4.4). This index is based only on initial flight height observations and relative abundance and does not account for other possible collision risk factors such as foraging, courtship, or avoidance behavior. Twelve bird species had an exposure index greater than 0.1, with red-tailed hawk having the highest probability of turbine exposure with an exposure index of 0.12, followed by American goldfinch (0.10), and horned lark (0.08; Table 4.4). The only other raptor species with relatively high exposure indices were Swainson's hawk (0.02) and golden eagle (also 0.02).

4.1.5 Spatial Use

Flight paths for waterfowl, raptor subtypes, and vultures were digitized and mapped for the LSRWRA (Appendices A-D). No obvious flyways or concentration areas were observed for any species. The available data do not indicate that any portions of the study area warrant being excluded from development due to very high bird use.

Table 4.1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Season	Number of Visits	Mean Use	# Species/ Survey	# Species	# Surveys Conducted
Winter	17	7.00	1.36	45	487
Spring	14	5.68	2.40	60	298
Summer	11	5.72	2.23	66	480
Fall	11	6.47	1.61	52	390
Overall	**53**	**6.39**	**1.78**	**89**	**1,655**

Table 4.2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**
great blue heron	*Ardea herodias*	0	0	0	0	1	1	0	0	1	1
Waterfowl		**7**	**115**	**1**	**2**	**0**	**0**	**0**	**0**	**8**	**117**
Canada goose	*Branta canadensis*	5	48	0	0	0	0	0	0	5	48
mallard	*Anas platyrhynchos*	0	0	1	2	0	0	0	0	1	2
snow goose	*Chen caerulescens*	1	57	0	0	0	0	0	0	1	57
tundra swan	*Cygnus columbianus*	1	10	0	0	0	0	0	0	1	10
Shorebirds		**3**	**4**	**2**	**2**	**1**	**1**	**0**	**0**	**6**	**7**
killdeer	*Charadrius vociferus*	3	4	2	2	1	1	0	0	6	7
Raptors		**323**	**341**	**277**	**314**	**388**	**453**	**362**	**408**	**1,350**	**1,516**
Accipiters		*4*	*4*	*5*	*5*	*3*	*3*	*13*	*14*	*25*	*26*
Cooper's hawk	*Accipiter cooperii*	1	1	2	2	2	2	1	1	6	6
sharp-shinned hawk	*Accipter striatus*	3	3	3	3	1	1	12	13	19	20
Buteos		*211*	*225*	*184*	*219*	*281*	*330*	*234*	*263*	*910*	*1,037*
ferruginous hawk	*Buteo regalis*	0	0	0	0	1	1	1	1	2	2
red-tailed hawk	*Buteo jamaicensis*	132	142	154	187	202	243	190	217	678	789
rough-legged hawk	*Buteo lagopus*	65	69	7	7	0	0	20	20	92	96
Swainson's hawk	*Buteo swainsoni*	0	0	14	14	77	85	16	18	107	117
unidentified buteo		14	14	9	11	1	1	7	7	31	33
Northern Harrier		*49*	*52*	*48*	*49*	*39*	*40*	*42*	*43*	*178*	*184*
northern harrier	*Circus cyaneus*	49	52	48	49	39	40	42	43	178	184
Eagles		*23*	*23*	*6*	*6*	*5*	*5*	*11*	*11*	*45*	*45*
bald eagle	*Haliaeetus leucocephalus*	3	3	0	0	0	0	0	0	3	3
golden eagle	*Aquila chrysaetos*	19	19	6	6	5	5	11	11	41	41
unidentified eagle		1	1	0	0	0	0	0	0	1	1

Table 4.2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Falcons		*24*	*24*	*33*	*34*	*57*	*72*	*55*	*70*	*169*	*200*
American kestrel	*Falco sparverius*	18	18	30	31	55	70	53	68	156	187
merlin	*Falco columbarius*	1	1	0	0	0	0	2	2	3	3
prairie falcon	*Falco mexicanus*	5	5	3	3	2	2	0	0	10	10
Owls		*3*	*3*	*0*	*0*	*2*	*2*	*0*	*0*	*5*	*5*
great-horned owl	*Bubo virginianus*	1	1	0	0	0	0	0	0	1	1
short-eared owl	*Asio flammeus*	2	2	0	0	2	2	0	0	4	4
Other Raptors		*9*	*10*	*1*	*1*	*1*	*1*	*7*	*7*	*18*	*19*
osprey	*Pandion haliaetus*	0	0	1	1	0	0	3	3	4	4
unidentified raptor		9	10	0	0	1	1	4	4	14	15
Vultures		**0**	**0**	**2**	**4**	**2**	**2**	**1**	**1**	**5**	**7**
turkey vulture	*Cathartes aura*	0	0	2	4	2	2	1	1	5	7
Upland Gamebirds		**20**	**50**	**85**	**96**	**77**	**109**	**21**	**48**	**203**	**303**
California quail	*Callipepla californica*	3	12	3	3	5	12	5	17	16	44
chukar	*Alectoris chukar*	2	3	2	2	1	1	0	0	5	6
gray partridge	*Perdix perdix*	2	12	3	5	4	8	2	10	11	35
ring-necked pheasant	*Phasianus colchicus*	13	23	77	86	66	85	14	21	170	215
wild turkey	*Meleagris gallopavo*	0	0	0	0	1	3	0	0	1	3
Doves/Pigeons		**37**	**291**	**25**	**135**	**77**	**392**	**48**	**571**	**187**	**1,389**
mourning dove	*Zenaida macroura*	4	31	10	18	35	87	12	56	61	192
rock pigeon	*Columba livia*	33	260	15	117	42	305	36	515	126	1,197
Passerines		**841**	**5,298**	**852**	**2,301**	**1,006**	**2,835**	**667**	**3,750**	**3,366**	**14,184**
American crow	*Corvus brachyrhynchos*	0	0	1	1	3	10	1	2	5	13
American goldfinch	*Carduelis tristis*	29	319	11	85	9	12	29	355	78	771
American pipit	*Anthus rubescens*	0	0	1	30	1	12	0	0	2	42
American robin	*Turdus migratorius*	7	168	13	67	7	7	3	7	30	249
American tree sparrow	*Spizella arborea*	9	33	0	0	0	0	0	0	9	33
bank swallow	*Riparia riparia*	0	0	0	0	24	152	0	0	24	152

Table 4.2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
barn swallow	*Hirundo rustica*	0	0	4	7	23	36	7	45	34	88
Bewick's wren	*Thryomanes bewickii*	0	0	1	1	0	0	0	0	1	1
black-billed magpie	*Pica pica*	48	106	18	26	29	56	31	76	126	264
Brewer's blackbird	*Euphagus cyanocephalus*	1	16	10	30	19	59	3	151	33	256
brown-headed cowbird	*Molothrus ater*	0	0	1	2	5	6	2	3	8	11
Bullock's oriole	*Icterus bullockii*	0	0	1	1	9	14	0	0	10	15
Cassin's finch	*Carpodacus purpureus*	0	0	0	0	2	5	0	0	2	5
cedar waxwing	*Bombycilla cedrorum*	0	0	0	0	0	0	1	1	1	1
cliff swallow	*Petrochelidon pyrrhonota*	0	0	12	42	26	92	1	10	39	144
common raven	*Corvus corax*	175	311	108	178	99	307	150	443	532	1,239
dark-eyed junco	*Junco hyemalis*	23	226	1	5	0	0	3	7	27	238
eastern kingbird	*Tyrannus tyrannus*	0	0	0	0	22	27	2	5	24	32
European starling	*Sturnus vulgaris*	45	1,097	29	286	39	272	47	1,335	160	2,990
grasshopper sparrow	*Ammodramus savannarum*	0	0	12	15	44	55	0	0	56	70
Harris' sparrow	*Zonotrichia querula*	1	4	0	0	0	0	0	0	1	4
horned lark	*Eremophila alpestris*	365	2,203	300	890	306	1,047	209	850	1,180	4,990
house finch	*Carpodacus mexicanus*	19	215	2	16	8	29	11	43	40	303
house sparrow	*Passer domesticus*	11	275	8	50	5	21	3	11	27	357
house wren	*Troglodytes aedon*	0	0	3	3	4	4	1	1	8	8
lark sparrow	*Chondestes grammacus*	0	0	1	1	6	7	0	0	7	8
lazuli bunting	*Passerina amoena*	0	0	1	1	3	4	0	0	4	5
MacGillivray's warbler	*Oporornis tolmiei*	0	0	0	0	2	2	0	0	2	2
marsh wren	*Cistothorus palustris*	0	0	1	1	0	0	0	0	1	1
mountain bluebird	*Sialia currucoides*	6	7	19	27	7	9	9	29	41	72
mountain chickadee	*Poecile gambeli*	0	0	0	0	0	0	1	1	1	1
northern rough-winged swallow	*Stelgidopteryx serripennis*	0	0	2	2	2	3	0	0	4	5
northern shrike	*Lanius excubitor*	14	15	2	2	0	0	9	11	25	28

Table 4.2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
pine siskin	*Carduelis pinus*	1	15	0	0	0	0	0	0	1	15
red-winged blackbird	*Agelaius phoeniceus*	6	92	9	15	5	32	0	0	20	139
rock wren	*Salpinctes obsoletus*	0	0	2	2	14	17	3	5	19	24
sage thrasher	*Oreoscoptes montanus*	0	0	0	0	0	0	1	1	1	1
savannah sparrow	*Passerculus sandwichensis*	1	1	31	42	34	45	23	36	89	124
Say's phoebe	*Sayornis saya*	2	3	15	17	25	29	5	5	47	54
snow bunting	*Plectrophenax nivalis*	1	20	0	0	0	0	0	0	1	20
song sparrow	*Melospiza melodia*	13	23	7	9	5	8	8	10	33	50
spotted towhee	*Pipilo maculatus*	0	0	1	1	1	1	0	0	2	2
tree swallow	*Tachycineta bicolor*	0	0	10	17	0	0	3	24	13	41
unidentified empidonax		0	0	0	0	2	6	0	0	2	6
unidentified finch		0	0	0	0	1	5	0	0	1	5
unidentified passerine		15	29	8	12	12	12	18	55	53	108
unidentified sparrow		1	1	3	5	1	3	1	1	6	10
unidentified swallow		0	0	4	8	6	44	5	60	15	112
unidentified warbler		0	0	1	1	0	0	0	0	1	1
vesper sparrow	*Pooecetes gramineus*	0	0	7	7	10	14	2	6	19	27
violet-green swallow	*Tachycineta thalassina*	0	0	2	5	1	1	0	0	3	6
western bluebird	*Sialia mexicana*	0	0	2	4	2	6	3	15	7	25
western kingbird	*Tyrannus verticalis*	0	0	14	21	55	125	4	4	73	150
western meadowlark	*Sturnella neglecta*	37	58	156	276	118	227	50	95	361	656
western tanager	*Piranga ludoviciana*	0	0	0	0	3	4	0	0	3	4
white-crowned sparrow	*Zonotrichia leucophrys*	11	61	17	89	2	3	18	47	48	200
willow flycatcher	*Empidonax traillii*	0	0	0	0	1	1	0	0	1	1
yellow-breasted chat	*Icteria virens*	0	0	0	0	1	1	0	0	1	1
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	0	0	0	1	1	0	0	1	1

Table 4.2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
yellow-rumped warbler	*Dendroica coronata*	0	0	1	1	2	2	0	0	3	3
Other Birds		**1**	**1**	**6**	**12**	**10**	**17**	**16**	**36**	**33**	**66**
common nighthawk	*Chordeiles minor*	0	0	0	0	5	9	0	0	5	9
downy woodpecker	*Picoides pubescens*	0	0	0	0	0	0	1	1	1	1
northern flicker	*Colaptes auratus*	1	1	3	4	1	1	5	5	10	11
unidentified hummingbird		0	0	0	0	2	2	0	0	2	2
Vaux's swift	*Chaetura vauxi*	0	0	3	8	2	5	9	27	14	40
white-throated swift	*Aeronautes saxatalis*	0	0	0	0	0	0	1	3	1	3
Unidentified Birds		**1**	**1**	**2**	**2**	**1**	**14**	**1**	**1**	**5**	**18**
unidentified bird		1	1	2	2	1	14	1	1	5	18
Overall		**1,233**	**6,101**	**1,252**	**2,868**	**1,563**	**3,824**	**1,116**	**4,815**	**5,164**	**17,608**

Table 4.3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Waterbirds	**0**	**0**	**<0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.2**	**0**
great blue heron	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2	0
Waterfowl	**0.16**	**<0.01**	**0**	**0**	**2.3**	**0.1**	**0**	**0**	**1.0**	**0.2**	**0**	**0**
Canada goose	0.09	0	0	0	1.3	0	0	0	0.9	0	0	0
mallard	0	<0.01	0	0	0	0.1	0	0	0	0.2	0	0
snow goose	0.07	0	0	0	1.1	0	0	0	0.1	0	0	0
Shorebirds	**0.01**	**<0.01**	**<0.01**	**0**	**0.1**	**0.1**	**<0.1**	**0**	**0.7**	**0.3**	**0.2**	**0**
killdeer	0.01	<0.01	<0.01	0	0.1	0.1	<0.1	0	0.7	0.3	0.2	0
Raptors	**0.56**	**0.91**	**0.79**	**0.76**	**8.0**	**16.1**	**13.9**	**11.8**	**34.4**	**48.9**	**41.4**	**38.6**
Accipiters	*0.01*	*0.03*	*0.01*	*0.03*	*0.1*	*0.4*	*0.1*	*0.5*	*1.0*	*1.9*	*0.5*	*2.9*
Cooper's hawk	<0.01	0.01	<0.01	<0.01	<0.1	0.2	0.1	<0.1	0.2	1.2	0.4	0.2
sharp-shinned hawk	0.01	0.01	<0.01	0.03	0.1	0.2	<0.1	0.5	0.8	1.3	0.2	2.7
Buteos	*0.33*	*0.55*	*0.54*	*0.48*	*4.7*	*9.6*	*9.4*	*7.4*	*23.4*	*31.9*	*30.2*	*25.7*
ferruginous hawk	0	0	<0.01	<0.01	0	0	<0.1	<0.1	0	0	0.2	0.2
red-tailed hawk	0.21	0.50	0.40	0.41	3.0	8.8	7.0	6.3	15.0	30.4	25.6	23.3
rough-legged hawk	0.11	0.01	0	0.03	1.6	0.2	0	0.5	9.3	1.3	0	3.2
Swainson's hawk	0	0.03	0.14	0.04	0	0.5	2.4	0.6	0	2.8	8.9	3.0
unidentified buteo	0.01	0.01	0	0	0.2	0.1	0	0	1.3	0.7	0	0
Northern Harrier	*0.09*	*0.18*	*0.07*	*0.08*	*1.2*	*3.2*	*1.2*	*1.2*	*7.1*	*16.7*	*6.7*	*6.2*
northern harrier	0.09	0.18	0.07	0.08	1.2	3.2	1.2	1.2	7.1	16.7	6.7	6.2
Eagles	*0.06*	*0.02*	*0.01*	*0.03*	*0.9*	*0.3*	*0.3*	*0.5*	*5.3*	*1.8*	*1.4*	*2.7*
bald eagle	0.01	0	0	0	0.2	0	0	0	1.1	0	0	0
golden eagle	0.05	0.02	0.01	0.03	0.7	0.3	0.3	0.5	4.2	1.8	1.4	2.7
Falcons	*0.06*	*0.14*	*0.16*	*0.14*	*0.9*	*2.4*	*2.8*	*2.2*	*5.3*	*10.0*	*9.9*	*9.9*
American kestrel	0.06	0.13	0.15	0.14	0.8	2.3	2.7	2.1	4.6	9.6	9.8	9.6
merlin	<0.01	0	0	<0.01	<0.1	0	0	<0.1	0.1	0	0	0.3
prairie falcon	0.01	<0.01	<0.01	0	0.1	0.1	0.1	0	0.6	0.5	0.3	0

Table 4.3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Owls	*0.01*	*0*	*0.01*	*0*	*0.1*	*0*	*0.2*	*0*	*0.8*	*0*	*0.9*	*0*
great-horned owl	<0.01	0	0	0	<0.1	0	0	0	0.2	0	0	0
short-eared owl	0.01	0	0.01	0	0.1	0	0.2	0	0.7	0	0.9	0
Other Raptors	*<0.01*	*<0.01*	*0*	*0.01*	*<0.1*	*<0.1*	*0*	*0.1*	*0.1*	*0.2*	*0*	*0.6*
osprey	0	<0.01	0	0.01	0	<0.1	0	0.1	0	0.2	0	0.6
unidentified raptor	<0.01	0	0	0	<0.1	0	0	0	0.1	0	0	0
Vultures	**0**	**0.01**	**<0.01**	**<0.01**	**0**	**0.1**	**0.1**	**<0.1**	**0**	**0.3**	**0.3**	**0.2**
turkey vulture	0	0.01	<0.01	<0.01	0	0.1	0.1	<0.1	0	0.3	0.3	0.2
Upland Gamebirds	**0.14**	**0.30**	**0.26**	**0.12**	**2.0**	**5.3**	**4.6**	**1.8**	**3.7**	**24.7**	**17.4**	**5.1**
California quail	0.02	0.01	0.02	0.02	0.2	0.2	0.3	0.4	0.5	1.4	0.8	0.6
Chukar	0.01	<0.01	<0.01	0	0.2	0.1	<0.1	0	0.6	0.3	0.2	0
gray partridge	0.05	0.02	0.03	0.02	0.7	0.4	0.4	0.2	0.6	1.1	1.9	0.3
ring-necked pheasant	0.06	0.26	0.21	0.08	0.9	4.6	3.7	1.2	2.5	22.5	15.0	4.5
wild turkey	0	0	<0.01	0	0	0	0.1	0	0	0	0.2	0
Doves/Pigeons	**0.55**	**0.54**	**0.71**	**2.14**	**7.9**	**9.6**	**12.4**	**33.1**	**7.6**	**7.2**	**13.3**	**11.3**
mourning dove	0.07	0.06	0.17	0.12	1.0	1.1	3.0	1.8	1.1	2.6	6.6	2.8
rock pigeon	0.48	0.48	0.54	2.02	6.9	8.4	9.5	31.3	7.3	4.6	7.2	8.5
Passerines	**5.57**	**3.85**	**3.89**	**3.36**	**79.5**	**67.9**	**68.0**	**52.0**	**57.2**	**82.8**	**75.8**	**60.6**
American crow	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2	0
American goldfinch	0.43	0.20	0.02	0.50	6.1	3.6	0.3	7.8	4.3	3.1	1.2	8.0
American pipit	0	0	0.02	0	0	0	0.3	0	0	0	0.2	0
American robin	0.06	0.02	0.01	0.01	0.9	0.4	0.2	0.1	0.3	1.2	1.0	0.8
American tree sparrow	0.11	0	0	0	1.6	0	0	0	3.0	0	0	0
bank swallow	0	0	0.24	0	0	0	4.3	0	0	0	3.7	0
barn swallow	0	0.02	0.06	0.05	0	0.3	1.1	0.8	0	1.3	3.7	1.1
Bewick's wren	0	<0.01	0	0	0	<0.1	0	0	0	0.1	0	0
black-billed magpie	0.03	0.01	0.03	0.03	0.4	0.2	0.6	0.4	1.3	0.8	2.5	0.6
Brewer's blackbird	0.02	0.02	0.09	0.03	0.2	0.3	1.6	0.5	0.1	0.9	3.8	0.1

Table 4.3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
brown-headed cowbird	0	<0.01	0.01	<0.01	0	0.1	0.1	0.1	0	0.2	0.6	0.3
Bullock's oriole	0	0	0.02	0	0	0	0.3	0	0	0	1.0	0
Cassin's finch	0	0	0.01	0	0	0	0.1	0	0	0	0.3	0
cedar waxwing	0	0	0	<0.01	0	0	0	<0.1	0	0	0	0.3
cliff swallow	0	0.07	0.11	0	0	1.3	1.9	0	0	2.1	3.4	0
common raven	0.11	0.03	0.04	0.07	1.5	0.6	0.8	1.2	3.6	2.6	2.2	4.2
dark-eyed junco	0.31	0.01	0	0.02	4.5	0.1	0	0.4	4.8	0.1	0	0.8
eastern kingbird	0	0	0.03	0.01	0	0	0.5	0.1	0	0	2.6	0.2
European starling	0.79	0.21	0.12	0.41	11.3	3.6	2.1	6.3	1.9	2.4	2.4	2.5
grasshopper sparrow	0	0.08	0.14	0	0	1.4	2.4	0	0	5.5	8.9	0
Harris' sparrow	0.01	0	0	0	0.1	0	0	0	0.2	0	0	0
horned lark	2.82	2.18	2.04	1.57	40.3	38.4	35.7	24.3	43.7	61.1	49.5	37.3
house finch	0.26	0	0.05	0.12	3.7	0	0.8	1.8	2.3	0	1.3	2.5
house sparrow	0.22	0.08	0.03	0	3.2	1.4	0.6	0	0.5	0.6	1.2	0
house wren	0	0	<0.01	<0.01	0	0	0.1	<0.1	0	0	0.5	0.2
lark sparrow	0	0	0.01	0	0	0	0.2	0	0	0	1.0	0
lazuli bunting	0	<0.01	0.01	0	0	<0.1	0.1	0	0	0.2	0.5	0
MacGillivray's warbler	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2	0
mountain bluebird	0.01	0.06	0.01	0.09	0.2	1.1	0.2	1.4	1.3	4.8	0.9	3.5
mountain chickadee	0	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2
northern rough-winged swallow	0	0.01	0.01	0	0	0.1	0.1	0	0	0.8	0.4	0
northern shrike	0.01	<0.01	0	0.03	0.1	<0.1	0	0.5	0.6	0.1	0	2.1
pine siskin	0.03	0	0	0	0.4	0	0	0	0.2	0	0	0
red-winged blackbird	0.15	0.02	0.05	0	2.2	0.4	0.8	0	0.8	1.3	0.6	0
rock wren	0	0.01	0.03	0.01	0	0.2	0.4	0.2	0	1.2	1.9	0.7
sage thrasher	0	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2
savannah sparrow	<0.01	0.15	0.12	0.06	<0.1	2.6	2.1	0.9	0.3	10.9	8.3	3.4

Table 4.3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Say's phoebe	<0.01	0.04	0.05	0.01	<0.1	0.6	0.8	0.1	0.1	2.9	3.9	0.9
snow bunting	0.03	0	0	0	0.5	0	0	0	0.2	0	0	0
song sparrow	0.04	0.04	0.01	0.04	0.6	0.7	0.2	0.5	2.3	3.1	0.7	3.2
spotted towhee	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
tree swallow	0	0.04	0	0.03	0	0.7	0	0.5	0	2.6	0	0.4
unidentified empidonax	0	0	0.02	0	0	0	0.3	0	0	0	0.9	0
unidentified finch	0	0	0.01	0	0	0	0.1	0	0	0	0.2	0
unidentified passerine	<0.01	0.01	<0.01	0.03	<0.1	0.2	0.1	0.5	0.2	0.6	0.3	1.7
unidentified sparrow	<0.01	0.03	0	0.01	0.1	0.5	0	0.1	0.5	1.8	0	0.8
unidentified warbler	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
vesper sparrow	0	0.02	0.02	0.01	0	0.3	0.4	0.2	0	1.6	1.4	0.4
violet-green swallow	0	0.01	<0.01	0	0	0.1	<0.1	0	0	0.3	0.2	0
western bluebird	0	0.01	0.01	0.02	0	0.1	0.2	0.4	0	0.3	0.3	0.5
western kingbird	0	0.03	0.12	0.01	0	0.6	2.2	0.1	0	2.6	6.4	0.6
western meadowlark	0.04	0.22	0.32	0.08	0.6	3.9	5.7	1.2	2.3	12.7	13.9	4.0
western tanager	0	0	0.01	0	0	0	0.1	0	0	0	0.5	0
white-crowned sparrow	0.08	0.21	0.01	0.11	1.1	3.7	0.2	1.7	1.4	5.1	0.9	4.0
yellow-breasted chat	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2	0
yellow-headed blackbird	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2	0
yellow-rumped warbler	0	0.01	0	0	0	0.1	0	0	0	0.6	0	0
Other Birds	**<0.01**	**0.04**	**0.03**	**0.08**	**<0.1**	**0.7**	**0.6**	**1.2**	**0.1**	**1.8**	**2.0**	**2.5**
common nighthawk	0	0	0.01	0	0	0	0.3	0	0	0	0.8	0
downy woodpecker	0	0	0	<0.01	0	0	0	<0.1	0	0	0	0.2
northern flicker	<0.01	0.01	<0.01	0.01	<0.1	0.1	<0.1	0.1	0.1	0.4	0.2	0.7
unidentified hummingbird	0	0	0.01	0	0	0	0.2	0	0	0	0.9	0
Vaux's swift	0	0.03	0.01	0.06	0	0.6	0.1	1.0	0	1.3	0.2	1.5

Table 4.3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
white-throated swift	0	0	0	0.01	0	0	0	0.1	0	0	0	0.2
Unidentified Birds	**<0.01**	**0.01**	**0.02**	**<0.01**	**0.1**	**0.2**	**0.4**	**<0.1**	**0.5**	**1.2**	**0.2**	**0.2**
unidentified bird	<0.01	0.01	0.02	<0.01	0.1	0.2	0.4	<0.1	0.5	1.2	0.2	0.2
Overall	**7.00**	**5.68**	**5.72**	**6.47**	**100**	**100**	**100**	**100**				

Table 4.4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
red-tailed hawk	474	0.34	77.7	46.3	0.12	75.6
American goldfinch	60	0.32	89.2	34.0	0.10	55.4
horned lark	594	2.30	52.0	7.0	0.08	18.0
rock pigeon	100	0.79	73.4	8.0	0.05	37.1
snow goose	1	0.03	100	100	0.03	100
European starling	99	0.48	52.6	10.1	0.03	43.2
common raven	418	0.07	87.1	35.9	0.02	62.6
Brewer's blackbird	27	0.03	94.5	69.8	0.02	71.5
Swainson's hawk	100	0.04	93.2	45.9	0.02	87.2
American robin	16	0.03	69.5	69.4	0.02	72.8
Canada goose	3	0.04	100	44.4	0.02	44.4
golden eagle	33	0.03	91.7	51.5	0.02	78.8
rough-legged hawk	67	0.06	78.0	29.6	0.01	57.7
northern harrier	165	0.10	93.4	11.2	0.01	19.4
Vaux's swift	14	0.02	100	45.0	0.01	75.0
American kestrel	111	0.11	65.6	11.7	0.01	40.8
tree swallow	13	0.01	100	31.7	<0.01	68.3
unidentified passerine	46	0.01	91.7	42.4	<0.01	55.6
sharp-shinned hawk	17	0.01	94.7	33.3	<0.01	55.6
mountain bluebird	26	0.04	72.2	13.5	<0.01	36.5
unidentified buteo	5	0.01	83.3	60.0	<0.01	80.0
house finch	23	0.14	77.9	3.0	<0.01	3.0
bald eagle	3	<0.01	100	66.7	<0.01	100
dark-eyed junco	6	0.14	11.3	14.8	<0.01	14.8
cliff swallow	35	0.03	96.5	6.5	<0.01	26.6
Cooper's hawk	6	<0.01	100	33.3	<0.01	50.0
house sparrow	18	0.11	49.0	2.3	<0.01	42.9

Table 4.4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
white-throated swift	1	<0.01	100	100	<0.01	100
unidentified bird	5	0.01	100	11.1	<0.01	11.1
ferruginous hawk	2	<0.01	100	100	<0.01	100
osprey	4	<0.01	100	50.0	<0.01	75.0
western kingbird	53	0.03	59.3	3.4	<0.01	5.6
red-winged blackbird	7	0.08	61.9	1.2	<0.01	1.2
cedar waxwing	1	<0.01	100	100	<0.01	100
unidentified raptor	1	<0.01	100	100	<0.01	100
prairie falcon	10	<0.01	100	10.0	<0.01	10.0
merlin	3	<0.01	100	33.3	<0.01	66.7
turkey vulture	3	<0.01	42.9	33.3	<0.01	100
barn swallow	31	0.02	95.5	1.2	<0.01	47.6
eastern kingbird	17	<0.01	68.8	4.5	<0.01	9.1
black-billed magpie	79	0.03	61.6	0.6	<0.01	4.3
western meadowlark	71	0.14	22.1	0	0	4.8
ring-necked pheasant	16	0.13	11.7	0	0	0
mourning dove	27	0.10	44.8	0	0	0
white-crowned sparrow	15	0.10	53.0	0	0	0
savannah sparrow	22	0.06	25.8	0	0	0
bank swallow	23	0.05	99.3	0	0	17.2
American tree sparrow	2	0.05	9.1	0	0	0
grasshopper sparrow	6	0.04	10.0	0	0	0
song sparrow	5	0.03	16.0	0	0	0
gray partridge	6	0.03	68.6	0	0	0
Say's phoebe	18	0.02	38.9	0	0	0
California quail	0	0.02	0.0	0	0	0
snow bunting	1	0.01	100	0	0	0
pine siskin	1	0.01	100	0	0	0

Table 4.4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
unidentified sparrow	4	0.01	80.0	0	0	0
rock wren	2	0.01	16.7	0	0	0
vesper sparrow	7	0.01	55.6	0	0	0
northern shrike	14	0.01	57.1	0	0	0
western bluebird	6	0.01	96.0	0	0	12.5
chukar	2	0.01	50.0	0	0	0
short-eared owl	3	<0.01	75.0	0	0	0
killdeer	3	<0.01	57.1	0	0	0
American pipit	2	<0.01	100	0	0	71.4
Bullock's oriole	4	<0.01	46.7	0	0	0
northern flicker	6	<0.01	54.5	0	0	0
unidentified empidonax	1	<0.01	83.3	0	0	0
brown-headed cowbird	5	<0.01	63.6	0	0	0
Harris' sparrow	0	<0.01	0	0	0	0
common nighthawk	5	<0.01	100	0	0	88.9
northern rough-winged swallow	4	<0.01	100	0	0	0
lark sparrow	2	<0.01	37.5	0	0	0
violet-green swallow	3	<0.01	100	0	0	50.0
unidentified hummingbird	2	<0.01	100	0	0	50.0
lazuli bunting	0	<0.01	0	0	0	0
Cassin's finch	1	<0.01	80.0	0	0	0
unidentified finch	1	<0.01	100	0	0	0
house wren	0	<0.01	0	0	0	0
spotted towhee	0	<0.01	0	0	0	0
western tanager	0	<0.01	0	0	0	0
unidentified warbler	0	<0.01	0	0	0	0
yellow-rumped warbler	2	<0.01	66.7	0	0	0
wild turkey	0	<0.01	0	0	0	0

Table 4.4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
great-horned owl	0	<0.01	0	0	0	0
mallard	1	<0.01	100	0	0	0
sage thrasher	1	<0.01	100	0	0	0
downy woodpecker	1	<0.01	100	0	0	0
mountain chickadee	1	<0.01	100	0	0	0
American crow	2	<0.01	69.2	0	0	0
great blue heron	1	<0.01	100	0	0	0
MacGillivray's warbler	2	<0.01	100	0	0	0
yellow-breasted chat	0	<0.01	0	0	0	0
yellow-headed blackbird	1	<0.01	100	0	0	0
Bewick's wren	0	<0.01	0	0	0	0
willow flycatcher	0	0.00	0	0	0	0
marsh wren	0	0.00	0	0	0	0
tundra swan	0	0.00	0	0	0	0
unidentified eagle	0	0.00	0	0	0	0
unidentified swallow	15	0.00	100	73.2	0	96.4

Table 4.5. Flight height characteristics by bird type during the fixed-point bird use surveys at the Lower Snake River Wind Resource Area, April 9, 2007 – January 14, 2009.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0-82 ft	82-410 ft	> 410 ft
Waterbirds	1	1	20.00	100	100	0	0
Waterfowl	5	104	244.00	100	1.9	74.0	24.0
Shorebirds	3	4	10.00	57.1	100	0	0
Raptors	1,004	1,124	41.80	80.5	59.6	35.9	4.5
Accipiters	*23*	*24*	*55.04*	*96.0*	*54.2*	*33.3*	*12.5*
Buteos	*648*	*753*	*48.73*	*79.8*	*50.1*	*44.9*	*5.0*
Northern Harrier	*165*	*170*	*16.44*	*93.4*	*87.6*	*11.2*	*1.2*
Eagles	*36*	*36*	*93.89*	*92.3*	*33.3*	*52.8*	*13.9*
Falcons	*124*	*133*	*19.57*	*67.9*	*87.2*	*12.0*	*0.8*
Owls	*3*	*3*	*0.00*	*60.0*	*100*	*0*	*0*
Other Raptors	*5*	*5*	*121.00*	*100*	*0*	*60.0*	*40.0*
Vultures	3	3	43.33	42.9	66.7	33.3	0
Upland Gamebirds	24	52	2.46	17.2	100	0	0
Doves/Pigeons	127	965	15.96	69.5	92.7	7.3	0
Passerines	1,813	8,319	16.71	58.8	82.6	17.0	0.4
Other Birds	29	61	24.59	92.4	65.6	34.4	0
Unidentified Birds	5	18	25.00	100	88.9	11.1	0
Overall	**3,014**	**10,651**	**25.41**	**61.1**	**80.3**	**18.7**	**1.0**

4.2 Raptor Nest Surveys

One-hundred-two red-tailed hawk nests, 18 great-horned owl nests, five Swainson's hawk nests, two golden eagle nests, one barn owl (*Tyto alba*), and one prairie falcon (*Falco mexicanus*) nest were within the study area and surrounding 2-mile buffer (Figure 4.1), resulting in an active raptor nest density of 0.40 nests/mi^2. When considering the nests within the boundaries of the LSRWRA alone, 50 red-tailed hawk nests, 10 great-horned owl nests, three Swainson's hawk nests, and the barn owl nest were within the study area (Figure 4.1), resulting in an active raptor nest density of 0.32 nests/mi^2 (Table 4.6).

Additionally, 180 inactive nests were located within the study area and adjacent two-mile buffer (Table 4.6; Figure 4.1). Two of the inactive nests were historic ferruginous hawk nests, one of which lies within the boundaries of the LSRWRA. Most of the remaining inactive nests were likely those of red-tailed hawk, based on the number of active nests and abundance of red-tailed hawk in the LSRWRA; however, these nests could also potentially be used by other raptor species, such as great-horned owl or Swainson's hawk.

The barn owl was observed only during raptor nest surveys and was not observed during other surveys in the LSRWRA.

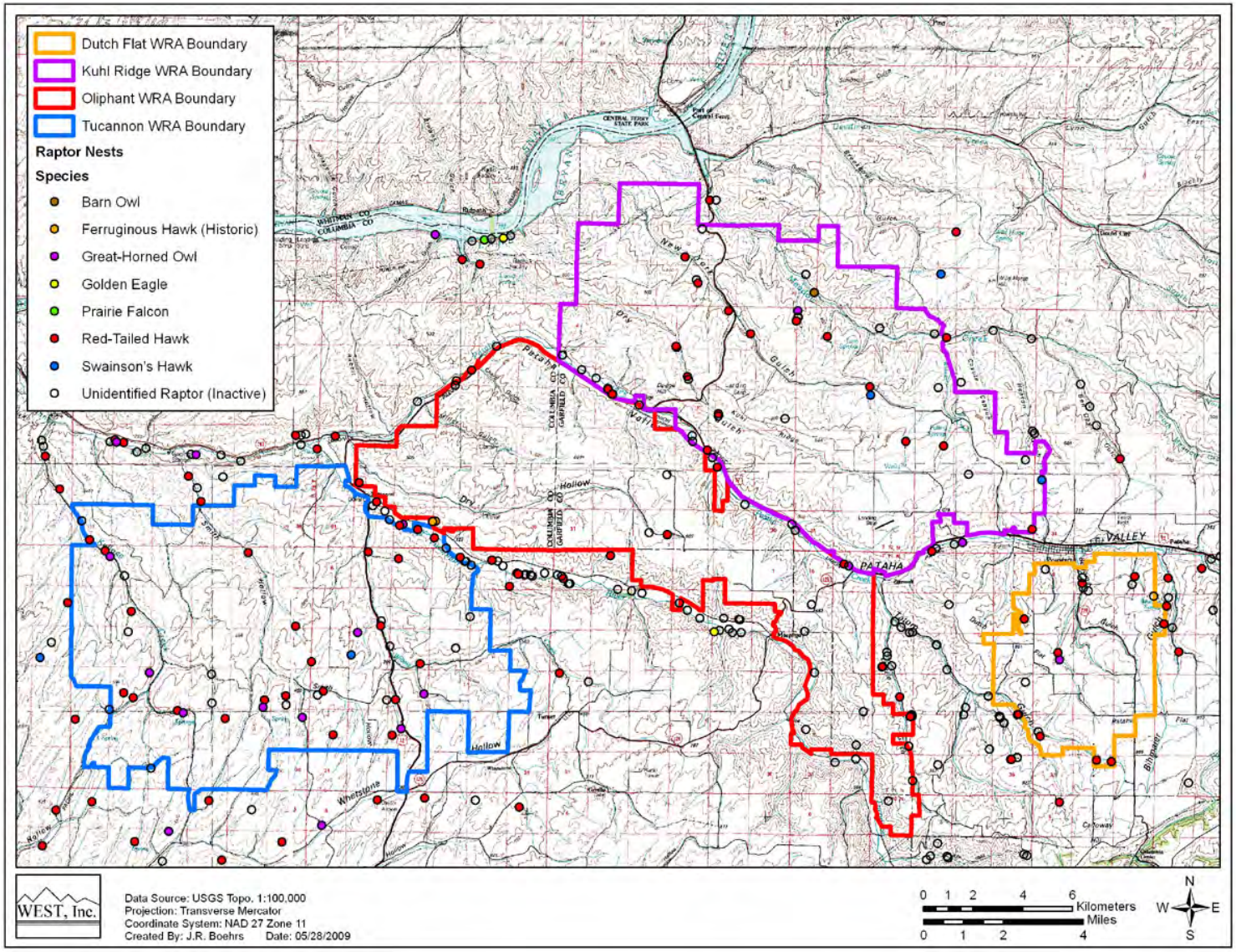


Figure 4.1 Raptor nest locations at the Lower Snake River Wind Resource Area.

Table 4.6 Nesting raptor species and nest density for the Lower Snake River Wind Resource Area and the study area, based on raptor nest surveys.

Species	Scientific name	# of nests within LSRWRA	# of nests within 1-mi buffer of LSRWRA	Density LSRWRA (# of nests/mi^2)	Density 1-mi buffer of LSRWRA (#nests/mi^2)
red-tailed hawk	*Buteo jamaicensis*	50	102	0.25	0.32
great-horned owl	*Bubo virginianus*	10	18	0.05	0.06
Swainson's hawk	*Buteo swainsoni*	3	5	0.01	0.02
golden eagle	*Aquila chrysaetos*	0	2	0	0.01
barn owl	*Tyto alba*	1	1	<0.01	<0.01
prairie falcon	*Falco mexicanus*	0	1	0	<0.01
inactive		63	180	0.31	0.56
Total		**128**	**309**	**0.64**	**0.96**

4.3 Acoustic Bat Surveys

Acoustic bat surveys were conducted using two detectors at each of the four wind resource areas within the LSRWRA (Figure 3.3). Fourteen different bat species could be expected within the Lower Snake River Wind Resource Area (Table 4.7).

Bat activity was monitored at eight sampling locations over a total of 185 nights during the period April 30 to October 31, 2008 (Figure 3.3). Anabat units were operable for 94.9% of the sampling period (Figure 4.2), recording 1,472 bat passes on 1,219 detector-nights (Table 4.8). Levels of wind and insect noise were high on some nights (Figure 4.3), and may have interfered with bat detection. Averaging bat passes per detector-night across locations, we detected a mean of 1.08 bat passes per detector-night.

4.3.1 Spatial Variation

Bat activity was highest at Station OL2, which recorded 5.13 bat passes per detector night (64.5% of all bat passes). Bat activity was similar at the other stations, ranging from 0.33 bat passes per detector night at Station TU1 to 0.86 at Station DF2 (Figure 4.4). Patterns of nightly activity were similar among stations, although Station OL2 recorded far more bat passes than other stations (Figure 4.5).

4.3.2 Temporal Variation

Bat activity was at its lowest from the beginning of the study period through May, but gradually increased through June and July (Figure 4.5). Activity was highest from mid-July through mid-August, with peak activity occurring on July 24 (Figure 4.5). Activity levels abruptly decreased in mid-August to much lower levels for the remainder of the study period; however, there was a second, smaller peak in activity throughout September (Figure 4.5). Temporal patterns were largely consistent among stations, although Station OL2 recorded more calls per night (Figures 4.4 and 4.5).

4.3.3 Species Composition

Overall, passes by high-frequency bats (HF; 66.0%) outnumbered passes by low-frequency bats (LF; 34.0%; Table 4.6); however, the proportion of HF and LF bat passes was similar among Anabat ground stations (Figures 4.6 and 4.7). HF passes outnumbered LF passes for the majority of the study period, but LF activity was higher than HF activity in late-September (Figures 4.6 and 4.7). LF bat passes were more frequent in September and October when overall activity was much lower.

Species identification for specific passes was possible for the hoary bat; therefore, passes by this species could be separated from passes by other low-frequency bats. Hoary bats comprised 2.2% of total passes detected within the study area. Hoary bat activity was similar among Anabat stations (Figure 4.8). Patterns of hoary bat activity were congruent with the overall trend (Figures 4.5 and 4.9), peaking in mid- to late-August.

Table 4.7 Bat species determined from range-maps (Harvey et al. 1999; BCI website) as likely to occur within the Lower Snake River Wind Resource Area, sorted by call frequency.

Common Name	Scientific Name
High-frequency (> 35 kHz)	
California bat	*Myotis californicus*
western small-footed bat	*Myotis ciliolabrum*
western long-eared bat	*Myotis evotis*
little brown bat[3]	*Myotis lucifugus*
long-legged bat	*Myotis volans*
Yuma bat	*Myotis yumanensis*
western pipistrelle[2,3]	*Parastrellus hesperus*
Low-frequency (< 35 kHz)	
pallid bat	*Antrozous pallidus*
Townsend's big-eared bat	*Corynorhinus townsendii*
big brown bat[3]	*Eptesicus fuscus*
spotted bat[2]	*Euderma maculatum*
silver-haired bat[1,3]	*Lasionycteris noctivagans*
hoary bat[1,3]	*Lasiurus cinereus*
fringed bat	*Myotis thysanodes*

1 = long-distance migrant; 2 = species distribution on edge or just outside project area; 3 = known casualty from wind turbines.

Table 4.8 Results of acoustic bat surveys conducted at the Lower Snake River Wind Resource Area, April 30 - October 31, 2008.

Anabat Location	# of HF Bat Passes	# of LF Bat Passes	# of Hoary Bat Passes*	Total Bat Passes	Detector-Nights	Bat Passes/ Night
DF1	5	105	7	110	177	0.62
DF2	17	59	4	76	88	0.86
KR1	0	73	3	73	178	0.41
KR2	8	1	0	9	57	0.16
OL1	64	58	2	122	185	0.66
OL2	820	129	11	949	185	5.13
TU1	30	31	3	61	184	0.33
TU2	27	45	2	72	165	0.44
Total	**971**	**501**	**32**	**1,472**	**1,219**	**1.08**

*Passes by hoary bats included in low-frequency (LF) numbers.

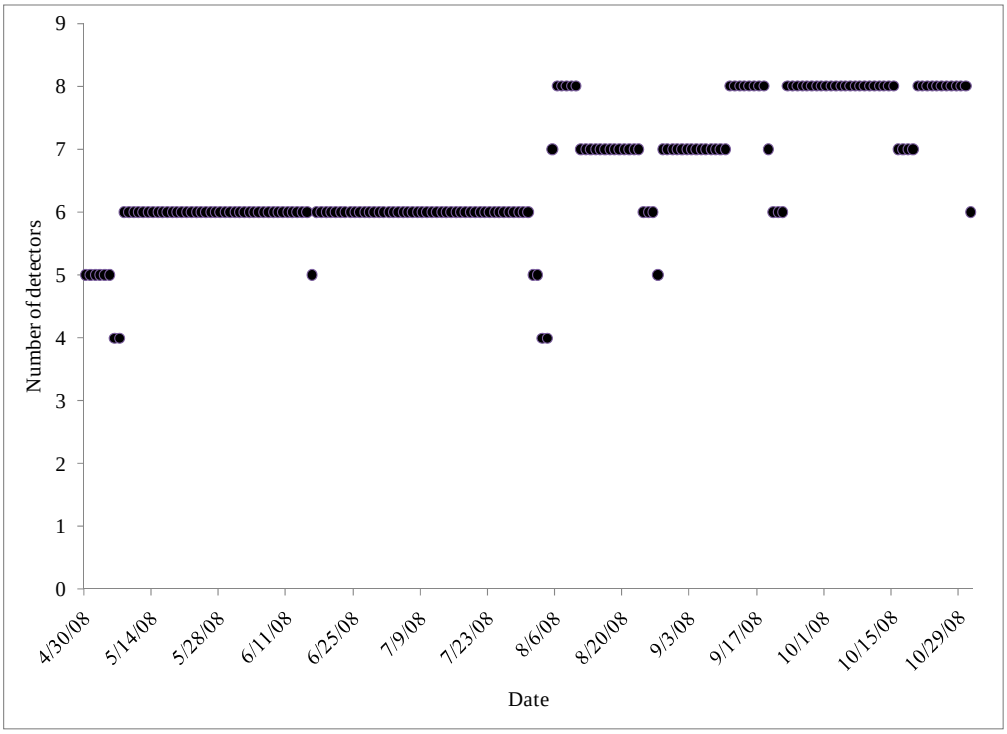


Figure 4.2 Number of Anabat detectors (n = 8) at the Lower Snake River Wind Resource Area operating during each night of the study period April 30 – October 31, 2008.

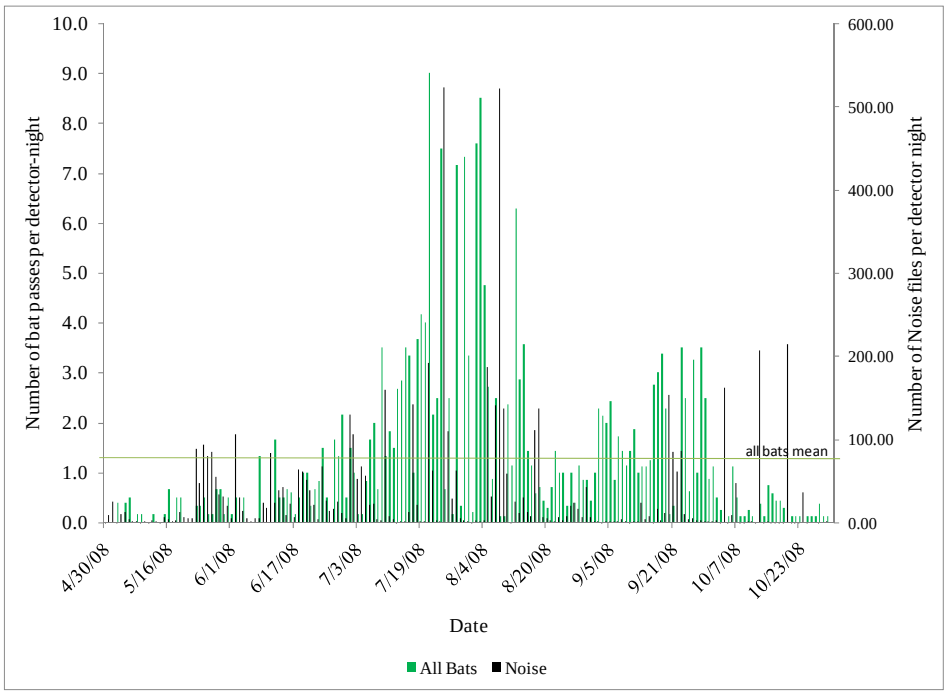


Figure 4.3 Number of bat passes and noise files detected per detector-night at the Lower Snake River Wind Resource Area for the study period April 30 – October 31, 2008, presented nightly. Noise files are indicated on the second axis.

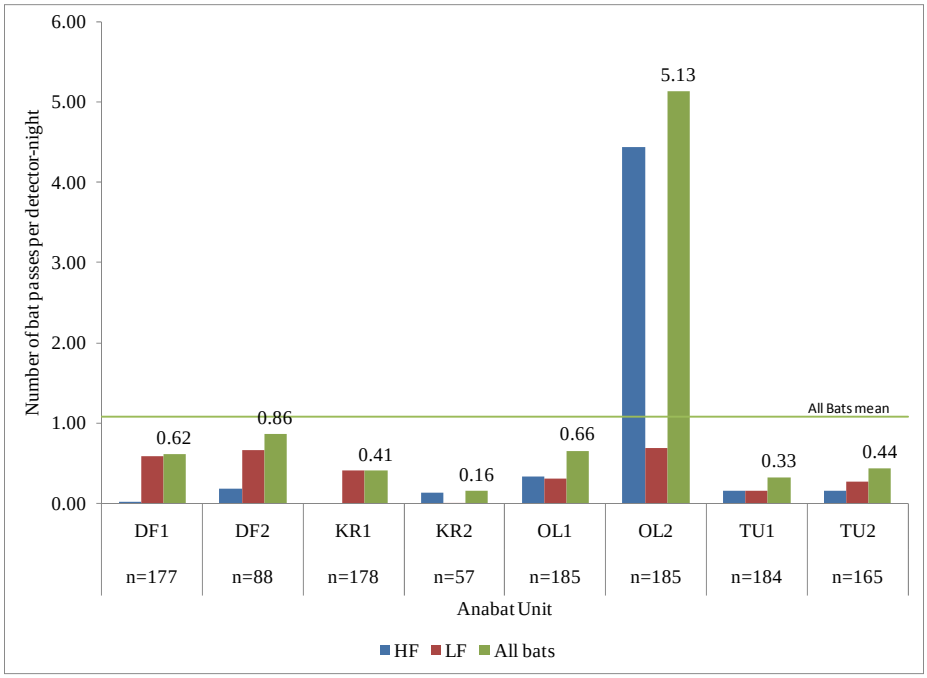


Figure 4.4 Number of bat passes per detector-night by Anabat station at the Lower Snake River Wind Resource Area for the study period April 30 – October 31, 2008.

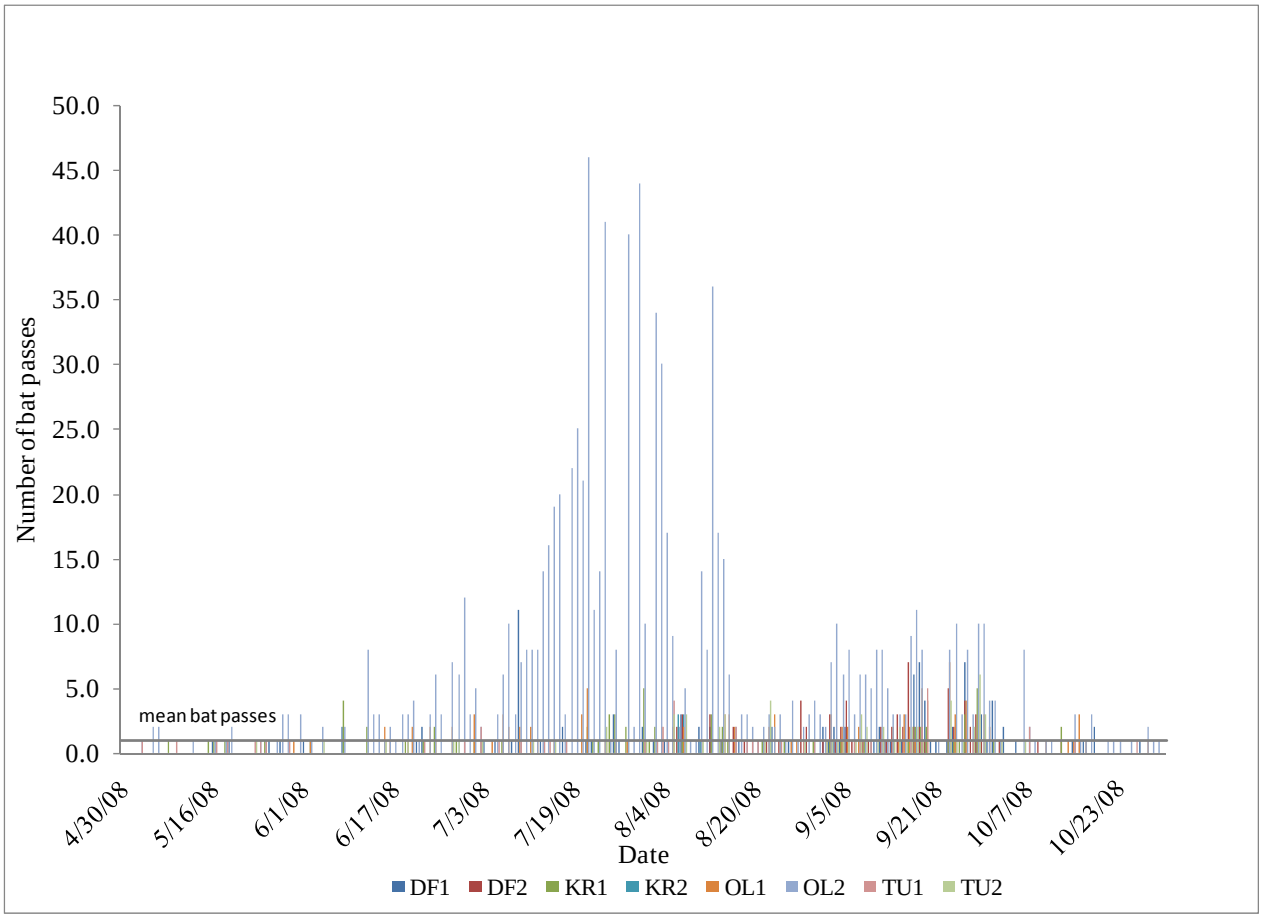


Figure 4.5 Number of nightly bat passes, grouped by Anabat station at the Lower Snake River Wind Resource Area for the for the study period April 30 – October 31, 2008. Station OL2 recorded far more activity than other stations through the end of August.

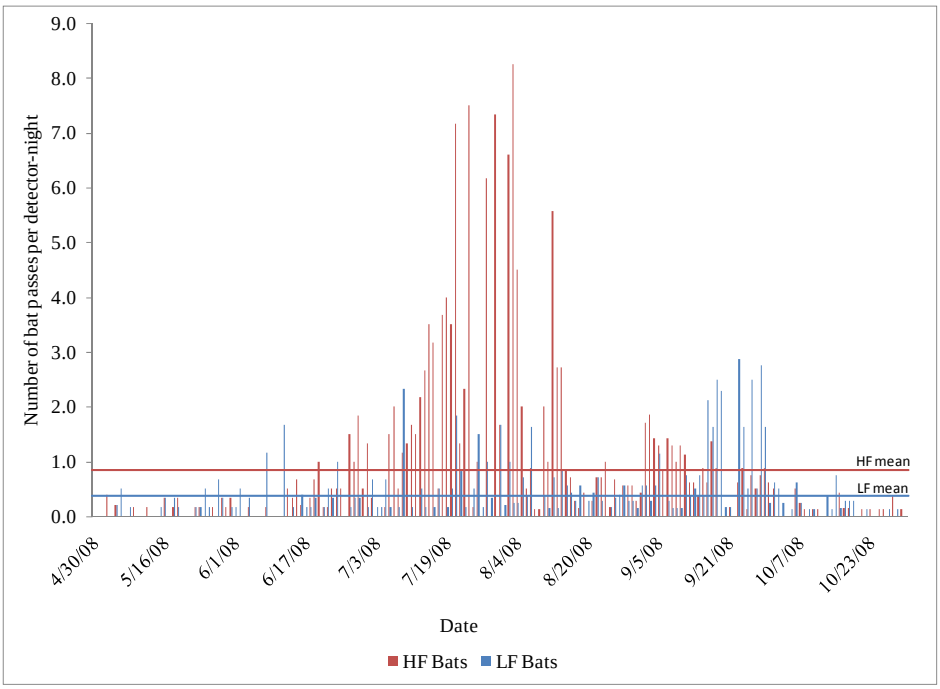


Figure 4.6 Nightly activity by high-frequency (HF) and low-frequency (LF) bats at the Lower Snake River Wind Resource Area for the study period April 30 – October 30, 2008.

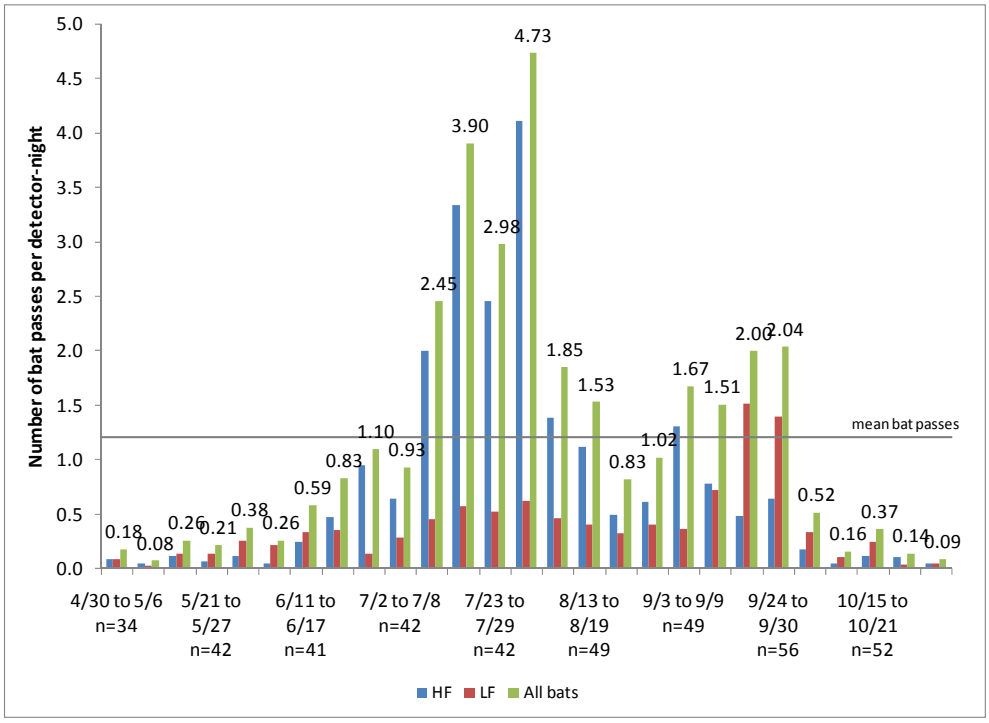


Figure 4.7 Weekly activity by high-frequency (HF) and low-frequency (LF) bats at the Lower Snake River Wind Resource Area for the study period April 30 – October 31, 2008.

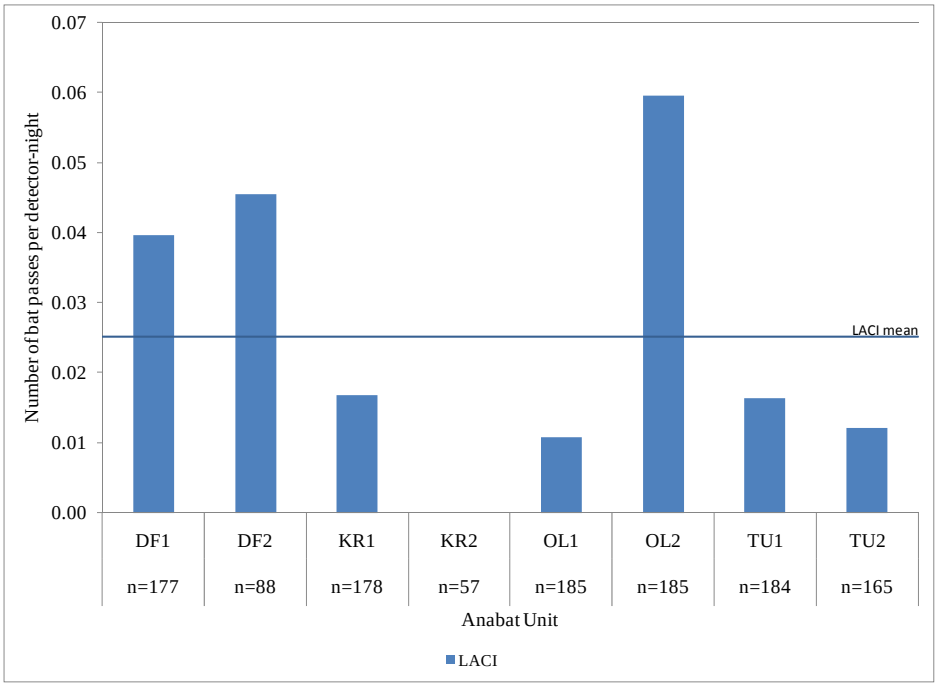


Figure 4.8 Number of passes per detector–night by hoary bats, by Anabat station at the Lower Snake River Wind Resource Area, for the study period April 30 – October 31, 2008.

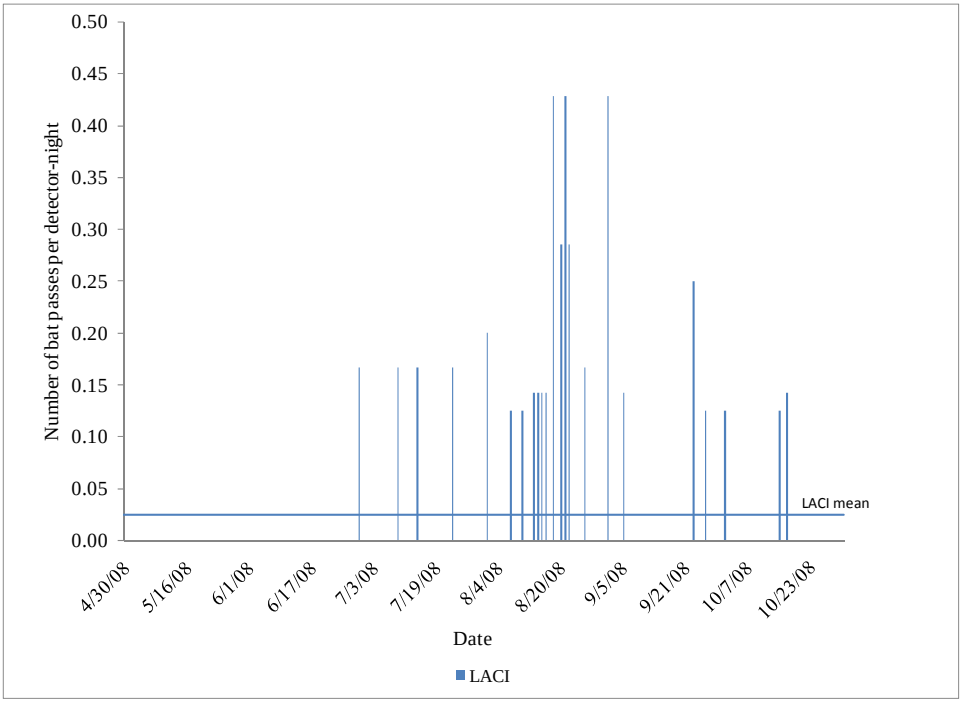


Figure 4.9 Number of passes per detector–night by hoary bats at the Lower Snake River Wind Resource Area, presented nightly for the study period April 30 – October 31.

4.4 Incidental Wildlife and Species of Concern Observations

A total of 1,990 individual birds within 799 separate groups, and comprising 30 species, were observed incidentally in the LSRWRA (Table 4.9). The most abundant bird species recorded as an incidental observation was rock pigeon (715 individuals within two groups) followed by red-tailed hawk (617 individuals), American kestrel (116), and northern harrier (105). Three bird species were only observed incidentally (i.e., were not observed during fixed-point avian use or raptor nest surveys): gray-crowned rosy finch (*Leucosticte arctoa*; a single group of 15 individuals), common yellowthroat (*Geothlypis trichas*; one individual), and western wood-pewee (*Contopus virens*; one individual). The most abundant mammal species recorded incidentally were mule deer (*Odocoileus hemionius*; 523 individuals within 114 groups) and white-tailed deer (*Odocoileus virginianus*; 142 individuals within 45 groups; Table 4.9). Incidental reptiles observations included three species, northern pacific rattlesnake (*Crotalus oreganus oreganus*; two individuals), western yellow-bellied racer (*Coluber constrictor*; one), and gopher snake (*Pituophis catenifer*; one; Table 4.9).

The WDFW maintains a list of State and Federal threatened, endangered, candidate, and sensitive species (WDFW 2008; WDRN 2008). No Federal-threatened, endangered, or candidate species were observed in the LSRWRA (ECOS 2009; WDFW 2008). Seven State species of concern totaling 138 observations within 104 separate groups were observed during fixed-point surveys, raptor nest surveys, or incidentally at the LSRWRA (Table 4.10). These included the State threatened ferruginous hawk (four individuals), the state sensitive bald eagle (one), and five State candidates for listing: golden eagle (52 observations), Vaux's swift (*Chaetura vauxi*; 40), vesper sparrow (*Pooecetes gramineus*; 27), merlin (*Falco columbarius*; six), and sage thrasher (*Oreoscoptes montanus*; one). The majority of species of concern (84.8%) were recorded during fixed-point bird use surveys. Of the four study areas, Oliphant had the most species of concern (70.9%) recorded during fixed-point surveys, primarily due to 28 observations of golden eagle and 35 observations of Vaux's swift (Table 4.11).

Additionally, the WDFW maintains a list of State monitored species (WDFW 2008; WDNR 2008). These monitored species are not considered species of concern by the WDFW, but are managed as required to prevent these species from being listed as endangered, threatened, or sensitive. Seven monitored species totaling 348 observations within 258 separate groups were observed during fixed-point surveys, raptor nest surveys, or incidentally at the LSRWRA (Table 4.10). These included Swainson's hawk (189 observations), grasshopper sparrow (*Ammodramus savannarum*; 72), great blue heron (*Ardea Herodias*; 32), western bluebird (*Sialia mexicana*; 25), prairie falcon (19), turkey vulture (7), and osprey (*Pandion haliaetus*; 4). The majority of monitored species (67.2%) were recorded during fixed-point bird use surveys. Of the four study areas, Tucannon had the most monitored species (44.9%) recorded during fixed-point surveys, primarily due to 69 observations of Swainson's hawk (Table 4.11).

Table 4.9 Incidental wildlife observed during surveys at the Lower Snake River Wind Resource Area.

Species	Scientific Name	# grps	# obs
Birds			
rock pigeon	*Columba livia*	2	715
red-tailed hawk	*Buteo jamaicensis*	430	617
American kestrel	*Falco sparverius*	79	116
northern harrier	*Circus cyaneus*	95	105
house sparrow	*Passer domesticus*	1	85
rough-legged hawk	*Buteo lagopus*	68	75
common raven	*Corvus corax*	3	74
Swainson's hawk	*Buteo swainsoni*	55	72
snow bunting	*Plectrophenax nivalis*	1	40
gray-crowned rosy finch	*Leucosticte arctoa*	1	15
great horned owl	*Bubo virginianus*	12	14
sharp-shinned hawk	*Accipter striatus*	11	13
golden eagle	*Aquila chrysaetos*	8	8
prairie falcon	*Falco mexicanus*	8	8
bald eagle	*Haliaeetus leucocephalus*	4	4
mountain bluebird	*Sialia currucoides*	1	4
merlin	*Falco columbarius*	3	3
Cooper's hawk	*Accipiter cooperii*	2	3
unidentified buteo		1	3
ferruginous hawk	*Buteo regalis*	2	2
northern shrike	*Lanius excubitor*	2	2
grasshopper sparrow	*Ammodramus savannarum*	1	2
killdeer	*Charadrius vociferus*	1	2
unidentified grouse		1	1
common nighthawk	*Chordeiles minor*	1	1
common yellowthroat	*Geothlypis trichas*	1	1
spotted towhee	*Pipilo maculatus*	1	1
short-eared owl	*Asio flammeus*	1	1
western wood-pewee	*Contopus virens*	1	1
Say's phoebe	*Sayornis saya*	1	1
ring-necked pheasant	*Phasianus colchicus*	1	1
Bird Subtotal	**30 species**	**799**	**1,990**
Mammals			
mule deer	*Odocoileus hemionus*	114	523
white-tailed deer	*Odocoileus virginianus*	45	142
coyote	*Canis latrans*	30	48
unidentified deer		8	29
elk	*Cervus elephus*	3	11
unidentified ground squirrel		1	1
red fox	*vulpes vulpes*	1	1

Table 4.9 Incidental wildlife observed during surveys at the Lower Snake River Wind Resource Area.

Species	Scientific Name	# grps	# obs
badger	*Taxidea taxus*	1	1
Mammal Subtotal	**10 species**	**203**	**756**
Reptiles			
northern pacific rattlesnake	*Crotalus oreganus oreganus*	2	2
western yellow-bellied racer	*Coluber constrictor*	1	1
gopher snake	*Pituophis catenifer*	1	1
Reptile Subtotal	**3 species**	**4**	**4**
Total		**1,006**	**2,750**

Table 4.10 Summary of species of concern and monitored species observed during fixed-point bird use surveys, raptor nest surveys, and incidentally at the Lower Snake River Wind Resource Area.

			Fixed-Point Bird Use Surveys		Raptor Nest Surveys		Incidental Observations		Total	
Species	**Scientific Name**	**Status**	**grp**	**obs**	**grp**	**obs**	**grp**	**obs**	**grp**	**obs**
golden eagle	*Aquila chrysaetos*	SC	41	41	3	3	8	8	52	52
Vaux's swift	*Chaetura vauxi*	SC	14	40	0	0	0	0	14	40
vesper sparrow	*Pooecetes gramineus affinis*	SC	19	27	0	0	0	0	19	27
bald eagle	*Haliaeetus leucocephalus*	SS	3	3	0	0	4	4	7	7
merlin	*Falco columbarius*	SC	3	3	0	0	3	3	6	6
ferruginous hawk	*Buteo regalis*	ST	2	2	0	0	2	2	4	4
sage thrasher	*Oreoscoptes montanus*	SC	1	1	0	0	0	0	1	1
State Special-Status Species Subtotal			**83**	**117**	**3**	**3**	**17**	**17**	**104**	**138**
Swainson's hawk	*Buteo swainsoni*	SM	107	117	0	0	55	72	162	189
grasshopper sparrow	*Ammodramus savannarum*	SM	56	70	0	0	1	2	57	72
great blue heron	*Ardea herodias*	SM	1	1	4	31	0	0	5	32
western bluebird	*Sialia mexicana*	SM	7	25	0	0	0	0	7	25
prairie falcon	*Falco mexicanus*	SM	10	10	1	2	7	7	18	19
turkey vulture	*Cathartes aura*	SM	5	7	0	0	0	0	5	7
osprey	*Pandion haliaetus*	SM	4	4	0	0	0	0	4	4
Monitored Species Subtotal			**190**	**234**	**5**	**33**	**63**	**81**	**258**	**348**
Total			**273**	**351**	**8**	**36**	**80**	**98**	**362**	**486**

ST = State threatened; SS = State sensitive; SC = State candidate; SM = State monitored species.

Table 4.11 Special-status and monitored species observed during fixed-point surveys in the Tucannon, Oliphant, Kuhl Ridge, Dutch Flats areas, and for the Lower Snake River Wind Resource Area as a whole.

			Tucannon		Oliphant		Kuhl Ridge		Dutch Flats		LSRWRA (Total)	
Species	**Scientific Name**	**Status**	**grp**	**obs**	**grp**	**obs**	**grp**	**obs**	**grp**	**obs**	**grp**	**obs**
golden eagle	*Aquila chrysaetos*	SC	8	8	28	28	1	1	4	4	41	41
Vaux's swift	*Chaetura vauxi*	SC	2	5	12	35	0	0	0	0	14	40
vesper sparrow	*Pooecetes gramineus*	SC	1	4	13	17	1	1	4	5	19	27
bald eagle	*Haliaeetus leucocephalus*	SS	0	0	3	3	0	0	0	0	3	3
merlin	*Falco columbarius*	SC	1	1	0	0	2	2	0	0	3	3
ferruginous hawk	*Buteo regalis*	ST	0	0	0	0	2	2	0	0	2	2
sage thrasher	*Oreoscoptes montanus*	SC	1	1	0	0	0	0	0	0	1	1
State Special-Status Species Subtotal			**13**	**19**	**56**	**83**	**6**	**6**	**8**	**9**	**83**	**117**
Swainson's hawk	*Buteo swainsoni*	SM	63	69	2	2	39	43	3	3	107	117
grasshopper sparrow	*Ammodramus savannarum*	SM	11	16	30	34	11	15	4	5	56	70
western bluebird	*Sialia mexicana*	SM	3	11	0	0	1	3	3	11	7	25
prairie falcon	*Falco mexicanus*	SM	0	0	0	0	7	7	3	3	10	10
turkey vulture	*Cathartes aura*	SM	4	6	0	0	0	0	1	1	5	7
osprey	*Pandion haliaetus*	SM	2	2	0	0	2	2	0	0	4	4
great blue heron	*Ardea herodias*	SM	1	1	0	0	0	0	0	0	1	1
Monitored Species Subtotal			**84**	**105**	**32**	**36**	**60**	**70**	**14**	**23**	**190**	**234**
Total			**97**	**124**	**88**	**119**	**66**	**76**	**22**	**32**	**273**	**351**

ST = State threatened; SS = State sensitive; SC = State species of concern; SM = State monitored species.

5.0 DISCUSSION AND IMPACT ASSESSMENT

5.1 Fixed-Point Bird Use Surveys

The primary objective of the study was to provide site-specific data on bird and bat use of the LSRWRA that could be helpful in estimating potential impacts from the proposed wind-energy facility and in project planning to minimize risk and potential impacts to bird and bat resources. The proposed LSRWRA encompassed a wide variety of terrain from broad, flat plateau topographic features primarily used for agriculture that are interspersed with steep drainages to larger creeks and rivers (e.g., Tucannon River, Snake River). These areas create distinct physiographic features that could influence bird use in the study area and therefore provide variable spatial density or abundance of birds and bats across the study area. The surveys were designed to allow comparison with numerous other studies conducted at wind-energy facilities across the west, and in particular the CPE, where numerous post construction monitoring studies have been conducted.

5.1.1 Raptor Use and Exposure Risk

Although high numbers of raptor fatalities have been documented at some wind-energy facilities (e.g., Altamont Pass, California), and thus a reason raptors are a concern with wind development, a review of studies at newer-generation wind-energy facilities across the United States indicated that approximately 3.2% of casualties were raptors (Erickson et al. 2001a, 2002b; Kerlinger et al. 2005). Within the Pacific Northwest and CPE the percent of raptor fatalities was higher, at approximately 8.6% (Johnson and Erickson 2008). Although raptors occur in most areas with the potential for wind-energy development, individual species appear to differ from one another in their susceptibility to collision (NRC 2007). Overall, the data set is still relatively limited, but it indicates that while several factors likely influence raptor fatality rates, the level of raptor use may be one factor in estimating raptor mortality.

The annual mean raptor use at the LSRWRA was compared with 36 other wind-energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these other wind-energy facilities ranged from 0.09 to 2.34 birds/20-min survey (Figure 5.1). Mean raptor use at the LSRWRA, 0.71 birds/20-min survey, ranked near the middle when compared to these other facilities.

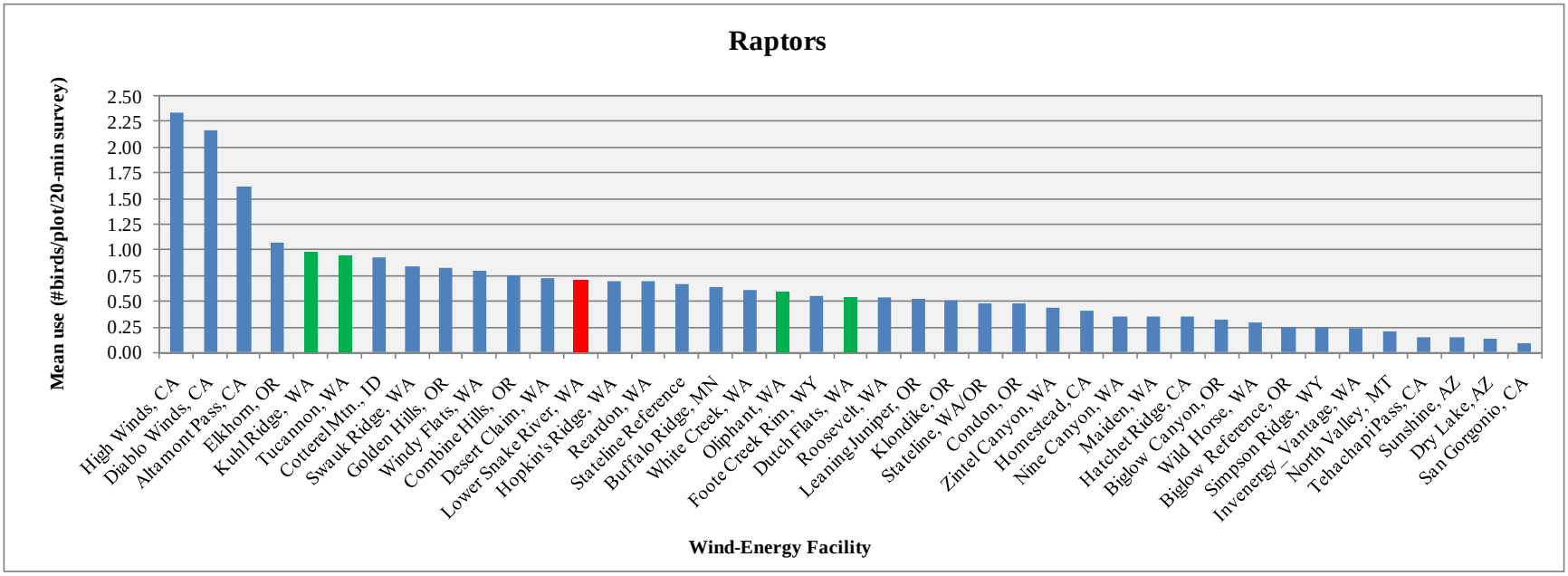


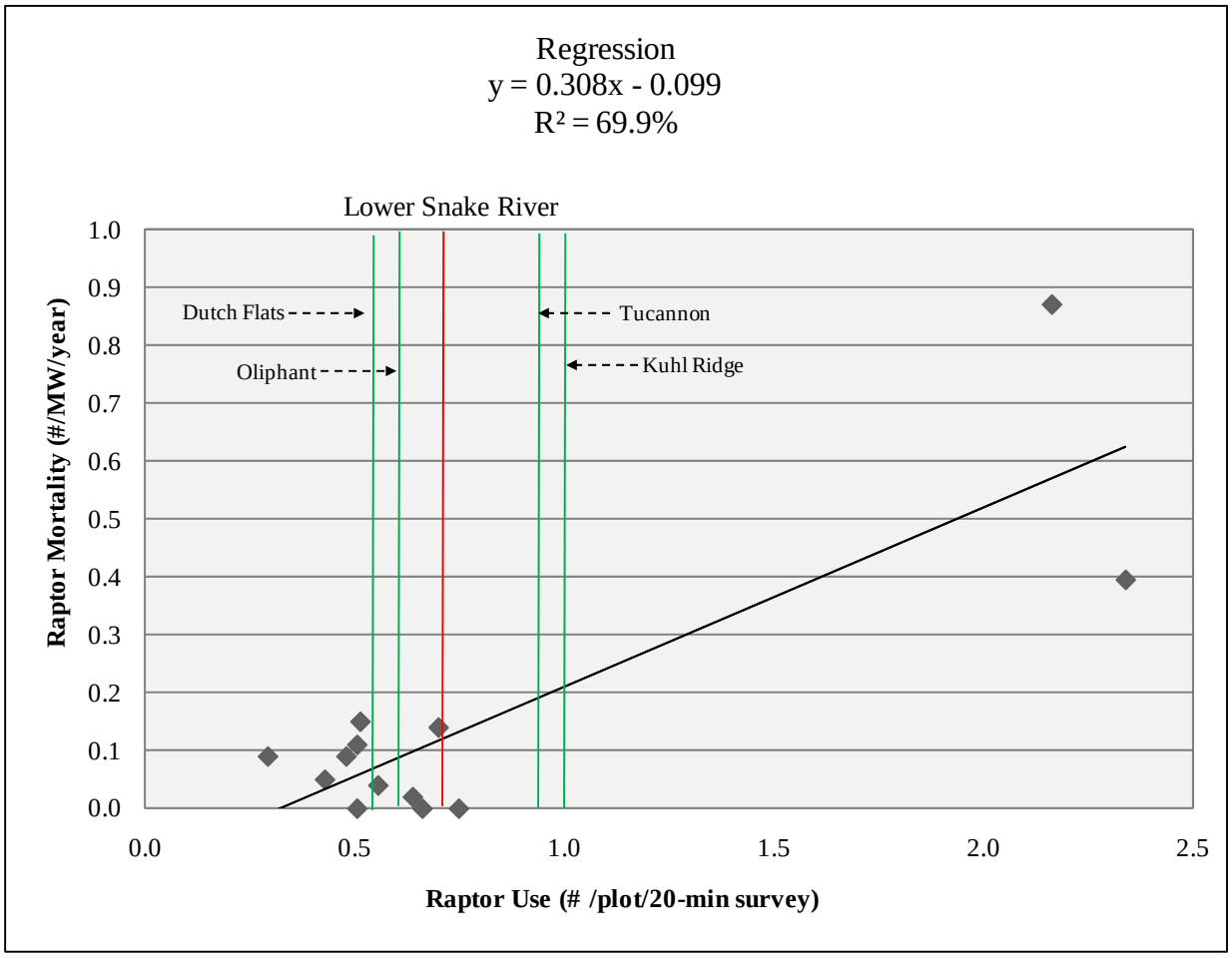
Figure 5.1. Comparison of overall raptor use between the Lower Snake River Wind Resource Area and other US wind-energy facilities.

Data from the following sources:

Lower Snake River, OR	This study.				
High Winds, CA	Kerlinger et al. 2005	Stateline Reference	URS et al. 2001	Maiden, WA	Erickson et al. 2002b
Diablo Winds, CA	WEST 2006a	Buffalo Ridge, MN	Erickson et al. 2002b	Hatchet Ridge, CA	Young et al. 2007b
Altamont Pass, CA	Erickson et al. 2002b	White Creek, WA	NWC and WEST 2005a	Biglow Canyon, OR	WEST 2005c
Elkhorn, OR	WEST 2005a	Foote Creek Rim, WY	Erickson et al. 2002b	Wild Horse, WA	Erickson et al. 2003c
Cotterel Mtn., ID	Cooper et al. 2004	Roosevelt, WA	NWC and WEST 2004	Biglow Reference, OR	WEST 2005c
Swauk Ridge, WA	Erickson et al. 2003a	Leaning Juniper, OR	NWC and WEST 2005b	Simpson Ridge, WY	Johnson et al. 2000
Golden Hills, OR	Jeffrey et al. 2008	Klondike, OR	Johnson et al. 2002	Invenergy_Vantage, WA	WEST 2007
Windy Flats, WA	Johnson et al. 2007	Stateline, WA/OR	Erickson et al. 2002b	North Valley, MT	WEST 2006b
Combine Hills, OR	Young et al. 2003c	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Erickson et al. 2002b
Desert Claim, WA	Young et al. 2003b	Zintel Canyon, WA	Erickson et al. 2002a	Sunshine, AZ	WEST and CPRS 2006
Hopkin's Ridge, WA	Young et al. 2003a	Homestead, CA	WEST et al. 2007	Dry Lake, AZ	Young et al. 2007c
Reardon, WA	WEST 2005b	Nine Canyon, WA	Erickson et al. 2001b	San Gorgonio, CA	Erickson et al. 2002b

A regression analysis of raptor use and mortality for 13 modern wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 69.9%; Figure 5.2). Using this regression to predict raptor collision mortality at the LSRWRA, based on an adjusted mean raptor use of 0.71 birds/20-min survey, yields an estimated fatality rate of 0.09 raptors/MW/year, or nine raptor fatalities per year for a 100-MW wind-energy facility. A 90% prediction interval around this estimate is 0 to 0.23 raptors/MW/year. Raptor fatalities at wind-energy facilities near the LSRWRA fall within this range: Combine Hills wind project (0.0/MW/year; Young et al. 2005), Nine Canyon wind project (0.05/MW/year; Erickson et al. 2003b), Stateline wind project (0.09/MW/year; Erickson et al. 2004), and the Hopkins Ridge wind project (0.14/MW/year; Young et al. 2007a) which is less than two miles south of LSRWRA. The Hopkins Ridge project had a similar pre-project raptor use estimate (0.64 birds/20-min survey) as the LSRWRA, further supporting the relatively low predicted raptor mortality range.

Exposure index analysis may also provide insight into which species might be the most likely turbine casualties; however, the index only considers relative probability of exposure based on abundance, proportion of observations flying, and proportion of flight height of each species within the ZOR for turbines likely to be used at the wind-energy facility. This analysis is based on observations of birds during the daylight period and does not take into consideration flight behavior (e.g. during foraging or courtship). It also does not take into consideration habitat selection, the varying ability among species to detect and avoid turbines, and other factors that may vary among species and influence likelihood for turbine collision. For these reasons, the actual risk for some species may be lower or higher than indicated by these data. For example, at the Altamont Pass Wind Resource Area, American kestrels, red-tailed hawks, and golden eagles were killed more often, and turkey vultures and common ravens were killed less often than predicted, based on abundance (Orloff and Flannery 1992). At the LSRWRA, the raptor species with the highest exposure index was red-tailed hawk, which was influenced by the relatively high use estimates of this species. Swainson's hawk, golden eagle, and rough-legged hawk (a winter resident) ranked much lower, due again primarily to the lower use estimates for these species. Based on the results of other studies (see Johnson and Erickson 2008 for a summary of CPE projects) and the results of the baseline studies at the LSRWRA, red-tailed hawk is the raptor species most likely to be affected by the wind-energy facility through direct impacts.



Overall Raptor Use 0.71
Predicted Fatality Rate 0.09/MW/year
90.0% Prediction Interval (0, 0.23)

Figure 5.2 Regression analysis comparing raptor use estimations versus estimated raptor mortality at the Lower Snake River Wind Resource Area.

Data from the following sources:

Study Site and Location	Raptor Use	Source	Raptor Mortality	Source
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003c	0.00	Young et al. 2005
Diablo Winds, CA	2.16	WEST 2006a	0.87	WEST 2006a
Foote Creek Rim, WY	0.55	Erickson et al. 2002b	0.04	Erickson et al. 2002b
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Klondike, OR	0.50	Johnson et al. 2002	0.00	Johnson et al. 2003a
Stateline, WA/OR	0.48	Erickson et al. 2002b	0.09	Erickson et al. 2002b
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2002b
Wild Horse, WA	0.29	Erickson et al. 2003c	0.09	Erickson et al. 2008
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b
Bighorn, WA	0.51	Johnson and Erickson 2004	0.15	Kronner et al. 2008

5.1.2 Non-raptor Avian Use and Exposure Risk

Of the non-raptor avian groups, passerines have been the most abundant avian fatality at newer generation wind-energy facilities, often comprising more than 80% of the avian fatalities (Erickson et al. 2001a; Johnson and Erickson 2008). Both migrant and resident passerine fatalities have been observed. Based on species and date information, in some studies up to 70% of fatalities found were believed to be migrants (Howe et al. 2002); however, the estimates are highly variable and range from zero to 70%. In general, the number of migrant fatalities is higher at wind-energy facilities in the eastern United States (see Erickson et al. 2002b). The overall national average for passerine fatalities at wind-energy facilities has been approximately 2.2 birds/turbine/year (Erickson et al. 2002b).

The LSRWRA does not appear to provide important stopover habitat for migrant songbirds based on the results of the fixed-point bird use surveys. The primary land use, agriculture, likely does not provide attractive stopover habitat and the site is not unique compared to the surrounding landscape. The study area appears to receive very little use by waterfowl, waterbirds, or shorebirds, and these species are unlikely to be affected by the proposed wind-energy facility either directly or indirectly. Passerines, doves/pigeons, and upland gamebirds were the most abundant non-raptor bird types observed. While upland gamebird and dove/pigeon use estimates were relatively low compared to passerines, results from monitoring studies in the CPE, including the nearby Hopkins Ridge facility, indicate that these species will likely sustain some direct mortality impacts. However, most of the gamebird species are introduced species and impacts are not likely to be significant. Additionally, the most common dove/pigeon species was rock pigeon, also an introduced and non-protected bird species.

Exposure indices of passerines indicate that the vast majority of species recorded during the surveys tend not to fly within the rotor swept zone and are relatively uncommon in the study area. While use was variable across seasons, a few common open grassland species (horned lark, western meadowlark, common raven, European starling, and American goldfinch), made up the vast majority of passerine use in the study area. Provided that relative abundance is related to exposure and risk of collision, these species would be the most likely affected by the project through direct impacts. Results of other monitoring studies corroborate this as horned lark, European starling, and western meadowlark are three of the most commonly found passerine fatalities at CPE wind-energy facilities (Johnson and Erickson 2008). Population estimates for horned lark and western meadowlark in the CPE are large. Results of US Geological Survey (USGS) Breeding Bird Surveys (BBS surveys) suggest that the CPE population for these species is well over 100,000 breeding birds (Sauer et al. 2008). Potential mortality impacts to these species from the facility will likely be insignificant. European starling, as with rock pigeon, is an introduced, non-protected species and there is no concern over impacts to European starling. Despite relatively high use and exposure, common ravens are rarely reported as fatalities according to monitoring studies at other wind-energy facilities (Erickson et al. 2001a, 2002b; Young and Poulton 2007; Johnson and Erickson 2008) and no common raven fatalities were recorded during two years of monitoring at the nearby Hopkins Ridge facility (Young et al. 2007, 2009). No significant impacts to common ravens are expected from the proposed wind-energy facility.

Predicting numbers of fatalities is difficult; however, the results of monitoring studies within the CPE provide a basis for estimating mortality (Table 5.1). Estimates of mortality for all birds have ranged from approximately 1.0 to 3.2 birds/MW/year for CPE wind-energy facilities. Using this as a basis for the proposed LSRWRA, it is expected that between approximately 100 and 300 bird fatalities would occur per year for each 100 MW constructed. The majority of these fatalities would likely be passerines, as up to 80% of fatalities recorded at CPE facilities are passerines (Young and Poulton 2007; Johnson and Erickson 2008). Due to the overall relatively low numbers of non-raptor fatalities expected and the relatively high population sizes for the species most likely affected, is unlikely that non-raptor populations will be adversely affected by direct mortality from the operation of the wind-energy facility.

Table 5.1 Raptor, all bird, and bat mortality estimates at existing wind energy projects in the Columbia Plateau Ecoregion.

	Fatality Rate (#/MW/year)			
Project	**Raptors**	**All birds**	**Bats**	**Source**
Wild Horse, WA	0.09	1.6	0.4	Erickson et al. 2008
Bighorn I, WA	0.15	2.6	1.9	Kronner et al. 2008
Combine Hills, OR	0.00	2.6	1.9	Young et al. 2005
Hopkins Ridge I, WA, 2006	0.14	1.2	0.6	Young et al. 2007a
Hopkins Ridge I, WA, 2008	0.07	3.0	1.4	Young et al. 2009
Klondike I, OR	0.00	0.9	0.8	Johnson et al. 2003a
Klondike II, OR	0.11	3.1	0.4	NWC and WEST 2007
Leaning Juniper, OR	0.06	3.2	0.9	Kronner et al. 2007
Nine Canyon, WA	0.05	2.8	2.5	Erickson et al. 2001b
Stateline, WA/OR	0.10	2.4	1.7	Erickson et al. 2004, 2007
Vansycle, OR	0.00	1.0	1.1	Erickson et al. 2000
Condon, OR	0.02[a]	0.05[a]	NA[a]	Fishman 2003
Mean	**0.06**	**2.3**	**1.2**	

[a] not adjusted for searcher efficiency or scavenger removal; study methods differed from other projects and were not as rigorous; therefore estimate should be regarded as a minimum mortality estimate and is not included in the overall mean calculation.

5.2 Raptor Nest Surveys

The area surveyed for raptor nests was approximately 255 square miles (about 660 km^2). Nest density for all raptors in this area was approximately 0.40 nests/mi^2. Buteos (e.g. red-tailed hawk, Swainson's hawk) accounted for approximately 83% of the nests and red-tailed hawk was by far the most common nesting raptor, accounting for approximately 79% of all active raptor nests found. This index of raptor nest density is similar to other nearby wind-energy facilities that have been studied in the Oregon/Washington region. For example, raptor nest density within a 2-mile buffer around the Hopkins Ridge facility (Oregon) to the south was 0.43 nests/mi^2 (Young et al. 2003), the Stateline facility (Washington/Oregon) was 0.20 nests/mi^2 (URS et al. 2001), and the Combine Hills facility (Oregon) was 0.24 nest/mi^2 (Young et al. 2002).

The raptor nest density in the LSRWRA appears to be influenced by the proximity of several tributaries to the Snake River (e.g., the Tucannon River, Pataha Creek), which have good raptor nesting habitat in the form of large cottonwood trees and rocky cliffs lining the valley (see Figure 4.2). There are also some raptor nests in isolated trees located in the steep draws, which lead from the flat agriculture areas on top of the ridges down towards the rivers.

Potential impacts to nesting raptors include direct loss of nests, disturbance of nesting habitat by construction, and potential disturbance or displacement effects if construction or facilities occur in close proximity to nests. Because the majority of nests in the LSRWRA are located in riparian corridors and drainages, and proposed facilities will be placed in agricultural areas on the ridge tops, there is little potential for direct loss or take of a raptor nest. Additionally, information on the location of raptor nests collected during this survey effort may be used in project planning and design to avoid direct loss of nests.

The nests higher on the ridges or in isolated trees near the flat agricultural areas will be in closer proximity to the proposed turbines and more likely affected through disturbance or displacement. In general, raptor nests are believed to be at greater risk of disturbance (indirect) effects during the construction phases than during facility operation. There have been few studies that have addressed nesting raptor displacement at wind-energy facilities; however, the studies that are available suggest that indirect effects are generally negligible (Howell and Noone 1992; Johnson et al. 2000, 2003a; Madders and Whitfield 2006). A Swainson's hawk (*Buteo swainsonii*) was reported nesting within 0.25 mile (0.8 km) of a turbine string at the Klondike facility in Oregon, suggesting little disturbance or habituation to the turbines by this species (Johnson et al. 2003a). At the Foote Creek Rim wind-energy facility in southern Wyoming, one pair of red-tailed hawks nested within 0.3 mile (0.48 km) of the turbine strings, and seven red-tailed hawk, one great horned owl, and one golden eagle nests located within one mile (1.61 km) of the facility successfully fledged young (Johnson et al. 2000). The golden eagle pair successfully nested 0.5 mile (800 m) from the wind-energy facility for three different years after it became operational. Studies at the Stateline wind-energy facility in Oregon and Washington have not shown any measurable short-term effects to nesting raptors (Erickson et al. 2004).

These observations suggest that there will be limited displacement of nesting raptors at the LSRWRA. Also, as evidenced by the raptor nest survey results, there are numerous active nests in close proximity to the existing Hopkins Ridge and Marengo facilities. Nesting raptors appear to become habituated to the wind facilities once construction is complete and no disturbance or displacement effects are expected from wind project operation.

Red-tailed hawk and great-horned owl, as the most abundant nesting raptors in the study area, are the species at highest risk to disturbance or displacement effects from construction activity. Red-tailed hawk is likely the most common *Buteo* species and great-horned owl is likely the most common owl species in North America and both species are nearly ubiquitous across the U.S. and Canada (Preston and Beane 2009; Houston et al. 1998). Generally less concern is raised over these species than other species with far smaller populations. Of the nesting raptors recorded, golden eagle is a Washington State Candidate species and scrutiny over potential impacts to this species is expected to be higher. The two golden eagle nests located during the survey are unlikely to be affected by the construction or operation of the proposed facility, as

they were both located in the buffer zone for the survey and greater than 0.50 mile from the proposed facility areas (see Figure 4.2). No impacts to nesting golden eagles are expected from the LSRWRA.

5.3 Acoustic Bat Surveys

Assessing the potential impacts of wind energy development on bats at the LSRWRA is complicated by a current lack of understanding of why bats die at wind turbines (Kunz et al. 2007b; Baerwald et al. 2008), combined with the inherent difficulties of monitoring elusive, night-flying animals (O'Shea et al. 2003). To date, monitoring studies of wind-energy facilities suggest that: (a) migratory tree-roosting species (eastern red [*Lasiurus borealis*], hoary, and silver-haired bats) comprise almost 75% of reported bats killed; (b) the majority of fatalities occur during the post-breeding dispersal or fall migration season (roughly August and September); and (c) the highest reported fatalities occur at wind facilities located along forested ridge tops in the eastern US (Gruver 2002; Johnson et al. 2003b; Kunz et al. 2007b; Arnett et al. 2008), although recent studies in agricultural regions of Iowa and Alberta, Canada, report relatively high fatalities as well (Jain 2005, Baerwald 2006).

Some studies of wind projects have recorded both Anabat detections per night and bat mortality (Table 5.2). The number of bat calls per night as determined from bat detectors shows a rough correlation with bat mortality, but may be misleading because effort, timing of sampling, species recorded, and detector settings (equipment and locations) varied among studies. The best available estimate of mortality levels at a proposed wind-energy facility often involves evaluation of on-site bat acoustic data in terms of activity levels, seasonal variation, species composition, and topographic features of the study area in conjunction with results of regional monitoring studies.

Table 5.2 Wind projects in the U.S. with both Anabat sampling data and mortality data for all bat species.

Project Area	Study Period	Bat activity (#/detector /night)	Mortality (#/turbine /year)	Reference
Lower Snake River, WA	Apr 30-Oct 31, 2008	1.1	na	This study
Buffalo Ridge, MN	Jun 15-Sep 1, 2001	2.1	2.2	Johnson et al. 2003b
Foote Creek Rim, WY	Jun 15-Sep 1, 2000-01	2.2	1.3	Gruver 2002
Buffalo Mountain, TN	Apr 1-Sep 30, 2001-02	23.7	20.8	Fiedler 2004
Top of Iowa, IA	May 26-Sep 24, 2004	34.9	10.2	Jain 2005
Mount Storm, WV	July 17-Oct 17, 2008	35.2	24.2	Young et al. 2009
Mountaineer, WV	Aug 1-Sep 14, 2004	38.3	38.0	Arnett 2005

Influence of Activity

Bat activity within the LSRWRA (mean of 1.08 bat passes per detector-night) was lower than activity observed at facilities in Minnesota and Wyoming, where bat mortality was relatively

low, and was much lower than activity recorded at facilities in West Virginia, Iowa, and Tennessee, where bat mortality rates were relatively high (Table 5.2). Thus, based on the presumed relationship between bat activity as measured by Anabat detectors and post-construction fatalities, bat mortality rates at LSRWRA are expected to be relatively low and likely to be similar to the average for other wind-energy facilities within the CPE (Table 5.1).

Spatial Variation
Bat activity was variable across the sampling stations but the highest activity recorded, 5.13 bat detections/detector-night at station OL2, was still much lower than facilities where bat mortality has been relatively high. The proposed wind-energy facility is not located near any known bat colonies or other features that are likely to attract large numbers of bats, but it is expected that areas within the LSRWRA, such as the riparian corridors, likely receive higher bat use than the areas where turbines will be constructed. The LSRWRA does not appear to contain topographic features that may funnel migrating bats, and is lacking forest cover, such as present at the high-mortality sites in the eastern US. However, the larger numbers of bat fatalities have been reported in northern Iowa (Jain 2005) and southwestern Alberta (Baerwald 2006) and indicate that an open landscape is no guarantee of low mortality.

Temporal Variation
Bat activity at the site was relatively consistent from June to August and likely represented foraging by resident bats and the fall migration period for bats (August). Overall activity dropped off in September, which is likely an indication that most migrant bats have moved through by this time and resident bats have retreated to areas around hibernacula.

Fatality studies of bats at wind-energy facilities in the US have shown a peak in mortality in August and September and generally lower mortality earlier in the summer (Johnson 2005; Arnett et al. 2008). While the survey effort varies among the different studies, the studies that combine Anabat surveys and fatality surveys show a general association between the timing of increased bat call rates and timing of mortality, with both call rates and mortality peaking during the fall. These findings are supported by monitoring studies from CPE wind-energy facilities (see for example Young et al. 2007a, 2009). Based on the available data, it is expected that bat mortality at the LSRWRA will be highest in mid-July through September, with little to no mortality in the spring, early summer, and late fall.

Species Composition
Of the 14 species of bat with potential to occur in the study area, five are known fatalities at wind-energy facilities (see Table 4.7). Bat acoustic surveys were unable to determine all bat species present in the study area, but they were able to distinguish high-frequency (HF) from low-frequency (LF) species and hoary bats from other bat species. Roughly two-thirds of passes were by high-frequency bats, suggesting higher relative abundance of species such as western pipistrelle and *Myotis* sp. High frequency bats do not appear to be at as high a risk of turbine collision as low frequency bats. Despite the higher relative abundance of high frequency bats, CPE monitoring studies have consistently found that high frequency bats are at relatively lower risk (Young and Poulton 2007; Johnson and Erickson 2008). In general, high frequency bats were more common than low frequency bats during the summer months and low frequency bats were more common in the fall, which likely represents migration through the areas by low frequency bats.

Overall, the Anabat survey results do not suggest that bat mortality impacts from the LSRWRA would be different than other CPE wind-energy facilities. Mortality is likely to consist primarily of hoary bats and silver-haired bats, and likely to be highest during the months of August and September. Minor impacts are expected to other species (e.g. little brown [*Myotis lucifugus*] and big brown bats) during the spring and early summer.

6.0 CONCLUSION AND RECOMMENDATIONS

The data collected during baseline wildlife surveys suggest that the Lower Snake River Wind Resource Area is not within a high bird use area or major migration pathway. No obvious flyways or concentration areas were observed, and no strong association with topographic features within the study area was noted for raptors or other large birds. Based on data collected during this study, raptor use of the study area is consistent with other proposed and existing wind-energy facilities in the Pacific Northwest and CPE. The avian and bat studies at this site suggest mortality at the Lower Snake River Wind Resource Area would likely be similar to that documented at existing wind-energy facilities located in the Pacific Northwest and CPE, where fatalities have been relatively low. Overall, results of the studies to date do not suggest that a wind development at the proposed site would have significant impacts to avian and bat species.

Additional studies recommended for the LSRWRA include surveys for sensitive plant and wildlife species and raptor nests within or near proposed development corridors prior to construction. The intent of these surveys would be to provide data useful in project planning to minimize potential impacts.

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Appendix A: Tables and Figures for the Tucannon Wind Resource Area.

Table A-1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Season	Number of Visits	Mean Use	# Species/ Survey	# Species	# Surveys Conducted
Winter	10	10.07	1.62	32	157
Spring	5	8.31	2.56	45	90
Summer	8	5.96	2.31	51	164
Fall	7	5.19	1.75	35	135
Overall	**30**	**7.99**	**1.96**	**69**	**546**

Table A-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**
great blue heron	*Ardea herodias*	0	0	0	0	1	1	0	0	1	1
Waterfowl		**2**	**42**	**1**	**2**	**0**	**0**	**0**	**0**	**3**	**44**
Canada goose	*Branta canadensis*	2	42	0	0	0	0	0	0	2	42
mallard	*Anas platyrhynchos*	0	0	1	2	0	0	0	0	1	2
Shorebirds		**2**	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**4**	**5**
killdeer	*Charadrius vociferus*	2	3	2	2	0	0	0	0	4	5
Raptors		**116**	**127**	**89**	**105**	**161**	**197**	**123**	**137**	**489**	**566**
Accipiters		*2*	*2*	*1*	*1*	*2*	*2*	*4*	*5*	*9*	*10*
Cooper's hawk	*Accipiter cooperii*	1	1	0	0	1	1	0	0	2	2
sharp-shinned hawk	*Accipter striatus*	1	1	1	1	1	1	4	5	7	8
Buteos		*84*	*93*	*68*	*83*	*134*	*163*	*83*	*94*	*369*	*433*
red-tailed hawk	*Buteo jamaicensis*	50	56	55	70	86	109	71	82	262	317
rough-legged hawk	*Buteo lagopus*	30	33	3	3	0	0	7	7	40	43
Swainson's hawk	*Buteo swainsoni*	0	0	10	10	48	54	5	5	63	69
unidentified buteo		4	4	0	0	0	0	0	0	4	4
Northern Harrier		*18*	*20*	*10*	*10*	*12*	*13*	*17*	*17*	*57*	*60*
northern harrier	*Circus cyaneus*	18	20	10	10	12	13	17	17	57	60
Eagles		*4*	*4*	*2*	*2*	*0*	*0*	*2*	*2*	*8*	*8*
golden eagle	*Aquila chrysaetos*	4	4	2	2	0	0	2	2	8	8
Falcons		*5*	*5*	*8*	*9*	*12*	*18*	*15*	*17*	*40*	*49*
American kestrel	*Falco sparverius*	5	5	8	9	12	18	14	16	39	48
merlin	*Falco columbarius*	0	0	0	0	0	0	1	1	1	1
Owls		*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*
short-eared owl	*Asio flammeus*	0	0	0	0	1	1	0	0	1	1

Table A-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Other Raptors		*0*	*0*	*0*	*0*	*2*	*2*	*3*	*3*	*5*	*5*
osprey	*Pandion haliaetus*	0	0	0	0	0	0	2	2	2	2
unidentified raptor		3	3	0	0	0	0	0	0	3	3
Vultures		**0**	**0**	**1**	**3**	**2**	**2**	**1**	**1**	**4**	**6**
turkey vulture	*Cathartes aura*	0	0	1	3	2	2	1	1	4	6
Upland Gamebirds		**4**	**13**	**34**	**42**	**29**	**44**	**12**	**26**	**79**	**125**
California quail	*Callipepla californica*	1	9	1	1	5	12	5	17	12	39
gray partridge	*Perdix perdix*	0	0	2	3	1	5	0	0	3	8
ring-necked pheasant	*Phasianus colchicus*	3	4	31	38	22	24	7	9	63	75
wild turkey	*Meleagris gallopavo*	0	0	0	0	1	3	0	0	1	3
Doves/Pigeons		**5**	**60**	**9**	**20**	**21**	**76**	**6**	**42**	**41**	**198**
mourning dove	*Zenaida macroura*	2	24	7	9	16	55	3	35	28	123
rock pigeon	*Columba livia*	3	36	2	11	5	21	3	7	13	75
Passerines		**226**	**1,705**	**190**	**750**	**275**	**813**	**172**	**932**	**863**	**4,200**
American crow	*Corvus brachyrhynchos*	0	0	1	1	1	1	0	0	2	2
American goldfinch	*Carduelis tristis*	20	205	6	73	1	1	9	70	36	349
American robin	*Turdus migratorius*	5	92	6	33	4	4	1	1	16	130
bank swallow	*Riparia riparia*	0	0	0	0	21	147	0	0	21	147
barn swallow	*Hirundo rustica*	0	0	1	4	6	10	1	8	8	22
Bewick's wren	*Thryomanes bewickii*	0	0	1	1	0	0	0	0	1	1
black-billed magpie	*Pica pica*	21	52	8	14	13	31	16	45	58	142
Brewer's blackbird	*Euphagus cyanocephalus*	1	16	5	12	1	1	2	150	9	179
brown-headed cowbird	*Molothrus ater*	0	0	1	2	2	2	2	3	5	7
Bullock's oriole	*Icterus bullockii*	0	0	0	0	5	9	0	0	5	9
Cassin's finch	*Carpodacus purpureus*	0	0	0	0	1	1	0	0	1	1
cliff swallow	*Petrochelidon pyrrhonota*	0	0	9	29	12	48	0	0	21	77
common raven	*Corvus corax*	38	65	21	41	27	50	49	117	135	273
dark-eyed junco	*Junco hyemalis*	8	157	1	5	0	0	0	0	9	162

Table A-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
eastern kingbird	*Tyrannus tyrannus*	0	0	0	0	9	12	1	3	10	15
European starling	*Sturnus vulgaris*	6	293	6	109	6	71	7	184	25	657
grasshopper sparrow	*Ammodramus savannarum*	0	0	1	2	10	14	0	0	11	16
Harris' sparrow	*Zonotrichia querula*	1	4	0	0	0	0	0	0	1	4
horned lark	*Eremophila alpestris*	69	422	43	197	58	230	39	210	209	1,059
house finch	*Carpodacus mexicanus*	16	187	1	10	5	13	8	31	30	241
house wren	*Troglodytes aedon*	0	0	3	3	4	4	0	0	7	7
lark sparrow	*Chondestes grammacus*	0	0	0	0	5	6	0	0	5	6
lazuli bunting	*Passerina amoena*	0	0	1	1	2	3	0	0	3	4
MacGillivray's warbler	*Oporornis tolmiei*	0	0	0	0	1	1	0	0	1	1
marsh wren	*Cistothorus palustris*	0	0	1	1	0	0	0	0	1	1
northern rough-winged swallow	*Stelgidopteryx serripennis*	0	0	1	1	1	1	0	0	2	2
northern shrike	*Lanius excubitor*	1	1	0	0	0	0	0	0	1	1
pine siskin	*Carduelis pinus*	1	15	0	0	0	0	0	0	1	15
red-winged blackbird	*Agelaius phoeniceus*	6	92	8	14	5	32	0	0	19	138
rock wren	*Salpinctes obsoletus*	0	0	0	0	6	7	0	0	6	7
sage thrasher	*Oreoscoptes montanus*	0	0	0	0	0	0	1	1	1	1
savannah sparrow	*Passerculus sandwichensis*	1	1	7	9	12	16	0	0	20	26
Say's phoebe	*Sayornis saya*	1	2	7	8	9	10	4	4	21	24
song sparrow	*Melospiza melodia*	9	19	2	3	3	6	4	6	18	34
unidentified passerine		0	0	0	0	0	0	1	17	1	17
vesper sparrow	*Pooecetes gramineus*	0	0	0	0	1	4	0	0	1	4
violet-green swallow	*Tachycineta thalassina*	0	0	2	5	1	1	0	0	3	6
western bluebird	*Sialia mexicana*	0	0	2	4	0	0	1	7	3	11
western kingbird	*Tyrannus verticalis*	0	0	3	6	15	22	2	2	20	30
western meadowlark	*Sturnella neglecta*	14	30	34	86	22	47	18	40	88	203
western tanager	*Piranga ludoviciana*	0	0	0	0	3	4	0	0	3	4

Table A-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
white-crowned sparrow	*Zonotrichia leucophrys*	8	52	8	76	1	2	6	33	23	163
yellow-breasted chat	*Icteria virens*	0	0	0	0	1	1	0	0	1	1
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	0	0	0	1	1	0	0	1	1
Other Birds		**1**	**1**	**3**	**6**	**3**	**4**	**6**	**9**	**13**	**20**
common nighthawk	*Chordeiles minor*	0	0	0	0	3	4	0	0	3	4
northern flicker	*Colaptes auratus*	1	1	2	3	0	0	4	4	7	8
Vaux's swift	*Chaetura vauxi*	0	0	1	3	0	0	1	2	2	5
white-throated swift	*Aeronautes saxatalis*	0	0	0	0	0	0	1	3	1	3
Unidentified Birds		**0**	**0**	**0**	**0**	**1**	**14**	**0**	**0**	**1**	**14**
unidentified bird		0	0	0	0	1	14	0	0	1	14
Overall		**356**	**1,951**	**329**	**930**	**493**	**1,151**	**320**	**1,147**	**1,498**	**5,179**

Table A-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Waterbirds	**0**	**0**	**<0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.6**	**0**
great blue heron	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
Waterfowl	**0.30**	**0.02**	**0**	**0**	**3.0**	**0.3**	**0**	**0**	**1.5**	**1.1**	**0**	**0**
Canada goose	0.30	0	0	0	3.0	0.0	0	0	1.5	0	0	0
mallard	0	0.02	0	0	0.0	0.3	0	0	0	1.1	0	0
Shorebirds	**0.02**	**0.02**	**0**	**0**	**0.2**	**0.2**	**0**	**0**	**1.1**	**2.0**	**0**	**0**
killdeer	0.02	0.02	0	0	0.2	0.2	0	0	1.1	2.0	0	0
Raptors	**0.72**	**1.12**	**1.18**	**1.01**	**7.2**	**13.5**	**19.8**	**19.4**	**47.5**	**51.7**	**53.9**	**54.9**
Accipiters	*0.01*	*0.01*	*0.01*	*0.03*	*0.1*	*0.1*	*0.2*	*0.6*	*1.0*	*1.1*	*1.1*	*2.6*
Cooper's hawk	<0.01	0	<0.01	0	<0.1	0	<0.1	0	0.6	0	0.6	0
sharp-shinned hawk	<0.01	0.01	<0.01	0.03	<0.1	0.1	<0.1	0.6	0.5	1.1	0.6	2.6
Buteos	*0.54*	*0.89*	*0.99*	*0.69*	*5.3*	*10.7*	*16.6*	*13.2*	*38.1*	*44.1*	*47.6*	*38.6*
red-tailed hawk	0.29	0.75	0.65	0.62	2.8	9.0	11.0	11.9	20.3	37.4	36.7	36.4
rough-legged hawk	0.24	0.05	0	0.04	2.4	0.6	0	0.7	18.4	4.6	0	3.6
Swainson's hawk	0	0.09	0.33	0.03	0	1.1	5.6	0.6	0	9.1	19.5	3.2
unidentified buteo	0.01	0	0	0	0.1	0	0	0	1.4	0	0	0
Northern Harrier	*0.12*	*0.10*	*0.07*	*0.14*	*1.2*	*1.2*	*1.2*	*2.8*	*8.6*	*8.8*	*6.8*	*12.7*
northern harrier	0.12	0.10	0.07	0.14	1.2	1.2	1.2	2.8	8.6	8.8	6.8	12.7
Eagles	*0.02*	*0.02*	*0*	*0.02*	*0.2*	*0.2*	*0*	*0.4*	*2.3*	*2.0*	*0*	*1.9*
golden eagle	0.02	0.02	0	0.02	0.2	0.2	0	0.4	2.3	2.0	0	1.9
Falcons	*0.03*	*0.10*	*0.10*	*0.11*	*0.3*	*1.3*	*1.7*	*2.2*	*2.5*	*9.4*	*5.1*	*9.1*
American kestrel	0.03	0.10	0.10	0.11	0.3	1.3	1.7	2.1	2.5	9.4	5.1	8.8
merlin	0	0	0	0.00	0	0	0	<0.1	0	0	0	0.3
Owls	*0*	*0*	*<0.01*	*0*	*0*	*0*	*<0.1*	*0*	*0*	*0*	*0.6*	*0*
short-eared owl	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0

Table A-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Other Raptors	*<0.01*	*0*	*0*	*<0.01*	*<0.1*	*0*	*0*	*0.3*	*0.5*	*0*	*0*	*1.3*
osprey	0	0	0	0.01	0	0	0	0.3	0	0	0	1.3
unidentified raptor	<0.01	0	0	0	<0.1	0	0	0	0.5	0	0	0
Vultures	**0**	**0.03**	**0.01**	**<0.01**	**0**	**0.4**	**0.2**	**0.1**	**0**	**1.1**	**1.1**	**0.6**
turkey vulture	0	0.03	0.01	<0.01	0	0.4	0.2	0.1	0	1.1	1.1	0.6
Upland Gamebirds	**0.09**	**0.50**	**0.28**	**0.13**	**0.9**	**6.0**	**4.7**	**2.5**	**3.5**	**33.1**	**16.7**	**4.9**
California quail	0.04	<0.01	0.08	0.08	0.4	0.1	1.3	1.6	0.5	0.9	3.5	1.9
gray partridge	0	0.06	0.03	0	0	0.7	0.5	0	0	3.4	0.6	0
ring-necked pheasant	0.05	0.43	0.16	0.05	0.5	5.2	2.6	0.9	3.1	32.2	13.9	3.6
wild turkey	0	0	0.02	0	0	0	0.3	0	0	0	0.6	0
Doves/Pigeons	**0.32**	**0.19**	**0.44**	**0.26**	**3.2**	**2.2**	**7.4**	**5.1**	**2.5**	**8.5**	**12.0**	**3.6**
mourning dove	0.14	0.08	0.31	0.22	1.4	1.0	5.2	4.2	1.0	6.5	9.1	1.6
rock pigeon	0.19	0.10	0.13	0.05	1.8	1.2	2.1	0.9	1.4	2.0	3.5	1.9
Passerines	**8.61**	**6.38**	**3.94**	**3.73**	**85.5**	**76.7**	**66.2**	**71.9**	**63.0**	**74.4**	**68.9**	**49.4**
American crow	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
American goldfinch	1.48	1.20	<0.01	0.51	14.7	14.5	<0.1	9.8	14.8	9.2	0.6	5.5
American robin	0.30	0.07	0.02	0	3.0	0.9	0.4	0	1.6	3.2	2.3	0
bank swallow	0	0	0.85	0	0	0	14.2	0	0	0	12.0	0
barn swallow	0	0.04	0.06	0	0	0.4	1.0	0	0	0.9	3.4	0
Bewick's wren	0	0.01	0	0	0	0.1	0	0	0	1.1	0	0
black-billed magpie	0.11	0.02	0.05	0.10	1.1	0.3	0.8	2.0	3.5	1.1	2.4	1.9
Brewer's blackbird	0.07	0.08	<0.01	0.10	0.7	1.0	<0.1	1.9	0.5	5.4	0.6	0.3
brown-headed cowbird	0	0.02	<0.01	0.01	0	0.2	<0.1	0.3	0	0.9	0.6	1.0
Bullock's oriole	0	0	0.07	0	0	0	1.2	0	0	0	3.5	0
Cassin's finch	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
cliff swallow	0	0.26	0.24	0	0	3.2	4.0	0	0	8.2	6.9	0

Table A-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
common raven	0.08	0.04	0.02	0.10	0.8	0.5	0.3	1.9	3.0	2.0	1.8	3.9
dark-eyed junco	0.54	0.05	0	0	5.4	0.6	0	0	3.1	1.1	0	0
eastern kingbird	0	0	0.07	0.02	0	0	1.2	0.4	0	0	5.2	0.6
European starling	1.61	0.58	0.27	0.56	16.0	7.0	4.5	10.7	2.3	3.8	1.7	2.6
grasshopper sparrow	0	0.02	0.08	0	0	0.2	1.3	0	0	0.9	5.7	0
Harris' sparrow	0.02	0	0	0	0.2	0	0	0	0.5	0	0	0
horned lark	2.08	2.26	1.33	1.43	20.7	27.2	22.4	27.6	37.7	46.6	32.7	31.2
house finch	0.90	0	0.07	0.24	8.9	0	1.2	4.6	7.8	0	2.8	5.8
house wren	0	0	0.02	0	0	0	0.3	0	0	0	1.7	0
lark sparrow	0	0	0.03	0	0	0	0.6	0	0	0	2.8	0
lazuli bunting	0	<0.01	0.02	0	0	0.1	0.3	0	0	0.9	1.1	0
MacGillivray's warbler	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
northern rough-winged swallow	0	<0.01	<0.01	0	0	0.1	<0.1	0	0	0.9	0.6	0
pine siskin	0.13	0	0	0	1.2	0	0	0	0.8	0	0	0
red-winged blackbird	0.68	0.10	0.17	0	6.8	1.2	2.9	0	4.7	3.9	2.3	0
rock wren	0	0	0.03	0	0	0	0.6	0	0	0	2.3	0
sage thrasher	0	0	0	<0.01	0	0	0	0.1	0	0	0	0.6
savannah sparrow	0.01	0.13	0.09	0	<0.1	1.6	1.5	0	1.0	9.7	6.8	0
Say's phoebe	0.01	0.07	0.05	0.03	0.1	0.9	0.9	0.5	0.5	6.0	4.5	2.6
song sparrow	0.20	0.02	0.05	0.04	2.0	0.2	0.8	0.8	6.5	0.9	2.4	2.6
vesper sparrow	0	0	0.02	0	0	0	0.4	0	0	0	0.6	0
violet-green swallow	0	0.05	<0.01	0	0	0.6	<0.1	0	0	2.0	0.6	0
western bluebird	0	0.04	0	0.02	0	0.4	0	0.4	0	1.8	0	0.3

Table A-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
western kingbird	0	0.05	0.11	0.01	0	0.7	1.9	0.3	0	2.7	8.0	1.3
western meadowlark	0.13	0.30	0.13	0.32	1.3	3.6	2.1	6.3	6.1	10.7	5.1	11.7
western tanager	0	0	0.02	0	0	0	0.4	0	0	0	1.7	0
white-crowned sparrow	0.26	0.94	0.01	0.23	2.6	11.4	0.2	4.5	3.6	8.4	0.6	4.5
yellow-breasted chat	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
yellow-headed blackbird	0	0	<0.01	0	0	0	<0.1	0	0	0	0.6	0
Other Birds	**<0.01**	**0.06**	**0.02**	**0.05**	**<0.1**	**0.7**	**0.4**	**1.0**	**0.5**	**3.0**	**1.7**	**3.2**
common nighthawk	0	0	0.02	0.00	0	0	0.4	0	0	0	1.7	0
northern flicker	<0.01	0.03	0	0.02	<0.1	0.4	0	0.4	0.5	2.1	0	1.9
Vaux's swift	0	0.03	0	<0.01	0	0.3	0	0.3	0	0.9	0	0.6
white-throated swift	0	0	0	0.02	0	0	0	0.4	0	0	0	0.6
Unidentified Birds	**0**	**0**	**0.08**	**0**	**0**	**0**	**1.3**	**0**	**0**	**0**	**0.6**	**0**
unidentified bird	0	0	0.08	0	0	0	1.3	0	0	0	0.6	0
Overall	**10.07**	**8.31**	**5.96**	**5.19**	**100**	**100**	**100**	**100**				

Table A-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
red-tailed hawk	191	0.51	76.5	41.5	0.16	74.3
American goldfinch	22	0.96	77.7	14.8	0.11	14.8
Brewer's blackbird	7	0.07	97.2	95.4	0.06	95.4
Canada goose	2	0.13	100	40.5	0.05	40.5
Swainson's hawk	58	0.09	91.3	47.6	0.04	85.7
rough-legged hawk	29	0.12	76.2	31.3	0.03	56.3
American robin	5	0.14	43.8	35.1	0.02	35.1
common raven	116	0.06	89.3	28.9	0.02	53.3
northern harrier	50	0.11	86.7	9.6	<0.01	15.4
horned lark	61	1.85	29.8	1.6	<0.01	13.6
Vaux's swift	2	<0.01	100	100	<0.01	100
golden eagle	8	0.02	100	37.5	<0.01	50.0
rock pigeon	9	0.13	76.0	5.3	<0.01	5.3
sharp-shinned hawk	7	0.01	100	37.5	<0.01	37.5
white-throated swift	1	<0.01	100	100	<0.01	100
red-winged blackbird	6	0.34	61.6	1.2	<0.01	1.2
western kingbird	13	0.03	63.3	10.5	<0.01	10.5
unidentified raptor	1	<0.01	100	100	<0.01	100
Cooper's hawk	2	<0.01	100	50.0	<0.01	50.0
American kestrel	25	0.07	58.3	3.6	<0.01	28.6
osprey	2	<0.01	100	50.0	<0.01	100
merlin	1	<0.01	100	100	<0.01	100
black-billed magpie	41	0.08	73.2	1.0	<0.01	3.8
European starling	7	0.95	24.5	0	0	0
house finch	15	0.44	73.4	0	0	0
white-crowned sparrow	11	0.34	59.5	0	0	0
dark-eyed junco	0	0.24	0	0	0	0

Table A-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
western meadowlark	9	0.20	11.8	0	0	0
mourning dove	12	0.18	35.0	0	0	0
bank swallow	21	0.16	100	0	0	17.7
ring-necked pheasant	6	0.14	9.3	0	0	0
song sparrow	3	0.11	14.7	0	0	0
cliff swallow	18	0.10	94.8	0	0	21.9
pine siskin	1	0.05	100	0	0	0
California quail	0	0.05	0	0	0	0
savannah sparrow	2	0.05	11.5	0	0	0
Say's phoebe	7	0.03	33.3	0	0	0
grasshopper sparrow	0	0.02	0	0	0	0
barn swallow	8	0.02	100	0	0	36.4
eastern kingbird	7	0.02	66.7	0	0	0
gray partridge	1	0.02	25.0	0	0	0
unidentified bird	1	0.02	100	0	0	0
Bullock's oriole	1	0.01	33.3	0	0	0
northern flicker	4	0.01	50.0	0	0	0
western bluebird	2	0.01	90.9	0	0	0
violet-green swallow	3	0.01	100	0	0	50.0
killdeer	3	0.01	80.0	0	0	0
turkey vulture	2	<0.01	33.3	0	0	100
Harris' sparrow	0	<0.01	0	0	0	0
brown-headed cowbird	4	<0.01	85.7	0	0	0
lark sparrow	1	<0.01	33.3	0	0	0
rock wren	0	<0.01	0	0	0	0
unidentified buteo	1	<0.01	50.0	0	0	0
lazuli bunting	0	<0.01	0	0	0	0
common nighthawk	3	<0.01	100	0	0	75.0

Table A-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
vesper sparrow	1	<0.01	100	0	0	0
western tanager	0	<0.01	0	0	0	0
mallard	1	<0.01	100	0	0	0
house wren	0	<0.01	0	0	0	0
wild turkey	0	<0.01	0	0	0	0
northern rough-winged swallow	2	<0.01	100	0	0	0
Bewick's wren	0	<0.01	0	0	0	0
sage thrasher	1	<0.01	100	0	0	0
American crow	0	<0.01	0	0	0	0
Cassin's finch	0	<0.01	0	0	0	0
great blue heron	1	<0.01	100	0	0	0
MacGillivray's warbler	1	<0.01	100	0	0	0
short-eared owl	0	<0.01	0	0	0	0
yellow-breasted chat	0	<0.01	0	0	0	0
yellow-headed blackbird	1	<0.01	100	0	0	0
marsh wren	0	0	0	0	0	0
northern shrike	0	0	0	0	0	0
unidentified passerine	1	0	100	100	0	100

Table A-5. Flight height characteristics by bird type during the fixed-point bird use surveys at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories 0-82 ft	82-410 ft	> 410 ft
Waterbirds	1	1	20.00	100	100	0	0
Waterfowl	3	44	368.33	100	4.5	38.6	56.8
Shorebirds	3	4	10.00	80.0	100	0	0
Raptors	375	439	52.64	78.5	57.4	35.5	7.1
Accipiters	*9*	*10*	*58.11*	*100*	*40.0*	*40.0*	*20.0*
Buteos	*279*	*337*	*56.05*	*78.7*	*51.3*	*41.5*	*7.1*
Northern Harrier	*50*	*52*	*21.98*	*86.7*	*86.5*	*9.6*	*3.8*
Eagles	*8*	*8*	*215.63*	*100*	*37.5*	*37.5*	*25.0*
Falcons	*26*	*29*	*17.31*	*59.2*	*93.1*	*6.9*	*0*
Owls	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*3*	*3*	*101.67*	*100*	*0*	*66.7*	*33.3*
Vultures	2	2	15.00	33.3	100	0	0
Upland Gamebirds	7	9	6.57	7.2	100	0	0
Doves/Pigeons	21	100	12.43	50.5	97.0	3.0	0
Passerines	398	2,063	21.37	49.1	83.7	15.6	0.7
Other Birds	10	16	35.00	80.0	50.0	50.0	0
Unidentified Birds	1	14	30.00	100	100	0	0
Overall	**821**	**2,692**	**36.68**	**52.1**	**78.6**	**18.8**	**2.6**

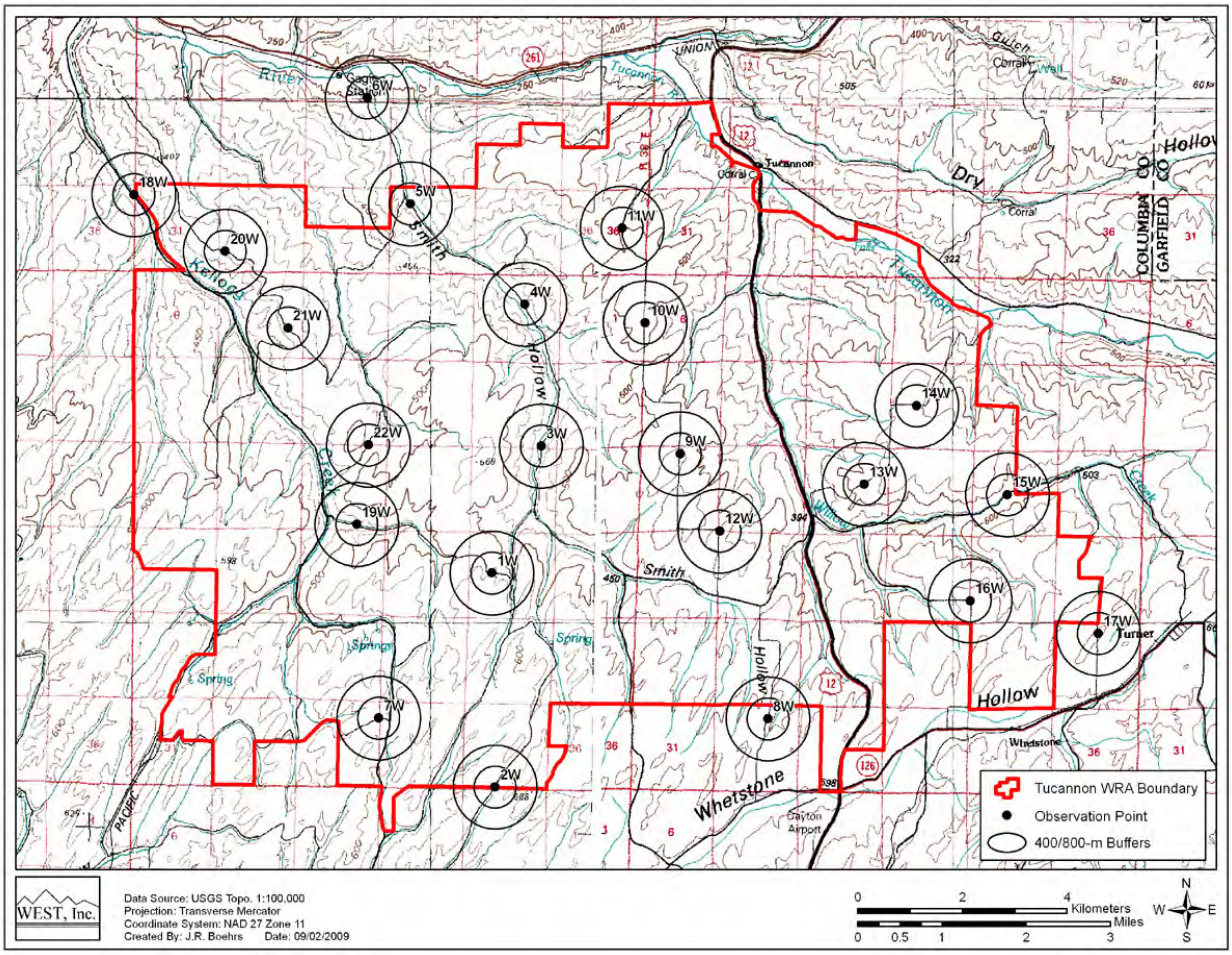


Figure A-1. Fixed-point bird use survey points at the Tucannon Wind Resource Area.

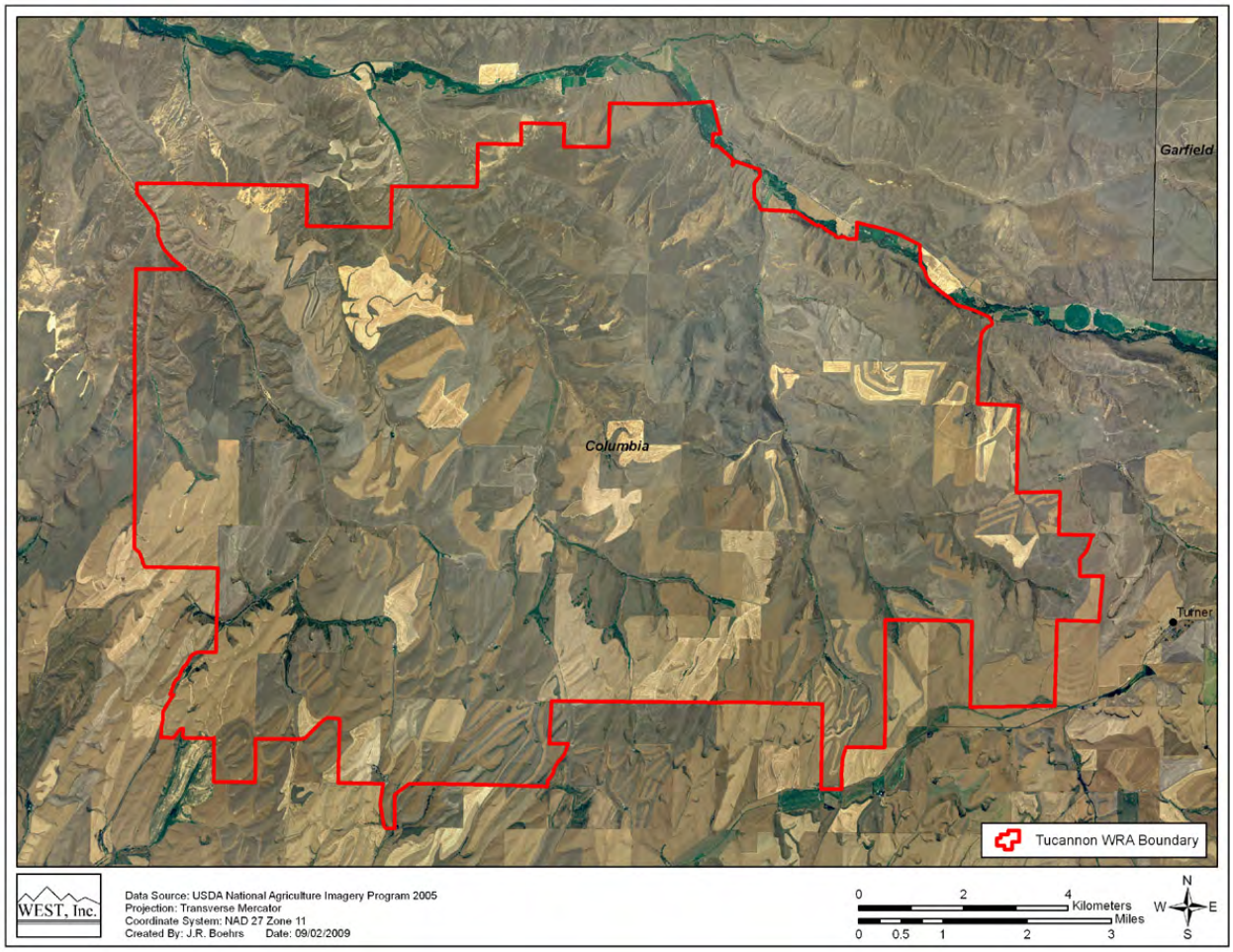


Figure A-2. Aerial photograph of the Tucannon Wind Resource Area representing landscape coverage base.

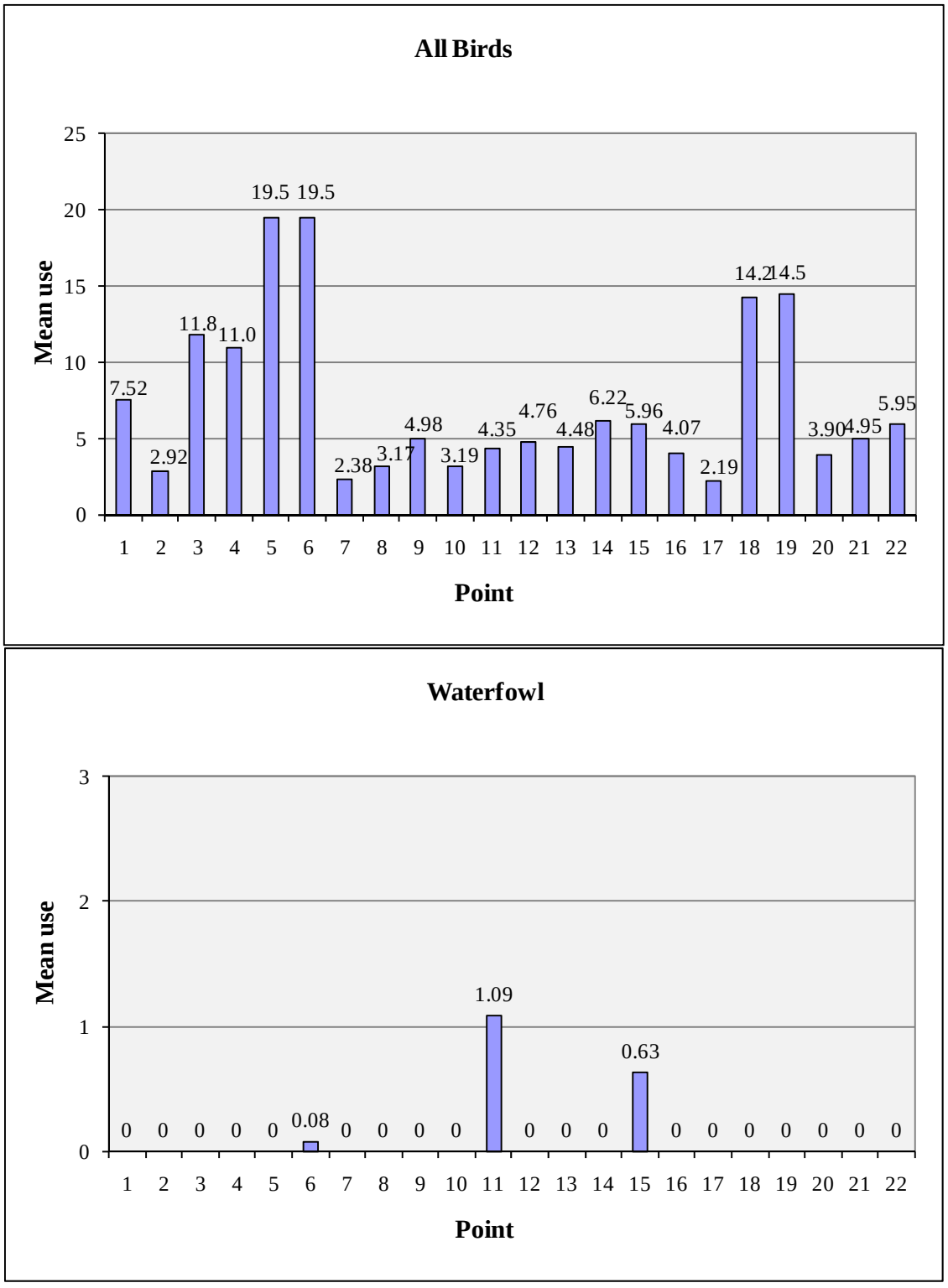


Figure A-3. Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Tucannon Wind Resource Area.

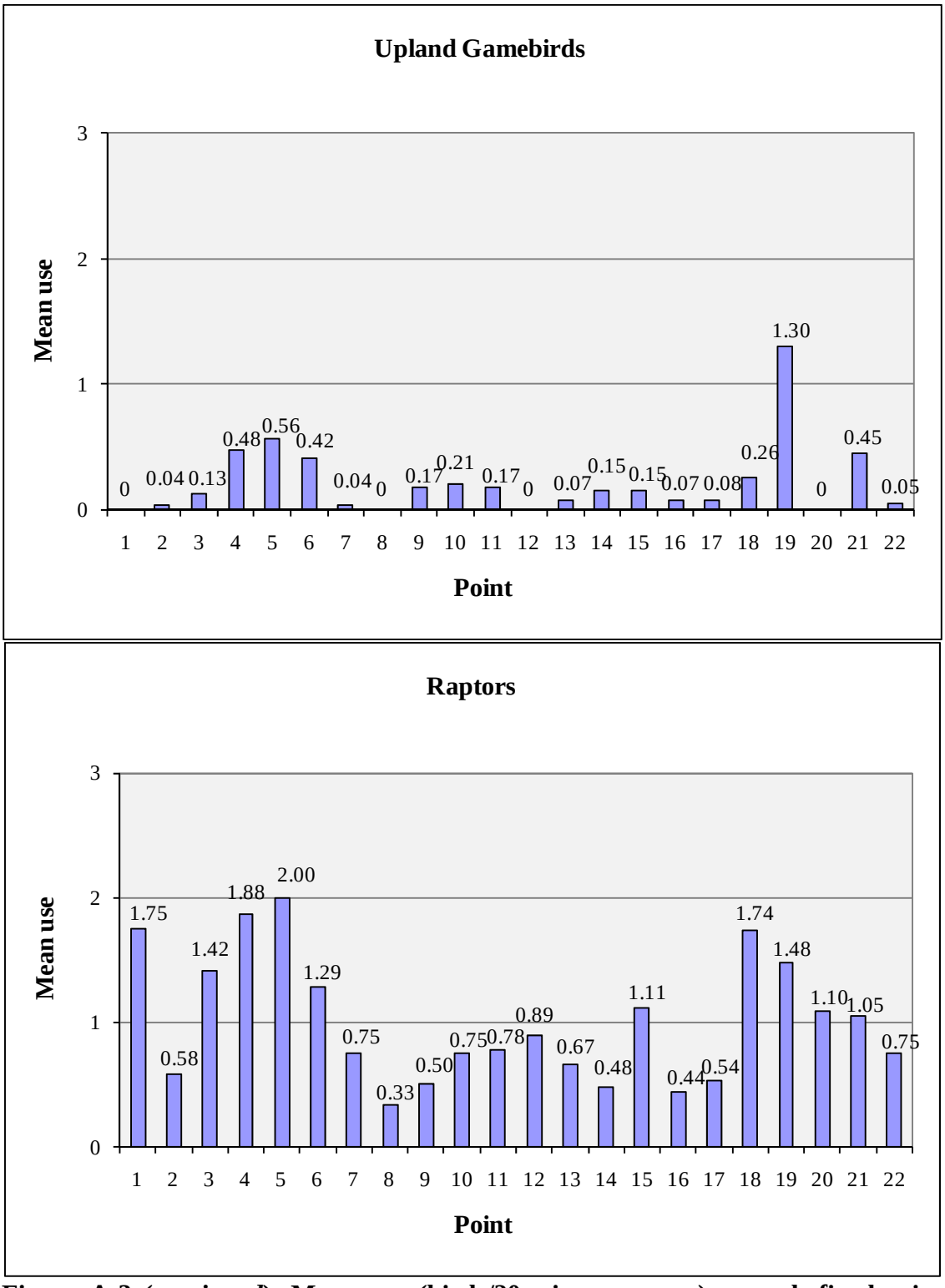


Figure A-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Tucannon Wind Resource Area.

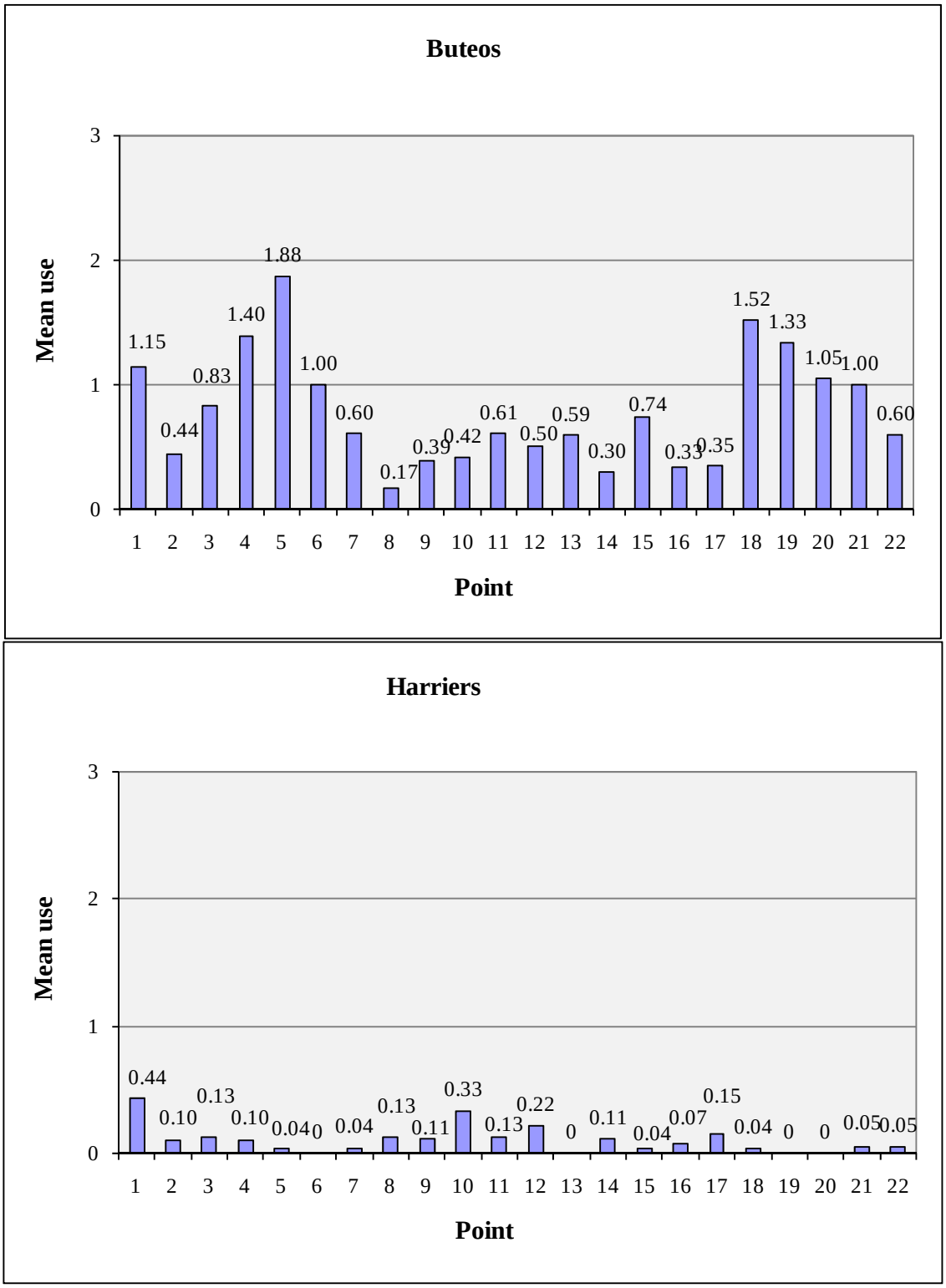


Figure A-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Tucannon Wind Resource Area.

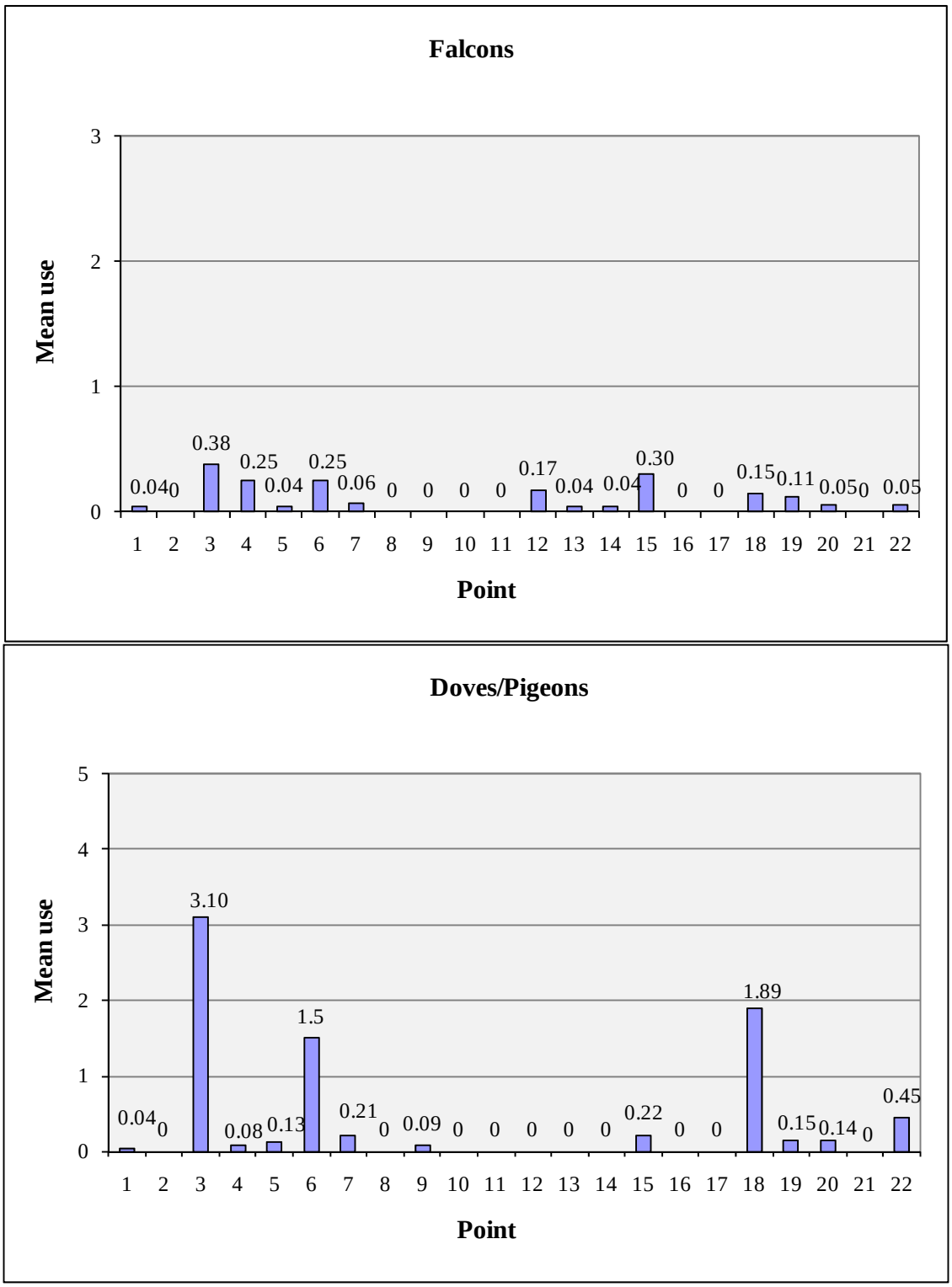


Figure A-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Tucannon Wind Resource Area.

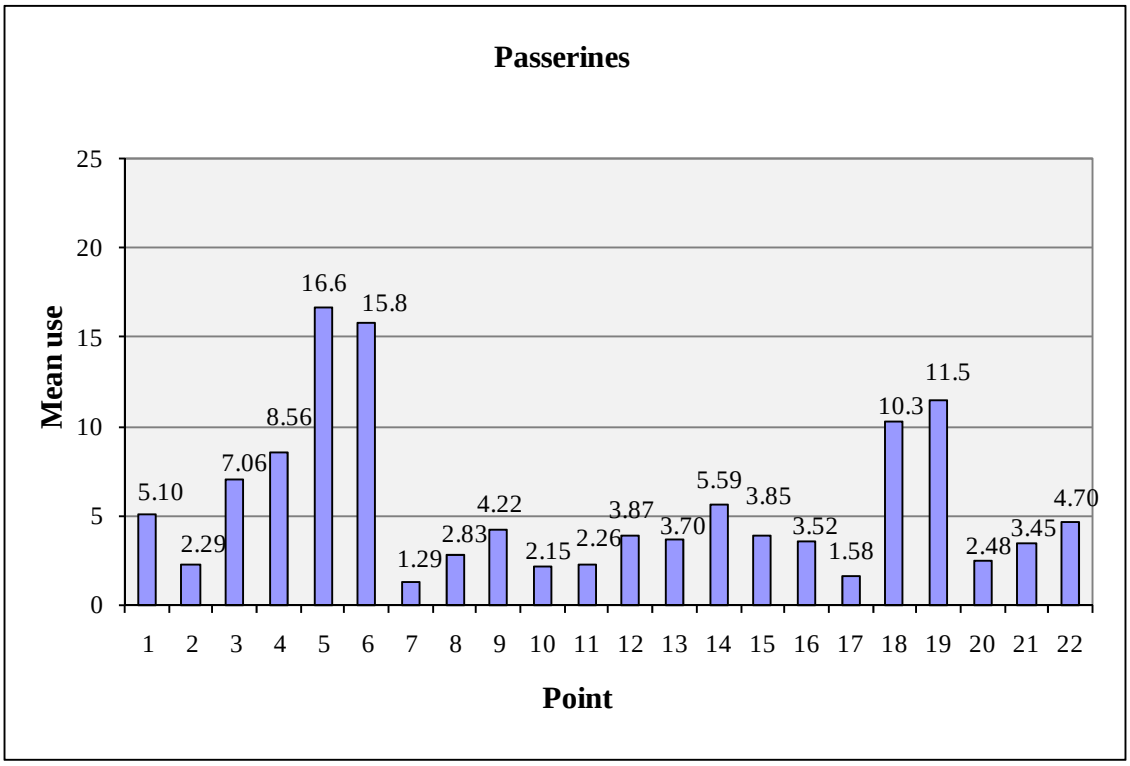


Figure A-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Tucannon Wind Resource Area.

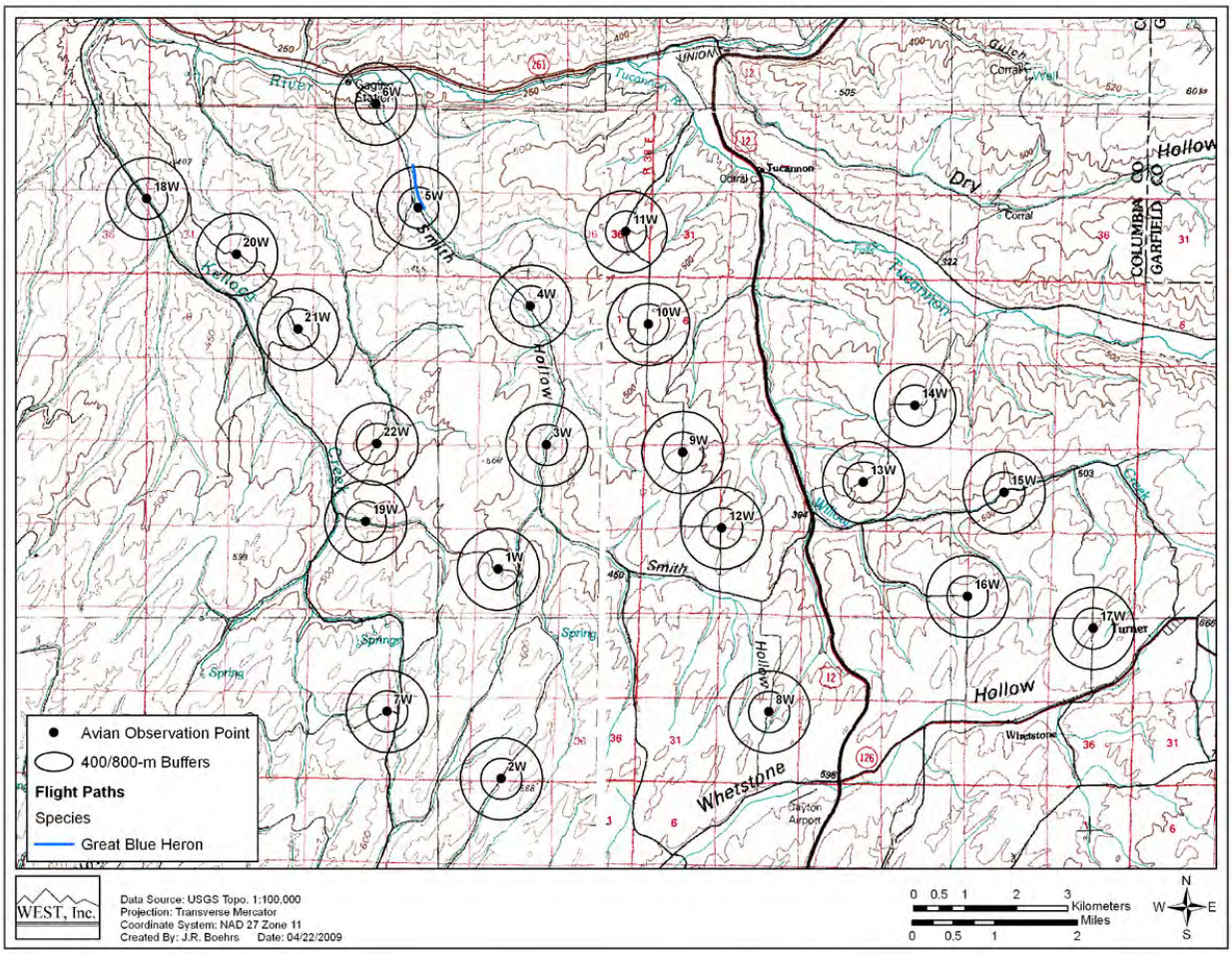


Figure A-6. Mapped flight paths in relation to fixed-point bird use survey stations for waterbirds at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

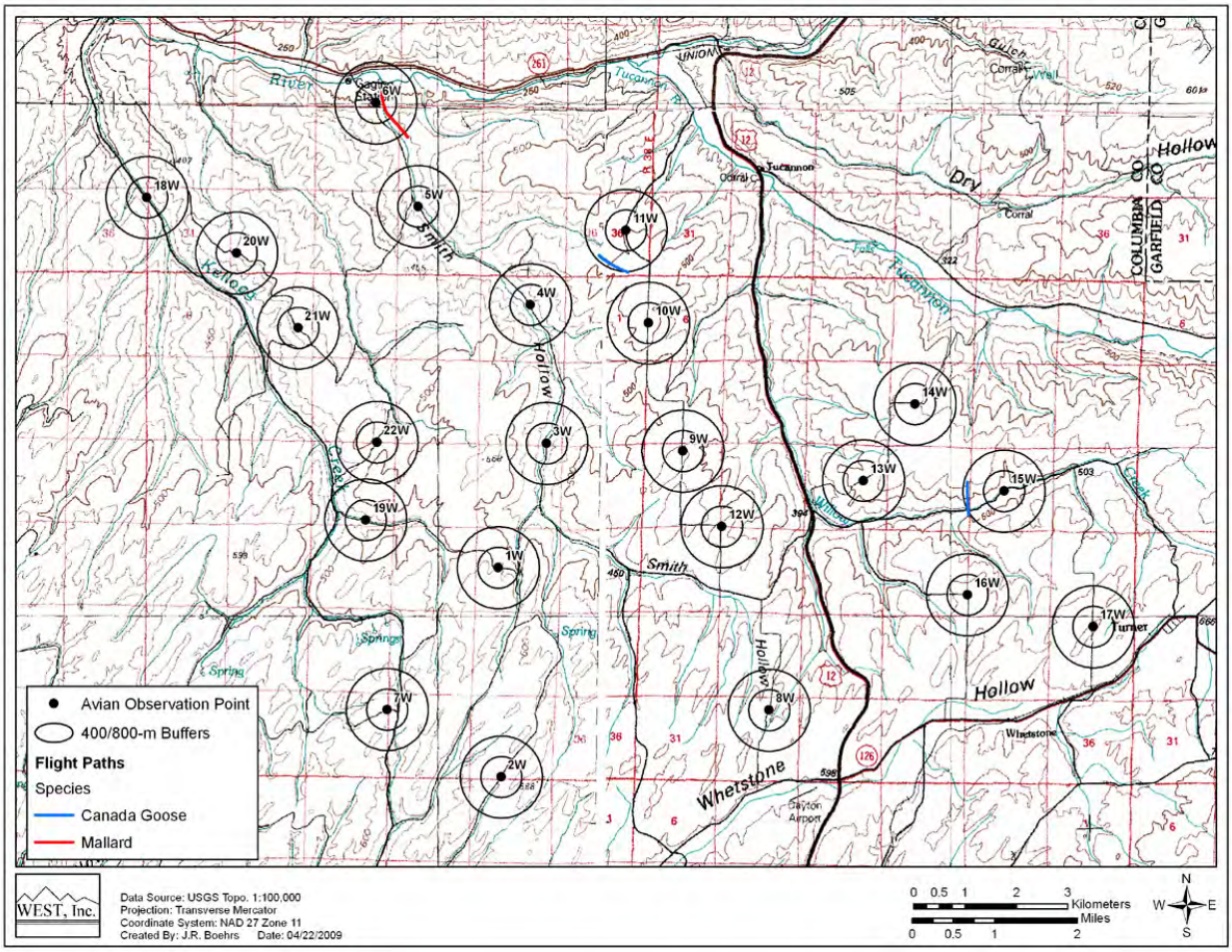


Figure A-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for waterfowl at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

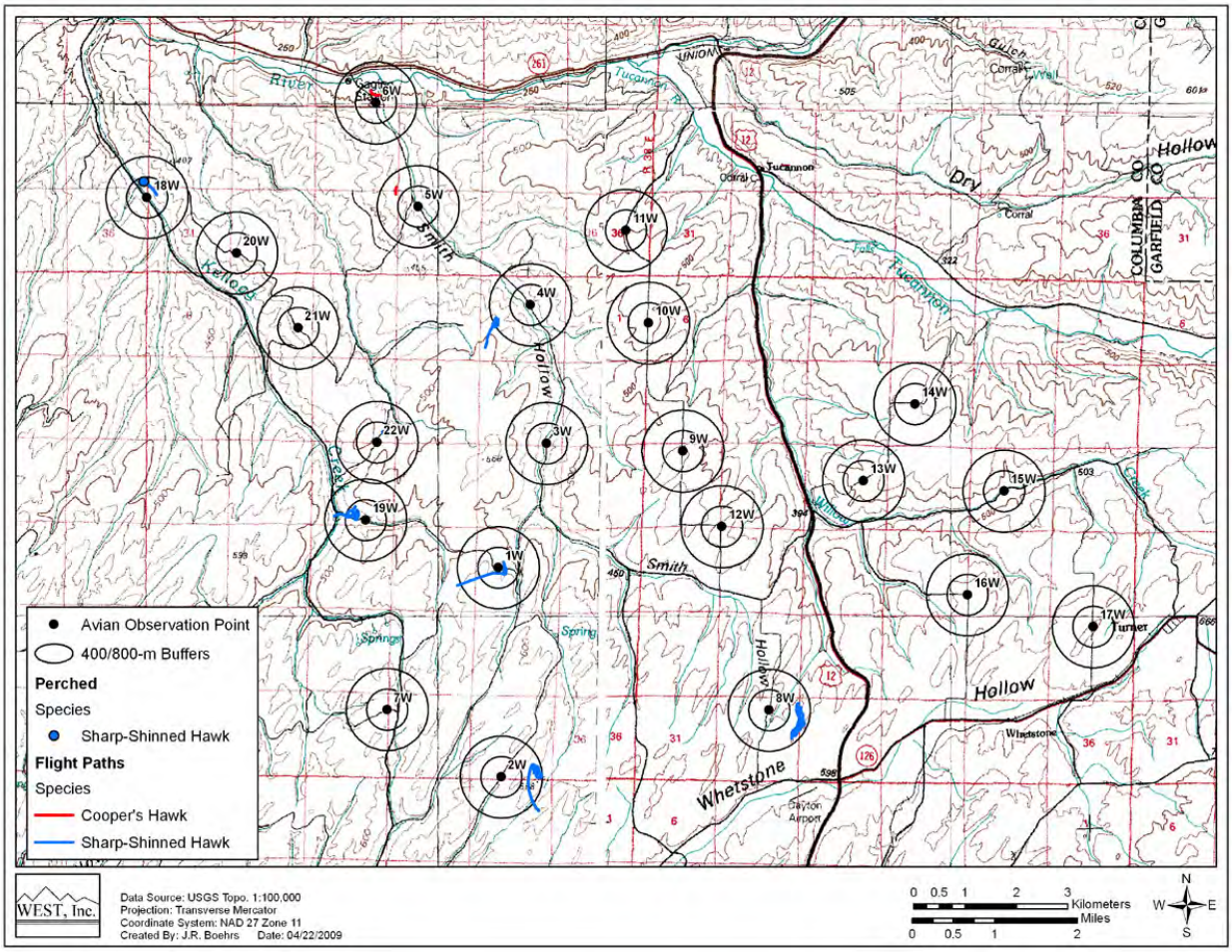


Figure A-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for accipiters at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

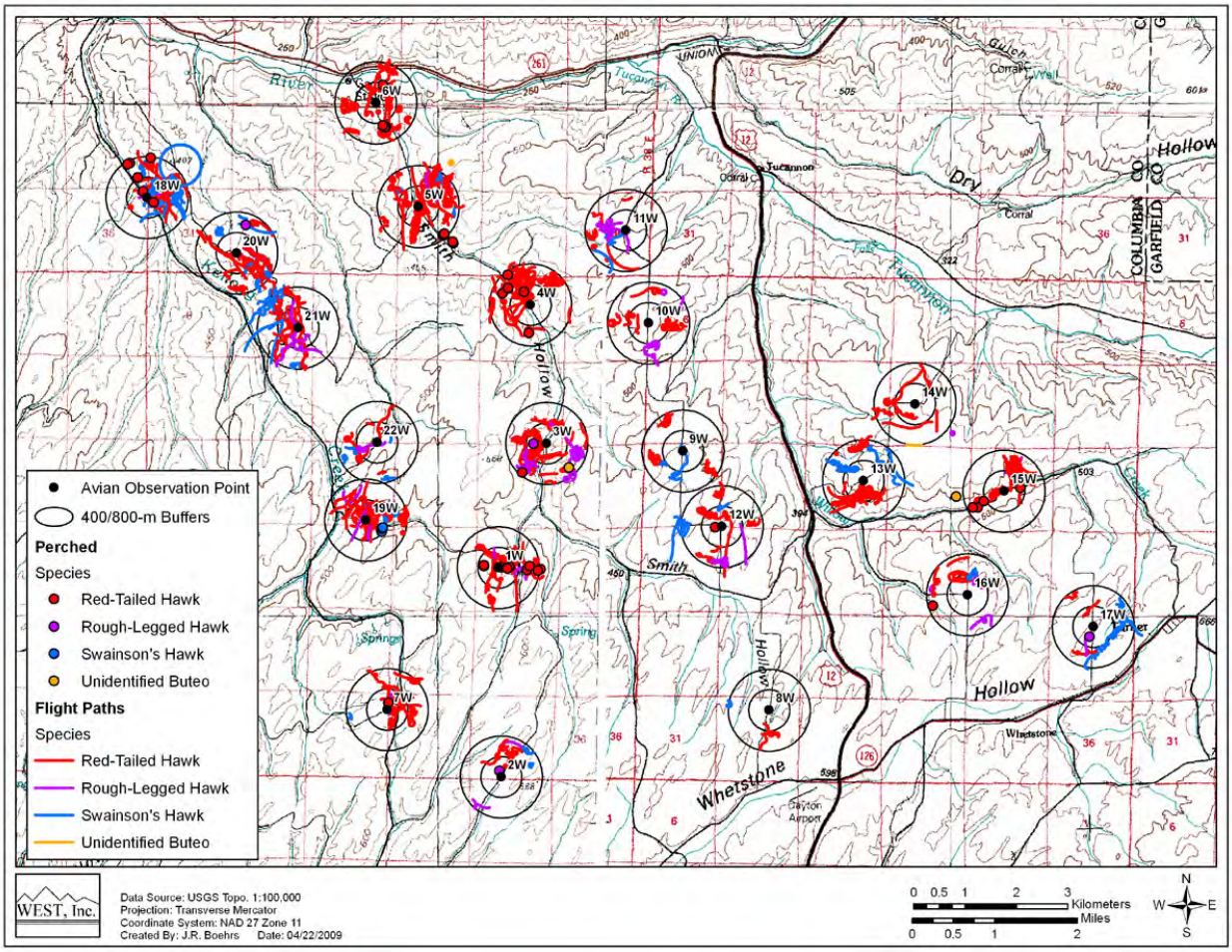


Figure A-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for buteos at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

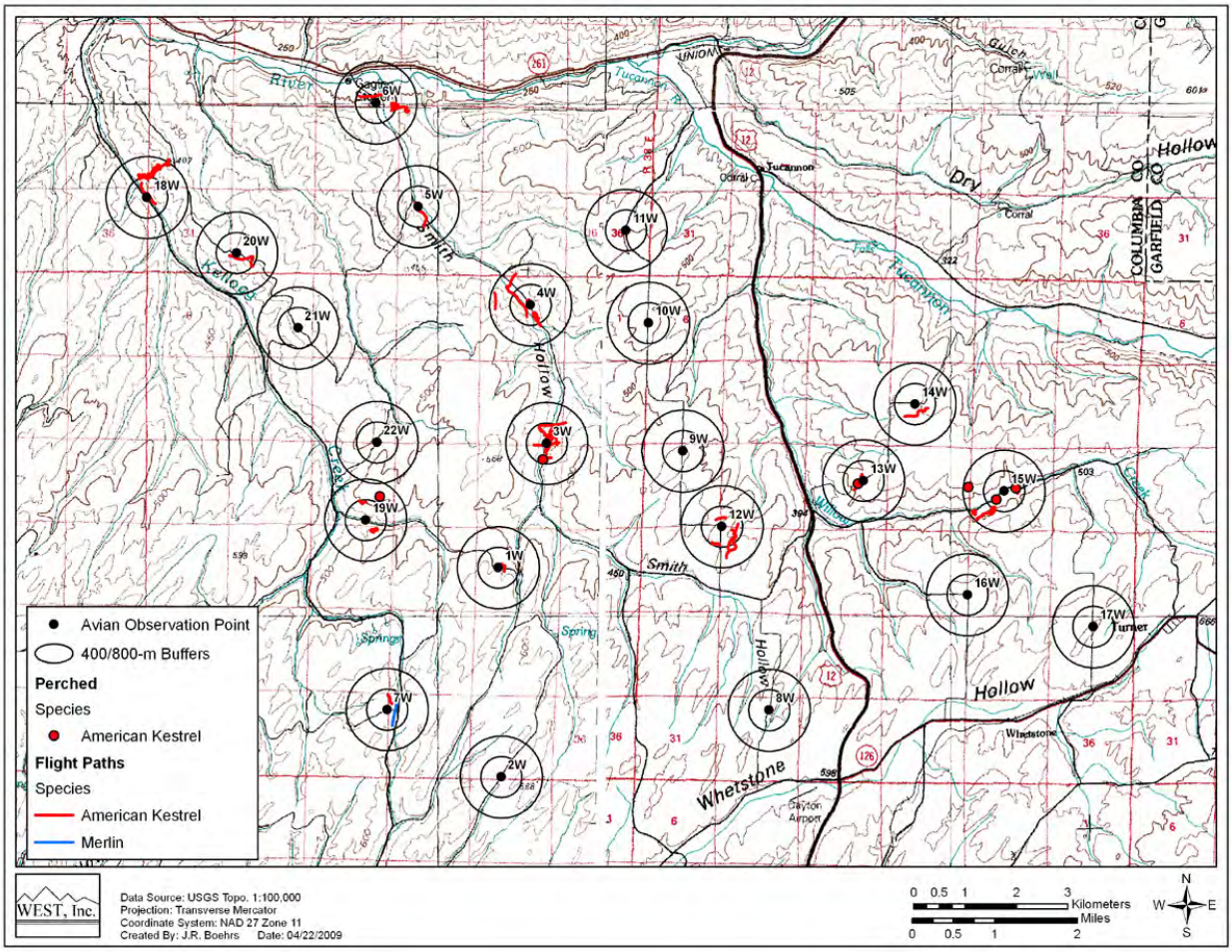


Figure A-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for falcons at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

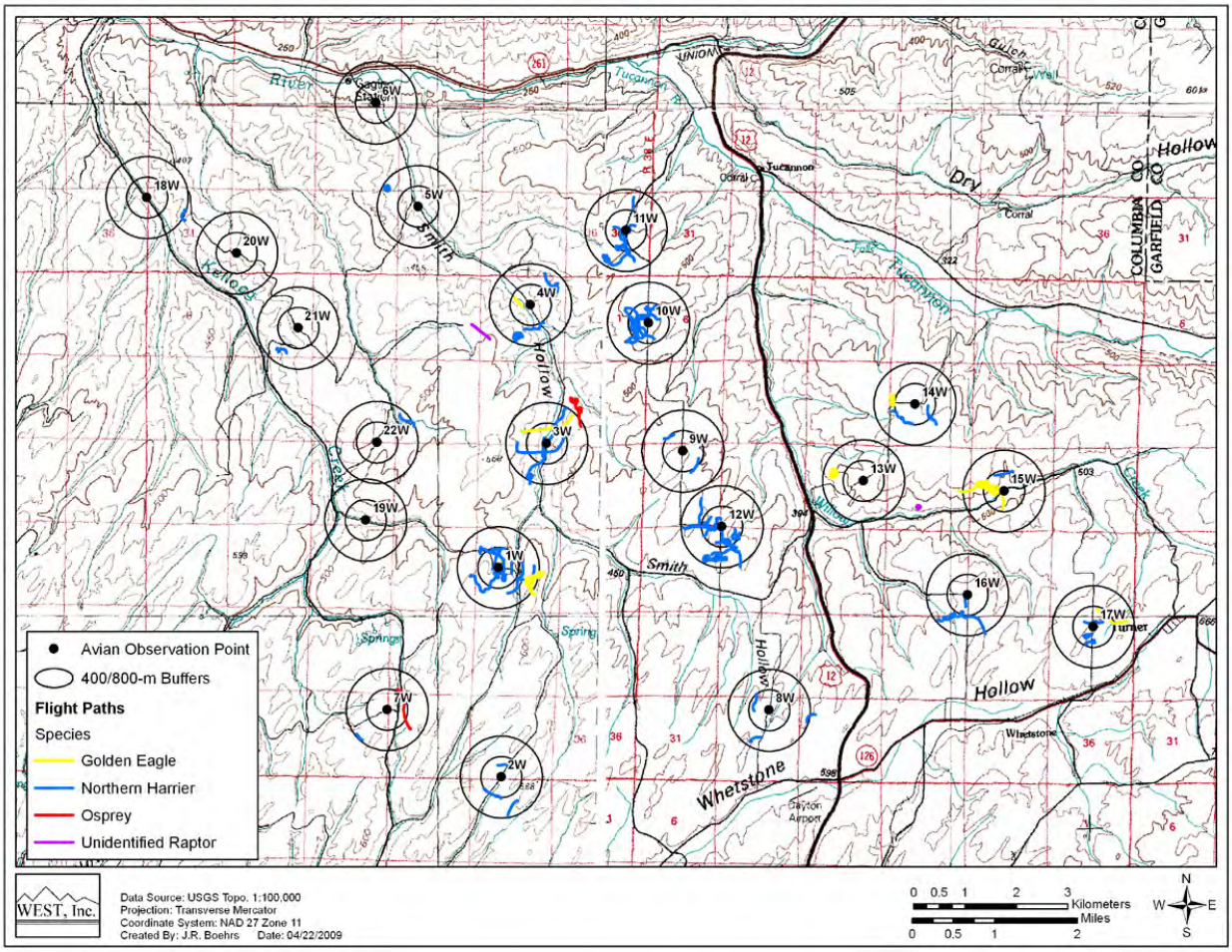


Figure A-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for eagles, harriers, and other raptors at the Tucannon Wind Resource Area, January 24, 2008 – January 14, 2009.

Appendix B: Tables and Figures for the Oliphant Wind Resource Area.

Table B-1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007-March 25, 2008.

Season	Number of Visits	Mean Use	# Species/ Survey	# Species	# Surveys Conducted
Spring	10	9.94	3.85	43	117
Summer	11	9.61	3.07	40	132
Fall	10	19.65	2.71	37	120
Winter	14	14.16	2.31	30	163
Overall	**45**	**13.48**	**2.87**	**62**	**532**

Table B-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 26, 2008.

		Spring		Summer		Fall		Winter		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterfowl		**0**	**0**	**0**	**0**	**0**	**0**	**4**	**16**	**4**	**16**
Canada goose	*Branta canadensis*	0	0	0	0	0	0	3	6	3	6
tundra swan	*Cygnus columbianus*	0	0	0	0	0	0	1	10	1	10
Shorebirds		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
killdeer	*Charadrius vociferus*	0	0	0	0	0	0	1	1	1	1
Raptors		**115**	**131**	**77**	**87**	**93**	**109**	**103**	**107**	**388**	**434**
Accipiters		*4*	*4*	*0*	*0*	*4*	*4*	*1*	*1*	*9*	*9*
Cooper's hawk	*Accipiter cooperii*	2	2	0	0	0	0	0	0	2	2
sharp-shinned hawk	*Accipter striatus*	2	2	0	0	4	4	1	1	7	7
Buteos		*69*	*84*	*33*	*37*	*44*	*47*	*55*	*58*	*201*	*226*
red-tailed hawk	*Buteo jamaicensis*	58	71	32	36	36	39	29	32	155	178
rough-legged hawk	*Buteo lagopus*	1	1	0	0	0	0	16	16	17	17
Swainson's hawk	*Buteo swainsoni*	1	1	0	0	1	1	0	0	2	2
unidentified buteo		9	11	1	1	7	7	10	10	27	29
Harrier		*21*	*22*	*8*	*8*	*2*	*2*	*12*	*12*	*43*	*44*
northern harrier	*Circus cyaneus*	21	22	8	8	2	2	12	12	43	44
Eagles		*3*	*3*	*4*	*4*	*7*	*7*	*18*	*18*	*32*	*32*
bald eagle	*Haliaeetus leucocephalus*	0	0	0	0	0	0	3	3	3	3
golden eagle	*Aquila chrysaetos*	3	3	4	4	7	7	14	14	28	28
unidentified eagle		0	0	0	0	0	0	1	1	1	1
Falcons		*18*	*18*	*30*	*36*	*32*	*45*	*10*	*10*	*90*	*109*
American kestrel	*Falco sparverius*	18	18	30	36	32	45	10	10	90	109
Owls		*0*	*0*	*1*	*1*	*0*	*0*	*2*	*2*	*3*	*3*
short-eared owl	*Asio flammeus*	0	0	1	1	0	0	2	2	3	3
Other Raptors		*0*	*0*	*1*	*1*	*4*	*4*	*5*	*6*	*10*	*11*
unidentified raptor		0	0	1	1	4	4	5	6	10	11

Table B-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 26, 2008.

		Spring		Summer		Fall		Winter		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Upland Gamebirds		**30**	**31**	**21**	**26**	**7**	**12**	**12**	**32**	**70**	**101**
California quail	*Callipepla californica*	2	2	0	0	0	0	0	0	2	2
chukar	*Alectoris chukar*	0	0	0	0	0	0	2	3	2	3
gray partridge	*Perdix perdix*	1	2	2	2	0	0	2	12	5	16
ring-necked pheasant	*Phasianus colchicus*	27	27	19	24	7	12	8	17	61	80
Doves/Pigeons		**7**	**75**	**21**	**101**	**22**	**410**	**18**	**170**	**68**	**756**
mourning dove	*Zenaida macroura*	2	8	7	12	7	12	2	7	18	39
rock pigeon	*Columba livia*	5	67	14	89	15	398	16	163	50	717
Passerines		**504**	**957**	**423**	**1,065**	**333**	**1,845**	**412**	**2,038**	**1,672**	**5,905**
American crow	*Corvus brachyrhynchos*	0	0	2	9	0	0	0	0	2	9
American goldfinch	*Carduelis tristis*	4	5	8	11	17	99	7	78	36	193
American pipit	*Anthus rubescens*	1	30	0	0	0	0	0	0	1	30
American robin	*Turdus migratorius*	3	27	0	0	2	6	2	76	7	109
American tree sparrow	*Spizella arborea*	0	0	0	0	0	0	9	33	9	33
barn swallow	*Hirundo rustica*	3	3	8	11	5	36	0	0	16	50
black-billed magpie	*Pica pica*	7	8	8	12	9	21	21	43	45	84
Brewer's blackbird	*Euphagus cyanocephalus*	2	3	10	24	1	1	0	0	13	28
Bullock's oriole	*Icterus bullockii*	1	1	2	3	0	0	0	0	3	4
cedar waxwing	*Bombycilla cedrorum*	0	0	0	0	1	1	0	0	1	1
cliff swallow	*Petrochelidon pyrrhonota*	0	0	6	8	1	10	0	0	7	18
common raven	*Corvus corax*	46	69	36	164	50	203	72	144	204	580
dark-eyed junco	*Junco hyemalis*	0	0	0	0	3	7	15	69	18	76
eastern kingbird	*Tyrannus tyrannus*	0	0	10	12	1	2	0	0	11	14
European starling	*Sturnus vulgaris*	13	125	14	125	31	976	30	640	88	1,866
grasshopper sparrow	*Ammodramus savannarum*	11	13	19	21	0	0	0	0	30	34
horned lark	*Eremophila alpestris*	203	340	144	360	99	206	190	608	636	1,514
house finch	*Carpodacus mexicanus*	1	6	0	0	1	7	0	0	2	13
house sparrow	*Passer domesticus*	8	50	4	20	3	11	11	275	26	356

Table B-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 26, 2008.

		Spring		Summer		Fall		Winter		Total	
Species/Type	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
house wren	*Troglodytes aedon*	0	0	0	0	1	1	0	0	1	1
lark sparrow	*Chondestes grammacus*	1	1	0	0	0	0	0	0	1	1
Macgillivray's warbler	*Oporornis tolmiei*	0	0	1	1	0	0	0	0	1	1
mountain bluebird	*Sialia currucoides*	19	27	6	7	7	23	6	7	38	64
mountain chickadee	*Poecile gambeli*	0	0	0	0	1	1	0	0	1	1
northern rough-winged swallow	*Stelgidopteryx serripennis*	1	1	1	2	0	0	0	0	2	3
northern shrike	*Lanius excubitor*	2	2	0	0	4	5	9	10	15	17
red-winged blackbird	*Agelaius phoeniceus*	1	1	0	0	0	0	0	0	1	1
rock wren	*Salpinctes obsoletus*	2	2	4	6	3	5	0	0	9	13
savannah sparrow	*Passerculus sandwichensis*	19	27	9	13	21	33	0	0	49	73
Say's phoebe	*Sayornis saya*	6	7	6	6	1	1	1	1	14	15
song sparrow	*Melospiza melodia*	5	6	1	1	4	4	4	4	14	15
spotted towhee	*Pipilo maculatus*	1	1	1	1	0	0	0	0	2	2
tree swallow	*Tachycineta bicolor*	9	16	0	0	3	24	0	0	12	40
unidentified empidonax		0	0	1	1	0	0	0	0	1	1
unidentified finch		0	0	1	5	0	0	0	0	1	5
unidentified passerine		8	12	12	12	17	38	15	29	52	91
unidentified sparrow		3	5	1	3	1	1	1	1	6	10
unidentified swallow		4	8	6	44	5	60	0	0	15	112
unidentified warbler		1	1	0	0	0	0	0	0	1	1
vesper sparrow	*Pooecetes gramineus*	5	5	6	6	2	6	0	0	13	17
western kingbird	*Tyrannus verticalis*	9	11	22	60	1	1	0	0	32	72
western meadowlark	*Sturnella neglecta*	99	137	70	113	27	43	19	20	215	313
white-crowned sparrow	*Zonotrichia leucophrys*	5	6	1	1	11	13	0	0	17	20

Table B-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 26, 2008.

		Spring		Summer		Fall		Winter		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
willow flycatcher	*Empidonax traillii*	0	0	1	1	0	0	0	0	1	1
yellow-rumped warbler	*Dendroica coronata*	1	1	2	2	0	0	0	0	3	3
Other Birds		**2**	**5**	**6**	**9**	**8**	**25**	**0**	**0**	**16**	**39**
common nighthawk	*Chordeiles minor*	0	0	1	1	0	0	0	0	1	1
northern flicker	*Colaptes auratus*	0	0	1	1	0	0	0	0	1	1
unidentified hummingbird		0	0	2	2	0	0	0	0	2	2
Vaux's swift	*Chaetura vauxi*	2	5	2	5	8	25	0	0	12	35
Unidentified Birds		**2**	**2**	**0**	**0**	**1**	**1**	**1**	**1**	**4**	**4**
unidentified bird		2	2	0	0	1	1	1	1	4	4
Overall		**660**	**1,201**	**548**	**1,288**	**464**	**2,402**	**551**	**2,365**	**2,223**	**7,256**

Table B-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 25, 2008.

	Use				% Composition				% Frequency			
Species/Type	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterfowl	**0**	**0**	**0**	**0.02**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**0.6**
Canada goose	0	0	0	0.02	0	0	0	0.1	0	0	0	0.6
Shorebirds	**0**	**0**	**0**	**0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.6**
killdeer	0	0	0	0.01	0	0	0	<0.1	0	0	0	0.6
Raptors	**0.84**	**0.54**	**0.67**	**0.47**	**8.4**	**5.6**	**3.4**	**3.3**	**46.6**	**30.3**	**35.0**	**27.9**
Accipiters	*0.03*	*0*	*0.03*	*0.01*	*0.3*	*0*	*0.1*	*<0.1*	*2.5*	*0*	*2.5*	*0.6*
Cooper's hawk	0.02	0	0	0	0.2	0	0	0	1.7	0	0	0
sharp-shinned hawk	0.02	0	0.03	0.01	0.2	0	0.1	<0.1	1.7	0	2.5	0.6
Buteos	*0.44*	*0.17*	*0.24*	*0.23*	*4.4*	*1.8*	*1.2*	*1.6*	*27.2*	*14.4*	*17.5*	*16.9*
red-tailed hawk	0.40	0.17	0.23	0.13	4.1	1.8	1.2	0.9	26.2	14.4	17.5	10.1
rough-legged hawk	0.01	0	0	0.09	0.1	0	0	0.6	1.0	0	0	6.8
Swainson's hawk	0.01	0	0.01	0	0.1	0	<0.1	0	0.8	0	0.8	0
unidentified buteo	0.02	0	0	0.01	0.2	0	0	0.1	1.8	0	0	1.2
Northern Harrier	*0.18*	*0.05*	*0.02*	*0.08*	*1.9*	*0.6*	*0.1*	*0.6*	*16.7*	*5.3*	*1.7*	*7.2*
northern harrier	0.18	0.05	0.02	0.08	1.9	0.6	0.1	0.6	16.7	5.3	1.7	7.2
Eagles	*0.03*	*0.03*	*0.04*	*0.09*	*0.3*	*0.3*	*0.2*	*0.6*	*2.7*	*3.0*	*4.2*	*7.6*
bald eagle	0	0	0	0.02	0	0	0	0.1	0	0	0	1.8
golden eagle	*0.03*	*0.03*	*0.04*	*0.07*	*0.3*	*0.3*	*0.2*	*0.5*	*2.7*	*3.0*	*4.2*	*5.8*
Falcons	*0.15*	*0.27*	*0.34*	*0.06*	*1.5*	*2.8*	*1.7*	*0.4*	*10.0*	*15.2*	*18.3*	*4.8*
American kestrel	0.15	0.27	0.34	0.06	1.5	2.8	1.7	0.4	10.0	15.2	18.3	4.8
Owls	*0*	*0.01*	*0*	*0.01*	*0*	*0.1*	*0*	*0.1*	*0*	*0.8*	*0*	*1.2*
short-eared owl	0	0.01	0	0.01	0	0.1	0	0.1	0	0.8	0	1.2
Upland Gamebirds	**0.26**	**0.20**	**0.09**	**0.21**	**2.6**	**2.0**	**0.5**	**1.5**	**23.8**	**13.6**	**5.0**	**6.4**
California quail	0.02	0	0	0	0.2	0	0	0	1.7	0	0	0
chukar	0	0	0	0.02	0	0	0	0.1	0	0	0	1.2
gray partridge	0.02	0.02	0	0.07	0.2	0.2	0	0.5	0.8	1.5	0	1.2
ring-necked pheasant	0.23	0.18	0.09	0.12	2.3	1.9	0.5	0.9	21.3	12.1	5.0	4.6

Table B-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 25, 2008.

	Use				% Composition				% Frequency			
Species/Type	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Doves/Pigeons	**0.66**	**0.77**	**3.42**	**1.02**	**6.7**	**8.0**	**17.4**	**7.2**	**6.1**	**10.6**	**15.0**	**8.8**
mourning dove	0.07	0.09	0.10	0.04	0.7	0.9	0.5	0.3	1.7	4.5	5.8	1.2
rock pigeon	0.59	0.67	3.32	0.98	6.0	7.0	16.9	6.9	4.4	6.1	9.2	8.8
Passerines	**8.12**	**8.05**	**15.26**	**12.42**	**81.7**	**83.7**	**77.7**	**87.7**	**98.3**	**88.6**	**86.7**	**87.1**
American goldfinch	0.04	0.08	0.83	0.46	0.4	0.9	4.2	3.3	3.3	5.3	9.2	4.2
American pipit	0.25	0	0	0	2.5	0	0	0	0.8	0	0	0
American robin	0.27	0	0.05	0.45	2.7	0	0.3	3.2	3.0	0	1.7	1.2
American tree sparrow	0	0	0	0.20	0	0	0	1.4	0	0	0	5.4
barn swallow	0.03	0.08	0.30	0	0.3	0.9	1.5	0	2.5	6.1	4.2	0
black-billed magpie	0.07	0.09	0.18	0.27	0.7	0.9	0.9	1.9	6.0	6.1	5.8	11.6
Brewer's blackbird	0.03	0.18	0.01	0	0.3	1.9	<0.1	0	1.7	6.8	0.8	0
Bullock's oriole	0.01	0.02	0	0	0.1	0.2	0	0	0.8	1.5	0	0
cedar waxwing	0	0	0.01	0	0	0	<0.1	0	0	0	0.8	0
cliff swallow	0	0.06	0.08	0	0	0.6	0.4	0	0	3.0	0.8	0
common raven	0.54	1.22	1.58	0.84	5.4	12.7	8.1	5.9	30.8	18.2	30.8	33.3
dark-eyed junco	0	0	0.06	0.49	0	0	0.3	3.5	0	0	1.7	7.6
eastern kingbird	0	0.09	0.02	0	0	0.9	0.1	0	0	6.1	0.8	0
European starling	1.07	0.95	8.13	3.81	10.8	9.9	41.4	26.9	9.4	6.1	20.0	14.9
grasshopper sparrow	0.11	0.16	0	0	1.1	1.7	0	0	7.5	10.6	0	0
horned lark	2.89	2.73	1.71	3.83	29.0	28.4	8.7	27.0	78.6	63.6	40.8	60.0
house finch	0.05	0	0.06	0	0.5	0	0.3	0	0.9	0	0.8	0
house sparrow	0.43	0.15	0.09	1.64	4.3	1.6	0.5	11.6	5.1	3.0	2.5	4.2
house wren	0	0	0.01	0	0	0	<0.1	0	0	0	0.8	0
lark sparrow	0.01	0	0	0	0.1	0	0	0	0.8	0	0	0
MacGillivray's warbler	0	0.01	0	0	0	0.1	0	0	0	0.8	0	0
mountain bluebird	0.23	0.05	0.19	0.04	2.3	0.6	1.0	0.3	14.5	3.8	5.8	3.6
mountain chickadee	0	0	0.01	0	0	0	<0.1	0	0	0	0.8	0

Table B-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 25, 2008.

	Use				% Composition				% Frequency			
Species/Type	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
northern rough-winged swallow	0.01	0.02	0	0	0.1	0.2	0	0	0.8	0.8	0	0
northern shrike	0.02	0	0.04	0.06	0.2	0	0.2	0.4	1.8	0	3.3	4.8
red-winged blackbird	0.01	0	0	0	0.1	0	0	0	0.8	0	0	0
rock wren	0.02	0.05	0.04	0	0.2	0.5	0.2	0	1.7	3.0	2.5	0
savannah sparrow	0.23	0.10	0.28	0	2.3	1.0	1.4	0	12.5	6.8	14.2	0
Say's phoebe	0.06	0.05	0.01	0.01	0.6	0.5	<0.1	<0.1	5.0	3.8	0.8	0.6
song sparrow	0.05	0.01	0.03	0.02	0.5	0.1	0.2	0.2	4.2	0.8	3.3	2.4
spotted towhee	0.01	0.01	0	0	0.1	0.1	0	0	0.9	0.8	0	0
tree swallow	0.13	0	0.20	0	1.3	0	1.0	0	6.7	0	2.5	0
unidentified empidonax	0	0.01	0	0	0	0.1	0	0	0	0.8	0	0
unidentified finch	0	0.04	0	0	0	0.4	0	0	0	0.8	0	0
unidentified passerine	0.10	0.09	0.32	0.17	1.0	0.9	1.6	1.2	6.7	9.1	12.5	8.3
unidentified sparrow	0.04	0.02	0.01	0.01	0.4	0.2	<0.1	<0.1	2.5	0.8	0.8	0.6
unidentified swallow	0.07	0.33	0.50	0	0.7	3.5	2.5	0	3.3	4.5	3.3	0
unidentified warbler	0.01	0	0	0	0.1	0	0	0	0.8	0	0	0
vesper sparrow	0.04	0.05	0.05	0	0.4	0.5	0.3	0	4.2	4.5	1.7	0
western kingbird	0.09	0.45	0.01	0	0.9	4.7	<0.1	0	6.7	14.4	0.8	0
western meadowlark	1.16	0.86	0.36	0.12	11.6	8.9	1.8	0.9	60.1	43.9	18.3	9.9
white-crowned sparrow	0.05	0.01	0.11	0	0.5	0.1	0.6	0	4.2	0.8	7.5	0
willow flycatcher	0	0.01	0	0	0	0.1	0	0	0	0.8	0	0
yellow-rumped warbler	0.01	0.02	0	0	0.1	0.2	0	0	0.8	1.5	0	0
Other Birds	**0.04**	**0.07**	**0.21**	**0**	**0.4**	**0.7**	**1.1**	**0**	**1.7**	**3.8**	**5.0**	**0**
common nighthawk	0	0.01	0	0	0	0.1	0	0	0	0.8	0	0
northern flicker	0	0.01	0	0	0	0.1	0	0	0	0.8	0	0

Table B-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007 – March 25, 2008.

	Use				% Composition				% Frequency			
Species/Type	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
unidentified hummingbird	0	0.02	0	0	0	0.2	0	0	0	1.5	0	0
Vaux's swift	0.04	0.04	0.21	0	0.4	0.4	1.1	0	1.7	0.8	5.0	0
Unidentified Birds	**0.02**	**0**	**0.01**	**0.01**	**0.2**	**0**	**<0.1**	**<0.1**	**1.7**	**0**	**0.8**	**0.6**
unidentified bird	0.02	0	0.01	0.01	0.2	0	<0.1	<0.1	1.7	0	0.8	0.6
Overall	**9.94**	**9.61**	**19.65**	**14.16**	**100**	**100**	**100**	**100**				

Table B-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007-March 26, 2008.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
common raven	127	1.01	85.2	66.7	0.58	81.7
horned lark	420	2.95	73.1	23.4	0.50	27.6
European starling	63	3.55	58.7	21.4	0.45	62.1
rock pigeon	44	1.33	75.7	35.2	0.35	49.0
American robin	6	0.24	99.1	98.1	0.23	98.1
American goldfinch	32	0.37	97.4	48.9	0.18	77.1
house sparrow	18	0.75	49.2	42.9	0.16	42.9
red-tailed hawk	92	0.22	87.6	73.6	0.14	84.0
unidentified swallow	15	0.19	100.0	74.1	0.14	96.4
unidentified passerine	45	0.17	90.1	43.9	0.07	46.3
American pipit	1	0.05	100.0	100.0	0.05	100.0
American kestrel	64	0.18	65.7	39.1	0.05	53.6
Vaux's swift	12	0.06	100.0	60.0	0.04	71.4
golden eagle	22	0.05	95.7	68.2	0.03	86.4
mountain bluebird	23	0.12	68.8	36.4	0.03	43.2
barn swallow	16	0.09	100.0	32.0	0.03	64.0
tree swallow	12	0.07	100.0	32.5	0.02	70.0
rough-legged hawk	12	0.03	92.3	66.7	0.02	91.7
cliff swallow	7	0.03	100.0	61.1	0.02	61.1
house finch	2	0.02	100.0	53.8	0.01	53.8
dark-eyed junco	6	0.19	35.5	14.8	0.01	14.8
northern harrier	40	0.08	97.6	12.2	0.01	24.4
Canada goose	1	0.01	100.0	100.0	0.01	100.0
unidentified buteo	4	0.01	100.0	75.0	0.01	100.0
black-billed magpie	22	0.17	37.3	9.7	0.01	9.7
sharp-shinned hawk	6	0.01	100.0	50.0	0.01	83.3
Brewer's blackbird	11	0.04	89.3	12.0	<0.01	28.0

Table B-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007-March 26, 2008.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
bald eagle	3	0.01	100.0	66.7	<0.01	100.0
unidentified bird	4	0.01	100.0	50.0	<0.01	50.0
western kingbird	22	0.12	38.9	7.1	<0.01	10.7
Cooper's hawk	2	<0.01	100.0	50.0	<0.01	100.0
Swainson's hawk	2	<0.01	100.0	50.0	<0.01	100.0
cedar waxwing	1	<0.01	100.0	100.0	<0.01	100.0
eastern kingbird	7	0.02	64.3	11.1	<0.01	22.2
common nighthawk	1	<0.01	100.0	100.0	<0.01	100.0
unidentified hummingbird	2	<0.01	100.0	50.0	<0.01	50.0
American crow	1	0.01	77.8	0	0	0
American tree sparrow	2	0.07	9.1	0	0	0
Bullock's oriole	3	0.01	100.0	0	0	0
MacGillivray's warbler	1	<0.01	100.0	0	0	0
Say's phoebe	9	0.03	66.7	0	0	0
chukar	2	0.01	100.0	0	0	0
grasshopper sparrow	3	0.06	8.8	0	0	0
gray partridge	4	0.03	93.8	0	0	0
lark sparrow	1	<0.01	100.0	0	0	0
mountain chickadee	1	<0.01	100.0	0	0	0
mourning dove	8	0.07	59.0	0	0	0
northern rough-winged swallow	2	<0.01	100.0	0	0	0
northern shrike	8	0.03	52.9	0	0	0
red-winged blackbird	1	<0.01	100.0	0	0	0
ring-necked pheasant	10	0.15	22.8	0	0	0
rock wren	2	0.02	30.8	0	0	0
savannah sparrow	19	0.13	38.4	0	0	0
short-eared owl	3	0.01	100.0	0	0	0
song sparrow	2	0.03	20.0	0	0	0

Table B-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007-March 26, 2008.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
unidentified finch	1	0.01	100.0	0	0	0
unidentified sparrow	4	0.02	80.0	0	0	0
vesper sparrow	4	0.03	47.1	0	0	0
western meadowlark	49	0.54	27.2	0	0	1.2
white-crowned sparrow	2	0.03	10.0	0	0	0
yellow-rumped warbler	2	<0.01	66.7	0	0	0
California quail	0	<0.01	0	0	0	0
house wren	0	<0.01	0	0	0	0
killdeer	0	<0.01	0	0	0	0
northern flicker	0	<0.01	0	0	0	0
spotted towhee	0	<0.01	0	0	0	0
tundra swan	0	0	0	0	0	0
unidentified eagle	0	0	0	0	0	0
unidentified empidonax	0	<0.01	0	0	0	0
unidentified raptor	0	0	0	0	0	0
unidentified warbler	0	<0.01	0	0	0	0
willow flycatcher	0	<0.01	0	0	0	0

Table B-5. Flight height characteristics by bird type during the fixed-point bird use surveys at the Oliphant Wind Resource Area, April 9, 2007-March 26, 2008.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0-82 ft	82-410 ft	> 410 ft
Waterfowl	1	3	65.00	100.0	0	100.0	0.0
Shorebirds	0	0	0	0	0	0	0
Raptors	250	270	35.47	83.3	44.4	53.0	2.6
Accipiters	*8*	*8*	*40.00*	*100.0*	*50.0*	*50.0*	*0*
Buteos	*110*	*124*	*50.41*	*88.6*	*23.4*	*72.6*	*4.0*
Northern Harrier	*40*	*41*	*8.55*	*97.6*	*87.8*	*12.2*	*0*
Eagles	*25*	*25*	*56.60*	*96.2*	*24.0*	*68.0*	*8.0*
Falcons	*64*	*69*	*19.45*	*65.7*	*60.9*	*39.1*	*0*
Owls	*3*	*3*	*0*	*100.0*	*100.0*	*0*	*0*
Upland Gamebirds	16	36	0.75	36.0	100.0	0	0
Doves/Pigeons	52	566	16.17	74.9	66.3	33.7	0
Passerines	973	3,833	15.12	65.3	65.8	33.9	0.2
Other Birds	15	38	20.33	97.4	39.5	60.5	0
Unidentified Birds	4	4	23.75	100.0	50.0	50.0	0
Overall	**1,311**	**4,750**	**18.99**	**67.0**	**64.7**	**35.0**	**0.3**

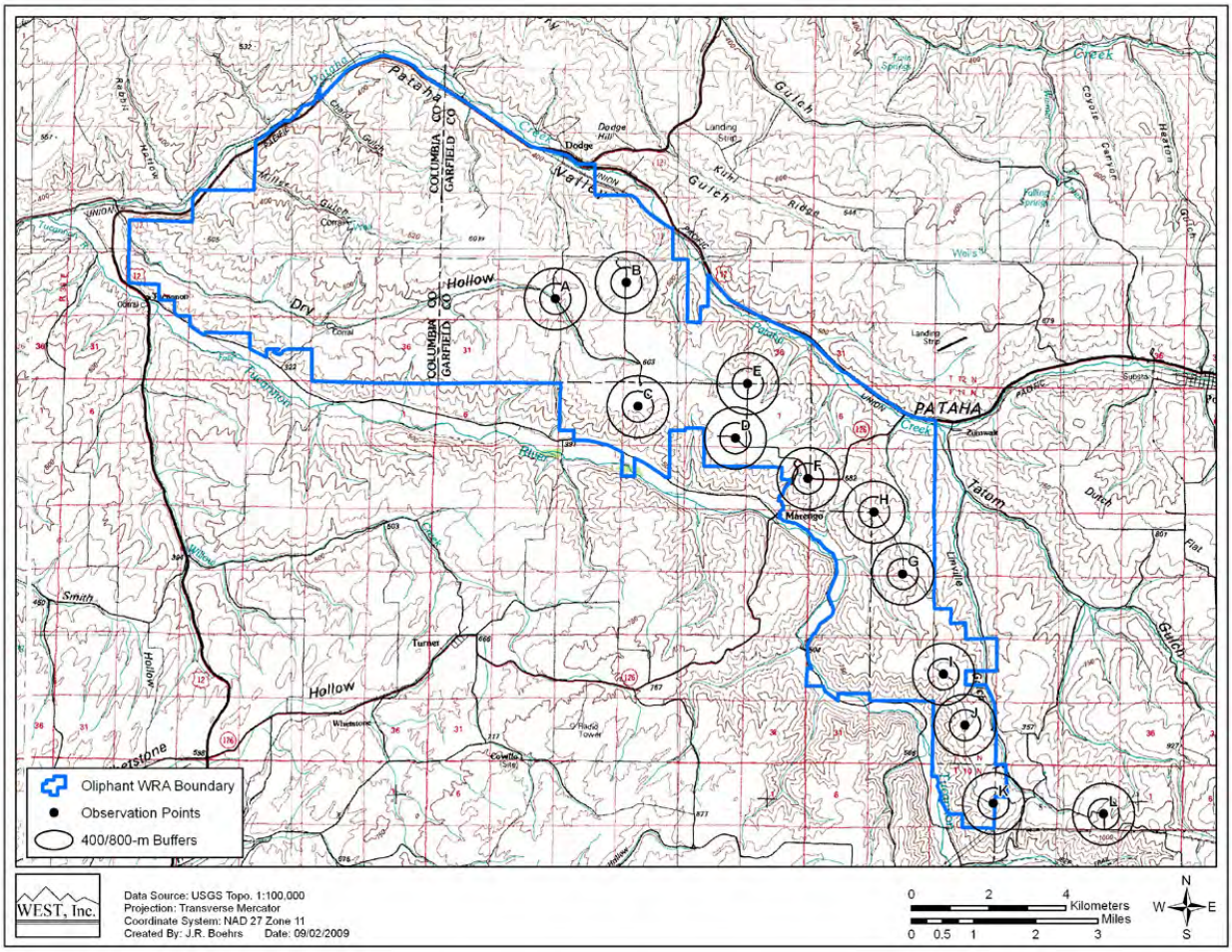


Figure B-1. Fixed-point bird use survey points at the Oliphant Wind Resource Area.

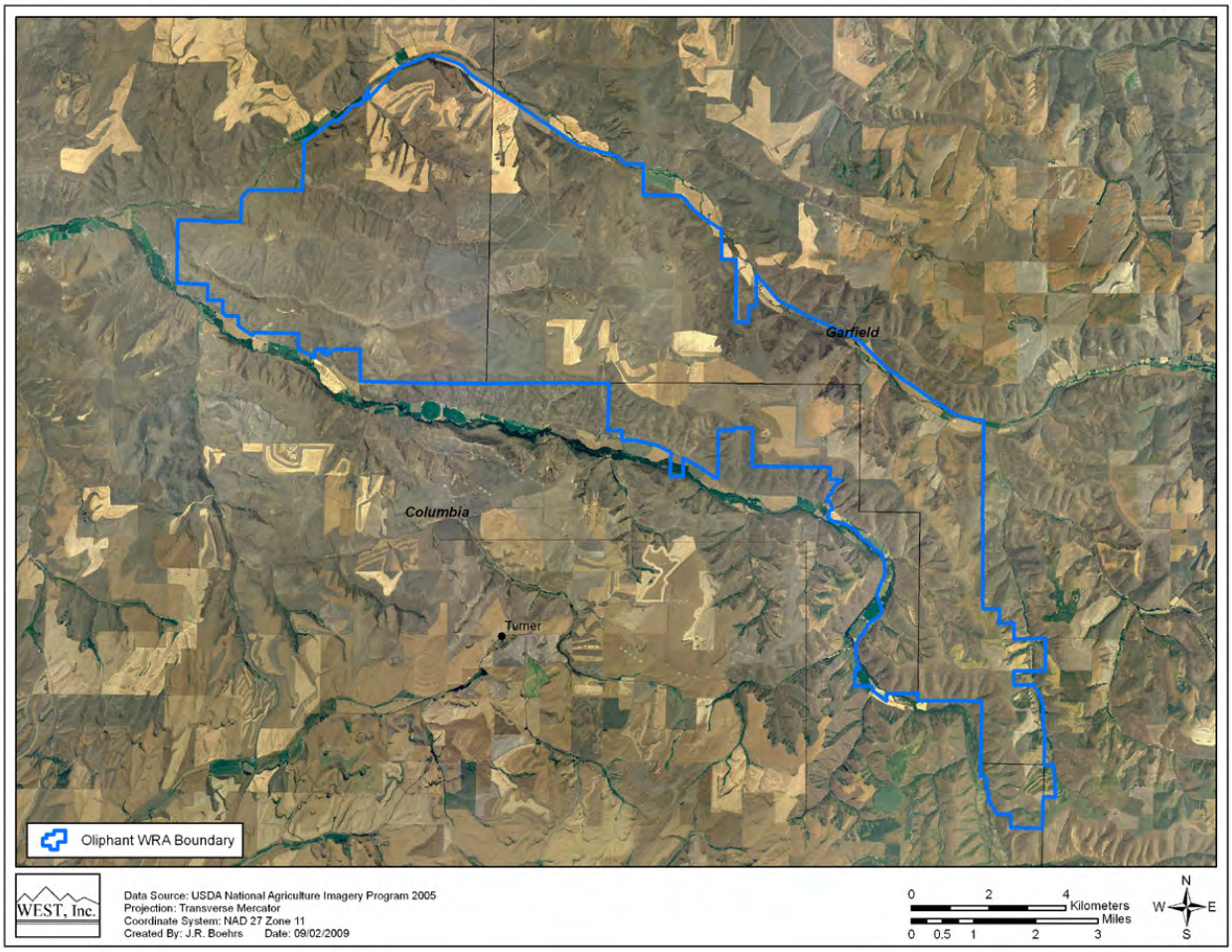


Figure B-2. Aerial photograph of the Oliphant Wind Resources Area representing landscape coverage base.

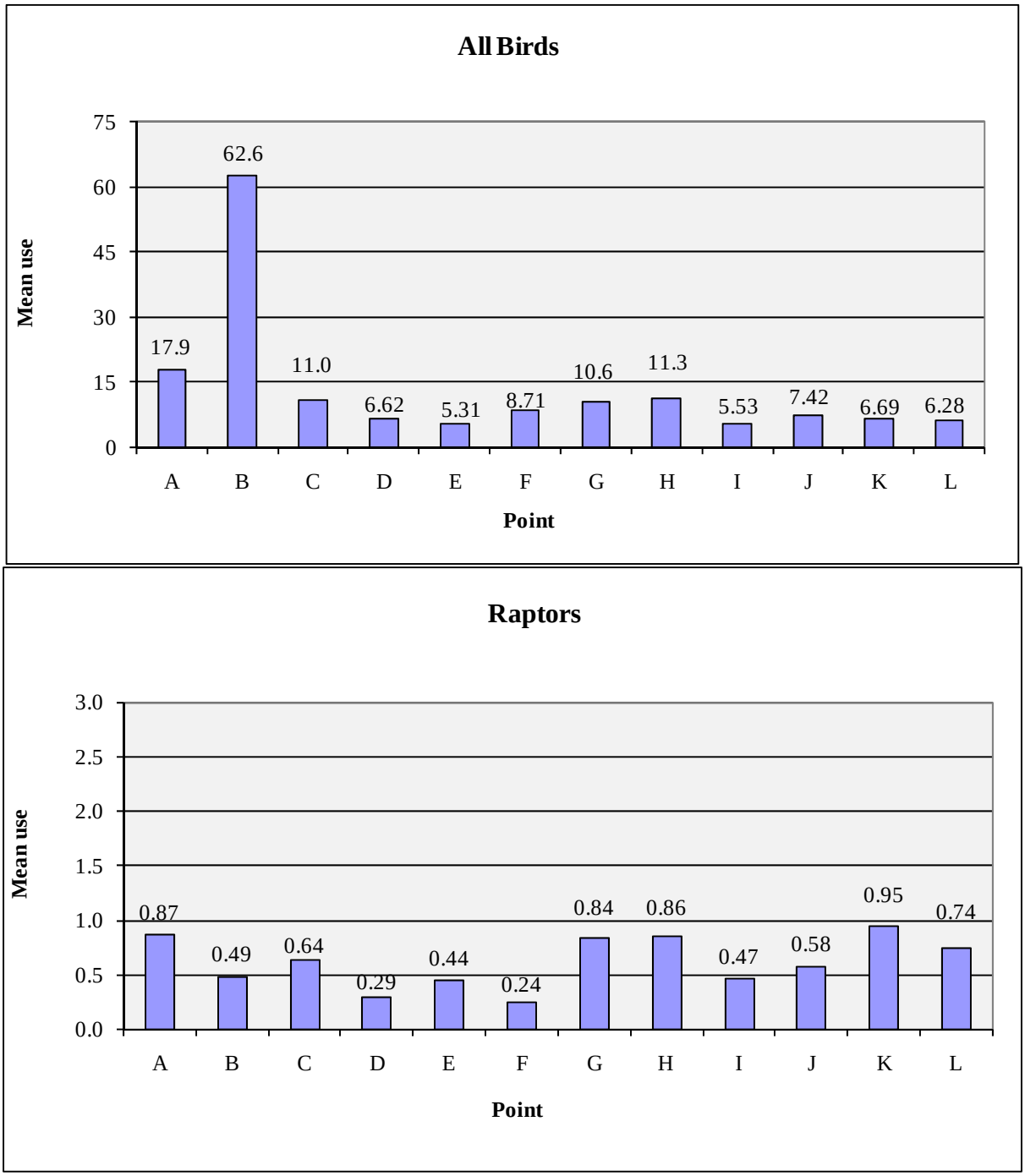
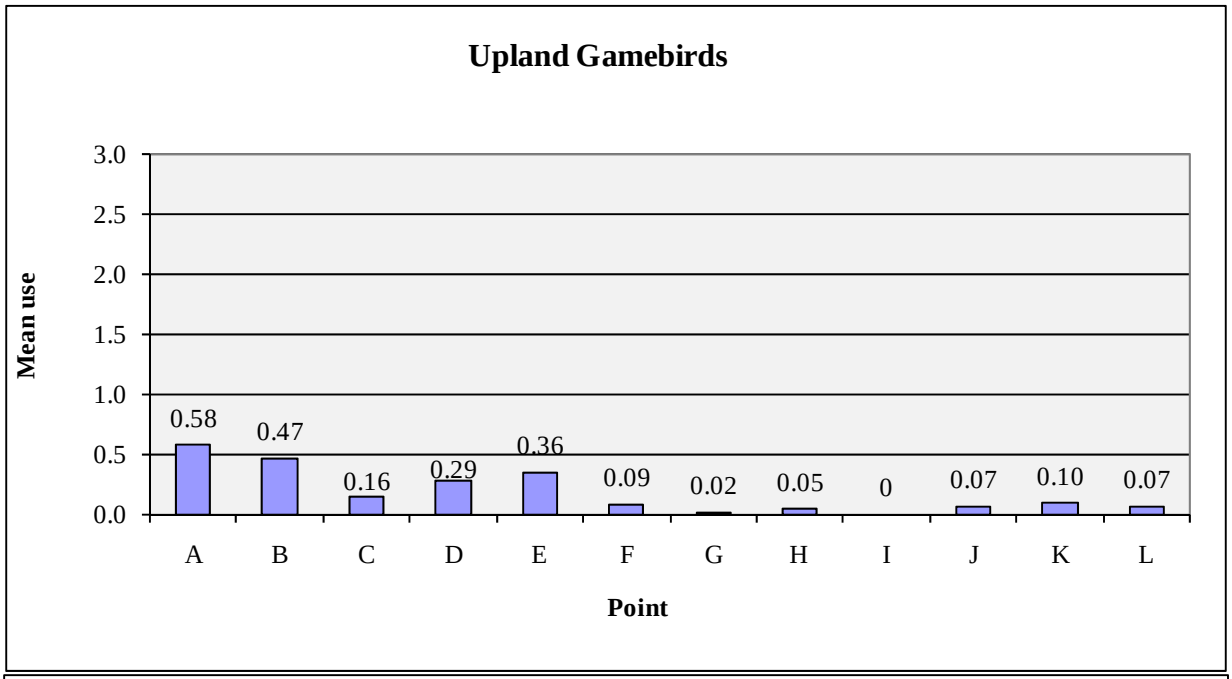


Figure B-3. Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Oliphant Wind Resource Area.



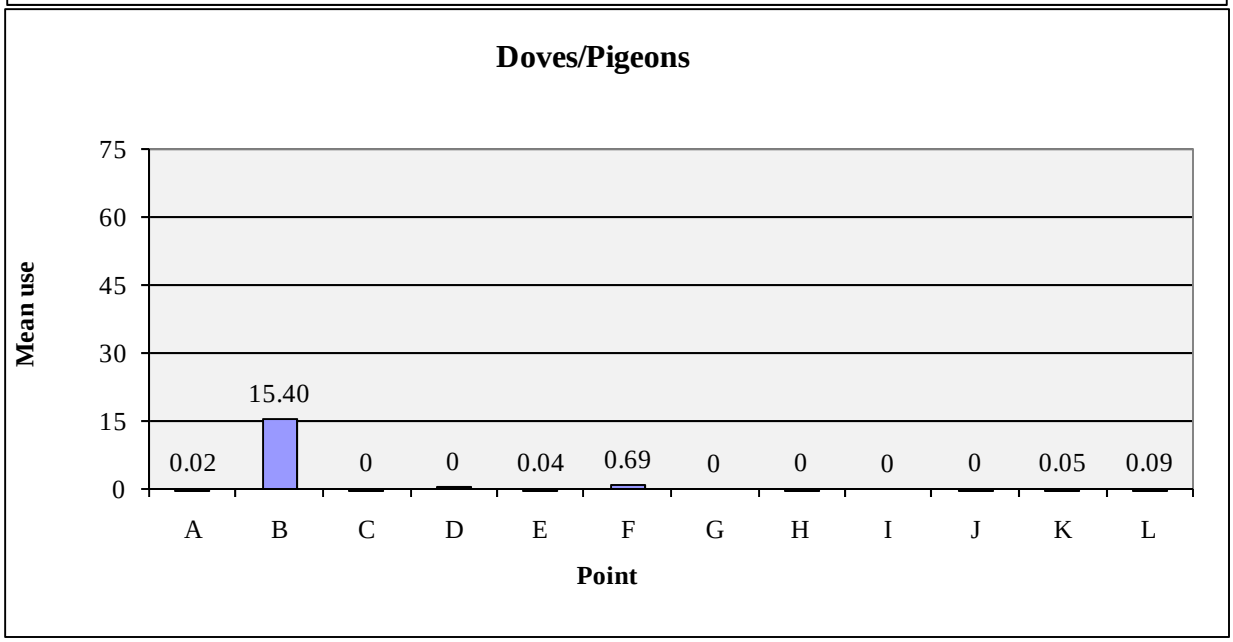


Figure B-3(*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Oliphant Wind Resource Area.

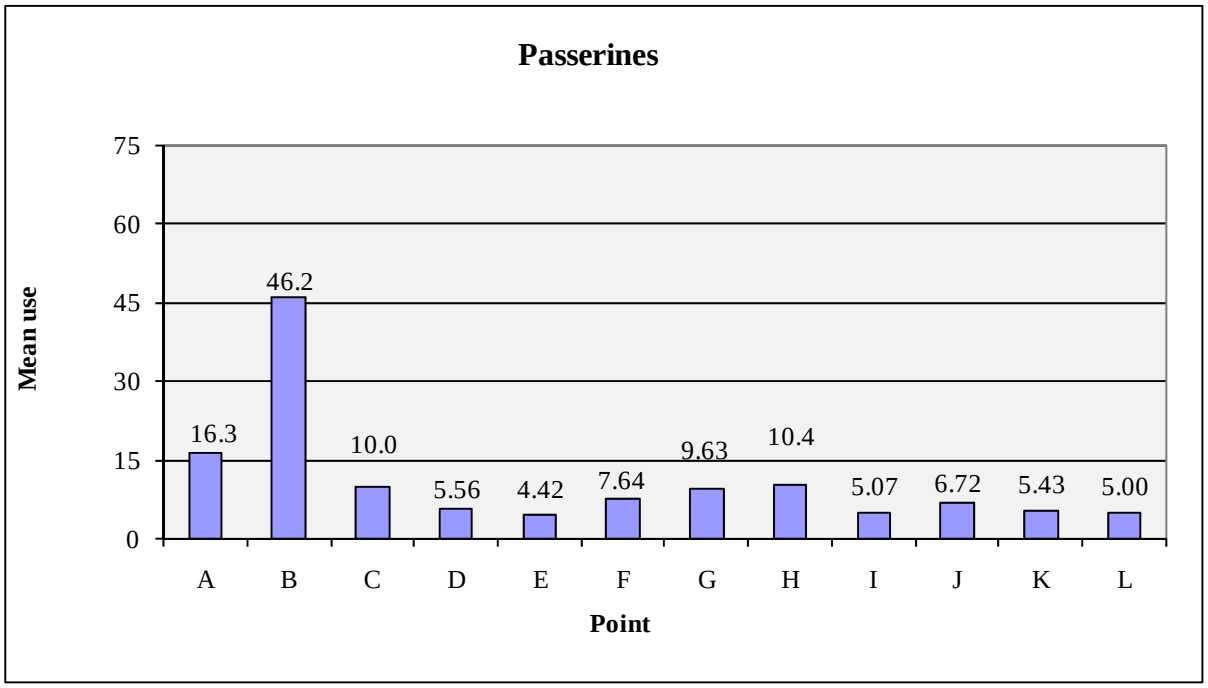


Figure B-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Oliphant Wind Resource Area.

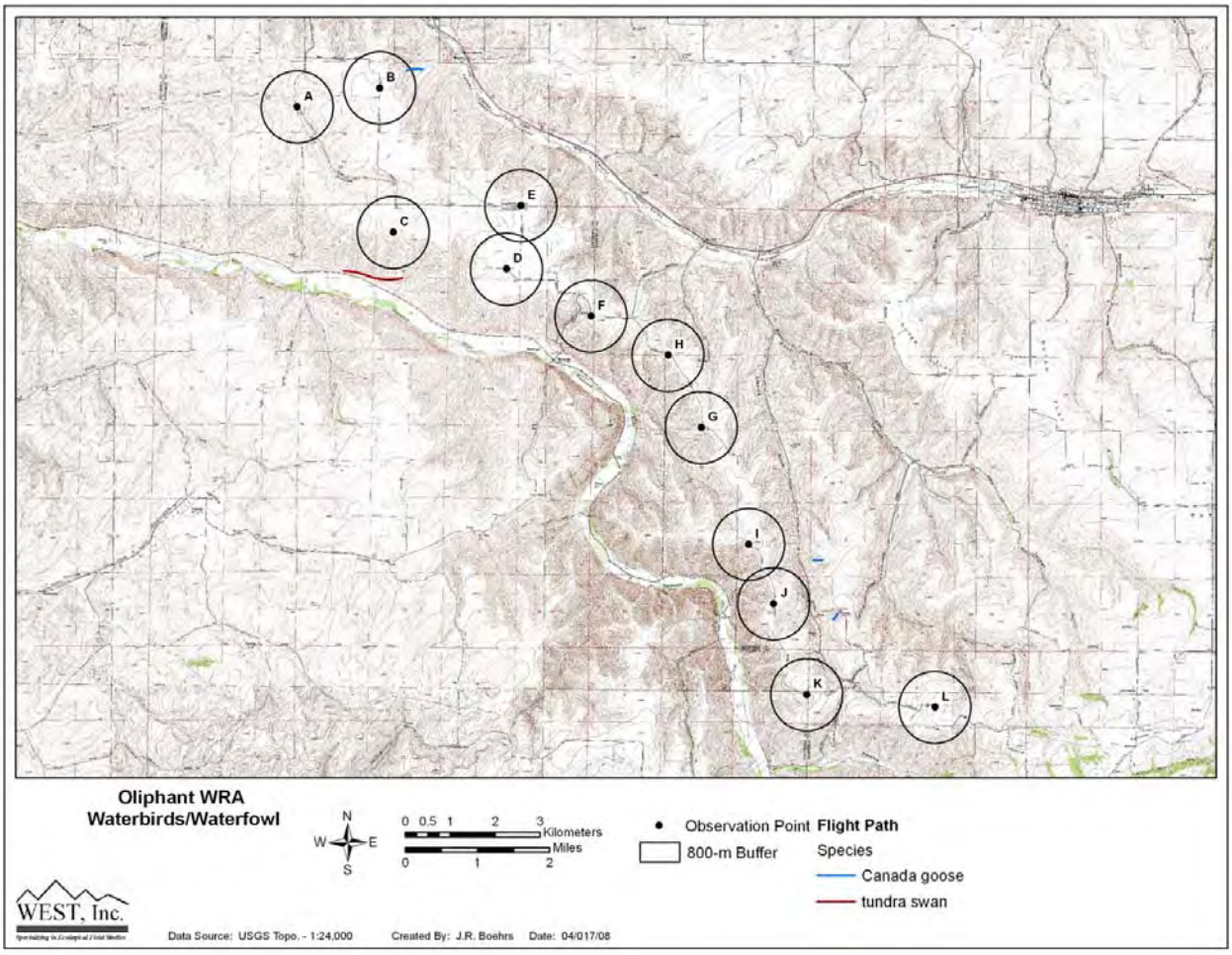


Figure B-6. Mapped flight paths in relation to fixed-point bird use survey stations for waterfowl at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

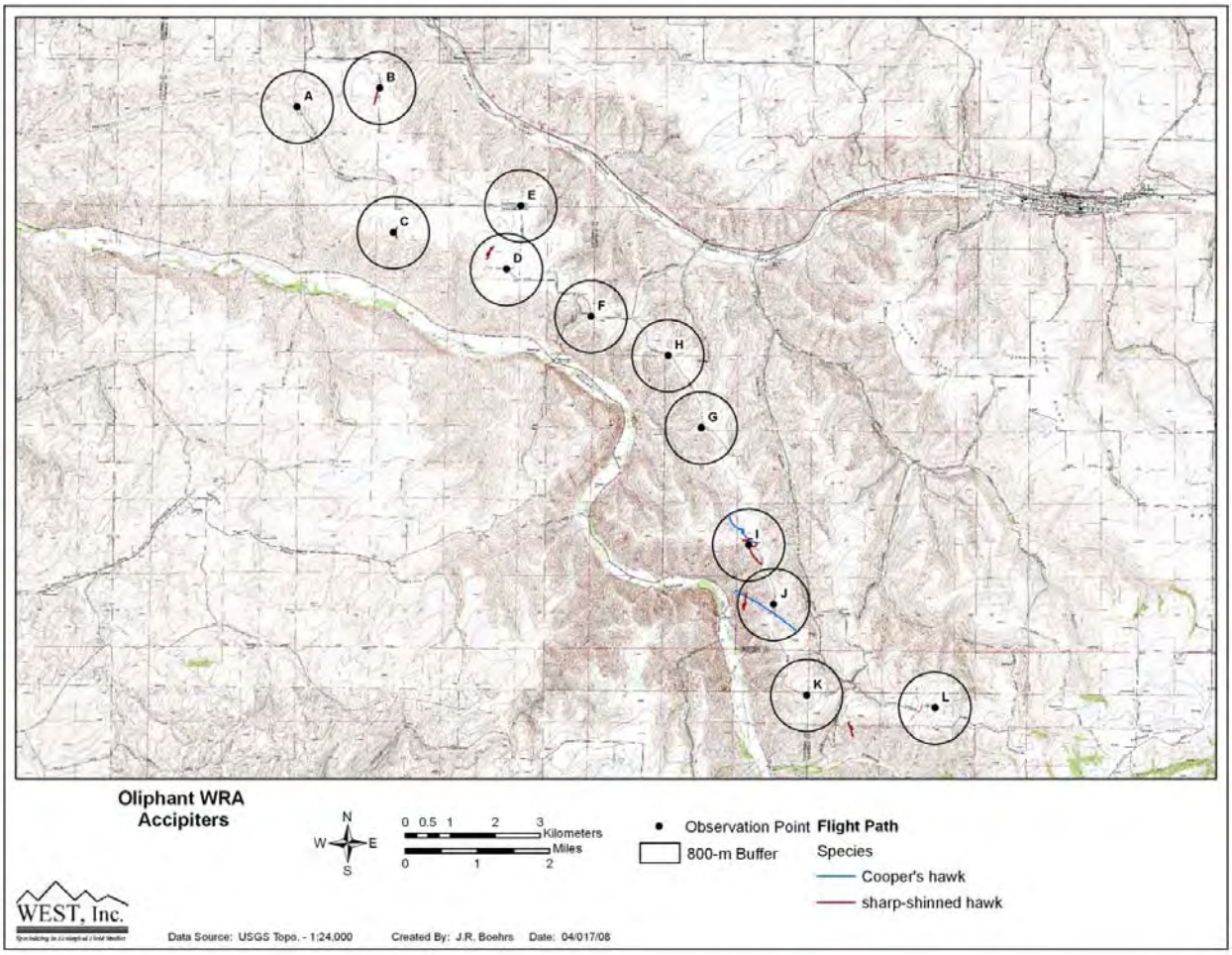


Figure B-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for accipiters at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

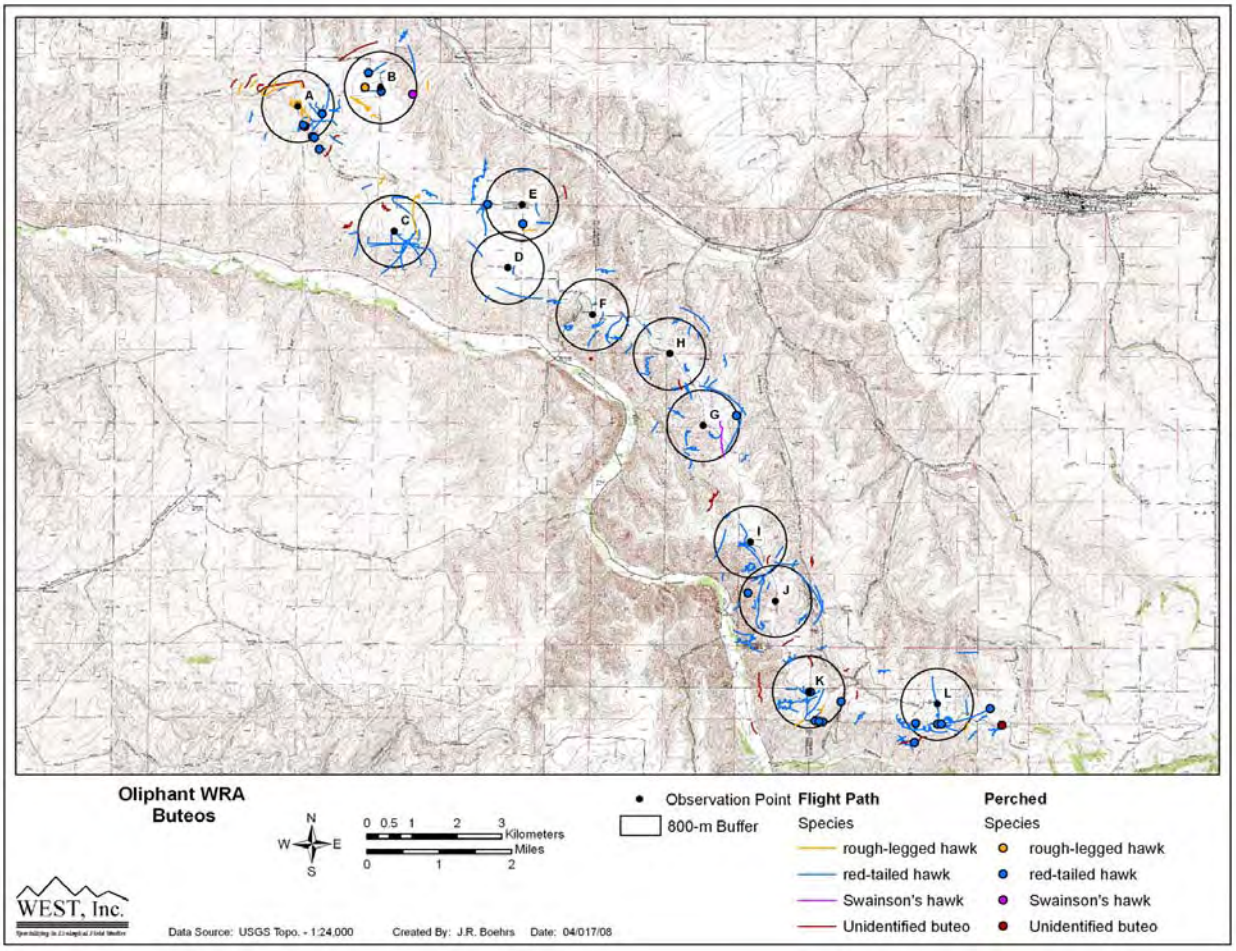


Figure B-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for buteos at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

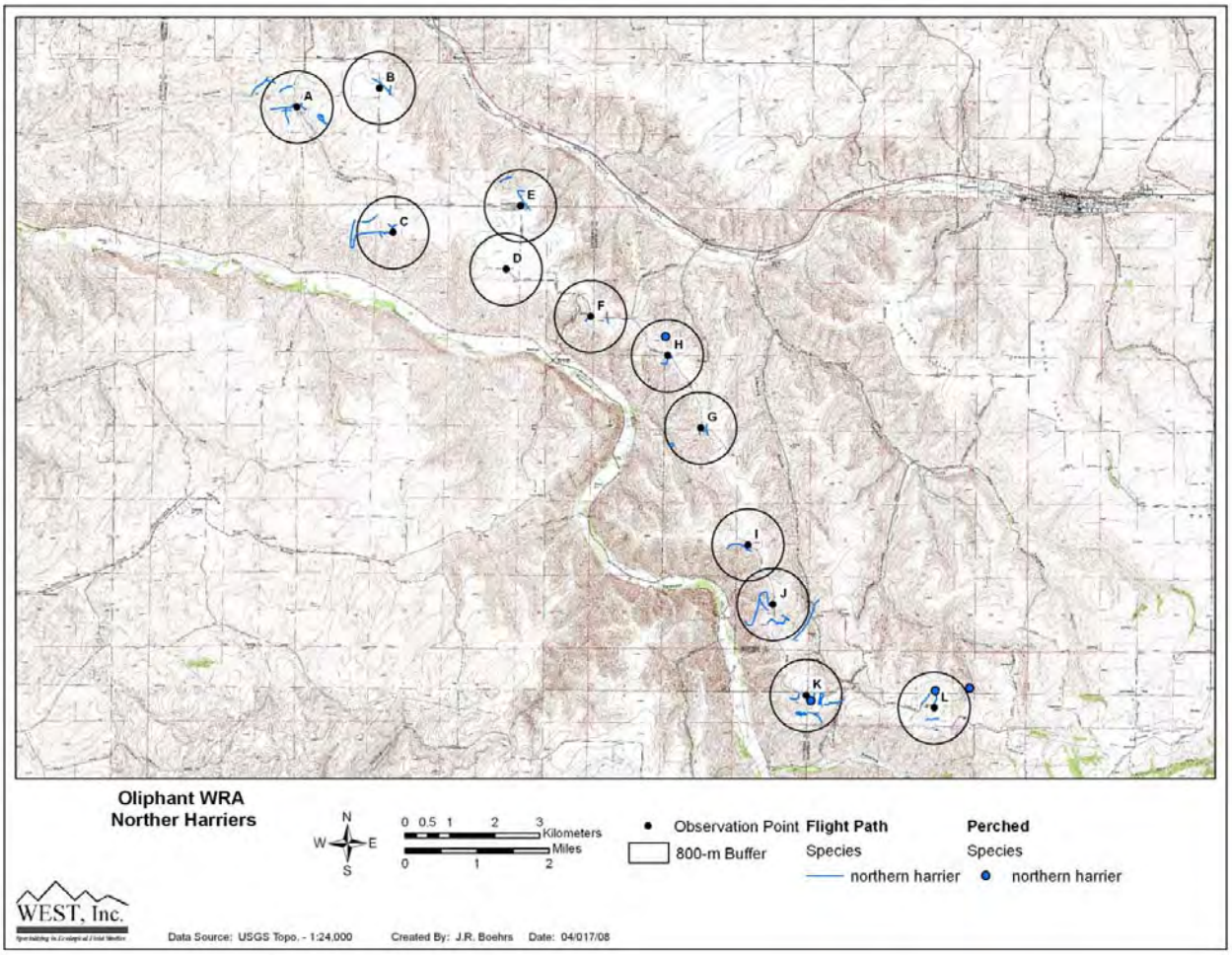


Figure B-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for northern harriers at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

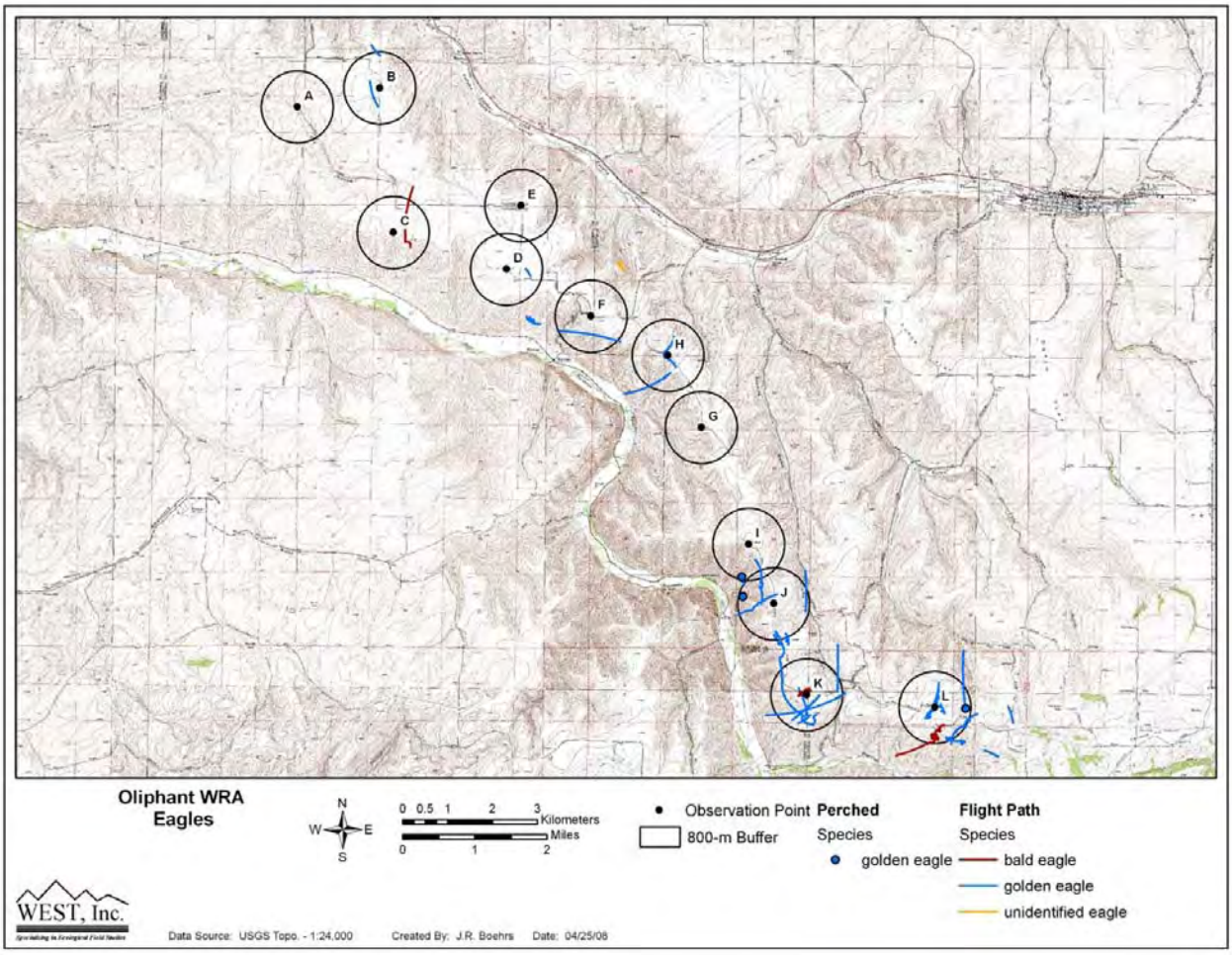


Figure B-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for eagles at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

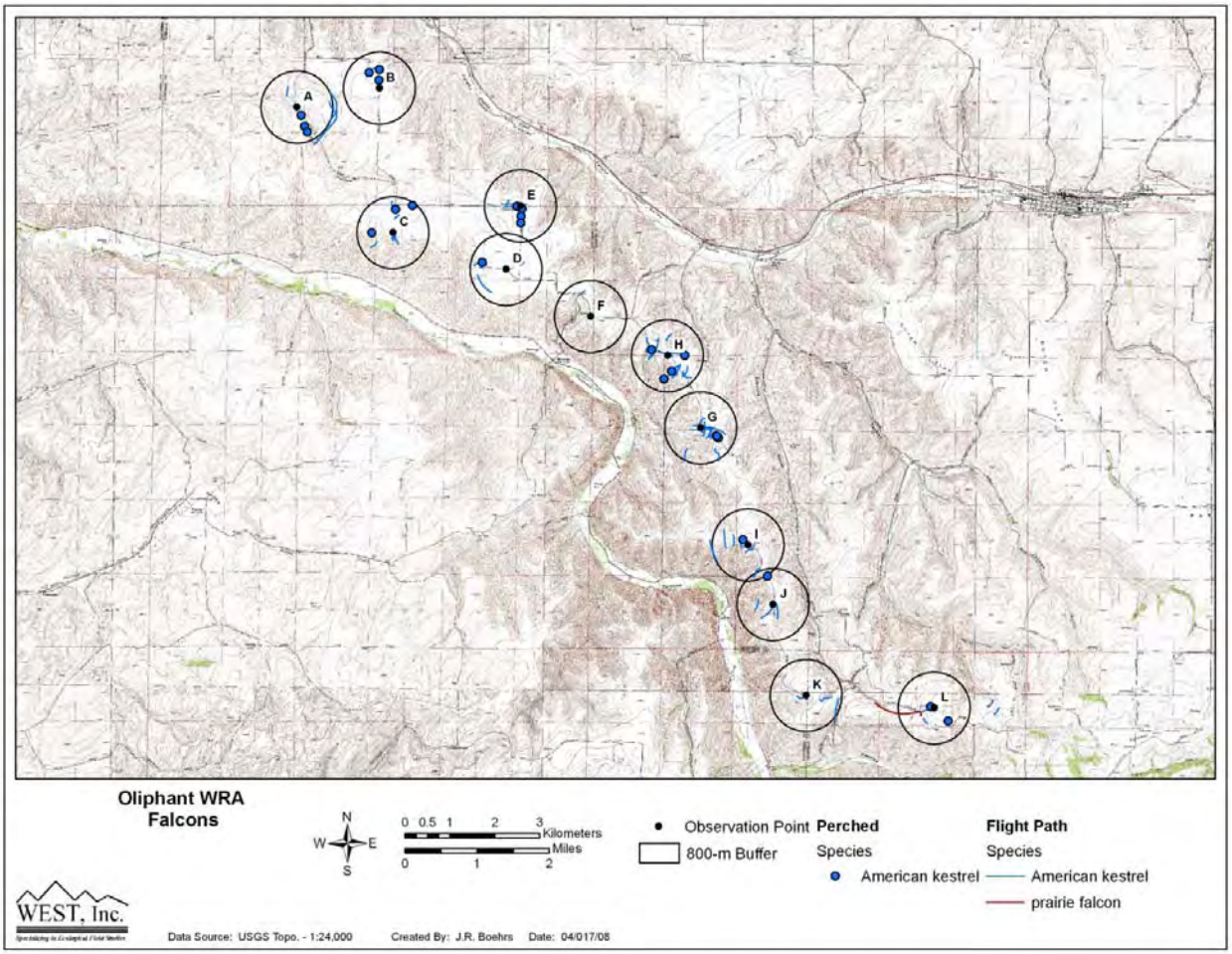


Figure B-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for falcons at the Oliphant Wind Resource Area, April 9, 2007 through March 25, 2008.

Appendix C: Tables and Figures for the Kuhl Ridge Wind Resource Area.

Table C-1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

Season	Number of Visits	Mean Use	# Species/ Survey	# Species	# Surveys Conducted
Winter	9	9.14	1.36	16	111
Spring	5	7.21	2.16	22	59
Summer	8	6.27	2.32	30	120
Fall	7	6.64	1.87	22	89
Overall	**29**	**7.73**	**1.80**	**46**	**379**

Table C-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Shorebirds		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**
killdeer	*Charadrius vociferus*	0	0	0	0	1	1	0	0	1	1
Raptors		**83**	**86**	**50**	**54**	**107**	**121**	**119**	**134**	**359**	**395**
Accipiters		*0*	*0*	*0*	*0*	*0*	*0*	*4*	*4*	*4*	*4*
Cooper's hawk	*Accipiter cooperii*	0	0	0	0	0	0	1	1	1	1
sharp-shinned hawk	*Accipter striatus*	0	0	0	0	0	0	3	3	3	3
Buteos		*57*	*59*	*37*	*41*	*85*	*98*	*90*	*105*	*269*	*303*
ferruginous hawk	*Buteo regalis*	0	0	0	0	1	1	1	1	2	2
red-tailed hawk	*Buteo jamaicensis*	43	44	31	35	58	69	70	83	202	231
rough-legged hawk	*Buteo lagopus*	14	15	3	3	0	0	9	9	26	27
Swainson's hawk	*Buteo swainsoni*	0	0	3	3	26	28	10	12	39	43
Northern Harrier		*16*	*17*	*10*	*10*	*14*	*14*	*19*	*19*	*59*	*60*
northern harrier	*Circus cyaneus*	16	17	10	10	14	14	19	19	59	60
Eagles		*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*1*	*1*
golden eagle	*Aquila chrysaetos*	0	0	1	1	0	0	0	0	1	1
Falcons		*9*	*9*	*1*	*1*	*8*	*9*	*5*	*5*	*23*	*24*
American kestrel	*Falco sparverius*	3	3	1	1	6	7	4	4	14	15
merlin	*Falco columbarius*	1	1	0	0	0	0	1	1	2	2
prairie falcon	*Falco mexicanus*	5	5	0	0	2	2	0	0	7	7
Other Raptors		*1*	*1*	*1*	*1*	*0*	*0*	*1*	*1*	*3*	*3*
osprey	*Pandion haliaetus*	0	0	1	1	0	0	1	1	2	2
unidentified raptor		1	1	0	0	0	0	0	0	1	1
Upland Gamebirds		**2**	**2**	**16**	**17**	**21**	**33**	**2**	**10**	**41**	**62**
gray partridge	*Perdix perdix*	0	0	0	0	1	1	2	10	3	11
ring-necked pheasant	*Phasianus colchicus*	2	2	16	17	20	32	0	0	38	51
Doves/Pigeons		**11**	**49**	**8**	**39**	**27**	**196**	**16**	**105**	**62**	**389**
mourning dove	*Zenaida macroura*	0	0	0	0	8	10	0	0	8	10
rock pigeon	*Columba livia*	11	49	8	39	19	186	16	105	54	379

Table C-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Passerines		**128**	**1143**	**105**	**423**	**194**	**539**	**102**	**669**	**529**	**2,774**
American crow	*Corvus brachyrhynchos*	0	0	0	0	0	0	1	2	1	2
American goldfinch	*Carduelis tristis*	0	0	0	0	0	0	2	161	2	161
American robin	*Turdus migratorius*	0	0	3	6	2	2	0	0	5	8
bank swallow	*Riparia riparia*	0	0	0	0	3	5	0	0	3	5
barn swallow	*Hirundo rustica*	0	0	0	0	6	7	1	1	7	8
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	2	4	4	10	0	0	6	14
Bullock's oriole	*Icterus bullockii*	0	0	0	0	1	1	0	0	1	1
cliff swallow	*Petrochelidon pyrrhonota*	0	0	1	7	5	7	0	0	6	14
common raven	*Corvus corax*	41	69	31	52	32	82	42	105	146	308
eastern kingbird	*Tyrannus tyrannus*	0	0	0	0	1	1	0	0	1	1
European starling	*Sturnus vulgaris*	6	142	8	43	11	45	6	126	31	356
grasshopper sparrow	*Ammodramus savannarum*	0	0	0	0	11	15	0	0	11	15
horned lark	*Eremophila alpestris*	72	885	34	254	67	254	46	263	219	1,656
house finch	*Carpodacus mexicanus*	1	11	0	0	0	0	0	0	1	11
house sparrow	*Passer domesticus*	0	0	0	0	1	1	0	0	1	1
mountain bluebird	*Sialia currucoides*	0	0	0	0	1	2	1	4	2	6
northern shrike	*Lanius excubitor*	1	1	0	0	0	0	0	0	1	1
rock wren	*Salpinctes obsoletus*	0	0	0	0	4	4	0	0	4	4
savannah sparrow	*Passerculus sandwichensis*	0	0	5	6	13	16	0	0	18	22
Say's phoebe	*Sayornis saya*	0	0	1	1	5	7	0	0	6	8
snow bunting	*Plectrophenax nivalis*	1	20	0	0	0	0	0	0	1	20
tree swallow	*Tachycineta bicolor*	0	0	1	1	0	0	0	0	1	1
unidentified empidonax		0	0	0	0	1	5	0	0	1	5
vesper sparrow	*Pooecetes gramineus*	0	0	1	1	0	0	0	0	1	1
western bluebird	*Sialia mexicana*	0	0	0	0	0	0	1	3	1	3
western kingbird	*Tyrannus verticalis*	0	0	1	2	6	22	0	0	7	24
western meadowlark	*Sturnella neglecta*	4	8	16	45	20	53	2	4	42	110

Table C-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
white-crowned sparrow	*Zonotrichia leucophrys*	2	7	1	1	0	0	0	0	3	8
Other Birds		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
northern flicker	*Colaptes auratus*	0	0	0	0	0	0	1	1	1	1
Overall	.	**224**	**1,280**	**179**	**533**	**350**	**890**	**240**	**919**	**993**	**3,622**

Table C-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Shorebirds	**0**	**0**	**<0.01**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**0.8**	**0**
killdeer	0	0	<0.01	0	0	0	0.1	0	0	0	0.8	0
Raptors	**0.69**	**0.93**	**1.01**	**1.70**	**7.5**	**12.9**	**16.1**	**25.6**	**38.2**	**49.5**	**51.7**	**60.8**
Accipiters	*0*	*0*	*0*	*0.04*	*0*	*0*	*0*	*0.6*	*0*	*0*	*0*	*3.0*
Cooper's hawk	0	0	0	<0.01	0	0	0	0.1	0	0	0	1.0
sharp-shinned hawk	0	0	0	0.03	0	0	0	0.5	0	0	0	2.0
Buteos	*0.48*	*0.71*	*0.82*	*1.37*	*5.2*	*9.8*	*13.0*	*20.6*	*29.4*	*39.7*	*42.5*	*51.0*
ferruginous hawk	0	0	0.01	0.02	0	0	0.1	0.3	0	0	0.8	2.0
red-tailed hawk	0.36	0.63	0.58	1.07	4.0	8.7	9.2	16.2	23.9	38.3	35.0	43.5
rough-legged hawk	0.12	0.04	0	0.11	1.3	0.6	0	1.7	9.4	4.2	0	11.1
Swainson's hawk	0	0.04	0.23	0.16	0	0.6	3.7	2.4	0	4.0	16.7	12.0
Northern Harrier	*0.14*	*0.17*	*0.12*	*0.23*	*1.5*	*2.3*	*1.9*	*3.4*	*11.1*	*16.9*	*11.7*	*18.7*
northern harrier	0.14	0.17	0.12	0.23	1.5	2.3	1.9	3.4	11.1	16.9	11.7	18.7
Eagles	*0*	*0.01*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*1.3*	*0*	*0*
golden eagle	0	0.01	0	0	0	0.2	0	0	0	1.3	0	0
Falcons	*0.07*	*0.03*	*0.08*	*0.06*	*0.7*	*0.4*	*1.2*	*0.9*	*6.8*	*2.9*	*5.8*	*5.9*
American kestrel	0.02	0.03	0.06	0.05	0.2	0.4	0.9	0.7	2.3	2.9	5.0	5.0
merlin	<0.01	0	0	<0.01	<0.1	0	0	0.1	0.8	0	0	1.0
prairie falcon	0.04	0	0.02	0	0.4	0	0.3	0	3.8	0	1.7	0
Other Raptors	*0*	*0.01*	*0*	<0.01	*0*	*0.2*	*0*	*0.1*	*0*	*1.3*	*0*	*1.0*
osprey	0	0.01	0	<0.01	0	0.2	0	0.1	0	1.3	0	1.0
Upland Gamebirds	**0.02**	**0.29**	**0.28**	**0.10**	**0.2**	**4.0**	**4.4**	**1.4**	**1.8**	**22.8**	**15.8**	**1.9**
gray partridge	0	0	<0.01	0.10	0	0	0.1	1.4	0	0	0.8	1.9
ring-necked pheasant	0.02	0.29	0.27	0	0.2	4.0	4.3	0	1.8	22.8	15.8	0
Doves/Pigeons	**0.44**	**0.66**	**1.63**	**1.21**	**4.8**	**9.2**	**26.1**	**18.3**	**9.9**	**14.9**	**20.8**	**20.2**
mourning dove	0	0	0.08	0	0	0	1.3	0	0	0	6.7	0
rock pigeon	0.44	0.66	1.55	1.21	4.8	9.2	24.7	18.3	9.9	14.9	15.8	20.2

Table C-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Passerines	**8.00**	**5.33**	**3.34**	**3.62**	**87.5**	**73.9**	**53.3**	**54.6**	**66.4**	**77.7**	**75.8**	**61.1**
American goldfinch	0	0	0	0.22	0	0	0	3.4	0	0	0	2.0
American robin	0	0.06	0.02	0	0	0.8	0.3	0	0	2.9	1.7	0
bank swallow	0	0	0.04	0	0	0	0.7	0	0	0	2.5	0
barn swallow	0	0	0.06	<0.01	0	0	0.9	0.1	0	0	5.0	1.0
Brewer's blackbird	0	0	0.08	0	0	0	1.3	0	0	0	3.3	0
cliff swallow	0	0.16	0.06	0	0	2.2	0.9	0	0	2.2	4.2	0
common raven	0.05	0.13	0.10	0.14	0.5	1.8	1.6	2.1	3.1	10.0	5.8	8.8
eastern kingbird	0	0	<0.01	0	0	0	0.1	0	0	0	0.8	0
European starling	0.07	0.61	0.13	0.28	0.7	8.5	2.0	4.2	1.5	11.3	5.8	2.9
grasshopper sparrow	0	0	0.13	0	0	0	2.0	0	0	0	8.3	0
horned lark	7.54	3.84	2.12	2.89	82.5	53.2	33.8	43.5	62.2	56.6	55.0	49.4
house finch	0.08	0	0	0	0.9	0	0	0	0.7	0	0	0
house sparrow	0	0	<0.01	0	0	0	0.1	0	0	0	0.8	0
mountain bluebird	0	0	0.02	0.04	0	0	0.3	0.6	0	0	0.8	1.0
northern shrike	<0.01	0	0	0	<0.1	0	0	0	0.8	0	0	0
rock wren	0	0	0.02	0	0	0	0.3	0	0	0	1.7	0
savannah sparrow	0	0.08	0.13	0	0	1.1	2.0	0	0	6.9	10.0	0
Say's phoebe	0	0	0.06	0	0	0	0.9	0	0	0	4.2	0
snow bunting	0.17	0	0	0	1.9	0	0	0	0.9	0	0	0
tree swallow	0	0.02	0	0	0	0.3	0	0	0	2.2	0	0
unidentified empidonax	0	0	0.04	0	0	0	0.7	0	0	0	0.8	0
vesper sparrow	0	0.02	0	0	0	0.3	0	0	0	2.2	0	0
western bluebird	0	0	0	0.03	0	0	0	0.4	0	0	0	1.0
western kingbird	0	0.04	0.15	0	0	0.6	2.4	0	0	2.2	3.3	0
western meadowlark	0.02	0.34	0.19	0.02	0.2	4.7	3.1	0.3	1.9	10.7	6.7	1.0

Table C-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
white-crowned sparrow	0.06	0.02	0	0	0.7	0.3	0	0	1.9	2.2	0	0
Other Birds	**0**	**0**	**0**	**<0.01**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**1.0**
northern flicker	0	0	0	<0.01	0	0	0	0.1	0	0	0	1.0
Overall	**9.14**	**7.21**	**6.27**	**6.64**	**3.7**	**3.0**	**2.6**	**2.7**	**84.2**	**95.9**	**94.2**	**93.3**

Table C-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
red-tailed hawk	157	0.59	79.0	39.2	0.18	71.8
rock pigeon	43	0.84	71.0	17.5	0.10	20.4
horned lark	74	4.88	51.0	2.0	0.05	13.6
American goldfinch	2	0.04	100	93.2	0.04	100
Swainson's hawk	37	0.08	95.3	43.9	0.03	90.2
northern harrier	56	0.16	95	19.3	0.03	24.6
common raven	133	0.09	89.0	26.3	0.02	45.3
cliff swallow	5	0.04	92.9	53.8	0.02	69.2
rough-legged hawk	22	0.08	85.2	17.4	0.01	39.1
ferruginous hawk	2	<0.01	100	100	<0.01	100
American kestrel	11	0.04	80.0	8.3	<0.01	8.3
osprey	2	<0.01	100	50.0	<0.01	50.0
sharp-shinned hawk	3	<0.01	100	33.3	<0.01	66.7
European starling	19	0.22	75.8	0	0	0
ring-necked pheasant	0	0.11	0	0	0	0
western meadowlark	11	0.11	29.1	0	0	18.8
snow bunting	1	0.07	100	0	0	0
savannah sparrow	0	0.04	0	0	0	0
western kingbird	7	0.04	100	0	0	0
house finch	1	0.03	100	0	0	0
white-crowned sparrow	2	0.03	87.5	0	0	0
grasshopper sparrow	1	0.02	13.3	0	0	0
gray partridge	1	0.02	63.6	0	0	0
prairie falcon	7	0.02	100	0	0	0
Brewer's blackbird	5	0.02	85.7	0	0	0
mourning dove	3	0.02	40.0	0	0	0

Table C-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
American robin	4	0.01	87.5	0	0	0
barn swallow	5	0.01	75.0	0	0	0
Say's phoebe	2	0.01	37.5	0	0	0
mountain bluebird	2	0.01	100	0	0	0
bank swallow	2	<0.01	80.0	0	0	0
unidentified empidonax	1	<0.01	100	0	0	0
western bluebird	1	<0.01	100	0	0	100
merlin	2	<0.01	100	0	0	50.0
tree swallow	1	<0.01	100	0	0	0
vesper sparrow	0	<0.01	0	0	0	0
northern shrike	1	<0.01	100	0	0	0
rock wren	0	<0.01	0	0	0	0
golden eagle	1	<0.01	100	0	0	100
Cooper's hawk	1	<0.01	100	0	0	0
northern flicker	1	<0.01	100	0	0	0
eastern kingbird	1	<0.01	100	0	0	0
house sparrow	0	<0.01	0	0	0	0
killdeer	0	<0.01	0	0	0	0
American crow	1	0	100	0	0	0
Bullock's oriole	0	0	0	0	0	0
unidentified raptor	0	0	0	0	0	0

Table C-5. Flight height characteristics by bird type during the fixed-point bird use surveys at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories 0-82 ft	82-410 ft	> 410 ft
Raptors	301	332	37.65	84.7	63.0	32.8	4.2
Accipiters	*4*	*4*	*95.75*	*100*	*50.0*	*25.0*	*25.0*
Buteos	*218*	*247*	*40.73*	*82.1*	*57.5*	*38.5*	*4.0*
Northern Harrier	*56*	*57*	*18.73*	*95.0*	*80.7*	*19.3*	*0*
Eagles	*1*	*1*	*200.00*	*100*	*0*	*0*	*100.0*
Falcons	*20*	*21*	*26.10*	*87.5*	*90.5*	*4.8*	*4.8*
Other Raptors	*2*	*2*	*150.00*	*100*	*0*	*50.0*	*50.0*
Upland Gamebirds	1	7	1.00	11.3	100	0	0
Doves/Pigeons	46	273	17.28	70.2	82.8	17.2	0.0
Passerines	282	1,709	16.39	61.6	85.4	14.4	0.2
Other Birds	1	1	20.00	100	100	0	0
Overall	**631**	**2,322**	**26.58**	**64.2**	**81.9**	**17.3**	**0.8**

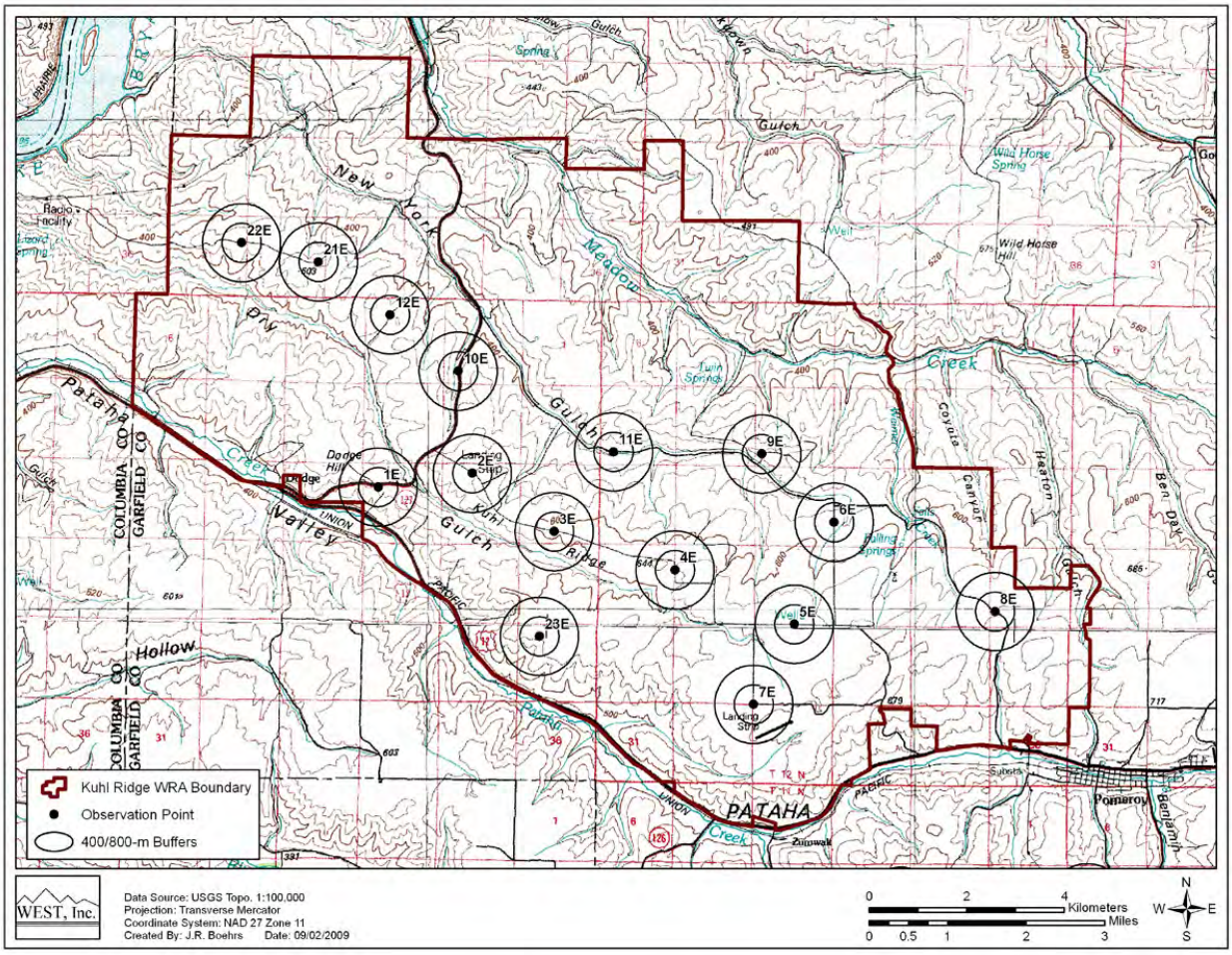


Figure C-1. Fixed-point bird use survey points at the Kuhl Ridge Wind Resource Area.

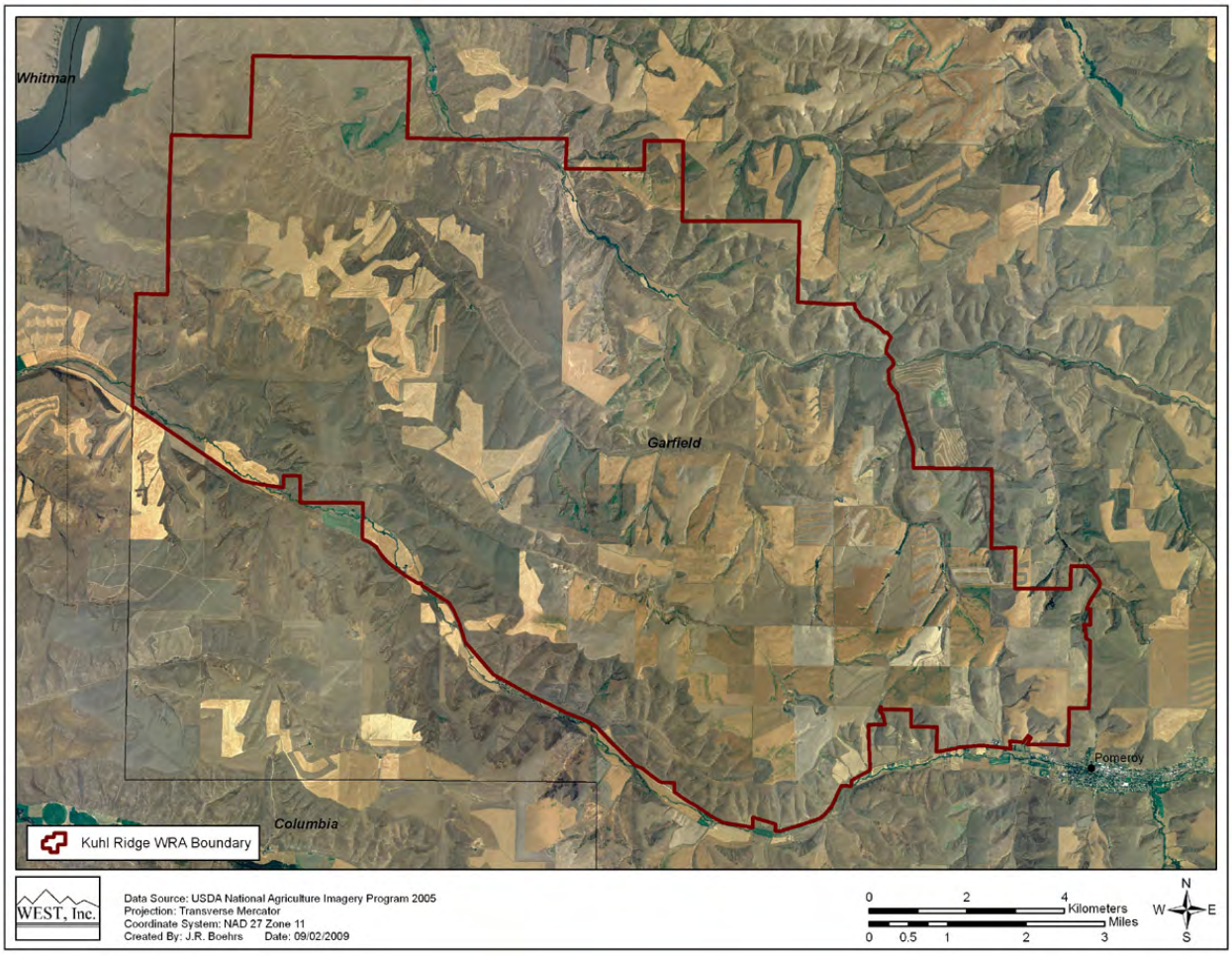


Figure C-2. Aerial photograph of the Kuhl Ridge Wind Resources Area representing landscape coverage base.

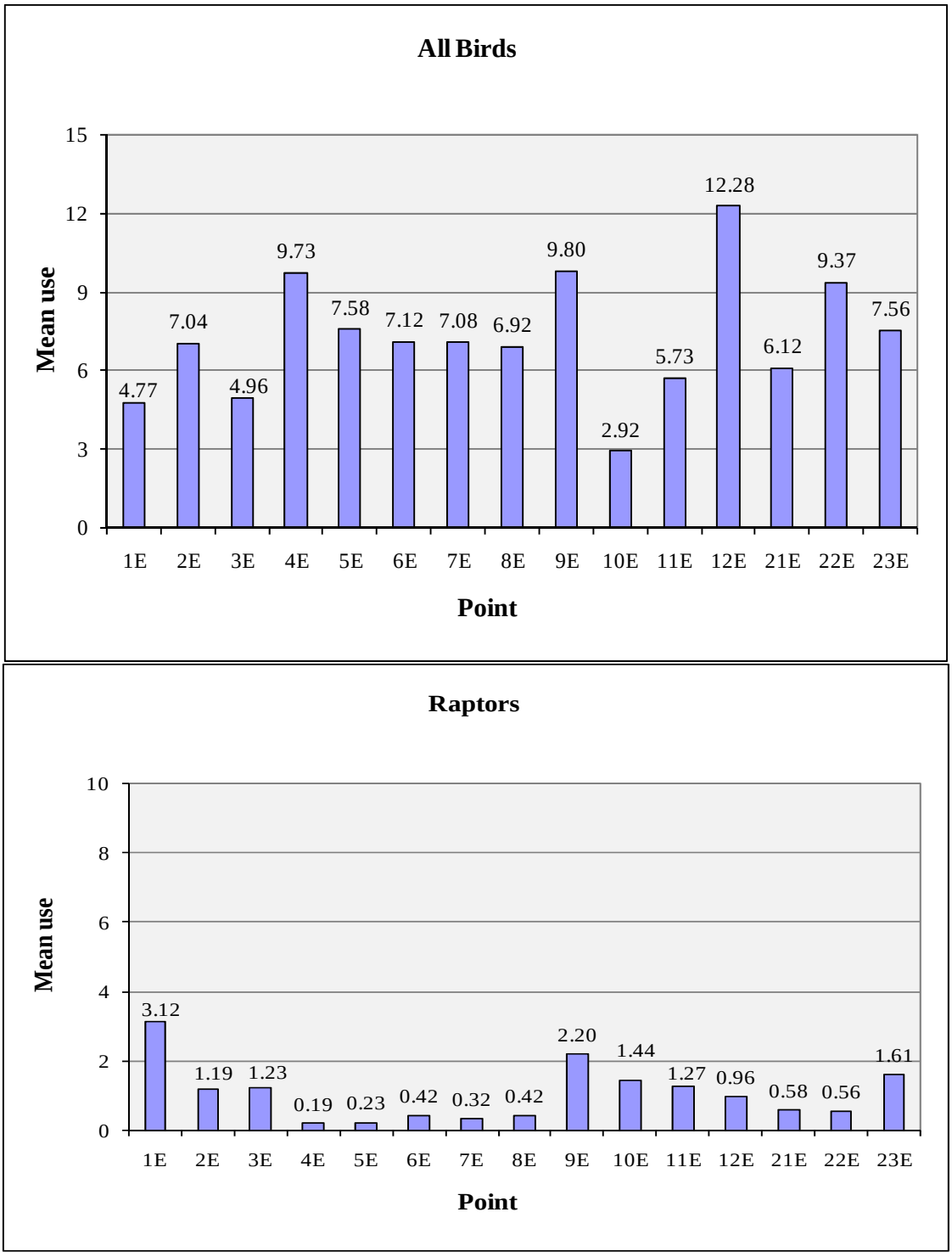


Figure C-3. Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Kuhl Ridge Wind Resource Area.

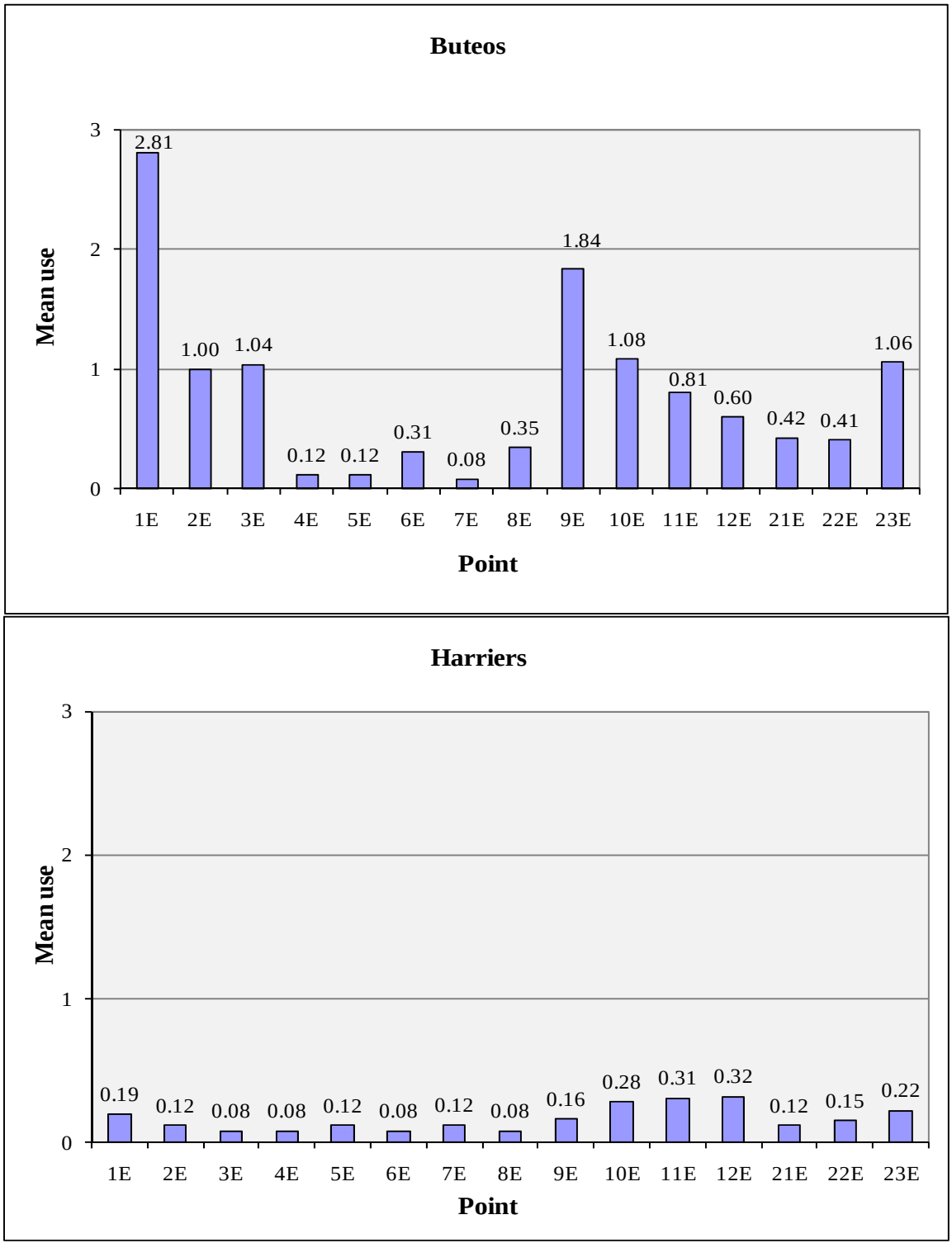
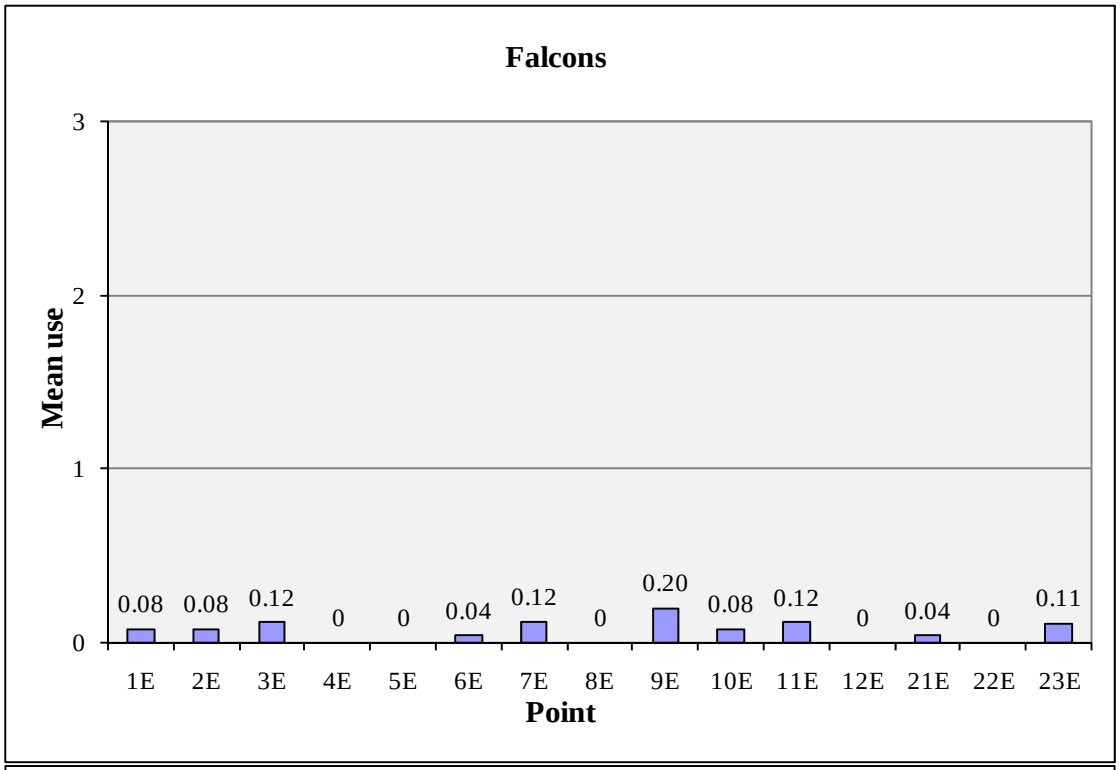


Figure C-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Kuhl Ridge Wind Resource Area.



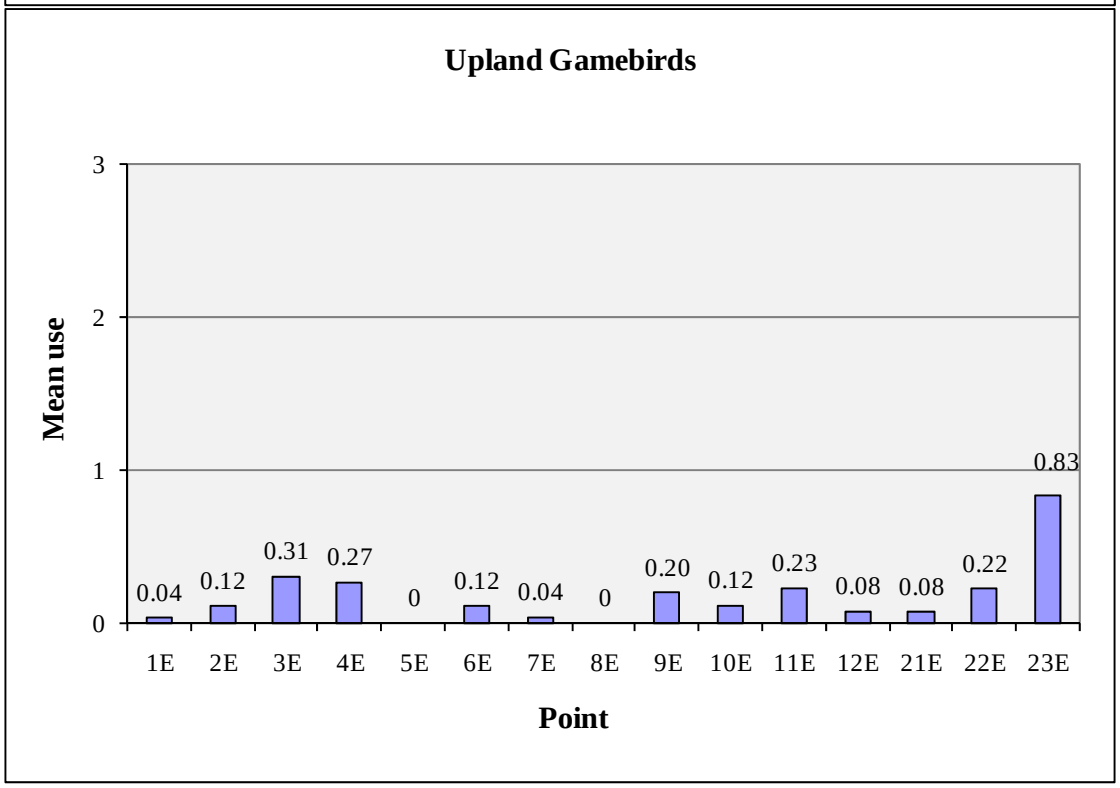


Figure C-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birdsat the Kuhl Ridge Wind Resource Area.

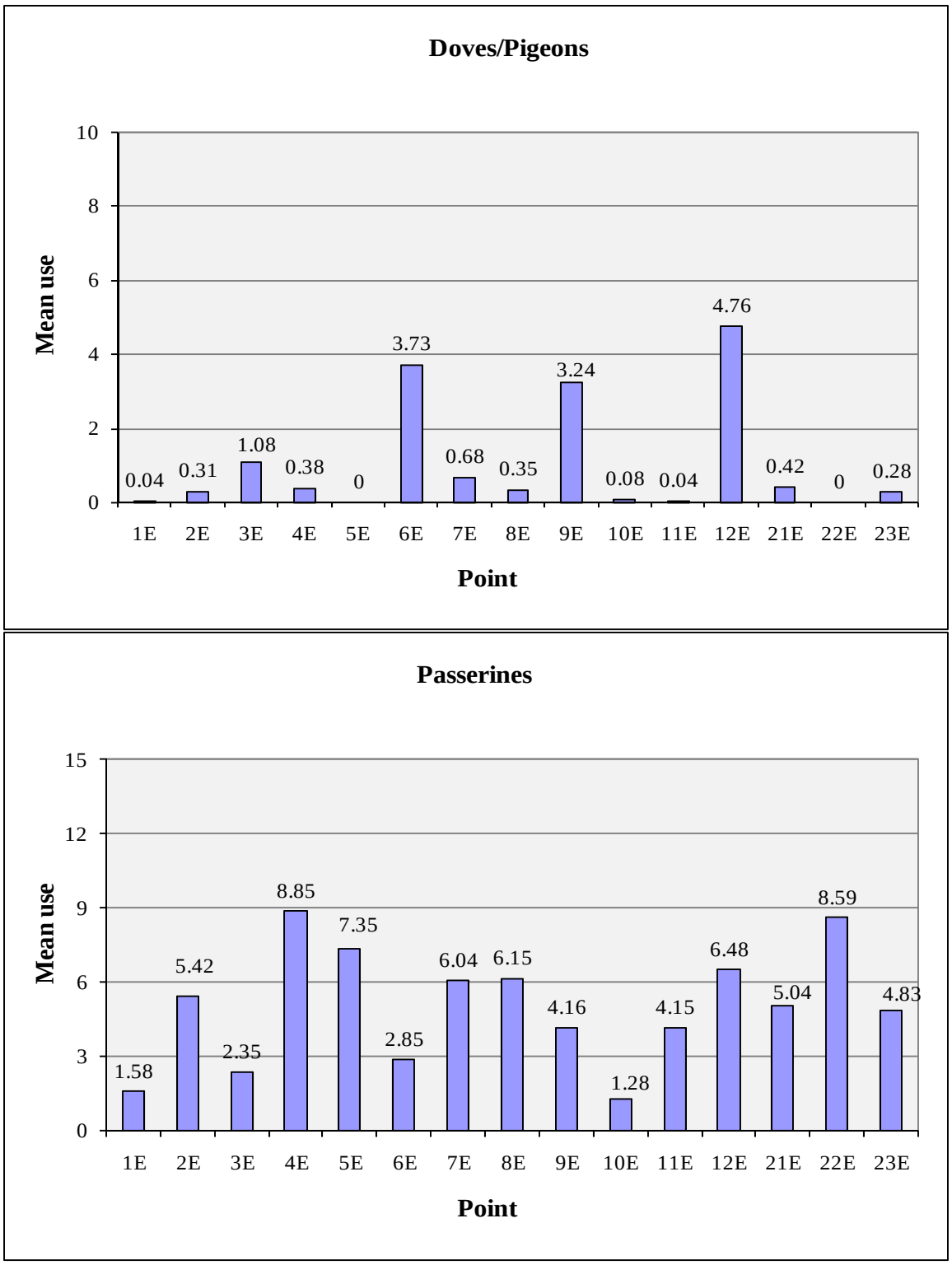


Figure C-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Kuhl Ridge Wind Resource Area.

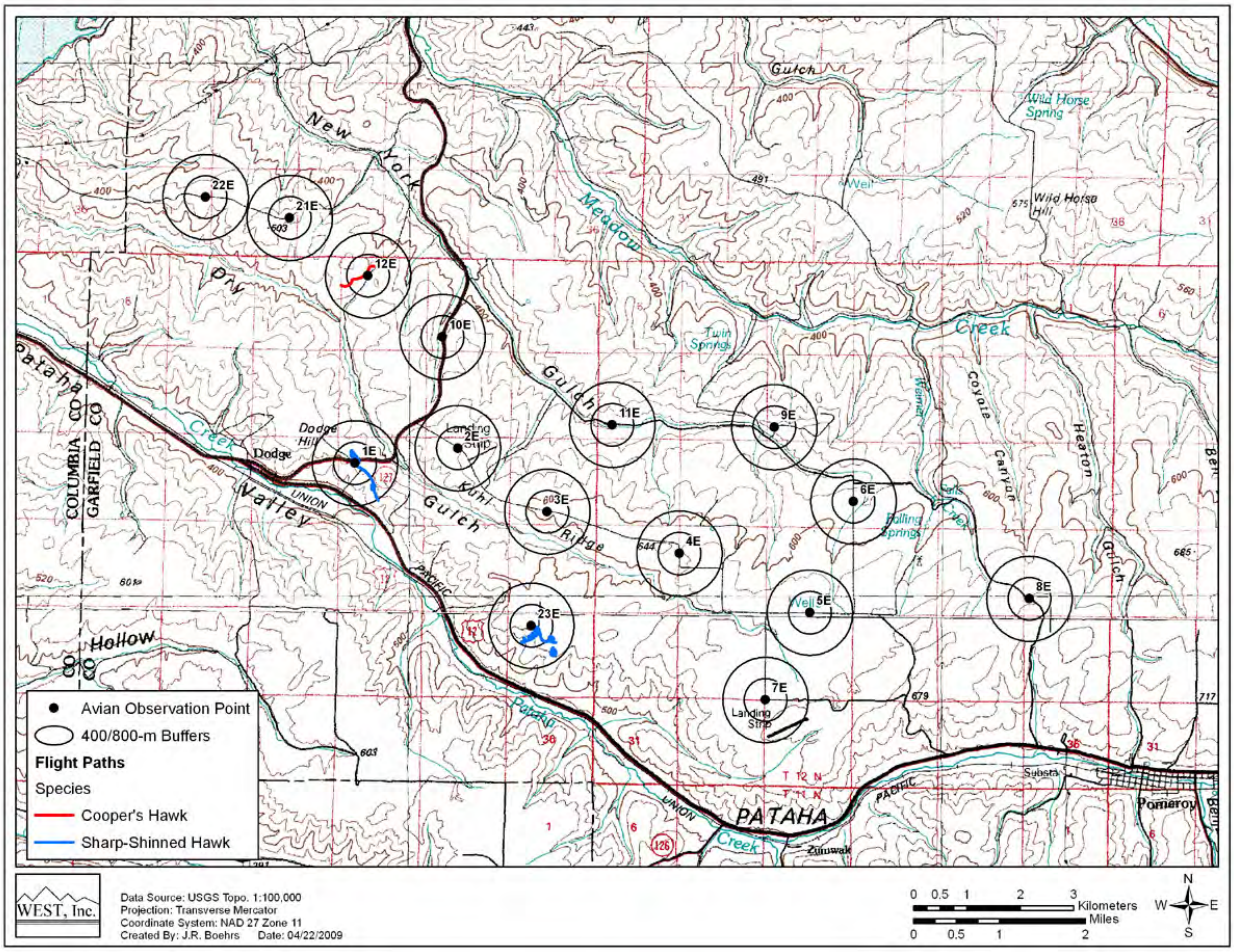


Figure C-6. Mapped flight paths in relation to fixed-point bird survey stations for accipiters at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

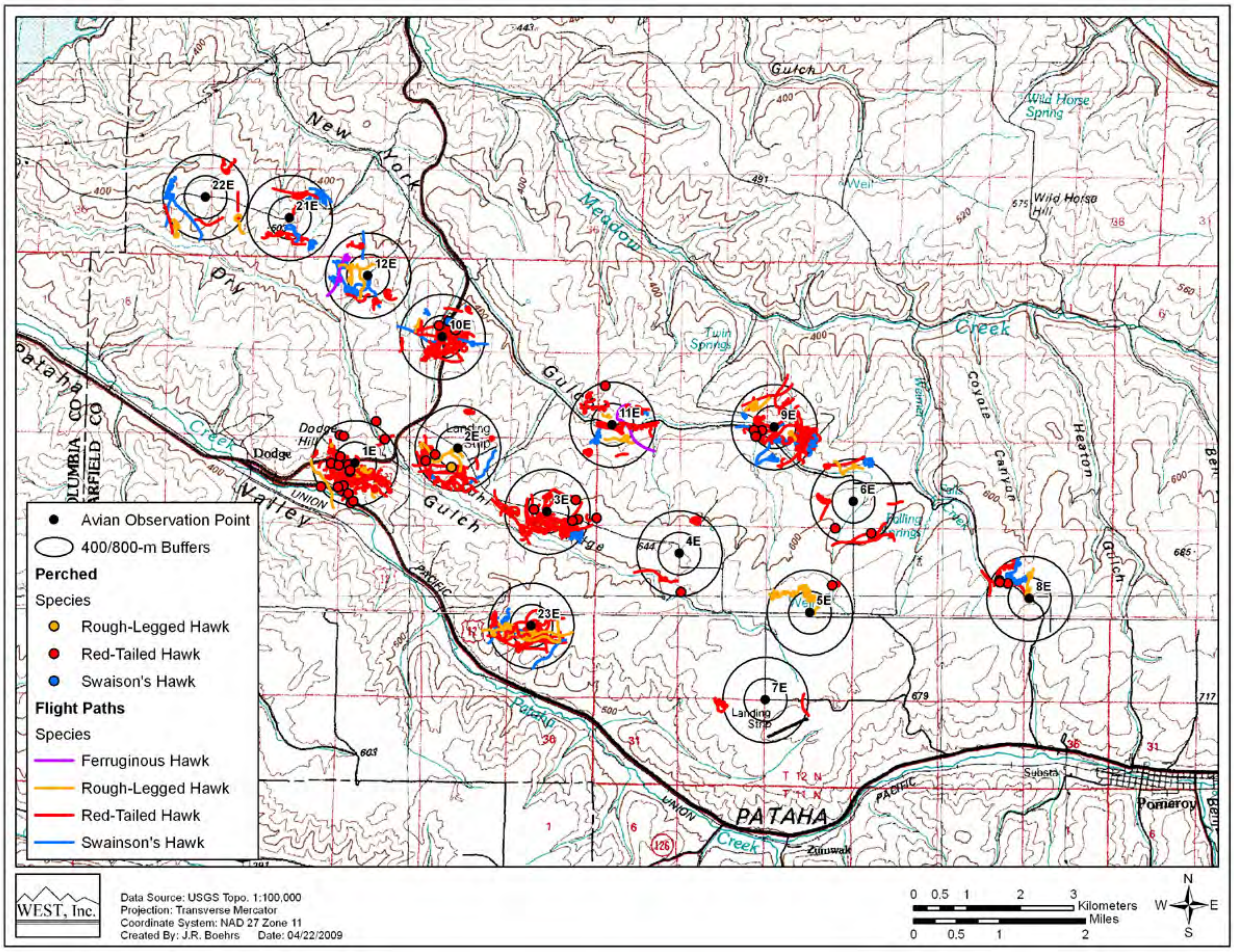


Figure C-6 (*continued*). Mapped flight paths in relation to fixed-point bird survey stations for buteos at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

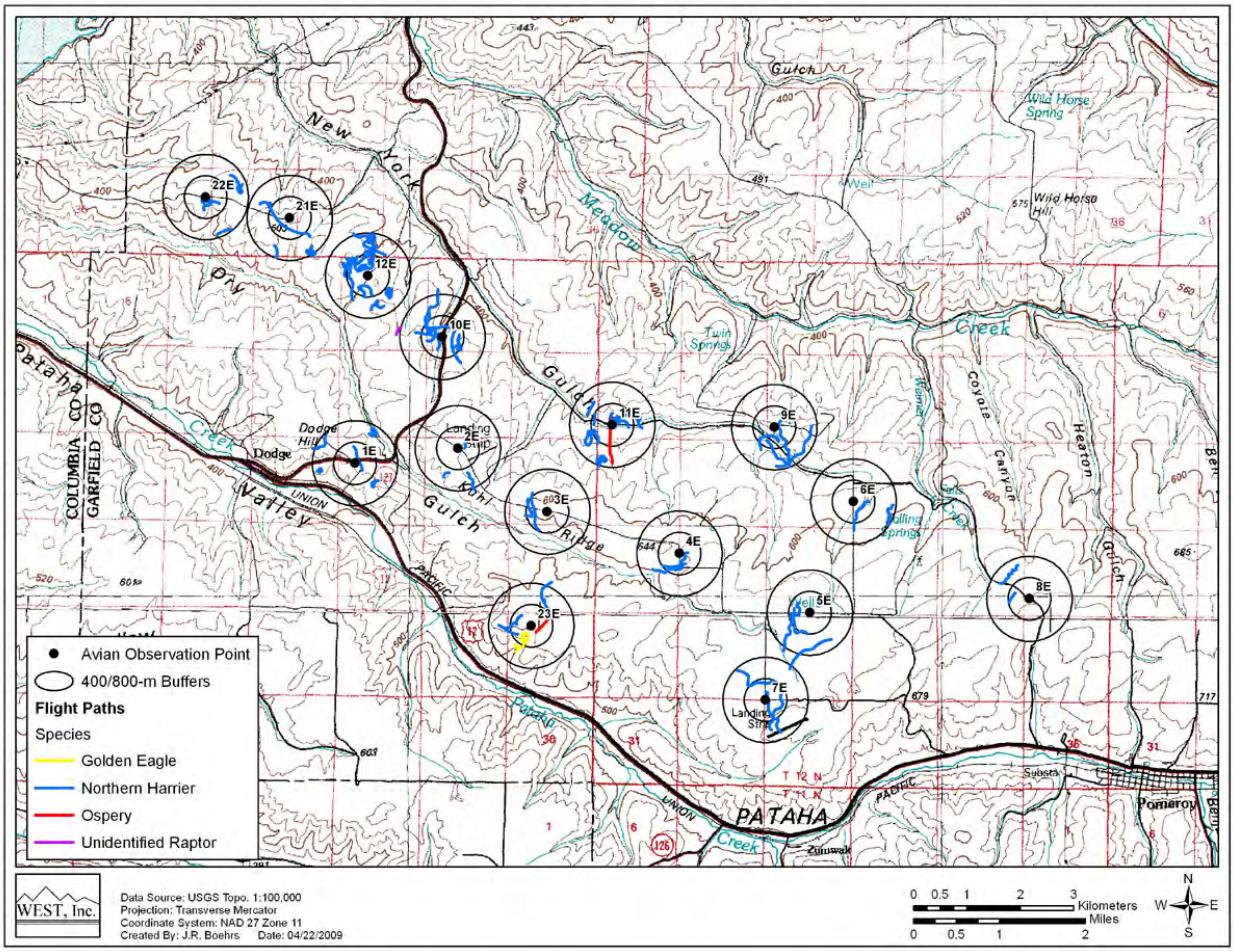


Figure C-6 (*continued*). Mapped flight paths in relation to fixed-point bird survey stations for northern harriers, eagles, and other raptors at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

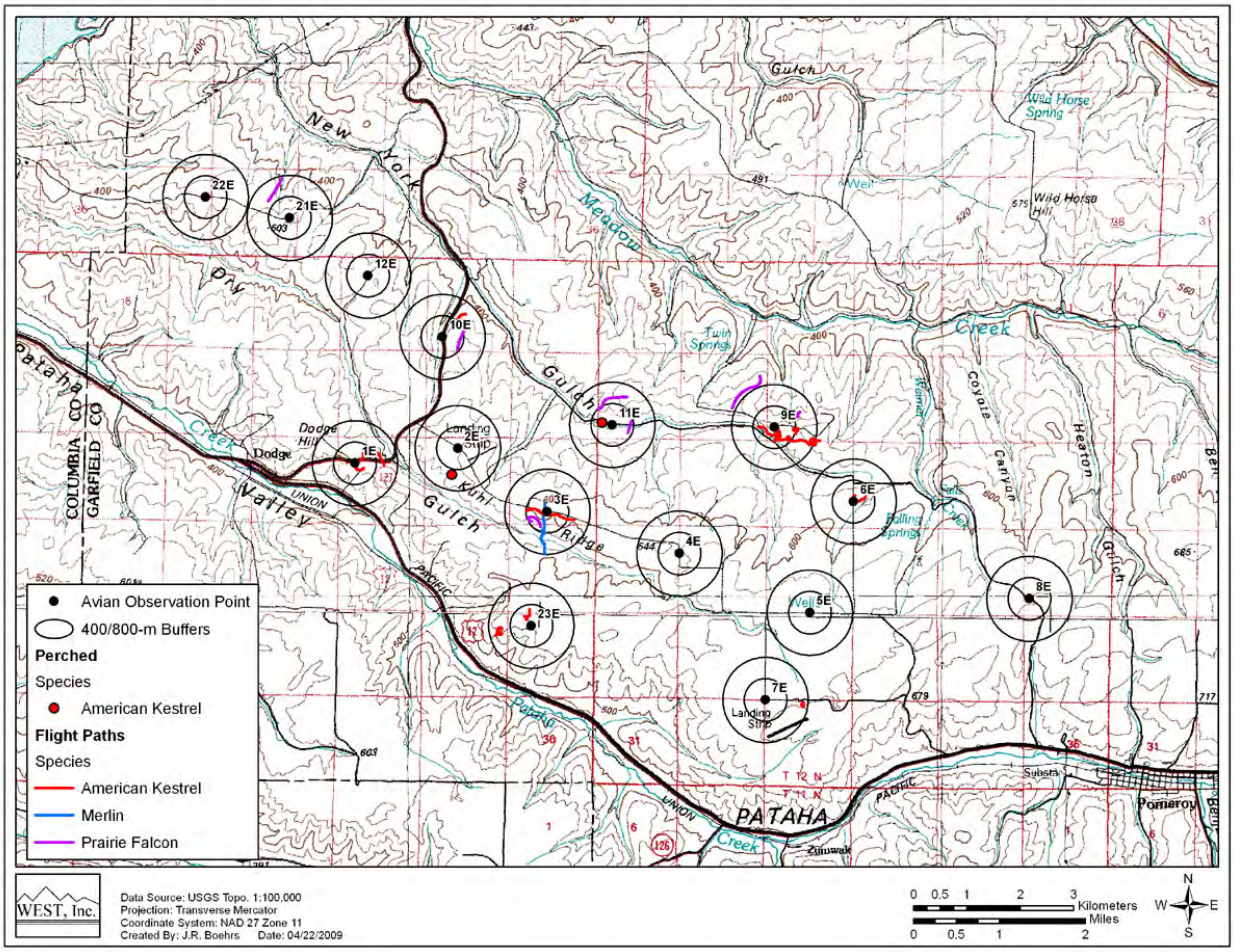


Figure C-6 (*continued*). Mapped flight paths in relation to fixed-point bird survey stations for falcons at the Kuhl Ridge Wind Resource Area, January 24, 2008 – January 13, 2009.

Appendix D: Tables and Figures for the Dutch Flats Wind Resource Area.

Table D-1. Summary of bird use, species richness, and sample size by season and overall during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

Season	Number of Visits	Mean Use	# Species/ Survey	# Species	# Surveys Conducted
Winter	9	6.80	1.19	17	56
Spring	5	4.50	1.93	22	32
Summer	8	6.70	2.23	34	64
Fall	7	6.29	1.46	22	46
Overall	**29**	**6.24**	**1.59**	**48**	**198**

Table D-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterfowl		**1**	**57**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**57**
snow goose	*Chen caerulescens*	1	57	0	0	0	0	0	0	1	57
Raptors		**21**	**21**	**23**	**24**	**43**	**48**	**27**	**28**	**114**	**121**
Accipiters		*1*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*3*	*3*
Cooper's hawk	*Accipiter cooperii*	0	0	0	0	1	1	0	0	1	1
sharp-shinned hawk	*Accipter striatus*	1	1	0	0	0	0	1	1	2	2
Buteos		*15*	*15*	*10*	*11*	*29*	*32*	*17*	*17*	*71*	*75*
red-tailed hawk	*Buteo jamaicensis*	10	10	10	11	26	29	13	13	59	63
rough-legged hawk	*Buteo lagopus*	5	5	0	0	0	0	4	4	9	9
Swainson's hawk	*Buteo swainsoni*	0	0	0	0	3	3	0	0	3	3
Northern Harrier		*3*	*3*	*7*	*7*	*5*	*5*	*4*	*5*	*19*	*20*
northern harrier	*Circus cyaneus*	3	3	7	7	5	5	4	5	19	20
Eagles		*1*	*1*	*0*	*0*	*1*	*1*	*2*	*2*	*4*	*4*
golden eagle	*Aquila chrysaetos*	1	1	0	0	1	1	2	2	4	4
Falcons		*0*	*0*	*6*	*6*	*7*	*9*	*3*	*3*	*16*	*18*
American kestrel	*Falco sparverius*	0	0	3	3	7	9	3	3	13	15
prairie falcon	*Falco mexicanus*	0	0	3	3	0	0	0	0	3	3
Owls		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
great-horned owl	*Bubo virginianus*	1	1	0	0	0	0	0	0	1	1
Vultures		**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**
turkey vulture	*Cathartes aura*	0	0	1	1	0	0	0	0	1	1
Upland Gamebirds		**2**	**3**	**5**	**6**	**6**	**6**	**0**	**0**	**13**	**15**
California quail	*Callipepla californica*	2	3	0	0	0	0	0	0	2	3
chukar	*Alectoris chukar*	0	0	2	2	1	1	0	0	3	3
ring-necked pheasant	*Phasianus colchicus*	0	0	3	4	5	5	0	0	8	9
Doves/Pigeons		**3**	**12**	**1**	**1**	**8**	**19**	**4**	**14**	**16**	**46**
mourning dove	*Zenaida macroura*	0	0	1	1	4	10	2	9	7	20
rock pigeon	*Columba livia*	3	12	0	0	4	9	2	5	9	26

Table D-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Passerines		**75**	**412**	**53**	**171**	**114**	**418**	**60**	**304**	**302**	**1,305**
American goldfinch	*Carduelis tristis*	2	36	1	7	0	0	1	25	4	68
American pipit	*Anthus rubescens*	0	0	0	0	1	12	0	0	1	12
American robin	*Turdus migratorius*	0	0	1	1	1	1	0	0	2	2
barn swallow	*Hirundo rustica*	0	0	0	0	3	8	0	0	3	8
black-billed magpie	*Pica pica*	6	11	3	4	8	13	6	10	23	38
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	1	11	4	24	0	0	5	35
brown-headed cowbird	*Molothrus ater*	0	0	0	0	3	4	0	0	3	4
Bullock's oriole	*Icterus bullockii*	0	0	0	0	1	1	0	0	1	1
Cassin's finch	*Carpodacus purpureus*	0	0	0	0	1	4	0	0	1	4
cliff swallow	*Petrochelidon pyrrhonota*	0	0	2	6	3	29	0	0	5	35
common raven	*Corvus corax*	24	33	10	16	4	11	9	18	47	78
eastern kingbird	*Tyrannus tyrannus*	0	0	0	0	2	2	0	0	2	2
European starling	*Sturnus vulgaris*	3	22	2	9	8	31	3	49	16	111
grasshopper sparrow	*Ammodramus savannarum*	0	0	0	0	4	5	0	0	4	5
horned lark	*Eremophila alpestris*	34	288	20	99	37	203	25	171	116	761
house finch	*Carpodacus mexicanus*	2	17	0	0	3	16	2	5	7	38
lark sparrow	*Chondestes grammacus*	0	0	0	0	1	1	0	0	1	1
lazuli bunting	*Passerina amoena*	0	0	0	0	1	1	0	0	1	1
mountain bluebird	*Sialia currucoides*	0	0	0	0	0	0	1	2	1	2
northern shrike	*Lanius excubitor*	3	3	0	0	0	0	5	6	8	9
savannah sparrow	*Passerculus sandwichensis*	0	0	0	0	0	0	2	3	2	3
Say's phoebe	*Sayornis saya*	0	0	1	1	5	6	0	0	6	7
song sparrow	*Melospiza melodia*	0	0	0	0	1	1	0	0	1	1
vesper sparrow	*Pooecetes gramineus*	0	0	1	1	3	4	0	0	4	5
western bluebird	*Sialia mexicana*	0	0	0	0	2	6	1	5	3	11
western kingbird	*Tyrannus verticalis*	0	0	1	2	12	21	1	1	14	24
western meadowlark	*Sturnella neglecta*	0	0	7	8	6	14	3	8	16	30

Table D-2. Total number of groups and individuals for each bird type and species by season and overall during fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

		Winter		Spring		Summer		Fall		Total	
Species/Type	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
white-crowned sparrow	*Zonotrichia leucophrys*	1	2	3	6	0	0	1	1	5	9
Other Birds		**0**	**0**	**1**	**1**	**1**	**4**	**1**	**1**	**3**	**6**
common nighthawk	*Chordeiles minor*	0	0	0	0	1	4	0	0	1	4
downy woodpecker	*Picoides pubescens*	0	0	0	0	0	0	1	1	1	1
northern flicker	*Colaptes auratus*	0	0	1	1	0	0	0	0	1	1
Overall		**102**	**505**	**84**	**204**	**172**	**495**	**92**	**347**	**450**	**1,551**

Table D-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Waterfowl	**0.79**	**0**	**0**	**0**	**11.6**	**0**	**0**	**0**	**1.4**	**0**	**0**	**0**
snow goose	0.79	0	0	0	11.6	0	0	0	1.4	0	0	0
Raptors	**0.31**	**0.78**	**0.75**	**0.62**	**4.6**	**17.2**	**11.2**	**9.8**	**25.5**	**55.0**	**46.9**	**41.5**
Accipiters	*0.02*	*0*	*0.02*	*0.02*	*0.3*	*0*	*0.2*	*0.3*	*1.9*	*0*	*1.6*	*1.8*
Cooper's hawk	0	0	0.02	0	0	0	0.2	0	0	0	1.6	0
sharp-shinned hawk	0.02	0	0.00	0.02	0.3	0	0	0.3	1.9	0	0	1.8
Buteos	*0.21*	*0.35*	*0.50*	*0.35*	*3.1*	*7.8*	*7.5*	*5.5*	*16.7*	*30.0*	*34.4*	*29.3*
red-tailed hawk	0.14	0.35	0.45	0.26	2.0	7.8	6.8	4.1	12.5	30.0	32.8	22.2
rough-legged hawk	0.07	0	0	0.09	1.0	0	0	1.4	6.9	0	0	7.1
Swainson's hawk	0	0	0.05	0	0	0	0.7	0	0	0	4.7	0
Northern Harrier	*0.06*	*0.25*	*0.08*	*0.13*	*0.8*	*5.6*	*1.2*	*2.0*	*5.6*	*20.0*	*7.8*	*9.2*
northern harrier	0.06	0.25	0.08	0.13	0.8	5.6	1.2	2.0	5.6	20.0	7.8	9.2
Eagles	*0.01*	*0*	*0.02*	*0.04*	*0.2*	*0*	*0.2*	*0.6*	*1.4*	*0*	*1.6*	*2.0*
golden eagle	0.01	0	0.02	0.04	0.2	0	0.2	0.6	1.4	0	1.6	2.0
Falcons	*0*	*0.18*	*0.14*	*0.08*	*0*	*3.9*	*2.1*	*1.3*	*0*	*17.5*	*10.9*	*8.3*
American kestrel	0	0.10	0.14	0.08	0	2.2	2.1	1.3	0	10.0	10.9	8.3
prairie falcon	0	0.08	0	0	0	1.7	0	0	0	7.5	0	0
Owls	*0.01*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*1.4*	*0*	*0*	*0*
great-horned owl	0.01	0	0	0	0.2	0	0	0	1.4	0	0	0
Vultures	**0**	**0.03**	**0**	**0**	**0**	**0.6**	**0**	**0**	**0**	**2.5**	**0**	**0**
turkey vulture	0	0.03	0	0	0	0.6	0	0	0	2.5	0	0
Upland Gamebirds	**0.06**	**0.15**	**0.09**	**0**	**0.8**	**3.3**	**1.4**	**0**	**3.7**	**10.0**	**9.4**	**0**
California quail	0.06	0	0	0	0.8	0	0	0	3.7	0	0	0
chukar	0	0.05	0.02	0	0	1.1	0.2	0	0	5.0	1.6	0
ring-necked pheasant	0	0.10	0.08	0	0	2.2	1.2	0	0	7.5	7.8	0

Table D-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Doves/Pigeons	**0.23**	**0.03**	**0.30**	**0.26**	**3.4**	**0.6**	**4.4**	**4.1**	**6.0**	**2.5**	**12.5**	**7.4**
mourning dove	0	0.03	0.16	0.16	0	0.6	2.3	2.6	0	2.5	6.3	3.6
rock pigeon	0.23	0	0.14	0.09	3.4	0	2.1	1.5	6.0	0	6.3	3.8
Passerines	**5.41**	**3.50**	**5.50**	**5.40**	**79.6**	**77.8**	**82.1**	**85.9**	**64.4**	**75.0**	**81.3**	**66.8**
American goldfinch	0.49	0	0	0.45	7.1	0	0	7.1	1.4	0	0	1.8
American pipit	0	0	0.19	0	0	0	2.8	0	0	0	1.6	0
American robin	0	0.03	0	0	0	0.6	0	0	0	2.5	0	0
barn swallow	0	0	0.13	0	0	0	1.9	0	0	0	4.7	0
black-billed magpie	0.03	0	0.06	0	0.5	0	0.9	0	3.2	0	4.7	0
Brewer's blackbird	0	0	0.33	0	0	0	4.9	0	0	0	4.7	0
brown-headed cowbird	0	0	0.06	0	0	0	0.9	0	0	0	4.7	0
Bullock's oriole	0	0	0.02	0	0	0	0.2	0	0	0	1.6	0
Cassin's finch	0	0	0.06	0	0	0	0.9	0	0	0	1.6	0
cliff swallow	0	0.15	0.23	0	0	3.3	3.5	0	0	5.0	3.1	0
common raven	0.07	0.13	0.13	0.02	1.0	2.8	1.9	0.3	5.6	10.0	3.1	1.8
eastern kingbird	0	0	0.03	0	0	0	0.5	0	0	0	3.1	0
European starling	0.08	0.10	0.17	0.27	1.2	2.2	2.6	4.3	2.8	2.5	6.3	1.8
grasshopper sparrow	0	0	0.08	0	0	0	1.2	0	0	0	4.7	0
horned lark	4.63	2.70	3.09	4.24	68.1	60.0	46.2	67.4	57.9	60.0	53.1	59.7
house finch	0.04	0	0.25	0.09	0.5	0	3.7	1.4	1.9	0	4.7	3.6
lark sparrow	0	0	0.02	0	0	0	0.2	0	0	0	1.6	0
lazuli bunting	0	0	0.02	0	0	0	0.2	0	0	0	1.6	0
northern shrike	0.04	0	0	0.11	0.6	0	0	1.7	4.2	0	0	7.1
savannah sparrow	0	0	0	0.05	0	0	0	0.9	0	0	0	3.6
Say's phoebe	0	0.03	0.09	0	0	0.6	1.4	0	0	2.5	7.8	0
vesper sparrow	0	0.03	0.06	0	0	0.6	0.9	0	0	2.5	4.7	0
western bluebird	0	0	0.09	0.09	0	0	1.4	1.4	0	0	3.1	1.8

Table D-3. Mean bird use (number/plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

	Use				% Composition				% Frequency			
Species/Type	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
western kingbird	0	0.05	0.27	0.02	0	1.1	4.0	0.3	0	2.5	15.6	1.8
western meadowlark	0	0.10	0.13	0.05	0	2.2	1.9	0.9	0	7.5	4.7	1.8
white-crowned sparrow	0.03	0.20	0	0.02	0.4	4.4	0	0.3	1.4	10.0	0	1.8
Other Birds	**0**	**0.03**	**0.06**	**0.02**	**0**	**0.6**	**0.9**	**0.3**	**0**	**2.5**	**1.6**	**1.8**
common nighthawk	0	0	0.06	0	0	0	0.9	0	0	0	1.6	0
downy woodpecker	0	0	0	0.02	0	0	0	0.3	0	0	0	1.8
northern flicker	0	0.03	0	0	0	0.6	0	0	0	2.5	0	0
Overall	**6.80**	**4.50**	**6.70**	**6.29**	**100**	**100**	**100**	**100**				

Table D-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
snow goose	1	0.33	100	100	0.33	100
American goldfinch	4	0.29	100	51.5	0.15	51.5
red-tailed hawk	34	0.26	60.3	47.4	0.08	78.9
common raven	42	0.08	85.9	28.4	0.02	34.3
horned lark	39	3.89	43.5	0.9	0.02	0.9
rock pigeon	4	0.14	38.5	20.0	0.01	20.0
northern harrier	19	0.11	100	5.0	<0.01	5.0
prairie falcon	3	0.01	100	33.3	<0.01	33.3
turkey vulture	1	<0.01	100	100	<0.01	100
Swainson's hawk	3	0.01	100	33.3	<0.01	66.7
cliff swallow	5	0.07	100	2.9	<0.01	2.9
European starling	10	0.14	42.3	0	0	0
house finch	5	0.08	92.1	0	0	0
mourning dove	4	0.07	80.0	0	0	0
western kingbird	11	0.06	75.0	0	0	0
Brewer's blackbird	4	0.06	88.6	0	0	0
American kestrel	11	0.06	73.3	0	0	27.3
white-crowned sparrow	0	0.05	0	0	0	0
western meadowlark	2	0.05	13.3	0	0	0
rough-legged hawk	4	0.05	44.4	0	0	75.0
northern shrike	5	0.04	66.7	0	0	0
American pipit	1	0.04	100	0	0	0
western bluebird	3	0.04	100	0	0	0
ring-necked pheasant	0	0.03	0	0	0	0
black-billed magpie	16	0.03	71.1	0	0	0
barn swallow	2	0.02	75.0	0	0	0
California quail	0	0.02	0	0	0	0

Table D-4. Relative exposure index and flight characteristics by species during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within Rotary Height at anytime
Say's phoebe	0	0.02	0	0	0	0
vesper sparrow	2	0.02	60.0	0	0	0
golden eagle	2	0.02	50.0	0	0	100
grasshopper sparrow	2	0.01	40.0	0	0	0
chukar	0	0.01	0	0	0	0
brown-headed cowbird	1	0.01	25.0	0	0	0
Cassin's finch	1	0.01	100	0	0	0
common nighthawk	1	0.01	100	0	0	100
sharp-shinned hawk	1	0.01	50.0	0	0	0
savannah sparrow	1	0.01	33.3	0	0	0
eastern kingbird	2	<0.01	100	0	0	0
great-horned owl	0	<0.01	0	0	0	0
American robin	1	<0.01	50.0	0	0	0
northern flicker	1	<0.01	100	0	0	0
downy woodpecker	1	<0.01	100	0	0	0
Bullock's oriole	0	<0.01	0	0	0	0
Cooper's hawk	1	<0.01	100	0	0	0
lark sparrow	0	<0.01	0	0	0	0
lazuli bunting	0	<0.01	0	0	0	0
mountain bluebird	1	0	100	0	0	0
song sparrow	0	0	0	0	0	0

Table D-5. Flight height characteristics by bird type during the fixed-point bird use surveys at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories 0-82 ft	82-410 ft	> 410 ft
Waterfowl	1	57	50.00	100	0	100	0
Raptors	78	83	25.99	68.6	74.7	25.3	0
Accipiters	*2*	*2*	*20.00*	*66.7*	*100*	*0*	*0*
Buteos	*41*	*45*	*36.95*	*60.0*	*57.8*	*42.2*	*0*
Northern Harrier	*19*	*20*	*11.68*	*100*	*95.0*	*5.0*	*0*
Eagles	*2*	*2*	*20.00*	*50.0*	*100*	*0*	*0*
Falcons	*14*	*14*	*15.00*	*77.8*	*92.9*	*7.1*	*0*
Owls	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Vultures	1	1	100	100	0	100.0	0
Upland Gamebirds	0	0	0	0	0	0	0
Doves/Pigeons	8	26	16.25	56.5	92.3	7.7	0
Passerines	160	714	15.39	54.7	91.6	8.1	0.3
Other Birds	3	6	12.67	100	100	0	0
Overall	**251**	**887**	**19.15**	**57.2**	**84.1**	**15.7**	**0.2**

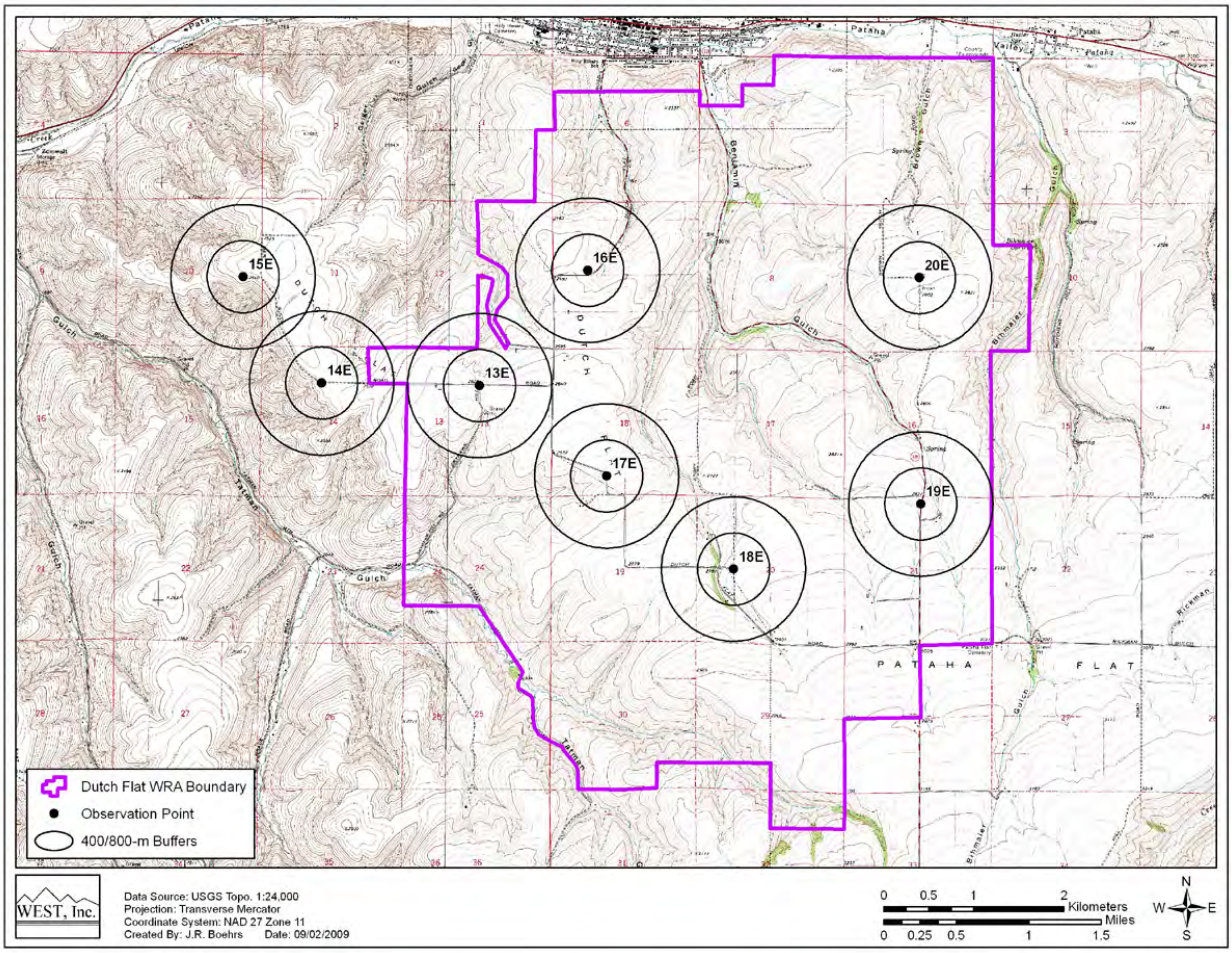


Figure D-1. Fixed-point bird use survey points at the Dutch Flats Wind Resource Area.

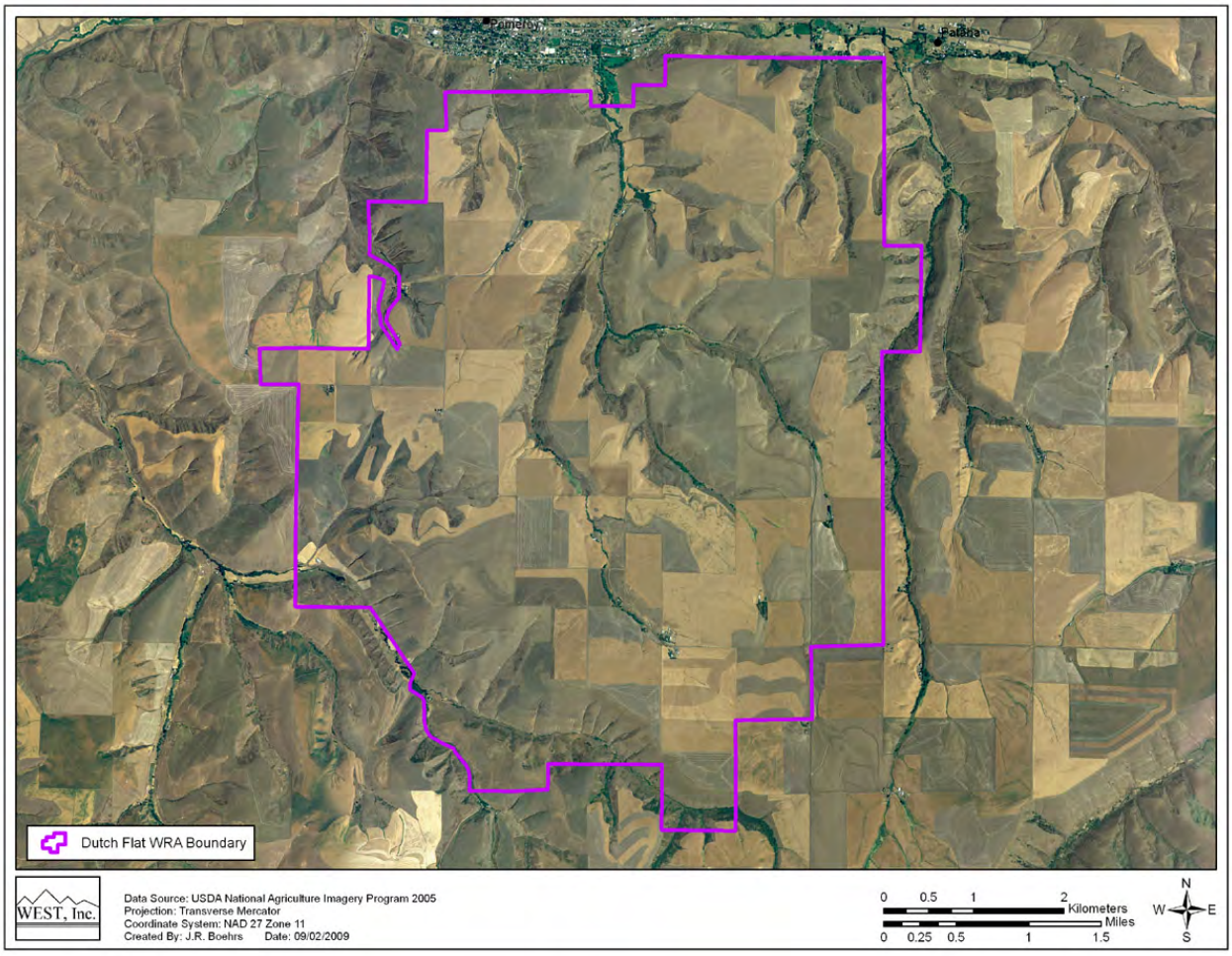


Figure D-2. Aerial photograph of the Dutch Flats Wind Resources Area representing landscape coverage base.

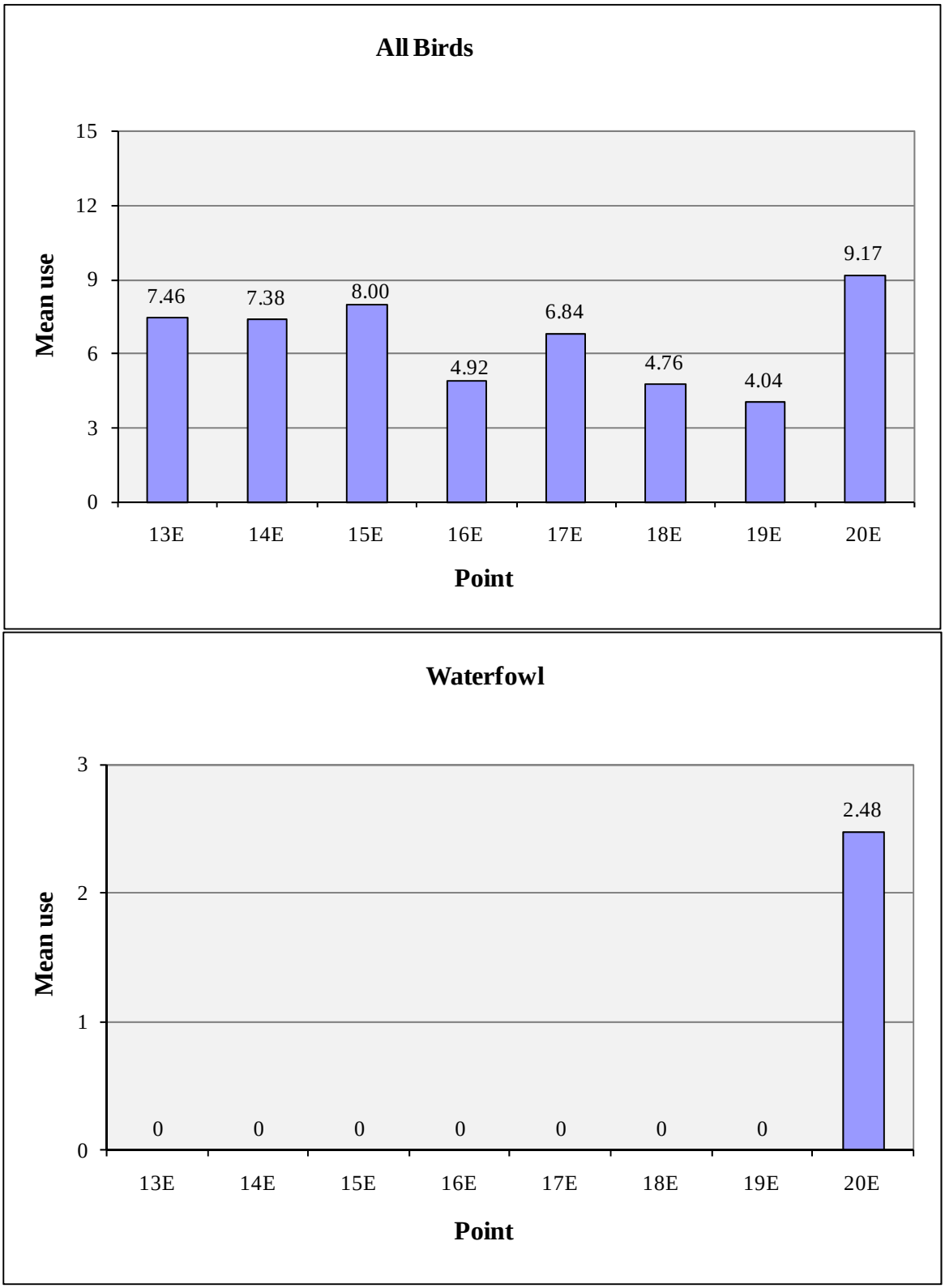


Figure D-3. Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Dutch Flats Wind Resource

Area.

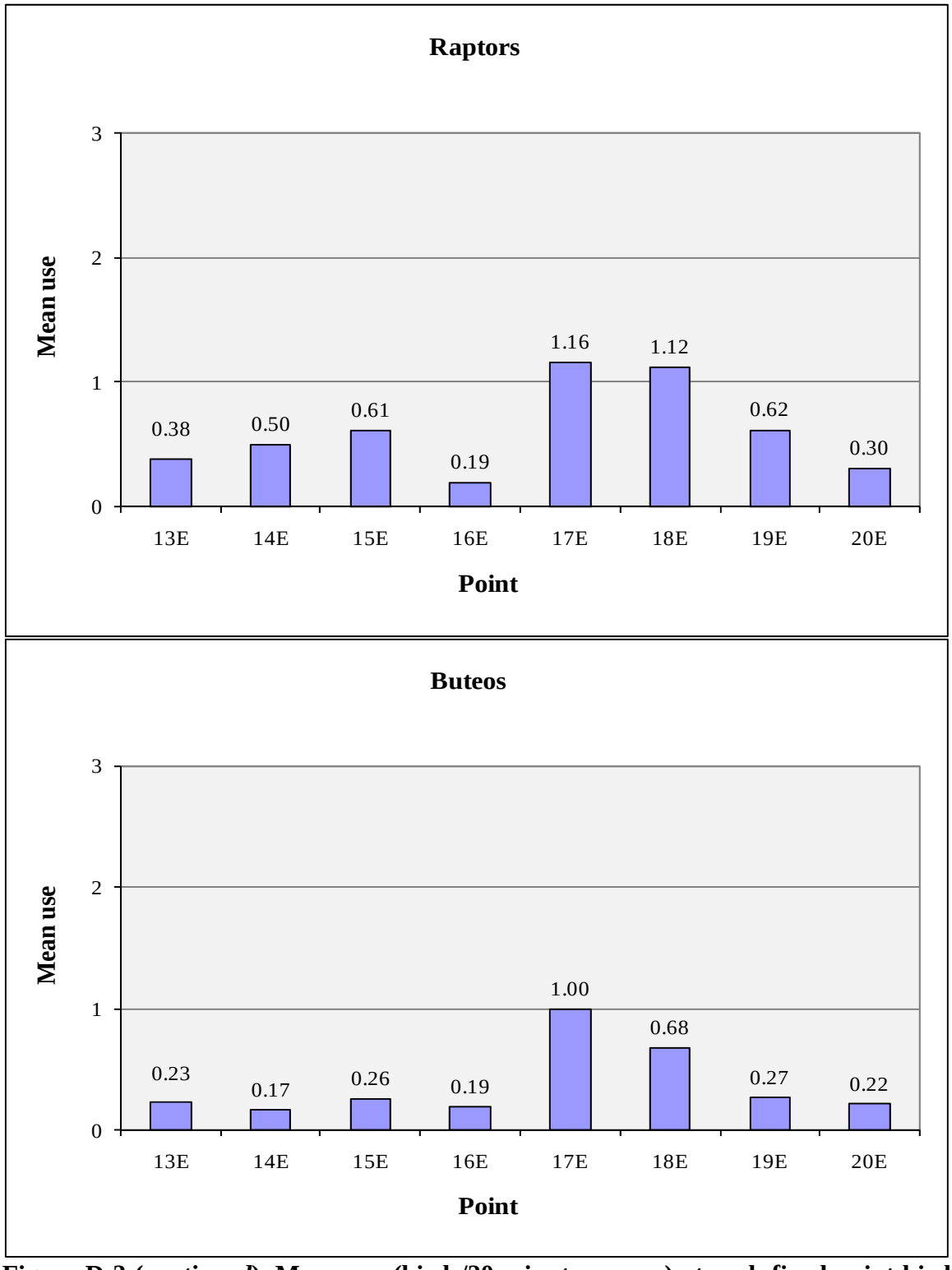


Figure D-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Dutch Flats Wind Resource Area.

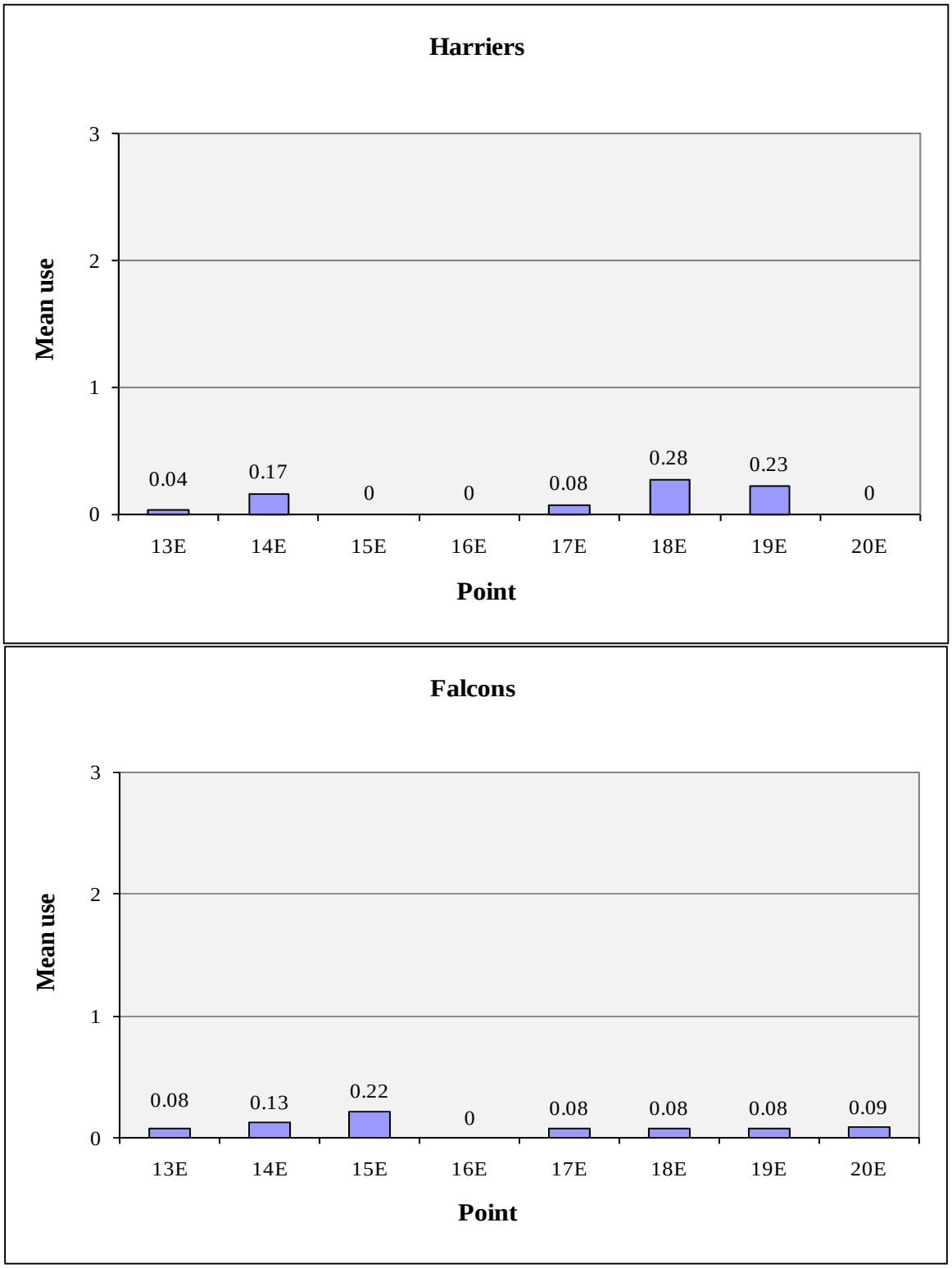


Figure D-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Dutch Flats Wind Resource Area.

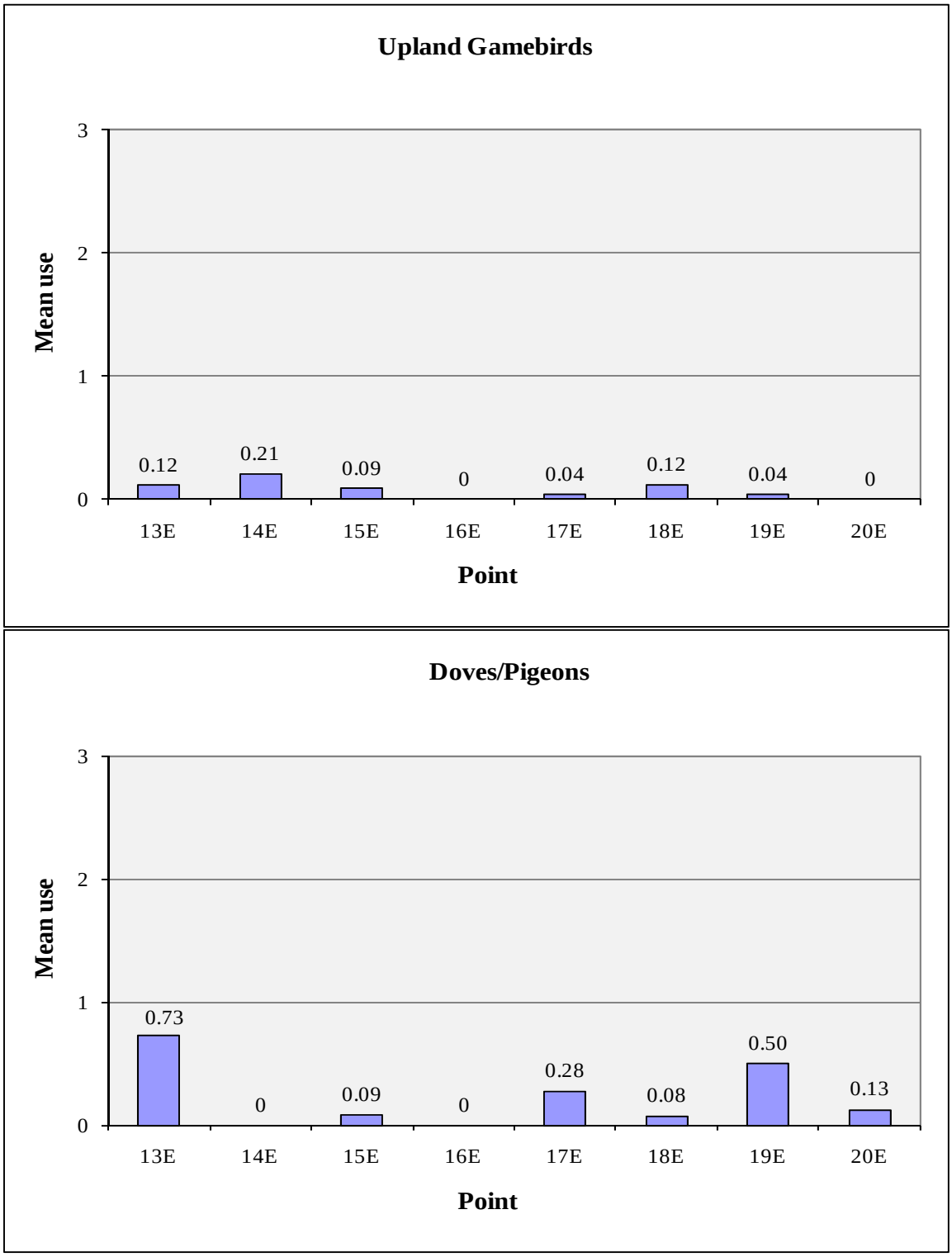


Figure D-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Dutch Flats Wind Resource Area.

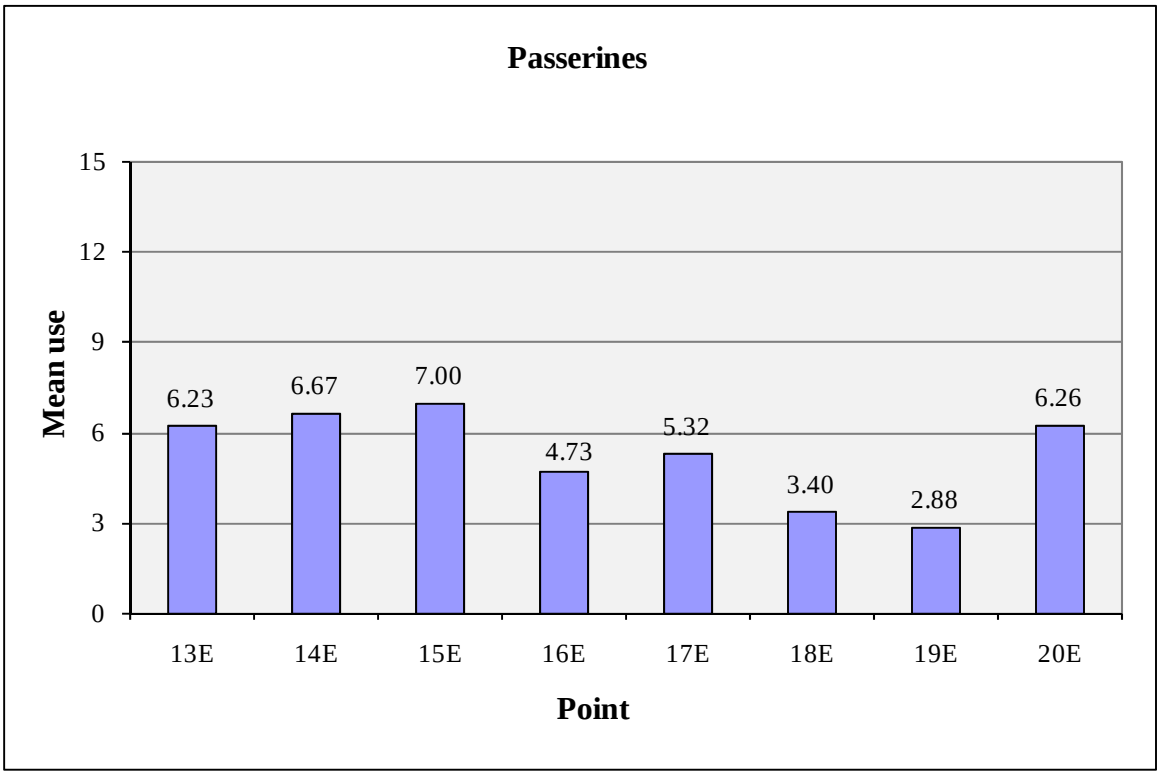


Figure D-3 (*continued*). Mean use (birds/20-minute survey) at each fixed-point bird use survey point for all birds and major bird types at the Dutch Flats Wind Resource Area.

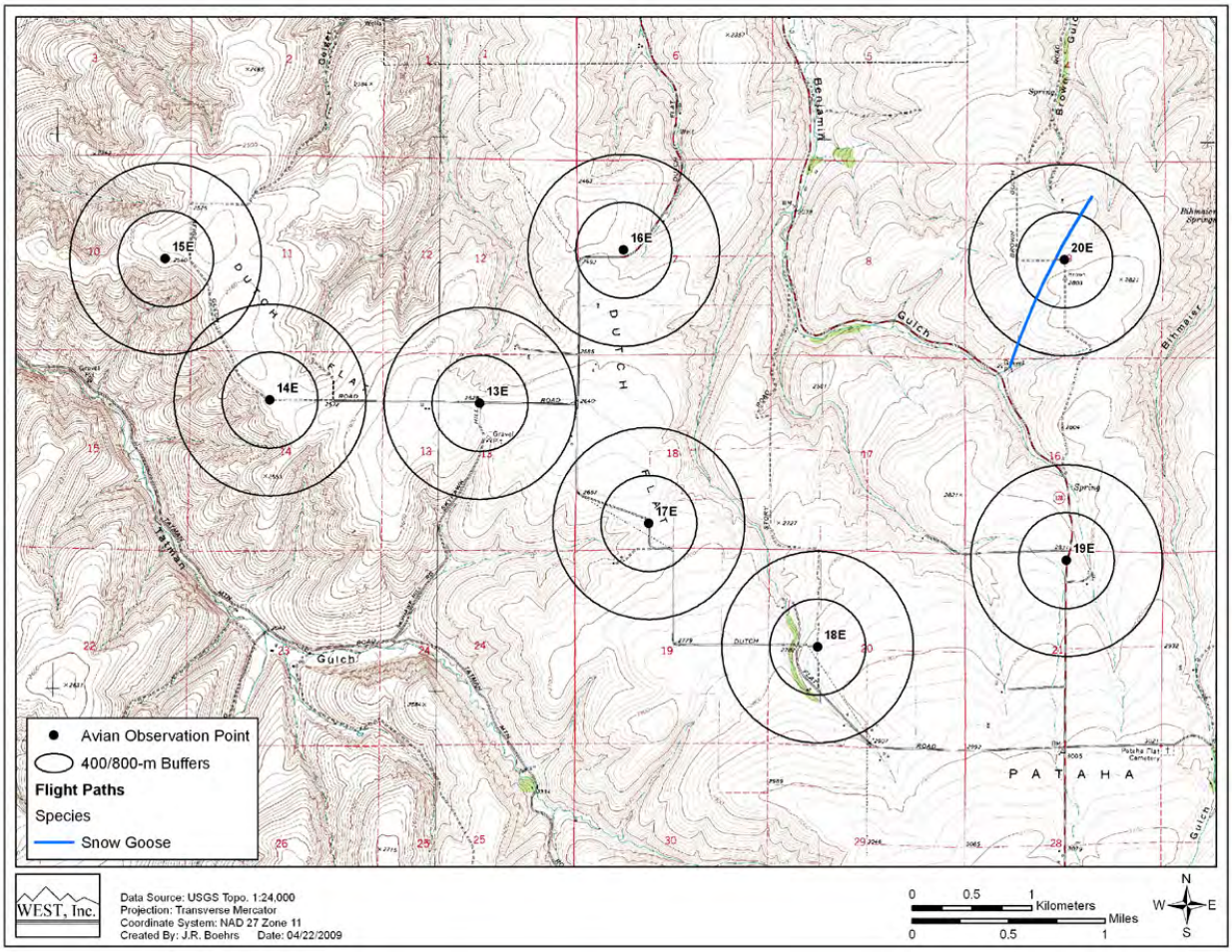


Figure D-6. Mapped flight paths in relation to fixed-point bird use survey stations for waterfowl at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

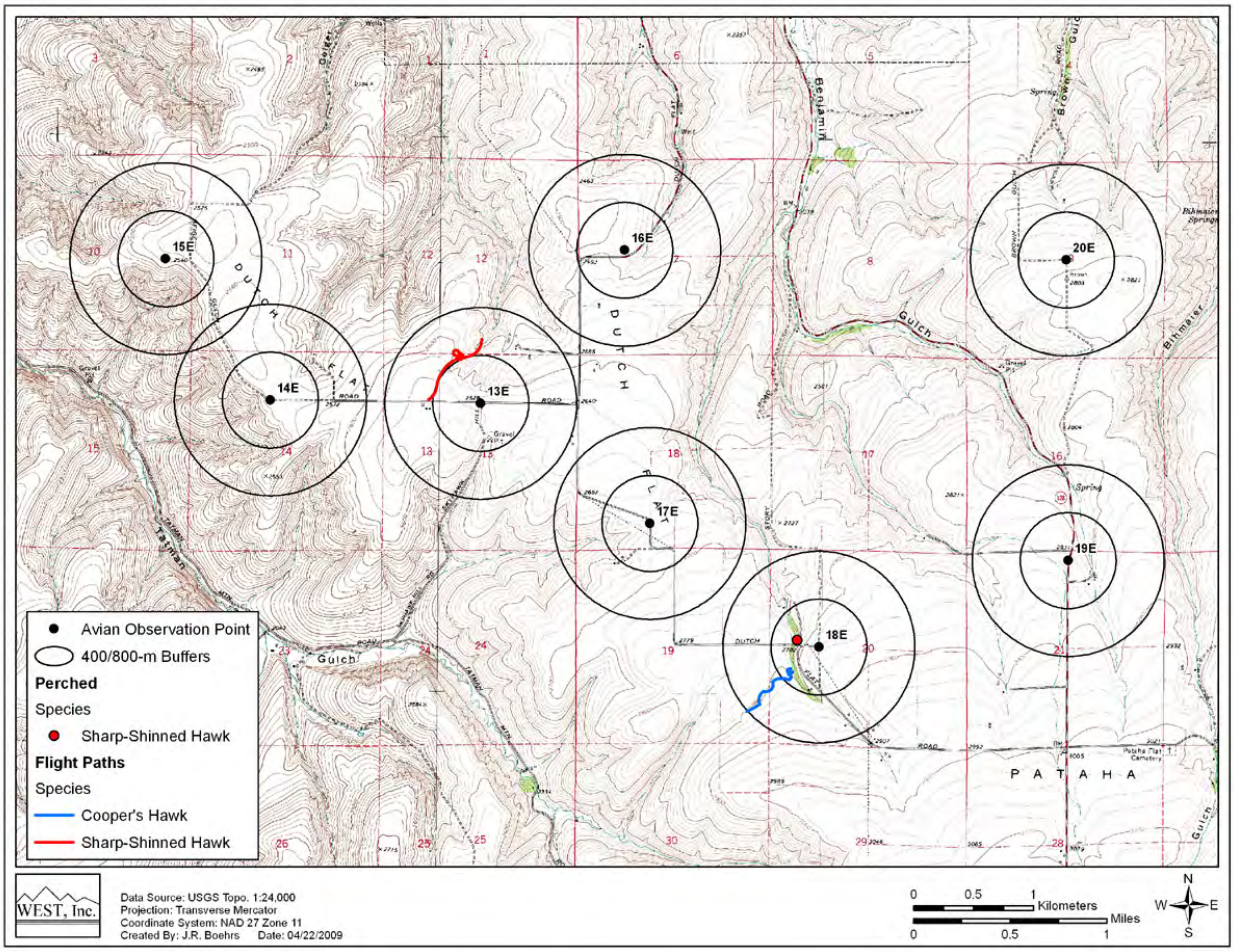


Figure D-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for accipiters at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

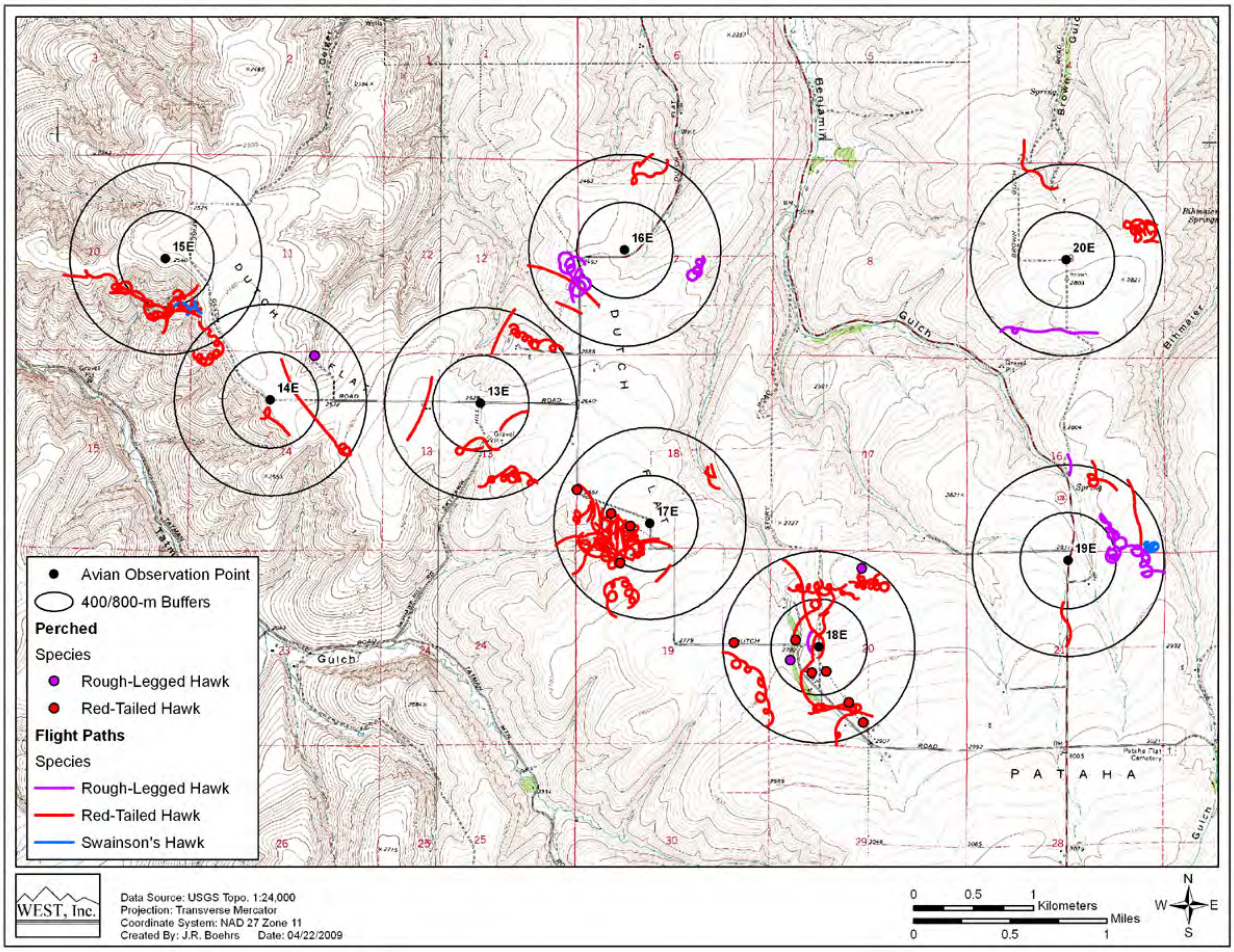


Figure D-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for buteos at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

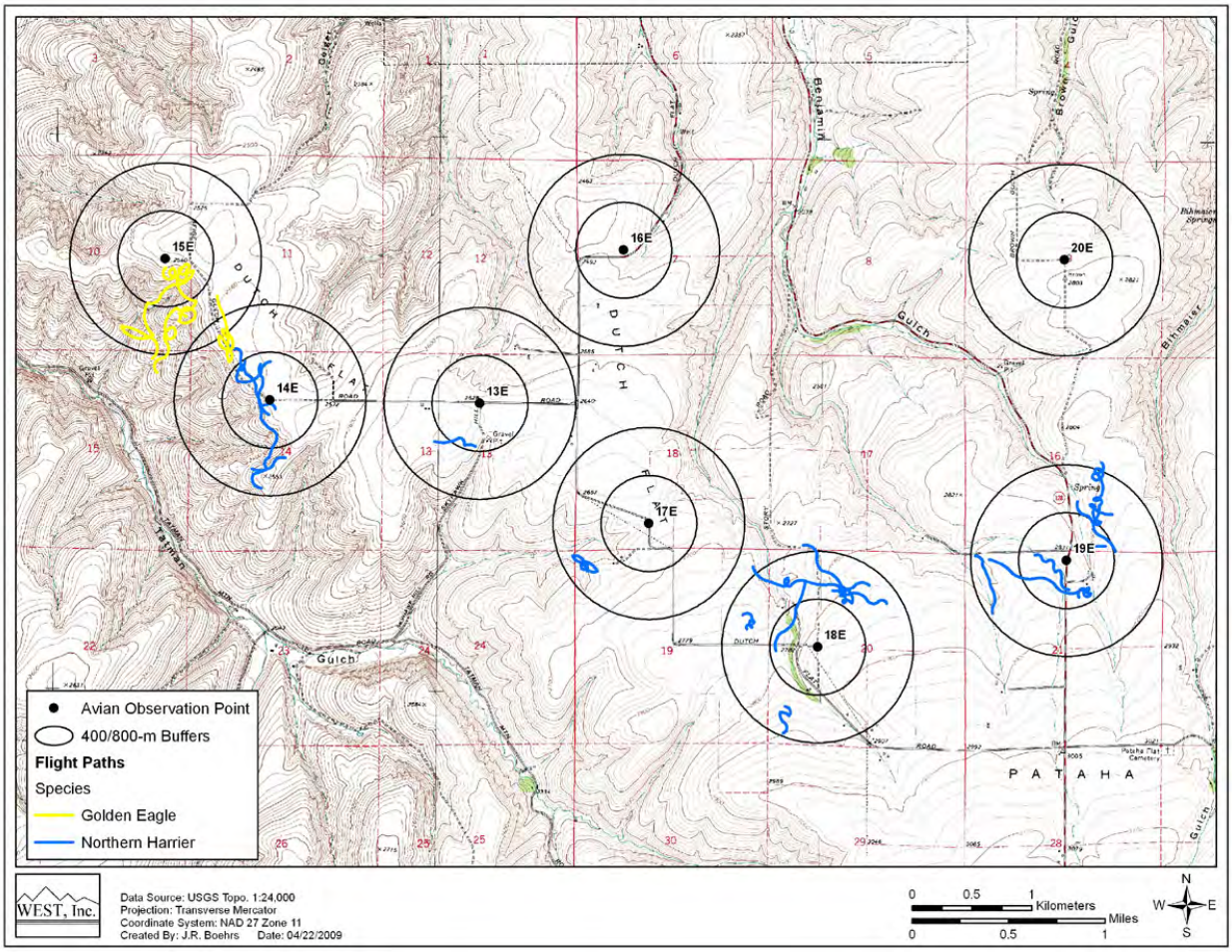


Figure D-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for northern harriers and eagles at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

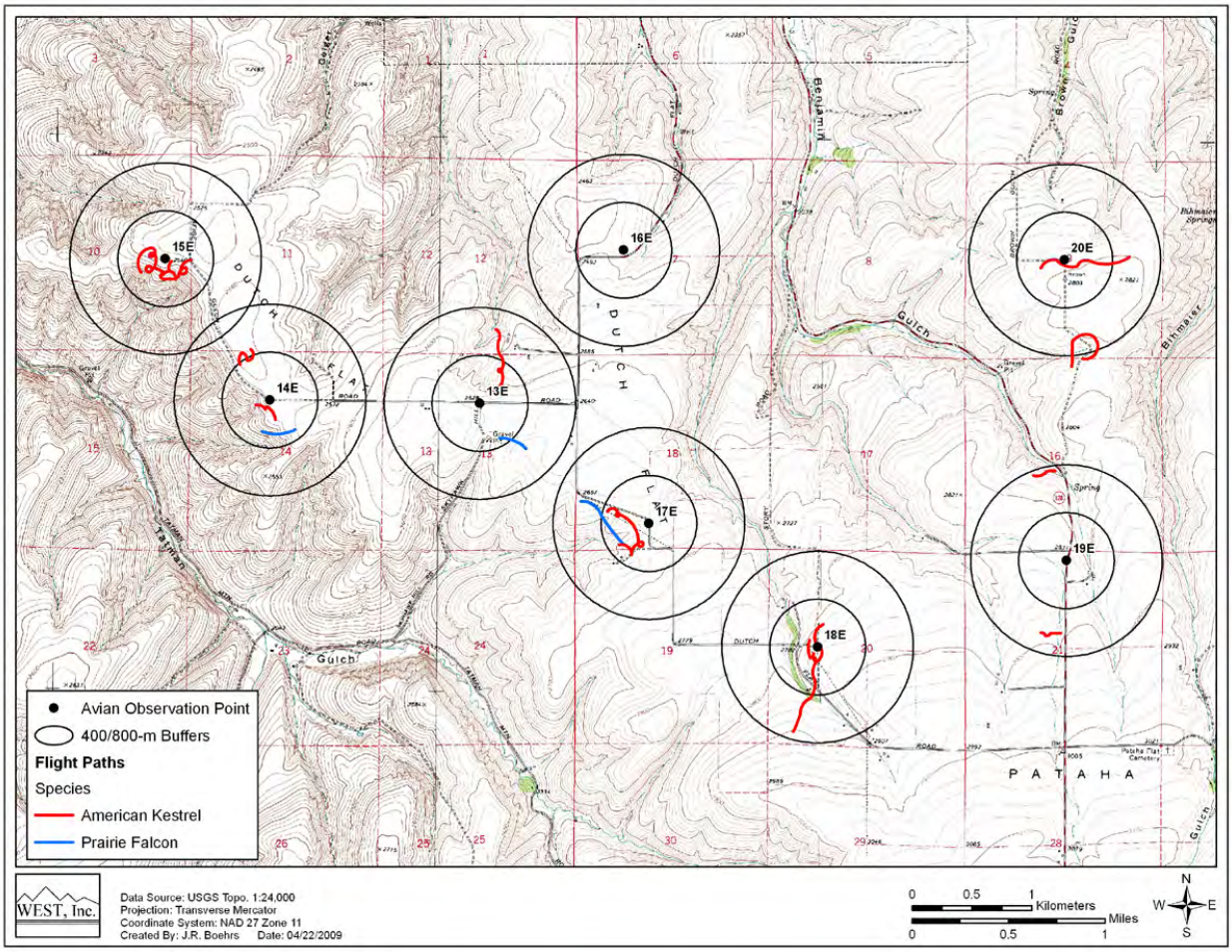


Figure D-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for falcons at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.

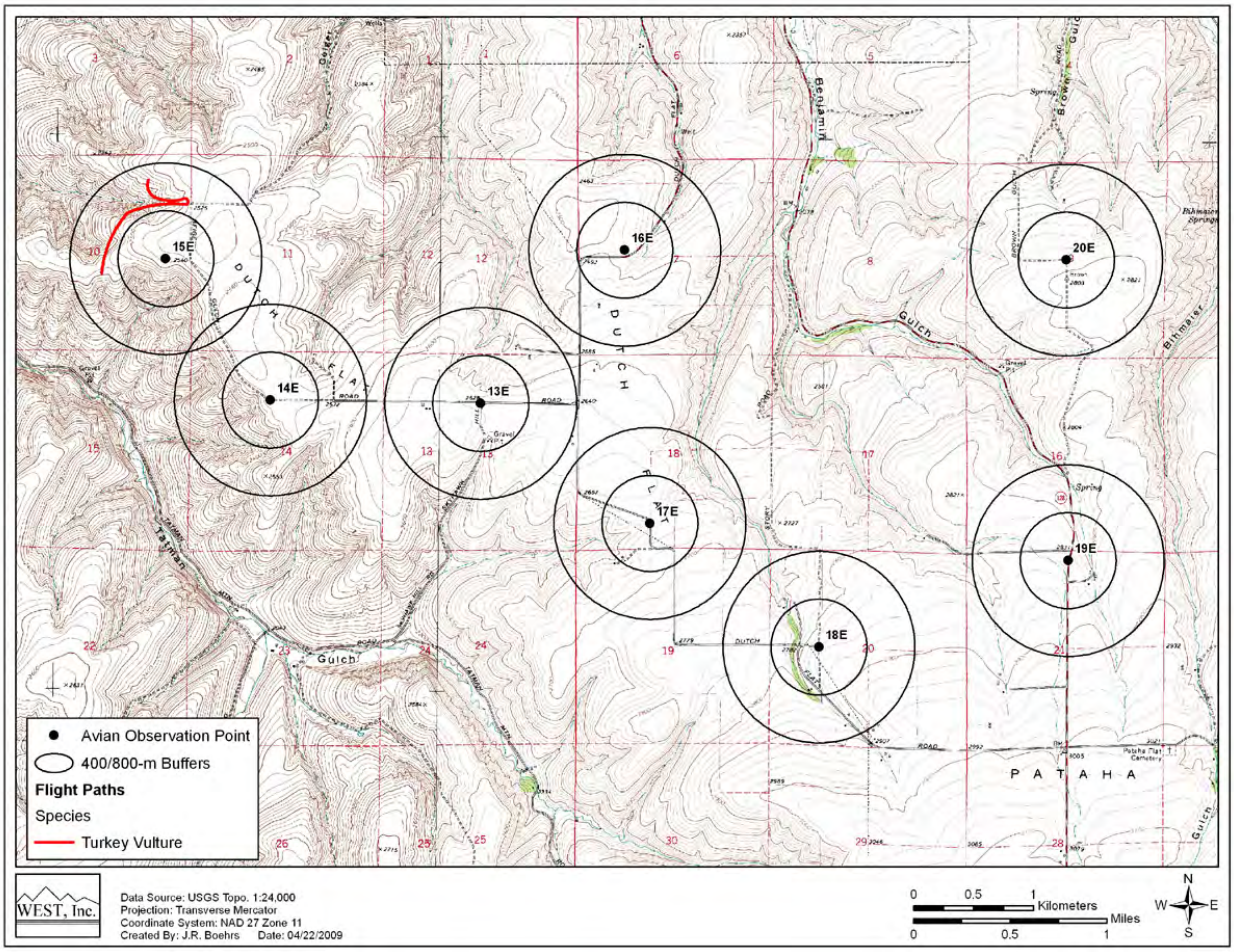


Figure D-6 (*continued*). Mapped flight paths in relation to fixed-point bird use survey stations for vultures at the Dutch Flats Wind Resource Area, January 25, 2008 – January 13, 2009.